

Changes for the Better

MITSUBISHI CNC

Instruction Manual
M800/M80 Series

A grayscale image of the Earth from space, showing continents and clouds. Overlaid on the center of the Earth is the text "MITSUBISHI CNC" in a large, white, stylized font. The text is partially obscured by a semi-transparent, curved band that follows the curvature of the globe.

**MITSUBISHI
CNC**

Introduction

This manual is a guide for using the MITSUBISHI CNC M800/M80 Series.

Supported models are as follows:

Supported models	Abbreviations in this manual
M800W Series	M800 Series, M800, M8
M800S Series	
M80W Series	M80 Series, M80, M8
M80 Series	

This manual describes operations, production processes and maintenances for users who operate the MITSUBISHI CNC installed machine tool. Read this manual thoroughly before using CNC unit. Moreover study the "Precautions for Safety" on the next page before use to use the unit safely. Be sure to keep this manual always at hand.

Details described in this manual

CAUTION

- ⚠ For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder (MTB) takes precedence over this manual.
- ⚠ Items not described in this manual must be interpreted as "not possible".
- ⚠ This manual is written on the assumption that all the applicable functions are included. Some of them, however, may not be available for your NC system. Refer to the specifications issued by the machine tool builder before use.
- ⚠ Refer to the Instruction Manual issued by each MTB for details on each machine tool.
- ⚠ Some screens and functions may differ depending on the NC system (or its version), and some functions may not be possible. Please confirm the specifications before use.

Refer to the following documents for details:

MITSUBISHI CNC M800/M80/C80 Series Programming Manual

Lathe System (1/2)	IB-1501275
Lathe System (2/2)	IB-1501276
Machining Center System (1/2)	IB-1501277
Machining Center System (2/2)	IB-1501278

MITSUBISHI CNC M800/M80/C80 Series Alarm/Parameter Manual	IB-1501279
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Precautions for Safety

Always read the specifications issued by the MTB, this manual, related manuals and attached documents before installation, operation, programming, maintenance or inspection to ensure correct use. Understand this numerical controller, safety items and cautions before using the unit.

This manual ranks the safety precautions into "DANGER", "WARNING" and "CAUTION".

DANGER


When the user may be subject to imminent fatalities or major injuries if handling is mistaken.

WARNING

When the user may be subject to fatalities or major injuries if handling is mistaken.

CAUTION


When the user may be subject to bodily injury or when physical damage may occur if handling is mistaken.

Note that even items ranked as " CAUTION", may lead to major results depending on the situation. In any case, important information that must always be observed is described.

The following signs indicate prohibition and compulsory.



This sign indicates prohibited behavior (must not do).

For example, "Keep fire away" is indicated by .



This sign indicates a thing that is critical (must do).

For example, "it must be grounded" is indicated by .

The meaning of each pictorial sign is as follows.

 CAUTION	 CAUTION rotate object	 CAUTION HOT	 Danger Electric shock risk	 Danger explosive
 Prohibited	 Disassembly is prohibited	 KEEP FIRE AWAY	 General instruction	 Earth ground



For Safe Use

MITSUBISHI CNC is designed and manufactured solely for applications to machine tools to be used for industrial purposes. Do not use this product in any applications other than those specified above, especially those which are substantially influential on the public interest or which are expected to have significant influence on human lives or properties.

DANGER






Not applicable in this manual.

WARNING


-  If the operation start position is set from a block in the program and the program is started, the program before the set block is not executed. Please confirm that G and F modal and coordinate values are appropriate. If there are coordinate system shift commands or M, S, T and B commands before the block set as the start position, carry out the required commands using the MDI, etc. If the program is run from the set block without carrying out these operations, there is a danger of interference with the machine or of machine operation at an unexpected speed, which may result in breakage of tools or machine tool or may cause damage to the operators.
-  Under the constant surface speed control (during G96 modal), if the axis targeted for the constant surface speed control moves toward the spindle center, the spindle rotation speed will increase and may exceed the allowable speed of the workpiece or chuck, etc. In this case, the workpiece, etc. may jump out during machining, which may result in breakage of tools or machine tool or may cause damage to the operators.

CAUTION



1. terms related to installation and assembly

-  For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder (MTB) takes precedence over this manual.
-  Items not described in this manual must be interpreted as "not possible"
-  This manual is written on the assumption that all the applicable functions are included. Some of them, however, may not be available for your NC system. Refer to the specifications issued by the machine tool builder before use.
-  Refer to the Instruction Manual issued by each MTB for details on each machine tool.
-  Some screens and functions may differ depending on the NC system (or its version), and some functions may not be possible. Please confirm the specifications before use.








2. Items related to installation and assembly

-  Ground the signal cables to ensure stable system operation. Also ground the NC unit main frame, power distribution panel and machine to one point, so they all have the same potential.

3. Items related to preparation before use

-  Always set the stored stroke limit. Failure to set this could result in collision with the machine end.
-  Always turn the power OFF before connecting/disconnecting the input/output device cable. Failure to do so could damage the input/output device and NC unit.

4. Items related to screen operation

-  Always keep the touchscreen surface clean. When it gets dirty, remove the dirt immediately. Do not perform any operation on the dirty touchscreen.
-  If the tool compensation amount or workpiece coordinate system offset amount is changed during automatic operation (including during single block stop), the changes will be valid from the command in next block or after several subsequent blocks.
-  All of the various data in the NC memory is erased when formatting. Be sure to use the transfer function to transfer all necessary data to another storage device before formatting.
-  Even if the tool compensation amount write command, parameter write command or variable data write command is executed with graphic check, the data will be actually written in, and the original data will be overwritten.
-  Pay close attention to the sequence operation when carrying out forced data setting (forced output) in the I/F diagnosis screen during machine operation.
-  If a machining surface is selected in the machining surface selection screen, the coordinate system defined along the machining target surface (feature coordinate system) remains selected even when NC reset is executed. However, when it enters the emergency stop state or the menu [Surface cancel] is selected, the machining target surface will be canceled and the selected coordinate system will be back to the machine coordinate system.
-  The program including a character of any language other than the display language is not correctly displayed. Do not edit such a program. Any part of the program other than the comment part may also be changed if edited.

CAUTION

! To prevent influence from data omission and data transformation in the communication circuit, always verify the data after inputting and outputting machining programs.

⊘ Do not change setup parameters without prior approval from the MTB.

5. Items related to programming

⚠ If there is no value after the G command, the operation will be the "G00" operation when the program is run due to key chattering, etc., during editing.

⚠ ";", "EOB", "%", and "EOR" are symbols used for explanation. The actual codes for ISO are "CR, LF" ("LF") and "%". "%" and "EOR" are represented by "%" in ISO.

The programs created on the edit screen are stored in the NC memory in a "CR, LF" format, however, the programs created with external devices may be stored in an "LF" format.

The actual codes for EIA are "EOB (End of Block)" and "EOR (End of Record)".

⊘ Do not change the fixed cycle program without prior approval from the MTB.

6. Items related to operation

⚠ Do not enter the machine's movable range during automatic operation. During rotation, keep your hands, feet and face away from the spindle.

⚠ Carry out dry operation before actually machining, and confirm the machining program, tool offset and workpiece coordinate system offset.

⚠ If the operation start position is set from a block in the program and the program is started, the program before the set block is not executed. If there are coordinate system shift commands or M, S, T, and B commands before the block set as the starting position, carry out the required commands using the MDI, etc. There is a danger of interference with the machine if the operation is started from the set starting position block without carrying out these operations.

⊘ Program so the mirror image function is turned ON/OFF at the mirror image center. The mirror image center will deviate if the function is turned ON/OFF at a position other than the mirror image center.

7. Items related to faults and abnormalities

! If the battery low warning is issued, save the machining programs, tool data and parameters in an input/output device, and then replace the battery. When the battery alarm is issued, the machining programs, tool data and parameters may be destroyed. Reload the data after replacing the battery.

⚠ If the battery low warning is issued in the drive unit side, immediately replace the battery. Replace the batteries while applying the drive unit's control power.

! If the axis overruns or emits an abnormal noise, immediately press the emergency stop button and stop the axis movement.

! Turn OFF the power immediately if any smoke, abnormal noise or odor is generated from the controller, drive unit or motor.

8. Items related to maintenance

⚠ Incorrect connections may damage the devices. Always connect the cables to the indicated connectors.

⚠ Do not apply voltages other than those indicated according to specification on the connector. Failure to observe this could cause bursting, damage, etc.

⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

⊘ Do not connect or disconnect the PCBs while the power is ON.

⊘ Do not connect the cable by pulling on the cable wire.

⚠ Do not short circuit, charge, overheat, incinerate or disassemble the battery.

⚠ Dispose the spent battery according to local laws.

⚠ Dispose the spent cooling fan according to local laws.


⚠ Do not replace the control unit while the power is ON.

 **CAUTION**

- ⚠ Do not replace the operation panel I/O unit while the power is ON.
- ⚠ Do not replace the control section power supply PCB while the power is ON.
- ⚠ Do not replace the expansion PCB while the power is ON.
- ⚠ Do not replace the memory cassette while the power is ON.
- ⚠ Do not replace the cooling fan while the power is ON.
- ⚠ Do not replace the battery while the power is ON.
- ⚠ Be careful that metal cutting chips, etc., do not come into contact with the connector contacts of the memory cassette.
- ⚠ Do not replace the high-speed program server unit while the power is ON.
- ⚠ Before touching the unit, always touch a metal with a ground section to discharge any static electricity in the human body etc. If static electricity is not discharged, the breakdown and the malfunction of the unit are caused.
- ⚠ When connecting to a personal computer and a unit with the RS-232C/USB interface, an electric shock or a unit failure may occur.
Operate these correctly according to the manual of a unit and a personal computer.
Observe the following cautions when a personal computer in an AC power supply is used.
 - (1) For a personal computer that uses a 3-pin power plug or power plug with a ground lead type, make sure to use a plug socket including a ground input electrode or ground the earth lead, respectively.
 - (2) For a personal computer that uses a 2-pin power plug without ground lead, make sure to connect the unit to the personal computer according to the following procedures. And, it is recommended to supply the same power supply line to a personal computer and the unit.
 - (a) Pull out the power plug of the personal computer from the AC outlet.
 - (b) Confirm that the power plug of the personal computer has been pulled out from the AC outlet, and connect RS-232/USB cables.
 - (c) Insert the power plug of the personal computer into the AC outlet.
- ⚠ Before using this product after a long period of storage, performance check must be conducted. Otherwise contact the MTB of your machine tool.

 **CAUTION**

9. Other items

 **MITSUBISHI CNC should be operated and stored under the following environment conditions. Refer to the instruction manual issued by the MTB for details of the environment conditions for the machine tool including the CNC unit.**

Unit name		Control unit		Display unit	Keyboard unit	Operation panel I/O unit
Ambient temperature	During operation	0 to 55°C (M800W/M80W Series)	0 to 58°C (M800S/M80 Series)	0 to 58 °C		
	During storage	-20 to 60 °C				
Ambient Humidity	Long term	10 to 75% RH (with no dew condensation)				
	Short term (*1)	10 to 95% RH (with no dew condensation)				
Vibration resistance		4.9m/s ² [0.5G] or less				
Shock resistance		29.4m/s ² [3G] or less				
Operating atmosphere		No corrosive gases, dust or oil mist				
Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level				

(*1) "Short term" means within one month.

Note

- (1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

Treatment of waste

The following two laws will apply when disposing of this product. Considerations must be made to each law. The following laws are in effect in Japan. Thus, when using this product overseas, the local laws will have a priority. If necessary, indicate or notify these laws to the final user of the product.

- (1) Requirements for "Law for Promotion of Effective Utilization of Resources"
 - (a) Recycle as much of this product as possible when finished with use.
 - (b) When recycling, often parts are sorted into steel scraps and electric parts, etc., and sold to scrap contractors. Mitsubishi recommends sorting the product and selling the members to appropriate contractors.

- (2) Requirements for "Law for Treatment of Waste and Cleaning"
 - (a) Mitsubishi recommends recycling and selling the product when no longer needed according to item (1) above. The user should make an effort to reduce waste in this manner.
 - (b) When disposing a product that cannot be resold, it shall be treated as a waste product.
 - (c) The treatment of industrial waste must be commissioned to a licensed industrial waste treatment contractor, and appropriate measures, including a manifest control, must be taken.
 - (d) Batteries correspond to "primary batteries", and must be disposed of according to local disposal laws.

Disposal



(Note) This symbol mark is for EU countries only.
This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.

This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.

If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:

Hg: mercury (0,0005%), Cd: cadmium (0,002%), Pb: lead (0,004%)

In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!

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(日本語 /Japanese)

本製品は工業用 (クラス A) 電磁環境適合機器です。販売者あるいは使用者はこの点に注意し、住商業環境以外での使用をお願いいたします。

Handling of our product

(English)

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

본 제품의 취급에 대해서

(한국어 /Korean)

이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정외의 지역에서 사용하는 것을 목적으로 합니다.

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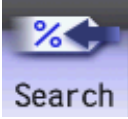


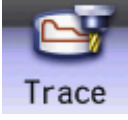
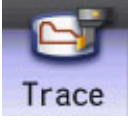




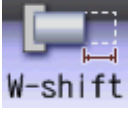

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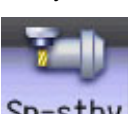










Outline of Menu Items






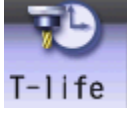



This chapter explains the outline of the menus for each screen.
Refer to the corresponding section for detailed operation.

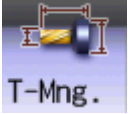










Monitor screen (Monitr)



Menus	Details	Reference
 Search	This executes operation search.	10.1 Operation Search
 Reserch	This executes restart search.	10.4 Restart Search
 Edit	This edits the searched machining program.	10.6 Correcting the Machining Program
M system  Trace L system  Trace	This executes graphic trace.	10.3 Checking the Movement under Machining (Trace Screen)
 Check	This checks the program.	4 Checking a Machining Program on Screen
M system  Offset L system  Offset	This displays the tool compensation amount. A value can also be set for the tool compensation amount.	6.4 Setting Tool Compensation Amount (Tool Offset Screen)
 Coord	This displays the workpiece coordinate system offset. A value can also be set for the workpiece coordinate system offset.	6.8 Setting Workpiece Coordinate System Offset
 W-shift	This displays the workpiece coordinate system shift. <Note> ♦This menu is not displayed for M system, or when the parameter "#11056 Workshift invalid" is set to "1".	6.9 Setting Workpiece Coordinate System Shift
 Dsp sw.	This displays the sub-menu to change the display type of the monitor screen.	10.2.2 Switching the Display Format

Menus	Details	Reference
 Modal	This displays the program modal.	10.2.7 Modal Display
 Tree	This displays the program tree.	10.2.8 Program Tree Display
 Time	This displays the date, time and integrated time, etc. The date, time and integrated time, etc., can also be set.	9.3 Integrated Time
 Com var	This displays the common variables. A value can also be set for the common variable.	3.10.1 Common variable
 Loc var	This displays the local variables.	3.10.2 Local Variables
 P corr	This corrects the buffer.	10.6.2 Buffer Correction
 PLC SW	This turns the PLC switches ON or OFF.	9.8 PLC switch
 G92 set	This sets and cancels the origin.	9.5 Origin Set, Origin Cancel
 Col stp	This executes verification stop.	10.5 Verification Stop
 LdMeter	Use the user PLC to display the spindle load, NC axis load, etc., with a bar graph. The display contents differ depending on MTB specification.	10.2.10 Load Meter Display
M system  Sp-stby L system  Sp-stby	This displays the current spindle tool number and the tool number that is standby to be used next. The display contents differ depending on MTB specification.	10.2.11 Spindle, Standby Display




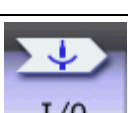
Menus	Details	Reference
	Displays the tool tip coordinate, handle interruption amount (tool axis movement), and tool tip speed. <Note> ♦This menu is not displayed when all the 5-axis-related additional specifications (tool center point control, tool length compensation along the tool axis, tool handle feed & interruption, workpiece installation error compensation, inclined surface machining command, simple inclined surface machining command, 3-dimensional tool radius compensation (tool's vertical-direction compensation), 3-dimensional manual feed, and R-Navi) are disabled.	10.2.12 Tool Center Coordinate Display
	The command rotation speed and actual rotation of all spindles are displayed.	10.2.13 All Spindles' Rotation Speed Display
	This selects a machining surface to apply side machining or inclined surface machining to. <Note> ♦This menu is not displayed when the R-Navi additional specification is disabled.	9.2.4 Surface Selection
	This switches the counter display to replace the currently displayed axis.	10.2.4 Switching the Spindle No. to be Displayed on Counter
	This enlarges the counter to display all axes.	10.2.6 Counter All-axis Display
	An arbitrary value can be set in the relative position counter.	9.4 Counter set
	This executes a manual numerical value command.	9.6 Manual Numerical Value Command

Setup screen (Setup)		
Menus	Details	Reference
M system  Offset L system  Offset	This sets tool compensation amount. Depending on the setting of the parameter "#1046 cmdtyp", there are three types of tool compensation: tool compensation type I/II (M system only), and tool compensation type III. The number of tool compensation sets to be designated or displayed varies depending on the additional specifications.	6.4 Setting Tool Compensation Amount (Tool Offset Screen)
M system  T-meas L system  T-meas	This executes tool measurement. The distance from the basic point to the measurement point is measured by moving the tool to the measurement point manually, and this value can be set as the tool offset amount. <Note> ♦This menu is displayed when the parameter "#8932 Hide measure scrn" is set to "0".	6.3 Measuring a Tool (Tool Measurement Screen)
 T-reg	This registers a tool. A tool No. is assigned to each tool to make the tools installed on the machine recognizable to the NC. The tool No. is registered corresponding to the magazine pot and spindle where that tool is installed, and the standby location.	6.2 Registering a Tool (Tool Registration Screen)
M system  T-life L system  T-life	This manages the tool life data. The life management data such as the tool usage is set and displayed. There are two types of the tool life management method.	6.6 Tool Life Management
 Coord	This sets the workpiece coordinate system offset. The offset value managed by NC can be set and displayed.	6.8 Setting Workpiece Coordinate System Offset
 W-meas	This executes workpiece measurement, it also sets and measures the workpiece coordinate system shift. <Note> ♦This menu appears under any of the following conditions: - The parameter "#8932 Hide measure scrn" is set to "0". - The parameter "#11056 Workshift invalid" is set to "0" for L system.	6.9 Setting Workpiece Coordinate System Shift


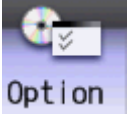







Menus	Description	Reference
M system  T-Mng. L system  T-Mng.	This sets and displays the management data for each tool. These data are relevant to which displayed on the [T-ofs] or [T-life] screen, that can be set the tool information. Thus the mutually-referenced data can be set and displayed on this screen.	6.5 Setting the Tool Management Data (Tool Management Screen)
 MDI	Edit the MDI program. The pop-up window appears to display the MDI program contents by pressing main menu [MDI].	9.7 MDI Program Editing
 Cnt set	This is to set the relative value counter. This displays the pop-up window of the relative position counter to execute the counter setting.	9.4 Counter set
 MST	This sets an arbitrary value for S, M, T and B. Manual numerical value command is set and executed by inputting an address key, such as S, M, T and B.	9.6 Manual Numerical Value Command
M system  T-list L system  T-list	This searches the T command in designated machining program (including the subprograms) and lists it in the order of appearance.	4.4 Checking the Tool Command (T Code List)
 APC Pallet	This registers the machining program per each pallet of the automaticpallet changer (hereinafter APC). <Note> ♦This menu is not displayed when the additional specification for pallet program registration is not added.	9.1 Pallet Program Registration
 User	This sets the user parameters. The parameter can be set and displayed by switching types.	7.1 Setting User Parameters
 Surf	This registers the workpiece and its target surface, on which side surface or inclined surface machining is executed. <Note> ♦This menu is not displayed for L system, or when the R-Navi additional specification is not added.	9.2 R-Navi
 MacCond	This sets the high-accuracy parameter which meets the machining purpose or machining process. <Note> ♦This menu is not displayed when the additional specifications related to high-accuracy control are not added.	7.2 Selecting High-accuracy Control Parameters (Machining Cond I Screen)

Menus	Description	Reference
 Barrier	This sets and displays the chuck barrier and tailstock barrier. <Note> ♦For M system, this menu is not displayed.	8.2 Chuck Barrier/Tailstock Barrier (L System)
 Storage	This stores the thread groove position to enable re-thread machining. <Note> ♦This menu is not displayed when the additional specification for thread recutting is not added.	9.9 Thread Recutting Function




Edit screen

Menus	Details	Reference
 Edit	Edit the machining program.	3 Inputting a Machining Program and Defining Variables
 Check	This checks the program. This function allows you to check the machining program without automatic operations. It can draw machining program movement path (2D), workpiece shape in the cutting process and tool movement (3D), and displays the operation result of NC internal data.	4 Checking a Machining Program on Screen
 NAVI	This allows an operator to interactively set data to create a machining program automatically. The program can be created easily on the interactive pattern input screen. <Note> ♦This menu is not displayed when the parameter "#8996 Simple program ON" is set to "0".	
 I/O	This inputs and outputs the program between the NC internal memory and the external input/output device. <Note> ♦This menu is not displayed when the parameter "#8923 Hide Edit-IO menu" is set to "1".	5 Inputting and Outputting a Machining Program

Diagnose screen (Diagn)

Menus	Details	Reference
 Config	This displays the hardware and software (software No. and version) configurations.	11.2.1 System Configuration Screen
 Option	This displays the details of the additional specifications registered in the NC memory.	11.2.2 Option Display Screen
 I/F dia	This sets and displays input/output signals of the ladder program.	11.5.1 Displaying and Setting the PLC Device Data (I/F Diagnosis Screen)
 Drv mon	This displays drive diagnostic information (servo/spindle/power supply unit).	11.2.3 Display Items for the Servo Axis Unit (Drive Monitor Screen) 11.2.4 Display Items for the Spindle Unit (Drive Monitor Screen) 11.2.5 Display Items for the Power Supply Unit (Drive Monitor Screen) 11.2.6 Display Items for the Synchronous Error (Drive Monitor Screen) 11.2.7 Clearing the Alarm History (Drive Monitor Screen)
 Mem dia	This sets and displays NC internal data.	11.5.2 Writing and Reading the Data Using the NC Data Designation (NC Memory Diagnosis Screen)
 Alarm	This displays a list of currently occurring alarms and their messages.	11.1 Confirming the NC Message (Alarm Screen)
 Self dia	Display the status of the hardware and operation stop.	11.3.1 Self Diagnosis Screen
 NC Smp	This display the hardware and operation stop state.	11.5.3 Collecting the NC Data (Data Sampling Screen)
 Safety	This executes the diagnosis related to functional safety.	11.5.4 Safety Observation Screen

Maintenance screen (Mainte)

Menus	Details	Reference
 Mainte	This performs NC memory format, absolute position parameter setting and maintenance data backup.	11.3.2 Servo Diagnosis Screen 11.3.3 Collecting the Data on the Diagnosis Data Collection Setting Screen
 Param	This sets and displays user parameters and machine parameters.	7 Setting Parameters
 I/O	This inputs and outputs the various data between the NC memory and the external input/output device.	12 Performing a Backup Operation

Screen Operations

This chapter describes the common functions of the screen.

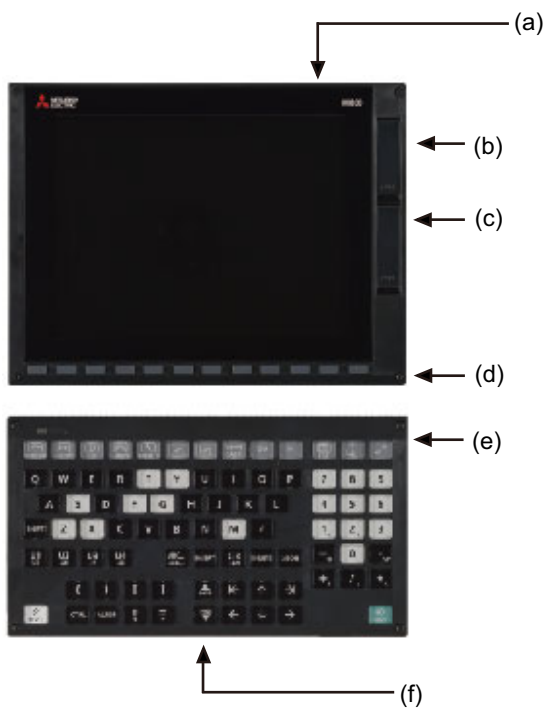
2.1 Display Unit and Keyboard Unit

Setting display unit consists of the display and keyboard unit. (Except for 19-type display unit.)

Names of parts are as follows.

For details on the 19-type vertical display unit, refer to "2.5 19-type Vertical Display Unit and Home Applications".

<Example for 10.4-type display unit and vertical keyboard>






- (a) Display unit
- (b) Front-side USB memory I/F
- (c) Front-side SD card I/F
- (d) Menu keys
- (e) Keyboard unit
- (f) Operation keys

There are other types of keyboard units. Refer to the manual of your machine tool for details.













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































- (1) Do not hit the key repeatedly.

The following keys are provided on the menu key.

Key type	Key	Operation
Menu changeover keys	 (left side)	The displayed screen operation menu is switched to the screen selection menu of the current screen group. This is also used to cancel the menu operations of the displayed screen.
	 (right side)	When all of the menus cannot be displayed at once, this displays the menus not currently displayed. The  marks at the bottom of the screen indicate that there are menus not displayed.
Menu keys		This changes the screen and displays the data.

The following keys are provided on the keyboard.

Key type	Key	Operation
Function keys (Function selection key)	 (MONITOR)	This displays the screen related to "operations".
	 (SETUP)	This displays the screen related to "setup".
	 (EDIT)	This displays the screen related to "editing".
	 (DIAGN)	This displays the screen related to "diagnosis".
	 (MAINTE)	This displays the screen related to "maintenance".
Page changeover keys	 Previous page key	When the displayed contents cover several pages, this displays the contents of the previous page. The "▲" mark at the top of the screen indicates that there is a previous page.
	 Next page key	When the displayed contents cover several pages, this displays the contents of the next page. The "▼" mark at the top of the screen indicates that there is a next page.
Previous screen display keys (Part system changeover)	 (BACK) Previous screen display key	This redisplay the previously displayed screen.
	 (\$↔\$) (\$→\$) Part system changeover key	When using a multi-part system NC, this displays the data of the next part system. The screen does not change if it is a part system common screen or when only one part system is used.
Data setting keys	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 0 1 2 3 4 5 6 7 8 9 + - = / . ; etc.	These keys are pressed to set alphabetic characters, numerals and operation symbols, etc.
Particular keys	? Help key	This displays the operation guidance, parameter guidance and alarm guidance corresponding to the current operation.
	 / 	This varies depending on the MTB specifications.
		
	SFP	
	F0	

Key type	Key	Operation
Data correction keys	 (INSERT) Data insert key	This inputs the data insertion mode. When a data setting key is pressed, a character is inserted in front of the current cursor position. The overwrite mode is entered when the [DELETE], [C.B CAN], [INPUT], cursor or TAB, etc., keys are pressed, or when the screen is changed.
	 (DELETE) Data delete key	This deletes the character just before the cursor position in the data setting area. When editing a program, the character on which the cursor is will be deleted and data after the cursor will move to the left.
	 /   (C.B CAN) Cancel key	This cancels the setting in the data setting area.
Lower-case letter input key	 (LOWER CASE)	This changes the input between upper case and lower case alphabetic characters.
Block end key	 (EOB)	This inputs ";".
Shift key	 (SHIFT)	This validates the setting on the lower line of the data setting key.
Cursor keys	 	This moves the cursor up or down one when setting data in the screen display items.
	 	This moves the cursor one item to the left or right when selecting data in the screen display items.  at cursor left end: Moves to the right end of previous line.  at cursor right end: Moves to left end of next line.
	 	This moves the data input cursor one character to the left or right in the data setting area.
Frame keys	 	This switches the tab.
INPUT key	 (INPUT)	This fixes the data in the data setting area, and writes it to the internal data. The cursor moves to the next position.
RESET key	 (RESET)	This resets the NC.
Menu list key	 (Menu List)	This is function that displays each screen's menu configuration as a list.
Operation keys	 (ALTER)	This is alternate key (Alt key).
	 (CTRL)	This is control key.
	 (SP)	This is space key.
User-defined key	       	Arbitrary character string can be assigned to this key. Up to eight character strings can be registered. For details, refer to "2.12 Assigning Arbitrary Character String to a User-defined Key".

2.2 External Memory Interface

There is an external memory interface on right side of display unit.



Refer to the manual issued by MTB for the installation position of side memory interface unit.

Front-side SD card interface/Front-side USB memory interface

It can insert a SD card or a USB memory.

Following operations are available for the stored data in the SD card or USB memory.

- Data input/output
- Machining program (text file) editing
- Machining program operation
- External search by PLC signal

Precautions

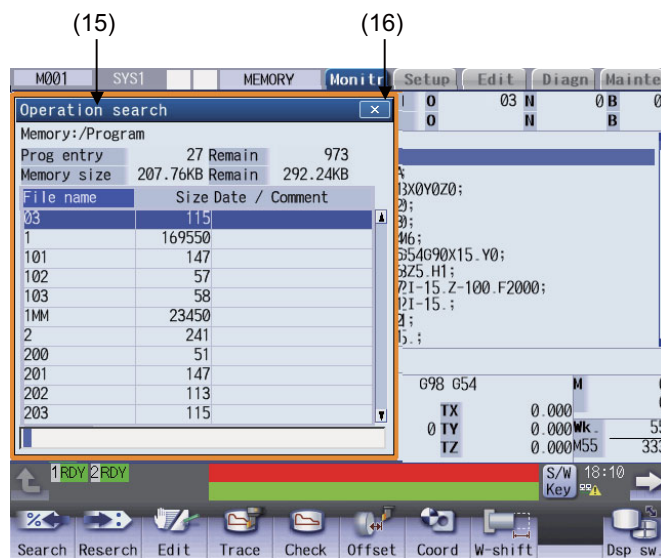
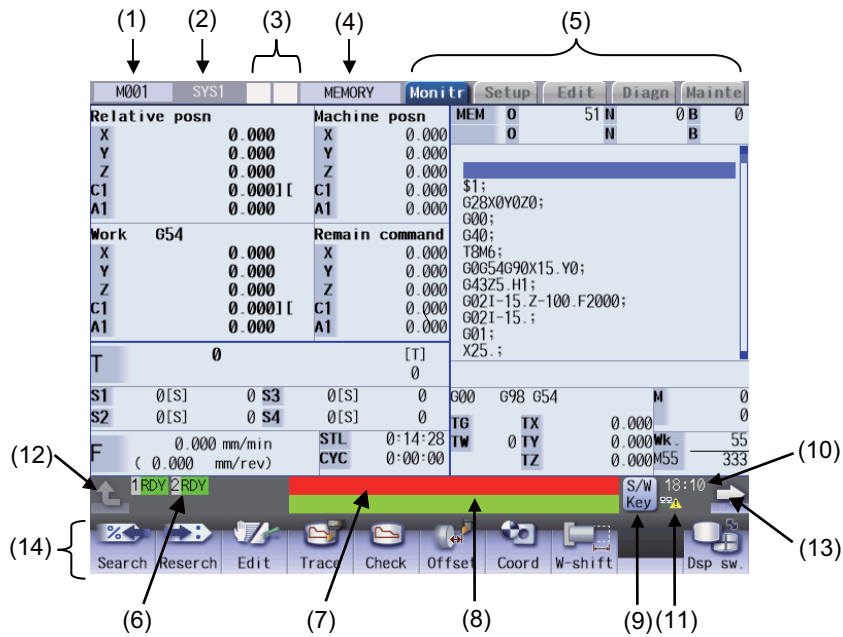
- (1) MITSUBISHI will not provide performance guarantee and maintenance for commercially available SD card or USB memory. In case of using, careful performance check must be required.
Commercially available devices may not be compatible with MITSUBISHI units or suitable FA environment for temperature- or noise-wise.
- (2) When inserting/removing an SD card, turn the MITSUBISHI device's power OFF.
- (3) When Inserting/removing a USB memory just after the device's power is ON, be sure to have enough interval to perform that (about 10 seconds or more).
- (4) Machine vibration may cause the USB memory to fall out depending on environment. Therefore, the operation with the front-side USB memory is performed to handle on your own responsibility.
- (5) Do not pull out the card or turn OFF the power during access to the SD card. Failure to observe this could cause the memory contents to be erased.
In case of emergency, always perform backups by having your important data duplicate, etc. as MITSUBISHI will not guarantee the broken or lost data.
Refer to the manual of your SD card or USB memory for details.
- (6) Do not connect a device other than a USB memory device. (including extension cable and USB hub, etc.)
- (7) Keep the external memory interface cover closed except when in front-side USB memory mode.
- (8) Precautions for use
 - Insert the card in the correct direction.
 - Do not touch the connector area with hands or metal.
 - Do not apply excessive force to the connector area.
 - Do not subject the card to bending or strong impacts.
 - Do not open the cover or disassemble the card.
 - Do not use the card in dusty locations.
- (9) Precautions for storage
 - Do not store the card in locations having a high temperature or humidity.
 - Do not store the card in dusty locations.

2.3 Standard Screen

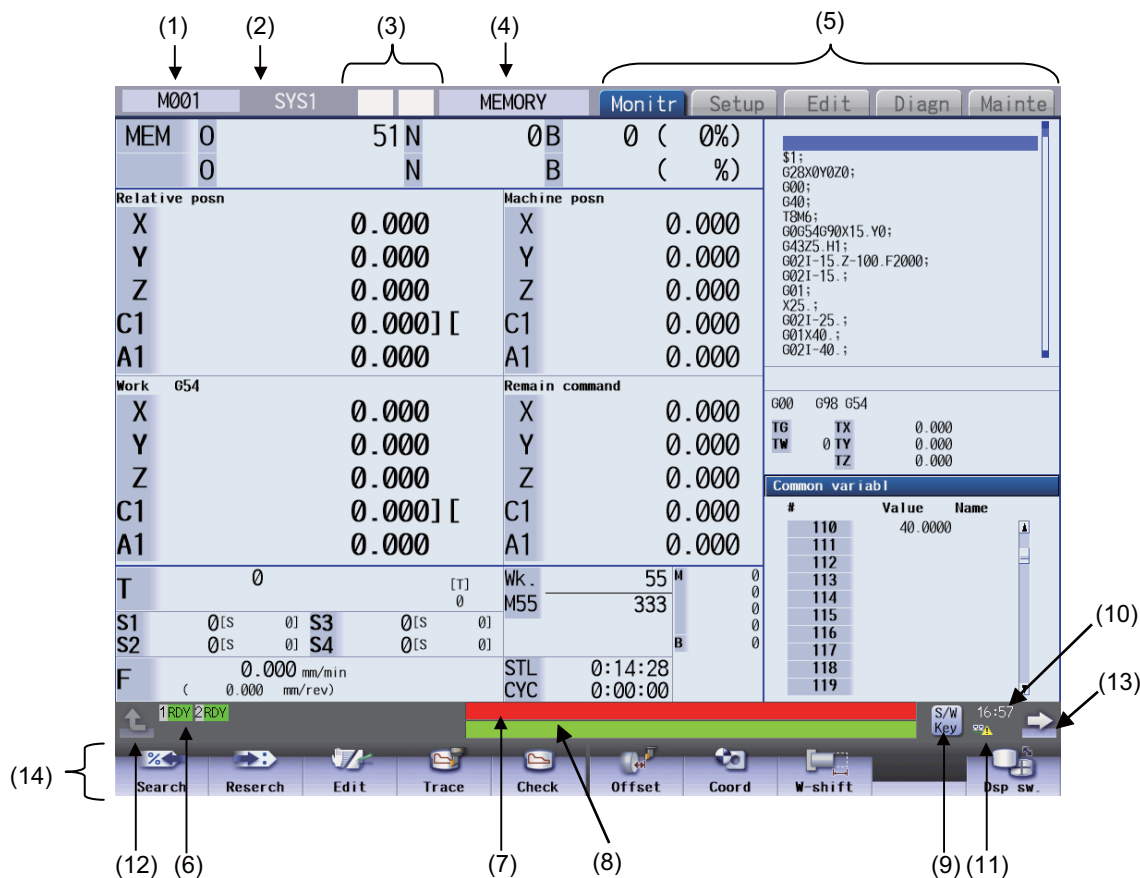
Note

(1) In this manual, a screen with no size indicated is intended for the 10.4-type display unit.

- 8.4-type/10.4-type



- 15-type/19-type




Display items

Display items	Details
(1) Unit name/icon display/ transition button to home screen	The display is changed in the following order of priority: 1. Transition button to home screen When the home screen display is valid by the parameter "#11080 HomeScreen display", the transition button to home screen is displayed. When the home screen display is invalid, either icon display or unit name is displayed. 2. Icon display When there is an icon prepared by MTB, the icon is displayed. When there is no icon prepared, the unit name is displayed. 3. Unit name The currently displayed unit name (name set in the parameter "#1135 unt_nm") is displayed. When the unit name is not set, it is not displayed.
(2) Part system name	When you use the multi-part system, the name of currently displayed part system (name set in the parameter "#1169 part system name", or name set in the parameter "#12059 SBS_name" for operating as the sub part system) is displayed. The part system name is not displayed for the 1-part system. When the values are not set in the parameter, "'\$' + (part system number)" is displayed. (Example) \$2 for the 2nd part system. When the values are not set in the parameter for the name of sub part system, "SUB + (part system number)" is displayed. (Example) SUB2 for the 2nd part system.
(3) NC Status	The current NC status is displayed. When the status is multiple, the high-priority contents are displayed.
(4) Operation mode/MDI status	The displayed part system's operation status is displayed. The MDI status is also displayed when the MDI operation mode is selected.

Display items	Details
(5) Screen group	The currently selected screen group is displayed.
(6) Operation status	The NC operation status is displayed.
(7) Alarm message	The highest-priority message among the currently occurring alarms or warnings is displayed.
(8) Operation message	The operation message is displayed.
(9) S/W Key button	When the button is touched, the software keyboard is displayed. The [S/W key] button is not displayed when the parameter "#11010 Software keyboard" is set to "0". However, when the NC keyboard is not mounted, the [S/W key] button is displayed regardless of the parameter setting.
(10) Time	The current time is displayed. (hour:minute)
(11) Host connected status	This appears in the form of an icon when the parameter "#8931 Display/Set limit" is "0" or "1", and the other host PC or display unit is connected.
(12) Menu return button	The displayed screen operation menu is switched to the screen selection menu of the current screen group. This is also used to cancel the menu operations of the displayed screen.
(13) Menu change button	When all menus cannot be displayed at a time, the menus other than currently displayed menus are displayed.
(14) Menus	This is used to switch the screen, select the screen specific operation, etc.
(15) Window name	Then name of currently displayed window is displayed.
(16) Close button	When the button is touched, the window is closed.

2.3.1 Displayed Part System

Changing the part system with  key


Press  key to change the displayed part system.

The displayed part system No. is counted up by one each time the key is pressed. If the displayed part system No. exceeds the parameter "#11055 Disp. sysno", the displayed part system No. returns to "1".

Changing the part system with a touchscreen

Displayed part system will change when the part system name on the touchscreen is pressed. The displayed part system No. is counted up by one each time the key is pressed. If the displayed part system No. exceeds the parameter "#11055 Disp. sysno", the displayed part system No. returns to "1".

Restrictions when changing the displayed part system

The operation to change the displayed part system by the  key or touchscreen is restricted by the setting of parameter "#11035 Sys. change limit".

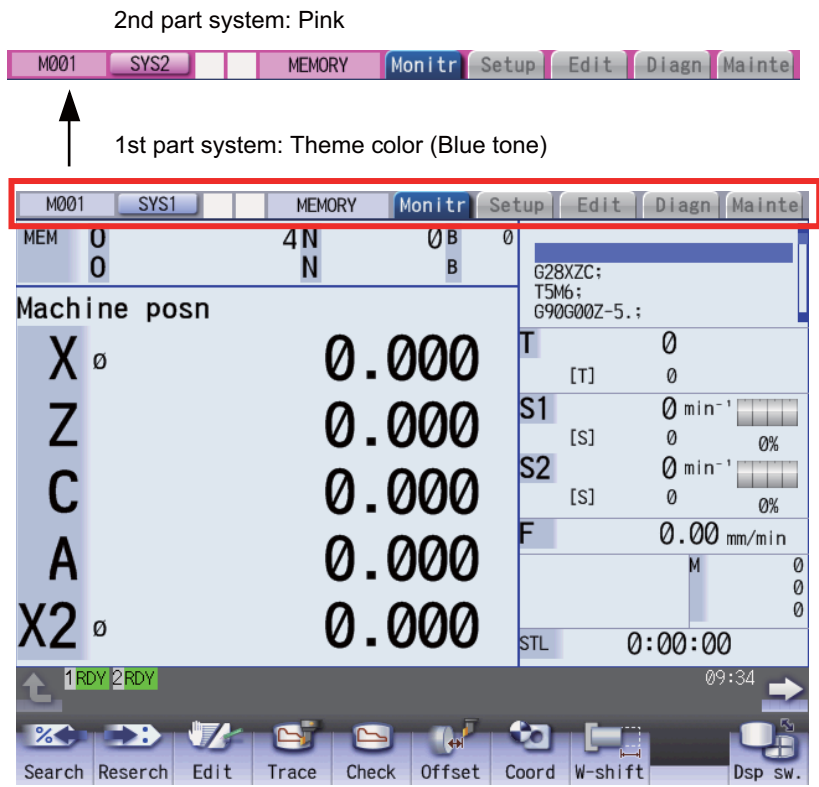
Setting the color of displayed part system

The color combination for the top left of the screen and the window title can be changed with the setting of parameters "#8942 \$1 color" to "#8945 \$4 color", "#8962 \$5 color" to "#8965 \$8 color". Each part system can have a unique color combination which makes easy to understand the displayed part system.

When the part system is changed, the color of the upper left of the screen changes according to the setting with each parameter. A color set with "#8942 \$1 color" will be displayed for the 1st part system.

When the color of displayed part system is changed, the display of part system name changes to the button image.

[Setting example] When "1" is set to the parameter "#8942 \$1 color", "2" is set to the parameter "#8943 \$2 color", and "1" is set to the parameter "#11060 Screen theme color".



Note

(1) When "1" is set, the color is changed depending on the setting of the parameter "#11060 Screen theme color".

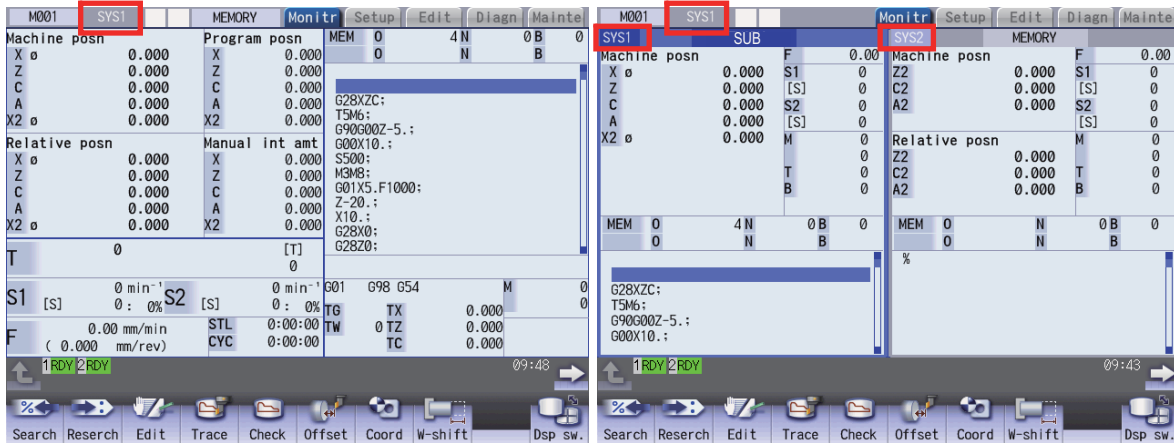
Displaying the sub part system name

When the part system operates, which is set to sub part system with the parameter "#12049 SBS_no", the sub part system name can be displayed as the part system name. The name can be set with parameter "#12059 SBS_name".

Display area for the part system names shown in the following figures can switch main/sub part system display according to NC operation status.

[1-part system display]

[2-part system display]



2.3.2 NC Status

The display area for NC status indicates current NC operation status. (nothing is displayed in normal condition.)

When the NC operates with three or more status, the higher-priority two status are displayed. (The items in the following table are listed in order of priority.) While any status is being displayed, this indicator flashes at intervals of approximately 1 second.

Display position	Display items	Meaning
Left side	PR	The parameter has changed, and it requires turning the power ON again. The parameter will be validated after turning the power ON.
Right side	AT	Indicates when auto tuning is valid. In this case, the automatic start is disabled.
	HC	Indicates when the high cycle sampling is valid.
	RN	Indicates when selecting machining surface.
	BT	Indicates when backlash auto adjustment is ON.

2.3.3 Operation mode/MDI status

The displayed part system operation mode and MDI status are displayed.

When the operation mode or MDI status is changed, the display changes as follows.

Display	Details	Details
Memory	Memory operation	Automatic operation is based on programs stored in the memory.
TAPE	Tape operation	Automatic operation is based on tape command (RS232C input) programs stored in NC tape.
MDI NON	No MDI setting	Automatic operation is performed with the program set in the MDI screen.
MDI SET	MDI setting completed	
MDI RUN	MDI running	
Manual feed	Jog	The jog feed mode enables the axis to be moved by hand consecutively at the feed rate set by using the MANUAL FEED RATE switch.
Manual handle	Manual handle	The handle feed mode enables the axis to be moved by turning the manual handle. The travel distance per graduation of the handle depends on how the "HANDLE/INCREMENTAL MAGNIFICATION" switch is set.
Step	Step	The step feed mode enables the axis to be moved by hand at feed rate when the "FEED AXIS SELECT" switch is ON. The travel distance per graduation of the handle depends on how the "HANDLE/INCREMENTAL MAGNIFICATION" switch is set.
MANUAL	Manual arbitrary feed	This mode enables to move manually with arbitrary amount or arbitrary positioning position.
Reference position return	Reference position return	This mode enables a controlled axis to be returned manually to the defined position unique to the machine (reference position).
INIT-SET	Automatic dog-less reference position return	This mode enables this mode to manually push against the machine end stopper and carry out zero point return.
Rapid traverse	Rapid traverse	The rapid traverse feed mode enables the machine to be moved consecutively at rapid traverse rate manually.
JOG+HND	Jog + Handle	This is the jog and handle synchronous feed mode.
RAP+HND	Rapid traverse + Handle	The rapid traverse and handle can be used simultaneously.
NO MODE	No operation mode	The operation mode is not selected.

2.3.4 Operation Status

The operation status displays the currently selected NC operation status for each part system. (The maximum number of the part system which can be displayed.)

The inverted number expressing the part system No. is not displayed for 1-part system.

Symbol	Details	Character color	Background color
EMG	In emergency stop	White	Red
RST	Resetting NC	White	Dark gray
BST	In block stop	White	Dark gray
HLD	Operation halted	White	Dark gray
SYN	Synchronizing	White	Dark gray
CRS	Cross conversion waiting	White	Dark gray
AUT	In automatic operation	White	Dark gray
RDY	Operation completed state	Black	Green

2.3.5 Alarms/Warnings

When an alarm or warning occurs, the alarm No. and alarm message character string are displayed.

(Example) Warning message display

SYS2 M01 No operation mode

Type	Details	Character color	Background color
NC alarm message	The operation alarm, program error, MCP alarm, servo alarm, or system alarm which is currently occurred is displayed.	White	Red
NC warning message		Black	Yellow
PLC alarm message	The message such as the machine error contents is displayed using user PLC.	White	Red
PLC operator message	The operator information message is displayed using user PLC.	Black	Yellow
NC alarm message at the background check	The message is displayed when a program error occurs during the check, or when the macro alarm message (message display by #3000 variable command) is displayed.	White	Orange

The display format of PLC alarms and operator messages can be selected by the parameter "#11021 PLC mesg disp type".

0: Display up to the first 40 characters.

1: If text is longer than 40 characters, divide it into two and display separately. (Classification No. is displayed together)

2.3.6 Operation Messages

(Example)

Search completed

Type	Details	Character color	Background color
Operation messages	This displays the messages for operation.	Black	Yellowish green

The operation message can be reset by pressing any key.


2.3.7 Menus

The menu can be used to select screens and to select functions or setting items. Up to ten menus can be displayed at once.


[When using the keyboard for operations]

To select the menu, use the menu key below the menu display.

To change the menu, use the menu changeover key.

: The operation menu is canceled.


The screen selection menu for the currently displayed screen group appears.

: When there are more than 11 menus, this key displays the remaining menus.


[When using the touchscreen for operations]

To select a menu, touch the desired menu.

To change a menu, touch  (menu changeover key).

: The operation menu is canceled.

The screen selection menu for the currently displayed screen group appears.

: When there are more than 11 menus, this key displays the remaining menus.

If you flick the menu rightward (quickly run your fingertip rightward along the screen), the menu slides, and changes to the next menu.

Note

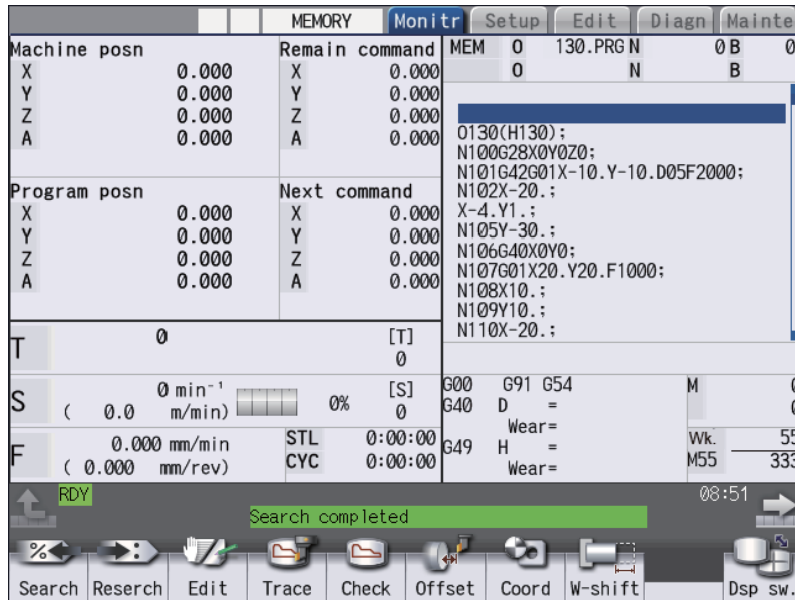
(1) The 8.4-type display unit does not support touchscreen.

2.3.8 Changing the Screen Theme Color

The theme color (display color) of the entire screen can be changed with the setting of the parameter "#11060 Screen theme color".

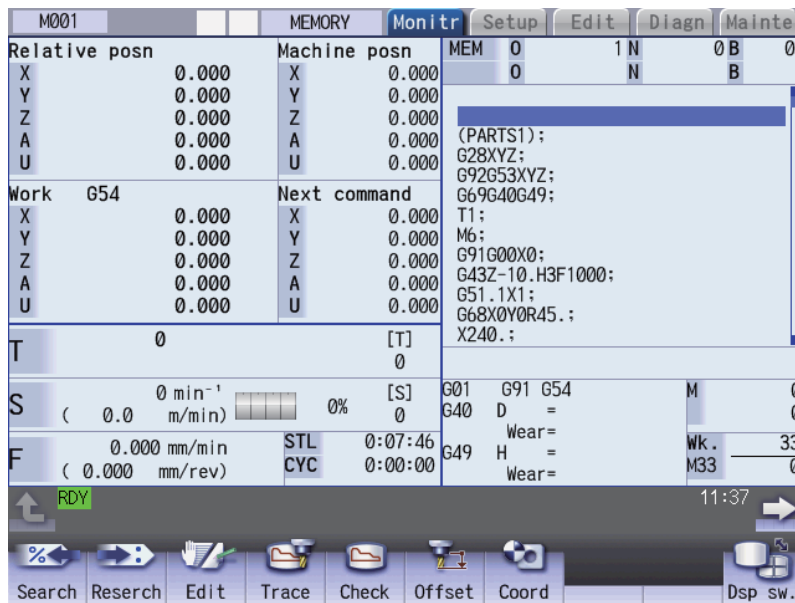
[Parameter "#11060 Screen theme color" is set to "0" (standard color (gray tone))]

<Example of monitor screen>



[Parameter "#11060 Screen theme color" is set to "1" (blue tone)]

<Example of monitor screen>

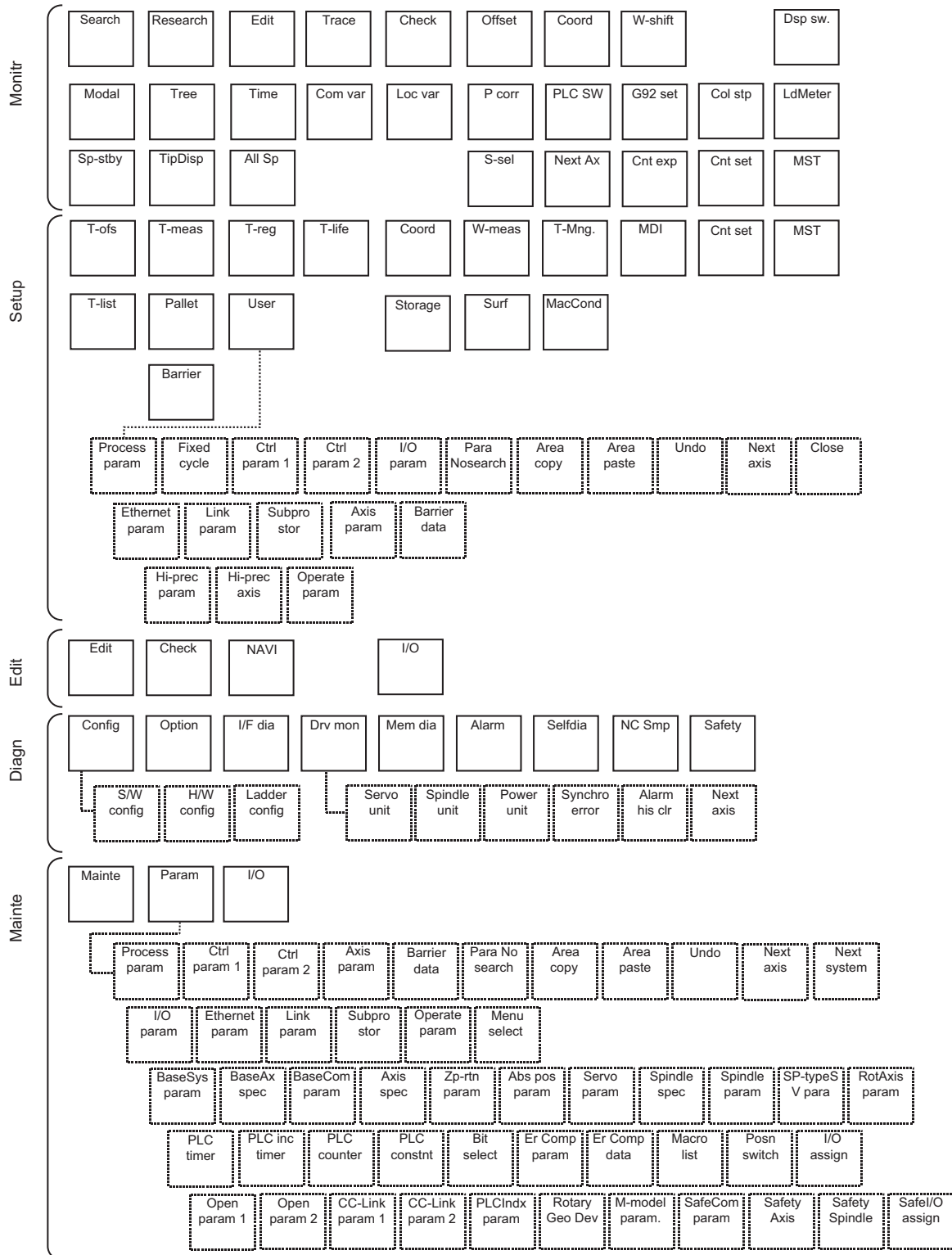


2.3.9 Screen Transition Diagram

The screen is configured of operation groups. The screen selection can be done by switching the tab on the top of the screen or pressing the function key such as [MONITOR] and [SETUP].

Note

- (1) The display contents differ depending on MTB settings.
- (2) You can freely relocate the main menus of the monitor (Monitr), setup (Setup) and edit (Edit) screens. For details, refer to "2.11 Menu Customization Function".



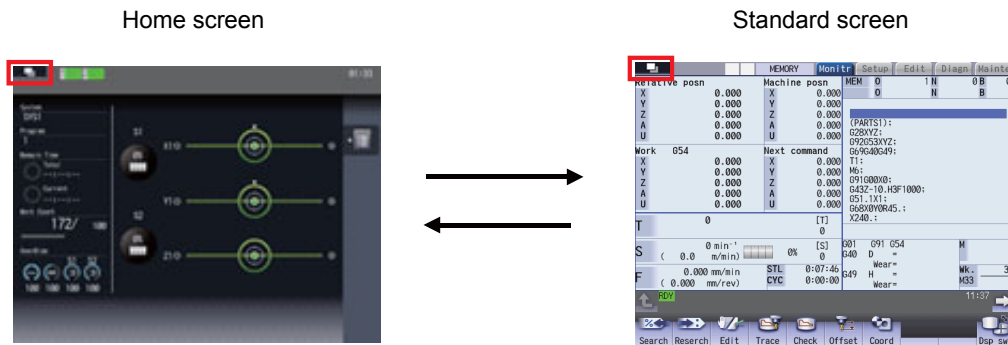
2.4 Home Screen


On the home screen, the machine state (spindle load, linear axis/rotary axis position, etc.) can be displayed and monitored. Also, each application can be called by pressing the application button on the home screen. Registered applications differ depending on MTB.

The home screen display can be selected from the three options (Not display/Display (displayed at the power ON)/Display (not displayed at the power ON)) using the parameter "#11080 HomeScreen display".

2.4.1 Switching between Standard Screen and Home Screen

You can switch between the standard screen and home screen with the switch button on the upper left of the screen.



The window display key () performs the same function.

The screen can be changed to the specified screen directly by pressing the function key such as MONITOR or SETUP.

Note

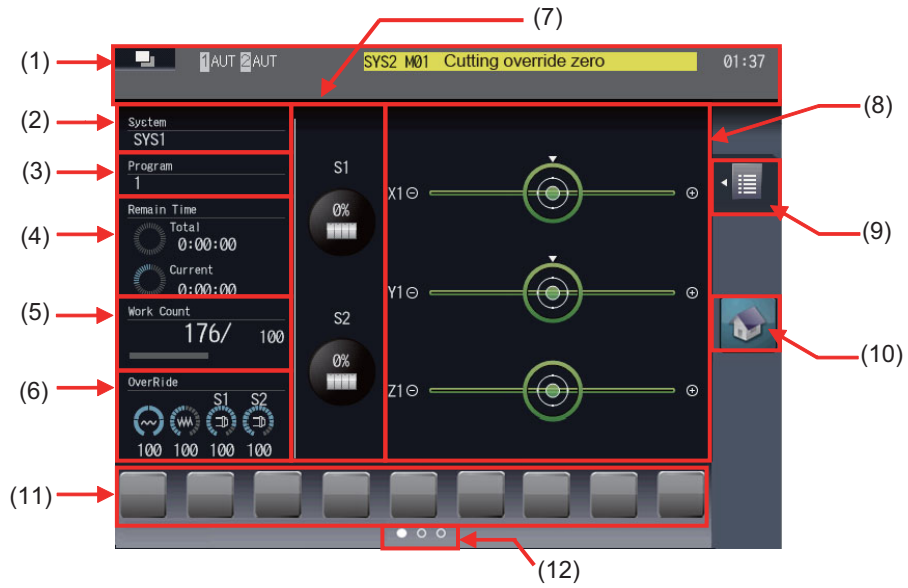
- (1) When you move to the home screen with any window, including the operation search window, open, the window is closed. After you return to the standard screen, the window remains closed.
- (2) The menu list or guidance does not appear while the home screen is displayed.
- (3) When you move to the home screen with the software keyboard displayed, the keyboard is closed.

<For 19-type vertical display unit>

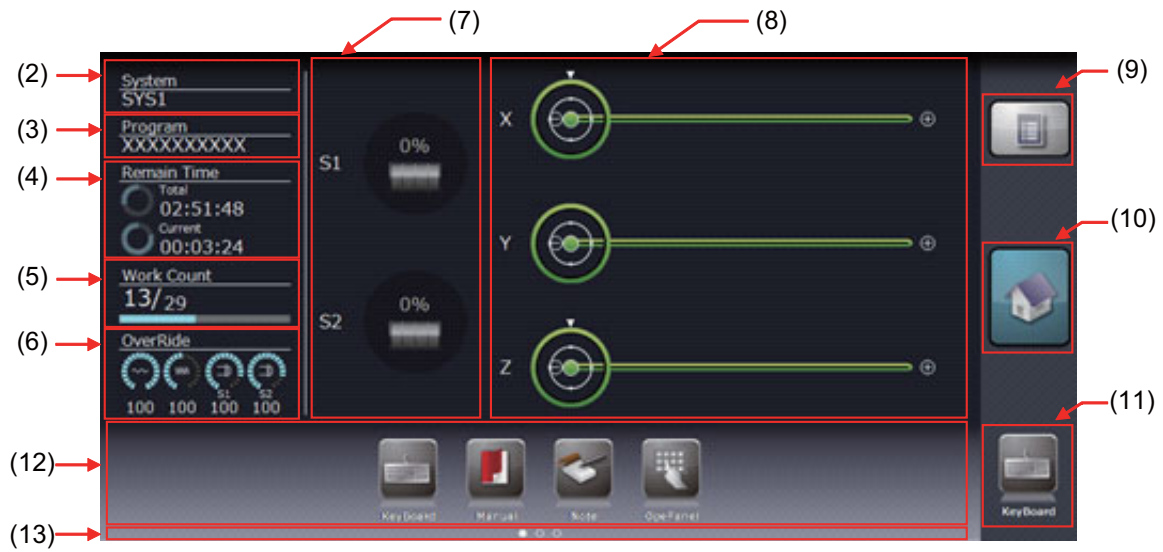
Home application screen is displayed on the bottom of the standard screen. For details, refer to "2.5 19-type Vertical Display Unit and Home Applications".




2.4.2 Screen Configuration


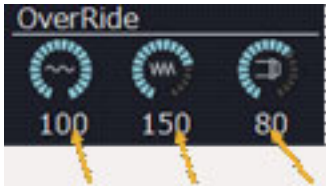




<For 19-type vertical display unit>



Display items

Display items	Details
(1) Fixed display part (*1)	<p>The following items are displayed.</p> <ul style="list-style-type: none"> •Standard screen switch button When you touch the button, the screen is changed to the previously displayed standard screen. The window display key () performs the same function. •Operation status The NC operation status is displayed. •Alarm messages Currently occurring alarm or warning is displayed. For details, refer to "2.3.5 Alarms/Warnings". •Operation messages •Time (h:m)
(2) Part system name	<p>When you use the multi-part system, the name of currently displayed part system (name set in the parameter "#1169 part system name", or name set in the parameter "#12059 SBS_name" for operating as the sub part system) is displayed.</p> <p>The part system name is not displayed for the 1-part system.</p> <p>When the values are not set in the parameter, "\$ + (part system number)" is displayed. (Example: \$2 for the 2nd part system)</p> <p>When the values are not set in the parameter for the name of sub part system, "SUB + (part system number)" is displayed. (Example) SUB2 for the 2nd part system</p> <p><For 19-type vertical display unit></p> <p>Displays the name of part system which is selected in the home application when the name of each part system (the parameter "#1169 part system name") has been set.</p> <p>When the values are not set in the parameter, "SYS + (part system number)" is displayed. (Example: SYS2 for 2nd part system)</p>
(3) Machining program	<p>Displays the name of machining program being in the operation search.</p> <p>The name of main program is displayed when the main program is being executed, and the name of sub program is displayed when the sub program is being executed.</p> <p>If the program name is 14 characters or longer, first to 13th characters are displayed.</p>

Display items	Details
<p>(4) Remaining machining time</p>	<p>Displays the remaining machining time and reference information of progress rate based on the time from the cycle start to the M command specified with the parameter "#8001 WRK COUNT M" or from the cycle start to M02/M30 command, that is memorized as the machining time per one machining.</p> <p>To display the total time, the workpiece machining count (parameters "#8001" to "#8003") must be specified.</p> <p><Note></p> <ul style="list-style-type: none"> •Time of one machining program which is most recently executed is memorized as the machining time. •If the target program has never been executed after the operation search, the remaining machining time and remaining machining rate are not displayed, but "--:--:--" is displayed. •When the operation search or restart search is executed, the remaining machining time and remaining machining rate are not displayed, but "--:--:--" is displayed. •When the restart search or sequence No. search is executed, the time from the search point is memorized as the machining time. •When reset is performed during the machining, the display returns to the previous state before the machining. When re-machining is performed after the reset, the time from the beginning of re-machining is memorized as the machining time. •When the integrated time is set with variables during the machining, the memorized machining time may not be displayed properly.
	<p>Total</p> <p>Displays the remaining time and progress rate of the machining for all workpieces.</p> <p><Display example></p> <p>Progress rate of the machining = 25% and the remaining machining time = 12 hours 34 minutes 56 seconds</p>  <p>Progress rate of machining Remaining machining time</p>
	<p>Current</p> <p>Displays the remaining time and progress rate of the machining of a workpiece.</p>
<p>(5) Work count</p>	<p>Displays the number of machining times at present (number of machined workpieces/total number of workpieces to be machined) and the proportion.</p> <p>The display depends on the number of workpiece machining that has been set with the parameters "#8001 to #8003".</p> <p>However, when the parameter "#8001 WRK COUNT M" is set to "0", M command is not counted and the work count is not displayed.</p>
<p>(6) Override</p>	<p>Displays the rapid traverse override (%), cutting feed override (%) and spindle override (%).</p> <p>The rapid traverse override is displayed in the range of 0 to 100%, the spindle override is displayed in the range of 0 to 120%, and the cutting feed override is displayed in the range of 0 to 200%.</p> <p><Display example></p> <p>Rapid traverse override 100%, Cutting feed override 150%, and Spindle override 80%</p>  <p>Rapid traverse Cutting feed Spindle</p>

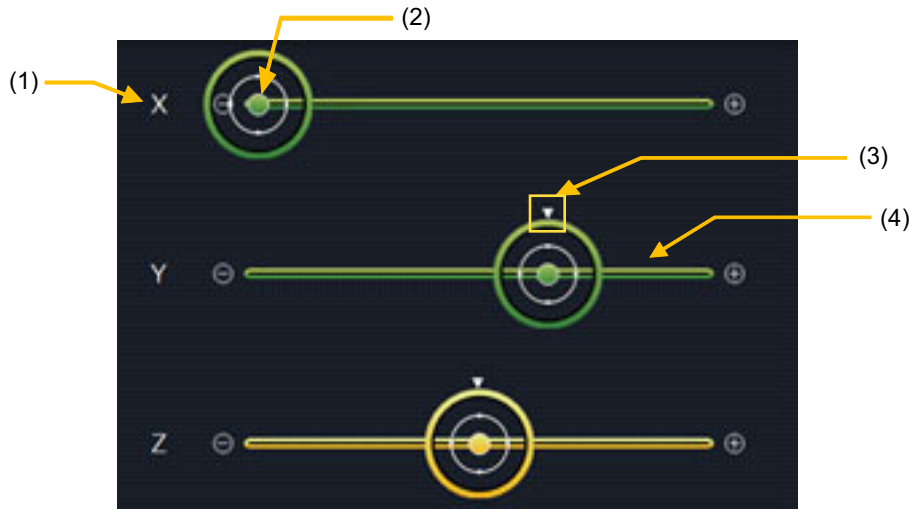
Display items	Details
(7) Spindle	<p>Displays the spindle load rate (%) with the graph and numeric. Up to two spindles can be displayed per part system. The displayed color of graph varies depending on the spindle load condition. The thresholds of the displayed color (caution/warning) are made in accordance with the parameters (#3192 to #3194). <Display example></p> <p>(Normal: Green) (Caution: Yellow) (Warning: Red)</p> 
(8) Machining axis	<p>Displays the position and load condition (load) of linear axes and the position of rotary axes by animation. Up to three linear or rotary axes can be displayed per part system. Refer to the explanation in next section for details.</p>
(9) Operation menu button	<p>Displays the operation menu for each screen. Home screen: Operation menu to switch the displayed part system Each application: Operation menu for each application (Refer to the specifications issued by MTB for details.)</p> <p>Touch the operation menu button to display/perform the menu. The same operation can be performed with the following keys:</p> <p>Show/hide the operation menu: menu list key () Select/move the menu: cursor keys Determine the menu: [INPUT] key</p>
(10) Home button	Returns to the home screen.
(11) Shortcut button (*2)	<p>This is the application button to switch to the application set by MTB and always displayed on any screen. Two applications can be registered on the shortcut button, and first registered application is usually displayed on the shortcut button. The second registered application is displayed on the shortcut button during the activation of the first registered application.</p>
(12) Application button	<p>Switches to each registered application. Application buttons can be deleted.</p>
(13) Page position	Displays the page position of application buttons.

(*1) This is not displayed on the 19-type vertical display unit.

(*2) This is displayed only on the 19-type vertical display unit.

Machining axes display

The position and load condition of linear axes and the position of rotary axes are displayed by animation.



Display items	Details
(1) Name of linear axis	Displays the specified linear axis name which has been set with "#1013 Axis name". Only linear axis name is displayed, but the rotary axis name is not displayed.
(2) Linear axis position display	<p>Indicates the linear axis position (disk-shaped figure) by animation. When the axis moves, the disk-shaped figure shifts right and left in accordance with the machine position.</p> <p>The range of coordinate position is determined by the parameters "#2013 OT-" and "#2014 OT+".</p> <p>If the parameters are not set, the operation is performed in the range of -1000.000 to 1000.000.</p> <p><Display example> OT- = -40.000, OT+ = 300.000, and Machine position = 130.000</p>
(3) Rotary axis position display	<p>Indicates the rotary axis position (triangle mark on the disk-shaped figure) by animation.</p> <p>The triangle mark moves to upper side of the disk-shaped figure for 0 degree and moves to lower side of the disk-shaped figure for 180 degree.</p>
(4) Linear axis load condition display	<p>The displayed color of the bar changes depending on the linear axis load condition (load value).</p> <p>The bar is colored with green for normal state, yellow for caution and red for warning.</p> <p>The thresholds of the displayed color (caution/warning) are made in accordance with the parameters "#2643 LdMeter thresholdY" and "#2644 LdMeter thresholdR".</p>

2.4.3 Switching Displayed Part System from the Operation Menu

When you touch the operation menu [System Switching] and select the part system (SYS1, etc.) that appears at the touch, the display switches to the selected part system.

(Example: Switch to 2nd part system)

(1) Touch the operation menu button.



The operation menu is displayed.



(2) Touch the menu [System Switching].



Names of selectable part systems are displayed. Currently selected part system is highlighted.

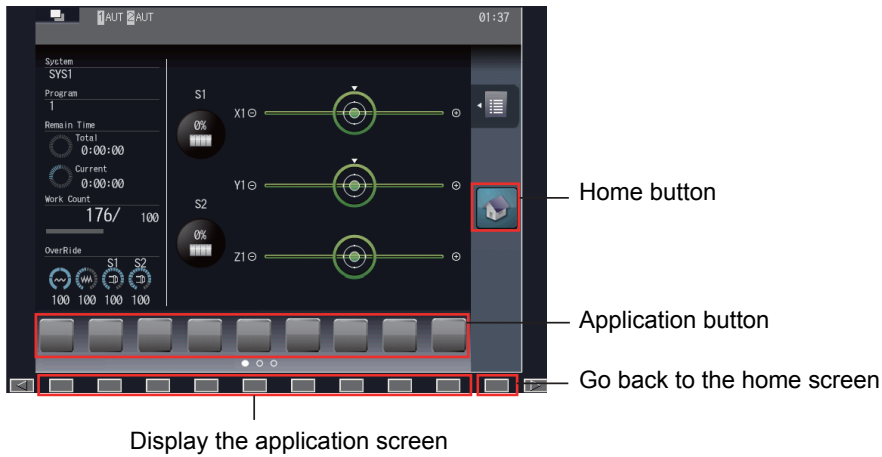
(3) Touch [SYS2].



The operation menu is closed, and the displayed part system is changed to the 2nd part system.



2.4.4 Operating the Application

To move to the application button screen, touch the application button on the bottom of the screen. The same operation can be performed by touching the 1st to the 9th menu keys from the left.







Touch the home button to go back to the home screen. The same operation can be performed by touching the 10th menu key from the left. For a full-screen application, however, follow the operation specifications of each application.

Operating the application menus





The operation for each application can be selected by touching the operation menu button () or pressing the menu list key ().

However, as some applications are displayed in full-screen mode, the operation menu button may not be displayed.

■Operating with the operation menu button

- (1) Touch the  button.  The main menu is displayed.
- (2) Select the main menu.  The sub-menu is displayed on the left of the main menu.
- (3) Touch the sub-menu to be executed.  The menu disappears and the display goes back to the application screen. On the application screen, the selected sub-menu is executed.

■Operating with the menu list keys

- (1) Press the  key.  The main menu is displayed.
- (2) Use the cursor key [↑] or [↓] to select the main menu.
- (3) Press the cursor key [←].  The sub-menu is displayed on the left of the main menu.
- (4) Use the cursor key [↑] or [↓] to select the sub-menu to be executed.
- (5) Press the [INPUT] key.  The menu disappears and the display goes back to the application screen. On the application screen, the selected sub-menu is executed.

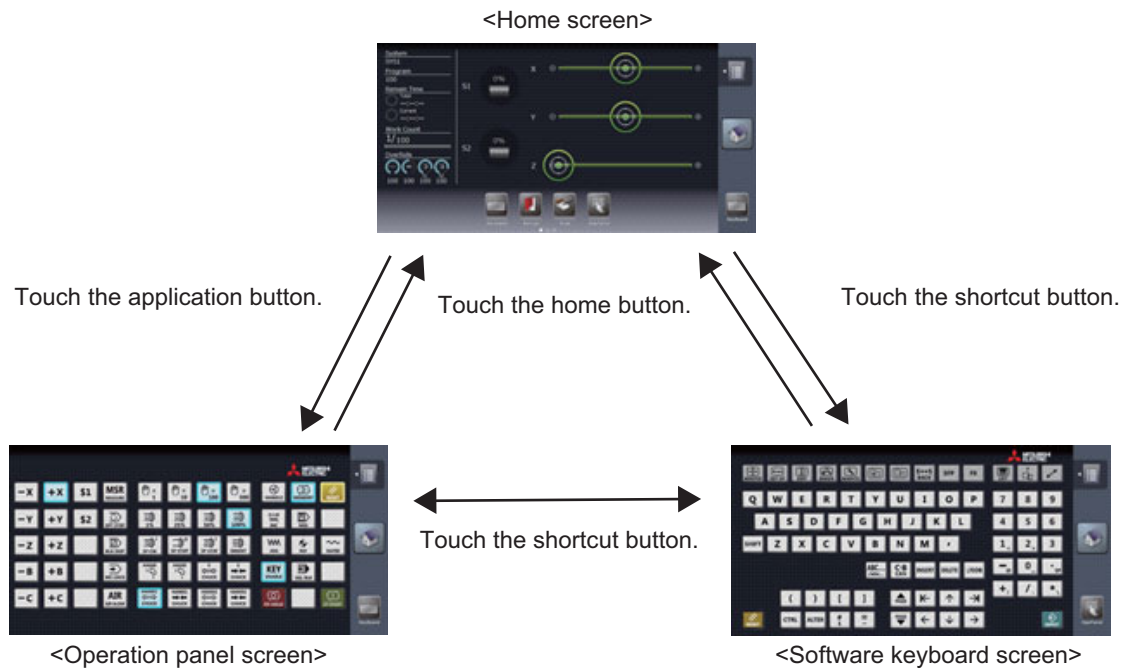
2.5 19-type Vertical Display Unit and Home Applications

19-type vertical display unit has the expansion applications that display the machine status, software keyboard, etc. in the lower half of the screen in no linkage with the upper half.

The following expansion applications are provided as standard MITSUBISHI specifications:

- ◆Home screen (machine state display)
- ◆Software keyboard
- ◆Software operation panel
- ◆Manuals
- ◆Notepad

MTB unique applications can also be added.



2.5.1 Home Screen (Machine Status Display)

Refer to "2.4.2 Screen Configuration" for details of the display items on the home screen.

Switching to a registered application

The screen can be switched to the registered application by touching the shortcut button or one of application buttons.

Note

(1) The expansion application registered to the shortcut button differs depending on MTB specifications.

Switching to the home screen

Each application screen can be switched to the home screen (machine state display) by touching the home button.

Switching the pages of application buttons

The pages can be switched by flicking the application button area.

Deleting an application button

Each application button can be deleted by touching the delete menu.

- (1) Touch and hold an application button to be deleted for seconds.
- (2) Release your finger when the application button icon becomes the movable state.
- (3) The delete menu appears. Touch the delete menu.
- (4) Touch the [OK] button in the pop-up window to delete the application button.

Rearrange the application buttons

Application buttons can be rearranged by drag-and-drop operation.

Note

(1) When the application buttons on the page you moved are maximum numbers (7 pcs), the latest registered icon goes to next page.

Changing the displayed part system for the home screen

A displayed part system can be switched by selecting the name of part system to be displayed (SYS1, etc.) on the menu [System Switching] of the operation button.

- (1) Touch the operation menu button.
- (2) Touch [System Switching] on the main menu. Selectable part system names are displayed on the sub menu. Select a part system name to be displayed, and the display changes.

Registering an application button

Application buttons can be registered from the application list displayed on the menu [Add Application] of the operation menu button.

- (1) Touch the operation menu button.
- (2) Touch [Add Application] on the main menu.
- (3) The list of applications which can be registered to application button is displayed on the sub menu.
- (4) Touch the application to be registered.
- (5) Touch the [OK] button in the pop-up window to add the application button.

Note

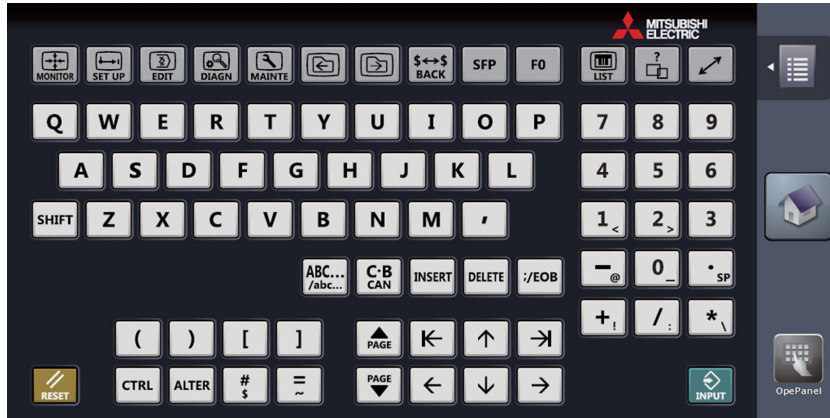
- (1) When the displayed page contains the maximum number of application buttons (seven buttons), the button will be added to the end of next or succeeding page which contains the application buttons less than seven. The page of which the application button is added is displayed.
- (2) If all pages contain the maximum number of application buttons (seven buttons), the error message appears.

Displaying the application version

The version of application for 19-type vertical display is displayed by [Version] of the operation button.

2.5.2 Keyboard Application

The keyboard application enables the key input by touching buttons.



Display items

For details on the keys, refer to "2.1 Display Unit and Keyboard Unit".

This section explains only keys which have different meanings with the keyboard application.

Key type	Key	Operation
Window operation key		Displays the menu list window.
		Displays the parameter/operation guidance window.
	SHIFT +	Switches the prototype screen and mass production screen.
	SHIFT +	This varies depending on the MTB specifications.
		Switches the active window.
Shift key	SHIFT	Enables the lower column of each key. Once the [SHIFT] key is selected, the [SHIFT] key remains in effect until any other keys are touched or the home screen is restored. The menu is highlighted while the [SHIFT] key is enabled.
F0 key	F0	Displays the on-board screen or MTB created screen. <Note> ♦This action differs depending on MTB specifications
Modifier key	CTRL ALTER	Once the [CTRL] (or [ALTER]) key is selected, the key remains in effect until any other keys are touched. When the home screen is restored, the [CTRL] (or [ALTER]) key is also canceled.

Note

- For eight types of keys; , , , , , , , and the key is continuously input (key repeat state) during being touched.
- The key is interlocked with the CapsLock key of Windows. By pressing the key, the input characters on the operation panel are also changed uppercase and lowercase.
- The key is input when it is touched. Even when sliding a finger and releasing another key, only first key is input.

2.5.3 Operation Panel Application

The operation panel application enables the same operation as the switches and buttons of the actual machine operation panel, such as operation mode selection, automatic operation start and override setting.

Refer to the instruction manual issued by the MTB for meanings and layout of buttons.

Screen image example



Display items

Display items	Details
Machine operation button	Turns ON the PLC input signal which has been assigned to the button when it is touched. When the PLC output signal which has been assigned to the button becomes ON state, the button turns color that indicates ON state (blue, for example).

Operating the machine on operation panel

- (1) When the machine operation button is touched, the button is changed to the pressed state color, and the X device signal which has been assigned to the button is turned ON. The device signal input is performed the moment the button is touched.
- (2) The button returns to the normal color when the operation panel button is released.

Note

- (1) When the PLC output signal turns ON, the button turns the ON state color (blue in the example above).

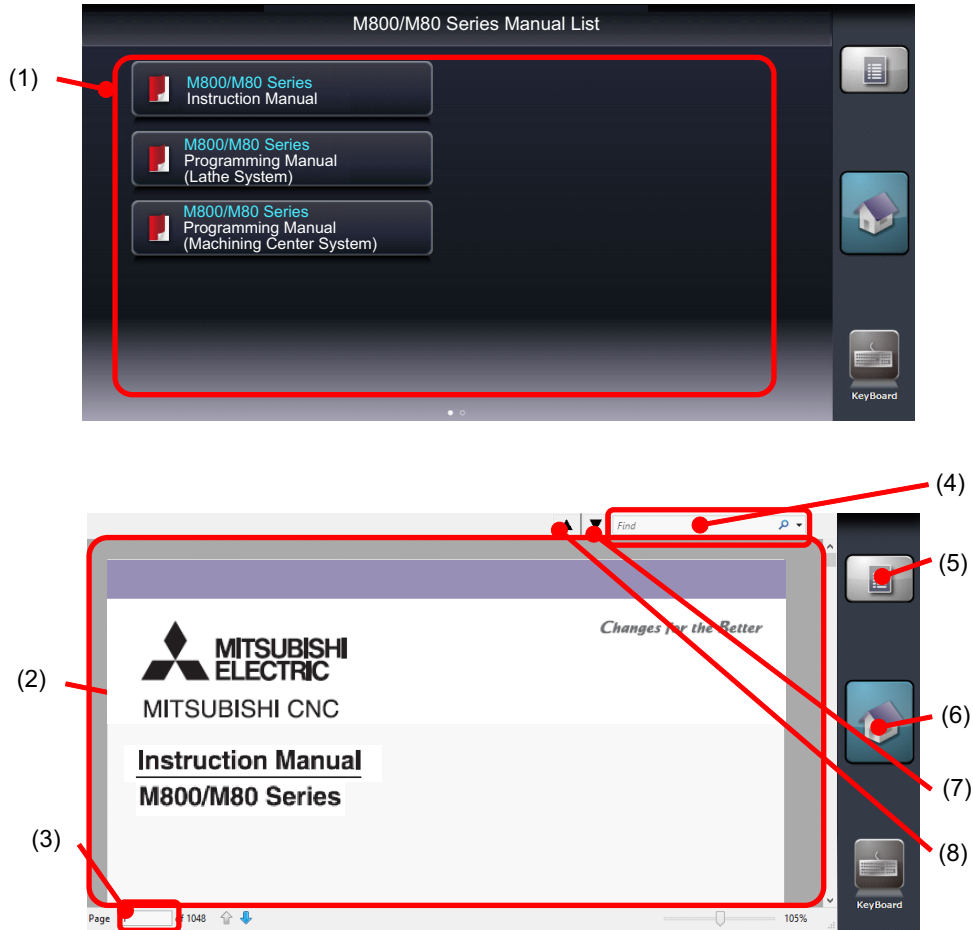
2.5.4 Manual Application

The manual application enables to refer to each manual.

Text search, page jump with touch operation, zooming in/out display, etc., are available.

The displayed manuals differ depending on MTB.

Screen image example (file selection screen/manual display screen)



Display items

Display items	Details
(1) Manual button	Touch a button to open a manual.
(2) Main window	Displays the contents of manual.
(3) Page No. input area	Input a page number for page designation.
(4) Retrieval input area	Input a search string for retrieval.
(5) [Operation] button	Performs the retrieval, page designation, etc.
Search	Performs the retrieval.
Page Jump	Displays the designated page.
(6) [Home] button	Returns to the home screen.
(7) Find next	Displays the next retrieval point.
(8) Find previous	Displays the previous retrieval point.

Selecting a manual

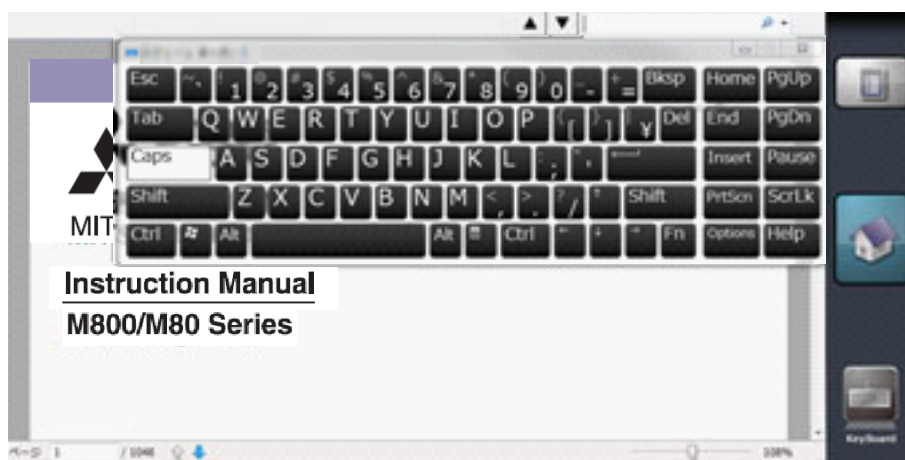
- (1) Activate the manual application, and the file selection screen appears.
- (2) Flick on the file selection screen to change the page.
- (3) Select (touch) a manual to be referred, and the selected manual is displayed.



Scrolling the manual

Flick the main window. When sliding your finger to up, the page moves to up and next page is displayed.

Searching the characters in the manual

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Touch [Search].
- (3) The cursor appears in the retrieval input area and the screen key board starts.



- (4) Input a search string with the screen keyboard and press the Enter () key. The point at which the search string is found will be displayed.
Press the Enter key again, and next point will be searched.
Touch the close button () in the top right to close the screen keyboard when the screen keyboard becomes unnecessary.
- (5) To continue the retrieval, press the [▼] button to find the next point and press the [▲] button to find the previous point.

Note

- (1) The Caps key of the screen keyboard also switches the upper case/lower case input on the standard screen.
- (2) When the area other than the retrieval input area is touched, the search string cannot be input. To input the search string again, touch the retrieval input area.
- (3) Only alphanumeric characters and symbols can be input.

Displaying the manual by page designation

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Touch [Page Jump].
- (3) The cursor appears in the page number input area and the screen key board starts.
- (4) Input a page number to be referred and press the Enter key. The designated page is displayed.
Touch the close button in the top right to close the screen keyboard when the screen keyboard becomes unnecessary.

Note

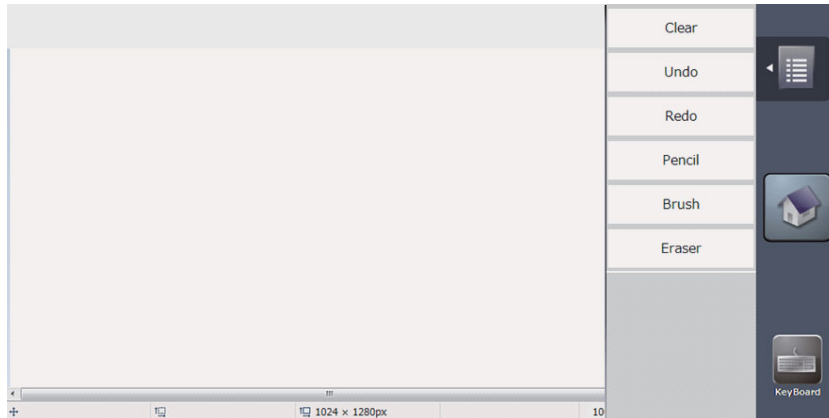
- (1) The front page of the manual file is the first page for the page number designation.

2.5.5 Note Application

The note application enables the hand writing with the touch operation. This can be used as a memo.

The written contents are saved automatically when the home screen is restored, and the contents will be displayed next time the note application is started.

Screen image (when the operation button is pressed)



Display items

Display items	Details
Memo area	Characters, etc., can be written by tracing a finger.
[Operation] button	Performs the all erasure of memo area, undo, and various tools selection.
Clear	Erases all contents in the memo area.
Undo	Cancels a last action.
Redo	Redoes a canceled action.
Pencil	To select the pencil tool for thin lines.
Brush	To select the brush tool for thick lines. This tool is selected when the application is started.
Eraser	To select the eraser tool to erase a part of memo.

Writing a memo

Lines can be drawn with the selected tool by tracing your finger in the memo area.

When the note application is started, the brush tool which is used for drawing thick lines is selected.

Delete all contents of memo

- (1) Touch the [Operation] button on the right of screen.
- (2) Touch [Clear] on the sub menu.
- (3) The memo area is all deleted and the sub menu is closed.

Undo a last action

Touch [Undo] on the sub menu to cancel a last action.

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Select [Undo] on the sub menu.
- (3) One action will be undone.

Note

- (1) When no action is performed after the application is started from the home screen, the [Undo] action cannot be performed because there is no action can be canceled.
- (2) Once the home screen is restored, the previous action cannot be canceled.
Available undo actions are as follows.
 - ♦Action between drawing a line and releasing a finger
 - ♦Action between erasing a line and releasing a finger
 - ♦[Clear] action
 - ♦[Redo] action
- (3) Use [Redo] to cancel the [Undo] action.
- (4) Up to 50 actions can be undone.

Redo a canceled action

Touch [Redo] on the sub menu, and the canceled action can be redone.

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Select [Redo] on the sub menu.
- (3) One action taken back by the [Undo] action will be redone.

Note

- (1) When no action is performed after the application is started from the home screen, the [Redo] action cannot be performed because there is no undo action performed.
- (2) The [Undo] action can be redone by touching [Redo], however, once the home screen is restored, the [Undo] action cannot be redone.

Selecting the line width

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Touch [Pencil] or [Brush] on the sub menu.
- (3) Touch [Pencil] to select the pencil tool to draw the thin lines, or touch [Brush] to select the brush tool to draw the thick lines.

Note

- (1) The tool selection is not held after the home screen is restored. The brush tool is selected with the note application start-up.

Erasing a part of memo

- (1) Touch the [Operation] button on the right of screen.
- (2) The sub menu appears. Touch [Eraser] on the sub menu.
- (3) The eraser tool is selected. Only the part traced with finger can be erased.
- (4) Select the pencil tool or brush tool to draw the lines again.

Note

- (1) The tool selection is not held after the home screen is restored. The brush tool is selected with the note application start-up.

2.6 Setting Data

2.6.1 Setting Numerals and Alphabetical Characters

Operation method

The data is basically set with the following methods:

- (1) Menu selection
- (2) No. selection
- (3) Cursor movement
- (4) Data key input
- (5) [INPUT] key input

Note

- (1) The contents in the data setting area are only displayed until the [INPUT] key is pressed. These contents are invalidated if the screen is changed. The data is written into the memory when the [INPUT] key is pressed.
- (2) Special settings may be required depending on the data type. Refer to each item.
- (3) The cursor may move to the right of the display item depending on the data type.
- (4) If an illegal key is set, an error occurs when [INPUT] is pressed. Reset the correct data.

Operations in the data setting area

The key is input at the position where the cursor is displayed. If a cursor is not displayed, the key input is invalid. When a key is input, the data appears at the cursor position, and the cursor moves one character space to the right.

[→]/[←] keys: Moves the cursor one character to the left or right.

[INSERT] key: Enters the insert mode.

The mode returns to the overwrite mode when the [DELETE], [C.B CAN] keys are pressed, or when the screen is changed.


[DELETE] key: Deletes the character in front of the cursor.


[C.B] key: Deletes all characters in the data setting area.

Cursor operations on the screen


If a cursor is displayed on the screen, data is set in the data setting area and the [INPUT] key is pressed, the data appears at the cursor position on the screen. The cursor moves to the next position.

The following keys can be used to move the cursor with the cursor keys.

: Moves the cursor to the previous line.

: Moves the cursor to the next line.

: Moves the cursor one item to the left.

: Moves the cursor one item to the right.

2.6.2 Inputting Operations

In addition to the method of directly inputting numeric data for specific data settings, a method to input the operation results using four rules operators and function symbols can be used.

Input method



Numeric values, function symbols, operators and parentheses () are combined and set in the data setting area.

The operation results appear when the [INPUT] key is pressed. Data for the currently selected setting item will be set when [INPUT] key is pressed again. The contents in the data setting area are erased.

Examples of operator settings, and results		
Operation	Setting example	Operation results
Addition	=100+50	150
Subtraction	=100-50	50
Multiplication	=12.3*4	49.2
Division	=100/3	33.3333333
Function	=1.2 * (2.5 + SQRT(4))	5.4

Function symbols, setting examples and results			
Function	Function symbol	Setting example	Operation results
Absolute value	ABS	=ABS(50 - 60)	10
Square root	SQRT	=SQRT(3)	1.7320508
Sine	SIN	=SIN(30)	0.5
Cosine	COS	=COS(15)	0.9659258
Tangent	TAN	=TAN(45)	1
Arc tangent	ATAN	=ATAN(1.3)	52.431408

Operation examples

- (1) Set as shown below, and press the [INPUT] key. $=12*20$ [INPUT]  The operation results appear in the data setting area. 240
- (2) Press the [INPUT] key again.  Data for the selected setting item is set. The result is displayed on the screen. The cursor moves to the next position.

Notes for using operators and functions

Division : Zero division causes an error.

Square root : If the value in the parentheses is negative, an error occurs.

Triangle function : The unit of angle θ is degree ($^{\circ}$).

Arc tangent : $-90 < \text{operation results} < 90$.

Restrictions

- (1) Always use "=" for the first character.
- (2) Do not use the following characters as the second character or last character.
Invalid as second character: * , /,)
Invalid as last character: * , /, (, +, -
- (3) Make sure that the left parentheses and right parentheses are balanced.
- (4) The 360° limit does not apply on the angle. SIN (500) is interpreted as SIN (140).
- (5) While the monitor screen or the setup screen displaying, if the axis name address, M, S, T, 2nd miscellaneous function code (B, etc.) is pressed when "=" is set in data setting area as the first character, the operation input is given to priority. So, the window does not open, and the cursor does not move.
- (6) The exponential setting, like "1.23E-4", cannot be used. The operation result is not displayed with exponential.
- (7) It is not possible to set characters exceeding the number of characters which can be input to the data setting area.
- (8) It is not possible to omit "0" before the decimal point, like ".5", when operation inputting. An error will occur.
- (9) The accuracy is guaranteed for the calculation with 15 digits or less. The calculation with over 15 digits does not guarantee its accuracy.
- (10) The operator or the function which does not exist in the above-mentioned, such as "ASIN", cannot be used. The operation message "Setting error" appears, and the display of the data setting area does not change.
- (11) Regardless of the input setting unit and metric system/inch system, the digit numbers below the decimal point of the operation result is seven digits or less.

2.7 Guidance Function

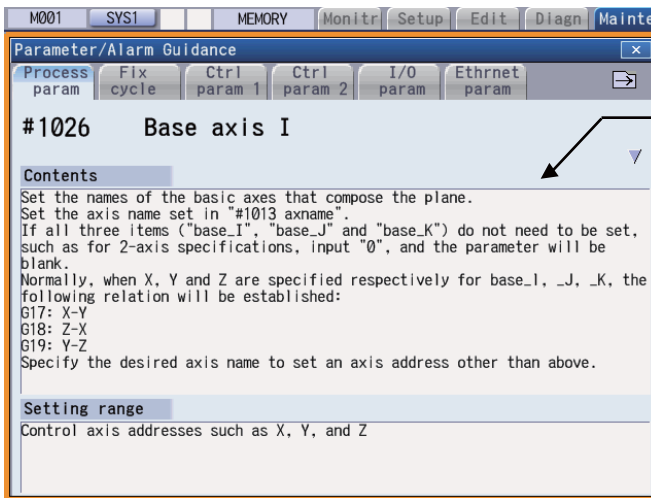
2.7.1 Parameter Guidance

The parameter guidance function displays the details of the parameters according to the state of the screen currently being displayed.

Screen Configuration

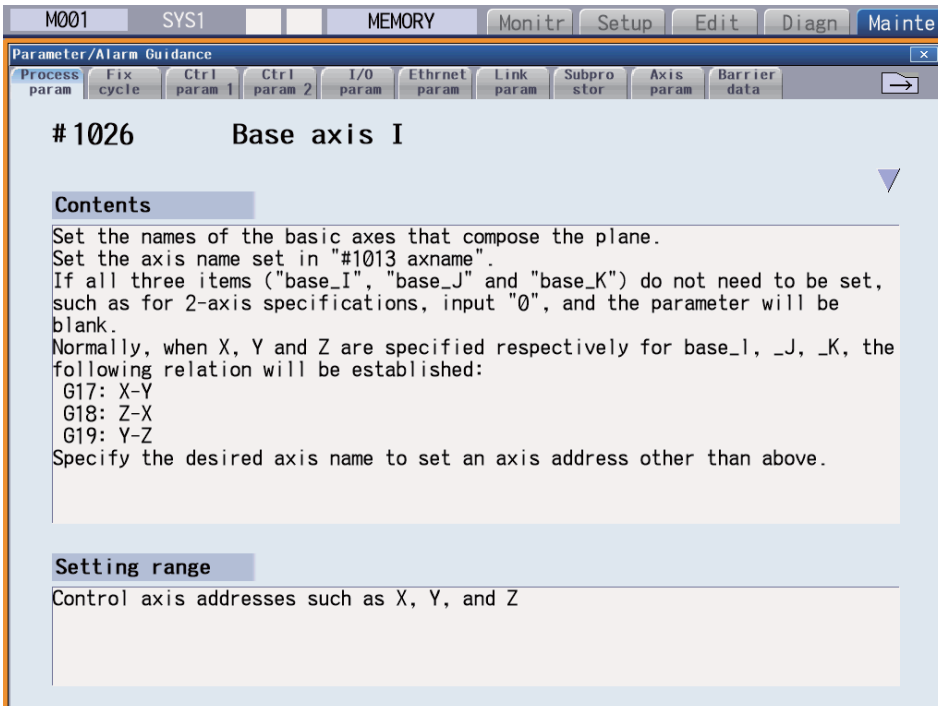
The parameter/alarm guidance window is displayed with the following type of configuration.

- 8.4-type/10.4-type



The parameter No., name, details and setting range are displayed.



- 15-type/19-type







Operation method

If the [?] key is pressed on any screen, the guidance window will open. If a pop-up window other than the guidance window is open, the guidance window will open over the currently opened pop-up window. In this case, the menu state does not change. If [?] key or [CANCEL] key is pressed again when the guidance window is open, the guidance window will close and the screen will return to the previous state in which the [?] key was pressed.

Displaying the parameter guidance (Example: "#8005 ZONE r")

- (1) Press the menu [Param] on maintenance screen.  The parameter screen is displayed.
- (2) Press the [↓] key, and move the cursor to "#8005 ZONE r" parameter.
- (3) Press the [?] key.  The guidance window is opened, and the detail of "#8005 ZONE r" parameter is displayed.




Note

- (1) The contents of the parameter "#8004 SPEED" (the previous parameter on the parameter screen) are displayed by pressing the  key. However, when the  key is pressed on the first parameter of each parameter type, the displayed contents do not change. The contents of the parameter "#8006 ZONE d" (next parameter on the parameter screen) are displayed by pressing the  key. However, when the  key is pressed on the last parameter of each parameter type, the displayed contents do not change.

Pressing the [↑] or [↓] key scrolls the explanation contents of the parameter guidance in a page unit.

When the [↓] key is pressed while the last line is displayed, next guidance appears. When the [↑] key is pressed while the top line is displayed, the previous guidance appears.

However, when the [↑] key is pressed while the first parameter guidance is displayed, or when the [↓] key is pressed while the last parameter guidance is displayed, the display does not change.

- (2) The contents of the first parameter for the fixed cycle parameter are displayed by pressing the  key. While the parameter guidance window is displayed, the displayed parameter contents are recorded for each parameter type. When the parameter type is changed with /  key, the contents of the previously displayed parameter are displayed.
- (3) When the parameter No. could not be acquired (when the cursor was non-display or was on a blank or comment line), the top of parameter guidance for each parameter appears.
- (4) The parameters whose contents/setting range are similar or same are collectively displayed.
(Example: PLC integrated timer)

Precautions

- (1) If the [?] key is pressed when alarm occurs, the alarm guidance window will open.
- (2) Once the guidance data is read, the guidance can be displayed even when the memory card is removed.
- (3) Press the [?] key on a screen other than [Mainte] - [Param] and [Setup] - [User parameter] when an alarm is not being occurred, and the head parameter guidance of parameters is displayed.

2.7.2 Alarm Guidance

The alarm guidance is the function that displays message, details and remedy for the currently occurring alarms.

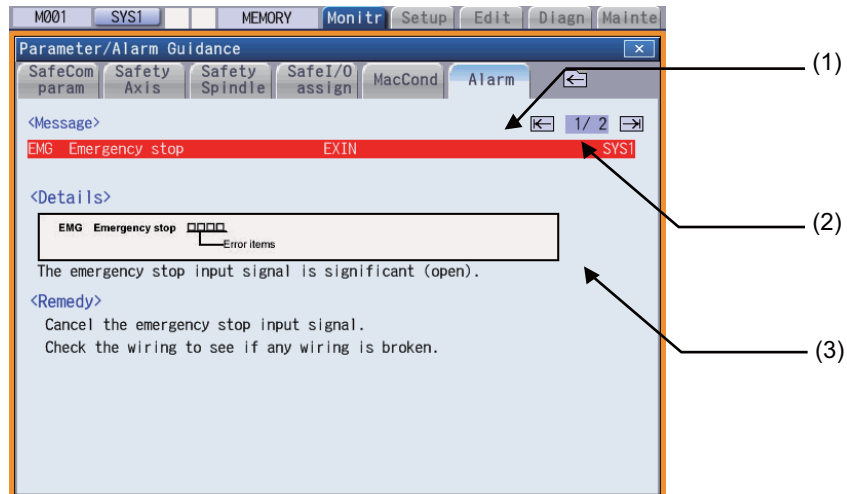
Screen Configuration

The alarm guidance is displayed in "alarm" tab on "parameter/alarm guidance window".

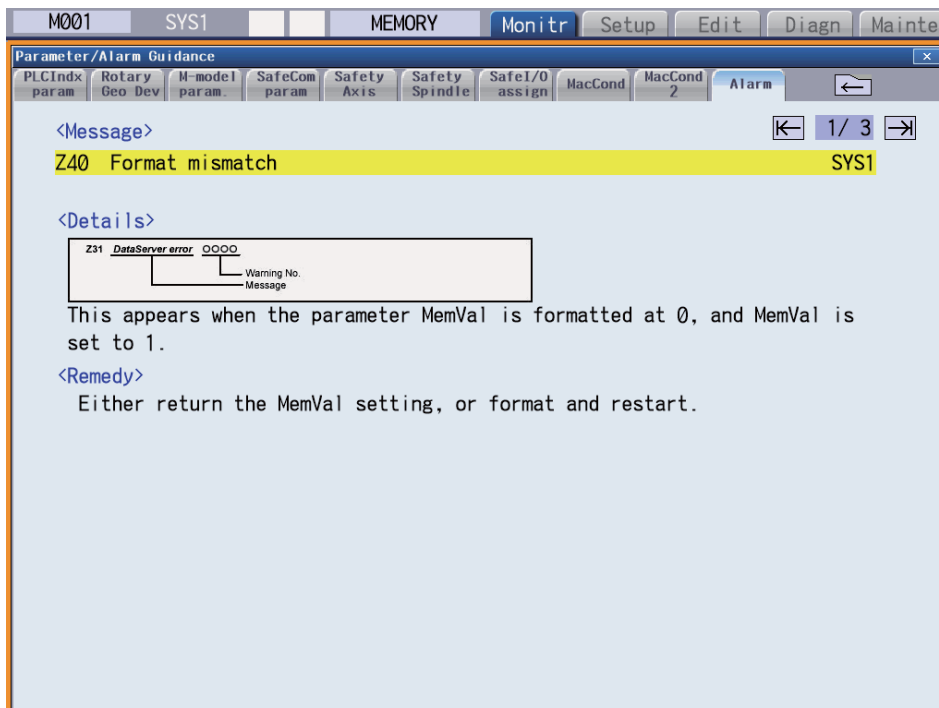
The "alarm" tab is on the rightmost end of the guidance window.

A scroll bar appears when details and remedy, etc. do not fit in one page.

- 8.4-type/10.4-type



- 15-type/19-type




Display items



Display items	Details
(1) Messages	This displays the currently occurring "NC alarm" and "PLC alarm message". The displayed content is same as the content displayed in the alarm message of the diagnosis screen.
(2) Number of page	This displays "order of priority / total number of occurring alarms".
(3) Details/Remedy, etc.	This displays detail and remedy, etc. for alarm message.

Operation method






All alarms are displayed for alarm guidance regardless of part system.

If the [?] key or the  key is pressed on any screen when alarm occurs, alarm guidance window will open. If a pop-up window other than the guidance window is open, the guidance window will open over the currently opened pop-up window. In this case, the menu state does not change. If [?] key or [CANCEL] key is pressed again when the guidance window is open, the guidance window will close and the screen will return to the previous state in which the [?] key was pressed.

Displaying the alarm guidance

- (1) Press the [?] key or the  key during occurring alarm on monitor screen.  The guidance window is opened while "alarm" tab is valid. The alarm details and remedy are displayed for "H/W stroke end axis exists".
(Example) When "H/W stroke end axis exists" and another alarm occur.

Note

- (1) Pressing the  or  key scrolls the explanation contents by page.
- (2) Pressing the [↑] or [↓] key scrolls the explanation contents in a line unit.
- (3) When each parameter tab, such as the parameter, fixed cycle parameter, etc., is opened with the  key, the contents of first parameter in each parameter tab is displayed.
- (4) The alarm guidance is executed for the alarm that is occurred when the [?] key or the  key has been pressed. Therefore, the guidance is not displayed for the alarm that has been handled or has occurred while the alarm guidance is displayed.
- (5) If the [?] key is pressed when an alarm is not occurring, the parameter guidance appears. In this state, if the "alarm" tab is selected with the  key, nothing is displayed in the alarm guidance panel. (These columns are blank.)
- (6) All the explanations of the alarm having the same error class and No. are displayed in the details column.
- (7) When no alarm or only one alarm occurs, the arrow next to the page number is not displayed.

Changing the alarm guidance

- (1) Press the [→] key or [→] key when the alarm guidance is displayed. ➡

The alarm guidance with one priority lower than the current alarm guidance is displayed.

If the [→] key or [→] key is pressed when the lowest priority alarm is displayed, the alarm with the highest priority is displayed.

(Example) When 3 alarms occur.

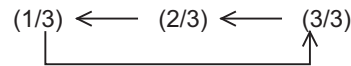


- (2) Press the [←] key or [←] key when the alarm guidance is displayed. ➡

The alarm guidance with one priority higher than the current alarm guidance is displayed.

If the [←] key or [←] key is pressed when the highest priority alarm is displayed, the alarm with the lowest priority is displayed.

(Example) When 3 alarms occur.

**Note**

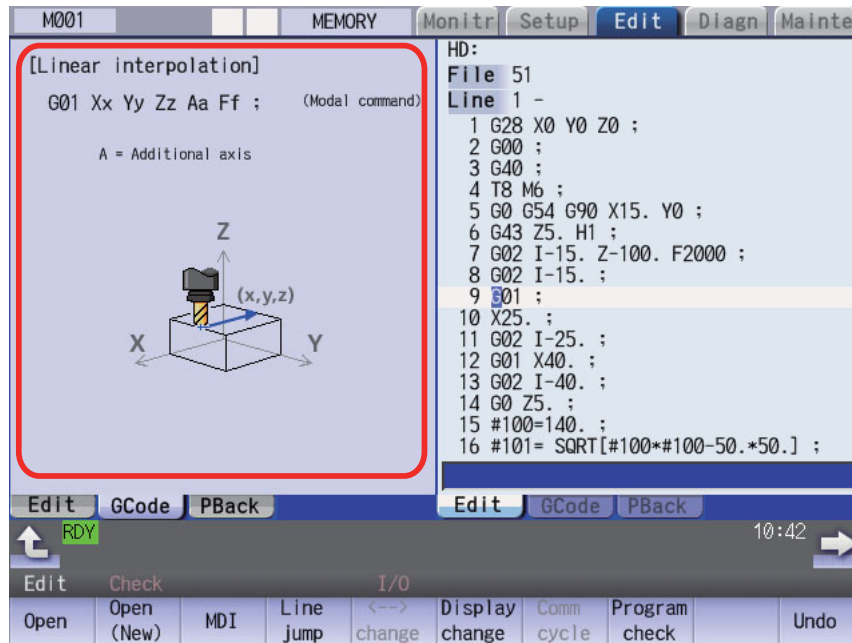
- (1) Up to 18 alarm or warning messages can be displayed for alarm guidance from highest priority.
(The messages are displayed in order of NC alarm or warning message (10 messages maximum) -> PLC alarm message (four messages maximum) -> NC alarm message for background check (four messages maximum).)
- (2) Even if the [→], [←], [←] or [→] key is pressed when only one alarm occurs, the screen display is not switched.

Precautions

- (1) The alarm guidance of stop code and operator message is not displayed.
- (2) The PLC device information, which is displayed for the PLC alarm message guidance, displays the PLC device status when the alarm guidance is displayed. Accordingly, even if the device value changes when the alarm guidance is being displayed, the displayed PLC device information is not updated automatically. To update the information, close the alarm guidance once and display it again by pressing the [?] key again. However, when the PLC device information is redisplayed with [→], [←], [←] or [→] key at occurrence of multiple alarms, the PLC device information is updated.
- (3) Once the guidance data is read, the guidance can be displayed even when the memory card is removed.

2.7.3 G Code Guidance

G code guidance is a function that shows the command format details or the outline of its operation for the G code being edited while creating or editing the machining program. With this function, the G code format can be confirmed immediately. G code guidance is also displayed in the same manner even when MDI program is displayed.



G code displayed in the G code guidance area is refreshed as the cursor moves across the program edit screen. When you change the available edit area during program simultaneous program edit (3 programs), G code guidance is also refreshed. The G code that meets following conditions are displayed in this area.

- G code that exists between the head of block and cursor position including the cursor position.
- G code that exists immediately before the cursor if multiple G codes meet the above condition.

Specific example

- | | | |
|------------------------|---|--|
| G91 G17 ; █ | ➡ | The guidance is not refreshed because the cursor is out of the block. |
| G91 G17 █ | ➡ | The guidance for G17 is displayed. |
| G91 █G17 ; | ➡ | The guidance for G91 is displayed. |
| G91 G00 X100. █Y100. ; | ➡ | The guidance for G00 is displayed because G00 is the nearest G code to the cursor. |

G codes displayed in the G code guidance area

With G code guidance function, the commands having "G" followed by 1 or more numbers are regarded as the G code. Thus, when "G" that is located immediately before the cursor is within the comment, the guidance will not be refreshed. In the same manner, when a G code is commanded using variables such as "G#100" or "G#500", etc. but numbers, the guidance will not be refreshed.

The G code that can be displayed in the guidance area is as follows.

Gnnnnnnn.m L l ("n", "m", and "l" are arbitrary number.)

Commanded value	Number of valid digits	Remarks
n (integer)	1 to 8 digit	When including "0" before integer command value, unnecessary "0" is ignored.
m (decimal places)	0 to 1 digit	-
l (value commanded using "L")	0 to 2 digit	This is valid when "L" exists immediately after the integer command value or decimal command value and is followed by a command value. If the command with "L" address precedes G code, the "L" command will not be described in the guidance.

Note

(1) As for the G codes not included in the specifications, the guidance is not displayed even if the above condition is met.



- G00 X100. (GCODE) ; ➔ "G" included in the comment "GCODE" is ignored, thus, G code guidance is not refreshed.
- N11 GOTO1 ; ➔ "G" included in the command "GOTO" is ignored, thus, G code guidance is not refreshed.
- G91 G120 X100 Y100. ; ➔ G code "G120" is not included in the specifications, thus, G code guidance is not refreshed.
- G0000031.1 ; ➔ The guidance for G31.1 is displayed.
- G0000031.10 ; ➔ Commanded value exceeds the number of valid digits, thus, G code guidance is not refreshed.
- L50 G10 ; ➔ The guidance not for "G10 L50" but "G10" is displayed.

Precautions for G code guidance

- (1) G code guidance may be refreshed when the cursor is located near the comment.

(Example) (PROG01);  The guidance for G01 is displayed.



- (2) When the cursor is located at the axis address, etc., the guidance for the nearest G code is displayed even if the address has no relationship with the G code.


(Example) G01 G90 X100;  G code that has a relationship with "X100." is "G01", however, G code guidance for "G90" is displayed.

- (3) When moving the cursor to the block with no G code as follows, the contents of the G code guidance will differ depending on the cursor's route even if the cursor is in the same block.

(Example)

```

N01 G91 G01 X100. F1000
      ↓
N02 Y100. Z100.  ← ... a
      ↑ b
N03 G02 X50. Y50. R50. ;
  
```

 When the cursor is moved by the route "a", the guidance for G01 which is displayed last in N01 block is also displayed in N02 block.
When the cursor is moved by the route "b", the guidance for G02 which is displayed last in N03 block is also displayed in N02 block.

- (4) The G code guidance description is common for M800/M80 Series.

Thus, G code could not function though the guidance is displayed.

- (5) Basically, the G code format in the G code guidance is displayed using the format of 3-axis specifications of X, Y, and Z.

- (6) Whichever plane is selected among the plane selection functions G17 to G19, the display data in the guidance is displayed using X-Y plane (G17) format.

- (7) When the G code command includes an address that has two or more meanings, both contents is displayed.

- (8) G code guidance will not be refreshed while the character string is searched or replaced.

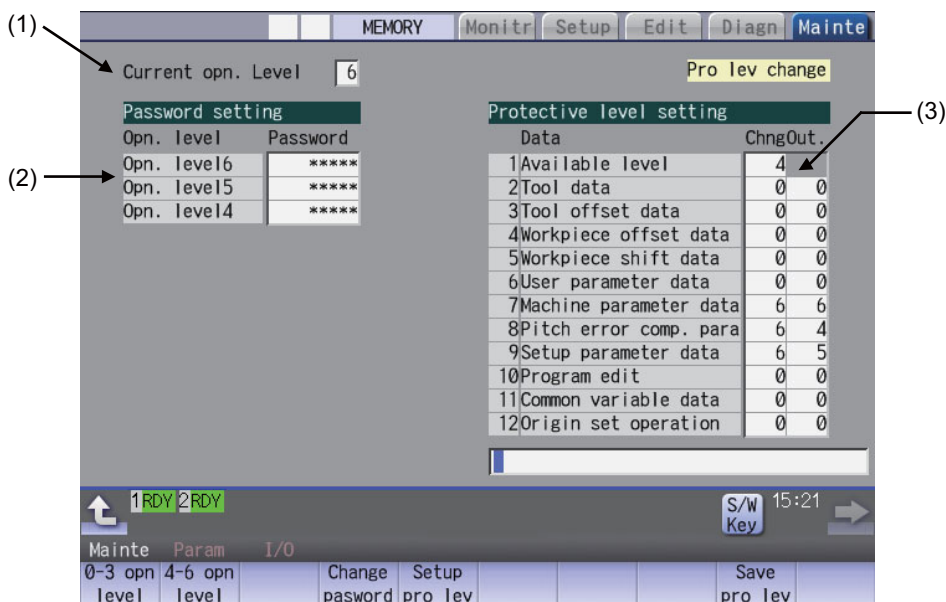
- (9) G code guidance cannot be displayed in mass-editing.

- (10) If "cmdtyp" varies in each part system for the L system, the display is switched to the guidance of the corresponding part system when the part system is changed during the G code guidance display.

2.8 Changing the Operation Level (Protect Setting Screen)



Operating the maintenance screen reduces a phenomenon in which defective workpieces run out due to an operation mistake, by implementing a restriction with seven operation levels. The operation level varies depending on the MTB specifications. Refer to the instruction manual issued by the MTB for details.



Display Items

Display items	Details
(1) Current operation level	Displays the current operation level.
(2) Passwords at operation levels 4 to 6	Displays the passwords of operation levels 4 to 6 with "*****".
(3) Protection level of each data item	<p>Displays the protection level of each data item.</p> <p>The data set below the current operation level can be changed as needed. Changing the protection level displays the message "Pro lev change" at the upper right.</p> <p>Change: Specify the protection level to change data (including a case to input a file).</p> <p>Output: Specify the protection level to output a file.</p>

2.9 Menu List

The menu list is a function that displays each screen's menu configuration as a list. The Menu list window opens when the



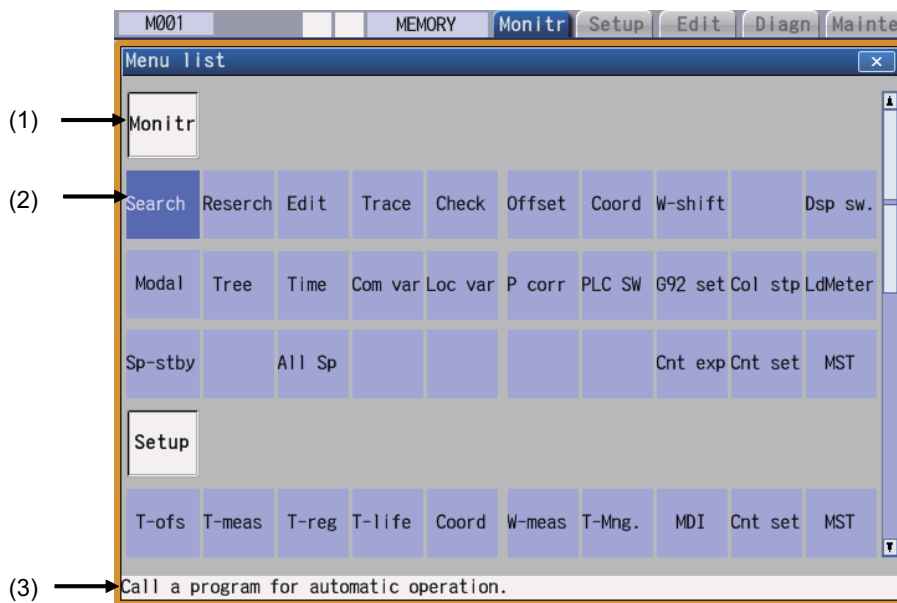
key is pressed on each screen.

If a pop-up window other than the menu list is displayed, the Menu list window appears above the displayed pop-up window. The menu does not change in this case.



If the key is pressed again while the Menu list window is open, the Menu list window closes, and the state


before the key was pressed is recovered.



Display Items


Display items	Details
(1) Screen name	The screen name is displayed. (Example) Monitr/Setup
(2) Menu name	A list of the menu names (functions) included on each screen is displayed. (Example) Search/Reserch
(3) Function outline display area	An outline of the currently selected menu name (function) is displayed.

Operation method

- (1) Press the  key.



The Menu list window appears showing the selected screen's menu list at the top.

If you press the  key while editing the file on the edit screen, a prompt to confirm whether to save the program appears before Menu list window opens.

- (2) Using the [↑], [↓], [→], [←], and page keys, move the cursor to the menu for which the function outline is to be displayed.



The function outline for the selected menu appears. The function outline does not appear if a menu with no name is selected.

The cursor does not move to the group name.

Each cursor key moves as follows.

[↑] key: The cursor moves up.

[↓] key: The cursor moves down.

[→] key: The cursor moves to the right.

[←] key: The cursor moves to the left.



key: The screen scrolls down.



key: The screen scrolls up.

<Note>

- Pressing the [↑] key also moves the cursor in the same way as the [←] key.
- Pressing the [↓] key also moves the cursor in the same way as the [→] key.

- (3) Press the [INPUT] key.



The selected menu function can be moved to directly. The menu is not moved to if a menu with no name is selected. The Menu list window closes after moving.

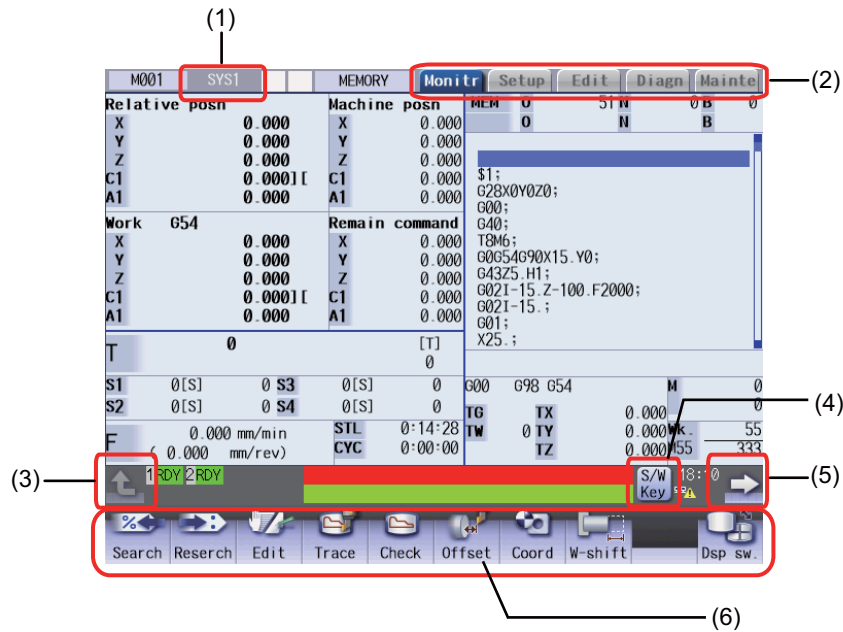
When using the touchscreen display, touching it once activates the menu where you touched. And then touch the menu again or press the [INPUT] key to display the menu screen.

2.10 Touchscreen Functions

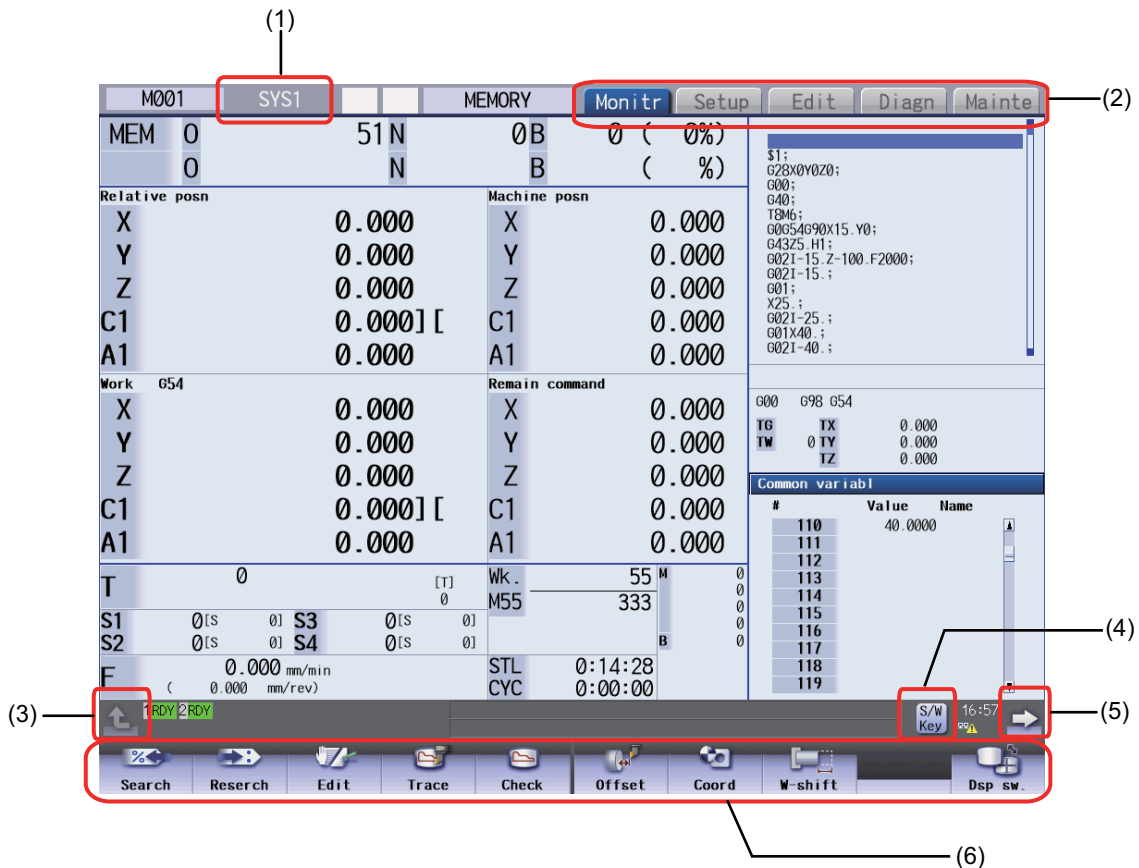
Touchscreen operation is available with a touchscreen display.

2.10.1 Basic Operation

- 10.4-type



- 15-type/19-type



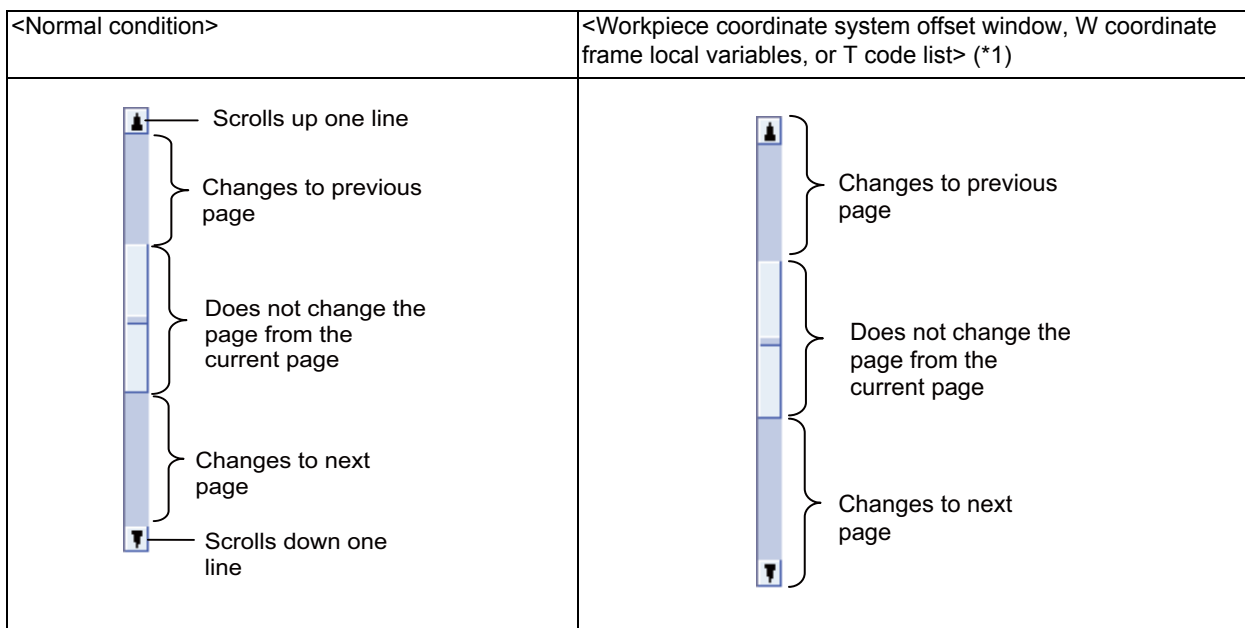
Display Items

Display items	Details
(1) System change	This switches from the current part system to the next part system.
(2) Function change	A selected screen will open. As in the case with a screen change by key inputting, if a pop-up window is displayed, close it before changing screens. If there is a file under editing, confirm if the file is saved before changing screens.
(3) Menu operation cancel	The displayed screen operation menu is switched to the screen selection menu of the current screen group. This is also used to cancel the menu operations of the displayed screen.
(4) Software keyboard display	This displays the software keyboard on the screen.
(5) Menu change to the next	This switches to the next menu if available.
(6) Menu selection	When a menu is selected by touching, the menu's process is executed.

Page changing area by scroll bar

If you touch [▲] or [▼] of the scroll bar, the screen is scrolled up or down by one line. Also, if you touch the empty portion of the scroll bar, the page is switched to the next page or previous page.

Pages cannot be changed by dragging the slider.



(*1) For the workpiece coordinate system offset window and local variable window on the monitor screen as well as coordinate system offset frame and T code list window on the setup screen, the page changes to the previous page when [▲] of scroll bar is touched, and the page changes to the next page when [▼] of scroll bar is touched. (It is not possible to scroll in a line unit.)

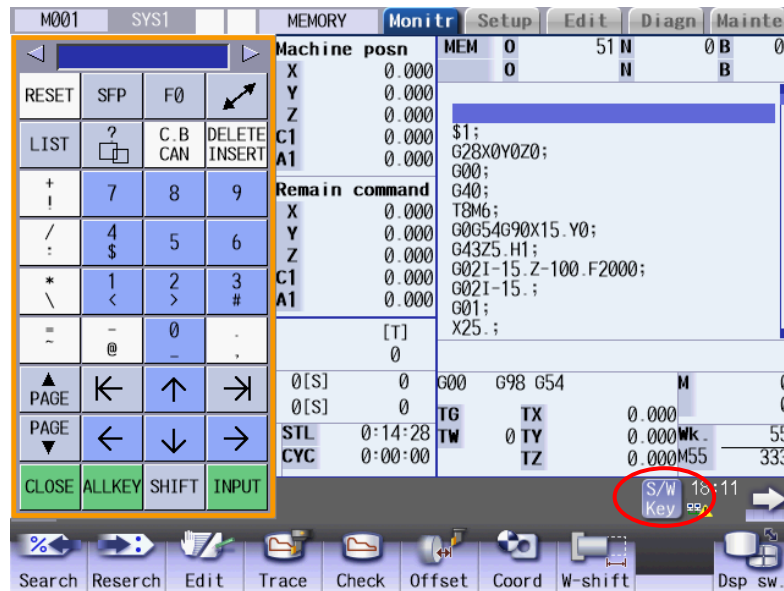
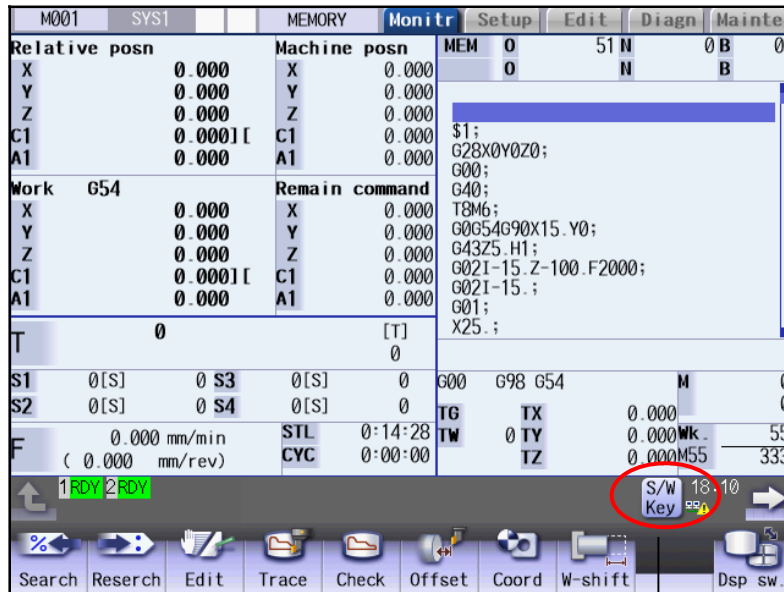
Disable touchscreen operation

When the touchscreen needs to be disabled, set the parameter "#1480 tp_invalid (Disable touch panel operation)" to "1", or turn the touchscreen operation invalidation signal ON. Refer to the instruction manual issued by the MTB for details.

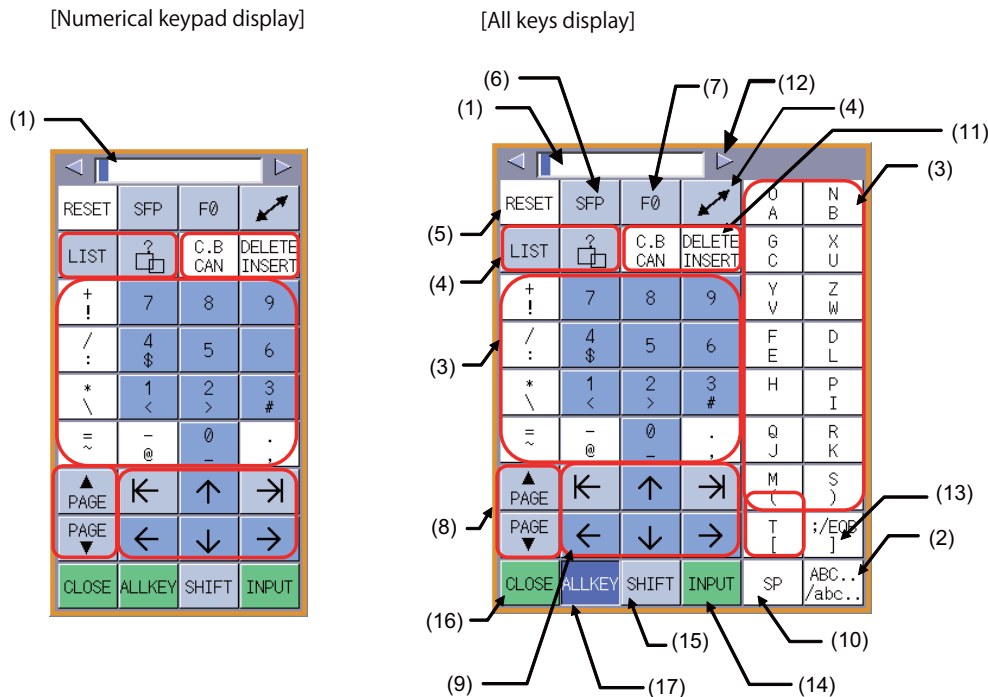
2.10.2 Software Keyboard

With the software keyboard, a key input is possible by a key menu on the software keyboard which is displayed on the screen. Software keyboard is displayed if [S/W Key] button is touched in each screen. In this case, screen or menu status will not change. Software keyboard is always displayed on the front screen. When the [CLOSE] key on the software keyboard is touched, the software keyboard will be closed.

Software keyboard will be enabled when the parameter "#11010 Software keyboard" is set to "1" or "2". Even if the parameter is 0, software keyboard can be used when the keyboard has not been connected. When software keyboard is disabled, [S/W Key] button is not displayed.



During the software keyboard is displayed, the [S/W Key] button is inverted.



Display items

Display items	Details
(1) Input section	This displays a character string according to the keys touched by the operator.
(2) Lower-case letter input key	This changes upper/lower-case of alphabet. The [ABC../abc..] key is highlighted when the lower-case-letter-setting is valid.
(3) Data setting key	This enters characters in the input area or screen.
(4) Window operation keys	[LIST]: This displays the menu list window. [?]: This displays the parameter/guidance window. [SHIFT] key + [LIST]: Switches the prototype screen and mass production screen. [SHIFT] key + [?]: Displays the custom screen (*1). [↔]: This changes active windows.
(5) RESET key	This resets the NC.
(6) SFP key	This displays the custom screen (*1).
(7) F0 key	This displays the onboard screen or custom screen (*1).
(8) Page changeover keys	This displays the contents in the previous/next page.
(9) Cursor keys	If data is set in the display items on the screen, the cursor is moved to up, down, left and right.
(10) Blank key	This enters a blank.
(11) Data correction keys	[INSERT]:The mode changes to data insertion mode, and characters are input at the current cursor position when data setting key is pressed. When [DELETE], [C.B CAN], [INPUT], cursor key, or tab key, etc. is pressed, or when the screen is changed to another, the mode returns to overwriting mode. [DELETE]: This deletes a letter before the cursor position. [C.B]: This cancels the settings in the input area. [CAN]: This cancels.
(12) Display position switch	This switches the display position of the software keyboard.
(13) Block end key	This enters ";".
(14) INPUT key	This confirms the data entered in the input area or screen.
(15) Shift key	This validates the setting on the lower line of the data setting key. Once [SHIFT] key is selected, it will be valid until another key is pressed or the software keyboard is closed. Menus are displayed in highlight while [SHIFT] key is valid.
(16) CLOSE key	This closes the software keyboard.
(17) Key display switch key	This switches numerical keypad display/all keys display.

(*1) Operations vary depending on the MTB specifications.

Input area of software keyboard

If the software keyboard is displayed while the input area exists on the screen, the input area of the software keyboard is displayed in the enable state. When the data setting key or data correction key is selected while the input area is enabled, enter a key in the input area of the software keyboard, and use the [INPUT] key to enter data in the screen.

Furthermore, if the software keyboard is displayed to edit a program file when the input area does not exist on the screen or while the editing window or MDI editing window is being displayed, the input area of the software keyboard is displayed into the disable state. In this case, directly enter a key in the screen.

When you enter a key to type the password, an asterisk "*" appears in the input area of the software keyboard.

Displaying/closing the software keyboard

Touching the [S/W Key] button on the lower left of the screen allows you to display the software keyboard on the screen.

- | | | |
|---|---|--|
| (1) Touch the [S/W Key] button. | ➔ | The software keyboard is displayed on the front screen. [S/W Key] button is highlighted. |
| (2) Touch the [CLOSE] key.
Or, touch the [S/W Key] button again. | ➔ | The software keyboard will close. |



Switching the view mode (all keys display/numerical keypad display)



Touching the [ALLKEY] key on the software keyboard allows you to switch the software keyboard view mode between "numeric keypad view" and "all key view". "Numeric keypad view" is specified by default.






- | | | |
|--|---|---|
| (1) Touch the [S/W Key] button. | ➔ | The software keyboard is displayed on the left side of the screen.
The software keyboard is displayed as a numerical keypad. |
| (2) Touch the [ALLKEY] key at the bottom of the software keyboard. | ➔ | All keys, including alphabet character keys, are displayed.
The [ALLKEY] key is highlighted. |
| (3) Touch the [ALLKEY] key at the bottom of the software keyboard. | ➔ | The display is switched to the numerical keypad only.
The [ALLKEY] key is unhighlighted. |

Changing the display position


The software keyboard can be relocated using one of the following methods:

- Touch the  or  key at the top of the software keyboard.
The software keyboard moves to the three fixed positions: left, middle or right.
- Pan or flick on the software keyboard
Pan the screen (touch the surface and move your finger without losing contact) or flick the screen (quickly run your fingertip across the screen) to move the keyboard to any desired position.





■ Touch the  or  at the top of the software keyboard.

- (1) Touch the [S/W Key] button.  The software keyboard is displayed on the left side of the screen.
[S/W Key] button is highlighted.
- (2) Touch the  key located at the upper right corner of the software keyboard.  The software keyboard moves to the right, and it appears on the center of the screen.
- (3) Touch the  key located at the upper right corner of the software keyboard.  The software keyboard moves to the right, and it appears on the right side of the screen.

Note

- (1) When the  key is pressed, the software keyboard moves to the left.

■ Pan or flick on the software keyboard

- (1) Touch the [S/W Key] button.  The software keyboard is displayed on the left side of the screen.
[S/W Key] button is highlighted.
- (2) Pan or flick in the lower right direction on the software keyboard.  The software keyboard moves in the lower right direction.
- (3) Touch the  key located at the upper right corner of the software keyboard.  The software keyboard moves to the right, and appears on the right side of the screen.

Entering data when the input area is enabled

If displaying the software keyboard while input area is being displayed on a screen, such as in the case where the operation search window or setup screen is being displayed, the software keyboard input area will be valid. At this time, the key selected on the software keyboard is temporarily displayed in the software keyboard input area, and then is input and set in the screen by selecting the [INPUT] key.

(Example) Set the value in T tool compensation amount

- | | | |
|--|---|---|
| (1) Display T compensation tab on the setup screen and touch the [S/W Key] button. | ➔ | The software keyboard is displayed on the left side of the screen.
Software keyboard input area will be invalid. |
| (2) Touch the [↑], [↓], [←], [→] keys to move the cursor to an arbitrary position. | ➔ | The cursor for tool compensation amount is moved. |
| (3) Touch the data setting key and enter the value.
Example: 15 | ➔ | "15" is displayed in the software keyboard input area. |
| (4) Touch the [INPUT] key. | ➔ | "15" is input at the tool compensation amount cursor position. |

Note

- (1) It is possible to make an operation input in the entry field of the software keyboard. For details on settings and operations, refer to "2.6.2 Inputting Operations".
- (2) If 20 or more characters are entered in the entry field of the software keyboard, character strings displayed in the input area are scrolled in sequence.
- (3) If you touch the [←] or [→] key while the input area of the software keyboard is enabled, the cursor will move in the relevant direction in the entry field.

Entering data when the input area is disabled

If software keyboard is displayed while edit window is displayed for program editing or input area is not displayed on a screen, or when the monitor screen main menu is displayed, software keyboard input area will be invalid. At this time, the key selected on the software keyboard is directly input to the screen.

- | | | |
|--|---|--|
| (1) Display the edit window on the monitor screen and touch the [S/W Key] button. | ➔ | Software keyboard is displayed.
Software keyboard input area will be invalid. |
| (2) Touch the [↑], [↓], [←], [→] keys to move the cursor to an arbitrary position. | ➔ | The cursor for the edit window is moved. |
| (3) Touch the data setting key and enter the value.
Example: G28 | ➔ | "G28" is displayed in the edit window. |
| (4) Touch the [INPUT] key. | ➔ | "G28" which has been input in the edit window is confirmed. |

2.10.3 Operating the Screen by Touch Gestures

The screen can also be operated by touch gestures.

- (1) Changing the menu display Right- /left-flick
If you flick the menu horizontally (quickly run your fingertip along the screen), the menu changes to the previous or next menu.
- (2) Scrolling the displayed data (Up/down flick, pan)
If you flick the screen vertically (quickly run your fingertip across the screen) to edit a program or process various table data items such as the compensation amount and common variable, or you pan the screen (touch the surface and move your finger without losing contact), the displayed data is scrolled.
- (3) Enlarging or reducing, moving, and rotating a 3D check shape (Pinch-in, pinch-out, pan)
If you pinch in (a gesture to pinch a target between the thumb and index finger on the screen) a machining shape for 3D check, it is reduced. If you pinch out (a gesture to spread the thumb and index finger on the screen) a machining shape, it is enlarged. Also, if you pan the screen, you can move or rotate a machining shape.
- (4) Changing a page (Right- or left-flick)
If you flick a page horizontally (quickly run your fingertip horizontally along the screen) to display the workpiece coordinate system offset or guidances such as the alarm and parameter guidances, the page changes to the right or left page.
- (5) Displaying the next axis/next part system with right- or left-flick
When flicking (quickly run your fingertip vertically along the screen) in the right/left direction on the parameter screen, etc., the axis or part system to be displayed can be switched.
- (6) Selecting or determining a file (Double-tap)
If you double-tap a target file on the file list screen, operations such as "Search execution", "Open file", and "Erase file" can be performed in the same way as when the [INPUT] key is pressed. However, the value of the input section is ignored.

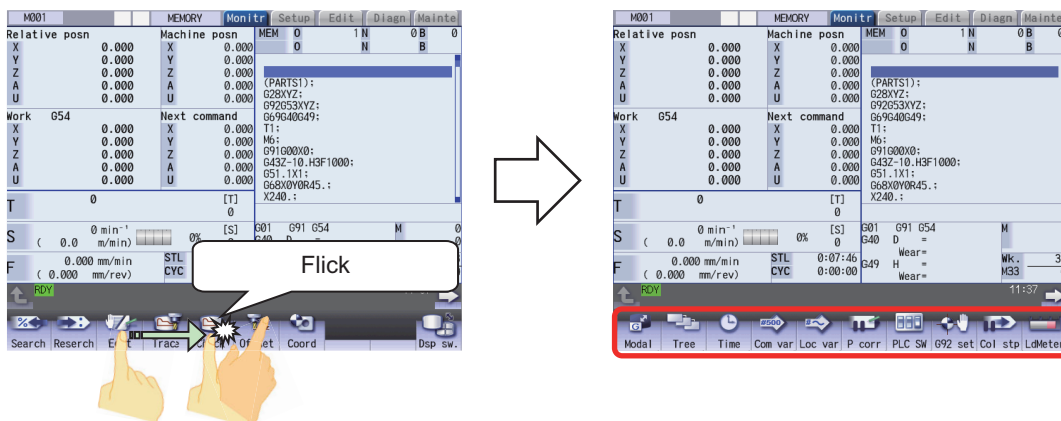
[Gesture operation enabled judgment]

When you move your fingertip from the gesture-enabled range to the outside while keeping your finger touching the screen, the gesture operation is enabled until you take your finger off the screen. If you first touch the outside of the gesture-enabled range, the gesture operation is disabled until you take your finger off the screen, even when you move your fingertip in the gesture-enabled area.

Changing the menu display

If you flick the menu horizontally (quickly run your fingertip horizontally along the screen), the menu slides, and changes to the previous or next menu.

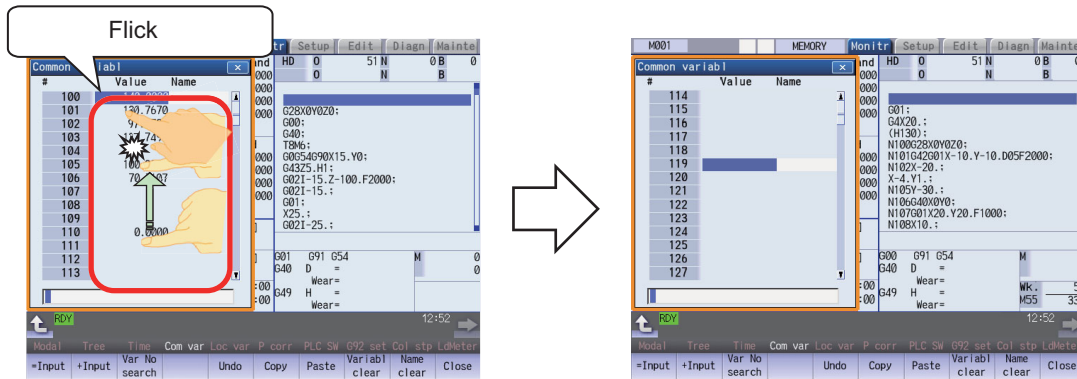
(Example)



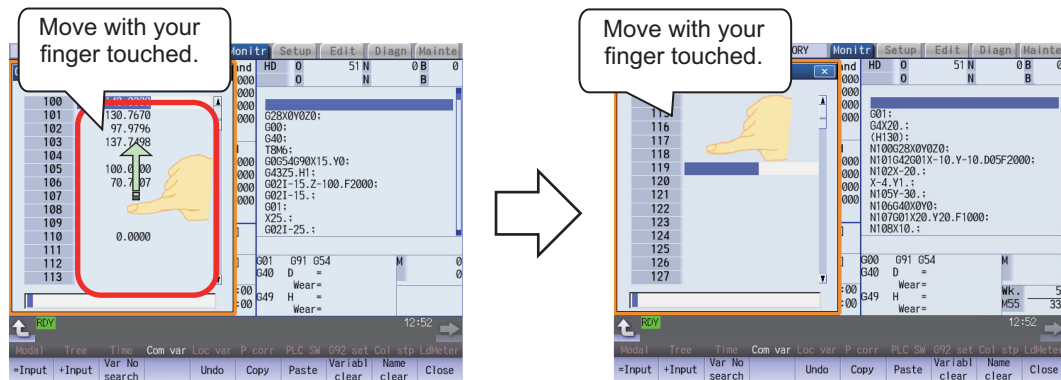
Scrolling the displayed data

If you flick the screen vertically (quickly run a fingertip across the screen) to edit the operation, setup, or editing program or process various table data items such as the compensation amount and common variable, or you pan the screen (touch the surface and move your finger without losing contact), the displayed data is scrolled.

(Example) Scroll by vertical flick



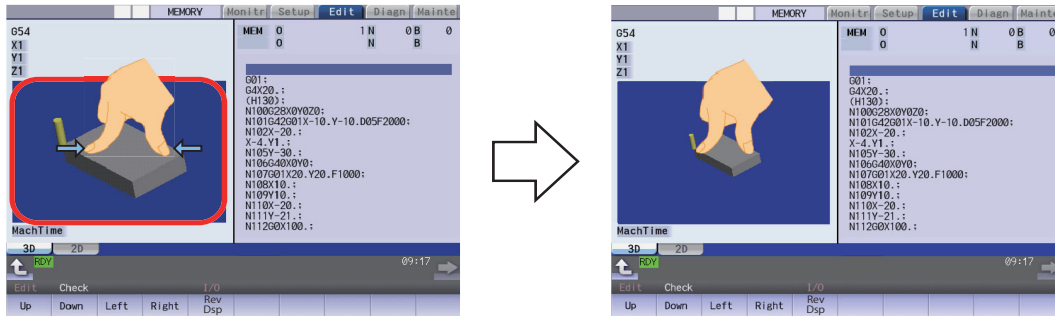
(Example) Scroll by pan



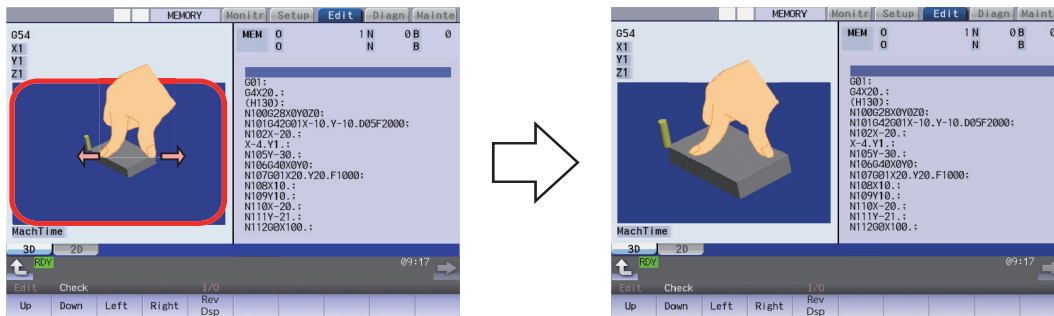
Enlarging or reducing, moving, and rotating a 3D check shape

If you pinch in (a gesture to pinch a target between the thumb and index finger on the screen) a machining shape for 3D check, it is reduced. If you pinch out (a gesture to spread the thumb and index finger on the screen) a machining shape, it is enlarged. If necessary, you can move or rotate a machining shape by pan operation (a gesture involving putting your fingertip on the screen and moving it vertically or horizontally while keeping it touching the screen). However, 3D check gesture operations are disabled during check searching or while the tool setting screen or "Work set" screen is being displayed. 3D check gesture operations are enabled while the [S/W Key] is being displayed.

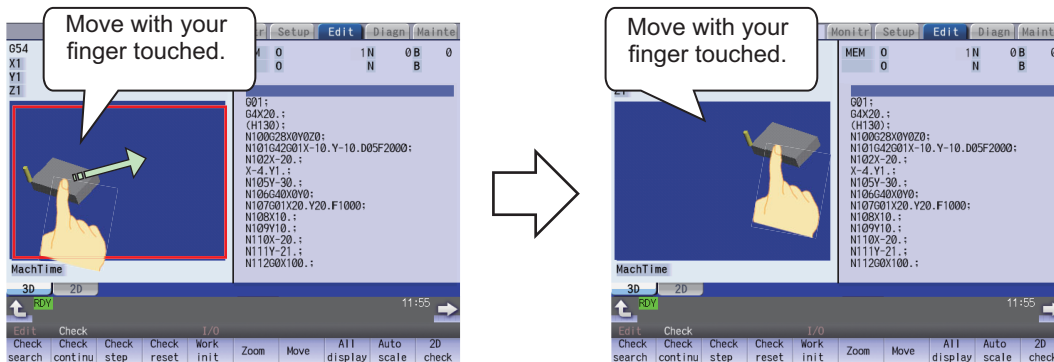
(Example) Zoom-out



(Example) Zoom-in

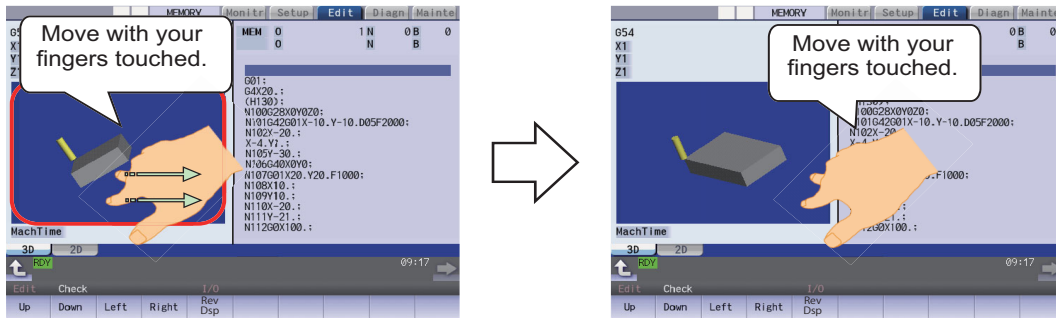


(Example) Move

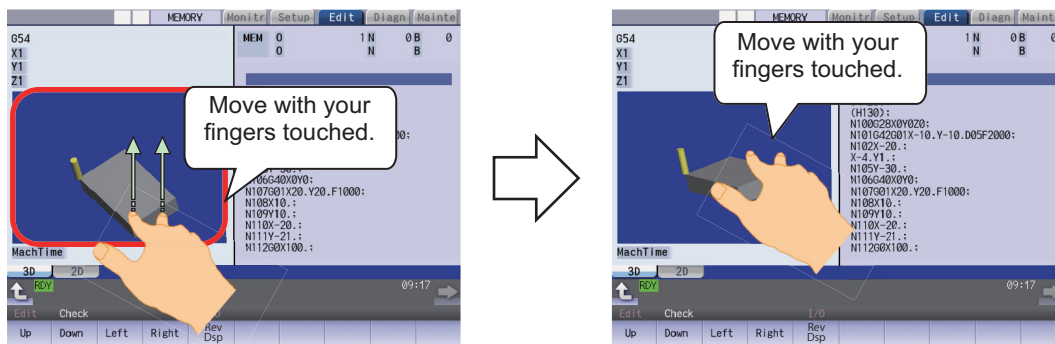


If necessary, you can rotate a machining shape using a two-finger pan operation (a gesture involving putting two fingertips on the screen and moving them vertically or horizontally while keeping them touching the screen).

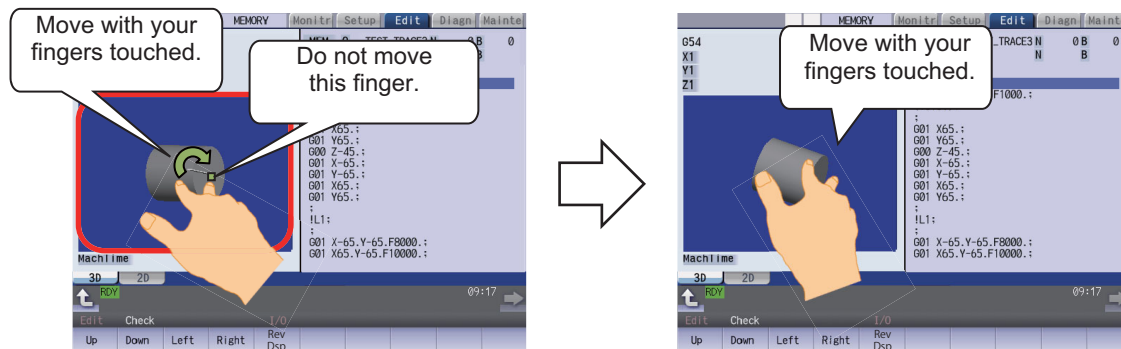
(Example) Rotate about the horizontal axis



(Example) Rotate about the vertical axis



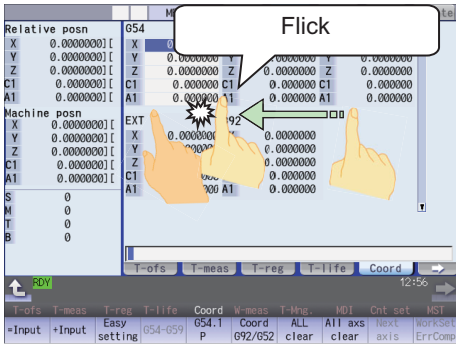
(Example) Rotate about the center coordinate of the material



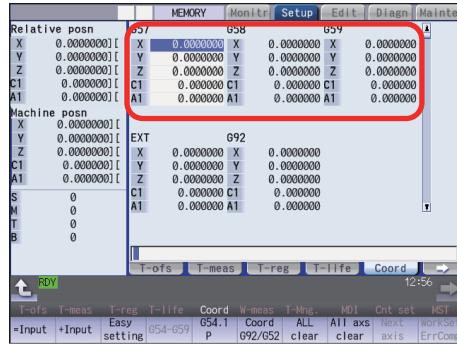
Changing a page

If you flick a page horizontally (quickly run your fingertip along the screen) to display the workpiece coordinate system offset or guidance such as the alarm and parameter guidance, the page changes to the right or left page.

(Example) Page changing for workpiece coordinate system offset

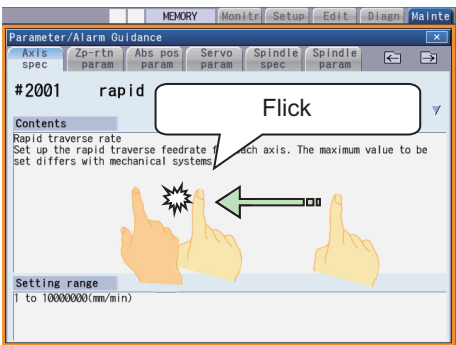


A workpiece coordinate system offset (G54-G56) is being displayed.

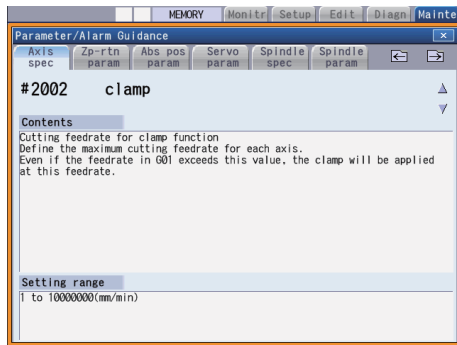


Changed to the next workpiece coordinate system offset (G57-G59) page.

(Example) Page changing for parameter guidance



A parameter guidance (#2001) is being displayed.



Changed to the next guidance (#2002) page.

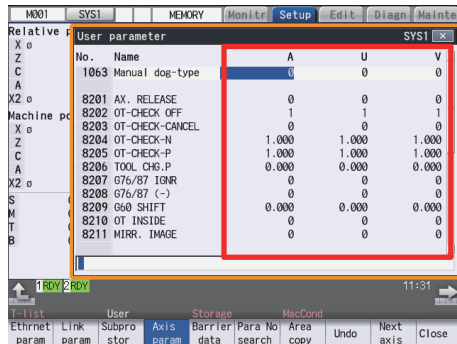
Switching axis or part system

On the screen where you can switch the axes being displayed with the [Next axis] menu such as the axis parameter screen, flick (quickly run your fingertip across the screen) horizontally to switch an axis or a part system to be displayed.

(Example) Displaying the next axes' parameters.



The axis parameters (X, Y and Z axes) are displayed.

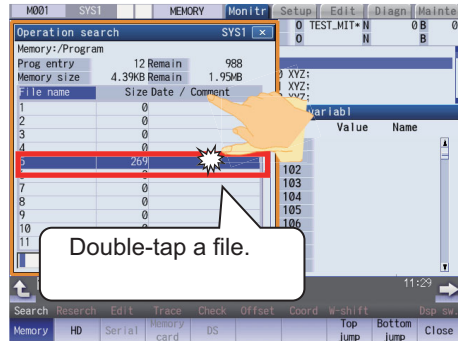


The next axes (A, U and V axes) are displayed.

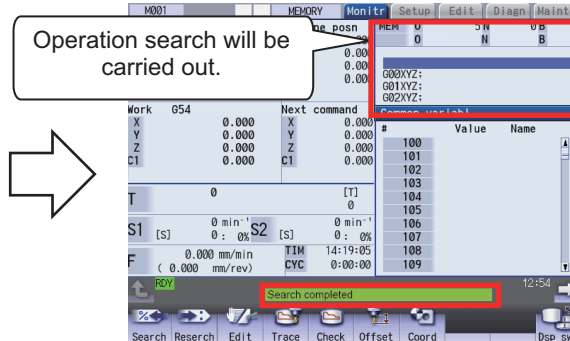
Selecting or determining a file

If you double-tap a target file on a screen that displays a file list, for example, on the Operate search screen, operation is performed in the same way as when the [INPUT] key is pressed.

(Example) Double-tap on [Monitr] - [Search]



The Search screen is being displayed.



Search is executed.

Note

- (1) The subsequent operation varies depending on the target you double-tapped.
 - When the target is a file: The selected file name is specified.
 - When the target is a folder: The list of files in the selected folder is displayed.

2.11 Menu Customization Function

You can freely relocate the main menus of the monitor (Monitr), setup (Setup) and edit (Edit) screens.

This function enables to place the often-used keys in the first page.

It can be used when a parameter "#11032 Menu sel para lkof" (Validate menu selection parameter setting) is set to "2".

MTB password is required when it is set to "1".

The main menu of monitor screen, setup screen and edit screen correspond to the following parameters:

<Menu selection parameter>

Main menu for monitor screen: "#10501 Monitr main menu 1" to "#10530 Monitr main menu 30"

Main menu for setup screen: "#10551 Setup main menu 1" to "#10580 Setup main menu 30"

Main menu for edit screen: "#10601 Edit main menu 1" to "#10630 Edit main menu 30"

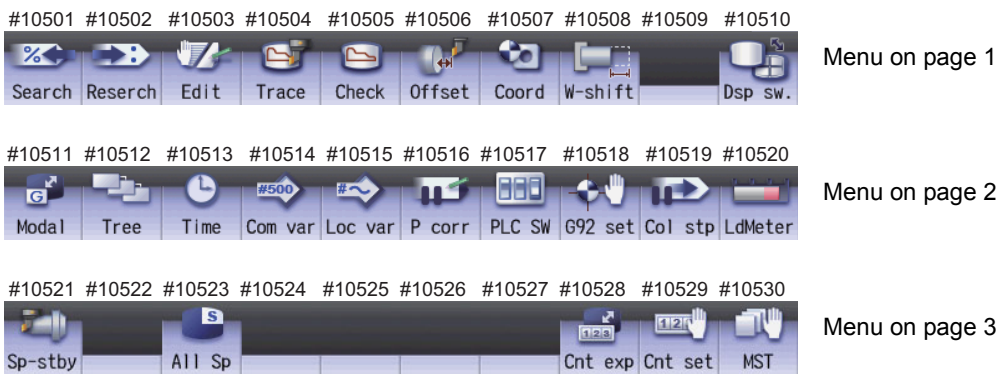
Refer to "M800/M80/C80 Series Alarm/Parameter Manual" for details.

Setting example

Main menu for monitor screen is changed as follows.

The figure below is the default layout.

<Default layout>



(1) Set the parameters "#10501 Monitr main menu 1" to "#10530 Monitr main menu 30" as shown in the right.

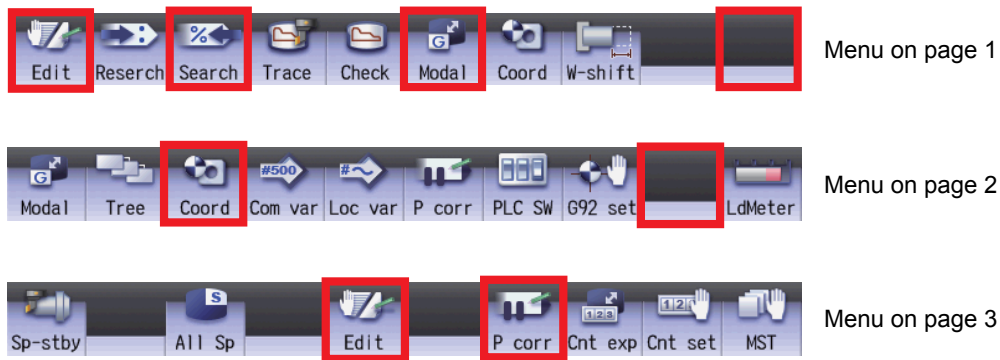
<Parameter>	<After>
#10501	3 (Edit)
#10503	1 (Search)
#10506	11 (Modal)
#10510	1 (Not display)
#10513	7 (Coord)
#10519	-1 (Not display)
#10525	3 (Edit)
#10527	16 (P corr)

Set "0" to the parameters other than the listed above.

(2) Turn the power ON again

➡ The new layout of the monitor screen's main menu is displayed.

<After parameter change>



Precautions

- (1) When you set the number which the main menu is not allocated with the menu selection parameter, the menu is not displayed. Menu which is set with other menu non-display parameter ("#8923 Hide Edit-IO menu", "#8932 Hide measure scrn") is also not displayed even if it is set with the menu selection parameter.
- (2) A menu selection parameter setting will be reflected to the menu list.
- (3) Menus which are allocated to the short cut key (it is enabled after the axis address is input), such as [Counter Set] and [MST], become valid by pressing a short-cut key even if they are set as "Not display".
- (4) When the parameter "#11032 Menu sel para lkof" (Menu select param setting enabled) is set to "0", the menu [Menu select param] is not displayed.
- (5) When the parameter "#11032 Menu sel para lkof (Menu select param setting enabled)" is set to "1" and the MTB password is not entered, the menu [Menu select param] appears, but the menu select param setting screen does not appear even if you press the menu.

2.12 Assigning Arbitrary Character String to a User-defined Key

To use this function, define the registration number of the user-defined key and any character string, which is input when the user-defined key is pressed, in the configuration file (KEYDEF.TXT), then place the configuration file in the "M01:\MSYS\CUSTOM" folder.

There are two definition types of user-defined keys: type 1 and type 2. Specify the desired type with the parameter "#8956 User key type".

For information on the correspondence between the assignable user-defined keys and registration numbers, refer to "Key correspondence table" shown below.

[Definition format]

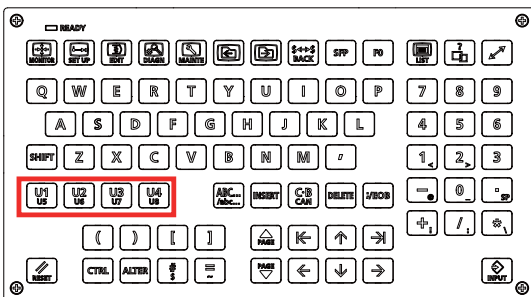
n[character string] (n: Indicates a registration number between "0" and "7".

Key correspondence table

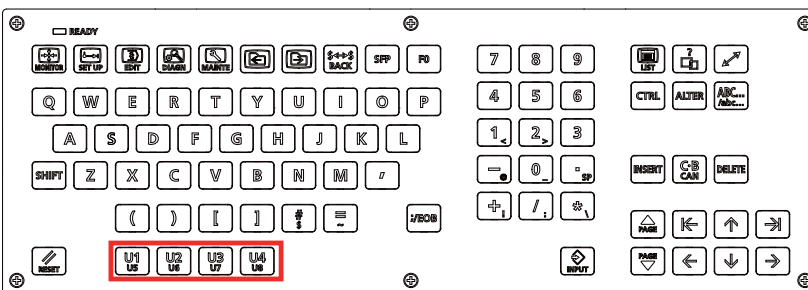
n	Key input
0	U1
1	U2
2	U3
3	U4
4	U5(SHIFT + U1)
5	U6(SHIFT + U2)
6	U7(SHIFT + U3)
7	U8(SHIFT + U4)

[Position of user-defined keys]

FCU8-KB047



FCU8-KB083



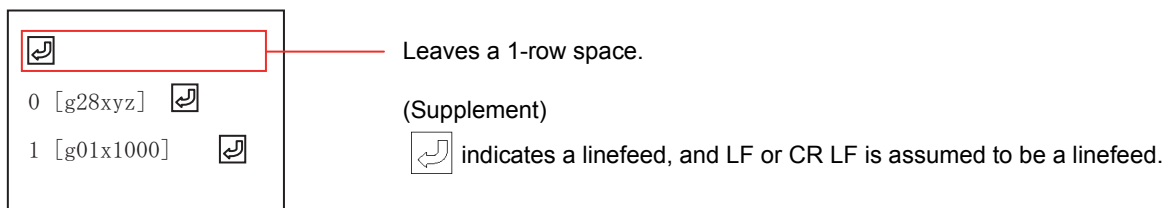
Precautions

- (1) Always input registration number "n" at the head of a row.
- (2) Only the character string enclosed in brackets [] is to be defined.
- (3) If no configuration file is defined, no registration number is assigned to a user-defined key, or if a description is illegal, the default operation is performed as shown in the correspondence table above.

2.12.1 Format of Configuration File

This section describes the format of the configuration file (KEYDEF.TXT) using a type 1 description example.

(Configuration file description example)



- (1) Insert a row of only a linefeed at the top of KEYDEF.TXT.
- (2) Describe a definition of each key in the second row and after. In this case,
 - ♦"0" means that character string "g28xyz" is defined as the operation of the "U1" key. As the actual operation, pressing the "U1" key inputs character string "G28 XYZ".
 - ♦"1" means that character string "g01x1000" is defined as the operation of the "U2" key. As the actual operation, pressing the "U2" key inputs character string "G01X1000".

Precautions

- (1) When a row is prefixed by a number other than "0" or "7", it is assumed to be a comment line.
- (2) The keys to be defined in the configuration file can be described in no particular order. If necessary, No. 7 can be first described.
- (3) The range enclosed in brackets [] is assumed to be a definition. Characters following the right bracket "]" are assumed to be a comment.
- (4) Only ASCII characters are available, excluding two-byte characters or Chinese characters.
- (5) To describe a definition in the configuration file, be sure to leave a one-row space at the top. This is because the first row is not displayed by a parameter setting when the configuration file is opened on the edit screen.
- (6) Describe only the keys to be defined.
- (7) If you press another key while the defined characters are being output, it causes the defined-key output to be ended.
- (8) When different defined-character strings are assigned to the same key in the file, the last assigned character string is input.
- (9) When a key combined with the "ALTER" key is input (e.g. "ALTER + SHIFT + U1"), it functions as the user-defined key "SHIFT + U1", and the "ALTER" key is ignored.
- (10) When a key with both the "CTRL" and "SHIFT" keys combined is specified (e.g. "CTRL + SHIFT + U1"), it functions as the user-defined key "SHIFT + U1", and the "CTRL" key is ignored.
- (11) A character "A" to "B" at the head of a row can be defined in either uppercase or lowercase characters.

2.12.2 Definition Types of User-defined Keys

The user-defined keys are classified into two definition types: type 1 and type 2, which provide different operations as shown below.

	Type 1	Type 2
Linefeed in brackets []	Not handled as a semicolon ";".	Handled as a semicolon ";".
Dependence of the Caps Lock key	The defined characters are converted to uppercase or lowercase characters depending on the status of the Caps Lock key before they are input.	Characters are input as defined regardless of the status of the Caps Lock key.
Conversion of symbol characters	Symbol characters are converted to specific ones.	No symbol characters are converted.

2.12.2.1 Type 1

Linefeed in brackets []

In the configuration file, a character string to be defined is described in the range enclosed in brackets []. However, if a linefeed is included within the brackets, it causes a format error that assumes that no definition is described for that key.

(Example) Contents of KEYDEF.TXT

```

[ ]
0[1 [ ]
2] [ ]
1[7¥ [ ]
8] [ ]
    
```

(Supplement)

- [] indicates a linefeed, and LF or CR LF is assumed to be a linefeed.

With the configuration file above registered, the following characters are input when the "U1" and "U2" keys are pressed.

Key input	Characters to be input	Supplement
U1	None	No characters are input because the format of the configuration file is invalid.
U2	78	If a linefeed is inserted in a row that includes symbol "\" at the end, it is assumed that the row is continued to the next file.

Handling the Caps Lock key

Characters are input in accordance with the status of the Caps Lock key.

Status of the Caps Lock key	Definition in uppercase characters	Definition in lowercase characters
ON	Lowercase characters are input.	Uppercase characters are input.
OFF	Uppercase characters are input.	Lowercase characters are input.

Note

(1) In NC, the Caps Lock key is set ON when the power is turned on.

(Example) Contents of KEYDEF.TXT

```

[ ]
0[ABCdef] [ ]
1[123xYz] [ ]
    
```

(Supplement)


- [] indicates a linefeed, and LF or CR LF is assumed to be a linefeed.

Input characters with the "U1" and "U2" keys input

Key input	At Caps Lock ON	At Caps Lock OFF
U1	abcDEF	ABCdef
U2	123xYz	123xYz

Conversion of defined characters

There is a case in which the defined-characters described in the range enclosed in brackets [] are converted and input. When symbol "\" is described, the input characters (behavior) vary depending on the succeeding characters. The following shows the correspondence between the defined characters and input characters (behavior).

Defined character		Input character (behavior)	
(Alphabetical characters)		(The defined characters are input in uppercase or lowercase characters depending on the status of the Caps Lock key.)	
(Digits)		(Digits are input as defined.)	
\\]		\]	Right bracket
		(If a linefeed is inserted in a row that includes symbol "\" at the end, it is assumed that the row is continued to the next file.)	
\t		The [→] key (tab key) is input.)	
\n		(The [INPUT] key is input.)	
\@		@	At mark
\\[		\[	Left bracket
\	Back slash	(No data is input. Symbol "\" other than the above is ignored.)	
!	Exclamation	!	Exclamation
"	Double quotation	*	Asterisk
#	Sharp	#	Sharp
\$	Dollar	\$	Dollar
%	Percent	%	Percent
&	Ampersand	'	Single quotation
'	Single quotation	:	Colon
(	Left parenthesis	)	Right parenthesis
)	Right parenthesis	(No data is input.)	
=	Equal	^	Hat
~	Tilde	(No data is input.)	
|	Pipeline	}	Right brace
`	Backquote	(No data is input.)	
{	Left brace	`	Backquote
}	Right brace	{	Left brace
+	Plus	~	Tilde
*	Asterisk	(	Left parenthesis
<	Left angle bracket	<	Left angle bracket
>	Right angle bracket	>	Right angle bracket
?	Question mark	?	Question mark
_	Underscore	=	Equal
-	Hyphen	-	Hyphen
^	Hat	&	Ampersand
@	At mark	"	Double quotation
[	Left bracket	(Not available)	
]	Right bracket	(Specified at the end of a definition.)	
;	Semicolon	;	Semicolon
:	Colon	+	Plus
,	Comma	,	Comma
.	Period	.	Period
/	Slash	/	Slash

2.12.2.2 Type 2

Linefeed in brackets []

In the configuration file, a character string to be defined is described in the range enclosed in brackets []. However, if a linefeed is included in this range, it is handled as a semicolon ";". This is assumed that a semicolon ";" is defined as one character for linefeed.

(Example) Contents of KEYDEF.TXT

```

[ ]
0[1 [ ]
2] [ ]
1[7¥ [ ]
8] [ ]
    
```

(Supplement)

- [] indicates a linefeed, and LF or CR LF is assumed to be a linefeed.

Input characters with the "U1" and "U2" keys input

Key input	Input characters	Supplement
U1	1;2	A linefeed is handled as a semicolon ";".
U2	7;8	A linefeed is handled as a semicolon ";". This is handled as an independent symbol "\", and ignored.

Handling the Caps Lock key

Characters are input as defined regardless of the status of the Caps Lock key.

```

[ ]
0[ABCdef] [ ]
1[123xYz] [ ]
    
```

(Supplement)

- [] indicates a linefeed, and LF or CR LF is assumed to be a linefeed.

Input characters with the "U1" and "U2" keys input

Key input	Input characters
U1	ABCdef
U2	123xYz

Conversion of defined characters

The defined-characters described in the range enclosed in brackets [] are input as defined. However, when symbol "\" is described, the input characters (behavior) vary depending on the succeeding characters.

The following shows the correspondence between the defined characters and input characters (behavior).

Defined character		Input character (behavior)	
(Alphabetical characters)		(Characters are input as defined regardless of the status of the Caps Lock key.)	
(Digits)		(Digits are input as defined.)	
\		\	Back slash
\t		The [→] key (tab key) is input.)	
\n		(The [INPUT] key is input.)	
\\[		\[	Left bracket
\\]		\]	Right bracket
\	Back slash	(No data is input. Symbol "\" other than the above is ignored.)	
!	Exclamation	!	Exclamation
"	Double quotation	"	Double quotation
#	Sharp	#	Sharp
\$	Dollar	\$	Dollar
%	Percent	%	Percent
&	Ampersand	&	Ampersand
'	Single quotation	'	Single quotation
(	Left parenthesis	(	Left parenthesis
)	Right parenthesis	)	Right parenthesis
=	Equal	=	Equal
~	Tilde	~	Tilde
|	Pipeline	|	Pipeline
`	Backquote	`	Backquote
{	Left brace	{	Left brace
}	Right brace	}	Right brace
+	Plus	+	Plus
*	Asterisk	*	Asterisk
<	Left angle bracket	<	Left angle bracket
>	Right angle bracket	>	Right angle bracket
?	Question mark	?	Question mark
_	Underscore	_	Underscore
-	Hyphen	-	Hyphen
^	Hat	^	Hat
@	At mark	@	At mark
[	Left bracket	(Not available)	
]	Right bracket	(Specified at the end of a definition.)	
;	Semicolon	;	Semicolon
:	Colon	:	Colon
,	Comma	,	Comma
.	Period	.	Period
/	Slash	/	Slash

2.12.3 Editing a Configuration File

On the edit screen, you can edit the configuration file (KEYDEF.TXT) in "M01:\MSYS\CUSTOM". The edited data is enabled when the power is turned on again.



(1) Press the menu [Open].



The list appears as a pop-up window.

(2) Input "KEYDEF.TXT".



"KEYDEF.TXT" is displayed in the input field of the list.



(3) Press the [INPUT] key.



The configuration file (KEYDEF.TXT) is displayed. Edit the file.

Note

(1) To input or output the configuration file, enter "/MSYS/CUSTOM" in the directory on [Mainte] - [I/O] screen.

Restrictions

- (1) Up to eight key types can be registered.
- (2) Up to 256 characters can be described in each definition. If this maximum number is exceeded, the definition is ignored.
- (3) Only the keys on the operation board are available as the types of characters to be registered.
- (4) When the edit screen is in the playback edit mode, the operation message "Can't execute playback edit" is displayed if an attempt is made to perform playback editing.
- (5) When the configuration file (KEYDEF.TXT) is edited on the edit screen, ;(EOB) cannot be replaced.
- (6) When the configuration file (KEYDEF.TXT) is edited on the edit screen, the first row is not read if the parameter "#19006 EOR disable" is set to "0". Therefore, if any characters are defined on the first row, their definition is deleted by an editing operation.
- (7) The configuration file (KEYDEF.TXT) cannot be erased on the edit screen.
- (8) Any user-defined keys are not displayed on the soft keyboard.
- (9) Always open the configuration file (KEYDEF.TXT) in regular editing mode regardless of the setting of the parameter "#8921 Mass Edit select". No editing can be carried out in mass-editing mode.
- (10) On the edit screen, a block is split-displayed in words; however, spaces are not saved even if specified.
- (11) On the edit screen, up to 255 characters can be input to one block, and the 256th character and after are cut to be displayed. If data is saved in this status, the 256th character and after will be cut.
- (12) If the configuration file is not created, or if no defined character string is assigned to a key, no operation is performed when the "U1" to "U8" keys are pressed.

Inputting a Machining Program and Defining Variables

This chapter explains creating and editing the machining program. Generally, operations are performed on the edit (Edit) screen.

Refer to "Programming Manual" for details on G code programming.

3.1 Inputting a Machining Program

When using the program created by external device, input it to NC by using program input/output function. For information on the data input/output function, refer to "5.1 Inputting and Outputting a Program".

3.2 Creating and Editing a Machining Program



Program editing (add, erase, change) can be performed in the NC memory, HD, memory card (front-side SD card), DS (SD card inside the control unit) or USB memory.

This function is used for machining program, MDI program and fixed cycle program.

On the edit screen, editing (add, erase, change) and cursor position search can be performed.

There are 3 types of display as shown below:

Selected display type is retained after screen transition.

Multi-program display type	Enables to edit two programs using each editing area.
G-code guidance display type	Enables to edit a program referring to the G code guidance.
Playback display type	Enables to edit program trying sample machining.

You can edit the program on the monitor screen as well. For details, refer to "10.6 Correcting the Machining Program".

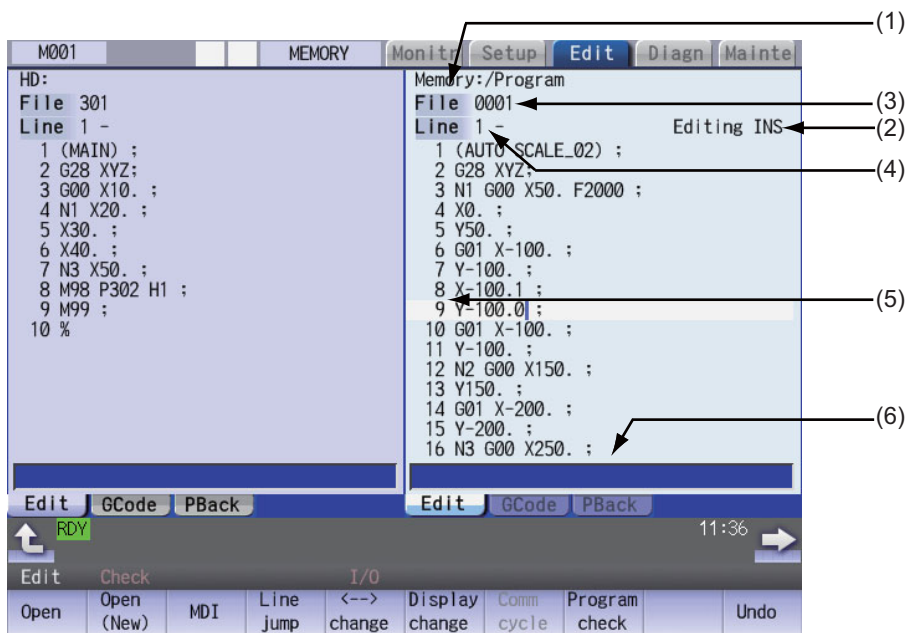
There are two types of editing available: regular editing and mass-editing. The specification and the limitation are different between regular editing and mass-editing.

The conditions and the maximum edit size of mass-editing are as follows:

Model	Conditions of mass-editing	Maximum edit size
M800 Series	<ul style="list-style-type: none"> ♦Storage location of the opened machining program is either HD, memory card, USB memory or DS. ♦The size of the file is 1.0MB or more. (Except when the parameter "#8910 Edit undo" is "0", which needs 2.0MB or more.) 	M800S: 20MB M800W (Windows-based display unit): 1GB
M80W Series	<ul style="list-style-type: none"> ♦Storage location of the opened machining program is either HD, memory card, USB memory or DS. ♦The size of the file is 1.0MB or more. (Except when parameter "#8910 Edit undo" is "0", which needs 2.0MB or more.) 	Windows-based display unit: 1GB
M80 Series	<ul style="list-style-type: none"> ♦Storage location of the opened machining program is memory card, USB memory or DS. ♦The size of the file is 0.5MB or more. 	10MB

CAUTION

The program including a character of any language other than the display language is not correctly displayed. Do not edit such a program. Any part of the program other than the comment part may also be changed if edited.



Display items

Display items	Details
(1) Path display	The path of the currently opened program file is displayed. (Example) Memory:/program When the path is too long, the characters exceeding the 37 characters (1-byte code) cannot be displayed.
(2) N No. incremental value display Edit type display Current edit display "Editing" Insert mode display "INS"	<N No. incremental value display> This displays an automatic additional value of sequence No. <Edit type display> This displays "EX" in mass-editing. <Current edit display "Editing"> This displays when performing edit operations after displaying the program. <Insert mode display "INS"> The overwrite mode and insert mode are switched by pressing the [INSERT] key. This is displayed when the insert mode is selected. This is displayed when the insert mode is selected.
(3) Program name display	This displays the file name of the program currently being edited. This displays "MDI" when the MDI program name is being edited.
(4) Regular editing: top line of the displayed program Mass-editing: display position	This displays the top line of the displayed program. Proving an entire program is regarded as 100%, the position of the page currently displayed is shown in percentage during mass-editing.
(5) Line number Program display	<Line number> This displays the last 3 digits of the program line number. When over two or more lines are displayed on the screen because one line is long, the line No. does not attach to the beginning of the next line. The line No. does not attach during mass-editing. <Program display> This displays the contents of the program (machining program, MDI program) currently being edited. The line that the cursor is on is highlighted. The line is not emphasized during mass-editing.
(6) Input section	This inputs the program line number and search character string.

Menus

Menus	Details
Open	This edits and references the existing programs. When the program number is designated and the [INPUT] key is pressed, the program contents appear and can be edited.
Open (New)	This creates a new program. When the program number is set and the [INPUT] key is pressed, new comment or program contents can be created.
MDI	This edits the MDI program. When this menu key is pressed, the MDI program appears and can be edited.
Line jump	When the line number is set and the [INPUT] key is pressed, the program data for the set number and later is displayed on the screen. The cursor moves to the set line number.
% jump	With mass-editing, proving an entire program is regarded as 100%, designate the position of the page to be displayed in percentage and press the [INPUT] key. The program data of the designated display position is displayed on the screen. The cursor jumps to the top line of the displayed program.
<--> change	The area that can be edited is switched between the left and right areas. This menu is available for multi-program display type or the multi-part system simultaneous program editing (3 programs).
Display change	The display type (multi-program display, G code guidance display, and playback display) is switched.
Intrctv cycle	This edits the cycle interactively. <Note> <ul style="list-style-type: none"> •If the parameter "#8991 Interactive cycle" is "0" or the program is being opened in mass-editing mode, this menu is grayed out and non-selectable. •If there is no specification of the interactive cycle insertion, or for the M system, this menu is not displayed.
Program check	Program check is carried out for the program displayed in the area that can be edited.
Synchro view	A blank line is inserted so that the timing synchronization symbols (the timing synchronization operations of the machining program) are aligned horizontally. <Note> <ul style="list-style-type: none"> •This menu is grayed out and non-selectable in the following cases. <ul style="list-style-type: none"> - When the parameter "#1285 ext21/bit0" (Multi-part system program management) is invalid (0). - When two or more edit areas do not display the same name programs of different part systems that are stored on NC memory. - When the program numbers displayed in the left and right editing areas are different.
Cursor OP srch	An operation search is carried out for the currently opened program with the block located by the cursor at the top. When the operation search is completed, the display switches to the monitor screen. <Note> <ul style="list-style-type: none"> •If the parameter "#1285 ext21/bit0" (Multi-part system program management) is enabled (1), or the program is being edited, this menu is grayed out and non-selectable. •If the displayed part system is a sub-part system which does not accept the operation search, this menu is grayed out and non-selectable.
String search	When the character string is designated and the [INPUT] key is pressed, that character string is searched for.
String replace	If the character string to be searched for and the character string to be replaced are separated with a "/" and designated, when the [INPUT] key is pressed, the character string is replaced. This menu cannot be selected during mass-editing.
Line copy	This copies the designated line (multiple lines can be copied.) This menu cannot be selected during mass-editing.
Char copy	The character string (multiple lines acceptable) designated by the cursor is copied.

Menus	Details
Paste	This inserts the most recently copied contents to the line before the cursor or the position before the cursor.
Line clear	This erases the designated line (multiple lines can be erased). This menu cannot be selected during mass-editing.
Miss warning	This enables the input mistake check for the program being edited. This menu cannot be selected during mass-editing.
Next miss	This moves the cursor to the next input mistake warning location. This menu cannot be selected during mass-editing.
Undo	This returns the contents of the program to that prior to saving and display. This menu cannot be selected when parameter "#8910 Edit undo" is set to "0". This menu cannot be selected during mass-editing. <Note> <ul style="list-style-type: none"> When the parameter "#8939 Undo confirm msg" is set to "1", the menu is highlighted while the operation message is displayed.
N auto add	The sequence No. can be added automatically by pressing the [INPUT] key after designating an additional value. This menu cannot be selected during mass-editing.
Display change	This switches the display type.
MDI regist	This registers the MDI program in the memory. This can be performed only when the MDI program is displayed. This menu cannot be selected during mass-editing.
Erase file	This deletes the programs. When the name of the program to be erased is designated, the designated file is deleted.
Display setting	This menu switches the display format of multi-part system simultaneous program editing (2 or 3 programs). <Note> <ul style="list-style-type: none"> This menu is available for 15-type or 19-type.
Guide M/L	This menu switches G code guidance display (M/L system). The switchable G code system follows the parameter "#11082 Lsys_change_Gtype". <Note> <ul style="list-style-type: none"> This is displayed only when the specification for G code switch of program format is valid and the parameter "#1254 set26/bit1" is set to "1". When the G code guidance is not displayed, this menu is grayed out and non-selectable.
Pback next ax	The axis to be displayed in the playback editing is switched from the first to fifth axes and among the sixth and further axes. <Note> <ul style="list-style-type: none"> This menu is enabled if the playback editing (L system) is enabled and the number of axes is 6 or more.
File close	This closes the pop-up window and quits this function.

Operation method (Creating a new machining program)

- (1) Press the menu [Open (New)] on the edit screen.
- (2) Select the device.
(Example) Menu [Memory]

The selected device name and directory (memory: /program) appear in the device name and directory display columns.
For the devices other than NC memory, root directory is selected.
The device on the side being edited is displayed first. If a file is not opened, NC memory will be opened.
- (3) (In case of the device other than NC memory.)
Press [↑], [↓], or key to move the cursor to the directory with the machining program or the directory to be newly created.
If the list contents differ from the actual device or directory, press the menu [List Update].
- (4) (For the devices other than NC memory)
Press the [INPUT] key.

Moves into the directory.
- (5) Enter the program file name to be newly created.
- (6) Press the [INPUT] key.

When new creation is enabled, an EOR-only program is created.
The list display is closed.
- (7) Edit the machining program.

Refer to "3.6 Editing Operations".
- (8) Press the [INPUT] key.


The edited machining program is saved to the device.



Precautions for creating a new machining program


- (1) If an existing program number is designated, it causes an error.
- (2) The part enclosed in parentheses () in the head block of the program is used as a comment.
- (3) If an existing file is set, the message "Designate new creation for existing file" appears.
- (4) Single-byte digits, single-byte uppercase alphabet characters, and Windows-recognizable single-byte symbols are available for the file name or directory name. Therefore, a double-byte code file name such as a Japanese file name cannot be used.
Characters which cannot be used: \ / : , * ? " < > | a to z and space
Also, the followings cannot be treated as file names:
 - File name with extension "\$\$\$", "\$\$0", "\$\$1", "\$\$2", "\$\$3", "\$\$4", "\$\$5", "\$\$6", "\$\$7", "\$\$8", or "\$\$9"
 - "0" (File named "single-byte zero")
- (5) A program, which has a file name consisting of 33 or more characters, cannot be newly created.
- (6) If the parameter "#8936 Delete leading 0" is set to "1" and the file name is designated only by digits, the existing file, edit lock B, and edit lock C are checked by deleting "0" at the head.
For details, refer to "5.8.6 Leading Zero".



Operation method (editing machining program)


- (1) Press the menu [Open] on the edit screen.


- (2) Select the device.
(Example) Menu [Memory]  The selected device name and directory (memory: /program) appear in the device name and directory display columns.
For the devices other than NC memory, root directory is selected.
The device on the side being edited is displayed first. If a file is not opened, NC memory will be opened.


- (3) (In case of the device other than NC memory.)
Press [↑], [↓], , or  key to move the cursor to the directory with the machining program or the directory to be newly created.
If the list contents differ from the actual device or directory, press the menu [List Update].

- (4) (For the devices other than NC memory)
Press the [INPUT] key.  Moves into the directory.

- (5) Press [↑], [↓], , or  key to move the cursor to the machining program to be edited.
The name of the machining program to be edited can be input in the input area.

- (6) Press the [INPUT] key.  The program appears at the top if the file can be opened.
If the program name has been entered in the input area, the program contents is displayed. The cursor moves to the head character of the program. The mode changes to the overwrite mode.
(When it is the initial insert mode, "INS" is displayed to the right of the file name and the mode changes to the insert mode.)
The list display is closed.

- (7) Edit the machining program.  Refer to "3.6 Editing Operations".

- (8) Press the [INPUT] key.  The edited machining program is saved to the device.

Precautions for editing machining program

- (1) An error occurs if a nonexistent program No. is set.
- (2) If the selected program is running or program restarting, it can be displayed but not edited.
An error occurs when the data is set or the [INPUT] key is pressed.
- (3) The fixed cycle program list is displayed when the parameter "#1166 fixpro" is set to "1".
- (4) Editable size differs depending on each device. When the editable size is exceeded, the operation message "Can't edit because of size over" appears.
- (5) "Loading" is displayed in flickering until the file is opened.
- (6) Editing is not possible for a program with 33 or more file name characters.
- (7) When the program in search was edited, the program is searched again as follows depending on the last operation.
 - Search -> Edit: The position in which ONB is displayed is searched again.
 - Search -> Reset 1-> Edit: The program top is searched again.
 - Search -> Reset 2-> Edit: The search is not executed. If a program was added or deleted, the search position may shift.
 - Search -> Reset & Rewind -> Edit: The program top is searched again.
- (8) If an attempt was made to open the currently edited file in the custom screen from this screen, the operation message "Read-only as the file is being edited" may appear.
- (9) If an attempt was made to edit the currently edited file in the custom screen from this screen, the operation message "Read-only file - Can't edit" appears and may not be able to edit.
- (10) If the protection level ("Program edit" data output) designated on the protection setting screen is higher than the current operation level, the machining program cannot be opened (message "data protection" is displayed). However, if the protection level is set to a higher value on the protection setting screen while a machining program remains opened, the machining program is kept opened even after the display has returned to the edit screen. To hide the machining program after changing the protection level, press the menu [Close] to close the machining program, and change the protection level on the protection setting screen. For details, refer to "2.8 Changing the Operation Level (Protect Setting Screen)".
- (11) Display will be changed as follows depending on the value set in the user parameter "#19006 EOR Disable".
 - <When the parameter "#19006 EOR Disable" = "0">
 - When a file including "%" is opened in the edit screen, characters up to "%" will be displayed. By saving the file, characters after "%" will be discarded.
 - When a file not including "%" is opened, "%" will be displayed at the end of the edit screen. By saving the file, "%" will also be saved.
 - When an external device file, other than NC memory, is opened, it will be displayed in the edit file with skipping the first line.
 - <When the parameter "#19006 EOR Disable" = "1">
 - The contents of a file is displayed on the edit screen as it is.
 - When a file whose last character is other than "%" is opened, "%" will be displayed at the end of the edit screen. "%" will be saved by saving the file. For example, if the end of the file is "%" + "CRLF", an extra "%" will be added at the end.
 - When an external device file, other than NC memory, is opened, the first line will not be skipped.
 - "Line copy" and "Line clear" can be made at the lines other than the last line which includes "%".

3.3 Registering and Editing the MDI Program



Operation method for editing MDI program

- | | | |
|--|---|--|
| (1) Press the menu [MDI] on the edit screen. | ➔ | <p>The menu is highlighted.
 The MDI program is displayed from the head of the editing side. The cursor moves to the head character of the program.
 The cursor moves to the head character of the program. The mode changes to the overwrite mode.
 (When it is the initial insert mode, "INS" is displayed to the right of the file name and the mode changes to the insert mode.)</p> |
| (2) Edit the MDI program. | ➔ | Refer to "3.6 Editing Operations". |

Note

- (1) Before starting MDI operation, confirm that the MDI settings are completed. If "Editing" or "MDI no setting" is displayed, the MDI operation cannot be started.
 When the [INPUT] key is pressed, the head block will be searched, and the message "MDI Set ended" will appear. The setting will then be completed.
 If the cursor is moved without editing, the block indicated by the cursor will be searched for when the [INPUT] key is pressed.
- (2) If the [INPUT] key is pressed when the number of MDI program characters including EOB (;) and EOR (%) exceeds 2000, "Memory capacity over" message will appear and the MDI program will not be searched for execution.
 Note that the contents edited after the MDI program is saved last will not be saved in the NC.
- (3) When the parameter "#1288 ext24(bit0)" (MDI program clear) is set to "1", the MDI programs are cleared when MDI operation ends, the power is turned ON again, reset is input and emergency stop is canceled, and only % programs are saved.
 - ◆When the multi-part system program management is ON, the MDI program of the part system in which MDI operation ends or the reset signal issues is cleared.
 - ◆The MDI programs before editing is cleared during the MDI program editing.
 - ◆Reset input refers to NC reset 1, NC reset 2 and reset & rewind.
 - ◆MDI program clear is performed regardless of operation mode.
 - ◆When MDI program is cleared during the character string replacement confirmation waiting or line clear confirmation waiting, the character string replacement or line clear is canceled and each menu highlight returns to normal.
 - ◆When MDI program is cleared after the range of the target block for line copy and line clear has been set, the designated machining program is de-highlighted.

Operation method for registering MDI program

- (1) Press the menu [MDI] on the edit screen.
- (2) Select the program to register, and then press the [INPUT] key.

Note

- (1) The program is registered as a general program of NC memory.
When the fixed cycle or MTB macro is selected with the parameter "#1166 fixpro" (Fixed cycle editing), the program cannot be registered. The "Save not possible" message appears.
- (2) Program cannot be registered while "Editing" is being displayed. The "Save not possible" message appears. Press the [INPUT] key to be "MDI Set ended".
- (3) When the general program remaining capacity is less than the value of MDI program to be registered, the program cannot be registered. The "Memory over" message appears.
- (4) When the number of remaining general programs is zero, the program cannot be registered. The "Program entry over" message appears.
- (5) When the [INPUT] key is pressed without entering the program name, "setting error" occurs.
- (6) If the program name is input with only numbers when the parameter "#8936 Delete leading 0" is set to "1", the number without the leading zero is registered as the program name. However, when a number without a leading zero is outside the range 1 to 99999999, the leading zero is not deleted.
- (7) If the input program name already exists in the NC memory, the MDI program cannot be registered during the operation, program restart or program checking. The operation message "Executing automatic operation", "Program restarting" or "Program checking" appears.
If the program name is input with only numbers when the parameter "#8936 Delete leading 0" is set to "1", the program is checked with the leading zero deleted. (Example: If the MDI registration is specified as "0001" when the program "1" is in automatic operation, the "Executing automatic operation" message appears and the registration cannot be performed.)
- (8) When the input program name already exists in the NC memory and it is not being in operation, the "Overwrite this file? (Y/N)" message appears. When the [Y] or [Input] key is input, the program name is overwritten, and when a key other than those is pressed, the registration is canceled.
If the program name is input with only numbers when the parameter "#8936 Delete leading 0" is set to "1", the program is checked with the leading zero deleted. (Example: If the MDI registration is specified as "0002" when the program "2" already exists in the NC memory and it is not in the operation, the "Overwrite this file? (Y/N)" message appears.)
- (9) When the program name to be input is subject to edit lock (edit lock B: 8000 to 9999, edit lock C: 9000 to 9999), the message "Edit lock B" or "Edit lock C" appears, and the program name cannot be registered.
If the program name is input with only numbers when the parameter "#8936 Delete leading 0" is set to "1", the program is checked with the leading zero deleted. (Example: If the MDI registration is specified as "008000" when the edit lock B is valid, the "Edit lock B" message appears and the program cannot be registered.)
- (10) When the data protection is valid, "Data protect" is displayed and the program cannot be registered in the NC memory.

3.4 Registering and Editing the Fixed Cycle Program

The subprogram for the fixed cycle can be input, output and edited.

However, it may not be changed without permission from the MTB.

Refer to "Programming Manual" for details on the fixed cycle program.



CAUTION



Do not change the fixed cycle program without prior approval from the MTB.

3.4.1 Fixed Cycle Operation Parameters

To input/output or edit the data of each fixed cycle subprogram, use the Data I/O and edit screens in the same way as when creating usual user-created work programs. In this case, the parameters must have been set. Set "1" in parameter "#1166 fixpro". If this parameter is valid, the IN/OUT and edit screens are usable only for operating a fixed cycle control subprogram. During this period, program file displays only fixed cycle programs. Thus, after the fixed cycle program operation, return the parameter to "0".

Note

(1) Parameter "#1166 fixpro" will be set to "0" when the power is turned OFF.

3.4.2 Transmitting and Erasing the Fixed Cycle Program

Transmit/erase the fixed cycle program from the Data I/O screen. Check that fixed cycle operation parameter "#1166 fixpro" is valid.

The operating procedure is the same as a user machining program.



3.5 Erasing a File





Operation method

- (1) Press the menu [Erase file] on the edit screen.
- (2) Select the device.
(Example) Menu [Memory]

➔

The selected device name and directory (memory: /program) appear in the device name and directory display columns.
For the devices other than NC memory, root directory is selected.
The device on the side being edited is displayed first.
If a file is not opened, NC memory will be opened.
- (3) (In case of the device other than NC memory.)
Press the [↑], [↓], , or  key to move the cursor to the directory with the machining program or the directory to be newly created.
If the list contents differ from the actual device or directory, press the menu [List Update].
- (4) (For the devices other than NC memory)
Press the [INPUT] key.

➔

Moves into the directory.
- (5) Press [↑], [↓], , or  key to move the cursor to the machining program to be edited.
The name of the machining program to be erased can be input in the input area.
- (6) Press the [INPUT] key.
When a name of machining program is inputted in the input area, the confirmation message appears.
- (7) Press the [Y] or [INPUT] key.
Press the [N] key to cancel.

Note

- (1) The file is not erased in the following cases.
 - ♦The file that is to be erased is currently being used in automatic operation.
 - ♦The file that is to be erased is subject to edit lock B or C.
 - ♦Data protection is valid.
 - ♦The file to be erased is in the "program restarting" state.

3.6 Editing Operations



When the program is edited, the key input data is directly written into the program display area. All data is overwritten from the cursor position. "Editing" appears on the right side of the file name display once input is started.

Press the [INPUT] key to save the program to the device and clear the "editing" message.

The editing operations from when the file is actually opened are explained in this and the following sections. These editing operations are common for the machining program and MDI program.

Note

- (1) The initial mode (overwrite/insert) at start of editing and the [DELETE] key operation (DELETE/BackSpace) can be selected with the parameters. The operation with overwrite mode and DELETE operation is explained in this manual unless otherwise specified.



CAUTION

If there is no value after the G command, the operation will be the "G00" operation when the program is run due to key chattering, etc., during editing.

3.6.1 Changing the Display

Switching the active area

Switching the active area is possible only when the multi-program display type is selected.

Press the [←→ change] key to switch the active area between the left and right window.

Changing the display using the page changeover keys (: Previous Page, : Next Page)



key: This displays one page of preceding lines of the current top line.

When there is less than one page of data, a page of data will be displayed including the data currently displayed. The cursor moves to the last line of the screen.



key: This displays one page of following lines of the current bottom line.

The cursor moves to the top line of the screen.

Note

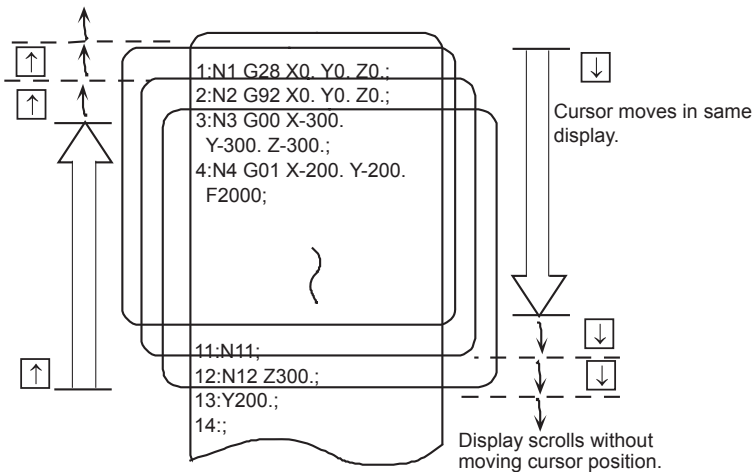
- (1) The cursor does not move in mass-editing.

Changing the display with the cursor key

The cursor will move up one line in the program each time the cursor key ([↑], [↓]) is pressed.

If the [↓] key is pressed at the top line of the program display area, the program will scroll up one line. If the [↑] key is pressed at the end, the program will scroll down one line.

When a block is displayed over 2 or more lines, [↑], [↓] keys move the cursor by block unit. The cursor moves by line in mass-editing.

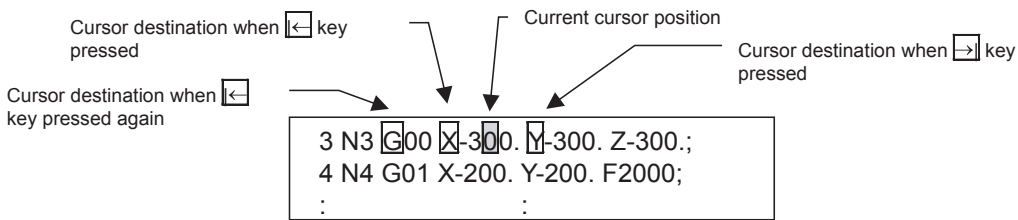


Move the cursor using the tab keys ([←]: back tab/ [→]: tab)

[←] key : Moves to the start of the word where the cursor is currently positioned.

If the cursor is at the start of a word, it moves to the start of the previous word.

[→] key : Moves to the word after the word where the cursor is currently positioned.



Note

(1) Pressing [←] [→] keys or [←] [→] keys does not make any difference in mass-editing.

Split display by word unit

The program is split by word unit and displayed.

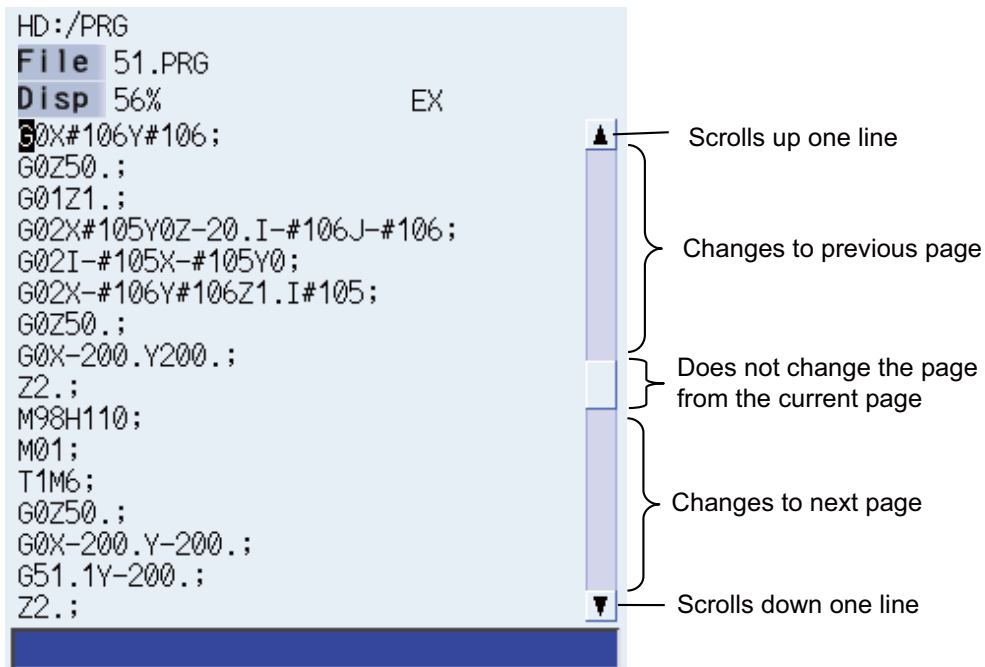
In mass-editing, program is not split by word unit and displayed as text data.

Switching the page by the scroll bar (Mass-editing)

For mass-editing, if you touch the scroll bar, the page is switched or the screen is scrolled by one line.

If you touch [▲] or [▼] of the scroll bar, the screen is scrolled up or down by one line. Also, if you touch the empty portion of the scroll bar, the page is switched to the next page or previous page.

Pages cannot be changed by dragging the slider.



3.6.2 Displaying an Arbitrary Line

Operation method

(1) Press the menu [Line jump].

(2) Input the line No.
(Example) 6 [INPUT]



The program appears with the designated line No. at the head.

Note

- (1) When "0" is input, the cursor moves to the first line.
- (2) When "E" is input, the cursor moves to the end.

3.6.3 Rewriting Data

Operation method (Initial data overwrite mode)

- | | | | |
|-----|--|---|--|
| (1) | Move the cursor to the position where data is to be inserted.
The cursor can be moved to one place to the right of EOB (;). | | |
| (2) | Set the data. | ➔ | The message "Editing" appears when setting is started. The data is set from the position of the cursor. Data at the area is overwritten. The cursor moves one space (character) at a time to the right as the data is set. |
| (3) | When the setting is completed, press the [INPUT] key. | ➔ | EOB (;) is added to the set data and the data is fixed. When newly creating data, the cursor moves to the head of the next line. When changing existing data, the cursor does not move. |

Note

- (1) When the cursor is on or one place to the right of EOB (;), input data is inserted even if not in input mode (refer to "3.6.5 Overwriting Data (Initial Data Insertion Mode)").

Operation method (Initial data insertion mode)

- | | | | |
|-----|--|---|---|
| (1) | Move the cursor to the position where data is to be inserted.
The cursor can be moved to one place to the right of EOB (;). | | |
| (2) | Set the data. | ➔ | The message "Editing" appears when setting is started. The data is set from the position of the cursor. The data from the cursor position moves to the right. The cursor moves one space (character) at a time to the right as the data is set. |
| (3) | When the setting is completed, press the [INPUT] key. | ➔ | The set data is fixed. The cursor does not move, but if there is no EOB (;) at the end of the line, it will be added. Then, the cursor moves to the next line. The message "Editing" disappears. |



Precautions

- (1) When changing to another function such as the program check, or to another screen such as the monitor screen when "Editing" displays, the operation message "Save current file? (Y/N)" displays. If [N] key is pressed changing to the other screen once, and the edit screen is selected again, the program before editing operation will be displayed. (Edited contents will be invalid.)
- (2) When changing to another function such as the program check, or to another screen such as the monitor screen when "Editing" displays, the operation message "Save current file? (Y/N)" displays. If the file could not be saved due to "Memory over", etc., even the [Y] key is pressed, the error message displays and the screen is not changed. The screen display varies depending on the succeeding operation (a) or (b) as follows.
When the file could not be saved and the error message displays due to "Memory over", etc., even the [INPUT] key is pressed before the screen change operation, the screen display also varies depending on the succeeding operation (a) or (b) as follows.
- (a) When changing to another function such as the program check, or to another screen such as the monitor screen without editing, the screen transition is performed without displaying the operation message. If the display returns to the program edit screen again, the previously saved contents are displayed.
- (b) When changing to another function such as the program check, or to another screen such as the monitor screen after editing (data setting key operation, data correction key operation, or the menu [Paste], [Line clear] or [String replace] operation), the operation message "Save current file? (Y/N)" is displayed.



- (3) When editing a program that is being checked, the "Checking other programs. Reset? (Y/N)" message is displayed. Press the [Y] or [INPUT] key to reset the check, and the edit operation can be continued. When pressing any other key, "Program checking" displays and the program cannot be edited.
- (4) Up to 255 characters can be input in one block in regular editing and 127 characters in mass-editing.
- (5) "Saving" is displayed in flickering during saving.

3.6.4 Inserting Data (Initial Data Overwrite Mode)

Operation method




- (1) Move the cursor to the position where data is to be inserted.
- (2) Press the [INSERT] key.  The mode changes to the insertion mode. "INS" appears to the right of the file name. The cursor changes to '|'.
- (3) Set the data.
- (4) When the setting is completed, press the [INPUT] key.  The set data is fixed. The cursor does not move, but if there is no EOB (;) at the end of the line, it will be added. Then, the cursor moves to the next line. The mode returns to the overwrite mode, and the message "Editing" disappears.

Note



- (1) Up to 256 characters can be set in one line.
- (2) The insertion mode will be finished if a key such as [DELETE], [C.B], [CAN], [INPUT], [↑], [↓], [←], [→], [|←], [|→],  or  pressed.
- (3) For normal editing, EOB(;) is added to a row without EOB(;), and the cursor moves to the next line. A row with EOB(;) is skipped, and the cursor moves to the next line. (No cursor movement.)
- (4) During mass-editing, linefeed is inserted every time EOB (;) is input. (Cursor moves to the head of the next line.)

3.6.5 Overwriting Data (Initial Data Insertion Mode)

Operation method



- (1) Move the cursor to the position where data is to be inserted.
- (2) Press the [INSERT] key.  The mode changes to the overwrite mode. "INS" appears to the right of the file name. The cursor changes to '■'.
- (3) Set the data.  The data is set from the position of the cursor. Data at the area is overwritten. The cursor moves one space (character) at a time to the right as the data is set.
- (4) When the setting is completed, press the [INPUT] key.  The set data is fixed. The mode returns to the insertion mode, "INS" is displayed in the right side of the file name, and the message "Editing" disappears. The cursor returns to '|'.

Note



- (1) The insertion mode will be finished if a key such as [DELETE], [C.B], [CAN], [INPUT], [↑], [↓], [←], [→], [↵], [↶], [↷],  or  pressed.
- (2) For normal editing, EOB(;) is added to a row without EOB(;), and the cursor moves to the next line. A row with EOB(;) is skipped, and the cursor moves to the next line. (No cursor movement.)
- (3) During mass-editing, linefeed is inserted every time EOB (;) is input. (Cursor moves to the head of the next line.)

3.6.6 Deleting Data



Operation method (Deleting one character) (Deleting by DELETE key action ("#8967 DELETE key action" is set to "0"))

- (1) Move the cursor to the character to be deleted.
- (2) Press the [DELETE] key.  1 character is deleted at the cursor position, and "Editing" appears. The data from the cursor position moves to the left. When this key is held down, the characters can be deleted one at a time.
- (3) Press the [INPUT] key.  The edited machining program is saved to the device and "Editing" disappears.

Operation method (Deleting one character) (Deleting by BackSpace key action ("#8967 DELETE key action" is set to "1"))

- (1) Move the cursor to the right side of the character to be deleted.
- (2) Press the [DELETE] key.  1 character at the left side of the cursor position is deleted, and "Editing" appears. The data from the cursor position moves to the left. When this key is held down, the characters can be deleted one at a time.
- (3) Press the [INPUT] key.  The edited machining program is saved to the device and "Editing" disappears.

Operation method (Deleting one line)

- (1) Move the cursor to the line to be erased.
- (2) Press the [C.B] key.  1 line is deleted at the cursor position, and "Editing" appears. The lines following the cursor position are shifted upward. The cursor position does not change. When this key is held down, the line can be deleted one at a time.
- (3) Press the [INPUT] key.  The edited machining program is saved to the device and "Editing" disappears.

Note

- (1) In the case where the block for the deleted line covers multiple lines, these lines are also deleted.
- (2) Last line only with "%" cannot be deleted.
- (3) "Executing" is displayed during line clear. The message flashes every second.

Operation method (Deleting designated lines)

(1) Press the menu [Line clear].

(2) Designate the deletion range.



The background color for the range to be deleted turns light blue.

(Example) From line 8 to line 10
8/10 [INPUT]

When deleting 1 line, it is also possible to make a selection using the [↑], [↓] keys and designate by pressing the [INPUT] key.

(3) Press the [Y] or [INPUT] key.
Press the [N] key not to delete.

Note

(1) If the [INPUT] key is pressed without setting a line No., the line where the cursor is will be deleted.

(2) If the last line of the file is the range to be deleted, the last line can be designated as "E".

(Example) From 8th line to last line: 8/E

From 1st line to last line: /E

(3) "Executing" is displayed in flickering during line clear.

(4) During mass-editing, a line to be deleted cannot be designated.

Operation method (Deleting several lines (one screen of data) displayed on a screen)

(1) Press the [CAN] key.



The editing data (machining program) for one screen is deleted and "Editing" appears.




(2) Press the [INPUT] key.



The edited machining program is saved to the device and "Editing" disappears.

3.6.7 Searching for Character Strings

Operation method




- (1) Press the menu [String search].
- (2) Set the character string to be searched for, and press the [INPUT] key.  The character string is searched downward from the character after the current cursor position. If the character string is discovered, the cursor moves to the start of that character string. A message appears if there is no character string applicable to the program. Marking can be performed by adding an option to the character string being searched for. (Example) Mark G20/MR: G20 in red. (Refer to "Marking function" described below for further details.)
(Example) G20 [INPUT]
- (3) To continue searching, press the [INPUT] key again.  The next corresponding character string is searched for. The search finishes when the end of the program is reached.
<Note>
 - ♦It is not possible to return to the head of the program and resume the search. To search from the head of the program, move the cursor to the top line and carry out the search operation again.
- (4) To end the search, press the menu key.  The menu highlight returns to normal, and the character string in the input area disappears. The search mode is held until the menu key is pressed. (The character string remains in the input area.)

Note

- (1) "Executing" is displayed in flickering during string search.
- (2) During mass-editing, the marking cannot be made.

Marking function

Character strings to be searched for can be marked in colors.

Argument character string format	Details	Marking color
"Search character string"	The cursor moves to the character string searched for.	None
"Search character string/MR"	The cursor moves to the character string searched for. All displayed searched character strings are marked in red.	Red 
"Search character string/MB"	The cursor moves to the character string searched for. All displayed searched character strings are marked in blue.	Blue 
"Search character string/MG"	The cursor moves to the character string searched for. All displayed searched character strings are marked in green.	Green 
"/MC"	The marking for all marked character strings is cleared.	-
"/MCR"	The marking for character strings marked in red is cleared.	-
"/MCB"	The marking for character strings marked in blue is cleared.	-
"/MCG"	The marking for character strings marked in green is cleared.	-

Note

- (1) The marking status is maintained when another program is opened while character strings are still marked.
- (2) If the input mistake check warning function is enabled while character strings are still marked, the marking is given priority in the case where the input mistake location and the marked display overlap.
- (3) In the case where the search marking and input mistake check warning function are displayed simultaneously, the marking is cleared and the input mistake warning display remains.
- (4) With the multi-program display type, the search and marking is valid only in the area where the search and marking is carried out.
- (5) With the multi-program display type, the character string and color to be marked are not synchronized in the each editing area.
- (6) The marked status is maintained until the NC power is turned OFF.
- (7) Marking function is invalid in mass-editing.

Important points when performing search

- (1) If the designated character string cannot be found, the operation message "Designated character string not found" appears.
- (2) A search is performed for a character string containing the designated character string, irrespective of the characters before and after. As a result, if "G2" is designated, G20 - G29 and G200 etc. will also be the subject of a search.
Character string data setting example

Designated character string	Search character string example
N10	Character strings that include "N10" such as "N10" and "N100".
N10 X100.	Character string "N10 X100."
X-012.34	Character string "X-012.34" (A search is not performed for "X-12.34".)





3.6.8 Replacing Character Strings

A character string in a program can be searched for and replaced.

The following three methods can be used.

- The applicable character string is searched for and replaced one by one. (To search for the next character string, press the [INPUT] key.)
- All applicable character strings in the program are replaced in a batch. (Designate "/G" when setting.)
- The program character strings from the current cursor position to the last line are to be replaced in a batch. (Designate "/E" when setting.)

Operation method

- | | |
|---|--|
| (1) Press the menu [String replace]. | |
| (2) Designate the search character string and the replace character string.
(Example) Search character string: G02
Replace character string: In the case of G03
G02/G03 [INPUT] (*1) |  The character string is searched downward from the character after the current cursor position.
If a character string is discovered, the cursor moves to the start of that character string, and the operation message "Replace? (Y/N)" appears.
If any character string is not found in the program, the cursor does not move. |
| (3) Press the [Y] or [INPUT] key.
Press the [N] key not to replace. |  The character string is replaced, and a search is performed for the next applicable character string.
(If a batch replacement is performed, a search is not made as the replace operation has been completed.)
The operation message "Designated character string not found" appears when the end of the program is reached.
"Editing" appears if replace is performed. |
| (4) Press the [Y] or [INPUT] key again if continuing the search/replace. |  The same operation as above is performed. |
| (5) To end search/replace, press the [String replace]. |  The menu highlight returns to normal, and the character string in the input area disappears.
The replacement mode is held until the menu key is pressed.
(The character string remains in the setting area.) |

(*1) When batch replacing for all the character strings in the program, add "/G" to the above setting.

Search character string/replace character string/G (Example) G02/G03/G

During batch replacement, after replacing all character strings to the end of the program, the process ends while showing the last character string replaced. Note that the replacement mode is held, and the character string remains in the input area.

Note

- (1) If the program character strings from the current cursor position to the last line are to be replaced in a batch, add "/E" to the above setting.
Search character string/replace character string/E (Example) G02/G03/E
- (2) With the multi-program display type, the replacement on the side which is not being edited is not performed.
- (3) "Executing" is displayed in flickering during string replace.
- (4) During mass-editing, the character string cannot be replaced.

3.6.9 Copying and Pasting Data

Operation method (Copying a line)

- (1) Press the menu [Line copy].
- (2) Designate the copy range.
(Example) From line 8 to line 10
8/10 [INPUT]

➔

 The background color for the range to be copied turns light blue.
 When copying 1 line, it is also possible to make a selection using the [↑] or [↓] key and designate by pressing the [INPUT] key.

Note

- (1) If [INPUT] key is input without setting a line No., the line where the cursor is at is copied.
- (2) The highlight of the copy target lines disappears when editing operations are resumed.
- (3) If the file is edited, or turned back to the previous saved status by pressing the menu [Undo] after the Line copy menu is pressed, the data copied in the line is canceled.
- (4) During mass-editing, the string copy cannot be performed.
- (5) If the last line of the file is the range to be copied, the last line can be designated as "E".
(Example) From 8th line to last line: 8/E
- (6) The copied data is maintained while the copy source file is opened even if the display type or editing area is switched to another one. The data will be discarded after screen transition.

Operation method (Copying character)

- (1) Move the cursor to the head character to be copied.
- (2) Press the menu [Char copy].
- (3) Move the cursor to the end character to be copied, and press the [INPUT] key.

➔

 The background color for the range to be copied turns light blue. The range is fixed by pressing the [INPUT] key.

Note

- (1) Characters of up to 500 bytes can be copied at a time. When the size of the selected characters exceeds 500 bytes, the message "Can not copy more" appears and the cursor does not move.
- (2) The Copying will be canceled, if the [↑], [↓], [←], [→], [|←] or [|→] key is pressed before pressing the [INPUT] key.
- (3) Light blue background for copy range will disappear when editing operation is resumed.
- (4) As long as the original file is opened, the copied content will be saved even if you change the display type or shift the display left and right side. The data will be discarded after screen transition.

Operation method (Pasting the copied data)

(1) Move the cursor to the line where the data is to be pasted.

(2) Press the menu [Paste].



<When copying a line data>

The copied data is inserted upward on the line where the cursor is positioned.

<When copying characters>

The copied data is inserted in front of the cursor position.

<Note>

- In the overwrite mode, the data is inserted in front of the cursor position as well.

(3) Press the [INPUT] key.

Note

- (1) With multi-program display type, data can be copied and pasted between the each editing areas by pressing the [←→ change] key.
- (2) "Executing" is displayed in flickering during pasting.
- (3) During mass-editing, copied data in the regular editing mode cannot be pasted.

3.6.10 Undoing Program Changes

This is used to return the program to the form when [INPUT] was last pressed to save. This operation is valid for the operation of "Rewriting program", "Insert", "Delete", "Line Paste", "Line Clear", "Character String Replace" and "Undo" functions.

Operation method

- | | |
|---|--|
| (1) Change the operation to memory mode, and then press the main menu [Edit]. | |
| (2) Move the cursor to the position to be corrected, and input a character.
(Example) 135
If [Undo] is pressed during "Editing", the system will be returned to the state saved last. | |
| (3) Press the [INPUT] key. | ➔ The edited machining program is saved to the device. The message "Editing" disappears. |
| (4) Press the menu [Undo]. | ➔ The contents of the file return to the same condition as when the editing was started. These contents of the file are saved to the device. |
| (5) Press the menu [Undo] again. | ➔ The contents of the file return to the same condition as when the file was saved in the procedure (3). These contents of the file are saved to the device. |

Note

- (1) This function is only valid when parameter "#8910 Edit undo" is set to "1".
- (2) When returned to the previous status, the cursor will move to the head line.
- (3) With the multi-program display type, returning to the previous contents is valid only in the active area.
- (4) Undoing is not possible in mass-editing mode.
- (5) When undoing is performed, the copied data will be canceled.
- (6) "Executing" is displayed in flickering during undoing.
- (7) When the parameter "#8939 Undo confirm msg" is set to "1", if [Undo] is pressed, the menu is highlighted and the operation message "OK? (Y/N)" appears. The program returns to the previous status by pressing [Y] or [INPUT] key. If other key is pressed, the operation is canceled. When the operation is canceled, the menu highlight returns to normal and the message is deleted.
- (8) When the program does not return to the previous status by pressing [Undo], [Undo] is not highlighted and the operation message "Data protect" or "Executing automatic operation" appears.

3.7 Program Editing Support Function



3.7.1 Displaying Input Mistakes

The input mistake check warning function regards the following cases as input mistakes and displays a warning.

Check item	Warning display range	Details
No decimal point input	Applicable address and data	The decimal point was omitted from the data. (Example) N01 G0 X100 Y50.; "X100" displayed as warning

The addresses to check no decimal point input are shown below.

(○: Check performed, -: No check performed)

Address- es	Decimal point command	Application	M/L	Decimal point check
A	Enabled	Coordinate position data		○ Only for axis name
	Disabled	Miscellaneous function code		
	Enabled	Geometric linear angle data		
	Disabled	Rotation table	M	
	Disabled	MRC program number	L	
	Disabled	Data settings, axis number	L	
	Enabled	Deep hole drilling cycle (2) Safety distance	L	
B	Enabled	Coordinate position data		○ Only for axis name
	Disabled	Miscellaneous function code		
	Disabled	Rotation table	M	
C	Enabled	Coordinate position data		○ Only for axis name
	Disabled	Miscellaneous function code		
	Enabled	Corner chamfering amount (.C)		
	Disabled	Rotation table	M	
	Enabled	Program tool compensation input	L	
	Enabled	Nose R compensation amount (Incremental)	L	
D	Disabled	Compensation number (tool position, tool radius compensation)	M	-
	Enabled	Auto tool length measurement, deceleration ranged	L	
	Enabled	Data settings	L	
	Disabled	Sub-program storage device number (.D)	M	
E	Enabled	N number of threads per inch, precision thread lead		-
F	Enabled	Feedrate		-
	Enabled	Thread lead		
G	Enabled	Preparation function code		-
H	Disabled	Sequence number in sub-program		-
	Disabled	Compensation number (tool position, tool length compensation)	M	
I	Enabled	Circular center coordinates		○
	Enabled	Vector component for tool radius compensation/nose R compensation		
	Enabled	Custom fixed cycle hole pitch	M	
	Enabled	1st cut amount for deep hole drilling cycle (2)	L	

3 Inputting a Machining Program and Defining Variables

Address- es	Decimal point command	Application	M/L	Decimal point check
J	Enabled	Circular center coordinates		○
	Enabled	Vector component for tool radius compensation/nose R compensation		
	Enabled	Custom fixed cycle hole pitch, angle	M	
	Disabled	Dwell at deep hole drilling cycle (2) return point	L	
K	Enabled	Circular center coordinates		○
	Enabled	Vector component for tool radius compensation/nose R compensation		
	Disabled	Custom fixed cycle hole count	M	
	Disabled	Hole drilling cycle repeat count	L	
	Enabled	2nd cut amount for deep hole drilling cycle (2)	L	
	Disabled	Fixed cycle repeat count	M	
L	Disabled	Sub-program repeat count		-
	Disabled	Fixed cycle repeat count	M	
	Disabled	Program tool compensation input type selection (L2, L10, L11)	L	
	Disabled	Data setting selection (L70)	L	
M	Disabled	Miscellaneous function code		-
N	Disabled	Sequence No.		-
	Disabled	Data setting, data number	L	
O	Disabled	Program No.		-
P	Enabled/ Disabled	Dwell time (parameter)		-
	Disabled	Sub-program call program number		
	Disabled	Program tool compensation input compensation number		
	Disabled	Custom fixed cycle hole count	M	
	Disabled	Helical pitch count	M	
	Disabled	Surface speed radius	M	
	Enabled	Scaling factor	M	
	Disabled	High-speed mode type	M	
	Disabled	2nd reference position number	L	
	Disabled	Constant surface speed control axis number	L	
	Disabled	MRC finished shape start sequence number	L	
	Enabled	Cut-off cycle, shift amount/cut amount	L	
	Disabled	Compound thread cutting cycle cut count, chamfering, nose angle	L	
	Enabled	Compound thread cutting cycle thread height	L	
	Disabled	Data settings large division number	L	
	Disabled	Restore sequence number fro sub-program	L	
	Enabled	Coordinate position data	L	
Q	Enabled	Deep hole drilling cycle cut amount	M	-
	Enabled	Back boring shift amount	M	
	Enabled	Fine boring shift amount	M	
	Disabled	Spindle minimum clamp rotation speed	L	
	Disabled	MRC finished shape end sequence number	L	
	Enabled	Cut-off cycle cut amount/shift amount	L	
	Enabled	Compound thread cutting cycle minimum cut amount	L	
	Enabled	Compound thread cutting cycle 1st cut amount	L	
	Enabled	Cut amount each time for deep drilling cycle 1	L	
	Disabled	Program tool compensation input hypothetical nose point number	L	
	Disabled	Dwell at cut point for deep drilling cycle 2	L	

Address- es	Decimal point command	Application	M/L	Decimal point check
R	Enabled	R-designated circular radius		○
	Enabled	Corner rounding circular radius (.R)		
	Enabled	Program tool compensation input compensation amount		
	Enabled	Fixed cycle R point	M	
	Enabled	Synchronous tap/asynchronous tap change	M	
	Enabled	Auto tool length measurement deceleration area r	L	
	Enabled	MRC longitudinal, edge, and escape amount	L	
	Disabled	MRC molding division amount	L	
	Enabled	Cut-off cycle return amount	L	
	Enabled	Cut-off cycle escape amount	L	
	Enabled	Compound thread cutting cycle finishing allowance	L	
	Enabled	Compound thread cutting cycle, cutting cycle taper difference	L	
	Enabled	Distance to R point for hole drilling cycle, deep hole drilling cycle 2	L	
	Enabled	Coordinate position data	L	
S	Disabled	Spindle function code		-
	Disabled	Spindle maximum clamp rotation speed	L	
	Disabled	Constant surface speed control surface speed	L	
T	Disabled	Tool function code		-
U	Enabled	Coordinate position data		○ Only for axis name
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	
V	Enabled	Coordinate position data		○ Only for axis name
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	
W	Enabled	Coordinate position data		○ Only for axis name
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	
X	Enabled	Coordinate position data		○ Only for axis name
	Enabled	Dwell time		
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	
Y	Enabled	Coordinate position data		○ Only for axis name
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	
Z	Enabled	Coordinate position data		○ Only for axis name
	Disabled	2nd miscellaneous function code	L	
	Enabled	Program tool compensation input	L	

Performing a consecutive input mistake check when creating a program

- (1) Press the menu [Open (New)], input a new file name, and press the [INPUT] key. → Only an EOR program is created.
- (2) Press the menu [Miss warning].
- (3) Edit the program. → A warning is displayed at the moment the [INPUT] key is pressed.

Memory:/Program

File 100

Line 1 - 3

1 G28 XYZ;

2 G00 X1 ;

3

- (4) Correct the input mistake and continue with program creation.

Performing a batch input mistake check for an existing program

- (1) Change the operation to memory mode or MDI mode and perform a machining program operation search.
- (2) Press the [Edit].
- (3) Press the menu [Miss warning]. → A warning displays the position where an input mistake occurred.
The cursor moves from its current position to the first input mistake that was found.

Memory:/Program

File 348

Editing

Line 11 - 26

11 F1000 S3000 ;

12 M3 ;

13 N20 ;

14 G41 D3 ;

15 G3 Z-20. I20. P3. ;

16 G1 X90. Y100. F1000 ;

17 G91 X100. ;

18 Y100 ;

19 X-100 ;

20 Y-110 ;

21 N30 ;

22 G90 G0 Z5. ;

23 G40 ;

24 G91 G28 Z0 ;

25 M2 ;

(4) Press the menu. [Next miss]



The cursor moves to the next input mistake position.

```
Memory:/Program
File 348 Editing
Line 11 - 26
11 F1000 S3000 ;
12 M3 ;
13 N20 ;
14 G41 D3 ;
15 G3 Z-20. I20. P3. ;
16 G1 X90. Y100. F1000 ;
17 G91 X100. ;
18 Y100 ;
19 X-100 ;
20 Y-110 ;
21 N30 ;
22 G90 G0 Z5. ;
23 G40 ;
24 G91 G28 Z0 ;
25 M2 ;
```

(5) Correct the input mistake and continue with program creation.

Precautions

(1) The input mistake check timing is outlined in the following table.



Timing	Check range	Check item	Example
When an edit key (alphabet, numbers, symbols, [Delete] etc.) is pressed (Does not include the cursor key and [Page Up/Down] keys.	1 block where the cursor is located	Decimal point	A warning is displayed upon pressing [INPUT] when "X10;" is input.
			A warning is displayed upon pressing [INPUT] when the "X10.Y" "." is inserted in the case where "X10Y" is input.

If the menu [Miss warning] is pressed again when the input mistake check warning function is enabled, this function is then disabled. The character color of the location of an input mistake then returns to normal.

- (2) The menu [Next miss] is grayed out and cannot be selected when the menu [Miss warning] is not highlighted.
- (3) An input mistake check warning function can be performed even when editing a MDI program.
- (4) An input mistake check warning function can also be performed for a comment block.
- (5) If the data in an address that is subject to a decimal point input mistake is "0", no warning is issued regardless of the presence of a decimal point.
(Example) No warning is issued for "X0"
If the data in an address that is subject to a decimal point input mistake has been omitted, no warning is issued.
(Example) No warning is issued for "G28XYZ"
- (6) Blocks with "[,]" are not subject to an input mistake check warning function.
- (7) The input mistake status is held in the operation screen edit window, setup screen MDI edit window, and edit screen edit area.
- (8) If an input mistake is found after the current cursor position, the operation message "Input miss was detected" appears. If no input mistake is found, the operation message "Input miss was not detected" appears.
- (9) With the multi-program display type, the input mistake check of the non-active area is not performed. When the editable side is switched with the menu [←→ change] during the input mistake check warning function ON, the cursor moves to next input mistake position. The messages "Input miss was detected" and "Input miss was not detected" are judged referring to the cursor position on the side being edited.
- (10) Input mistake check warning function is disabled in mass-editing.
- (11) "Executing" is displayed in flickering during checking input mistakes.
- (12) Decimal point command is enabled or disabled for each address depending on the G code type, but the input mistake check is independent of the G code type. Thus the mistake check is carried out while the state of whether the decimal point command is enabled or disabled is kept the same for each address. Refer to the table in the previous section for whether the decimal point command is enabled or disabled for each address.

3.7.2 Performing Operation Search at the Cursor Position

By pressing the menu [Cursor OP srch] when the device is in the normal status (not being in status such as editing or character searching, etc.), operation search of the selected part system is carried out starting.

- (1) Select the part system that the cursor operation search is performed.
- (2) Open the program on the edit screen.  The program edit window appears.
- (3) Move the cursor to the block to be carried out the cursor operation search.
- (4) Press the menu [Cursor OP srch].  Operation search is carried out starting from the block that the cursor is positioned. During the search "Searing" will display blinking. After search is completed, the display returns to the monitor screen.

Note

- (1) When the multi-part system program management is valid, the menu [Cursor OP srch] is disabled and the cursor operation search cannot be performed.
- (2) During program editing, the menu [Cursor OP srch] is disabled and the cursor operation search cannot be performed.
- (3) During the MDI program is displayed, the menu [Cursor OP srch] is disabled and the cursor operation search cannot be performed.
- (4) During automatic operation, checking or restart search by selected part system, the cursor operation search cannot be performed displaying the messages "Executing automatic operation", "Program checking" and "Program restarting" for each status.
In such cases, the display does not transit to the monitor screen. However, it is enabled when the parameter "#11039 Cusr pos srch typ" is set to "1" even if the operation is under single block stop. For details, refer to "Search during single block stop" in "10.6.1 Program Editing".
- (5) During automatic operation, checking or restart search by other than the selected part system, the cursor operation search can be performed, and the messages "Executing automatic operation", "Program checking" and "Program restarting" will not appear. In this case, the display transits to the monitor screen.
- (6) The cursor position search is not available for the sub part system I or II in M80/M80W Series, or the sub part system II in M800 Series. This menu is non-selectable when the search cannot be operated.

3.7.3 Adding Sequence No. (N No.) Automatically

When the sequence No. (N No.) is input once, the sequence No. to which a constant value is added can be automatically added to each block of the machining program.

The added sequence No. data is to N2 to N99999999.

This function is disabled during mass-editing.

Operation method

(1) Press the menu [N auto add].

(2) Input the incremental value.
(Example) 10 [INPUT]

<When creating a new program>

(3) Press the menu [Open (New)], then press the menu [Memory].

(4) Input a file name not used, then press the [INPUT] key.
(Example) 101

(5) Input a program with N No.
(Example) N100G28XYZ

<When editing an existing program>

(3) Press the menu [Open], then press the menu [Memory].

(4) Select a file, then press the [INPUT] key.

(5) Move the cursor to the position where data is to be inserted. Press the [INSERT] key.

(6) Input " ; " (EOB).

(7) Input the second block data and " ; " (EOB).
(Example) G92X0.Y0.Z0.;

(8) Press the [INPUT] key.

Note

- (1) When the menu [N auto add] is pressed again while the menu is highlighting, N No. additional value display column is cleared, and N No. automatic addition is canceled.
- (2) The setting range is 1 to 1000. When "01" is input, "1" is set. When "0" is input, this function is canceled. When an illegal value or 9 characters or more is input, an error will occur.
- (3) When "0" is input, this function is canceled.
- (4) When an illegal value or 9 characters or more is input and [INPUT] is pressed, the "Setting error" appears.
- (5) The incremental value can be set even when the machining program has been not opened. Even if the machining program is opened again, the incremental value is not invalid.
- (6) The incremental value is not cleared with the screen transition.
- (7) This function is enabled only during regular editing of edit screen.
- (8) This function is disabled during mass-editing. However, the set N No. additional value in regular editing is not cleared, and the additional value is valid during regular editing again.
- (9) Even if the same N No. exists by automatic addition, an error will not occur.
- (10) The system separately has N No. in a right area and left area of the edit screen.
- (11) When the previous block is leading zero like "N010", N No. automatic addition can be executed. However, "0" is not added, and "N10" is displayed.

Example when N No. is added

(1) When the previous block has N No. (When the cursor is located at the last character in the overwrite mode.)

N100 G28 X0 Y0 Z0 ; -> Input ";" -> N100 G28 X0 Y0 Z0;N110;
 N100 G28 X0 Y0 Z0 ; -> Input ";" -> N100 G28 X0 Y0 Z0 ;N110;
 N100 G28 X0 Y0 Z0 ; -> Input ";" -> N100 G28 X0 Y0 Z0 ;N110;

(2) When the previous block has N No. (When the insertion mode)

N100 G28 X0 Y0 Z0 ; → Input ";" → N100 G;N11028 X0 Y0 Z0 ;
 N100 G28 X0 Y0 Z0 ;N200G90X20.Y20.Z20.; → Input ";" → N100 G28 X0 Y0 Z0 ;N110N200G90X20.Y20.Z20.;

Example when N No. is not added

(1) When the previous block has no N No.

G00X10.% -> Input ";" -> G00X10.;%

(2) When the head of previous block has no N No.

•Usually

G00N100X10.% -> Input ";" -> G00N100X10.;%

•When comment

(N100)G00N100X10.% -> Input ";" -> (N100)G00N100X10.;%

•When the previous block has a space

N100G00N100X10.% -> Input ";" -> N100G00N100X10.;%

(3) When the N No. of previous block is over 9 characters.

N000001000% -> Input ";" -> N000001000;%

(4) When limits of total characters display per block is exceeded.

(5) When the N No. is over 100000000.

(6) When the N No. automatic additional value is not set.

(7) When the display character string in overwrite mode is interrupted.

N100 G28 X0 Y0 Z0 ; -> Input ";" -> N100 G28 X0;Y0 Z0 ;

3.7.4 G Code Guidance

For details, refer to "2.7.3 G Code Guidance".

3.7.5 Playback editing area

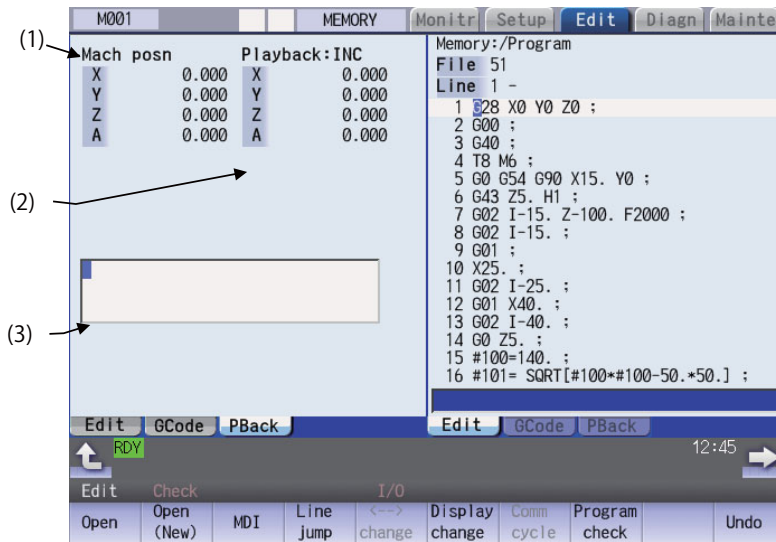


The playback function enables creation of a program while trying sample machining by manual (handle or jog) feed or mechanical handle feed. A machining program can be created with movement distance data obtained by manual operation used as programmed command values.

The playback counter and valid address key (X, Y, U, V, etc.) are different depending on the parameter "#1076 AbsInc" (ABS/INC address) setting. A parameter "#1076 AbsInc" can be set individually for each part system.

	#1076 AbsInc (For L system only)	#1126 PB_G90	Reference
M system	(This setting is meaningless.)	0 (Incremental value)	Absolute/incremental command depending on G command
		1 (Absolute value)	
L system	0 (Absolute/incremental command depends on G command)	(This setting is meaningless.)	Absolute/incremental command depending on address code
	1 (Absolute/incremental command depends on address code)		

<Absolute/incremental command depending on G command>



Display Items


Display Items	Details
(1) Machine position counter	This displays the machine position counter. Up to max. number of axes in a part system can be displayed. M system: Max. eight axes L system: Max. five axes, the sixth axis or later is switched by the menu [Next axis]. When the rotary axis (except for all coordinate linear type), the display range is 0.000° to 359.999°.
(2) Playback counter	This displays the playback movement amount (axis movement value). When "absolute/incremental command depending on G command", the title and playback movement amount differs according to the parameter "#1126 PB_G90". (*1) When "Absolute/incremental command depending on address code", both titles are displayed. Up to max. number of axes in a part system can be displayed. M system: Max. eight axes L system: Max. five axes, the sixth axis or later is switched by the menu [Pback next ax]. When the rotary axis (except for all coordinate linear type), the display range is following below. For INC (Rotary type short-cut disabled, workpiece coordinate linear type): -359.999° to 359.999° For INC (Rotary type short-cut enabled): -180.000° to 179.999° For ABS: 0.000° to 359.999°
(3) Playback editing area	The contents of playback editing is input. When the axis address keys such as X and Y are input, the playback counter value currently displayed is input after the axis address.

(*1) The displayed title and playback movement amount are as follows.

#1126 PB_G90	Title	Playback movement amount
0 (Incremental value)	Playback: INC	Playback movement amount before axis moves + axis movement amount
1 (Absolute value)	Playback: ABS	The program position + manual interrupt amount

Operation method (Absolute/incremental command depending on G command)

- (1) Set "#1126 PB_G90" to "0" on the parameter screen. ➡ Incremental value mode is set.

- (2) Press the main menu [Edit] on the edit screen, and press [Displaychange] or  key several times. ➡ The "playback display type" is displayed. The menu [←→ change] cannot be used. When the incremental value is set, the initial value is "0".

- (3) Open the program pressing [Edit] and [Open] on the edit screen. ➡ The selected program is displayed in right area.
 <Note>
 - When the program is displayed on the right side, the playback edit is displayed on the right side.
 - When the incremental value is set, playback movement amount is cleared to "0" for all axes.

- (4) Move the axis during manual mode. ➡ The axis movement amount is displayed in playback movement amount. When the absolute value is set, "the program position + manual interrupt amount" is displayed as the playback movement amount. In the incremental value mode, the axis movement amount by manual mode is added to currently playback movement amount.

- (5) Input the data such as the G codes in the area for playback editing.



The alphanumeric characters, [←], [→] and [DELETE] keys can be input in the area for playback editing.

<Note>

- If the [C.B] key is pressed, all the data in the playback editing area will be deleted.
 - When the [↑] or [↓] key is pressed, the program cursor in the program editing area will move.
 - When the page-switching key is pressed, the program in the program editing area will scroll.
 - When the menu key is pressed, the process corresponding to the program editing area will run.
- When the cursor appears on input area of the program editing area by pressing [Line jump], [Line copy], [Line clear], [String search], [String replace], [MDI registration] or [N auto add], the key input is made to the input area of the program editing area. When window is displayed by pressing [Open], [Open(New)] or [Erase file], the key input is made to the currently displayed window.
- The program cursor in the program editing area cannot move left and right, but can move only up and down.

- (6) Press the axis address key such as [X] or [Y].



The playback movement amount is input after the axis address in the playback editing area. If the axis address key is pressed while the playback movement amount is being changed, the playback movement amount at the time the key was pressed will be input.

<Note>

- When inputting a comment, etc., the characters that are the same as the axis address will all be handled as the axis address.

- (7) Press the [INPUT] key.



The program in the playback editing area will be inserted at the block before the cursor position in the right area, is saved.

When there is no "EOB" (;) at the end of the character string, it is added automatically.

The cursor moves to the line head being cleared the content of the playback edit.

For an absolute value, the playback movement amount will not change.

For an incremental value, the difference of the axis command value for the axis used in step (6) and the playback movement amount will remain as the playback movement amount.

The program in the program editing area is saved.

Operation method (Absolute/incremental command depending on address code)

- (1) Confirm that the parameter "#1076 AbsInc" is "1".
- (2) Edit a program the same as the procedure (2) to (6) of "Absolute/incremental command depending on G command".

Notes for playback editing

- (1) Playback editing of a program in automatic operation or program restart is not possible.
- (2) Up to 95 characters can be edited in the playback editing area.
- (3) If the program created by playback editing is not suffixed by "EOB(;)", it is automatically added by [INPUT].
- (4) If the screen/part system is changed or the program file is opened when the input program is in the playback edit area, the program being edited will be aborted. The playback absolute counter has the G92 coordinate system preset released, and returns to "program position + manual interrupt amount". The playback increase counter is cleared to "0".
- (5) Other files can be opened during playback editing. Playback editing can be continued even when other file is opened. However, if an incremental value is designated, the playback movement amount will be cleared to "0" for all axes. A new file can be created and edited, and MDI editing carried out in the same manner.
- (6) If the program being playback edited automatically starts, playback editing cannot be continued.
- (7) The playback movement amount after playback editing will differ according to the parameter "#1126 PB_G90" state and the commanded G code. The playback movement amount after [INPUT] is pressed is calculated for each block that has been playback edited.

X axis playback movement amount before editing	Details to be playback edited	X axis playback movement amount after [INPUT]	
		For an absolute value	For an incremental value
X 100.000	G01 X10.;	X 100.000 The program position + manual interrupt amount is inserted as the playback movement amount.	X 90.000 The difference of the axis command value (X10.) and playback movement amount before [INPUT] (X100.) is inserted as the playback movement amount.
	G92 X10.;	X 10.000 The command value (X10.) following G92 is inserted as the playback movement amount.	X 0.000 Regardless of the command value following G92, "0" is inserted as the playback movement amount.

- (8) The playback editing is disabled during mass-editing.
- (9) Do not set the same address to the parameter "#1013 axname" and "#1014 incax". If the same address is set, the absolute counter has priority. (However, the same address as the address used in other part system can be specified.)
- (10) The playback editing cannot be enabled for an axis of auxiliary axis state. When an axis address of auxiliary axis state is input, a setting error will occur.

3.8 Editing a Multi-part System Program

3.8.1 Multi-part System Simultaneous Program Editing

When the operation parameter "#8977 Multi-\$ simul edit" is set to "1" (valid), if you perform the operation (*1) to open a machining program in NC memory on the edit screen, the specified machining program of the displayed part system in the currently selected editing area and the machining program (*2) of the same name in another part system in the deselected editing area are opened simultaneously in the right and left panes.

(*1) To open a machining program, follow the steps shown below. The details on each operation are described in the table later.

- Select menu [Edit] - [Open] to open an existing machining program.
- Select menu [Edit] - [Open(New)] to create and open a new machining program.
- The parameter "#8938 Edit-Not show Prg" is set to "0" and the display changes to the edit screen after operation search or check search has been carried out. Then, the searched machining program is opened automatically.

(*2) The machining program that satisfies the following conditions is opened in the deselected editing area.

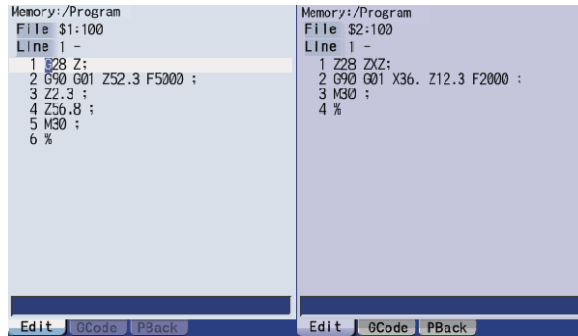
- Machining program in another part system of the same name as for the machining program that is to be opened in the currently selected editing area
- If any machining program that satisfies machining program conditions is not registered in the smallest part system other than the currently selected part system, no machining program is opened in the deselected editing area. Then, the machining program opened in the deselected editing area is closed.

Note

- (1) If a machining program in NC memory is opened while the parameter "#8977 Multi-\$ simul edit" is set to "1" (valid), the machining program opened in the deselected editing area is closed.
- (2) The multi-part system simultaneous program editing is also available for MTB macro program and MDI.
- (3) When the machining program for multi-part system simultaneous program editing is opened while the display type is not set to the multi-program display type, if the display type is changed to the multi-program display type, the machining program that is in another part system, of the same name as for the machining program opened in the currently selected editing area is displayed in the deselected editing area.

Operation to select the menu [Edit] - [Open] and open an existing machining program (Case in which the 1st part system is set as the displayed part system)

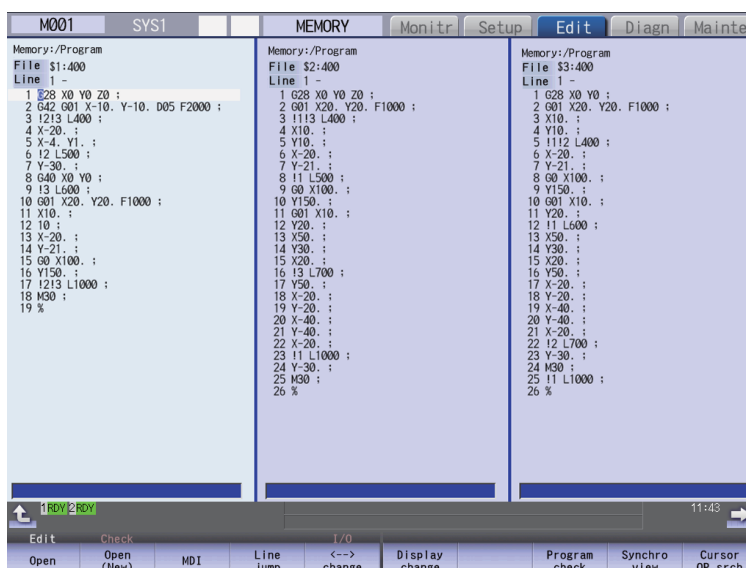
<For 2-program simultaneous editing>



- : Machining program registered
- ×: Machining program not registered or protection converted machining program registered

\$1	\$2 (*1)	Operation
○	○	A machining program in the 1st part system is displayed in the currently selected editing area, and that in the 2nd part system is simultaneously displayed in the deselected editing area.
○	×	This displays a machining program in the 1st part system in the currently selected editing area. Then, if the machining program is opened in the deselected editing area, it is closed.
×	○	A confirmation message (*2) is then displayed. Selecting "Y" creates and displays a new empty file in the 1st part system in the currently selected editing area. Machining programs in the 2nd part system are displayed in the deselected editing area.
×	×	If the designated machining program does not exist in all part systems, the message "Designated file does not exist" appears, that machining program is not displayed.

<For 3-program simultaneous editing> (15-type/19-type)



○: Machining program registered ×: Machining program not registered or protection converted machining program registered

\$1	\$2 (*1)	\$3 (*1)	Operation
○	○	○	A machining program in the 1st part system is displayed in the currently selected editing area, and those in the 2nd and 3rd part systems are simultaneously displayed in the deselected editing areas. The position to open the machining program in the 2nd and 3rd part system will be decided depending on the position of the currently selected editing area; on the left, in the middle or on the right. (The machining program will be opened in empty area from the left in ascending order of the part systems. Even though the G code guidance is displayed, the machining program will be opened behind the G code guidance.)
○	×	×	This displays machining programs in the 1st part system in the currently selected editing area. Then, if the machining program is opened in the deselected editing area, it is closed.
○	○	×	This displays a machining program in the 1st part system in the currently selected editing area. This displays a machining program in the 2nd or the 3rd part system in deselected editing area. Then, if the machining program is opened in another deselected editing area, it is closed.
○	×	○	This displays a machining program in the 1st part system in the currently selected editing area. This displays a machining program in the 2nd or the 3rd part system in deselected editing area. Then, if the machining program is opened in another deselected editing area, it is closed.
×	○	×	A confirmation message (*2) is then displayed. Selecting "Y" creates and displays a new empty file in the 1st part system on the currently selected editing area.
×	×	○	Machining program in the 2nd or the 3rd part system is displayed in the deselected editing area. Then, if the machining program is opened in another deselected editing area, it is closed.
×	○	○	A confirmation message (*2) is then displayed. Selecting "Y" creates and displays a new empty file in the 1st part system on the currently selected editing area. Machining programs in the 2nd and the 3rd part systems are displayed in the deselected editing areas. Then, if the machining program is opened in another deselected editing area, it is closed.
×	×	×	If the designated machining program does not exist in all part systems, the message "Designated file does not exist" appears and that machining program is not displayed.

(*1) For part systems other than the 1st part system, the 2nd or the 3rd part system is described as a typical one.

3 Inputting a Machining Program and Defining Variables

(*2) The operation message "Create new file? (Y/N)" appears. If "N" is selected, the message "A file does not exist" appears, and the target file is not opened. If "Y" is selected while the remaining number of registered machining programs is "0", the message "Program entry over" appears, and no machining program is displayed.
 When the parameter "#1285 ext21/bit2" (Multi-system program generation and operation) is ON, "Create new file? (Y/N)" does not appear and the file will not be opened.
 Also, when the protection converted machining program exists, "Create new file? (Y/N)" does not appear and the file will not be opened.

Operation to select the menu [Edit] - [Open (New)] and open an existing machining program (Case in which the 1st part system is set as the displayed part system)

Multi-system program generation and operation (#1285 ext21 bit2)	Operation
ON (Newly creates only a machining program in the displayed part system.)	This displays a machining program in the 1st part system in the currently selected editing area. When machining programs exist in the 2nd part system, it is simultaneously displayed in the deselected editing area. (*1) For 3-program simultaneous editing, machining programs in the 2nd and the 3rd part systems are simultaneously displayed in the deselected editing area. (*1) When no machining programs exist in the 2nd part system, the machining programs opened in the deselected editing area are closed. (*1)
OFF (Collectively creates new machining programs in all the part systems.)	When no machining programs exist in all the part systems, a machining program in the 1st part system is displayed in the currently selected editing area and a machining program in the 2nd part system is displayed in the deselected editing area simultaneously. (*1) For 3-program simultaneous editing, machining programs in the 2nd and the 3rd part systems are simultaneously displayed in the deselected editing area. (*1) When the machining programs in the 2nd part system exist, the message "Designate new creation for existing file" appears and the file cannot be opened. (*1)

(*1) For part systems other than the 1st part system, the 2nd or the 3rd part system is described as a typical one.

Operation to automatically open the searched machining program (When the 1st part system is set as the displayed part system)

<For 2-program simultaneous editing>

Currently selected editing area	Deselected editing area	Operation
A machining program is not opened.	A machining program is not opened.	A machining program in the 1st part system is displayed in the currently selected editing area, and that in the 2nd part system is simultaneously displayed in the deselected editing area. (*1)

For the conditions other than the above, no operation is performed.

<For 3-program simultaneous editing> (15-type/19-type)

Currently selected editing area	Deselected editing area 1	Deselected editing area 2	Operation
A machining program is not opened.	A machining program is not opened.	A machining program is not opened.	The currently selected editing area shows a machining program of the 1st part system. The deselected editing areas show machining programs in ascending order of the part systems from the left.

For the conditions other than the above, no operation is performed.

(*1) For part systems other than the 1st part system, the 2nd or the 3rd part system is described as a typical one.

Note

(1) If the searched machining program is not registered in the displayed part system, it is not opened. When the searched machining program is registered only in the displayed part system, no file is opened in the deselected editing area.

Operation method (Opening the existing machining programs of the same name in all part systems (When the 1st part system is set as the displayed part system))

Perform the following procedure to open the machining program, "100", under the following conditions.

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The machining program, "100", is registered in all part systems of NC memory.

(1) Press the menu [Open].

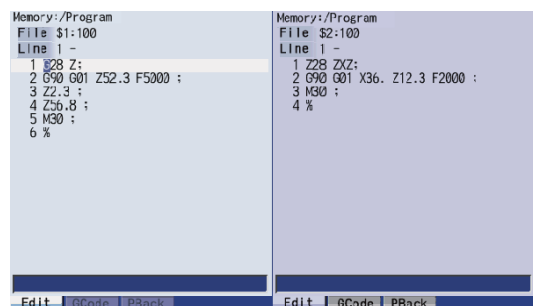


The list appears as a pop-up window.

(2) Use the [↑], [↓], [←], and [→] keys to align the cursor with the target machining program (100), and press the [INPUT] key.



The machining program "100" in the 1st part system is displayed in the currently selected editing area, and the machining program "100" in the 2nd part system is displayed in the deselected editing area.



Operation method (Opening the existing machining programs of the same name in the 1st and 4th part systems (When the 1st part system is set as the displayed part system))

Perform the following procedure to open the machining program, "200", under the following conditions.

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The machining program, "200", is registered in the 1st and 4th part systems of NC memory.

(1) Press the menu [Open].



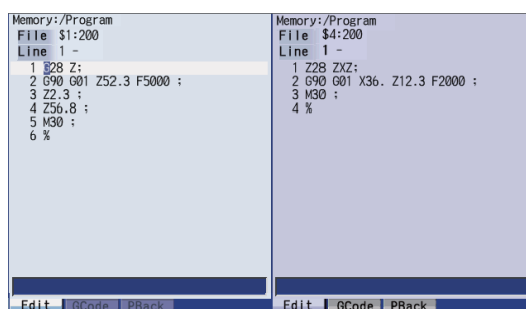
The list appears as a pop-up window.

(2) Use the [↑], [↓], [←], and [→] keys to align the cursor with the target machining program (200), and press the [INPUT] key.



The machining program "200" in the 1st part system is displayed in the currently selected editing area, and the machining program "200" in the 4th part system is displayed in the deselected editing area.

The same operation can also be performed by inputting the machining program name (200) to be edited in the input section and pressing the [INPUT] key.


Operation method (Opening the existing machining programs only in the 1st part system (When the 1st part system is set as the displayed part system))

Perform the following procedure to open the machining program, "300", under the following conditions:

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The machining program, "300", is registered in the 1st part system of NC memory.

(1) Press the menu [Open].



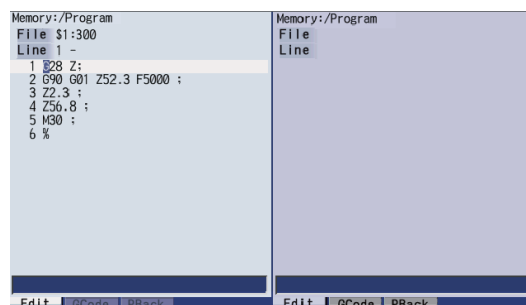
The list appears as a pop-up window.

(2) Use the [↑], [↓], [←], and [→] keys to align the cursor with the target machining program (300), and press the [INPUT] key.



The machining program "300" in the 1st part system is displayed in the currently selected editing area, and the machining program opened in the deselected editing area is closed.

The same operation can also be performed by inputting the machining program name (300) to be edited in the input section and pressing the [INPUT] key.



Operation method (Opening the existing machining programs only in the 3rd part system (When the parameter "#1285 ext21/bit2" is set OFF and the 1st part system is set as the displayed part system))

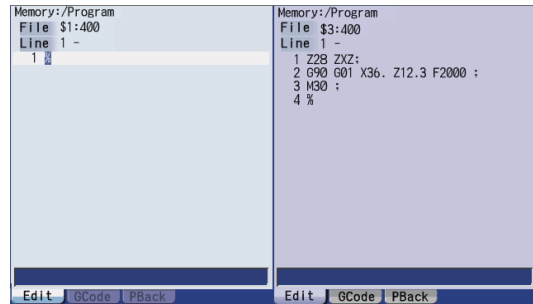
Perform the following procedure to open the machining program, "400", under the following conditions.

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The machining program, "400", is registered in the 3rd part system of NC memory.

- (1) Press the menu [Open]. ➔ The list appears as a pop-up window.

- (2) Use the [↑], [↓], [←], and [→] keys to align the cursor with the target machining program (400), and press the [INPUT] key. ➔ The operation message "Create new file? (Y/N)" appears.
 The same operation can also be performed by inputting the machining program name (400) to be edited in the input section and pressing the [INPUT] key.

- (3) Press the [Y] key. ➔ The machining program, "400", is newly created in the 1st part system.
 The machining program "400" in the 1st part system is displayed in the currently selected editing area, and the machining program "400" in the 3rd part system is displayed in the deselected editing area.



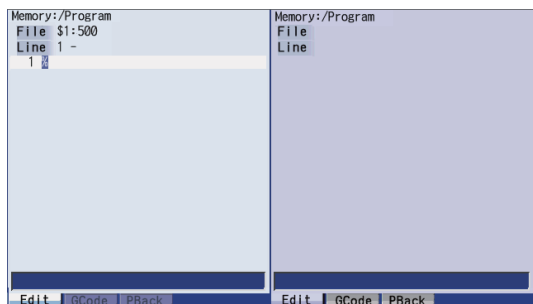
Operation method (Creating a new machining program (When the parameter "#1285 ext21/bit2" is set ON and the 1st part system is set as the displayed part system))

Perform the following procedure to create a new machining program, "500", under the following conditions:

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The parameter "#1285 ext21/bit2" is set to "1" (to newly create only machining programs in the displayed part system).

- (1) Press the menu [Open(New)]. ➔ The list appears as a pop-up window.

- (2) Input the machining program name (500) to be newly created in the input section, then press the [INPUT] key. ➔ The machining program "500" in the 1st part system is displayed in the currently selected editing area, and the machining program opened in the deselected editing area is closed.



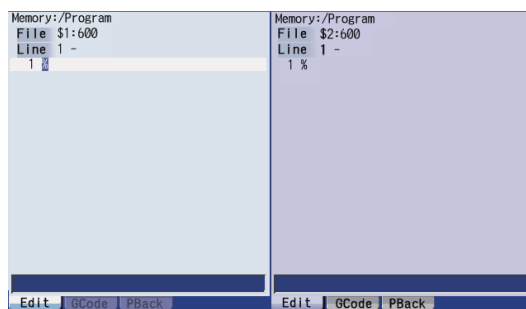
Operation method (Creating a new machining program (When the parameter "#1285 ext21/bit2" is set OFF and the 1st part system is set as the displayed part system))

Perform the following procedure to create a new machining program, "600", under the following conditions.

- The parameter "#8977 Multi-\$ simul edit" is set to "1" (valid).
- The machining parameter "#1285 ext21/bit2" is set to "0" (to collectively create new machining programs in all part systems).

(1) Press the menu[Open(New)]. ➔ The list appears as a pop-up window.

(2) Input the machining program name (600) to be newly created in the input section, then press the [INPUT] key. ➔ The machining program "600" in the 1st part system is displayed in the currently selected editing area, and the machining program "600" in the 2nd part system is displayed in the deselected editing area.



Operation to be performed when the menu [Open], [Open(New)], or [MDI] is pressed while editing a machining program

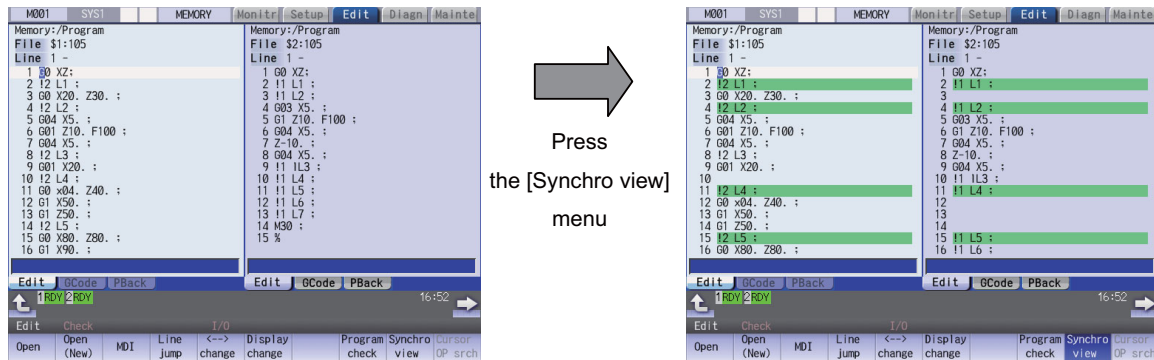
If the menu [Open], [Open(New)], or [MDI] is pressed during editing of a machining program while the operation parameter "#8977 Multi-\$ simul edit" is set to "1" (valid), whether to save both the contents of the currently selected editing area and those of the deselected editing area is confirmed regardless of whether the machining program to be opened actually is targeted for multi-part system simultaneous program editing.

Currently selected editing area	Deselected editing area	Operation
Not editing	Not editing	The operation of the pressed menu is performed.
Editing	Not editing	(1) The operation message "Save current file? (Y/N)" is displayed. (2) After any key has been pressed, the operation of the pressed menu is performed.
Not editing	Editing	(1) The operation message "Save right side file? (Y/N)" ("Save left side file? (Y/N)", "Save center file?(Y/N)") is displayed. (2) After any key has been pressed, the operation of the pressed menu is performed.
Editing	Editing	(1) The operation message "Save current file? (Y/N)" is displayed. (2) After any key has been pressed, the operation message "Save right side file? (Y/N)" ("Save left side file? (Y/N)", "Save center file?(Y/N)") is displayed. (3) After any key has been pressed, the operation of the pressed menu is performed.

3.8.2 Special Program Editing Display for Synchronization between Part Systems



Pressing the menu [Synchro view] on the edit (Edit) screen enables synchronized display of the left- and right-side programs aligned using the timing synchronization symbols, when all the following conditions are met: - The parameter "#1285 ext21/bit0" (Multi-part system program management) is ON - "Multi-program display type" is selected - The left and right edit areas are displaying the same named programs of different part systems stored on the NC memory.

**Note**

- (1) The synchronous display is also available for MTB macro program and MDI.
- (2) Editing can be performed in the selected editing area, and the synchronous display is disabled when "Editing" is being displayed. The synchronous display becomes enabled again when the edited contents are determined.
- (3) Blank lines, which are inserted automatically to align the left- and right-side programs for the synchronization position, cannot be pasted with the menu [Paste] operation when the blank lines are specified as the copying range with the menu [Copy] operation.
- (4) The editable machining program size is up to 240 KB per part system.
 - ◆When the menu [Synchro view] is pressed in the state where a machining program exceeding 240 KB is opened, the "Can't edit because of size over" message is displayed and the synchronous display cannot be performed.
 - ◆When a file exceeding 240 KB is opened with "Synchro view" highlighted, the "Can't edit because of size over" operation message is displayed and the machining program cannot be opened.
- (5) The state where the "Synchro view" is highlight is held until the power is turned OFF and ON, a machining program for which the synchronous display is not available is opened, or the display type is changed to other than "Multi-program display type".
- (6) When the G code guidance, etc. is opened in the 3-program simultaneous display, the other two program edit areas show timing synchronization of the part systems.
- (7) If a timing synchronization symbol has no counterpart, the message "Can't display synchronous program" appears and the subsequent synchronous display is not performed.

[Display during synchronous view]

Memory:/Program
File \$1:106
Line 1 -
1 G0 XZ ;
2 !2 L1 ;
3 G0 X20. Z30. ;
4 !2 L2 ;
5 G04 X5. ;
6 G01 Z10. F100 ;
7 G04 X5. ;
8
9
10
11 !2 L3 ;
12 G01 X20. ;
13 !2 L4 ;
14 G0 X04. Z40. ;
15 G1 X50. ;
16 G1 Z50. ;
Edit | GCode | PBack

Memory:/Program
File \$2:106
Line 1 -
1 G0 XZ ;
2 !1 L1 ;
3
4 !1 L2 ;
5 G03 X5. ;
6 G1 Z10. F100 ;
7 !1 ;
8 G04 X5. ;
9 Z-10. ;
10 G04 X5. ;
11 !1 L3 ;
12
13 !1 L4 ;
14
15
16
Edit | GCode | PBack

Blank lines are inserted to align the left- and right-side synchronization position.

Cursor line is not highlighted.

The line is displayed with the line No. includes blank lines.

The line with the timing synchronization symbols is highlighted (with green color).

The line with the timing synchronization symbol which does not have the synchronizing target is not highlighted.

Memory:/Program
File \$1:1000
Line 1 -
1 G0 XZ ;
2 !2 L1 ;
3 G0 X20. Z30. ;
4 !2 L2 ;
5 G04 X5. ;
6 !2 L3 ;
7 G01 X20. ;
8 !2 L4 ;
9 G0 X04. Z40. ;
10 G1 X50. ;
11 G1 Z50. ;
12 !2 L5 ;
13 ;
14 %
Edit | GCode | PBack

Memory:/Program
File \$2:1000
Line 1 -
1 G0 XZ ;
2 !1 L1 ;
3
4 !1 L2 ;
5 G03 X5. ;
6 G01 Z10. F100 ;
7 !1 ;
8 G04 X5. ;
9 !1 L3 ;
10 G01 X20. ;
11 !1 L4 ;
12 G0 X04. Z40. ;
13 G1 X50. ;
14 G1 Z50. ;
15 !1 L5 ;
16 ;
17 %
Edit | GCode | PBack

Lines after the one where the error is displayed, do not show the synchronous display.

The line with the timing synchronization symbols is highlighted (with green color).

Since the line does not have the synchronizing target, the message "Can't display synchronous program." is displayed.

3.9 Inserting Cycle Interactively



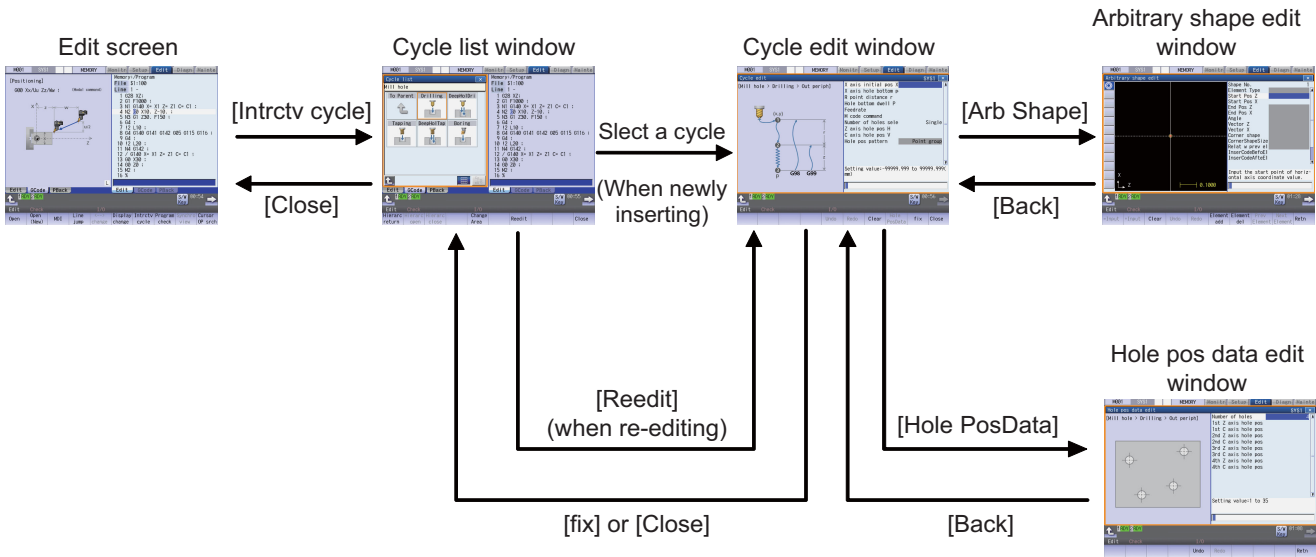
This function enables you to interactively insert a cycle that assists machining and setup for the program opening on the edit screen.

The programming time can be reduced by using this function.

The cycle can easily be inserted simply by editing data in an interactive window.

Once you insert a cycle block, you can edit it directly on the program edit screen, or re-edit it in the cycle edit window if the cycle format is not changed.

Screen transition



Screen/window	Details
Edit screen	This is a screen to edit the program. To insert or re-edit the cycle, press the menu [Intrctv cycle] on this screen.
Cycle list window	This is a window to select the cycle to be inserted.
Cycle edit window	This is a window to edit machining data of the cycle.
Arbitrary shape edit window	This is a window to edit arbitrary shape data of the cycle.
Hole pos data edit window	This is a window to edit hole position data of the cycle.

3.10 Defining Variables

Refer to "Programming Manual" for more details on variables.

3.10.1 Common variable

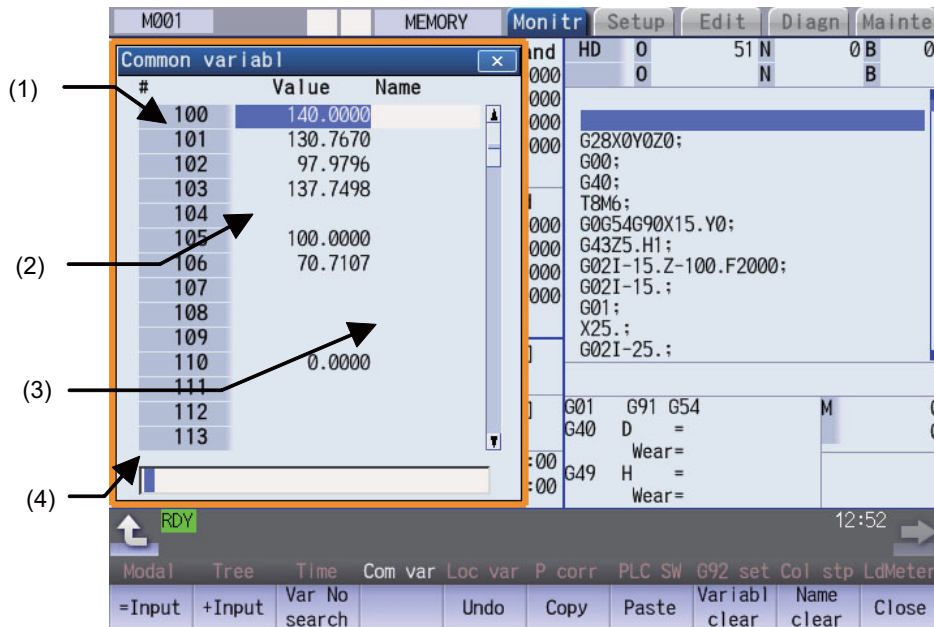


Select [Com var] on the monitor (Monitr) screen to set or display the details of the common variables.

If there is a common variable command (*1) in the machining program, the variable value (variable name) set when the block is executed is displayed.

The number of common variable sets differs according to the specifications.

(*1) The variable names can be set for common variables #100 to #199 and #500 to #599.



Display items

Display items	Details																								
(1) Variable number	<p>This is the common variable No. There are common variable 1(Shared between part systems) (#400 to #999, #100100 to #800199, #900000 to #907399) and common variable 2(for each part system) (#100 to #199). The #100 variables appear at the head when the power is turned ON. If "#1052 MemVal" is set to "1" (Designate No. of common variable for common part system), "*" is attached to the part system common variable. (Note that if there is only one part system, "*" will not appear.)</p> <table border="1"> <thead> <tr> <th>System</th> <th>Number of sets</th> <th>Common variable 1 (shared between part system)</th> <th>Common variable 2 (for each part system)</th> </tr> </thead> <tbody> <tr> <td rowspan="4">One part system</td> <td>200 sets</td> <td>500 to 599</td> <td>100 to 199</td> </tr> <tr> <td>600 sets</td> <td>500 to 999 100100 to 800199 (*2)</td> <td>100 to 199</td> </tr> <tr> <td>700 sets</td> <td>400 to 999 (*1) 100100 to 800199 (*2)</td> <td>100 to 199</td> </tr> <tr> <td>8000 sets</td> <td>400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)</td> <td>100 to 199</td> </tr> <tr> <td rowspan="2">Multi-part system (n = number of part systems)</td> <td>600+100*n set(s)</td> <td>400 to 999 (*1) 100100 to 800199 (*2)</td> <td>100 to 199 *n</td> </tr> <tr> <td>7900+100*n set(s)</td> <td>400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)</td> <td>100 to 199 *n</td> </tr> </tbody> </table>	System	Number of sets	Common variable 1 (shared between part system)	Common variable 2 (for each part system)	One part system	200 sets	500 to 599	100 to 199	600 sets	500 to 999 100100 to 800199 (*2)	100 to 199	700 sets	400 to 999 (*1) 100100 to 800199 (*2)	100 to 199	8000 sets	400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)	100 to 199	Multi-part system (n = number of part systems)	600+100*n set(s)	400 to 999 (*1) 100100 to 800199 (*2)	100 to 199 *n	7900+100*n set(s)	400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)	100 to 199 *n
System	Number of sets	Common variable 1 (shared between part system)	Common variable 2 (for each part system)																						
One part system	200 sets	500 to 599	100 to 199																						
	600 sets	500 to 999 100100 to 800199 (*2)	100 to 199																						
	700 sets	400 to 999 (*1) 100100 to 800199 (*2)	100 to 199																						
	8000 sets	400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)	100 to 199																						
Multi-part system (n = number of part systems)	600+100*n set(s)	400 to 999 (*1) 100100 to 800199 (*2)	100 to 199 *n																						
	7900+100*n set(s)	400 to 999 (*1) 100100 to 800199 (*2) 900000 to 907399 (*3)	100 to 199 *n																						
(2) Variable value	<p>The setting range is -999,999,999 to 999,999,999 or blank. An exponential is displayed when 7 digits are set in the integer section and 5 digits or more are set in the decimal section. (Example) 1234567 -> 1.2346E+006, 0.00001 -> 1.0000E-005 The minimum setting unit that can be set is 1.0000E-099 (99 digits below decimal point). <Note> •When the setting is "blank", the setting will be handled as "0" in the calculations. However, when the conditional expressions EQ or NE are used, the blank will not be handled as "0". •Common variables protected by the parameters #12111 to #12114 are unable to be set.</p>																								
(3) Variable name	<p>A variable name can be assigned for #100 to #199 and #500 to #599. Two-byte characters such as Chinese character can be displayed, however, only symbols and alphanumeric characters can be input on the screen. The maximum number of one-byte characters is 10. <Note> •Common variables protected by the parameters #12111 to #12114 are unable to be set.</p>																								
(4) Input section	This displays details of the key input.																								

(*1) Address #400s common variable can be used only when the sets of common variable is "700 sets or more" and the parameter "#1336 #400_Valtype" is "1".

3 Inputting a Machining Program and Defining Variables

(*2) When the parameter "#1316 CrossCom" is set to "1", the common variables #100100 to #800199 can be used for common variable shared between the part systems. The common variable shared between part systems which can be used is shown in the table below.

Common variables 1 (When "#1316 CrossCom" = "1")	
#100100 to #100199	Equivalent to # 100 to #199 in 1st part system
#200100 to #200199	Equivalent to # 100 to #199 in 2nd part system
#300100 to #300199	Equivalent to # 100 to #199 in 3rd part system
#400100 to #400199	Equivalent to # 100 to #199 in 4th part system
#500100 to #500199	Equivalent to # 100 to #199 in 5th part system
#600100 to #600199	Equivalent to # 100 to #199 in 6th part system
#700100 to #700199	Equivalent to # 100 to #199 in 7th part system
#800100 to #800199	Equivalent to # 100 to #199 in 8th part system

(*3) When the parameter "#1052 MemVal" is set to "1", you cannot use the variables #900000 to #907399 that are available when the specification "8000 sets of variables" is enabled.



Menus

Menus	Details
=Input	This executes an absolute input. If "#8930 Disable=INPUT:var" is set to "1", this menu cannot be selected.
+Input	This executes an incremental input.
Var No search	This designates the variable No. to be displayed at the head. Common variable 1 (shared between part system) #400 to #999, common variable 1 (shared between part system) #100100 to #800199, and common variable 2 (for each part system) #100 to #199 are displayed in each area. When another area is displayed, press this menu and specify the common variable No.
Move window	This moves the display position of the common variable window.
Undo	This returns the last rewritten data to its original value. This menu key is valid for "Data Input", "Paste" and "Undo" operations. Note that return to the original value is not possible after variable clear and comment clear operations. <Note> •When the parameter "#8939 Undo confirm msg" is set to "1", the menu is highlighted while the operation message is displayed.
Copy	This copies the variable value and variable name at the cursor position.
Paste	This pastes the copied variable value and variable name.
Variabl clear	This clears the contents of the variable No. at the cursor position or continuous variable Nos. <Note> •The contents are not cleared to "0". The state with no data is entered. •Common variables protected by the parameters #12111 to #12114 are unable to be cleared.
Name clear	This clears the variable No. at the cursor position or the continuous variable number's variable name (Variable name: variable No. 100 to 199 or 500 to 599). <Note> •Common variables protected by the parameters #12111 to #12114 are unable to be cleared.
Close	This closes the pop-up window and quits this function.

Operation method (Setting "135.000" in variable No. 102)

(1) Press the menu [Var No search].

(2) Designate the variable No.
102 [INPUT]

The cursor can be moved to 102 using the [↑], [↓], , or  key.

(3) Input a numeric value.
135 [INPUT]

The value can also be designated by pressing the menu [=INPUT] instead of the [INPUT] key.
The value can also be input as an exponential.
(1.35E2 [INPUT] or 1.35E2 [=INPUT].)

Operation method (Adding "1.234" to variable No. 102)

(1) Select common variable 102 with the same procedure as steps (1) and (2) above.


(2) Input a numeric value.
1.234 [+INPUT]



The input value added to the original value is displayed.
(Example) If the original value is 135.000, 136.234 appears. (135.000 + 1.234 = 136.234)

Operation method (Setting "COUNTER" as the variable name for variable No. 509)

(1) Select common variable 509 with the same procedure as steps (1) and (2) above.

(2) Press the  key.

(3) Input the variable name.
COUNTER [INPUT]



Note

(1) The variable name can be set only for variable No. 100 to 199 or 500 to 599.

Operation method (Copying and pasting the common variable)

(1) Select the variable to be copied.

One of the following methods can be used to select the variable.

- Using the cursor movement key [↑], [↓], , or , move the cursor to the variable to be selected.
- Press [Var No search] and set the variable No. in the input area, and press the [INPUT] key.

(2) Press the menu [Copy].

(3) Select the variable to be pasted, and press the menu [Paste].
The copied variable is held until a variable is newly copied.

Operation method (Erasing the variable value for variable number 102 to 104)

- (1) Press the menu [Variabl clear].
- (2) Input the No. (range) of the variable to be erased.
102/104 [INPUT]
To erase only one variable, input one variable No.
(102 [INPUT])
- (3) Press the [Y] key.

Note

- (1) The variable at the cursor position will become the target of the erasing if the [INPUT] key is pressed without designating a variable No.
- (2) The variables in the range below are the erasing target when /E is designated.

Input example	Erasing range	Supplement
100/E	100 to 199 100100 to 100199 (when the displayed part system is 1)	Only common variable in the displayed part system is cleared.
400/E	400 to 999 100100 to 800199 900000 to 907399	Range to be cleared varies depending on the number of common variable sets.

- (3) If you include a variable between 100s and 500s in the range designation, the erasing is not performed. (Example) When you set "110/510", "setting error" is displayed and the variables are not erased.
- (4) When the variables protected in the parameters #12111 to #12114 are included, the erasing is performed excluding the protected variables. When the whole range designated by the variables clear is within the protected range, "setting error" is displayed.

Operation method (Erasing the variable name for variable No. 509)

- (1) Press the menu [Name clear].
- (2) Select the variable , and press the [INPUT] key.
509 [INPUT]
- (3) Press the [Y] key.



The variable name for 509 only is erased.
The variable value is not erased.

Note

- (1) The variable at the cursor position will become the target of the erasing if the [INPUT] key is pressed without designating a variable No.
- (2) The variables in the range below are the erasing target when /E is designated.

Input example	Erasing range	Supplement
100/E	100 to 199	Only variable name in the displayed part system is cleared.
500/E	500 to 599	

- (3) Variable names protected in the parameters #12111 to #12114 are not erased.

Switching the variable No.



Methods to switch the display areas are as follows:

- (1) Use the menu [Var No search].
- (2) Use the page changeover key.
 - If you press the next page key during displaying the last page of the area, the first page of the next area will be displayed.
 - If you press the previous page key during displaying the first page of the area, the last page of the previous area will be displayed.
(Example) If you press the next page key during displaying the last page of the common variable 2 (for each part system) (#100 -), the first page of the common variable 1 (shared between part system) (#500 -) will be displayed.
- (3) Use a cursor key
 - When a cursor key is placed at the biggest variable No. in the area, the first page in the next area will be displayed by pressing [↓] or [→].
 - When a cursor key is placed at the first variable No. in the area, the biggest variable No. in the previous area will be displayed at the top by pressing [↑] or [←].
- (4) Use a scroll bar
 - The first page of the next area will be displayed by pressing ▼, while the last page of the area is displayed.
 - The biggest variable No. in the previous area is displayed at the head by pressing ▲, while the first page is displayed.

Variable numbers cannot be displayed continuously if another display area is inserted in between.

Switching the window display position

Press the menu [Move window] to change the currently displayed window position.

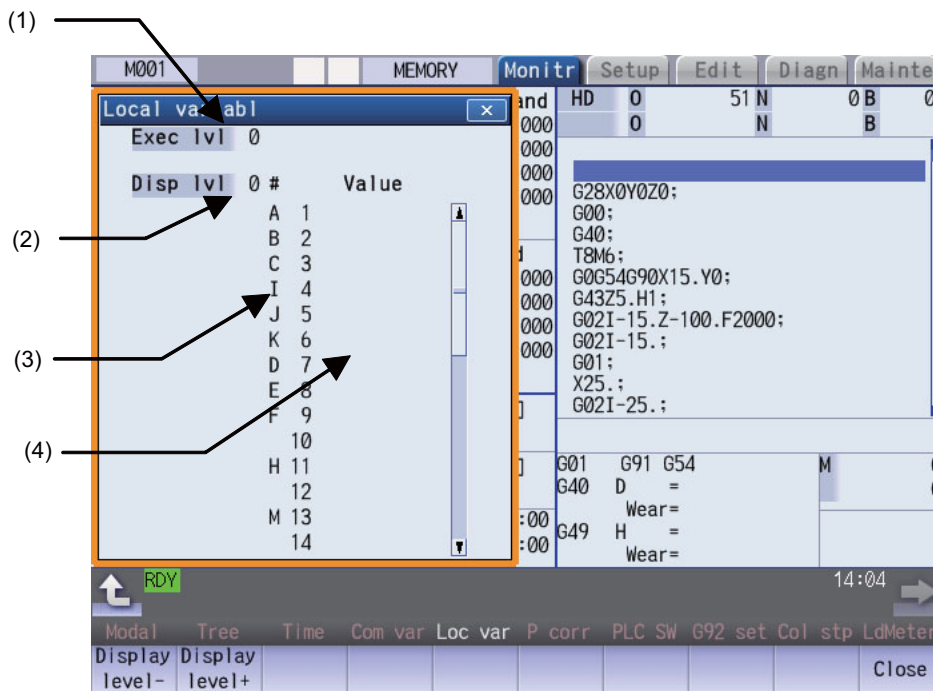
- | | | |
|------------------------------------|---|---|
| (1) Press the main menu [Com var]. |  | The common variable window is displayed in the pop-up window on the left of the screen. |
| (2) Press the menu [Move window]. |  | The common variable window will be move to the right. The window position will be switched every time the [Move window] is pressed. |

3.10.2 Local Variables



Select [Loc var] on the monitor (Monitr) screen, and the details of the local variables are displayed.

Local variables 1 to 33 are prepared for each user macro subprogram call level. Up to 33 local variable data items are displayed on one level. A 5-level configuration from level 0 to level 4 is used in page order. If there is a local variable command or an argument designation called by the user macro subprogram in the block, and that block is executed first, the set variable value (variable name) will be displayed.

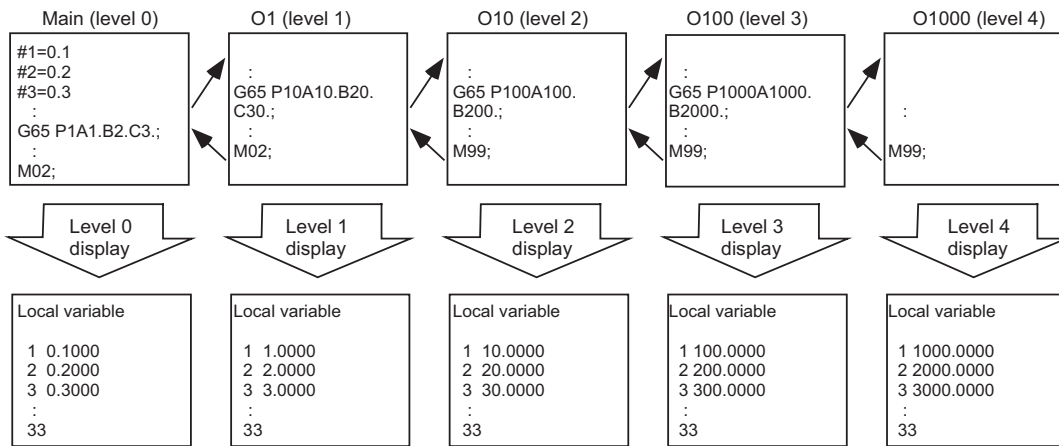


Display Items

Display items	Details
(1) Execution level	This displays the nest level of the subprogram control called by the user macro. 0: Not in user macro call state 1: User macro call level 1 2: User macro call level 2 3: User macro call level 3 4: User macro call level 4
(2) Display level	This displays the nest level of the local variable displayed in the area.
(3) Variable number	This displays the local variable No. The alphabetic character before the local variable No. is the argument code. G, N, O cannot be used as arguments, and thus not displayed. There are 33 local variables (1 to 33) for each user macro subprogram call level.
(4) Variable value	This displays the local variable value. If the variable data is "blank", the display will be blank. An exponential is displayed when a 7 digits are set in the integer section and 5 digits or more as set in the decimal section. (Example)1234567 -> 1.2346E+006, 0.00001 → 1.0000E-005 <Note> ♦When the setting is "blank", the setting will be handled as "0" in the calculations. However, when the conditional expressions EQ or NE are used, the blank will not be handled as "0".

Menus	
Menus	Details
Display level-	This lowers the local variable display level one by one. If this menu is pressed when the display level is 0, the level changes to display level 4.
Display level+	This increases the local variable display level one by one. If this menu is pressed when the display level is 4, the level changes to display level 0.
Close	This closes the pop-up window and quits this function.

Relation of user macro subprogram call execution level and display level



Precautions

The local variables are not erased when reset or when the power is turned OFF. They are erased at macro call.

Operation method (Displaying the next level)

When the current display level is 0

- (1) Press the menu [Display level +].



The level 1 local variables appear from the head.

When the menu [Display level +] is pressed again, the display level changes in the order of 2 -> 3 -> 4 -> 0 -> 1 -> 2 -> ... and so forth.

Operation method (Displaying the previous level)

When the current display level is 2



- (1) Press the menu [Display level -].

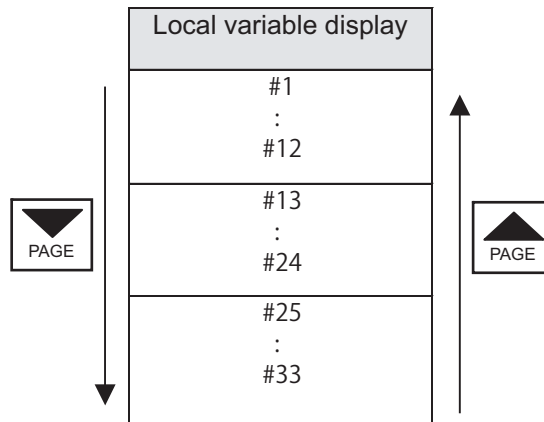


The level 1 local variables appear from the head.

When the menu [Display level -] is pressed again, the display level changes in the order of 0 -> 4 -> 3 -> 2 -> 1 -> 0 -> ... and so forth.

Operation method (Changing the displayed variable No.)

The displayed local variable No. changes when the page changeover keys (previous page , next page ) are pressed.



Checking a Machining Program on Screen


This chapter explains checking the machining program. Generally, operations are performed on the edit (Edit) and monitor (Monitr) screen.

4.1 Graphic Check (2D)



Graphic check (2D) is a function that allows you to check the machining program movement path only by drawing without automatic operations. Therefore, the graphics can be drawn at a high speed and high accuracy, and the machining program can be checked.

Press the menu [Check] on the monitor or edit screen to switch to the graphic check screen.

The graphic check screen allows you to check the currently displayed part system program. In the 2-part system or more, press the part system switch key  to switch the display to the target part system before starting checking.

Note that program check is carried out in the 2-part system or more regardless of the command such as the timing synchronization between a hidden part system and another part system.

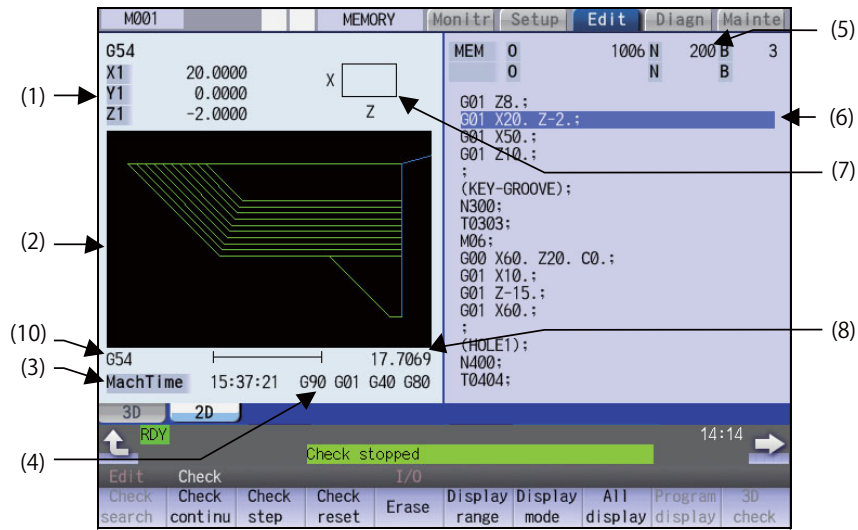
Using the menu [All display], normal display and whole display modes can be switched.

Note

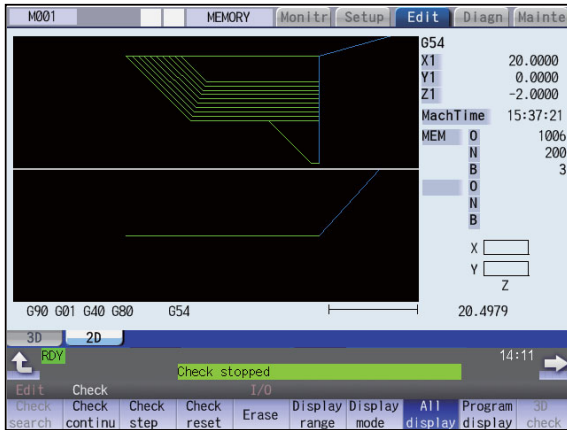
(1) When changing the screen to the edit screen, display depends on the previous checking type (2D/3D). If 3D graphic data appears, press the menu [2D check].

However, if the previous two-dimensional check screen is displayed during tracing, the display switches to the 2D check screen only when tracing is turned OFF after a message was displayed to check that tracing is turned OFF.

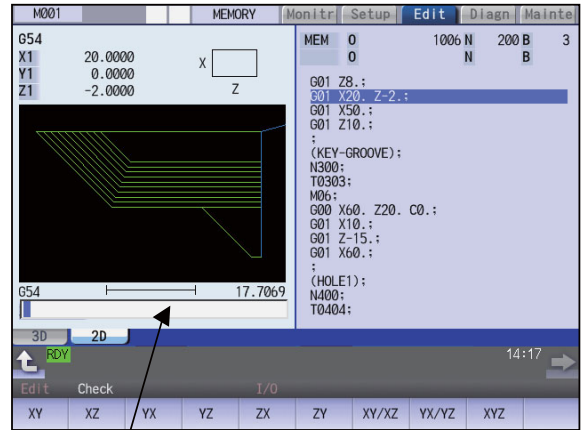
■ Normal display ([All display] is OFF)



<Drawing area: 2-plane>

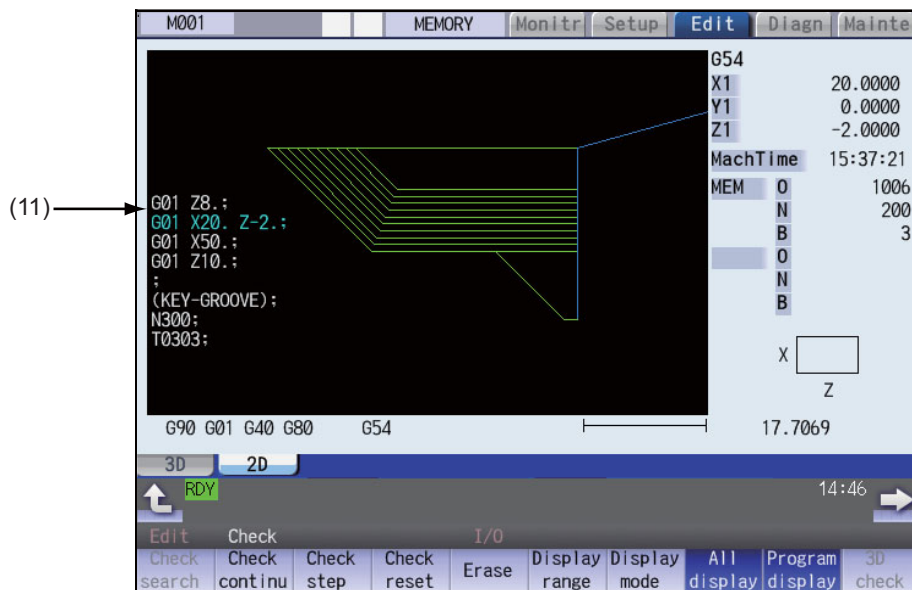


<Input area displayed>



(9)

■ Full-screen display ([All display] is ON)



Display Items

Display items	Description
(1) Check counter	<p>This displays the axis counter for the check drawing. When the drawn coordinate system is set to all workpiece coordinates with the menu [Drawing System], the counter name and value are switched according to the setting values of the parameters "#1231 set03(bit1)" (Switch graphic coordinates) and "#1231 set03(bit5)" (Switch graphic check counter display) as follows:</p> <p>#1231 set03/bit1=0 and #1231 set03/bit5=0: Machine position #1231 set03/bit1=0 and #1231 set03/bit5=1: Workpiece coordinate position #1231 set03/bit1=1 and #1231 set03/bit5=0: Tool position (machine coordinate system) #1231 set03/bit1=1 and #1231 set03/bit5=1: Tool position (workpiece coordinate system)</p> <p>When the selected drawn coordinate system is other than all workpiece coordinates, the displayed counter is the workpiece coordinate position or the tool position (workpiece coordinate system) regardless of the parameter "#1231 set03(bit5)".</p> <p>The part system common axis name ("#1022 axname2") which conforms to the basic axis name set in the parameters "#1026 base_I", "#1027 base_J", and "#1028 base_K" are displayed for the three axes to display.</p> <p><Note></p> <ul style="list-style-type: none"> •The settings of the parameters "#1026 base_I", "#1027 base_J" and "#1028 base_K" cannot be changed during the execution of 2D program check. The message "Program checking" appears.
(2) 2D drawing area	<p>This is the area where the tool path is drawn. The drawing viewpoint can be moved, and the drawing size can be enlarged and reduced.</p> <p>The display for the path to be drawn will be switched among "only tool center path/only program path/both tool center path and program path" by setting parameters "#1231 set03(bit1)" (Switch graphic coordinates) and "#1231 set03(bit2)" (Switch graphic check trace).</p> <p>#1231 set03/bit1=0 and #1231 set03/bit2=0: Draws both paths #1231 set03/bit1=0 and #1231 set03/bit2=1: Draws only tool center path (machine position) #1231 set03/bit1=1 and #1231 set03/bit2=0: Draws both paths #1231 set03/bit1=1 and #1231 set03/bit2=1: Draws only program path (tool position)</p> <p><Note></p> <ul style="list-style-type: none"> •If the radius compensation has not been set, only tool center path (machine position) is drawn even when the both paths are set to be drawn. <p>The zero point mark display position is switched between the machine coordinate zero point and workpiece coordinate zero point by the parameter "#1231 set03(bit4)" (Switch zero point mark display position).</p>
(3) Machining time display	The time required for machining is calculated and displayed.
(4) G modal display for check	<p><M system></p> <p>The following items are displayed from the left.</p> <ul style="list-style-type: none"> •Absolute/incremental (G90, G91: Group 3) •Operation mode (G00, G01, etc.: Group 1) •Tool compensation (G40, G41, G42: Group 7) •Fixed cycle (G70 etc.: Group 9) <p>The item to be displayed is changed depending on the status of grup 24 command modal, when the G code dynamic switching specification for M/L system is valid.</p> <p><L system></p> <p>The following items are displayed from the left.</p> <ul style="list-style-type: none"> •Feed per minute/Feed per revolution (G98, G99: Group 5) •Operation mode (G00, G01, etc.: Group 1) •Nose R compensation (G40, G41, G42: Group 7) •Fixed cycle (G70 etc.: Group 9) <p>The items to be displayed vary depending on the status of group 24 command modal.</p>

4 Checking a Machining Program on Screen

Display items		Description
(5)	Currently executed machining program	Main O10...
		Sub O1234...
(6)	Buffer display	This displays the contents of the machining program currently being executed. The block being executed is highlighted.
(7)	Display mode	This shows the plane to be displayed for the 3-dimensional display. It can be selected with the menu [Display mode].
(8)	Scale	This shows the display range scale. The unit is set to [mm/100pixel] in millimeters and [inch/100pixel] in inches. Use the menu [Zoom in] or [Zoom out] to change the scale value.
(9)	Input section	This displays details of the key input when setting the scale value and the display axis name, and when setting the extended workpiece coordinate system as the coordinate to draw. Select the menu [Display range] and [Display mode] to display the input area. With the [INPUT] key, the input area is hidden for the scale value and display axis name settings. With the menu [Drawing system], the input area is displayed in the disabled state. With the menu [Coord G54.1P], the input area is enabled and the input area is hidden using the [INPUT] key.
(10)	Coordinate System Drawing coordinate settings	This displays the currently selected drawing coordinate settings.
(11)	Program display	At the full screen display, the contents of the machining program that is in the process of drawing are displayed. The block currently being executed is displayed in blue characters.

Menus

Menus	Description
Check search	This performs a check search. Select a program to be checked from the program file list displayed in the pop-up window. For only the machining programs in NC memory, the check search is executed across all part systems in batch when the multi-part system program management is valid (#1285 ext21/bit0 =1, ext21/bit1 =1).
Check continu	This checks the program continuously.
Check step	This checks the program per block.
Check reset	This resets the program check.
Erase	This erases the graphics displayed on the screen. Each time this menu is pressed, the graphic data is erased in the order of rapid traverse and cutting feed. When the graphic is drawn after the parameter "#1231 set03/bit2" (Switch graphic check trace) is set to "1", pressing this button again will erase whichever a path of rapid traverse or cutting feed at once.
Display range	This changes the graphic drawing display range. Press this menu to display the input area for setting the scale value. When the display range is changed, the graphic data displayed on the screen is erased.
Display mode	This changes the drawing plane. Press this menu to display the input area for setting three axes of drawing targets. There are three types of graphic drawing mode: 1-plane, 2-plane, and 3-dimension. This changes the drawing plane and erases the graphic data displayed on the screen.
All display	This switches the normal display mode and the full-screen display mode.

Menus	Description
Program display	This displays the machining program being checked on the graphic drawing area. This menu can be selected only when the full-screen display mode is applied.
3D check	This changes the program check (3D) display. This menu cannot be selected while the check is performed or interrupted.
Opt Skip	Select whether to execute a block that has a slash "/" in the program to be checked. Selecting "ON" skips a block with a slash "/" to carry out drawing. Selecting "OFF" also draws a block with a slash "/".
Rotate	This sets the viewpoint angle for the 3-dimension display mode. When the viewpoint angle is changed, the graphic data displayed on the screen is erased. However, this menu cannot be used for other than the 3-dimension display mode.
Std range	The display range (scale and display position) is automatically set from the machine movable area. The machine movable area is set with the parameters "#2013 OT-" and "2014 OT+" (software limit). When the display range is changed, the graphic data displayed on the screen is erased.
Drawing System	This sets the name and values of the counter to display in the graphic check, and the coordinate system to be drawn.
M0/M1 neglect	Designate whether to stop program check when M0/M1 is commanded. If [M0/M1 neglect] is set to ON, program check does not stop even when M0/M1 is commanded. If [M0/M1 neglect] is set to OFF, program check stops when M0/M1 is commanded.
Auto Graphic	After the scale is automatically adjusted so that the entire machining program can be displayed in the 90% of the drawing area, the graphic is drawn on the center of the drawing area. It is automatically adjusted in the following cases for 1-plane display mode. <ul style="list-style-type: none"> •When the program is selected •When display size is switched (normal display <-> full display) •When the part system is changed •When the display range is changed When auto graphic is valid, the menu is highlighted.
Grid display	Whether to display or not the grid line in the drawing area for the 1-plane display mode can be selected. When the grid view is enabled, the scale value and scale bar size are obtained as the dimension value per grid. Enabling the grid view displays the scale extension line. Disabling the grid view erases the scale extension line. When the grid display is valid, the menu is highlighted.
Next axis	This changes the axis to be displayed on the counter. This switches between "the basic axes IJK" and "C axis". <Note> <ul style="list-style-type: none"> •This menu cannot be selected in the following cases: <ul style="list-style-type: none"> - When the control axis address other than C is specified in the parameter "#19405 Rotary ax drawing". - When C axis is specified in the user parameter "#1026 base_I" (Base axis I), "#1027 base_J" (Base axis J), or "#1028 base_K" (Base axis K). - When the "Graphic check/trace rotary axis drawing" specification is invalid

Note

- (1) The menus [Check search], [Check continu], [Check step] and [Check reset] cannot be selected while the check is performed or interrupted.
Menu can be selected after [Check reset] is pressed.
- (2) The menus [Check Search], [Check continue], [Check step], and [Check reset] are dimmed during automatic operation in trace mode, and the 3D solid check is disabled. If the program is not in the process of automatic operation, a check is possible only for 3D solid.
- (3) The menu [M0/M1 neglect] is displayed in gray during continuous check, and the menu cannot be selected.




4.1.1 Checking Continuously

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

Operation method (Selecting a program to be checked)

Checking the specified program

- (1) Press the  key to switch the part system.
In addition to the above, the PLC signal and touch-screen operation are provided as the part system switching method.
- (2) Press the main menu [Check] on the edit screen.
Press the menu [2D Check] when the program check (3D) appears.
- (3) Press the menu [Check search].
If you press the menu [Commentnondisp] in the second page, the comment is hidden.
- (4) Select the device.
(Example) Menu [Memory]
- (5) (For the devices other than NC memory)
Use the [\uparrow], [\downarrow], , or  key to align the cursor with a directory to be newly created.






The selected device name and directory (memory: /program) appear in the device name and directory display columns.
For the devices other than NC memory, root directory is selected.

Press the [INPUT] key to move to inside the directory.

<Note>

- ♦If the contents of list are different from the actual device or directories, press the menu [List update].
- ♦Press the menu [Sort change] to change the sort. Each time the menu key is pressed, the sort method shifts in the following order: file names in ascending order -> file names in descending order -> dates and comments in ascending order -> dates and comments in descending order -> file names in ascending order.

- (6) Press the [↑], [↓],  or  key to move the cursor to the program to be searched.
The name of the machining program to be edited can be input in the input area.
When the touchscreen display unit is used, you can also select a program by touch operation.
- (7) Press the [INPUT] key.  The check search is started.
When setting data exists in the input area, a search is performed in this data. This procedure is also used when performing an NB search.
The operation message "Search complete" appears when the search is completed.
(Example)
After performing the search, the device and program position appear in the current machining program display column.
The list is then closed.
The system distinguishes between the presence or lack of an extension, and therefore due care should be taken.
- ```


1001/1/2 O1001 N1 B2
1001.PRG/1/2 O1001.PRG N1 B2
/1/2 (current O number) N1 B2
1001//2 O1001 N0 B2
1001/1 O1001 N1 B0
1001 O1001 N0 B0
/1 (current O number) N1 B0
//2 (current O number) N0

```


### Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.

### Checking the program currently opened on the edit screen

- (1) Press the  key to switch the part system.  
In addition to the above, the PLC signal and touchscreen operation are provided as the part system switching method.
- (2) Press the menu [Program check] on the edit screen.  
Press the menu [2D Check] when the program check (3D) appears.

### Checking the program searched on the monitor screen

- (1) Press the  key to switch the part system.  
In addition to the above, the PLC signal and touchscreen operation are provided as the part system switching method.
- (2) Press the menu [Check ] on the monitor screen.  
Press the menu [2D Check] when the program check (3D) appears.

**Operation method (Executing the program check)**

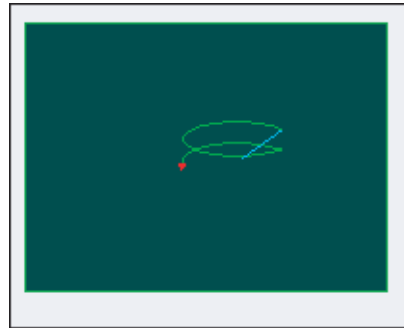
- (1) Press the menu [Check continu].

Behaviors during check operation

- Press the menu [Check step], the program check is carried out block by block starting from the next block.
- Press the menu [Check continue], the program check is stopped. Press the menu [Check continu] during block stoppage, the program check is carried out continuously.
- Press the menu [Check reset], the program check is reset after completion of the currently executing block.



A program check is executed and that path is drawn. A "Checking" message appears and the menu is highlighted. The check counter display is updated. The check G modal is not displayed. The machining time is updated. Program check is carried out for the currently displayed part system. As necessary, switch the part system to be displayed.



When the check is completed, a message appears and the mode returns to normal. The menu highlight returns to normal.

When the setting of the bit1 or bit2 of parameter #1231 is changed, you can switch the drawing path. Refer to "4.1.14 Switching the Draw Path" for operation procedures.

**Note**

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.



## 4.1.2 Checking One Block at a Time

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

Perform the same procedure as "4.1.1 Checking Continuously" on selecting a program.

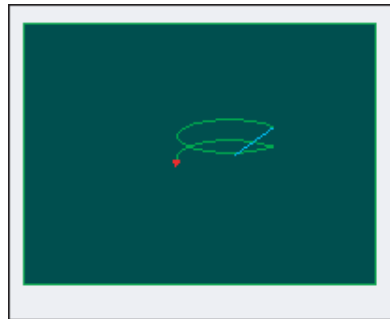
**Operation method (Executing the program check)**

- (1) Press the menu [Check step].

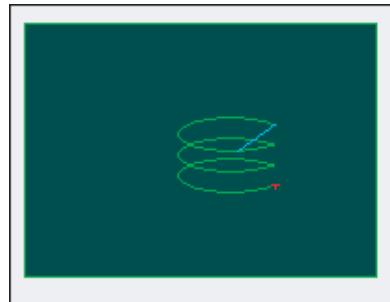


The program check is executed for one block, and a graphic drawing of the machining program movement path is made.  
The check counter display is updated.  
The check G modal display is updated.  
The machining time is updated.

<State during one block check>



<State when one block check is completed>



- (2) Press the menu [Check step].



Behaviors during check operation

- Press the menu [Check continue], program check is carried out continuously up to the end of the program.
- Press the menu [Check reset], the program check is reset.

The program check is executed for the single block.  
When the check is completed, a message appears and the mode returns to normal.  
The menu highlight returns to normal.

When the setting of the bit1 or bit2 of parameter #1231 is changed, you can switch the drawing path.  
Refer to "4.1.14 Switching the Draw Path" for operation procedures.

**Note**

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.

### 4.1.3 Setting the Coordinate System to Draw

Press the menu [Drawing system] to select the coordinate system to draw from among the coordinate selection menus below. During the graphic check, it is possible to draw paths of the running programs of the selected coordinate system only. If "All wk. coord" is selected, all paths of the program will be drawn. If other than "All wk. coord" is selected, paths of the program of only selected coordinate will be drawn. The default setting is "All wk. coord".

#### Note

- (1) The coordinate system to draw that is set here is held even after turning the power ON again.
- (2) When the parameter "#1231 set03/bit4" (Switch zero point mark display position) is set to "1", the zero point mark's position is not of the selected coordinate system to draw, but of the workpiece coordinate system or extended workpiece coordinate system specified by the machining program being checked.
- (3) The coordinate system to draw is common between part systems.
- (4) The drawing coordinate system settings of 2D and 3D graphic check are not linked.
- (5) When the drawing coordinate system is set for other than "All Wk. Coord", if switching the coordinate system has not been commanded in the program to execute the program check, this draws the program performs drawing in the currently set coordinate system, that is not the correct position. Thus, note that the coordinate system is specified in the program.

#### Menus to select the coordinate system to draw

| Menus         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All wk. Coord | This draws all workpiece coordinate systems. The display for the check counter switches by the setting of the parameter "#1231 set03/bit1" (Switch graphic coordinates) and "#1231 set03/bit5" (Switch graphic check counter display).<br>In the area to show the setting of the coordinate system to draw, "All Work" is displayed.<br>#1231 set03/bit1=0 and #1231 set03/bit5=0 : Machine position<br>#1231 set03/bit1=0 and #1231 set03/bit5=1 : Workpiece coordinate position<br>#1231 set03/bit1=1 and #1231 set03/bit5=0 : Tool position (machine coordinate system)<br>#1231 set03/bit1=1 and #1231 set03/bit5=1 : Tool position (workpiece coordinate system) |
| G54           | This specifies the workpiece coordinate (between G54 and G59) as a coordinate system to draw. In the graphic check counter, the workpiece coordinate position or tool position (workpiece coordinate system) counter is displayed regardless of the setting of the parameter "#1231 set03/bit5" (Switch graphic check counter display).<br>In the area to show the setting of the coordinate system to draw, the selected workpiece coordinate system is displayed.                                                                                                                                                                                                   |
| G55           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| G56           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| G57           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| G58           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| G59           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Coord G54.1 P | This specifies the extended workpiece coordinate (G54.1 Pn) as the coordinate system to draw. The extended workpiece coordinate (G54.1 Pn) can be selected for the type of coordinate system to draw by inputting the P No.<br>The graphic check counter is changed to the workpiece coordinate position or tool position (workpiece coordinate system) counter regardless of the setting of the parameter "#1231 set03/bit5" (Switch graphic check counter display).<br>In the area to show the setting of the coordinate system to draw, the selected workpiece coordinate system is displayed.                                                                     |

**Select the type of workpiece coordinate system to draw (When selecting all workpiece coordinates, or coordinate system G54-59)**

(1) Press the menu [All wk. coord].



In the area to show the setting of the coordinate system to draw, "All Work" is displayed.

In the same manner, by pressing a menu between [G54] and [G59], in the area to show the setting of the coordinate system to draw, the selected workpiece coordinate system is displayed.

**Select the type of workpiece coordinate system to draw (When selecting the coordinate system G54.1P)**

(1) Press the menu [Coord G54.1P].

(2) Input "20", and press the [INPUT] key.



In the area to show the setting of the coordinate system to draw, "G54.1P20" is displayed.

**Note**

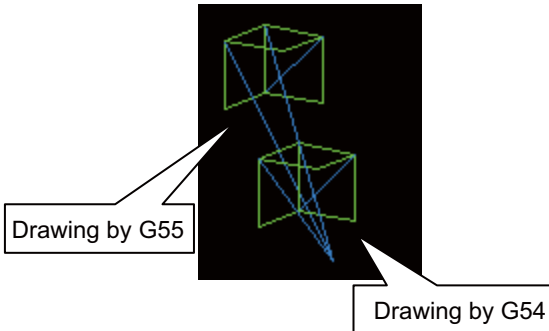
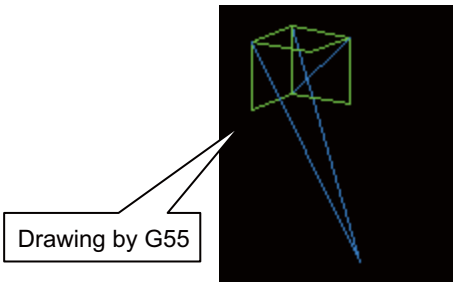
(1) When the [All wk. coord] or G54 to G59 is pressed while the menu [G54.1P] is being selected, the pressed menu is selected as the coordinate system to draw.

**Difference of drawing by combination of "CoordinateSystem" and "Coord Select"**

By combination of the drawing coordinate system (CoordinateSystem) and the workpiece coordinate system selection (Coord Select), the drawing at 2D check changes as follows.

(Example)

|                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>[Workpiece coordinate]<br/>                 G54: X 100.000 Y 100.000 Z 0.000<br/>                 G55: X 200.000 Y 200.000 Z 0.000</p> | <p>[Machining program]<br/>                 N1 G28 XYZ<br/>                 N10 G90 G54 G0 X100. Y100. Z100.<br/>                 N11 G91 G01 X-100. F500<br/>                 N12 Y-100.<br/>                 N13 X100.<br/>                 N14 Y100.<br/>                 N15 Z-100.<br/>                 N16 Y-100.<br/>                 N17 Z100.<br/>                 N18 G0 Y100. Z-100.<br/>                 N19 G01 X-100. F500<br/>                 N20 Z100.<br/>                 N30 G28 XYZ<br/>                 N40 G90 G55 G0 X200. Y200. Z200.<br/>                 N41 G91 G01 X-100. F500<br/>                 N42 Y-100.<br/>                 N43 X100.<br/>                 N44 Y100.<br/>                 N45 Z-100.<br/>                 N46 Y-100.<br/>                 N47 Z100.<br/>                 N48 G0 Y100. Z-100.<br/>                 N49 G01 X-100. F500<br/>                 N40 Z100.<br/>                 N50 G28 XYZ<br/>                 M30<br/>                 %</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Drawing coordinate system selection | Drawing at 2D check                                                                  |                                                      |
|-------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------|
| All wk. coord                       |  | Workpiece coordinates G54 and G55 both are drawn.    |
| Workpiece coordinate system G55     |   | Workpiece coordinate G55 is drawn. G54 is not drawn. |

## 4.1.4 Drawing during a Program Check

During the program check, the tool center path (machine position) is drawn. However, if a radius compensation is applied on the program being checked, the program path (tool position) and tool center path (machine position) are drawn. The colors of the lines displayed during the program check are expressed as follows.

|                |                       | With radius compensation | Without radius compensation |
|----------------|-----------------------|--------------------------|-----------------------------|
| Manual feed    |                       | -                        | -                           |
| Rapid traverse | Programmed path       | White                    | -                           |
|                | Tool center move path | Blue                     | Blue                        |
| Cutting feed   | Programmed path       | White                    | -                           |
|                | Tool center move path | Green                    | Green                       |

## 4.1.5 Changing the Display Range

The graphic drawing's scale can be enlarged or reduced, and the position moved or centered.

**Operation method (Enlarging the and reducing the drawing)**

(1) Press the menu [Display range].

(2) Press the menu [Zoom In] or [Zoom out].

To enlarge the figure:

Press the menu [Zoom in] or [-] key.

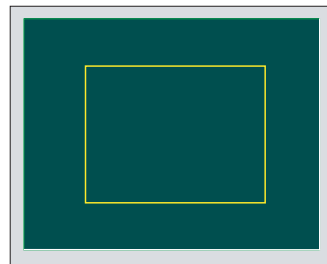
To reduce the figure:

Press the menu [Zoom out] or [+] key.

A solid-line frame appears with respect to the original scale when enlarging, and a dotted-line frame appears when reducing.



The size of the white frame can be changed by using key operations.



(3) Press the [INPUT] key.



The display scale changes.

By changing the display scale, the graphic data displayed on the screen is erased.

When auto graphic is valid, the graphic data is automatically drawn again on the changed display scale.

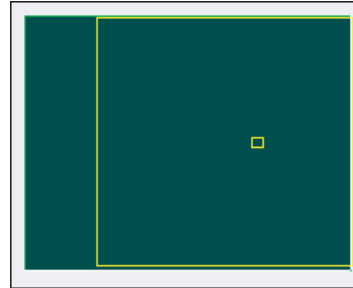
**Operation method (Changing the drawing display position)**

(1) Press the menu [Display range].

(2) Press the menus [ $\uparrow$ ], [ $\downarrow$ ], [ $\leftarrow$ ], [ $\rightarrow$ ] or cursor movement keys [ $\uparrow$ ], [ $\downarrow$ ], [ $\leftarrow$ ], [ $\rightarrow$ ].



The cursor ( $\square$ ) indicating the center of the display and the frame line move up, down, left and right according to the key operations.



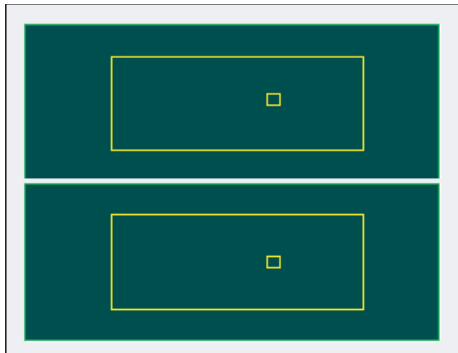
(3) Press the [INPUT] key.



The display position changes so that the cursor position ( $\square$ ) is the center of the area. When display position is changed, the graphic data displayed on the screen is erased. The scale value is not changed.

**Note**

(1) When changing the display range while the 2-plane display mode such as [XY/XZ], the display range (scale and display position) for the upper and lower areas changes in the same manner. The operation method is the same as the 1-plane display mode.



The white-framed display range in the upper and lower areas simultaneously move to the left/right when the [ $\leftarrow$ ], [ $\rightarrow$ ] keys are pressed.

The white-framed display range of either upper or lower areas moves up and down when the [ $\uparrow$ ], [ $\downarrow$ ] keys are pressed. Which frame to be moved up/down can be changed with the page key.

(2) The set display angle is maintained even after rebooting the machine.

(3) The graphics are not automatically drawn even when auto graphic is valid.

**Operation method (Centering)**

(1) Press the menu [Display range].

(2) Press the menu [Centering].



The display position is changed so that the current machine position appears in the center of the drawing area. The graphic displayed up to that point is cleared and the drawing starts again from the current position (the center of the drawing area).

When auto graphic is valid, the graphic data is automatically drawn again in the changed display range.

**Note**

- (1) In the 2-plane display mode such as [XY/XZ], centering is applied for the upper and lower areas. The operation method is the same as the 1-plane display mode.
- (2) When the menu [Centering] is pressed after the display scale has changed, only the centering is applied without changing the scale value.

Setting range of the scale value

| #1003 Input setup unit | #1041 I_inch            |                           |
|------------------------|-------------------------|---------------------------|
|                        | 0 (mm)                  | 1 (inch)                  |
| B                      | 0.100 to 9999.999       | 0.0100 to 9999.9999       |
| C                      | 0.0100 to 9999.9999     | 0.00100 to 9999.99999     |
| D                      | 0.00100 to 9999.99999   | 0.000100 to 9999.999999   |
| E                      | 0.000100 to 9999.999999 | 0.0000100 to 9999.9999999 |

- (3) The set scale value is maintained even after the power is turned OFF and ON.
- (4) In the 2-plane display mode such as [XY/XZ], the change of the scale input range is applied for the upper and lower area. The operation method is the same as the 1-plane display mode.

#### 4.1.6 Changing the Display Mode

There are three types of graphic drawing mode: 1-plane, 2-plane, and 3-dimension. Press the menu [Display mode] key, and by selecting one of the following display mode menus, the axis configuration for each plane changes, and the menu display returns to normal. Set the axis name in the input area and select the [INPUT] key to change three axes of the drawing targets.

**Note**

- (1) When the display angle is changed, the graphics displayed up to that point are erased.
- (2) These set display mode is maintained even after rebooting the machine.
- (3) The display mode can be set independently for the trace function and program check function. These settings are not linked with one another.
- (4) The menu axis names XYZ are compatible with the basic axes IJK. X = base axis I, Y = base axis J, and Z = base axis K.

**Display mode menu**

| Menus | Description                                                                                                                                                                   |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| XY    | This changes to the 1-plane display mode configured of X-Y.<br>The X axis is displayed in the horizontal axis, and the Y axis is displayed in the vertical axis.              |
| XZ    | This changes to the 1-plane display mode configured of X-Z.<br>The X axis is displayed in the horizontal axis, and the Z axis is displayed in the vertical axis.              |
| YX    | This changes to the 1-plane display mode configured of Y-X.<br>The Y axis is displayed in the horizontal axis, and the X axis is displayed in the vertical axis.              |
| YZ    | This changes to the 1-plane display mode configured of Y-Z.<br>The Y axis is displayed in the horizontal axis, and the Z axis is displayed in the vertical axis.              |
| ZX    | This changes to the 1-plane display mode configured of Z-X.<br>The Z axis is displayed in the horizontal axis, and the X axis is displayed in the vertical axis.              |
| ZY    | This changes to the 1-plane display mode configured of Z-Y.<br>The Z axis is displayed in the horizontal axis, and the Y axis is displayed in the vertical axis.              |
| XY/XZ | This changes to 2-plane display mode configured of X-Y and X-Z. The X axis is displayed as the horizontal axis, and the Y axis and Z axis are displayed as the vertical axis. |
| YX/YZ | This changes to 2-plane display mode configured of Y-X and Y-Z. The Y axis is displayed in the horizontal axis, and the X and Z axes are displayed in the vertical axis.      |
| XYZ   | This changes to the 3D display mode. A cube is displayed on the lower right of the screen.                                                                                    |

**Changing the display axis name**

- (1) Set the axis name and press the [INPUT] key.  
XYC [INPUT]



XYZ appears the graphic display mode name. There are 3 drawing axes: X, Y, and C.  
The X axis, Y axis and C axis are the three axes for drawing.

There are three types of display mode: 1- plane, 2- plane, and 3D. An image displays which display mode is currently selected. The selected axis name displays for the image axis name.

Display example

| <1-plane> (XY) | <2-plane> (XY/XZ) | <3-dimension> (XYZ) |
|----------------|-------------------|---------------------|
|                |                   |                     |



### 4.1.7 Changing the Display Angle

This is used to set the graphic drawing display angle when in 3-dimension display mode.

Press the menu key or cursor keys to rotate the cubic displayed at the screen upper right and press the [INPUT] to set.

#### Note

- (1) When the display angle is changed, the graphics displayed up to that point are erased.
- (2) The set display angle is maintained even after rebooting the machine.
- (3) The display angle can be set independently at the trace function and program check function. These settings are not linked with one another.

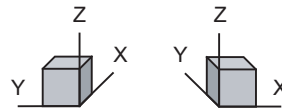
#### Operation method

- (1) Press the menu [Rotate].

- (2) Use the menus [ $\uparrow$ ], [ $\downarrow$ ], [ $\leftarrow$ ], [ $\rightarrow$ ] to adjust the display angle.  
The cursor movement keys ([ $\uparrow$ ], [ $\downarrow$ ], [ $\leftarrow$ ], [ $\rightarrow$ ]) can also be used to rotate.



Rotate the cubic display in the lower right of the screen using the operation keys.



- (3) Press the [INPUT] key.



The display angle changes.  
By changing the display angle, the graphic data displayed on the screen is erased.

#### Note

- (1) The set display angle is maintained even after rebooting the machine.

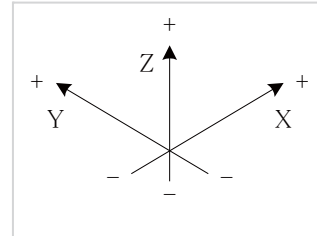
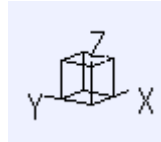
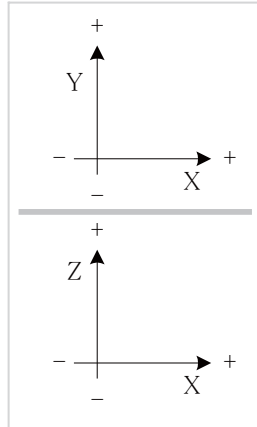
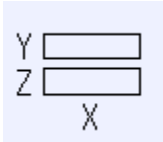
### 4.1.8 Switching the Axis Movement Direction (+, -)

The path is drawn according to the axis movement direction designated by the parameter "#1495 grf\_ax\_direction". The movement direction can be set for each axis.

When "#1495 grf\_ax\_direction" is set to "0", the axis movement directions are as follows.

<2D mode>

<3D mode>

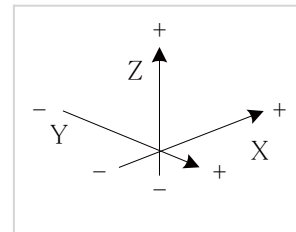
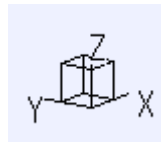
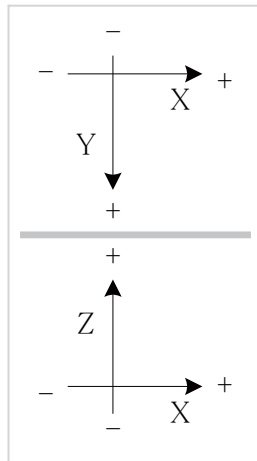
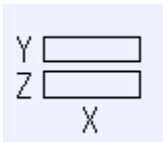


When the axis movement direction is opposite direction, the axis direction movement of 2D or 3D mode are as follow.

(Example) When the Yaxis movement direction is set in the opposite direction

<2D mode>

<3D mode>



#### 4.1.9 Displaying the Machining Program on Checking

When pressing the menu [Program display], the contents of the machining program on checking is displayed on the drawing area.

When pressing the menu [Program display] again, the displayed program is erased.

Note that this menu can be used only when the full-screen display mode is selected.

##### Note

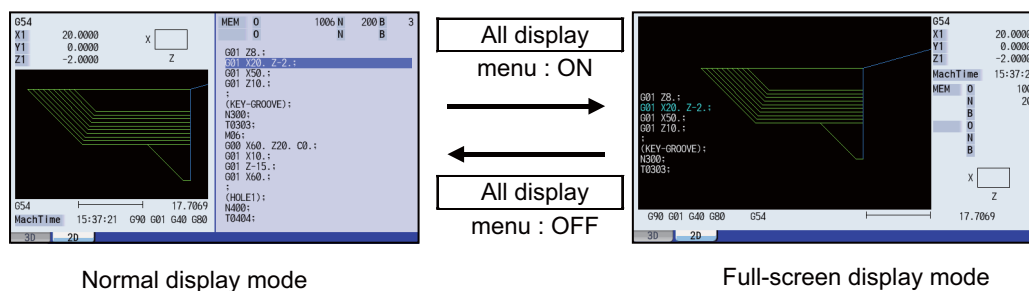
- (1) The selected display mode is maintained even after rebooting the machine.
- (2) The program display mode is applied to the trace function and program check (2D) function commonly.
- (3) The menu [Program display] cannot be selected while the normal display mode is selected. Program display mode is valid only when the full-screen display mode is selected.
- (4) The program display mode is applied commonly to all part systems.

#### 4.1.10 Switching to Full-screen Display Mode

Press the menu [All display] to display the program check window on the whole screen (full-screen display mode).

Press this menu again to return the normal display.

##### Switching the display mode



##### Note

- (1) The selected display mode is maintained even after rebooting the machine.
- (2) The full-screen display mode is applied to the trace function and program check (2D/3D solid) function commonly.
- (3) The full-screen display mode is applied commonly to all part systems.
- (4) When auto graphic is valid, the graphic is drawn after the drawing's scale is automatically adjusted to the scale to draw the entire machining program (the area of about 90% of the drawing area).

## 4.1.11 Setting Auto Graphic

If [Auto graphic] is valid, a graphic is automatically drawn when a file is selected to check a graphic, the display size is switched (normal display <-> whole display), the part system is changed or the display range is changed.

When a file is selected, the part system is changed, or the display size is switched, a graphic is drawn in the center of the drawing area after the scale is automatically adjusted so that the entire machining program can be drawn in the 90% of the drawing area.

A drawing path is switched according to the setting of parameter "#1231 set03/bit1, bit2".



Refer to "4.1.14 Switching the Draw Path" for operation procedures.

(1) Press the menu [Auto Graphic].

(2) Press the menu [Check search].



The check search list is displayed.

(3) Use the [↑], [↓], , and  keys to point the cursor with the target machining program.  
(Or enter the target file name in the input area.)

(4) Press the [INPUT] key.



The check search is started.

The message "Search completed" appears when the search is completed.

When the check search is completed, the graphic previously displayed is erased and the auto-adjustment of the scale will start.

During the auto-adjustment, a message "Executing auto scale" will be highlighted.

When the auto-adjustment of the scale is completed, "Checking" message is displayed and the graphic drawing is performed automatically.

When the graphic drawing is completed, "Program check completed" message is displayed and the graphic drawing mode will be canceled. Each menu is displayed normally, and the menu selection will be available.

**Precautions**

- (1) Auto graphic is executed only for the 1-plane display mode. The menu [Auto Graphic] cannot be selected for the other modes. Auto graphic mode always remains as it is in the 1-plane display mode.
- (2) Once the auto graphic mode is set, it is retained after the power is turned ON again.
- (3) The auto graphic cannot be set for the trace function.
- (4) The auto graphic mode is common between part systems.
- (5) Even M00 or M01 command does not cause "PROGRAM STOP".
- (6) If a program which contains M99 command is selected, auto adjustment of the scale will be executed repeatedly and the adjustment will not be completed with the "Executing auto scale" message blinking.  
Do not select a program which contains M99.  
Execute check reset when it happens.
- (7) When a large capacity program is selected, it may take time to perform the auto graphic.
- (8) The graphics are not automatically drawn for the display size change (between normal screen and full screen) and display range change during program check even when auto graphic is valid. Auto graphic drawing is performed only when the figure is enlarged or reduced.
- (9) If a check search is performed on a file which went through an auto-adjustment of the scale, only graphic drawing will be performed as long as there is no changes in "a path and a file name (including a device)", "the date of updating", or display mode (XY/YZ/XZ.. etc). Maximum 12 files can be memorized, to which an auto-adjustment of the scale has been executed.  
Therefore, if the 13th file is check-searched and the scale is automatically adjusted, information of the first file will be lost. When the first file is check-searched again, the automatic scale adjustment is started after check search has been completed.
- (10) Auto adjustment of the scale will be interrupted if one of the following operations is taken:
  - ♦Press the menu [Check reset].
  - ♦Press the menu [Auto Graphic].
  - ♦The screen is changed to other than [2D check].
  - ♦A program error occurs.

## 4.1.12 Availability of Check Mode with Other Functions

It is important to be aware that certain NC parameters, program commands, and machine operation panel switches cannot be used while performing a program check.

| Function name                                   | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Decimal point programming                       | Both decimal point input type I and II are valid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Mirror image<br>(Parameters, external input)    | A mirror image is applied and a check drawing is made at the setting status prior to starting the check.<br>For external input, the signal is ignored, and check drawing is carried out.                                                                                                                                                                                                                                                                                                                                               |
| Z axis command cancel                           | Signals are ignored and a check drawing is made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Interlock                                       | Signals are ignored and a check drawing is made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| External deceleration                           | Signals are ignored and a check drawing is made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Override                                        | Signals are ignored and a check drawing is made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Auto operation pause (feed hold)                | Signals are ignored and a check drawing is made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Auto operation start-up (cycle start)           | If you press the cycle start button during checking, the operation alarm "M01 program check mode" is displayed (foreground) while the button is held down. The operation can be started automatically even during check drawing (background).                                                                                                                                                                                                                                                                                          |
| Auto-restart                                    | The check is completed at M02/M30 and is not restarted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Workpiece coordinate offset                     | Offset is enabled (the target is drawn at the position determined with the designated offset amount).                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Manual mode/handle                              | If the mode is switched to the manual mode during checking, the operation alarm "M01 program check mode" is displayed (foreground). During checking, you can switch to the manual mode, HANDLE, to move the machine. However, the drawing position of the check will not be affected by the mode change (background).                                                                                                                                                                                                                  |
| F1-digit feed                                   | The speed command does not influence the check drawing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| User macro I, II                                | Basic variable calculations, decisions and branch functions are all enabled. However, the following functions are ignored, or indefinite values are input.<br><ul style="list-style-type: none"> <li>•Macro interface input/output,</li> <li>•Single block stop</li> <li>•Miscellaneous function complete signal waiting control,</li> <li>•Feed hold</li> <li>•Feedrate override</li> <li>•G09 enabled/disabled control,</li> <li>•Reading of position information for other than the previous block end point coordinates</li> </ul> |
| M, S, T and 2nd miscellaneous function commands | M, S, T and 2nd miscellaneous function command signals commanded by the program during the check are not output. Neither do they display on the Operation screen etc. The auxiliary function command by manual operation on the position display screen is output even during checking.                                                                                                                                                                                                                                                |
| G command modal                                 | G modal displays on the modal display screen while the check drawing is being made.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Optional block skip                             | The setting status when starting the check drawing are used (foreground). Use the menu to switch ON and OFF. The optional block skip state is held until the power is turned on again, which is common to part systems. However, when the power is turned on again, the mode is always turned OFF (Background).                                                                                                                                                                                                                        |

**Note**

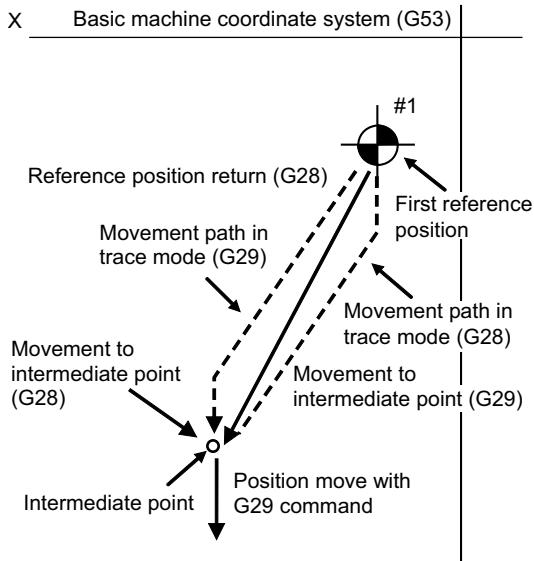
(1) Reference position return and start position return

The reference position return command and start position return command are valid, but actual machine motion (trace display) is partially different from the drawing by program check.

As shown in the figure below, when returning to the reference position via the intermediate point with the G28 or G30 command, positioning to the intermediate point is done by a straight line and positioning from there to the reference position is done by each axis independently.

With the G29 command, positioning to the intermediate point is done by each axis independently.

Under program checking, however, positioning is always done by a straight line even when returning via the intermediate point. This may cause a little difference from the trace display.



#### 4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input

If a program check is performed for a machining program for which the variable command data etc. is rewritten, all data types are treated as shown in the following table after completion. The setting commands, which are executed to various data during program check, are reflected on only drawing of background check. The actual machining operation is not affected.

Handling of variables, parameter and compensation amount (foreground)

| Data type                          | Returning to pre-checked data after check completion | Details                                                                                                                                                                                                                                                                             |
|------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                          | ×                                                    | The programmable parameter input commands are set as actual data.<br>(The data before the check is not saved.)                                                                                                                                                                      |
| Local variable                     | ○ / ×                                                | It is possible to return to the status prior to starting the program check based on the "#1231 set03(bit0) " graphic check interchangeable parameter value.<br>0: Returns to original status after check completion<br>1: Does not return to original status after check completion |
| Common variable                    | ○ / ×                                                |                                                                                                                                                                                                                                                                                     |
| Workpiece coordinate system offset | ○ / ×                                                |                                                                                                                                                                                                                                                                                     |
| Tool compensation amount           | ○ / ×                                                |                                                                                                                                                                                                                                                                                     |

Handling of variables, parameter and compensation amount (background)

| Data type                          | Returning to pre-checked data after check completion | Details                                                                                                                                             |
|------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                          | ○                                                    | The parameter input commands which have been executed at the program check are not set as actual data.<br>(The data before the check is not saved.) |
| Local variable                     | ○                                                    | The parameter "#1231 set03(bit0)" (Graphic check compatibility parameter) is disabled.                                                              |
| Common variable                    | ○                                                    |                                                                                                                                                     |
| Workpiece coordinate system offset | ○                                                    |                                                                                                                                                     |
| Tool compensation amount           | ○                                                    |                                                                                                                                                     |



## 4.1.14 Switching the Draw Path

The path to be drawn can be switched by designating a parameter.

■Parameter "#1231 set03(bit2) Switch graphic check trace"

The number of the paths to be drawn can be switched. It is immediately activated after the setting.

| Parameter value | Description                                                                                                                                                      |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0               | Both the tool center path (machine position) and program path (tool position) are drawn. However, the radius compensation is not reflected for the program path. |
| 1               | Only path designated with Switch graphic coordinate (#1231 set03(bit1)) is drawn.                                                                                |

■Parameter "#1231 set03(bit1) Switch graphic coordinate"

The drawn path where the parameter "switch graphic check trace" is set to "1" can be switched. It is immediately activated after the setting.

| Parameter value | Description                                                                                       |
|-----------------|---------------------------------------------------------------------------------------------------|
| 0               | Only the tool center path (machine position) is drawn.                                            |
| 1               | Only program path (tool position) is drawn.<br>The path does not reflect the radius compensation. |

The counter display is switched by combination of the parameters "#1231 set03/bit1" and "#1231 set03/bit5". When the drawing coordinate system by the menu [Drawing system] is set for other than "All wk. coord", the counter of the workpiece coordinate position or the tool position (workpiece coordinate system) is displayed regardless of a parameter "#1231 set03/bit5".

| #1231      |   | set03/bit5                                |                                                  |
|------------|---|-------------------------------------------|--------------------------------------------------|
|            |   | 0                                         | 1                                                |
| set03/bit1 | 0 | Machine position                          | Workpiece coordinate position (*1)               |
|            | 1 | Tool position (machine coordinate system) | Tool position (workpiece coordinate system) (*1) |

(\*1) The name of the counter display is changed according to the currently executed workpiece coordinate system.

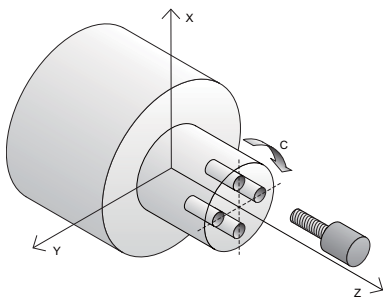
4.1.15 Drawing a Path Corresponding to the Rotary Axis (L System)

When the rotary axis (C axis) is designated with the parameter "#19405 Rotary ax drawing" in program check (2D), the path is drawn depending on the rotary axis. The rotary axis can be set for each part system.

**Note**

- (1) The "Graphic check/trace rotary axis drawing" option is also required to use this function.
- (2) When the control axis address other than C axis is designated with the user parameter "#19405 Rotary ax drawing", the path corresponding to the rotary axis is not drawn.
- (3) The workpiece coordinate system must be set so that the center of the rotary axis becomes the coordinate system zero point.

Image of the actual tool and workpiece



Example of machining program

```

%
O0512
T1
G97S1000M74
M19
G28H0
G0C0
G0X50.Z5.
G98
G83Z-20.R-5.Q5000F300
G0C90.
G83Z-20.R-5.Q5000F300
G0C180.
G83Z-20.R-5.Q5000F300
G0C270.
G83Z-20.R-5.Q5000F300
G80
G0Z20.
G28U0.M75
M18
M30
%
```

| Drawing image for 2D mode               |                                       | Drawing image for 3D mode               |                                       |
|-----------------------------------------|---------------------------------------|-----------------------------------------|---------------------------------------|
| When the rotary axis drawing is invalid | When the rotary axis drawing is valid | When the rotary axis drawing is invalid | When the rotary axis drawing is valid |
|                                         |                                       |                                         |                                       |

## 4.1.16 Notes for Graphic Check (2D)

**Check function**

- (1) The check function is drawn with only NC internal operation results. Thus, the path is not drawn for commands requiring machine movement.
- (2) For the handling of various types of data being set in the program, refer to "4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input".
- (3) If the menu [M0/M1 neglect] is OFF, the Program check is stopped by the M0/M01 command. When executing the M01 command, drawing is stopped regardless of the ON/OFF status of the optional stop switch signal (XC41).
- (4) When the menu [M0/M1 neglect] is ON, the program check does not stop even if M00/M01 is commanded.
- (5) "Program check completed" appears with M02/M30 command.
- (6) Graphic check is not available for serial and MDI program.
- (7) Operation search is available for a program that has a file name consisting of up to 32 characters. Operation search is not available for programs with 33 or more file name characters.
- (8) When the check is executed, the drawing starts from the machine coordinate zero point. However, the machine coordinate zero point is (0, 0, 0) even when the value is set to the parameter "#2037 G53ofs" (zero point return).
- (9) The drawing coordinate system settings of 2D and 3D graphic check are not linked.
- (10) Drawing is continued even after changing to another screen during the tracing or checking modes.
- (11) Graphic check (2D) cannot be performed during the trace mode.
- (12) If the screen is switched to 2D check screen during trace, the confirmation message for trace OFF appears. Only when trace is turned OFF, the transition to 2D check screen is performed. If trace is not turned OFF, the message "Tracing" appears and 2D check screen displays blank.
- (13) When trace window is displayed during check, check will be terminated. (This applies for all the part systems under checking.)
- (14) The drawing is erased if the performance such as enlarge, reduce, move, change display mode, or rotate is set during check drawing. Also, the program does not stop.
- (15) When switching part systems during checking, drawing will be erased. When the displayed part system is undone, check operation will be continued from the previous state (program position before part systems were switched).
- (16) Status during checking (in "Check continu" or "Check step") is held per part system.
- (17) Check reset is available only for the displayed part system.
- (18) When the drawing coordinate system is set for other than "All Wk. Coord", the drawing is not executed because the drawing is performed in currently set coordinate system when there is no command to switch the coordinate system in the program to execute the program check. Thus, note that the coordinate system is specified in the program.
- (19) When the parameter "#1231 set03(bit4)" (Switch zero point mark display position) is set to "1", and when the workpiece coordinate system or extended workpiece coordinate system is selected as the drawing coordinate system, the displayed zero point mark's position is not of the selected coordinate system to draw, but of the workpiece coordinate system or extended workpiece coordinate system specified by the machining program being checked.
- (20) When the rotary axis (C axis) is specified by the parameter "#19405 Rotary ax drawing" and the C axis is used as the spindle position control (spindle C axis control) axis, a path corresponding to the rotary axis will be drawn as long as the rotary axis moves regardless of the state.
- (21) The machine position of the rotary axis may not be temporarily clamped at 360°.
- (22) When the rotary axis drawing function is ON, an arc in cylindrical interpolation will be drawn as a straight line.
- (23) If Nose R compensation is carried out during cylindrical interpolation with the rotary axis drawing function ON, the tool path may be different from the programmed path.
- (24) The check search cannot be executed when the sub part system that cannot be operated is displayed. If the search is carried out, the message "Search error" appears. (Only L system)

**Precautions for drawing on foreground**

- (1) If you press the auto start button when an arbitrary part system is being checked, the operation alarm "M01 program check mode" is generated and the cycle start is disabled while the button is held down.  
Press the auto start button after the check is completed or after the check is stopped with the menu [Check reset].
- (2) If you carry out the operation search or check operation (continuous or step check) during cycle start or automatic stop of an arbitrary part system, an operation message "Executing automatic operation" is displayed, and no search or check drawing is carried out.
- (3) "Program check completed" appears with M02/M30 command. For the tape mode, the rewind process is not carried out.
- (4) The check ends with the reset (the menu [NC Reset] or [Check reset]).  
When a program error occurs, cancel the error with the above operation.  
If NC Reset is selected when the check screen is being displayed, check drawing ends but the menu to switch to the 2D Check or 3D Check is kept invalid. To enable this switching, press the menu [Check reset].
- (5) During automatic operation, the contents of automatic operation program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the check screen. During checking, the contents of the checking program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the monitor screen.
- (6) If you carry out the operation search or check operation (continuous or step check) when the program is restarted, the "Program restarting" operation message is displayed, and no search or check drawing is carried out.
- (7) If the manual operation mode is selected during checking, the "M01 program check mode" is displayed and the axis cannot be moved. If you need to move the axis, temporarily stop the current check by executing a reset and then move the axis. When you switch from the manual operation mode to the memory mode, the alarm is released. Also, you can continue the current check even if an alarm is output.
- (8) When the PLC Interrupt signal is turned ON during checking, the "M01 Program check mode" is selected. To start the PLC interrupt, terminate the current check by executing a reset. When you turn the PLC interrupt signal OFF, the alarm is released. You can continue the current checking even if the PLC Interrupt signal is ON.
- (9) The check mode ends with the reset or other operations, such as setting the tracing ON.
- (10) All part systems are reset if NC reset is executed during checking. If a part system other than that displayed is being checked, switching the part system executes the program check from the top of the program.
- (11) If the origin set operation is performed during checking, the result of the origin set is reflected to the value of the work-piece coordinate counter; however, the value returns to that before the check when the check is completed or with the reset.

**Precautions for drawing on background**

- (1) The program that you have selected during Check Search is not the program that is executed during automatic operation. Search the program for automatic operation by using the operation search function of the monitor screen.
- (2) The parameters and compensation amount do not reflect on check drawing even if you set them during checking. To reflect them on the drawings, reset the check once. Then, press the menu [Check continu] or [Check step] and execute the check again.
- (3) "Program check completed" appears with M02/M30 command.
- (4) The check is not terminated via execution of a reset.  
If a program error occurs, release the error by selecting the menu [Check reset].
- (5) When switching part systems during checking, drawing will be erased. Note that even if the part system is returned to the original one, its cutting drawing is not displayed.
- (6) During check search, if the length of the full path name exceeds 48 characters, you cannot move to another directory.
- (7) If the menu [Optional Skip] is ON (highlighted status), the blocks that have the "/" character are skipped and the T-code list is obtained.
- (8) The file name continues to be displayed as an O-number display even if you erase or rename the file after it is checked and searched. If you check a file in this status, the "Push [Check reset] menu" message is displayed.
- (9) During checking, if you read the run-out time by using variable number #3001 or #3002, the checking start time is obtained. You cannot write the run-out time.
- (10) When [Check continu] is executed, even if variable number #3006 is used for checking, you cannot stop the program and you cannot display the message.
- (11) The check mode ends with the operations, such as setting the tracing ON.

**Full screen display of program check function (2D)**

- (1) This function is an additional specification. When the menu [M0/M1 neglect] is set to OFF and trace 2D check is enabled, the graphic drawing area is enlarged or reduced horizontally or vertically if the normal screen is changed to the full screen. At this time, the scale value remains unchanged.

**Precautions for automatic graphic**

- (1) Auto graphic is executed only for the 1-plane display mode. The menu [Auto Graphic] cannot be selected for the other modes. The menu is grayed out. Auto graphic mode always remains as it is in the 1-plane display mode.
- (2) Once the auto graphic mode is set, it is retained after the power is turned ON again.
- (3) The auto graphic cannot be set for the trace function.
- (4) The auto graphic mode is common between part systems.
- (5) If the display size is switched (between normal and full screen) or the display range is changed during program check, the auto graphic drawing is not carried out even if the auto graphic is valid.
- (6) If a program error occurs during the auto scale adjustment, a message "Push [Check reset] menu" appears, and no auto scale adjustment or graphic drawing is carried out.
- (7) Even M00 or M01 command does not cause "PROGRAM STOP".
- (8) If a program which contains M99 command is selected, auto adjustment of the scale will be executed repeatedly and the adjustment will not be completed with the "Executing auto scale" message blinking.  
Do not select a program which contains M99.  
Execute check reset when it happens.
- (9) When a large capacity program is selected, it may take time to perform the auto graphic.
- (10) If the display position of a figure is changed by changing the display range, auto graphic drawing is not carried out.

**Precautions for grid display**

- (1) Grids are displayed only in the one-plane display mode. The menu [Grid display] cannot be selected in any other mode than the one-plane display mode. The menu is grayed out. During the grid display mode, the status in the one-plane display mode is maintained.
- (2) If the display mode is switched (to two-plane or three-dimensional) while the grid display is valid, the scale extension line is erased. However, the scale extension line is displayed when the mode is returned to the one-plane display mode.
- (3) The set grid display is maintained even after the screen is switched. However, it is not maintained after the power is turned OFF and ON.
- (4) The grid display mode cannot be set for the trace function.
- (5) The grid display mode is common among part systems.

## 4.2 Graphic Check (3D) (M System)



Graphic check (2D) is a function that allows you to check the machining program movement path only by drawing without automatic operations. Therefore, the graphics can be drawn at a high speed and high accuracy, and the machining program can be checked.

Press the menu [Check] on the monitor or edit screen to switch to the graphic check screen.

Program check (3D) can draw a solid image in the basic machine coordinate system or the workpiece coordinate system. The coordinate system used to draw can be switched on "Work set" screen. In the workpiece coordinate system, a solid image is drawn by using the workpiece coordinate system designated by the program.

This function requires workpiece and tool shape settings.

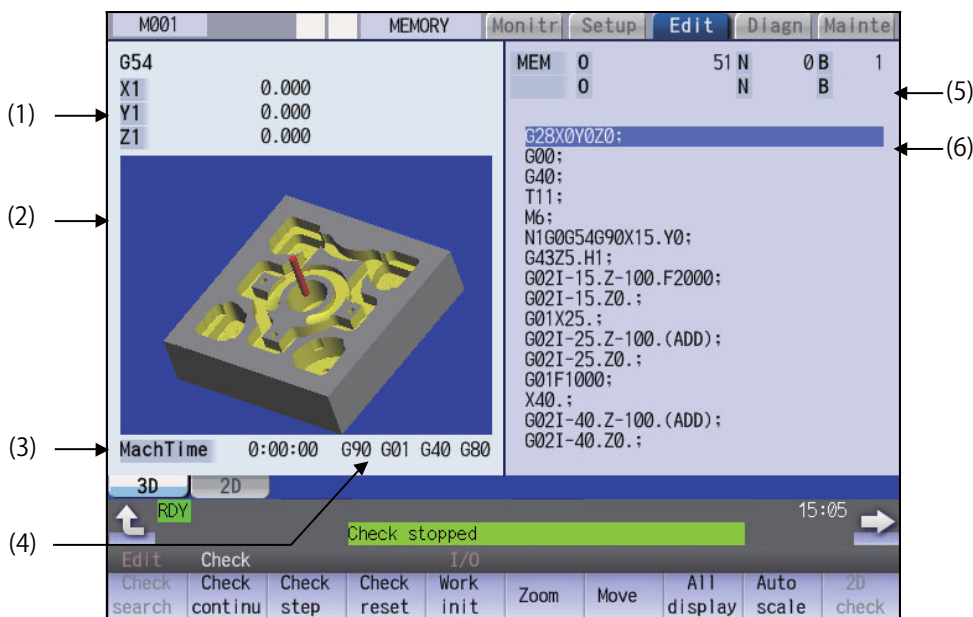
Using the menu [All display], normal display and whole display modes can be switched.

### Note

(1) When changing the screen to the edit screen, display depends on the previous checking type (2D/3D). If 2D graphic data appears, press the menu [3D check]. Note that when transferring to this screen during graphic trace, 3D solid program check is displayed.

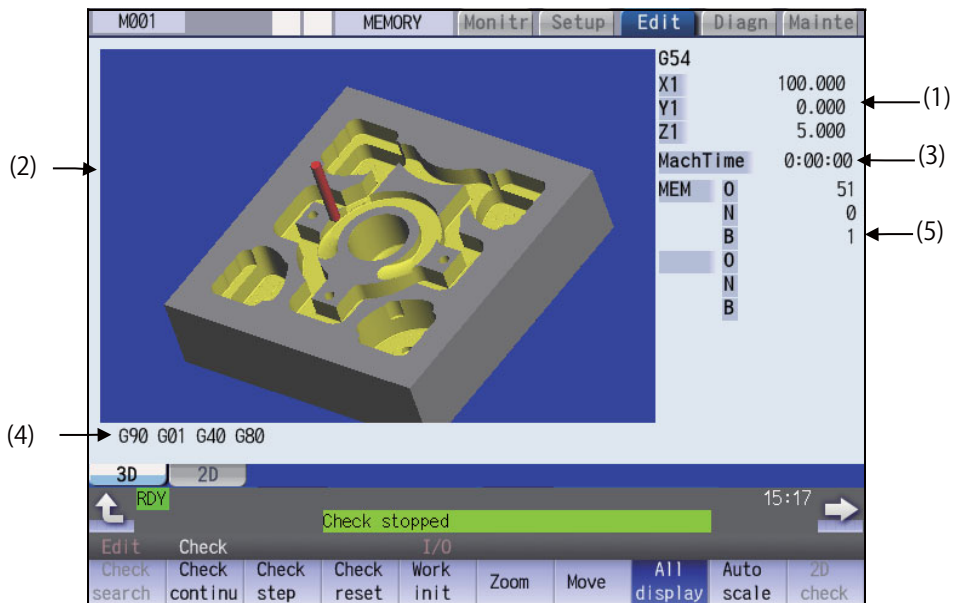
■ Normal display ([All display] is OFF)

<Drawing area>



■ Full-screen display ([All display] is ON)

<Drawing area>



Display items

| Display items |                                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1)           | Check counter                        | This displays the axis counter for the check drawing. As for the counter, the machine position or workpiece coordinate position is displayed according to setting the drawing coordinate system on "Work set" screen.<br>As for the axes name, system common axis name ("#1022 axname2") based on the basic axis name set by the parameters "#1026 base_I", "#1027 base_J", and "#1028 base_K" are displayed.                         |
| (2)           | 3D drawing area                      | This area is used to display a solid graphic drawing of the workpiece shape and tool movement during the cutting process in the machining program. The drawing viewpoint can be moved, and the drawing size can be enlarged and reduced.<br>The coordinate system used to draw switches the basic machine coordinate system or a workpiece coordinate system according to setting the drawing coordinate system on "Work set" screen. |
| (3)           | Machining time display               | The time required for machining is calculated and displayed.                                                                                                                                                                                                                                                                                                                                                                          |
| (4)           | G modal display for check            | The following items are displayed from the left.<br><ul style="list-style-type: none"> <li>•Absolute/incremental (G90, G91: Group 3)</li> <li>•Operation mode (G00, G01, etc.: Group 1)</li> <li>•Tool compensation (G40, G41, G42: Group 7)</li> <li>•Fixed cycle (G70, etc.: Group 9)</li> </ul> The items to be displayed vary depending on the status of group 24 command modal.                                                  |
| (5)           | Currently executed machining program | Main<br>O10...                                                                                                                                                                                                                                                                                                                                                                                                                        |
|               |                                      | Sub<br>O1234...                                                                                                                                                                                                                                                                                                                                                                                                                       |
| (6)           | Buffer display                       | This displays the contents of the machining program currently being executed. The block being executed is highlighted.                                                                                                                                                                                                                                                                                                                |

| Menus         |                                                                                                                                                                                                                                                                                                                                        |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Menus         | Description                                                                                                                                                                                                                                                                                                                            |
| Check search  | This performs a check search.<br>Select a program to be checked from the program file list displayed in the pop-up window.<br>For only the machining programs in NC memory, the check search is executed across all part systems in batch when the multi-part system program management is valid (#1285 ext21/bit0 =1, ext21/bit1 =1). |
| Check continu | This checks the program continuously.                                                                                                                                                                                                                                                                                                  |
| Check step    | This checks the program per block.                                                                                                                                                                                                                                                                                                     |
| Check reset   | This resets the program check.                                                                                                                                                                                                                                                                                                         |
| Work init     | This initializes the workpiece shape. Displays the pre-machining workpiece shape set at the "Work set" window (workpiece shape setting).                                                                                                                                                                                               |
| Zoom          | This enlarges/reduces the displayed workpiece shape.                                                                                                                                                                                                                                                                                   |
| Move          | This moves the displayed workpiece shape.                                                                                                                                                                                                                                                                                              |
| All display   | This switches the normal display mode and the full-screen display mode.                                                                                                                                                                                                                                                                |
| Auto scale    | The scale is automatically set so that the unmachining workpiece shape set at the "Work set" window (workpiece shape setting) to be approximately 90% of the graphic area.                                                                                                                                                             |
| 2D check      | This changes the program check (2D) display.<br>This menu cannot be selected while the check is performed or interrupted.                                                                                                                                                                                                              |
| Colli check   | This enables or disables the interference check.<br>When the interference check is enabled, if the tool and workpiece contact each other when performing rapid traverse (G0) movement, the contact location is drawn in a color highlighting the interference.                                                                         |
| Rotate        | This rotates the displayed workpiece shape.                                                                                                                                                                                                                                                                                            |
| M0/M1 neglect | Designate whether to stop program check when M0/M1 is commanded.<br>If [M0/M1 neglect] is set to ON, program check does not stop even when M0/M1 is commanded.<br>If [M0/M1 neglect] is set to OFF, program check stops when M0/M1 is commanded.                                                                                       |
| Work setting  | This sets the workpiece shape used at the solid display.                                                                                                                                                                                                                                                                               |
| Tool setting  | This sets the workpiece shape used at the solid display.                                                                                                                                                                                                                                                                               |

### Note

- (1) When automatic operation is running during the graphic trace mode, the menu [Check search], [Check continu], [Check step], [Check reset] cannot be selected and the 3D solid program check cannot be performed. If the program is not in the process of automatic operation, a check is possible only for 3D solid.
- (2) The menus [2D check], [Check search], [Work setting] and [Tool setting] cannot be selected while the check is performed or interrupted.
- (3) The menu [M0/M1 neglect] is grayed out during continuous check, and the menu cannot be selected.



## 4.2.1 Checking Continuously

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

**Operation method (Selecting a program to be checked)**
**Checking the specified program**



- (1) Press the main menu [Check] on the edit screen.  
Press the menu [3D Check] when the program check (2D) appears.

- (2) Press the menu [Check search].  
If you press the menu [Commentnondisp] in the second page, the comment is hidden.

- (3) Select the device.  
(Example) Menu [Memory]





The selected device name and directory (memory: /program) appear in the device name and directory display columns.  
For the devices other than NC memory, root directory is selected.

- (4) (For the devices other than NC memory)  
Use the [↑], [↓], , or  key to align the cursor with a directory to be newly created.

Press the [INPUT] key to move to inside the directory.

<Note>

- If the contents of list are different from the actual device or directories, press the menu [List update].
- Press the menu [Sort change] to change the sort. Each time the menu key is pressed, the sort method shifts in the following order: file names in ascending order -> file names in descending order -> dates and comments in ascending order -> dates and comments in descending order -> file names in ascending order.

- (5) Press the [↑], [↓],  or  key to move the cursor to the program to be searched.  
The name of the machining program to be edited can be input in the input area.  
When the touchscreen display unit is used, you can also select a program by touch operation.

- (6) Press the [INPUT] key. When setting data exists in the input area, a search is performed in this data. This procedure is also used when performing an NB search.
- (Example)
- ```
1001/1/2 O1001 N1 B2
1001.PRG/1/2 O1001.PRG N1 B2
/1/2 (current O number) N1 B2
1001//2 O1001 N0 B2
1001/1 O1001 N1 B0
1001 O1001 N0 B0
/1 (current O number) N1 B0
//2 (current O number) N0
```
- The check search is started.
The operation message "Search complete" appears when the search is completed.
After performing the search, the device and program position appear in the current machining program display column.
The list is then closed.
The system distinguishes between the presence or lack of an extension, and therefore due care should be taken.

Checking the program currently opened on the edit screen

- (1) Press the menu [Program check] on the edit screen.
Press the menu [3D Check] when the program check (2D) appears.

Checking the program searched on the monitor screen

- (1) Press the menu [Check] on the edit screen.
Press the menu [3D Check] when the program check (2D) appears.

Operation method (Executing the program check)

- (1) Press the menu [Check continu].
- Behaviors during check operation
- ◆ Press the menu [Check step], the program check is carried out block by block starting from the next block.
 - ◆ Press the menu [Check continue], the program check is stopped. Press the menu [Check continu] during block stoppage, the program check is carried out continuously.
 - ◆ Press the menu [Check reset], the program check is reset after completion of the currently executing block.
- The program check is executed for one block, and work-piece shape in the cutting process is drawn.
A "Checking" message appears and the menu [Check continu] is highlighted.
The check counter display is updated.
The check G modal is not displayed.
The machining time is updated.
- When the check is completed, a message appears and the mode returns to normal.
The menu highlight returns to normal.

Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check is disabled.

4.2.2 Checking One Block at a Time

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

Perform the same procedure as "4.2.1 Checking Continuously" on selecting a program.

Operation method (Executing the program check)

- | | | |
|---|---|---|
| <p>(1) Press the menu [Check step].</p> | ➔ | <p>The program check is executed for one block, and workpiece shape in the cutting process is drawn.
The check counter display is updated.
The check G modal display is updated.
The machining time is updated.</p> |
| <p>(2) Press the menu [Check step] again.</p> <p>Behaviors during check operation</p> <ul style="list-style-type: none"> •Press the menu [Check continue], program check is carried out continuously up to the end of the program. •Press the menu [Check reset], the program check is reset. | ➔ | <p>The program check is executed for the single block. When the check is completed, a message appears and the mode returns to normal.
The menu highlight returns to normal.</p> |

Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.

4.2.3 Enlarging and Reducing the Workpiece Shape

Operation method

- (1) Press the menu [Zoom].
- (2) Press the menu [Zoom in].
To enlarge the figure:
Press the menu [Zoom in] or [-] key.
To reduce the figure:
Press the menu [Zoom out] or [+] key.

4.2.4 Moving the Workpiece Shape

Operation method

- (1) Press the menu [Move].
- (2) Use the menus [↑], [↓], [←], [→] to adjust the display position.
The cursor movement keys ([↑], [↓], [←], [→]) can also be used for moving.

4.2.5 Rotating the Workpiece Shape

Operation method

- (1) Press the menu [Rotate].
- (2) Use the menus [↑], [↓], [←], [→] to adjust the display angle.
The cursor movement keys ([↑], [↓], [←], [→]) can also be used for moving.

Note

- (1) The set display angle is maintained even after rebooting the machine.
- (2) When all of storage data concerning the drawing such as display angle become zero by NC data reset, the scale setting is automatically performed (same state as when the menu [Auto scale] is pressed).

4.2.6 Performing an Interference Check

If the tool and workpiece contact when performing rapid traverse (G0) movement, the contact location is drawn in a color highlighting the interference.

Operation method

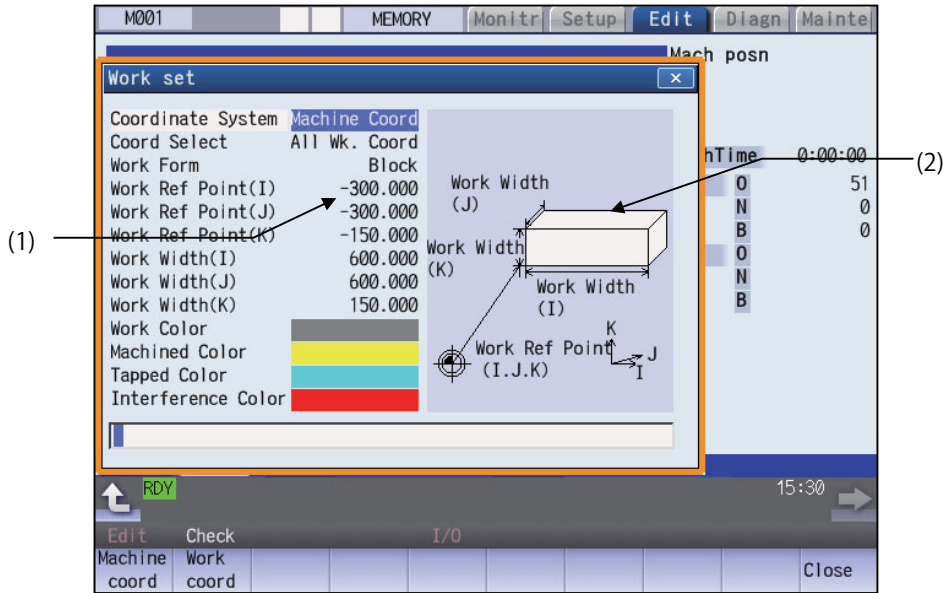
- (1) Press the menu [Colli check].
- (2) Press the menu [Check step] or [Check continu].



The program check is executed for one block, and workpiece shape in the cutting process is drawn.
A "Checking" message is displayed and the menu [Check step] or [Check continu] is highlighted.
The workpiece and tool contact, this is drawn in a color highlighting the interference.

4.2.7 Setting the Workpiece Shape

Press the menu [Work setting] to display a pop-up window similar to the following, and set the workpiece shape used in the solid display.



Display Items

Display Items	Description
(1) Workpiece shape setting area	This sets all workpiece shape items.
(2) Workpiece setting guide drawing	This displays a material shape guide drawing. The displayed guide drawing is changed according to the coordinates set on "Work set" screen.

Menus (the cursor is at "Coordinate System" (drawing coordinate system))

Menus	Description
Machine coord	This specifies the coordinate system used to 3D drawing. The name and value of the check counter displayed on 3D check screen are switched to the machine position and the workpiece coordinates counter position.
Work coord	The default setting is the "Machine coord" (machine position). When "Machine coord" is selected, "All Wk. Coord" (all workpiece coordinates) is set at "Coord Select" (workpiece coordinate system selection).
Close	This closes the pop-up window and quits this function.

Menus (the cursor is at "Coord Select" (workpiece coordinate system selection))

Menus	Description
All wk. Coord	This draws all workpiece coordinate systems. When the menu is selected, "All Wk. Coord" (all workpiece coordinates) is displayed at the cursor position. When the drawing coordinate system is "Machine coord" (machine coordinate), "All Wk. Coord" is selected. The default setting is "All Wk. Coord"
Coord G54-G59	This specifies the workpiece coordinate (G54 to G59) to the drawn coordinate system. The drawn coordinate system is selected from sub-menu (G54 to G59). If the drawing coordinate system is "Machine coord", this is displayed in gray and cannot be selected.
Coord G54.1 P	This specifies the external workpiece coordinate (G54.1 Pn) to the drawn coordinate system type. The extended workpiece coordinate (G54.1 Pn) can be selected for the type of coordinate system to draw by inputting the P No. If the drawing coordinate system is "Machine coord", this is displayed in gray and cannot be selected.

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Menus	Description
Close	This closes the pop-up window and quits this function.

Menus (the cursor is at "Work Form" (material shape))

Menus	Description
Default shape	This sets the material shape. The drawings are made as a block when the default shape is selected.
Block	
Close	This closes the pop-up window and quits this function.

Menu (the cursor is at "Work Ref Point" (material basic point), or "Work Width" (material width))

Menus	Description
Close	This closes the pop-up window and quits this function.

Menus (the cursor is at the "Work Color", "Machined Color", "Tapped Color", "Interference Color" in the window)

Menus	Description
Default color	This sets the material color (Work Color), machining surface color (Machined Color), tap surface color (Tapped Color), interference surface color (Interference Color). The drawings are made using the following colors when the default colors are selected. Material color: Gray Machining surface color: Yellow Tap machining surface color: Light blue Interference surface color: Red <Note> ♦The "Tapped Color", that is the same as when the tapping tool is selected, is used on the "Work set" screen. Therefore, switching of the tap surface color and normal surface color depends on not G command but the selected tool. However, even with the tapping tool being selected, if it is moved in the arc or helical direction, the "Work Set" screen does not have the "Tapped Color".
Gray	
Red	
Yellow	
Blue	
Green	
Light blue	
Purple	
Pink	
Close		This closes the pop-up window and quits this function.

Setting the drawing coordinate system

- (1) Use the [↑] or [↓] key to move the cursor to the drawing coordinate settings column.
 - (2) Press the menu [Work coord].
It is also possible to set input values.
0 [INPUT]: Machine coord
1 [INPUT]: Work coord
- ➔ "Work coord" appears at the cursor position.
The cursor moves one place down.
A guide drawing with workpiece coordinate origin appears in the guide drawing area.

Selecting the drawn workpiece coordinate system

When the drawing coordinate system is the workpiece coordinate, the drawn coordinate system can be selected. Only the coordinate system selected here is drawn.

When the drawing coordinate system is the machine coordinate, "All Wk. Coord" (all workpiece coordinates) is set at "Coord Select" (workpiece coordinate system selection). Therefore, the menu [Coord G54-G59] or [Coord G54.1P] cannot be selected.

(Example) When "Coord G54-G59" is selected

- (1) Use the [↑] or [↓] key to move the cursor to "Coord Select" column.
 - (2) Press the menu [Coord G54-G59].
 - (3) Press the menu [G56].
- ➔ The sub-menus, which select G54 to G59, are displayed.
- ➔ "G56" appears at the cursor position.
The cursor moves one place down.
The sub-menus of the material shape (WorkForm) are displayed.
- When the menu [Return] is selected, return to the menu [Coord Select].

Note

- (1) The drawing coordinate system settings of 2D and 3D graphic check are not linked.

Setting the material shape (Work Form)

- (1) Use the [↑] or [↓] key to move the cursor to the material shape settings column.
 - (2) Press the menu [Block].
It is also possible to set input values.
0 [INPUT]: Default shape
1 [INPUT]: Block
- ➔ "Block" appears at the cursor position.
The cursor moves one place down.
A block guide drawing appears in the guide drawing area.

Setting the material basic point (Work Ref Point (I)) and size (Work Width)

Enter the material basic point and size. Specify the material basic point with the specified coordinate on "Work set" screen.

- (1) Use the [↑] or [↓] key to move the cursor to the material basic point or width (I) setting column.
- (2) Input data. ➔ "100.000" appears at the cursor position.
 (Example) 100 [INPUT] The cursor moves one place down.
- (3) Other basic points and width data are set in the same way.

Note

- (1) The workpiece is not displayed if two or more size data are "0".
- (2) The setting range of the material basic point and width is as follows. However, the value of less than 0 cannot be set to width.

#1003 Input setup unit	#1041 I_inch	
	0 (mm)	1 (inch)
B	-99999.999 to 99999.999	-9999.9999 to 9999.9999
C	-99999.9999 to 99999.9999	-9999.99999 to 9999.99999
D	-99999.99999 to 99999.99999	-9999.999999 to 9999.999999
E	-99999.999999 to 99999.999999	-9999.9999999 to 9999.9999999

Setting the material color (WorkColor)

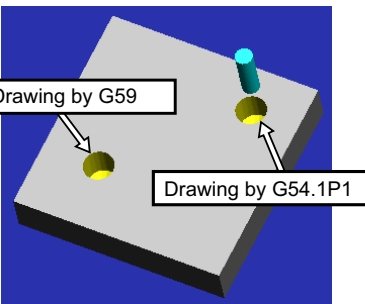
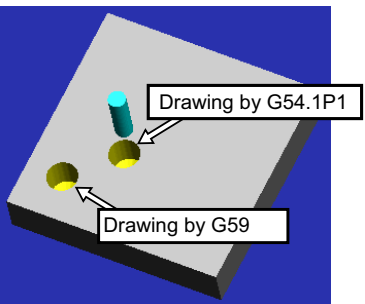
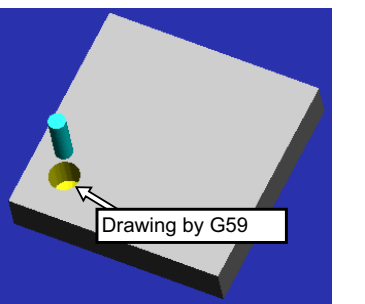
- (1) Use the [↑] or [↓] key to move the cursor to the material color setting column.
- (2) Press the material color menu. ➔ The cell where the cursor is located appears in gray.
 (Example) Menu [Gray] The cursor moves one place down. (The cursor does not move when at the interference color.)
 It is also possible to set input values.
 0 [INPUT]: Default color
 1 [INPUT]: Gray
 2 [INPUT]: Red
 3 [INPUT]: Yellow
 4 [INPUT]: Blue
 5 [INPUT]: Green
 6 [INPUT]: Light blue
 7 [INPUT]: Purple
 8 [INPUT]: Pink
- (3) Set the other color data in the same way.
 <Note>
 ♦The following colors are used if the default colors are designated.
 Material color: Gray
 Machining surface color: Yellow
 Tap machining surface color: Light blue
 Interference surface color: Red

Difference of drawing by combination of "CoordinateSystem" and "Coord Select"

By combination of the drawing coordinate system (CoordinateSystem) and the workpiece coordinate system selection (Coord Select), the drawing at 3D check changes as follows:

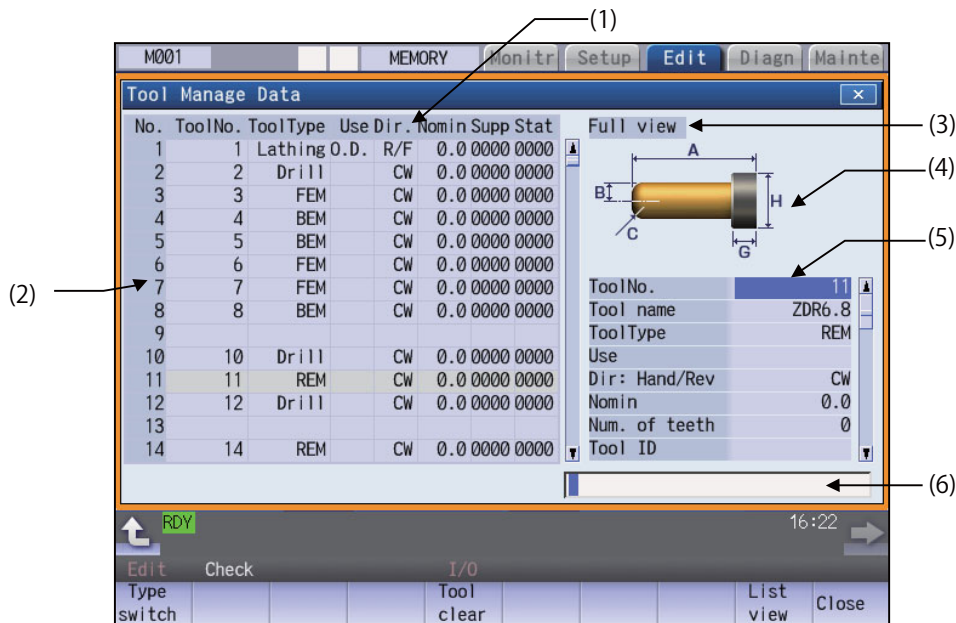
(Example)

<p>[Parameter] #8920 = 1 [Tool compensation] No.1: Length 150.000 L wear 0.000 Radius 20.000 R wear 0.000 [Workpiece coordinate] G59: X 50.000 Y 50.000 Z 0.000 G54.1P1: X 200.000 Y 200.000 Z 0.000 [Workpiece shape setting] Workrefpoint (I,J,K) = (0.000, 0.000, -200.000) WorkWidth (I,J,K) = (500.000, 500.000, 100.000)</p>	<p>[Machining program] N1 G28 XYZ N2 T1 M6 N3 G43 H1 N10 G0 G90 G59 X100. Y100. Z0. N11 G91 G01 Z-200. F100 N12 G02 I-15 N13 G01 Z200. N20 G0 G90 G54.1 P1 X200. Y200. Z0. N21 G91 G01 Z-200. F100 N22 G02 I-15 N23 G01 Z200. M30 %</p>
--	---

Coordinate system	Coord Select	Drawing result when 3D check in example	
Machine coord	All wk. coord		<p>Arranges the workpiece based on the machine coordinate zero point. Both workpiece coordinate systems G59 and G54.1P1 are drawn.</p>
Work coord	All wk. coord		<p>Arranges the workpiece based on the workpiece coordinate zero point which is selected at the check execution. Both workpiece coordinate systems G59 and G54.1P1 are drawn.</p>
Work coord	G59		<p>Arranges the workpiece based on the workpiece coordinate zero point which is selected at the check execution. Only draws the workpiece coordinate system G59. The workpiece coordinate systems G54.1P1 is not drawn.</p>

4.2.8 Setting the Tool Shape

Press the menu [Tool setting] to display the tool management screen. Set the tool shape used in the solid display for graphic check on the tool management screen.



Display Items

Display items	Description
(1) Tool management data list	The preset tool management data is listed. The tool management data list consists of the right side and left side parts. When you select the [Tool Manage Data - Detail View] and switch to the [Detail View], the right part of the tool management data list is switched to the detail view of tool management data.
(2) Data No.	Indicates the number of the tool management data.
(3) Display data type	It indicates the item type that is displayed in the detail view of tool management data. The display data type can be "Full view", "Basic info", "Shape info", "Cut cond.", "Offset", "T-life", or "Added info". The display data type is "Full view" during the time immediately after power-on.
(4) Tool shape drawing	It displays the tool shape of the tool management data at cursor position according to the tool type. The display and hiding are switched according to the display data type.
(5) Tool management data detailed portion	Displays or sets the tool data that has been selected from the tool management data list. The display item will be switched depending on the tool type and the display data type.
(6) Input section	This displays the input data.

[Setting items for "Tool Manage Data" portion]

Setting item	Description	Setting range
Tool No.	Sets the tool No. A maximum of 8 digits of data can be input.	1 to 99999999
Type	Sets the tool type. The tool type will be "Drill" when no value is input.	1: Ball end mill 2: Flat end mill 3: Drill 4: Radius end mill 5: Chamfer 6: Tap 7: Face mill 51: Lathe turning 52: Groove 53: Thread cut 54: Lathing drill 55: Lathing tap
Use	Sets the usage of the tool.	0: None 1: Outer diameter 2: Inner diameter 3: End face
Dir: Hand/Rev	Sets the tool hand and spindle rotation direction. The items to be set varies depending on the tool type. <Tools that are set by spindle rotation direction> Mill tools, lathing drill and lathing tap <Tools that are set by tool hand> Lathe turning, groove, thread cut	<Spindle rotation direction> 0: CW 1: CCW <Tool hand> 0: Right/Front (R/F) 1: Right/Back (L/F) 2: Left/Front (R/B) 3: Left/Back (L/B) <Note> •The codes in parentheses are displayed in "Tool Manage Data" section.
Setting angle	Sets the tool installation angle. Specifies the angle, assuming the direction perpendicular to Z axis as 0 degrees with CW as positive (+).	0 to 359.999 degrees

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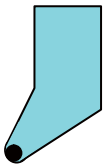
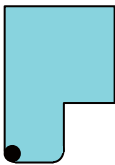
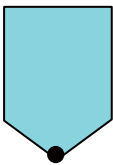


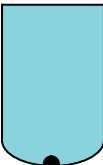
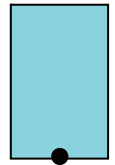
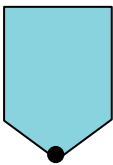
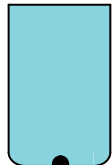

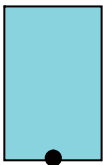
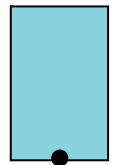
Setting item	Description	Setting range
Length : A	Tool type: all tools Sets the tool length.	<Length> Setting range varies depending on the parameter "#1041 Initial inch".
Diameter : B	Tool type: Mill tools, lathing drill and lathing tap Sets the tool diameter. (*1)	mm: 0.000 to 9999.999 inch: 0.0000 to 999.9999
Length : B	Tool type: Lathe turning, groove, thread cut Sets the tool length.	<Angle> 0.000 to 180.000 degrees
Nose angle : C	Tool type: Drill Sets the nose angle.	
Corner R : C	Tool type: Radius end mill Sets the corner R arc radius.	
Nose angle : C	Tool type: Chamfer Sets the nose angle.	
Pitch : C	Tool type: Tap Sets the pitch.	
Cutter L : C	Tool type: Face mill Sets the cutter length.	
Nose R : C	Tool type: Lathe turning, groove Sets the nose R.	
Tip dia. : D	Tool type: Chamfer Sets the tool tip diameter. (*1)	
Root dia. : D	Tool type: Tap Sets the root diameter.	
Shank dia. : D	Tool type: Face mill Sets the shank diameter. (*1)	
Nose angle : D	Tool type: Lathe turning Sets the nose angle.	
Nose width : D	Tool type: Groove Sets the nose width	
Edge angle : E	Tool type: Lathe turning Sets the edge angle.	
Max groove D: E	Tool type: Groove Sets the groove depth.	
Tool width: F	Tool type: Lathe turning, groove, thread cut Sets the tool width.	
Holder H : G	Tool type: all tools Sets the holder height.	
Holder D : H	Tool type: all tools Sets the holder diameter.	
Setting Angle	Tool type: all tools Sets the tool setting angle.	-359.000° to 360.000°
3D CHK Tool CR	Sets the color to be used in 3D check screen. Tool type: all tools Red will be set when no value is input.	1: Gray 2: Red 3: Yellow 4: Blue 5: Green 6: Light blue 7: Purple 8: Pink

(*1) When the parameter "#8968 Tool shape radius" is set to "0", input the value of diameter. When the parameter is set to "1", input the value of radius.

Note

- (1) If a value outside of the setting range is entered, an error occurs, and the value cannot be set.
- (2) When the sorting of tool data is in progress, the operation message "Sorting of tool data is in progress" appears, and the data cannot be set.

Refer to the figures below for the graphic and the nose position of each tool.

Lathe turning 	Groove 	Thread cut 	Lathing drill 	Lathing tap 
Ball end mill 	Flat end mill 	Drill 	Radius end mill 	Chamfer 
Tap 	Face mill 			

● indicates the tool nose position.

Menus (List view)

Menus	Description
Mng No search	Displays the tool management data with the designated tool number at top.
Tool No search	Displays the tool management data with the designated tool number at top.
Tool No sort	Sorts the tool No. in ascending order.
Tool clear	Clears the tool management data from the cursor line. Setting method: First data number to be cleared / last data number (Example) 10/30: The line data of data numbers 10 to 30 is cleared. 10/E: All line data that has data number 10 or less is cleared. If you press the [INPUT] key without entering the data number, data at the current cursor line is cleared.
Line copy	Copies a single line of data locating at the cursor position.
Line paste	Writes the copied data (single line data) in the cursor line.
Disp details	Switches to the detail view of tool management data.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [ToolNo.] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Tool clear	Clear the tool management data of the currently selected tool number.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [ToolType] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Ball endmill	Select the [Ball endmill]. It is also selected if the value "1" is entered.
Flat endmill	Select the [Flat endmill]. It is also selected if the value "2" is entered.
Drill	Select the [Drill]. It is also selected if the value "3" is entered.
Bulnose endmill	Select the [Bulnose endmill]. It is also selected if the value "4" is entered.
Chamfer	Select the [Chamfer]. It is also selected if the value "5" is entered.
Tap	Select the [Tap]. It is also selected if the value "6" is entered.
Face mill	Select the [Face mill]. It is also selected if the value "7" is entered.
Close	This closes the pop-up window and quits this function.
Lathe turning	Select the [Lathing]. It is also selected if the value "51" is entered.
Groove	Select the [Groove]. It is also selected if the value "52" is entered.
Thread cut	Select the [Thrding]. It is also selected if the value "53" is entered.
Lathing drill	Select the [Lathing drill]. It is also selected if the value "54" is entered.
Lathing tap	Select the [L-tap]. It is also selected if the value "55" is entered.

Menus (when the cursor is at [3D CHK Tool CR] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Gray	Select the gray color. It is also selected if the value "1" is entered.
Red	Select the red color. It is also selected if the value "2" is entered.
Yellow	Select the yellow color. It is also selected if the value "3" is entered.
Blue	Select the blue color. It is also selected if the value "4" is entered.
Green	Select the green color. It is also selected if the value "5" is entered.
Light blue	Select the aqua color. It is also selected if the value "6" is entered.
Purple	Select the purple color. It is also selected if the value "7" is entered.
Pink	Select the pink color. It is also selected if the value "8" is entered.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [Use] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Leave blank	Select the [Leave blank]. This column is set to blank. It is also selected if the value "0" is entered.
Outer dia.	Select the [O.D.]. It is also selected if the value "1" is entered.
Inner dia.	Select the [I.D.]. It is also selected if the value "2" is entered.
End face	Select the [End face]. It is also selected if the value "3" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [Spindle rotation direction] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
CW	Select the [CW]. It is also selected if the value "0" is entered.
CCW	Select the [CCW]. It is also selected if the value "1" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.



Menus (when the cursor is at [Tool hand] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Right/ Front	Select the [Right/Front]. It is also selected if the value "0" is entered.
Left/ Front	Select the [Left/Front]. It is also selected if the value "1" is entered.
Right/ Back	Select the [Right/Back]. It is also selected if the value "2" is entered.
Left/ Back	Select the [Left/Back]. It is also selected if the value "3" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.



Menus (List Menus (when none of the above conditions is met))

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Registering new tool management data

- (1) Display the tool management screen.  The tool management data list is displayed.
 If the details of tool management data is already displayed, press the menu [List view] and switch to the display of tool management data list.
- (2) Use the [↑] or [↓] key to select the data number, which the tool No. is not specified yet.
- (3) Press the [INPUT] key.
- (4) Input the tool number.
100 [INPUT]  The tool management data of tool number 100 is registered in the selected data number, and the cursor is shifted to the next lower position.

Switching the item type of the tool management data detail


- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Use the [↑] or [↓] key to select the data number to be displayed its details.
- (3) Press the [INPUT] key.
- (4) Press the menu [Type switch].  Each time you press the menu, the item type shown in the detailed view is switched in the following sequence. "Full view" -> "Basic info" -> "Shape info" -> "Cut cond." -> "Offset" -> "T-life" -> "Added info" (*1) -> "Full view". The cursor is moved to the top of the tool management data detail view.

(*1) If the machine parameter "#1445 Tol-Custom-nondisp" (Hide added info on tool management screen) is set to "1", the "Added info" type is skipped and it is switched to the next type.



Displaying the data by designating the tool management data No. or tool No.

There are two methods to switch the display from the designated tool management data number. You can switch the operation by using the "#8975 No. search process" parameter.

(Example 1) Select data number 12. ("#8975 No. search process" is "0")

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Press the menu [Manage. No. search].
- (3) Enter the tool management data number to display, and press the [INPUT] key.
12 [INPUT]

(Example 2) Select data number 12. ("#8975 No. search process" is "1")

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Enter the tool management data number to be displayed.
12
- (3) Press the menu [Manage. No. search].  The specified data number is displayed at the top, and the cursor is located onto the first data.

To display the designated tool number first, select the menu [Tool No. search] in the similar procedure above.


Note

- (1) If a data number exceeding the limit is designated, the operation message "Setting error" is displayed.


Sorting the data by tool No.

Sort the tool management data in ascending order of tool numbers.

(Example 1) Sort the tool management data in ascending order of tool numbers.

- (1) Display the tool management screen.  The tool management data list is displayed.

- (2) Press the menu [Tool No sort].



- (3) Press the [Y] or [INPUT] key.  The operation message "Sorting of tool data is in progress" flashes during tool data sorting. The operation message "Sorting of tool data is complete" is displayed after the tool data has been sorted. The tool management data is sorted in ascending order of tool numbers, and they are displayed from the beginning. The cursor moves to the top line. The highlight of the menu [Tool No. sort] returns to normal.

Note


- (1) During data sorting in ascending order of tool numbers, you cannot stop this sorting on the way.
- (2) Once you have sorted the data in ascending order of tool numbers, you cannot return them to the previous sort order.
- (3) If the same tool number is found multiple times, data is sorted in the order in which they are found from the top.
- (4) If no tool number is set and if data is sorted, that line is skipped during display.
- (5) The tool data is sorted for the currently displayed part system.
- (6) During data sorting, you cannot operate on the screen. Operate the screen after data sorting.


Deleting the tool management data in [List view]

■ Method 1: Delete the tool management data of the cursor line.

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Use the [↑] or [↓] key to move the cursor onto the line to be deleted.
- (3) Delete the selected data.
Menu [Tool clear] [INPUT]
- (4) Press the [Y] or [INPUT] key.  Press any key except [Y] and [INPUT] keys to cancel. To cancel the erasing, press a key other than [Y] or [INPUT]. Once deleted, the data is empty.

■ Method 2: Delete the tool management data of the designated line.



- (1) Display the tool management screen.  The tool management data list is displayed.

If the details of tool management data is displayed, press the menu [List view] and switch to the display of tool management data list.
- (2) Press the menu [Tool clear].
- (3) Specify the line clear range, by separating the first and last data numbers by a slash (/) from each other, and press the [INPUT] key.
1/5 [INPUT]
To delete data down to the last line, set "E".
(Example) 5/E:
- (4) Press the [Y] or [INPUT] key.  The tool management data, that corresponds to the designated data number, is cleared and highlight of the menu display is released. To cancel the erasing, press a key other than [Y] or [INPUT]. Data of the cleared range is empty.

Note

- (1) If a value outside of the clear range is specified, the operation message "Setting error" is displayed.



Deleting the tool management data in [Disp details]

- (1) Display the tool management screen.  The tool management data list is displayed.
If the details of tool management data is displayed, press the menu [Disp details] and switch to the display of tool management data list.
- (2) Use the [↑] or [↓] key to move the cursor onto the tool number.
- (3) Delete the selected data.
Menu [Tool clear]
The menu [Tool clear] is displayed only when the cursor is located on the tool number.
- (4) Press the [Y] or [INPUT] key.  The tool management data, that is displayed in the detailed view of tool management data, is erased.
To cancel the erasing, press a key other than [Y] or [INPUT].

Note

- (1) If you wish to change the tool data to be deleted, locate the cursor onto the tool management data list and select a tool data again.

Copying and pasting the tool management data

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Use the [↑] or [↓] key to move the cursor onto the line to be copied.
- (3) Press the menu [Line copy].
- (4) Use the [↑] or [↓] key to move the cursor onto the line to be pasted.
- (5) Press the menu [Line paste].  The copied data is written in the line at the cursor position.
The highlighted copy line is released.

Note

- (1) Once data is copied, it is held until the next tool management data is copied or until the tool management screen is closed.
- (2) For tool life management I, you cannot paste to the data that does not have the tool number. It causes a paste error.

(3) The following information is not copied or pasted.

×: Not copied or pasted

Display data	Common
Tool shape drawing	×

×: Not copied or pasted

-: Not managed

Display data			Tool life management I/II	Tool life management III
Life data	Life	Status	×	×
		Method	×	×
		H No.	×	×
		L offset	×	×
		D No.	×	×
		R offset	×	×
		Aux.	×	×
		Offset num	-	-
		Life	×	×
		Used	×	×
		Operating time	-	-
		Life time	-	-
		T usage count	-	-
		T life count	-	-
		Status A	-	-
		Status B	-	-

×: Not copied or pasted

-: Not managed

Display data			Tool compensation type		
			I	II	III
Compensation data	Compensation	Length	×	×	×
		L wear	-	×	×
		Radius	-	×	×
		R wear	-	×	×
		Tool L offset #	-	-	-
		Wear offset #	-	-	-
		Length 1st axis name	-	-	-
		Length 2nd axis name	-	-	-
		Length additional axis name	-	-	-
		Wear 1st axis name	-	-	-
		Wear 2nd axis name	-	-	-
		Wear additional axis name	-	-	-
		Nose R	-	-	-
		R-wear	-	-	-
		Point	-	-	-

4.2.9 Availability of Check Mode with Other Functions

Refer to "4.1.12 Availability of Check Mode with Other Functions".

4.2.10 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input

Refer to "4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input".

4.2.11 Notes for Graphic Check (3D)

- (1) The check function is drawn with only NC internal operation results. Thus, the path is not drawn for commands requiring machine movement.
- (2) For the handling of various types of data being set in the program, refer to "4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input".
- (3) If the menu [M0/M1 neglect] is OFF, the Program check is stopped by the M0/M01 command. The drawing is also stopped during M01 command execution regardless of the ON/OFF switch status of the optional Stop Switch signal (XC41).
- (4) When the menu [M0/M1 neglect] is ON, the program check does not stop even if M00/M01 is commanded.
- (5) "Program check completed" appears with M02/M30 command.
- (6) Graphic check is not available for serial and MDI program.
- (7) Operation search is available for a program that has a file name consisting of up to 32 characters. Operation search is not available for programs with 33 or more file name characters.
- (8) When the check is executed, the drawing starts from the machine coordinate zero point. However, the machine coordinate zero point is (0, 0, 0) even when the value is set to the parameter "#2037 G53ofs" (zero point return).
- (9) The drawing coordinate system settings of 2D and 3D graphic check are not linked.
- (10) The origin mark is not drawn on the 3D drawing parts.
- (11) If the screen is switched during checking, the check reset occurs and the check is interrupted.
- (12) If tracing is turned ON during automatic operation, the menus such as [Check Search], [Check Continue], [Check Step], and [Check Reset] are grayed out. You cannot check with 3D Solid.
- (13) The drawing is not initialized even if the performance such as enlarge, reduce, move, change display mode, or rotate is set during check drawing. The program does not stop, either.
- (14) If the part system is switched during checking, the check is reset.
- (15) The tool shape is drawn according to the parameter "#8920 3D tool ofs select" parameter and according to the compensation amount (radius and length) (corresponding to the T command number) and the values (tool radius, tool length, and shape data 1 and 2) being set on the 3D Tool Shape setting screen.
Therefore, if the tool length or compensation number being assigned during tool radius compensation differs from the T command number, a misalignment occurs between the tool shape and machine position, resulting in the 3D workpiece being machined excessively or not enough.
- (16) When the tool change is specified and if the following data of the tool corresponding to the T number is zero, the tool is drawn as the default tool.
 - If the tool type is not specified: Drill tool
 - If the tool length is 0: 150-mm tool length
 - If tool radius is 0: 20-mm tool radius
 - If shape data 1 is 0: 1-mm shape data 1 (it is 5 mm for the tap of tool type)
 - If shape data 2 is 0: 1-mm shape data 2 (Tool diameter x 0.05 mm for the tap of tool type)
 - If the color is not designated: Red tool
- (17) If the parameter "#8920 3D tool ofs select" is set to "0" or "1" and if the tool radius to be displayed is 0 or less, the 20-mm default tool radius is assumed and drawn.
- (18) If the fine segment program or complex shape program is executed for 3D checking, the "Solid check disabled (memory shortage)" message is displayed and the drawing may be erased. In such case, divide the program into subprograms and repeat check drawing. Before starting check drawing, press the menu [Initialize Workpiece] once.
- (19) If the coordinate system is set to "Work Coord", the workpiece coordinate position is not changed even when a coordinate system switching command is included in the program that executes the program check. Therefore, the drawings may be overlapped and displayed.

4 Checking a Machining Program on Screen

- (20) If the coordinate system is set to "Work Coord" and if a coordinate system switching command is not included in the program that executes the program check, the currently specified coordinate system is used and, therefore, drawing is not executed. Thus, note that the coordinate system is specified in the program.
- (21) The "Tapped Color", that is the same as when the tapping tool is selected, is used on the "Work set" screen. Therefore, switching of the tap surface color and normal surface color depends on not G command but the selected tool. However, even with the tapping tool being selected, if it is moved in the arc or helical direction, the "Work Set" screen does not have the "Tapped Color".
- (22) During 3D check, the tap is drawn as a straight rod and the shape data is not reflected (refer to "4.2.8 Setting the Tool Shape").

Precautions for drawing on foreground

- (1) If you press the auto start button when an arbitrary part system is being checked, the operation alarm "M01 program check mode" is generated and the cycle start is disabled while the button is held down.
Press the auto start button after the check is completed or after the check is stopped with the menu [Check reset].
- (2) If you carry out the operation search or check operation (continuous or step check) during cycle start or automatic stop of an arbitrary part system, an operation message "Executing automatic operation" is displayed, and no search or check drawing is carried out.
- (3) "Program check completed" appears with M02/M30 command. For the tape mode, the rewind process is not carried out.
- (4) The check ends with the reset (the menu [NC Reset] or [Check reset]).
When a program error occurs, cancel the error with the above operation.
If NC Reset is selected when the check screen is being displayed, check drawing ends but the menu to switch to the 2D Check or 3D Check is kept invalid. To enable this switching, press the menu [Check reset]. To enable this switching, press the menu [Check reset].
- (5) During automatic operation, the contents of automatic operation program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the check screen. During checking, the contents of the checking program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the monitor screen.
- (6) If you carry out the operation search or check operation (continuous or step check) when the program is restarted, the "Program restarting" operation message is displayed, and no search or check drawing is carried out.
- (7) If the manual operation mode is selected during checking, the "M01 program check mode" is displayed and the axis cannot be moved. If you need to move the axis, temporarily stop the current check by executing a reset and then move the axis. When you switch from the manual operation mode to the memory mode, the alarm is released. Also, you can continue the current check even if an alarm is output.
- (8) When the PLC Interrupt signal is turned ON during checking, the "M01 Program check mode" is selected. To start the PLC interrupt, terminate the current check by executing a reset. When you turn the PLC interrupt signal OFF, the alarm is released. You can continue the current checking even if the PLC Interrupt signal is ON.

Precautions for drawing on background

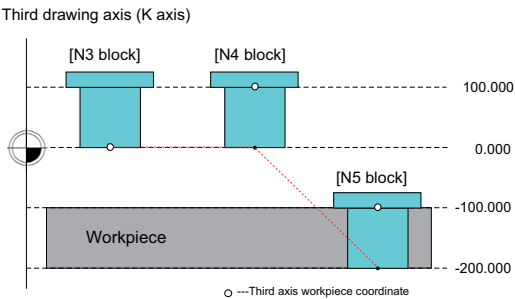
- (1) The program that you have selected during Check Search is not the program that is executed during automatic operation. Search the program for automatic operation by using the operation search function of the monitor screen.
- (2) The parameters and compensation amount do not reflect on check drawing even if you set them during checking. To reflect them on the drawings, reset the check once. Then, press the menu [Check continu] or [Check step] and execute the check again.
- (3) "Program check completed" appears with M02/M30 command.
- (4) The check is not terminated via execution of a reset.
If a program error occurs, release the error by selecting the menu [Check reset].
- (5) During check search, if the length of the full path name exceeds 48 characters, you cannot move to another directory.
- (6) If the menu [Optional Skip] is ON (highlighted status), the blocks that have the "/" character are skipped and the T-code list is obtained.
- (7) The file name continues to be displayed as an O-number display even if you erase or rename the file after it is checked and searched. If you check a file in this status, the "Push [Check reset] menu" message is displayed.
- (8) During checking, if you read the run-out time by using variable number #3001 or #3002, the checking start time is obtained. You cannot write the run-out time.
- (9) When [Check continu] is executed, even if variable number #3006 is used for checking, you cannot stop the program and you cannot display the message.

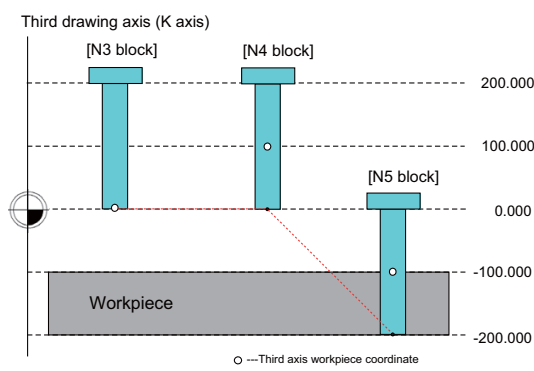
Full-screen display of graphic check function (3D)

(1) For 3D check, the drawn workpiece shape is enlarged or reduced to be 90% of drawing area in accordance with the size of graphic drawing area when the screen is switched between normal display and full-screen display.

Drawing position

Set the drawing position with the parameter (#8920 3D tool ofs select) according to the tool length measurement type (I/II). The following table shows the drawing position and the diameter and length of the tool to be displayed based on the combination with the tool length measurement type (I/II).

"3D tool ofs select" parameter	Drawing position (X, Y, Z)	Radius and length of tool to be displayed
To use the following with tool length measurement type I: Tool radius: Tool compensation amount on the NC screen Tool length: Data in the 3D tool setting screen	X: Machine position Y: Machine position Z: Machine position	Radius: Tool radius compensation amount Length: Tool length in the 3D tool setting screen
1: To use the following with tool length measurement type II: Tool compensation amount in the NC screen	X: Machine position Y: Machine position Z : During G43 (offset in positive (+) direction) modal Machine position - (Tool length compensation amount + wear compensation amount) During G44 (offset in negative (-) direction) modal Machine position + (Tool length compensation amount + wear compensation amount) G49 (Offset cancel) Machine position Drawing position when #8920 = 1 [Tool compensation] Number 50: Length dimension 110.000 Length wear -10.000 Radius dimension 60.000 Radius wear -10.000 [Radius and length of tool to be displayed] Length = 100.000 (110.000 + (-10.000)) Radius = 50.000 (60.000 + (-10.000)) [Machining program] N1 G28 XYZ N2 T50 M6 N3 G0 G90 G54 X100. Y100. Z0. N4 G43 Z0. H50. N5 G91 G01 Z-200. F100. :	Radius: Tool radius compensation amount Length: Tool length compensation amount + wear compensation amount 
2: To use the following with tool length measurement type I: Tool radius and length: Data in the 3D tool setting screen	X: Machine position Y: Machine position Z: Machine position	Radius: Tool radius compensation amount Length: Tool length in the 3D tool setting screen

"3D tool ofs select" parameter	Drawing position (X, Y, Z)	Radius and length of tool to be displayed
<p>3: To use the following with tool length measurement type II: Data in the 3D tool setting screen</p>	<p>X: Machine position Y: Machine position Z: During G43 (offset in positive (+) direction) modal Machine position - (Tool length compensation amount + wear compensation amount) During G44 (offset in negative (-) direction) modal Machine position + (Tool length compensation amount + wear compensation amount) G49 (Offset cancel) Machine position</p> <p>Drawing position when #8920 = 3 [3D tool shape setting] Tool No. 50: Tool length 200.000 Tool radius 20.000 [Tool compensation] Number 50: Length dimension 110.000 Length wear -10.000 Radius dimension 60.000 Radius wear -10.000 [Radius and length of tool to be displayed] Length = 200.000 Radius = 20.000 [Machining program] N1 G28 XYZ N2 T50 M6 N3 G0 G90 G54 X100. Y100. Z0. N4 G43 Z0. H50. N5 G91 G01 Z-200. F100. :</p>	<p>Radius: Tool radius compensation amount Length: Tool length in the 3D tool setting screen</p> 

Note

- (1) During the G43/G44 offset, drawing position compensation is applied only to the third axis (base axis K). A graphic is drawn at the machine position in the first and second axes (base axes L and J).
- (2) If a graphic is drawn based on the workpiece coordinate system, "Machine position" in the above chart is replaced with "Workpiece coordinate position".

4.3 Graphic Check (3D) (L System)



The graphic check (3D) function enables the confirmation of machining program movement path with drawing without executing automatic operation. Therefore, the graphics can be drawn at a high speed and high accuracy, and the machining program can be checked.

The turning machining and milling on the front and back sides of a workpiece can be drawn with 3D check of the graphic check function.

This function requires workpiece and tool shape settings.

Press the menu [Check] on the monitor or edit screen to switch to the graphic check screen.

The graphic check screen allows you to check the currently displayed part system program. In the 2-part system or more, press the part system switch key $\$ \leftrightarrow \$$ to switch the display to the target part system before starting checking.

Note that program check is carried out in the 2-part system or more regardless of the command such as the timing synchronization between a hidden part system and another part system.

Using the menu [All display], normal display and whole display modes can be switched.

Note

(1) When changing the screen to the edit screen, display depends on the previous checking type (2D/3D). If 2D graphic data appears, press the menu [3D check]. Note that when selecting this screen during graphic trace, 3D solid program check is displayed.

(1) Targets of drawing

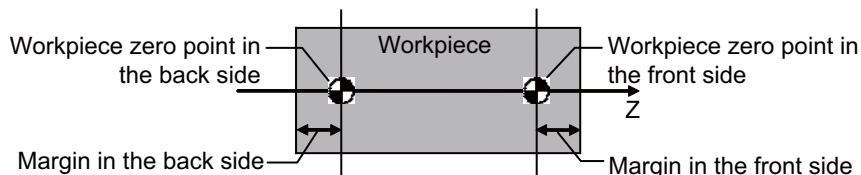
The workpiece and tool that can be drawn with the program check per part system are as shown below:

- Workpiece: 1 (Based on the premise that the workpiece is machined by the front-side spindle and the back-side spindle at a time.)
- Tool: 1 (The tool used in the currently displayed part system is drawn. The part system can be switched.)

(2) Coordinate system during drawing

3D graphic is drawn based on the programming coordinate system by setting the zero points in the following positions.

- X-axis zero point: Center of workpiece
- Y-axis zero point: Fix to 0
- Z-axis zero point: Workpiece zero point Z (Zero point can be designated respectively for the front side and back side.)



Refer to "Setting the Workpiece Shape" in Chapter 4 for details on setting the workpiece zero point Z.

(3) Drawing shape of tool

Turning tools are always drawn according to the tool information in the tool management screen; however, the shape of milling tools is set via the parameter (#8920 3D tool ofs select).

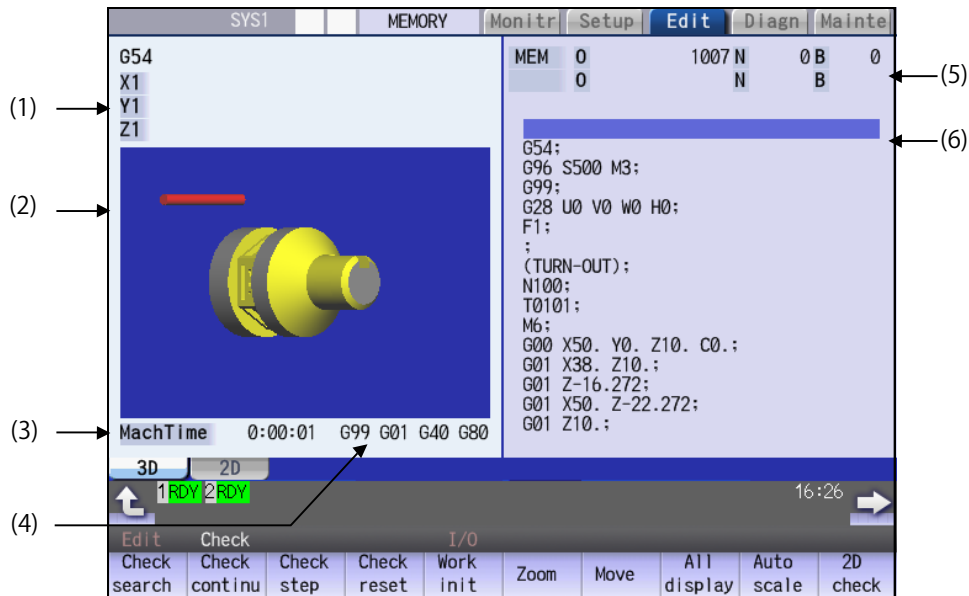
The shape of milling tools is set via the parameter (#8920 3D tool ofs select) as shown below:

"3D tool ofs select" parameter	Radius and length of tool to be displayed
0: Tool radius: Tool compensation amount on the NC screen Tool length: Data on the tool management screen	Radius: Nose R compensation amount + wear compensation amount Length: Tool length "A" on the tool management screen
1: Tool radius: Tool compensation amount on the NC screen Tool length: Tool compensation amount on the NC screen	Radius: Nose R compensation amount + wear compensation amount Length: Tool length compensation amount + wear compensation amount
2: Tool radius: Data on the tool management screen Tool length: Data on the tool management screen	Radius: Tool length "B" on the tool management screen Length: Tool length "A" on the tool management screen

For the data on the tool management screen to be used for drawing tools, refer to "4.3.8 Setting the Tool Shape".

■ Normal display ([All display] is OFF)

<Drawing area>



■ Full-screen display ([All display] is ON)

<Drawing area>



Display Items

Display Items		Description	
(1)	Check counter	This displays the axis counter for the check drawing. As for the axes name, system common axis name ("#1022 axname2") based on the basic axis name set by the parameters "#1026 base_I", "#1027 base_J", and "#1028 base_K" are displayed.	
(2)	3D drawing area	This area is used to display a solid graphic drawing of the workpiece shape and tool movement during the cutting process in the machining program. The drawing viewpoint can be moved, and the drawing size can be enlarged and reduced.	
(3)	Machining time display	The time required for machining is calculated and displayed.	
(4)	G modal display for check	The following items are displayed from the left. <ul style="list-style-type: none"> •Feed per minute/Feed per revolution (G98, G99: Group 5) •Operation mode (G00, G01, etc.: Group 1) •Nose R compensation (G40, G41, G42: Group 7) •Fixed cycle (G70 etc.: Group 9) However, the following modal items for M system may be displayed when the G code switching command for M/L system is given. <ul style="list-style-type: none"> •Absolute/incremental (G90, G91: Group 3) •Operation mode (G00, G01, etc.: Group 1) •Tool compensation (G40, G41, G42: Group 7) •Fixed cycle (G70 etc.: Group 9) 	
(5)	Currently executed machining program	Main O10...	This displays the device name, program No., sequence No., and block No. currently being executed. When they exceed the displayable number of characters (12 characters), the excess is abbreviated and displayed (*).
		Sub O1234...	This displays the sub-program device name, program number, sequence number, and block number for the sub-program currently being executed. When they exceed the displayable number of characters (12 characters), the excess is abbreviated and displayed (*).
(6)	Buffer display	This displays the contents of the machining program currently being executed. The block being executed is highlighted.	

Menus	
Menus	Description
Check search	This performs a check search. Select a program to be checked from the program file list displayed in the pop-up window. For only the machining programs in NC memory, the check search is executed across all part systems in batch when the multi-part system program memory management is valid (#1285 ext21/bit0 =1, ext21/bit1 =1).
Check continu	This checks the program continuously.
Check step	This checks the program per block.
Check reset	This resets the program check.
Work init	This initializes the workpiece shape. Displays the pre-machining workpiece shape set at the "Work set" window (workpiece shape setting). At this time, the cross-section status is canceled.
Zoom	This enlarges/reduces the displayed workpiece shape.
Move	This moves the displayed workpiece shape.
All display	This switches the normal display mode and the full-screen display mode.
Auto scale	This enlarges/reduces the unmachined workpiece shape (stored in the NC) to be approximately 90% of the graphic area, and also initializes the rotation.
2D check	This changes the program check (2D) display. This menu cannot be selected while the check is performed or interrupted.
Colli check	This enables or disables the interference check. When the interference check is enabled, if the tool and workpiece contact each other when performing rapid traverse (G0) movement, the contact location is drawn in a color highlighting the interference.
Opt Skip	Select whether to execute a block that has a slash "/" in the program to be checked. Selecting "ON" skips a block with a slash "/" to carry out drawing. Selecting "OFF" also draws a block with a slash "/". The menu [Opt skip] works commonly between part systems. When this menu is set to ON (highlighted) in the 1st part system, it will stay ON status even after the part system is changed.
Rotate	This rotates the displayed workpiece shape.
M0/M1 neglect	Designate whether to stop program check when M0/M1 is commanded. If [M0/M1 neglect] is set to ON, program check does not stop even when M0/M1 is commanded. If [M0/M1 neglect] is set to OFF, program check stops when M0/M1 is commanded.
Dsp Section	If [M0/M1 neglect] is set to OFF, program check stops when M0/M1 is commanded.
Work setting	This sets the workpiece shape used at the solid display.
Tool setting	This sets the tool shape used at the solid display.

Note






- (1) When automatic operation is running during the graphic trace mode, the menu [Check search], [Check continu], [Check step], [Check reset] cannot be selected and the 3D solid program check cannot be performed. If the program is not in the process of automatic operation, a check is possible only for 3D solid.
- (2) The menus [2D check], [Check search], [Work setting] and [Tool setting] cannot be selected while the check is performed or interrupted.
- (3) The menu [M0/M1 neglect] is displayed in gray during continuous check, and the menu cannot be selected.

4.3.1 Checking Continuously

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

Operation method (Selecting a program to be checked)**Checking the specified program**

- (1) Press the  key to switch the part system.
In addition to the above, the PLC signal and touch-screen operation are provided as the part system switching method.
- (2) Press the main menu [Check] on the edit screen.
Press the menu [3D Check] when the program check (2D) appears.
- (3) Press the menu [Check search].
If you press the menu [Commentnondisp] in the second page, the comment is hidden.
- (4) Select the device.
(Example) Menu [Memory]
- (5) (For the devices other than NC memory)
Use the [, [, ], or  key to align the cursor with a directory to be newly created.



The selected device name and directory (memory: /program) appear in the device name and directory display columns.
For the devices other than NC memory, root directory is selected.

Press the [INPUT] key to move to inside the directory.

<Note>

- If the contents of list are different from the actual device or directories, press the menu [List update].
- Press the menu [Sort change] to change the sort.
Each time the menu key is pressed, the sort method shifts in the following order: file names in ascending order -> file names in descending order -> dates and comments in ascending order -> dates and comments in descending order -> file names in ascending order.

- (6) Press the [↑], [↓],  or  key to move the cursor to the program to be searched.

The name of the machining program to be edited can be input in the input area.

When the touchscreen display unit is used, you can also select a program by touch operation.

- (7) Press the [INPUT] key.

When setting data exists in the input area, a search is performed in this data. This procedure is also used when performing an NB search.

(Example)

1001/1/2 O1001 N1 B2

1001.PRG/1/2 O1001.PRG N1 B2

/1/2 (current O number) N1 B2

1001//2 O1001 N0 B2

1001/1 O1001 N1 B0

1001 O1001 N0 B0

/1 (current O number) N1 B0

//2 (current O number) N0



The check search is started.

The operation message "Search complete" appears when the search is completed.

After performing the search, the device and program position appear in the current machining program display column.


The list is then closed.

The system distinguishes between the presence or lack of an extension, and therefore due care should be taken.

Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.


Checking the program currently opened on the edit screen

- (1) Press the  key to switch the part system.

In addition to the above, the PLC signal and touchscreen operation are provided as the part system switching method.

- (2) Press the menu [Program check] on the edit screen.
Press the menu [3D Check] when the program check (2D) appears.

Checking the program searched on the monitor screen

- (1) Press the  key to switch the part system.

In addition to the above, the PLC signal and touchscreen operation are provided as the part system switching method.

- (2) Press the menu [Check] on the edit screen.
Press the menu [3D Check] when the program check (2D) appears.

Operation method (Executing the program check)

- (1) Press the menu [Check continu].



The program check is executed for one block, and work-piece shape in the cutting process is drawn.

Behaviors during check operation

- Press the menu [Check step], the program check is carried out block by block starting from the next block.
- Press the menu [Check continue], the program check is stopped. Press the menu [Check continu] during block stoppage, the program check is carried out continuously.
- Press the menu [Check reset], the program check is reset after completion of the currently executing block.

A "Checking" message appears and the menu [Check continu] is highlighted.
 The check counter display is updated.
 The check G modal is not displayed.
 The machining time is updated.
 Program check is carried out for the currently displayed part system. As necessary, switch the part system to be displayed.

When the check is completed, a message appears and the mode returns to normal.
 The menu highlight returns to normal.

Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check is disabled.

4.3.2 Checking One Block at a Time

There are three types of method for checking the program.

- Checking the specified program
- Checking the program currently opened on the edit screen (Edit)
- Checking the program searched on the monitor screen (Monitr)

Perform the same procedure as "4.3.1 Checking Continuously" on selecting a program.

Operation method (Executing the program check)

- (1) Press the menu [Check step].



The program check is executed for one block, and work-piece shape in the cutting process is drawn.
 The check counter display is updated.
 The check G modal display is updated.
 The machining time is updated.

- (2) Press the menu [Check step] again.



The program check is executed for the single block.
 When the check is completed, a message appears and the mode returns to normal.
 The menu highlight returns to normal.

Behaviors during check operation

- Press the menu [Check continue], program check is carried out continuously up to the end of the program.
- Press the menu [Check reset], the program check is reset.

Note

- (1) The operation message "Now, sorting tool data" is displayed when tool data is being sorted, and the check search is disabled.

4.3.3 Enlarging and Reducing the Workpiece Shape

Operation method

- (1) Press the menu [Zoom].
- (2) Press the menu [Zoom in].
To enlarge the figure:
Press the menu [Zoom in] or [-] key.
To reduce the figure:
Press the menu [Zoom out] or [+] key.

4.3.4 Moving the Workpiece Shape

Operation method

- (1) Press the menu [Move].
- (2) Use the menus [↑], [↓], [←], [→] to adjust the display position.
The cursor movement keys ([↑], [↓], [←], [→]) can also be used for moving.

4.3.5 Rotating the Workpiece Shape

Operation method

- (1) Press the menu [Rotate].
- (2) Use the menus [↑], [↓], [←], [→] to adjust the display angle.
The cursor movement keys ([↑], [↓], [←], [→]) can also be used for moving.
The display of drawing parts will be highlighted by selecting the menu [Rev Dsp].

Note

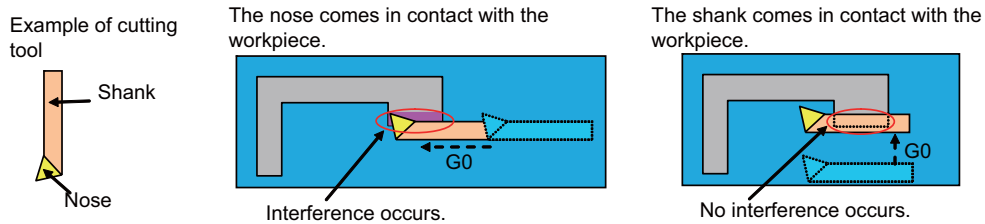
- (1) The set display angle is maintained even after rebooting the machine.
- (2) When all of storage data concerning the drawing such as display angle become zero by NC data reset, the scale setting is automatically performed (same state as when the menu [Auto scale] is pressed).

4.3.6 Performing an Interference Check

If the tool and workpiece contact when performing rapid traverse (G0) movement, the contact location is drawn in a color highlighting the interference.

It is possible to check whether the tool interferes with the workpiece during G0 movement before and after cutting. The drawing does not stop even when interference occurs.

Because the shank part is fixedly drawn in a liner form, the shank part may interfere with a workpiece during inner diameter machining. Therefore, the tool nose part is the target of interference check but the shank part is not the target. (The part of workpiece where the shank interferes is not shaved.)

**Operation method**

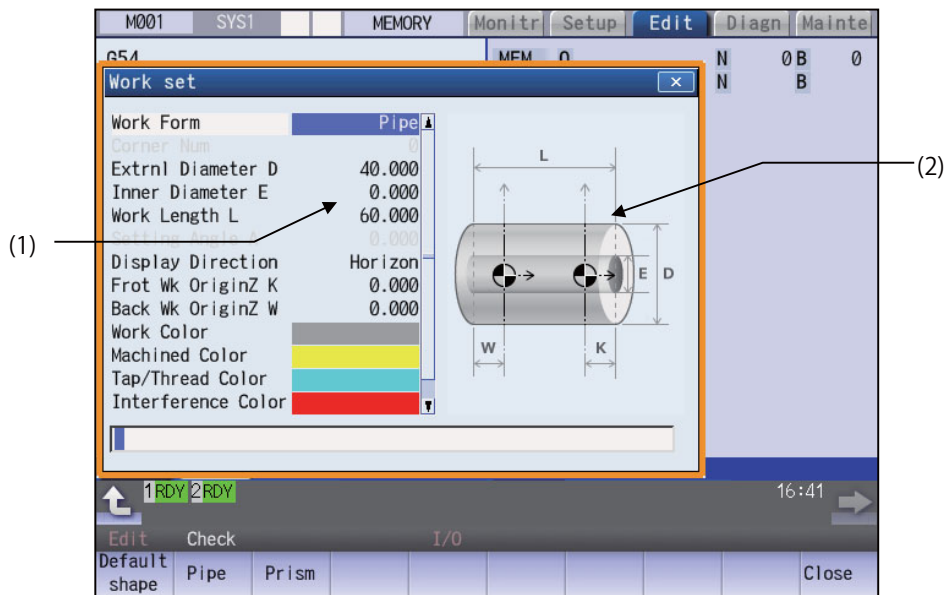
- (1) Press the menu [Colli check].
- (2) Press the menu [Check step] or [Check continu].



The program check is executed for one block, and workpiece shape in the cutting process is drawn. A "Checking" message is displayed and the menu [Check step] or [Check continu] is highlighted. The workpiece and tool contact, this is drawn in a color highlighting the interference.

4.3.7 Setting the Workpiece Shape

Press the menu [Work setting] to display a pop-up window similar to the following, and set the workpiece shape used in the solid display.



Display Items

Display Items	Description
(1) Workpiece shape setting area	This sets all workpiece shape items.
(2) Workpiece setting guide drawing	This displays a material shape guide drawing. The displayed guide drawing is changed according to the coordinates set on "Work set" screen.

Menus (the cursor is at "Work Form" (material shape))

Menus	Description
Default shape	This sets the material shape. If a default shape is selected, it is drawn as a round bar. Designate "Pipe" for a round bar. Designate "Prism" for a square bar.
Pipe	
Prism	
Close	This closes the pop-up window and quits this function.

Menus (the cursor is at the viewing direction)

Menus	Description
Horiz	This designates the viewing direction of the workpiece.
Verti	

Menus (the cursor is at the "Work Color", "Machined Color", "Tapped Color", "Interference Color", "Section Color" in the window)


Menus	Description
Default color	This sets the material color (Work Color), machining surface color (Machined Color), tap surface color (Tapped Color), interference surface color (Interference Color), and cross section color (Section Color). The drawings are made using the following colors when the default colors are selected.
Gray	Material color: Gray
Red	Machining surface color: Yellow
Close	Tap machining surface color: Light blue
Blue	Interference surface color: Red
Green	Cross section color: Green
Light blue	<Note>
Purple	♦The "Tapped Color", that is the same as when the tapping tool is selected, is used on the "Work set" screen. Therefore, switching of the tap surface color and normal surface color depends on not G command but the selected tool. However, even with the tapping tool being selected, if it is moved in the arc or helical direction, the "Work Set" screen does not have the "Tapped Color".
Pink	
Close	This closes the pop-up window and quits this function.

Menu (List Menus (when none of the above conditions is met))

Menus	Description
Close	This closes the pop-up window and quits this function.

Setting the workpiece zero point

For the workpiece zero point, set the margin from the face of the material. For the margin, set the distance in the Z axis direction between the face and the workpiece zero point.

- (1) Use the [↑] or [↓] key to move the cursor to the setting column of the front-side workpiece zero point Z.
- (2) Input data.
(Example) 10 [INPUT]  "10.000" appears at the cursor position.
The cursor moves one place down.
- (3) Set the back-side workpiece zero point Z in the same way.
If there is no back-side spindle, it is not necessary to set the back-side workpiece zero point Z.


Note

- (1) The following table shows the setting range of the workpiece zero point.
- (2) If a value outside of the setting range is entered, an error occurs, and the value cannot be set.

#1003 Input setup unit	#1041 I_inch	
	0 (mm)	1 (inch)
B	-99999.999 to 99999.999	-9999.9999 to 9999.9999
C	-99999.9999 to 99999.9999	-9999.99999 to 9999.99999
D	-99999.99999 to 99999.99999	-9999.999999 to 9999.999999
E	-99999.999999 to 99999.999999	-9999.9999999 to 9999.9999999

Setting the material outer diameter

Set the outer diameter of the material in millimeters in the millimeter system, and in inches in the inch system.

- (1) Use the [↑] or [↓] key to move the cursor to the setting column of material outer diameter.
- (2) Input data.
(Example) 100 [INPUT]  "100.000" appears at the cursor position.
The cursor moves one place down.
- (3) Set other dimensional data items in the same way.

Note

- (1) The following table shows the setting ranges of the outer diameter of the material and other dimensional data items.
- (2) If a value outside of the setting range is entered, an error occurs, and the value cannot be set.

#1003 Input setup unit	#1041 I_inch	
	0 (mm)	1 (inch)
B	0.001 to 99999.999	0.0001 to 9999.9999
C	0.0001 to 99999.9999	0.00001 to 9999.99999
D	0.00001 to 99999.99999	0.000001 to 9999.999999
E	0.000001 to 99999.999999	0.0000001 to 9999.9999999

Setting the material shape (Work Form)

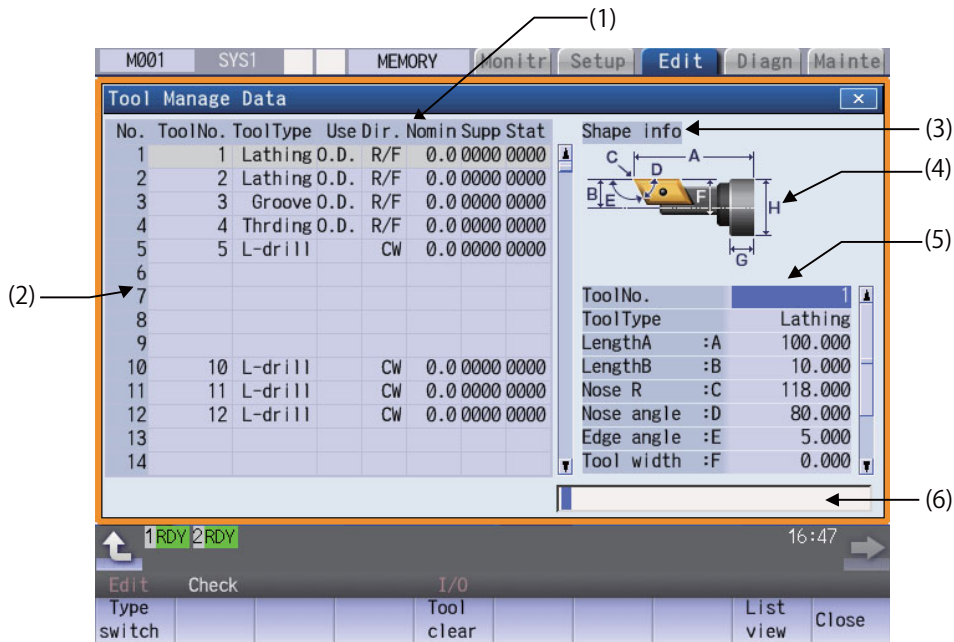
- (1) Use the [↑] or [↓] key to move the cursor to the material shape settings column.
- (2) Press the menu [Pipe].
It is also possible to set input values.
- | | | |
|--|---|--|
| <p>0 [INPUT]: Default shape
1 [INPUT]: Pipe
2 [INPUT]: Prism</p> | ➔ | <p>"Pipe" appears at the cursor position.
The cursor moves one place down.
A pipe guide drawing appears in the guide drawing area.</p> |
|--|---|--|

Setting the material color (WorkColor)

- (1) Use the [↑] or [↓] key to move the cursor to the material color setting column.
- (2) Press the material color menu.
(Example) [Gray]
It is also possible to set input values.
- | | | |
|---|---|---|
| <p>0 [INPUT]: Default color
1 [INPUT]: Gray
2 [INPUT]: Red
3 [INPUT]: Yellow
4 [INPUT]: Blue
5 [INPUT]: Green
6 [INPUT]: Light blue
7 [INPUT]: Purple
8 [INPUT]: Pink</p> | ➔ | <p>The cell where the cursor is located appears in gray.
The cursor moves one place down. (The cursor does not move when at the cross section color.)</p> |
|---|---|---|
- (3) Set the other color data in the same way.
- <Note>
- ♦The following colors are used if the default colors are designated.
- Material color: Gray
Machining surface color: Yellow
Tap machining surface color/screw machining surface color: Light blue
Interference surface color: Red
Cross section color: Green

4.3.8 Setting the Tool Shape

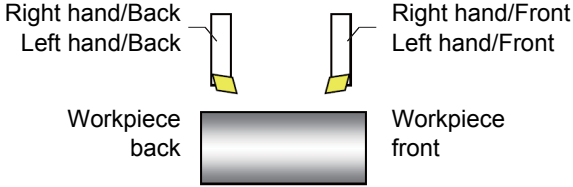
Press the menu [Tool setting] to display the tool management screen. Set the tool shape used in the solid display for graphic check on the tool management screen.

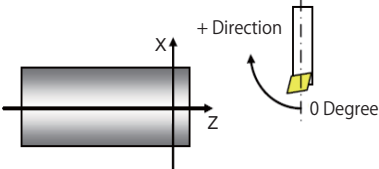

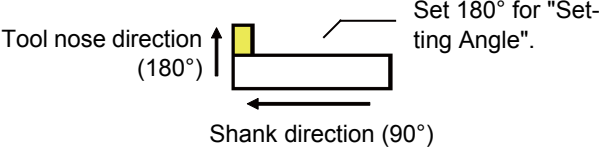


Display Items

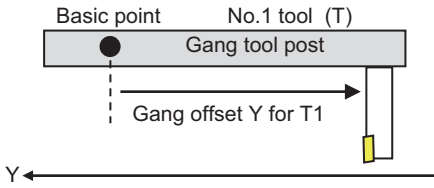
Display Items	Description
(1) Tool management data list portion	The preset tool management data is listed. The tool management data list consists of the right side and left side parts. When you select the [Tool Manage Data - Detail View] and switch to the [Detail View], the right part of the tool management data list is switched to the detail view of tool management data.
(2) Data No.	Indicates the number of the tool management data.
(3) Display data type	It indicates the item type that is displayed in the detail view of tool management data. The display data type can be "Full view", "Basic info", "Shape info", "Cut cond.", "Offset", "T-life", or "Added info". The display data type is "Full view" during the time immediately after power-on.
(4) Tool shape drawing	It displays the tool shape of the tool management data at cursor position according to the tool type. The display and hiding are switched according to the display data type.
(5) Tool management data detailed portion	Displays or sets the tool data that has been selected from the tool management data list. The display items are changed depending on the tool type and the display data type.
(6) Input section	This displays the input data.

[Setting items for "Tool Manage Data" portion]

Setting item	Description	Setting range
Tool No.	This sets the tool No. A maximum of 8 digits of data can be input.	1 to 99999999
Type	This sets the tool type. The tool type will be "Drill" when no value is input.	1: Ball end mill 2: Flat end mill 3: Drill 4: Radius end mill 5: Chamfer 6: Tap 7: Face mill 51: Lathe turning 52: Groove 53: Thread cut 54: Lathing drill 55: Lathing tap
Use	This sets the usage of the tool.	0: None 1: Outer diameter 2: Inner diameter 3: End face
Dir: Hand/Rev	<p>This sets the tool hand and spindle rotation direction. The items to be set vary depending on the tool type.</p> <p><Tools that are set by spindle rotation direction> Mill tools, lathing drill and lathing tap</p> <p><Tools that are set by tool hand> Lathe turning, groove, thread cut</p> <p>For turning tool or grooving tool, the tool direction will change depending on the tool hand setting.</p> <p><Example of turning tool></p> 	<p><Spindle rotation direction> 0: CW 1: CCW</p> <p><Tool hand> 0: Right/Front (R/F) 1: Right/Back (L/F) 2: Left/Front (R/B) 3: Left/Back (L/B)</p> <p><Note> ♦The codes in parentheses are displayed in "Tool Manage Data" section.</p>

Setting item	Description	Setting range
Installation angle	<p>Set the tool installation angle. Specifies the angle, assuming the direction perpendicular to Z axis as 0 degrees with CW as positive (+).</p>  <p><Setting example> Setting angle = 90 Setting angle = 180 Setting angle = 270</p>  <p>When there is a tool rotary axis, set the angle assuming that the angle of the axis is 0 degrees.</p> <p>If the directions of the tool nose and shank are different such as internal diameter machining tool, set the tool nose angle for "Setting Angle". <Example of grooving tool for front face machining></p> 	0 to 359.999 degrees

Setting item	Description	Setting range
Length: A	Tool type: all tools Set the tool length.	<Length> Setting range varies depending on the parameter "#1041 Initial inch".
Diameter: B	Tool type: Mill tools, lathing drill and lathing tap Set the tool diameter. (*1)	mm: 0.000 to 9999.999 inch: 0.0000 to 999.9999
Length: B	Tool type: Lathe turning, groove, thread cut Set the tool length.	<Angle> 0.000 to 180.000 degrees
Nose angle: C	Tool type: Drill Set the nose angle.	
Corner R: C	Tool type: Radius end mill Set the corner R arc radius.	
Nose angle: C	Tool type: Chamfer Set the nose angle.	
Pitch: C	Tool type: Tap Set the pitch.	
Cutter L: C	Tool type: Face mill Set the cutter length.	
Nose R: C	Tool type: Lathe turning, groove Set the nose R.	
Tip dia.: D	Tool type: Chamfer Set the tool tip diameter. (*1)	
Root dia.: D	Tool type: Tap Set the root diameter.	
Shank dia.: D	Tool type: Face mill Set the shank diameter. (*1)	
Nose angle: D	Tool type: Lathe turning Set the nose angle.	
Nose width: D	Tool type: Groove Set the nose width	
Edge angle: E	Tool type: Lathe turning Set the edge angle.	
Max groove D: E	Tool type: Groove Set the groove depth.	
Tool width: F	Tool type: Lathe turning, groove, thread cutting Sets the tool width.	
Holder H: G	Tool type: all tools Set the holder height.	
Holder D: H	Tool type: all tools Set the holder diameter.	
Installation angle	Tool type: all tools Set the tool setting angle.	-359.000° to 360.000°
3D CHK Tool CR	Set the color to be used in 3D check screen. Tool type: all tools Red will be set when no value is input.	1: Gray 2: Red 3: Yellow 4: Blue 5: Green 6: Light blue 7: Purple 8: Pink

Setting item	Description	Setting range
Gang Ofs Y	<p>For a machine equipped with a gang tool post, specify the basic point of the gang tool post offset Y, and input the offset in Y axis direction between the basic point and each tool. You can determine the basic point in any desired position.</p> <p><Setting example></p> 	<p>Setting range varies depending on the parameter "#1041 Initial inch".</p> <p>mm: -9999.999 to 9999.999</p> <p>inch: -999.9999 to 999.9999</p>

(*1) When the parameter "#8968 Tool shape radius" is set to "0", input the value of diameter. When the parameter is set to "1", input the value of radius.

Note

- (1) If a value outside of the setting range is entered, an error occurs, and the value cannot be set.
- (2) When the sorting of tool data is in progress, the operation message "Sorting of tool data is in progress" appears, and the data cannot be set.

Refer to "4.2.8 Setting the Tool Shape" for the graphic and the nose position of each tool.

Menus (List view)	
Menus	Description
Mng No search	Displays the tool management data with the designated tool number at top.
Tool No search	Displays the tool management data with the designated tool number at top.
Tool No sort	Sorts the tool No. in ascending order.
Tool clear	<p>Clears the tool management data from the cursor line.</p> <p>Setting method: First data number to be cleared / last data number</p> <p>(Example) 10/30: The line data of data numbers 10 to 30 is cleared.</p> <p>10/E: All line data that has data number 10 or less is cleared.</p> <p>If you press the [INPUT] key without entering the data number, data at the current cursor line is cleared.</p>
Line copy	Copies a single line of data locating at the cursor position.
Line paste	Writes the copied data (single line data) in the cursor line.
Disp details	Switches to the detail view of tool management data.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [ToolNo.] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Tool clear	Clear the tool management data of the currently selected tool number.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [ToolType] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Lathe turning	Select the [Lathing]. It is also selected if the value "51" is entered.
Groove	Select the [Groove]. It is also selected if the value "52" is entered.
Thread cut	Select the [Thrding]. It is also selected if the value "53" is entered.
Lathing drill	Select the [Lathing drill]. It is also selected if the value "54" is entered.
Lathing tap	Select the [L-tap]. It is also selected if the value "55" is entered.
Close	This closes the pop-up window and quits this function.
Ball endmill	Select the [Ball endmill]. It is also selected if the value "1" is entered.
Flat endmill	Select the [Flat endmill]. It is also selected if the value "2" is entered.
Drill	Select the [Drill]. It is also selected if the value "3" is entered.
Bulnose endmill	Select the [Bulnoseendmill]. It is also selected if the value "4" is entered.
Chamfer	Select the [Chamfer]. It is also selected if the value "5" is entered.
Tap	Select the [Tap]. It is also selected if the value "6" is entered.
Face mill	Select the [Face mill]. It is also selected if the value "7" is entered.

Menus (when the cursor is at [3D CHK Tool CR] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Gray	Select the gray color. It is also selected if the value "1" is entered.
Red	Select the red color. It is also selected if the value "2" is entered.
Yellow	Select the yellow color. It is also selected if the value "3" is entered.
Blue	Select the blue color. It is also selected if the value "4" is entered.
Green	Select the green color. It is also selected if the value "5" is entered.
Light blue	Select the aqua color. It is also selected if the value "6" is entered.
Purple	Select the purple color. It is also selected if the value "7" is entered.
Pink	Select the pink color. It is also selected if the value "8" is entered.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [Use] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Leave blank	Select the [Leave blank]. This column is set to blank. It is also selected if the value "0" is entered.
Outer dia.	Select the [O.D.]. It is also selected if the value "1" is entered.
Inner dia.	Select the [I.D.]. It is also selected if the value "2" is entered.
End face	Select the [End face]. It is also selected if the value "3" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [Spindle rotation direction] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
CW	Select the [CW]. It is also selected if the value "0" is entered.
CCW	Select the [CCW]. It is also selected if the value "1" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (when the cursor is at [Tool hand] of [Disp details])

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
Right/ Front	Select the [Right/Front]. It is also selected if the value "0" is entered.
Left/ Front	Select the [Left/Front]. It is also selected if the value "1" is entered.
Right/ Back	Select the [Right/Back]. It is also selected if the value "2" is entered.
Left/ Back	Select the [Left/Back]. It is also selected if the value "3" is entered.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Menus (List Menus (when none of the above conditions is met))

Menus	Description
Type switch	Switch the display data type of the detail view of tool management data by pressing the button.
List view	Switch to the tool management data list.
Close	This closes the pop-up window and quits this function.

Registering new tool management data

- (1) Display the tool management screen.



The tool management data list is displayed.

If the details of tool management data is already displayed, press the menu [List view] and switch to the display of tool management data list.

- (2) Use the [↑] or [↓] key to select the data number, which the tool No. is not specified yet.

- (3) Press the [INPUT] key.

- (4) Input the tool number.
100 [INPUT]



The tool management data of tool number 100 is registered in the selected data number, and the cursor is shifted to the next lower position.

Switching the item type of the tool management data detail

- (1) Display the tool management screen.



The tool management data list is displayed.

- (2) Use the [↑] or [↓] key to select the data number to be displayed its details.

- (3) Press the [INPUT] key.

- (4) Press the menu [Type switch].




Each time you press the menu, the item type shown in the detailed view is switched in the following sequence. "Full view" -> "Basic info" -> "Shape info" -> "Cut cond." -> "Offset" -> "T-life" -> "Added info" (*1) -> "Full view". The cursor is moved to the top of the tool management data detail view.

(*1) If the machine parameter "#1445 Tol-Custom-nondisp" (Hide added info on tool management screen) is set to "1", the "Added info" type is skipped and it is switched to the next type.



Displaying the data by designating the tool management data No. or tool No.

There are two methods to switch the display from the designated tool management data number. You can switch the operation by using the "#8975 No. search process" parameter.

(Example 1) Select data number 12. ("#8975 No. search process" is "0")

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Press the menu [Manage. No. search].
- (3) Enter the tool management data number to display, and press the [INPUT] key.
12 [INPUT]

(Example 2) Select data number 12. ("#8975 No. search process" is "1")

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Enter the tool management data number to be displayed.
12
- (3) Press the menu [Manage. No. search].  The specified data number is displayed at the top, and the cursor is located onto the first data.

To display the designated tool number first, select the menu [Tool No. search] in the similar procedure above.



Note

- (1) If a data number exceeding the limit is designated, the operation message "Setting error" is displayed.

Sorting the data by tool No.

Sort the tool management data in ascending order of tool numbers.

(Example 1) Sort the tool management data in ascending order of tool numbers.



- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Press the menu [Tool No sort].
- (3) Press the [Y] or [INPUT] key.  The operation message "Sorting of tool data is in progress" flashes during tool data sorting.
The operation message "Sorting of tool data is complete" is displayed after the tool data has been sorted.
The tool management data is sorted in ascending order of tool numbers, and they are displayed from the beginning. The cursor moves to the top line.
The highlight of the menu [Tool No. sort] returns to normal.

Note


- (1) During data sorting in ascending order of tool numbers, you cannot stop this sorting on the way.
- (2) Once you have sorted the data in ascending order of tool numbers, you cannot return them to the previous sort order.
- (3) If the same tool number is found multiple times, data is sorted in the order in which they are found from the top.
- (4) If no tool number is set and if data is sorted, that line is skipped during display.
- (5) The tool data is sorted for the currently displayed part system.
- (6) During data sorting, you cannot operate on the screen. Operate the screen after data sorting.


Deleting the tool management data in [List view]

■Method 1: Delete the tool management data of the cursor line.

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Use the [↑] or [↓] key to move the cursor onto the line to be deleted.
- (3) Delete the selected data.
Menu [Tool clear] [INPUT]
- (4) Press the [Y] or [INPUT] key.  Press any key except [Y] and [INPUT] keys to cancel. Once deleted, the data is empty.
To cancel the erasing, press a key other than [Y] or [INPUT].

■Method 2: Delete the tool management data of the designated line.



- (1) Display the tool management screen.  The tool management data list is displayed.

If the details of tool management data is displayed, press the menu [List view] and switch to the display of tool management data list.
- (2) Press the menu [Tool clear].
- (3) Specify the line clear range, by separating the first and last data numbers by a slash (/) from each other, and press the [INPUT] key.
1/5 [INPUT]
To delete data down to the last line, set "E". (Example: 5/E)
- (4) Press the [Y] or [INPUT] key.  The tool management data, that corresponds to the designated data number, is cleared and highlight of the menu display is released. Data of the cleared range is empty.
To cancel the erasing, press a key other than [Y] or [INPUT].

Note

- (1) If a value outside of the clear range is specified, the operation message "Setting error" is displayed.



Deleting the tool management data in [Disp details]

- (1) Display the tool management screen.  The tool management data list is displayed.
If the details of tool management data is displayed, press the menu [Disp details] and switch to the display of tool management data list.
- (2) Use the [↑] or [↓] key to move the cursor onto the tool number.
- (3) Delete the selected data.
Menu [Tool clear]
The menu [Tool clear] is displayed only when the cursor is located on the tool number.
- (4) Press the [Y] or [INPUT] key.  The tool management data, that is displayed in the detailed view of tool management data, is erased.
To cancel the erasing, press a key other than [Y] or [INPUT].

Note

- (1) If you wish to change the tool data to be deleted, locate the cursor onto the tool management data list and select a tool data again.

Copying and pasting the tool management data

- (1) Display the tool management screen.  The tool management data list is displayed.
- (2) Use the [↑] or [↓] key to move the cursor onto the line to be copied.
- (3) Press the menu [Line copy].
- (4) Use the [↑] or [↓] key to move the cursor onto the line to be pasted.
- (5) Press the menu [Line paste].  The copied data is written in the line at the cursor position.
The highlighted copy line is released.

Note

- (1) Once data is copied, it is held until the next tool management data is copied or until the tool management screen is closed.
- (2) For tool life management I, you cannot paste to the data that does not have the tool number. It causes a paste error.

(3) The following information is not copied or pasted.

×: Not copied or pasted

Display data	Common
Tool shape drawing	×

×: Not copied or pasted

-: Not managed

Display data		Tool life management I	Tool life management II
Life data	Life	Status	-
		Method	-
		H No.	-
		L offset	-
		D No.	-
		R offset	-
		Aux.	-
		Offset num	-
		Life	-
		Used	-
		Operating time	×
		Life time	×
		T usage count	×
		T life count	×
		Status A	×
Status B	×		

×: Not copied or pasted

-: Not managed

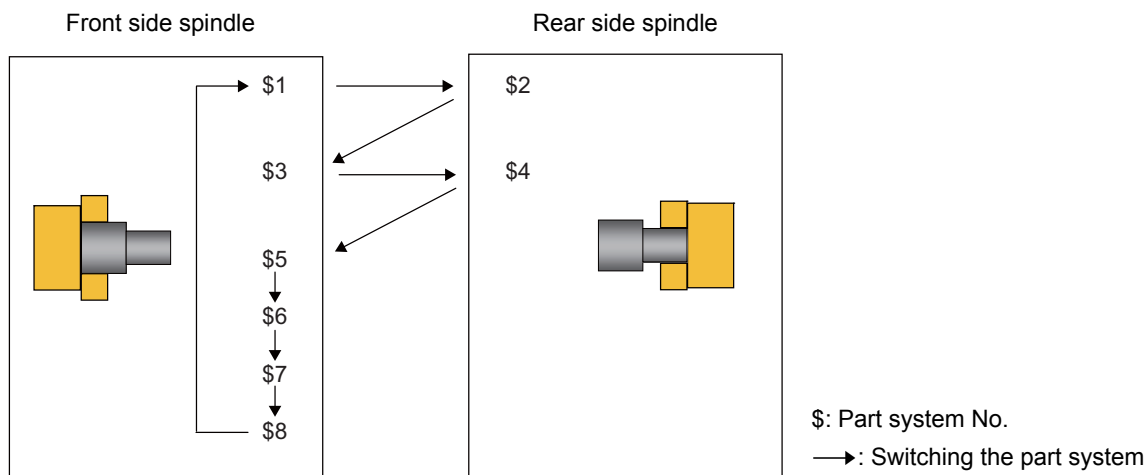
Display data		Tool compensation type III	
Compensation data	Compensation	Length	-
		L wear	-
		Radius	-
		R wear	-
		Tool L offset num	×
		Wear offset #	×
		Length 1st axis name	×
		Length 2nd axis name	×
		Length additional axis name	×
		Wear 1st axis name	×
		Wear 2nd axis name	×
		Wear additional axis name	×
		Nose R	×
		R-wear	×
		Point	×

4.3.9 Checking a Machining Program between Part Systems

When checking multi-part system programs, check a program of one part system first, and then switch the part system to check the other program. (Multiple programs cannot be checked at a time.)

It depends on the part system as to whether a workpiece is mounted to the front side or rear side spindle when the check starts, as shown in the figure below.

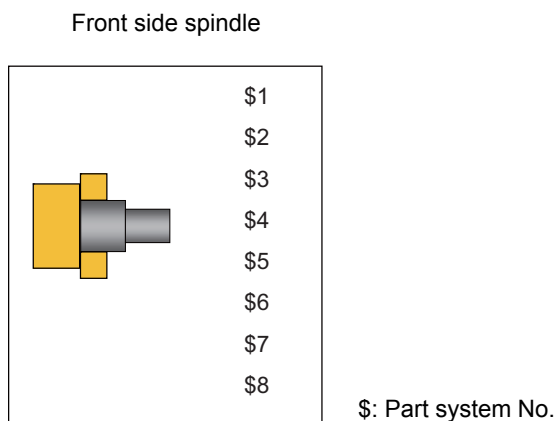
When the rear side spindle exists (the parameter "#12628 sub sp no" is set to nonzero), and you switch the part system to 2nd or 4th, the workpiece is assumed to be mounted to the rear side spindle. When the rear side spindle exists, and you switch the part system to a part system other than 2nd or 4th, the workpiece is assumed to be mounted to the front side spindle.



When the rear side spindle exists, and operation is started with the 2nd or 4th part system, the workpiece is assumed to be mounted to the rear side spindle.

When the rear side spindle exists, and operation is started with a part system other than 2nd or 4th, the workpiece is assumed to be mounted to the front side spindle.

When the rear side spindle does not exist, the workpiece is assumed to be mounted to the front side spindle.



When the spindle is switched between the front and rear sides, the workpiece zero point position Z will also be switched. Thus, the workpiece on the screen is not changed, but the coordinate of the tool is displayed based on the workpiece zero point position Z of the spindle side.

If it is necessary to change the zero point position Z of the front or rear workpiece after switching the part system, change it on the "Work set " screen. When the parameter "#1231 set03/bit6" (Initialization of drawing in graphic check) is valid, the workpiece shape is retained if you change the setting values.

The setting items for a workpiece shape are common to all part systems. Thus, when the part system is switched, the settings do not change. When executing the multi-part system program, and if you change any setting including the workpiece zero point position after switching between the front and rear side spindles, the workpiece is initialized. Therefore, when the parameter "#1231 set03/bit6" (Initialization of drawing in graphic check) is valid, the workpiece will not be initialized even if specific setting item for the workpiece shape is changed.

Refer to the following table to see whether the workpiece is initialized or not by changing each item for workpiece shape.

No.	Setting item for workpiece shape	Parameter "#1231 set03/bit6"	
		Enabled	Disabled
1	Work form	x	x
2	Number of corner	x	x
3	Workpiece outer diameter	x	x
4	Workpiece inner diameter	x	x
5	Workpiece length	x	x
6	Setting angle	x	x
7	Display direction	o	x
8	Front workpiece zero point position Z	o	x
9	Rear workpiece zero point position Z	o	x
10	Workpiece color	o	x
11	Machined color	o	x
12	Tapped/Threaded color	o	x
13	Interference Color	o	x
14	Section Color	o	x

x: Initialized o: Not initialized

4.3.10 Availability of Check Mode with Other Functions

Refer to "4.1.12 Availability of Check Mode with Other Functions".

However, in the program check (3D) for L system, the workpiece coordinate offset is disabled, the drawing will be performed setting the following position as zero point.

- X axis zero point: the center position of the workpiece
- Z axis zero point: front-side workpiece zero point, rear-side workpiece zero point (set on the workpiece setting screen)
- Y axis zero point: the center position of the workpiece
- Rotary axis zero point: 0 °

4.3.11 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input

Refer to "4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input".

4.3.12 Notes for Graphic Check (3D)

- (1) The check function is drawn with only NC internal operation results. Thus, the path is not drawn for commands requiring machine movement.
- (2) For the handling of various types of data being set in the program, refer to "4.1.13 Handling of Variable Commands, Programmable Parameter Input, and Programmable Compensation Data Input".
- (3) If the menu [M0/M1 neglect] is OFF, the Program check is stopped by the M0/M01 command. The drawing is also stopped during M01 command execution regardless of the ON/OFF switch status of the optional Stop Switch signal (XC41).
- (4) When the menu [M0/M1 neglect] is ON, the program check does not stop even if M00/M01 is commanded.
- (5) "Program check completed" appears with M02/M30 command.
- (6) Graphic check is not available for serial and MDI program.
- (7) Operation search is available for a program that has a file name consisting of up to 32 characters. Operation search is not available for programs with 33 or more file name characters.
- (8) When the check is executed, the drawing starts from the machine coordinate zero point. However, the machine coordinate zero point is (0, 0, 0) even when the value is set to the parameter "#2037 G53ofs" (zero point return).
- (9) The drawing coordinate system settings of 2D and 3D graphic check are not linked.
- (10) The origin mark is not drawn on the 3D drawing parts.
- (11) If the screen is switched during checking, the check reset occurs and the check is interrupted.
- (12) If tracing is turned ON during automatic operation, the menus such as [Check Search], [Check Continue], [Check Step], and [Check Reset] are grayed out. You cannot check with 3D Solid.
- (13) The drawing is not initialized even if the performance such as enlarge, reduce, move, change display mode, or rotate is set during check drawing. Also, the program does not stop.
- (14) If the part system is switched during checking, the check is reset.
- (15) Tool shape is drawn using the value (shape data A to H) set in the tool management screen, regardless of the value of the parameter "#8920 3D tool ofs select".

4 Checking a Machining Program on Screen

- (16) When the tool change is specified and if the data corresponding to the T number does not exist, the tool is drawn as the default tool.

Data	Value
Tool type	Lathe turning
Hand	Front/Right hand: except 2nd/4th part system
	Back/Right hand: 2nd/4th part system (setting of #1268 is nonzero.)
	Front/Right hand: 2nd/4th part system (setting of #1268 is "0".)
Tool length A	150mm
Tool length B	25mm
Nose angle	80°
Cutting edge angle	95°
Nose R	1mm
Gang offset Y	0mm

The tool to be displayed is switched to the tool corresponding to the T number when the tool exchange command is issued.

The previous tool is maintained and displayed until the next tool exchange command is issued.

It is not maintained when the power is turned on again. The default tool is displayed.

- (17) When the tool change is specified and if the following data of the tool corresponding to the T number is zero, the tool is drawn as the default tool.

Turning tool

Turning		Groove		Thread cutting		Turning drill		Turning tapping	
Tool length A	150mm	Tool length A	150mm	Tool length A	150mm	Tool length A	150mm	Tool length A	150mm
Tool length B	25mm	Tool length B	25mm	Tool length B	25mm	Tool length B	25mm	Tool length B	25mm
Nose angle	80°	Nose R	1mm	Tool width	10mm	Nose angle	118°	Pitch	5mm
Cutting edge angle	95°	Nose width	3mm	Gang offset Y	0mm	Gang offset Y	0mm	Root diameter	1.25mm
Nose R	1mm	Maximum groove depth	12mm	Color designation	Red	Color designation	Red	Gang offset Y	0mm
Gang offset Y	0mm	Tool width	10mm					Color designation	Red
Color designation	Red	Gang offset Y	0mm						
		Color designation	Red						

Milling tool

- If the tool length is 0: 150-mm tool length
- If tool radius is 0: 20-mm tool radius
- If shape data 1 is 0: 1-mm shape data 1 (it is 5 mm for the tap of tool type)
- If shape data 2 is 0: 1-mm shape data 2 (Tool diameter x 0.05 mm for the tap of tool type)
- Gang offset Y is 0 mm.
- If the color is not designated: Red tool

- (18) If the parameter "#8920 3D tool ofs select" is set to "0" or "1" and if the tool radius to be displayed is 0 or less, the 20-mm default tool radius is assumed and drawn.
- (19) If the fine segment program or complex shape program is executed for 3D checking, the "Solid check disabled (memory shortage)" message is displayed and the drawing may be erased. In such case, divide the program into subprograms and repeat check drawing. Before starting check drawing, press the menu [Initialize Workpiece] once.
- (20) The workpiece zero point is not changed even when a coordinate system switching command is included in the program that executes the program check. Therefore, the drawings may be overlapped and displayed.
- (21) The "Tapped Color", that is the same as when the tapping tool is selected, is used on the "Work set" screen. Therefore, switching of the tap surface color and normal surface color depends on not G command but the selected tool. However, even with the tapping tool being selected, if it is moved in the arc or helical direction, the "Work Set" screen does not have the "Tapped Color".
- (22) During 3D check, the tap is drawn as a straight rod and the shape data is not reflected (refer to "4.3.8 Setting the Tool Shape").

- (23) The check search cannot be executed when the sub part system that cannot be operated is displayed. If the search is carried out, the message "Search error" appears.
- (24) If there is a phase difference between the front and rear side spindles when passing a workpiece, the graphic may not be drawn correctly.
- (25) When the simple inclined surface machining is executed, the counter on the check screen is displayed with the feature coordinate system.
- (26) If such circular interpolation is executed that causes the angle between the start point and the end point to be 180 degrees or more during turning interpolation, the message "Draw library inside error(4)" appears. The tool moves to the end point of the circular interpolation; however, the workpiece is not machined.
- (27) If a travel command is executed during polar coordinate interpolation or cylindrical interpolation on the machine which cannot perform C axis control on its workpiece spindle, the message "Draw library inside error(4)" appears and the tool does not move.
- (28) If polar coordinate interpolation or circular interpolation is executed on the machine equipped with Y axis while Y axis is not at 0, the path is drawn differently from the actual machining.
- (29) If polar coordinate interpolation or circular interpolation is executed while the axis for which [Gang Ofs Y] is set to non-zero is in use, the path is drawn differently from the actual machining.

Precautions for drawing on foreground

- (1) If you press the auto start button when an arbitrary part system is being checked, the operation alarm "M01 program check mode" is generated and the cycle start is disabled while the button is held down.
Press the auto start button after the check is completed or after the check is stopped with the menu [Check reset].
- (2) If you carry out the operation search or check operation (continuous or step check) during cycle start or automatic stop of an arbitrary part system, an operation message "Executing automatic operation" is displayed, and no search or check drawing is carried out.
- (3) "Program check completed" appears with M02/M30 command. For the tape mode, the rewind process is not carried out.
- (4) The check ends with the reset (the menu [NC Reset] or [Check reset]).
When a program error occurs, cancel the error with the above operation.
If NC Reset is selected when the check screen is being displayed, check drawing ends but the menu to switch to the 2D Check or 3D Check is kept invalid. To enable this switching, press the menu [Check reset].
- (5) During automatic operation, the contents of automatic operation program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the check screen. During checking, the contents of the checking program are displayed by the "Currently executed machining program" (ONB display) and "Buffer display" on the monitor screen.
- (6) If you carry out the operation search or check operation (continuous or step check) when the program is restarted, the "Program restarting" operation message is displayed, and no search or check drawing is carried out.
- (7) If the manual operation mode is selected during checking, the "M01 program check mode" is displayed and the axis cannot be moved. If you need to move the axis, temporarily stop the current check by executing a reset and then move the axis. When you switch from the manual operation mode to the memory mode, the alarm is released. Also, you can continue the current check even if an alarm is output.
- (8) When the PLC Interrupt signal is turned ON during checking, the "M01 Program check mode" is selected. To start the PLC interrupt, terminate the current check by executing a reset. When you turn the PLC interrupt signal OFF, the alarm is released. You can continue the current checking even if the PLC Interrupt signal is ON.

Precautions for drawing on background

- (1) The program that you have selected during Check Search is not the program that is executed during automatic operation. Search the program for automatic operation by using the operation search function of the monitor screen.
- (2) The parameters and compensation amount do not reflect on check drawing even if you set them during checking. To reflect them on the drawings, reset the check once. Then, press the menu [Check continu] or [Check step] and execute the check again.
- (3) "Program check completed" appears with M02/M30 command.
- (4) The check is not terminated via execution of a reset.
If a program error occurs, release the error by selecting the menu [Check reset].
- (5) During check search, if the length of the full path name exceeds 48 characters, you cannot move to another directory.
- (6) If the menu [Optional Skip] is ON (highlighted status), the blocks that have the "/" character are skipped and the T-code list is obtained.
- (7) The file name continues to be displayed as an O-number display even if you erase or rename the file after it is checked and searched. If you check a file in this status, the "Push [Check reset] menu" message is displayed.
- (8) During checking, if you read the run-out time by using variable number #3001 or #3002, the checking start time is obtained. You cannot write the run-out time.
- (9) When [Check continu] is executed, even if variable number #3006 is used for checking, you cannot stop the program and you cannot display the message.

Full-screen display of graphic check function (3D)

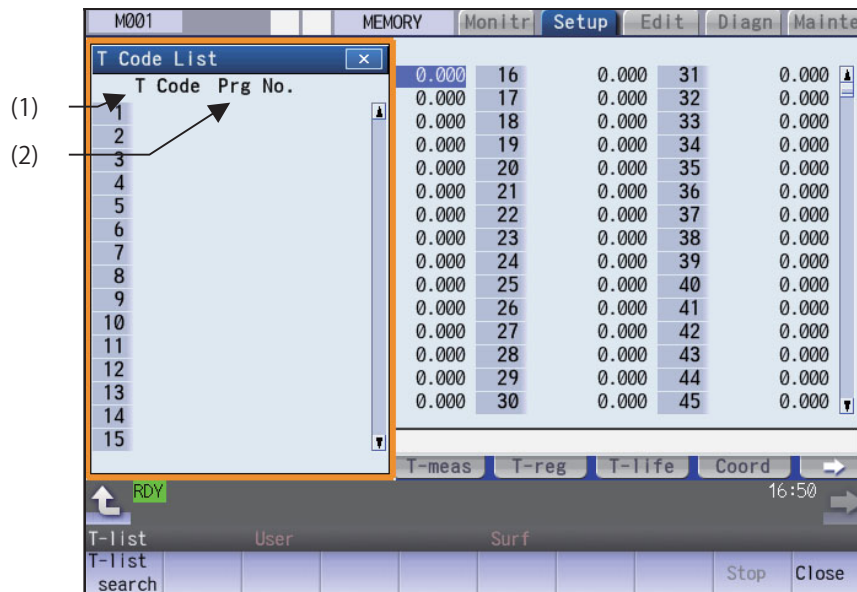
- (1) For 3D check, the drawn workpiece shape is enlarged or reduced to be 90% of drawing area in accordance with the size of graphic drawing area when the screen is switched between normal display and full-screen display.

4.4 Checking the Tool Command (T Code List)



This function searches the T code in designated machining program (including the subprograms) and lists it in the order the T codes are commanded (Max. 100 codes).

As for the T code of the tool that has not been registered, it is indicated with text color and background color changed. Refer to "6.2 Registering a Tool (Tool Registration Screen)" for details on registering a tool.



Display Items

Display items	Description
(1) T code	T codes are listed in the order that the T code is commanded in the designated machining program (including subprogram). (As for the T code of the tool that has not been registered, it is indicated with text color and background color changed.)
(2) Prg No.	This shows designated program No. When the number of characters exceeds 15, the excess is indicated as "***".



Menus (T code list display window)

Menus	Description
T-list search	This designates the program. This menu is invalid while getting the T codes.
Stop	This interrupts getting the T codes. This menu is valid only while getting the T codes.
Close	This closes the pop-up window and quits this function.

Menus (T code list search window)




Menus	Description
Memory	This selects the device for searching for the program. When a device with directory is selected, the root directory is selected first. (For M800S and M80 Series, [HD] is not displayed and cannot be selected.)
HD	
Memory card	
DS	
USB Memory	
Top jump	Display starts from the first page of the directory/list of files. The cursor moves to the top line.
Bottom jump	The last page of the directory/list of files is displayed. The cursor moves to the bottom line.
Comment nondisp	This hides the comment field in the list. The file name field can be enlarged.
List update	This updates the list contents. The latest contents of the currently selected device and directory are listed.
Sort change	This changes the method that the list is sorted.
Retn	This closes the pop-up window and starts getting T codes.

Operation method (Display the T code list)

- (1) Press the menu [T-list] on Setup screen.
- (2) Press the menu [T-list search].
- (3) Select the device.
(Example) Memory
- (4) Use the [↑], [↓], , or  key to align the cursor with the directory of target file, and press the [INPUT] key.

<Note>

- ◆ If the list contents differ from the actual device or directory, press the menu [List update].
- ◆ Press the menu [Sort change] to change the sort.
Sorting method changes to File name ascending order -> File name descending order -> Date/Comment ascending order -> Date/Comment descending order -> File name ascending order -> every time the menu key is pressed.

- (5) Use the [↑], [↓], , or  key to align the cursor with the target machining program, and press the [INPUT] key.  T code list appears as a pop-up window. Getting T code and listing starts. The menu [Stop] becomes valid. The [T-list search] is invalid.

T code list cannot be displayed when [INPUT] key is pressed with the following programs selected:

- The program that does not exist.
- The program being checked. For M80 series, T code list cannot be displayed when [INPUT] key is pressed with the following programs selected:
 - The program during automatic operation.
 - The program that is waiting to be restarted. The list window will not change.

Note

- (1) When switching to the other screen (monitor screen or edit screen), getting T code is interrupted automatically.
- (2) When the menu [Close] is pressed, getting T code is interrupted automatically.
- (3) For some models, T list search cannot be carried out with manual operation mode (except memory, tape, online, MDI, PC or direct mode). Switch it to automatic operation mode.
- (4) T list search is not available for sub part system I/II for M80 Series. If the search is carried out, the message "Search error" appears.
- (5) T list search is not available for sub part system II for M800 Series. If the search is carried out, the message "Search error" appears.
- (6) T code list for MDI program cannot be displayed.
- (7) T code list of a program with 33 or more file name characters cannot be gotten.
- (8) When you designate the program which occurs a program error, T code list can be gotten up to the previous block of the error. Error message is not displayed.

Inputting and Outputting a Machining Program

This chapter explains the details of Inputting and outputting the machining program mainly based on the menu [I/O] on the Edit screen.

This operation can be performed with the menu [I/O] on the Maintenance (Mainte) screen as well.

5.1 Inputting and Outputting a Program



The machining program can input/output between the NC internal memory and the external input/output device on the Edit screen. The built-in disk of the display unit inside the NC unit is also treated as an external device.

Note

(1) When the program input/output function is used, set the parameter "#8923 Hide Edit-IO menu" to "0".

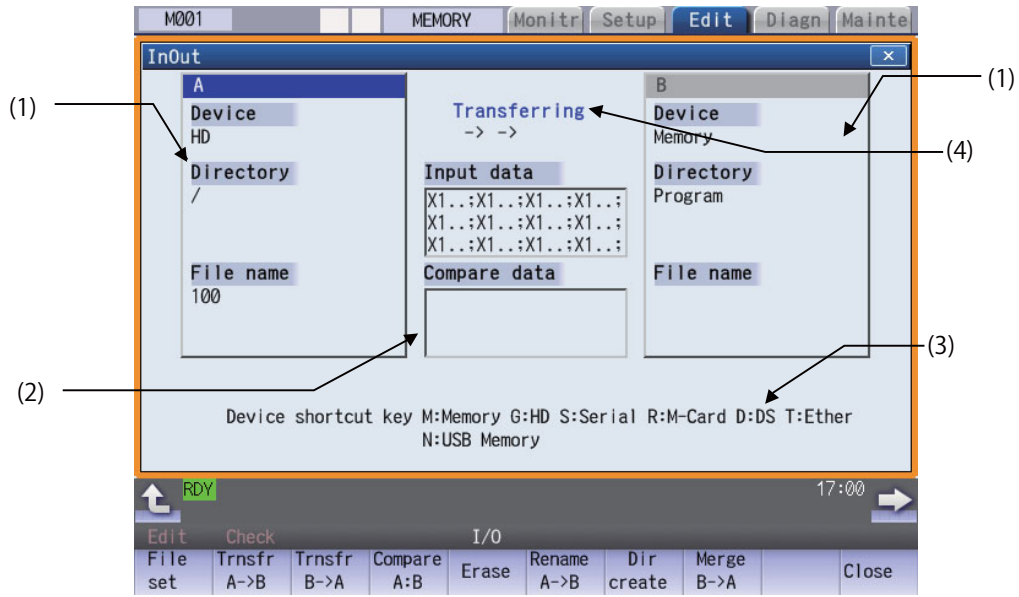
When the multi-part system program management is valid (#1285 ext21/bit0 =1) and the selected device is the NC memory, a program input and output will be executed across all part systems in batch if a parameter "#1285 ext21/bit2" (Multi-part system program management) is set to "0". When it is set to "1", the program input and output will be executed for the program of displayed part system.

However, when the machining program is transferred from the NC memory to the device other than the NC memory, the transfer will be executed across all part systems in batch if "#1286 ext22/bit5 Selection of multi-part system program input/output method" is set to "0". If it is set to "1", only displayed part system's program will be transferred.

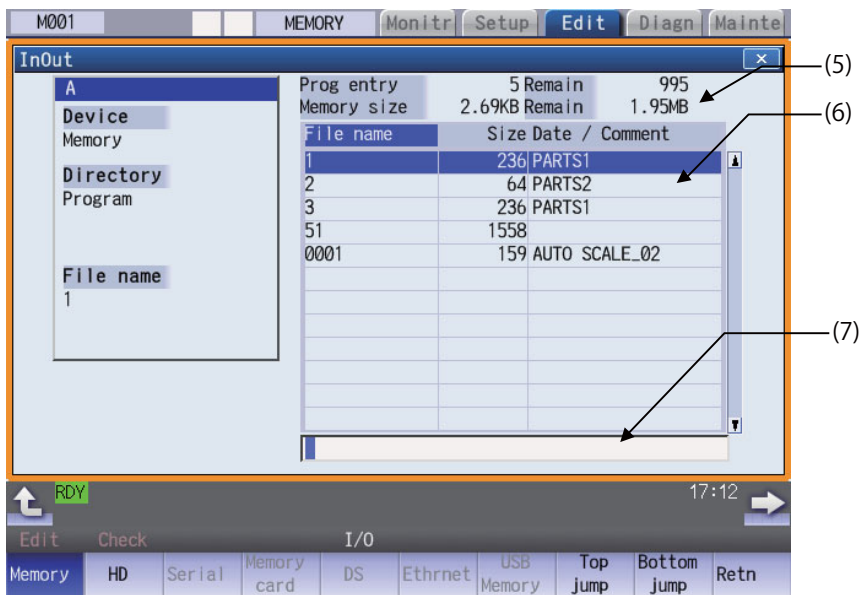
This function applies to the following devices.

- (1) Memory (SRAM memory at NC)
- (2) HD
- (3) Serial
- (4) Memory card (front-side SD card)
- (5) DS (control unit-side SD card)
- (6) Ethernet
- (7) USB memory

<During file transmission>



<During file setting>



Display Items	
Display items	Details
(1) Device, directory, file name setting area	This sets the device, directory, and file name for which the transmission, compare, and erase functions are used. When the number of characters exceeds the display possible number (directory: 63 in three lines, file name: 42 in two lines), the excess is not displayed. As for the device and directory, the setting values are retained even when the power is turned OFF.
(2) Input/compare data display	This displays data that is being transferred or compared. If an error occurs while comparing data, the block for which the error occurred is displayed.
(3) Guidance display area	This displays the device name shortcut key.
(4) Process progress display section	This displays the details and data input/output direction for the process currently being performed.
(5) Capacity display section (*1)(*2)	This displays the file (machining program) registration count information and memory capacity information for the selected device. Prog entry: Displays the number of programs that are already registered as the user's machining programs. Remain: This displays the remaining number of programs that can be registered. When memory is selected as the device, the total of the number of programs registered and the remainder is the maximum number of registrations set in the specifications. Memory size: Displays the capacity that is already registered as the user's machining programs. Remain: Displays the remaining capacity that can be registered. When memory is selected, the total of the memory capacity and the remaining capacity is used as the maximum memory capacity defined in the specifications.
(6) List display section (*3)	This displays the directory contents list (directory and file name) of the device A or B where the cursor is currently located. When the menu [Commentnondisp] is highlighted, the [Date/Comment] column is not displayed. Up to 32 characters are displayed in the file name column. File name: <ul style="list-style-type: none"> ♦When "Memory" is selected for the device, this displays the file name (program No.) of the machining programs already registered. The file names are displayed in order from the smallest number, from 1 to 99999999. ♦When a device other than memory is selected, this displays the file name and directory to be included in the directory that is set in the current setting column. ♦When the number of characters exceeds the maximum (13 characters with the comment column, 32 characters without the comment column), the excess is indicated as "***". Size: <ul style="list-style-type: none"> ♦This displays the size of each file. (The number of characters in the machining program when the memory is selected for the device.) ♦When the directory is selected, this displays <DIR>. Date/Comment: <ul style="list-style-type: none"> ♦This displays the comment (up to 19 alphanumeric characters and symbols) of each file. ♦The date which the file is updated is displayed for the HD, memory card, DS, USB memory or Ethernet. ♦When the number of characters exceeds 19, the excess is not displayed. The excess is not abbreviated to "***".
(7) Input section	This displays the input key.

(*1) Some items may not be displayed depending on the device.

○: Displayed ×: Not displayed

Display item/Device	Memory	HD	Serial	Memory card	DS/USB memory	Ethernet
Number of programs registered	○	○	×	○	○	○
Remain	○	×	×	×	×	×
Number of memory characters	○	○	×	○	○	○*
Remain	○	○	×	○	○	×
List	○	○	×	○	○	○

* When the parameter "#97*1 Host n no total siz" is set to "1", the number of host memory characters will not appear.

(*2) When the device is not mounted, a registration count and a memory capacity are not displayed and an empty list is displayed.

(*3) When the device is serial, an empty list is displayed.

Note


(1) When the number of characters in the directory path (full path) from the root directory exceeds 100, the directory path is not retained, but a previously set directory path containing 100 characters or less retained.

When the device is "Memory", the initial directory display is "Program".

When the device is "Ethernet", refer to "Initial directory when the Ethernet is selected" in "5.2 Selecting a Device, Directory and File" for details about the initial directory display.

Menus

Menus	Details
File set	This sets the device, directory and file name for which input/output operations are performed. <Note> •When the device is serial or nothing, an empty list is displayed. When the device is not mounted, an operation message "(Device name) not ready" appears.
Transfr A→B	This copies the file in file setting column A (transfer origin) to the file setting column B (transfer destination). (The transfer origin file is not changed.)
Transfr B→A	This copies the file in file setting column B (transfer origin) to the file setting column A (transfer destination). (The transfer origin file is not changed.)
Compare A:B	This compares the files in file setting column A and file setting column B.
Erase	This erases the selected file in file setting column.
Rename A→B	This changes the name of the file in file setting column A to that of in file setting column B. <Note> •The same device must be selected for A and B.
Dir create	This creates a new directory in the selected file setting column. The directory can be created when HD is selected for the device.
Merge B→A	This adds the contents of the file in file setting column B to that of in file setting column A. (The file in file setting column B is not changed.)
Close	This closes the pop-up window and quits this function.
Warning cancel	This cancels a warning from network service.

Menus	Details
	This interrupts the process (transfer, compare, etc.) during its execution.

Switching the valid area

It is necessary to enable the areas including device, directory, and file name in the file setting column A or B in order to set those items.

Change the display area using the [←], [→], direction cursor keys or the [[←], [→]] tab keys.

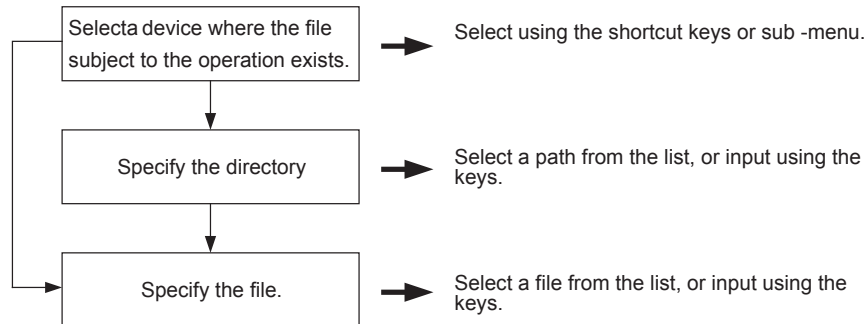
For the touchscreen display, it is also possible to change the invalid area by touching the display area.

5.2 Selecting a Device, Directory and File



This section explains the file device, directory, and file name specification methods for the file transfer and erase commands etc. performed on the I/O screen of the edit (Edit) screen.

File operation procedure



Outline of device, directory, and file name designating methods

Device	Designation target file	Designation method		
		Device	Directory	File name
NC memory	<ul style="list-style-type: none"> ♦Machining program ♦User macro program ♦Fixed cycle program 	Select from the sub menu.	- (Default)	Key input in the input area, then press the [INPUT] key.
		Designate using the shortcut key.		Select from the list.
Device other than the NC memory	All files	Select from the sub menu.	Key input in the input area, then press the [INPUT] key.	Key input in the input area, then press the [INPUT] key.
		Designate using the shortcut key.	Select from the list.	Select from the list.

- (1) The device can be selected using the sub-menu or shortcut keys.
(The devices that can be used will differ depending on the specifications.)
- (2) One of the following methods can be used to designate the directory (for devices other than the NC memory) and file name.
 - ♦Designate the directory path or file name in the input area and press the [INPUT] key.
 - ♦Move the cursor in the list display section to the target directory or file name and press the [INPUT] key.
A wildcard (*) can be used for the file name.

Note

- (1) When the number of characters of directory path (full path) exceeds 128, changing directories cannot be performed.

Notes when selecting a file

- (1) During directory and file name setting, the designated directory, path or file name will be set, even if it does not actually exist. This will not cause an error. Note that the previously set directory is overwritten.
- (2) When selecting a fixed cycle program, it is necessary to set the parameter "#1166 fixpro". Furthermore, select "Memory" for the device, and "Program" for the directory.

Initial directory when the Ethernet is selected

If you reboot the system while the previously selected device is "Ethernet", or if you select Ethernet initially after startup, the initial directory will be the host directory that is set by the parameter (#9714, #9734, #9754 or #9774) when the HMI starts up.

The directory to be applied varies depending on the setting of the parameter "#9706 Host No.".

Operation method (Selecting an NC memory program)

- (1) Press the [M] short cut key. on the I/O screen of the edit screen. → The device name changes to "Memory". "Program" appears in the directory.
- (2) Press the menu [File set]. → The NC memory program list and input area appear.

By pressing the operation menu at this point, it is possible to change the device.

When the menu [Program] or [Program all] is selected, the setting of "File name" column is cleared.

Only when the device functions as the memory, the menu [Program] or [Program all] is valid.

<When selecting the file name from the list>

- (3) Move the cursor to the file name to be selected, and set.

[↑], [↓] [INPUT]

<When inputting the file name from the input area>

- (3) Input the file name.

10013 [INPUT]

Designating multiple files

A wildcard (*) can be used for the file name.

By using a wildcard, multiple files can be transferred, compared, and erased at one time.

- (Example 1) When programs 1 to 1000 exist in the NC memory.

Designate "*" in the file name: The target program is "1 to 1000".

Designate "*.*" in the file name: There is no target program.

Designate "1*" in the file name: The target program is "1, 10 to 19, 100 to 199, 1000".

Designate "1*.*" in the file name: There is no target program.

Designate "**1" in the file name: The target program is that where the position of the 1 is "1".

(1, 11, 21, 31,101, 111,981, 991)

Designate "**1*" in the file name: The target program is all of the programs containing "1".

(1, 10 to 19, 21, 31,100 to 199, 201, 210,981, 991,1000)

Designate "1*1" in the file name: The target program is "11, 111, 121, 131, 141, 151, 161, 171, 181, 191".

- (Example 2) When programs 1.PRГ to 1000.PRГ, and 1 to 1000 exist in the USB memory.





Designate "*" in the file name: The target program is "1 to 1000".

Designate "*.*" in the file name: The target program is "1.PRГ to 1000.PRГ".

Designate "1*" in the file name: The target program is "1, 10 to 19, 100 to 199, 1000".

Designate "1*.*" in the file name: The target program is "1.PRГ, 10.PRГ to 19.PRГ, 100.PRГ to 199.PRГ, 1000.PRГ".

Operation method (Selecting a file from a device other than the NC memory)

- (1) Press a device selection shortcut key on the I/O screen of the edit screen.  The device name changes to "USB memory". The root directory (/) appears in the directory.
(Example) [N]
- (2) Press the menu [File set].  The program list of the USB memory and the input area appear.
By pressing the operation menu at this point, it is possible to change the device.
Only when the device functions as the memory, the menu [Program] or [Program all] is valid.
- <When selecting the file name from the list>
- (3) Move the cursor to the directory to be selected and set.  The directory selected in the directory column appears. The contents of the selected directory appear in the list. Select "." to move to one directory above. There is no change when "." is selected.
[↑], [↓] [INPUT]
Repeat this operation until the cursor arrives at the target directory.
Next, refer to operation (4).
- <When inputting the file name from the input area>
- (3) Input the directory path.  The input directory path appears in the directory column.
(Example) /PRG/PRECUT [INPUT]
- <When selecting the file name from the list>
- (4) Move the cursor to the file name to be selected, and set.
[↑], [↓] [INPUT]
- <When inputting the file name from the input area>
- (4) Input the file name.
10013.PRG [INPUT]



5.3 Transferring a File




This section explains the method used to transfer files between different devices, or between the same device on the I/O screen of the edit (Edit) screen.

Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Operation method

- (1) Use the [←] or [I←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the transfer source device, directory and file name.  The designated file displays in file setting column A. A wildcard "*" can be used for the file name to designate multiple files.
- (3) Use the [→] or [I→] key to select file setting column B.
- (4) Designate the transfer destination device, directory and file name.
- (5) Press the menu [Transfr A→B].
Press the menu [Transfr B→A] when transferring from device B to device A.
- (6) Press the [Y] or [INPUT] key.  File transfer is commenced. The process progress display area displays message indicating that transfer is in progress, and also indicates the transfer direction. The data being merged appears in the input/comparison data display area input data display column. A message appears indicating a transfer completion after transfer has been completed.

CAUTION

 ";", "EOB", "%", and "EOR" are symbols used for explanation. The actual codes for ISO are "CR, LF" ("LF") and "%". "%" and "EOR" are represented by "%" in ISO. The programs created on the edit screen are stored in the NC memory in a "CR, LF" format, however, the programs created with external devices may be stored in an "LF" format. The actual codes for EIA are "EOB (End of Block)" and "EOR (End of Record)".

 To prevent influence from data omission and data transformation in the communication circuit, always verify the data after inputting and outputting machining programs.

Notes (Notes related to transferring in general)

- (1) Depending on the type of file, some data cannot be transferred during automatic operation. Do not transfer during automatic operation.
- (2) When the capacity of the transfer destination is reached during file transfer, only the data transferred up to that point is registered as a file, and an error will result.
- (3) During input to the NC memory or comparison, if the file format size on the NC memory side differs from the other side file format size (when the maximum number of registrations differs between the NC memory and the other side), processing is carried out matched to the smaller size.
 - (Example 1) If a format size of 200 files is input for a format size of 1000 NC files, 200 files are registered.
 - (Example 2) If 1000 files are input to the NC that formatted for 200 files, the files up to the 200th file can be registered and an error message appears. (The remaining files are not registered.)
- (4) Do not perform any file operation on the transfer source and destination files during the file transfer. The file may be damaged with the file operation.

Notes (Notes when transferring machining program files)

- (1) For the serial, always set both ends of the "EOR" code at the head and end to feed (NULL). If "EOB" etc., is directly after "EOR", the operation may not be executed normally due to the input buffer influence during the next input operation.
- (2) The transfer speed is slower if there are many registrations.
- (3) The size of one block of the machining program should be 250 characters or less.
- (4) The characters that can be used for the file name and directory path are 1-byte number, 1-byte capital alphabetical letters, and 1-byte symbols recognized by the system. Note that the following characters cannot be used.
|, /, :, ", " (comma), *, ?, ", <, >, a to z (small letters), space
Up to 32 characters are allowed for the file name to create in or transfer to NC memory.
- (5) If the file whose name includes lower case alphabet is transferred to NC memory, the lower case letter will be converted into the capital letter.
- (6) When using tape, carry out parity V adjustment to improve the reliability of the tape format. Then use with the input/output parameter "Parity V" validated.
- (7) When the MTB macro and fixed cycle program are input, change the program type with the parameter (#1166 fixpro). Also, set the device and directory as follows.
Device: Memory, Directory: Program
- (8) Transferring or verifying the multiple files between the external device connected serially and that other than the serial connection.
- (9) With machining program created by the MELDAS500 Series or earlier model, "EOB" is registered as "LF". However, when these programs are stored in the M800/M80 Series NC memory, "EOB" will be converted to "CR LF", and the number of characters will increase. Thus, when all of the machining programs output from an MELDAS500 Series or earlier model, having the same specifications as the maximum memory capacity, are stored in the M800/M80 Series NC memory, the memory capacity may be exceeded.
- (10) When the file to be transferred (input) is running or in "program restarting" mode, the operation message "Executing automatic operation" or "Program restarting" is displayed and file will not be transferred (input).
- (11) If the file to be transferred (input) is being edited in the custom screen, the operation message "Can't write into being edited file" appears and may not be transferred (input).
- (12) When "#8936 Delete leading 0" is set to "1", if a file name consisting only of numerical figures is input, "0" at the head of the file name is deleted to be checked.
However, if the file name is out of the range between 1 and 99999999, the leading "0" is not deleted. This also applies to MTB macros.
Therefore, for example, while the program "1" is in automatic operation, if a file name to transfer (input) is named "0001", the operation message "Executing automatic operation" appears, and transfer cannot be carried out.
In the case of fixed cycles, regardless of the setting of "#8936 Delete leading 0", the name of the file to transfer must be 9 digits, and it must not start from "0". Attempting to transfer a file whose name does not satisfy the conditions above will cause an error.
- (13) If the file to be transferred (input) is targeted for edit lock (edit lock B: 8000 to 9999 or edit lock C: 9000 to 9999), the operation message "Edit lock B" or "Edit lock C" is displayed, causing a transfer failure.
If "#8936 Delete leading 0" is set to "1" and the program name consisting only of numerical figures is input, "0" at the head will be deleted and checking will be performed. (Example: If the transferring (inputting) file name is "008000", the operation message "Edit lock B" appears and it cannot be transferred.)

- (14) When the multi-part system program management is valid (#1285 ext21/bit0 =1) and "#1285 ext21/bit2" (Multi-part system program generation and operation) is set to "0", the machining program's transfer from the NC memory to the device other than the NC memory will be executed across all part systems in batch. When it is set to "1", only displayed part system's machining program will be transferred.
- (15) When the multi-part system program management is valid (#1285 ext21/bit0 =1) and "#1286 ext22/bit5 Selection of multi-part system program input/output method" is set to "0", the machining program's transfer from the NC memory to the device other than the NC memory will be executed across all part systems in batch. When it is set to "1", only displayed part system's machining program will be transferred.
- (16) The transfer range from the external device other than serial to NC memory will change depending on the value set in the parameter "#19006 EOR Disable".
- <When the parameter "#19006 EOR disable" is set to "0">
 The head line will not be transferred.
 Up to "%" in the second line onward will be transferred, and data after "%" will not be transferred.
 If there is no "%", all data will be transferred.
- <When the parameter "#19006 EOR disable" is set to "1">
 All file contents will be transferred.
- (17) When a wildcard "*" is designated for the file to be transferred, the transfer is executed excluding the programs which are subject to the edit lock according to the status of Edit lock B and C.
- (18) If the device shown below and the directory are designated for the transfer destination, the following operation is performed depending on conditions.
- When an existing file is designated: The file is transferred with a temporary file name, and changed to the designated file name after transfer processing has been completed.
 - When a new file is designated: A new file is transferred with a temporary file name, and changed to the designated file name after transfer processing has been completed.
- (1) Transfer destination device: Memory
 Directory: Machining program
- (2) Transfer destination device: DS, memory card (M800S/M80), USB memory (M800S/M80)
- A temporary file is designated by the file name that consists of 11 digits, beginning with the symbol "~".
 After transfer is terminated properly, the temporary file is changed to the designated file name.
 A temporary file remains in the cases below, but can be deleted in the same way as for a normal file.
- When the transfer has terminated abnormally, for example, because the destination's capacity became full.
 - When the transfer has been interrupted.

5.4 Comparing Files (Compare)



This section explains method used compare files after transferring on the I/O screen of the edit (Edit) screen. Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Operation method

- (1) Use the [←] or [←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the device, directory and file name to be compared.
- (3) Use the [→] or [→] key to select file setting column B.
- (4) Designate the other device, directory and file name to be compared.
- (5) Press the menu [Compare A:B].



The file comparison starts. The input data and comparison data appear in the input/comparison data display area. A message appears when the comparison is completed. If a comparison error occurs, the block with the error is displayed in the comparison data display column on the screen.

Note

- (1) Files that can be compared are text files only. Correct outcome will not be obtained through binary file comparison.
- (2) In a file comparison, even if "#8936 Delete leading 0" is set to "1", when comparing one separate file that contains one program, "0" at the head of the program name is not deleted. Designating the file name is required. However, in the case of serial/batch file, comparison is carried out with a leading zero in the program name deleted.
- (3) Designating "*" for the compared file name causes "Setting error" when the comparison is executed with serial. Designate no file name or designate a target file name.
- (4) When a wildcard "*" is designated for the transfer source file, the comparison is executed excluding the programs which are subject to the edit lock according to the status of Edit lock B and C.

5.5 Erasing a File



This section explains the method used to erase files on the I/O screen of the edit (Edit) screen.

Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Operation method (Erasing a file in file setting column A)

- (1) Use the [←] or [I←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the device, directory and file name to be erased.
- (3) Press the menu [Erase].
- (4) Press the [Y] or [INPUT] key.

Note

- (1) If the file to be erased is running, an error will occur, and the file will not be erased.
- (2) If the file to be erased is being edited in the custom screen, the operation message "Can't erase designated file" appears and may not be erased.
- (3) When a wildcard "*" is designated for the file to be erased, the erasing is executed excluding the programs which are subject to the edit lock according to the status of Edit lock B and C.

Operation method (Erasing a file in file setting column B)

Use the [→] or [I→] key to select file setting column B, and designate the device, directory, and file name for file setting column B. Following this, the operation method is same as for "Erasing a file in file setting column A".

5.6 Changing a File Name (Rename)



This section explains the method used to change the file name on the I/O screen of the edit (Edit) screen.

Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Changing a file name

- (1) Use the [←] or [I←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the original device, directory and file name.
- (3) Use the [→] or [I→] key to select file setting column B.
- (4) Designate the new device, directory and file name.
- (5) Press the menu [Rename A→B].
- (6) Press the [Y] or [INPUT] key.

Note

- (1) Make sure the original and new devices are the same.
- (2) If the file to be renamed is running or program restarting, an error will occur, and the name will not be changed.
- (3) If the file to be renamed is being edited in the custom screen, the operation message "Can't rename designated file" appears and may not be changed.
- (4) If a file that does not exist is designated for the original file, or if an existing file name is designated for the new file selection, an error occurs, and the name is not changed.
- (5) The directory where the file in operation search/check search is stored cannot be renamed. The operation message "Can't rename designated file" appears.



5.7 Creating a Directory



This section explains the method used to newly create a directory.

Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Operation method

- (1) Use the [←] or [I←] key to select file setting column A.
- (2) Designate the device.
- (3) Select a directory to be newly created from the list, or designate by inputting from the input area.
- (4) Set the new directory in file setting column A.  The directory contents appear.
- (5) Press the menu [Dir create].  The directory is created.
The directory can also be created in file setting column B.

Note

- (1) Up to 223 files, including the directory, can be registered in the FD's root directory.
- (2) Make sure that the directory path is less than 100 characters. When the path exceeds 100 characters, it cannot be recognized as a path.

5.8 Other Functions



5.8.1 Merging a File

This section explains the method used to add a file in file setting column B to a file in file setting column A on the I/O screen of the edit (Edit) screen.

Refer to "5.2 Selecting a Device, Directory and File" for details of the device, directory, and file specification method.

Operation method

- (1) Use the [←] or [←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the merge destination device, directory, and file name.
- (3) Use the [→] or [→] key to select file setting column B.
- (4) Designate the merge source device, directory, and file name.
- (5) Press the menu [Merg B→A].
- (6) Press the [Y] or [INPUT] key.



The file merge starts. The data being merged appears in the input/comparison data display area input data display column. Furthermore, a message indicating that merging is being performed, and an arrow from the merge source (file setting column B) to the merge destination (file setting column A) display in the process progress display area.

A message appears when the merge is completed. The details of the file in file setting column A will be as follows when the merge is completed.

<pre>(FILE A) G28 XYZ G90 F800 G00 X100. Y100.; (FILE B) G91 G28 XYZ F1000; G01 X200. Y200.; M02; %</pre>	} Details of file in file setting column A before merge.
	} Details of file in file setting column B before merge.

The details of the file in file setting column B do not change.

Note

- (1) If the merge destination file (file in file setting column A) is running, an error will occur, and the files will not be merged.
- (2) If the merge destination file (file in file setting column A) is being edited in the custom screen, the operation message "Can't write into being edited file" appears and may not be changed.
- (3) The devices that can be merged are the memory, HD, memory card, DS and USB memory.
- (4) Do not perform the file operation on the merge source and destination files during the merge. The file may be damaged with the file operation.

5.8.2 List of File Names

There is a directory for each type of data in the NC memory.

The NC memory directory and file name handled on the I/O screen of the edit (Edit) screen is as follows.

Furthermore, when storing the NC memory file in a device other than the NC memory, be careful not to change the file extension (.XXX).

Data type	NC memory directory path	File name
Machining program	/PRG/USER	(Program No.)
Fixed cycle program	/PRG/FIX	(Program No.)

5.8.3 Edit Lock B and C

This function prohibits editing, erasing, etc., of the machining programs B and C, and protects the machining programs in NC memory.

Machining program	Edit Lock B	Edit Lock C
A 1 to 7999 10000 to 99999999	---	---
B (user standard program) 8000 to 8999	Editing prohibited	---
C (MTB custom) 9000 to 9999	Editing prohibited	Editing prohibited

The operations below in the Edit MDI and the Input/Output screens are influenced by the edit lock setting.

An error will occur if operations that are not possible are attempted.

When the edit lock is valid, processing is executed (except the edit lock target program) by the input/output function.

○: Operation possible ×: Operation not possible

Screen	Operation	Edit Lock B			Edit Lock C		
		Machining program			Machining program		
		A	B	C	A	B	C
Edit	Search	○	○	×	○	○	×
	Edit	○	×	×	○	○	×
	MDI registration	○	×	×	○	○	×
Edit (Input/Output)	Transfer	○	×	×	○	○	×
	Compare	○	×	×	○	○	×
	Copy	○	×	×	○	○	×
	Merge	○	×	×	○	○	×
	Rename	○	×	×	○	○	×
	Erase	○	×	×	○	○	×
Operate	Buffer Correction	○	×	×	○	○	×

Note

- When the multiple part system specification is valid, the machining programs of all the part systems are protected by edit lock B and C.
- When multiple serial files or a wildcard (*) is designated for input/output function, programs except subject to edit lock will be processed.
- When a multiple programs are input to the memory without designating the file name like serial input or program batch input, the message "Edit lock B" or "Edit lock C" appears and the input is interrupted if the program which is subject to edit lock is detected.
- A machining program in the USB memory is assumed as machining program A whatever its file name is, it is not subject to the protection of Edit Lock B or C.

5.8.4 Program Display Lock C

This function prohibits display and search for machining program C (MTB custom program).

The following influences are received on each screen according to parameter "#1122 pglk_c" (Program display lock).

Influences of program display lock parameter on operation screen		
Screen operation #1122 pglk_c	1 (Display: Prohibited, Search: Possible)	2 (Display: Prohibited, Search: Prohibited)
Buffer display of operating program	The program contents are not displayed. Only "%" is displayed.	
Display when [Program display] highlights on the 2D check full-screen	The program contents are not displayed. Only "%" is displayed. (Drawing is performed.)	
Display when [Program display] highlights on Trace full-screen		
When the menu [Edit] was pressed	The operation message "Program display lock C" appears. The window is opened. (When the edit lock B or C is valid, edit lock B or C is given to priority.)	
When the main menu [P corr] was pressed		
Search from the operation search window	The search can be executed.	The search cannot be executed. The operation message "Program display lock C" appears. The window is not closed. The contents of input area are not cleared.
Search from the restart search window		
Search from the top search window (of restart search)		

Influences of program display lock parameter on edit screen		
Screen operation #1122 pglk_c	1 (Display: Prohibited, Search: Possible)	2 (Display: Prohibited, Search: Prohibited)
The file is automatically opened when changing the edit screen (*1)	The program contents are not displayed. Only "%" is displayed.	- (It is not possible to search, so the file is never automatically opened when changing the edit screen.)
When the file is opened by the menu [Open].	The operation message "Program display lock C" appears. The window is not closed. (When the edit lock B or C is valid, edit lock B or C is given to priority.)	
Display when [Program display] highlights on the 2D check full-screen	The program contents are not displayed. Only "%" is displayed.	
Right side program display when check main menu is selected		
Search from the operation search window of 2D/3D check	The search can be executed.	The search cannot be executed. The operation message "Program display lock C" appears. The window is not closed. The contents of input area are not cleared.

(*1) When changing the edit screen, the file opened immediately before or operation searched/check searched is automatically opened.

5.8.5 Data Protection Keys

Data protection key prevents various data from being set or erased.

The key name differs according to the MTB. Refer to the instruction manual issued by the MTB for details.

The following data can be protected with the data protection key:

- All tool data and the coordinate system preset data using the origin set
- User parameters and common variables
- Machining programs
- Files in the memory card
- Files in the DS

The data protection key is enabled to prohibit the setting, erasing, etc. while the PLC signal is OFF (B contact).

Data protection key has higher protection level than that of Data protection by user's level.

5.8.6 Leading Zero

When creating a new machining program

When the parameter "#8936 Delete leading 0" is set to "1", if a file name consisting only of numerical figures is input, the file is created with "0" at the head of the file name deleted.

However, if the file name is out of the range between 1 and 99999999, the leading "0" is not deleted. This also applies to MTB macros.

In the case of fixed cycles, regardless of the setting of "#8936 Delete leading 0", a file name to create must be 9 digits, and it must not start from "0". Attempting to create a name not following the conditions above will cause an error.

When "#8936 Delete leading 0" is set to "1", if a file name consisting only of numerical figures is input, the leading "0" is deleted when checking whether the file exists or not, and when checking edit lock B/edit lock C.

(Example) For a directory that has a file "1", if a file name "0001" is attempted to be input as a new file, an error will occur.

Example of deleting of leading zero

Input file name	Created file name	Remarks
0012345678	12345678	The leading "0"s are deleted
0123456789	0123456789	As this name is out of the range between 1 and 99999999, the leading "0" is not deleted
0123A	0123A	As a nonnumerical character (alphabet) is included, the leading "0" is not deleted
0123.PR	0123.PR	As a nonnumerical character (extension) is included, the leading "0" is not deleted

When transferring, or comparing files

In a file transfer with "#8936 Delete leading 0" set to "1", only when the file name of the transfer destination consists only of numerical figures, the leading "0" is deleted when the file is transferred.

However, if the file name is out of the range between 1 and 99999999, the leading "0" is not deleted. This also applies to MTB macros.

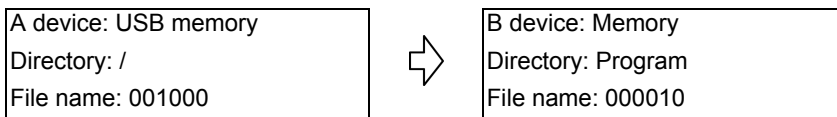
In the case of fixed cycles, regardless of the setting of "#8936 Delete leading 0", the name of the file to transfer must be 9 digits, and it must not start from "0". Attempting to transfer a file whose name does not satisfy the conditions above will cause an error.

In a file comparison, even if "#8936 Delete leading 0" is set to "1", when comparing one separate file that contains one program, "0" at the head of the program name is not deleted. Designating the file name is required.

However, in the case of serial/batch file, comparison is carried out with a leading zero in the program name deleted.

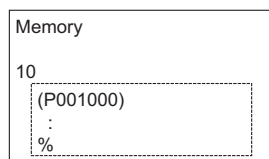
■(Example 1) One file has one program

(1) The files are transferred from the USB memory to the memory.

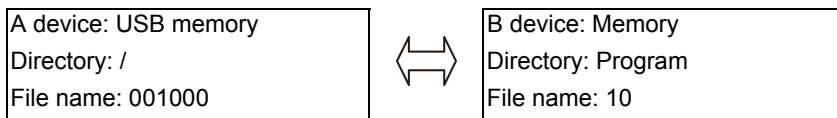


The files are transferred to the memory as follows.

The leading zero is deleted from the file name.

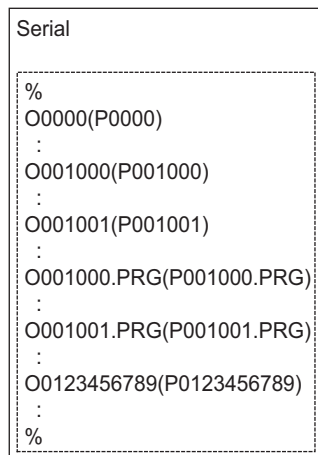


- (2) In order to carry out comparison, change the file name of the transfer destination to "10".
 (In a comparison of one separate file that has one program, as "0" at the head of the program name is not deleted, if the file name remains "000010", it will be compared with the file "000010" of the transfer destination.)

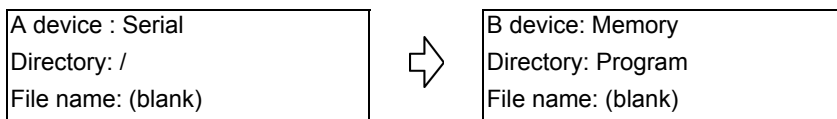


■(Example 2) Serial/Batch file

- (1) The serial of the transfer destination has files as below.

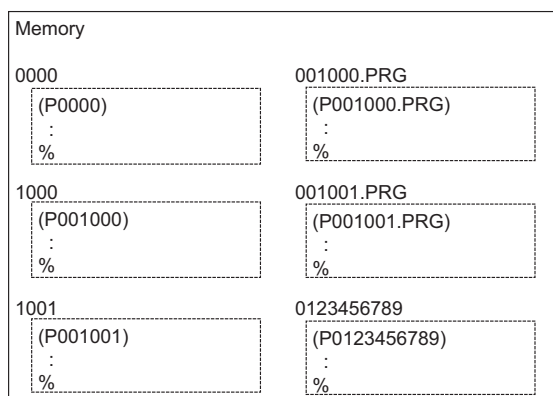


- (2) The files are transferred from the serial to memory.

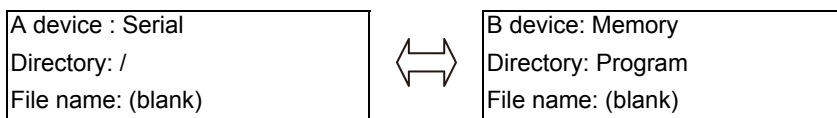


The files are transferred to the memory as follows.

- Files whose leading zeros are deleted: 001000, 001001
- Files whose leading zeros are not deleted as the names are out of the range between 1 and 99999999: 0000, 0123456789
- Files whose leading zeros are not deleted as the names contain nonnumerical characters: 001000.PRG, 001001.PRG



- (3) Comparison is carried out. (As the serial/batch files are compared with the leading zeros deleted, changing file names is not required.)



5.9 The Batch Input/Output the Machining Program of NC Memory

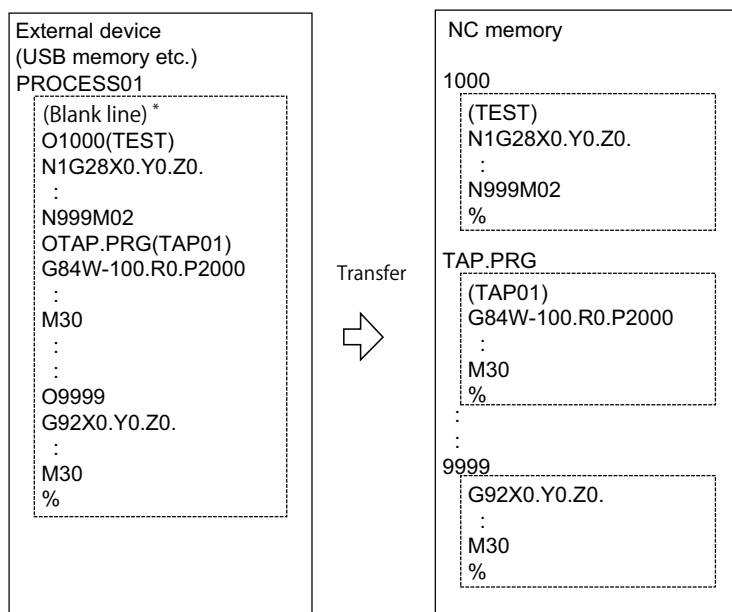


On the I/O screen of the edit (Edit) screen, one file which consists of two or more machining programs can be transferred to NC memory by dividing the file. The machining programs united with one file can be transferred to the external device. The targets are the machining programs of the user.

The target external devices are HD, memory card, DS, Ethernet, serial and USB memory.

Batch input and verify to NC memory

Example of "the external device -> NC memory" of machining program batch transfer



When the external device is serial, the top line is %.


When the transfer direction file name is designated, the top program name of transfer source can be omitted ("O1000" can be omitted in above example).


Comment is not added after a program name when a program is output to an external device, however, if there is comment after a program name when a program is input, the comment is input to the head of the first part system.

- (1) Use the [←] or [⇐] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the transfer source device and directory.
- (3) Designate the file which consists of two or more machining programs.
- (4) Use the [→] or [⇒] key to select file setting column B.
- (5) Designate the transfer direction device (memory).

- (6) Press the menu [Program all].
When the file name is designated, only the top program of transfer source is stored in the designated file. For example of "Example of "the external device -> NC memory" of machining program batch transfer", when "TESTCUT" is designated as the transfer direction file name, the top program is transferred as not "1000" but "TESTCUT".

- (7) Press the menu [Transfr A→B].

- (8) Press the [Y] or [INPUT] key.
When the same machining program already exists in transfer direction device, the operation message "Overwrite this file?(Y/N)" appears. The transferring the following program is continued by selecting [Y] or [N] key.  File transfer is commenced. Transmitting data is displayed in input data display column. The operation message "Transfer complete" appears upon the completion of transmission.

- (9) Press the menu [Compare A:B].  The file comparison starts. The verifying data is displayed. A message appears when the comparison is completed. When the verification error occurs, the error block is displayed in verification data display column and the operation message "Compare error. Compare next file?(Y/N)" appears.

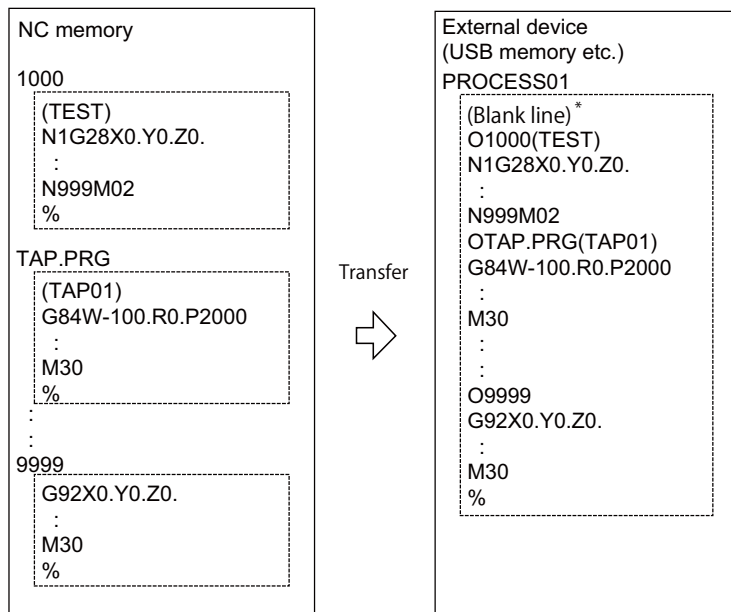
Note

- (1) When programs are input in a batch to NC memory, always specify "Program batch" to NC memory directory as transfer direction. If "Program batch" is not specified, one file is transferred (No batch).
- (2) When the program which is subject to edit lock exists in transfer source, the message "Edit lock B" or "Edit lock C" appears, and transfer is interrupted. When the program which is not subject to edit lock is transferred, delete the program which is subject to edit lock in transfer source. (Refer to "5.8.3 Edit Lock B and C".)
- (3) When the protection of the machining program is valid, the program cannot be transferred/verified. (Refer to "5.8.5 Data Protection Keys".)
- (4) The program during automatic operation, program restart or program checking cannot be overwritten. The operation message "Executing automatic operation", "Program restarting" or "Program checking" appears, and transfer is interrupted.
- (5) If the transfer destination includes the file being edited on the custom screen, the operation message "Can't write into being edited file" appears and the transfer may be interrupted.
- (6) The first line of the transfer source file is ignored.
- (7) When the transfer source is serial, the file is similarly transferred even if the transfer direction setting is the following case 1 and case 2:

	Case 1	Case 2
Device name	Memory	Memory
Directory	Program batch	Program
File name	(Null or file designation)	(Null or file designation)

Batch output and verify from NC memory

Example of "NC memory -> the external device" of machining program batch transfer



When the external device is serial, the top line is %.

- (1) Use the [←] or [←] key to select file setting column A on the I/O screen of the edit screen.
- (2) Designate the transfer source device (memory).
- (3) Press the menu [Program all].
Do not specify the file name. If the name is specified, an error will occur.
- (4) Use the [→] or [→] key to select file setting column B.
- (5) Designate the transfer direction device and directory.
- (6) Designate the transfer direction file to input multiple machining programs.
When the file name is not designated, output to the file "ALL.PRG" of the designated directory.
- (7) Press the menu [Transfr A→B].
- (8) Press the [Y] or [INPUT] key.
When the same machining program already exists in transfer direction device, the operation message "Overwrite this file?(Y/N)" appears. The transferring the following program is continued by selecting [Y] or [N] key.



File transfer is commenced. Transmitting data is displayed in input data display column.
The operation message "Transfer complete" appears upon the completion of transmission.

- (9) Press the menu [Compare A:B].



The file comparison starts. The verifying data is displayed. A message appears when the comparison is completed. When the verification error occurs, the error block is displayed in verification data display column and the operation message "Compare error. Compare next file?(Y/N)" appears.

Note

- (1) When programs are output in a batch from NC memory, always specify "Program batch" to NC memory directory as transfer source. If "Program batch" is not specified, the program is transferred by one program per one file.
- (2) When the programs which are subject to edit lock exists in NC memory, those file is not transferred. (The files are transferred excluding those files.) The verification is executed excluding the programs which are subject to edit lock. (Refer to "5.8.3 Edit Lock B and C".)
- (3) When the protection of the machining program is valid, the program cannot be transferred/verified. (Refer to "5.8.5 Data Protection Keys".)
- (4) When the transfer direction is serial, the program is similarly transferred even if source of following case 1 and case 2 is set.

	Case 1	Case 2
Device name	Memory	Memory
Directory	Program batch	Program
File name	(Null)	* (Wildcard)

Precautions

- (1) When the machining program batch input/output function of NC memory is used, "(" cannot be used for the machining program name. It is recognized that the inside of "(" is a comment.
- (2) The file name of file which consists of two or more machining program can have up to 32 characters, including the extension as well as the machining program.
- (3) When the "Program batch" is designated to NC memory directory, it is not possible to delete, rename and merge files. When the files are deleted in a batch, use "Program" for directory, and a wildcard (*) for file name.
- (4) When you use the all-program batch input/output function for the NC memory, the programs except for those protected are output. If the NC memory contains any protected program, the operation message "Transfer complete. Some file not output" appears.
- (5) For other precautions, refer to "5.3 Transferring a File".

Setting a Tool and a Workpiece

This chapter explains the details of tools and workpieces based on respective menus on the setup (Setup) screen.

6.1 Setting a Tool

Refer to the instruction manual issued by the MTB for details on the tool setting.

6.2 Registering a Tool (Tool Registration Screen)

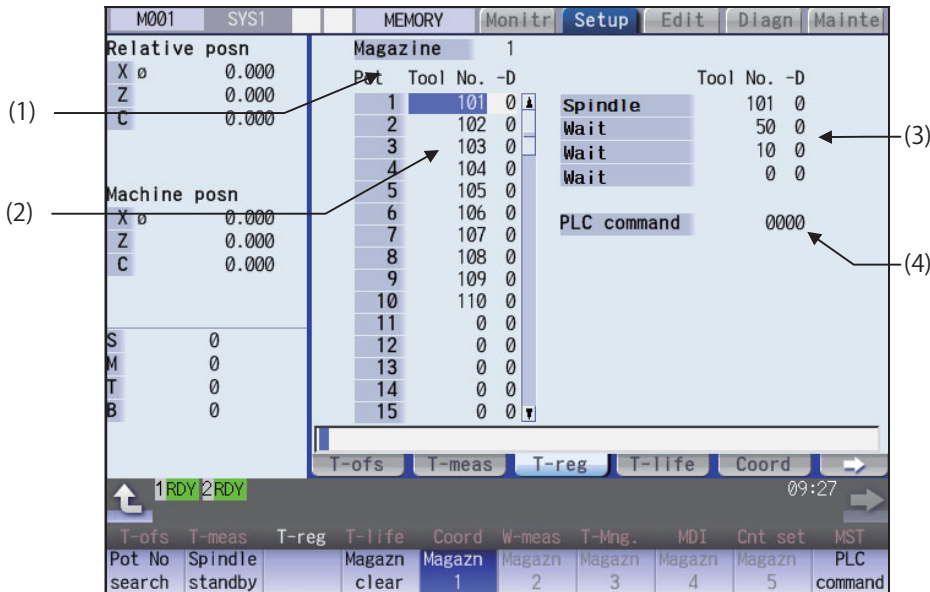


A tool No. is assigned to each tool to make the tools installed on the machine recognizable to the NC on the tool registration (T-reg) screen of the Setup screen. The tool No. is registered corresponding to the magazine pot and spindle where that tool is installed, and the standby location.

When the tool No. and magazine pot are changed by a tool selection command or tool replacement command, the new tool No. is displayed.

When not making an arbitrary setting for the number of registered tools, there are maximum 3 magazines, and up to 120 tools can be registered for each magazines. When making an arbitrary setting, there are a maximum of 5 magazines, and up to 360 tools can be registered for all magazines.

This function differs depending on the specifications of the MTB. Refer to the instruction manual issued by the MTB for details.



Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

Display Items																																																																																		
Display items	Description																																																																																	
(1) Magazine	This displays the currently selected magazine No.																																																																																	
(2) Tool No.-D	A maximum of 8 digits of data can be input for a tool No. (Refer to the manual issued by the MTB for details on the "D" functions and purposes.) When the "Tool No." column is blank, confirm the tool first, since the tool could not be mounted, or the tool could not match the spindle. Setting "0" erases the registered tool.																																																																																	
(3) Spindle/Wait (used by PLC program)	<p>This displays spindle or standby tool No. (The name of this area differs depending on the output from the PLC program.) Spindle/standby display for each magazine varies depending on the setting of the parameter "#11054 Sp-stby disp type".</p> <p><Note></p> <ul style="list-style-type: none"> Spindle/standby tool display varies depending on the setting of the ATC control parameter (R10600). <p>(1) Spindle tool only</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>Spindle</td> <td>101</td> <td>0</td> </tr> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table> <p>(2) Spindle tool, Standby 1</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>Spindle</td> <td>101</td> <td>0</td> </tr> <tr> <td>Stanby1</td> <td>50</td> <td>0</td> </tr> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table> <p>(3) Spindle tool, Standby 1 to 2</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>Spindle</td> <td>101</td> <td>0</td> </tr> <tr> <td>Stanby1</td> <td>50</td> <td>0</td> </tr> <tr> <td>Stanby2</td> <td>10</td> <td>0</td> </tr> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table> <p>(4) Spindle tool, Standby 1 to 3</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>Spindle</td> <td>101</td> <td>0</td> </tr> <tr> <td>Stanby1</td> <td>50</td> <td>0</td> </tr> <tr> <td>Stanby2</td> <td>10</td> <td>0</td> </tr> <tr> <td>Stanby3</td> <td>0</td> <td>0</td> </tr> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table> <p>(5) Spindle tool, Standby 1 to 4</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>Spindle</td> <td>101</td> <td>0</td> </tr> <tr> <td>Stanby1</td> <td>50</td> <td>0</td> </tr> <tr> <td>Stanby2</td> <td>10</td> <td>0</td> </tr> <tr> <td>Stanby3</td> <td>0</td> <td>0</td> </tr> <tr> <td>Stanby4</td> <td>0</td> <td>0</td> </tr> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table> <p>(6) No display</p> <table border="1"> <thead> <tr> <th></th> <th>Tool No.</th> <th>-D</th> </tr> </thead> <tbody> <tr> <td>PLC command</td> <td>1234</td> <td></td> </tr> </tbody> </table>		Tool No.	-D	Spindle	101	0	PLC command	1234			Tool No.	-D	Spindle	101	0	Stanby1	50	0	PLC command	1234			Tool No.	-D	Spindle	101	0	Stanby1	50	0	Stanby2	10	0	PLC command	1234			Tool No.	-D	Spindle	101	0	Stanby1	50	0	Stanby2	10	0	Stanby3	0	0	PLC command	1234			Tool No.	-D	Spindle	101	0	Stanby1	50	0	Stanby2	10	0	Stanby3	0	0	Stanby4	0	0	PLC command	1234			Tool No.	-D	PLC command	1234	
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	Tool No.	-D																																																																																
PLC command	1234																																																																																	
(4) PLC command	This command is used to input data and perform sequence processing using the PLC program.																																																																																	

Menus

Menus	Description
Pot No search	Magazines are displayed sequentially with the selected pot number on the top of them. The cursor moves to the data of the configured pot number, and tool number can be entered.
Spindle standby	This sets or erases the tool No. of spindle and standby tools. The cursor will move to the top tool No. of the spindle and standby tools and the setting mode will be entered.
Magazn clear	This erases all the currently selected magazine tool data (tool number and D). <Note> <ul style="list-style-type: none"> ♦Unselected magazine tool data is not erased. ♦The spindle and standby data cannot be erased.
Magazn 1 : Magazn 5	This designates the magazine No. to be displayed on the screen. The displayed menu differs according to the machine specifications. For example, when there are two magazines, only the menus [Magazine 1] and [Magazine 2] display.
PLC command	The cursor moves to the PLC command setting area and the mode changes to the setting mode.

Tool registration duplication check

When the tool No. is set to the magazine pot and the spindle/standby, tool registration duplication can be checked. Either of "Executing the duplication check for all valid magazines", "The duplication check invalid" or "Executing the duplication check only in the selected magazine" can be selected by the parameter "#8922 T-reg-dup check".

<Priority of duplication check>

Operation	Setting of the operation parameter "#8922 T-reg-dup check"		
	0: Executing the duplication check for all valid magazines	1: The duplication check invalid	2: Executing the duplication check only in the selected magazine
Register tool to magazine pot (Refer to "6.2.1 Registering a Tool in the Magazine Pot".)	1. Magazine n (n =1,2...) 2. Spindle/standby	The duplication check is not executed.	1. Selected magazine 2. Spindle/standby
Set tool No. to spindle/standby (Refer to "6.2.3 Setting and Erasing the Tool No. of Spindle/Standby Tools".)	1. Spindle/standby 2. Magazine n (n =1,2...)	The duplication check is not executed.	1. Spindle/standby 2. Selected magazine

When the value of the parameter "#8922 T-reg-dup check" is out of the range, the check of setting "0" is performed (Executing the duplication check for all valid magazines).

6.2.1 Registering a Tool in the Magazine Pot


Operation method (Selecting a magazine No.)

- (1) Press the menu [Magazn 2].  The tool data of the set magazine No. appears.


Note

- (1) The No. of magazines differs according to the machine specification.

Operation method (Registering the tool in the magazine pot)






- (1) Designate the pot No.
[Pot No search] 21 [INPUT]
- (2) Input the tool number.
50 [INPUT]
- When the [INPUT] key is pressed without setting a value, the tool number does not change and the cursor moves to the "tool number" for the next pot number.
-  When the duplication check is valid, the operation message "Exists in magazine 1. Set? (Y/N)" or "Exists in spindle/standby. Set? (Y/N)", etc. appears if the input tool No. already exists in invalid magazine, spindle/standby.

Note

- (1) Move the cursor with  key to set the "D" data. Refer to the manual issued by the MTB for details on the "D" functions and purposes.
- (2) The duplication check is executed for only the tool No. The check does not depend on the setting of "D".
- (3) If parameter "#8922 T-reg-dup check" is set to "1", the operation message will not appear even when the tool No. duplicates.
- (4) The magazine to be checked varies depending on the setting of the parameter "#8922 T-reg-dup check".

6.2.2 Setting the PLC Command

Operation method (Setting the PLC command)




- (1) Set the value after the menu [PLC command].
[PLC command] 12 [INPUT]  The set value displays in the PLC command setting field, and the PLC command setting mode is enabled. The function of the command depends on the MTB specifications.
- (2) Press either the menu [PLC command],  key or   key to complete the setting.  The PLC command setting mode is released, and the menu highlight returns to normal.

Note




- (1) Select the menu [PLC Command] again before pressing the [INPUT] key, then the menu highlight returns to normal, and the PLC command setting mode becomes disable.

6.2.3 Setting and Erasing the Tool No. of Spindle/Standby Tools

Operation method (Setting the tool No. of spindle/standby tools)

- (1) Press the menu [Spindle standby].
- (2) Move the cursor to the data to be set using the [↑], [↓] keys.
- (3) Input a new tool No.
50 [INPUT]
- (4) Press either the menu [Spindle standby],  key or  The spindle/standby setting mode is canceled.
 key to complete the setting.


Note

- (1) When the menu [Spindle standby],  key or  key is pressed before pressing the [INPUT] key, the spindle/standby setting mode will be canceled and the set data will be ignored.
- (2) Move the cursor with  key to set the "D" data.

Operation method (Erasing the tool No. of spindle/standby tools)


- (1) Press the menu [Spindle standby].
- (2) Move the cursor to the tool No. to be erased and input "0".
0 [INPUT]

Note

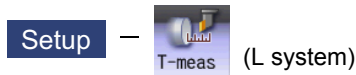
- (1) Move the cursor with  key and set "0" to erase the "D" data as the same manner as the tool No.

6.2.4 Erasing the Tool Registration Data

Operation method (Selecting a magazine number and erasing the tool registration data.)

- (1) Press the menu [Magazn 2].
- (2) Press the menu [Magazn clear].
- (3) Press the [Y] or [INPUT] key.  All selected magazine tool data (tool number and D) is erased.
Spindle/standby tool data is not erased.

6.3 Measuring a Tool (Tool Measurement Screen)



6.3.1 Tool Measurement (M System)

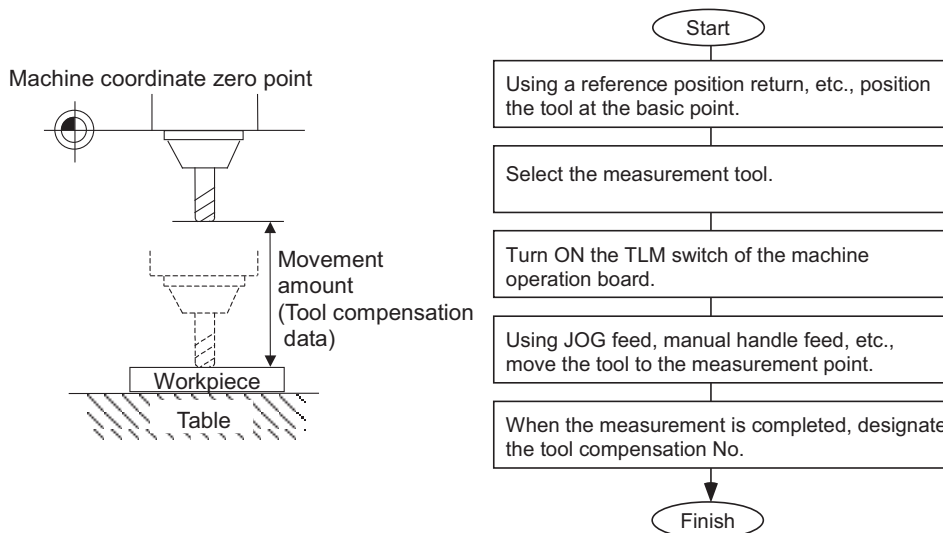
On the tool registration (T-reg) screen of the setup (Setup) screen, the movement distance from the basic point to the measurement point is measured by moving the tool to the measurement point manually, and this value can be set as the tool compensation amount.

Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

There are two types of tool measurement: Tool length measurement I, Tool length measurement II.

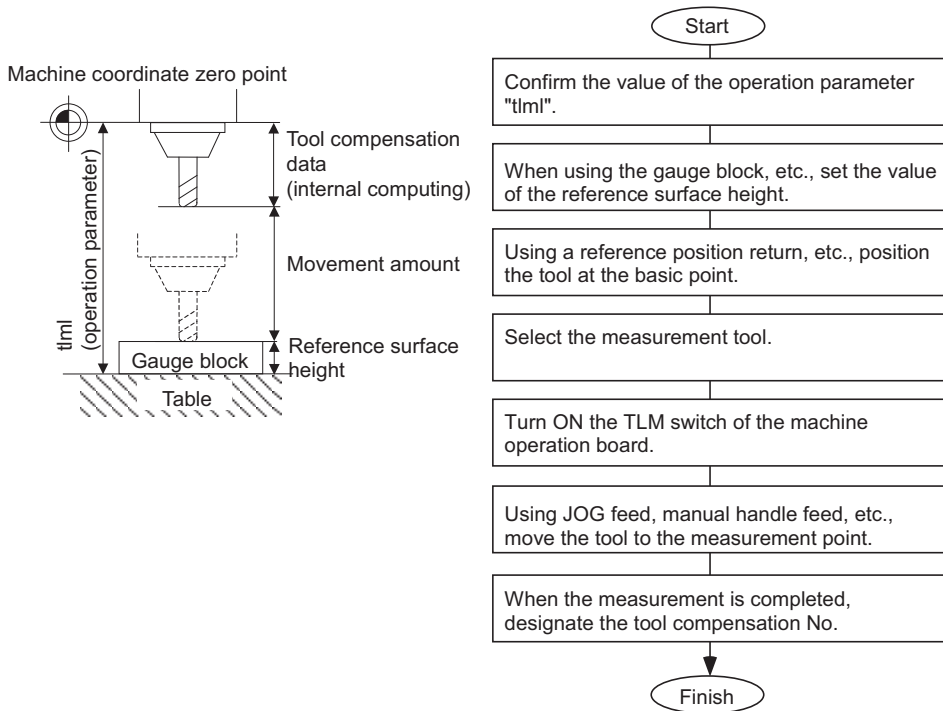
■ Tool length measurement I

When the tool is at the machine coordinate zero point, the distance from the tool tip to the measurement point (workpiece upper end) is measured, and can be set as tool compensation data.



■ Tool length measurement II

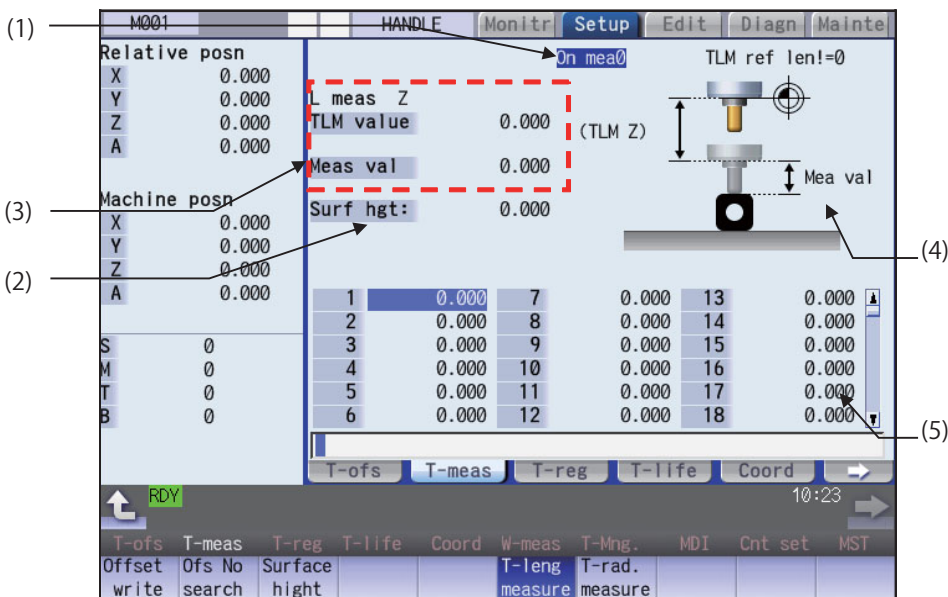
When the tool is at the machine coordinate zero point, the distance from the machine coordinate zero point to the tool tip is measured, and can be set as tool compensation data.

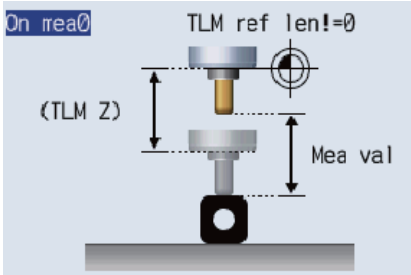
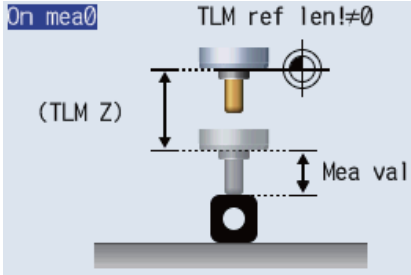


Note

(1) Changing of the tool measurement type is determined based on the measurement axis (tool length measurement axis, tool radius measurement axis) TLM reference length (parameter "#2016 TLM std length") at each measurement mode. When parameter "#2016 TLM std length" is set to "0", or "Surface hight #0=0" is set, the tool measurement type is tool length measurement I.

■ Screen image



Display Items		
Display items	Description	
(1) Manual measurement status display	This displays the manual measurement status. Refer to "Manual measurement status display" described later in this section.	
(2) Reference surface height	This displays a value for the reference surface height. Setting range: -99999.999 to 99999.999 (mm)	
(3) Counter display	<p>TLM value: This displays the value during measurement. (*1)</p> <p>This will be the same as the machine position until the sensor is contacted. This will be the skip coordinate position after the sensor is contacted.</p> <p>Measurement value:</p> <p>For tool length measurement type I: TLM value - Reference surface height</p> <p>For tool length measurement type II: TLM value - Reference surface height + TLM reference length</p> <p>For tool radius measurement, measurement result is displayed in absolute value.</p>	
L meas: (Axis name) R meas: (Axis name)	The axis selected in the parameters "#8711 TLM L meas axis" and "#8712 TLM D meas axis" is the target axis for the measurement.	
(4) Guide graphic	<p>Displays the measurement image. The contents of the guide drawing will differ depending on the tool length measurement (I or II).</p> <p>Tool length measurement I guide drawing Tool length measurement II guide drawing</p> <div style="display: flex; justify-content: space-around;">   </div>	
(5) Tool compensation data	<p>Displays the tool compensation data. The contents of the tool compensation data to be displayed vary depending on the tool compensation type (I, II, or III).</p> <p>When tool compensation type III is selected, the display is the same as for tool compensation type II.</p> <p>Cursor movement, data input and part system changing operation are same as tool compensation types I and II.</p>	

(*1) The TLM value counter differs according to the parameter "#1328 TLM type" value.
 0: The position when the measurement switch was turned ON is displayed as 0.
 1: The display is based on the machine zero point.





Note

(1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data can be measured in the automatic operation mode or operation pause mode.

Menus

Menus	Description
Offset write	This writes the value displayed in "Mea value" as the tool compensation amount. The wear amount is cleared to "0" for the tool compensation type II. The tool compensation amount cannot be written in when the menu [Offset No.] or [Surface hight] is highlighted. <Note> •When the parameter "#8924 Meas. confirm msg" is "1", this menu is highlighted and the operation message "OK? (Y/N)" appears. The measurement result is written as tool compensation amount by pressing [Y] or [INPUT] key. Even if other key is pressed, the result is not written. When this menu is pressed again while displaying the message, the highlighting is canceled and the operation message is erased.
Ofs No search	When the compensation No. is set and the [INPUT] key is pressed, the tool compensation data with that number at its head appears. The cursor moves to the length dimension data of the top line of that data.
Surface hight	This sets the reference surface height data. (The cursor moves to the reference surface height.) When the data is set in the input area and the [INPUT] key is pressed, the reference surface height is set.
T-leng measure	This changes the mode to the tool length measurement mode. This mode is enabled when turning ON the power. (The cursor moves to the length dimension position for tool compensation type II or III.)
T-rad. measure	This changes the mode to the tool radius measurement mode. (The tool measurement type is valid only for tool length measurement II.) (The cursor moves to the radius dimension position for tool compensation type II or III.)

Carrying out tool length measurement

- (1) Turn ON the measurement switch.
Refer to the PLC Interface Manual for details on measurement switch signals.  The message "On mea 0" appears.
- (2) Press the menu [T-leng measure].  The menu is highlighted, and the tool length measurement starts. The measurement values are displayed in "Meas value" during the measurement.
The menu [T-leng measure] is highlighted as a default after the power is turned ON.
- (3) Contact the measurement tool against the sensor, using manual feed and manual handle feed. Stop the feed when the tool contacts the sensor.  When the measurement tool contacts the sensor, the skip position displayed in the measurement values counter.
- (4) The cursor moves to the compensation No. that sets the measurement results.
(Example) [Ofs No search] 12 [INPUT]
The cursor display position differs depending on the measurement mode.
Tool length measurement mode: Length dimension
Tool radius measurement mode: Radius dimension
- (5) Press the menu [Offset write].  The measurement values are written as a tool compensation amount.
The wear amount is cleared to "0" for the tool compensation type II.
- (6) Turn OFF the measurement switch to finish measuring.

Note

- (1) The measurement values are not written if the cursor is in a position other than "Length" or "Radius".
- (2) The axis returns and stops after contacting the sensor, but be careful not to move the axis after that. If the axis moves after contacting the sensor, the distance that was actually moved will be added to the measurement values counter, and the skip position will not be held.

Manual measurement status display

The display will change as shown below during manual measurement.

Display	Meaning
On mea 1	This state is entered if a skip signal is input during manual measurement. The "On mea 2" state is shifted to after deceleration stop is confirmed.
On mea 2	This is the state during the first retract operation. The "On mea 3" state is shifted to after retracting the retract amount.
On mea 3	This is the state in which retract by the retract amount has completed. If the skip after deceleration stop confirmation signal is ON, the status display will remain the same. The "On mea 0" state is shifted to when this state is reset.
On mea 4	This is the state during the second measurement. If the skip signal is not input even after moving to the specified position, a warning will appear, and the status display will remain the same. The "On mea 0" state is shifted to when this state is reset.
On mea 5	This state is entered when the skip signal is input during the second measurement. The "On mea 6" state is shifted to after deceleration stop is confirmed.
On mea 6	This is the state during the second return operation. The "On mea 0" state is shifted to after retracting the retract amount.
On mea 0	This state is entered when not in the "On mea 1" to "On mea 6" states.

Carrying out tool radius measurement

The operating procedure of the tool radius measurement and submenu details are the same as when measuring tool length. (Use [T-rad. measure] instead of [T-leng measure].)

6.3.2 Tool Measurement (L System)

Manual tool length measurement I or II can be performed on the tool registration (T-reg) screen of the setup (Setup) screen. Either one is selected depending on the setting of measurement switch and operation mode.

Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

There are two types of key operation for Manual tool length measurement I: normal operation mode and simple operation mode, which can be selected by the parameter "#8957 T meas (L)-Simple".

#8957	Manual tool length measurement I operation mode
0	Normal operation mode
1	Simple operation mode

■Manual tool length measurement I (when measurement switch is ON)

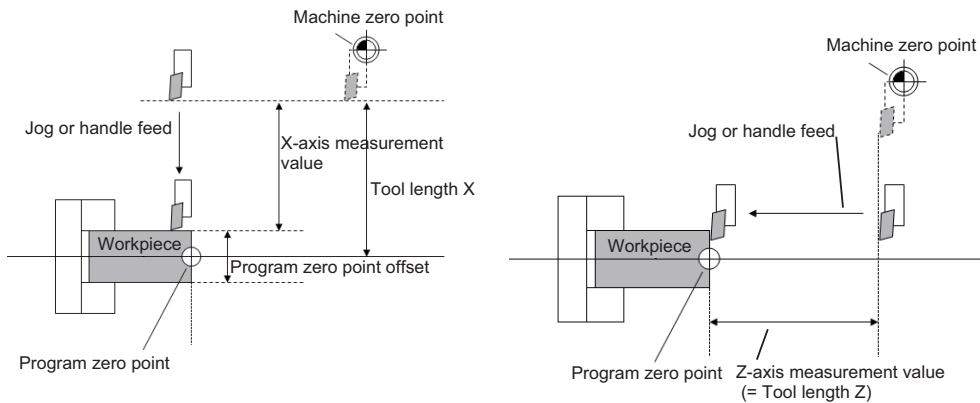
There are three methods for manual tool length measurement I, and the values to set for the measurement basic point will differ. Set the measurement method by the parameter "#11087 Meas basic point".

#11087	Method	Measurement basic point
0	Machine zero point designation method	Machine coordinate zero point
1	Parameter designation method	The coordinates set by "#2015 tml-"
2	Workpiece coordinate system offset designation method	Workpiece coordinate offset (modal)

<Machine zero point designation method (#11087 = 0)>

In this method, the machine coordinate system zero point is the measurement point.

Move the tool to the face or side, and calculate the tool compensation amount from the measurement position (machine position) and program zero point offset (L).



The tool length is automatically calculated by the following formula:
 Tool length = Measurement position - Program zero point offset (L)

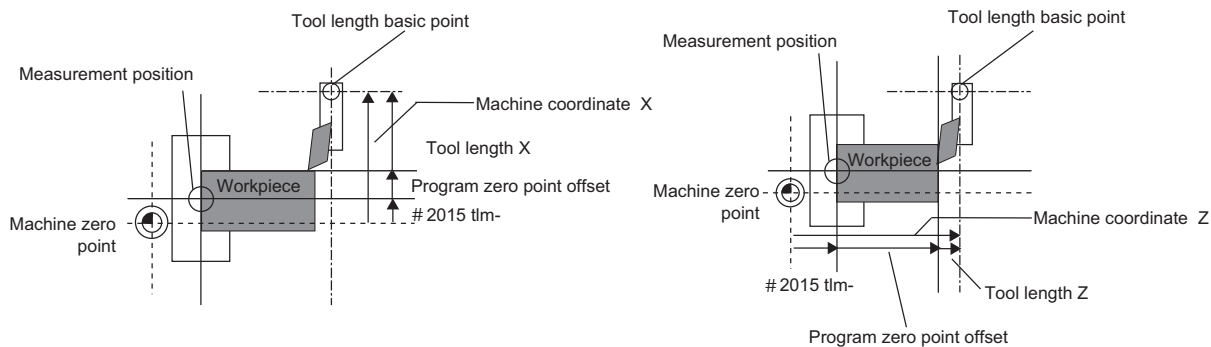
Note

- (1) To the program zero point offset (L), set the diameter value for a diameter axis (#1019 dia = 1) and the radius value for a radius axis (#1019 dia = 0).

<Parameter designation method (#11087 = 1)>

In this method, the offset from the machine coordinate system zero point set in "#2015 tml-" is treated as the measurement basic point.

Move the tool to the face or side, and calculate the tool compensation amount from the measurement position (machine position - measurement zero point (#2015 tml-)) and program zero point offset (L).



The tool length is automatically calculated by the following formula:

Tool length = Measurement position (machine coordinate value - measurement zero point (#2015 tml-)) - Program zero point offset (L)

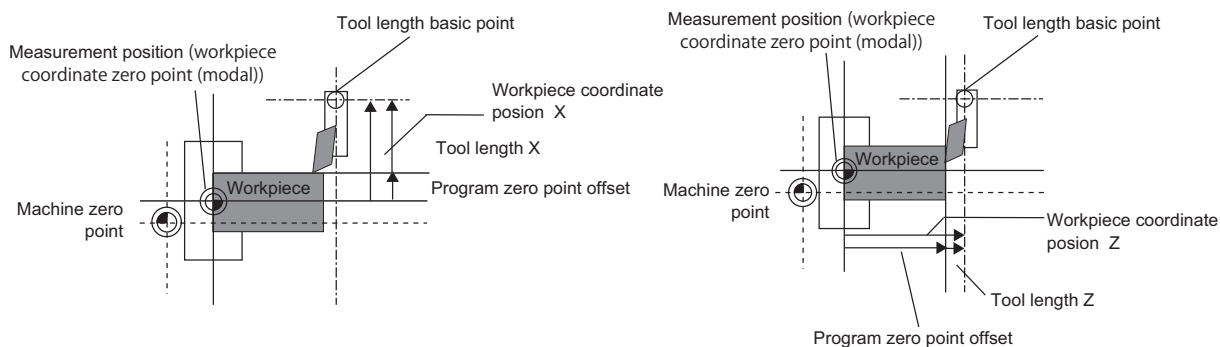
Note

- (1) The measurement zero point is always the radius value regardless of the diameter/radius command.
- (2) For the program zero point offset (L), set the diameter value for a diameter axis (#1019 dia = 1) or the radius value for a radius axis (#1019 dia = 0).

<Workpiece coordinate system offset method (#11087 = 2)>

In this method, the workpiece coordinate system offset (modal) is treated as the measurement basic point.

Move the tool to the face or side, and calculate the tool compensation amount from the measurement position (workpiece coordinate position) and program zero point offset (L).



The tool length is automatically calculated by the following formula:

Tool length = Measurement position (workpiece coordinate position) - Program zero point offset (L)

Note

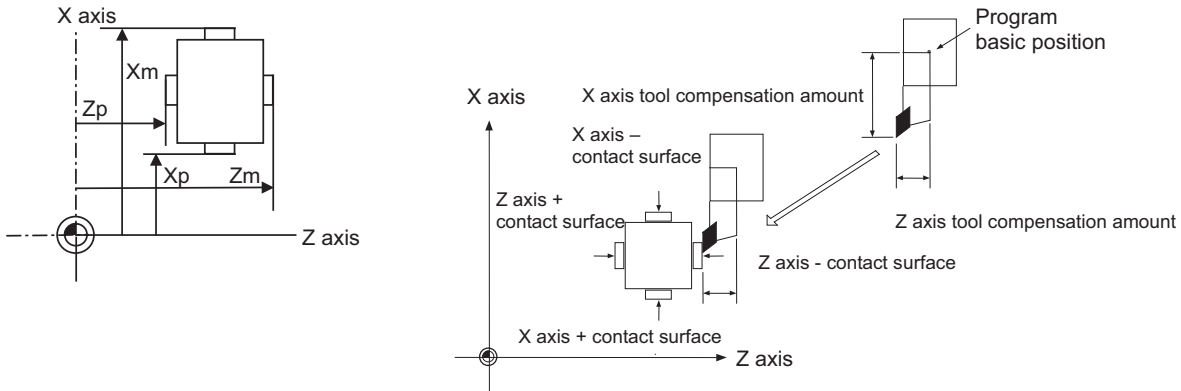
- (1) For the program zero point offset (L), set the diameter value for a diameter axis (#1019 dia = 1) or the radius value for a radius axis (#1019 dia = 0).

■ Manual tool length measurement II

By using a device having a touch sensor, the tool compensation amount can be calculated just by contacting the tool nose against the touch sensor with manual feed.

Set the measurement basic position (sensor position) with the parameter "#2015 tlmI-" and "#2016 tlmI+" when using the main spindle side, "#2097 tlmI-" and "#2098 tlmI+" when using the sub spindle side.

[Setting the measurement basic position]



When measured at the main spindle side:

Xm: - sensor machine coordinate position X axis (position measured by moving in - direction) -> #2015 tlmI- X axis

Zm: - sensor machine coordinate position Z axis (position measured by moving in - direction) -> #2015 tlmI- Z axis

Xp: + sensor machine coordinate position X axis (position measured by moving in + direction) -> #2016 tlmI+ X axis

Zp: + sensor machine coordinate position Z axis (position measured by moving in + direction) -> #2016 tlmI+ Z axis

When measured at the sub spindle side:

Xm: - sensor machine coordinate position X axis (position measured by moving in - direction) -> #2097 tlmI2- X axis

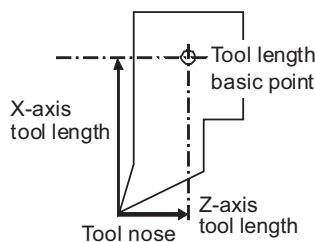
Zm: - sensor machine coordinate position Z axis (position measured by moving in - direction) -> #2097 tlmI2- Z axis

Xp: + sensor machine coordinate position X axis (position measured by moving in + direction) -> #2098 tlmI2+ X axis

Zp: + sensor machine coordinate position Z axis (position measured by moving in + direction) -> #2098 tlmI2+ Z axis

Tool compensation amount = Machine coordinate position (machine coordinate position at the time of skip input) - Measurement basic position (sensor position)

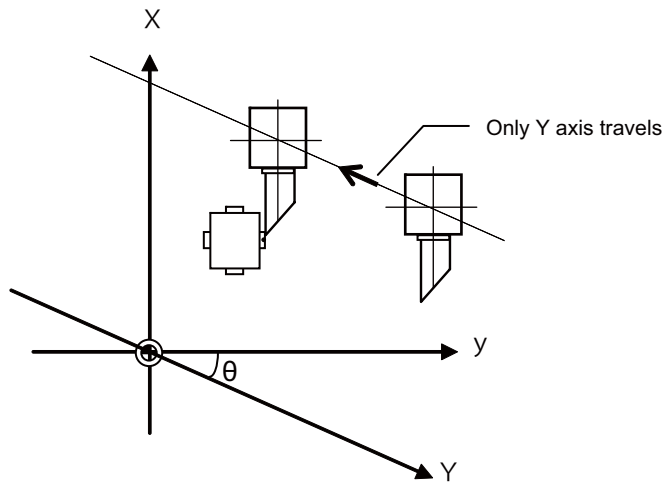
The expression above is used for automatic calculation in Manual tool length measurement II.



When the tool touches the touch sensor while measurement switch is ON, the calculation result is set in the tool data of the compensation No. specified with "Tool No. (Tool length measurement 2)" (PLC device), and the wear data of the compensation No. set in "Wear compensation No. (Tool presetter)" (PLC device) is cleared.

When measuring the tool length of the basic axis and inclined axis during the inclined axis control, the measurement basic position (sensor position) is set on the sensor position within the orthogonal coordinate, not the position within the machine coordinate.

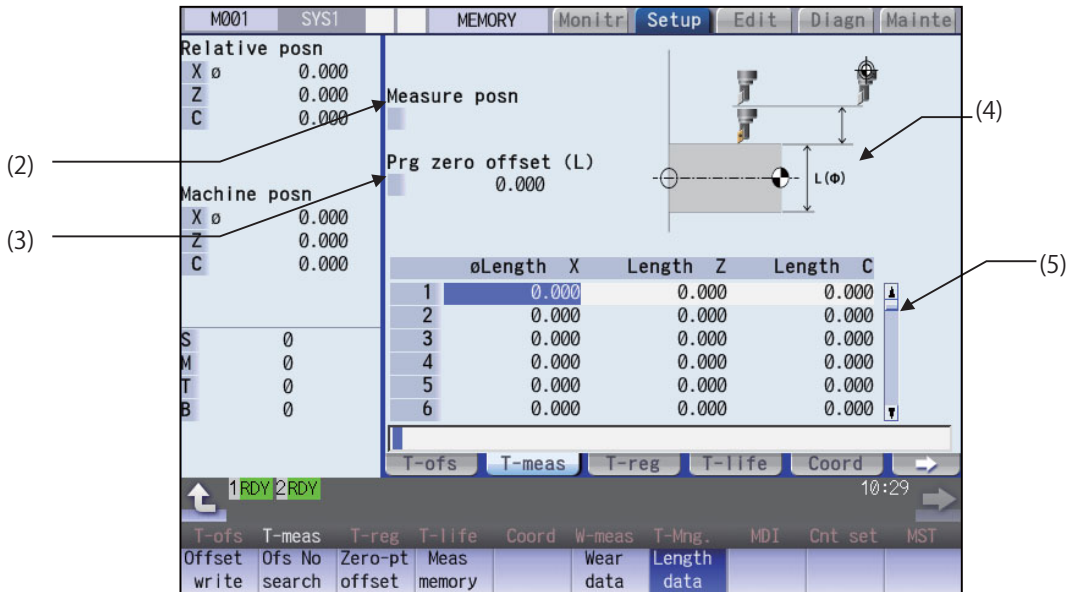
(Example) When X axis is the basic axis and Y axis is the inclined axis.



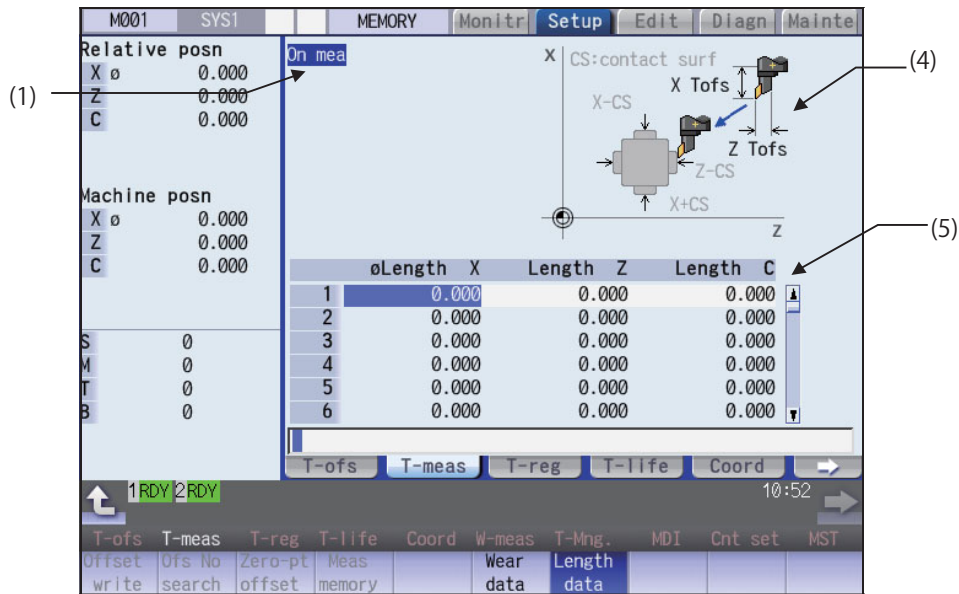
X: Actual X axis
Y: Actual Y axis
y: Orthogonal coordinate
 θ : Inclined angle

■Screen image

[Manual tool length measurement I]

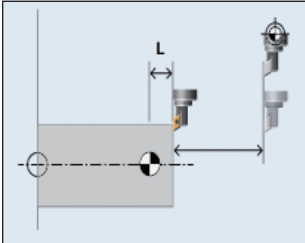
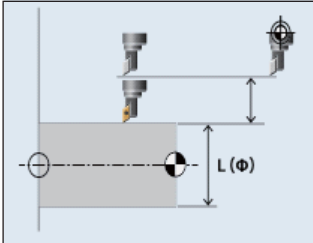
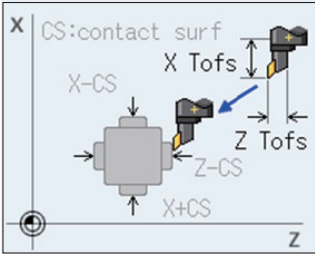




[Manual tool length measurement II]



Display Items

Display items	Description
(1) On mea	<p>"On mea" is displayed when the measurement switch is ON.</p> <p><Note></p> <ul style="list-style-type: none"> ♦This is displayed only in "Manual tool length measurement II".
(2) Measure posn	<p>When "Manual tool length measurement I" is performed, the measurement result and measurement axis are displayed.</p> <p><Normal operation mode></p> <p>Measurement result is displayed by pressing the menu [Meas memory] when the cursor is placed at the axis to be measured.</p> <p>Measurement Position: Machine position when the menu operation is performed.</p> <p><Simple operation mode></p> <p>Measurement result for the axis selected using either the menu [Measure X] or the axis address key.</p> <p>Measurement Position: Machine position when the menu operation or address key operation is performed.</p> <p><Note></p> <ul style="list-style-type: none"> ♦This is displayed only in "Manual tool length measurement I". ♦The data of maximum 3 axes displays when "Manual tool length measurement I (Simple operation mode)" is selected.
(3) Prg zero offset (L)	<p>Workpiece measurement result is set and displayed.</p> <p>Setting range: -99999.999 to 99999.999 (mm)</p> <p><Normal operation mode></p> <p>Setting is possible by pressing the menu [Zero-ptoffset] or touching the value area of the "Prg zero offset (L)".</p> <p><Simple operation mode></p> <p>Select the axis to measure using either the menu [Measure X] or the axis address key. Then the cursor moves to "Prg zero offset (L)", where setting a measured value is enabled.</p> <p><Note></p> <ul style="list-style-type: none"> ♦The data of maximum 3 axes displays when "Manual tool length measurement I (Simple operation mode)" is selected.

Display items	Description
(4) Guide graphic	<p>Displays the measurement image. The contents of the guide drawing will differ depending on which measurement type (Manual tool length measurement I or II) is selected.</p> <p><Manual tool length measurement I:> The guide drawing will be switched to the selected axis, when the handle mode is selected.</p> <p><Z axis></p>  <p><Other axes></p>  <p><Manual tool measurement II> The guide drawing when using the touch sensor is displayed.</p> 
(5) Tool compensation data	<p>Displays the tool compensation data.</p> <p><Note></p> <ul style="list-style-type: none"> ♦Cursor movement, data input and part system changing operation are same as "Tool compensation type III (L system)". ♦Automatically jumps to the compensation No. registered in "Tool No. (Tool length measurement 2)" (PLC device) during manual tool length measurement II. (Jumps even when the wear data is being displayed.) Note that the [↑], [↓],  and  keys are disabled. ♦The screen displays the compensation data of four axes when the parameter "#12103 2nd add T-ofs ON" (2nd additional axis tool offset ON) is valid.

Note

- (1) The values of "Measure posn" and "Prg zero offset (L)" will be cleared when changing of part systems, screens and measurement modes are carried out.
- (2) When the parameter "#11017 T-ofs set at run" (Tool compensation amount setting during automatic operation enabled) is set to "1", the tool compensation amount data can be set even during automatic operation or operation pause.

Menus (Manual tool length measurement 1 (normal operation mode) and Manual tool length measurement 2)

Menus	Description
Offset write	<p>Depending on the mode, the following value is input as the tool compensation amount at the cursor position, and the wear amount is cleared to "0".</p> <p>Manual tool length measurement I Tool compensation amount = "Measure posn" value - "Prg zero offset (L)" value The values of "Meas posn" and "Prg zero offset (L)" will be cleared after compensation amount is written in "Manual tool length measurement I".</p> <p><Note></p> <ul style="list-style-type: none"> ♦ Tool compensation amount cannot be written in the following cases: <ul style="list-style-type: none"> - When the menu [Offset No.] and [Zero-ptoffset] are highlighted - When the wear data is being displayed - When the measurement result exceeds the setting range ♦ If "Manual tool length measurement II", this is grayed out and non-selectable. ♦ When the parameter "#8924 Meas. confirm msg" is "1", this menu is highlighted and the operation message "OK? (Y/N)" appears. The measurement result is written as tool compensation amount by pressing [Y] or [INPUT] key. Even if other key is pressed, the result is not written. When this menu is pressed again while displaying the message, the highlighting is canceled and the operation message is erased.
Ofs No search	<p>When the compensation No. is set and the [INPUT] key is pressed, the tool compensation data with that number at its head appears.</p> <p><Note></p> <ul style="list-style-type: none"> ♦ If the measurement switch is turned ON, this is grayed out and non-selectable.
Zero-pt offset	<p>This sets the "Prg zero offset (L)" value. If this menu is pressed, the cursor moves to the "Prg zero offset (L)" value.</p> <p>Point the cursor to the axis to be set, and set the data in the data setting area. Press the [INPUT] key to set the "Prg zero offset (L)" value.</p> <p><Note></p> <ul style="list-style-type: none"> ♦ If any mode other than "Manual tool length measurement I" is selected, this is grayed out and non-selectable.
Meas memory	<p>Measurement result is calculated from the current machine position and displayed.</p> <p><Note></p> <ul style="list-style-type: none"> ♦ If any mode other than "Manual tool length measurement I" is selected, this is grayed out and non-selectable.
Wear data	<p>Wear data is displayed in tool compensation data.</p>
Length data	<p>Tool length data is displayed in tool compensation data. This is the default mode when the power is initially turned ON.</p>

Note

- (1) The data displayed on the tool offset screen are not linked with the tool offset data on the tool measurement screen. (If the tool measurement screen is opened with tool wear data shown on the tool offset screen, the wear data will not always appear on the tool measurement screen.)

Menus (Manual tool length measurement 1 (Simple operation mode))

Menus	Description
Offset write	<p>The following value is written as the tool compensation amount, and the wear is cleared to "0".</p> <p>Tool compensation amount = "Measure posn" value - "Prg zero offset (L)" value</p> <ul style="list-style-type: none"> ◆When the tool offset is written, the "Measure posn" and "Prg zero offset (L)" are cleared. The cursor moves to the tool compensation data. ◆The offset cannot be written in the following state. The operation message - "Can't write compensation data" is displayed. <ul style="list-style-type: none"> (a) When the menu [Offset number] is highlighted (b) During wear data display (c) When the measurement axis is not selected ◆If the tool compensation amount is outside the setting range, the offset writing fails. The operation message "Setting error" is displayed. <p><Note></p> <ul style="list-style-type: none"> ◆When the parameter "#8924 Meas. confirm msg" is set to "1", the menu "Offset write" is highlighted and confirmation message "OK? (Y/N)" is displayed. When you press the [Y] (or [INPUT]) key, the measurement position is written as the tool compensation amount. When you press any other key, the offset is not written. At this time, menu highlighting is canceled and the operation message is erased. <p>If you press the menu [Offset Write] again during operation message display, the reverse display is released and the operation message is also erased.</p>
Ofs No search	<p>When the compensation No. is set and the [INPUT] key is pressed, the tool compensation data with that number at its head appears.</p> <p>This operation will not change the column where the cursor is placed.</p> <p>If this operation is carried out with the cursor placed at "Prg zero offset (L)", the cursor will remain displayed at "Prg zero offset (L)".</p>
Measure X	<p>Select the axis to measure. The menu is highlighted when it is selected. Multiple axes can be selected. To cancel, press the menu key again or press [Cancel value]. (*1)</p>
Measure Z	<p>Select the axis to measure. The menu is highlighted when it is selected. Multiple axes can be selected. To cancel, press the menu key again or press [Cancel value]. (*1)</p>
Measure C	<p>Select the axis to measure. The menu is highlighted when it is selected. Multiple axes can be selected. To cancel, press the menu key again or press [Cancel value]. (*1)</p>
Wear data	<p>Wear data is displayed in tool compensation data.</p>
Length data	<p>Tool length data is displayed in tool compensation data.</p> <p>This mode is enabled when turning ON the power.</p>
Cancel value	<p>This cancels displaying the value of the measurement result and "Prg zero offset (L)". The cursor moves from "Prg zero offset (L)" to the tool compensation data.</p> <p>If any mode other than "Manual tool length measurement I" is selected, this menu will be grayed out and non-selectable.</p>

(*1) The axis name to be displayed follows the parameter "#1013 axname".






Note

- (1) The data displayed on the tool offset screen are not linked with the tool offset data on the tool measurement screen. (If the tool measurement screen is opened with tool wear data shown on the tool offset screen, the wear data will not always appear on the tool measurement screen.)

Carrying out tool measurement (Manual tool length measurement I)


■ Normal operation mode

(Example) Carrying out tool measurement for compensation No.3, X axis

- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
- (2) Point the cursor to the position (compensation No. 3, X axis) where the measurement result are to be set.  The cursor is displayed at compensation No.3, X axis.
<Note>
 - In order to measure a different axis, point the cursor to the axis to be measured and perform the following operations.
- (3) Move the tool to the side surface of the workpiece. (In the case of Z-axis move the tool to the end surface of the workpiece.)
- (4) The menu [Meas memory] is pressed without retracting the tool.  Save the measurement result. Saved value is displayed in the measurement area.
- (5) Retract the tool and measure the workpiece. And then press the menu [Zero-ptoffset].  The menu [Zero-ptoffset] is highlighted and the cursor moves to the program zero-point offset (L) value.
- (6) Measure the workpiece and set the offset value from the tool position (side surface of the workpiece) to the program zero-point.
10 [INPUT]  10 is set for the "Prg zero offset (L)" value. Highlight of the menu [Zero-ptoffset] is canceled and the cursor moves to the tool compensation data.
<Note>
 - Compensation amount is written in diameter value for diameter command, or in radius value for radius command.
- (7) Press the menu [Offset write].  "Measurement result - workpiece measurement value" is set to compensation No.3, X axis.
<Note>
 - The values of "Measure posn" and "Prg zero offset (L)" are cleared.

■ Simple operation mode

(Example) Carrying out tool measurement for compensation No.3, X axis




- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
- (2) Move the cursor to the position to input the measurement result (compensation No.3).  The cursor is displayed at compensation No.3.
- (3) Move the tool to the side surface of the workpiece. (In the case of Z-axis move the tool to the end surface of the workpiece.)

- (4) Press the address key of the axis to measure or the menu [Measure X], without retracting the tool. → Save the measurement result. The memorized value is displayed at "Prg zero offset (L)", and the cursor moves to "Work meas". The operation message "Input program Z-point offset" displays.
- (5) To measure the other axes at the same time, repeat (3) to (4). → Save the measurement value of the selected axis. Saved value is displayed in the measurement area. The cursor will not move from the top line.
- (6) Retract the tool and measure the workpiece.
- (7) Measure the workpiece and set the offset value from the tool position (side surface of the workpiece) to the program zero-point. (Example) 10 [INPUT] → The value 10 is set in the top line of "Prg zero offset (L)". If there are two or more axes to measure, the cursor moves down to the next line.
<Note>
♦ Compensation amount is written in diameter value for diameter command, or in radius value for radius command.
- (8) To set the "Prg zero offset (L)" of the other axes, repeat (7). (Example) 5 [INPUT] → The value "5" is set to the 2nd line of "Work meas".
<Note>
♦ Compensation amount is written in diameter value for diameter command, or in radius value for radius command.
- (9) Press the menu [Offset write]. The result of "Meas val - Prg zero offset (L)" will be set as the compensation amount for X and Z axes of the compensation No.3 (where the cursor is currently positioned).
<Note>
♦ The values of "Measure posn" and "Prg zero offset (L)" are cleared, and the highlighted menus ([Measure X] - [Measure C]) will return to original status.

Precautions for manual tool measurement I

- (1) When compensation amount is written for an axis that has not completed zero point return, the operation message "TLM axis not returned to ref. position" will appear.
- (2) When the parameter "#8924 Meas. confirm msg" is set to "1", the menu "Offset write" is highlighted and confirmation message "OK? (Y/N)" is displayed. When you press the [Y] (or [INPUT]) key, the measurement position is written as the tool compensation amount. When you press any other key, the offset is not written. At this time, menu highlighting is canceled and the operation message is erased.
- (3) When the parameter "#1124 ofsfix" is set to "0", the cursor moves to the next offset No. However, when "#1124 ofsfix" is "1", the cursor does not move to the next offset No.
- (4) When the parameter "#11017 T-ofs set at run" (Tool compensation amount setting during automatic operation enabled) is set to "1", the tool compensation amount data can be set even during automatic operation or operation pause.
- (5) When the parameter "#8174 T meas. in mirror" is set to "1", the measurement result of the axis in mirror image (PLC signal (MIR 1 to 8) is ON) will be set to the compensation amount with the sign highlighted.

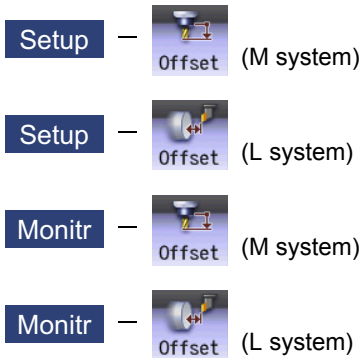
Carrying out tool measurement (Manual tool length measurement II)

- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
- (2) Set the compensation No. of the compensation data to be set in "Tool No. (Tool length measurement 2)" (PLC device).
- (3) Set the compensation No. of the wear data to be cleared in "wear compensation No. (tool presetter)" (PLC device).
- (4) Turn ON the measurement switch.  "On mea" is displayed.
Guide drawing for manual tool length measurement II is displayed.
Tool compensation data is displayed, placing the compensation No. set in "Tool No. (Tool length measurement 2)" (PLC device) at the top.
<Note>
♦The row at the cursor position will not be changed.
- (5) Move the additional axis in the minus direction by manual feed and have the tool nose contact with the touch sensor.  Measurement value is set for the additional axis of the compensation No. set in "Tool No. (Tool length measurement2)" (PLC device).
- (6) Turn the measurement switch OFF.  "On mea" disappears.

Note

- (1) When entering the sensor area, the axis can be moved only in one direction selected from +X, -X, +Z, -Z, (+Y, -Y). If two axes are moved simultaneously, measurement will not be carried out. However the axis movement stops for safety with displaying "TLM axis is illegal".
- (2) If the tool nose is contacting the sensor, the axis can be moved only in the direction moving away from the sensor. Whether or not the tool nose is detached from the sensor can be judged by the following conditions.
 - ♦The sensor signal has been turned OFF for 500 ms or more.
 - ♦The tool nose is moved 100 μm or more after the sensor signal has turned OFF.
 The above conditions are set with parameter "#1227 aux11/bit2" (measures against tool setter chattering).
- (3) When the parameter "#8174 T meas. in mirror" is set to "1", the measurement result of the axis in mirror image (PLC signal (MIR 1 to 8) is ON) will be set to the compensation amount with the sign highlighted.

6.4 Setting Tool Compensation Amount (Tool Offset Screen)



The tool compensation data can be set and displayed tool offset (T-ofs) screen of the setup (Setup) screen.

For M system, three types of tool compensation can be switched by the setting of the parameters "#1037 cmdtyp" and "#1046 T-ofs disp type".

- Tool compensation type I (#1037=1/#1046=0)
- Tool compensation type II (#1037=2/#1046=0)
- Tool compensation type III (#1046=1)

For L system, tool compensation type III is selected regardless of the setting of the parameter #1037/#1046".

The tool radius compensation can be carried out using the diameter value if the parameter "#8117 OFS Diam DESIGN" is set to "1".

The number of tool compensation sets to be designated or displayed varies depending on the additional specifications.

Tool compensation data can be set or displayed on the monitor (Monitr) screen.

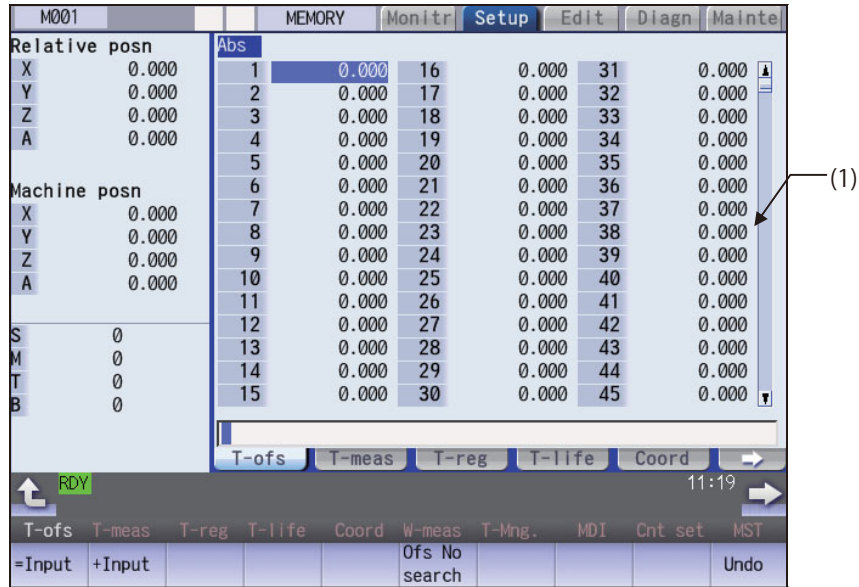
Note

- (1) When the tool compensation amount setting during automatic operation is enabled ("#11017 T-ofs set at run" = "1"), the tool compensation amount data can be set even during automatic operation or operation pause.

[Tool compensation type I](M System): Parameter "#1037 cmdtyp" = 1

The combined amount of the shape compensation and wear compensation are set as the compensation data, with no distinction between shape compensation memory and wear compensation memory. (The tool compensation data is the shape compensation amount + wear compensation amount.)

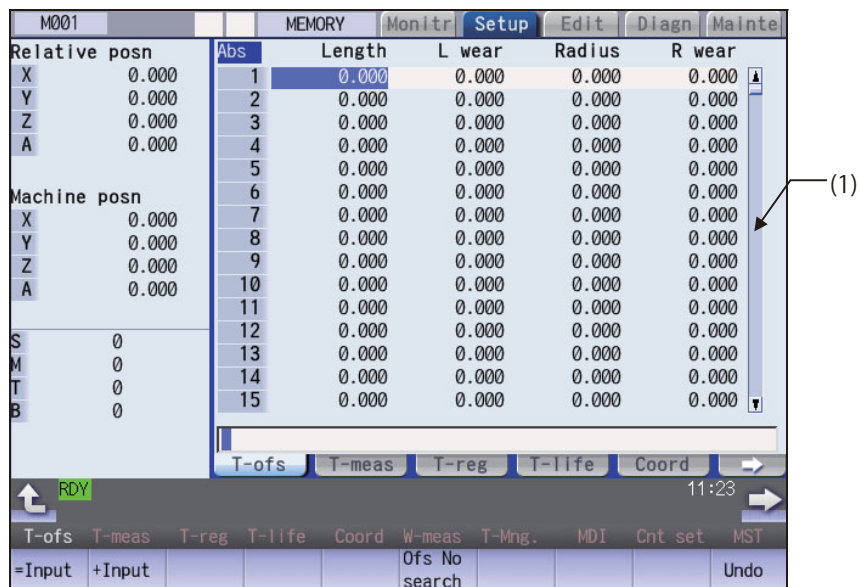
The compensation data is used commonly for the tool length compensation, tool position offset, tool radius compensation, and three-dimensional tool radius compensation.



[Tool compensation type II] (M System): Parameter "#1037 cmdtyp" = 2

The shape compensation amount and wear compensation amount are set separately. The shape compensation amount is furthermore divided into length and radius dimensions.

Of the compensation data, the length dimension data is used for the tool length compensation and tool position offset, and the radius dimension data is used for the tool radius compensation and three-dimensional tool radius compensation (compensation vector designation).



[Tool compensation type III] (M/L System): Parameter "#1037 cmdtyp" = 3

This type has 3 kinds of display such as wear data, tool length data, and nose data. The display can be switched by the sub menu. The compensation data can be set or displayed for four axes by the parameter setting "#12103 2nd add T-ofs ON" (2nd additional axis tool offset ON).

■Wear data

Set the wear amount of nose for each tool you use. When a tool compensation number is designated by the tool command (T command), the wear data is offset together with the tool length data and nose data.



■Tool length data

Set the tool length according to the reference position of program for each tool used. When a tool compensation number is designated by the tool command (T command), the tool length data is offset together with the wear data and nose data.







■Nose data

Set the radius (Nose R), wear radius (R-wear), and point (Point) of the nose that is mounted on the tool for each tool used. When a tool compensation number is designated by the tool command (T command), the nose data is offset together with the tool length data and wear data.

		Abs	Nose R	R-wear	Point
Relative posn					
X	0	0.000	0.000	0.000	0
Z		0.000	0.000	0.000	0
C		0.000	0.000	0.000	0
Machine posn					
X	0	0.000	0.000	0.000	0
Z		0.000	0.000	0.000	0
C		0.000	0.000	0.000	0
S	0				
M	0				
T	0				
B	0				
		1	0.000	0.000	0
		2	0.000	0.000	0
		3	0.000	0.000	0
		4	0.000	0.000	0
		5	0.000	0.000	0
		6	0.000	0.000	0
		7	0.000	0.000	0
		8	0.000	0.000	0
		9	0.000	0.000	0
		10	0.000	0.000	0
		11	0.000	0.000	0
		12	0.000	0.000	0
		13	0.000	0.000	0
		14	0.000	0.000	0
		15	0.000	0.000	0

CAUTION
 If the tool compensation amount or workpiece coordinate system offset amount is changed during automatic operation (including during single block stop), the changes will be valid from the command in the next block or after several subsequent blocks.

Display Items

Display items	Description
(1) Display area	<p>Displays the tool compensation data. The cursor is displayed, and you can set the data. The data exceeding the display area can be displayed by the following keys.</p> <p> ,  : Scroll one line at a time.</p> <p> ,  : Switches the display contents for each number of compensation data sets.</p> <p>Compensation number: This is a compensation data number.</p> <p>The other display items change according to the tool compensation type.</p> <p>Refer to the following table for details.</p>

<Standard setting/display range >

The display range is when the minimum command unit is 1 μ m ("#1003 iunit"= B, "#1041 Initial inch" = 0).

Type	Setting item	Description	Setting/display range
I	Compensation data	Sets the tool length compensation amount. (*5)	-9999.999 to 9999.999
II	Length	Sets the tool length compensation amount. (*5)	Length dimension/Radius dimension -9999.999 to 9999.999 Length wear/Radius wear -9999.999 to 9999.999
	L wear	Sets the compensation amount of tool length wear. (*5)	
	Radius	Sets the tool radius compensation amount. (*5)	
	R wear	Sets the tool radius wear compensation amount. (*5)	
III	Wear data	<p><L system> Sets the wear compensation amount of 1st axis, 2nd axis, additional axis, and 2nd additional axis. (*1) (*2) (*5) (*7) (*8)</p> <p><M system> Sets the wear compensation of the axes designated by the parameters "#1026 base_I", "#1027 base_J" and "#1028 base_K". (*5) (*9)</p>	-9999.999 to 9999.999
	Tool length data	<p><L system> Sets the tool length compensation amount of 1st axis, 2nd axis, additional axis, and 2nd additional axis. (*1) (*2) (*7) (*8)</p> <p><M system> Sets the tool length compensation amount of the axes designated by the parameters "#1026 base_I", "#1027 base_J" and "#1028 base_K". (*5) (*9)</p>	-9999.999 to 9999.999
	Nose R (*3)	Sets the tool radius (Nose R).	-9999.999 to 9999.999
	R-wear (*3) (*6)	Sets the tool radius (Nose R) wear.	-9999.999 to 9999.999
	Point (*4)	Sets the nose point (number).	0 to 9

(*1) Select the additional axis by specifying the parameter (#1281 ext17 bit1/#1520 Tch34).

(*2) If the number of axes in the part system is 2 or less, the name of non-existing axis is displayed according to the parameter setting as follows.

If "#1281(PR) ext17 bit1 Tool offset additional axis selection" is set to "0":
The axis name is not displayed.

If "#1281(PR) ext17 bit1 Tool offset additional axis selection" is set to "1":
If the 2nd axis does not exist, the axis name designated by "#1028 base_K" is displayed. If the additional axis does not exist, the axis name designated by "#1027 base_J" is displayed.

(*3) If parameter "#1019 dia" (Diameter command) is set to "0", set the radius. If it set to "1", set the diameter.

(*4) The nose point is entered as the absolute value even if you press the menu [+ Input].

(*5) It may differ from the above display/setting range due to the "#8010 ABS. MAX." and "#8011 INC. MAX." parameter settings.

(*6) It may differ from the above display/setting range due to the "#8010 ABS. MAX." parameter settings.

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- (*7) The axis names set by the parameter "#1022 axname2" are displayed for 1st axis, 2nd axis, additional axis, and 2nd additional axis.
- (*8) The 2nd additional axis can be set or displayed when the parameter "#12103 2nd add T-ofs ON" is set to "1". The axis name is not displayed when a non-existing axis is designated by the parameter "#12104 2nd add T-ofs".
- (*9) The 2nd axis names set by "#1022 axname2" are displayed for the axes set in the parameters "#1026 base_I", "#1027 base_J" and "#1028 base_K". However, if any axes designated by the parameter "#1026 base_I" to "#1028 base_K" does not exist, the axis name of the parameter "#1026 base_I" to "#1028 base_K" will be displayed instead.

The setting/display ranges are as follows based on the combination of "#1003 iunit(Input unit) " and "#1041 Initial inch".
(Type I, Type II, Type III (data of wear, tool radius, tool nose R and R wear))

#1003 iunit	#1041 I_inch	Setting/display range	
		Type II (Length wear/Radius wear) Type III (Wear data/Radius wear)	Type I (Length dimension/Radius dimension) Type III (Tool length data/Nose R)
B	0	-999.999 to 999.999	
		-9999.999 to 9999.999	
	1	-99.9999 to 99.9999	
		-999.9999 to 999.9999	
C	0	-999.9999 to 999.9999	
		-9999.9999 to 9999.9999	
	1	-99.99999 to 99.99999	
		-999.99999 to 999.99999	
D	0	-999.99999 to 999.99999	
		-9999.99999 to 9999.99999	
	1	-99.999999 to 99.999999	
		-999.999999 to 999.999999	
E	0	-999.999999 to 999.999999	
		-9999.999999 to 9999.999999	
	1	-99.9999999 to 99.9999999	
		-999.9999999 to 999.9999999	

When data without the decimal point is input, a set unit can be specified by the parameter "#8119 Comp. unit switch".

The standard settings and display ranges are as follows.

Type	Display position
I	Upper part of display area (*1)
II	Left side of radius Left side of radius wear (*1)
III	<L system> Left side of axis name (*2) <M system> Nose R, left side of radius wear (*1)

(*1) It is displayed if "#8117 OFS Diam DESIGN" is "1".

(*2) It is displayed at the left of axis name if parameter "#1019 dia (Diameter command)" is set to "1".

Menus



Menus	Description
=Input	This executes an absolute input. When "#8929 Disable=INPUT:comp" is set to "1", this menu cannot be selected.
+Input	This executes an incremental input.
Wear data	This switches to the wear data display. <Note> ♦This menu is displayed for type III only.
Length data	This switches to the tool length data display. <Note> ♦This menu is displayed for type III only.
Nose data	This switches to the nose data display. <Note> ♦This menu is displayed for type III only.
Ofs No search	When the compensation No. is set and the [INPUT] key is pressed, the tool compensation data with that number at its head appears. The cursor moves to the contents of that first line.
Measure	Measure the tool compensation amount. <Note> ♦This menu is displayed only for type III, and is valid for "L system" and "tool length data display".
Undo	This undoes the last changes to the tool compensation data. (This menu is valid for the "Data Input", "Paste Line" and "Undo" operations.) <Note> ♦When an operation parameter "#8939 Undo confirm msg" is set to "1", the menu is highlighted while the operation message is displayed.
Line copy	This copies the contents of the tool compensation data in the selected line (one line).
Line paste	The contents (one line) of the copied tool compensation data are written to the line where the cursor is. If the copied data is changed after the menu [Line copy] is pressed, the data before changing is written when pasted. The data in the copied line can be pasted as many times as is required until new data is copied.
Line clear	This erases the compensation data in the selected line (multiple lines can be erased). Selection method: Select the first and the last compensation number to be erased. (Example) 1/E: Set all compensation data to "0". If the [INPUT] key is pressed without selecting a line, the compensation data in the line where the cursor is currently positioned is erased.
Abs/Inc	Switch the setting method (absolute/incremental input) for the tool compensation data by [INPUT] key. <Note> ♦When a parameter "#8941 ABS/INC for T-ofs" is set to "0", it is fixed to an absolute input.

With type III, wear data is displayed when the power is turned ON.

After turning the power ON, the display selection for wear data, length data, and nose data will be retained.

6.4.1 Setting the Tool Compensation Data

Operation method (Setting "10.000" in the length wear data of compensation No. (102))

- (1) Press the menu [Ofs No search].
- (2) Designate the Compensation No.
102 [INPUT]
The cursor can be moved to 102 using the [↑], [↓],
 or  keys.
- (3) Use the [→] key to move the cursor to the length wear position.
- (4) Input the length wear value.
10 [INPUT]
The value can also be designated by pressing the menu [=INPUT] instead of the [INPUT] key.

Note

- (1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be set.
- (2) When the parameter "#8929 Disable=INPUT:comp" is set to "1", [=Input] menu will be grayed.
- (3) This setting will be disabled due to the parameter "#8933 Disable lngth comp" or "#8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".
- (4) The above shows the setting of the tool compensation data when the parameter "#8941 ABS/INC for T-ofs" is set to "0". For details, refer to "6.4.2 Switching the Input Method for the Tool Compensation Data".
- (5) When [=Input], [+Input] and [Input] are pressed and when the parameter "#1124 ofsfix" is set to "0", the cursor will move to the next compensation No.

Operation method ("0.012" is calculated and set in the length wear data for compensation number (102).)

(1) Use the same procedure as in the previous page to move the cursor to the compensation No. 102 length wear position.

(2) Input a numeric value.
0.012 [+INPUT]



The input value added to the original value is displayed.
(Example) If the original data is 10.000:
 $10.000 + 0.012 = 10.012$ is displayed.

Note

- (1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be set.
- (2) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".
- (3) When [=Input], [+Input] and [Input] are pressed and when the parameter "#1124 ofsfix" is set to "0", the cursor will move to the next compensation No.
- (4) When entering data without decimal points, you can select the 1-mm (or 1-inch) data input or the input in the minimum input unit (same as "#1003 iunit") by designating the "#8119 Comp. unit switch" parameter.

<1-mm unit: "#8119 Comp. unit switch" is "0".>

Input	Result
1	1.000
100	100.000
10.	10.000
.012	0.012



<Minimum input unit (#1003 iunit B): "#8119 Comp. unit switch" is "1".>

Input	Result
1	0.001
100	0.100
10.	10.000
.012	0.012



6.4.2 Switching the Input Method for the Tool Compensation Data

When a parameter "#8941 ABS/INC for T-ofs" is set to "1", the absolute/incremental input by the [INPUT] key can be switched. When attempting to switch it, the current input mode is displayed on the upper left of the tool compensation amount. The absolute/incremental input can be switched either by the short cut key ([I] key) or by pressing the menu [Abs/Inc]. The chosen method is kept after switching the screen and turning the power OFF.

(1) Absolute input mode

In this mode, the absolute input is applied when the tool compensation data is input by the [INPUT] key.

Displaying that this is the absolute input mode.

Abs					
1	0.000	16	0.000	31	0.000
2	0.000	17	0.000	32	0.000
3	0.000	18	0.000	33	0.000
4	0.000	19	0.000	34	0.000
5	0.000	20	0.000	35	0.000
6	0.000	21	0.000	36	0.000
7	0.000	22	0.000	37	0.000
8	0.000	23	0.000	38	0.000
9	0.000	24	0.000	39	0.000
10	0.000	25	0.000	40	0.000
11	0.000	26	0.000	41	0.000
12	0.000	27	0.000	42	0.000
13	0.000	28	0.000	43	0.000
14	0.000	29	0.000	44	0.000
15	0.000	30	0.000	45	0.000

T-ofs T-meas T-reg T-life Coord →

(2) Incremental input mode

In this mode, the incremental input is applied when the tool compensation data is input by the [INPUT] key.




Displaying that this is the incremental input mode.

Inc					
1	0.000	16	0.000	31	0.000
2	0.000	17	0.000	32	0.000
3	0.000	18	0.000	33	0.000
4	0.000	19	0.000	34	0.000
5	0.000	20	0.000	35	0.000
6	0.000	21	0.000	36	0.000
7	0.000	22	0.000	37	0.000
8	0.000	23	0.000	38	0.000
9	0.000	24	0.000	39	0.000
10	0.000	25	0.000	40	0.000
11	0.000	26	0.000	41	0.000
12	0.000	27	0.000	42	0.000
13	0.000	28	0.000	43	0.000
14	0.000	29	0.000	44	0.000
15	0.000	30	0.000	45	0.000


T-ofs T-meas T-reg T-life Coord →

6.4.3 Erasing the Tool Compensation Data

Operation method (Erasing one line of tool compensation data at the cursor position)

- (1) Move the cursor to the data to be erased using the [↑], [↓], , or  key.
- (2) Press the menu [Line clear] and the [INPUT] key.
- (3) Press the [Y] or [INPUT] key.
To cancel the erasing, press a key other than [Y] or [INPUT].  The selected line of data (one line amount) is cleared to "0".
The cleared data is displayed at the top of the compensation data.

Operation method (Erasing the compensation data from compensation number 122 to 125.)

- (1) Press the menu [Line clear].
- (2) Input the compensation number of the data range to be erased.
122/125 [INPUT]
- (3) Press the [Y] or [INPUT] key.
To cancel the erasing, press a key other than [Y] or [INPUT].  The compensation data for the selected compensation number is erased, and the menu highlight returns to normal.
The cleared data is displayed at the top of the compensation data.



Note

- (1) If the [INPUT] key is pressed without selecting a compensation number, the line where the cursor is located is erased.
- (2) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be erased.
- (3) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".

6.4.4 Copying and Pasting the Tool Compensation Data

Operation method (Copying/pasting one line of tool compensation data)

- (1) Move the cursor to the data to be copied using the [↑],

[↓],  or  key.

- (2) Press the menu [Line copy].

- (3) Move the cursor to the line (compensation No.: 109) where the data is to be pasted.

- (4) Press the menu [Line paste].



The copied compensation data is written in the line where the cursor is.
The background color returns to normal.
The copied compensation data is held until another line is copied.

Note

- (1) If the compensation data for the copied line is changed after the menu [Line copy] is pressed, the data prior to the change is written when pasted.
- (2) In tool compensation type III, the copied data cannot be pasted to the different item (Wear/Length/Nose).
- (3) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be erased.
- (4) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".

6.4.5 Disabling the Setting of Tool Compensation Amount

Depending on the setting of the parameter "#8933 Disable lngth comp"/"#8934 Disable wear comp", the setting of the shape compensation amount/wear compensation amount is disabled.

Depending on the tool compensation type, different operation will be disabled.

Tool compensation type		"#8933 Disable lngth comp" = "1"	"#8934 Disable wear comp" = "1"
Type I	----	The menus [=Input], [+Input], [Line copy], [Line paste], [Line clear], and [Undo] are grayed out and cannot be selected. Any setting by [INPUT] key is disabled.	----
Type II	----	The menus [Line copy], [Line paste], and [Line clear] are grayed out and cannot be selected. The length and radius setting by [=Input], [+Input], and [INPUT] keys are disabled.	The menus [Line copy], [Line paste], and [Line clear] are grayed out and cannot be selected. The length wear and radius wear setting by [=Input], [+Input], and [INPUT] keys are disabled.
Type III	"Wear"	----	The menus [=Input], [+Input], [Line copy], [Line paste], [Line clear], and [Undo] are grayed out and cannot be selected. Any setting by [INPUT] key is disabled.
	"Length"	The menus [=Input], [+Input], [Measure], [Line copy], [Line paste], [Line clear], and [Undo] are grayed out and cannot be selected. Any setting by [INPUT] key is disabled.	----
	"Nose"	The menus [Line copy], [Line paste], and [Line clear] are grayed out and cannot be selected. The nose R setting by [=Input], [+Input], and [INPUT] keys are disabled.	The menus [Line copy], [Line paste], and [Line clear] are grayed out and cannot be selected. The R wear setting by [=Input], [+Input], and [INPUT] keys are disabled.

6.4.6 Measuring Tool Compensation Amount

The measurement method will differ depending on the setting of the parameter "#11087 Meas basic point".

Measuring the tool compensation amount of Z axis and X axis (diameter axis) with the machine zero point designation method (#11087 = 0)

- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
(Example) T1003

- (2) Displays the tool compensation amount screen. Menu [Offset]



The tool compensation amount screen is displayed. The tool compensation number of the selected tool is displayed at the top, and the cursor is located on the first line.

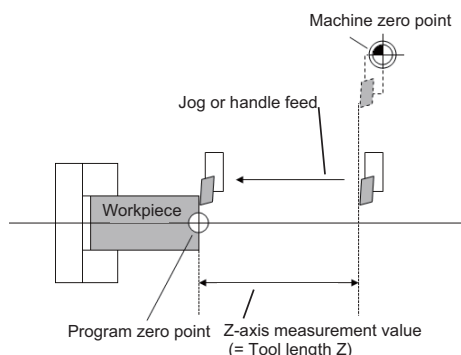
<Note>

- ♦If the parameter "#8972 T code offset disp" is set to "0", the tool compensation number of selected tool is not displayed at the top. Locate the cursor onto the tool compensation number of the tool to be measured.

- (3) Press the menu [Tool length data].

- (4) Select the "Manual handle feed" mode or "Jog feed" mode.

- (5) Select the Z axis, and manually move the tool to the work end face (program origin).



- (6) Enter the name of axis to be measured, and the measurement value (radius) of workpiece.
Z0.



When you enter "Z", the cursor is moved to the Z axis column.

<Note>

- ♦If you input an axis name that does not exist, the cursor does not move.
 - ♦The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor does not move on the Z axis.)
- Also, if anything other than tool length data is displayed, the cursor does not move even when the first input value is the axis name.

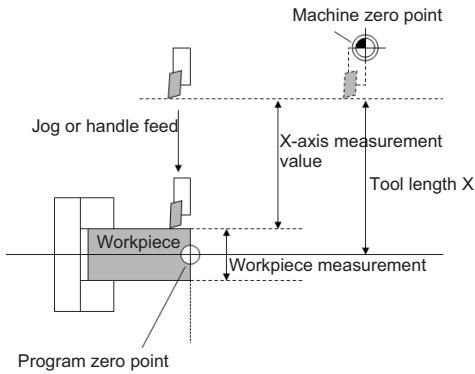
Value "Z0." is displayed in the input column.

- (7) Press the menu [Measure].

The measured value (Z axis machine position - Input value (0)) is set in the tool length data at the cursor position. The input column is cleared.

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- (8) Select the X axis, and manually move the tool to the work side face.



- (9) Enter the name of axis to be measured, and the measurement value (diameter) of workpiece. X20.



When you enter "X", the cursor is moved to the X-axis column.

<Note>

- If you input an axis name that does not exist, the cursor does not move.
 - The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor does not move on the Z axis.)
- Also, if anything other than tool length data is displayed, the cursor does not move even when the first input value is the axis name.

Value "X20." is displayed in the input column.

- (10) Press the menu [Measure].



The measured value (X-axis machine position - Input value (20)) is set in the tool length data at the cursor position. The input column is cleared.

Note

- (1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be measured.
- (2) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".
- (3) When entering data without decimal points, you can select the 1-mm (or 1-inch) data input or the input in the minimum input unit (same as "#1003 iunit") by designating the "#8119 Comp. unit switch" parameter.

<1-mm unit: "#8119 Comp. unit switch" is "0".>

Input	Result
1	1.000
100	100.000
10.	10.000
.012	0.012



<Minimum input unit (#1003 iunit B): "#8119 Comp. unit switch" is "1".>

Input	Result
1	0.001
100	0.100
10.	10.000
.012	0.012



- (4) When the parameter "#8174 T meas. in mirror" is set to "1", the measurement result of the axis in mirror image (PLC signal (MIR 1 to 8) is ON) will be set to the compensation amount with the sign highlighted.

Measuring the tool compensation amount of Z axis and X axis (diameter axis) with the parameter designation method (when #11087 = 1)

- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
(Example) T1003

- (2) Displays the tool compensation amount screen.
Menu [Offset]



The tool compensation amount screen is displayed. The tool compensation number of the selected tool is displayed at the top, and the cursor is located on the first line.

<Note>

- If the parameter "#8972 T code offset disp" is set to "0", the tool compensation number of selected tool is not displayed at the top. Locate the cursor onto the tool compensation number of the tool to be measured.

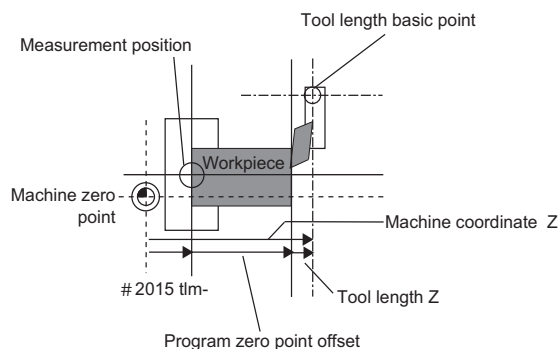
- (3) Press the menu [Tool length data].



This switches to the tool length data display.

- (4) Select the "Manual handle feed" mode or "Jog feed" mode.

- (5) Select the Z axis, and manually move the tool to the work side face.



- (6) Enter the name of axis to be measured, and the measurement value (radius) of workpiece.
Z50.



When you enter "Z", the cursor is moved to the Z axis column.

<Note>

- If you input an axis name that does not exist, the cursor does not move.
 - The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor is not moved on the Z axis.)
- Also, if anything other than tool length data is displayed, the cursor does not move even when the first input value is the axis name.

Value "Z50." is displayed in the input column.

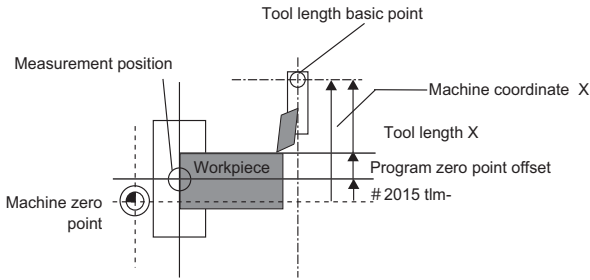
- (7) Press the menu [Measure].



The measured value (Z axis machine position - measurement zero point (#2015 tlm-) - Input value (50)) is set in the tool length data at the cursor position. The input column is cleared.

6 Setting a Tool and a Workpiece

- (8) Select the X axis, and manually move the tool to the work side face.



- (9) Enter the name of axis to be measured, and the measurement value (diameter) of workpiece. X20.

When you enter "X", the cursor is moved to the X-axis column.

<Note>

- If you input an axis name that does not exist, the cursor does not move.
- The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor is not moved on the Z axis.)

Value "X20." is displayed in the input column.

- (10) Press the menu [Measure].

The measured value (X axis machine position - measurement zero point (#2015 tml-) - Input value (20)) is set in the tool length data at the cursor position. The input column is cleared.

Note

- (1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be measured.
- (2) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".
- (3) When entering data without decimal points, you can select the 1-mm (or 1-inch) data input or the input in the minimum input unit (same as "#1003 iunit") by designating the "#8119 Comp. unit switch" parameter.

<1-mm unit: "#8119 Comp. unit switch" is "0".>

Input	Result
1	1.000
100	100.000
10.	10.000
.012	0.012

<Minimum input unit (#1003 iunit B): "#8119 Comp. unit switch" is "1".>

Input	Result
1	0.001
100	0.100
10.	10.000
.012	0.012

- (4) When the parameter "#8174 T meas. in mirror" is set to "1", the measurement result of the axis in mirror image (PLC signal (MIR 1 to 8) is ON) will be set to the compensation amount with the sign highlighted.

Measuring the tool compensation amount of Z axis and X axis (diameter axis) with the workpiece coordinate system offset designation method (when #11087 = 2)

- (1) Select the tool to be measured with manual numerical value command. (Refer to "9.6 Manual Numerical Value Command" for details.)
(Example) T1003

- (2) Displays the tool compensation amount screen. Menu [Offset]

➔ The tool compensation amount screen is displayed. The tool compensation number of the selected tool is displayed at the top, and the cursor is located on the first line.

<Note>

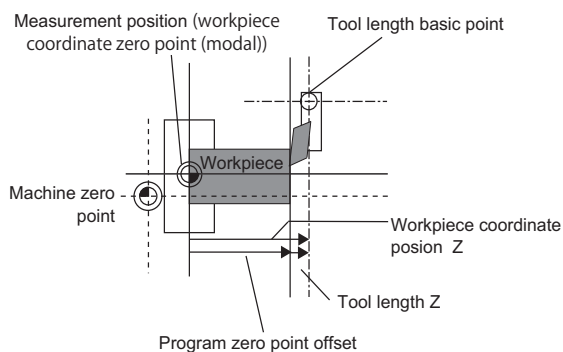
- If the parameter "#8972 T code offset disp" is set to "0", the tool compensation number of selected tool is not displayed at the top. Locate the cursor onto the tool compensation number of the tool to be measured.

- (3) Press the menu [Tool length data].

➔ This switches to the tool length data display.

- (4) Select the "Manual handle feed" mode or "Jog feed" mode.

- (5) Select the Z axis, and manually move the tool to the work side face.



- (6) Enter the name of axis to be measured, and the measurement value (radius) of workpiece. Z50.

➔ When you enter "Z", the cursor is moved to the Z axis column.

<Note>

- If you input an axis name that does not exist, the cursor does not move.
 - The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor is not moved on the Z axis.)
- Also, if anything other than tool length data is displayed, the cursor does not move even when the first input value is the axis name.

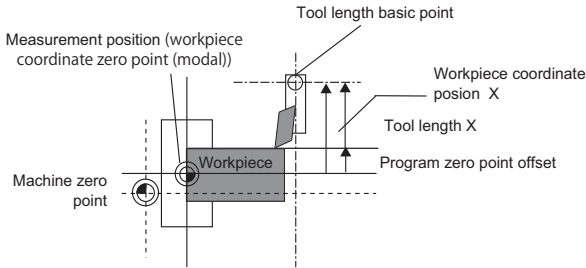
Value "Z50." is displayed in the input column.

- (7) Press the menu [Measure].

➔ The measured value (Z axis workpiece coordinate position - Input value (50)) is set in the tool length data at the cursor position. The input column is cleared.

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- (8) Select the X axis, and manually move the tool to the work side face.



- (9) Enter the name of axis to be measured, and the measurement value (diameter) of workpiece. X20.

When you enter "X", the cursor is moved to the X-axis column.

<Note>

- If you input an axis name that does not exist, the cursor does not move.
 - The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor is not moved on the Z axis.)
- Also, if anything other than tool length data is displayed, the cursor does not move even when the first input value is the axis name.

Value "X20." is displayed in the input column.

- (10) Press the menu [Measure].

The measured value (X axis workpiece coordinate position - Input value (20)) is set in the tool length data at the cursor position. The input column is cleared.

Note

- (1) If the parameter "#11017 T-ofs set at run" is set to "1", the tool compensation amount data during automatic operation or during pause of operation can be measured.
- (2) This setting may be disabled due to the parameter "#8933 Disable lngth comp" or "8934 Disable wear comp" setting. For details, refer to "6.4.5 Disabling the Setting of Tool Compensation Amount".
- (3) When entering data without decimal points, you can select the 1-mm (or 1-inch) data input or the input in the minimum input unit (same as "#1003 iunit") by designating the "#8119 Comp. unit switch" parameter.

<1-mm unit: "#8119 Comp. unit switch" is "0".>

Input	Result
1	1.000
100	100.000
10.	10.000
.012	0.012

<Minimum input unit (#1003 iunit B): "#8119 Comp. unit switch" is "1".>


Input	Result
1	0.001
100	0.100
10.	10.000
.012	0.012

- (4) When the parameter "#8174 T meas. in mirror" is set to "1", the measurement result of the axis in mirror image (PLC signal (MIR 1 to 8) is ON) will be set to the compensation amount with the sign highlighted.


6.4.7 Moving to designated Compensation Number

There are two methods to switch from the designated compensation number display. You can switch the operation by using the "#8975 Change No. search" parameter.

(Example 1) Select compensation number 16. (If "#8975 Change No. search" is "0")

- (1) Displays the tool compensation amount screen.
- (2) Press the menu [Ofs No search].
- (3) Enter the compensation number you wish to display, and press [INPUT].
16 [INPUT]  The compensation number that you have set is displayed at the top, and the cursor is located on the first data. The highlighting of the menu [Comp. No. search] is canceled.

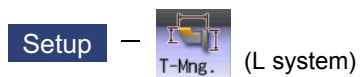
(Example 2) Select compensation number 16. (If "#8975 Change No. search" is "1")

- (1) Displays the tool compensation amount screen.
- (2) Enter the compensation number you wish to display.
16
- (3) Press the menu [Ofs No search].  The compensation number that you have set is displayed at the top, and the cursor is located on the first data.

Note

- (1) If a compensation number exceeding the limit is designated, the operation message "Setting error" is displayed.

6.5 Setting the Tool Management Data (Tool Management Screen)



Tool management data can be set and displayed on the tool management (T-Mng.) screen. These data are relevant to which displayed on the [T-ofs] or [T-life] screen, that can be set the tool information. Thus the mutually-referenced data can be set and displayed on this screen. For details, refer to "4.2.8 Setting the Tool Shape" (M system) or "4.3.8 Setting the Tool Shape" (L system).

6.6 Tool Life Management



The life management data such as the tool usage is set and displayed on the tool life management (T-life) screen of the setup (Setup) screen.

There are some types of the tool life management method, two for M system and three for L system.

The management method can be changed by the parameter "#1096 T_Ltyp".

L system: Tool life management I (T_Ltyp = 1) and tool life management II (T_Ltyp = 2)

M system: Tool life management I (T_Ltyp = 1), tool life management II (T_Ltyp = 2) and tool life management III (T_Ltyp = 3)

Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

<M system>

■ Tool life management I

This method monitors the accumulation of the tool usage, such as operating time, count, and wear condition, that is commanded by the program.

■ Tool life management II

This method is the same as tool life management I, but with a spare tool selection function added.

A spare tool is selected from the group of tool commands commanded in the program. Tool compensation (tool length compensation and tool radius compensation) is carried out for the selected tool.

The tool life management II related parameters (basic common parameters) include the following.

#	Name	Setting	Description
1103	T_Life	0	This ignores the tool life management data.
	T-life manage valid	1	This controls the tool life management.
1104	T_Com2 Tool cmd mthd 2 (When tool life management is valid.)	0	This treats the program tool command as a group No. Search for the tools that match with the group No. in the tool registration data, and select the spare tool from them.
		1	This treats the program tool command as a tool No. Search for the group No. that matches with the tool No. in the tool registration data, and select the spare tool from there.
1105	T_sel2 Tool select mthd 2 (When tool life management is valid.)	0	This selects the tool from the tools in use in the same group, following the registration No. order. If there are no "Tools in use", the tools are selected in order of "Tools not in use", "Normal life tools" and "Abnormal tools", following the registration No. order.
		1	This selects the tool with the maximum remaining life from the tools in use and not in use in the same group. When several tools have the same remaining life, the tools are selected in order of registration No. If there are no "Tools in use" or "Tools not in use", the tools are selected in order of "Tools not in use", "Normal life tools" and "Abnormal tools", following the registration No. order.

■ Tool life management III

It is not managed by the group number.

This method monitors the accumulation of the tool usage, such as operating time, count, and wear condition, that is commanded by the program.

<L system>

■ Tool life management I - Tool life data display

The tool usage time and usage count indicated in the program is accumulated, and the usage status for that tool is monitored.

Tool life management can be performed for a maximum of 80 tools (tool Nos. 1 to 80).

(1) Time based control

The cutting time (G01, G02, G33 etc.) after performing the tool selection command (T) is calculated in the tool usage time corresponding to the designated tool.

A warning is issued if the usage time at the time the tool selection command is performed reaches the life time.

(2) Usage count based control

The tool usage count corresponding to the designated tool No. increases each time the tool selection command (T) is performed.

A warning is issued if the usage count at the time the tool selection command is performed exceeds the life time.

■ Tool life management II - Tool life data display / registration group list display

The life (usage time, usage count) of each tool is controlled, and if the life is reached, the same spare tools are selected and used one by one from the group to which that tool belongs.

Group count: Multi-part system spec. max. 40 groups for each part system / Single part system spec: max. 80 groups

No. of tools in group: Max. 16

The tool life management related parameters (basic shared parameters) are shown below.

#	Name	Setting	Description
1096	T_Ltyp Tool life management type	1, 3	Tool life management I
		2	Tool life management II
1103	T_life Enable tool life management	0	The tool life management is not performed.
		1	This controls the tool life management.
1107	TlIfsc (For L system only) Tool life management Display screen division	Set the no. of groups displayed at the tool life management II (L system) screen.	
		0	Displayed no. of groups: 1, Max. No of registered tools: 16
		1	Displayed no. of groups: 2, Max. No of registered tools: 8
		2	Displayed no. of groups: 4, Max. No of registered tools: 4

The tool life management screen is made up of the group list display screen and the life management data screen.

(There is no group list display screen in L system tool life management I. Only the life management data screen exists.)

Refer to the following sections and later for details of the display contents, menus, and an explanation of the operations for each screen.

"6.6.1 Displaying the Group List (M system: Tool life management I, II / L system: Tool life management II)"

"6.6.2 Displaying the Life Management Data in Group Units (M system)"

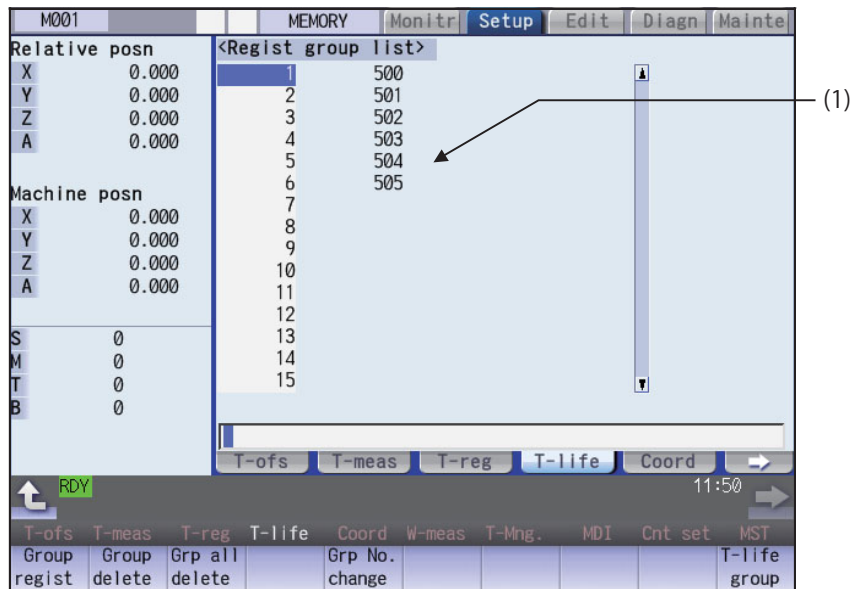
"6.6.3 Displaying the Life Management Data (L system: Tool life management I)"

"6.6.4 Displaying the Tool Life Management Data in Group Units (L system: Tool life Management II)"



6.6.1 Displaying the Group List (M system: Tool life management I, II / L system: Tool life management II)

Tool life management data groups can be registered and erased. Press [Group list] when displaying the group unit. When changing from a group unit display to the group list display, the cursor displays at the group No. at the group unit display.

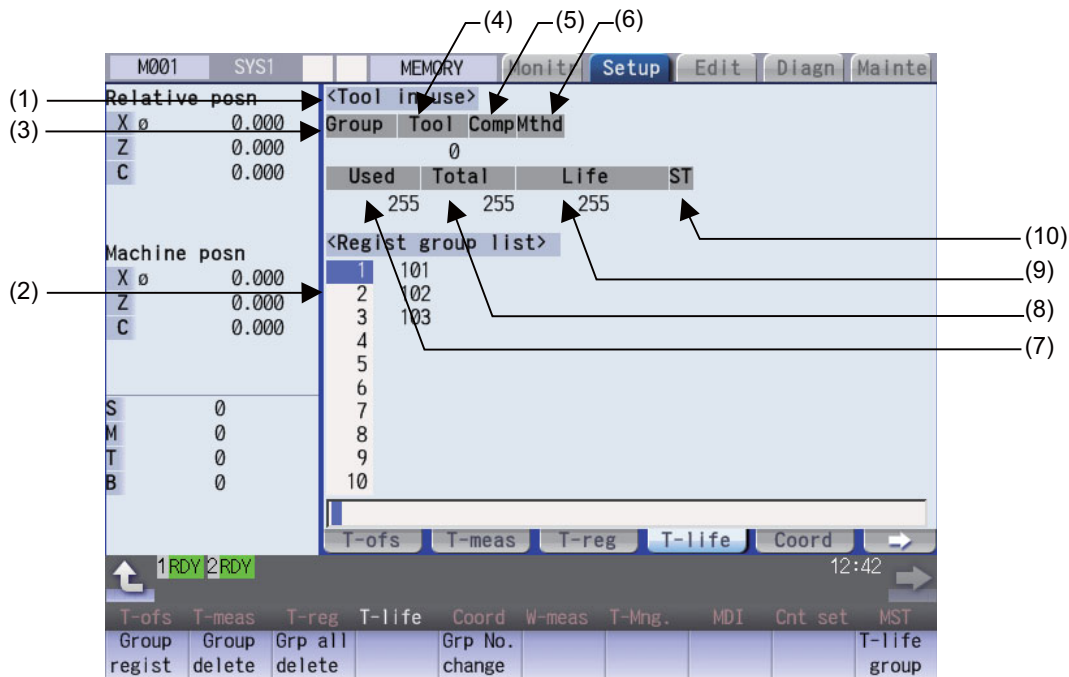
<M system>



Display Items

Display Items	Description
(1) Regist group list	<p>The group Nos. registered as the tool life management data are listed in ascending order.</p> <p>Group Nos. can be set from 1 to 99999999, and maximum 1000 groups can be set.</p> <p>Maximum 60 groups can be displayed at a time. Use the  and  keys to change the display if the No. of registered groups exceeds 60.</p> <p>An asterisk will be added to the No. of the group in which all tools have reached their lives.</p> <p><Note></p> <ul style="list-style-type: none"> ♦The maximum number of the registered groups depends on the specifications. ♦In tool life management II, when all the tools' statuses (ST) of the target group become 2 to 4, "*" is displayed.

<L system>



Display Items

Display Items	Description
(1) Tool in use	The life management information of the tool currently being used appears here.
(2) Regist group list	The group Nos. registered as the tool life management data are displayed in a list. Group Nos. can be set from 1 to 9999, and maximum 80 groups can be set. An asterisk will be added to the No. of the group in which all tools have reached their lives. <Note> ♦The maximum number of the registered groups depends on the specifications.

[CHOSEN TOOL]

Display Items	Description	Display range
(3) Group	Displays the life management group No. currently being used.	1 to 9999
(4) Tool No.	Displays the tool No. currently being used.	1 to 999999
(5) Comp No.	Displays the compensation No. currently being used.	1 to 80
(6) Method	Displays whether the group currently being used is controlled by the usage time or usage count.	0: Hours 1: Times
(7) Used	Displays the usage data for the tool currently being used.	Usage time: 0 to 99999999 (s) Usage count: 0 to 999999 (set)
(8) Total	Displays the total usage data for the tool currently being used. In the case of tools using multiple compensation Nos., the total usage data for all compensation Nos. displays. In the case of only one compensation No., the same value as "Used" displays.	Usage time: 0 to 99999999 (s) Usage count: 0 to 999999 (set)
(9) Life	Displays the life value for the tool currently being used.	Usage time: 0 to 99999999 (s) Usage count: 0 to 999999 (set)

Display Items	Description	Display range
(10) ST	Displays the status of the tool currently being used.	0: Unused tool 1: Used tool 2: Normal life tool 3: Skipped tool

Menus (M system/L system)

Menus	Details
Group regist	Creates a new group and adds the group No. to the list.
Group delete	This erases all of the tool life management data included in the designated group No. If the group No. is not designated, the tool life management data for the group No. indicated by the cursor will be erased.
Grp all delete	This erases all groups and their tool life management data registered in the part system which is currently selected.
Grp No. change	This changes a group No. Specify a new group No. and press the [INPUT] key to change the group No. and then change the contents of the list. An error occurs if an existing group No. is specified.
T-life group	The tool life data for the group No. indicated by the cursor is displayed. This changes to the mode enabling tool life management data to be set and displayed with group unit Nos.

Operation method (Registering a group) (M system/L system)

- (1) Press the menu [Group regist].
- (2) For L system, set group No./method/life value.
(Example) 25/1/3000 [INPUT]
For M system, designate the group No. to be registered.
25 [INPUT]

Note


- (1) An error occurs if the group No. duplicates a pre-existing group No.
- (2) The group is not registered if one of the operations below is performed after registering a new group No.
 - ♦If the application is exited without registering even 1 item of tool life data.
 - ♦The screen is changed to that of other than the group unit display.
 - ♦The part system is changed.

Operation method (Erasing a group) (M system/L system)

- (1) Press the menu [Group delete].
- (2) Designate the group to be erased.  The selected group No. is erased.
72 [INPUT]

If nothing is input in the input area, the group at the cursor location is erased.

Operation method (Erasing all groups) (M system/L system)





- (1) Press the menu [Grp all delete].
- (2) Press the [Y] or [INPUT] key.  All the registered groups and their tool life management data is erased.

Note

- (1) If no group has been registered, the operation message "Can't delete all groups" will appear.




Operation method (Changing the group No.) (M system/L system)

(Example) Changing the group No. from 5 to 20

- (1) Use the [↑], [↓], , and  keys to move the cursor to group No. 5.
- (2) Press the menu [Grp No.change].  The menu is highlighted.
- (3) Designate the group No. after changing.
20 [INPUT]  The group No. changes to "20".



Operation method (Changing to the group unit display) (M system/L system)

(Example) Displaying the group No. 5 tool life data.

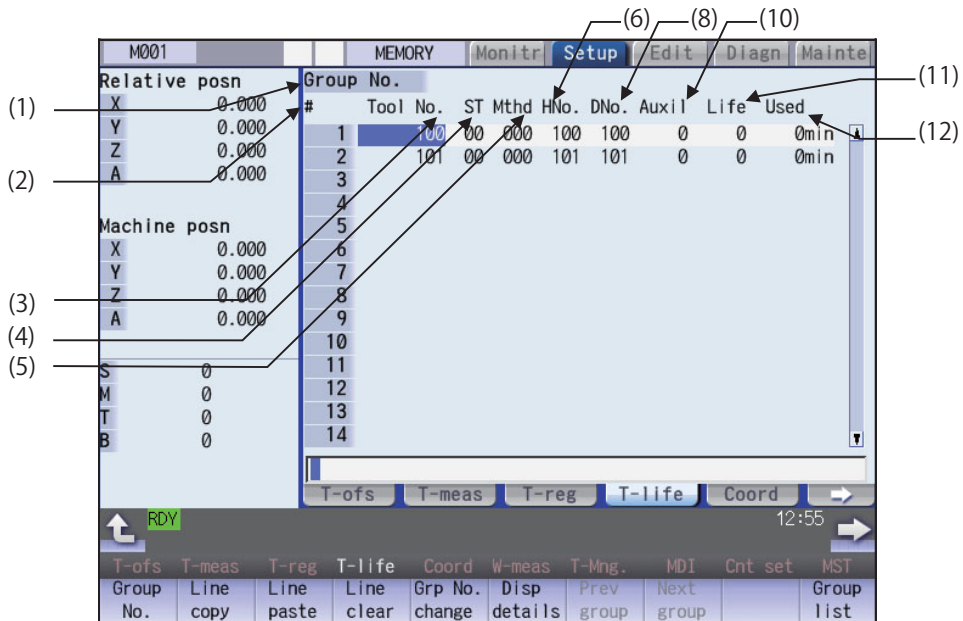
- (1) Use the [↑], [↓], , and  keys to move the cursor to group No. 5.
- (2) Press the menu [T-life group] or [INPUT] keys.  The screen changes to the group unit display and the group No. "5" tool life management data displays.

6.6.2 Displaying the Life Management Data in Group Units (M system)

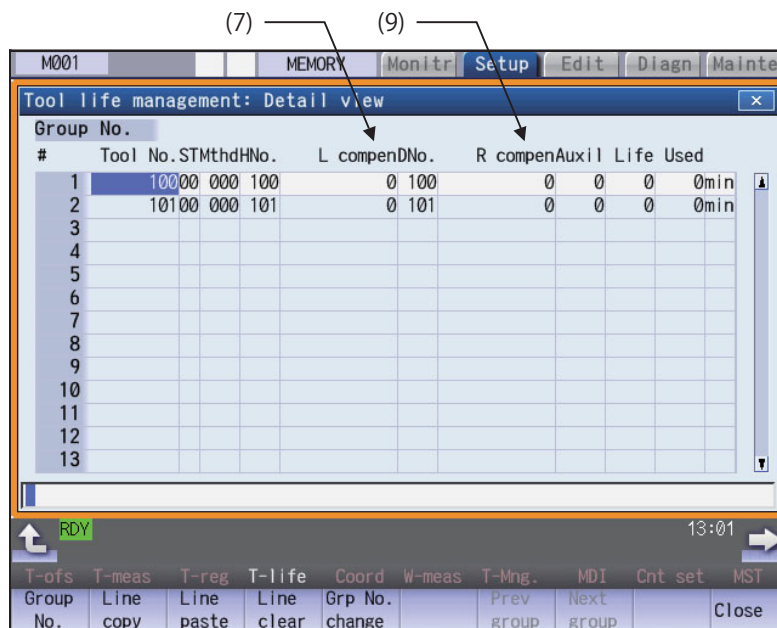
The tool life management data of an arbitrary group is set and displayed. Press the menu [T-life group] when the group list is displayed.

Use the  and  keys to scroll between screens if all of the registered tools cannot be displayed on one screen.

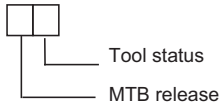
<Normal display>


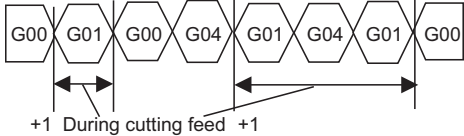


<Detailed display>



Display Items

Display items	Description	Setting range
(1) Group No.	This is the group No. of the tool for which tool life management is performed. (*1) Tools with the same group No. are regarded as spare tools.	1 to 99999999
(2) #	This is the data setting No. This is not the magazine pot No.	
(3) Tool No.	This is the No. corresponding to the each individual tool. Maximum 1000 tools can be registered. This is a fixed tool No. actually output for the tool command and so on.	1 to 99999999
(4) ST	 <p>Tool status MTB release</p> <p>Tool status 0: Unused tool Normally set to "0" when the tool is replaced with a new tool. 1: Tool in use This becomes "1" when the cutting actually starts. 2: Normal life tool This becomes "2" when the usage data (usage time and No. of uses) exceeds the life data. 3: Tool abnormality 1 tool (*2) 4: Tool abnormality 2 tool (*2)</p>	

Display items	Description	Setting range
(5) Method	 <p>(a) Tool life management method</p> <p>(b) Tool radius compensation data format</p> <p>(c) Tool length compensation data format</p> <p>(a) Tool life management method</p> <p>0: Operating time This manages by the cutting execution time.</p> <p>1: No. of mounting times This manages by the No. of times the tool became the spindle tool in tool replacement, etc. However, in the case where the cutting feed command (G01, G02, G03 etc.) is not executed even once after becoming the spindle tool, the No. of times is not counted.</p> <p>2: T usage count This is counted when the rapid traverse command (G00 etc.) is changed to the cutting feed command (G01, G02, G03 etc.). However, this is invalid in the case of a rapid traverse or cutting feed command with no movement.</p>  <p>(b) Tool radius compensation data format</p> <p>(c) Tool length compensation data format</p> <p>0, 2: Length dimension/Radius dimension Displays the length dimension or radius dimension of the tool compensation amount of the compensation number designated by HNo. or Dno. in the display item "L compen" or "R compen". If the value of the display item "L compen" or "R compen" is changed, the length dimension or radius dimension of the tool compensation amount is rewritten.</p> <p>1: Length wear/Radius wear Displays the length wear or radius wear of the tool compensation amount designated by HNo. or Dno. in the display item "L compen" or "R compen". If the value of the display item "L offset" or "R offset" is changed, the length wear or radius wear of the tool compensation amount is rewritten.</p>	
(6) HNo.	<p>Length compensation number.</p> <p>Entering a new tool number automatically assigns the same compensation number as for the tool number.</p> <p>If a new tool number is entered that is outside the allowable compensation number range, the compensation number is assigned to "0".</p> <p>The compensation number can also be changed to any number as needed.</p>	1 to 999
(7) L compen	<p>Length compensation value.</p> <p>One of the following values is displayed depending on the tool length compensation data format utilized by the method.</p> <p>The value can be changed as needed.</p> <p>0, 2: Length dimension of tool compensation amount of the compensation number designated by HNo.</p> <p>1: Length wear of tool compensation amount of the compensation number designated by HNo.</p>	(*3)

Display items	Description	Setting range
(8) DNo.	Tool radius compensation number. Entering a new tool number automatically assigns the same compensation number as for the tool number. If a new tool number is entered that is outside the allowable compensation number range, the compensation number is assigned to "0". The compensation number can also be changed to any number as needed.	1 to 999
(9) R compen	Tool radius compensation value. One of the following values is displayed depending on the tool radius compensation data format utilized by the method. The value can be changed as needed. 0, 2: Radius dimension of tool compensation amount of the compensation number designated by DNo. 1: Radius wear of tool compensation amount of the compensation number designated by DNo.	(*3)
(10) Aux.	This depends on the MTB specifications.	0 to 65535
(11) Life	Set the usage time (minutes), attachment count (No. of times attached to the spindle), or usage count (No. of holes drilled) for the life for each tool based on the data format set for "Method". The life is infinite when "0" is set.	Usage time: 0 to 4000 (min) No. of mounting times: 0 to 65000 (set) Usage count: 0 to 65000 (set)
(12) Used	This displays the usage data for individual tools based on the method specified for the tool life management method. <Note> ♦This data is not counted during machine lock, auxiliary function lock, dry run or for a single block.	Usage time: 0 to 4000 (min) No. of mounting times: 0 to 65000 (set) Usage count: 0 to 65000 (set)

(*1) The group No. is not displayed for the tool life management III.

(*2) This action differs depending on MTB specifications.

(*3) The "Length compensation" and "Radius compensation" calculation/direct compensation amount setting/display range are as follows based on a combination of settings of "#1003 iunit (input unit)" and "#1041 Initial inch".

#1003 iunit	#1041 I_inch	Setting/display range
B	0	-9999.999 to 9999.999
	1	-999.9999 to 999.9999
C	0	-9999.9999 to 9999.9999
	1	-999.99999 to 999.99999
D	0	-9999.99999 to 9999.99999
	1	-999.999999 to 999.999999
E	0	-9999.999999 to 9999.999999
	1	-999.9999999 to 999.9999999

When data without the decimal point is input, a set unit can be specified by the parameter "#8119 Comp. unit switch".

Note

- (1) When the part system is changed while displayed on the group unit display, the registered data is not displayed because the screen enters the "data unregistered" state. To display the group unit of the changed part system, return to the group list display screen and execute the group unit display again.
- (2) If "Cutter compen. data format" or "T-length compen data format" is set to "0", "2" (Length/radius), or "1" (Length wear/radius wear), the tool compensation amount to be displayed by "L compen" and "R compen" are switched as follows:

Tool compensation type	Item	Method	Setting/display range
I	L compen	0	The compensation amount that is set in the designated compensation number
		1	
		2	
	R compen	0	The compensation amount that is set in the designated compensation number
		1	
		2	
II	L compen	0	The compensation amount that is set in the length of the designated compensation number
		1	The compensation amount that is set in the length wear of the designated compensation number
		2	The compensation amount that is set in the length of the designated compensation number
	R compen	0	The compensation amount that is set in the radius of the designated compensation number
		1	The compensation amount that is set in the radius wear of the designated compensation number
		2	The compensation amount that is set in the radius of the designated compensation number
III	L compen	0	The compensation amount that is set in the Z axis of tool length data of the designated compensation number
		1	The compensation amount that is set in the Z axis of wear data of the designated compensation number
		2	The compensation amount that is set in the Z axis of tool length data of the designated compensation number
	R compen	0	The compensation amount that is set in nose R of the designated compensation number
		1	The compensation amount that is set in the R wear of the designated compensation number
		2	The compensation amount that is set in nose R of the designated compensation number

Menus	
Menus	Description
Group No.	This displays the data of a group when that group No. of tool life management data is set and the [INPUT] key is pressed. (*1) The group No. can be referred to in the group list.
Line copy	Copies one line of tool life management data where the cursor is located.
Line paste	The copied tool life management data is written to the data in the line where the cursor is located. If the copied data is changed after the menu [Line copy] is pressed, the data before changing is written when pasted. The copied data can be pasted as many times as is required until new data is copied.
Line clear	This erases a designated line (multiple lines possible) of tool life management data. The first and the last line No. of the data to be erased is specified with a "/" separating the Nos.. If the [INPUT] key is pressed without specifying a line, the data in the line where the cursor is located is erased.
Grp No. change	This changes a group No. (*1) If a new group No. is set and the [INPUT] key pressed, the group No. changes. An error occurs if an existing group No. is specified.
Disp details	Displays the pop-up window for details of the selected group.
Prev group	Displays the previous group No. data. (*1)
Next group	Displays the next group No. data. (*1)
Group list	This displays the list of tool life data groups. (*1)
Group regist	This creates a new group. (*2)
Group delete	This erases all tool life management data contained in the currently displayed group No. (*2)
Close	This closes the pop-up window for details of the selected group.

(*1) This menu is not valid for the tool life management III.

(*2) This menu is not displayed for the tool life management III.

Operation method (Designating a group No.)

- (1) Press the menu [Group No].
- (2) Designate the group No. to be displayed.
12 [INPUT]

Note

- (1) If a group No. that does not exist is designated, a message appears to confirm the creation of a new No. A new group is created if [Y] or [INPUT] is pressed.



Operation method (Changing a group No.)

- (1) Press the menu [Grp No.change].
- (2) Designate the group No. after changing.
112 [INPUT]

Note

- (1) An error occurs if the group No. duplicates a pre-existing group No.

Operation method (Setting the tool life data)

- (1) Move the cursor to the data to be set using the , , [↑], [↓], [←], or [→] key.
It is possible to move to the line after the registered line.
Set a tool No. for this line to newly register tool life management data.
- (2) Set a value.
20 [INPUT]

Note

- (1) The other settings will be invalid when the tool ST (status) setting data are not set.
- (2) The same tool cannot be registered in more than one group.
- (3) If the tool No. is not set, the other data cannot be set.
- (4) Change the "Method" to initialize the related items.
Change the tool life management method (the 1st digit) to clear the "Life" and "Usage", and also change the units.
Change the tool radius compensation data (the 2nd digit) to clear the "Radius Compensation".
Change the tool length compensation data (the 3rd digit) to clear the "Length Compensation".
Figures after the decimal point are also changed in line with the specifications.

Operation method (Copying/pasting the tool life data)

- (1) Move the cursor to the line to be copied.
- (2) Press the menu [Line copy].
- (3) Move the cursor to the line where the data is to be pasted.
- (4) Press the menu [Line paste].

Note

- (1) It is not possible to paste into a line for which a tool No. has not been set.
- (2) Once copied, the data is held until a new data item is copied.

Operation method (Erasing one line of tool life management data)

- (1) Move the cursor to the line to be erased.
- (2) Press the menu [Line clear] and [INPUT] keys.
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Operation method (Designating and erasing the multiple lines)

- (1) Press the menu [Line clear].
- (2) Set the range to be erased by marking the first and last # Nos. with a "/".
122/125 [INPUT]
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Operation method (Registering a group)

- (1) Press the menu [Group regist].
- (2) Set the No. of the group to be registered.
25 [INPUT]



Note

- (1) An error occurs if the group No. duplicates a pre-existing group No.
- (2) The group is not registered if one of the operations below is performed after registering a new group No.
 - If the application is exited without registering even 1 item of tool life data.
 - The screen is changed to that of other than the group unit display.
 - The part system is changed.

Operation method (Erasing a group)

- (1) Move the cursor to the group No. to be erased.
- (2) Press the menu [Group delete] and [INPUT] key.
- (3) Press the [Y] or [INPUT] key.

6.6.3 Displaying the Life Management Data (L system: Tool life management I)




The tool life management data can be set and displayed. Use the  and  keys to scroll between screens if all of the registered tools cannot be displayed on one screen.

#	[Time]		[Count]		[Status]	
	Used	Life	Used	Life	A	B
1	0: 0: 0	0: 0	0	0	0	0
2	0: 0: 0	0: 0	0	0	0	0
3	0: 0: 0	0: 0	0	0	0	0
4	0: 0: 0	0: 0	0	0	0	0
5	0: 0: 0	0: 0	0	0	0	0
6	0: 0: 0	0: 0	0	0	0	0
7	0: 0: 0	0: 0	0	0	0	0
8	0: 0: 0	0: 0	0	0	0	0
9	0: 0: 0	0: 0	0	0	0	0
10	0: 0: 0	0: 0	0	0	0	0
11	0: 0: 0	0: 0	0	0	0	0
12	0: 0: 0	0: 0	0	0	0	0
13	0: 0: 0	0: 0	0	0	0	0
14	0: 0: 0	0: 0	0	0	0	0



Display items

Display Items		Description	Setting range
(1)	#	Tool No. The # No. is highlighted if the usage time reaches the life time or if the usage count exceeds the life count.	
(2)	Time	Used	The integrated time the tool is used. The count goes up during cutting.
		Life	Tool life time Set the service lifetime. Unit of second is set to "0".
(3)	Count	Used	The integrated count the tool is used. The count goes up during cutting.
		Life	Tool life count Set the service life count.
(4)	Status	Left side	The tool life management status is indicated. 0: Not used 1: Current tool (tool being used) 2: Service lifetime (service life count) is exceeded.
		Right side	(Used by MTB)

Menus

Menus	Description
	Copies one line of tool life management data where the cursor is located.
	The copied tool life management data is written to the data in the line where the cursor is located. If the copied data is changed after the menu key [Line copy] is pressed, the data before changing is written when pasted. The copied data can be pasted as many times as is required until new data is copied.
	This erases a designated line (multiple lines possible) of tool life management data. The first and the last line No. of the data to be erased is specified with a "/" separating the Nos.. If the [INPUT] key is pressed without specifying a line, the data in the line where the cursor is located is erased.

Operation method (Setting the tool life data)

- (1) Move the cursor to the data to be set using the , , [↑], [↓], [←] and [→] keys.
It is possible to move to the line after the registered line.
- (2) Input the value.
20 [INPUT]

Operation method (Copying/pasting the tool life data)

- (1) Move the cursor to the line to be copied.
- (2) Press the menu [Line copy].
- (3) Move the cursor to the line where the data is to be pasted.
- (4) Press the menu [Line paste].

Note

- (1) Once copied, the data is held until a new data item is copied.

Operation method (Erasing one line of tool life management data)

- (1) Move the cursor to the line to be erased.
- (2) Press the menu [Line clear] and [INPUT] keys.
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Operation method (Designating and erasing the multiple lines)



- (1) Press the menu [Line clear].
- (2) Set the erasing range by marking the first and last # Nos. with a "/", and press the [INPUT] key.
122/125 [INPUT]
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Note

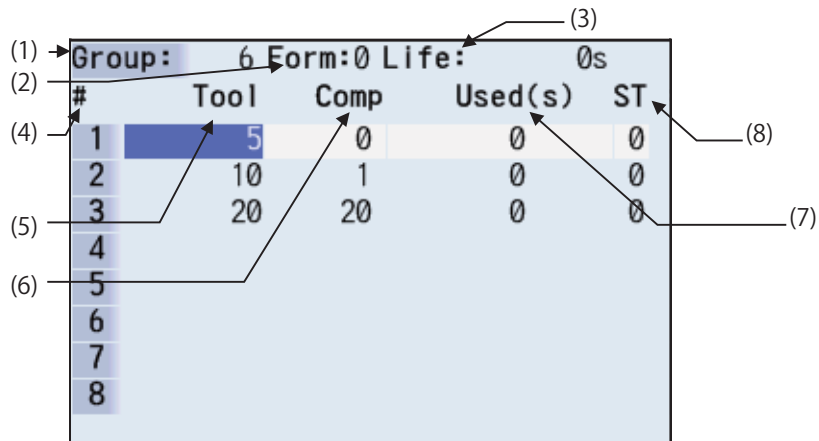
- (1) If the [INPUT] key is pressed without setting a # No., the line at the cursor is erased.

6.6.4 Displaying the Tool Life Management Data in Group Units (L system: Tool life Management II)

The tool life management data of an arbitrary group is set and displayed.

Use the  and  keys to scroll between screens if all of the registered tools cannot be displayed on one screen.

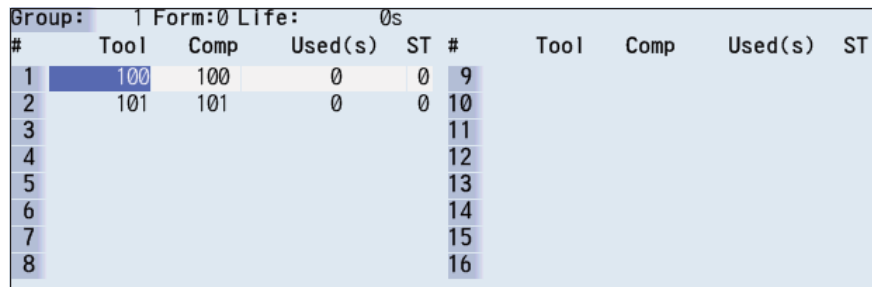
This screen is enabled only for tool life management II ("#1096 T_Ltyp" = 2).



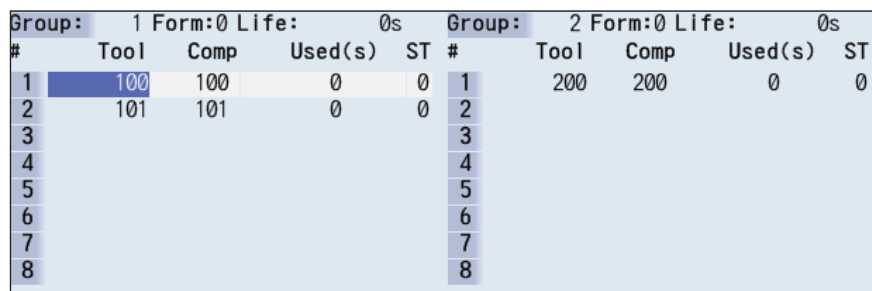
By setting parameter "#1107 TlIfsc", it is possible to select the life management data display mode for multiple groups.

"#1107 TlIfsc" setting value	0	1	2
No. of display groups	1	2	4
Max. No. of registered tools	16	8	4

<Group 1 display mode> (#1107 TlIfsc = 0)



<Group 2 display mode> (#1107 TlIfsc = 1)



<Group 4 display mode> (#1107 TlIfsc = 2)

Group: 1 Form:0 Life: 0s					Group: 2 Form:0 Life: 0s				
#	Tool	Comp	Used(s)	ST	#	Tool	Comp	Used(s)	ST
1	100	100	0	0	1	200	200	0	0
2	101	101	0	0	2				
3					3				
4					4				
Group: 3 Form:0 Life: 0s					Group: 4 Form:0 Life: 0s				
#	Tool	Comp	Used(s)	ST	#	Tool	Comp	Used(s)	ST
1	300	300	0	0	1	400	400	0	0
2					2				
3					3				
4					4				

Display Items

<Group information>

Display Items	Description	Setting range
Group	Life management group No.	1 to 9999
Method	This displays whether to control the currently displayed group in usage hours or usage count.	0: Hours 1: Times
Life	This sets the tool life data for the currently displayed group. The following tool life data units display based on the control method. Usage time: (s) Usage count: (set)	Usage time: 0 to 99999999 (s) Usage count: 0 to 999999 (set)

<Life management data within group>

Display Items	Description	Setting range
#	This displays whether the tool for which the # No. is highlighted is a life tool (ST=2) or a skip tool (ST=3).	
Tool No.	Set the tool No.	1 to 999999
Comp No.	This sets the compensation No.	1 to 80
Used	This sets the usage data at such times as when the tool is not an unused tool. This becomes "0" when the usage data is not set. The following usage data units display based on the control method. Usage time: (s) Usage count: (set)	Usage time: 0 to 99999999 (s) Usage count: 0 to 999999 (set)
ST	This sets the tool status. This becomes "0" when the tool status is not set. 0: Unused tool 1: Used tool 2: Normal life tool 3: Skipped tool	0 to 3 (Setting can be omitted.)

In the M system, if a part system is switched when the group unit is being displayed, registered data is not displayed, and you need to return to the group list once. However, in the L system: tool life management II, registered data is displayed, so you do not need to return to the group list.

Menus	
Menus	Description
Group No.	This displays the data of a group when that group No. of tool life management data is set and the [INPUT] key is pressed. The group No. can be referred to in the group list.
Line copy	Copies one line of tool life management data where the cursor is located.
Line paste	The copied tool life management data is written to the data in the line where the cursor is located. If the copied data is changed after the menu key [Line copy] is pressed, the data before changing is written when pasted. The copied data can be pasted as many times as is required until new data is copied.
Line clear	This erases a designated line (multiple lines possible) of tool life management data. The first and the last line No. of the data to be erased is specified with a "/" separating the Nos.. If the [INPUT] key is pressed without specifying a line, the data in the line where the cursor is located is erased.
Grp No. change	This changes a group No. If a new group No. is specified and the [INPUT] key pressed, the group No. changes. An error occurs if an existing group No. is specified.
Group change	The group active area is changed if parameter "#1107 Tllfsc" is set to "1" or "2".
Multi group	Changes to the multiple group life management data display mode based on the parameter "#1107 Tllfsc" setting value.
Group regist	This creates a new group and displays the life management data containing no data.
Group list	This displays the list of tool life data groups.
Close	The multiple group life management data display mode is canceled.

Operation method (Designating a group No.)

- (1) Press the menu [Group No].
- (2) Designate the group No. to be displayed.
12 [INPUT]

Note

- (1) If a group No. that does not exist is set, a message appears to confirm the creation of a new No. A new group is created if [Y] or [INPUT] is pressed.
When creating a new group, set the method and life data at the end of the group No., separating the data with a "/". If the method and life data are omitted, a new group is created with method = 0 (usage time), and life data = 0.



Operation method (Changing a group No.)

- (1) Press the menu [Grp No.change].
- (2) Designate the group No. after changing.
112 [INPUT]

Note

- (1) An error occurs if the group No. duplicates a pre-existing group No.

Operation method (Setting the tool life data)

- (1) Move the cursor to the data to be set using the , , [↑], [↓], [←] and [→] keys.
It is possible to move to the line after the registered line.
Set a tool No. for this line to newly register tool life management data.
- (2) Set a value.
20 [INPUT]

Note

- (1) It is not possible to set any other data if the tool No. and compensation No. have not been set.

Operation method (Copying/pasting the tool life data)

- (1) Move the cursor to the line to be copied.
- (2) Press the menu [Line copy].
- (3) Move the cursor to the line where the data is to be pasted.
- (4) Press the menu [Line paste].

Note

- (1) Once copied, the data is held until a new data item is copied.

Operation method (Erasing one line of tool life management data)

- (1) Move the cursor to the line to be erased.
- (2) Press the menu [Line clear] and [INPUT] keys.
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Operation method (Designating and erasing the multiple lines)

- (1) Press the menu [Line clear].
- (2) Set the range to be erased by marking the first and last # Nos. with a "/".
1/5 [INPUT]
- (3) Press the [Y] or [INPUT] key.
Press a key other than [Y] or [INPUT] in order not to erase the data.

Note

- (1) If the [INPUT] key is pressed without setting a # No., the line at the cursor is erased.

Operation method (Registering a group)

- (1) Press the menu [Group regist].
- (2) Set the No. of the group to be registered.
25/1/3000 [INPUT]

Note

- (1) If the method and life data are omitted, a new group is created with method = 0 (usage time), and life data = 0.
- (2) An error occurs if the group No. duplicates a pre-existing group No.
- (3) The group is not registered if one of the operations below is performed after registering a new group No.
 - If the application is exited without registering even 1 item of tool life data.
 - The screen is changed to that of other than the group unit display.
 - The part system is changed.

Operation method (Changing the active area for multiple group displays)

- (1) Press the menu [Group change].  The cursor indicating the active status moves to the next group.

6.7 Setting and Measuring a Workpiece

6.7.1 Workpiece Measurement (M System)

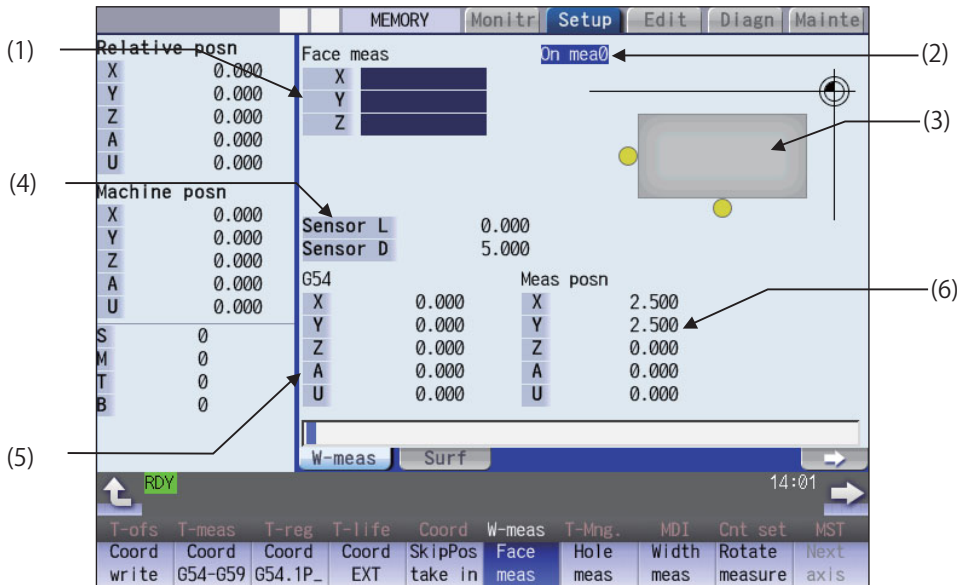


The coordinate point for each axis can be measured on the workpiece measurement screen of the Setup screen. Install the sensor on the spindle, turn the measurement switch ON, and select manual feeding or handle feeding on the workpiece position measurement screen to bring the sensor into contact with the workpiece. Then, measure the coordinate point of each axis.

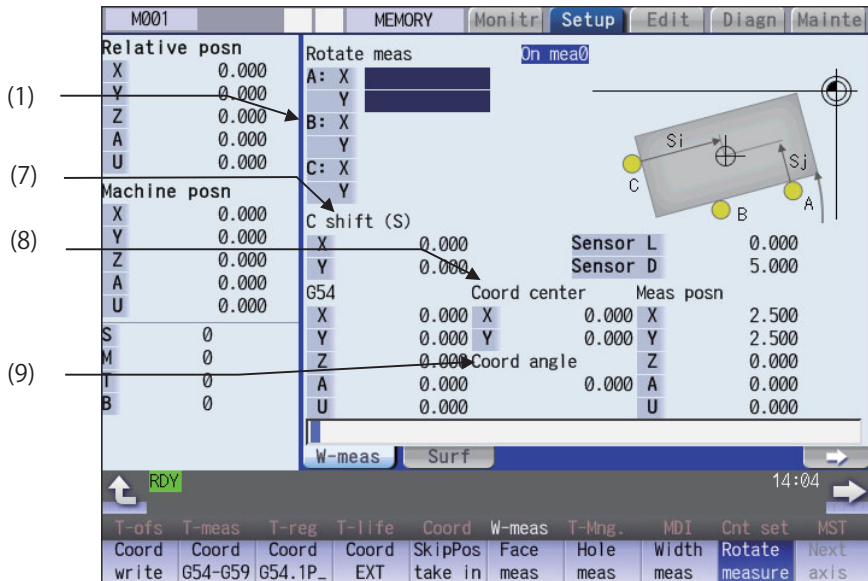
To make surface, hole, and width measurements, calculate each center coordinate from the measured coordinate, and set the obtained value to the workpiece coordinate system offset.

For the rotation measurement, the measurement result is set in the workpiece coordinate system offset (rotation center) and parameters "#8623 Coord rot centr(H)", "#8624 Coord rot centr(V)", and "#8627 Coord rot angle".

■For surface measurement (As for the hole or width measurement, the guide drawing (3) differs.)



■For rotation measurement



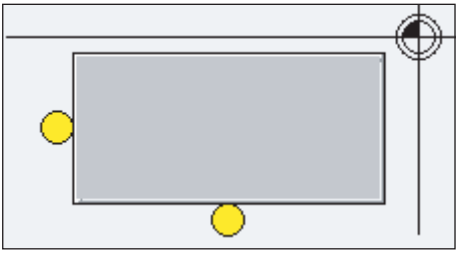
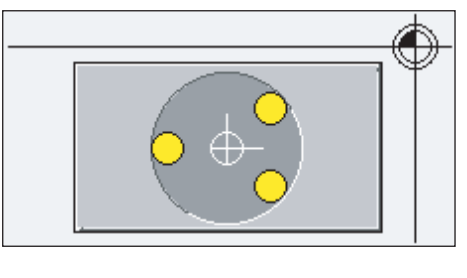
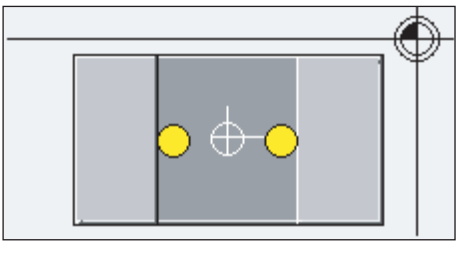
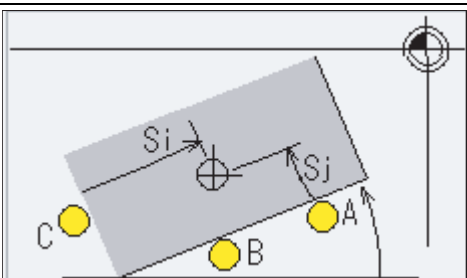
Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

Display Items	
Display Items	Description
(1) Measurement counter	<p>Displays the measurement position.</p> <p>The measurement axis is compatible with parameters "#1026 base_I", "#1027 base_J", and "#1028 base_K". (Hereafter indicated as I=X, J=Y, and K=Z axes in this manual.)</p> <p>The measurement position becomes blank when setting the coordinate system offset amount, resetting the NC, or changing the measurement mode (when the menu [face meas], [hole meas], [width meas], or [rotate meas] is selected).</p> <p>The display contents differ depending on the measurement pattern (surface measurement, hole measurement, width measurement, or rotation measurement).</p>
Surface measurement counter	Displays the calculated measurement position from the skip position for each axis (X-, Y-, Z-axes).
Hole measurement counter	Displays 3 (A, B, C) measurement positions.
Width measurement counter	Displays 2 (A, B) measurement positions.
Rotation measurement counter	Displays 3 (A, B, C) measurement positions (X-, Y-axes).
(2) Display of measurement in progress	<p>"On mea" is displayed when the measurement switch on the machine operation board is ON.</p> <p>Refer to "Manual measurement status display" in "6.3.1 Tool Measurement (M System)" for details.</p>
(3) Guide graphic	<p>Displays the measurement image.</p> <p>The contents of the guide drawing differ depending on the measurement pattern (surface measurement, hole measurement, width measurement, or rotation measurement).</p>
(4) Sensor length and diameter	<p>Sensor length: Displays the length to the tip of the touch sensor. ("#8701 Tool Length" setting value)</p> <p>Sensor diameter: Displays the diameter of the ball at the tip of the touch sensor. ("#8702 Tool Dia" setting value)</p>
(5) Coordinate system offset	Displays the currently selected coordinate system offset.
(6) Measurement position counter	<p>Displays the measurement position for all axes.</p> <p>X axis: X axis machine position + sensor radius +center compensation (Horizontal)</p> <p>Y axis: Y axis machine position + sensor radius +center compensation (Vertical)</p> <p>Z axis: Z axis machine position - sensor length</p> <p>4th axis and over: Respective machine position</p> <p>Sensor length: "#8701 Tool Length"</p> <p>Sensor radius: "#8702 Tool Dia" /2</p> <p>Center compensation (H): "#8703 OFFSET X"</p> <p>Center compensation (V): "#8704 OFFSET Y"</p>
(7) Center shift amount	Displays the shift amount of the coordinate rotation center.
(8) Coordinate rotation center	<p>Displays the coordinates that are the center during coordinate rotation.</p> <p>This is the setting value of "#8623 Coord rot centr (H)" and "#8624 Coord rot centr (V)".</p>
(9) Coordinate rotation angle	<p>This displays the angle to rotate the coordinate.</p> <p>Displays the rotation angle during coordinate rotation. This is the setting value of "#8627 Coord rot angle".</p>

Menus

Menus	Description
Coord write	The results calculated from the measurement counter are set in the displayed workpiece coordinate system offset. Only the axis for which a value is displayed in the measurement counter can be set. <Note> <ul style="list-style-type: none"> •If the workpiece coordinate system to be set is G54 to G59, the local coordinate system offset value will be zero. (Only for the measured axis.) •When the parameter "#8924 Meas. confirm msg" is "1", this menu is highlighted and the operation message "OK? (Y/N)" appears. The measurement result is written as tool compensation amount by pressing [Y] or [INPUT] key. Even if other key is pressed, the result is not written. When this menu is pressed again while displaying the message, the highlighting is canceled and the operation message is erased.
Coord G54-G59	This selects the displayed workpiece coordinate system from the sub-menu (G54 - G59). Select the workpiece coordinate system to display the selected workpiece coordinate system offset in the coordinate system offset section. (Perform the offset amount setting at the menu [Coord write].)
Coord G54.1 P	Input the P number to display the selected extended workpiece coordinate system (G54.1 Pn) offset in the coordinate system offset section. (Perform the offset amount setting at the menu [Coord write].) This menu is not displayed if the extended workpiece coordinate system offset specification is disabled.
Coord EXT	This displays the external workpiece coordinate system offset in the coordinate system offset section. (Perform this setting at the menu [Coord write].)
SkipPos take in	This creates a false signal when performing simple measurement (measurement without using the touch sensor) and reads the skip position. Press this menu to display the measurement position measured from the machine position of the axis moved last (axis 1 or 2) at the measurement counter. The skip position cannot be read for an axis of auxiliary axis state.
Face meas	This enables surface measurement. Surface measurement is possible when the power is turned ON.
Hole meas	This enables hole measurement. (The cursor moves to the measurement counter point A.)
Width meas	This enables width measurement. (The cursor moves to the measurement counter point A.)
Rotate meas	This enables rotation measurement. (The cursor moves to the measurement counter point A.)
Next axis	This changes the axes displayed at the coordinate system offset and measurement position counter every 5 axes. <Note> <ul style="list-style-type: none"> •This displays when the number of enabled axes is 6 or over.
Center shift	This sets the center shift amount. (The cursor moves to the 1st axis of "C shift (S)" when this is selected.)
Rotate center	This sets the coordinate rotation center. (The cursor moves to the 1st axis of "Coord center" when this is selected.)
Rotate angle	This sets the coordinate rotation angle. (The cursor moves to "Coord rot angle" when this is selected.)

Details of the "Measurement counter" and "Guide drawing" display areas

Menus	Measurement counter	Guide graphic
Face meas	Face meas X -1566.122 Y -433.368 Z	
Hole meas	Hole meas A:X -1566.122 Y -433.368 B:X Y C:X Y	
Width meas	Width meas A:X -1566.122 Y -433.368 Z B:X Y Z	
Rotate meas	Rotate meas A:X1 -1566.122 Y1 -433.368 B:X1 Y1 C:X1 Y1	

6.7.1.1 Carrying Out Surface Measurement

When carrying out surface measurement, the position of each axis is measured and the measurement results are set in the workpiece coordinates system offset. The measurement position displays at the measurement counter.

<Measurement using touch sensor>

Measurement counter X = X axis skip position + sensor radius (*1)

Measurement counter Y = Y axis skip position + sensor radius (*1)

Measurement counter Z = Z axis skip position - sensor length

(*1) The sign (+ and -) changes depending on the direction of the axis moved last.

Item	Reference
Sensor radius	"#8702 Tool Dia"/2
Sensor length	"#8701 Tool Length"

<Simple measurement (measurement without using touch sensor)>

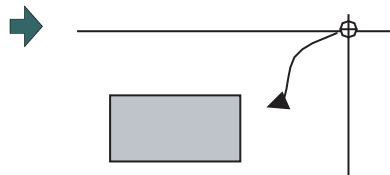
Measurement counter X: X axis measurement position

Measurement counter Y: Y axis measurement position

Measurement counter Z: Z axis measurement position

Operation method

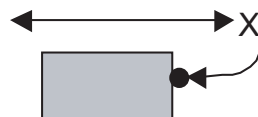
- (1) Press the menu [Face meas].
- (2) Perform the reference position return command, etc. to position the tool at the basic point.
- (3) Turn ON the measurement switch on the machine operation board.
- (4) Move the tool near the workpiece using manual feed and manual handle feed.



<Measurement using touch sensor>



- (5) Move the tool in the X-direction until the sensor contacts the workpiece.

Upon contact, the axis automatically contacts the workpiece again. The measurement position measured from the skip position displays in the measurement counter X axis section.



6 Setting a Tool and a Workpiece

<Simple measurement (without the touch sensor)>

- (5) Move the tool in the X-direction to the arbitrary position and press the menu [SkipPos take in].  The skip position is calculated and the result displays in the measurement counter X axis section.
- (6) Select the workpiece coordinate system offset in which the measurement data will be set.
(Example) To select G55
Press the menus [Coord G54-G59] [G55].
- (7) Press the menu [Coord write].  The value achieved by adding or subtracting the external workpiece offset to or from the X axis measurement position based on the "#8709 Ext work sign rvs" is set in workpiece coordinate system selected at (6).
The measurement counter displays blank.
- (8) Carry out the operations in steps (4) to (7) in the same way for the Y and Z axes.
- (9) Return the tool to the reference position, and turn the measurement switch OFF.

6.7.1.2 Carrying Out Hole Measurement

For hole measurement, measure the measurement position coordinate of two axes (X and Y) at three points, calculate the center of the hole, and set the result to the designated workpiece coordinate offset. The measurement position coordinate is displayed on the measurement counter.

<Measurement using touch sensor>

Measurement counter X = X axis skip position

Measurement counter Y = Y axis skip position

<Simple measurement (measurement without using touch sensor)>

Measurement counter X = X axis machine position + center compensation (H) + skip past amount (Horizontal axis) (*1)



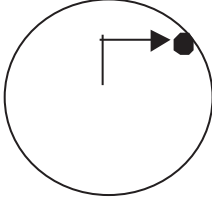


Measurement counter Y = Y axis machine position + center compensation (V) + skip past amount (Vertical axis) (*1)

(*1) The skip past amount is added for only the axis that moved last.

The sign (+ or -) of the past amount depends on the movement direction of the axis.

Item	Reference
Center compensation (H)	"#8703 OFFSET X"
Center compensation (V)	"#8704 OFFSET Y"
Skip past amount (H)	"#8707 Skip past amout(H)"
Skip past amount (V)	"#8708 Skip past amout(V)"

Operation method

- (1) Press the menu [Hole meas].  The menu is highlighted and the cursor displays at point A.
Use the [\uparrow] or [\downarrow] key to move to points B and C.
- (2) Perform the reference position return command, etc. to position the tool at the basic point.
- (3) Turn ON the measurement switch on the machine operation board.
- (4) Move the tool into the hole using manual feed and manual handle feed.
- <Measurement using touch sensor>
- (5) Position the tool against the inner wall of the hole. Contact is performed by moving a single axis.  
- Upon contact, the axis automatically contacts the workpiece again. The skip position displays in the measurement counter point A, X and Y axis section.
The cursor moves to point B. For point C, the cursor moves to point A.
- <Without the touch sensor (simple measurement)>
- (5) Move the tool to the arbitrary position and press the menu [SkipPos take in].  The skip position is calculated and the result is displayed for X and Y axes in the measurement counter A.
The cursor moves to point B. For point C, the cursor moves to point A.
- (6) Measure points B and C in the same way.
- (7) Select the workpiece coordinate system offset in which the measurement data will be set.
(Example) To select G55
Press the menus [Coord G54-G59] [G55].
- (8) Press the menu [Coord write].  The hole center position is measured, and based on the "#8709 Ext work sign rvs", value achieved by adding or subtracting the external workpiece to or from the measurement result is set in workpiece coordinate system selected at (7).
The measurement counter displays blank.
- (9) Return the tool to the reference position, and turn the measurement switch OFF.

6.7.1.3 Carrying Out Width Measurement

With width measurement, two points of the measurement position coordinate for each axis are measured, and then calculates the center between the points to set it as the workpiece coordinate offset. The measurement position displays at the measurement counter.

<Measurement using touch sensor>

Measurement counter X = X axis skip position

Measurement counter Y = Y axis skip position

Measurement counter Z = Z axis skip position - sensor length

<Simple measurement (measurement without using touch sensor)>

Measurement counter X = X axis machine position + center compensation (H) + skip past amount (Horizontal axis) (*1)

Measurement counter Y = Y axis machine position + center compensation (V) + skip past amount (Vertical axis) (*1)

Measurement counter Z = Z axis machine position - sensor length

(*1) The skip past amount is added for only the axis that moved last.

The sign (+ or -) of the past amount depends on the movement direction of the axis.

Item	Reference
Sensor length	"#8701 Tool Length"
Center compensation (H)	"#8703 OFFSET X"
Center compensation (V)	"#8704 OFFSET Y"
Skip past amount (H)	"#8707 Skip past amout(H)"
Skip past amount (V)	"#8708 Skip past amout(V)"

Operation method

- (1) Press the menu [Width meas].

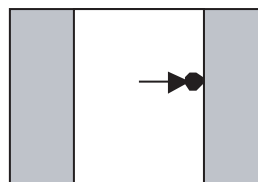


The menu is highlighted and the cursor displays at point A. Use the [↑] or [↓] key to move to points A and B.

- (2) Perform the reference position return command, etc. to position the tool at the basic point.
- (3) Turn ON the measurement switch on the machine operation board.
- (4) Move the tool to the center of the groove using manual feed or manual handle feed.

<Measurement using touch sensor>




- (5) Position the tool against the inner wall of the groove. Contact is performed by moving a single axis.



Upon contact, the axis automatically contacts the workpiece again. The skip position displays in the measurement counter point A.

The cursor moves to point B. For point B, the cursor moves to point A.

<Simple measurement (without the touch sensor)>

- (5) Move the tool to the arbitrary position and press the menu [SkipPos take in].  The skip position is calculated and the results displays in the movement axis section of the measurement counter A point.
The cursor moves to point B. For point B, the cursor moves to point A.
- (6) Similarly, position the tool against the opposite side.  Upon contact, the axis automatically contacts the workpiece again. The skip position displays in the measurement counter point B.
- (7) Select the workpiece coordinate system offset in which the measurement data will be set.
(Example) To select G55
Press the menus [Coord G54-G59] [G55].
- (8) Press the menu [Coord write].  The width center position is measured, and based on the "#8709 Ext work sign rvs", value achieved by adding or subtracting the external workpiece offset to or from the measurement result is set in workpiece coordinate system offset G55 (coordinate system selected at (7)). The measurement counter displays blank.
- (9) Carry out the operations in steps (4) to (8) in the same way for the Y and Z axes.
- (10) Return the tool to the reference position, and turn the measurement switch OFF.

6.7.1.4 Carrying Out Rotation Measurement

When carrying out rotation measurement, the offset (rotation center and rotation angle) of the rotary coordinate system is measured, and the results are set to the workpiece coordinate system offset (rotation center) and the parameters "#8623 Coord rot centr(H)", "#8624 Coord rot centr(V)", and "#8627 Coord rot angle".

<Measurement using touch sensor>

Measurement counter X = X axis skip position

Measurement counter Y = Y axis skip position

<Simple measurement (measurement without using touch sensor)>

Measurement counter X = X axis machine position + center compensation (H) + skip past amount (Horizontal axis) (*1)

Measurement counter Y = Y axis machine position + center compensation (V) + skip past amount (Vertical axis) (*1)

(*1) The skip past amount is added for only the axis that moved last.

The sign (+ or -) of the past amount depends on the movement direction of the axis.

Item	Reference
Center compensation (H)	"#8703 OFFSET X"
Center compensation (V)	"#8704 OFFSET Y"
Skip past amount (H)	"#8707 Skip past amount(H)"
Skip past amount (V)	"#8708 Skip past amount(V)"

Operation method (Setting the center shift amount)

- (1) Press the menu [Rotate meas].
- (2) Press the menu [Center shift].
- (3) Input the center shift amount (Si).
10.000 [INPUT]
- (4) Input the center shift amount (Sj).
-5.000 [INPUT]
- (5) Press the menu [Center shift].

Operation method (Setting the center and angle of the coordinate rotation)


The setting of the parameters "#8623 Coord rot centr(H)", "#8624 Coord rot centr(V)", and "#8627 Coord rot angle" can be changed.

- (1) Press the menu [Rotate meas].
- (2) Press the menu [Rotate center].
- (3) Input data in the 1st axis of "Coord center" column.
0 [INPUT]
- (4) Input data in the 2nd axis of "Coord center" column.
0 [INPUT]
- (5) Press the menu [Rotate center].

Note

- (1) Set the angle of the coordinate rotation in the same manner.

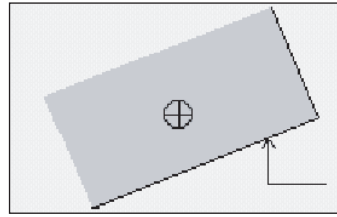
Operation method (Carrying out the rotation measurement using touch sensor to set the measurement results to the workpiece coordinate offset)

- (1) Press the menu [Rotate meas].  The menu is highlighted and the cursor displays at point A. The cursor can be moved to A, B, or C, using the [↑] or [↓] key.
- (2) Set the parameter "#8116 Coord rot para invd" to "1" (invalid).
- (3) Turn the manual absolute switch ON.
- (4) Set the following parameters to "0".
#8623 Coord rot centr(H)
#8624 Coord rot centr(V)
#8627 Coord rot angle (*1)
- (5) Perform the reference position return command, etc. to position the tool at the basic point.
- (6) Turn ON the measurement switch on the machine operation board.
- (7) Referring to "Setting the center shift amount", set the center shift amount.
This setting is not necessary if the coordinate rotation center is served as the workpiece coordinate zero point.

(*1) These parameter should be set to "0" to set the measured value to them.
If the value other than "0" has been set, an error occurs when writing to the coordinate system.

(8) <Measurement using touch sensor>

Make the spindle contact the workpiece using manual feed or manual handle feed. ➔



Upon contact, the skip position displays in the measurement counter point A.
The cursor moves to point B. For point C, the cursor moves to point A.

<Without the touch sensor (simple measurement)>

Move the spindle to the arbitrary position and press the menu [SkipPos take in]. ➔

The skip position is calculated and the results appear in the measurement counter point A.
The cursor moves to point B. For point C, the cursor moves to point A.

(9) Measure points B and C in the same way.

(10) Select the workpiece coordinate system offset in which the measurement data will be set.

(Example) To select G55
Press the menus [Coord G54-G59] [G55].

(11) Press the menu [Coord write]. ➔

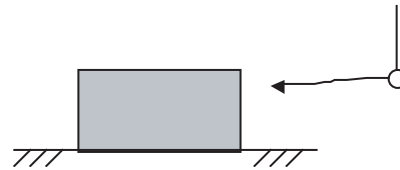
The hole center position is measured.
Based on the parameter "#8709 Ext work sign rvs" setting, the value achieved by adding or subtracting the external workpiece offset to or from the measurement result is set in workpiece coordinate system selected at (10).
The parameters "#8623 Coord rot centr(H)", "#8624 Coord rot centr(V)", and "#8627 Coord rot angle" are updated.
The measurement counter displays blank.

(12) Return the tool to the reference position, and turn the measurement switch OFF.

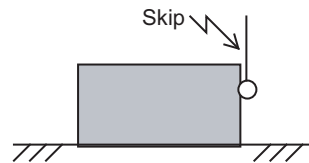
6.7.1.5 Performing Automatic Recontact When Contacting the Workpiece

When performing workpiece position measurement in either the JOG or handle mode, the following operations (automatic recontact) are performed after contacting the workpiece.

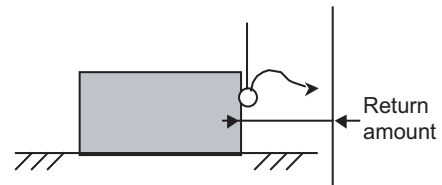
- (1) Moves to the measurement point using either the JOG or handle mode.



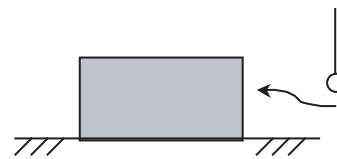
- (2) Stops at the measurement point.



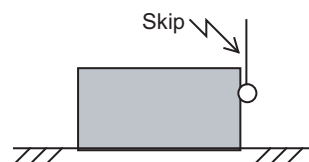
- (3) Returns by the measurement parameter return amount (#8705).



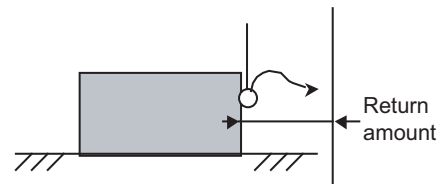
- (4) Moves to measurement point again at the measurement parameter feedrate (#8706).



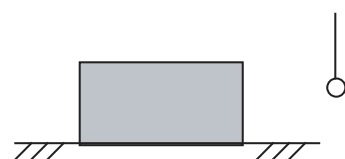
- (5) Stops at the measurement point. (The skip position is read.)



- (6) Returns by the measurement parameter return amount (#8705).



- (7) The next measurement can be performed after automatically contacting the workpiece again.



The return speed for (3) and (6) is 40 times the measurement parameter feedrate (#8706). However, if the return speed is faster than rapid traverse rate (override 100%), the rapid traverse rate will become the return speed.

6.7.2 Workpiece Measurement (L System)

The external workpiece coordinate offset data for the Z axis can be set by cutting the workpiece face by means of manual operations and inputting the workpiece measurement signal. By pressing the menu key, data can be set in the Z axis of an arbitrary coordinate offset.

Coordinate offset setting for the Z axis (2nd axis) of the part system 1 to 4 is possible.

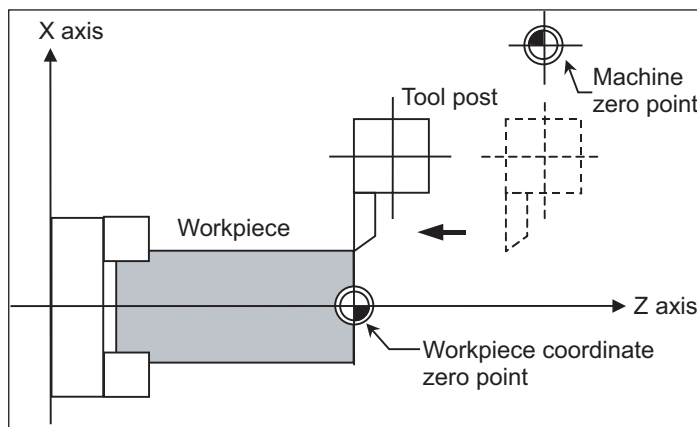
Note that the workpiece coordinate offsets for multiple part systems cannot be measured at the same time.

For signals and R registers, refer to the instruction manual issued by the MTB.

Note

(1) Measurement is disabled for the part system with one-axis structure.

■ Example of measurement of external workpiece coordinate offset data for Z axis



M001	SYS1	MEMORY	Monitr	Setup	Edit	Diagn	Mainte
Relative posn		EXT	On mea0				
(1)	X 0	0.00000	X	0.00000	x		
	Z	0.00000	Z	0.00000	z		
	C	0.00000	C	0.00000			
(2)	A	0.00000	A	0.00000			
Machine posn		Tool offset num	0				
	X 0	0.00000	Wear offset num				
	Z	0.00000	0				
(3)	C	0.00000	G54				
	A	0.00000	X	0.00000			
(4)	S	0	Z	0.00000			
	M	0	C	0.00000			
	T	0	A	0.00000			
	B	0					
W-meas		11:58					
T-ofs	T-meas	T-reg	T-life	Coord	W-meas	T-Mng.	MDI
	Coord	Coord		MeasVal			
	G54-G59	G54.1P_		take in			

Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

Display Items

Display items	Description
(1) External workpiece coordinate offset	This displays the external workpiece coordinate offset. When the workpiece measurement signal is input, the measurement result is set to 2nd axis of the external workpiece coordinate. <Note> •The 5th axis and following are not displayed.
(2) Tool L offset num	This displays the compensation No. of tool length data used by automatic calculation. <Note> •If an illegal value is set, the value is blank. ("0" is displayed.) •The No. is displayed by BCD code.
(3) Wear offset num	This displays the compensation No. of tool nose wear data used by automatic calculation. <Note> •If an illegal value is set or tool nose wear data is not used for measurement ("#1226 aux10/bit0" is 1), the value is blank. ("0" is displayed.) •The No. is displayed by BCD code.
(4) Coordinate system offset	This displays the coordinate system offset in which the measurement result is written when the menu [MeasVal take in] is pressed. G54 is displayed in default. When the menu [MeasVal take in] is pressed, the measurement result is set to 2nd axis of the external workpiece coordinate. <Note> •The 5th axis and following are not displayed. •The display of Coordinate system offset area is switched by page changeover keys. For details, refer to "6.8.4 Changing the Coordinate System Display".
(5) On mea	When the measurement switch is ON and the operation mode is manual mode (handle, jog, rapid traverse, or step), "On mea" is displayed, and the workpiece can be measured by the workpiece measurement signal.
(6) Guide graphic	This displays the measurement area.





Menus

Menus	Description
Coord G54-G59	This selects the coordinate system offset which sets the measurement value when [MeasVal take in] is executed from sub-menu (G54 - G59). The workpiece coordinate system offset data is displayed after selected. However, the cursor is not displayed and the data cannot be set.
Coord G54.1 P	This selects the coordinate system offset which sets the measurement value when [MeasVal take in] is executed. Input the P No. to display the selected external workpiece coordinate system (G54.1 Pn) offset in the coordinate system offset area. However, the cursor is not displayed and the data cannot be set. If the extended workpiece coordinate system offset specification is invalid, this menu is grayed out and non-selectable.
MeasVal take in	This measures G54 - G59 and G54.1Pn. When this menu is pressed, the workpiece coordinate offset data is calculated from the machine coordinate, the used tool length, the tool nose wear compensation amount and the external workpiece coordinate offset, and the data is stored in Z axis of the selected coordinate system offset.

Operation method (When the workpiece measurement signal is used)

- | | | |
|---|---|--|
| <p>(1) Execute the reference position return.</p> | ➡ | <p>The coordinate system is established.</p> <p><Note></p> <ul style="list-style-type: none"> •If the workpiece is measured without establishing the reference position return, the operation message "Meas axis not returned to ref. position" appears. |
| <p>(2) Set the mode selection switch to the manual mode (handle, jog, rapid traverse, or step).</p> | | |
| <p>(3) Set the tool length measurement signal to "1".</p> | | |
| <p>(4) Select whether to measure the workpiece coordinate on the main spindle side or sub-spindle side by using tool presetter sub-side valid signal.</p> <p><Note></p> <ul style="list-style-type: none"> •Hold the state of this signal until the measurement with the selected tool is completed. | | |
| <p>(5) Issue the T command with MDI operation, etc.</p> | ➡ | <p>The tool is selected.</p> <p><Note></p> <ul style="list-style-type: none"> •Set the selected tool compensation No. in R register. The set R register differs according to parameter setting and the state of the tool presetter sub-side valid signal. •Set the "tool length/wear data" for the tool being used beforehand. |
| <p>(6) Cut the workpiece face slightly to even it.</p> <p><Note></p> <ul style="list-style-type: none"> •Do not move the tool in the Z axis direction after cutting the workpiece face. •If the workpiece does not need to be cut, carry out positioning to the measurement position. | | |
| <p>(7) Input the workpiece measurement signal.</p> | ➡ | <p>The Z axis external workpiece coordinate offset data is automatically calculated from the tool compensation data of the used tool and the machine value at the point this signal is input. The results are set as the data.</p> |
| <p>(8) Set the tool length measurement signal to OFF.</p> | | |

Operation method (When the menu [MeasVal take in] is used)

- | | | |
|---|---|--|
| (1) Execute the reference position return. |  | The coordinate system is established.
<Note>
•If the workpiece is measured without establishing the reference position return, the operation message "Meas axis not returned to ref. position" appears. |
| (2) Set the mode selection switch to the manual mode (handle, jog, rapid traverse, or step). | | |
| (3) Select an arbitrary coordinate system offset. |  | The designated coordinate system offset is selected.
<Note>
•When switching to an arbitrary coordinate system offset display, press one of these menus; [Coord G54 - G59] [Coord G54.1P] or page key. |
| (4) Select whether to measure the workpiece coordinate on the main spindle side or sub-spindle side by using tool presetter sub-side valid signal.
<Note>
•Hold the state of this signal until the measurement with the selected tool is completed. | | |
| (5) Issue the T command with MDI operation, etc. |  | The tool is selected.
<Note>
•Set the selected tool compensation No. in R register. The set R register differs according to parameter setting and the state of the tool presetter sub-side valid signal.
•Set the "tool length/wear data" for the tool being used beforehand. |
| (6) Cut the workpiece face slightly to even it.
<Note>
•Do not move the tool in the Z axis direction after cutting the workpiece face.
•If the workpiece does not need to be cut, carry out positioning to the measurement position. | | |
| (7) Press the menu [MeasVal take in]. |  | The workpiece measurement is executed.
The operation message "OK? (Y/N)" appears, so press the [Y] or [INPUT].
The Z axis external workpiece coordinate offset data is automatically calculated from the tool compensation data of the used tool and the machine value at the point this signal is input. The results are set as the data. |

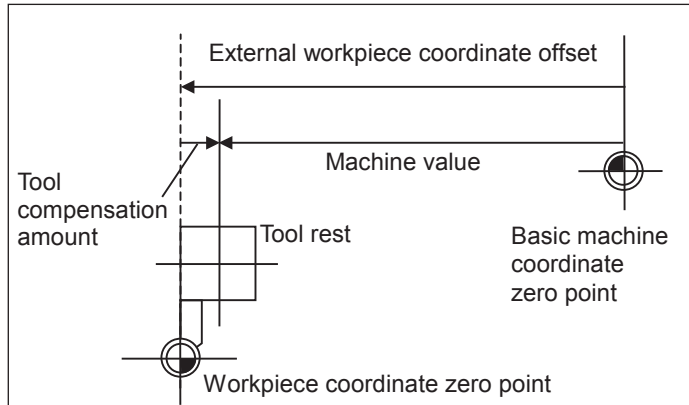
Details of automatic calculation expression (When the workpiece measurement signal is used)

The external workpiece coordinate offset data is automatically calculated with the following expression.

$$\text{External workpiece coordinate offset} = \text{Machine coordinate value} - \text{Tool compensation data}$$

The tool compensation data used for the measurement is selected with the base specification parameter "#1226 aux10 bit0".

#1226 aux10 bit0	Tool compensation data
0	Tool length data + nose wear data
1	Tool length data



Details of automatic calculation expression (When the menu [MeasVal take in] is used)

The workpiece coordinate offset data is automatically calculated with the following expression.

The calculation expression changes according to the parameter "#8709 Ext work sign rvs".

When "#8709" is "0":

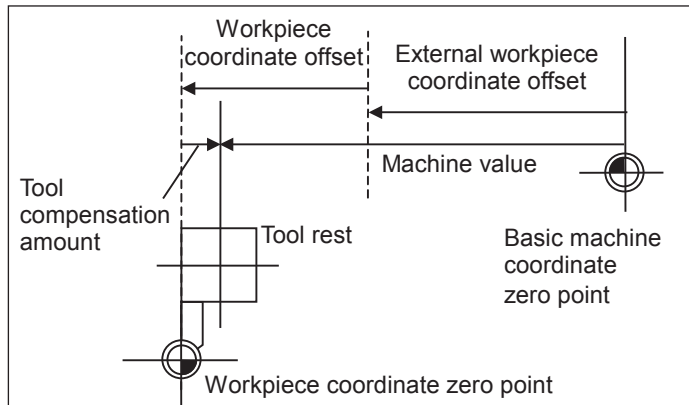
$$\text{Workpiece coordinate offset} = \text{Machine coordinate value} - \text{External workpiece coordinate offset} - \text{Tool compensation data}$$

When "#8709" is "1":

$$\text{Workpiece coordinate offset} = \text{Machine coordinate value} + \text{External workpiece coordinate offset} - \text{Tool compensation data}$$

Select the tool compensation data used for the measurement with the parameter "#1226 aux10 bit0".

#1226 aux10 bit0	Tool compensation data
0	Tool length data + nose wear data
1	Tool length data



The selected tool compensation No.

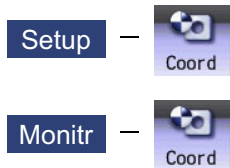
For the compensation No. of the tool length and tool nose wear data used by automatic calculation, the No. set in R register in the following table is used.

#1098 Tlno.	#1130 set_t	#1218 aux02 bit4	Tool L offset num		Wear offset num	
			Main side	Sub-side	Main side	Sub-side
0	0/1	0/1	R2600, R2601	R2604, R2605	R2600, R2601	R2604, R2605
1	0	0	R536, R537		R2600, R2601	R2604, R2605
		1	R2602, R2603	R2606, R2607		
	1	0/1				

Note

- (1) When the compensation No. is 0, the compensation amount will be calculated as "0".
- (2) If the compensation No. exceeds the number of specified offset sets, the operation message "Offset No. not found" appears.
However, when the workpiece measurement screen is not displayed, the message will not appear.
- (3) If the input data exceeds the setting range, the operation message "Data range error" appears.
However, when the workpiece measurement screen is not displayed, the message will not appear.
- (4) If the data protection is valid, the operation message "Data protect" appears.
However, when the workpiece measurement screen is not displayed, the message will not appear.
- (5) Whether to use the main side or sub-side is selected with the tool presetter sub-side valid signal.
(OFF: Main side, ON: Sub-side)
However, when the workpiece measurement screen is not displayed, the message will not appear.
- (6) Set the compensation No. in R register by the BCD code.

6.8 Setting Workpiece Coordinate System Offset

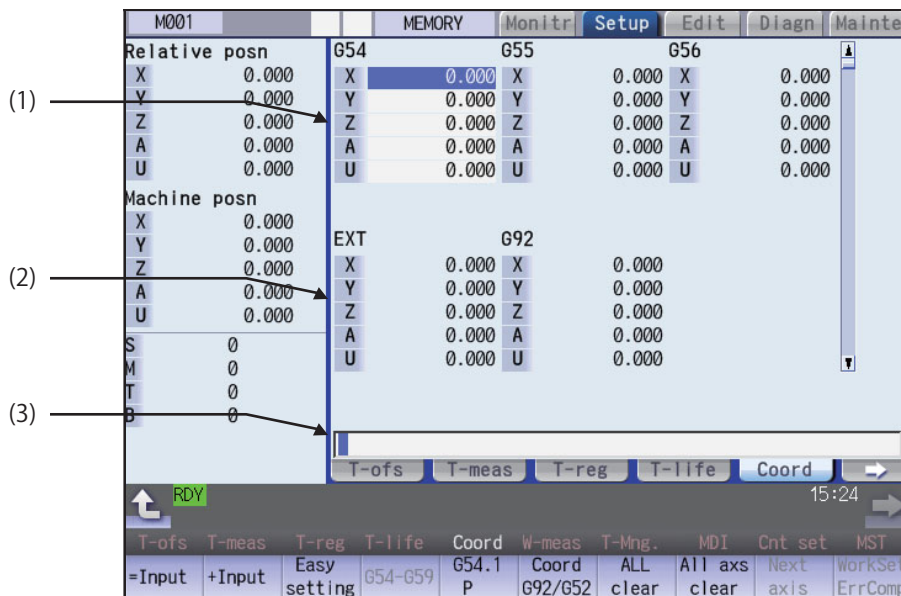


The coordinate system offset and workpiece installation error compensation controlled by the NC can be set and displayed on the monitor (Monitr) screen or the Setup screen.

Depending on the specifications, the number of coordinate system offset sets can be increased by 48, 96, or 300 sets.

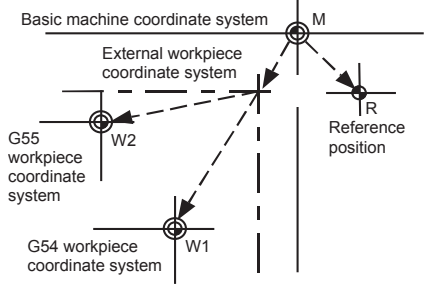
Note

- (1) The G92/G52 coordinate system offset cannot be set.
- (2) Workpiece installation error compensation is displayed only when the workpiece installation error compensation specification is valid.



Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

Display Items

Display Items	Description
(1) Coordinate system offset area	<p>This sets and displays the offset amount for the workpiece coordinate system (G54 - G59), or the extended workpiece coordinate system (G54.1Pn). Use the menu operation or page change key to specify which workpiece coordinate system offset to display or set. The workpiece coordinate system offset amount data can be set in absolute or additional mode.</p> 
(2) EXT offset area	This displays or sets the offset amount for the external workpiece system.
(3) G92/G52 offset area	This displays the offset amount for G92 or the local coordinate system. The offset amount of the corresponding local coordinate system (G52) is displayed only when the cursor is at G54 to G59.

 **CAUTION**

If the tool compensation amount or workpiece coordinate system offset amount is changed during automatic operation (including during single block stop), the changes will be valid from the command in the next block or after several subsequent blocks.

Menus








Menus	Description
=Input	This inputs the offset amount with the absolute mode. When "#8929 Disable=INPUT:comp" is set to "1", this menu cannot be selected.
+Input	This inputs the offset amount with the additional mode.
Easy setting	This sets the workpiece coordinate system offset so that the current machine coordinate becomes the workpiece coordinate zero point. Only the axis at the cursor position is set. When "#8935 W COORD CONFIRM" is set to "1", a operation message is displayed, and the menu is highlighted.
G54-G59	This displays the G54 - G59 workpiece coordinate system offset amount. The cursor moves to the G54 offset. This menu can be used when the G54 - G59 offsets are not displayed.
G54.1 P	Enter the P number displayed at the screen to display the extended workpiece coordinate (G54.1 Pn) offset in the coordinate system offset area. This menu is not displayed if the extended workpiece coordinate system offset specification is disabled. If the local coordinate system offset (G52) displays in the G92/G52 area, the display changes to G92.
Coord G92/G52	This displays the G92 or G52 coordinate system offset amount. The G92 offset data is always displayed when the cursor is not at the G54 to G59 offset data.
All clear	Coordinate system offset All coordinate system offset amounts for all axes are erased with the exception of G92 and EXT. Workpiece Installation Error Compensation This erases all of workpiece installation error compensation data except the common workpiece installation error compensation amount.
All axis clear	Coordinate system offset This erases the local offset data for all axes corresponding to the offset data of the coordinate system where the cursor is located. Workpiece Installation Error Compensation This erases the coordinate system compensation data where the cursor is located.
Next axis	This changes the axes displayed at the coordinate system offset and measurement position counter every 5 axes. <Note> ♦This displays when there are 6 or more axes.
WorkSet ErrComp	This displays workpiece installation error compensation screen. While the workpiece installation error is displayed, the menu will be kept highlighted. <Note> ♦It cannot be selected when the workpiece installation error compensation specification is not valid.

Note

(1) [Easy setting], [G54-G59], [G54.1P], [Coord G92/52] and [Next axis] are not displayed for workpiece installation error compensation.

6.8.1 Setting the Coordinate System Offset Amount

Operation method (Setting the workpiece coordinate system G54 - G59 offset amount)

- (1) Press the menu [G54-G59].  The G54 - G59 workpiece coordinate system offset displays.
- (2) Use the ( ) keys to move the cursor to the workpiece coordinate system offset to be set.
- Use the  and  page keys to change the coordinate system display.
Refer to "Changing the coordinate system offset using the page change keys (previous page: , next page: )" in "6.8.4 Changing the Coordinate System Display" for details.)
- (3) Use the [\uparrow] or [\downarrow] key to move the cursor to the axis for which data is to be set.
- (4) Set the offset amount.
122 [INPUT]
The value can also be designated by pressing the menu [=INPUT] instead of the [INPUT] key.
- (5) Set other data using the same method.

Note


- (1) It is possible to perform incremental input by pressing the menu [+INPUT] key instead of the [INPUT] key or the menu [=INPUT].
(Example) If the original data is 122.000:
 $1.234 [+INPUT] \rightarrow 122.000 + 1.234 = 123.234$


Setting the external coordinate system offset amount

Set the external coordinate system offset amount to keep the current workpiece coordinate system offset amounts from G54 to G59, and also apply an offset to the entire system.
Furthermore, it is also possible to use the data transfer function to write data directly to the external coordinate system offset (EXT). (Refer to "Chapter 12 Performing a Backup Operation" for details of the data transfer function.)


6.8.2 Erasing the Coordinate System Offset Amount


Operation method (Erasing the coordinate system (excluding G92) offset amount where the cursor is displayed for all axes.)

- (1) Press the menu [All axis clear].  A message displays confirming whether it is okay to erase the data.

- (2) Press the [Y] key.  All of the coordinate system indicated by the cursor is cleared to zero. In addition, all axes data of the local offset (G52) for the coordinate system will be erased.

Operation method (Erasing all axis offset data of all coordinate systems (excluding G92 and EXT))

- (1) Press the menu [All clear].  A message displays confirming whether it is okay to erase the data.

- (2) Press the [Y] key.  All coordinate system data is erased. In addition, all axes data of the local offset (G52) for the G54 to G59 coordinate systems will be erased.

Note

- (1) G92 data cannot be erased.

6.8.3 Setting the Workpiece Coordinate Origin

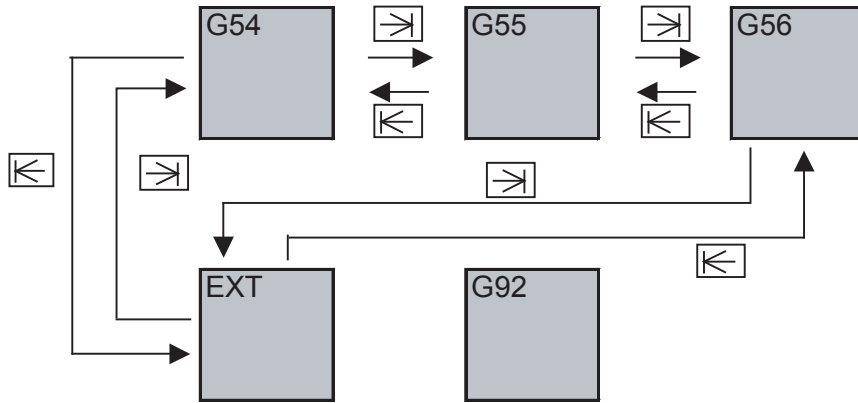
Press the menu [Easy setting] to set the coordinate system offset so that the current machine position (for all axes) becomes the workpiece coordinate origin. It is only possible to set those axes where the cursor is located.



If the menu [Easy setting] is pressed when there is the cursor in coordinate system offset (G54 to G59), the local offset (G52) data of the axis will be also erased.

6.8.4 Changing the Coordinate System Display

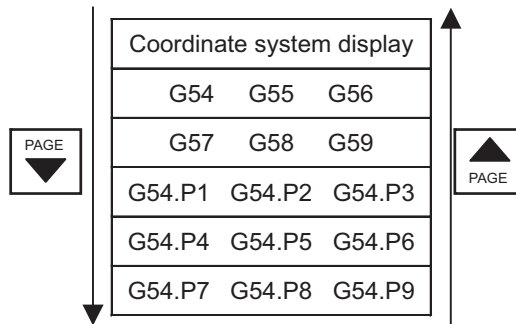
Using the  and  tab keys to change the coordinate system offset cursor position

A cursor position can be changed with tab keys as shown below.



Changing the coordinate system offset using the page change keys (previous page: , next page: )

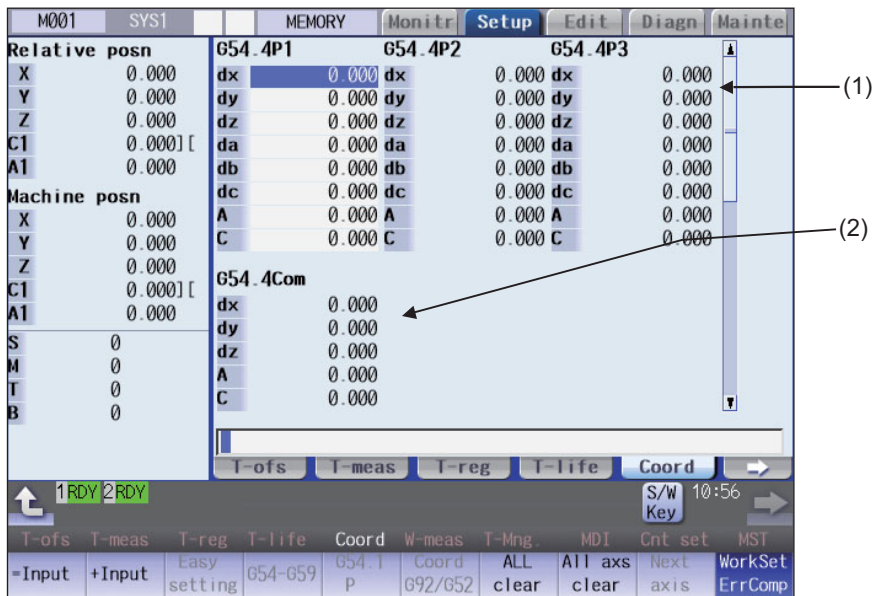
Use the page change keys to change the coordinate system offset display as shown below.



The additional specification is required for the G54.P1 - P300 workpiece coordinate system offset display.

6.8.5 Compensating the Workpiece Installation Error Data

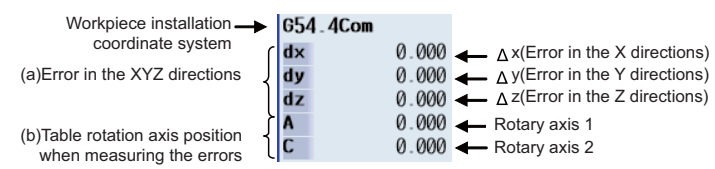
This function can set and display the workpiece installation error compensation controlled by the NC.



Display Items

Display Items	Description																																
(1) Workpiece installation error compensation amount	<p>This displays and sets an error compensation amount of the workpiece installation coordinate system (G54.4Pn). Absolute value or incremental value can be set in the error compensation amount.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Workpiece installation coordinate system → G54.4P1</p> <table border="0"> <tr> <td>(a) Error in the XYZ directions</td> <td>dx</td> <td>1.000</td> <td>← Δx(Error in the X directions)</td> </tr> <tr> <td></td> <td>dy</td> <td>10.000</td> <td>← Δy(Error in the Y directions)</td> </tr> <tr> <td></td> <td>dz</td> <td>100.000</td> <td>← Δz(Error in the Z directions)</td> </tr> <tr> <td>(b) Error in the rotation direction of each axis</td> <td>da</td> <td>1000.000</td> <td>← Δa(Error in the rotation direction of X axis)</td> </tr> <tr> <td></td> <td>db</td> <td>10000.000</td> <td>← Δb(Error in the rotation direction of Y axis)</td> </tr> <tr> <td></td> <td>dc</td> <td>-10.000</td> <td>← Δc(Error in the rotation direction of Z axis)</td> </tr> <tr> <td>(c) Table rotation axis position when measuring the errors</td> <td>A</td> <td>-100.000</td> <td>← Rotary axis 1</td> </tr> <tr> <td></td> <td>C</td> <td>-1000.000</td> <td>← Rotary axis 2</td> </tr> </table> </div> <p>(a) Errors in the XYZ directions (Δx, Δy, Δz) Set the zero point of the workpiece installation coordinate system seen from the original workpiece coordinate system. The error name of the each axis direction starts with d (fixed) then a small letter of an orthogonal coordinate axis (#7900 RCDAX_I, #7901 RCDAX_J, #7902 RCDAX_K) of \$1. ♦#7900 RCDAX_I ... If X, it is "dx". ♦#7901 RCDAX_J ... If Y, it is "dy". ♦#7902 RCDAX_K ... If Z, it is "dz".</p> <p>(b) Error in the rotation direction of each axis (Δa, Δb, Δc) Set Δa, Δb, and Δc to determine the XYZ directions of the workpiece installation coordinate system. Compared to the original workpiece coordinate system, the workpiece installation coordinate system's X axis is rotated by the angle Δa, Y axis is rotated by the angle Δb, and Z axis is rotated by the angle Δc. The positive direction of the rotation angle is the right-handed rotation.</p> <p>(c) Table rotary axis position when measuring the errors Set the machine coordinate values of the table rotary axis when Δx, Δy, Δz, Δa, Δb, and Δc are measured. The setting is not required for the machine configuration which does not have the table rotary axis. Two axes should be set for 5-axis machine table tilt type. Axis name to be displayed in the rotary axis 1 and 2 differs depending on the machine configuration.</p> <ul style="list-style-type: none"> ♦Table tilt type Displays the axis name #7942 ROTAXW1 for "Rotary axis1", and the axis name #7952 ROTAXW2 for "Rotary axis 2". ♦Tool tilt type Display the axis name "#7922 ROTAXT1" for "Rotary axis 1", and the axis name "#7932 ROTAXT2" for "Rotary axis 2". ♦Composite type Display the axis name "#7932 ROTAXT2" for "Rotary axis 1", and the axis name "#7952 ROTAXW2" for "Rotary axis 2". <div style="text-align: center;"> </div> <p><Note> ♦XYZ are set for the basic axis IJK in this example.</p>	(a) Error in the XYZ directions	dx	1.000	← Δx(Error in the X directions)		dy	10.000	← Δy(Error in the Y directions)		dz	100.000	← Δz(Error in the Z directions)	(b) Error in the rotation direction of each axis	da	1000.000	← Δa(Error in the rotation direction of X axis)		db	10000.000	← Δb(Error in the rotation direction of Y axis)		dc	-10.000	← Δc(Error in the rotation direction of Z axis)	(c) Table rotation axis position when measuring the errors	A	-100.000	← Rotary axis 1		C	-1000.000	← Rotary axis 2
(a) Error in the XYZ directions	dx	1.000	← Δx(Error in the X directions)																														
	dy	10.000	← Δy(Error in the Y directions)																														
	dz	100.000	← Δz(Error in the Z directions)																														
(b) Error in the rotation direction of each axis	da	1000.000	← Δa(Error in the rotation direction of X axis)																														
	db	10000.000	← Δb(Error in the rotation direction of Y axis)																														
	dc	-10.000	← Δc(Error in the rotation direction of Z axis)																														
(c) Table rotation axis position when measuring the errors	A	-100.000	← Rotary axis 1																														
	C	-1000.000	← Rotary axis 2																														

6 Setting a Tool and a Workpiece

Display Items	Description
(2) Common workpiece installation error compensation amount	<p>Error compensation amounts that are added commonly to the error compensation amounts for the workpiece installation coordinate system (G54.4Pn) can be set.</p> <div style="text-align: center;">  <p>Workpiece installation coordinate system → G54.4Com</p> <p>(a) Error in the XYZ directions { dx 0.000 ← Δx(Error in the X directions) dy 0.000 ← Δy(Error in the Y directions) dz 0.000 ← Δz(Error in the Z directions)</p> <p>(b) Table rotation axis position when measuring the errors { A 0.000 ← Rotary axis 1 C 0.000 ← Rotary axis 2</p> </div> <p>(a) Errors in the XYZ directions (Δx, Δy, Δz) Refer to the display item (1) "Workpiece installation error compensation amount".</p> <p>(b) The table rotary axis position when measuring the error Refer to the display item (1) "Workpiece installation error compensation amount".</p> <p><Note> •Error in the rotation direction of each axis (Δa, Δb, Δc) cannot be set.</p>

CAUTION

If the tool compensation amount, coordinate system offset amount or workpiece installation error compensation amount is changed during an automatic operation (including during single block stop), the changes will be valid from the command in the next block or after several subsequent blocks.

Menus

For details, refer to "6.8 Setting Workpiece Coordinate System Offset".

Setting the workpiece installation error data

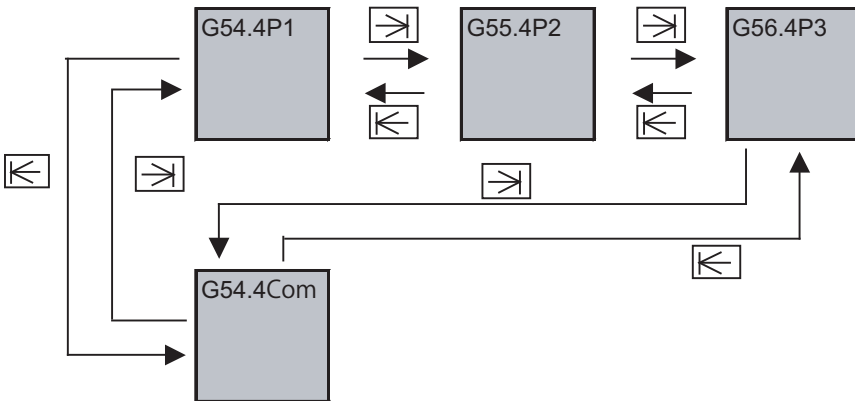
For details, refer to "6.8.1 Setting the Coordinate System Offset Amount".

Erasing the workpiece installation error data

For details, refer to "6.8.2 Erasing the Coordinate System Offset Amount".

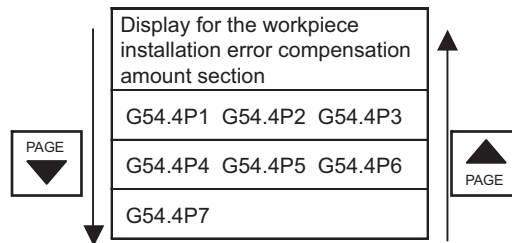
Changing a cursor position in the workpiece installation error compensation data area with the [←] and [→] tab keys

Press the Tab key to change the cursor position.

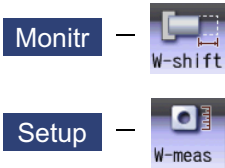


Changing the workpiece installation error compensation data using the page change keys (previous page: , next page: )

Workpiece installation error compensation amount section display can be changed with the page feed keys as shown below.



6.9 Setting Workpiece Coordinate System Shift



This function allows you to shift the workpiece coordinate system. Workpiece coordinate system that is created at the machining program creation may not match to the coordinate system that actually programmed or programmed by automatic coordinate system setting. This function allows you to machine without changing the machining program by shifting from the measured coordinate system to the coordinate system that is assumed when the program is created. In addition, workpiece can be machined using the same program even if their shapes are changed.

The workpiece coordinate system shift value can be designated by manual setting or automatic setting.

Manual setting: Allows you to directly input the workpiece coordinate system shift value from the workpiece coordinate system shift screen or select the menu [Measure] to designate the workpiece coordinate system shift value.

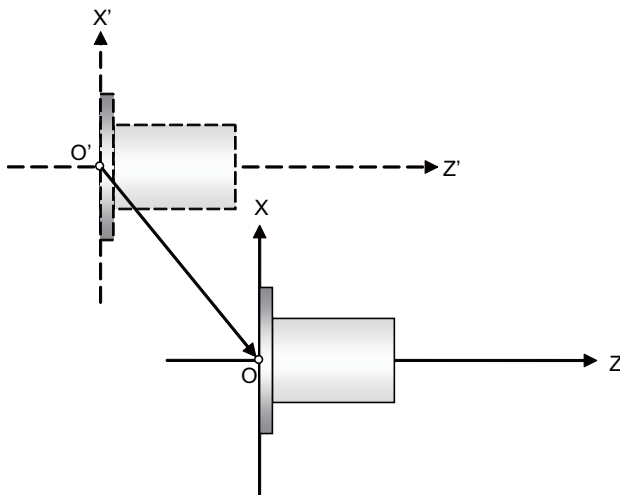
Automatic setting: Allows you to designate the workpiece coordinate system shift value with the workpiece measurement signal.

The manual setting and automatic setting to designate the workpiece coordinate system shift value using the menu [Measure] are additional specifications.

When this function is enabled, the menu [W-shift] is displayed on the monitor (Monitr) screen. If the menu [W-meas] is selected on the setup (Setup) screen, the setting screen for the workpiece coordinate system shift screen is displayed.

Note

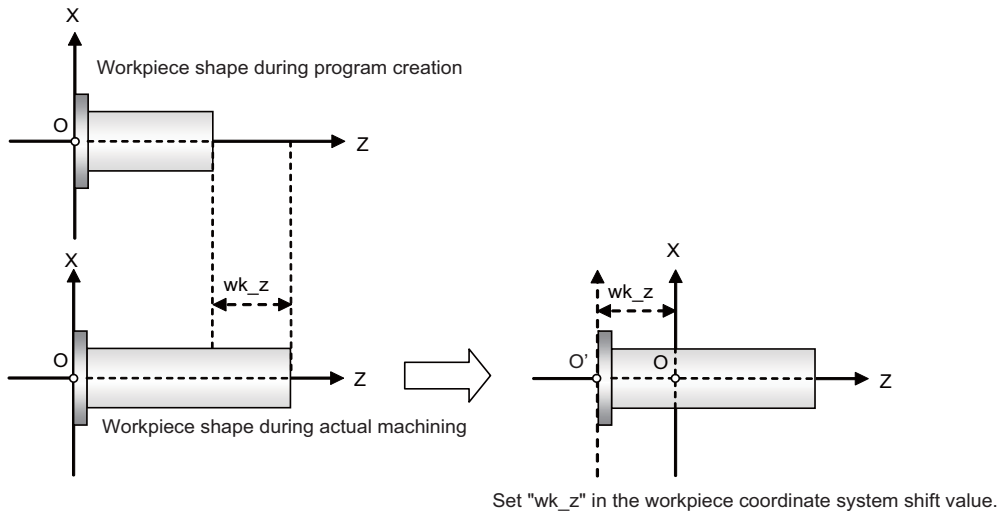
(1) When this function is disabled, the menu [W-shift] is not displayed on the monitor (Monitr) screen. If the menu [W-meas] is selected on the setup (Setup) screen, the external workpiece setting screen is displayed.



Set the shift value to O'- O as the shift value of the workpiece coordinate system shift value.

X' - Z': Measured coordinate system

X - Z: Coordinate system established when the program is created



X - Z: Coordinate system established when the program is created

wk_z: The degree of change of the workpiece shape

<Monitor screen>

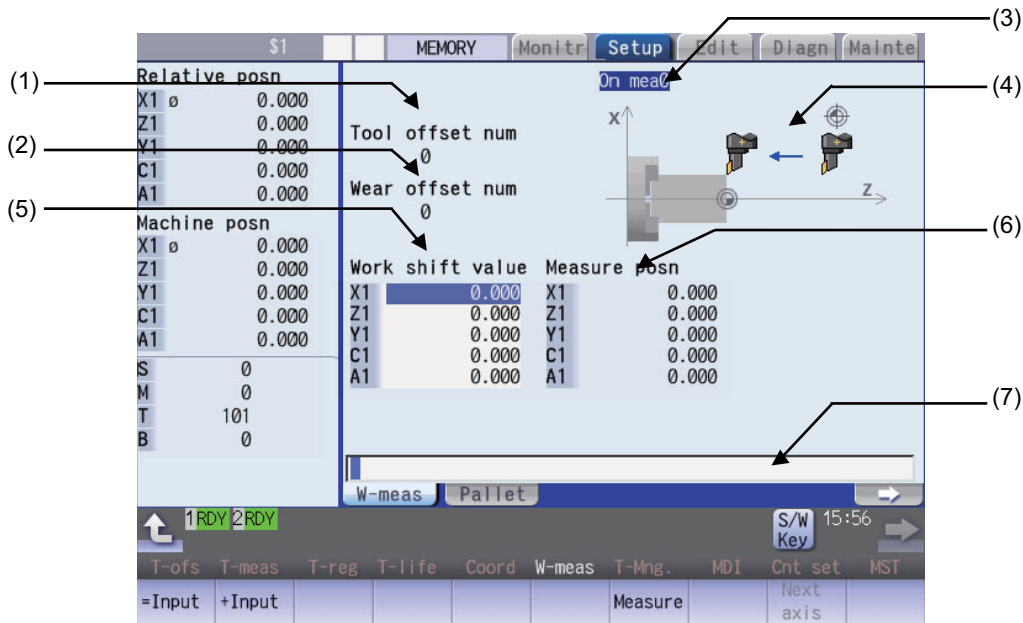
Machine posn	Program posn	MEM	0	4N	0B	0
X 0	X 0.000	0	0	N	B	
Z 0	Z 0.000					
C 0	C 0.000					
A 0	A 0.000					
X2 0	X2 0.000					

Relative posn	Work	G54
X 0	X	0
Z 0	Z	0
C 0	C	0
A 0	A	0
X2 0	X2	0

WK coordinate shift			
Work shift value	Measure	posn	
X	0.000	X	0.000
Z	0.000	Z	0.000
C	0.000	C	0.000
A	0.000	A	0.000
X2	0.000	X2	0.000

Labels in the screenshot:
 (5) points to the 'Work shift value' column.
 (6) points to the 'Measure' column.
 (7) points to the 'posn' column.

<Setup screen>



Display Items

Display items	Description
(1) Tool L offset num	This displays the compensation No. of the tool length data used in the automatic setting. (*1) (*2)
(2) Wear offset num	This displays the compensation No. of the tool nose wear data used in the automatic setting. (*2) (*3)
(3) On mea	When the measurement switch is ON and the operation mode is manual mode (handle, jog, rapid traverse, or step), "On mea" is displayed, and the workpiece can be measured by the workpiece coordinate system shift write mode signal. (*4)
(4) Guide graphic	This displays the measurement area.
(5) Work shift value	This displays the currently designated workpiece coordinate system shift value. (*5) The initial cursor position is located at the 1st axis in all part systems. If the cursor position is changed using cursor movement keys or the menu [Next axis], it is held until the program is placed into the following status. Monitor screen: The cursor position is not held. Setup screen: The cursor position is held until the power is turned on again.
(6) Meas posn	The measurement position (machine position - tool length compensation amount of the T-commanded tool) is displayed. (*5)
(7) Input section	This displays the input data.

(*1) If an illegal value is set, the value is blank ("0" is displayed).

(*2) The No. is displayed by BCD code.

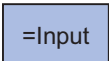
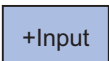
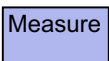

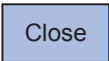
(*3) If an illegal value is set or tool nose wear data is not used for measurement (parameter "#1226 aux10/bit0" is "1"), the value is blank ("0" is displayed).

(*4) When the workpiece coordinate offset measurement specification is invalid, the value is not displayed during measurement even if the measurement switch is set ON.

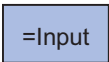
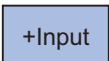
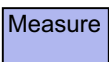

(*5) To display the 9th axis and after, use the menu [Next axis].

Menus

<Monitor screen>

Menus	Description
	This executes an absolute input. When the parameter "#8929 Disable=INPUT:comp" is set to "1", this menu is disabled.
	This executes an incremental input.
	The workpiece coordinate system shift value is measured.
	This changes the workpiece shift value and the axes displayed at the measurement position on a 8-axis basis. The cursor of the workpiece shift value then jumps to the top row. <Note> •When nine or more axes are included in a part system, this menu is enabled.
	This closes the pop-up window and quits this function.

<Setup screen>

Menus	Description
	This executes an absolute input. When the parameter "#8929 Disable=INPUT:comp" is set to "1", this menu is disabled.
	This executes an incremental input.
	The workpiece coordinate system shift value is measured.
	This changes the workpiece shift value and the axes displayed at the measurement position on a 8-axis basis. The cursor of the workpiece shift value then jumps to the top row. <Note> •When nine or more axes are included in a part system, this menu is enabled.

6.9.1 Manually Setting the Workpiece Coordinate System Shift Value

Operation method (Set the absolute value "10.000" to the workpiece coordinate system shift value of the Z axis (2nd axis) on the Monitor screen.)

- | | | |
|--|---|---|
| (1) This displays the workpiece coordinate system shift.
<Monitor screen>
Press the menu [W-shift].
<Setup screen>
Press the menu [W-meas]. | ➔ | The workpiece coordinate system shift screen is displayed. |
| (2) Use the [↑] or [↓] key to move the cursor onto the Z axis. | ➔ | The cursor moves to the Z axis. |
| (3) Designate the workpiece coordinate system shift value.
10 [INPUT]
The value can also be designated by pressing the menu [=INPUT] instead of the [INPUT] key. | ➔ | The designated value appears.
The cursor moves to the next axis. |

Note

- (1) If the parameter "#11017 T-ofs set at run" (Tool compensation amount setting during automatic operation enabled) is set to "1", the workpiece coordinate system shift value can also be designated in the automatic operation mode or operation pause mode.


Operation method (Add the value "1.234" to the workpiece coordinate system shift value of the C axis (3rd axis) on the Monitor screen.)


- | | | |
|---|---|---|
| (1) This displays the workpiece coordinate system shift.
<Monitor screen>
Press the menu [W-shift].
<Setup screen>
Press the menu [W-meas]. | ➔ | The workpiece coordinate system shift screen is displayed. |
| (2) Use the [↑] or [↓] key to move the cursor onto the C axis. | | |
| (3) Input a numeric value.
1.234 [+INPUT] | ➔ | The input value added to the original value is displayed.
(Example) When the original value is set to "10.000",
"10.000 + 1.234 = 11.234" is displayed. |

Note

- (1) If the parameter "#11017 T-ofs set at run" (Tool compensation amount setting during automatic operation enabled) is set to "1", the workpiece coordinate system shift value can also be designated in the automatic operation mode or operation pause mode.

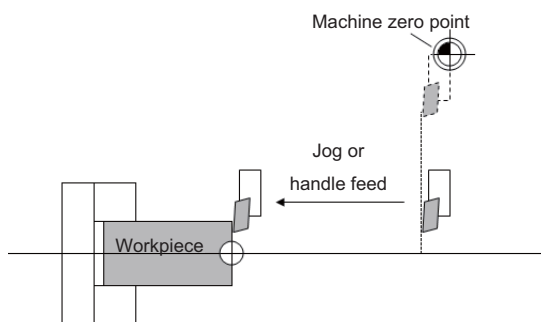
Operation method (Measure the workpiece coordinate system shift value of the Z axis (2nd axis) on the Monitor screen.)



- (1) Select the basic tool used to measure the workpiece shift value with the manual numerical value command.  The Manual numerical value command screen is displayed, and tool 1003 is selected.
- T1003
The T command can also be issued with MDI operation, etc. If one block contains multiple T commands, the last T command is used as the selected tool.

- (2) This displays the workpiece coordinate system shift.  The workpiece coordinate system shift screen is displayed.
- <Monitor screen>
Press the menu [W-shift].
<Setup screen>
Press the menu [W-meas].

- (3) Select the "Manual handle feed" mode or "Jog feed" mode.

- (4) Select the Z axis, and manually move the tool to the work end face (program origin).



- (5) Input the name of the axis to be measured, and the measurement value from the workpiece to the tool nose.  When you input "Z0", the cursor moves to the Z axis column. Value "Z0." is displayed in the input column. If you input an axis name that does not exist, the cursor does not move. The second and subsequent characters are not considered to be the axis name and, therefore, the cursor does not move. (Example: If you enter "XZ", the cursor is moved on the X axis, but the cursor does not move on the Z axis.)
- Z0.
- (6) Press the menu [Measure].  The measurement result is set to the workpiece coordinate system shift value pointed by the cursor. The input column is cleared.

<Details on formula>

The measurement result is calculated in the following formula.

When the parameter "#8709 Ext work sign rvs" is set to "0":

Measurement result = (Machine position of Z axis) - (Tool length compensation data of T-command tool) - (Input value)

When the parameter "#8709 Ext work sign rvs" is set to "1":

Measurement result = (Machine position of Z axis) - (Tool compensation data of T-command tool) * (-1) - (Input value)

Select the tool compensation data used for the measurement with the parameter "#1226 aux10/bit0".

#1226 aux10/bit0	Tool compensation data
0	Tool length data + nose wear data
1	Tool length data

Note

- (1) If the parameter "#11017 T-ofs set at run" (Tool compensation amount setting during automatic operation enabled) is set to "1", the tool compensation amount data can be input in the automatic operation mode or operation pause mode.
- (2) If you press the menu [Measure] while the axis name designated in the input section is different from that pointed at the cursor, the operation message "Setting error" is displayed.

6.9.2 Automatically Setting the Workpiece Coordinate System Shift Value

Carry out the automatic setting for the workpiece coordinate system shift value using the workpiece measurement signal. The PLC device is set to the value of the 1st part system. For information on how to carry out automatic setting in another part system, refer to the PLC Interface Instruction Manual.

Operation method

- | | | |
|---|---|--|
| <p>(1) Carry out the reference position return.
If the workpiece is measured without establishing the reference position return, the operation message "Meas axis not returned to ref. position" appears. However, when the setup workpiece coordinate system shift screen is not displayed, the message will not appear.</p> | ➔ | <p>After the power is turned on, carry out the dog-type reference position return, and establish the coordinate system.
In the absolute position detection specification, configure the initial setting in advance if the absolute position is not established.</p> |
| <p>(2) Select the mode.</p> | ➔ | <p>Set the mode selection switch to the manual mode (handle, jog, rapid traverse, or step).</p> |
| <p>(3) Input the tool measurement mode signal (YC21).</p> | ➔ | <p>Set the tool length measurement signal to "1". "On mea" is displayed on the setup workpiece coordinate system shift screen.</p> |
| <p>(4) Select the main or sub part system.</p> | ➔ | <p>Select whether to measure the workpiece coordinate system shift value on the main spindle side or sub-spindle side by using tool presetter sub-side valid signal (YC-DA).
Hold the status of this signal until the workpiece coordinate system shift value measurement with the selected tool is completed.</p> |

6 Setting a Tool and a Workpiece

- (5) Select a tool. Issue the T command by MDI operation, etc., then select tool.

Set the selected tool compensation No. in R register. The set R register differs according to parameter setting and the state of the tool presetter sub-side valid signal. Set the "tool length/wear data" for the tool being used beforehand.

- (6) Cut the workpiece face. If the workpiece does not need to be cut, carry out positioning to the measurement position. If the workpiece face is not cut, cut the workpiece face slightly to even it. Do not move the tool in the Z axis direction after cutting the workpiece face.

- (7) Input the workpiece measurement signal (Y9E1). Input the workpiece measurement signal. The Z axis external workpiece coordinate offset data is automatically calculated from the tool compensation data of the used tool and the machine value at the point this signal is input. The results are set as the data.

<Details on automatic calculation expression>

The workpiece coordinate system shift value is automatically calculated with the following expression:

When the parameter "#8709 Ext work sign rvs" is set to "0":

Workpiece coordinate system shift amount = Machine coordinate value - Tool compensation data
--

When the parameter "#8709 Ext work sign rvs" is set to "1":

Workpiece coordinate system shift value = -(Machine coordinate value - Tool compensation data) * (-1)

Select the tool compensation data used for the measurement with the parameter "#1226 aux10/bit0".

#1226 aux10/bit0	Tool compensation data
0	Tool length data + nose wear data
1	Tool length data

<Compensation No. of selected tool>

The compensation number of the tool length and nose wear data used for automatic calculation is determined by the PLC ladder.

<Note>

- When the compensation No. is 0, the compensation amount will be calculated as "0".
- If the compensation No. exceeds the number of specified offset sets, the operation message "Offset No. not found" appears. However, when the setup workpiece coordinate system shift screen is not displayed, the message will not appear.
- If the input data exceeds the setting range, the operation message "Data range error" appears. However, when the setup workpiece coordinate system shift screen is not displayed, the message will not appear.
- If the data protection is valid, the operation message "Data protect" appears. However, when the setup workpiece coordinate system shift screen is not displayed, the message will not appear.
- Measurement is disabled for the part system with one-axis structure. The operation message "Can't measure" is displayed. However, when the setup workpiece coordinate system shift screen is not displayed, the message will not appear.
- Whether to use the main side or sub-side is selected with the tool presetter sub-side valid signal (YCDA). (OFF: Main side, ON: Sub-side)
- Set the compensation No. in R register by the BCD code.

- (8) Set the tool length measurement signal to OFF. The measurement of the workpiece coordinate system shift value is completed. Select the tool compensation data used for the measurement with the parameter "#1226 aux10/bit0".

Precautions

- (1) When the automatic setting is carried out for the workpiece coordinate system shift value without displaying the setup workpiece coordinate system shift screen, the message is not displayed even if an error occurs.

7

Setting Parameters

The parameters contain the user and machine parameters.

This chapter explains the details and operations for the user parameters on the Setup screen.

Refer to "M800/M80/C80 Series Alarm/Parameter Manual" for details of each parameter.

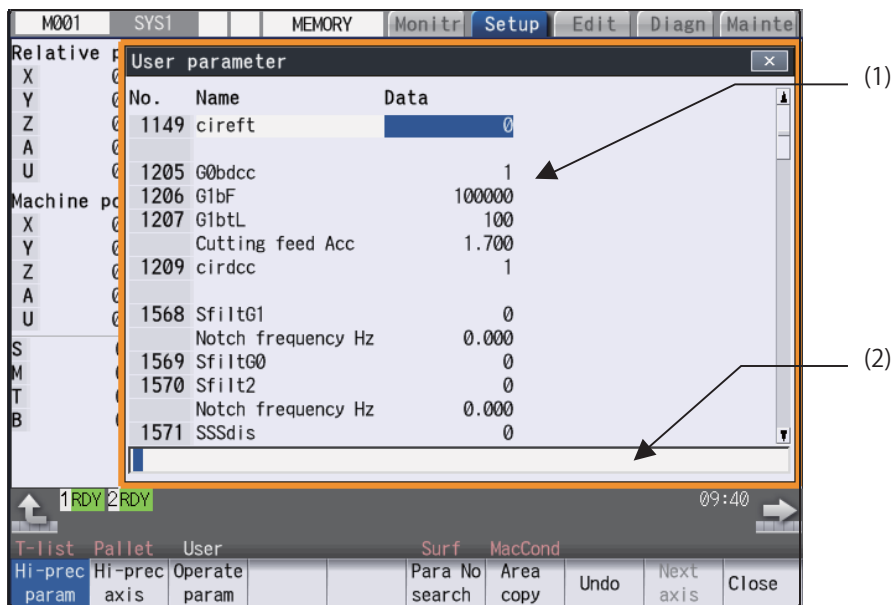
Parameters can be set on the maintenance (Mainte) screen.

7.1 Setting User Parameters

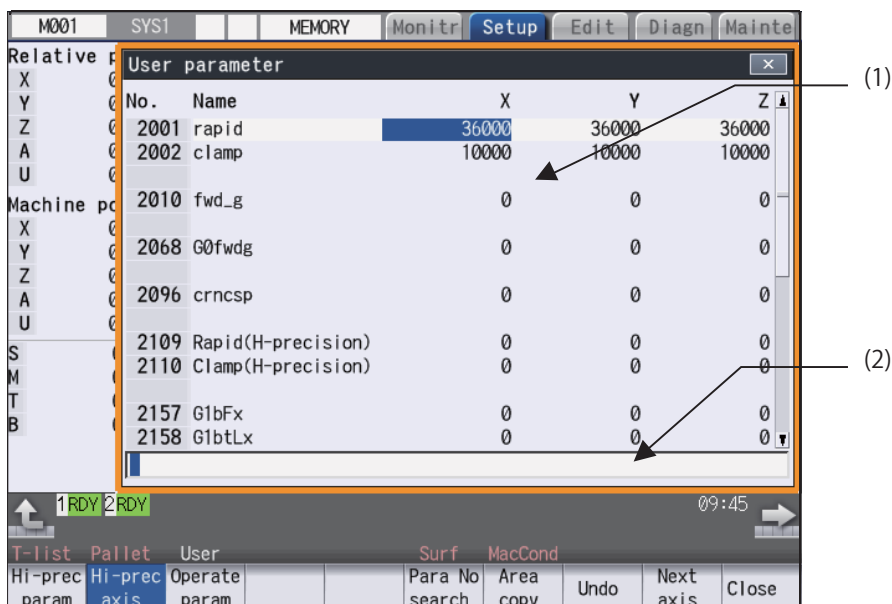


Press the menu [User] on the Setup screen to display various user parameters.

Display example by part system (Switch the part system using the $\$ \leftrightarrow \$$ key.)



Display example by axis (Switch the fourth axis and after on the menu [Next axis].)



Display Items

Display items		Description
(1)	Parameter display area	Press the parameter selection menu [Process param] or [Hi-prec param] etc. to change the parameter display contents. The screen layout can be switched by part system (with [\$] key) or by axis.
(2)	Input section	The set key displays. Press the [INPUT] key to set the display data in the parameter where the cursor is located.

Menus


Menus	Description
Process param	<p>This changes the display of each parameter type.</p> <p><Note></p> <ul style="list-style-type: none"> ♦ The barrier data appears only for L system. ♦ [Menu select param] is displayed only when the parameter "#11032 Menu sel para lkof" (Menu select param setting enabled) is set to "1" or "2".
Fixed cycle	
Ctrl param 1	
Ctrl param 2	
I/O param	
Ethnet param	
Link param	
Subprocessor	
Axis param	
Barrier data	
Hi-prec param	
Hi-prec axis	
Operate param	
Menu select	
Para No search	<p>This selects an arbitrary parameter number. Set the parameter number and press the [INPUT] key to move that number to the top and display the parameter. The cursor also moves to that number.</p>
Area copy	<p>This copies the parameter setting values in the designated range. The range is designated with numbers.</p> <p>When the range is not designated, this copies the value of the parameter pointed by the cursor.</p> <p>After copying, the menu will be changed to [Area paste].</p>
Area paste	<p>This pastes the range of parameters designated by [Area copy] to the corresponding parameters of the axis or part system pointed by the cursor.</p> <p>After pasting, the confirmation message "Change the menu back to Area copy? (Y/N)" appears. Press [Y] or [INPUT] to go back to [Area copy]. When pressing any key other than [Y] or [INPUT], the paste-enabled state will remain and you can continue pasting by pressing the menu [Area paste].</p> <p><Note></p> <ul style="list-style-type: none"> ♦ While the confirmation message "Paste? (Y/N)" is displayed, the menu will be highlighted. ♦ To go back to [Area copy] without pasting, switch the parameter type once.
Undo	<p>This returns the last rewritten data to its previous value.</p> <p><Note></p> <ul style="list-style-type: none"> ♦ When the parameter "#8939 Undo confirm msg" is set to "1", the menu is highlighted while the confirmation message is displayed.

Menus	Description
Next axis	This can be selected if the total number of part system display axes is 4 or more. This is used at the parameter screen with the array structure for each axis.
Close	This closes the pop-up window and quits this function.


7.1.1 Selecting the Parameter Number

There are two switching methods to display a screen by designating the parameter No. Use the parameter "#8975 No. search process" to switch the operation

Operation method ("#8975 No. search process" is "0") (Select "#1041 Initial inch")

- (1) Press the menu [Para No search].
- (2) Enter a parameter No. to be displayed, and then press the [INPUT] key.  "#1041 Initial inch" is displayed at the head. The cursor moves to "#1041 Initial inch".
1041 [INPUT]

Operation method ("#8975 No. search process" is "1") (Select "#1041 Initial inch")

- (1) Enter a parameter No. to be displayed.
1041
- (2) Press the menu [Para No search].  "#1041 Initial inch" is displayed at the head. The cursor moves to "#1041 Initial inch".

Note

- (1) When the parameter "#8975 No. search process" is set to "1" and the cursor is at the parameter to be echoed back, the set value is displayed in the input column. Delete the set value in the input column, and then perform the menu [Para No search] operation.

7.1.2 Setting the Parameters

The method of setting the parameters is explained. Refer to "M800/M80/C80 Series Alarm/Parameter Manual" for details of each parameter setting range.

Operation method (Normal) (Set "100" for Y1 axis of "#2001 rapid")

- (1) Press the menu [Hi-prec axis].
- (2) Use the [↑], [↓], [←] and [→] keys to move the cursor to the setting position.
- (3) Input the value.
100 [INPUT]

Operation method (Batch data setting) (Set "4000" for Y1 axis and "3000" for Z1 axis for "#2002 clamp")

- (1) Press the menu [Hi-prec axis].
- (2) Use the [↑], [↓] keys to move the cursor to the setting position.
- (3) Input the value.
Input format: 1st column/2nd column/3rd column
/4000/3000 [INPUT]


Note

- (1) When a parameter is changed and [PR] displays at the top of the screen, reboot the machine to enable that parameter change.
- (2) When the [INPUT] key is pressed without inputting a value, the parameter setting value is not changed, and the cursor moves.
- (3) Parameters that can be set simultaneously must display within the currently displayed three columns.
- (4) If parameter values are simultaneously input in multiple columns, settings are made from the currently displayed column on the left side, no matter which column the cursor is positioned.


7.1.3 Copying and Pasting Parameters

Parameters can be copied and pasted in a parameter with the same number for another axis or part system.

Operation method (Specifying and copying the parameter where the cursor is located)

- (1) Press the menu [Area copy].
- (2) Move the cursor to the position of the parameter to be copied and press the [INPUT] key.  Copying position is displayed in the selected area color. (If you move the cursor, the highlighted position can be confirmed.)
The menu highlight returns to normal and the menu will be changed to [Area paste].







Operation method (Copying parameter numbers in a specific range)

- (1) Move the cursor to the display area of the axis or part system to be copied.
- (2) Press the menu [Area copy].
- (3) Designate the copy range.
Format: First No./Last No.
8701/8705 [INPUT]  The range to be copied is displayed in the selected area color.
An "E" can be used if the last number to be copied is the last number in the currently displayed parameter type.
(Example) 8701/E
The menu highlight returns to normal and the menu will be changed to [Area paste].

Note

- (1) The copy range remains enabled immediately before you change the parameter type. If you change the parameter type, the menu returns to [Area copy].
- (2) Only the currently displayed parameter type can be copied.

Operation method (Pasting the copied parameters)

- (1) Move the cursor to the axis or part system display area where the data will be pasted.
- (2) Press the menu [Area paste].  The menu will be highlighted and the confirmation message "Paste? (Y/N)" appears.
- (3) Press the [Y] or [INPUT] key.  The copied data is written to the parameter with the same number in the area where the cursor is positioned. The menu highlight returns to normal and the confirmation message "Change the menu back to Area copy? (Y/N)" appears.
- When the keys other than [Y] or [INPUT] are pressed, the data will not be written.
- <When returning to copying operation>
- (4) Press the [Y] or [INPUT] key.  The selected area color of the range to be copied will return to the previous color. The menu will be changed to [Area copy].
- <When continuing to copy>
- (4) Press a key other than [Y] or [INPUT].  The range to be copied remains the selected area color. The menu remains [Area paste].
- (5) Move the cursor to the display area of the axis or the part system to be pasted and then press the menu [Area paste].  The menu will be highlighted and the confirmation message "Paste? (Y/N)" appears.
- (6) Press the [Y] or [INPUT] key.  The copied data is written to the parameter with the same number as the copy source in the area pointed by the cursor. The operation after this is the same as (3).



Note

- (1) If the relevant parameter is changed after specifying the range to be copied, the value after the change is pasted.

7.1.4 Undoing the Parameter Change

This can undo the last rewritten parameter.

The input data can be returned to the previous value. By pressing the menu [Undo] again, the previous value is changed back to the value that you last input.

- (1) Input the value in the area pointed by the cursor.  The setting value is displayed and the cursor moves.
- (2) Press the menu [Undo].  The cursor returns to the original position and the value before setting is displayed.

Note

- (1) Even when the multiple axes data are set simultaneously using "/", all the data will be returned to the previous values before the setting.
- (2) The undo operation remains enabled until the screen or the parameter type is changed.
- (3) When the operation parameter "#8939 Undo confirm msg" is set to "1", the menu [Undo] is highlighted and the confirmation message "OK? (Y/N)" appears. The program returns to the previous status by pressing [Y] or [INPUT] key. If any key other than [Y] or [INPUT] is pressed, the operation to undo will be canceled. When the operation is canceled, the menu highlight returns to normal and the message disappears.

7.1.5 Parameter Configuration

The parameter number range and permissible operations for all parameter types are shown below.

○: Can be used Δ: Operable under certain conditions (Refer to the section below for conditions.)

Parameter type	Menu [Next axis]	System change key	Menu [Area copy]	Menu [Area paste]
Fixed cycle parameter	-	Δ (*3)	Δ (*3)	Δ (*3)
Fixed cycle	-	Δ (*3)	Δ (*3)	Δ (*3)
Control parameter 1	-	-	-	-
Control parameter 2	-	Δ (*3)	Δ (*3)	Δ (*3)
I/O parameter	-	-	-	-
Ethernet parameter	-	-	-	-
Computer link parameter	-	-	-	-
Subprogram storage location parameter	-	Δ (*3)	Δ (*3)	Δ (*3)
Axis parameter	Δ (*1)	-	Δ (*2)	Δ (*2)
Barrier data (*4)	-	Δ (*3)	○	○
High-accuracy control parameter	-	Δ (*3)	Δ (*3)	Δ (*3)
High-accuracy control axis parameter	Δ (*1)	-	Δ (*2)	Δ (*2)
Operation parameter	-	-	-	-
Menu selection parameter	-	-	-	-

(*1) This is valid only when the total number of valid NC axes and PLC axes in the entire part system is four or more.

(*2) This is valid only when the total number of valid NC axes and PLC axes in the entire part system is two or more.

(*3) This is valid only when the number of valid part systems is two or more.

(*4) The barrier data appears only for L system.

7.1.6 Echoback

When 13 or more characters are set for Ethernet parameter to be echoed back, the set value is displayed in the input area and displayed in the data column with "...". When the cursor moves to a parameter which is not subject to echoback, the contents in the input area will be deleted.

7.1.7 Ethernet parameter

If the Ethernet parameter "Host 1 password" to "Host 4 password" is set, "*****" displays regardless of the password characters set in that data field.

7.1.8 Precautions

When the data protection is valid, the value cannot be set (including paste operation) for the high-accuracy control parameters (part system based) and high-accuracy control axis parameters.

7.2 Selecting High-accuracy Control Parameters (Machining Cond I Screen)



A machining which meets the machining purpose or machining process can be performed by switching the high-accuracy parameter set according to the machining object on the Machining cond (MacCond) screen.

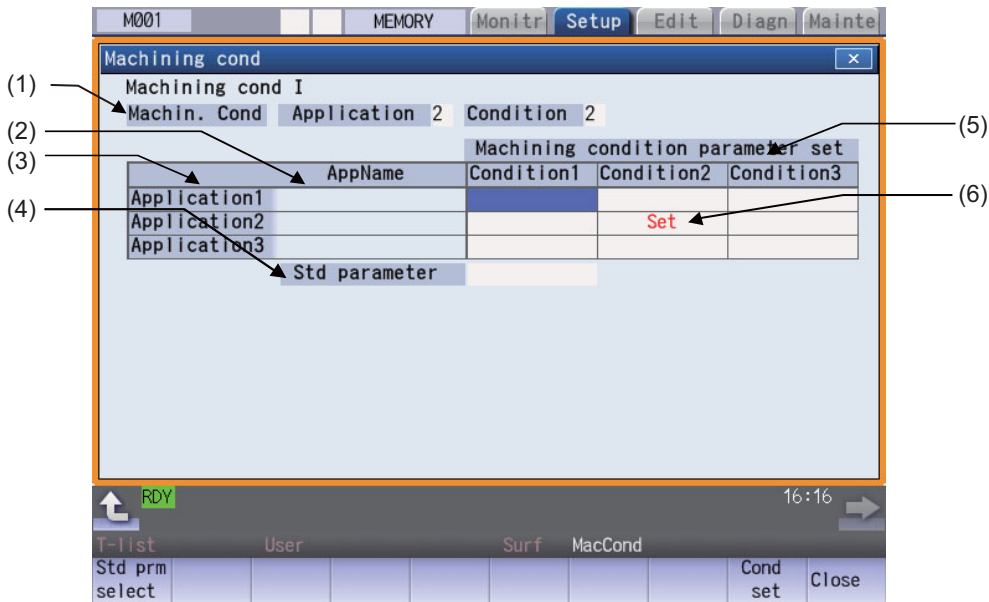
Multiple sets of high-accuracy parameter (parameter related to the high-accuracy control) can be configured in advance for each machining purpose (such as parts machining or die machining) and machining process (such as rough or finishing).

Procedure for using this function is as follows:

- (1) Initializing the machining condition parameter set
 - Initializing the machining condition parameter set in the "Machining cond" screen
 - Initializing the machining condition parameter set by data input/output
- (2) Setting the machining condition parameter set
 - Set the total of nine sets of machining condition parameter sets of "three applications x three conditions" in the "Machining cond" screen
- (3) Switching the machining condition parameter set
 - Switching the machining condition parameter set in the "Machining cond" screen
 - Switching the machining condition parameter set by G code command in the machining program

MTB password is required for operating this screen.

Machining condition selection I screen



Display Items

Display items	Description
(1) During machining condition	Displays the applications and conditions used for the current machining. This shows No. 0 through 3 of the machining applications and conditions, which you have selected on the [Machining condition selection] screen or switched with a G code command. While standard parameter is being selected, "0" is displayed on the applications and conditions.
(2) Application name	Displays the application name set in the menu [AppName set] in the "Machining cond screen".
(3) Application	Displays Application 1 to 3.
(4) Std parameter	"Set" is displayed in this column while the standard parameter is being selected.
(5) Machining condition parameter set	Displays the machining condition parameter set of application 1 to 3. "Set" is displayed in the column of the selected machining condition parameter set.
(6) Set	"Set" is displayed in the column of the selected machining condition parameter set. It will not update if an application/condition is switched by G code command. It will update when selected on the machining condition selection screen.

Menus

Menus	Description
Std prmselect	Switches machining condition to standard parameter. After the menu is highlighted and the cursor moves to standard parameter, the confirmation message "Change to standard parameters?(Y/N)" will appear. If you press [Y] (or [INPUT]), the status of standard parameter changes to "Set". If you press any key other than [Y] (or [INPUT]), it will be canceled. The cursor will remain on standard parameter even when canceled.
Cond set	Changes to the "Machining cond screen". <Note> •MTB password is required for the maintenance screen.
Close	This closes the pop-up window and quits this function.

Machining condition setting screen

The machining condition parameter to be displayed is switched by enabling or disabling tolerance control.

<When tolerance control is disabled>

		Machining condition parameter set		
No.	Name	Condition1	Condition2	Condition3
1206	G1bF	30000	30000	30000
1207	G1btL	0	0	0
	Cutting feed Acc	50.986	50.986	50.986
1568	SfiltG1	0	0	0
	Notch frequency Hz	0.000	0.000	0.000
1570	Sfilt2	0	0	0
	Notch frequency Hz	0.000	0.000	0.000
2010	fwd_g	0	0	0
8019	R COMP	0	0	0
	Theor R decrease	229.569	229.569	229.569
	R5mm arc dec speed	94868.422	94868.422	94868.422
	R1mm Arc dec speed	42426.448	42426.448	42426.448

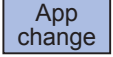
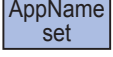
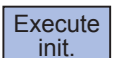
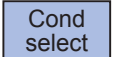

<When tolerance control is enabled>

		Ref. param	Machining condition parameter set		
No.	Name		Condition1	Condition2	Condition3
1206	G1bF	5000	5000	5000	5000
1207	G1btL	50	50	50	50
	Cutting feed Acc	0.170	0.170	0.170	0.170
1568	SfiltG1	50	50	50	50
	Notch frequency Hz	0.000	20.000	20.000	20.000
2659	tolerance	5.000	5.000	5.000	5.000

Display Items

Display items	Description
(1) Application	Displays the application being set. To change to the next machining purpose, press the menu [App change]. When machining purpose being selected, the background is emphasized in red. The background is not highlighted while the Standard parameter is selected.
(2) Parameter No.	Displays the number of a standard parameter.
(3) Parameter name	Displays the name of a standard parameter.
(4) Std parameter	Displays the value of the standard parameter designated on the parameter screen. This item is not displayed when the machining parameter "#12066 Tolerance ctrl ON" is set to "0". <Note> ♦"#2659 tolerance" indicates the setting value of the 1st axis in the 1st part system.
(5) Machining condition parameter set	Displays three sets of machining condition parameter set which belongs to the application purpose being set. The background of the selected machining condition is highlighted in red. The background is not highlighted while the Standard parameter is selected.

Menus

Menus	Description
	Switches the application being set to other application. It switches from Application1 -> Application2 -> Application3 -> Application1 -> ... each time this menu key is pressed.
	Sets the application name for the application being set. The name with up to 12 one-byte characters of numeric, English capital letter, and symbol can be set. <Note> ♦However, "\", "/", ", ", "*", "", "<", ">", "|", and "space" cannot be used as a one-byte symbol.
	Copies the setting values corresponding to the standard parameters to the all machining condition parameter sets.
	Changes to the machining condition selection screen.
	This closes the pop-up window and quits this function.

Initialize the machining condition parameter set

- (1) Press the menu [MacCond] in the setup screen.
- (2) Select the menu [Cond set] in the "Machining cond" screen.
- (3) Select the menu [Execute init].
- (4) Press the [Y] or [INPUT] key.



The setting value for the standard parameters corresponding to each machining condition parameter will be copied.

Set the machining condition parameter set

- (1) Press the menu [MacCond] in the setup screen.
- (2) Select the menu [Cond set] in the "Machining cond" screen.
- (3) Move the cursor to the position of the parameter to be set.
- (4) Input the value, and then press [INPUT].

Note

- (1) It cannot be set without initializing the machining condition parameter set.

Switching the machining condition parameter set

- (1) Place the cursor on the position of the machining condition parameter set (application/condition) to be switched in the "Machining cond" screen.
- (2) Press the [INPUT] key.
- (3) Press the [Y] or [INPUT] key.

Note

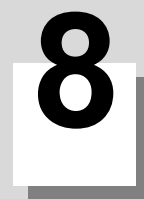
- (1) The machining condition which is selected on the Machining cond screen applies to all part systems.

Cancel the machining condition parameter set and switch to standard parameter (Switch by cursor).

- (1) Move the cursor to the standard parameter and press [INPUT] key on the "Machining cond" screen.
- (2) Press the [Y] or [INPUT] key.

Cancel the machining condition parameter set and switch to standard parameter (Switch by menu [Std prmselect]).

- (1) Select the menu [Std prmselect] in the "Machining cond" screen.
- (2) Press the [Y] or [INPUT] key.

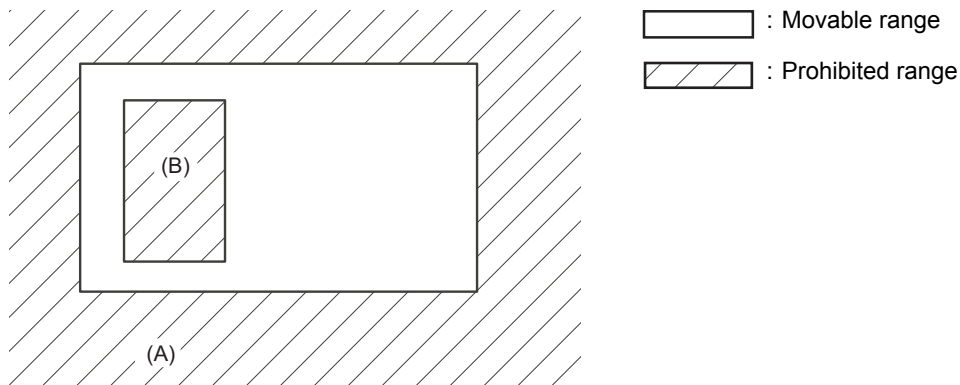


Setting Machine Movable Area

This chapter describes the contents which can be set with the user parameters. Refer to "M800S/M80 Series Connection and Setup Manual" and "M800W/M80W Series Connection and Setup Manual" for other functions.

8.1 Setting the Stored Stroke Limit

The tool entry prohibited ranges can be set with stored stroke limit II or IIB.
Set the parameters to select the entry prohibited range, stored stroke limit II or IIB.



(A): Entry prohibited range by stored stroke limit II (outside)

(B): Entry prohibited range by stored stroke limit IIB (inside)

If the axis is moving over the set range, an alarm will appear and the axis will decelerate to a stop.

If the prohibited range is entered and an alarm occurs, movement will be possible only in the direction opposite the entry direction.

Enabling conditions of stored stroke limit

When using the relative position detection system, the stored stroke limit is invalid until the reference position return is completed after the power is turned ON.

The stored stroke limit can be validated even if the reference position return is not yet completed, by setting "#2049 type" (Absolute position detection method) to "9".

Note

(1) If the absolute position detection is valid when using the absolute position detection system, the stored stroke limit will be validated immediately after the power is turned ON.

Stored stroke limit coordinates

The stored stroke limit check is carried out in the basic machine coordinate system established by the reference position return.

When the stored stroke limit has been validated while the reference position return has not been completed, the stored stroke limit check is executed with the basic machine coordinate system at the time of last power-OFF as temporary one. When the 1st dog-type reference position return is completed after the power is turned ON, the proper coordinate system is established.

Note

(1) While the reference position return has not been completed, only the manual and handle feed mode allow the axis movement. Automatic operation is validated after the reference position return is completed.

CAUTION

Always set the stored stroke limit. Failure to set this could result in collision with the machine end.

The stored stroke limit sets a prohibited range with the parameters or program command. The minimum and maximum values of the prohibited range are set as the coordinate value (radius value) on the machine coordinate system for each axis.

- The stroke check will not be executed when both maximum and minimum value are set to the same value.
- This function is valid after the reference position return if the system does not apply the absolute position detection system.
- Before the machine enters the prohibited range, an error "M01 Operation error 0007" (S/W stroke end) will occur, and the machine movement will stop. The alarm can be reset by moving the erroneous axis in the opposite direction.
- During automatic operation, if an alarm occurs with even one axis, all axes will decelerate to a stop.
- During manual operation, only the axis that caused the alarm will decelerate to a stop.
- The axis will always stop at a position before the prohibited range.
- The distance between the prohibited range and stop position will depend on the feedrate, etc.

The stored stroke limits II and IIB are handled as follows.

Type	Prohibited range	Details		Range setting parameters	Enabling conditions
II	Outside	Select II or IIB with the parameters.	•"#8210 OT INSIDE" = "0"	"#8204 OT-CHECK-N" "#8205 OT-CHECK-P"	<ul style="list-style-type: none"> •Reference position return is completed. •#8204 and #8205 are not set to the same value. •"#8202 OT-CHECK OFF" = "0"
IIB	Inside		•"#8210 OT INSIDE" = "1"		

8.1.1 Stored Stroke Limit II

The boundary is set with the axis parameters "#8204 OT-CHECK-N" and "#8205 OT-CHECK-P" or with program commands. Either the inside or the outside of the set boundary is the prohibited range. Whether the inside or outside of the range is prohibited is determined by "#8210 OT-INSIDE". When the inside is selected, this function is called stored stroke limit IIB.

When using program commands, entry of the tool into the prohibited range is prohibited with G22, and entry into the prohibited range is enabled with G23.

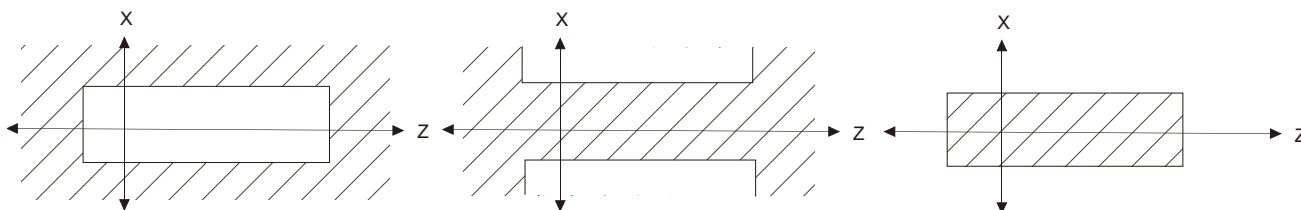
The stored stroke limit II can be invalidated for each axis with setting "#8202 OT-CHECK OFF" to "1".

Prohibited range

X: Outside Z: Outside

X: Inside Z: Outside

X: Inside Z: Inside



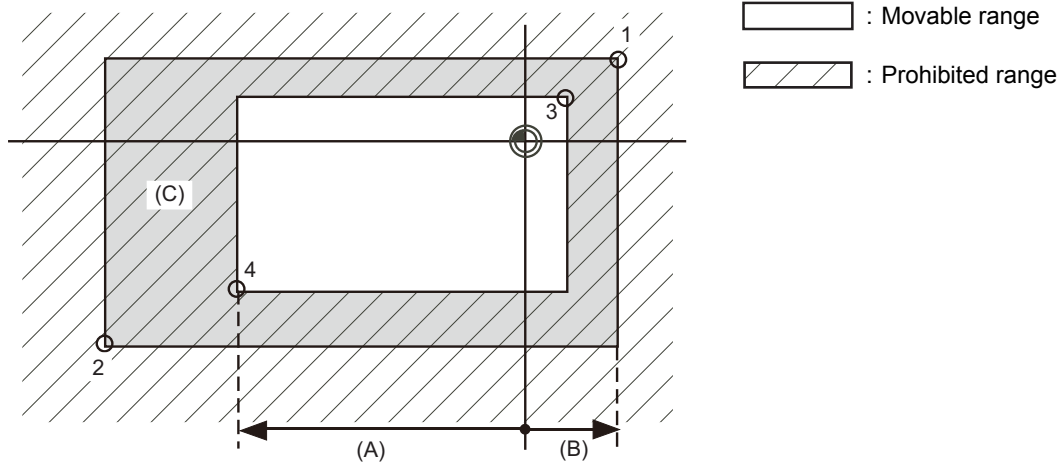
: Movable range

: Prohibited range

(1) Stored stroke limit II (When prohibited range is on outside)

When used with the stored stroke limit I function, the narrow range designated by the two types becomes the movement valid range.

The stored stroke limit I function is set by MTB.



(A): Set value for (-) side

(B): Set value for (+) side

(C): The following ranges prohibited by stored stroke limit II are set with the coordinate values in the basic machine coordinate system.

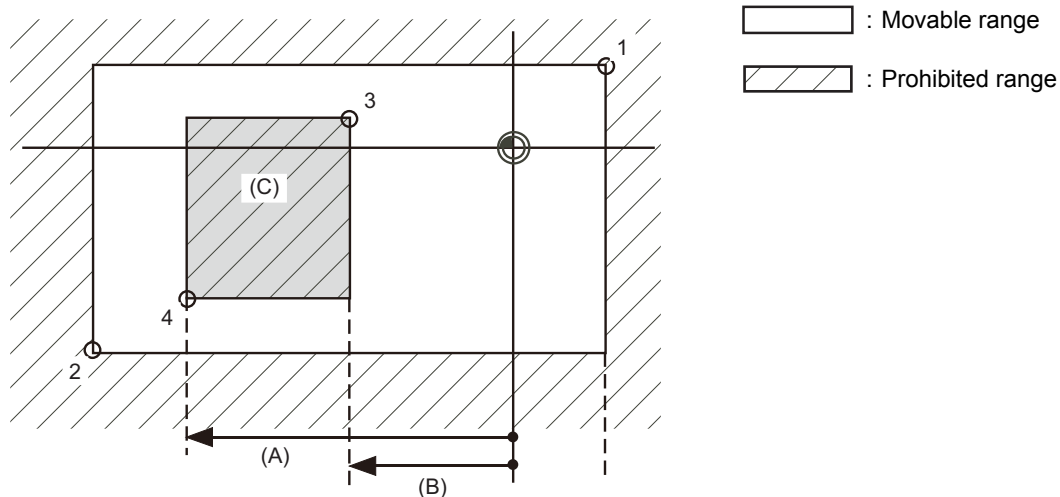
Point 3: "#8205 OT-CHECK-P"

Point 4: "#8204 OT-CHECK-N"

Points 1 and 2 are the prohibited range set by MTB using the stored stroke limit I.

(2) Stored stroke limit IIB (When prohibited range is on inside)

A range except for that of the stored stroke limit I becomes the movement prohibited range.



(A): Set value for (-) side

(B): Set value for (+) side

(C): The following ranges prohibited by stored stroke limit IIB are set with the coordinate values in the basic machine coordinate system.

Point 3: "#8205 OT-CHECK-P"

Point 4: "#8204 OT-CHECK-N"

Points 1 and 2 are the prohibited range set by MTB using the stored stroke limit I.

8.2 Chuck Barrier/Tailstock Barrier (L System)



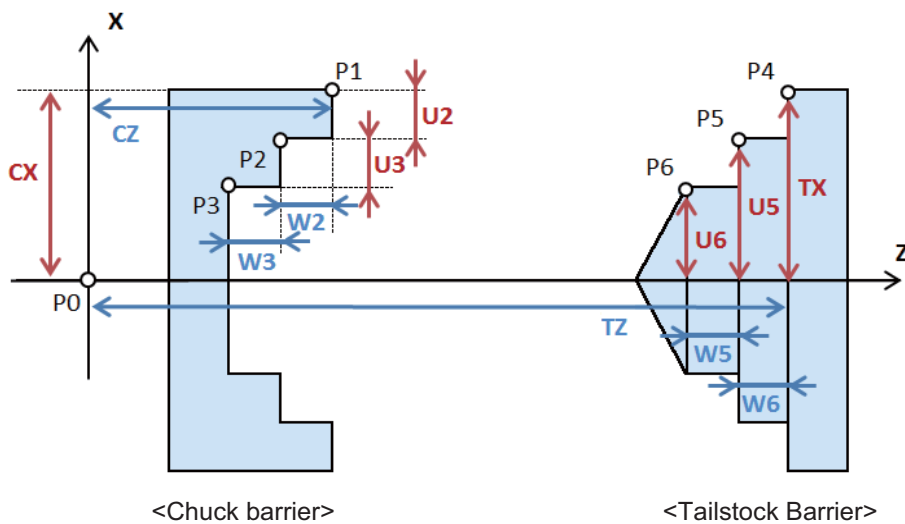
Use this function to set and display the chuck barrier and tailstock barrier.

By limiting the tool nose movement range, the chuck barrier and tailstock barrier prevent the tool from colliding with the chuck and tailstock due to programming errors.

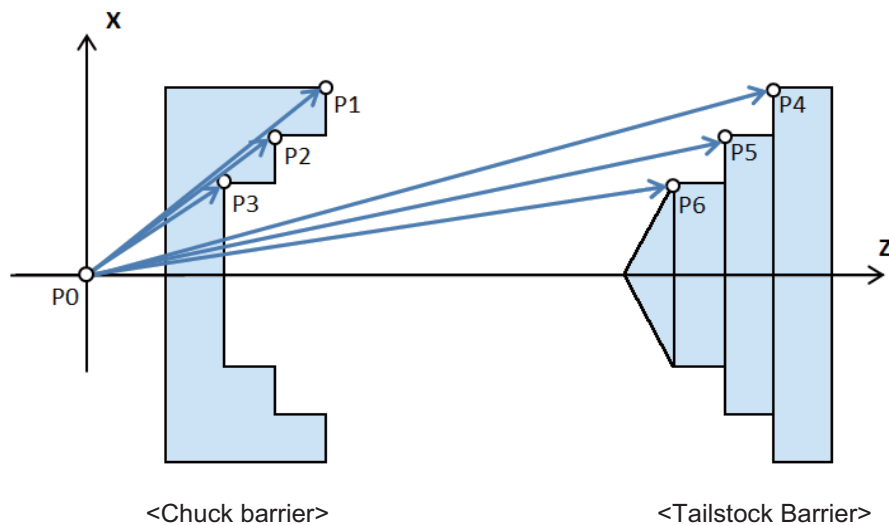
Three points can be input for both the chuck barrier and tailstock barrier. Select either [Enter length] or [Enter coordin] to input (set) the barrier data.

- (1) Enter length: To set the barrier position of the chuck or tailstock with the length (length between P points).
- (2) Enter coordin: To set the barrier positions of the chuck and tailstock with the distance from the workpiece center coordinates (P0). Input the radius value to set the X axis.

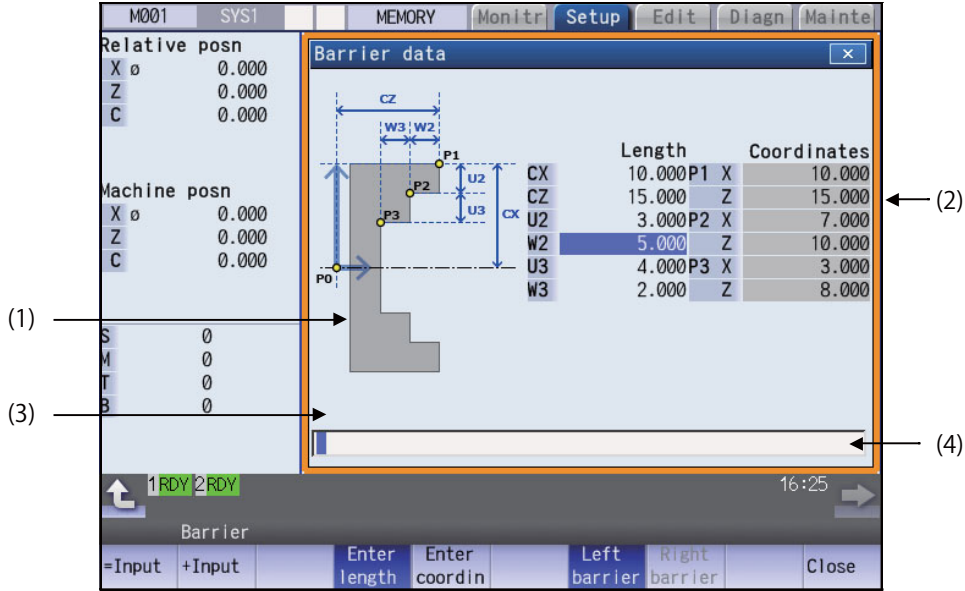
(1) Enter length



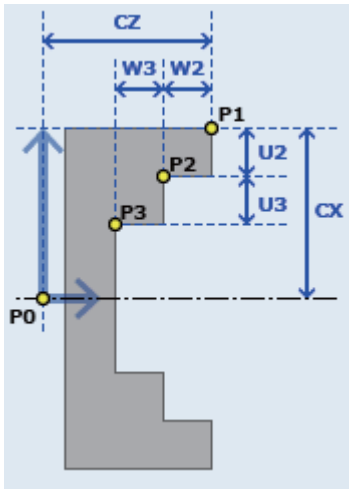
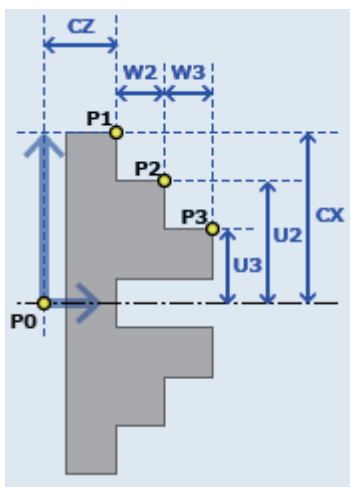
(2) Enter coordin

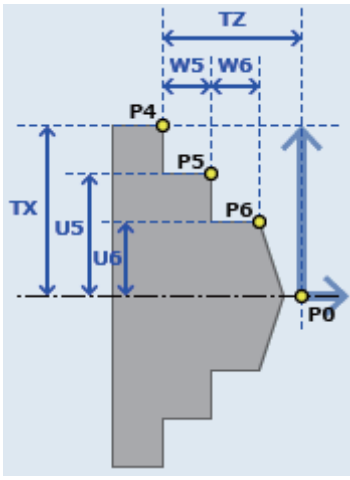
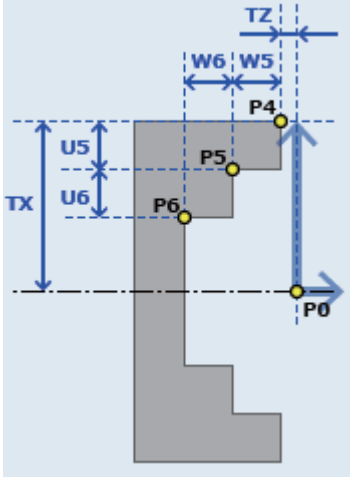


The barrier data which is set on this screen will be set to NC by converting to the parameter "#8301 P1" to "#8306 P6". Specify the workpiece center coordinates (P0) of X axis for the chuck and tailstock in advance with the parameter "#8300 P0" on the menu [Barrier data] of parameter screen. The workpiece center coordinates (P0) of Z axis are the machine coordinates zero point.



Display Items

Display items	Description
(1) Guide graphic	<p>This displays the guide drawing of barrier type. The guide drawing is switched according to the selected barrier form.</p> <p>The drawing is the left-side barrier guide drawing.</p> <p>Chuck type 1 guide drawing</p>  <p>Chuck type 2 guide drawing</p> 

Display items	Description																																																																																																																																	
(1) Guide drawing (continued)	<p>Tailstock type 1 guide drawing</p> 	<p>Tailstock type 2 guide drawing</p> 																																																																																																																																
(2) Barrier data	<p>This displays the barrier data. The display items differ depending on the length/coordinates value input and left/right-side barrier. The setting range is from -99999.999 to 99999.999 (mm). However, minus data cannot be input for length data.</p> <p><Length input mode> Set the chuck or tailstock position with the length (length between P points). When the value is set, the coordinates data is also updated.</p> <table border="0"> <tr> <td colspan="4" style="text-align: center;">Chuck barrier</td> <td colspan="4" style="text-align: center;">Tailstock barrier</td> </tr> <tr> <td></td> <td style="text-align: center;">Length</td> <td></td> <td style="text-align: center;">Coordinates</td> <td></td> <td style="text-align: center;">Length</td> <td></td> <td style="text-align: center;">Coordinates</td> </tr> <tr> <td>CX</td> <td style="text-align: center;">10.000</td> <td>P1 X</td> <td style="text-align: center;">10.000</td> <td>TX</td> <td style="text-align: center;">0.000</td> <td>P4 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>CZ</td> <td style="text-align: center;">15.000</td> <td>Z</td> <td style="text-align: center;">15.000</td> <td>TZ</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>U2</td> <td style="text-align: center;">3.000</td> <td>P2 X</td> <td style="text-align: center;">7.000</td> <td>U5</td> <td style="text-align: center;">0.000</td> <td>P5 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>W2</td> <td style="text-align: center;">5.000</td> <td>Z</td> <td style="text-align: center;">10.000</td> <td>W5</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>U3</td> <td style="text-align: center;">4.000</td> <td>P3 X</td> <td style="text-align: center;">3.000</td> <td>U6</td> <td style="text-align: center;">0.000</td> <td>P6 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>W3</td> <td style="text-align: center;">2.000</td> <td>Z</td> <td style="text-align: center;">8.000</td> <td>W6</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> </table> <p><Coordinates input mode> Set the chuck or tailstock position with the distance from the workpiece center coordinates (P0). When the value is set, the length data is also updated.</p> <table border="0"> <tr> <td colspan="4" style="text-align: center;">Chuck barrier</td> <td colspan="4" style="text-align: center;">Tailstock barrier</td> </tr> <tr> <td></td> <td style="text-align: center;">Length</td> <td></td> <td style="text-align: center;">Coordinates</td> <td></td> <td style="text-align: center;">Length</td> <td></td> <td style="text-align: center;">Coordinates</td> </tr> <tr> <td>CX</td> <td style="text-align: center;">10.000</td> <td>P1 X</td> <td style="text-align: center;">10.000</td> <td>TX</td> <td style="text-align: center;">0.000</td> <td>P4 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>CZ</td> <td style="text-align: center;">15.000</td> <td>Z</td> <td style="text-align: center;">15.000</td> <td>TZ</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>U2</td> <td style="text-align: center;">3.000</td> <td>P2 X</td> <td style="text-align: center;">7.000</td> <td>U5</td> <td style="text-align: center;">0.000</td> <td>P5 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>W2</td> <td style="text-align: center;">5.000</td> <td>Z</td> <td style="text-align: center;">10.000</td> <td>W5</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>U3</td> <td style="text-align: center;">4.000</td> <td>P3 X</td> <td style="text-align: center;">3.000</td> <td>U6</td> <td style="text-align: center;">0.000</td> <td>P6 X</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td>W3</td> <td style="text-align: center;">2.000</td> <td>Z</td> <td style="text-align: center;">8.000</td> <td>W6</td> <td style="text-align: center;">0.000</td> <td>Z</td> <td style="text-align: center;">0.000</td> </tr> </table>		Chuck barrier				Tailstock barrier					Length		Coordinates		Length		Coordinates	CX	10.000	P1 X	10.000	TX	0.000	P4 X	0.000	CZ	15.000	Z	15.000	TZ	0.000	Z	0.000	U2	3.000	P2 X	7.000	U5	0.000	P5 X	0.000	W2	5.000	Z	10.000	W5	0.000	Z	0.000	U3	4.000	P3 X	3.000	U6	0.000	P6 X	0.000	W3	2.000	Z	8.000	W6	0.000	Z	0.000	Chuck barrier				Tailstock barrier					Length		Coordinates		Length		Coordinates	CX	10.000	P1 X	10.000	TX	0.000	P4 X	0.000	CZ	15.000	Z	15.000	TZ	0.000	Z	0.000	U2	3.000	P2 X	7.000	U5	0.000	P5 X	0.000	W2	5.000	Z	10.000	W5	0.000	Z	0.000	U3	4.000	P3 X	3.000	U6	0.000	P6 X	0.000	W3	2.000	Z	8.000	W6	0.000	Z	0.000
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(3) Error message	This is displayed when barrier data setting is illegal.																																																																																																																																	
(4) Input section	This displays the input data.																																																																																																																																	

Menus

Menus	Description
=Input	This executes an absolute input.
+Input	This executes an incremental input.
Enter length	This changes to the length input.
Enter coordin	This changes to the coordinates value input.
Left barrier	This changes to the left-side barrier data setting. When the parameter "#8315 BARRIER TYPE (L)" is "0", this menu cannot be selected.
Right barrier	This changes to the right-side barrier data setting. When the parameter "#8316 BARRIER TYPE (R)" is "0", this menu cannot be selected.
Close	This closes the pop-up window and quits this function.

<Menus when the menu [Left barrier] or [Right barrier] is pressed>

Menus	Description
Chuck type 1	This changes the barrier form to the chuck barrier type 1. (*1)
Chuck type 2	This changes the barrier form to the chuck barrier type 2. (*1)
T-stock type 1	This changes the barrier form to the tailstock barrier type 1. (*2)
T-stock type 2	This changes the barrier form to the tailstock barrier type 2. (*2)

(*1) This menu can be selected when the parameter "#8315 BARRIER TYPE (L)" or "#8316 BARRIER TYPE (R)" is "1".

(*2) This menu can be selected when the parameter "#8315 BARRIER TYPE (L)" or "#8316 BARRIER TYPE (R)" is "2".

Setting the barrier position with length (length between P points)

- | | | |
|---|---|---|
| (1) Press the menu [Enter length]. | ➔ | The mode is switched to the length input mode. The highlight of the menu [Enter coordin] is canceled and the [Enter length] is highlighted.
The cursor is displayed at CX, and the length data can be set. |
| (2) Select whether the barrier to be set is right side or left side with the menu.
(Example) Press the menu [Left barrier]. | ➔ | The display is switched to the menu of the barrier form. |
| (3) Select the chuck type with the menu.
(Example) Press the menu [Chuck type 2]. | ➔ | The drawing is switched to the chuck barrier type 2 guide drawing. |
| (4) Input the value to CX.
20.000 [INPUT]
The setting can be performed also by pressing the menu [=Input] or [+Input] instead of the [INPUT] key. When the menu [+Input] is pressed, the value obtained by adding the input value to the original value is set. | ➔ | The value "20.000" is set to the cursor position (CX), and the coordinates value is also updated.
The cursor moves to CZ.
Consistency check is performed for respective setting data, and an error message is displayed when an illegality is detected. |
| (5) Input the values to CZ to W3 in the same way. | | |

Setting the barrier position with coordinates value (distance from the work center coordinates (barrier P0))

- | | | |
|---|---|--|
| (1) Press the menu [Enter coordin]. | ➔ | The mode is switched to the coordinates input mode. The highlight of the menu [Enter length] is cancelled and the menu [Enter coordin] is highlighted.
The cursor is displayed at P1 X, and the coordinates data can be set. |
| (2) Select whether the barrier to be set is right side or left side with the menu.
(Example) Press the menu [Right barrier]. | ➔ | The display is switched to the menu of the barrier form. |
| (3) Select the tailstock type with the menu.
(Example) Press the menu [T-stock type 1]. | ➔ | The drawing is switched to the tailstock barrier type 1 guide drawing. |
| (4) Input the value to P1 X.
30.000 [INPUT]
The setting can be performed also by pressing the menu [=Input] or [+Input] instead of the [INPUT] key. When the menu [+Input] is pressed, the value obtained by adding the input value to the original value is set. | ➔ | The value "30.000" is set to the cursor position (P1 X), and the length is also updated.
The cursor moves to P1 Z.
Consistency check is performed for respective setting data, and an error message is displayed when an illegality is detected. |
| (5) Input the values to P1 Z to P3 Z in the same way. | | |

Precautions

- (1) When the parameter "#8310 Barrier ON" is set to "0", the chuck and tailstock barriers settings are disabled.
- (2) The parameter "#8300 P0" and "#8311 P7" to "#8314 P10" cannot be set on this screen. Set the parameters with the menu [Barrier data] on the parameter screen.
- (3) When the parameters "#8315" and "#8316" are both "0", the barrier data is handled as left barrier and chuck type 1. The chuck type cannot be changed.
- (4) When the parameter for chuck or tailstock is set to both right and left barriers, an error message appears.
- (5) When multiple errors are occurred, an error concerning the X axis is preferentially displayed.

Other Setups

9.1 Pallet Program Registration



Machining programs can be registered per each pallet of the automatic pallet changer (hereinafter APC) and the indexing plane from the menu [Pallet] on the setup (Setup) screen.

The pallet program registration screens include "Standard Pallet Registration screen" and "Pallet 4 Page Registration screen", and those two screens can be switched by the parameters.

#11001APC type	Screen		Function
0	Standard Pallet Registration		Registration of machining programs for pallet 1 & 2 is carried out. Pallet 1 & 2 can be registered at once.
1	Pallet 4 Page Registration screen	Pallet List Screen	Machining program device, file name, machining status, and index planes under machining for 4 planes of the pallet 1 to 12 are displayed. Information of 2 pallets can be displayed at once.
		Pallet Details Screen	Machining program device, file name, machining status, and external workpiece coordinates for each plane of the pallet 1 to 12 are set. Information of one pallet's 2 indexing planes can be set at once.

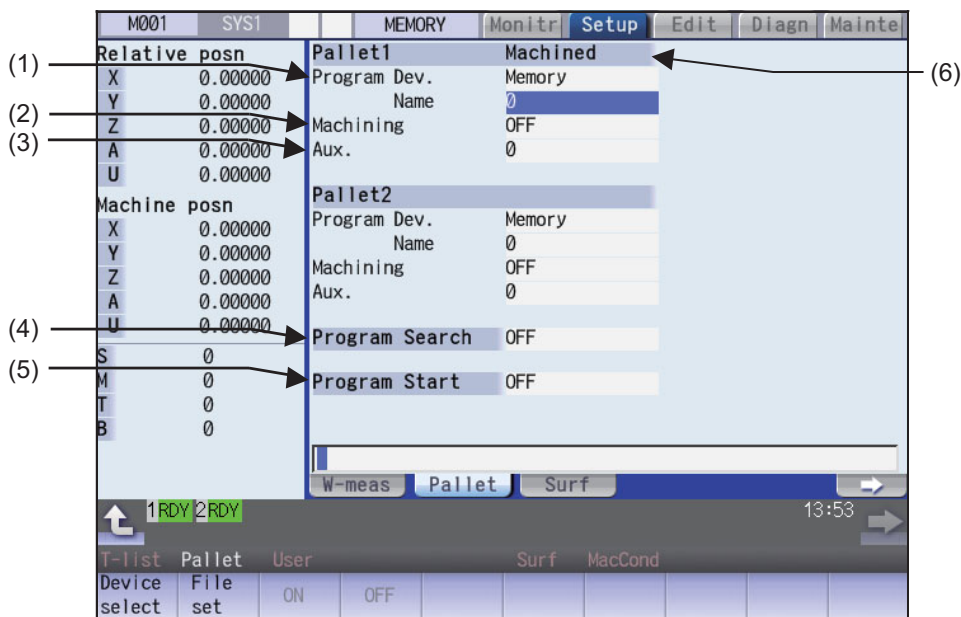
Note

(1) The number of pallets is determined by the parameter "#11002 Valid pallet num".

Manual numerical value command can be executed when manual numerical value command window is displayed by inputting an address key such as MST, etc.

For the pallet 4 page registration screen, the screen type (pallet list and pallet details) is memorized. When the screen is transferred to other screen and displayed again, the type which was displayed a moment ago is displayed. For the file selection, the pallet details is displayed.

9.1.1 Standard Pallet Registration




Display Items

Display Items	Description
(1) Pallet, Device, File name	The machining program device and file name registered for each pallet are displayed.
(2) Machining ON/OFF	The ON/OFF state of machining for each pallet is displayed.
(3) Aux.	If auxiliary function is available, the auxiliary function data for each pallet is displayed. Refer to the manual issued by the MTB for details on the corresponding functions.
(4) Program Search ON/OFF	The ON/OFF state of search for the registered machining program is displayed.
(5) Program Start ON/OFF	The ON/OFF state of continuous start for the registered machining program is displayed. When set to ON, the searched program will be started for the pallet in the machine. This setting is valid only when pallet program search is valid.
(6) Machined	"Machined" is displayed for the pallet in the machine.

Menus

Menus	Description
Device select	This displays the device menu. When selected, the device name of the pallet currently indicated by the cursor is changed.
File set	The file name to be registered can be selected from the list. A list of files of the currently selected device is displayed. This menu can be used only when the cursor is at file name.
ON	The state (Machining, Program Search, Program Start) indicated by the cursor is validated. This menu can be used only when the cursor is at Machining, Program Search, or Program Start.
OFF	The state (Machining, Program Search, Program Start) indicated by the cursor is invalidated. This menu can be used only when the cursor is at Machining, Program Search, or Program Start.

Operation method (Registering a machining program for the pallet)

- (1) Using the [↑], [↓], [←], [→] keys, move the cursor to the area of the pallet for which a program is to be registered.
- (2) Press the menu [Device select] and select a device.  The cursor moves to "Device". The device menu (memory, HD, memory card, DS or USB memory) is displayed. If selected, the device selected in "Device" is displayed.
- (3) Move the cursor to "Program Name" and input the program No.
- (4) Move the cursor to "Machining" and press the menu [ON] or [OFF].
- (5) Move the cursor to "Program Search" and press the menu [ON] or [OFF].
- (6) Move the cursor to "Program Start" and press the menu [ON] or [OFF].

Operation method (Selecting a file from the list)

- (1) Move the cursor to "File name" and press the menu [File set].
- (2) Move the cursor to an arbitrary file and press the [INPUT] key.
(An arbitrary file name can be directly entered as well.)

Note

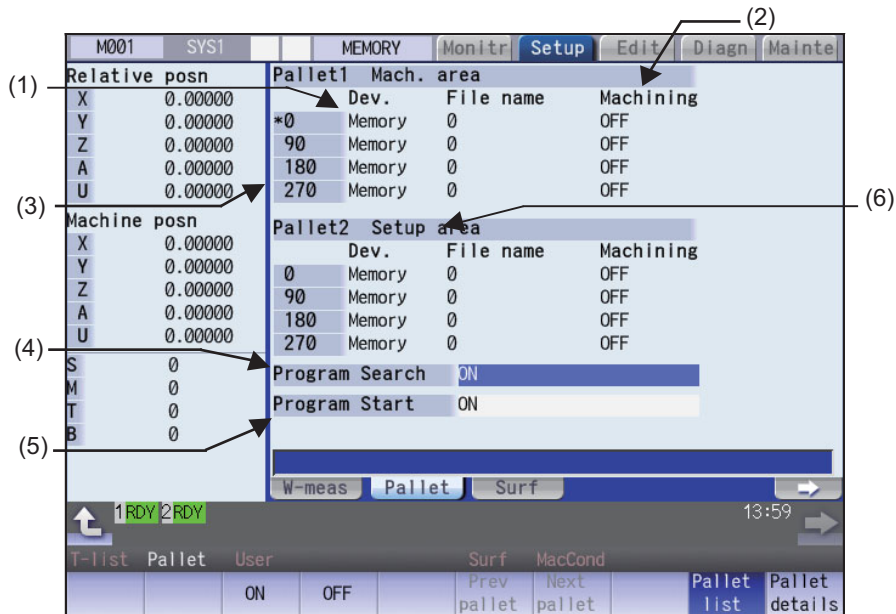
- (1) When a file name is directly entered, whether or not the file exists is not checked.
- (2) When a file name is directly entered, if other than character strings or values within the setting range (1 to 99,999,999) is set, an error occurs.
- (3) If a directory is specified, a setting error occurs.
- (4) When the menu [Sort change] is pressed, the sorting method is changed. For details, refer to "10.1.3 Changing the Sorting Method".

9.1.2 Pallet List Screen

Machining program device, file name, machining status, and index planes under machining for 4 planes of the pallet 1 to 12 are displayed.

Note

(1) The number of pallets is determined by the parameter "#11002 Valid pallet num".





Display Items

Display Items	Description
(1) Pallet, Device, File name	Machining program device name and file name to be registered in each pallet's index plane are displayed.
(2) Machining ON/OFF	Whether machining for each pallet's index plane is valid or invalid is displayed.
(3) Machining index plane	0°, 90°, 180°, 270° are displayed. An asterisk (*) is displayed with the angle of the index plane.
(4) Program Search ON/OFF	The ON/OFF state of search for the registered machining program is displayed. When valid, the next program registered will be searched automatically as soon as the currently machining program finishes. The next program is one of the valid index plane programs after the pallet in the machine. External workpiece coordinate set in the pallet detailed screen during search is set in the external workpiece coordinate system shift (EXT). Auto restart is disabled. If auto restart is turned ON by PLC switch, it will be automatically turned OFF.
(5) Program Start ON/OFF	The ON/OFF state of continuous start for the registered machining program is displayed. When set to ON, the searched program will be started for the pallet in the machine. This setting is valid only when pallet program search is valid.
(6) Pallet information in the machine	Whether pallet is in the machine is displayed. •Mach. area: When pallet is in the machine •Setup area: When pallet is not in the machine

Menus

Menus	Description
ON	The state (Machining, Program Search, Program Start) indicated by the cursor is validated. This menu can be used only when the cursor is at Machining, Program Search, or Program Start.
OFF	The state (Machining, Program Search, Program Start) indicated by the cursor is invalidated. This menu can be used only when the cursor is at Machining, Program Search, or Program Start.
Prev pallet	Information on the previous two pallets is displayed.
Next pallet	Information on the next two pallets is displayed.
Pallet list	A list of pallets is displayed.
Pallet details	The screen is shifted to the Pallet details screen. The 0° or 90° data of the pallet displayed on the top line of the Pallet list screen is displayed.


Operation method (Changing display pallet)

- (1) When the pallet 1 and 2 are displayed, press the menu [Next pallet] or next page key.  Pallet 3 and 4 are displayed.
- (2) Press the menu [Prev pallet] or previous page key.  Pallet 1 and 2 are displayed.

Operation method (Setting pallet program search)

- (1) Using the [↑], [↓], [←], [→] keys, move the cursor to "Program Search" and press the menu [ON] or [OFF].  The contents set in "Program Search" is displayed. The cursor moves to "Program Start".

Operation method (Setting continuous start)

- (1) Using the [↑], [↓], [←], [→] keys, move the cursor to "Program Start" and press the menu [ON] or [OFF].  The contents set in "Program Start" is displayed. The cursor moves to "Program Search".

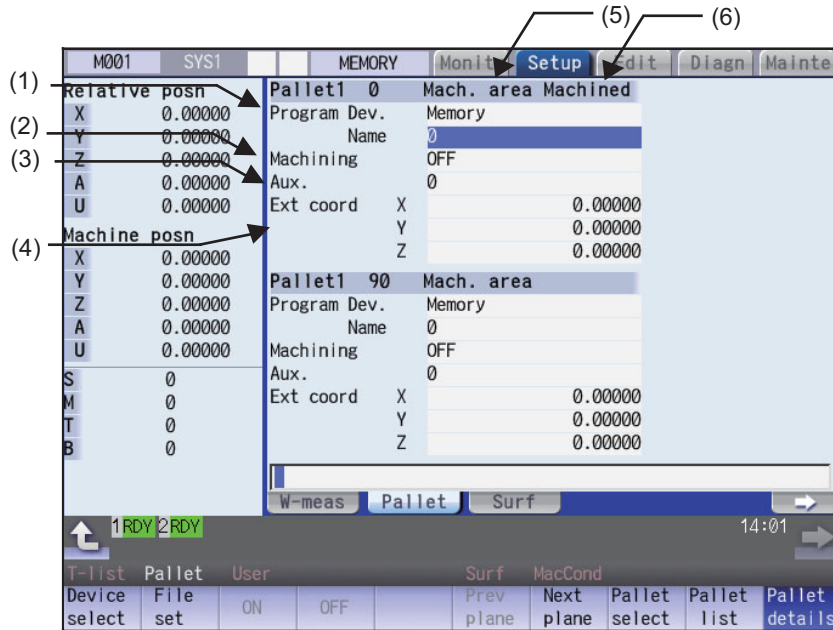
Every time the [↑], [↓], [←] or [→] key is pressed, the cursor switches between "Program Search" and "Program Start".

9.1.3 Pallet Details Screen

Machining program device, file name, machining status, Aux. and external workpiece coordinates for each plane of the pallet 1 to 12 are set.

Note

(1) The number of pallets is determined by the parameter "#11002 Valid pallet num".



Display Items

Display Items	Description
(1) Pallet, Device, File name	Machining program device name and file name to be registered in each pallet's index plane are displayed.
(2) Machining ON/OFF	Whether machining for each pallet's index plane is valid or invalid is displayed.
(3) Aux.	If auxiliary function is available, the auxiliary function data for each pallet is displayed. Refer to the manual issued by the MTB for details on the corresponding functions.
(4) Ext coord	The set data (X to Z axis) is set in the pallet No. and extended workpiece coordinate offset corresponding to the index plane. The value set in the extended workpiece coordinate offset is written into the external workpiece coordinate system shift (EXT) according to the command from PLC. When the extended workpiece coordinate offset for the machining surface of a pallet in machine is changed, only the changed axis data is written into the external workpiece coordinate system shift (EXT). X to Z axis: External workpiece coordinate data (Example) Pallet 1 0°: Extended workpiece coordinate offset 49 sets Pallet 1 90°: Extended workpiece coordinate offset 50 sets Pallet 1 180°: Extended workpiece coordinate offset 51 sets Pallet 1 270°: Extended workpiece coordinate offset 52 sets Pallet 2 0°: Extended workpiece coordinate offset 53 sets : Pallet 12 270°: Extended workpiece coordinate offset 96 sets
(5) Pallet information in the machine	Whether pallet is in the machine is displayed. •Mach. area: When pallet is in the machine •Setup area: When pallet is not in the machine
(6) Machined	"Machined" is displayed on the index plane of a pallet in the machine.


Note

- (1) "Pallet running" appears when the setting of "Program Dev.", "Program Name", "Machining", or "Aux." is executed to the index plane under machining of a pallet in machine. The "Program Dev.", "Program Name", "Machining", or "Aux." can be set when the index plane of a pallet in machine is not under machining.
Even if the index plane of a pallet in machine is under machining, the external workpiece coordinate can be set.
- (2) For the pallet 4 page registration screen, do not use the extended workpiece coordinate offset because the extended workpiece coordinate offset value is reflected on the external workpiece coordinate system shift.

Menus

Menus	Description
Device select	This displays the device menu. When selected, the device name of the pallet currently indicated by the cursor is changed. When a device other than memory is selected, the route is displayed first.
File set	The file name to be registered can be selected from the list. A list of files of the currently selected device is displayed. This menu can be used only when the cursor is at file name.
ON	The state (Machining) indicated by the cursor is validated. This menu can be used only when the cursor is at Machining.
OFF	The state (Machining) indicated by the cursor is invalidated. This menu can be used only when the cursor is at Machining.
Prev plane	Previous index plane is displayed. When 0° or 90° index plane is being displayed, this menu displays the previous pallet, 180° or 270° index plane. When 180° or 270° index plane is being displayed, this menu displays 0° or 90° index plane. When 0° or 90° index plane of the pallet 1 is displayed, this menu cannot be selected.
Next plane	Next index plane is displayed. When 0° or 90° index plane is being displayed, this menu displays 180° or 270° index plane. When 180° or 270° index plane is being displayed, this menu displays the next pallet, 0° or 90° index plane. When 180° or 270° index plane of the last pallet is displayed, this menu cannot be selected.
Pallet select	An arbitrary pallet can be selected. When the pallet No. is set and the [INPUT] key is pressed, the 0° or 90° pallet details data for that pallet is displayed. The cursor will move to the 0° machining program file name.
Pallet list	The Pallet list screen will open.
Pallet details	This displays the pallet details.

Operation method (Changing display pallet)

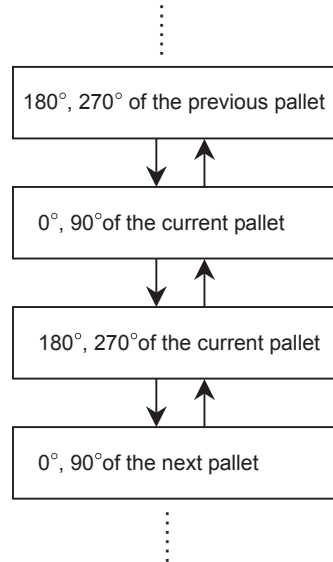
- (1) Press the menu [Pallet select]. Input pallet No. and press the [INPUT] key.  The pallet 5's 0° and 90° index plane will appear.
(Example) 5 [INPUT]

Operation method (Changing index planes)

(Example) When the screen display status acquired after the above (Changing display pallets) operation

- (1) Press the menu [Next plane] or next page key. ➡ The pallet 5's 0° and 90° index plane will appear.
- (2) Press the [Prev plane] or previous page key. ➡ The pallet 5's 0° and 90° index plane will appear.

The display of pallet and index plane changes as follows.

**Operation method (Setting values in each index plane)**

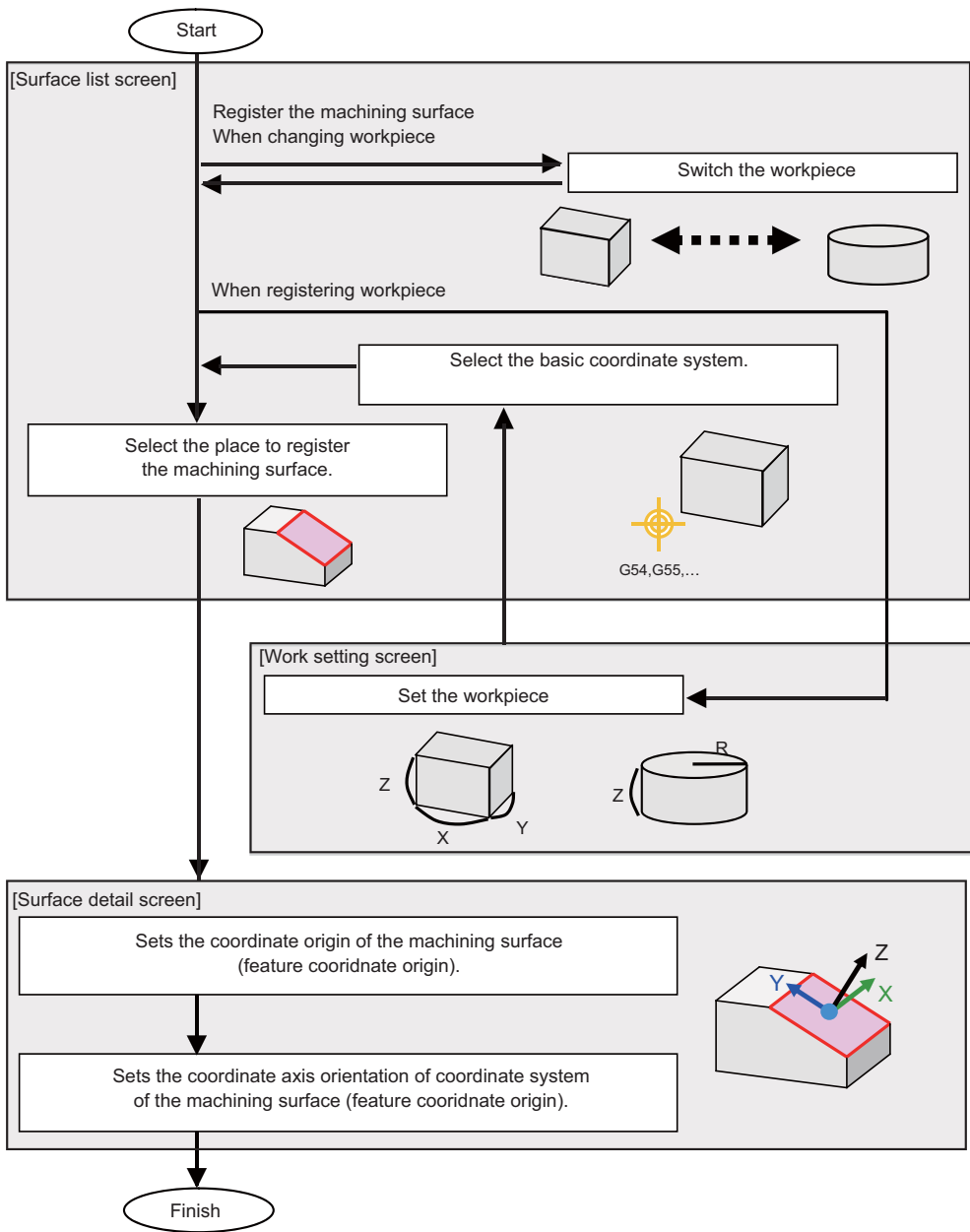
- (1) An arbitrary index plane is displayed using the operation method above.
- (2) Press the menu [Device select] and select a device. ➡ The cursor moves to "Device". The device menu (memory, HD, memory card, DS or USB memory) is displayed. If selected, the selected device is displayed in "Program Dev.". After setting, the cursor moves to "File name".
- (3) Move the cursor to "Program Name" and enter the program No.
- (4) Move the cursor to "Machining" and press the menu [ON] or [OFF].
- (5) Move the cursor to "Ext coord" and input values for 3 axes.

9.2 R-Navi



By setting machining surface coordinate system (feature coordinate system), an optional machining surface can be registered. By selecting registered machining surface on surface selection of monitor screen, commands programmed along three orthogonal axes can move the tool along the coordinate system of this machining surface (feature coordinate system). This selected surface is called a machining target surface. This enables a program with three orthogonal axes to carry out multi-surface machining including inclined surface machining. This function is an additional specification, and the setting is common for all the part systems.

The following flow chart shows the sequence of registering a machining surface.



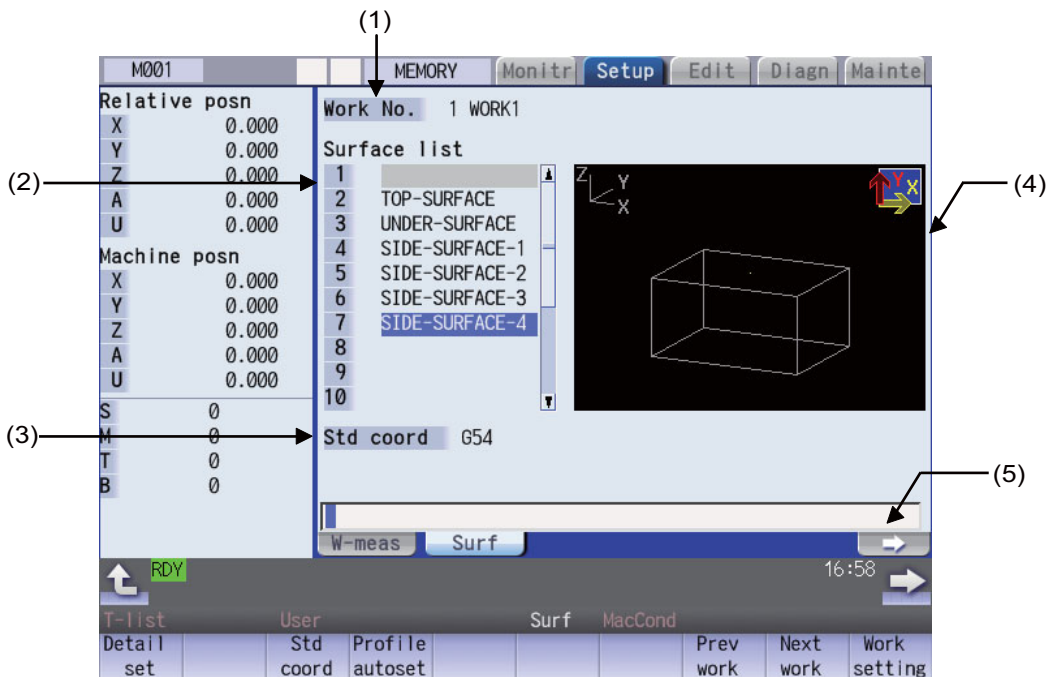
9.2.1 Selecting where to Register a Machining Surface (Machining Surface List Screen)

On the surface list screen the place to register a machining surface can be selected.

Note

(1) When workpiece is initially registered, the surface "BASE-SURFACE" registers. The coordinate zero and axial directions of this machining surface is the same as of the basic coordinate system. The following operations are disabled for this machining surface. The message "Setting error", "Clear not possible", or "Paste error" is displayed.

- Change the surface name
- Clear the surface
- Paste the surface
- Display the data (coordinate zero/axial direction) of the surface using the menu [Detail set]



Display items

Display items	Description
(1) Work No.	Displays the workpiece to which a machining surface is registered. The workpiece size, etc. are set through the work setting screen which is opened by the menu [Work setting].
(2) Surface list	Displays a list of machining surfaces registered to the workpiece. Besides BASE-SURFACE up to 16 surfaces can be registered in this list.
(3) Basic coordinate system	Displays the basic coordinate system of the workpiece (workpiece coordinate system G54, G55...).
(4) Workpiece graphic	Displays the workpiece and the registered surfaces in a graphic form. Displays the workpiece and the registered surfaces in a graphic form. The surface pointed by the cursor in the list is highlighted, and the X, Y and Z coordinate axes of the surface (feature coordinate system) are indicated with arrow marks. (X axis is in yellow, Y in red and Z in green)
(5) Input section	Displays the key entered. The data entered here will be reflected in the current cursor position when the [INPUT] key is pressed.

Menus (T code list search window)

Menus	Description
Detail set	This opens the surface detail screen as a pop-up window. The origin and axial directions of the feature coordinate system defined on the selected surface can be set on the surface detail screen.
Std coord	This selects the basic coordinate system of the workpiece that is subject to surface registration (G54 to G59 and extended workpiece coordinate G54.1Pn). After selecting, the workpiece coordinate system is displayed as the basic coordinate system. Pressing this switches to the menu [Std coord].
Profile autose	If this menu is pressed while the workpiece subject to surface registration is a block, the top, bottom and four side faces of the workpiece are automatically registered as machining surfaces. The coordinate systems (feature coordinate systems) of each surface are also registered automatically.
Graphic Dir	This changes the coordinate system direction of the workpiece graphic (graphic display of the surface). If the coordinate system direction is switched using this menu, it is reflected on the workpiece graphic on the details/work setting screen, and held even after the power is turned OFF and ON.
Graphic Rot	This switches the workpiece graphic (graphic display of the surface) by rotating it 90 degrees at a time around the vertical direction. The rotation by this menu is reflected on the workpiece graphic on the details/work setting screen, and held even after the power is turned ON again.
Prev work	This changes the workpiece subject to surface registration to the previous workpiece. If there is no previous workpiece, the last workpiece is displayed.
Next work	This changes the workpiece subject to surface registration to the next workpiece. If there is no next work, the first work is displayed.
Work setting	This opens the work setting screen as a pop-up window. On this screen, multiple workpieces can be registered (name registration), and the workpiece form (type and size) and position can be set to each of the registered workpieces.
Surface copy	This copies the surface data of the specified line (one line). (*1)(*3)(*4)(*5) If the [INPUT] key is pressed without specifying the line, the line where cursor is displaying will be copied.
Surface paste	This writes the copied surface data (one line) to the line where the cursor is displaying. (*1)(*2)(*3)(*5)
Surface clear	This clears the surface data of the specified line (multiple lines possible). (*5)(*6) Methods: Specify the No. of surface to start and the No. to finish deleting. (Example) 1/E: Delete all surface data. The line where the cursor is displaying will be deleted if the [INPUT] key is pressed without specifying the line.

If the size has not been set for the workpiece, the menus except for [Prev work], [Next work], and [Work setting] will be grayed out and non-selectable.

(*1) If the surface data of the copied line is changed, the data will be revised when it is pasted.

(*2) This operation is disabled for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) or the surface "BASE-SURFACE". The following message appears.

Machining target surface: "Can't paste machining surface"
Surface "BASE-SURFACE": "Paste error"

(*3) If the surface data of the copied line is deleted, pasting the data will be disabled. The message "Paste error" is displayed.

(*4) The copied line will be maintained even if the screen changes.

(*5) When the data protection is valid, this operation will be disabled. The message "Data protect" is displayed.



(*6) When a line is deleted, this operation is disabled for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) the surface "BASE-SURFACE". The following message appears.

Machining target surface: "Can't clear machining surface"
Surface "BASE-SURFACE": "Clear not possible"

If the range specified for this operation includes BASE-SURFACE or the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) (1/E, for example), the surface data except for the surface "BASE-SURFACE" and the machining target surface will be deleted.

9.2.1.1 Selecting Where to Register a Machining Surface

Operation method


- (1) Move the cursor to the line where a machine surface is registered by using arrow keys ([↑], [↓]).
- (2) Input the surface name.  The surface name is registered.
When not registering a surface name, skip this and go to operation (3).
- (3) Select the menu [Detail set] or press the [INPUT] key.  This opens the surface detail screen as a pop-up window.

Note

- (1) Set the surface name with up to 15 one-byte characters (numbers, upper-case alphabets and the symbols that the system recognizes). If a one-byte lower-case alphabet is used for naming, it will be changed to the upper-case letter.
Note that the following characters cannot be used.
\\ / : , * ? " < > | space
A character string made of a single-byte zero only cannot be registered as a work name.
- (2) The operation cannot be operated if the size is not set to workpiece. The message "Setting error" is displayed.
- (3) When the data protection is valid, the surface name cannot be changed. The message "Data protect" is displayed.

9.2.1.2 Changing the Surface Name

Operation method

- (1) Move the cursor to the row where the name of machine surface needs to be changed using arrow keys ([↑], [↓]).
- (2) Input the surface name.  The surface name is registered.
To clear the surface name, input "0" (one-byte zero).

Note

- (1) When this operation is operated to the surface "BASE-SURFACE", the message "Setting error" is displayed.
- (2) This operation cannot be operated to the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present). The message "Can't set machining surface" is displayed.
- (3) When the data protection is valid, the surface name cannot be changed. The message "Data protect" is displayed.

9.2.1.3 Switching the Workpiece

Operation method

- (1) Press the menus [Prev work] and [Next work].



<When the menu [Prev work] is pressed>

This will change the workpiece subject to surface registration to the previous workpiece. If there is no previous workpiece, the last workpiece is displayed. (The workpiece that has not set the size is displayed, too.) The cursor moves to the top line.

<When the menu [Next work] is pressed>

This will change the workpiece subject to surface registration to the next workpiece. If there is no next work, the first work is displayed. (The workpiece that has not set the size is displayed, too.) The cursor moves to the top line.

9.2.1.4 Selecting the Basic Coordinate System

The basic coordinate system of the workpiece subject to surface registration can be changed by selecting the menu [Std coord] and then selecting the sub-menu to be displayed.

Operation method

<Selecting the coordinate system G54-G59>

- (1) Press the menu [Std coord].
The screen returns to the main menu of the surface list screen when [Retn] is selected.



The sub-menu is displayed.

- (2) Press the menu [G56].



G56 is set to the basic coordinate system.
The screen returns to the main menu of the surface list screen.

<Selecting the coordinate system G54.1P>

- (1) Select the menu [Std coord].

(2) Select the menu [G54.1P].
Highlight of the menu will be canceled by selecting the menu [Retn].
The screen returns to the main menu of the surface list screen by selecting [Retn] again.



The sub-menu is displayed.



The message "Input P number" is displayed.
The menu is highlighted.

- (3) Input "20" and press the [INPUT] key.



G54.1P20 is set to the basic coordinate system.
The screen returns to the main menu of the surface list screen.

Note

- (1) The basic coordinate system of the workpiece to which the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) is registered cannot be changed. The message "Can't set work including mach surface" is displayed.
- (2) When the data protection is valid, the basic coordinate system cannot be changed. The message "Data protect" is displayed.

9.2.1.5 Automatically Registering Top and Side Faces as Machining Surfaces

By pressing the menu [Profile auto set], the top, bottom and four side faces of the workpiece are automatically registered as machining surfaces. The coordinate systems (feature coordinate systems) of each surface are also registered automatically.

Operation method

- | | | |
|---|---|---|
| (1) Select the menu [Profile auto set]. | ➔ | The menu will be highlighted and the confirmation message "Execute auto-registration?(Y/N)" is displayed. |
| (2) Press the [Y] or [INPUT] key. | ➔ | The automatic registration operates and the message "Auto-registration completed" is displayed. |

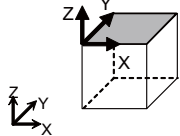
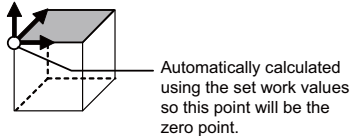
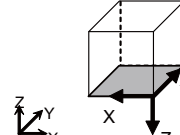
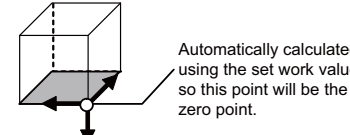
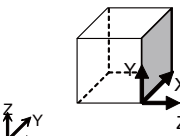
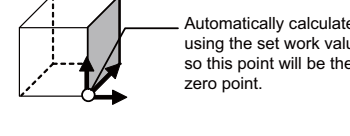
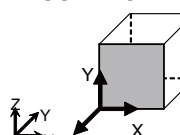
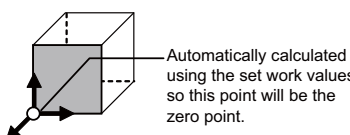
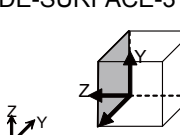
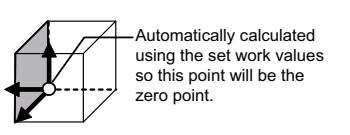
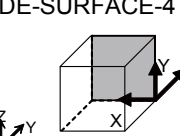
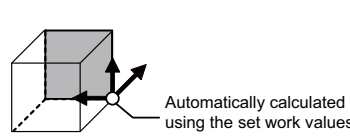
Note

- (1) This operation is valid when the workpiece form is block. If the form is other than block, the message "Setting error" is displayed.
- (2) When any of the workpiece size (X, Y and Z directions) is not set, the menu [Profile auto set] will be grayed out and non-selectable.
- (3) The surface names to be registered are as follows:

TOP-SURFACE	A surface whose normal direction is +Z of the basic coordinate system
UNDER-SURFACE	A surface whose normal direction is -Z of the basic coordinate system
SIDE-SURFACE-1	A surface whose normal direction is +X of the basic coordinate system
SIDE-SURFACE-2	The side surface that comes first when turning clockwise about Z axis from SIDE-SURFACE-1
SIDE-SURFACE-3	The side surface that comes second when turning clockwise about Z axis from SIDESURFACE-1
SIDE-SURFACE-4	The side surface that comes third when turning clockwise about Z axis from SIDE-SURFACE-1

- (4) This operation is disabled if 11 or more surfaces are registered besides those registered by this operation. The message "Setting error" is displayed.
- (5) If no surface name is registered, but the surface's coordinate system has been registered (the origin and coordinate axis directions of the feature coordinate system are other than zero), the surface is recognized as registered.
- (6) When the workpiece size is changed, this operation needs to be performed again because the coordinate systems set to each surface will shift. The setting of surface registered by this operation will be overwritten. However, the surface that is not able to overwrite (the registered surface is deleted or the name is changed) the setting will be registered again. (A renamed surface will be treated as the other surface.)
- (7) If a surface to register by this operation is the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present), this operation cannot be operated. The message "Can't set machining surface" is displayed.
- (8) When the data protection is valid, this operation will be disabled. The message "Data protect" is displayed.
- (9) If there are two surfaces having the same name to be overwritten, the surface with the smaller No. will be overwritten. If the surface is the machining target surface this operation cannot be operated. The message "Can't set machining surface" is displayed.
- (10) There will be no data to be changed when error occurred and automatic register fails.

(11) Listed below are the surface names and data that are automatically set with [Profile auto set].

Surface name	Feature coordinate origin	Axis direction	Method	Setting value
TOP-SURFACE 		Z axis direction	A point on the axis (+)	X: 0.000 Y: 0.000 Z: 1.000
		X axis direction	A point on the axis (+)	X: 1.000 Y: 0.000 Z: 0.000
UNDER-SURFACE 		Z axis direction	A point on the axis (+)	X: 0.000 Y: 0.000 Z: -1.000
		X axis direction	A point on the axis (+)	X: -1.000 Y: 0.000 Z: 0.000
SIDE-SURFACE-1 		Z axis direction	A point on the axis (+)	X: 1.000 Y: 0.000 Z: 0.000
		X axis direction	A point on the axis (+)	X: 0.000 Y: 1.000 Z: 0.000
SIDE-SURFACE-2 		Z axis direction	A point on the axis (+)	X: 0.000 Y: -1.000 Z: 0.000
		X axis direction	A point on the axis (+)	X: 1.000 Y: 0.000 Z: 0.000
SIDE-SURFACE-3 		Z axis direction	A point on the axis (+)	X: -1.000 Y: 0.000 Z: 0.000
		X axis direction	A point on the axis (+)	X: 0.000 Y: -1.000 Z: 0.000
SIDE-SURFACE-4 		Z axis direction	A point on the axis (+)	X: 0.000 Y: 1.000 Z: 0.000
		X axis direction	A point on the axis (+)	X: -1.000 Y: 0.000 Z: 0.000

TOP-SURFACE is a surface whose normal direction is +Z of the basic coordinate system.

UNDER-SURFACE is a surface whose normal direction is -Z of the basic coordinate system.

SIDE-SURFACE-1 is a surface whose normal direction is +X of the basic coordinate system.

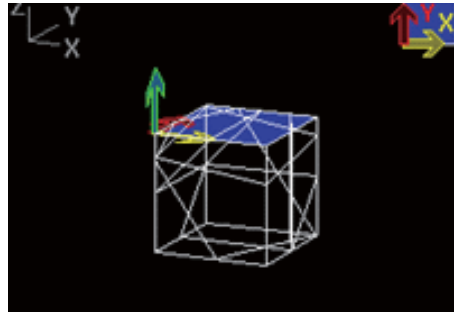
SIDE-SURFACE-2 to 4 are the surfaces obtained by rotating "SIDE-SURFACE1" about the Z axis of the basic coordinate system.

9.2.1.6 Switching the Coordinate System Direction of a Workpiece Graphic

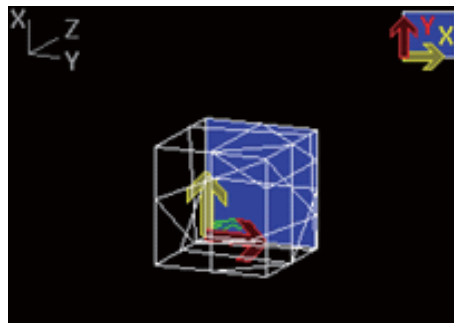
The coordinate system direction of the workpiece graphic (graphic display of the surface) can be switched to three coordinate system directions using the menu [Graphic dir] or [Graphic Rot]. The coordinate system direction of the workpiece graphic is reflected on the workpiece setting screen, Surface detail screen, and surface detail screen of the monitor screen, and the parameter "#8980 R-Navi graphic dir" is also updated.

Each time the menu [Graphic dir] is pressed, the direction of the workpiece graphic is switched in the order of (1) to (3) as shown below:

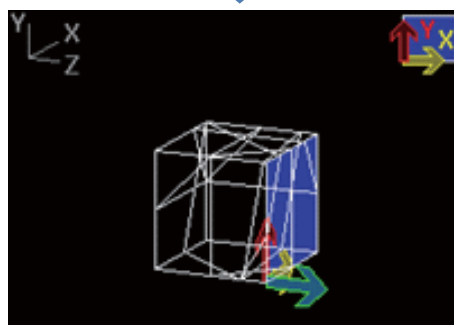
(1) #8980 R-Navi graphic direction = 0 (XYZ)



(2) #8980 R-Navi graphic direction = 1 (YZX)



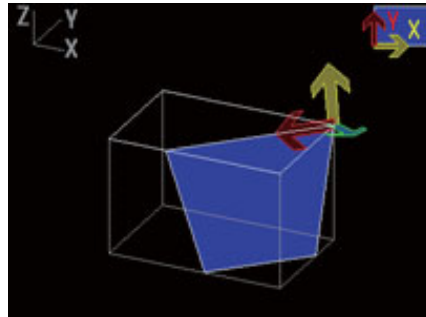
(3) #8980 R-Navi graphic direction = 2 (ZXY)



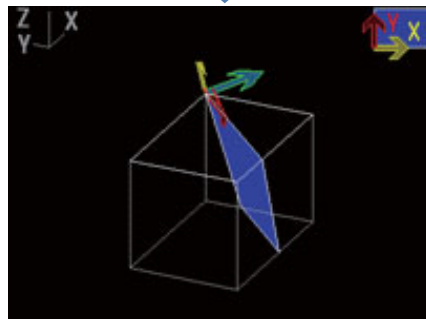
Each time the menu [Graphic Rot] is pressed, the direction of the workpiece graphic is switched in the order of (1) to (4) as shown below:

#8980 R-Navi graphic direction = 0 (XYZ)

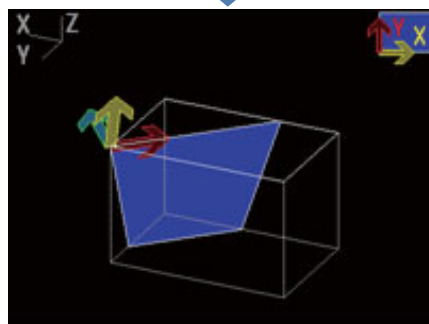
(1) Default view



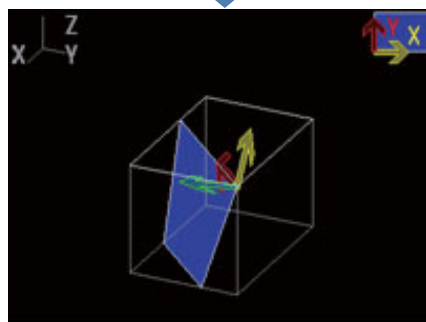
(2) Rotated by 90 degrees from the default view



(3) Rotated by 180 degrees from the default view



(4) Rotated by 270 degrees from the default view

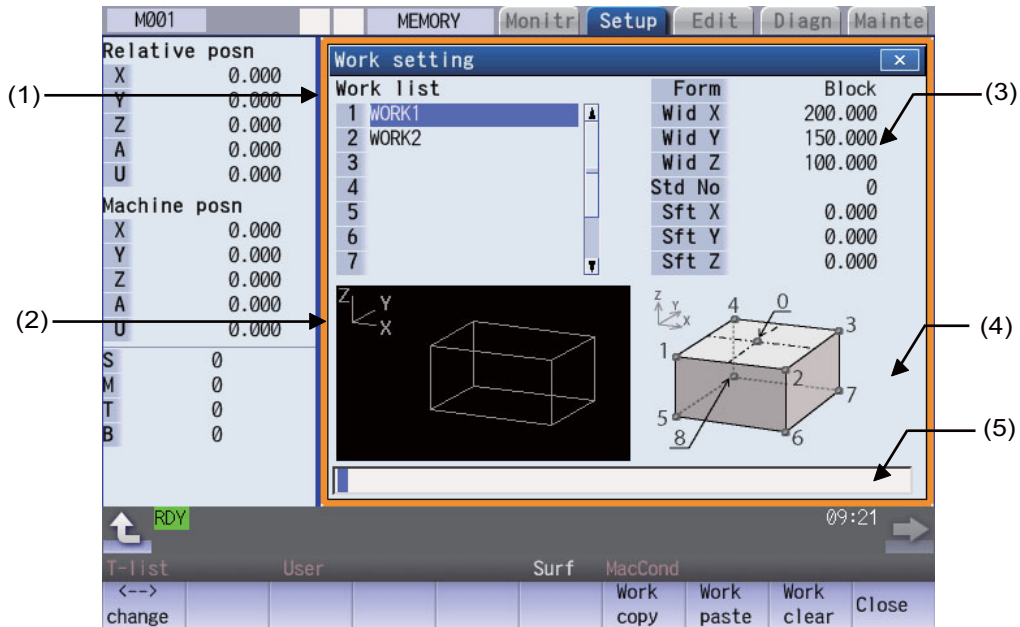


Note

- (1) When data protection is valid, the coordinate system direction of the workpiece graphic can be switched using the menu, but the parameter value is not rewritten. In this case, when the power is turned ON again, the coordinate system direction of the workpiece graphic reverts to the same graphic direction that the parameter value is in.
- (2) The view direction of the guide drawing is not switched due to the setting of the parameter or this menu.

9.2.2 Registering and Setting the Workpiece (on the Work Setting Screen)

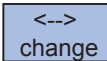
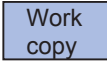
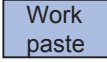
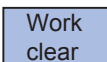
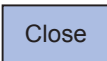
When the menu [Work setting] is pressed the workpiece setting screen opens as a pop-up window. On this screen, name, form, size, and position of the workpiece can be set.



Display items

Display items	Description
(1) Work list	Displays a list of currently registered workpieces. Up to 10 workpieces can be registered in this list.
(2) Workpiece graphic	Displays the form of the workpiece in 3D which is pointed by the cursor in the list.
(3) Work setting	Displays the setting value of the workpiece pointed by the cursor in the list. The number of digits after the decimal point will obey the parameter #1003 iunit of the 1st part system. (Example) - 99999.999 to 99999.999 (mm) (When "#1003 iunit"= B)
(4) Guide graphic	Displays the guide graphic that is related to the workpiece pointed by the cursor in the list.
(5) Input section	Displays the key entered. The data entered here will be reflected in the current cursor position when the [INPUT] key is pressed.

Menus when the cursor is on the workpiece list

Menus	Description
	This moves the cursor between workpiece list and workpiece setting.
	This copies the data of workpiece pointed by the cursor (by one line). (*1)(*3)(*4)(*5)
	This writes the copied workpiece data (one line) to the line where the cursor is displaying. (*1)(*2)(*3)(*5) The copied workpiece data will be deleted when pasted.
	This clears the workpiece data of the specified line (multiple lines possible). (*5)(*6) Methods: Specify the No. of workpiece data to start and the No. to finish deleting. (Example) 1/E: Delete all workpiece data. The line where cursor is displaying will be deleted if the [INPUT] key is selected without specifying the line.
	This closes the pop-up window and quits this function.

(*1) If the surface data being copied is changed, the data will be revised when it is pasted.

(*2) This operation cannot be operated to the workpiece that includes the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present). The message "Can't paste work including mach surface" is displayed.

(*3) If the surface data being copied is deleted, the paste cannot be done. The message "Paste error" is displayed.

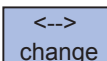


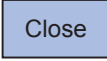
(*4) The copied data will be deleted when the window is closed.

(*5) When the data protection is valid, this operation will be disabled. The message "Data protect" is displayed.

(*6) When a line is deleted, this operation is disabled for a workpiece that includes the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) and the message "Can't clear machining surface" is displayed.

If the range specified for this operation includes the workpiece that has the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) (1/E, for example), the workpieces except for the workpiece that includes the machining target surface will be deleted.

Menus when the cursor is on the workpiece setting list

Menus	Description
	This moves the cursor between workpiece list and workpiece setting.
	The workpiece form will turn to block when this menu is selected. If the cursor is outside the form area, this menu will be grayed out and non-selectable.
	The workpiece form will turn to pillar when this menu is selected. If the cursor is outside the form area, this menu will be grayed out and non-selectable.
	This closes the pop-up window and quits this function.

9.2.2.1 Registering the Workpiece

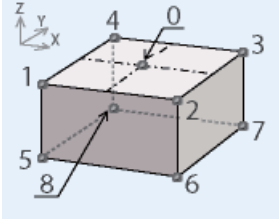
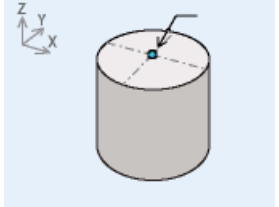
Operation method

- (1) Move the cursor to the workpiece list by using the menu [<-> change]. ➔ Move the cursor to the top of the workpiece list.
 Also, the cursor can be moved by tab keys ([←], [→]) to workpiece list.

- (2) Move the cursor to a line where no workpiece is registered.

- (3) Input the workpiece name. ➔ The name of workpiece is registered, and the cursor moves to the form line of workpiece setting.
 If naming the workpiece is unnecessary, select [INPUT]. Also, the menu corresponding to the value of form is valid.

- (4) Select the form menu ([Block], [Pillar]) that needs to be set. ➔ The selected form will be reflected to the line of form and the cursor moves down a line.
 Setting contents differs by the selected workpiece form.

Form	Guide graphic	Item	Description	Setting range (*1)
Block		Wid X	Width in the X direction	0.001mm(*2) - 99999.999mm
		Wid Y	Width in the Y direction	0.001mm(*2) - 99999.999mm
		Wid Z	Width in the Z direction	0.001mm(*2) - 99999.999mm
		Std No	Set a point to serve as a reference when setting the basic coordinate system's origin by the No. on guide graphic.	0: A center of the top 1 to 4: An angle of the top 5 to 8: An angle of the bottom
		Sft X	Shift distance from the point of Std No to the basic coordinate system's origin (in the X direction)	-99999.999mm - 99999.999mm
		Sft Y	Shift distance from the point of Std No to the basic coordinate system's origin (in the Y direction)	-99999.999mm - 99999.999mm
		Sft Z	Shift distance from the point of Std No to the basic coordinate system's origin (in the Z direction)	-99999.999mm - 99999.999mm
Pillar		Dia D	Diameter of the pillar	0.001mm(*2) - 99999.999mm
		Hgt Z	Height of the pillar	0.001mm(*2) - 99999.999mm
		Sft X	Shift distance from the top face's center to the basic coordinate system's origin (in the X direction)	-99999.999mm - 99999.999mm
		Sft Y	Shift distance from the top face's center to the basic coordinate system's origin (in the Y direction)	-99999.999mm - 99999.999mm
		Sft Z	Shift distance from the top face's center to the basic coordinate system's origin (in the Z direction)	-99999.999mm - 99999.999mm

(*1) These values follow the setting of "#1003 iunit" for the 1st part system.

(*2) Inputting 0 is possible.

(5) Input the workpiece size.



The value is input to the line where cursor is displaying and the cursor moves down a line.

Note

(1) Despite the presence of workpiece name, the workpiece will be treated as registered when its size meets the followings:

- Block: The three axes (X, Y and Z) are defined
- Pillar: The diameter D and height Z are defined

(2) Set the workpiece name with up to 20 one-byte characters (numbers, upper-case alphabets and the symbols that the system recognizes). If a one-byte lower-case alphabet is used for naming, it will be changed to the upper-case letter.

Note that the following characters cannot be used:

\ / : , * ? " < > | space

A character string made of a single-byte zero only cannot be registered as a work name.

(3) When the data protection is valid, registering a workpiece is disabled. The message "Data protect" is displayed.

Work size setting examples

	<p>Form: Block Wid X: 50.000 Wid Y: 30.000 Wid Z: 20.000 Std No: 1 Sft X: 0.000 Sft Y: 0.000 Sft Z: 0.000</p>
	<p>Form: Block Wid X: 50.000 Wid Y: 30.000 Wid Z: 20.000 Std No: 5 Sft X: -10.000 Sft Y: -5.000 Sft Z: -4.000</p>
	<p>Form: Pillar Dia D: 60.000 Hgt Z: 20.000 Sft X: 0.000 Sft Y: 0.000 Sft Z: 0.000</p>
	<p>Form: Pillar Dia D: 60.000 Hgt Z: 20.000 Sft X: 50.000 Sft Y: 35.000 Sft Z: 5.000</p>

9.2.2.2 Changing the Workpiece Name

Operation method

- | | | |
|--|---|---|
| (1) Move the cursor to the workpiece list by using the menu [<--> change].
Also, the cursor can be moved by tab keys ([←], [→]) to workpiece list. | ➔ | Move the cursor to the top of the workpiece list. |
| (2) Move the cursor to a line where the workpiece is registered using arrow keys ([↑], [↓]). | | |
| (3) Input the workpiece name.
To clear the workpiece name, input "0"(one-byte 0). | ➔ | The name of workpiece is changed, and the cursor moves to the form line of workpiece setting. |

Note

- (1) Form, size, data of the surface will not change by changing the name.
- (2) The name of workpiece for which the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present) has been registered, cannot be changed.
The message "Can't set work including mach surface" is displayed.
- (3) When the data protection is valid, a workpiece name cannot be changed. The message "Data protect" is displayed.

9.2.2.3 Changing the Form of the Work

Operation method

- | | | |
|---|---|--|
| (1) Move the cursor to workpiece setting by using the menu [<--> change].
If the cursor is already on the workpiece setting, move the cursor to the line of the workpiece shape by using arrow keys ([↑], [↓]).
The cursor can be moved by tab keys ([←], [→]) to workpiece setting.
Also, the cursor will move to workpiece setting by selecting the [INPUT] key when the cursor is in the workpiece list. | ➔ | Move the cursor to the top of workpiece setting.
The menu corresponding to the value of form becomes valid. |
| (2) Select the form menu ([Block], [Pillar]) that needs to be set. | ➔ | The selected form will be reflected to the line of form and the cursor moves down a line.
The guide graphic changes according to the selected form. |

Note

- (1) This operation cannot be operated to the workpiece that includes the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present). The message "Can't set work including mach surface" is displayed.
- (2) Even if the form changes, the size to be displayed is the data before the change, and the data of surface will not be changed.
- (3) When the data protection is valid, a workpiece form cannot be changed. The message "Data protect" is displayed.

9.2.2.4 Changing the Workpiece Size

Operation method

- | | | |
|--|---|--|
| <p>(1) Move the cursor to workpiece setting by using the menu [<--> change]. If the cursor is already on the workpiece setting this operation is unnecessary.
The cursor can be moved by tab keys ([←], [→]) to workpiece setting.
Also, the cursor will move to workpiece setting by selecting the [INPUT] key when the cursor is in the workpiece list.</p> | ➔ | <p>Move the cursor to the top of workpiece setting.</p> |
| <p>(2) Move the cursor to the line of size that needs to be set using arrow keys ([↑], [↓]).</p> | | |
| <p>(3) Input the workpiece size.</p> | ➔ | <p>The value is input to the line where cursor is displaying and the cursor moves down a line.</p> |

Note

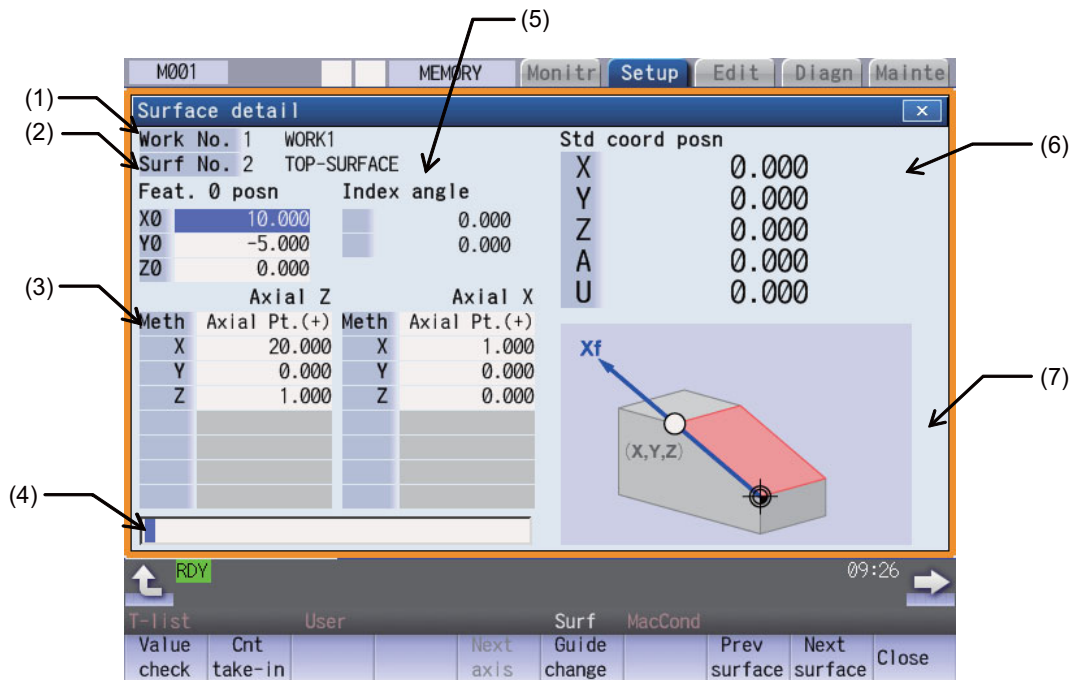
- (1) This operation cannot be operated to the workpiece that includes the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present). The message "Can't set work including mach surface" is displayed.
- (2) The data of surface will not change by changing the size. Set again on the surface detail screen.
- (3) When the data protection is valid, a workpiece size cannot be changed. The message "Data protect" is displayed.
- (4) The setting contents differ by selected workpiece form. Refer to "9.2.2.1 Registering the Workpiece" for details.

9.2.3 Setting the Details of the Surface (on the Surface Detail Screen)

By selecting the menu [Detail set] of the surface list screen, this opens the surface detail screen as a pop-up window. On this screen the coordinate origin (feature coordinate origin) and coordinate axis orientation of a coordinate system defined along the surface can be set.

Note

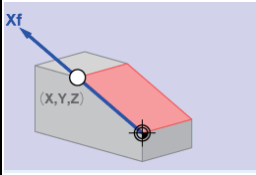
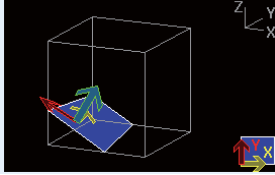
- (1) This screen is not displayed in the following case. The message "Setting error" is displayed.
 - When the surface "BASE-SURFACE" is selected on the surface list screen.



Display items

Display items	Description
(1) Workpiece No. / Surface No.	Displays the work and surface of current settings.
(2) Feature coordinate origin	Displays the settings of surface coordinate origin (feature coordinate origin). The number of digits after the decimal point will obey the parameter #1003 iunit of the 1st part system. (Example) - 99999.999 to 99999.999 (mm) (When "#1003 iunit"= B)
(3) Axis direction setting	Displays the designation type of two coordinate axis directions of the surface, and the values (coordinates, rotation type, etc.) needed for the designation type. The initial values of the designation type and the axis combination can be set by #8954 and #8955. The number of digits after the decimal point will obey the parameter #1003 iunit of the 1st part system. (Example) - 99999.999 to 99999.999 (mm) (When "#1003 iunit" = B)
(4) Input section	Displays the key entered. The data entered here will be reflected in the current cursor position when the [INPUT] key is pressed.

Display items	Description
(5) Index angle	<p>Displays the index angle calculated from the values set to the currently displaying two coordinate axes.</p> <p>The number of digits after the decimal point is fixed to three.</p> <p>The axis names to be displayed on the index angle are different according to the machine configuration.</p> <pre> Index angle A 0.000 ← Rotary axis 1 C 0.000 ← Rotary axis 2 </pre> <ul style="list-style-type: none"> ♦ Tool tilt Displays the axis name of #7932 ROTAXT2 for "Rotary axis1", the axis name of #7922 ROTAXT1 for "Rotary axis 2". ♦ Table tilt Displays the axis name #7942 ROTAXW1 for "Rotary axis1", the axis name #7952 ROTAXW2 for "Rotary axis 2" ♦ Compound Displays the axis name #7932 ROTAXT2 for "Rotary axis1", the axis name #7952 ROTAXW2 for "Rotary axis 2"
(6) Basic coordinate position counter	<p>Displays the value of the basic coordinate position counter (the counter that shows the coordinate position of basic coordinate system).</p> <p>Use the menu [Next axis] to open the counter of the 6th or subsequent axis.</p>
(7) Guide graphic/workpiece graphic	<p>Displays either the workpiece graphic or the guide graphic that illustrates the registration method of the currently selected coordinate axes.</p> <p>Switching between guide graphic and work graphic is performed by using the menu [Guide change].</p>

Menu	
Menu	Description
Value check	This menu enables you to check if it is possible to define a surface using the set coordinate axial directions.
Cnt take-in	This sets the cursor position values in the basic coordinate position counter. <Note> •The menu will be grayed out if the cursor is in display item (3) "Axis direction setting" and the counter take-in has been disabled by the selected designation type.
Next axis	This switches the axes displayed on the basic coordinate position counter between the 1st to 5th axes and the 6th and subsequent axes when the valid axis number is six or more. <Note> •The menu will be grayed out and non-selectable when the number of valid axes is five or less.
Guide change	This switches between guide graphic and work graphic. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>[Guide graphic]</p>  </div> <div style="font-size: 2em;">↔</div> <div style="text-align: center;"> <p>[Work graphic]</p>  </div> </div>
Prev surface	This switches the setting surface to the previous surface. If there is no previous surface, the last surface is displayed.
Next surface	This switches the setting surface to next surface. If there is no next surface, the first surface is displayed.
Close	This closes the pop-up window and quits this function.
Comb change	This changes the combination of two coordinate axes to be specified.
Axial rotate	This menu rotates the coordinate system (reversing the Z axis direction or rotating X/Y coordinates by 90 deg.) with respect to the coordinate axes defined along the machining surface.

Note

(1) The menus on the 1st page are different if the cursor is on the axial direction setting type.

9.2.3.1 Moving the Cursor

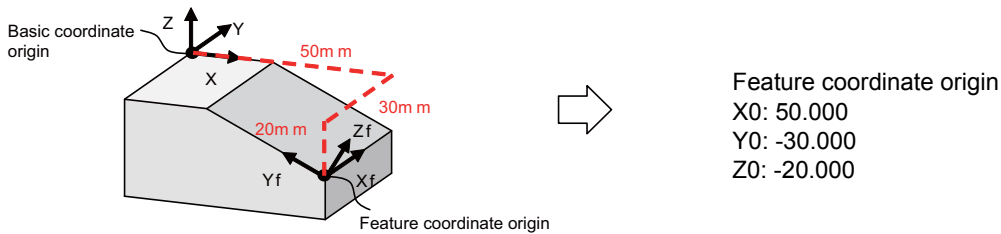
The cursor moves by the tab keys ([←], [→]) and the arrow keys ([↑], [↓]) on the surface detail screen.

9.2.3.2 Setting the Surface Coordinate Origin (Feature Coordinate Origin)

Specify the surface coordinate origin (feature coordinate origin). The value of the coordinate origin is the offset from the basic coordinate system's origin. Also the X, Y and Z directions are those of the basic coordinate system.

Note

- (1) When this operation is performed for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present), the error message "Can't set machining surface" is displayed.
- (2) When the data protection is valid, entering or changing data is disabled on this screen. The message "Data protect" is displayed.



Operation method

- (1) Move the cursor to the feature coordinate origin. ➡ The cursor moves to the top of the feature coordinate origin.
- (2) Move the cursor to the line to set the value of origin.
- <When inputting the value directly>
- (3) Input the value of origin. ➡ The inputted value will be set in the cursor position.
- <To take in the value of the basic coordinate position counter (a counter that displays the position with respect to the basic coordinate system)>
- (3) Select the menu [Cnt take-in]. ➡ The value of the basic coordinate position counter will be set to the position of the counter.

Note

- (1) The counter values of the axes specified by the parameters #7900 RCDAX_I to #7902 RCDAX_K will be taken. The relation between the feature coordinate origin and the parameters is listed below. If any of the parameter settings is illegal or any of the axes is set as non-display ("#1069 no_dsp" is "1"), the counter take-in will be disabled. In this case the message "Counter take in not possible" will appear.

Feature coordinate origin	Corresponding parameter
X0	#7900 RCDAX_I
Y0	#7901 RCDAX_J
Z0	#7902 RCDAX_K

9.2.3.3 Specifying the Surface Coordinate Axial Directions

Specify the surface coordinate axial directions. There are five types of methods for specifying the coordinate axial directions: "Axial point (+)", "Longitude/Latitude", "Longitude/Projection angle", "Start point/End point" and "Index angle". "Axial point (+)", "Start point/End point", and "Index angle" can take in the value of the basic coordinate position counter by selecting the menu [Cnt take-in].

Note

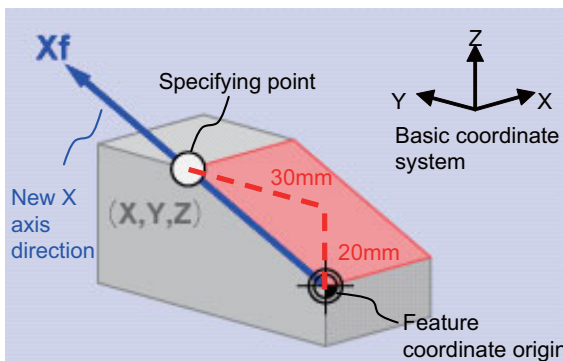
- (1) When this operation is performed for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present), the error message "Can't set machining surface" is displayed.
- (2) When the data protection is valid, entering or changing data is disabled on this screen. The message "Data protect" is displayed.

[Method 1] Axial point (+)

With this method you specify one point, except for the feature coordinate origin, using an offset from the feature coordinate origin (an offset in the basic coordinate system direction), and the coordinate axial direction is determined by this point and the feature coordinate origin. The direction from the feature coordinate origin to the designated point is positive (+).

[Setting value]

Offset from the coordinate origin (feature coordinate origin).



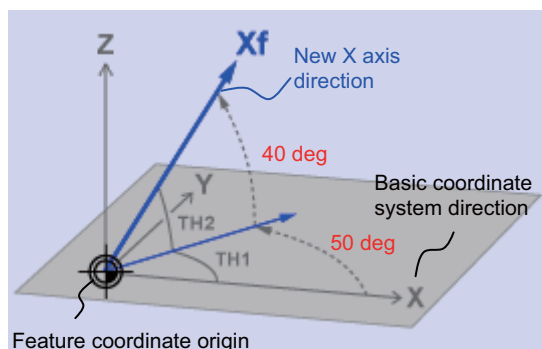
X axis direction
 X: 0.000
 Y: 30.000
 Z: 20.000

[Method 2] Longitude/Latitude

This method specifies coordinate axial direction by rotating the axes of the basic coordinate system by the designated longitude and latitude. The plane to be used as the basis of the longitude and latitude varies depending on which coordinate axis to set.

[Setting value]

Coordinate axis	$\theta 1$ (TH1)	$\theta 2$ (TH2)
X axis direction	Rotation angle about Z axis	Angle from XY plane
Y axis direction	Rotation angle about Z axis	Angle from XY plane
Z axis direction	Rotation angle about X axis	Angle from YZ plane



X axis direction
 TH1: 50.000
 TH2: -40.000

[Method 3] Longitude/Projection angle

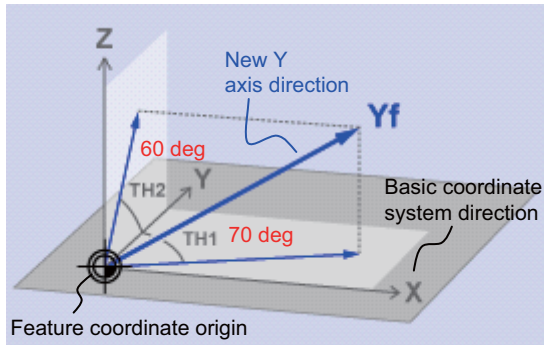
This method specifies coordinate axial direction by rotating the axes of the basic coordinate system by the designated longitude and latitude. The plane to be used as the basis of the longitude and latitude varies depending on which coordinate axis to set.

[Setting value]

Coordinate axis	θ_1 (TH1)	θ_2 (TH2)
X axis direction	Rotation angle about Z axis	Project angle on ZY plane
Y axis direction	Rotation angle about Z axis	Project angle on YZ plane
Z axis direction	Rotation angle about X axis	Project angle on ZY plane

Note

(1) If you set 90 deg. or -90 deg. for TH1, the projected angle on the plane cannot be calculated. In this case the directions after rotated by TH1 will be the coordinate axial directions, regardless of the TH2 value.



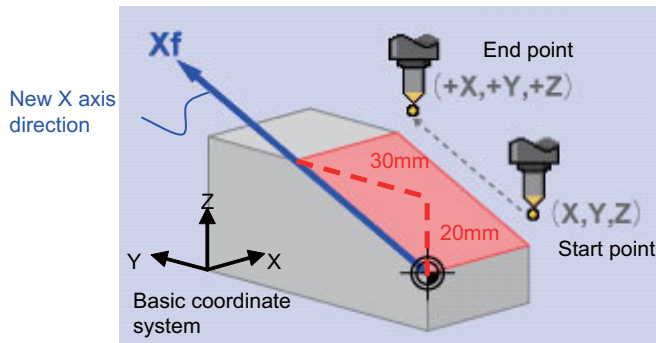
Y axis direction
 TH1: -70.000
 TH2: 60.000

[Method 4] Start point/End point

With this method you specify the start- and end-point coordinates by manual operation to specify the coordinate axial direction in the same direction as from the specified start-point to the end-point. The coordinate origin is that of the feature coordinate system, and the direction from the start point to the end point is positive.

[Setting value]

X, Y, Z: Start-point coordinate (basic coordinate position)
 +X, +Y, +Z: End-point coordinate (basic coordinate position)



X axis direction
 (Start point)
 X : 30.000
 Y : -50.000
 Z : 25.000
 (End point)
 +X : 30.000
 +Y : -20.000
 +Z : 45.000

[Method 5] Index angle

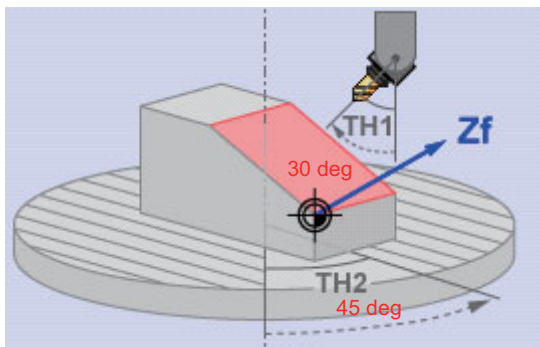
With this method you directly specify the indexing angle in the Z axis direction. This method is unusable for the X and Y directions. The message "Setting error" is displayed. If you select the "Index angle" method for Z axis, and select the [Axial point (+)] or [Start point/End point] method for X and Y axes with all the settings set to "0.000", the X/Y directions are controlled to be in the basic coordinate system directions after surface indexing, regardless of the methods for X and Y. (When the X/Y directions have been set, the setting values will be observed.)

[Setting value]

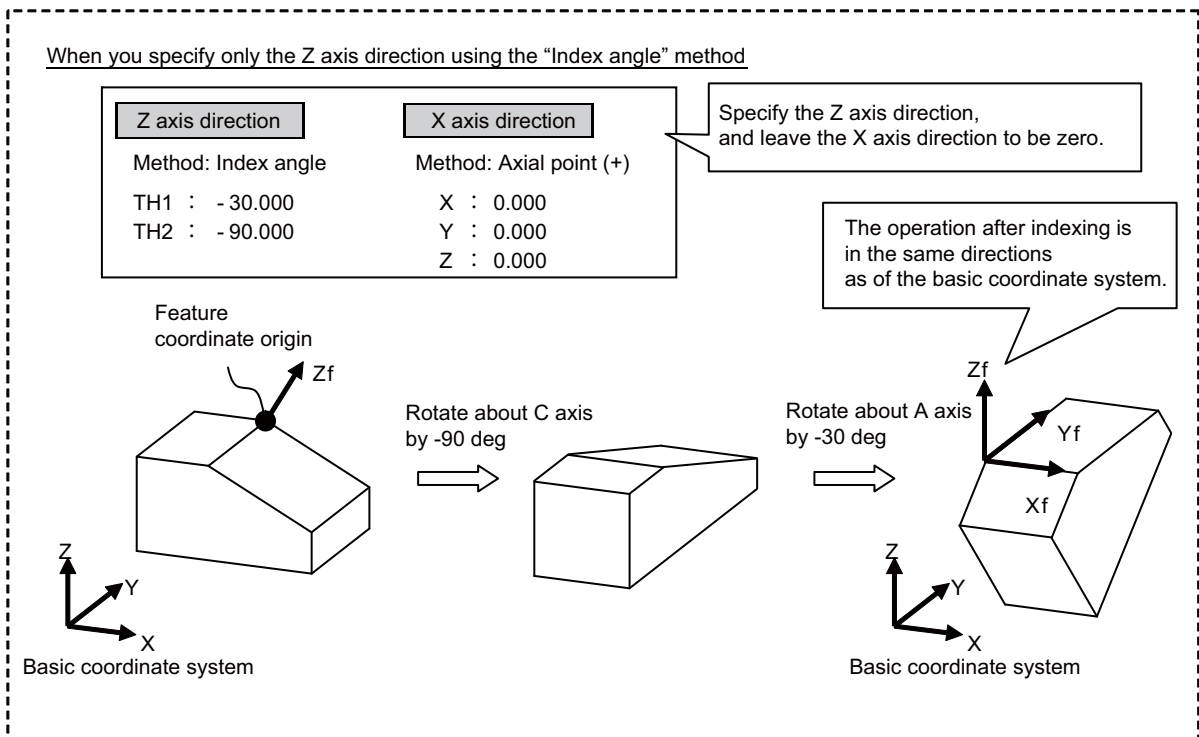
$\theta 1$ (TH1): The angle of rotary axis B

$\theta 2$ (TH2): The angle of rotary axis C

(When the rotary axis is set to B or C)



Z axis direction
 TH1: 30.000
 TH2: -45.000







Menus

When the cursor is moved to "Meth" (axial direction designation type), the menus on the 1st page will switch to the following ones. (The menus on the 2nd page will not change.)

Menu	Description
Axial Pt.(+)	This is the method to specify the coordinate axial direction using an optional point (except for feature coordinate origin) and feature coordinate origin.
Long./ lat.	This method specifies coordinate axial direction by rotating the axes of the basic coordinate system by the designated longitude and latitude.
Long./ p-angle	This is the method to specify the coordinate axial direction by rotating the basic coordinate system axis by the specified longitude/projection angle.
StartPt /EndPt	This is the method to specify the coordinate axial direction using the manually specified start-point and end-point.
Index angle	With this method you directly specify the indexing angle in the Z axis direction.

Operation method

- (1) Move the cursor to "Meth".  The menu change.
- (2) Select the menu [Long./ lat.].  The value of the specified method will be longitude/ projection angle.
- <When inputting the value directly>
- (3) Input the value.  The inputted value will be set in the cursor position.
- <To take in the value of the basic coordinate position counter (a counter that displays the position with respect to the basic coordinate system)>
- (3) Select the menu [Cnt take-in].  The value of the basic coordinate position counter will be set to the position of the counter.
After setting, the cursor moves down a line.

Note

- (1) Which axis to use for taking in the counter value is determined by the parameters. The relation between the axes for taking in counter value and the parameters is listed below. If any of the parameter settings is illegal or any of the axes is set as non-display ("#1069 no_dsp" is "1"), the counter take-in will be disabled. In this case the message "Counter take in not possible" will appear.

When the designated type is Axial point (+)

Setting item	Corresponding parameter
X	#7900 RCDAX_I
Y	#7901 RCDAX_J
Z	#7902 RCDAX_K

When the designated type is Start point/End point

Setting item	Corresponding parameter
X	#7900 RCDAX_I
Y	#7901 RCDAX_J
Z	#7902 RCDAX_K
+X	#7900 RCDAX_I
+Y	#7901 RCDAX_J
+Z	#7902 RCDAX_K

When the designated type is Index angle

Setting item	Corresponding parameter		
	Tool tilt	Table tilt	Composite type
TH1	#7932 ROTAXT2	#7942 ROTAXW1	#7932 ROTAXT2
TH2	#7922 ROTAXT1	#7952 ROTAXW2	#7952 ROTAXW2

9.2.3.4 Checking the Setting Value of Coordinate Axis



Pressing the menu [Value check] enables you to check if it is possible to define a surface using the set coordinate axial directions. When defining a surface is allowed, the message "Setting value check completed" appears. In the following cases, defining a surface is judged as impossible, and the message "Can't define machining surface" appears.

- (1) When the designation method is "axial point (+)" or the set value of "Start point/End point" is "0".
(When "Index angle" is selected for the Z axis, X/Y directions will be out of the scope of this check.)
- (2) When an angle formed by the set two coordinate axes is either "0 deg. or greater but 1 deg. or smaller" or "179 deg. or greater but 180 deg. or smaller".

9.2.3.5 Changing the Combination of Axial Direction

You can change the coordinate axial direction combination (Z/X, Z/Y, X/Y) to be displayed on coordinate axial direction setting.

Operation method


- (1) Select the menu [Comb change].  The menu switches.
The menu of the currently selected axis combination will be highlighted.
- (2) Select the menu [X/Y].  The coordinate axial direction of the coordinate axial direction setting changes to X/Y.
The menu returns to the main menu of the surface detail screen.

Note

- (1) The setting value of coordinate axis will not change even if the axis combination is changed. Please set it again.
- (2) When this operation is performed for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present), the error message "Can't set machining surface" is displayed.
- (3) When the data protection is valid, entering or changing data is disabled on this screen. The message "Data protect" is displayed.

9.2.3.6 Switching the Surface

Operation method

- (1) Select the menus [Prev surface] and [Next surface] 
 - <When the menu [Prev surface] is selected>
This will change the surface to the previous surface. (This will also display the surfaces for which no coordinate system has been set.)
If there is no previous surface, the last surface is displayed.
The feature coordinate origin and coordinate axial direction of the surface after switch are displayed.
The cursor will move to X0 of feature coordinate origin.
 - <When the menu [Next surface] is selected>
This will change the surface to the next surface. (This will also display the surfaces for which no coordinate system has been set.) If there is no next surface, the first surface is displayed. The feature coordinate origin and coordinate axial direction of the surface after switch is displayed. The cursor will move to X0 of feature coordinate origin.

9.2.3.7 Rotating the Axial Direction of Coordinate Axis

The coordinate axes of the coordinate system defined on a machining surface can be rotated.

- When this operation is performed for the machining target surface (a surface along which three orthogonal coordinate axes are controlled at present), the error message "Can't set machining surface" is displayed.
- When the data protection is valid, entering or changing data is disabled on this screen. The message "Data protect" is displayed.
- When "Index angle" method is applied to Z axis and "Axial point (+)" to X/Y axes, and the set values of "Star point/ End point" are all "0.000", it is not possible to rotate X and Y by 90 degrees.

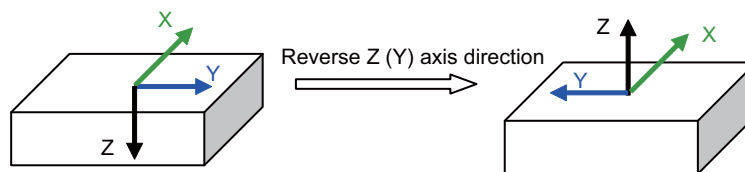
Note

- (1) When this operation is operated, the value of coordinate axial direction registered to NC and the value of coordinate axial direction displayed on the surface detail screen will be automatically changed.
- (2) When you reverse the Z axis direction twice, or rotate X/Y axes by 90 degrees four times, you restore the original axial directions, but a small deviation may result due to a calculation error.

The following two types of operation are possible

Operation method (Reverse Z axis direction)

While fixing the X axis direction, inversely rotate the Z and Y axes by 180 deg.

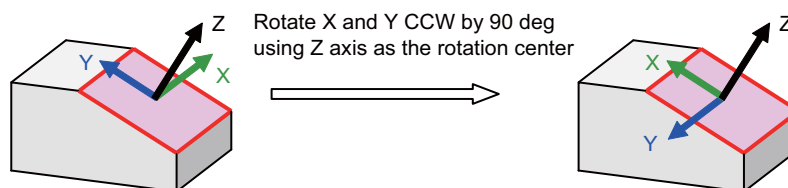


(1) Select the menu [Axial rotate].

(2) Select the menu [Z-axis reverse].



The Z (Y) axis direction of the feature coordinate defined on the machining surface will reverse.

Operation method (Rotate X and Y CCW by 90 deg. (the center of rotation is Z axis))

(1) Select the menu [Axial rotate].

(2) Select the menu [X/Y 90 rotate].



The X and Y coordinates of the feature coordinate defined on the machining surface will rotate 90 deg. counter-clockwise about Z axis

9.2.3.8 Default Settings of Designation Method and Axis Combination

Use the following parameters to specify the default settings of the axis direction designation method and the two-axis combination to be used for designating the direction. Specify the initial setting of the designation method with the parameter "#8954 Initial type". Specify the initial setting of the axis combination with the parameter "#8955 Init axis pair".

When any of the following operations is carried out, the values of #8944 and #8955 will be set as default values.

Operation	The surface to which the parameter values are set
When the workpiece size is set for the first time	All surfaces belonging to the work (except for Surface #1 (BASE-SURFACE))
When the workpiece size is set again after the workpiece is cleared.	All surfaces belonging to the work (except for Surface #1 (BASE-SURFACE))
When the surface is cleared.	The cleared surface

Note

- (1) When #8954 (Initial type) is set to 5 (Index angle), the "Index angle" method is applied to the Z axis direction. However, "Axial point (+)" is applied to the X and Y directions.
- (2) If you change the parameter #8944 or #8955 after setting the workpiece size, the designation method or axis combination will not change. To reflect the value of the parameter, reset the work size after clearing the workpiece or clear the surface.

9.2.4 Surface Selection



By selecting a machining surface, the commands programmed with three orthogonal axes can move the tool along the selected surface (feature coordinate system). This selected surface is called a machining target surface. This enables a program with three orthogonal axes to carry out multi-surface machining including inclined surface machining. Also, a tool can be set vertical to the machining target surface (indexing).

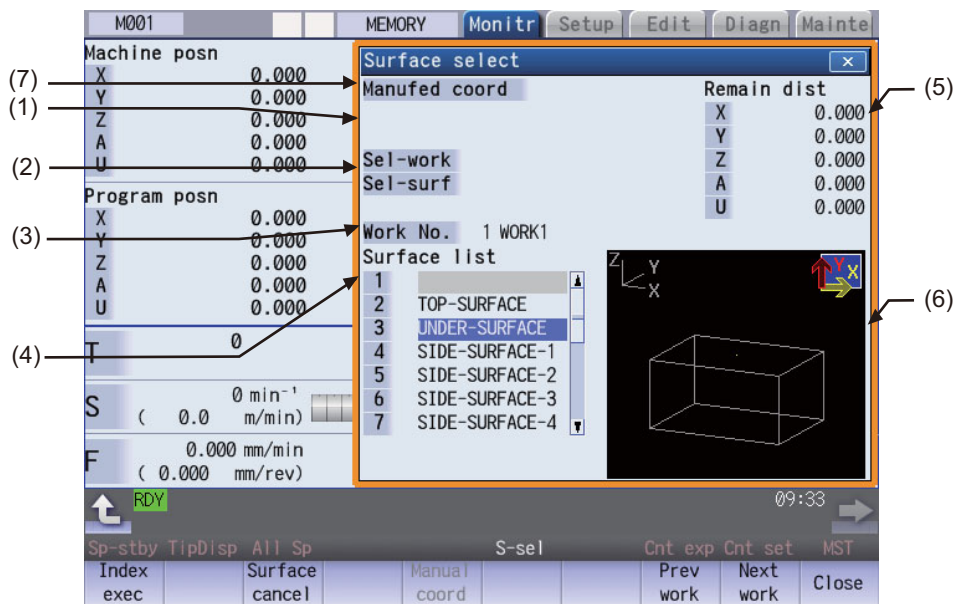
This function is an additional specification, and the machining surface can be selected for each part system.

Note

- (1) To select a machining surface, work and machining surface need to be registered beforehand on the surface setting screen of setup screen. For details, refer to "9.2 R-Navi".

CAUTION

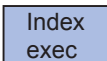
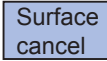
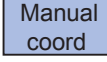
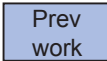
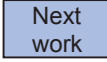
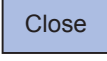
If a machining surface is selected in this operation, the coordinate system defined along the machining target surface (feature coordinate system) remains selected even when NC reset is executed. However, when it enters the emergency stop state or the menu [Surface cancel] is selected, the machining target surface will be canceled and the selected coordinate system will be back to the machine coordinate system



Display items

Display items	Description
(1) Index state	Displays the index state. When "#11037 R-Navi Index Type" is "0", "Indexing" is displayed with flicker by selecting the menu [Index exec]. When "#11037 R-Navi Index Type" is "1", "Indexing" is displayed with flicker by selecting the menu [Index exec] and then entering the tool length offset number (H).
(2) Selected work/Selected surface	Displays the machining target surface and its work of the part system being displayed.
(3) Work No.	Displays the work No. that is displayed on the surface list. The work can be switched by selecting the menus [Prev work] and [Next work].
(4) Surface list	Displays the list of surfaces that are registered for the work displayed at Work No. If the machining target surface is included, it is displayed with an asterisk (*).
(5) Remaining distance counter	Displays the remaining distance up to the point where the tool is vertical to the machining target surface (indexing position). When "#11037 R-Navi Index Type" is "0", remaining distance will be calculated automatically by pressing the menu [Index exec]. When "#11037 R-Navi Index Type" is "1", remaining distance will be calculated automatically by pressing the menu [Index exec] and then inputting the tool length compensation number. The counters of five axes are displayed in the order specified by "#1494 dsp_ax_change".
(6) Workpiece graphic	Displays the image of workpiece displayed at Work No. in 3D. It also displays with arrow marks, the surface pointed by the cursor in the list, and the directions of X, Y and Z axes of the coordinate system (feature coordinate system) registered for the surface. (X axis is in yellow, Y in red and Z in green)
(7) Manual feed coordinate system	Displays the coordinate system along which manual feed is carried out while the machining target surface is being selected. The machine coordinate system and the feature coordinate system can be switched by the menu [Manual coord]. If the target surface is not selected it is displayed as blank. The initial coordinate values when a machining target surface is selected will be those of the feature coordinate system when the parameter "#8127 R-Navi Manufed coord" is "0", and when #8127 is "1" the initial values will be those of the machine coordinate system. <Note> ♦The operation is performed along the feature coordinate system during automatic operation, regardless of the coordinate system displayed here.

Menus

Menus	Description
	Executes indexing to the machining target surface.
	Cancels the coordinate system (feature coordinate system) defined when a machining target surface is selected, and sets the current coordinate system as the machine coordinate system.
	Switches the coordinate system along which manual feed is performed during the machining target surface selection between the machine coordinate system and feature coordinate system. This menu is valid only during surface selection.(*1)
	Switches the work to display from the currently selected work to the previous work. If there is no previous workpiece, the last workpiece is displayed.
	Switches the work to display from the currently selected work to the next work. If there is no next work, the first work is displayed.
	This closes the pop-up window.

(*1) When the target surface is not selected, his menu is grayed out and cannot be selected.

9.2.4.1 Selecting a Machining Target Surface

Select a machining target surface. By selecting the machining surface, the commands programmed with three orthogonal axes can move the tool along the selected surface (feature coordinate system). This enables a program with three orthogonal axes to carry out multi-surface machining including inclined surface machining. Machining surface can be selected for each part system.

**CAUTION**

If a machining surface is selected in this operation, the coordinate system defined along the machining target surface (feature coordinate system) remains selected even when NC reset is executed. However, when it enters the emergency stop state or the menu [Surface cancel] is selected, the machining target surface will be canceled and the selected coordinate system will be back to the machine coordinate system

Operation method

- (1) Move the cursor to the row of machining surface to be selected using arrow keys ([↑], [↓]).
- (2) Press the [INPUT] key.



An asterisk (*) is placed in front of a surface name, indicating that the surface is the machining target surface. Also, the name of the selected work and its number, and the machining surface name and its number are displayed at Sel-work and Sel-surf. If coordinate system setting of machining surface is illegal, it cannot be selected. The message "Feat. coord setting error " is displayed.

Note

- (1) The machining target surface and its work will be canceled when the power is turned ON again.
- (2) This operation is disabled during automatic operation. The message "Executing automatic operation" is displayed.
- (3) This operation is disabled during surface indexing. The message "Indexing machined surface" is displayed.
- (4) This operation is disabled when rotary axis configuration parameter is illegal, surface selection is being processed (*1), or surface cancel is being processed (*2). The message "Machining surface cannot be selected" is displayed.
 - (*1) "Surface selection is being processed" means the period from when machining surface selection is performed (the [INPUT] key is pressed) until when the machining target surface is actually selected and the selected work and surface are displayed.
 - (*2) "Surface cancel is being processed" means the period from when machining surface cancel is performed (the menu [Surface cancel] is pressed) until the target surface is actually canceled and the display of the selected work and surface is canceled.
- (5) On MDI status "SEL" is displayed with flicker when a machining surface is selected. (Even under the MDI mode, "SEL" display is preferred during the surface selection.)
- (6) On the monitor screen of the 2-part system simultaneous display, "SEL" is not displayed with flicker on MDI status even if the part system that is under surface selection is displayed.
- (7) The graphic check or trace is carried out along the machine coordinate system while a machining target surface is being selected.

9.2.4.2 Indexing the Machining Target Surface

Given below is the procedure of indexing the currently selected machining surface (turning the tool to be perpendicular to the machining target surface). By setting the parameter "#11037 R-Navi Index Type", method can be selected from two types: moving the rotary axis only (type 1) and moving both rotary and orthogonal axes while fixing the tool tip at a position viewed from the workpiece (type 2).

Operation method

[Prepare indexing]
<When #11037=0>

- (1) Select the menu [Index exec].



"Indexing" flickers and the machining target surface will be in the indexing state. The remaining distance necessary to complete indexing is displayed on the remaining distance counter.

<When #11037=1>

- (1) Select the menu [Index exec].



The menu [Index exec] will be highlighted, and the message "Set the tool length compensation No.(H)." is displayed.

- (2) Input the tool length compensation No. and select the [INPUT] key.



"Indexing" flickers and the machining target surface will be in the indexing state. The remaining distance necessary to complete indexing is displayed on the remaining distance counter.

[Execute indexing]

<For manual indexing>

Use a handle to do indexing.

- (1) Select the memory mode and select auto start button.



Operates automatic operation until the remaining distance counter becomes "0". Also, when the value of counter becomes "0", flickering "Indexing" will disappear.

<For manual indexing>

Use a handle to do indexing. This allows the operator to do indexing while observing the work and tool positions. It is also possible to switch to automatic indexing in the middle of the operation.

- (1) Select the rotary axis in the handle mode and turn the handle.



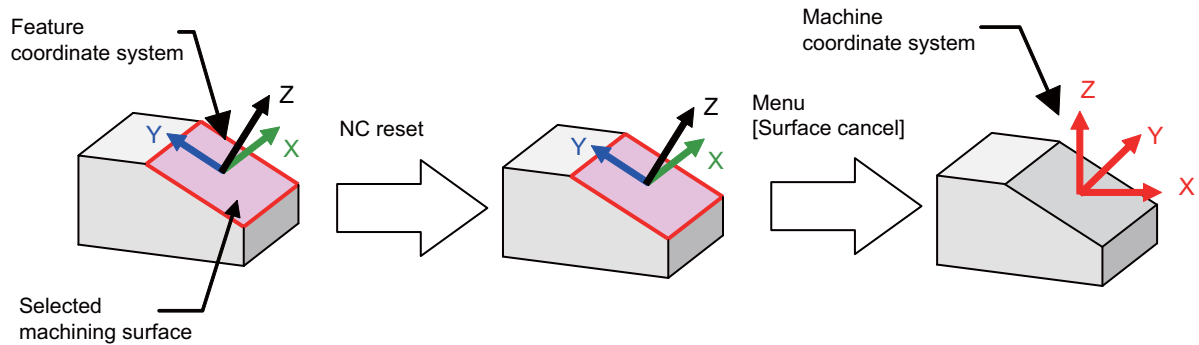
When the counter values reach all zero, flickering "Indexing" will disappear.

Note

- (1) This operation is disabled during automatic operation. The message "Executing automatic operation" is displayed.
- (2) The indexing will be canceled by NC reset operation.
- (3) This operation is disabled if no machining target surface is selected. The message "Machining surface not selected" is displayed.
- (4) This operation is disabled during surface indexing. The message "Indexing machined surface" is displayed.
- (5) This operation is disabled when surface selection is being processed (*1), or when surface cancel is being processed (*2). The message "Indexing not possible" is displayed.
 - (*1) "Surface selection is being processed" means the period from when machining surface selection is performed (the [INPUT] key is pressed) until when the machining target surface is actually selected and the selected work and surface are displayed.
 - (*2) "Surface cancel is being processed" means the period from when machining surface cancel is performed (the menu [Surface cancel] is pressed) until the target surface is actually canceled and the display of the selected work and surface is canceled.
- (6) When 3D machine interference check is valid, the manual indexing cannot be executed. The operation error (M01 0005) will occur if the indexing is executed.

9.2.4.3 Canceling the Machining Target Surface

When a machining surface is selected, the coordinate system defined on the machining surface (feature coordinate system) remains selected even if NC reset is executed. This operation, however, switches the selected coordinate system back to the machine coordinate system.



Operation method

- (1) Select the menu [Surface cancel]. ➔ The menu [Surface cancel] will be highlighted, and the message "OK? (Y/N)" is displayed.
 To cancel the highlight, select the menu [Retn] or select the menu [Surface cancel] again.
- (2) Press the [Y] or [INPUT] key. ➔ The selection of machining surface will be released.

Note





- (1) The "Executing automatic operation" error occurs during automatic operation, and canceling the surface is disabled.
- (2) This operation is disabled when surface selection is being processed (*1), or when surface cancel is being processed (*2). The message "Can't cancel" is displayed.
 - (*1) "Surface selection is being processed" means the period from when machining surface selection is performed (the [INPUT] key is pressed) until when the machining target surface is actually selected and the selected work and surface are displayed.
 - (*2) "Surface cancel is being processed" means the period from when machining surface cancel is performed (the [Surface cancel] key is pressed) until the target surface is actually canceled and the display of the selected work and surface is canceled.
- (3) The flickering "SEL" on the MDI status will be canceled.
- (4) This operation is disabled if no machining target surface is selected. The message "Machining surface not selected" is displayed.
- (5) This operation is disabled during surface indexing. The message "Indexing machined surface" is displayed.

9.2.4.4 Switching the Machining Target Surface

When selecting the menu [Manual coord] during surface selection, the coordinate system along which manual feed is conducted can be switched between the machine coordinate system and feature coordinate system. The initial coordinate values when a machining target surface is selected will be those of the feature coordinate system when the parameter "#8127 R-Navi Manufed coord" is "0" , and when #8127 is "1" the initial values will be those of the machine coordinate system. However, operation is performed along the feature coordinate system during automatic operation, regardless of the coordinate system displayed here.

Operation method

Assume that the parameter "#8127 R-Navi Manufed coord" is set to "0" (feature coordinate system).

- | | | |
|--|---|--|
| (1) Select a machining target surface. |  | The manual feed coordinate system becomes "feature coordinate system". |
| (2) Select the menu [Manual coord]. |  | The manual feed coordinate system becomes "machine coordinate system". |
| (3) Cancel the surface by the menu [Surface cancel]. |  | The manual feed coordinate system becomes blank. |
| (4) Select a machining target surface. |  | The manual feed coordinate becomes feature coordinate system. |

9.2.4.5 Switching the Workpiece

Switch the work that is displayed on "Work No." to the other work. When work is switched, the cursor on the surface list will move to the surface "BASE-SURFACE".

Operation method (Select next work)

Switch the currently displayed work to the next work. If there is no next work, the first work is displayed.

- | | | |
|----------------------------------|---|--|
| (1) Select the menu [Next work]. |  | The work switches to the next largest No. of work. |
|----------------------------------|---|--|

Operation method(Select previous work)

Switch the currently displayed work to the previous work. If there is no previous workpiece, the last workpiece is displayed.

- | | | |
|--------------------------------------|---|---|
| (1) Select the menu [Previous work]. |  | The work switches to the next smallest No. of work. |
|--------------------------------------|---|---|

9.3 Integrated Time

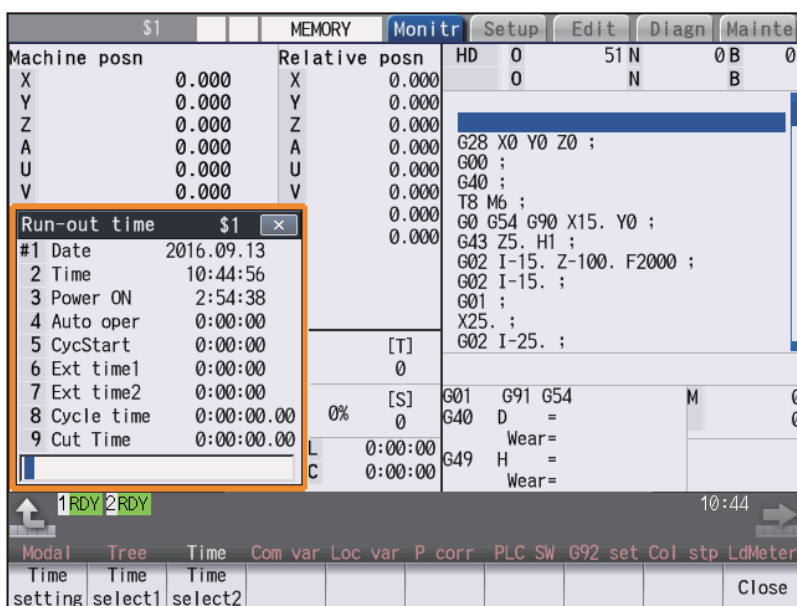
9.3.1 Integrated Time Display



The integrated time (date, time, power ON time, automatic operation time, automatic start time, external integrated time 1, external integrated time 2, cycle time and cutting time) controlled by the NC can be set and displayed.

Note that the cycle time cannot be set.

The integrated times displayed in cycle time display area on the Monitor screen can be set.



Display Items

Display items	Description
#1 Date	The current date set in the NC is displayed. Year: 4 digits, Month: 2 digit, Date: 2 digit (YYYY.MM.DD)
2 Time	The current time set in the NC is displayed using the 24-hour system. (HH:MM:SS)
3 Power ON	This displays the total integrated time of the time from NC power ON to OFF. (HHHH:MM:SS)
4 Auto oper	This displays the total integrated time of the work time from automatic start button pressing in the memory (tape) mode or MDI to M02/M30 or reset button pressing. (HHHH:MM:SS)
5 Auto strt	This displays the total integrated time during automatic starting from automatic start button pressing in the memory (tape) mode or MDI to feed hold stop, block stop, or reset button pressing. (HHHH:MM:SS)
6 Ext time 1	This content differs depending on MTB specification. (HHHH:MM:SS)
7 Ext time 2	This content differs depending on MTB specification. (HHHH:MM:SS)
8 Cycle time	This displays the time that automatic operation is started from when the automatic start button is pressed in the memory (tape) mode or MDI to when feed hold stop or block stop is applied or the reset button is pressed.
9 Cut time	This displays the total time of the cutting commands (a part of the group 1 modal commands (*1)) given in the memory (tape) mode or MDI mode, from when the cycle start button is pressed until a feed hold stop, block stop, or a press of the reset button. This time will be cleared to "0" by pressing the cycle start button.
Input section	This displays details of the key input.

(*1) The following table shows the group 1 modal commands, the times of which are added to the cut time.

G01	Linear interpolation
G02/G03	Circular interpolation
G02.1/G03.1	Spiral/Conical interpolation
G02.3/G03.3	Exponential interpolation
G02.4/G03.4	3-dimensional circular interpolation
G06.2	NURBS interpolation
G33	Thread cutting
G34	Variable lead thread cutting
G35/G36	Circular thread cutting

The automatic return to the restart position when the program is restarted is not added to the cut time.

A travel command given during the direct command mode specification is added to the cut time.

Note

(1) When the indicated value reaches the maximum, the items #3 Power ON to #9 Cut time stops adding, and the maximum value remains displayed.

<Maximum time>

•#3 Power ON to #7 Ext time 2: 59999:59:59




•#8 Cycle time to #9 Cut time: 7999:59:59.99

Menus

Menus	Description
Time setting	This sets the integrated time.
Time select1	The time that is displayed in upper line on cycle time display area is selected.
Time select2	The time that is displayed in bottom line on cycle time display area is selected.
Close	This closes the pop-up window and quits this function.

9.3.2 Setting the Integrated Time



Operation method

- (1) Press the menu [Time setting].  The mode changes to the time setting mode. The cursor appears at the "#1 Date" position in the integrated time display.
- (2) Input today's date.
(Example) 2015/4/1 [INPUT]  "2015.04.01" appears at "#1 Date", and the cursor moves to "#2 Time".
- (3) Set the data for each item, and press the [INPUT] key.
If the item does not need to be set, press the [↓] key and move the cursor.
Note that "#8 Cycle time" and "#9 Cutting time" cannot be set, so the cursor will not move.  When "#7 External integrated time 2" has been set, the cursor disappears, and the time setting menu highlight is turned OFF.

Note

(1) The data delimiters are as shown below:

Item	Valid delimiters during setting	Delimiters in display
#1 Date	". " or " / "	" . "
#2 Time to #7 Ext time2	" : " or " / "	" : "

(2) If the menu [Time setting],  or  key is pressed again during the time setting mode, the mode will be canceled.





Setting range

Display items	Range
#1 Date	1980.1.1 to 2069.12.31
2 Time	00:00:00 to 23:59:59
3 Power ON	00:00:00 to 59999:59:59
4 Auto oper	
5 Auto strt	
6 Ext time 1	
7 Ext time 2	

9.3.3 Setting the Time Display Selection

The displayed time is set on cycle time display area.

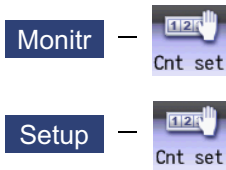
Operation method

- | | | |
|---|---|---|
| (1) Press the menu "Time select1". |  | The time selection mode is activated. |
| (2) Press the time type for the mode to display.
(Example) [Auto oper] |  | The automatic operation time is displayed in upper line on cycle time display area.
The menu display returns to integrated time sub-menu. |
| (3) Press the menu "Time select2". |  | The time selection mode is activated. |
| (4) Press the time type for the mode to display.
(Example) [Power ON] |  | The automatic operation time is displayed in bottom line on cycle time display area.
The menu display returns to integrated time sub-menu. |

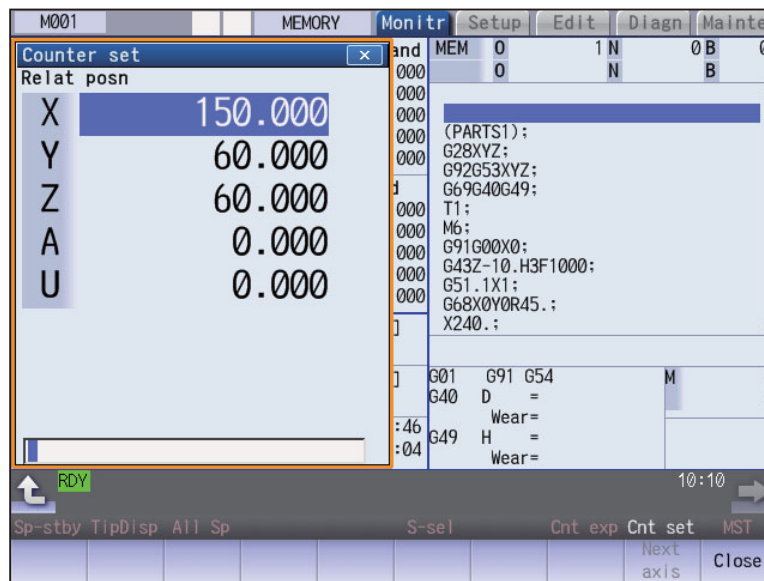
Note

- (1) The displayed time is held even after the power is turned OFF and ON.
- (2) The displayed time is common for part systems.
- (3) The minimum unit for the cycle time and the cutting time is second.

9.4 Counter set



An arbitrary value can be set in the relative position counter which opens as a pop-up window. The counter cannot be set for an axis of auxiliary axis state. It also can be set on the setup (Setup) screen.



Menus

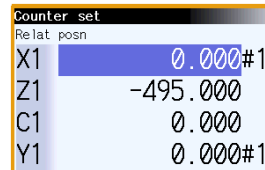
Menus	Description
Close	This closes the pop-up window and quits this function.
Next axis	This switches the axis to be displayed on the counter. <Note> ♦This menu is grayed out and non-selectable in the following cases: - The number of enabled axes is 8 or less. - The number of enabled axes is 9 or more, however, the number of displayed axes is 8 or less according to the parameter "#1069 no_dsp Axis with no counter display" setting.

Operation method

- (1) Press the main menu [Counter set].



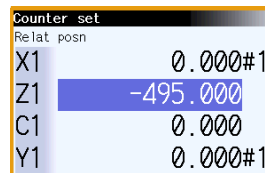
The relative position counter opens as a pop-up window. The cursor appears at the 1st axis of the relative position counter.



Instead of the operation above, the axis name address key can be pressed to set the counter. (Example) [Z]



The relative position counter opens as a pop-up window. The cursor appears at the designated axis (Z axis).



- (2) Using the [↑], [↓], or the axis name address key, move the cursor to the axis to be set.



The cursor moves.

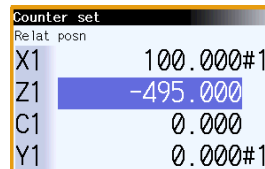
<Note>

- If two axes or more of the same name exist such as mixed control (cross axis control), the cursor moves to the axis corresponding to the address key to the axis name input first.

- (3) Input a numeric value.
(Example) 100.000 [INPUT]
If the [INPUT] key is pressed without inputting a value, zero (0) will be set.



The set value "100.000" appears at the cursor position. The cursor moves to the next axis.



- (4) Repeat step (3) for each axis.
For axes that are not to be operated, press the [↓] key and move the cursor.



The pop-up window closes when the counter has been set for the last axis.

Note

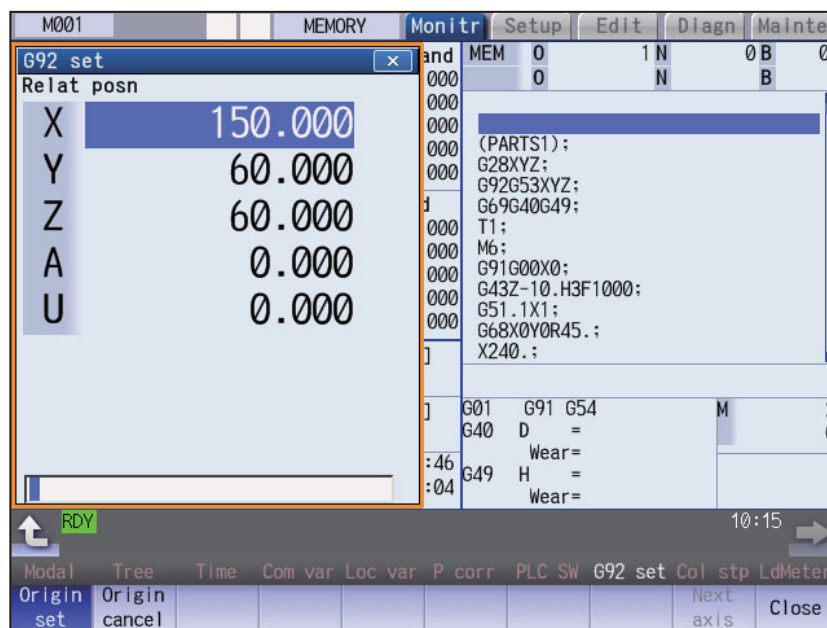
- (1) When an address such as "S", "M", "T" or "B" is used for the first character of axis name of the parameter "#1022 ax-name2", not the MSTB window but the Counter set window is displayed for address key input.

9.5 Origin Set, Origin Cancel



Origin set and origin cancel can be executed.

Origin set and origin cancel cannot be executed for an axis of auxiliary axis state.



Menus

Menus	Description
Origin set	The origin is set. When main menu [G92 set] is pressed, the menu [Origin set] is highlighted and the origin set mode is activated.
Origin cancel	The origin is canceled. The origin cancel mode is activated when this menu is pressed.
Next axis	This switches the axis to be displayed on the counter. <Note> ♦This menu is grayed out and non-selectable in the following cases: - The number of enabled axes is 8 or less. - The number of enabled axes is 9 or more, however, the number of displayed axes is 8 or less according to the parameter "#1069 no_dsp Axis with no counter display" setting.
Close	This closes the pop-up window and quits this function.

Differences between origin set and origin cancel

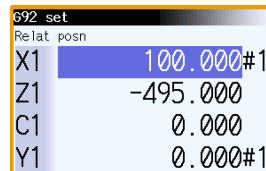
	Origin set	Origin cancel
Function	The coordinate system is shifted so the current position becomes the designated position of the workpiece coordinate system. This is equivalent to "G92 X0". (When X is the target axis.)	The coordinate system is shifted so the zero point of the workpiece coordinate system matches the zero point of the basic machine coordinate system. This is equivalent to "G92 G53 X0". (When X is the target axis.)
Changes in the counter value	The relative position counter and workpiece coordinate counters become "0".	The relative position counter matches the machine coordinate counter.
Offset	The G92 shift amount is updated.	The G92 shift amount and the G52 shift amount for the G54 to G59 coordinate system becomes "0".

Operation method (Setting the origin)

(1) Press the main menu [G92 set].



The relative position counter opens as a pop-up window. The menu [Origin set] is highlighted. The cursor appears at the 1st axis of the relative position counter.



(2) Using the [↑], [↓], or the axis name address key, move the cursor to the axis to be set.



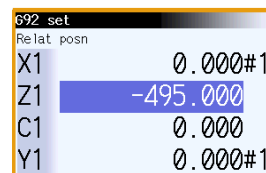
The cursor moves.
<Note>

- If two axes or more of the same name exist such as mixed control (cross axis control), the cursor moves to the axis corresponding to the address key to the axis name input first.

(3) Input 0, and then press the [INPUT] key. If the [INPUT] key is pressed without inputting a value, zero (0) will be set. (Origin zero)



"0.000" appears at the cursor position. The cursor moves to the next axis.



(4) Repeat step (3) for each axis. For axes that are not to be operated, press the [↓] key and move the cursor.



The pop-up window closes when the origin has been set for the last axis.

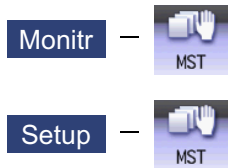
Note

(1) An error will occur if a value other than 0 is set.

Operation method (Canceling the origin)

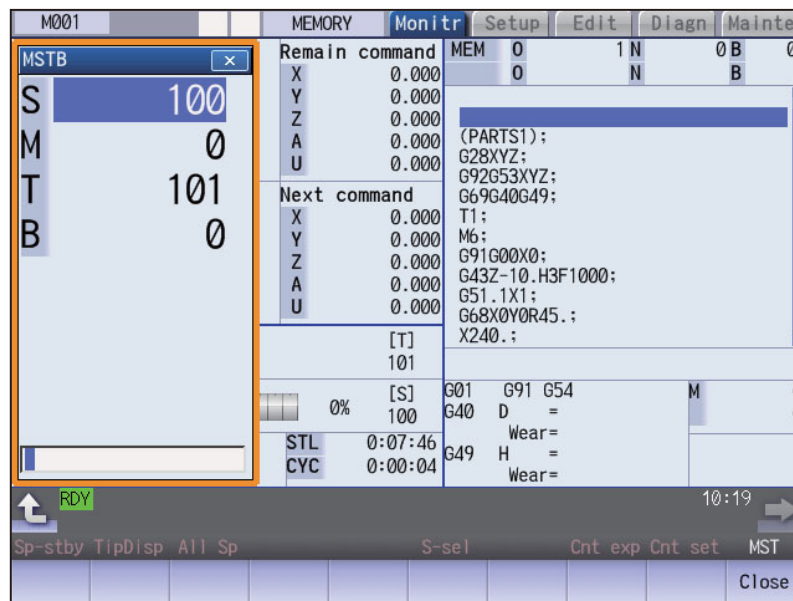
- | | | |
|---|---|---|
| (1) Press the main menu [G92 set], and then press the menu [Origin cancel]. | ➔ | The relative position counter opens as a pop-up window. The menu [Origin cancel] is highlighted. The cursor appears at the 1st axis of the relative position counter. |
| (2) Press the [INPUT] key. | ➔ | The same value as the machine position appears at the cursor position. The cursor moves to the next axis. |
| (3) Repeat step (2) for each axis. For axes that are not to be operated, press the [↓] key and move the cursor. | ➔ | The pop-up window closes when the origin has been canceled for the last axis. |

9.6 Manual Numerical Value Command



The spindle function (S), miscellaneous function (M), tool function (T) and 2nd miscellaneous function (B) commands can be executed.

The manual numerical value command can be executed by inputting an address such as S, M, T or B, as well. It also can be commanded on the setup (Setup) screen.



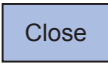
Display Items

Display items	Description
S (spindle function) command value	The command value of S (spindle rotation command value) is displayed. The number of displays varies depending on the value of the parameter "#1039 spinno Number of spindles". However, if the value of the parameter "#1300 ext36(bit0) multiple-spindle control" is set to "1 (Multiple-spindle control II)", the number of displays is set to "1" regardless of the value of the parameter "#1039 spinno Number of spindles".
M (miscellaneous function) command value	The command value of M (miscellaneous function command value) is displayed. The number of displays is set to "1" regardless of the value of the parameter "#12005 Mfig M count".
T (Tool function) command value	The command value of T (Tool function command value) is displayed. The number of displays is set to "1" regardless of the value of the parameter "#12009 Tfig T count". Only the tool number is displayed regardless of the value of the parameter "#11038 T disp type".
B (second (2nd) miscellaneous function) command value	The command value of B (second (2nd) miscellaneous function command value) is displayed. The number of displays is set to "1" regardless of the value of the parameter "#12011 Bfig B count". However, the value is displayed or hidden depending on the value of the parameter (#1170 M2name 2nd miscellaneous code).

Note

- (1) If the number of spindles is 5 or less, the scroll bar is not displayed.


Menus


Menus	Description
	This closes the pop-up window and quits this function.

Operation method (Executing T31 with a manual numerical value command)

- (1) Press the main menu [MST].  The S, M, T, B display opens as a pop-up window.

S	100
M	50
T	4
B	1000

Using the [↑] or [↓] key, move the cursor to the setting position.  The cursor moves.

- (2) The manual numerical value command can also be issued by using the address keys instead of the operation above.  The S, M, T, B display opens as a pop-up window. The cursor appears at T.
(Example) [T]

S	100
M	50
T	4
B	1000


- (3) Input a numeric value.
31 [INPUT]  The input value is set.

Note

- (1) The cursor moves to the first line when the part system is changed while displaying the manual numeric command window.

Operation method (Canceling the manual numerical value command)

The manual numerical value command mode is canceled by carrying out one of the following operations before pressing the [INPUT] key.

- Press the menu [Close].
- Press the  key.
- Change the screen.

Setting/output range of manual numerical value command

For each S, M, T, G and B command, the data type to output to PLC program is designated by parameters "#12006 Mbin M binary", "#12008 Sbin S binary", "#12010 Tbin T binary" and "#12012 Bbin B binary". The output data type and the manual numerical value command setting/output range are shown below:

		BCD	No-signed binary	Signed binary
Output range	S	-99999999 to 99999999 (*1)	0 to 99999999	-99999999 to 99999999
	M	0 to 99999999		
	T			
	B			
Setting range	S	-99999999 to 99999999 (*2)		
	M			
	T			
	B			

(*1) Even if the parameter "#12008 Sbin" (S binary) is set to "0" (BCD), the signed binary output is applied to S. BCD output is not applied.

(*2) If a negative value is set when the data type is "BCD type" or "No-signed binary type", a value converted into positive value is output to PLC program.

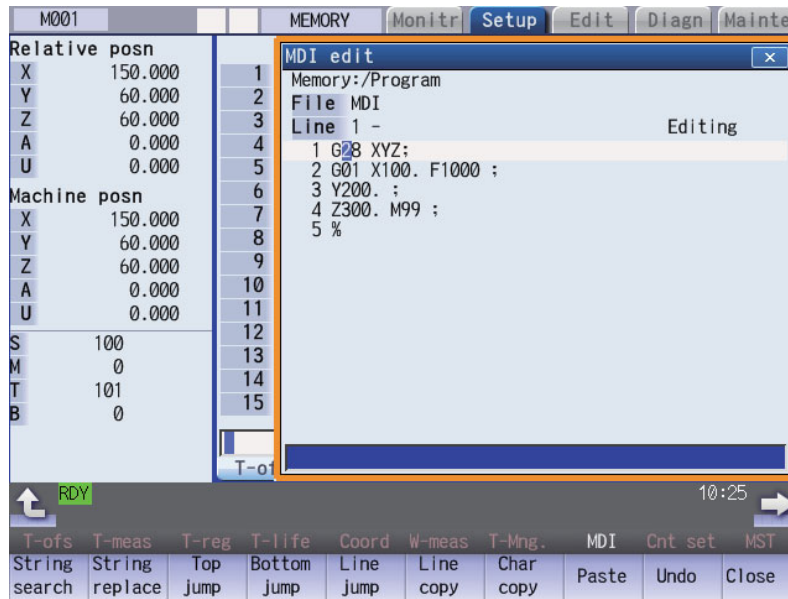
Note

- (1) Add a "-" sign before the value to set a negative value. The display will be a positive value.
- (2) A value larger than "#3001 slimt1" to "#3004 slimt4" or "#3005 smax1" to "#3008 smax4" cannot be output for S. Select a gear with "Spindle gear selection input" of Y device.

9.7 MDI Program Editing



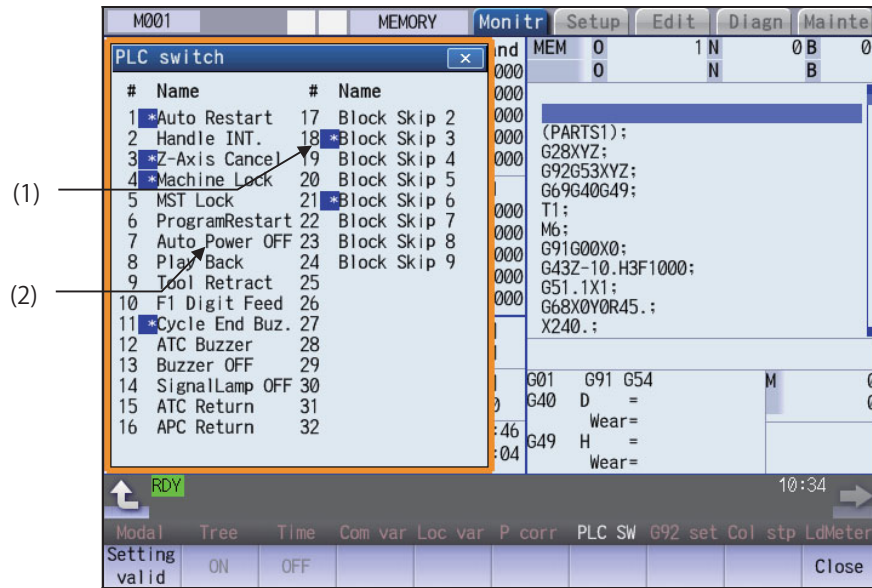
Press the main menu [MDI] key to display the contents of the MDI program in a pop-up window.
 When the parameter "#1144 mdlkof" is "0" (MDI setting impossible), switch to the MDI mode once to press the menu [MDI].
 For details, refer to "3.3 Registering and Editing the MDI Program".



9.8 PLC switch



The various control signals for NC operation can be switched ON and OFF. Refer to the instruction manual issued by the MTB for details. The following screen is an example.



Display items

Display items	Description
(1) Mark indicating switch ON	This is displayed for switches that are turned ON
(2) Switch name	The display contents differ depending on MTB specification.




Menus

Menus	Description
Setting valid	Setting of the PLC switch is started. When the parameter "#8974 Simple PLC switch" is valid, this menu will be disabled.
ON	This turns ON the switch currently indicated by the cursor. (*1)
OFF	This turns OFF the switch currently indicated by the cursor. (*1)
Move window	This moves the display position of the PLC switch window. For the display unit other than 8.4- or 10.4-type, or when the parameter "#11019 2-system display" is set to nonzero, this menu cannot be selected.
Close	This closes the pop-up window and quits this function.

(*1) In the state that the PLC switch cannot be set, the menu is grayed out and made unselectable. Also, when the cursor is at the PLC switch which cannot be set, the menu is grayed out and made unselectable. Which PLC switch cannot be set is determined by each MTB.

9.8.1 Turning PLC Switches ON/OFF

Operation method (To turn switch "#6 ProgramRestart" ON)

- (1) Press the menu [Setting valid].  The menu Setting valid will be highlighted. The message "Set up parameter? (Y/N)" is displayed. Whenever the parameter "#8974 Simple PLC switch" is valid, the parameter setting will be enabled.
- (2) Press the [Y] or [INPUT] key.  The PLC switch setting mode will be entered. The cursor will appear at the PLC switch No. position. The menus [ON] and [OFF] will appear normally.
- (3) Press the cursor keys [↑] and [↓] to move the cursor to "#6".  The #6 number is highlighted.





#	Name
1	Auto Restart
2	Handle INT.
3	Z-Axis Cancel
4	Machine Lock
5	MST Lock
6	ProgramRestart
7	Auto Power OFF
8	Play Back

- (4) Press the menu [ON].  The "#6 ProgramRestart" switch turns ON, and a [*] mark appears.
To turn OFF, press the menu key OFF.

#	Name
1	Auto Restart
2	Handle INT.
3	Z-Axis Cancel
4	Machine Lock
5	MST Lock
6	*ProgramRestart
7	Auto Power OFF
8	Play Back

"*" mark appears.

Note

- (1) If the menu [Setting valid],  or  key is pressed again during the PLC switch setting mode, the mode will be canceled.
- (2) The PLC switch setting mode is canceled when the PLC switch's pop-up window is closed.
- (3) The cursor will not appear in modes other than the PLC switch setting mode.
- (4) When the number of the switch is 64, the display range of the number can be switched between "# 1 to # 32" and "# 33 to # 64" by pressing the  or  key.

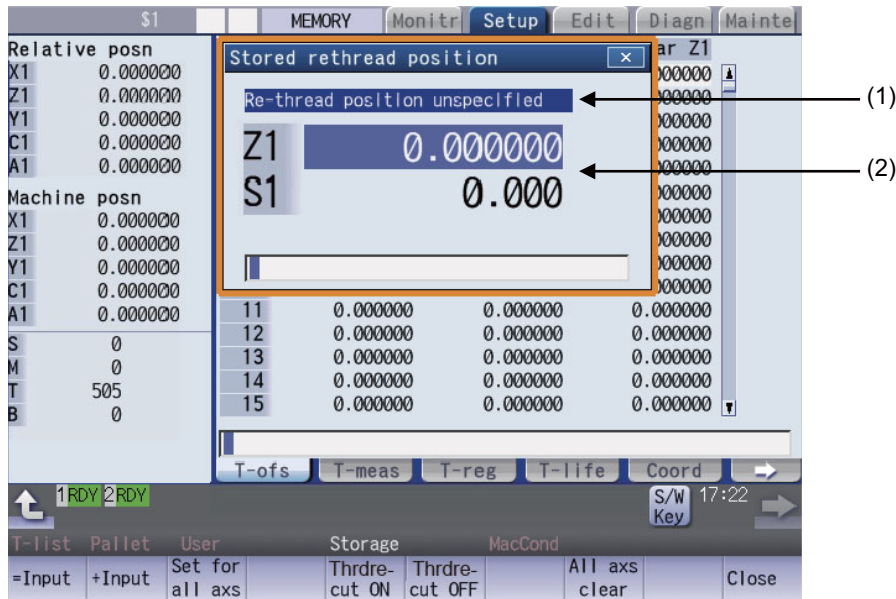
9.9 Thread Recutting Function



This function stores the thread groove position to enable thread re-machining.

Using this function allows the tool to pass through the machined thread groove by storing the lead axis machine position and the spindle angle to fit the groove position of the re-chucked workpiece.

This function is an additional specification.



Display Items

Display Items	Description								
(1) Thread recutting status	<p>Displays the status to suit the thread recutting machining status.</p> <table border="1"> <thead> <tr> <th>Status</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Re-thread position unspecified</td> <td>Displays the status in which the thread recutting position is not stored. When the menu [Thrdrecut ON] is pressed in this status, thread recutting is not enabled.</td> </tr> <tr> <td>Re-thread position specified</td> <td>Displays the status in which the thread recutting position is stored. When the menu [Thrdrecut ON] is pressed under this status, thread recutting is enabled. If thread cutting is commanded before the menu [Thrdrecut ON] is pressed, thread recutting is not carried out.</td> </tr> <tr> <td>In re-thread cutting</td> <td>Displays the status in which thread recutting is possible. When thread cutting is commanded under this status, thread recutting is carried out.</td> </tr> </tbody> </table>	Status	Description	Re-thread position unspecified	Displays the status in which the thread recutting position is not stored. When the menu [Thrdrecut ON] is pressed in this status, thread recutting is not enabled.	Re-thread position specified	Displays the status in which the thread recutting position is stored. When the menu [Thrdrecut ON] is pressed under this status, thread recutting is enabled. If thread cutting is commanded before the menu [Thrdrecut ON] is pressed, thread recutting is not carried out.	In re-thread cutting	Displays the status in which thread recutting is possible. When thread cutting is commanded under this status, thread recutting is carried out.
Status	Description								
Re-thread position unspecified	Displays the status in which the thread recutting position is not stored. When the menu [Thrdrecut ON] is pressed in this status, thread recutting is not enabled.								
Re-thread position specified	Displays the status in which the thread recutting position is stored. When the menu [Thrdrecut ON] is pressed under this status, thread recutting is enabled. If thread cutting is commanded before the menu [Thrdrecut ON] is pressed, thread recutting is not carried out.								
In re-thread cutting	Displays the status in which thread recutting is possible. When thread cutting is commanded under this status, thread recutting is carried out.								
(2) Stored thread groove position	<p>Displays the currently stored thread groove position. When the power is turned ON, "0" is displayed. Once the thread groove position is stored, it is held until the power is turned OFF or data is cleared.</p> <table border="1"> <tbody> <tr> <td>Z1</td> <td>Lead axis machine position The target axis follows the setting of the parameter "#8714 Thrdrecut lead ax".</td> </tr> <tr> <td>S1</td> <td>Spindle angle The target spindle follows the setting of the parameter "#8715 Thread recut SP#".</td> </tr> </tbody> </table>	Z1	Lead axis machine position The target axis follows the setting of the parameter "#8714 Thrdrecut lead ax".	S1	Spindle angle The target spindle follows the setting of the parameter "#8715 Thread recut SP#".				
Z1	Lead axis machine position The target axis follows the setting of the parameter "#8714 Thrdrecut lead ax".								
S1	Spindle angle The target spindle follows the setting of the parameter "#8715 Thread recut SP#".								

Menus	
Menus	Description
=Input	This executes an absolute input.
+Input	This executes an incremental input.
Set for all axs	Press this menu to automatically input the lead machine position or spindle angle in the stored rethread position window and store data.
Thrdre-cut ON	This changes the re-thread cutting status to "In thread recutting", enabling thread recutting using the stored data. If this menu is not pressed, thread recutting is not carried out. If this menu is pressed while thread recutting is disabled, the message "Thread recut position is unspecified" is displayed.
Thrdre-cut OFF	This changes the thread recutting status from "In thread recutting" to "Re-thread position specified", disabling thread recutting.
All axs clear	This erases all data of the stored positions.
Close	This closes the pop-up window.

9.9.1 Storing the Thread Groove Position

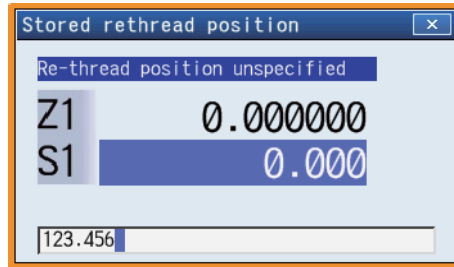
Operation method

Two methods are available to store the thread groove position: manual input and automatic input.

<Storing the thread groove position via manual input>

(1) Using the [↑] or [↓] key, switch the lead axis machine position (Z1) and the spindle angle (S1). → The cursor appears at the lead axis machine position (Z1) or the spindle angle (S1).

(2) Input the value in the item indicated by the cursor. → The input value is displayed in the input area.
 Z1: Lead axis machine position
 S1: Spindle angle



(3) Press the [INPUT] key or the menu [=Input].

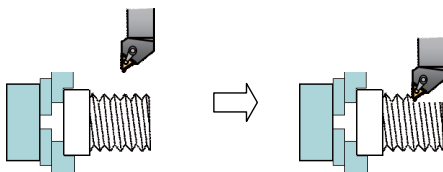
<Note>

- It is possible to perform incremental input by pressing the menu [+INPUT] key instead of the [INPUT] key or the menu [=INPUT].
 (Example) If the original data is 200:
 $250 + [+INPUT] \rightarrow 200 + 250 = 450$

The input value is displayed in the input area. The value is stored at the position indicated by the cursor, and the cursor then moves down. However, if the cursor is at the spindle angle (S1), press the [INPUT] key to move the cursor to the lead axis machine position (Z1).

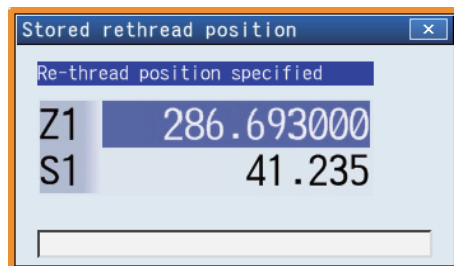
<Storing the thread groove position via automatic input>

(1) Manually move the nose of the thread cutting tool to the thread recutting groove.



(2) Press the menu [Set for all axs].

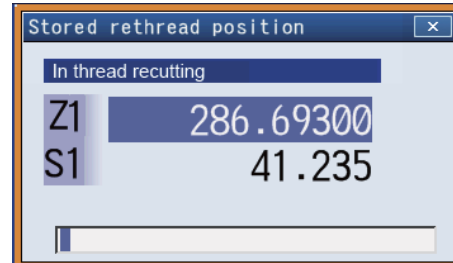
→ The thread cutting status is changed to "Re-thread position specified", and the current lead axis machine position (Z1) and spindle angle (S1) are stored collectively.



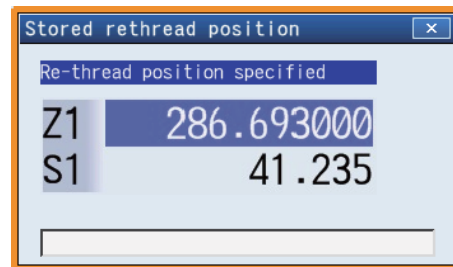
9.9.2 Switching the Stored Thread Groove ON/OFF

Operation method

- (1) Press the menu [Thrdrecut ON] while "Re-thread position specified" is ON. → The thread cutting status is changed to "In thread recutting". In this state, retract the tool and start the thread recutting program to enable the same thread machining as that carried out for the original thread.



- (2) Press the menu [Thrdrecut OFF] while "In re-thread cutting" is ON. → The re-thread cutting status returns to the "Re-thread position specified" status, and thread recutting is disabled.



9.9.3 Erasing the Stored Thread Groove Position

Operation method

- (1) Press the menu [All axis clear]. → The menu [All axis clear] is highlighted. A message displays confirming whether it is okay to erase the data.
- (2) Press the [Y] or [INPUT] key. → The lead axis machine position (Z1) or the spindle angle (S1) is cleared to "0".

Machining a Workpiece

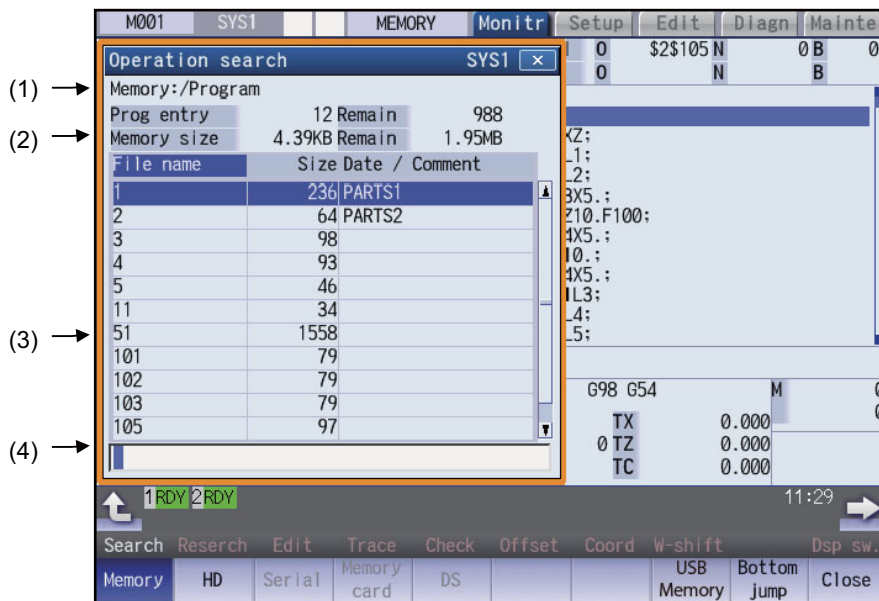
This chapter mainly describes the functions set on the monitor (Monitr) screen.

10.1 Operation Search



On this screen, the program can be called from the program storage site, such as a memory, by designating the program (program No.) to be automatically run and the program start position (sequence No., block No.).

When the multi-part system program management is valid (#1285 ext21/bit0 =1, ext21/bit1 =1), for only the machining program in the NC memory, the program search is executed across all part systems in batch.



Display Items

Display Items	Description
(1) Device name, directory display	This displays the device and directory where the searched machining program is located.
(2) Capacity display	This displays the capacity of the device displayed in (1).
(3) List of directories and files	<p>This displays a list of the contents contained in the device or directory displayed in (1). Use and to scroll the displayed list.</p> <p>If the device is an HD, memory card, DS or USB memory, the file update date/time is displayed in the <Date/Comment> field. For the NC memory, the machining program comment is displayed.</p> <p>Whether to show or hide the comment field can be selected by pressing the menu [Comment nondisp]. When the comment field is hidden, the file name field will be enlarged. (Up to 13 characters can be displayed in the file name field when the comment is shown, and 32 when the comment is hidden.)</p> <p>If the file name exceeds the maximum number of characters, ""*"" will appear at the last character.</p>
(4) Input section	This displays details of the key input.

Menus

Menus	Description
Memory	This selects the device for searching for the program. When a device with directory is selected, the route is selected first.
HD	
Serial	
Memory card	
DS	
USB Memory	
Top jump	Display starts from the first page of the directory/list of files. The cursor moves to the top line.
Bottom jump	The last page of the directory/list of files is displayed. The cursor moves to the bottom line.
Comment nondisp	This changes whether to show or hide the comment field in the list. When the comment field is hidden, the file name field will be enlarged.
List update	This updates the list contents. (The latest contents of the currently selected device and directory are listed.)
Sort change	This changes the method of sorting the list.
Close	This closes the pop-up window and quits this function.

Note

(1) Depending on the model, devices available on the monitor screens are different.

Devices	Model	
	M800W/M80W Series Windows-based display unit	M800S/M80 Series
Memory	○	○
HD	○	-
Serial	○	○
Memory card (front-side SD card)	○	○
DS (built-in SD card)	○	○
USB memory	○	○

(2) Some items may not be displayed depending on the device.















○: Displayed ×: Not displayed

Display item/Device	Memory	HD	Serial	Memory card	DS	USB memory
Number of programs registered	○	○	×	○	○	○
Remainder	○	×	×	×	×	×
Number of memory characters	○	○	×	○	○	○
Remainder	○	○	×	○	○	○
List	○	○	×	○	○	○

(3) When using serial, the port number set with parameter "#9005 TAPE MODE PORT" is connected, and search.

10.1.1 Executing an Operation Search

Operation method

- (1) Press the  to select the part system to run.  The selected part system appears on the upper left of the screen.
- (2) Press the main menu [Search].  The sub-menu is displayed.
The list appears as a pop-up window.
- (3) Select the device.
(Example) [Memory]  The selected device name and root directory (memory:/) are displayed in the device name and directory display fields.
- (4) Press the [, , ] or  key to move the cursor to the directory containing the file to be set.  Moves into the directory.
- (5) Press the [INPUT] key.
If the contents of list are different from the actual device or directories, press the menu [List update].
- (6) Press [, , ] or  key to move the cursor to the machining program to be edited.
- (7) Press the [INPUT] key.  The search starts.
When the search is completed, the searched device and program position appear in the display area for the machining program currently being executed.

When designating the sequence number and block number and searching for the program, input the search conditions in the input area.

The program No. is categorized according to the presence of an extension.

Input details	(Program No.)	Sequence number	Block No.
1001/1/2	O1001	N1	B2
1001.PRG/1/2	O1001.PRG	N1	B2
/1/2	(Currently searched O No.)	N1	B2
1001/2	O1001	N0	B2
1001/1	O1001	N1	B0
1001	O1001	N0	B0
/1	(Currently searched O No.)	N1	B0
//2	(Currently searched O No.)	N0	B2



Note

- (1) The maximum number of digits is eight for the sequence No. and five for the block No.
- (2) Program after operation search
 - (a) Operation search is canceled if the following operations are carried out on the edit screen after operation search. Execute restart search in this case.
 - If the searched program is erased.
 - If the searched sequence No. is erased.
 - If the block corresponding to the searched block No. is erased.
 - (b) Operation search cannot be executed in another mode during MDI operation even if the block is stopped. Wait for MDI operation to end or reset the NC before searching.
- (3) A program with 33 or more file name characters cannot be searched.
- (4) Memory card, DS and USB memory are in the device access state during the operation. Do not remove the memory card, DS and USB memory during its operation. Failure to observe this could result in faults.
- (5) Searched program No. is memorized in NC even after the power is turned OFF. When NC starts up after the power is turned ON again, the program which has the previously searched program No. will be operated.
- (6) In case the USB memory is changed to another one, if the program has the same No. as previously searched program exists in the currently inserted USB memory, the program will be operated. When the program of the same No. does not exist in the USB memory, the program error (P232) will occur.
- (7) Sub part system I/II cannot be searched for M80 Series.
- (8) Sub part system II cannot be searched for M800 Series.

10.1.2 Changing Whether to Show or Hide the Comment Field

The file name field can be extended by changing whether to show or hide the comment field.

Operation method

- (1) Press the menu [Comment nondisp].  The file name is displayed up to 32 alphanumeric characters and symbols after the comment field disappears.
- (2) Press the highlighted [Comment nondisp] again.  The comment field appears, and the file name is displayed up to 13 alphanumeric characters and symbols.

(Example) When the file name is "123456789A123456789B123456789C12"

- "Comment display" is validated: The file name display is omitted and "*" is attached.

File name	Size	Date / Comment
123456789A12*	126	COLOR_CHK_01

- "Comment display" is invalidated: The file name is displayed up to 32 alphanumeric characters and symbols.

File name	Size
123456789A123456789B123456789C12	126

Note

- (1) The set status is held even if the NC power is turned OFF.
- (2) The set status is common for list view of operation screen, restart search screen, etc.
- (3) The cursor moves to the head when display/non-display in the comment field is switched.

10.1.3 Changing the Sorting Method

Sorting method changes to 1 -> 2 -> 3 -> 4 -> 5 -> 1.....every time the menu [Sort change] is pressed.

The selected sorting method is also displayed in the list on the other screens. The method is common for all the devices, as well. The sorting method will be held even after the power is turned OFF and ON.

Up to the number shown in the table "Sortable number of files" (the total number of files and directories, including current directory "." and one directory above "..") can be sorted within a directory. If it exceeds the sortable number of files, the menu [Sort change] is grayed out and changing the sorting method is impossible. In this case, NC memory program is displayed with "6. Program No. ascending order". Other devices are displayed with "2. File name character code ascending order".

Sorting method

No.	Sorting method	Priority
1	File name No. ascending order	1. "." for current directory, ".." for one directory above 2. Numerical value (excluding the case where "0" is put at the beginning) ascending order 3. Character code ascending order
2	File name character code ascending order	1. "." for current directory, ".." for one directory above 2. Character code ascending order
3	File name character code descending order	1. Character code descending order 2. "." for current directory, ".." for one directory above
4	Comment ascending order	"Date/comment" character code ascending order
5	Comment descending order	"Date/comment" character code descending order
6	Program No. ascending order	1. Program No. (Numeric character) ascending order 2. Program No. (Character code) ascending order

Note

- (1) The selected sorting method is held even after the power is turned OFF.
- (2) The selected sorting method is common for list view of the Monitor screen, Restart search screen, etc.
- (3) The character code ascending (descending) order is the method in which file names are compared one by one using the ASCII code.
(Example) If the ascending order is applied, the appropriate order would be 1 to A because "1" equals to "0x31" and "A" equals to "0x41".
- (4) When the device is "Memory", display for "current directory" and "one directory above" is not available.
- (5) When comments are the same, sorting is carried out by the file name character code ascending (descending) order.
- (6) "Date/comment" for the devices other than "Memory" are compared using character code only. Thus, the order will not be one by the actual date.
- (7) When the number of the programs in the NC memory exceeds the sortable number of files, the programs are displayed with "6. Program No. ascending order".

Sortable number of files

Device	M800W/M80W Series Windows-based display unit	M800S Series	M80 Series
Memory	128	128	128
HD	1000	-	-
Memory card	1000 (*1)	250 (*1)	128
DS	1000 (*1)	250 (*1)	128
USB memory	1000 (*1)	250 (*1)	64

(*1) The available sort volume can be designated using the parameter "#8937 File sort volume".

10.2 Checking the Movement under Machining (Monitor Screen)

Monitr

Various information related to operation, such as the axis counter, speed display and MSTB command are displayed on the Monitor screen. In addition, you can perform various monitoring operations, as shown below.

- (1) Search
- (2) Research
- (3) Editing the searched machining program
- (4) Check (Display of NC program's tool movement path)
- (5) Trace (Display of machine movement path)
- (6) Correction of operating program's buffer
- (7) Counter set
- (8) Manual numerical value command, etc.

10.2.1 Screen Layout

The screen layout varies depending on whether the 2-part system simultaneous display (#11019 2-system display) is valid or invalid, operation mode, and the number of NC axes. Refer to the table below for details.

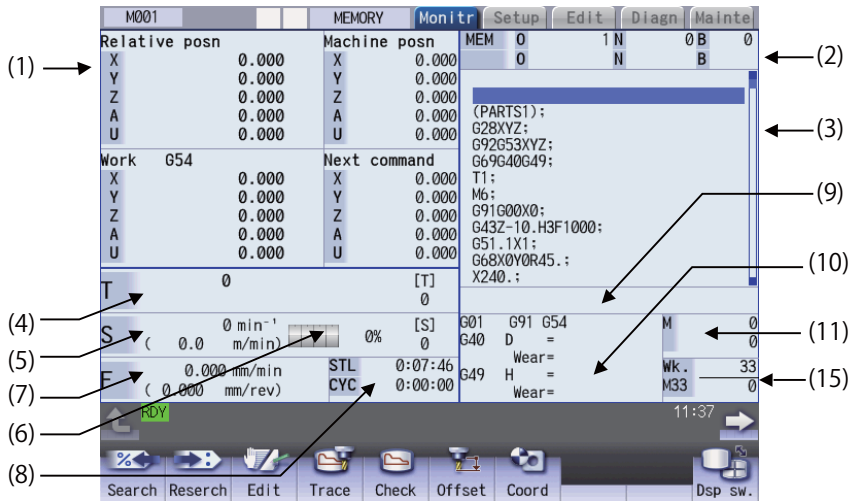
Screen		Number of counter display axes	Input setup unit (#1003 iunit)	Select display	Reference
Monitor screen (Normal view)		Up to 5 axes	-	Hidden	Screen 1
				Display	Screen 2
		6 axes or more	-	Hidden	Screen 3
				Display	-
Monitor screen (Simple view)		Up to 5 axes	Min. 0.01 μm	Display not possible	Screen 4
			Max. 0.001 μm	Display not possible	Screen 5
		6 axes or more	-	Display not possible	
Monitor screen (Single counter) (15-type/19-type)		Up to 5 axes	-	Display	Screen 6
Monitor screen (Dual counter) (15-type/19-type)		Up to 8 axes	-	Display	Screen 7
Monitor screen (Quad counter) (15-type/19-type)		Up to 5 axes	-	Display	Screen 8
2-part system simultaneous display	Counter1 (expand)	Up to 4 axes	-	Display not possible	Screen 9
	Dual counter	Up to 4 axes	-	Display not possible	Screen 10
		5 axes or more	-	Display not possible	Screen 11
	Quad counter	Up to 4 axes	-	Display not possible	Screen 12
2-part system simultaneous display (15-type/19-type)	Counter1 (expand)	Up to 5 axes	-	Display not possible	Screen 13
	Dual counter	Up to 5 axes	-	Display not possible	Screen 14
	Quad counter	Up to 5 axes	-	Display not possible	Screen 15
3-part system simultaneous display (15-type/19-type)	Counter1 (expand)	Up to 5 axes	-	Display not possible	Screen 16
	Dual counter	Up to 5 axes	-	Display not possible	Screen 17
		6 axes or more	-	Display not possible	Screen 18
	Quad counter	Up to 5 axes	-	Display not possible	Screen 19

[1-part system display] ...The parameter "11019 2-system display" = "0"

There are two types of screen displays: "Monitor screen (Normal view)" and "Monitor screen (Simple view)". This display can be switched using the menu [Dsp sw.]. However, the content of the display varies depending on the specification of NC axes.

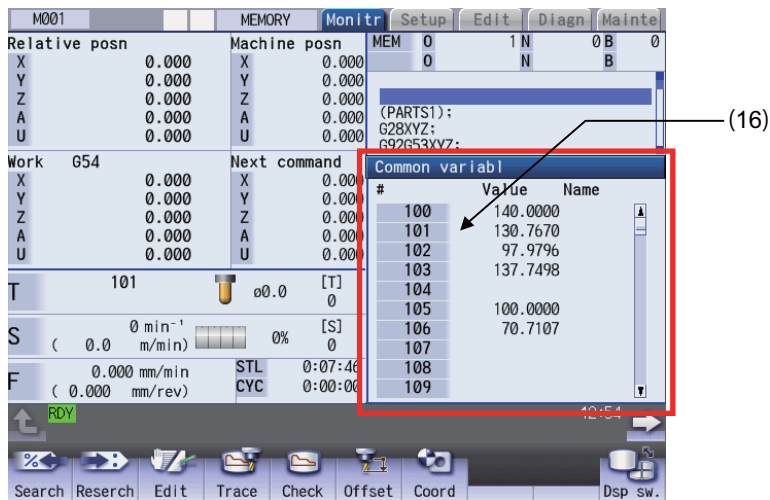
- 8.4-type/10.4-type

<Screen 1: Monitor screen (Normal view) (Up to 5 axes)>

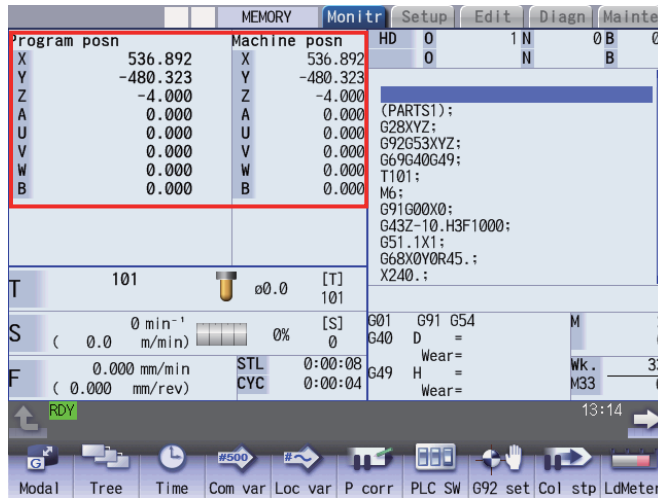


<Screen 2: Selectable display is valid>

When displaying monitor screen (normal view), display item on the bottom right of the screen can be changed, such as common variable, work coordinate system offset or tool compensation amount. To change the display, the parameter settings for "#8940 Selectable display" and "#8973 Set select display" are required.



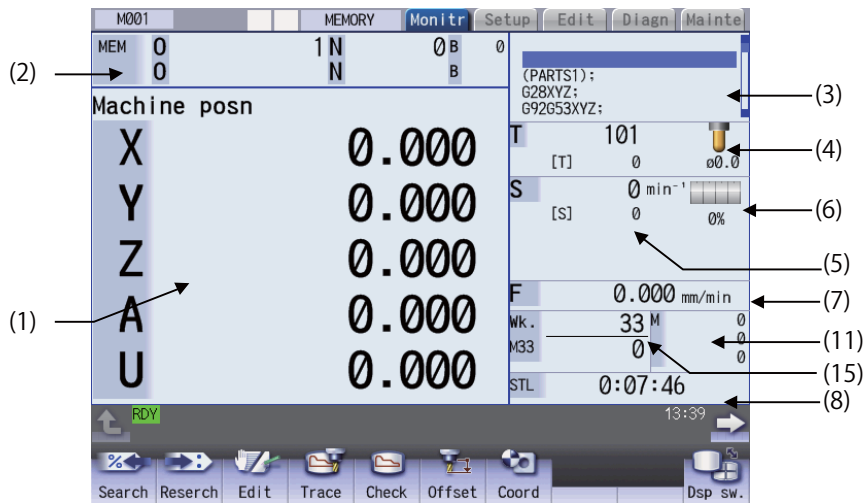
<Screen 3: Monitor screen (Normal view) (6 axes or more)>



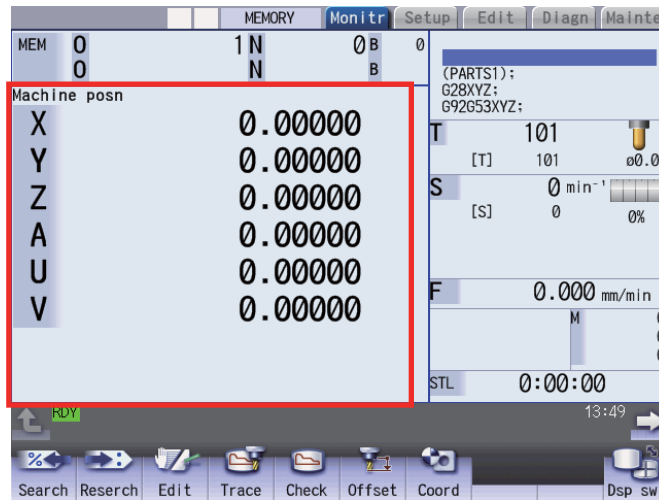
Note

- (1) The maximum number of axes that can be displayed is 10 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

<Screen 4: Monitor screen (Simple view) (Up to 5 axes and min. 0.01 μm)>



<Screen 5: Monitor screen (Simple view) (Up to 6 axes and min. 0.001 μm)>

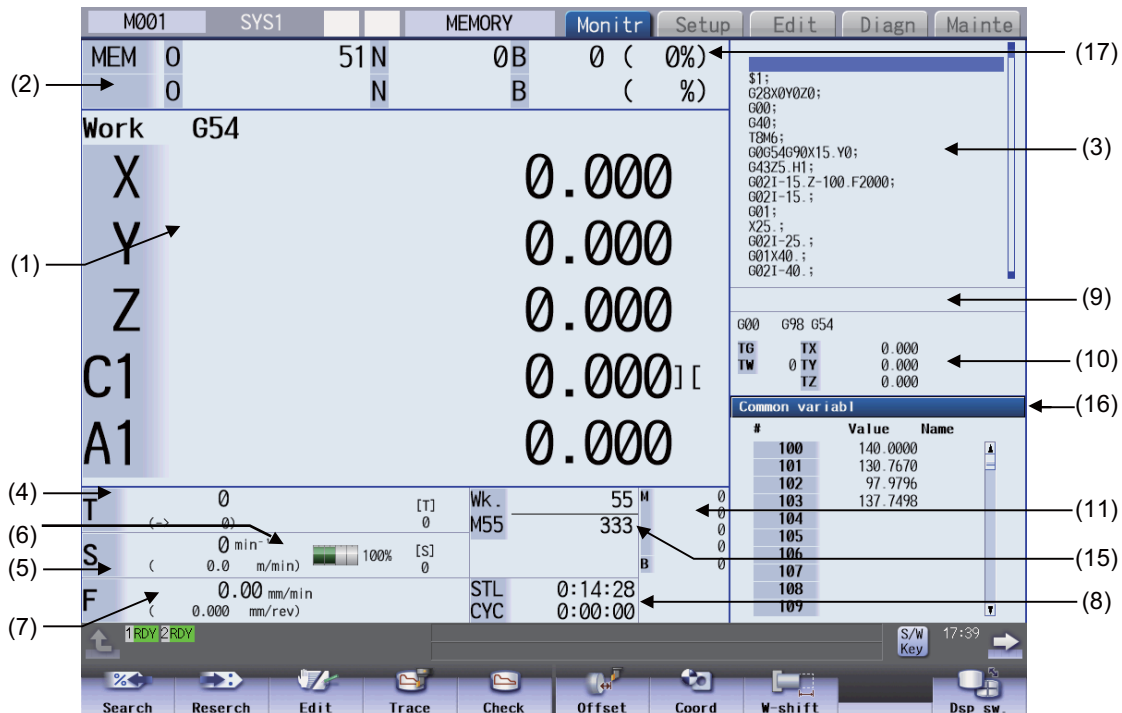


Note

(1) When the number of axes is 6 or more or the input unit is a maximum 0.01 μm in any one of the part systems, the screen display will change to the example shown above for all part systems. In this case the maximum number of axes that can be displayed are 8 axes.

- 15-type/19-type

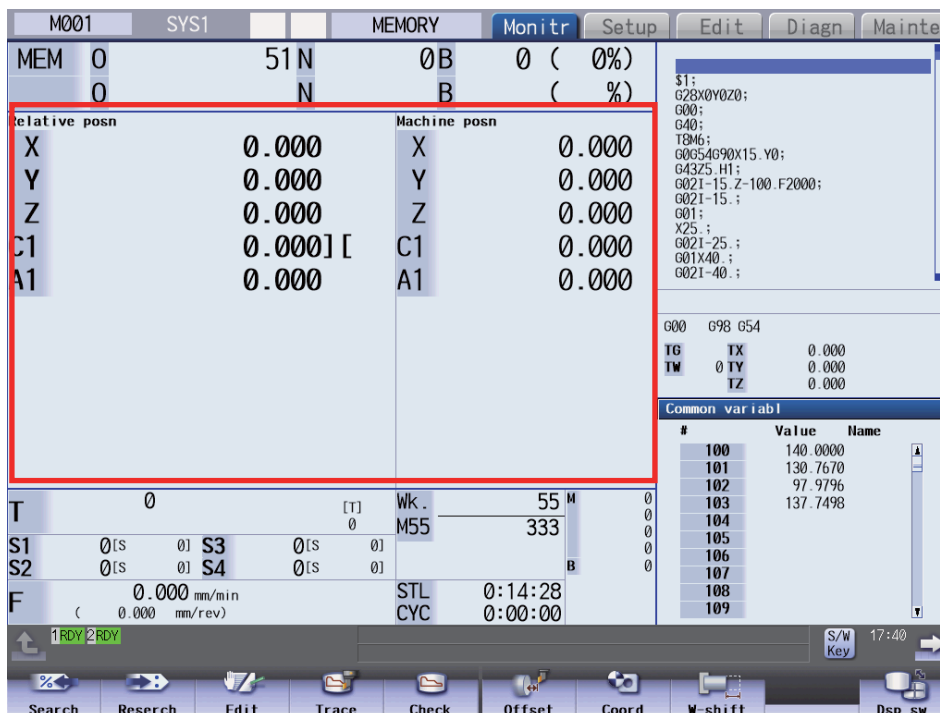
<Screen 6: Monitor screen (Single counter) (15-type/19-type)>



Note

(1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

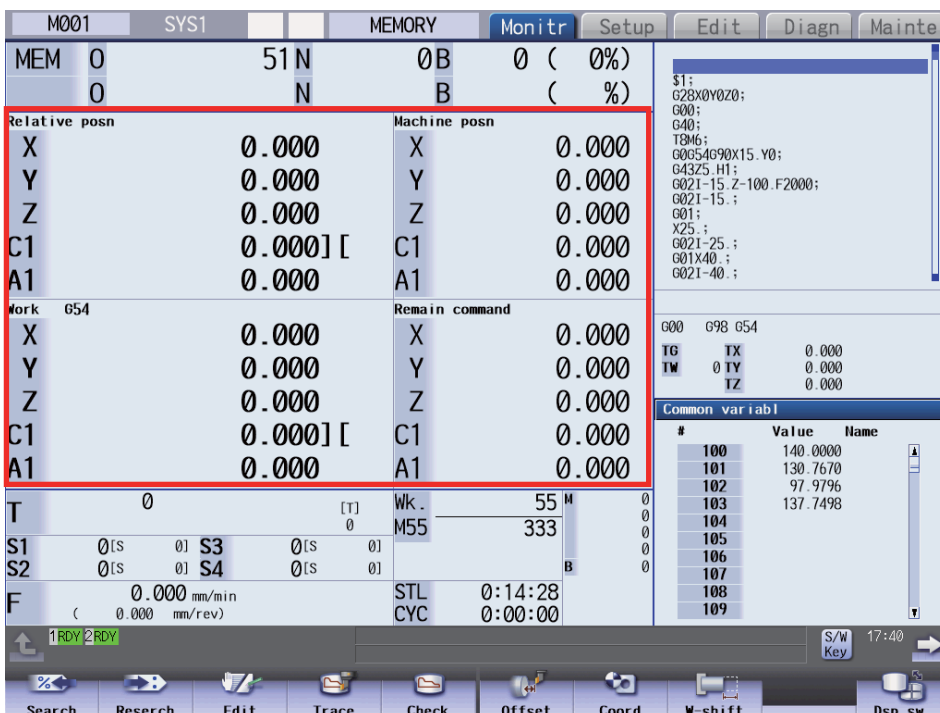
<Screen 7: Monitor screen (Dual counter) (15-type/19-type)>



Note

- (1) The maximum number of axes that can be displayed is 8 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

<Screen 8: Monitor screen (Quad counter) (15-type/19-type)>



Note

- (1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

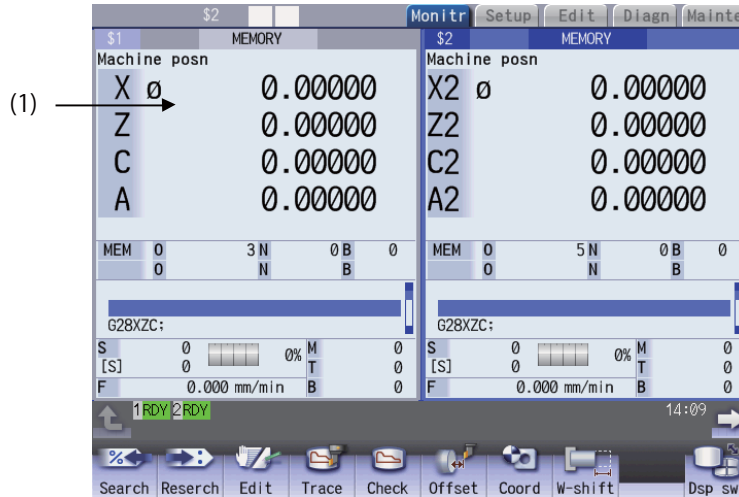
[2-part system simultaneous display]...Parameter "#11019 2-systm display" = 1

- 8.4-type/10.4-type

■ Counter1 (expand)

In "Counter1" (expand) display, single counter, MSTB display and currently executing program, etc. are displayed for each part system.

<Screen 9: Counter1 (expand) display>



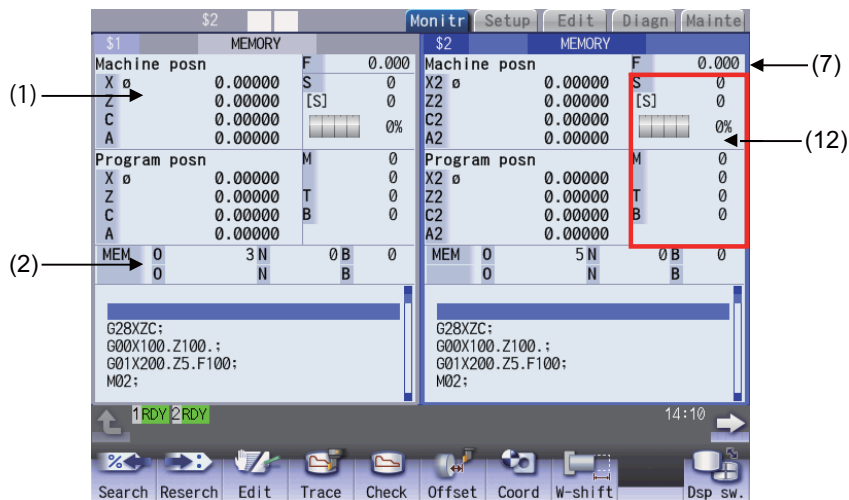
Note

(1) The maximum number of axes that can be displayed is 4 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

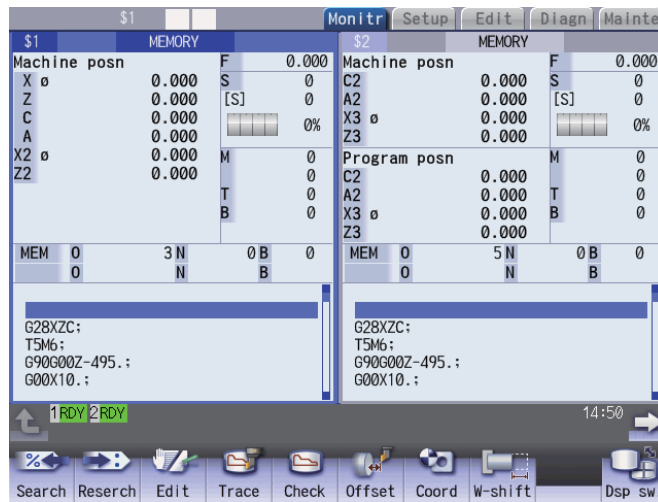
■ Dual counter

In "Dual counter" display, two counters, MSTB display and currently executing program, etc. are displayed for each part system.

<Screen 10: Dual counter display (up to 4 axes)>



<Screen 11: Dual counter display (5 axes or more)>



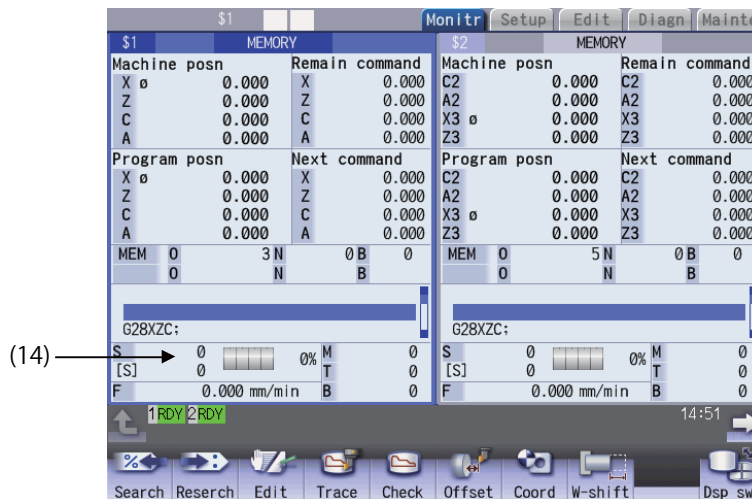
Note

- (1) The maximum number of axes that can be displayed is 8 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

■Quad counter

In "Quad counter" display, quad counter and currently executed program, etc. are displayed for each part system. In "Quad counter" display, the counter can display 0.001 μm or more.

<Screen 12: Quad counter display>



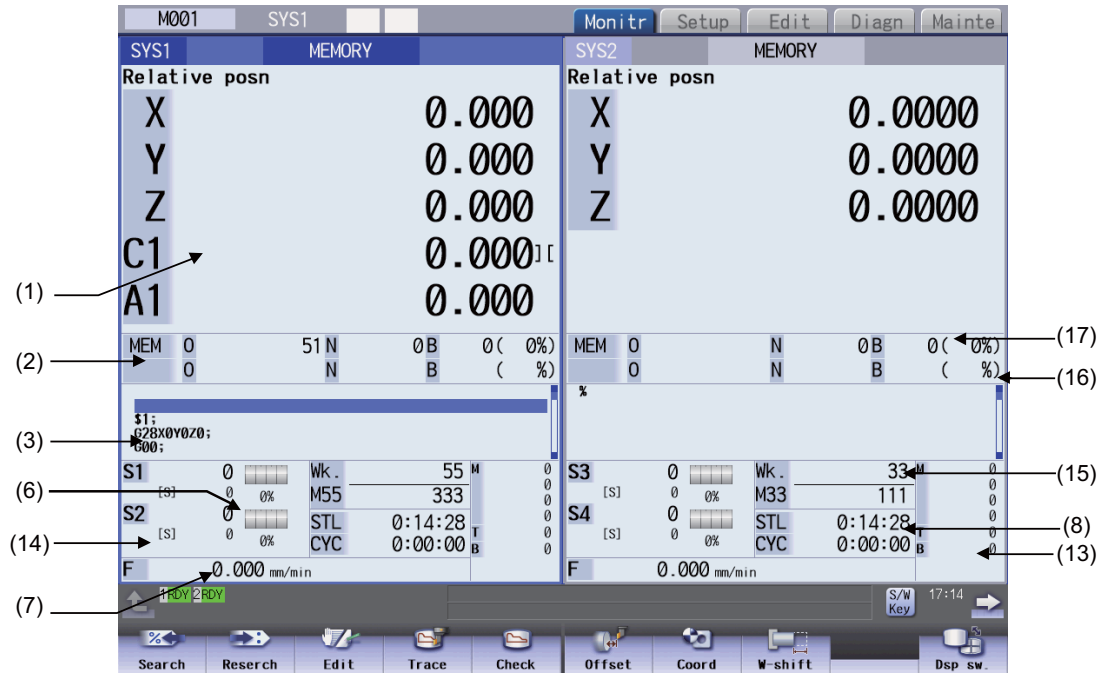
Note

- (1) The maximum number of axes that can be displayed is 4 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

- 15-type/19-type

■ Counter1 (expand)

<Screen 13: Counter1 (expand) (15-type/19-type)>

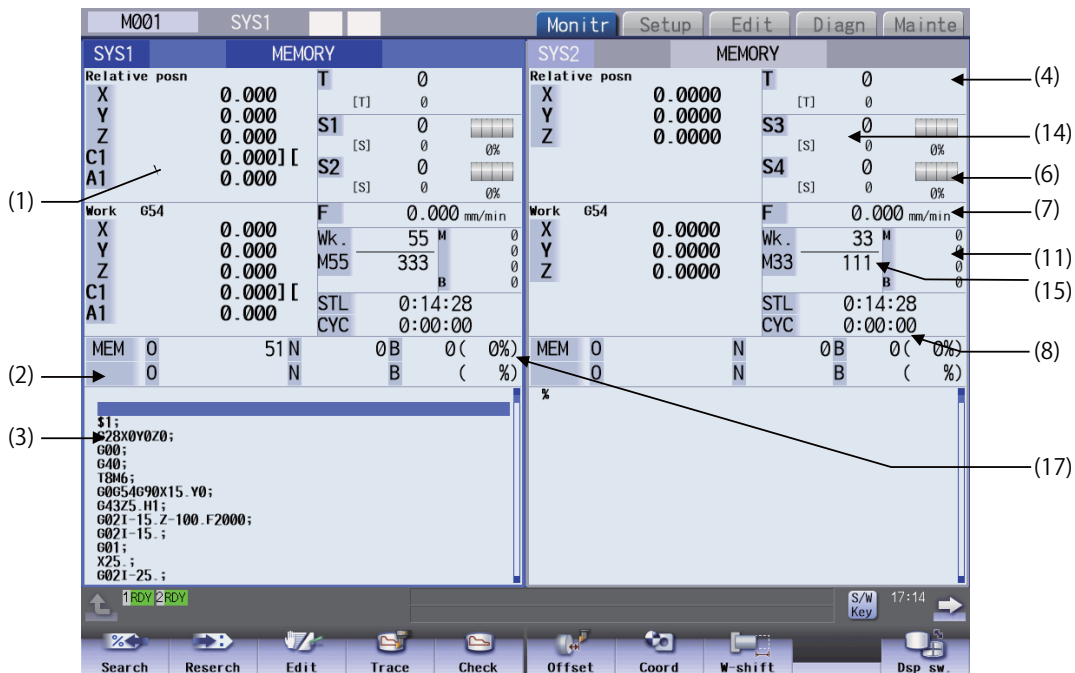


Note

(1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

■ Dual counter

<Screen 14: Dual counter display (up to 4 axes) (15-type/19-type)>

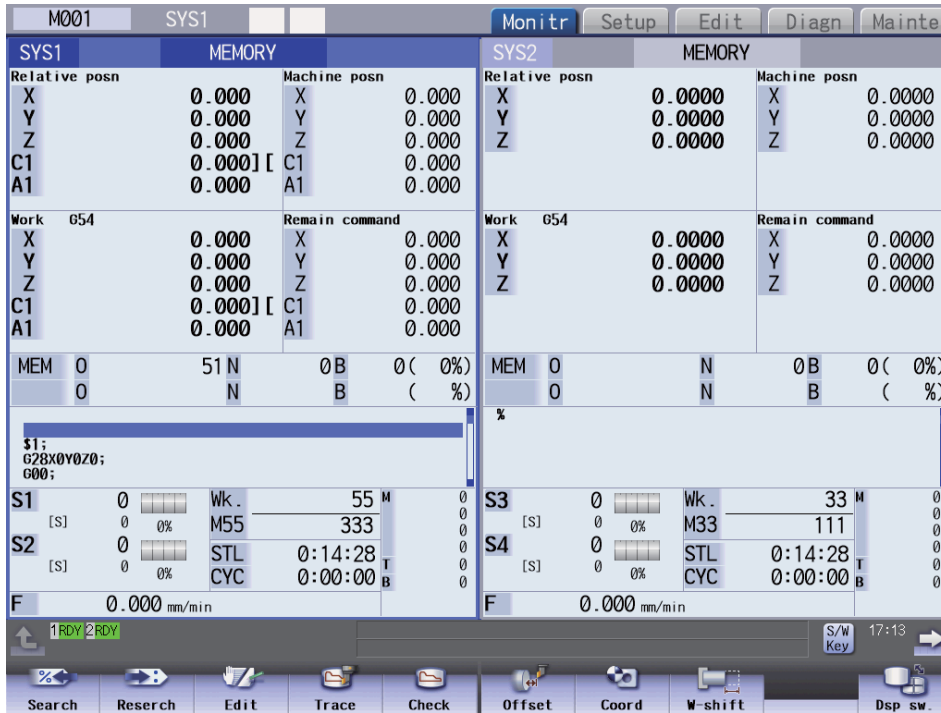


Note

(1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

■Quad counter

<Screen 15: Quad counter display (15-type/19-type)>



Note

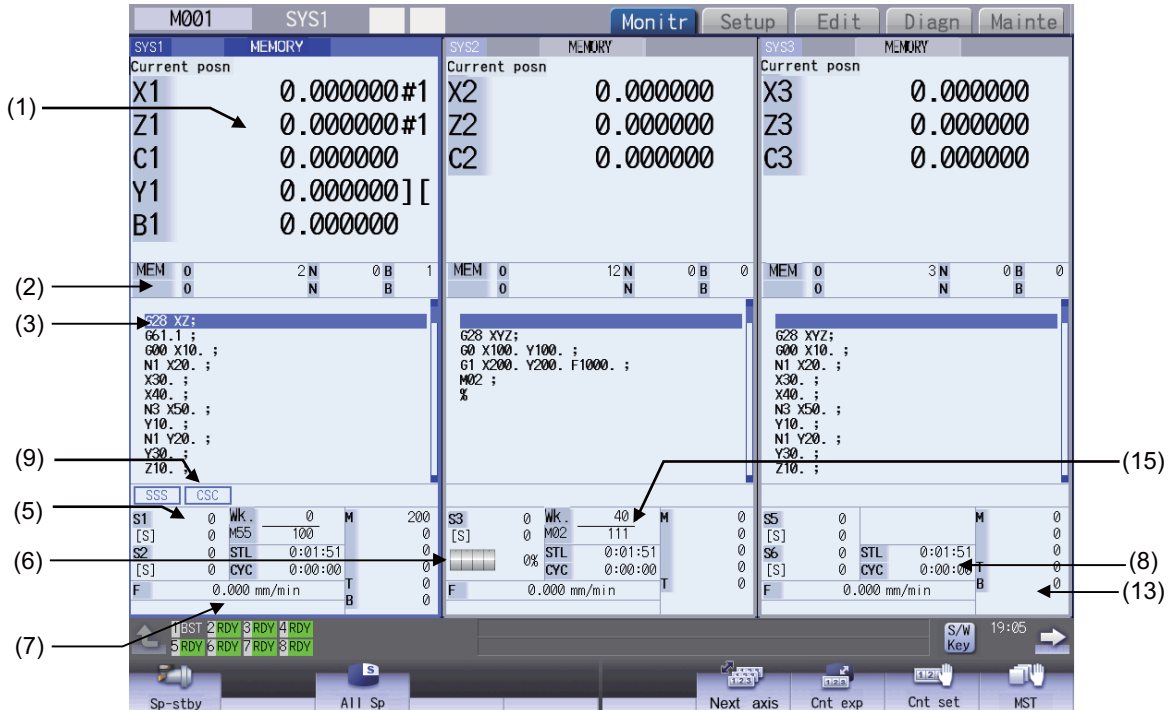
- (1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

[3-part system simultaneous display]...Parameter "#11019 2-systm display" = 3

- 15-type/19-type

■Counter1 (expand)

<Screen 16: Counter1 (expand) (15-type/19-type)>



Note

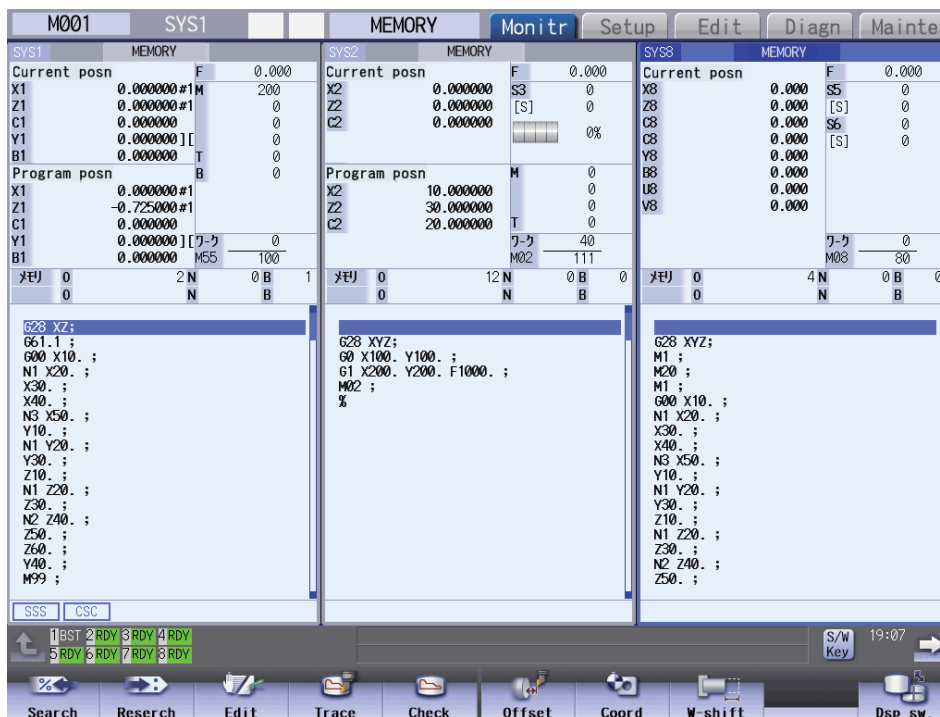
(1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

■Dual counter

<Screen 17: Dual counter display (up to 5 axes) (15-type/19-type)>



<Screen 18: Dual counter display (up to 6 axes) (15-type/19-type)>

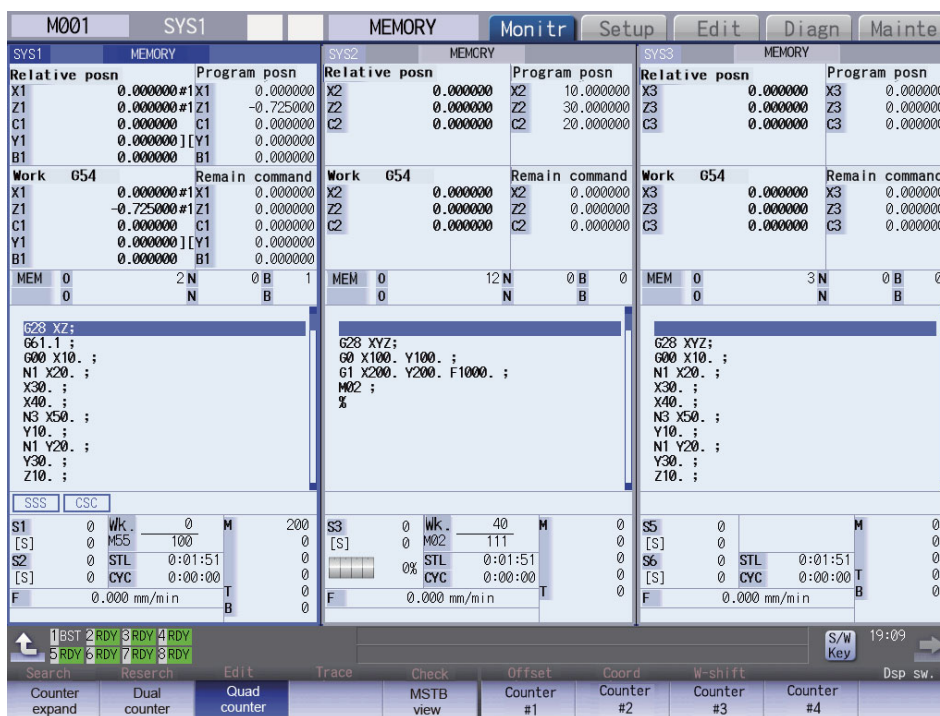


Note

- (1) The maximum number of axes that can be displayed is 10 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

■Quad counter

<Screen 19: Quad counter display (15-type/19-type)>

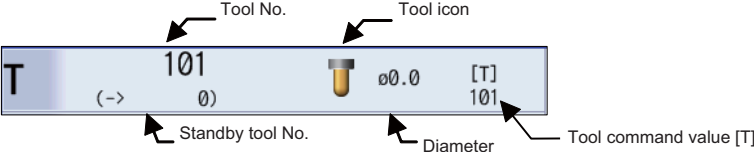
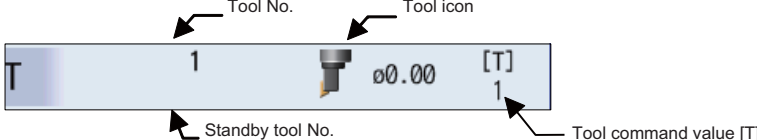
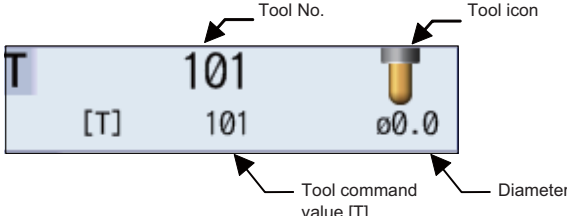
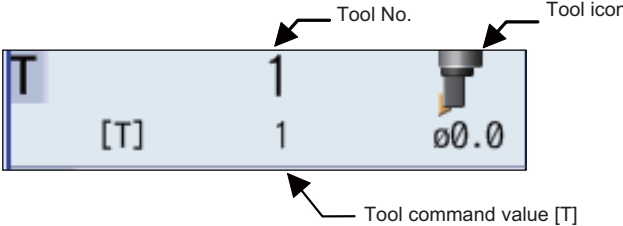




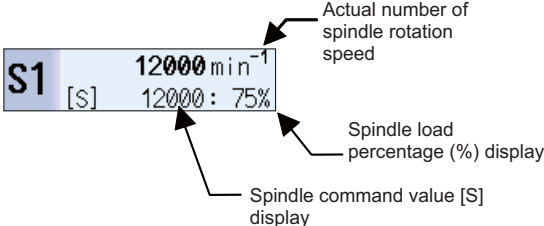
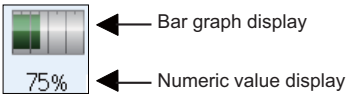









Note

- (1) The maximum number of axes that can be displayed is 5 axes. Press the menu [Next axis] to switch display to display the subsequent axes.

Display Items

Display items	Description				
(1) Counter display	<p>This area displays the counter of the relative position or workpiece coordinate position. If each axis is at a specific position or in a specific status, the following status abbreviations are displayed.</p> <p>#1 to #8: 1st to 8th reference position ♦[: Servo OFF state ♦MR: Mirror image ♦><: Axis removed state ♦CT: Auxiliary axis state</p> <p>(Displayed when an axis that can be switched between the NC axis and auxiliary axis is set to the auxiliary axis state.)</p> <p>You can designate whether to consider the tool length compensation or tool radius compensation depending on the value of the parameter "#1287 ext23/bit4".</p> <p>The axis counter can be displayed or hidden depending on the value of the parameter "#1069 no_dsp".</p> <p>Also, if the axis is set to the diameter axis or uncontrol axis, the following symbol is displayed on the right of the axis name.</p> <p>*: Uncontrol axis (axis where any part system does not have control rights) φ: Diameter axis</p> <p>(When the target axis is equivalent to both the uncontrol axis and diameter axis, the symbol of the uncontrol axis is displayed.)</p>				
(2) Currently executed machining program (*1)	<table border="1"> <tr> <td>Main O10...</td> <td>Displays the currently executed program number, sequence number and block number.</td> </tr> <tr> <td>Sub O1234...</td> <td>While a subprogram is executed, its program number, sequence number and block number are displayed.</td> </tr> </table>	Main O10...	Displays the currently executed program number, sequence number and block number.	Sub O1234...	While a subprogram is executed, its program number, sequence number and block number are displayed.
Main O10...	Displays the currently executed program number, sequence number and block number.				
Sub O1234...	While a subprogram is executed, its program number, sequence number and block number are displayed.				
(3) Buffer display	<p>This displays the contents of the machining program currently being executed. The block being executed is highlighted.</p> <p>When the parameter "#1122 pglk_c" is enabled, the contents of the program are not displayed. Only "%" is displayed.</p> <p><Note></p> <p>♦If the program comment includes the double-byte width character for one character code, the program may not be displayed correctly.</p>				

Display Items	Description
<p>(4) Tool No. display</p>	<p>This area displays the tool number, standby tool number, T command value and tool diagram of the currently selected tool.</p> <p><Monitor screen (Normal view) M system></p>  <p><Monitor screen (Normal view) L system></p>  <p><Monitor screen (Simple view) M system></p>  <p><Monitor screen (Simple view) L system></p>  <p>Tool No.: Displays the tool number of the currently selected tool.</p> <p>Standby tool No.: Displayed only when standby tool 1 is designated. This is not displayed on the monitor screen (simple view).</p> <p>Tool icon: Displays the type of the currently selected tool with an image.</p> <p>The icon designated on the tool management screen is displayed. (*2) If the lifetime of the tool in use exceeds 90% of the designated tool lifetime value, the background color of the tool icon is changed to yellow. When the lifetime of the tool in use is expired, the background color of the tool icon is changed to red, and it blinks.</p> <p><Display example></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>When the tool life will come soon</p>  </div> <div style="text-align: center;"> <p>When the tool life has been expired</p>  </div> </div> <p>(The background color blinks.)</p> <p>Diameter: Displays the diameter value of the currently selected tool. The value designated on the tool management screen is displayed.</p> <p><Note></p> <ul style="list-style-type: none"> ♦For M system, if a tool with no diameter designated such as a cutting tool is selected, the diameter value is not displayed. For L system, if a tool with the diameter designated such as a milling tool is selected, the diameter is displayed. <p>Tool command value [T]: Displays the T command value that is commanded last. In the L system, when "#11038 T disp typ" is set to "1", the diameter is displayed, including the compensation number.</p>

Display Items	Description						
<p>(5) Spindle rotation speed display</p>	<p>This area displays the actual number of spindle rotation speed as well as the spindle command value.</p>  <p>On the prototype or mass production screen, the values above vary depending on the value of the parameter "#1039 spinno".</p>						
<p>(6) Load Meter Display</p>	<p>This area displays the spindle load value (%) with a bar graph and numeric values. The simple view shows the load meter of up to two spindles.</p>  <p>The graph display color varies depending on the spindle load value. This item blinks when a warning occurs. The caution and warning thresholds conform to the parameters #3192 to #3194.</p> <p><Display example></p> <table border="0"> <tr> <td style="text-align: center;">80% (Normal)</td> <td style="text-align: center;">130% (Caution)</td> <td style="text-align: center;">175% (Warning)</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;"></td> <td style="text-align: center;"></td> </tr> </table>	80% (Normal)	130% (Caution)	175% (Warning)			
80% (Normal)	130% (Caution)	175% (Warning)					
							
<p>(7) Speed display</p>	<p>Interpolation feeding: Displays the vector-direction speed (FA), dwell time, etc. of the axis currently being moved. Each axis independent feeding: Displays the speed of the axis with the highest speed designated. In the L system, the surface speed is displayed. When the parameter "#1125 real_f" is set to "1", the actual machine feedrate is displayed.</p>						
<p>(8) Cycle time display</p>	<p>This area displays the automatic operation time and cycle time. The display item can be switched in the run-out time window.</p> <ul style="list-style-type: none"> ♦DAT: Date ♦TIM: Time ♦PON: Power ON ♦OP: Automatic operation ♦STL: Automatic start ♦EX1: Ext time1 ♦EX2: Ext time2 ♦CYC: Cycle time 						
<p>(9) Control mode display</p>	<p>This area displays the NC control mode.</p> <ul style="list-style-type: none"> ♦HTP: High-speed cycle tap ♦MOR: Manual arbitrary reverse run mode ♦SSS: SSS control ♦CSC: Corner smooth control ♦VAC: Variable-acceleration pre-interpolation acceleration/deceleration ♦EAC: Allowable acceleration for each axis (*3) ♦SFR: Smooth fairing ♦FRG: Fairing <p>Up to six control modes are displayed beginning at the top.</p>						

Display Items	Description
(10) G modal simple display	This area displays the following modal status. Display format varies depending on the status of G code group 24. <ul style="list-style-type: none"> ♦G command modal status of G code group 1 ♦G command modal status of G code group 3 ♦Currently selected workpiece coordinate system offset ♦Tool radius compensation modal, compensation number, tool shape amount, and tool radius wear ♦Tool length compensation modal, compensation axis name, compensation number, tool shape amount, and tool length wear
(11) M and B commands	This area displays the command value for each of the M (miscellaneous function command value) and B (2nd miscellaneous function command value) functions. <In 1-part system display> The M (miscellaneous function command value) and B (2nd miscellaneous function command value) displays vary depending on the values of the parameters "#12005 Mfig" and "#1170 M2name".
(12) M, S, T, and B commands (2-part system/3-part simultaneous display)	Using the menu [MST Chg] allows you to switch the MSTB display in the area to be operated. (For details, refer to "Changing MSTB display" in "10.2.5 Operation of 2-part/3-part System Simultaneous Display".)
(13) M, T, and B commands (15-type/19-type) (2-part system/3-part simultaneous display)	This area displays the command value for each of the M (miscellaneous function command value), T, and B (2nd miscellaneous function command value) functions. The M (miscellaneous function command value) and B (2nd miscellaneous function command value) displays vary depending on the values of the parameters "#12005 Mfig" and "#1170 M2name".
(14) Spindle rotation speed display (2-part system simultaneous display)	This area displays the spindle rotation speed and the spindle command value that are designated in the parameters "#8925 to #8928" ("SP on 1st part sys" to "SP on 4th part sys") and "#8958 to #8961" ("SP on 5th part sys" to "SP on 8th part sys").
(15) Workpiece machining count display	This area displays the current number of workpiece machining. The display depends on the number of workpiece machining that has been set with the parameters "#8001 to #8003". However, when the parameter "#8001 WRK COUNT M" is set to "0", the number of workpiece machining is not counted, and it is not displayed on the screen. The setting value of the parameter "#8001 WRK COUNT M" is displayed up to high-order two digits.
(16) Selective display area	This area displays NC data that is selected in the parameter "#8940 Set select display". Depending on the selected NC data, you can press the [↑] or [↓] key to scroll pages. Pressing the [INPUT] key displays the window that allows you to operate NC data displayed in the selective display area. The selective display area is displayed on the monitor screen (normal view), monitor screen (single counter) (15-type/19-type), monitor screen (dual counter) (15-type/19-type), or monitor screen (quad counter) (15-type/19-type). In 8.4 type/10.4 type, the monitor screen can be switched when the parameter "#8973 Selective display" is set to "1".
(17) Rate display (15-type/19-type)	The upper side displays the execution position in the main program in percentage (rate) when the entire size of the currently executed main program is assumed to be 100%. The lower side displays the execution position in the sub program in percentage (rate) when the entire size of the currently executed sub program is assumed to be 100%.

(*1) If the program number (program name) exceeds the number of digits that can be displayed, the last digit is indicated by an asterisk (*).

The device name displays the device name detected by operation search. However, "232C" is displayed at computer link B even if no operation search is carried out.

If the sequence number exceeds six digits, only the low-order six digits are displayed.

(*2) If the data of the designated tool number has not been registered on the tool management screen, the tool icon is not displayed.

(*3) When the variable-acceleration pre-interpolation acceleration/deceleration is enabled, the allowable acceleration speed for each axis is always enabled, and "EAC" is not displayed while the control mode "VAC" is being displayed.

Sub-menus displayed when pressing the [Dsp sw.]

Sub-menus displayed when pressing the [Dsp sw.], in case 2-part system simultaneous view is invalid (#11019=0) with 8.4-type or 10.4-type.

Menus	Description
Normal view	Switches the display format to the normal view.
Simple view	Switches the display format to the simple view.
Counter #1	Switches counter type 1. (*1)
Counter #2	Switches counter type 2. (*1) (*2)
Counter #3	Switches counter type 3. (*1)
Counter #4	Switches counter type 4. (*1) (*2)
Counter #5	Switches counter type 5. (*3)

(*1) This menu cannot be operated in simple view mode.

(*2) This menu cannot be operated in normal view mode (6 axes or more).

(*3) This menu cannot be operated in normal view mode.

Note

(1) The selected display format is also held when the power is turned on again.

Sub-menus displayed when pressing the [Dsp sw.], in case 2-part system simultaneous view is invalid (#11019=0) with 15-type or 19-type

Menus	Description
Single counter	Switches the display format to single counter.
Dual counter	Switches the display format to dual counter.
Quad counter	Switches the display format to quad counter.
Counter #1	Switches counter type 1. (*1)
Counter #2	Switches counter type 2. (*1) (*2)
Counter #3	Switches counter type 3. (*1)
Counter #4	Switches counter type 4. (*1) (*2)
Counter #5	Switches counter type 5. (*2) (*3)

(*1) This menu cannot be operated in single counter mode.

(*2) This menu cannot be operated in dual counter mode.

(*3) This menu cannot be operated in quad counter mode.

Note

(1) The selected display format is also held when the power is turned on again.

Sub-menus displayed when pressing the [Dsp sw.], in case 2-part/3-part system simultaneous display is valid (#11019=1, 2 or 3)

Menus	Description
Counter expand	Switches the counter display format to counter1 (expand).
Dual counter	Switches the counter display format to dual counter.
Quad counter	Switches the counter display format to quad counter.
MSTB view	Switches the MSTB display for the area to be operated. This menu cannot be operated when the display unit is 15-type/19-type.
Counter #1	Switches counter type 1.
Counter #2	Switches counter type 2. (*1) (*2)
Counter #3	Switches counter type 3. (*1) (*3)
Counter #4	Switches counter type 4. (*1) (*3)

(*1) This menu cannot be operated in single counter mode.

(*2) This menu cannot be operated in dual counter mode (5 axes or more).

(*3) This menu cannot be operated in dual counter mode.

Note

(1) The selected display format is also held when the power is turned on again.

10.2.2 Switching the Display Format



The monitor screen display format can be switched using the menu [Dsp sw.]. The switchable display format varies depending on the value of the parameter "#11019 2-system display".

- (1) In the 1-part system display (#11019 = 0), switch the display format between the normal view and simple view or among single counter, dual counter, and quad counter.
- (2) In the 2-part/3-part system simultaneous display (#11019 = 1, 2 or 3), switch the display format among the counter1 (expand), dual counter, and quad counter.

Switching the normal view and simple view

When the parameter "#11019 2-system display" (2-part system simultaneous display) is disabled, you can press the sub menu [Normal view] or [Simple view] in the [Dsp sw.] to switch the screen to the normal view or simple view. In 15-type/19-type, the screen can be switched using the sub menu [Single counter], [Dual counter], or [Quad counter].

Switching the Counter Display Format

When the parameter "#11019 2-system display" (2-part /3-part system simultaneous display) is enabled, the counter display format can be switched to the following three modes.

- Counter1 (expand): Displays one counter (Counter type 1) for each part system.
- Dual counter: Displays two counters (Counter types 1 and 2) for each part system.
- Quad counter: Displays four counters (Counter types 1 to 4) for each part system.

Note

- (1) For details on the screen image, refer to Screens 9 to 19 in "10.2.1 Screen Layout".
You can press the sub-menu [Counterexpand], [Dual counter], or [Quad counter] in the menu [Dsp sw.] to switch the display format.

10.2.3 Switching the Counter Types



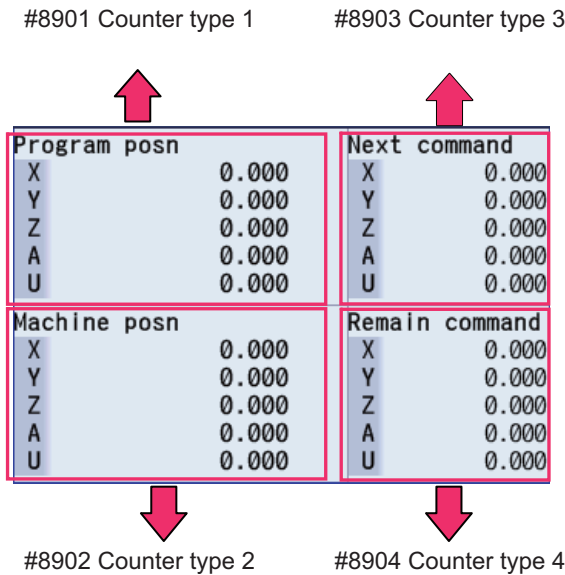
The counter mode on the monitor screen (monitor screen (normal view), monitor screen (simple view), and 2-part /3-part system simultaneous display screen) can be switched using the parameter or the menu [Counter].

- (1) Switching the counter type in the parameter setting
- (2) Switching the counter type in the menu [Counter]

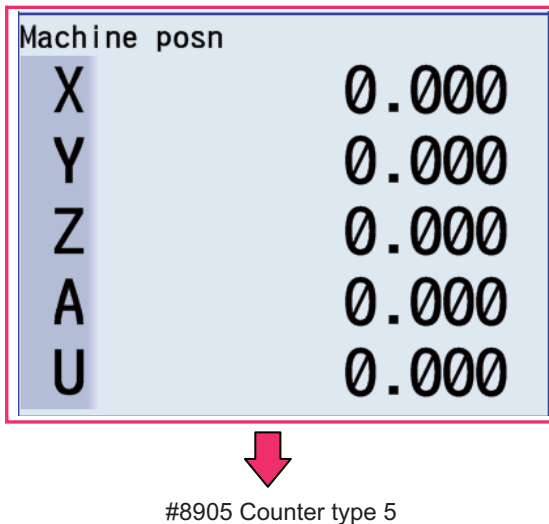
Switching in the parameter setting

The type of the counter to be displayed on the monitor screen can be switched using each of the counter type parameters "#8901" to "#8905". The figure below shows the relationship between counters and parameters using arrows.

<Monitor screen (Normal view)>



<Monitor screen (Simple view)>



<Monitor screen (Single counter) (15-type/19-type)>

Work	G54
X1	Ø-12345.123456789#1
Z1	0.000000000#1
Y1	0.000000000#1
C1	0.000000000#1
B1	0.000000000#1



#8905 Counter type 5

<Monitor screen (Dual counter) (15-type/19-type)>

Relative posn		Machine posn	
X1	Ø-12345.000000000 [	X1	-12345.000000
Z1	0.000000000 [	Z1	0.000000
Y1	0.000000000 [	Y1	0.000000
C1	0.000000000 [	C1	0.000000
B1	0.000000000 [	B1	0.000000
V1	-12345.000000000 [	V1	-12345.000000
H1	0.000000000 [	H1	0.000000
A1	0.000000000 [	A1	0.000000



#8901 Counter type 1



#8903 Counter type 3

<Monitor screen (Quad counter) (15-type/19-type)>

#8901 Counter type 1

#8903 Counter type 3



Relative posn		Machine posn	
X	0.000	X	0.000
Y	0.000	Y	0.000
Z	0.000	Z	0.000
C1	0.000] [	C1	0.000
A1	0.000	A1	0.000

Work G54		Remain command	
X	0.000	X	0.000
Y	0.000	Y	0.000
Z	0.000	Z	0.000
C1	0.000] [	C1	0.000
A1	0.000	A1	0.000



#8902 Counter type 2

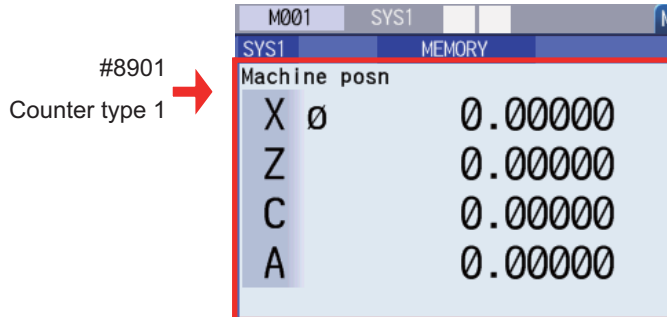


#8904 Counter type 4

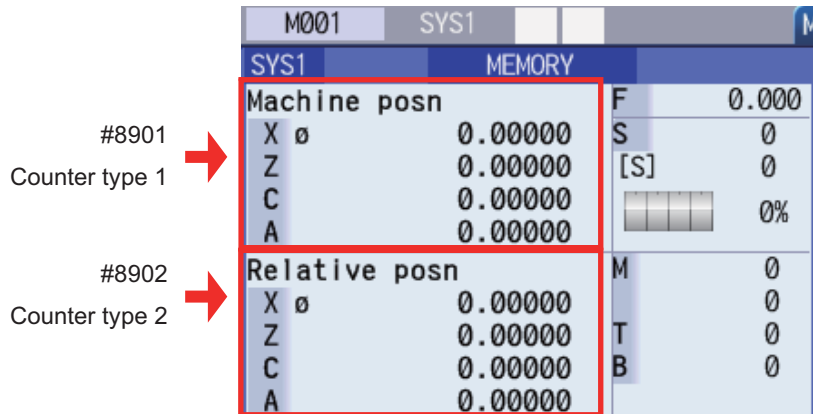
<Monitor screen (2-part/3-part system simultaneous display)>

The following counter type is displayed in the target operation area on the left. Also, the same counter type is displayed in the target operation area on the right.

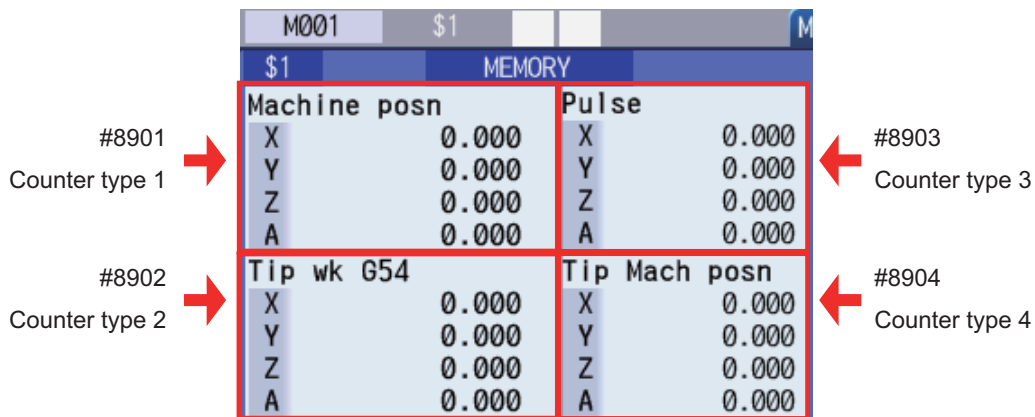
■[Counterexpand]



■[Dual counter]



■[Quad counter]

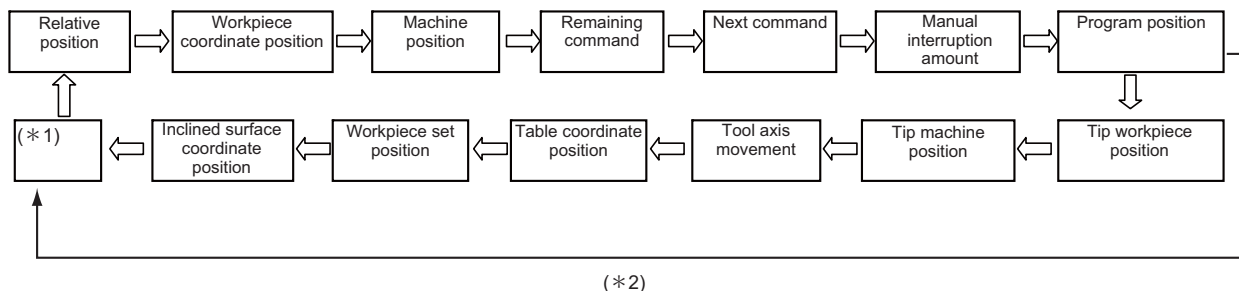


Switching the counter type using the menu

The type of the counter to be displayed on the monitor screen can be changed using the sub-menu [Counter] under the menu [Dsp sw.]. If the counter type is switched using the menus [Counter #1] to [Counter #5], the values of the parameters "#8901 Counter type 1" to "#8905 Counter type 5" are rewritten.

However, when data protection is valid, the displayed counter type can be switched using the menu, but the value of each parameter cannot be rewritten. In this case, if the display returns to the monitor screen after switching to another screen while the displayed counter type is different from the parameter value, the displayed counter is set to the counter type that matches the parameter value.

The figure below shows the counter types that can be displayed using the menu [Counter] as well as the switching order.



(*1) If a counter other than the 13 types of counters above ("Relative position" to "Inclined surface coordinate position") is set to the parameter ("#8901 Counter type 1" to "#8905 Counter type 5") before the counter type is switched using the menu [Counter], the counter type is switched among 14 types of counters, including that counter. When the counter type is switched to a counter type other than the 13 counter types above, it is held until the power is turned OFF. Furthermore, if the 13 counter types above are designated in parameters before the counter type is switched using the menu, the counter type is switched among these 13 counter types.

(*2) When the 5-axis-related additional specification is disabled, the counter type cannot be switched to "Tip workpiece position", "Tip machine position", "Tool axis movement", "Table coordinate position", "Workpiece set position" and "Inclined surface coordinate position" counters.

10.2.4 Switching the Spindle No. to be Displayed on Counter



The number of counter axes that can be displayed on the monitor screen is as follows. To refer to the subsequent axes, select the menu [Next axis].



- Monitor screen in 1-part system view (normal view): Up to 10 axes
- Monitor screen in 1-part system view (simple view): Up to 5 axes
- 2-part system simultaneous view (Counter1 (expand)): Up to 4 axes
- 2-part system simultaneous view (Dual counter): Up to 8 axes
- 2-part system simultaneous view (Quad counter): Up to 4 axes
- 3-part system simultaneous view (Counter1 (expand)): Up to 5 axes
- 3-part system simultaneous view (Dual counter): Up to 10 axes
- 3-part system simultaneous view (Dual counter): Up to 5 axes

Note

(1) When mixed synchronization control is enabled, the menu [Next axis] is displayed even if there is no axis to be switched.

10.2.5 Operation of 2-part/3-part System Simultaneous Display

Switching the area to be operated (right/left)

The area to be operated (right/left) can be switched by touching in the area using the tab key ( ) or on the touchscreen.


When the area to be operated is switched, the part system name to be operated is displayed on the selection bar. At NC startup, the left side is set as the area to be operated.

Note

- (1) The area to be operated cannot be switched while the pop-up window is being displayed.
- (2) The area to be operated can be switched while the software keyboard is being displayed.


Switching the display part system No.

The part system is switched for the area to be operated (right/left).

When the part system displayed in the non-target area is designated by incrementing displayed part systems by one each time you press the  key, the area to be operated is switched.

If the available number of displayed part systems is reached, the first part system is displayed.

Note

- (1) The same operation is also applied when you click a part system name in the selection bar on the touchscreen.
- (2) If the base common parameter "#11035 Sys. change limit" is set to "1", it disables part systems from being switched using the  key or on the touchscreen.

Changing MSTB display

On the monitor screen in 2-part/3-part system simultaneous view, you can press the [MST Chg] main menu to change the MSTB display for the area to be operated.

The MSTB display type is held for each part system when the screen is switched or the power is turned ON again.

<2-part system simultaneous view: Counter1 (expand) / Quad counter>

There are the following two types of MSTB displays, which are toggled each time the menu [MST Chg] is pressed.

•MSTB display type (*1) (*2) (*3)

•MSTB + Workpiece machining count display type (*1) (*2)

(*1) The S command is used to designate the spindle to be displayed for each part system using parameters (#8925 to #8928 ("SP on 1st part sys" to "SP on 4th part sys") and #8958 to #8961 ("SP on 5th part sys" to "SP on 8th part sys")). Up to two spindles can be designated in each part system. The M (miscellaneous function command value), T (tool command value), and B (2nd miscellaneous function command value) functions are displayed one by one regardless of the value of the parameter (#12005 Mfig M count, #12009 Tfig T count, or #12011 Bfig B count). However, the B (2nd miscellaneous function command value) function is displayed or hidden depending on the value of the parameter (#1170 M2name 2nd miscellaneous code).

(*2) The menu [MST Chg] is not available in the following cases:

•The parameter "#8001 WRK COUNT M" is set to "0".

•"F" is set to the low-order byte of parameters #8925 to #8928 ("SP on 1st part sys" to "SP on 4th part sys") and #8958 to #8961 ("SP on 5th part sys" to "SP on 8th part sys"), or the parameter "#1039 spinno" is set to "1".

(*3) When the number of spindles is set to "1" or only one spindle is displayed depending on the operation parameters (#8925 to #8928 ("SP on 1st part sys" to "SP on 4th part sys") and #8958 to #8961 ("SP on 5th part sys" to "SP on 8th part sys")), the load meter of the target spindle is displayed at the position at which the second spindle is to be displayed.

<2-part/3-part system simultaneous display: Dual counter>

There are the following six types of MSTB displays, which are toggled each time the menu [MST Chg] is pressed.

- MSTB display type (*1)
- S display type 1
- S display type 2
- MTB display type (2-part system simultaneous display only)
- MTB + Workpiece machining count display type
- MSTB + Workpiece machining count display type (*1)

(*1) When the number of spindles is set to "1" or only one spindle is displayed depending on the operation parameters (#8925 to #8928 ("SP on 1st part sys" to "SP on 4th part sys") and #8958 to #8961 ("SP on 5th part sys" to "SP on 8th part sys"), the load meter of the target spindle is displayed at the position at which the second spindle is to be displayed.

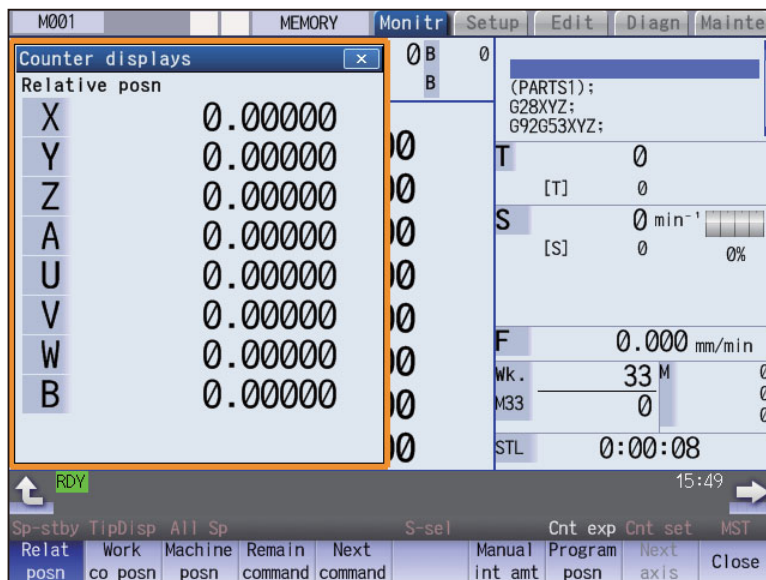
Customizing the screen display (Select display area (parameter "#8973 Selective display" = "1"))

A part of the monitor screen (normal view) can be customized to suit user's need (to display data which a user always needs to refer to). The select display area shows the screen that is selected using the parameter "#8940 Set select display".

10.2.6 Counter All-axis Display



A counter for all axes opens as a pop-up display.
The type of displayed counter can be selected with the menu.



Menus

Menus	Description
Relat posn	This displays the currently executed position.
Work co posn	This displays the G54 to G59 workpiece coordinate system modal No. and the workpiece coordinate position in that workpiece coordinate system.
Machine posn	This displays the coordinate position of each axis in the basic machine coordinate system having a characteristic position, specified by the machine, as a zero point.
Remain command	This displays the remaining distance of the movement command being executed during automatic start or automatic halt. (The remaining distance is the incremental distance from the current position to the end point of that block.)
Next command	This displays the details of the command in the block executed after the block currently being executed.
Manual int amt	This displays the amount moved with the manual mode while the manual absolute switch was OFF. When the parameter "# 8173 Hold intr amount" is set to "0", interrupt amount is cleared by pressing the reset button.
Program posn	This displays the value obtained by subtracting the tool compensation amount compensated for that axis from the position actually being executed for each axis. When the parameter "# 8173 Hold intr amount" is set to "0", interrupt amount is cleared by pressing the reset button.
Close	This closes the pop-up window and quits this function.
Tip wk posn	This displays the position of the tool center from the workpiece coordinate reference position in the selected workpiece coordinate system.
Tip machine	This displays the position of the tool center from the machine coordinate system reference position in the machine coordinate system.
Pulse	This displays the amount moved in the selected axis direction using the manual pulse generator in the hypothetical machine coordinate system. Basically this is updated only when manual ABS is OFF. If "#7905 NO_ABS" is set to "1", this will be updated regardless of the manual ABS ON/OFF.
Table co posn	This displays the table coordinate.
Wk Comp co posn	This displays the workpiece installation position coordinate.
Incline co posn	This displays the inclined surface coordinate.
Next axis	This switches the axis to be displayed on the counter. This switches the axes to be displayed on the counter between "1st axis to 12th axis" and "13th axis or after".

Note

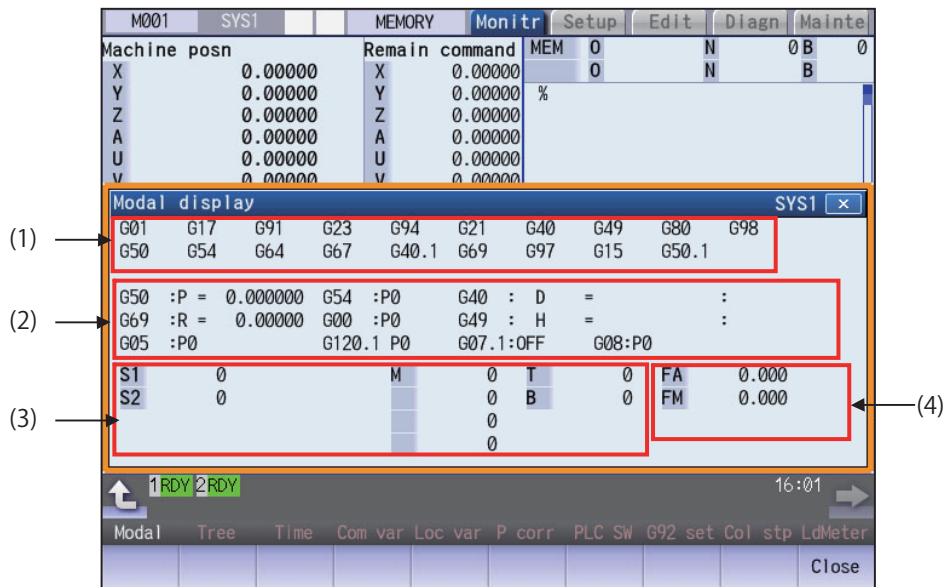
- (1) The type of counter displayed first when the pop-up display appears is the relative position. If the 5-axis-related additional specification is ON, the counter will be the "Tip wk posn". The counter which appears next is the type selected previously.
- (2) The menu [Tip wk posn], [Tip machine], [Pulse] and [Table co posn] appear when the 5-axis-related additional specification is ON.
- (3) The menu [Wk Comp co posn] is displayed when the workpiece installation error compensation specification is ON.
- (4) The menu [Incline co posn] is displayed when the inclined surface machining command specification is valid.
- (5) The menu [Incline co posn] is displayed when one of the additional specifications (inclined surface machining command, simple inclined surface machining command or R-Navi) is valid.

10.2.7 Modal Display



The state of each modal during automatic operation is displayed.
 The displayed details differ for the M system and L system.

<M system>



Even if operating area is switched in the 2-part system simultaneous display, the position of the pop-up window will not change. It is always displayed at the bottom of the screen.

Display Items

Display items	Description
(1) G modal list	<p>The list below shows the G command modal status of the currently executed groups 1 to 20 or group 24.</p> <p>Each item displays the following information.</p> <p>G00: Displays the G command modal status of the currently executed group 1. G17: Displays the G command modal status of the currently executed group 2. : Displays the G command modal status of each group in sequence. G50.1: Displays the G command modal status of the currently executed group 19.</p>

Display items	Description
(2) Details of G modal	This item displays detailed information of the G command modal status of the currently executed group. Each item displays the following information.
G50 :P= 0.000000	Scaling factor
G54.1:P1	Workpiece coordinate system offset No.
G42 : D 10= 0.000000: 0.000000 G42: D10: = 0.000000: 0.000000	Tool radius compensation modal Offset num Shape compensation amount of tool radius Tool radius wear amount
G69 :R = 0.000	Coordinate rotation angle (Displayed in the range of $\pm 360^\circ$.)
G54.4:P1	Workpiece installation error compensation No.
G43 :ZH 50= 0.000000: 0.000000 G43: Z H50 = 0.000000: 0.000000	Tool length compensation modal Compensation axis name Offset num Offset Tool length wear amount
G43 :ZH 50= 0.000000: 0.000000 G43: Z H50 = 0.000000: 0.000000	Tool length compensation modal Compensation axis name Offset num Offset Tool length wear amount
G05.1:P1000 (Display example) G05 :P0 G05.1: Q1 G05.1: Q2 G05 :P10000 G05 :P1 G05 :P2	High-speed machining mode High-speed high-accuracy control I Spline interpolation High-speed high-accuracy control II (SSS control OFF) High-speed machining mode I High-speed machining mode II
VAC CSC SFR SSS (*1)	Variable-acceleration pre-interpolation acceleration/ deceleration enabled Corner smooth control enabled Smooth fairing ON SSS enabled
G120.1 P1 Q1 (Display example) G120.1 P0 G120.1 P1 Q2 (*2)	Machining Condition Selection I Reference parameter selected Each machining condition parameter selected Pn: (n=1 to 3) Machining purpose Qm: (m=1 to 3) Condition
G07.1: ON G07.1: OFF	Cylindrical interpolation modal (Fixed to G07.1) Cylindrical interpolation mode (ON/OFF)
G08: P0 G08: P1	High-accuracy control mode OFF High-accuracy control mode ON

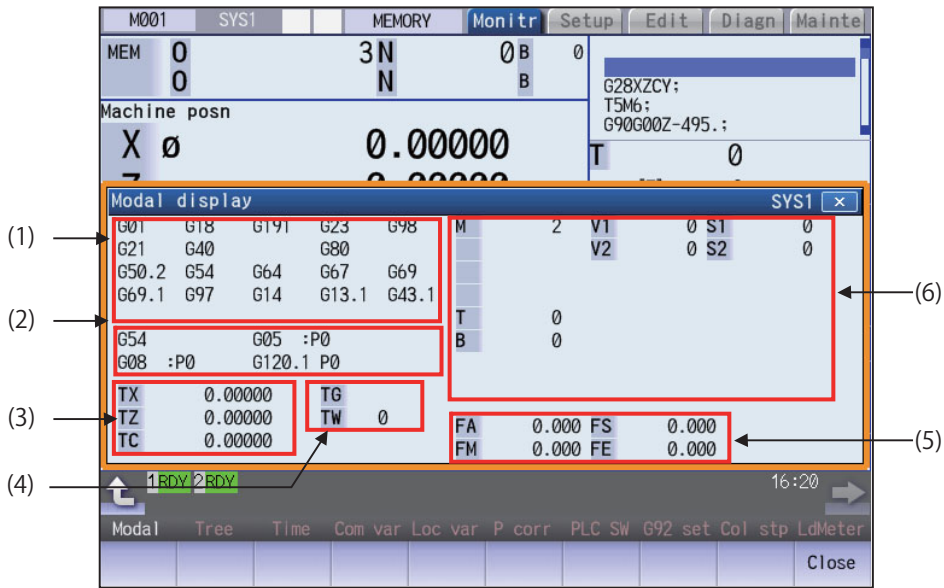
Display items	Description
(3) MSTB display area	<p>This area displays the program command modal value for each of the currently executed commands.</p> <p>Each item displays the following information.</p> <ul style="list-style-type: none"> ♦S command ♦M command ♦T command ♦2nd miscellaneous function (B) command <p>The number of S displays varies depending on the value of the parameter "#1039 spinno" (Number of spindles).</p> <p>The number of M displays varies depending on the value of the parameter "#12005 Mfig" (M count).</p> <p>The number of T or B displays is set to "1" regardless of the value of the parameters "#12009 Tfig" (T count) and "#12011 Bfig" (B count). However, for the B display, the value is displayed or hidden depending on the value of the parameter (#1170 M2name 2nd miscellaneous code).</p> <p>For the T display, only the tool number is displayed regardless of the value of the parameter "#11038 T disp type".</p>
(4) F modal display area	<p>This area displays the F modal value and manual feedrate.</p> <p>FA: Displays the program command F modal value of the currently executed command.</p> <p>FM: Displays the manual feedrate.</p>

(*1) Displays the current control mode. When multiple control modes are enabled simultaneously, one of them is displayed in the order in which the priority is higher. (The priority is higher beginning at the top.)

(*2) G121 command: Machining Condition Selection I Cancel

Changes to the machining condition selection command that is selected in [Setup] - [MacCond] screen.

<L system>



Even if operating area is switched in the 2-part system simultaneous display, the position of the pop-up window will not change. It is always displayed at the bottom of the screen.

Display Items

Display items	Description
(1) G modal list	<p>The list below shows the G command modal status of the currently executed groups 1 to 20 or group 24 (*1).</p> <p>Each item displays the following information.</p> <p>G00: Displays the G command modal status of the currently executed group 1. G17: Displays the G command modal status of the currently executed group 2. : Displays the G command modal status of each group in sequence. G43.1: Displays the G command modal status of the currently executed group 19.</p>

Display items	Description																																						
(2) Details of G modal	<p>This item displays detailed information of the G command modal status of the currently executed group. Each item displays the following information.</p> <table border="1"> <tr> <td>G54.1:P10</td> <td>Workpiece coordinate system offset No.</td> </tr> </table> <p>The data format of the workpiece coordinate system offset number is as follows:</p> <table border="1"> <tr> <td>G5x :P (x = 4 to 9)</td> <td>G54 Workpiece coordinate system selection 1 G55 Workpiece coordinate system selection 2 G56 Workpiece coordinate system selection 3 G57 Workpiece coordinate system selection 4 G58 Workpiece coordinate system selection 5 G59 Workpiece coordinate system selection 6</td> </tr> <tr> <td>G54.1: Pyy (yy = 1 to 96)</td> <td>G54.1 Workpiece coordinate system selection The number of extension sets is assigned to 0, 48, or 96 sets depending on the additional specifications.</td> </tr> </table> <p>When the high-speed machining mode, high-speed high-accuracy control, or direct command mode specification is enabled, the status of the high-speed machining mode, high-speed high-accuracy control, or direct command mode is displayed.</p> <table border="1"> <tr> <td>G05 :P0</td> <td>OFF</td> </tr> <tr> <td>G05 :P1</td> <td>High-speed machining mode I ON</td> </tr> <tr> <td>G05 :P2</td> <td>High-speed machining mode II ON</td> </tr> <tr> <td>G05.1: Q0</td> <td>High-speed high-accuracy control I OFF</td> </tr> <tr> <td>G05.1: Q1</td> <td>High-speed high-accuracy control I ON</td> </tr> <tr> <td>G05 :P10000</td> <td>High-speed high-accuracy control II ON</td> </tr> <tr> <td>G05 P4</td> <td>Direct command mode ON</td> </tr> </table> <p>Displays the current control mode. When multiple control modes are enabled simultaneously, one of them is displayed in the order in which the priority is higher. (The priority is higher beginning at the top.)</p> <table border="1"> <tr> <td>VAC</td> <td>Variable-acceleration pre-interpolation acceleration/deceleration enabled</td> </tr> <tr> <td>CSC</td> <td>Corner smooth control enabled</td> </tr> <tr> <td>SFR</td> <td>Smooth fairing ON</td> </tr> <tr> <td>SSS</td> <td>SSS enabled</td> </tr> </table> <p>When the high-accuracy control specification is enabled, the status of the high-accuracy control mode is displayed.</p> <table border="1"> <tr> <td>G08:P0</td> <td>High-accuracy control mode OFF</td> </tr> <tr> <td>G08:P1</td> <td>High-accuracy control mode ON</td> </tr> </table> <p>Displays the currently selected machining condition parameter group. * If the reference parameter is selected, "G120.1 P0" is displayed.</p> <table border="1"> <tr> <td>G120.1 P1 Q2 (Display example)</td> <td>Machining Condition Selection I</td> </tr> <tr> <td>G120.1 P0</td> <td>Reference parameter selected</td> </tr> <tr> <td>G120.1 P1 Q1 (*2)</td> <td>Each machining condition parameter selected Pn: (n=1 to 3) Machining purpose Qm: (m=1 to 3) Condition</td> </tr> </table>	G54.1:P10	Workpiece coordinate system offset No.	G5x :P (x = 4 to 9)	G54 Workpiece coordinate system selection 1 G55 Workpiece coordinate system selection 2 G56 Workpiece coordinate system selection 3 G57 Workpiece coordinate system selection 4 G58 Workpiece coordinate system selection 5 G59 Workpiece coordinate system selection 6	G54.1: Pyy (yy = 1 to 96)	G54.1 Workpiece coordinate system selection The number of extension sets is assigned to 0, 48, or 96 sets depending on the additional specifications.	G05 :P0	OFF	G05 :P1	High-speed machining mode I ON	G05 :P2	High-speed machining mode II ON	G05.1: Q0	High-speed high-accuracy control I OFF	G05.1: Q1	High-speed high-accuracy control I ON	G05 :P10000	High-speed high-accuracy control II ON	G05 P4	Direct command mode ON	VAC	Variable-acceleration pre-interpolation acceleration/deceleration enabled	CSC	Corner smooth control enabled	SFR	Smooth fairing ON	SSS	SSS enabled	G08:P0	High-accuracy control mode OFF	G08:P1	High-accuracy control mode ON	G120.1 P1 Q2 (Display example)	Machining Condition Selection I	G120.1 P0	Reference parameter selected	G120.1 P1 Q1 (*2)	Each machining condition parameter selected Pn: (n=1 to 3) Machining purpose Qm: (m=1 to 3) Condition
G54.1:P10	Workpiece coordinate system offset No.																																						
G5x :P (x = 4 to 9)	G54 Workpiece coordinate system selection 1 G55 Workpiece coordinate system selection 2 G56 Workpiece coordinate system selection 3 G57 Workpiece coordinate system selection 4 G58 Workpiece coordinate system selection 5 G59 Workpiece coordinate system selection 6																																						
G54.1: Pyy (yy = 1 to 96)	G54.1 Workpiece coordinate system selection The number of extension sets is assigned to 0, 48, or 96 sets depending on the additional specifications.																																						
G05 :P0	OFF																																						
G05 :P1	High-speed machining mode I ON																																						
G05 :P2	High-speed machining mode II ON																																						
G05.1: Q0	High-speed high-accuracy control I OFF																																						
G05.1: Q1	High-speed high-accuracy control I ON																																						
G05 :P10000	High-speed high-accuracy control II ON																																						
G05 P4	Direct command mode ON																																						
VAC	Variable-acceleration pre-interpolation acceleration/deceleration enabled																																						
CSC	Corner smooth control enabled																																						
SFR	Smooth fairing ON																																						
SSS	SSS enabled																																						
G08:P0	High-accuracy control mode OFF																																						
G08:P1	High-accuracy control mode ON																																						
G120.1 P1 Q2 (Display example)	Machining Condition Selection I																																						
G120.1 P0	Reference parameter selected																																						
G120.1 P1 Q1 (*2)	Each machining condition parameter selected Pn: (n=1 to 3) Machining purpose Qm: (m=1 to 3) Condition																																						
(3) Tool length and wear compensation amount display area	<p>This area displays the tool length and wear compensation amount.</p> <p>TX: Displays the sum of the tool length and wear compensation amount of the first axis for the tool in use. (*3)</p> <p>TZ: Displays the sum of the tool length and wear compensation amount of the second axis for the tool in use. (*3)</p> <p>TY: Displays the sum of the tool length and wear compensation amount of the additional axis for the tool in use. (*4)</p> <p>TC: Displays the sum of the tool length and wear compensation amount of the second additional axis for the tool in use. (*5)</p>																																						

Display items	Description
(4) Compensation number display area	This area displays the compensation number. TG: Displays the tool length compensation number. TW: Displays the wear compensation number.
(5) F modal area	This area displays the F modal value and manual feedrate. FA: Displays the program command asynchronous feedrate modal value of the currently executed command. FM: Displays the manual feedrate. FS : Displays the program command synchronous feedrate modal value of the currently executed command. FE : Displays the thread lead command synchronous feedrate modal value of the currently executed command.
(6) MSTB area and constant surface speed control (constant surface speed S) area	<p><MSTB area></p> <p>This area displays the program command modal value for each of the currently executed commands.</p> <p>Each item displays the following information:</p> <ul style="list-style-type: none"> ♦S command ♦M command ♦T command ♦2nd miscellaneous function (B) command <p>The number of S displays varies depending on the value of the parameter "#1039 spinno" (Number of spindles).</p> <p>The number of M displays varies depending on the value of the parameter "#12005 Mfig" (M count).</p> <p>The number of T or B displays is set to "1" regardless of the value of the parameter "#12009 Tfig" (T count) and "#12011 Bfig" (B count). However, for the B display, the value is displayed or hidden depending on the value of the parameter (#1170 M2name 2nd miscellaneous code).</p> <p>For the T display, only the tool number is displayed regardless of the value of the parameter "#11038 T disp type".</p>

(*1) The status of group 24 command modal is displayed only when the specification for G code switch of program format is valid and the parameter "#1254 set26/bit1" is set to "1".

(*2) G121 command: Machining Condition Selection I Cancel
Changes to the machining condition selection command that is selected in [Setup] - [MacCond] screen.

(*3) Displays the axis name that is set to the first and second axes in the part system for the base axis specification parameter "#1013 axname". (If no axis name is set to "#1013 axname", the axis name item is blank.)

(*4) When the parameter "#1281 ext17 bit1" (tool offset additional axis selection) is set to "0", the display will change as follows by the parameter "#1520 Tchg34" (additional axis tool) setting.
#1520 Tchg34 = 0: Displays the axis name configured as the third axis in the part system by the parameter "1013 axname".

#1520 Tchg34 = 1: Displays the axis name configured as the 4th axis in the part system.

(If no axis name is set to "#1013 axname", the axis name item is blank.)

When the parameter "#1281 ext17 bit1" (tool offset additional axis selection) is set to "1", the name of the axis designated by the parameter "#1027 base_J" (basic axis J) is displayed. (If the axis name designated in "#1027 base_J" is not set to "#1013 axname", the axis name item is blank.)

In the two-axis configuration system, the third row is not displayed.

(*5) The axis name which is designated by the parameter "#12104 2nd add T-ofs set" (2nd additional axis tool offset setting) is displayed. The 4th line is not displayed when the parameter "#12103 2nd add T-ofs ON" (2nd additional axis tool offset ON) is not configured.

Menus

Menus	Description
Close	This closes the pop-up window and quits this function.

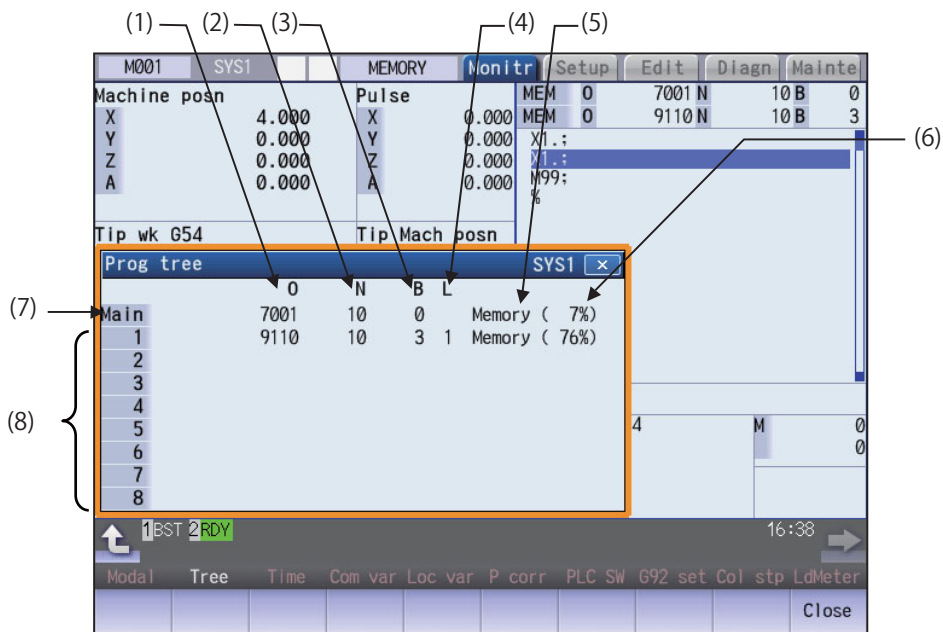
Note

(1) The menu is common for the M system and L system.

10.2.8 Program Tree Display



This displays the main program, subprogram, MDI interrupt and user macro call nesting structure. This also displays the execution position of the main program and the subprogram (the lowest level of the nest only) as a percentage during the automatic operation.

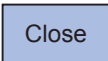


Display Items

Display Items	Description
(1) O	Program No. (0 to 15 characters) If the program No. (program name) exceeds 15 characters, "*" will appear at the 15th character.
(2) N	Sequence No. (0 to 99999999)
(3) B	Block No. (0 to 99999)
(4) L	Remaining number of subprogram repetitions (0 to 99)

Display Items	Description
(5) Devices	Operation device (0 to 7 characters) Displays the program storage device and MDI interruption. Memory: NC Memory HD: Hard disk Memory card: Memory card DS: Data server RS-232C: NC Serial MDI: MDI interruption USB Memory: USB Memory
(6) (%)	Program execution rate display Assuming the whole machining program size as 100%, the execution position during an automatic operation is displayed in % (percentage). When the automatic operation is not executed, 0% is displayed for the main program's percentage display. The subprogram's percentage is displayed only for the lowest level of the nest and other subprograms will display blank.
(7) Main	Main program
(8) 1 to 10	Called subprogram, user macro call and MDI interrupt

Menus

Menus	Description
	This closes the pop-up window and quits this function.

Precautions

- (1) Calling the subprogram in the subprogram (M98) is available up to 10 nest levels, in case the main program is counted as 0. If it exceeds the limit, a program error occurs.
- (2) Calling the subprogram of user macro is available from level 1 to 4.
- (3) Nesting level call is available up to 10 nest levels in total of subprogram call, user macro call and MDI interruption.
- (4) Subprogram called by fixed cycle is not displayed.

10.2.9 Integrated Time Display

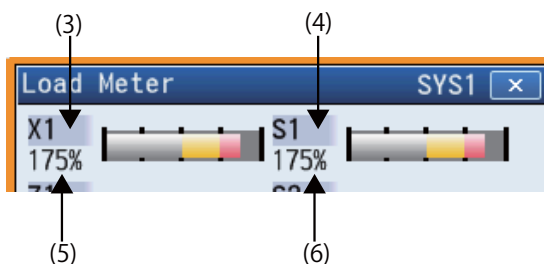
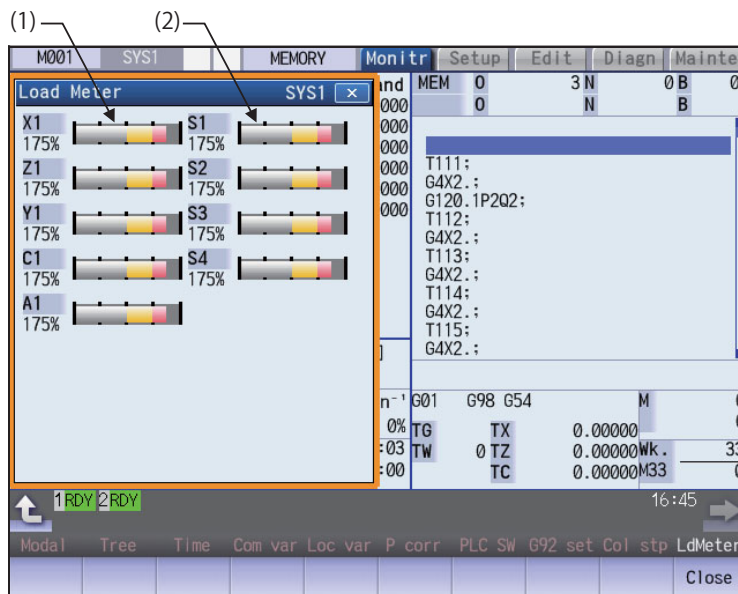


For details, refer to "9.3.1 Integrated Time Display".

10.2.10 Load Meter Display



The spindle load and Z axis load, etc., are displayed.



Display Items

Display Items	Description
(1) NC axis load meter	Up to eight NC axes loads (%) are displayed. The display color of graph is switched in accordance with the NC axis load. The threshold values of cautions (yellow) and warning (red) are determined according to the parameters (#2636 to #2638).
(2) Spindle load meter	Up to eight spindles loads (%) are displayed. The graph display color varies depending on the spindle load value. The threshold values of cautions (yellow) and warning (red) are determined according to the parameters (#3192 to #3194).
(3) NC axis name	This displays the axis name set with the parameter "#1022 axname2".
(4) Spindle name	This displays "S" + "Spindle No.".
(5) Load current (%)	This displays the NC axis load current.
(6) Load(%)	This displays the spindle motor load.

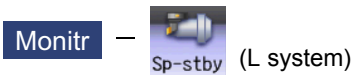
Menus

Menus	Description
Close	This closes the pop-up window and quits this function.

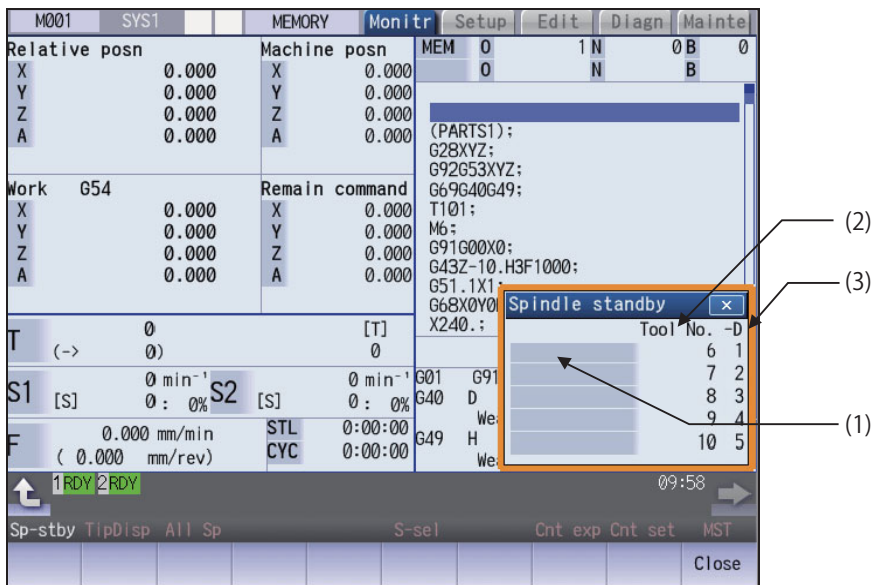
Note

(1) Due to the specifications issued by MTB, pressing the menu [Load meter] without setting ON load meter display causes an error.

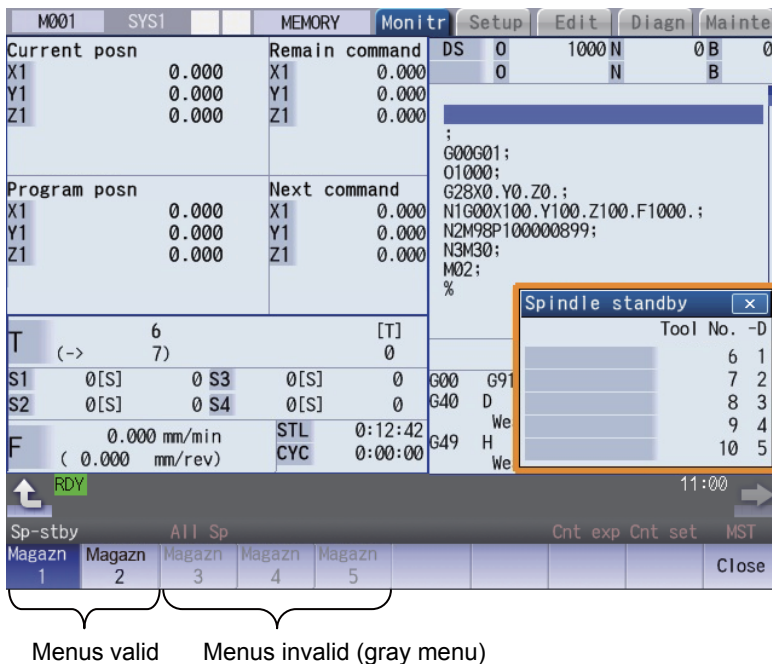
10.2.11 Spindle, Standby Display



The current spindle tool No. and the standby tool No. (a maximum of 4 tools) are displayed.



<"#11054 Sp-stby disp type" is set to "1">



Display Items

Display Items	Description
(1) Spindle standby	The name of this area differs depending on the output from the PLC program.
(2) Tool No.	This displays spindle or standby tool No. Spindle/standby display for each magazine varies depending on the setting of the parameter "#11054 Sp-stby disp type".
(3) -D	For D data function and purpose, refer to the instruction manual issued by the MTB.

Menus

Menus	Description
Magazn 1	This switches the spindle/standby display for each magazine. This menu can be switched when the parameter "#11054 Sp-stby disp type" is set to "1". When the parameter is set to "0", this menu is invalid (not displayed).
:	
Magazn 5	The selectable menu differs according to the machine specifications. If there are two magazines, the menus [Magazn 1] and [Magazn 2] only are selectable. The other menus will be grayed out and non-selectable.
Close	This closes the pop-up window and quits this function.

Precautions

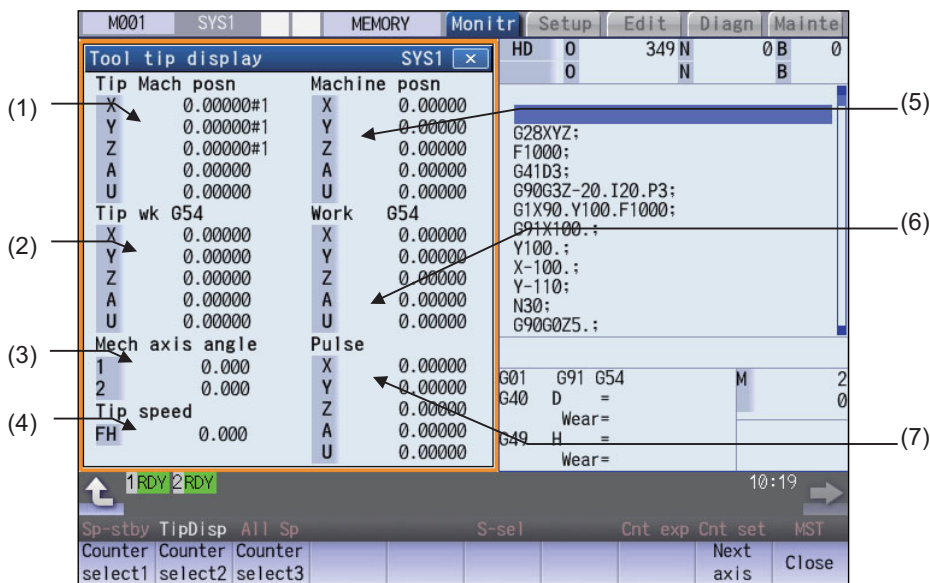
- (1) The number of the standby tool to be displayed can be changed by changing the value of bit 8 to F of ATC control parameter (R10600).
- (2) If the spindle/standby display is set not to be displayed by user PLC, when the menu [Sp-stby] is pressed, the operation message "Spindle/stndby tool display not possible" appears.

10.2.12 Tool Center Coordinate Display



The tool center coordinates, handle interrupt amount (tool axis movement) and tool center point speed are displayed by the following functions: the tool center point control function, the tool length compensation along tool axis function and the tool handle feed & interrupt function (handle feed along the tool axis, tool handle interrupt, tool diameter direction handle feed, nose center rotation handlefeed)

This function is an additional specification. The 5-axis related specification (tool center point control, tool length compensation along the tool axis, tool handle feed & interruption, workpiece installation error, inclined surface machining command, simple inclined surface machining command, and 3-dimensional tool radius compensation (tool's vertical-direction compensation), 3-dimensional tool radius compensation (tool's vertical-direction compensation), 3-dimensional manual feed, or R-Navi) is required.



Display Items

Display Items	Description
(1) Tip Mach posn	This displays the position of the tool center from the machine coordinate system reference position in the machine coordinate system.
(2) Tip wk G54	This displays the position of the tool center from the workpiece coordinate reference position in the selected workpiece coordinate system.
(3) Mech axis angle	This displays the rotation angle when using the mechanical axis. 1st rotary axis angle: R2628 (L)/R2629 (H) 2nd rotary axis angle: R2630 (L)/R2631 (H)
(4) Tip speed	This displays the movement speed of tool center. By the parameter "#1125 real_f", actual feedrate and command speed can be switched.
(5) Counter display1	The counter type can be selected from the menu.
(6) Counter display2	The following counters are displayed by default.
(7) Counter display3	Counter display 1: Machine position counter Counter display 2: Workpiece position counter Counter display 3: Tool axis movement counter

Note

- (1) Status abbreviations are displayed only in "Tip Mach posn" counter area. They are not displayed in other counter area.
- (2) The data for 5 axes can be displayed in each counter. In case the number of valid axis is 6 or more, and you want to display the 6th and subsequent axes, press the menu [Next axis] to switch display.

Menu

Menu	Description
Counter select1	Select the counter type to display on "the counter display 1 to 3". It is valid after the power is turned ON again.
Counter select2	The counters shown below can be selected. ♦Machine position counter ♦Workpiece coordinate position counter
Counter select3	♦Workpiece installation (*1) ♦Inclined surface (*2) ♦Tool axis movement
Next axis	This changes the displayed axes each counter.
Close	This closes the pop-up window and quits this function.

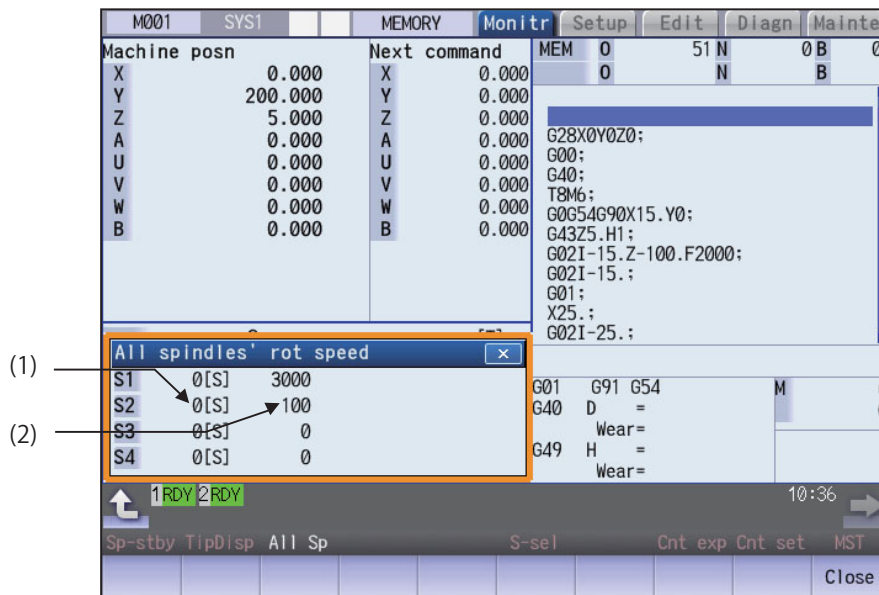
(*1) It cannot be selected when the workpiece installation error compensation specification is not valid.

(*2) This item cannot be selected when all of three additional specifications (inclined surface machining command, simple inclined surface machining command and R-Navi) are invalid.

10.2.13 All Spindles' Rotation Speed Display



The command rotation speed and actual rotation of all spindles are displayed.
 This function only displays the value. It is not possible to operate here.



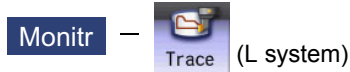
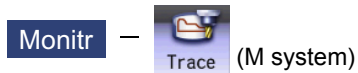
Display Items

Display Items	Description
(1) Spindles' command rotation speed	This displays the spindles' command rotation speed (S command value).
(2) Spindles' actual rotation speed	This displays the spindles' actual rotation speed (r/min).

Menus

Menus	Description
Close	This closes the pop-up window and quits this function.

10.3 Checking the Movement under Machining (Trace Screen)



This function illustrates the actual machine's movement path or tool center point movement path, and draws the actual machine movement. This allows the machine operation to be monitored during machining. Pressing [Trace ON] changes to the machine position trace mode and pressing [Tip traceON] changes to the tool center point trace mode.

The programs that can be traced are operation searched machining programs (MDI program for MDI mode).

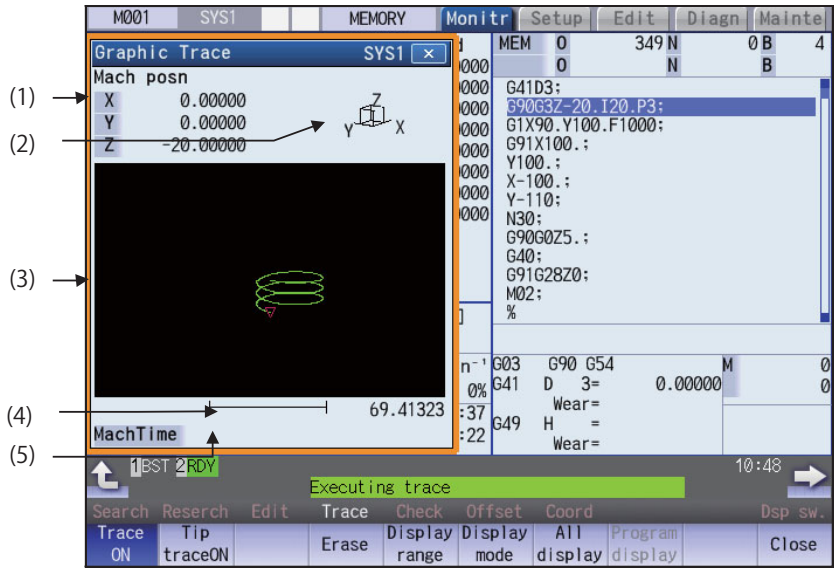
If no program has been operation searched, the trace window will not open.

Using the menu [All display], normal display and whole display modes can be switched.

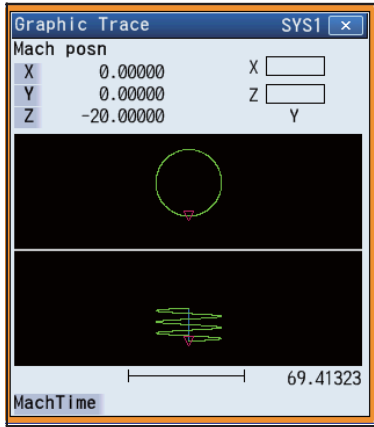
Note

- (1) The tool center point trace function is an additional specifications. The 5-axis-related specification (tool center point control, tool length compensation along the tool axis, tool handle feed & interruption, workpiece installation error, inclined surface machining command, simple inclined surface machining command and 3-dimensional tool radius compensation (tool's vertical-direction compensation), 3-dimensional tool radius compensation (tool's vertical-direction compensation), 3-dimensional manual feed, or R-Navi) is required.

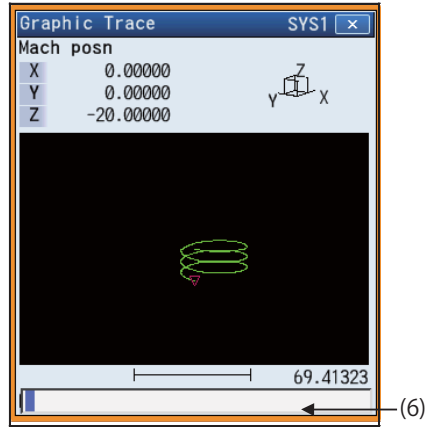
■ Normal display ([All display] is OFF)



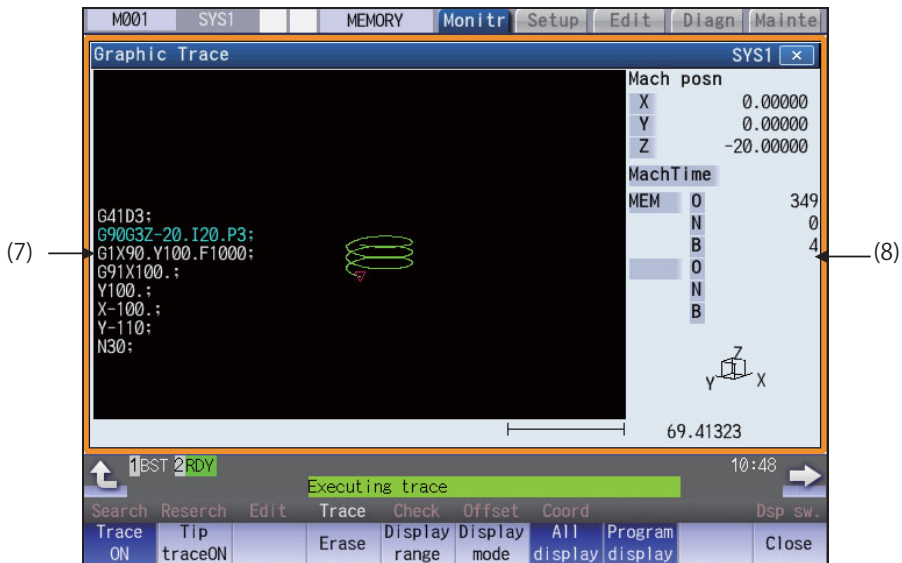
<2-plane drawing area>



<Displaying input area>



■ Full-screen display ([All display] is ON)



Display Items

Display items	Description
(1) Counter	<p>The counter of the axis targeted for the trace drawing is displayed. The three axes which are displayed are set with the parameters.</p> <p>The counter selected by the menu "Counter type" is displayed.</p> <p>The counter type displayed can be set for [Trace ON] and [Tip traceON] separately. And the setting is held even after the power is turned OFF and ON.</p> <p>The default setting is as follows: [Trace ON]: depends on the setting of "#1231 set03 (bit4)". (0: The machine position counter (Mach posn), 1: The workpiece coordinate position counter (Work co posn)) [Tip traceON]: The machine position of the tool center point counter (Tip Mach posn)</p>
(2) Display mode	The plane currently being drawn is displayed.
(3) Trace drawing area	<p>This area is used to draw the tool path as graphics.</p> <p>A movement path is drawn as shown below: Trace mode "#1231 set03(bit1)" = "0": Machine position "#1231 set03(bit1)" = "1": Tool position Tool center point trace mode: Tool center machine position</p> <p>The zero point to be displayed is as follows: Machine position trace mode: The zero point can be switched between the machine position zero point and workpiece coordinate position zero point with parameter "#1231 set03(bit4)". Tool center point trace mode: The machine position of tool center point zero point</p>
(4) Scale	The display range scale is displayed. The unit is set to [mm/100pixel] in millimeters and [inch/100pixel] in inches.
(5) Machining time display	The time required for machining is calculated and displayed. Nothing is displayed during tracing.
(6) Input section	<p>The input area appears when the menu [Display range] and [Display mode] are pressed.</p> <p>The scale value and display mode are set.</p> <p>The input area is hidden when the [INPUT] key is pressed.</p>
(7) Program display	<p>At the full screen display, the contents of the machining program that is in the process of drawing are displayed.</p> <p>The block currently being executed is displayed in blue characters.</p>
(8) Program No. display	<p>At the full screen display, the program number, sequence number, and block number which are currently being executed are displayed.</p> <p>While a subprogram is executed, its program number, sequence number, and block number are displayed.</p>

Menus

Menus	Description
Trace ON	This activates the trace mode. If any program is currently running, the machine position path or tool position path is traced from the current position. If this menu is pressed during the trace mode, the trace mode will be turned OFF.
Tip traceON	This activates the tool center point trace mode. If any program is currently running, the path of tool center point machine position path or tool position path is traced from the current position. If this menu is pressed during the tool center point trace mode, the trace mode will be turned OFF. Note that this menu does not appear if the 5-axis-related additional specification is OFF.
Erase	This erases the data in graphic drawing area displayed on the screen.
Display range	This changes the graphic drawing display range. When this menu is pressed, the menu changes to the display range change menu. The input area appears. It is also possible to designate the scale value with numerical input. When the display range is changed, the graphic data displayed on the screen is erased.
Display mode	This changes the drawing plane. When this menu is pressed, the menu changes to the display mode change menu. There are three types of graphic drawing mode: 1-plane, 2-plane, and 3-dimension. This changes the drawing plane and erases the graphic data displayed on the screen.
All display	This switches the normal display mode and the full-screen display mode.
Program display	This displays the currently executed program on the graphic drawing area. However, machining program contents being in the program lock state is not displayed. Only "%" is displayed. This menu can be selected only when the full-screen display mode is applied.
Rotate	This sets the viewpoint angle for the 3-dimension display mode. When the viewpoint angle is changed, the graphic data displayed on the screen is erased. However, this menu cannot be used for other than the 3-dimension display mode.
Std range	The display range (scale and display position) is automatically set from the machine movable area. The machine movable area is set with the parameters "#2013 OT-" and "2014 OT+" (software limit). When the display range is changed, the graphic data displayed on the screen is erased.
Counter type	This displays the selected counter. For each trace mode, the counter type can be set separately. And the setting is held after the power is turned OFF and ON. However, if the menu [Trace ON] or [Tip traceON] is not highlighted, this is grayed out and non-selectable.
Next axis	This changes the axis to be displayed on the counter. This switches between "the basic axes IJK" and "C axis". <Note> ♦This menu is grayed out and non-selectable in the following cases: - When the control axis address other than C is specified in the parameter "#19405 Rotary ax drawing". - When the C axis is specified by the parameter "#1026 base_I", "#1027 base_J", or "#1028 base_K". - When the "Graphic check/trace rotary axis drawing" specification is invalid
Close	This closes the pop-up window and quits this function.

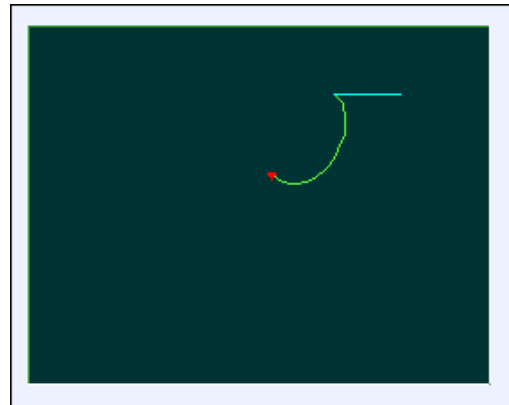
10.3.1 Displaying the Trace

Operation method

(1) Press the main menu [Trace ON].



The menu [Trace ON] is highlighted.
 If [Tip TraceON] is highlighted, unhighlight it.
 The machine position appears in the drawing area as a tool mark.
 The counter selected by the menu [Counter type] is displayed at the counter.
 The message "Tracing" appears.
 After this, the machine position path is drawn with graphics in the trace mode.



The path is drawn with a solid blue and green line.

Press the menu [Trace ON] again to cancel the trace.

Usually, paths are drawn at the machine position. Depending on the parameter setting, paths are drawn at the tool position.

#1231 set03/bit1 (Switch graphic coordinates)

Parameter value	Description
0	Paths are drawn at the machine position.
1	Paths are drawn at the tool position.

Note

- (1) At the machine position, the length compensation and radius compensation are applied to the path.
 At the tool position, only the length compensation is applied to the path. If the compensation direction is changed during the machining, such as the radius compensation, the drawn path does not match the machining path.
- (2) Even if the setting of the parameter "#1231 set03/bit1" is changed, the type of the displayed counter is not switched.
 Press the menu [Counter type] and select the counter to be displayed.
- (3) This parameter does not support the tip position trace mode.

Color of the path drawn by tracing

Manual feed	Drawing at the tool position	Solid line (white)
	Drawing at the machine position	Solid line (blue)
Rapid traverse	Drawing at the tool position	Solid line (white)
	Drawing at the machine position	Solid line (blue)
Cutting feed	Drawing at the tool position	Solid line (white)
	Drawing at the machine position	Solid line (green)

10.3.2 Displaying the Machine Position of the Tool Center Point Trace

Operation method

- (1) Press the main menu [Tip TraceON]. ➔ The menu [Tip TraceON] is highlighted. If [Trace ON] is highlighted, unhighlight it. The tool center point appears in the drawing area as a tool mark. The counter selected by the menu [Counter type] is displayed at the counter. The message "Tracing Tip Position" appears. After this, the tool center point path is drawn with graphics in the tool center point trace mode.

Press the menu [Tip traceON] again to cancel the machine position of the tool center point trace.

Note

- (1) Even if the menu is unhighlighted, the displayed counter type does not change. However, when the trace window is closed and displayed again, the displayed counter type will be the trace mode counter.

Color of the path drawn by tracing

Manual feed	Solid line (blue)
Rapid traverse	Solid line (blue)
Cutting feed	Solid line (green)

10.3.3 Changing the Display Range

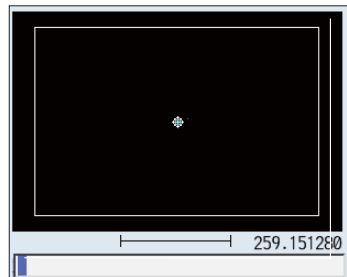
The graphic drawing's scale can be enlarged or reduced, and the position moved or centered.

Operation method (Enlarging the and reducing the drawing)

- (1) Press the menu [Display range]. ➔ A white frame indicating the display range appears on the screen. The display range input mode is activated.
- (2) Press the menu [Zoom in] or [Zoom out]. ➔ The size of the white frame can be changed by using key operations.

To enlarge the figure:
 Press the menu [Zoom in] or [-] key.
 To reduce the figure:
 Press the menu [Zoom out] or [+] key.

A solid-line frame appears with respect to the original scale when enlarging, and a dotted-line frame appears when reducing.



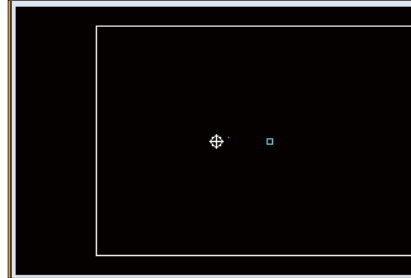
- (3) Press the [INPUT] key. ➔ The display scale changes. By changing the display scale, the graphic data displayed on the screen is erased.

Note

- (1) The changed scale value is held even after the power is turned OFF and ON.

Operation method (Changing the drawing display position)

- (1) Press the menu [Display range]. → A white frame indicating the display range appears on the screen.
The display range input mode is activated.
- (2) Press the menus [↑], [↓], [←], [→] or cursor movement keys [↑], [↓], [←], [→]. → The cursor (⊕) indicating the center of the display and the frame line move up, down, left and right according to the key operations.



- (3) Press the [INPUT] key. → The display position changes so that the cursor position (⊕) is the center of the area.
When display position is changed, the graphic data displayed on the screen is erased.
The scale value is not changed.

Note

- (1) When changing the display range while the 2-plane display mode such as [XY/XZ], the display range (scale and display position) for the upper and lower areas changes in the same manner.
The operation method is the same as the 1-plane display mode.





The white-framed display range in the upper and lower areas simultaneously move to the left/right when the [←], [→] keys are pressed.

The white-framed display range of either upper or lower areas moves up and down when the [↑], [↓] keys are pressed.

Which frame to be moved up/down can be changed with the page key.

Operation method (Centering)

- (1) Press the menu [Display range].  A white frame indicating the display range appears on the screen.
The display range input mode is activated.
- (2) Press the menu [Centering].  The display position is changed so that the current machine position appears in the center of the drawing area.
When display position is changed, the graphic data displayed on the screen is erased.

Note

- (1) In the 2-plane display mode such as "XY/XZ", centering is applied for the upper and lower areas. The operation method is the same as the 1-plane display mode.

Operation method (setting the display scale)

- (1) Select a scale value, and press the [INPUT] key.
(Example) 450 [INPUT]

Note

- (1) The setting range of scale value is as shown below.

#1003 Input setup unit	#1014 I_inch	
	0 (mm)	1 (inch)
B	0.100 to 9999.999	0.0100 to 9999.9999
C	0.0100 to 9999.9999	0.00100 to 9999.99999
D	0.00100 to 9999.99999	0.000100 to 9999.999999
E	0.000100 to 9999.999999	0.0000100 to 9999.9999999

- (2) The set scale value is maintained even after the power is turned OFF and ON.
- (3) If a scale value is entered while the screen is in the two-plane display mode, such as [XY/XZ], the display range (scale value) is changed for the two planes. The operation method is the same as the 1-plane display mode.

10.3.4 Changing the Display Mode

The graphics display mode includes the 1-plane, 2-plane and 3D mode. When the menu [Display mode] is pressed and the following display mode menu is selected, the axis configuration of each plane changes, and the menu display returns to the original state. It is also possible to change the display mode by setting the axis name to the input area.

Note

- (1) When display mode is changed, the graphic data displayed up to that point are erased.
- (2) These set display mode is maintained even after rebooting the machine.
- (3) The display mode can be set independently for the trace function and program check function. These settings are not linked with one another.
- (4) The menu axis names XYZ are compatible with the basic axes IJK. X = base axis I, Y = base axis J, and Z = base axis K.

Display mode menu

Menus	Description
XY	This changes to the 1-plane display mode configured of X-Y. The X axis is displayed in the horizontal axis, and the Y axis is displayed in the vertical axis.
XZ	This changes to the 1-plane display mode configured of X-Z. The X axis is displayed in the horizontal axis, and the Z axis is displayed in the vertical axis.
YX	This changes to the 1-plane display mode configured of Y-X. The Y axis is displayed in the horizontal axis, and the X axis is displayed in the vertical axis.
YZ	This changes to the 1-plane display mode configured of Y-Z. The Y axis is displayed in the horizontal axis, and the Z axis is displayed in the vertical axis.
ZX	This changes to the 1-plane display mode configured of Z-X. The Z axis is displayed in the horizontal axis, and the X axis is displayed in the vertical axis.
ZY	This changes to the 1-plane display mode configured of Z-Y. The Z axis is displayed in the horizontal axis, and the Y axis is displayed in the vertical axis.
XY/XZ	This changes to 2-plane display mode configured of X-Y and X-Z. The X axis is displayed as the horizontal axis, and the Y axis and Z axis are displayed as the vertical axis.
YX/YZ	This changes to 2-plane display mode configured of Y-X and Y-Z. The Y axis is displayed in the horizontal axis, and the X and Z axes are displayed in the vertical axis.
XYZ	This changes to the 3D display mode. A cube is displayed on the lower right of the screen.

Operation method (Changing the display mode)

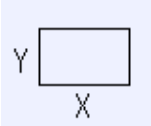
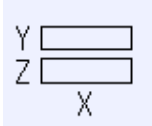
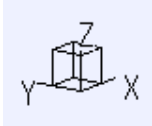
- (1) Press the menu [Display mode]. ➔ The menus for the selectable display modes appear. The input area appears.
- (2) Select the mode to display and press the menu.
(Example) [XY/XZ]

Operation method (Changing the display axis name)

- (1) Press the menu [Display mode]. ➔ The menus for the selectable display modes appear. The input area appears.
- (2) Set the axis name and press the [INPUT] key.
XYC [INPUT] ➔ XYC appears as the axis name in the display mode. The X axis, Y axis and C axis are the three axes for drawing.

There are three types of display mode: 1- plane, 2- plane, and 3D. The display mode currently selected is shown with an image. The selected axis name displays for the image axis name.

Display example

<1-plane> (XY)	<2-plane> (XY/XZ)	<3-dimension> (XYZ)
		

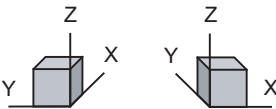
10.3.5 Changing the Display Angle

This is used to set the graphic drawing display angle when in 3-dimension display mode.

Note

- (1) When the display angle is changed, the graphics displayed up to that point are erased.
- (2) The set display angle is maintained even after rebooting the machine.
- (3) The display angle can be set independently at the trace function and program check function. These settings are not linked with one another.
- (4) The set display angle is maintained even after rebooting the machine.

Operation method

- (1) Press the menu [Rotate].
 - (2) Use the menus [↑], [↓], [←], [→] to adjust the display angle. ➔ Rotate the cubic display in the lower right of the screen using the operation keys.
The cursor movement keys ([↑], [↓], [←], [→]) can also be used to rotate.
- 
- (3) Press the [INPUT] key. ➔ The display angle changes. When display angle is changed, the graphic data displayed on the screen is erased.

10.3.6 Displaying the Machining Program on Checking

When pressing the menu [Program display], the contents of the machining program on checking is displayed on the drawing area.

When pressing the menu [Program display] again, the displayed program is erased.

Note that this menu can be used only when the full-screen display mode is selected.

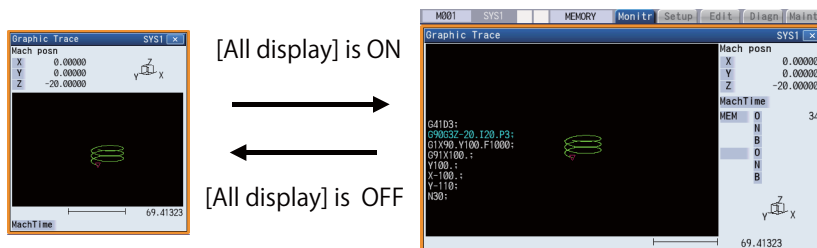
Note

- (1) The selected display mode is maintained even after rebooting the machine.
- (2) The program display mode is applied to the trace function and program check (2D) function commonly.
- (3) The menu [Program display] cannot be selected while the normal display mode is selected. Program display mode is valid only when the full-screen display mode is selected.
- (4) The program display mode is applied commonly to all part systems.

10.3.7 Switching the Full-screen Display Mode

Press the menu [All display] to display the trace window on the whole screen. (full-screen display mode).

Press this menu again to return the normal display.



Note

- (1) The selected display mode is maintained even after rebooting the machine.
- (2) The full-screen display mode is applied to the trace function and program check (2D/3D solid) function commonly.
- (3) The full-screen display mode is applied commonly to all part systems.

10.3.8 Switching the Axis Movement Direction (+, -)

Graphic trace draws the path according to the axis movement direction designated by the parameter "#1495 grf_ax_direction". The movement direction can be set for each axis. For details, refer to "4.1.8 Switching the Axis Movement Direction (+, -)".

10.3.9 Drawing a Path Corresponding to the Rotary Axis

If a rotation axis (C axis) is designated in the parameter "#19405 Rotary ax drawing", the graphic trace draws a path corresponding to the rotary axis. The rotary axis can be set for each part system. For details, refer to "4.1.15 Drawing a Path Corresponding to the Rotary Axis (L System)".

10.3.10 Precautions for Tracing

- (1) When the command speed increases in the trace mode, the shape being drawn with graphics will become distorted. Especially, correct graphic drawing is not possible during machine lock.
- (2) If program check (2D) is executed during the trace mode, the trace mode will be canceled.
- (3) If trace is executed during program check mode, the program check will be canceled.

For other precautions, refer to "4.1.16 Notes for Graphic Check (2D)".

10.4 Restart Search



With this function, the program search can be executed while updating the coordinate values and the modal information in the same manner as an actual program operation.

Therefore, this function enables machining from a block in the middle of the program as if the actual machining was carried out from the beginning.

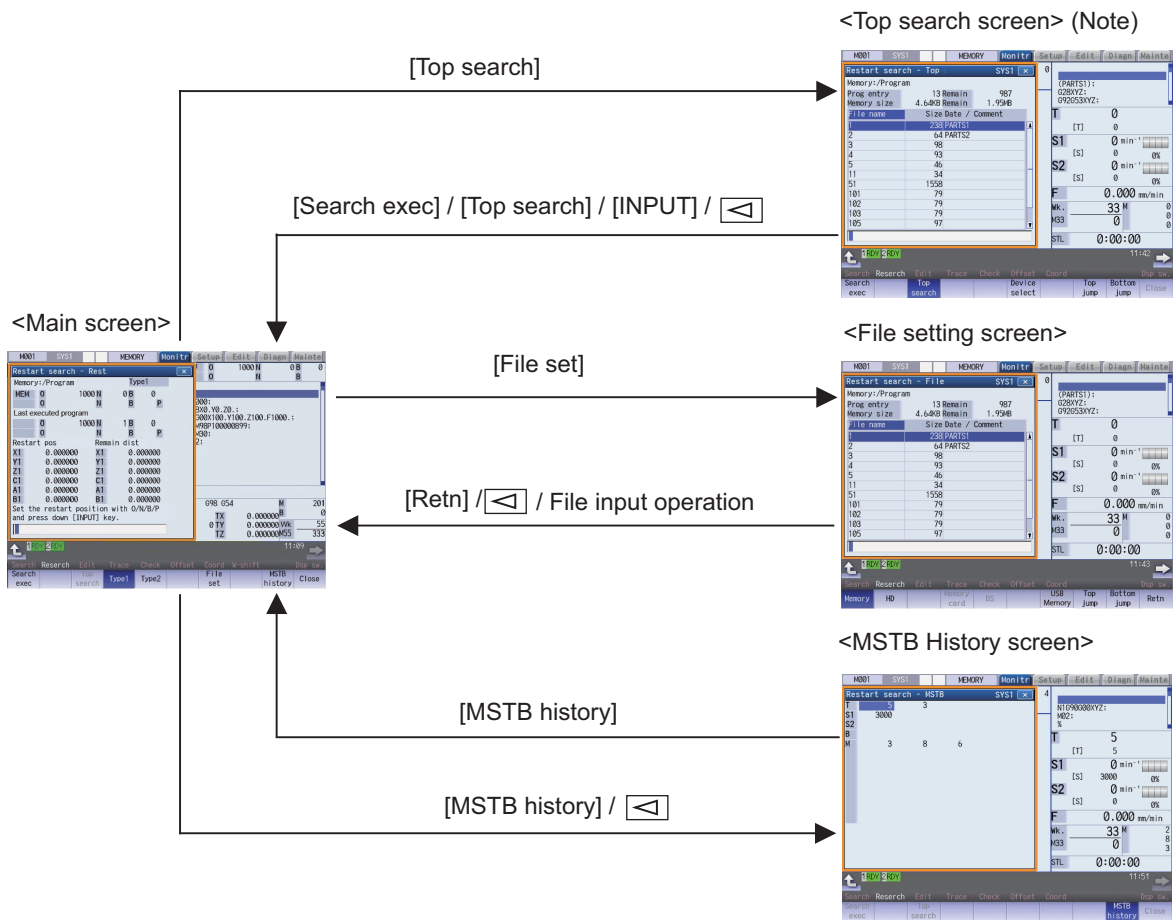
This function is used to restart machining when a machining program is to be resumed after it has been suspended midway due to tool damage or for some other reason.

There are two types of restart, type 1 and type 2.

Restart method	Description				
Restart type 1	<p>After machining is reset due to a tool breakage, etc., machining is restarted from the designated sequence number and/or block number.</p> <p>Only the program which had been executed just before can be restarted.</p> <p>Even after the power is turned ON again, the program can be restarted if the program has been executed before the power supply is turned OFF.</p> <p><Note></p> <ul style="list-style-type: none"> ♦In case that NC has been reset or the power supply has been turned OFF while fixed cycle, custom fixed cycle, MTB macro, or macro interruption is executed, the search with no input to the setting will be performed for each source program. ♦When the user macro is executed, the user macro execution position is searched. 				
Restart type 2	<p>If a machining program different from the machining program to be restarted was run before starting restart search, specify the sequence No. and block No. before restarting the machining.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Automatic top search OFF</td> <td>A top search must be executed from the screen. Then, command a sequence No. and block No., and restart a program.</td> </tr> <tr> <td>Automatic top search ON</td> <td> <p>A top search may not be executed from the screen. A top search is automatically executed, so it is not necessary to execute a top search from the screen. Command a sequence No. and block No., and restart a machining.</p> <p>An arbitrary program can be restarted by designating the program No. When a program No. is omitted, the program currently searched is restarted.</p> </td> </tr> </table>	Automatic top search OFF	A top search must be executed from the screen. Then, command a sequence No. and block No., and restart a program.	Automatic top search ON	<p>A top search may not be executed from the screen. A top search is automatically executed, so it is not necessary to execute a top search from the screen. Command a sequence No. and block No., and restart a machining.</p> <p>An arbitrary program can be restarted by designating the program No. When a program No. is omitted, the program currently searched is restarted.</p>
Automatic top search OFF	A top search must be executed from the screen. Then, command a sequence No. and block No., and restart a program.				
Automatic top search ON	<p>A top search may not be executed from the screen. A top search is automatically executed, so it is not necessary to execute a top search from the screen. Command a sequence No. and block No., and restart a machining.</p> <p>An arbitrary program can be restarted by designating the program No. When a program No. is omitted, the program currently searched is restarted.</p>				

The validity of the automatic top search can be changed with control parameter "#8914 Auto Top search".

Screen transition



Note

- (1) In the following cases, the screen cannot be switched to top search screen.
- Restart type 1
 - The parameter "#8914 Auto Top search" is "1" (automatic top search)

Precautions

- (1) Set the tool offset amounts and parameters before proceeding the program restart search. If they are not set beforehand, the axes will not return to the proper machining start position.
- (2) The axes will not return to the proper machining start position if a program using the user macro external signal input, machine coordinate readout or external mirror image command executes the restart search.
- (3) If an attempt was made to shift the coordinate systems by manual or MDI interrupt the last time the machining program was being executed, the axes will not return to the proper machining position.
- (4) When using the type 1, a top search for the head of the program is not available. Restart search of the type 1 searches from the previous operation start block and locates the designated block as it memorizes the operation start block previously operated.
- (5) When "#8914 Auto Top search" is set to "0" for the type 2, an error message "Top search not completed" appears if the search is attempted directly with the type 2 without executing the top search. Conduct the top search first.
- (6) The macro statement blocks cannot be searched for both type 1 and type 2. It is possible to execute the restart search if the control parameter "#8101 MACRO SINGLE" is set to ON. However, note that the tool path may change because of the radius compensation, the corner R/C, and geometric read ahead blocks.
- (7) When executing the restart for the type 1 with a tape, the axes will not return to the proper machining start position if the operation starts from midway of the tape.
- (8) WHILE/GOTO statement cannot be used for a tape operation. Thus, if a restart search is executed with the tape operation which includes WHILE/GOTO statement, a program error (P295) will occur.
- (9) In a multi-part system, perform restart search operation in each part system.
- (10) When the linear-type rotary axis returns to the restart position, control returns to the workpiece coordinate position.
- (11) A program restart search is not available at the head of the program. Restart search settings are possible, but control may not return to the correct position when the head of the program is searched.
- (12) If the parameter "#1151 rstini" is set to "0" (No reset initial) in the program without the sequence number, a restart search (type 1) may not function properly after reset 1 has been executed. Therefore, assign a sequence number to each program.
- (13) If INPUT/search is carried out without designating any value in the input area, a restart search is performed using the previously executed ONB number (type 1 only). If a reset is executed during MDI interruption processing, a restart search is performed using the previous ONB number for MDI interruption.
- (14) If INPUT/search is carried out without designating any value in the input area, the position of the ONB number that first matches the designated condition is searched at restart, regardless of the number of repetitions.
- (15) When the previously executed program is RS232C, the operation message "Search error" appears if INPUT/search is carried out without designating any value in the input area.
- (16) If a restart search is carried out while an error remains in the program, it may cause a search error. When a search error occurs, correct the program after resetting, and perform a restart search again.
- (17) When the operation mode is set to the MDI mode, a restart search is not available. If an attempt is made to carry out a restart search, the operation message "Can't search in MDI mode" is displayed.
- (18) Restart search is available for a program that has a file name consisting of up to 32 characters. Restart search is not available for a program that has a file name consisting 33 or more characters.
- (19) Restart search is not available for sub part system I/II for M80 Series. If restart search is carried out, the message "Search error" appears.
- (20) Restart search is not available for sub part system II for M800 Series. If restart search is carried out, the message "Search error" appears.
- (21) A search error will occur if an intended ONB is not found even M99 block is detected in the main program.
- (22) A error will occur if the M99 block in the main program is searched.
- (23) When "#1122 pglk_c" (Program display lock C) is set to "2", the restart search cannot be executed as "Program display lock C" is applied.
- (24) If both N and B are omitted, it will be assumed as the head of the program and the number of repetitions is considered as "1" even the P number is designated.
- (25) When either N or B is omitted, the omitted one is assumed as "0".
- (26) Restart search cannot be carried out during the surface selection by R-Navi. A program error (P49) will occur.
- (27) Restart search cannot be carried out for a block executing 3-dimensional circular interpolation, cylindrical interpolation, polar coordinate interpolation, milling interpolation or tool center point control. A program error (P49) will occur.
- (28) When you execute the restart search to a block in synchronous tapping cycle modal, issue the S code for a tapping spindle from MSTB history menu. If it is not issued, the tapping spindle will execute the synchronous tapping with current gear step without changing the gear.

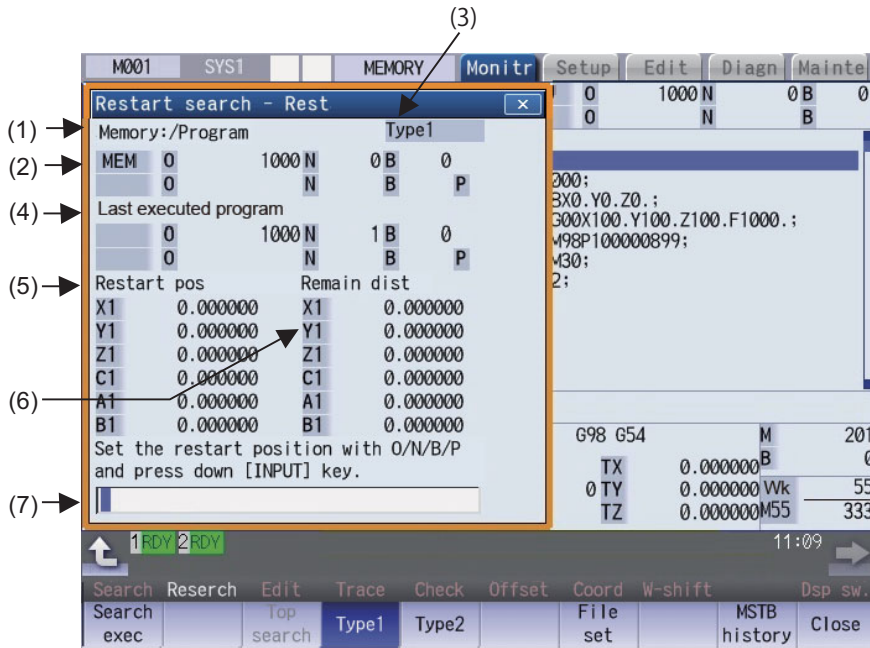
- (29) The number of program repetitions, "P", can be designated up to the total value of the same number of sub-program repetitions, "L", described on the program.
- (30) When "#8129 Subpro No. select" is set to "1" or "2", it triggers a restart search on a sub-program with the O number. Therefore, to designate the program number, it must be prefixed by an "O".

Precautions (For multi-part system)

- (1) If any ONBP is designated, restart search is only carried out in the displayed part system. (This operation is available when this function is invalid.)
- (2) The type 2 restart search cannot be carried out without ONBP designation; therefore, only the type 1 restart search becomes available for all part systems in batch.
- (3) The top search and type 2 restart search are carried out only in the displayed part system.
- (4) If an error occurs during a restart search for all part systems in batch, the numbers of all the part systems that are judged to be abnormal are displayed in the format "\$ + part system number" following the "Search error" message.
- (5) If the O number of the currently searched machining program is inconsistent in all part systems during the restart search for all part systems in batch, a restart search is carried out in the displayed part systems (a restart search in individual part systems).
When the restart search is completed, the number of the searched part system is displayed in the format "\$ + part system number" following the "Search completed" message.
- (6) When "#1285 ext21/bit1" is set to OFF (search by part system), restart search is only carried out in the displayed part systems even if search conditions (the O numbers of the machining programs in the NC memory and of the searched machining program are consistent in all the part systems with type 1 and no ONBP designation) are satisfied in all part systems.
- (7) y selected, the message "Executing automatic operation", "Program restarting", or "Program checking" is displayed while any part system is under automatic operation, program restarting, or program checking.
- (8) When "#1285 ext21/bit1" is OFF with the NC memory selected, the message "Executing automatic operation", "Program restarting", or "Program checking" is displayed while the displayed part system is under automatic operation, program restarting, or program checking.
- (9) In multi-part system, carry out restart search for the queued blocks. If a restart search is carried out in a block other than the queued blocks, the block execution timing is off between the 1st part system and 2nd part system, and the machine is in danger of collision.

10.4.1 Main Screen

The type 1 and type 2 restart search can be executed from the main screen.



Display Items

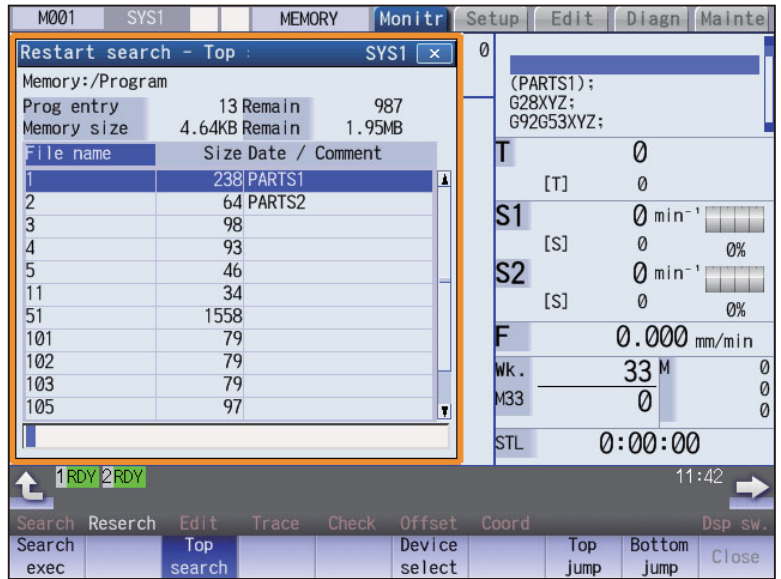
Display Items	Description
(1) Device name, directory display	This displays the device and directory where the searched machining program is located.
(2) Research position	This displays the researched main program position (program No., sequence No.(*1), repeat count, block No.).
(3) Restart type	This displays the restart search type.
(4) Last executed program position	This displays the last executed program position (program No., sequence No., block No., repeat count). When a restart search is executed with restart type1, actual program restart position may not match the position of last executed program. Because the position is updated at the timing of machine stop operations (NC reset, single block stop or feed hold stop).
(5) Position when restart search is completed	This displays the position on the local coordinate system when the restart search is completed.
(6) Remaining distance when restart search is completed	This displays the remaining distance when the restart search is completed.
(7) Input section	This displays details of the key input.

(*1) If the sequence number exceeds six digits, only the low-order six digits are displayed.

Menus	
Menus	Description
Search exec	This starts the restart search based on the designated device, directory, program number (O), sequence number (N), block number (B) and number of block execution times (P).
Top search	This changes to the pop-up window for executing top search, and enables top search. When the type 1 is selected or the parameter "#8914 Auto Top search" is set to "1", this menu cannot be selected.
Type1	This selects the restart search type. Restart search is executed with the highlighted restart type. The type 1 or type 2 menu is always highlighted.
Type2	When restart search is executed, the selected restart type is displayed at the display item (3) "Restart type".
File set	This changes to the pop-up window for setting the file, and enables the file to be selected.
Next axis	This switches the axis to be displayed on the counter with 8.4-type or 10.4-type. (*1)
MSTB history	This opens the MSTB history screen as a pop-up window. The M, S, T and B command used in the machining program are listed on the MSTB history screen. If the cursor is moved to the listed M, S, T or B command and the [INPUT] key is pressed, that command will be executed.
Close	This closes the pop-up window and quits this function.

(*1) The menu will be grayed out and cannot be selected when the number of valid axes is five or less.

10.4.2 Top Search Screen



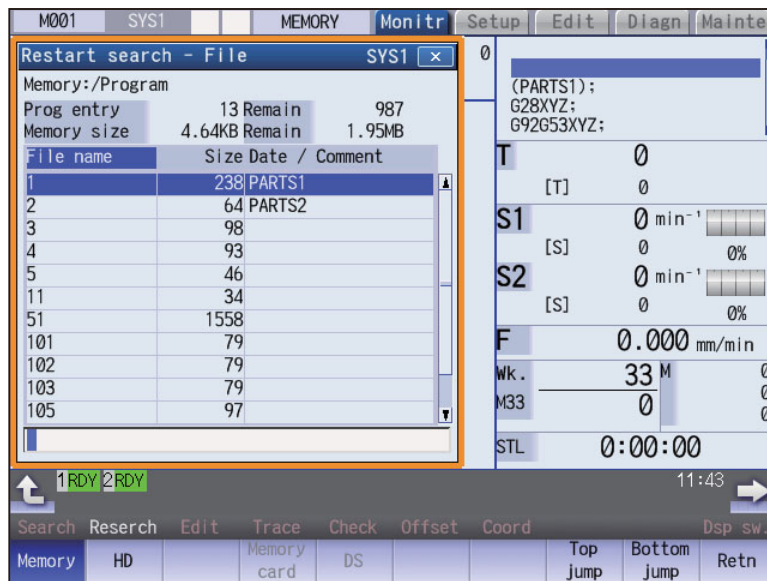
Display Items

Same as "Operation Search".

Menus

Menus	Description
Search exec	This starts the top search based on the designated device, directory, program number (O), sequence number (N), block number (B) and number of block execution times (P).
Top search	When the menu is highlighted, it indicates that the top search pop-up window is open. If pressed again when highlighted, the top search pop-up window closes, and the main pop-up window opens.
Device select	This displays the device menu. Select which device program to search for from this menu. When a device with directory is selected, the route is selected first.
Top jump	Display starts from the first page of the directory/list of files. The cursor moves to the top line.
Bottom jump	The last page of the directory/list of files is displayed. The cursor moves to the bottom line.
Comment nondisp	This changes whether to show or hide the comment field in the list. When the comment field is hidden, the file name field will be enlarged.
List update	This updates the list contents. (The latest contents of the currently selected device and directory are listed.)
Sort change	This changes the method of sorting the list.

10.4.3 File Setting Screen



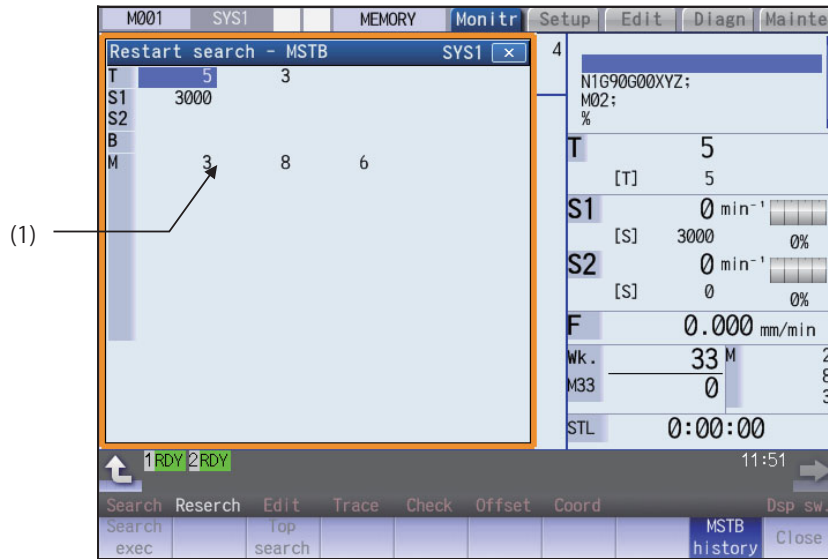
Display Items

Same as "Operation Search".

Menus

Menus	Description
Memory	This selects the device for searching for the program. When a device other than memory is selected, the root is selected first.
HD	
Memory card	
DS	
USB Memory	
Top jump	Display starts from the first page of the directory/list of files. The cursor moves to the top line.
Bottom jump	The last page of the directory/list of files is displayed. The cursor moves to the bottom line.
Retn	This returns the main menu.
Comment nondisp	This changes whether to show or hide the comment field in the list. When the comment field is hidden, the file name field will be enlarged.
List update	This updates the list contents. (The latest contents of the currently selected device and directory are listed.)
Sort change	This changes the method of sorting the list.

10.4.4 MSTB History Screen



Display Items

Display Items	Description
(1) MSTB history	<p>The MSTB codes used for the machining are listed after the restart search is completed.</p> <p>The displayed value can be set (manual numerical value command) as the current modal value until the reset or starting is applied. The character color is changed for the value which is once set.</p> <p>The number of displayed codes is as follows: M: up to 35, S1 to S8: 3 each, T: 3, B:3. If the number of codes used for the machining exceeds the displayable number of codes, the codes which have been used in the beginning is not displayed.</p> <p>Address T will display only the tool number regardless of the parameter (#11038 T disp type).</p>

Menus

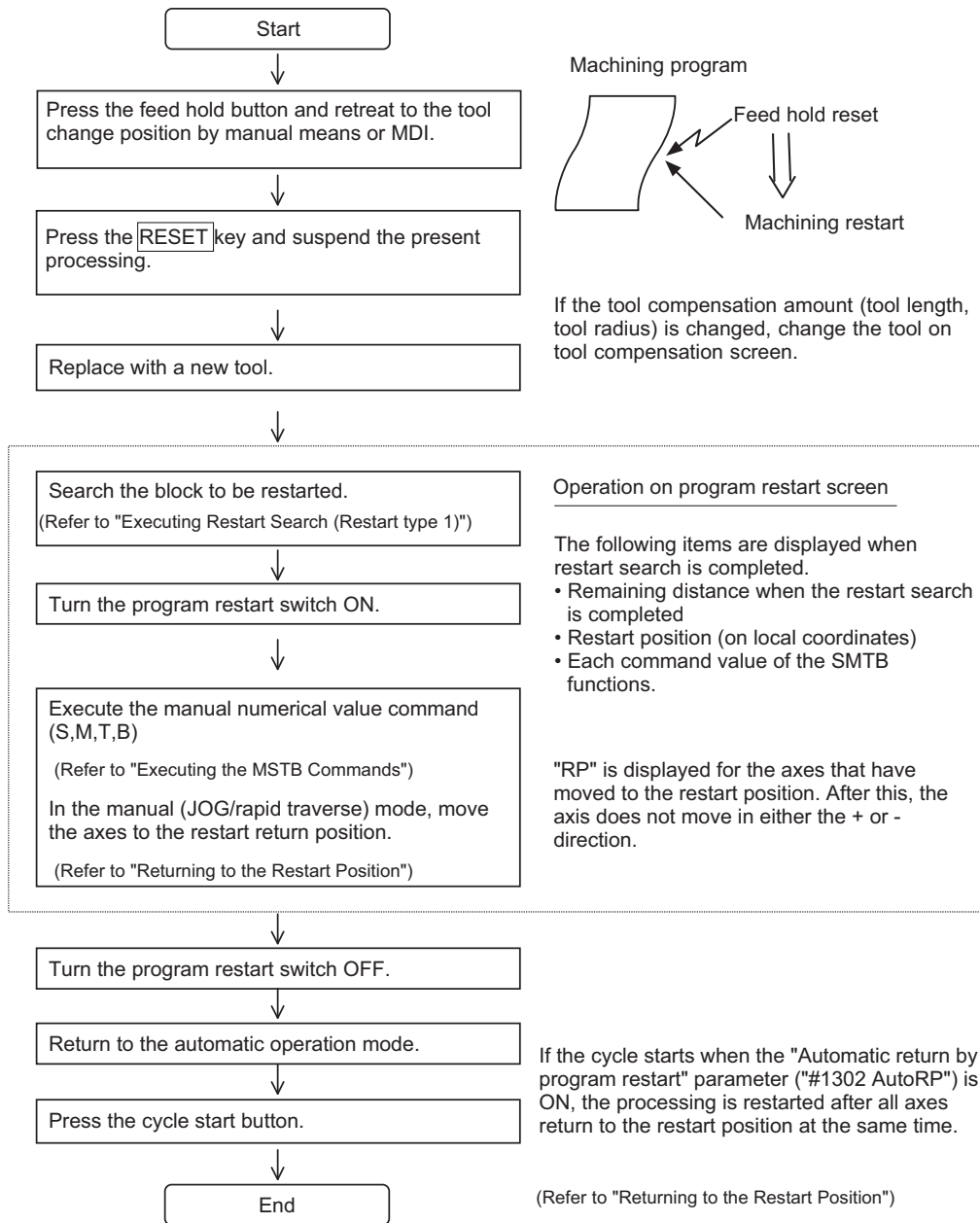
Menus	Description
MSTB history	<p>When this is highlighted, it indicates that the MSTB history pop-up window is open. If the menu is pressed when this menu is highlighted, the system will close the MSTB history pop-up window, and the main pop-up window opens.</p>

10.4.5 Operation Sequence for Program Restart

There are two types of restart, type 1 and type 2.

Restart type 1

When feed hold has been applied and reset because the tool has broken, etc., restart with restart type 1.



Note

- (1) When single block signal is OFF, the machining is restarted without stopping temporarily after the axes return to the restart position. (The cycle starts when the automatic return by program restart is valid.)
- (2) Execute "reset & rewind" for resetting.
- (3) Restart search is not available for a program that has a file name consisting 33 or more characters.

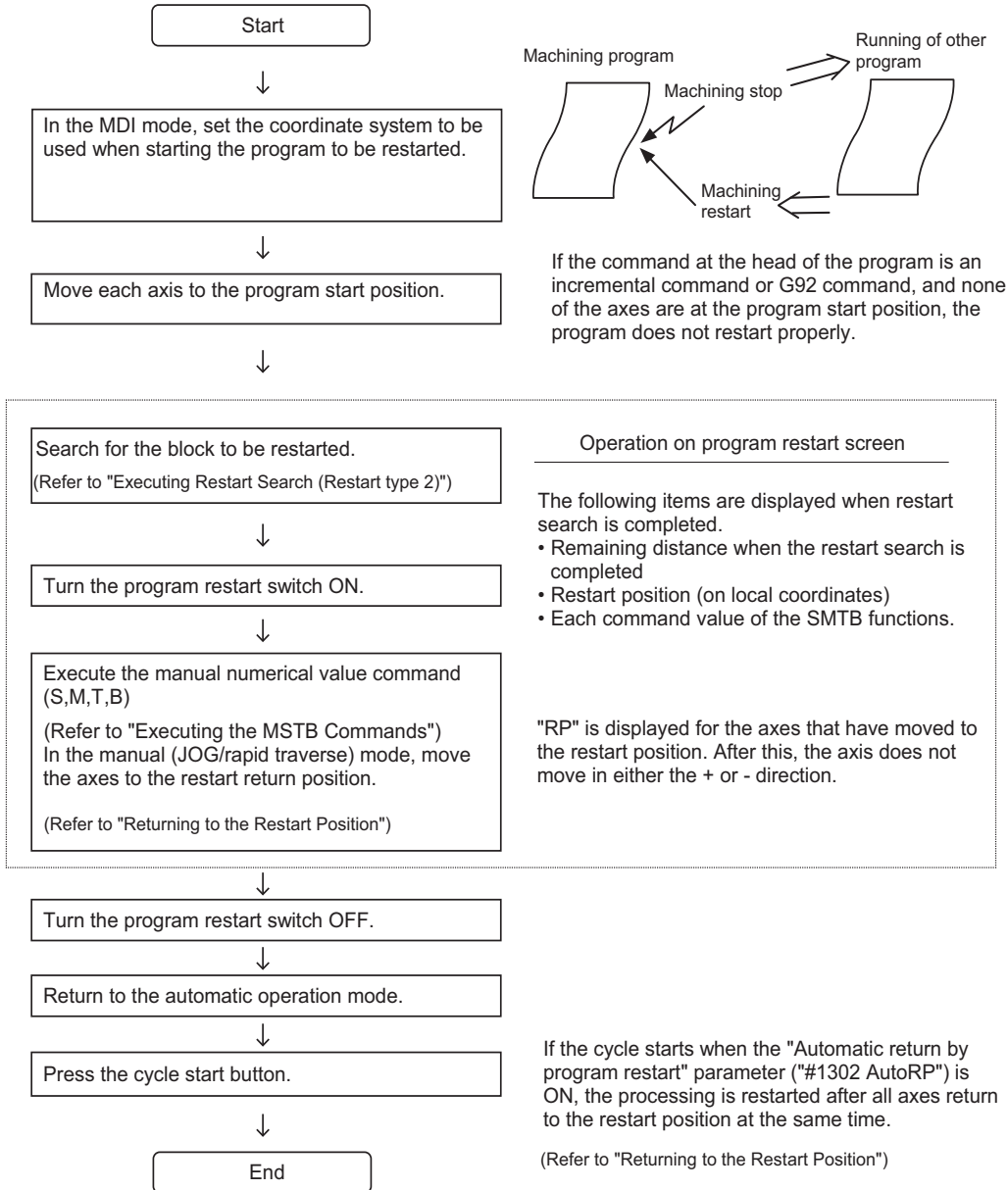
Restart type 2

If a machining program differing from the machining program to be restarted was run before starting restart search, restart with restart type 2.

When the coordinate system of the automatic operation last time and the coordinate system of the machining restart are changed, it is possible to restart.

Note

(1) The necessary matters for starting the machining program, such as setting the coordinate system, must be completed before starting restart search.



Note

- (1) When single block signal is OFF, the machining is restarted without stopping temporarily after the axes return to the restart position. (The cycle starts when the automatic return by program restart is valid.)
- (2) Restart search is not available for a program that has a file name consisting 33 or more characters.
- (3) When the searched program do not exist, the operation message "Search error" appears.

10.4.6 Executing Restart Search (Restart Type 1)




When feed hold has been applied and reset because the tool has broken, etc., restart with Restart type 1.

When the multi-part system program management is valid (#1285 ext21/bit0 =1, ext21/bit1 =1), the program search is executed across all part systems in batch. However, only when the following requirements are met, this is valid.

- It is the machining program in the NC memory.
- ONBP is not used.

Operation method

(Example) When tool breakage during execution of O1000 N7 occurred, and restarting from the O1000 N6 block

- (1) Press the feed hold button and retreat to the tool change position by manual means or MDI. Press the reset key and suspend the present processing.
- (2) Replace with a new tool.
When using tape operation, index the top of the tape.
- (3) Press the main menu [Reserch].  The sub-menu is displayed.
The main screen for restart search appears as a pop-up window.
- (4) Press the [Type 1].
Set the position to restart search in the setting area.  Delimit the ONB number in the setting area using /.
<When O No. was attached>
The main or sub program is targeted.
(Example) 1000/6/0
<When O No. was not attached>
The program currently searched is targeted.
(Example) /6/0
<Note>
•When the [INPUT] key is pressed without entering data in the input area, restart search will be carried out for the last executed block.
- (5) Press the [INPUT] key or the menu [Search exec].  Restart search is executed. (*1)
The message "Executing restart search" appears during the search process, and the message "Restart search is completed" appears when completed.
Each axis' restart position and the restart remaining distance are displayed.
When the menu [MSTB history] is pressed, the MSTB history screen will open as a pop-up window, and the M, S, T, B command used in the machining program will be listed.

(*1) The maximum number of digits is eight for the sequence No. and five for the block No.

Note

- (1) When the sorting of tool data is in progress, the operation message "Sorting of tool data is in progress" appears, and the search cannot be executed.

10.4.7 Executing Restart Search (Restart Type 2)









If a machining program differing from the machining program to be restarted was run with tape, memory or HD operation before starting restart search, restart the respective machining program with restart type 2.

The restart type 2 operation sequence is the same as restart type 1, but necessary matters for starting the machining program, such as setting the coordinate system, must be completed before starting restart search.

When the parameter "#8914 Auto Top search" is "0", execute the top search for the machining program.

Operation method (When the parameter "#8914 Auto Top search" is "0")

(Example) When restarting from subprogram O123 N6 B2 called from main program O1000

- (1) Turn the power ON, and return all axes to the reference position.
- (2) In the MDI mode, set the coordinate system to be used when starting the program to be restarted.
- (3) Move each axis to the program restart position.
When using tape operation, index the top of the tape.
- (4) Press the main menu [Reserch].  The sub-menu is displayed.
The main screen for restart search appears as a pop-up window.
- (5) Press the [Type 2].
- (6) Press the sub-menu [Top search].  The window for top search appears as a pop-up window.
- (7) Press the sub-menu [Device select].
Select a device and press the menu key.
- (8) Press the [↑], [↓],  or  key to move the cursor to the directory to which the file to be set belongs.
Press the [INPUT] key.
- (9) Press [↑], [↓],  or  key to move the cursor to  Set the cursor to 1000.
the machining program to be edited.
- (10) Press the [INPUT] key.  The top search starts.
The search can be executed by pressing the menu [Search exec] instead of the [INPUT] key. When the top search is completed, the operation message "Top search completed" appears.
The top search pop-up window closes, and the main screen for restart search appears as a pop-up window.

- (11) Set the position to restart search in the setting area. ➡
- Delimit the ONBP number in the setting area using /.
<When O No. was attached>
The restart search is executed at designated position by NBP No. with the set O No. at the head.
(Example) 123.PRG/6/2/1
 - <When O No. was not attached>
The program currently searched is targeted.
(Example) /6/2/1

If subprogram repeat count is designated to the block to be searched, set the count in "P".

For example, if a block in a subprogram is searched, and the subprogram is called out several times, the block to be searched is also executed several times. Thus, which execution block to be searched must be set. (If "0" is set, it is handled in the same manner as "1".)

To search the first execution block, or to search for a block executed only once, this item does not need to be set.

- (12) Press the [INPUT] key or the menu [Search exec]. ➡
- Restart search is executed. (*1)
 - The message "Executing restart search" appears during the search process, and the message "Restart search is completed" appears when completed.
 - Each axis' restart position and the restart remaining distance are displayed.
 - When the menu [MSTB history] is pressed, the MSTB history screen will open as a pop-up window, and the M, S, T, B command used in the machining program will be listed.











(*1) The maximum number of digits is eight for the sequence No. and five for the block No.

Note

- (1) When the sorting of tool data is in progress, the operation message "Sorting of tool data is in progress" appears, and the search cannot be executed.

Operation method (When the parameter "#8914 Auto Top search" is "1")

(Example) When restarting from subprogram O123 N6 B2 called from main program O1000

- (1) Turn the power ON, and return all axes to the reference position.
- (2) In the MDI mode, set the coordinate system to be used when starting the program to be restarted.
- (3) Move each axis to the program restart position.
When using tape operation, index the top of the tape.
- (4) Press the main menu [Restart].  The sub-menu is displayed.
The main screen for restart search appears as a pop-up window.
- (5) Press the [Type 2].
- (6) Press the sub-menu [File set].  The window for file set appears as a pop-up window.
- (7) Select a device and press the menu key.
- (8) Press the [↑], [↓],  or  key to move the cursor to the directory to which the file to be set belongs.
Press the [INPUT] key.
- (9) Press [↑], [↓],  or  key to move the cursor to the machining program to be edited.  Set the cursor to 1000.
- (10) Press the [INPUT] key.  The screen for restart search appears as a pop-up window.
- (11) Set the position to restart search in the setting area.  Delimit the ONBP number in the setting area using /.
<When O No. was attached>
The restart search is executed at designated position by NBP No. with the set O No. at the head.
(Example) 123.PRG/6/2/1
<When O No. was not attached>
The program currently searched is targeted.
(Example) /6/2/1
- (12) Press the [INPUT] key or the menu [Search exec].  Restart search is executed. The message "Executing restart search" appears during the search process, and the message "Restart search is completed" appears when completed.
Each axis' restart position and the restart remaining distance are displayed.
When the menu [MSTB history] is pressed, the MSTB history screen will open as a pop-up window, and the M, S, T, B command used in the machining program will be listed.

10.4.8 Returning to the Restart Position

The axis is returned to the restart position after restart search is completed.

The method for returning to the restart position (manual/automatic) can be selected with the parameters "#1302 AutoRP".

0: Manual restart position return

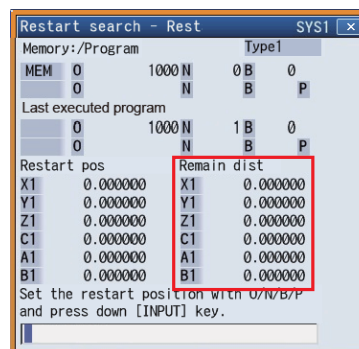
1: Automatic restart position return

Operation method (manual restart position return)

- (1) Turn the restart switch ON.
- (2) Enter the manual (JOG/rapid traverse) mode.
- (3) Move the axis in the restart return direction.



The restart position and "RP" appear sequentially from the axes that have been returned. The Restart remaining distance is "0".



- (4) When all axes have been returned, turn the restart switch OFF.

Note

- (1) When the restart switch is ON, move the axis in the same direction as the restart direction. If moved in the reverse direction, the operation error "M01 R-pnt direction illegal" occurs. If the tool needs to be retracted once, such as if the tool is interfering with the workpiece, turn the restart switch OFF and retract the axis manually.
- (2) After restart position return is completed, the axis cannot be moved if the restart switch is ON. If the axis is moved, the operation error "M01 restart switch ON" occurs.
- (3) If even one axis has not completed return to the restart position at cycle start, the error "M01 Restart pos. return incomplete" occurs. Note that if the axis has been returned to the restart position once and is not at the restart position during cycle start, the alarm does not occur.
- (4) If the axis to be returned to the restart position is a machine lock axis, the operation error "M01 program restart machine lock" occurs. Release the machine lock before returning to the restart position.
- (5) If the restart switch is turned to ON after the axis is returned to the restart position with the restart switch OFF, "PR" may not be displayed. Return to the restart position after the restart switch is turned ON.
- (6) After restart search had been completed, if the movement command is issued by MDI before automatic restart position return has been started, the program error (P48) occurs. Perform the operation again after reset.
- (7) After restart search had been completed, if the T command different from the program is issued by MDI before the searched program has been started, the program error (P48) may occur. Perform the operation again after reset. T commands which result in errors are shown below. (Only L system)
 - ◆When "#1100 Tmove" = "0"
T command that selects a tool with different tool length/wear amount than the tool selected by the program.
 - ◆When "#1100 Tmove" = "1"
A program error (P48) will not occur by T command.
 - ◆When "#1100 Tmove" = "2"
T command that selects a tool with different wear amount than the tool selected by the program.
- (8) After restart search had been completed, if the handle interruption is performed before the searched program has been started, always the same operation as manual absolute ON is executed regardless of "Manual absolute" signal.

Automatic restart position return

If the parameter "#1302 AutoRP" is set to "1", each axis returns to the restart position with dry run at cycle start. Machining restarts after returning. The order that the axes return follows parameter "#2082 a_rstax".

Note

- (1) Manually move the axis to a position where the tool does not interfere with the workpiece before starting the cycle.
- (2) Even if the parameter "#1302 AutoRP" is to "1", the axes can be returned manually to the restart position by turning the restart switch ON. In this case, move the axes in the order of manual restart position return -> automatic restart position return. After completing automatic restart position return, if the operation is stopped temporarily and the restart switch is turned ON, the operation error "M01 restart switch ON" occurs.
- (3) Once the axis has been manually returned to the restart position, if it is moved from the restart position, it will not return to the restart position even if automatic restart position return is executed.
- (4) The axis for which parameter "#2082 a_rstax" is set to "0" does not return to the restart position. Note that if "0" is set for all axes, all axes simultaneously return to the restart position. Designate the axes in part system units. If the axis for which parameter "#2082 a_rstax" is set to "0" has not completed manual restart position return when automatic restart position return is started, an error occurs. The error "M01 Restart pos. return incomplete" is displayed.
- (5) After automatic restart position return had been started, if the automatic start is executed during MDI mode before not all axes have yet to complete automatic restart position return, the error "M01 Restart pos. return incomplete" occurs.
- (6) After restart search had been completed, if the movement command is issued by MDI before automatic restart position return has been started, the program error (P48) occurs. Perform the operation again after reset.
- (7) After restart search had been completed, if the T command different from the program is issued by MDI before the searched program has been started, the program error (P48) may occur. Perform the operation again after reset.
T commands which result in errors are shown below. (Only L system)
 - When "#1100 Tmove" = "0"
T command that selects a tool with different tool length/wear amount than the tool selected by the program.
 - When "#1100 Tmove" = "1"
A program error (P48) will not occur by T command.
 - When "#1100 Tmove" = "2"
T command that selects a tool with different wear amount than the tool selected by the program
- (8) After restart search had been completed, if the handle interruption is performed before the searched program has been started, always the same operation as manual absolute ON is executed regardless of "Manual absolute" signal. When manual interruption is executed to the automatic restart position return completed axis, the axis never returns the automatic restart position again.
- (9) When an axis moved to return is operated manually, the axis cannot return to correct position.




10.4.9 Executing the MSTB Commands

If the menu [MTB history] is pressed after restart search is completed, the MSTB commands used for machining program appear. If the cursor is moved to the listed M, S, T or B command and the [INPUT] key is pressed, that command will be executed.

Up to 35 M commands, 3 commands each for S1 to S8, 3 T commands and 3 B commands are displayed.

If many MSTB commands are used for machining, the MSTB commands used at first will not appear.

Operation method

- | | | |
|---|--|---|
| (1) Press the sub-menu [MSTB history]. |  | The pop-up window changes to the MSTB history window. The MSTB commands used for machining program are listed. |
| (2) Using the [↑], [↓], [→] or [←] key, move the cursor to the position of the data to set. | | |
| (3) Press the [INPUT] key. |  | The designated command is executed. A value, which has been commanded once, is grayed out. The cursor will move to the next item. |
| (4) Repeat steps (2) and (3). | | |
| (5) When completed with all settings, press the menu [Close] or [MSTB history]. |  | The MSTB history pop-up window closes and the restart search main window appears as a pop-up window. |

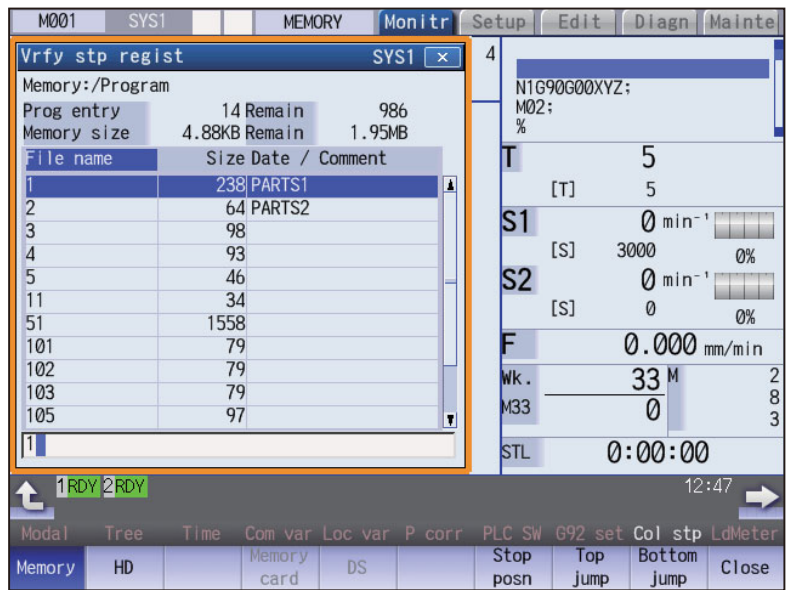
10.5 Verification Stop



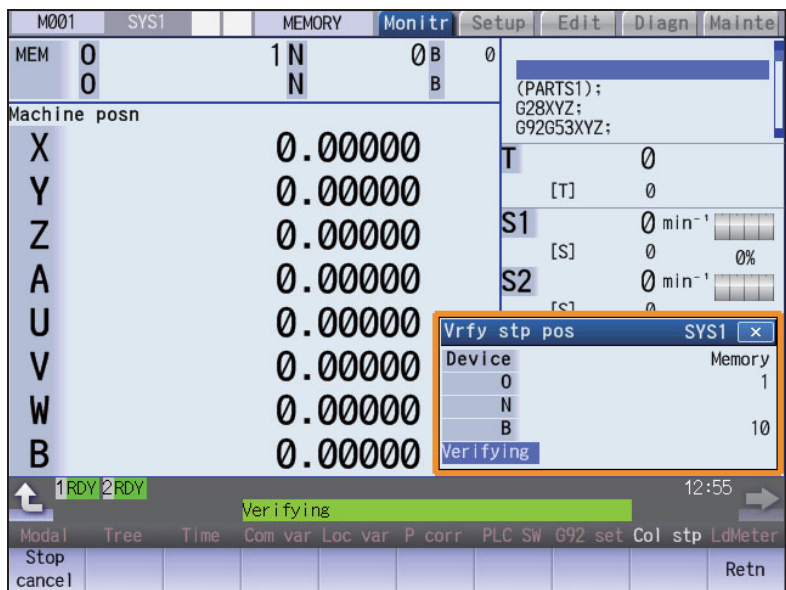
The machining program operation can be block stopped at a registered verification stop position. The registered verification stop position can be canceled.

When the specified block appears, NC status will change single block stop after the execution of the block.

■ When verification stop is registered



■ When verification stop position is displayed



Display Items

Display Items	Description
(1) Verification stop device name	This is the name of the device for which verification stop is to be executed.
(2) Verification stop position	This is the position of the program where verification stop is to be executed. This display is cleared when program stop is completed, or NC is reset or canceled. If the program No. (program name) exceeds 24 characters, "*" will appear as the 24th character.
(3) Display during verification	This is displayed during verification.




Menus (When verification stop is registered)

Menus	Description
Memory	This selects the device to be stopped for verification. When a device with directory is selected, the route is selected first.
HD	<Note> •Devices that can be selected are different by NC models.
Serial	
Memory card	
DS	
USB Memory	
Stop posn		This opens the verification stop position display window as a pop-up window.
Top jump	Display starts from the first page of the directory/list of files. The cursor moves to the top line.
Bottom jump	The last page of the directory/list of files is displayed. The cursor moves to the bottom line.
Comment nondisp	This changes whether to show or hide the comment field in the list. When the comment field is hidden, the file name field will be enlarged.
List update	This updates the list contents. (The latest contents of the currently selected device and directory are listed.)
Sort change	This changes the method of sorting the list.
Close	This closes the pop-up window and quits this function.

Menus (When verification stop position is displayed)

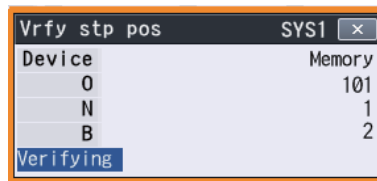
Menus	Description
Stop cancel	This cancels the verification stop setting. Note that automatic operation is not reset.
Retn	This returns the list when verification stop is registered.

Operation method (Registering the verification stop)

- (1) Press the  key to select the part system for executing verification stop. → The currently selected part system is displayed at the upper left of the screen.
- (2) Press the main menu [Col stp]. → The mode changes to the buffer correction mode.
- (3) Select the device.
(Example) [Memory] → The selected device name and root directory (memory:/) are displayed in the device name and directory display fields.
The menu [Memory] is highlighted.
- (4) Press the [↑], [↓],  or  key to move the cursor to the directory containing the file to be set.

If the list contents differ from the actual device or directory, press the menu [List update].

- (5) Press the [INPUT] key. → Moves into the directory.
- (6) Input the program No., sequence No. and block No. using / as a delimiter.
(Example) 1001/1/2 [INPUT]
When carrying out verification stop of MDI program, set "0" as the program No.
If pointing the cursor to a file name, the file name is echoed back to the input area.



- (7) Start the automatic operation. → When the verification stop is completed, a message indicating the end appears.
The stop position displayed on the screen is cleared, and the "Verifying" display is erased.

Press the menu [Stop cancel] to cancel the verification stop.

Note

- (1) The maximum number of digits is eight for the sequence No. and five for the block No.
- (2) Verification stop can be canceled during automatic operation.

Precautions

- (1) When registering the stop position (O, N, B values), confirm that the block exists in the searched program. Verification stop will not be executed if the corresponding block is not found at the registered stop position.
- (2) Always set one of the O, N or B numbers. If nothing is set, a setting error will occur.
- (3) If the O No. is not set, the O No. used during operation search will be used.
- (4) If the N and B numbers are not set, the block will be searched using the O No.
- (5) If there are several sequences and blocks with the same number in one program, verification stop will be executed after executing the first block that matches in the execution order.
- (6) The settings are canceled when verification stop is executed.
- (7) The settings are canceled when reset is executed.
- (8) If only the program number is set, verification stop will take place at the head of the program only when there is a program number at the first line.
- (9) Verification stop / verification stop cancel cannot be performed for blocks being executed or blocks already read into the prered buffer.
- (10) Verification stop is not performed in the tapping mode.
- (11) Verification stop is possible in a subprogram, but is not possible in a MTB macro program.
- (12) If verification stop is set for a fixed cycle block, verification stop will be executed after the positioning block is completed.
- (13) Verification stop is possible even when editing is locked.
- (14) Verification stop is executed after executing the block set for the verification stop position. If the verification stop position is set in a program call (M98) block, verification stop will be executed before the subprogram is called.
- (15) If the set block is set to be skipped, verification stop will not be executed.
- (16) The verification stop position can be registered for each part system.
- (17) The stop position cannot be registered during verification.
- (18) Registration of verification stop position is not possible for a program with 33 or more file name characters.
- (19) In the case where the device is HD, memory card, DS, or USB memory at the time of verification stop position registration, inputting "0/" will be resulted in a setting error.
- (20) When the verification stop position has been set in the following conditions, the verification stop is performed for the operation searched program.
(If the operation search target device is the same as the verification stop target, the verification stop is performed with the contents correctly set.)
(Example) When the same name programs exist in the memory and HD
 - (a) Operation searched program -> Memory: 100.PRG
Verification stop position set program -> HD: 100.PRG
 - (b) Operation searched program -> HD: 100.PRG
Verification stop position set program -> Memory: 100.PRG(The verification stop is performed for the memory in the condition (a) and performed for the HD in the condition (b).)
- (21) Verification stop position for sub part system I/II cannot be registered for M80 Series. If verification stop position is registered, the message "Search error" appears.
- (22) Verification stop position for sub part system II cannot be registered for M800 Series. If verification stop position is registered, the message "Search error" appears.

10.6 Correcting the Machining Program



10.6.1 Program Editing

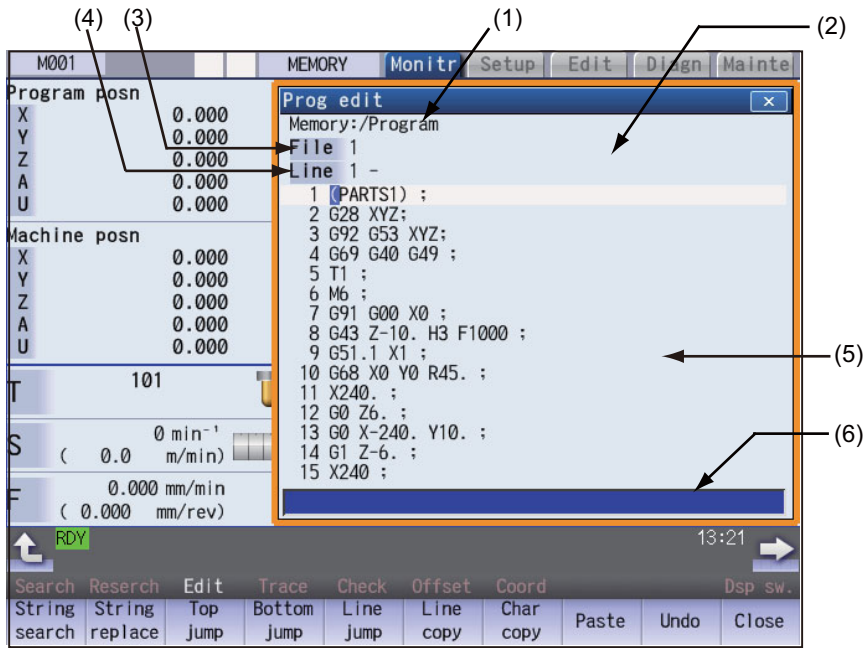
If you press the [Edit] main menu or set the edit/search signal ON, the program editing window appears to enable you to edit a program. However, if the target program is not found (displays "00") or programs are serially searched, the editing window does not appear. The program is opened on the unselected side for the 2-part system simultaneous display.

When the program is edited, the key input data is directly written into the program display area. All data is overwritten from the cursor position. "Editing" appears on the right side of the file name display once input is started.

When the [INPUT] key is pressed, the program is saved in the NC memory and the "Editing" message disappears.

A program to be edited can be switched to the other part system's program with $\boxed{\$ \leftrightarrow \$}$ key when a parameter "#8952 Edit-win \$ switch" is set to "1".

For information on editing operations, refer to "3.2 Creating and Editing a Machining Program".



Display Items



Display items	Description
(1) Path display	The path of the currently opened program file is displayed. (If the path is too long, the portion exceeding single-byte 49 characters is not displayed.) (Example) Memory: /Program, HD: /PRG/SUB
(2) Edit type display	For mass-editing, "EX" appears. For regular editing, nothing appears.
Current edit display "Editing"	Displayed when the program is edited after it was displayed.
Insert mode display	The overwrite mode and insert mode are switched by pressing the [INSERT] key. During insert mode: "INS" appears. During overwrite mode: Nothing appears.
(3) File name display	This displays the file name of the program currently being edited. "MDI" appears when the MDI program is edited.
(4) Regular editing: top line of the displayed program Mass-editing: display position	The top line of the program to be displayed is displayed. During mass-editing, the position of the currently displayed page is displayed in percentage (rate) when the entire size of the program is assumed to be 100%.
(5) Line number	Each line of the program is numbered, and only the last three digits are displayed. If a line is wrapped because a line is too long, no number is assigned to the top of the next line. For mass-editing, line number does not appear.
Program display	This displays the contents of the program (machining program, MDI program) currently being edited. The line that the cursor is on is highlighted. (During mass-editing, the line is not highlighted.) If the value of the parameter "#8952 Edit-win \$ switch" is set to "1" and a part system is switched while the window is displayed, the display is changed to the program of the part system. Machining program editing: Switch the mode selection switch to other than "MDI mode" and press the [Edit] main menu. However, to edit data, designate the machining program to execute a search. MDI program editing: Switch the mode selection switch to "MDI mode" and press the main menu [Edit].
(6) Input section	This displays details of the key input.

A selection part system operation search can be carried out using the block with the cursor as the top. There are 2 ways to search cursor position, "INPUT search" and "Edit/search signal search".

INPUT search

By pressing [INPUT] key when it is in the normal status (not being in status such as editing or character searching, etc.), operation search of the selected part system is carried out starting from the block that has the cursor.

This is enabled when "1" is set to the parameter "#11031 Cursor pos search".

- (1) Carry out the operation search to find the program to carry out the cursor position search.
- (2) Press the [Edit].  The program edit window appears.
The program is displayed starting from the block currently searched.
(During automatic operation or checking, the program is displayed from its top.)
- (3) Move the cursor to the block to be carried out the cursor operation search.
- (4) Press the [INPUT] key.  Operation search is carried out starting from the block that the cursor is positioned.
During the search "Searing" will display blinking.
When the search is completed, "Search completed" is displayed.

Note

- (1) When operating character string search, string replace, cursor on input unit, or editing it will not start cursor position search by pressing [INPUT] key.
- (2) A selection part system operation search can be carried out using the block with the cursor as the top.
- (3) Operating search program will be the program that was searched when program edit window was open.
- (4) Cursor position search is disabled during automatic operation, checking or restart search. However, it is enabled when the parameter "#11039 Cusr pos srch type" is 1 even if the operation is under single block stop. For details, refer to "Search during single block stop" in "10.6.1 Program Editing".
- (5) When MDI program is displayed, the block with the cursor will be set for MDI by pressing [INPUT] key.
- (6) If the [INPUT] key is pressed when the data protection is valid, the cursor position search will be executed without displaying the message "Data protect", and the message "Search completed" will appear upon completion.
- (7) If the INPUT key is pressed during automatic operation, check, or restart search while the program currently being displayed is not in a selected part system, message "Executing automatic operation", "Program checking" or "Program restarting" is not displayed. The cursor position search is carried out, and message "Search completed" is displayed.
- (8) If the N number of the block to be searched exceeds the maximum value or is set to "0", it causes a search error in all blocks that belong to the N number.
- (9) If characters other than digits follow "N" of the block to be searched, "N**" of the program is handled as a normal block, not a sequence number. Therefore, if the target block is searched, it is handled as a block that belongs to the previously searched N number.

Edit/search signal search

This is enabled when "2" or "3" is set to the parameter "#11031 Cursor pos search".

- (1) Carry out the operation search to find the program to carry out the cursor position search.

- (2) Turn ON the edit/search signal.



The "Edit/Search" window is displayed.
The program is displayed starting from the block currently searched.

(During automatic operation or foreground checking, the program is displayed from its top.)

```

Edit/Search
Memory:/Program
File 001
Line 1 -
1 G91 G28 Z0.0 ;
2 G28 X0.0 Y0.0 ;
3 Y10. ;
4 Z10. ;
5 M30 ;
6 %
  
```

- (3) Move the cursor to the block to be carried out the cursor operation search.

- (4) Turn OFF the edit/search signal.



The "Edit/Search" window is closed, and the operation search is carried out starting from the block that has the cursor.

When the search is completed, "Search completed" is displayed.

(Also in the case where the screen is changed with a function key, etc. and the "Edit/Search" window is closed, the operation search is carried out.)

Note

- (1) If the "edit/search signal" is set to ON on a screen other than the monitor screen, the "Edit/Search" window is not displayed. To display the "Edit/Search" window, switch to the monitor screen. Switching to the monitor screen automatically displays the "Edit/Search" window.
- (2) If a window (operation search window, menu list, guidance, custom window, etc.) other than the program edit window is displayed while the monitor screen is being displayed, the "Edit/Search" window is not displayed even if the edit/search signal is set to ON. To display the "Edit/Search" window, close the currently displayed window. When the currently displayed window is closed, the "Edit/Search" window is displayed automatically.
- (3) If the edit/search signal is set ON during display of the program edit window on the monitor screen, the display changes to the "Edit/Search" window while the editing contents, cursor position, and menu etc. remain unchanged.
- (4) If the "Edit/Search" window is attempted to be closed during editing, a message to confirm whether to save the data will appear.
When it appears, if save is carried out by pressing the [Y] or [INPUT] key, the operation search will be carried out starting from the block that has the cursor.
If save is not carried out, the edited data will be aborted, and the operation search will not be carried out.
- (5) If the "Edit/Search" window is closed while the cursor is positioned in the input area during string searching or string replacement, the operation is canceled, and the cursor returns to the editing area. After this, an operation search is carried out with the block located by the cursor at the top. However, during editing, the cursor returns to the editing area, and the same operation as that described in (3) is performed.
- (6) If the "Edit/Search" window is displayed while the automatic operation, check, or restart search is in process in the selected part system, message "Executing automatic operation", "Program checking" or "Program restarting" is displayed. However, when "#11039 Cusr pos srch type" is set to "1", cursor position search is possible even in the single block stop state. For details, refer to "Search during single block stop" in "10.6.1 Program Editing".

- (7) If the "Edit/Search" window is closed during automatic operation, program check, or restart search in the selected part system, message "Executing automatic operation", "Program checking" or "Program restarting" is displayed, but an operation search is not carried out. However, when "#11039 Cusr pos srch type" is set to "1", cursor position search is possible even in the single block stop state. For details, refer to "Search during single block stop" in "10.6.1 Program Editing".
- (8) If the "Edit/Search" window is opened while the operation mode is set to the MDI mode, the MDI program is displayed in the "Edit/Search" window. In this state, if the "Edit/Search" window is closed, the MDI setting at the cursor position is executed.
- (9) The part system that is selected when the "Edit/Search" window is opened is to be searched when the "Edit/Search" window is closed.
- (10) The program that is searched when the "Edit/Search" window is opened is to be searched when the "Edit/Search" window is closed.
- (11) In the following cases, edit/search is not available with the "Edit/Search" window. After an error is displayed, a blank "Edit/Search" window is displayed.
 - Edit lock B, C is enabled
 - Operation search is not carried out
 - Edit file size exceeded
 - A serial program is being searched
- (12) If the edit/search signal is set ON at power ON, the "Edit/Search" window is displayed.
- (13) The "Edit/Search" window cannot be closed with the cancel key. To open another window of the monitor screen, either turn OFF the edit/search signal or use the direct screen selection in the menu list.
- (14) If you switch to the monitor screen to edit using the direct screen selection while the "Edit/Search" window is displayed, the "Edit/Search" window is closed once, a search is carried out, and then the "Edit/Search" window is displayed again.
- (15) If the N number of the block to be searched exceeds the maximum value or is set to "0", it causes a search error in all blocks that belong to the N number.
- (16) If characters other than digits follow "N" of the block to be searched, "N***" of the program is handled as a normal block, not a sequence number. Therefore, if the target block is searched, it is handled as a block that belongs to the previously searched N number.

Search during single block stop

Cursor position search can be operated during single block stop when "1" is set to the parameter "#11039 Cusr pos srch type". By pressing menu [Edit] during single block stop, single block stop position becomes top of the program display.

(1) Pause automatic operation with single block stop.

(2) Press the menu [Edit].



The program edit window appears.

The block where the operation is stopped due to single block stop is displayed on the top.

However, for mass-editing, when the program that can be displayed within one page on the edit screen, or when the program has been in single block stop status at the block existing in the first or last page, the cursor is displayed at the stopped block. In these cases, the top or end of the program is displayed, not the stopped block at the head.

If the operation has been stopped in a subprogram, that subprogram is displayed.

(3) Move the cursor to the block to be carried out the cursor operation search.

(4) Press the [INPUT] key.



The search will operate by single block stop position with top.

During the search "Searing" will display blinking.

When the search is completed, "Search completed" is displayed.

Note

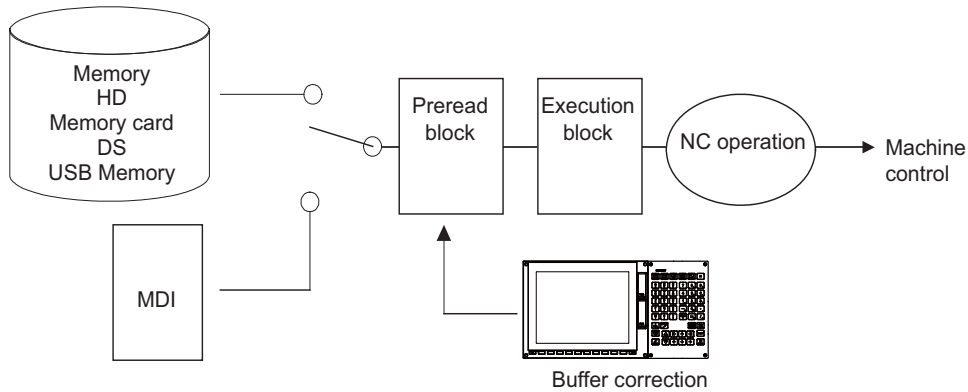
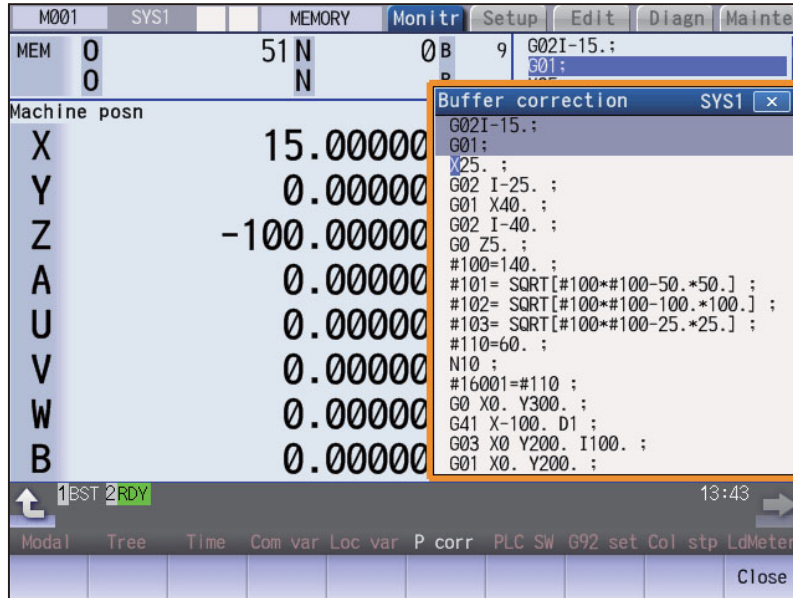
- (1) Blocks lower than the point of the single block stop only are eligible for cursor position search designation during single block stop. "Search error" will display and the search will fail when cursor position search is attempted at an already executed block.
- (2) The blocks between single block stop position and search position block will be ignored when cycle start is operated after cursor position search is operated during single block stop.
- (3) While the part system with a cursor position search to be performed is in block stop state in arbitrary reverse run mode (including a case in which the reverse run control mode signal is set ON), message "search error" is displayed, and a cursor position search cannot be carried out.
- (4) If the part system with a cursor position search to be performed is placed in block stop state due to a program error, message "During automatic operation" is displayed, and an operation search is not carried out.
- (5) If cursor position search is commanded at a block that causes a program error, the block of the single block stop, instead of the cursor position search target block, will appear on the top of program buffer display upon automatic start up.
- (6) If cursor position search is commanded at a block that comes later than a fixed cycle while stopped with single block stop in the midst of the fixed cycle, the cursor position search target block will appear on the top of the program buffer display. However, automatic operation will start from the top of the remaining of the fixed program, and after finishing the fixed cycle, will move on to executing the cursor search target program.
- (7) If a cursor position search is carried out for blocks after the MTB macro program while the MTB macro program is interrupted by a single block stop, a program buffer is displayed from a search block. However, when the system is started automatically, the MTB macro program is executed continuously, and the block detected by a cursor position search is processed after the MTB macro program has been completed.

10.6.2 Buffer Correction



During automatic operation (Memory, HD, DS, memory card or USB memory) or MDI operation, a block stop can be applied, and the next command can be corrected or changed.

When a program error occurs, the block in which the error occurred can be corrected without resetting the NC, and operation can be continued.



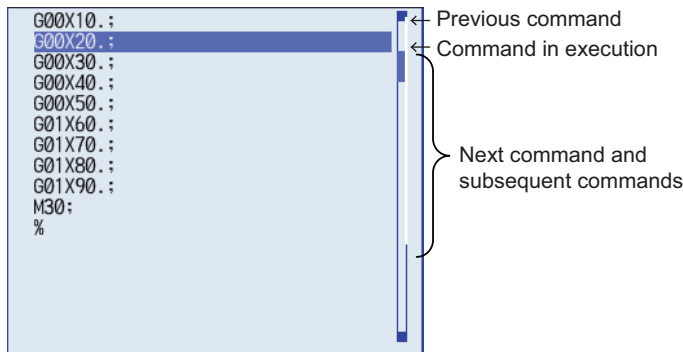
- (1) The next command can be corrected in the following two cases.
 - When single block stop is applied, and there is a command block to be corrected in the next command.
 - When there is an error (program error) in the next command and automatic operation is stopped.
- (2) Not only the displayed buffer data but also the contents in the device are corrected with the buffer corrections. (The corrected data is reflected.)
- (3) Several blocks following the next command can be corrected simultaneously.

Menus	
Menus	Description
Close	This closes the pop-up window and quits this function.

Operation method

During a single block stop or when a program error stop occurs, the buffer can be corrected with the following operations, and operation can be continued.

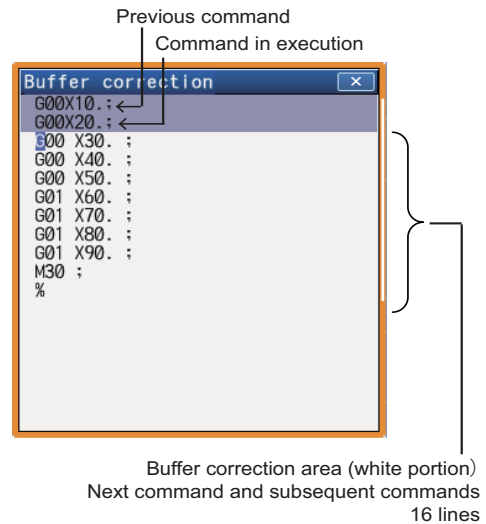
The normally executed program appears in the buffer correction area.



(1) Press the main menu [Prg correct].



The mode changes to the buffer correction mode.



The display changes so that the next command is at the head of the area. The buffer correction area becomes the valid area, and the keys can be input or the cursor moved.

The cursor can be moved freely within the buffer correction area using the cursor keys.

(2) Correct the program with the same method as a normal program editing.

(3) Press the [INPUT] key.



The buffer correction mode ends, and the corrected data is written into program. If a program error has occurred, the error display is erased.

(4) Confirm that the corrected data is correct, and then restart.





The program execution resumes from the currently stopped position.

Precautions

■ Buffer correction mode will not be applied in the following cases:

- (1) Machining program for buffer corrections is in edit lock or program display lock state.
- (2) When the data protection is valid.
- (3) Machining program for the device in write-protection state
- (4) Machining program in read-only state
- (5) During the compound type fixed cycle, the tool center point control or executing the MTB macro program

■ Starting and ending buffer corrections

- (1) If automatic operation is started or there is no next command data, the buffer correction mode is not entered even if the menu key is pressed.
- (2) To stop or to cancel the buffer corrections, press the menu [Close] again, or press the  or  key.
- (3) If another menu key, etc., is pressed before pressing the [INPUT] key, the corrected buffer contents return to the original data.
- (4) If changing to another screen or resetting the NC during buffer correction or changing system, the buffer correction is canceled. In this case, the corrected contents are not saved, and the buffer correction mode ends.

■ Display data during buffer correction

- (1) The key operations used for corrections in the buffer correction mode are the same as the operations when editing a program. Up to 16 blocks can be displayed. Even when a block is displayed over several lines, all 16 blocks can be displayed by scrolling the buffer correction area.
- (2) Number of characters in one block is max. 256 (including ";" (EOB)). If exceeds 256 characters, the block will be split into two.
- (3) Up to 4096 characters can be edited with buffer corrections.

■ Operations during buffer correction

- (1) If there is no ";" (EOB) at the data in the last block corrected when the [INPUT] key is pressed, it is added automatically.
- (2) When the buffer correction mode is set, the last block displayed in the buffer correction area may not fit in if the block is long, etc.
To correct this type of block, take care to the following points.
 - If a ";" (EOB) is added to the end of the displayed data, the section following the incomplete display becomes another block. If ";" (EOB) is not added, the following section stays the same, and is handled as the continuation of the displayed section.
 - If one block is deleted by pressing the [C.B] key, the block is deleted up to the section following the incomplete display (up to the ";").
- (3) Operation cannot be started during buffer correction. An alarm occurs.
- (4) If NC is reset during buffer correction, buffer correction mode will be canceled, although buffer correction window is left opened. At this time, editing operation is not possible. Close the correction window.
- (5) Buffer correction writing is not interrupted by NC reset.
- (6) The operation message "Can't write into file" appears at any attempt of the buffer mode correction to write into the program being operated or checked, which had stopped when the buffer correction mode started.

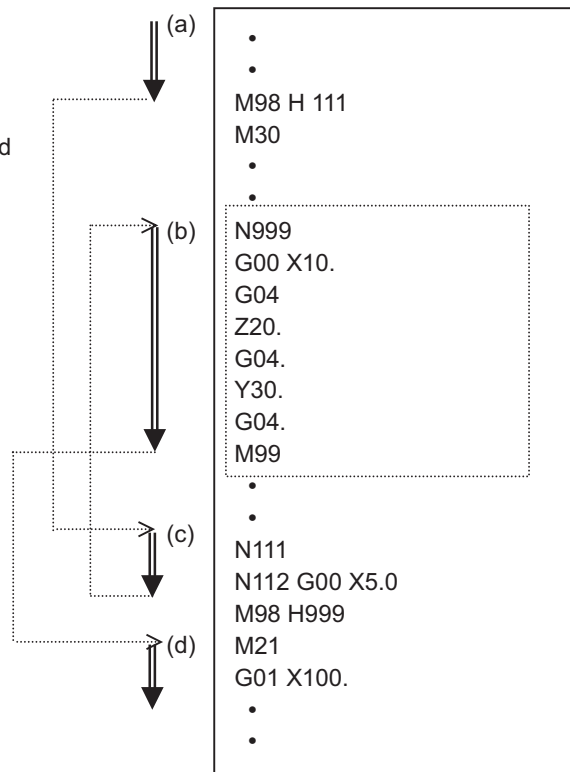
■ For multi-part system

- (1) When a machining program under buffer correction is called by another part system, a file input/output error occurs to the caller-side part system, and restart of the operation will be disabled.
- (2) Note that if the same program is executed in another part system after a buffer correction, there may be some changes in paths, etc.
- (3) The program which has searched for the sequence No. while operating in another part system cannot be buffer correction. The operation message "Buffer correct not possible" appears.

■ Previous command and command in execution

- (1) When the buffer is corrected following the operation mode change at single block stop, nothing will be displayed in previous command and command in execution.
- (2) When there is no block after sub program call or user macro call, a program error occurs at the last block of the destination program. If a buffer correction is made in this state, the destination program will be displayed in the buffer correction window, but the actual correction result will be reflected on the source program.
- (3) The buffer cannot be corrected when the block where the buffer is corrected is in the forward side from the block called at another nest level. The operation message "Buffer correct not possible" appears.
The buffer can be corrected when the block where the buffer is corrected is in the rear side from the block called at another nest level.

- (a) : The buffer can be corrected.
 (b)(d) : The buffer can be corrected because the block is in the rear side from (a).
 (c) : The buffer cannot be corrected because the block is in the forward side from (b).



10.7 Other Functions

The operation methods for the functions described in this section differ depending on MTB specifications. Check your MTB specifications.

10.7.1 Chamfering

Chamfering in the thread cutting cycle can be validated/invalidated using an external switch.

10.7.2 Miscellaneous Function Lock

- (1) M, S, T or B function execution can be ignored by turning ON the "MISCELLANEOUS FUNCTION LOCK" switch.
- (2) BCD output and the start signal of M, S, T or B function are not made.
- (3) If the "MISCELLANEOUS FUNCTION LOCK" switch is changed during command execution, automatic operation stops after the block being executed is terminated. Then, it becomes effective.

10.7.3 Single Block

- (1) When the "SINGLE BLOCK" switch is turned ON, automatic operation stops after the block being executed is terminated. That is, automatic operation stops after one program block is executed.
- (2) The single block stop point in the fixed cycle mode is fixed according to the fixed cycle.

10.7.4 Z-Axis Command Cancel

- (1) By turning ON the "Z AXIS CANCEL" switch, NC commands can be executed for the movement by automatic operation, without moving the machine in the Z axis only.
The Z axis does not move, but the current position display of the setting display unit is incremented.
- (2) The Z axis moves by manual operation even when the "Z AXIS CANCEL" switch is turned ON.
- (3) If the "Z AXIS CANCEL" switch is changed over during automatic operation, the new switch setting is validated when the automatic operation stops after the block being executed finishes.
- (4) In reference position returns (G28, G30), the axis is controlled to the middle point in a canceled Z axis state, but this state is ignored after the middle point.

10.7.5 Dry Run

When the "DRY RUN" switch is turned ON, the feedrate set by using the "MANUAL FEED RATE" switch takes precedence over the programmed feedrate (F).

10.7.6 Manual Override

- (1) When the "MANUAL OVERRIDE" switch is turned ON, the override value set by using the "FEED OVERRIDE" switch takes precedence over the value set by using the "MANUAL FEED RATE" switch.
- (2) The override value set by using the "FEED OVERRIDE" switch also takes precedence over the dry run during automatic operation.
- (3) Manual override becomes effective immediately when the switch is turned ON.

10.7.7 Override Cancel

- (1) When the "OVERRIDE CANCEL" switch is turned ON, the programmed F command value takes precedence over the override value set by using the "FEED RATE OVERRIDE" switch.
- (2) It is not effective for manual override.

10.7.8 Optional Stop

- (1) If M01 is programmed, the machine automatically stops by turning ON the "OPTIONAL STOP" switch. When the switch is OFF, M01 is ignored and the machine does not stop.
- (2) The machine stops after the M01 block is executed.

10.7.9 Optional Block Skip

There are two types of optional block skip codes: "/" and "/n". When the "OPTIONAL BLOCK SKIP" switch is turned ON, a block which begins with a "/" (slash) or "/n" code is skipped from after "/" code to end of the block; when the switch is OFF, the block is executed. This enables the operator to specify whether or not a block beginning with "/" (slash) or "/n" code is executed.

A block which has a "/" or "/n" code in not the head but the middle is operated according to the parameter "#1226 aux10(bit1)" (optional block skip type) setting.

0: Enable only at the beginning of a block.

1: Enable in the middle of a block, as well as at the beginning of the block.

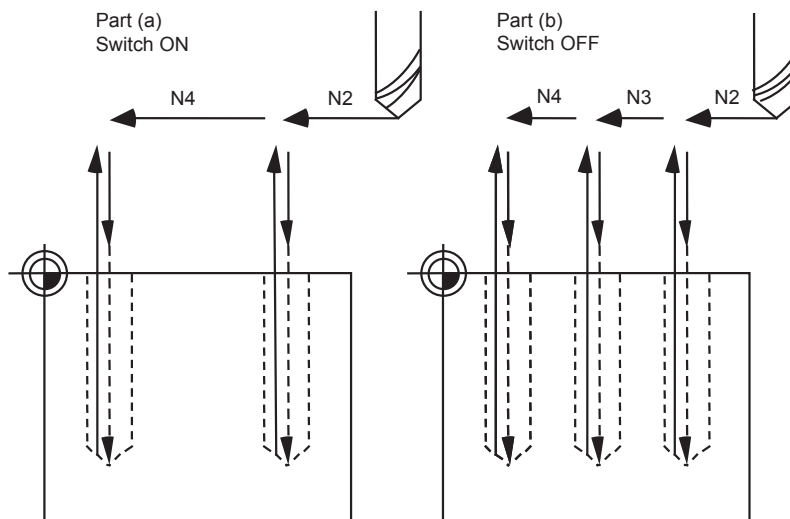
(Example) When machining two parts as illustrated below, if the following program is prepared and the machining is done by turning ON the "OPTIONAL BLOCK SKIP" switch, part (a) is provided; if the machining is done by turning OFF the switch, part (b) is provided:

Program

```

N1 G54 ;
N2 G90 G81 X50. Z-20. R3. F100 ;
/N3 X30. ;
N4 X10. ;
N5 G80 ;
M02 ;

```



If a slash code is placed not at the beginning but in the middle of a block, it operates according to the parameter "#1274 ext10(bit4)" (Optional block skip operation changeover).

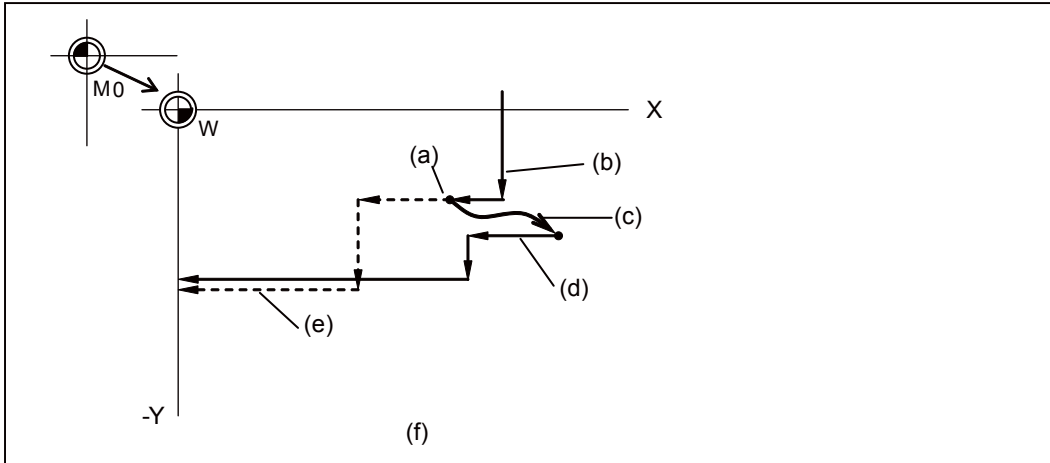
0: Follow the setting of the parameter "#1226 aux10/bit1" (Optional block skip operation type).

1: A slash code is enabled both at the head and in the middle of a block.

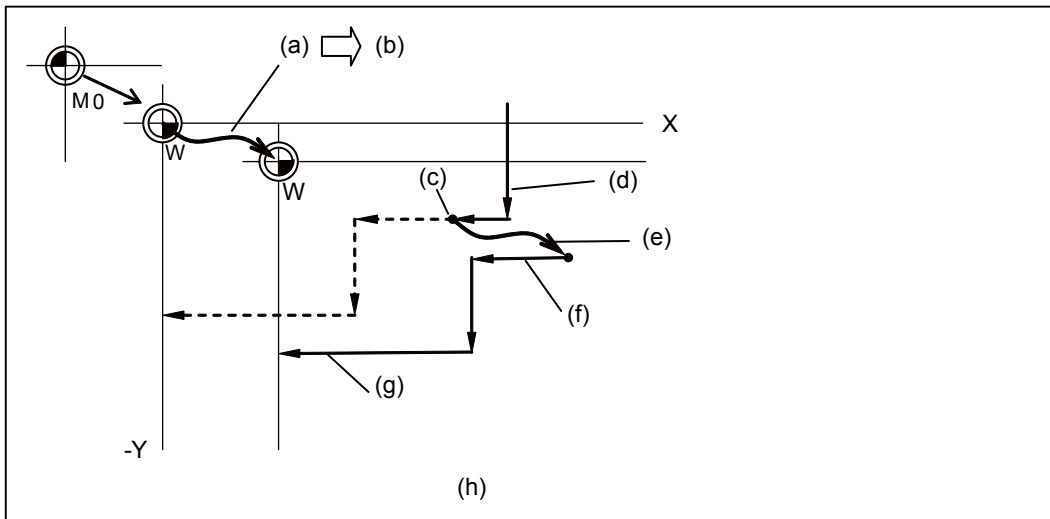
However, a slash code included in the right-hand side of an operation expression is treated as a division operator.

10.7.10 Manual Absolute

When the "MANUAL ABSOLUTE" switch is turned ON, while the program coordinate system is not updated, the coordinate position is updated by the distance in which the tool has been moved manually. If the switch is OFF, the program coordinate system is updated when the tool is manually moved.



- (a) Feed hold stop
- (b) Programmed path (absolute command)
- (c) Manual interrupt (The coordinate system W is not shifted)
- (d) Path after manual interrupt
- (e) Tool passes along same path as that programmed
- (f) With manual absolute signal ON



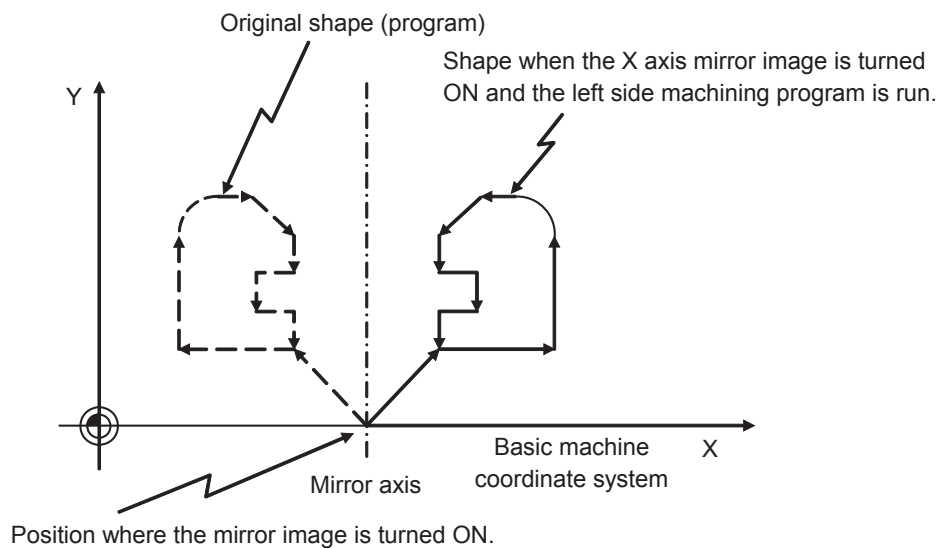
- (a) Manual interrupt (The coordinate system W is shifted)
- (b) Manual interrupt amount
- (c) Feed hold stop
- (d) Programmed path (absolute command)
- (e) Manual interrupt (The coordinate system W is shifted)
- (f) Path after manual interrupt
- (g) Path is shifted by an amount equivalent to manual interrupt value (Zero point of the coordinate system W moves)
- (h) With manual absolute signal OFF

10.7.11 Mirror Image

When cutting a shape having bilateral symmetry, this function can be used to machine either the right or left side of the shape from the program for the other side, thus saving programming time. The mirror image function is effective in this case. When cutting a shape having upper and lower symmetry, this function can be used to machine either the upper or lower side of the shape from the program for the other side.

For example, when there is a program for machining the left side of the shape shown in the following drawing, a symmetrical shape to the left side shape can be machined on the right side by applying the mirror image function and running the same program.

Be sure the machining program starts and finishes at the mirror center.



Mirror image includes external input mirror image, parameter setting mirror image, programmable mirror image, etc. The external input mirror image and parameter setting mirror image are explained here.

(Refer to "Programming Manual" for information on programmable mirror image.)

External input mirror image: The mirror image function is controlled with the "MIRROR IMAGE" switch installed on the machine operation panel.

Parameter setting mirror image: The mirror image function is controlled by the parameter setting on the NC unit screen.

The mirror image can be set to ON/OFF for each axis in both external input mirror image and parameter setting mirror image.

Note

(1) Refer to the Operation Manual issued by the MTB for information on the operation panel "MIRROR IMAGE" switch.

The external input mirror image

- (1) Before carrying out mirror image machining, move the axis to the mirror center using a mode such as MDI or JOG.
- (2) After positioning the axis on the mirror center, turn ON the "MIRROR IMAGE" switch.
- (3) Movement for the movement commands subsequently issued in the respective program run and MDI modes is carried out to positions symmetrical with the mirror center, and the shape is machined.
- (4) Return to the mirror image center.
- (5) Turn OFF the "MIRROR IMAGE" switch to cancel the mirror image function.

The parameter setting mirror image

The parameter setting mirror image operation is equivalent to that of the external input mirror image, except that the "1" or "0" is set in the parameter "#8211 Mirror image" instead of using a "MIRROR IMAGE" switch.

0: Mirror image OFF

1: Mirror image ON

This is used when there is no external switch for mirror image operation on the machine operation panel, etc.

Mirror image operation switching

The type of mirror image operation can be select by the parameter "#1271 ext07(bit0)" (Mirror image operation).

0: Type 1

- The program mirror image, external mirror image, and parameter mirror image are exclusive to each other.
- An increment command moves the image to the position indicated by the move amount with the sign inverted.

1: Type 2

- Mirror image operation is enabled when the program mirror image (G51.1) command is issued or when the external signal or parameter is ON.
- An increment command moves the image to the position determined by applying the mirror image to the absolute program coordinates.

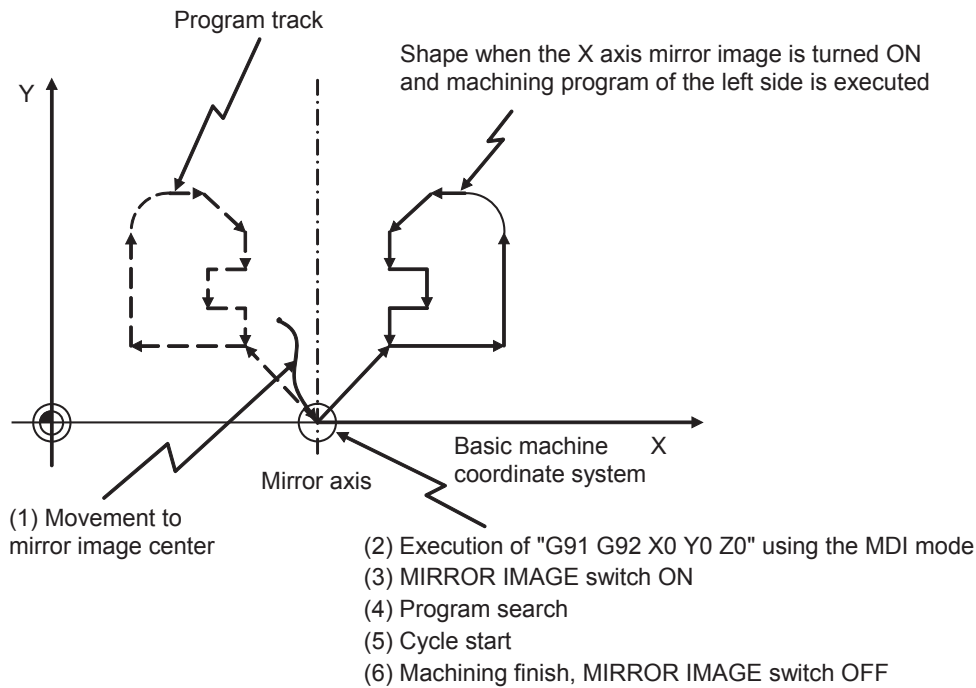
**CAUTION**

Program so the mirror image function is turned ON/OFF at the mirror image center. Otherwise the center of the mirror image cannot be set properly.

Operation examples

<Example of operation with an external switch>

- (1) Move the axis to the mirror image center using a the JOG mode.
- (2) Execute "G91 G92 X0 Y0 Z0" using the MDI mode.
- (3) Turn ON the "MIRROR IMAGE" switch.
- (4) Search for the program to which mirror image will be applied.
- (5) Press the "CYCLE START" switch to start the program.
- (6) Turn OFF the "MIRROR IMAGE" switch when the machining is finished.



Note

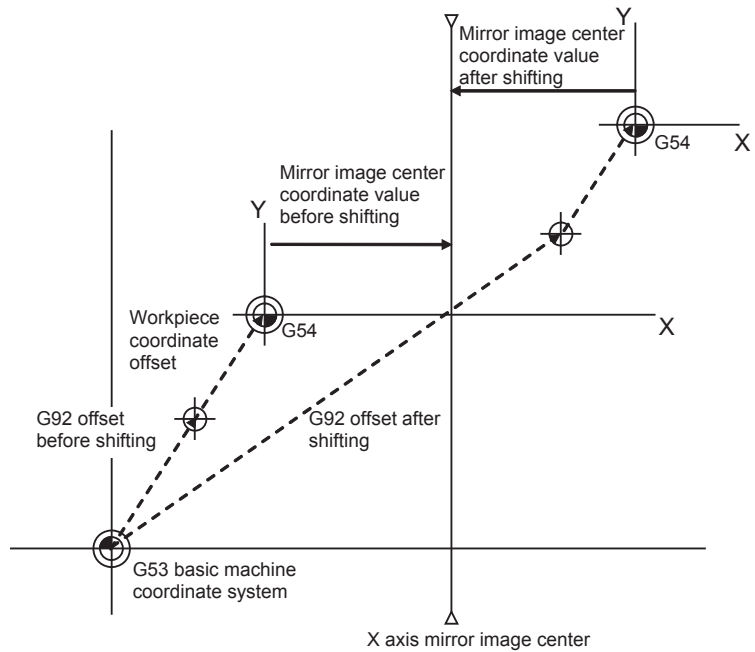
- (1) If an "NC reset" or "Machining program restart" is carried out during operation with "MIRROR IMAGE" switch ON, the mirror image center will move to the "Restart position" and the coordinate system will shift.

Combination with other functions

(1) Coordinate system setting, workpiece coordinate system

As for the mirror image center, the position in which an external signal or the parameter was turned ON is the center coordinates value.

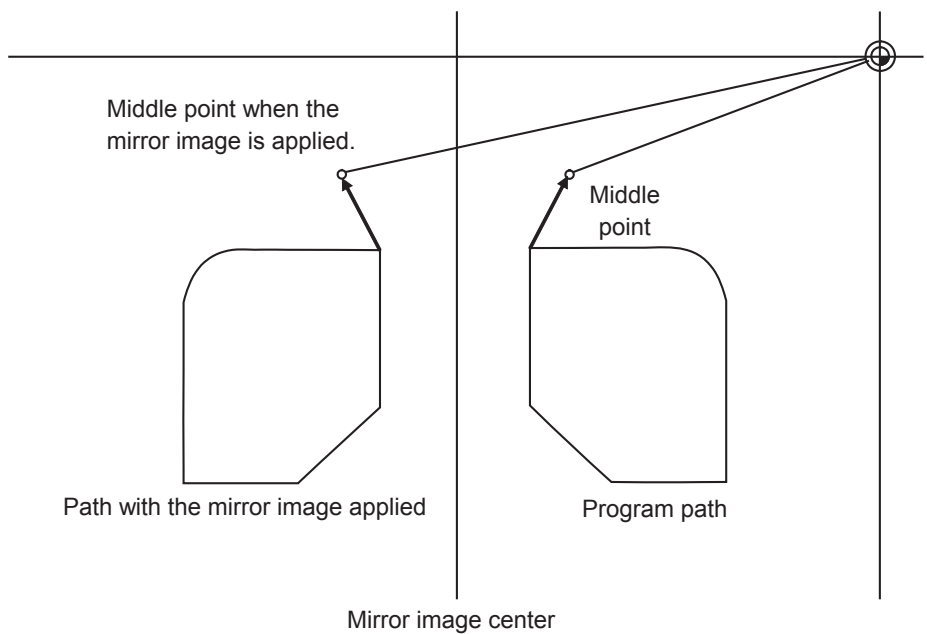
External input mirror image and parameter setting mirror image are processed on the basic machine coordinates. Therefore, the mirror image center is not shifted by the coordinates system setting (G92) and the workpiece coordinates change.



For the mirror image of external input mirror image and parameter setting mirror image, the coordinate value on the basic machine coordinate system is not shifted. However, the coordinate value on the local coordinate system is shifted according to the coordinate system specified with G92.

(2) Reference position return command (G28, G30) during mirror image

When a reference position return command (G28, G30) is issued during mirror image, the mirror image is valid in the operation until the middle point, but is invalid in the operation from the middle point to the reference position.

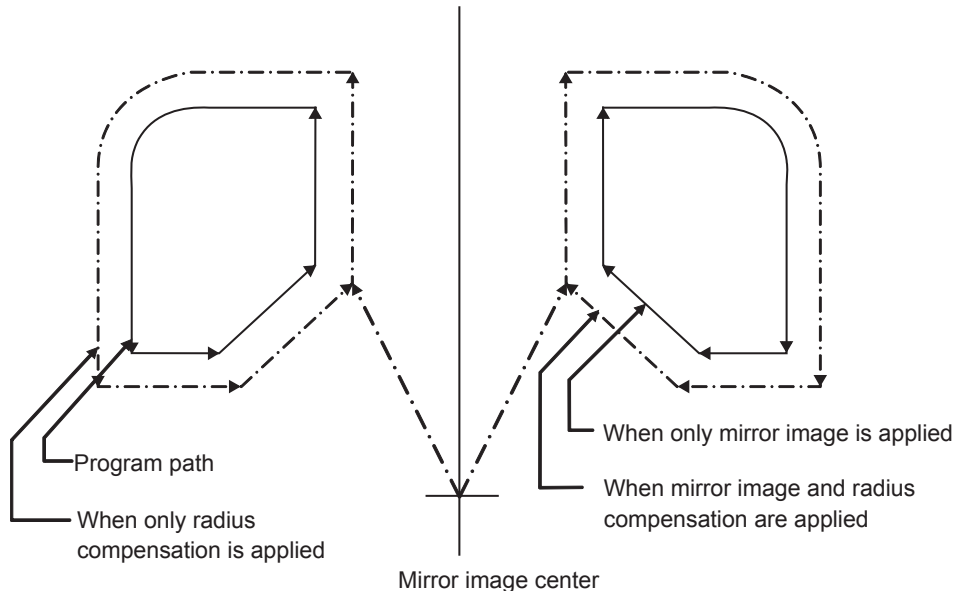


(3) Reference position return command (G29) from the zero point

When a reference position return command (G29) is issued from the reference position, the middle point becomes the middle point passed through during the previous reference position return command (G28, G30), unrelated to the current mirror state. The axis moves following the current mirror state (ON/OFF) for operations after the middle point.

(4) Radius compensation commands (G41, G42) during mirror image (M system)

Because the mirror image is processed after the radius compensation (G41, G42) is applied, the cutting is carried out as follows:



(5) Scaling

The mirror image is applied for the scaled shape.

(6) Machine coordinate system selection (G53)

The mirror image is not applied for positioning by a G53 command.
Issue the next movement command in the G90 mode.

(7) Fixed cycle (G76, G87) (M system)

The mirror image is not applied to shift operations in the XY direction for G76 and G87 commands.
The mirror image is applied to positioning operations.

(8) Handle interruption

When the manual ABS is ON, the handle interrupt amount is reflected on the workpiece coordinate system counter, and the workpiece coordinate system does not shift. Because of that, the mirror center also does not shift.
When the manual ABS is OFF, the handle interrupt amount is not reflected on the workpiece coordinate system counter. The amount is held as an interrupt amount, and the mirror center shifts.

(9) Arc, tool compensation

If mirror image is applied on only one axis in the designated plane, the rotation direction and compensation direction will be reversed for the arc or tool compensation and coordinate rotation, etc.

Precautions

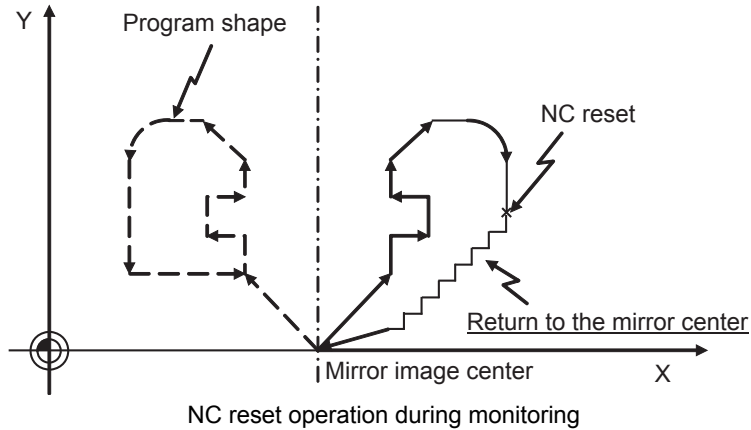
(1) Reset and mirror image cancel

The mirror image center is canceled by the NC reset (including M02, M30 internal resets). The next time the mirror image center will be established is when an automatic start is carried out.

This operation enables the mirror image center to be changed with the mirror image ON using a simple operation, so that another shape can be machined after the machining finishes.

Be sure to move the axis to the mirror image center with the manual handle, etc. before carrying out an automatic start when restarting the same machining program.

Be sure the final command M02 (or M30) position is at the mirror image center (program start position) when repeating the same machining program.

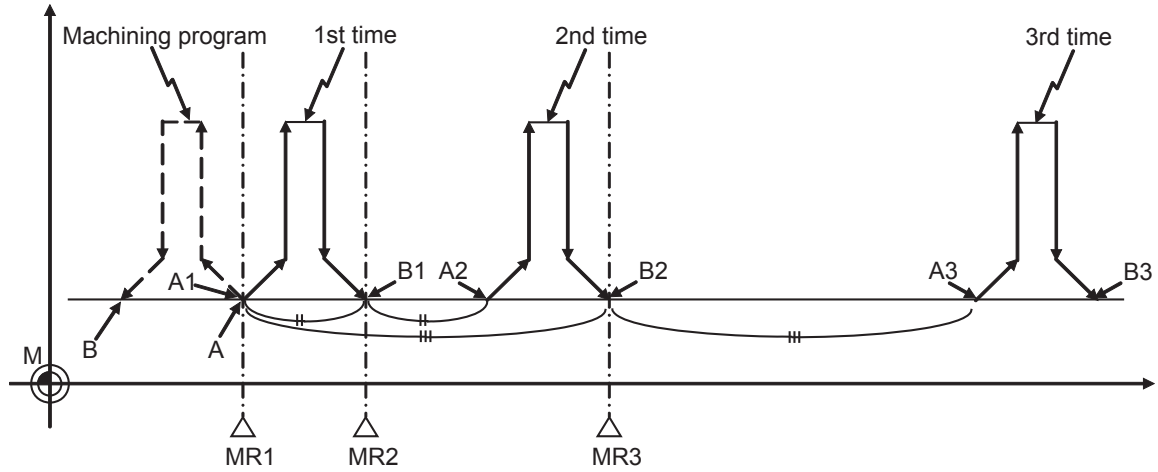


< Program example when repeating the program >

G90 G0 X0 Y0;	-----	Program start position
X___ Y___;		
:		
G0 X0 Y0;	-----	Return to program start position.
M02;	-----	NC reset

If the NC is reset at a point other than the mirror image center, and the same machining program is restarted, the mirror image center will move to that location. The coordinate system will shift.

If the machining program is repeated without returning to the mirror image center (program start position), the positioning point shifts from A1 -> A2 -> A3 as shown in the following drawing, and does not go to the desired position. This means the end point shifts from B1 -> B2 -> B3. At this point the M02 reset and automatic start is carried out, because the mirror image center moves from MR1 → MR2 → MR3.



< Example of a machining program in which the mirror image center shifts >

G90 G0 X0 Y0;	-----	A positioning point
G1 X__ Y__;	-----	
:	-----	
X-100. Y0;	-----	B end point
M02;	-----	NC reset

(2) Mirror image operation at reset

The operation type of the external input mirror image and parameter setting mirror image can be select by the parameter "#8124 Mirr img at reset". If the mirror image center is not changed when resetting, set to "1".

- 0: The current mirror image is canceled, and new mirror image will start with the machine position at reset as the mirror center.
- 1: The mirror center is kept to continue the mirror image. If it is necessary to change the mirror image center, command the mirror image again with new mirror image center after the mirror image is canceled once.

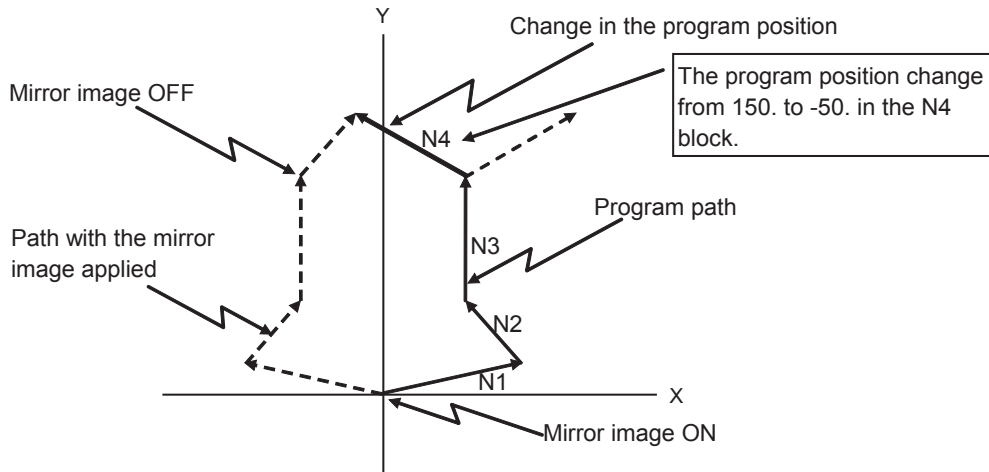
(3) Incremental commands after the mirror image is canceled

When the mirror image is canceled at a point other than the mirror image center, the program position and machine position will be in a shifted state as shown in the following drawing. To return this state to normal, carry out a process which returns the program position to the mirror image OFF position. Because of this, the program position in the cycle start may change greatly.

Cancel the mirror image at the mirror image center, or issue an absolute value positioning or reference position return command (G28, G30) once after canceling the mirror image.

The mirror state in the NC can be confirmed with the "MR" display. Even if the NC is reset, "MR" is displayed for mirror image valid axis immediately before reset. This is so the "MIRROR IMAGE" switch ON/OFF can be monitored.

The "MR" display disappears when the "MIRROR IMAGE" switch is turned OFF and the "CYCLE START" is pressed.



			Machine position		Program position	
			X axis	Y axis	X axis	Y axis
X axis mirror image ON	N1	G91 G00 X250. Y50. ;	-250. MR	50.	250.	50.
	N2	G01 X-100. Y100. ;	-150. MR	150.	150.	150.
	N3	Y200. ;	-150. MR	350.	150.	350.
X axis mirror image OFF	N4	X100. Y100. ; M02 ;	-50.	450.	-50.	450.

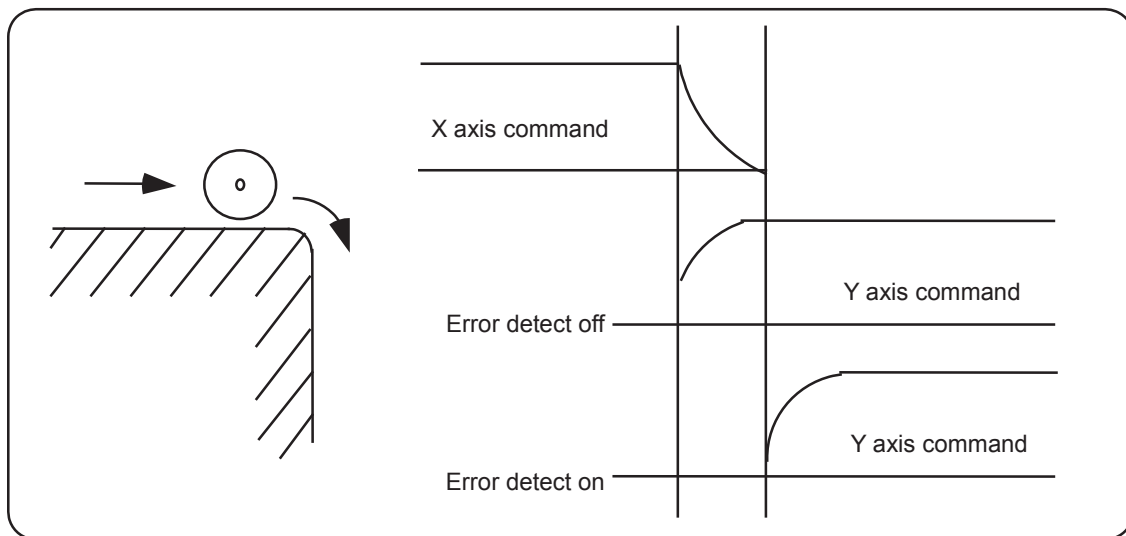
10.7.12 Error Detect

For positioning (G00), machine deceleration check is made before next block movement is started. For cutting (G01, G02, or G03), the next block is started before the machine reaches the movement command end point. Thus, the corner part is slightly rounded.

To prevent rounded corners, turn ON the error detect signal. This will cause the machine to decelerate until the remaining distance falls below the value of the parameter. The next block command is stopped during this time.

This function is equivalent to G09 in the program.

The parameter that is used by the error detect switch and the G09 command for determining the remaining distance after deceleration for moving to the next command can be set with the setting and display unit.



10.7.13 Follow-up Function

The follow-up function monitors machine motion in the emergency stop state and reflects it in the current position and workpiece coordinates. Thus, the work program can be continued without re-executing a reference position return after emergency stop.

10.7.14 Axis Removal

When the machine receives the axis removal signal, that axis no longer becomes the controlled axis. Accordingly, the alarm related with axis, such as the stroke end axis, and the servo alarms (excessive errors, lack of signal, drive alarm, etc.) will be ignored. At the same time, the axis will become interlocked.

Note

(1) This cannot be used for the absolute position detector specification axis.

10.7.15 F1-digit Feed

The feedrate registered by parameter can be assigned by designating a single digit following address F.

There are six F codes: F0 and F1 to F5. The rapid traverse rate is applied when F0 is issued which is the same as the G00 command.

When one of the codes from F1 to F5 is issued, the cutting feedrate set to support the code serves as the valid rate command.

If F6 or larger value is command, the value is regarded as the cutting feedrate which has been directly commanded with numerical values.

When "F1-digit speed change valid" signal is valid when F1-digit feed is issued, a feedrate which is set by a parameter can be increased or decreased by operating the manual handle.

Refer to "Programming Manual" for more details on F1-digit feed.

Validate the F1-digit feedrate

To validate the F1-digit feed, the parameter "#1079 f1digit" or "#8145 Validate F1 digit" must be ON.

When the F1-digit feed is valid, the feedrate of each command is as follows:

F0: Rapid traverse rate

F1 to F5: The feedrate configured by the corresponding parameter "#1185 spd_F1" to "#1185 spd_F5"(F1 digit feedrate F1 to F5)

Enabling conditions of the speed change with the handle

When the F1-digit command is valid, the feedrate can be increased/decreased by operating the first manual handle. (The feedrate cannot be changed by the 2nd and 3rd handles.)

Changing the feedrate by the handle is available satisfying the following conditions:

- (1) The operation must be in automatic start.
- (2) The operation must be in cutting feed, and F1-digit feedrate command must be issued.
- (3) The F1-digit feed parameter must be ON.
- (4) The F1-digit feed switch must be ON.
- (5) The operation must not be in handle mode.
- (6) The operation must not be in dry run.
- (7) Upper limit of F1-digit feedrate ("#1506 F1_FM") and F1-digit feedrate change constant("#1507 F1_K F1") are not zero.

Conversion of the F1-digit feedrate changing with handle operation

Once the F1-digit feedrate is changed with manual handle, the changed feedrate is valid until parameter is changed or the power is turned OFF. Changed feedrate can be checked only during the operation. Note that if the parameter "#1246 set18(bit16)" (switch over of the F1-digit feedrate changing method) is set to "1", even after the power is turned OFF, operation is kept at the changed feedrate because the parameter of F1-digit feedrate has been changed. In this case, if the screen is not switched, the changed parameter values are not reflected to the display.

The increase/decrease amount per handle gradient is expressed with the following equation.

$$\Delta F = \Delta P \times \frac{FM}{K}$$

ΔP : Handle pulse (\pm)
 FM : Upper limit of F1-digit feedrate (#1506 F1_FM)
 K : F1-digit feedrate change constant (#1507 F1_K)

(Example) When the handle scale unit is to be made ± 10 mm/min.

If FM is made 3600mm/min, feedrate change constant (K) must be set "360" according to the following formula.

$$\Delta F = 10 = 1 \times \frac{3600}{K}$$

Note

- (1) If F1-digit feedrate changing valid signal is turned ON when F1-digit feed is commanded and changing feedrate with the manual handle is valid, it is clamped at the upper limit of F1-digit feedrate if the F1-digit feedrate is greater than the upper limit of F1-digit feedrate.
- (2) When the F1-digit feedrate is 0 with the handle operation during the F1-digit feedrate command, the alarm "M01 F1-digit feedrate zero 0104" will occur. This alarm can be eliminated when the F1-digit feedrate is set in larger value than 0 with the handle operation.
- (3) When K is 0, the speed is not changed.

Precautions

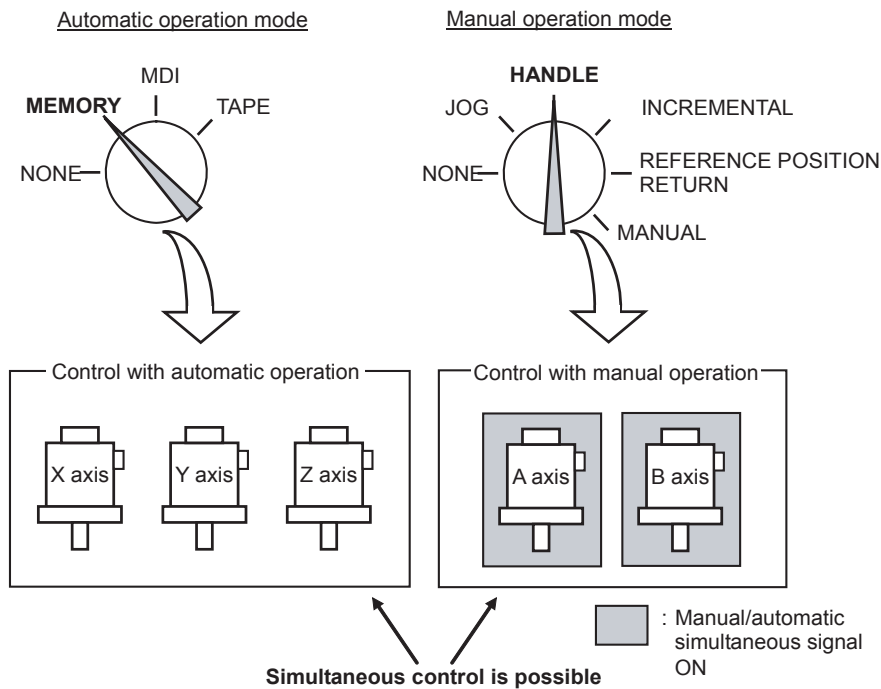
- (1) The number of manual handle pulses is 1 pulse per scale unit regardless of the scaling factor.
- (2) During a F1-digit feed command, the F1-digit feed number and F1-digit feed command signal are output as the PLC signals.
- (3) When F1. to F5. (with decimal point) are assigned, the 1mm/min to 5mm/min (direct numerical value command) are established instead of the F1-digit feed command.
- (4) When the commands are used with inch command, one-tenth of the feedrate set correspond to F1 to F5 serves at the assigned speed inch/min.
- (5) When the commands are used with the millimeter or degree units, the feedrate set to correspond to F1 to F5 serves as the assigned speed mm ($^{\circ}$)/mm.
- (6) When both the F1-digit feedrate changing and the manual speed command are present, the manual speed command will have the priority.
- (7) In the synchronous tapping command, the speed cannot be changed with the handle.

10.7.16 Manual/Automatic Synchronous Feed

Using this function, a random axis can be moved with manual operation even while another axis is moving with automatic operation. Select one automatic operation mode and one manual operation mode simultaneously with the PLC program, and then select the axis to be moved with manual operation. (This axis is hereafter called the "manual/automatic simultaneous valid axis".)

If the axis being moved with automatic operation is selected as the manual/automatic simultaneous valid axis, or if a movement command is issued with automatic operation to an axis already selected as the manual/automatic simultaneous valid axis, interlock will be applied on the movement by automatic operation, and the movement with manual operation will have the priority.

This function is an additional specification.



Enabling conditions of manual/automatic synchronous feed

This function is valid when the following conditions are established.

- This function is added.
- One automatic operation mode and one manual operation mode are selected.
(The manual operation mode can be selected during automatic operation. Normally, if the operation mode is selected in duplicate, the alarm "T01 Operation mode duplicated" will occur. However, this will not occur if this function's option is added.)
- The manual/automatic simultaneous valid axis is selected.
(The "Manual/Automatic simultaneous valid n-th axis" signal is ON for the axis to be controlled with manual operation.)
The manual/automatic simultaneous valid axis (axis for which "Manual/Automatic simultaneous valid n-th axis" signal is ON) can be controlled with the selected manual operation mode.

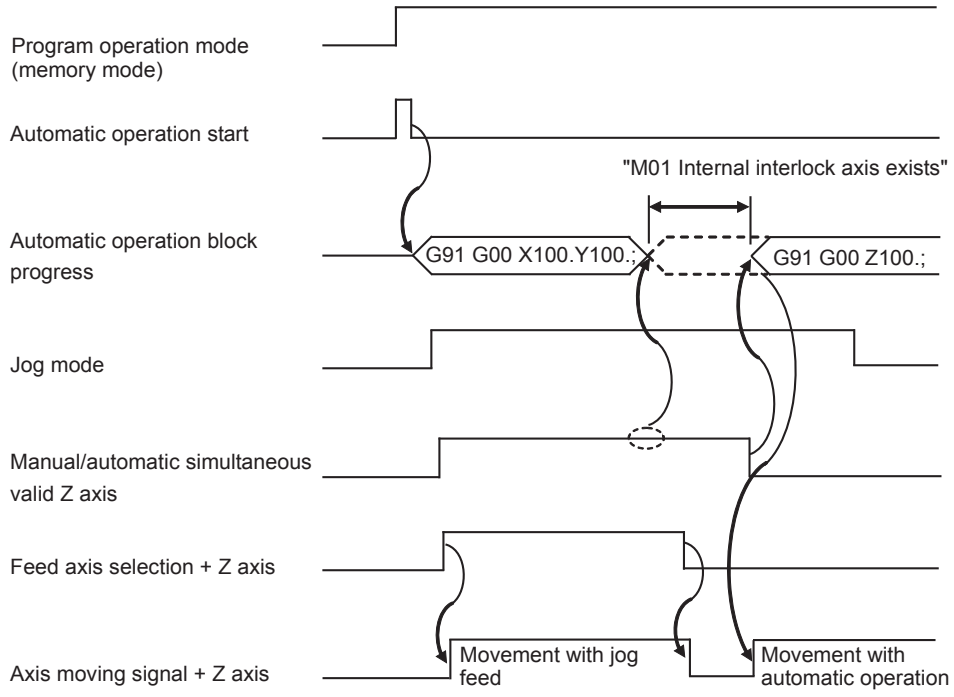
Operation during manual/automatic simultaneous operation

- (1) The manual operation and automatic operation feedrates are independent. The acceleration/ deceleration mode (rapid traverse/cutting feed) and time constants are also independent.
- (2) The rapid traverse override is valid for both automatic operation and manual operation. The cutting feed override and 2nd cutting feed override are valid only for automatic operation. However, these will also be valid during manual operation if the manual override method selection signal is ON. Override cancel is valid only for automatic operation.
- (3) Manual interlock is valid for the manual/automatic simultaneous valid axis, and automatic interlock is valid for the axis in automatic operation.
- (4) Manual machine lock is valid for the manual/automatic simultaneous valid axis, and automatic machine lock is valid for the axis in automatic operation.
- (5) The signals in cutting feed and in rapid traverse will follow the automatic operation movement mode.
- (6) Movement of the manual/automatic simultaneous valid axis will not stop with the single block stop or feed hold stop.
- (7) If the manual/automatic simultaneous valid axis reaches the stored stroke limit or stroke limit, the axis moving in automatic operation will also stop immediately, and the feed hold state will be entered. In this case, automatic operation can be restarted by canceling the stored stroke limit or stroke limit with manual operation.
- (8) Even if the automatic operation handle interrupt specification is added and the handle mode is selected for the manual operation mode, the manual/automatic simultaneous function has a priority for the axis for which the "Manual/Automatic simultaneous valid n-th axis" signal is ON.
- (9) The speed display indicates the following speeds according to the parameter "#1125 real_f".

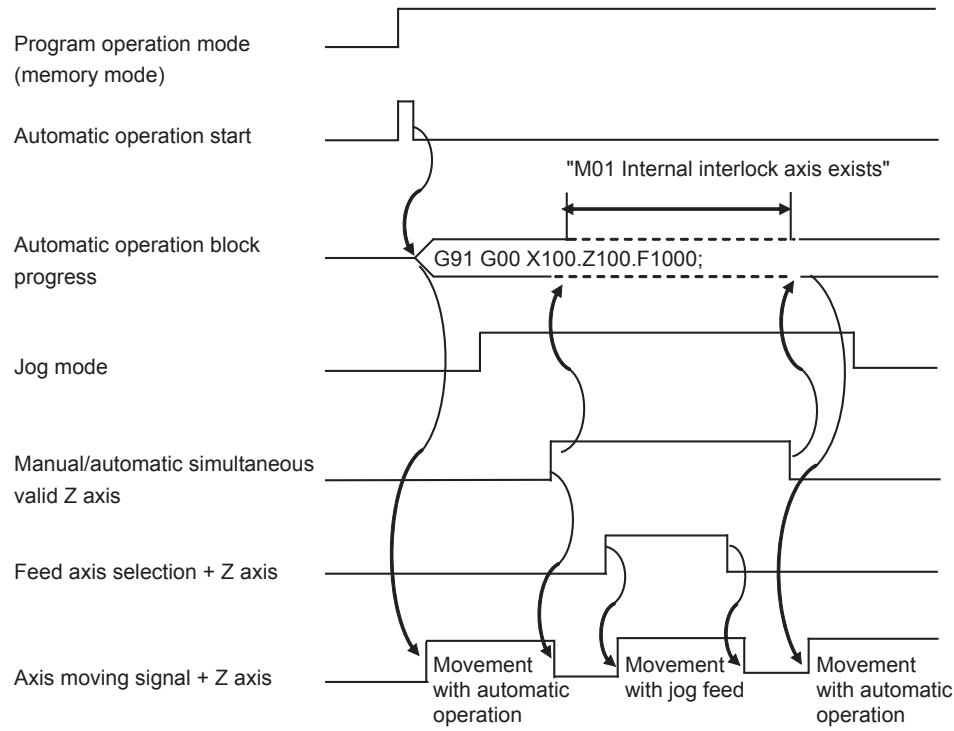
Function	#1125 real_f	
	1	0
Manual/automatic simultaneous operation	Composite manual and automatic speeds (The actual feedrates are independent.)	Automatic F command speed priority (Manual command speed when there is no axis moving with automatic operation)
Only manual operation	Manual actual feedrate	Manual command speed
Only automatic operation	Automatic actual feedrate	Automatic F command speed

Operation when automatic operation commands and manual/automatic simultaneous valid selection are issued for same axis

(1) If a movement command with automatic operation is issued to a manual/automatic simultaneous valid axis, the alarm "Internal interlock axis exists" will occur. Automatic operation will stop in the interlock state until the "Manual/Automatic simultaneous valid n-th axis" signal turns OFF. The manual/automatic simultaneous valid axis can be controlled in the manual operation mode during this time.



(2) If the "Manual/Automatic simultaneous valid n-th axis" signal is turned ON for an axis moving with automatic operation, the alarm "Internal interlock axis exists" will occur, and the operation will decelerate to a stop immediately. Automatic operation will stop in the interlock state until the "Manual/Automatic simultaneous valid n-th axis" signal turns OFF. The manual/automatic simultaneous valid axis can be controlled in the manual operation mode during this time. Note that the interlock will be applied even during a tap modal. Interlock will also be applied during synchronous tap cutting, and the spindle will also be synchronized to the manual drilling axis.



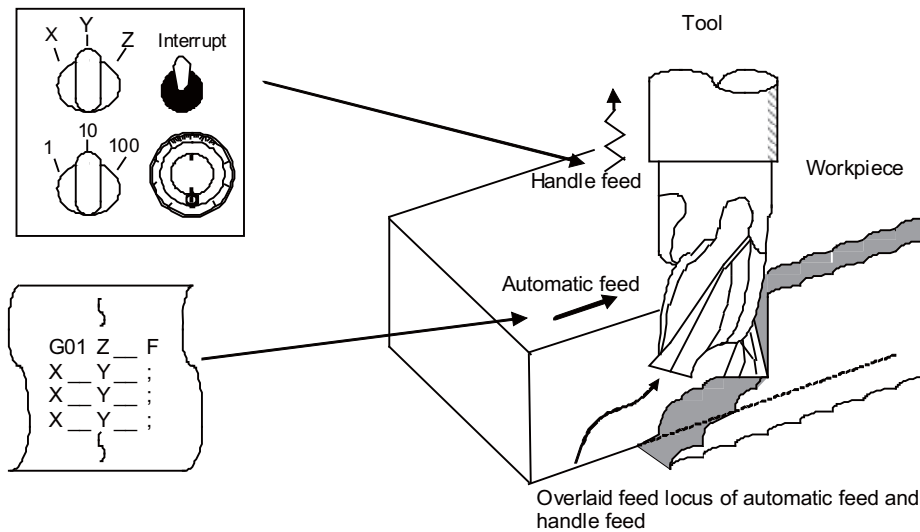
- (3) When the manual/automatic simultaneous valid axis is moving by manual, the G92 command from the automatic operation will be executed after the axes, including this axis, have stopped.
- (4) When several axes are interpolated and moving with automatic operation, all axes will stop if the "Manual/Automatic simultaneous valid n-th axis" signal turns ON for even one axis. When moving the axes independently such as during automatic reference position return, or during rapid traverse when the parameter "#1086 G00 non-interpolation" is ON, only the axis for which the "manual/automatic simultaneous valid" signal is ON will stop.
- (5) The interlock will not be applied even if the "Manual/Automatic simultaneous valid n-th axis" signal is turned ON for the virtual axis in virtual axis interpolation.
- (6) If the "Manual/Automatic simultaneous valid n-th axis" signal is turned ON for an axis moving with the automatic operation's G90 modal or G53 command and the manual/automatic simultaneous valid axis is moved manually, when the "Manual/Automatic simultaneous valid n-th axis" signal turns OFF, the end point of automatic operation will be deviated by the amount the axis was moved manually.
During the G90 modal, the command path will be returned to during the next block.
- (7) If the "Manual/Automatic simultaneous valid n-th axis" signal is turned ON for an axis during reference position return and the axis is manually moved, the reference position return operation will be executed again.
When the reference position is reached manually, the interlock will be released, and the block will end.
Manual operation after the block is completed will follow the manual operation block.

Precautions

- (1) If only the automatic operation mode is selected and the manual operation mode is not selected, the "Manual/Automatic simultaneous valid n-th axis" signal will be invalid.
- (2) Even if one automatic operation mode and one manual operation mode are selected, all manual operations of an axis for which the "Manual/Automatic simultaneous valid n-th axis" signal is OFF will be invalid. Note that if the automatic operation handle interrupt specification is added, interrupt can be applied with handle feed.
- (3) If the "Manual/Automatic simultaneous valid n-th axis" signal is ON for the 1st and 2nd axes and the "Circular feed in manual mode valid" signal is turned ON during automatic operation, the manual arc feed will not be validated.
If automatic operation is attempted while manual arc feed is valid, the manual arc feed will be invalidated even if the "Manual/Automatic simultaneous valid n-th axis" signal for the 1st and 2nd axes is ON. In this case, none of the axes can be moved with manual operation until the "Circular feed in manual mode valid" signal is turned OFF.
- (4) The "Manual/Automatic simultaneous valid n-th axis" signal is invalid for the chopping axis during chopping.
- (5) The "Manual/Automatic simultaneous valid n-th axis" signal is invalid for the slave axis during synchronous control.
When the "Manual/Automatic simultaneous valid n-th axis" signal is turned ON for the master axis, the slave axis will become the manual/automatic simultaneous valid axis.
- (6) Manual random feed will not be executed if even one axis other than the manual/automatic simultaneous valid axis is set as the manual random feed axis. Note that only the manual/automatic simultaneous valid axis is executed during non-interpolation.
- (7) When the manual mode is selected for the manual/automatic simultaneous valid axis while moving in the automatic high-accuracy mode, if the axis is moved manually before the automatic operation decelerates to a stop with the interlock, the speed may change in steps when the manual movement is started.
Start manual operation after the automatic operation has decelerated to a stop.

10.7.17 Handle Interruption

This section explains automatic handle interruption, which enables the operator to interrupt movement using the manual handle in automatic modes (tape, memory, MDI).



Interruptible conditions

- (1) The automatic handle interrupt function allows you to interrupt the program manually by selecting the manual handle mode in automatic mode selection (tape, memory, MDI, etc.). However the interrupt cannot be executed by the manual handle when an automatic reference position return command (G28, G29, G30), the thread cutting (G33), or the skip command (G31) has been executed or when tapping in the tapping cycle.
- (2) If automatic operation mode such as tape, memory, or MDI is being selected even when an automatic operation pause (including a block stop) is established, automatic handle interruption is enabled.
- (3) If the axis is moved during dwell (G04) command processing by using automatic handle interruption, the dwell count operation will stop. A check is made for the completion of the axis movement, then the dwell count operation continues.
- (4) Automatic handle interruption is enabled even if automatic machine lock has been set. If manual machine lock has been set, the machine does not move; it only updates the POSITION display. If manual machine lock has not been set, the machine moves by the interruption distance by the manual handle and the POSITION display is updated.
- (5) This function is disabled for an axis to which the interlock signal has been input or an axis of which interruption direction is the soft limit.

Interruption effective axis

- (1) Automatic handle interruption is enabled only for axes to which manual handle axis selection has been input.
- (2) Automatic handle interruption is enabled for a maximum of three axes. (The number of axes is restricted by the number of handles.)

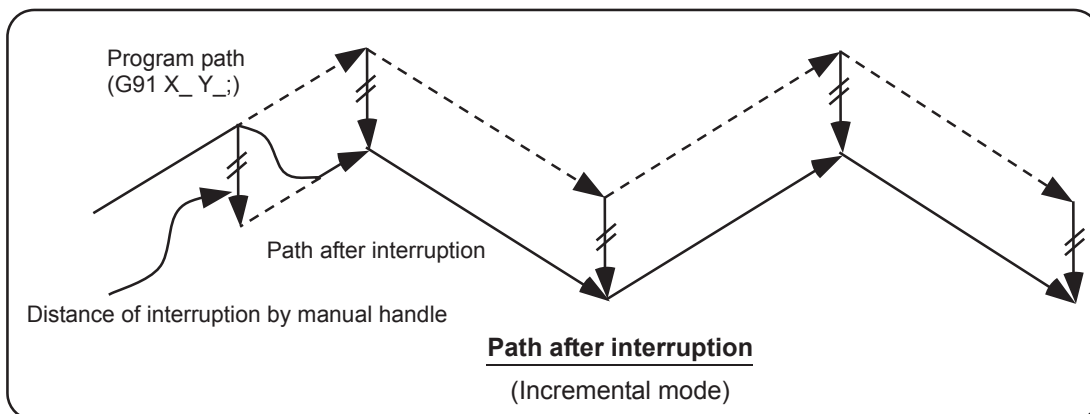
Axis movement speed resulting from interruption

- (1) The movement speed (Automatic-start movement speed + Speed resulting from manual handle interruption.) of the axis for which handle interruption is executed, may exceed the rapid traverse feedrate during rapid traverse feed command (G00) processing in automatic start. To prevent this, clamp the axis.
- (2) The movement speed (Automatic start movement speed + Speed resulting from manual handle interruption.) of the axis for which handle interruption is executed, may exceed the cutting feed speed during cutting feed command (G01, G02, G03) processing in automatic start. To prevent this, clamp the axis.
- (3) If, during automatic start, manual handle interruption is executed in the same direction for the axis that is moving at an external decelerating speed, the axis movement speed (Automatic start movement speed + Speed resulting from manual handle interruption.) may exceed the external decelerating speed. To prevent this, clamp the axis.
- (4) If an attempt is made to execute interruption at a speed exceeding the clamp speed, the reading on the handle scale does not match the distance of interruption.
- (5) The handle scale factor depends on the selected input of the manual handle/step scale factor.

Path resulting after handle interruption

(1) For incremental (G91) mode

The locus deviates from the program path by the distance of interruption. (See the figure below.)



(2) For absolute (G90) mode

If program absolute position update by the distance of handle interruption is disabled, the locus deviates from the program path by the distance of interruption.

If this update is enabled, the locus returns to the program path during processing of the following command: For single block running - Return command is issued in the block next to the one for which the interruption has been completed. For continuous running - Return command is issued in the third block, if the block for which the interruption has been completed is the first block.

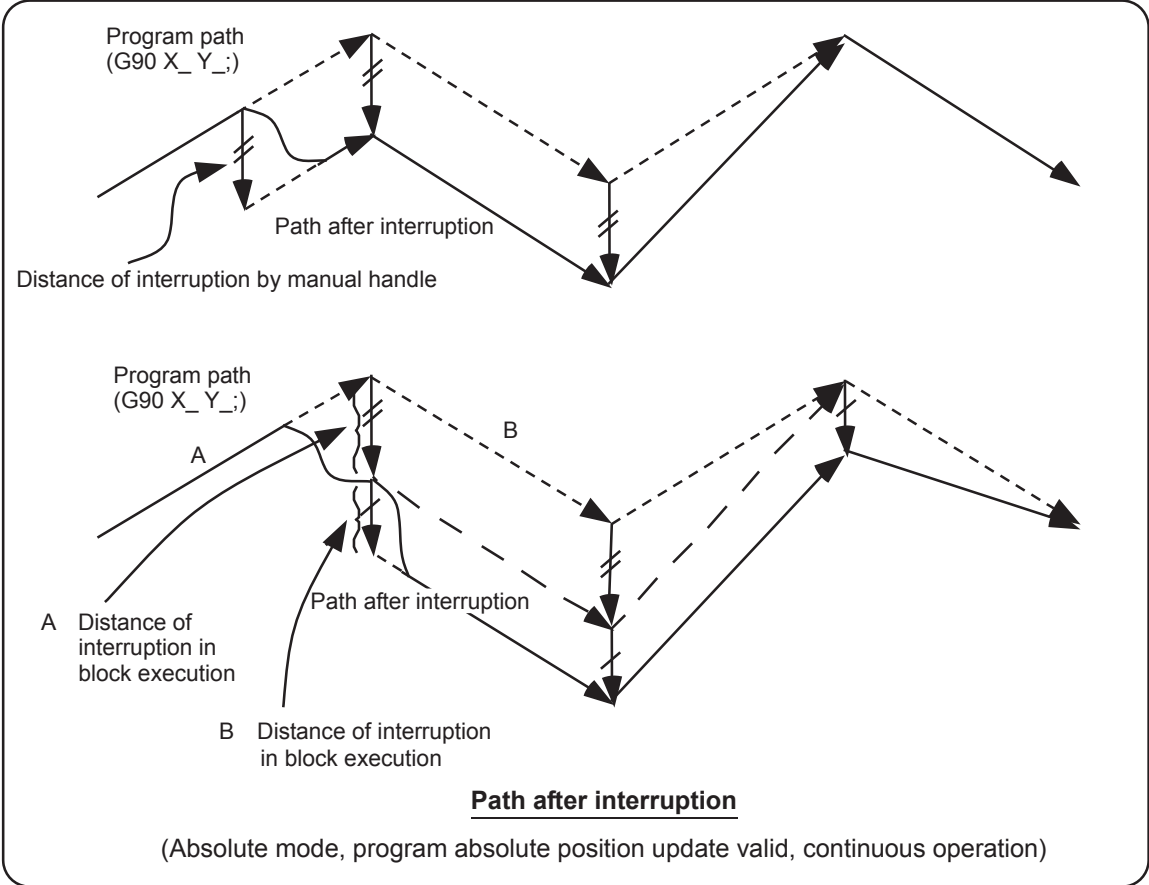
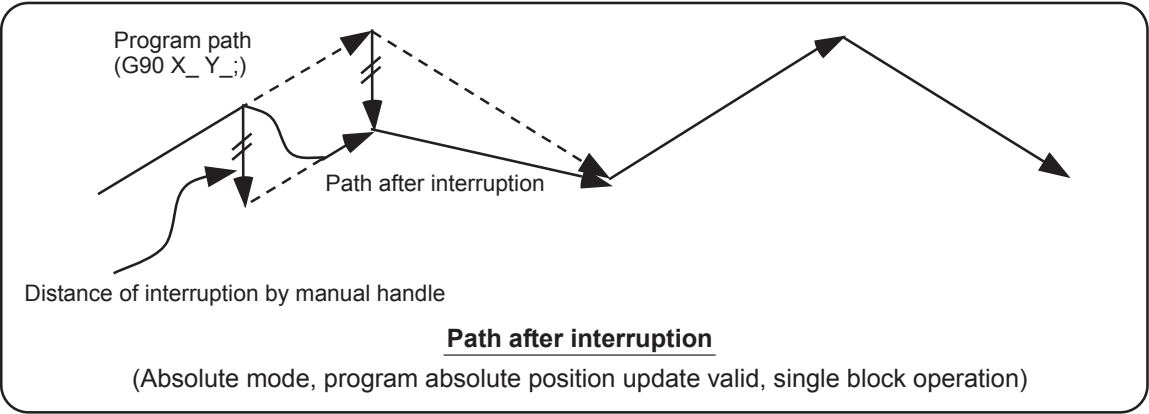
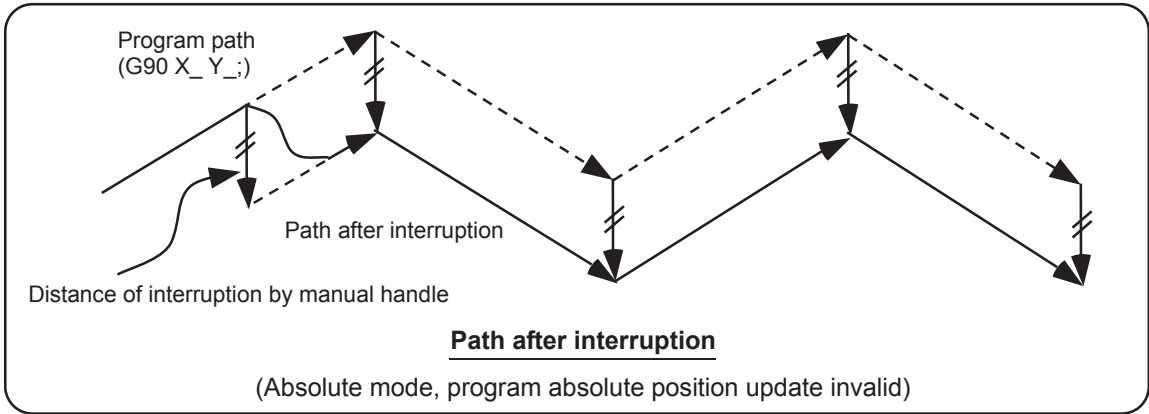
Note

(1) Both POSITION and MACHINE display include the distance of handle interruption. For automatic handle interruption, select whether absolute mode is updated or not, as follows:

- (a) Using machine parameters, set whether the manual absolute changeover switch or parameters are used.
- (b) If the parameters are used, set whether or not absolute position data is updated for each axis, by using machine parameters other than those in item.
- (c) If the manual absolute changeover switch is used, use the machine operation panel switch for selection.

Absolute position update conditions for automatic handle interruption

			Absolute data update		Servo monitor 2 screen Manual interrupt amount display
Parameter #1145 I_abs	ON 1	Parameter "#1061 ntabs" (Every axis)	ON 1	Absolute position is updated.	Not updated.
			OFF 0	Absolute position is not updated.	Updated.
	OFF 0	PLC interface Manual absolute switching	ON	Absolute position is updated.	Not updated.
			OFF	Absolute position is not updated.	Updated.



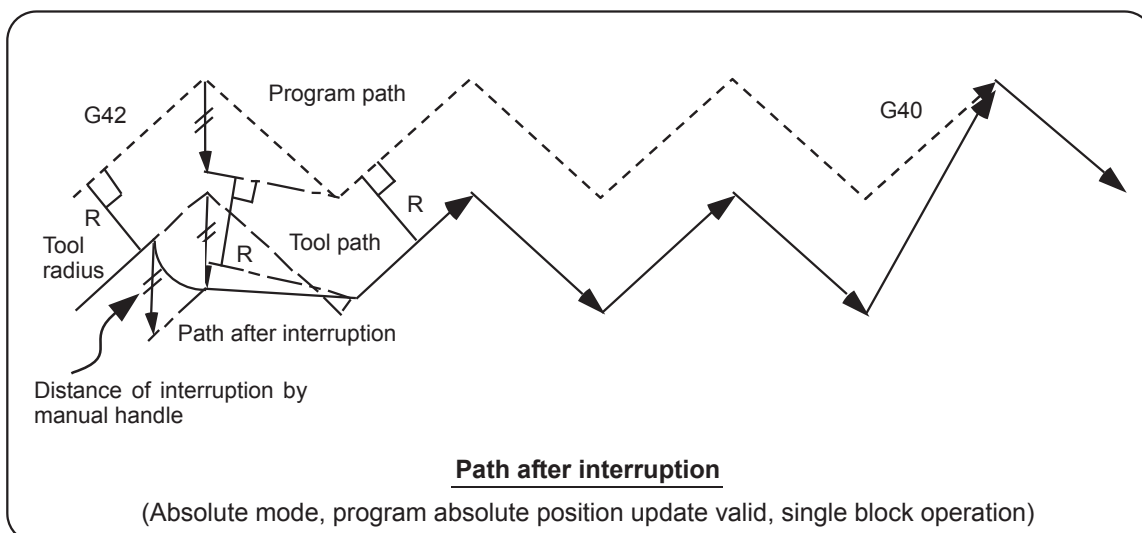
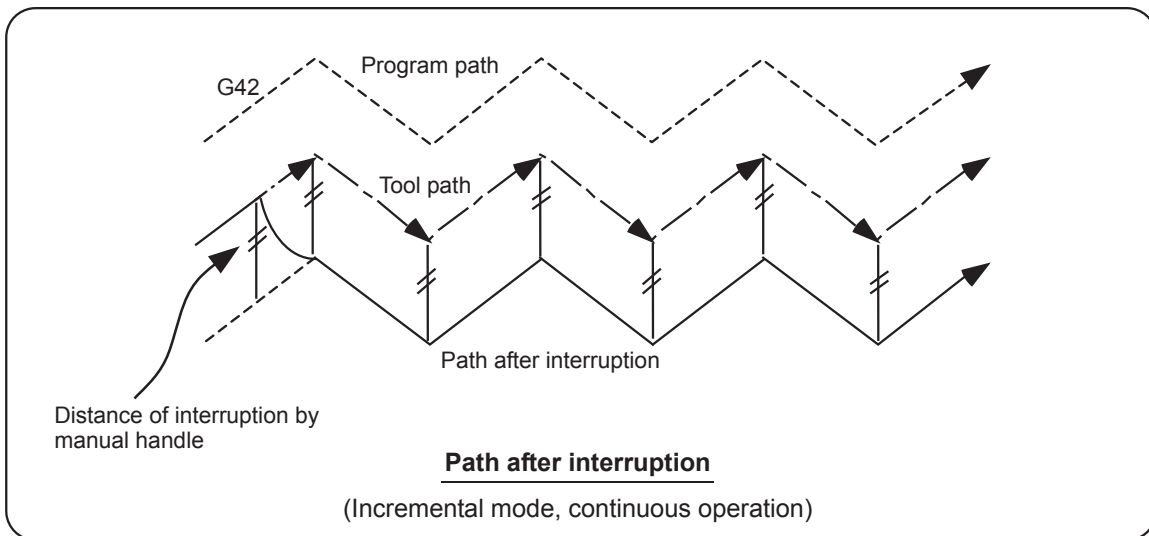
Movement during tool radius compensation

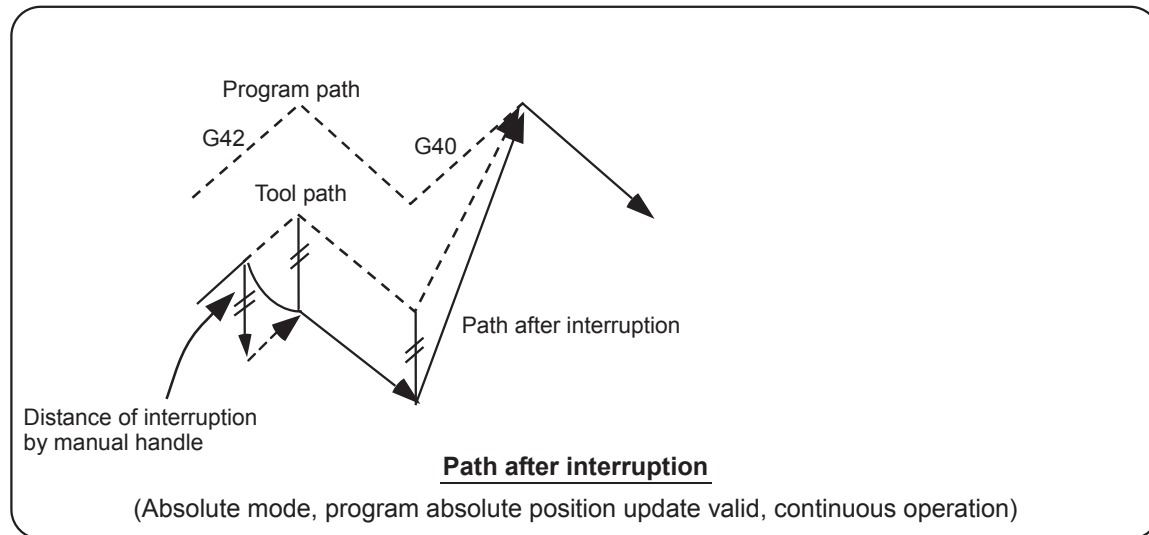
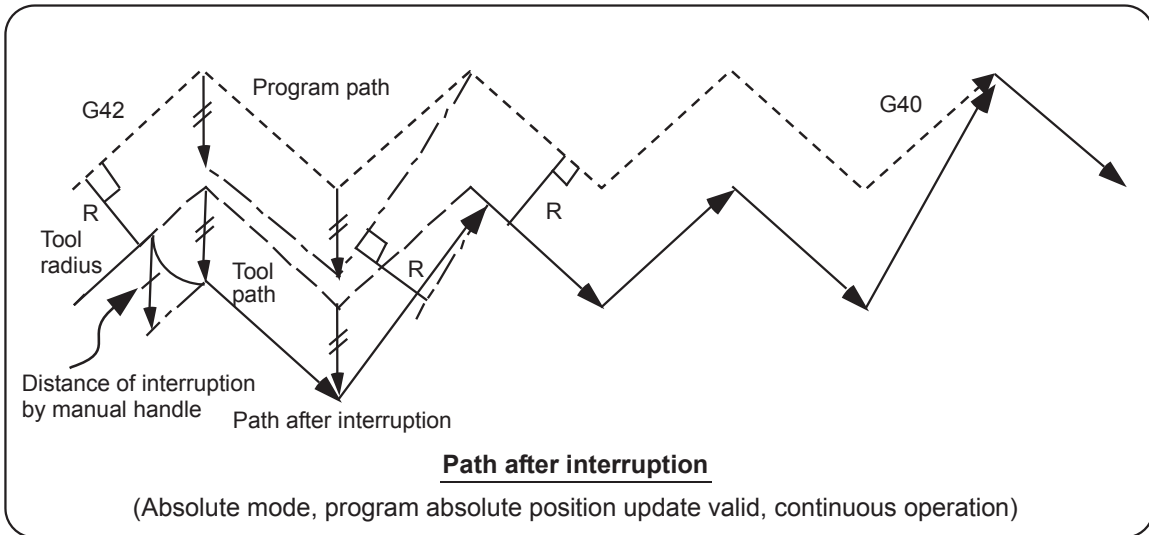
Special movement described below relates only to the tool radius compensation plane axis. It has no influence on the other axes.

During tool radius compensation (G41, G42):

In incremental mode (G91) - The quantity of deviation equals the distance of interruption.

In absolute mode (G90) - If handle interruption is executed in the block for which tool radius compensation (G41, G42) is being executed, the proper tool path will return in the succeeding block. This rule applies only when the program absolute position update is valid during single block running. If program absolute position update is valid during continuous running, the proper tool path will return at the fourth block after the one where the interruption has been completed. If there is no G block existed between the block where the interruption has been completed and the block that contains the tool radius compensation cancel command (G40), the proper tool path will return at the block next to the tool radius compensation cancel command (G40).





Interrupt amount reset

Interrupt amount is reset when

- (1) Dog reference position return is executed;
- (2) Emergency stop is released;
- (3) Reset rewind or reset 2 is executed; or
- (4) Reset 1 is executed when the setup parameter "#1151 rstint" is ON.

Operation method

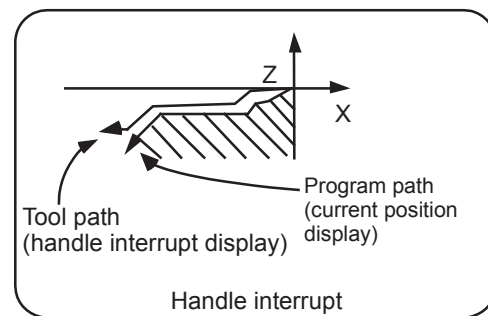
An operation example is given on the assumption that auto operation of XYZ axes is executed in the memory operation mode and the Z axis is used as a handle interrupt axis.

Perform automatic operation.

Turn ON the "HANDLE INTERRUPT" switch on the machine operation panel.

Select interrupt axis by setting the "HANDLE AXIS SELECTION" switch on the machine operation panel.
Select the travel distance per handle graduation by setting the "HANDLE/INCREMENTAL MAGNIFICATION" switch.

Turn the manual handle in the + or - direction and change the Z axis cut depth amount.



When M02 or M30 is executed, automatic operation will stop.

10.7.18 All Axis Machine Lock

- (1) When the "ALL AXES MACHINE LOCK" switch is turned ON, the NC commands for the manual operation or automatic operation movement can be executed without moving the machine.
The current position display on the setting and display unit will be counted.
- (2) The feedrate in the machine lock status is the command speed.
- (3) If the "ALL AXES MACHINE LOCK" switch is changed during automatic operation, the automatic operation will stop after the block currently being executed is completed, and then the setting will be validated.
- (4) During reference position return (G28, G30), the movement will be controlled with the machine lock status up to the middle point. The machine lock status will be ignored from the middle point to the reference position.
- (5) If the "MACHINE LOCK" switch is changed during manual operation, the setting will be validated after the feed is stopped once.
- (6) The M, S, T and B commands are executed according to the program.
- (7) When the "MACHINE LOCK" is turned OFF after the axis is moved in the "MACHINE LOCK" ON state, the current position display and the machine position will not match.
If AUTO START is pressed in this state, the difference between the current position and the machine position will be added to the movement amount.
If RESET is pressed, the current position display will be changed to match the machine position. Thus, after turning "MACHINE LOCK" OFF, press RESET before starting operation.

10.7.19 Each Axis Machine Lock

By turning ON the "MACHINE LOCK" switch provided for each axis, machine lock will be applied only on the control axis (axes) turned ON. All matters, other than the machine lock for each axis, are the same as all axes machine lock.

10.7.20 Tool Retract and Return

Due to tool breakage or temporary monitoring, the tool is manually escaped after the machine program is interrupted by feed hold. This function allows the machine to approach the interruption point via the transit point that was designated as the automatic start point and restart the machining, after the workpiece is checked or the tool is changed.

Up to two transit points can be designated in the escape path.

After the tool is changed, the compensation amount cannot be changed.

Designating the interruption point (return position)

In order to designate a halted point, turn ON a transit point switch when operation is stopped by feed hold or single block. When recognition of the halted point is completed, this signal turns ON and the tool retract and return mode will be established.

Escape methods

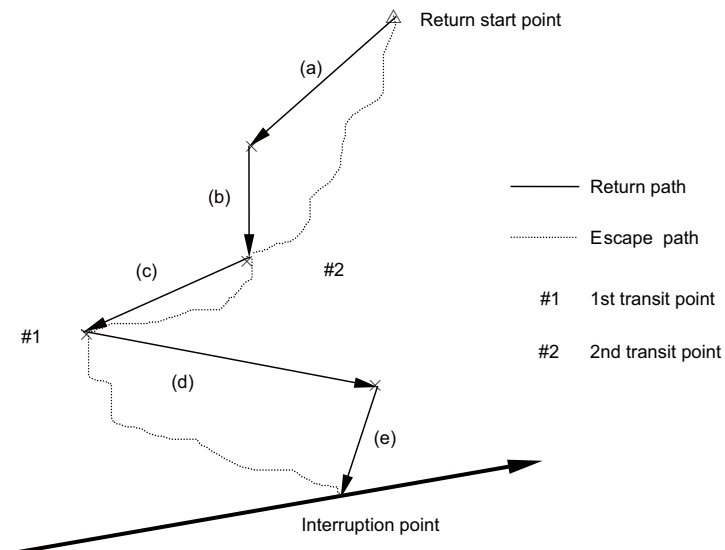
Escape is carried out manually by changing to the manual mode (handle, JOG, JOG rapid traverse). At this time, the transit point for designating the return path can be designated.

Escape is also possible by automatic operation handle interrupt.

Designating the transit point

Two transit points can be designated. To designate, move to the transit point with the manual mode, and then turn ON the transit point switch to memorize it.

The transit point 1 (#1) is the point designated first after interruption, and the transit point 2 (#2) is the point designated last. Stop all axes before designating the transit points. (The transit points will not be designated unless all axes are stopped.)



Example of escape operation

- (1) Stop the program by turning "FEED HOLD" switch or "SINGLE BLOCK" switch ON.
- (2) Designate the interruption point by turning the transit point switch ON.
- (3) Move to transit point #1 with the manual mode (JOG, handle, step).
- (4) Turn the transit point switch ON. ➡ Transit point #1 will be memorized.
- (5) Move to transit point #2 with the manual mode (JOG, handle, step).
- (6) Turn the transit point switch ON. ➡ Transit point #2 will be memorized.
- (7) Move to the return start point with the manual mode (JOG, handle, step).
- (8) Change to the automatic operation mode. ➡ The return will start.

Starting the return

To start the return, change from the manual mode to the automatic mode, and move toward the transit point with cycle start. The return and escape during the return.

Resetting the escape mode

The escape mode is reset when reset 1 is input, emergency stop occurs the return is completed. Escape is also possible by automatic operation handle interrupt.

Return path

The axis returns in the following order.

Return start point -> Transit point #2 -> Transit point #1 -> Interruption point

When transit point #2 is not designated	When only interruption point is designated without transit point designation
When transit point #2 is not designated, the return start point will be regarded as the transit point #2.	When only the interruption point is designated without a transit point designation, the return start point will be regarded as transit point #1.
Return path: Return start point (= transit point #2) -> transit point #1 -> interruption point	Return path: Return start point (= transit point #1) → interruption point

After the interruption point is reached, the retract return mode is canceled. Automatic operation starts, and the remaining blocks are executed.

Movement path

3 kinds of movement path are shown below. For types (1) and (3), the return type must be set with the parameters.

(1) Return start point to #2

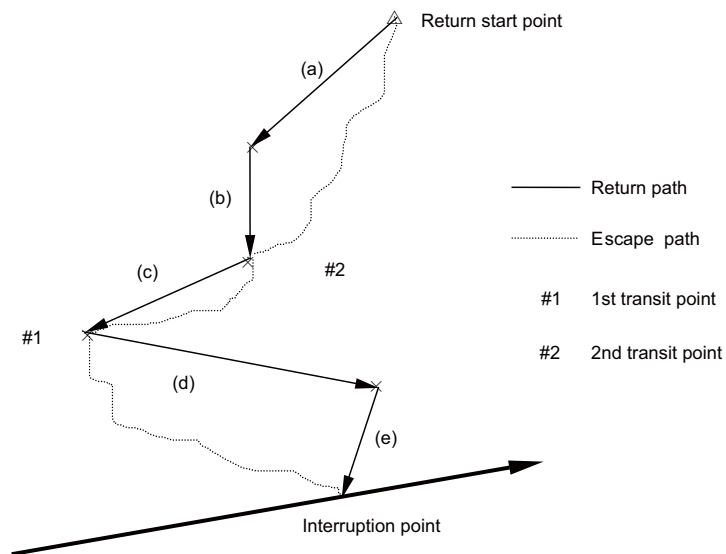
- (a) First, the axes other than that designated in parameter "#1574 Ret1" (Return type 2) simultaneously move.
- (b) Next, the axes designated in parameter "#1574 Ret1" (Return type 2) move simultaneously.

(2) #2 to #1

- (c) All axes move simultaneously.

(3) #1 to interruption point

- (d) First, the axes other than that designated in parameter "#1573 Ret1" (Return type 1) simultaneously move.
- (e) Next, the axes designated in parameter "#1573 Ret1" (Return type 1) move simultaneously.



Setting the parameters "#1573 Ret1" (Return type 1) and "#1574 Ret1" (Return type 2)

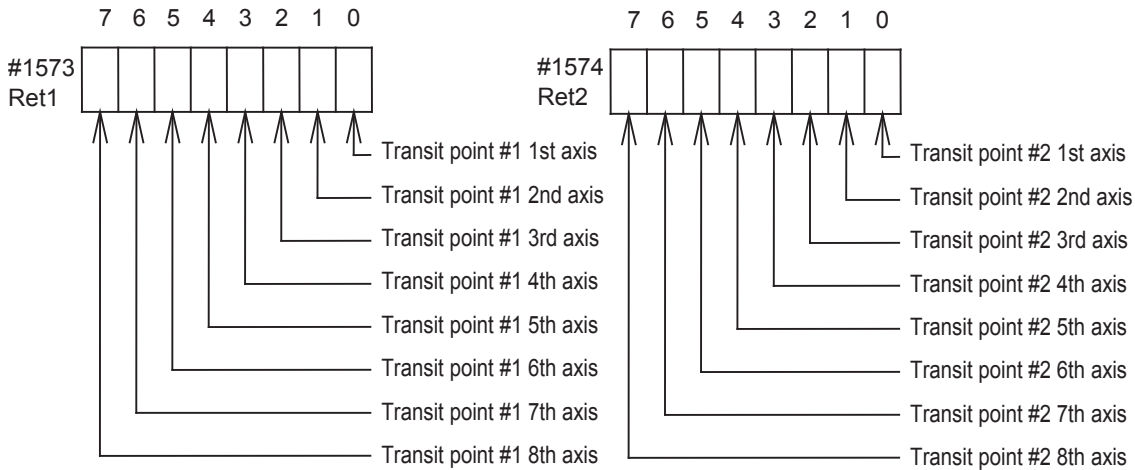
The return type are set with the parameters "#1573 Ret1" (Return type 1) and "#1574 Ret1" (Return type 2).

Set the axis to be moved as a bit unit in each parameter.

The axes designated with "#1573 Ret1" (Return type 1) move to the interruption point as shown with (e) in the previous drawing. The non-designated axes move as shown with (d) in the drawing.

The axes designated with "#1574 Ret1" (Return type 2) move to the #2 transit point shown as (b) in the drawing, while the non-designated axes move as shown with (a).

The parameter details are as shown below.



Example of operation

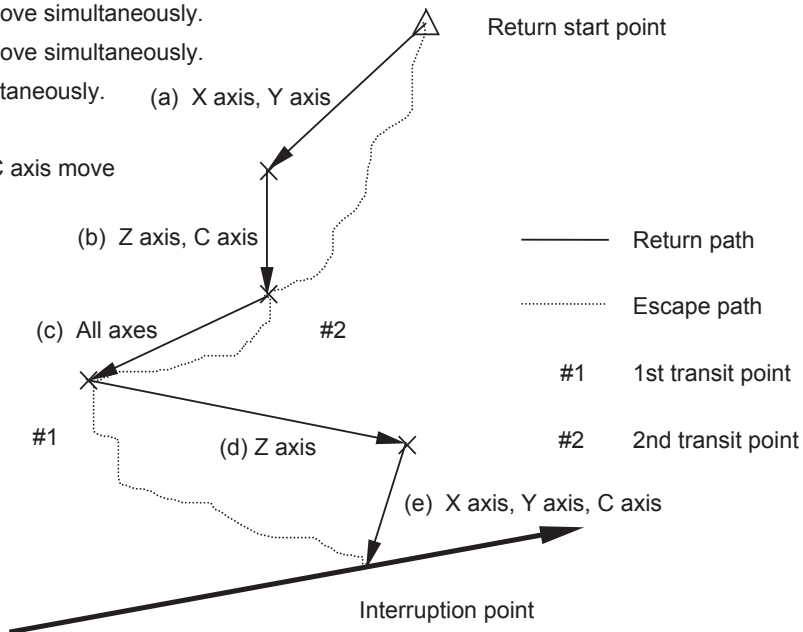
When using a 4-axis system with the X axis as the 1st axis and, Y, Z, C in the order, set the parameters "#1573 Ret1" (Return type 1) and "#1574 Ret2" (Return type 2) as shown below.

•#1573 Ret1 00001011

•#1574 Ret2 00001100

In this case, the return movement path will be as shown below:

- (a) X axis and Y axis move simultaneously.
- (b) Z axis and C axis move simultaneously.
- (c) All axes move simultaneously.
- (d) Z axis moves.
- (e) X axis, Y axis and C axis move simultaneously.



Precautions

- (1) If reset is applied between the designation of the interruption point and the restart of machining (in other words, during the escape mode), the memorized transit points and interruption point will be canceled. The halted or stopped automatic operation will be reset and finished.
- (2) The tool compensation amount cannot be changed during the escape mode.
- (3) The manual random feed function cannot be used during the escape mode.
- (4) As for the override, the manual override is valid.
- (5) The single block is valid.
- (6) If reference position return is carried out during the tool retract and return, the tool compensation amount will be invalidated when the reference position return is completed. Thus, if the tool is compensated before tool escape, when the tool is returned after reference position return, the path will shift by the tool compensation amount at the block following the block containing the interruption point.

Thus, if the operation mode is changed to reference position return during tool retract and return, an alarm will occur.

Alarm occurrence conditions	•If the reference position return mode is selected during the tool retract and return mode, operation alarm "M01 Tool ofs invld after R-pnt (0021)" will occur.
Alarm reset conditions	<ul style="list-style-type: none"> •The error is cleared if the operation mode is changed to other than reference position return before the axis performs reference position return. •The error is cleared when reference position return is completed. •The error is cleared if reset 1 is input or the emergency stop button is pushed.

10.7.21 External Deceleration

When the "External deceleration+ n-th axis" (*+EDT1 to *+EDT8), "External deceleration- n-th axis" (*-EDT1 to *-EDT8) signal, an external input from the PLC program, is input, this function immediately drops the feedrate to the external deceleration speed set in the parameters.

- (1) The external deceleration signal is provided for each axis and for each movement direction (+/-). The speed will decelerate when a signal in the direction matching the movement direction is input.
- (2) When the axis is returned in the reverse direction, the command speed will be returned to immediately.
- (3) During manual operation or automatic operation's non-interpolation positioning, only the axis for which a signal matching the movement direction is input will decelerate.
- (4) During automatic operation interpolation, if there is any axis for which the input signal matches the movement direction, the feedrate will be lowered to the external deceleration speed.

Combination with other functions

- (1) When the following functions are enabled, the external deceleration is disabled.
 - Machine lock axis
 - Synchronous tap modal
 - Tapping mode
 - While moving in the approach speed at automatic reference position return command (G28) or dog-type reference position return during the manual reference position return mode
 - Synchronous control slave axis
 - The axis moving with chopping
 - During thread cutting
 - Virtual axis
- (2) If the external deceleration speed is slower than the overridden speed, the speed will drop to the external deceleration speed.
- (3) When calculating the machining time, the external deceleration signal input is not considered.
- (4) When an inch command is issued, the axis moves at the speed obtained by converting the external deceleration speed into inches.
- (5) During the manual speed command, the external deceleration signal is valid for the movement axis as well as the axis and direction that is the same as the selected feed axis (+/-).

- (6) During manual random feed, the external deceleration axis is valid for the same axis and direction as the axis for which manual random feed is valid.
(If the manual random feed is valid for the axis but the movement amount is 0, the external deceleration signal + for the same axis will be valid.)
- (7) During manual arc feed, the external deceleration signal for same axis and direction as the selected feed axis (+/-) will be valid instead of the movement axis.

Precautions

- (1) If the external deceleration signal is input while moving at a speed lower than the external deceleration speed, the feedrate will not be affected.
- (2) Excluding during G00 non-interpolation, the composite speed of each axis will be the external deceleration speed during automatic operation.
- (3) The signal is valid after resetting and applying emergency stop.

10.7.22 Reference Position Retract

This function returns immediately to a set reference position when the Reference position retract signal is input. This function is used to return to a set position for changing the tool.

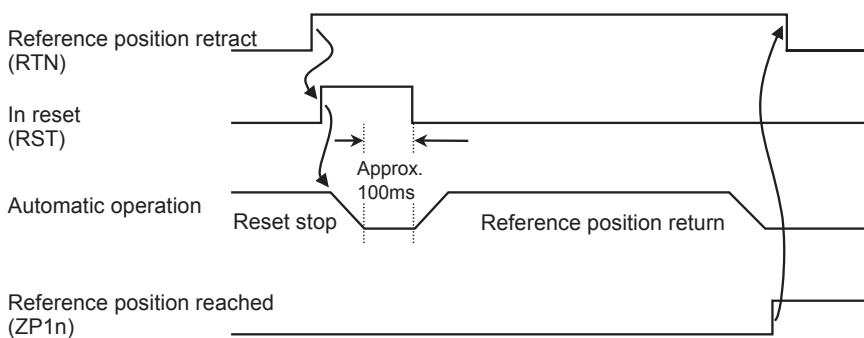
Reference position return is executed when this signal is turned ON. At the rising edge of the signal, the program is automatically reset (reset & rewind) and then reference position return is executed.

During the automatic or MDI operation, the operation is interrupted and stopped by the reset, and reference position return is executed.

If this signal is input during execution of a tap cycle in the automatic or MDI operation modes, the "Tap retract possible" signal will be output by the reset interruption, and the return operation will be the tap retract operation. The tap retract is completed at the initial point, and after that the reference position return will be carried out.

- (1) If there are two or more axes, set the return order with parameter "#2019 revnum".
- (2) When the reference position is reached, the corresponding "Reference position reached" signal will be output.
- (3) This signal must be held until the "Reference position reached" signal is output. If it is turned OFF midway, the return operation will be interrupted and stop. If the signal is input again, the operation will restart from execution of resetting.
- (4) The reference position return speed is handled in the same manner as the normal reference position return speed.
- (5) In this function, an axis returns to the reference position set by the Reference position selection code 1 and 2 signal.
- (6) Even if the return signal is input during the thread cutting cycle, it will be invalid. However, if the return signal is executed in a block other than the thread cutting block, the return operation will be executed.
- (7) The return signal is invalid if the coordinate system is not established. An alarm "M01 Ref point retract invalid" will occur when the return signal is input.

<Timing chart>



10.7.23 Spindle Orientation

■ Orientation

This function stops the spindle rotation at a certain position when using the digital spindle.

When the orientation command is used, the spindle will rotate several times and then stop at the orientation point.

The orientation position differs depending on the detector.

<When the encoder orientation (PLG and external encoder/ring sensor) is used>

At the Z-phase position

<When the magnetic sensor (proximity switch) is used>

At the magnetic sensor installation position

■ Multi-point orientation

This function performs orientation to a position other than the Z-phase position by inputting a shift amount with the parameter or PLC. The shift amount is 0 to 35999. (Units: $\frac{360^\circ}{36000} = 0.01^\circ$)

■ Note

- (1) Multi-point orientation cannot be executed when using the magnetic sensor.
- (2) Orientation is possible only when the gear ratio is 1:1 for the PLG orientation.

(The orientation is completed at the PLG encoder's Z-phase, so when using reduction gears, the orientation points will be generated at several points during one spindle rotation.)

■ Orientation in-position advance output

This function turns the spindle in-position signal ON as soon as the spindle reaches within the second in-position width (parameter "#3132 ori_inp2" (2nd in-position width for orientation)). Then, the spindle 2nd in-position signal is turned ON as soon as the spindle reaches within the in-position width (parameter "#13024 SP024 INP" (In-position width)).

Since orientation completion can be predicted using this function, it is possible to eliminate the sequence delay time, etc. for tool changes and other such operations, thereby achieving a faster tact time.

Orientation operation

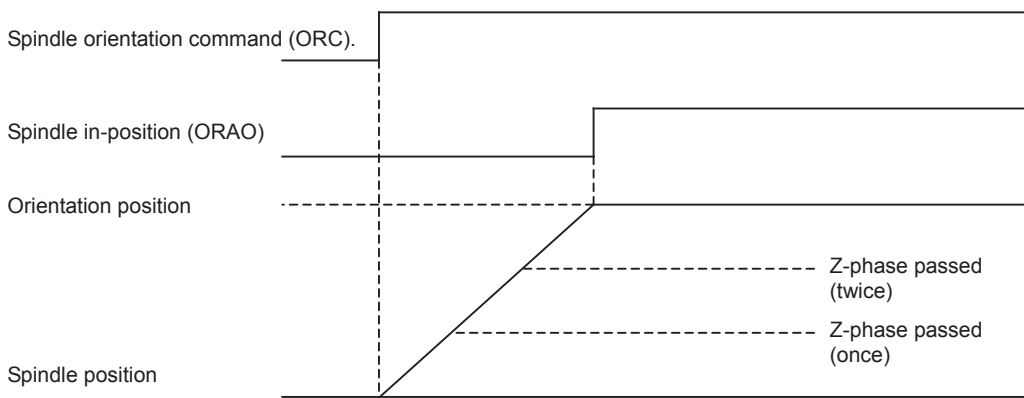
When Z-phase has not yet been passed, pass Z-phase twice (excluding reciprocations within one rotation), and then position to the orientation position.

When Z-phase has been passed already, immediately position to the orientation position.

The spindle does not rotate if Z-phase has been passed and the orientation position is already established when orientation command is issued.

When the spindle has been rotating in the direction opposite from that of orientation rotation when the orientation command is issued, orientation operation will be executed after decelerating to stop.

Orientation operations when the Z-phase has not been passed



The acceleration/deceleration patterns

■ The acceleration/deceleration patterns at orientation/position loop reference position return

For the acceleration/deceleration patterns at orientation/position loop reference position return (C axis, tapping), the time constant is set by the parameter "#3115 sp2_t1" to "#3118 sp2_t4" (Time constant in orientation/position loop reference position return). The orientation acceleration/deceleration time is calculated with the following expression.

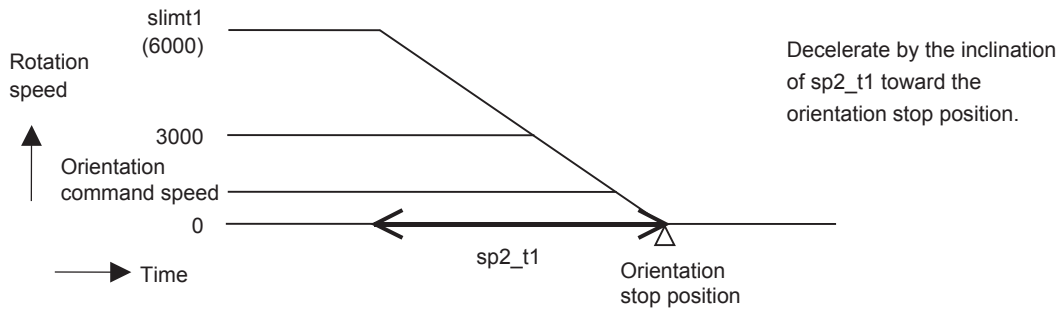
(Example: The acceleration/deceleration time for gear 00)

$$\text{The acceleration/deceleration time} = \text{sp2_t1} \times \frac{\text{Orientation command speed (\#3107 ori_spd)}}{\text{Limit rotation speed (\#3001 slimt 1)}}$$

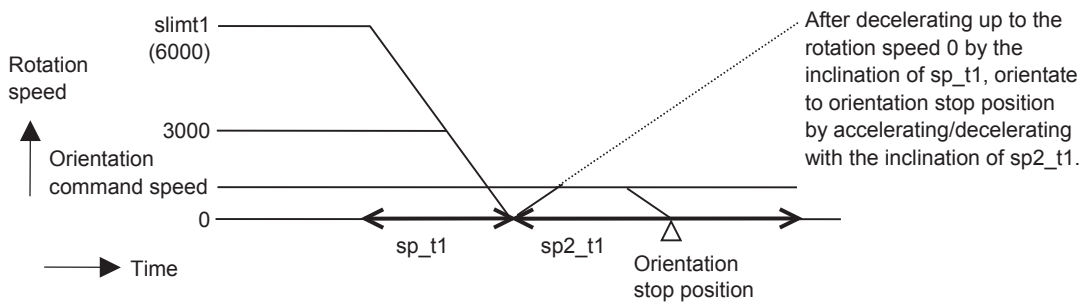
For position loop reference position return, the parameter "#3110 tap_spd" (Synchronous tapping zero point return speed) or "#3112 cax_spd" (Spindle C axis zero point return speed) is used for position loop reference position return (C axis, tapping) instead of the orientation command speed.

In any case, when "#3101 sp_t 1" is larger than "#3102 sp_t 2" (Time constant for spindle rotation with S command), "#3101 sp_t 1" is used.

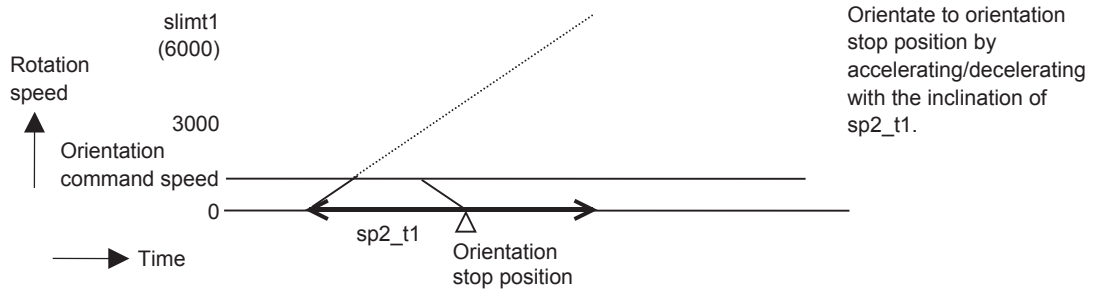
(1) During spindle rotation, and the orientation direction is the same



(2) During spindle rotation, and the orientation direction is opposite

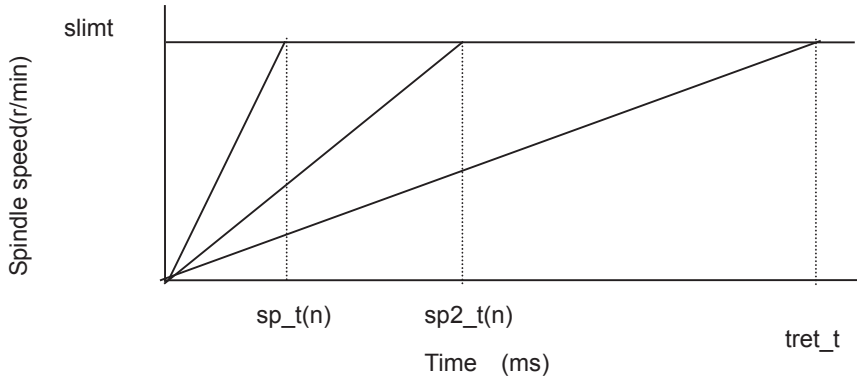


(3) When the spindle is stopping



■Time constant

The parameter "#3115 sp2_t1" to "#3118 sp2_t4" (Time constant in orientation/position loop reference position return) are used as the time constant of orientation/position loop reference position return. The parameter "#3124 tret_t" (Turret indexing time constant) is used at the turret indexing. Set the relation to the parameters "#3101 sp_t 1" to "#3104 sp_t 4" (Time constant for spindle rotation with S command) as follows.



Gain

If the orientation is commanded when the spindle has been stopping, usually the spindle rotates to orientation position using the position loop gain set in the parameter "#13002 SP002(PGN)" (Position loop gain interpolation mode).

By setting the parameter "#3106 zrn_typ/bitE" (Interpolation mode selection in orientation), if the orientation is commanded when the spindle has been stopping, the spindle rotates to orientation position using the parameter "#13001 SP001(PGV)" (Position loop gain Non-interpolation mode). When the parameter "#3106 zrn_typ/bitF" (Spindle zero point detection with contactless switch) or the parameter "#3121 tret" (Turret indexing) is set, the parameter "#3106 zrn_typ/bitE" (Interpolation mode selection in orientation) setting is not enabled.

Troubleshooting

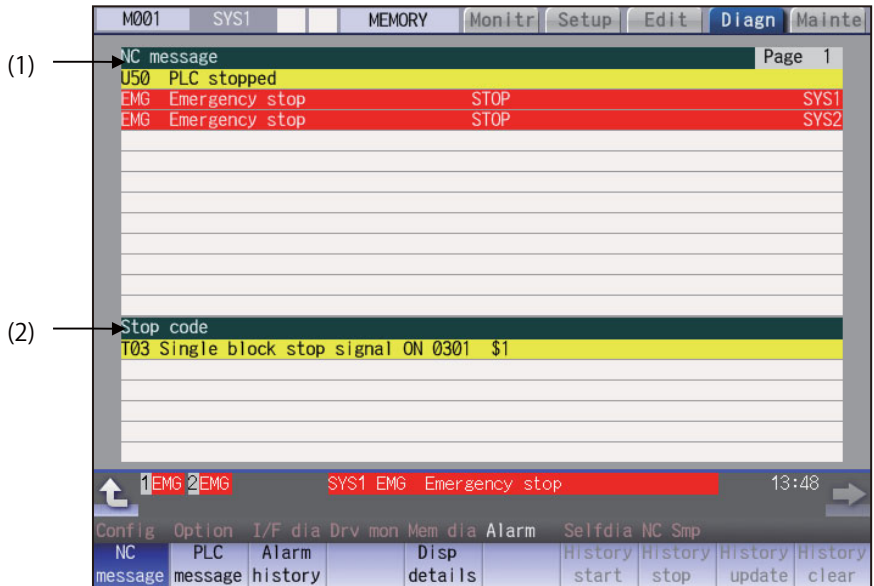
This chapter explains remedies when any alarm message is displayed, and how to check the NC status. The operations are mainly performed on the diagnosis (Diagn) or maintenance (Mainte) screen.

11.1 Confirming the NC Message (Alarm Screen)

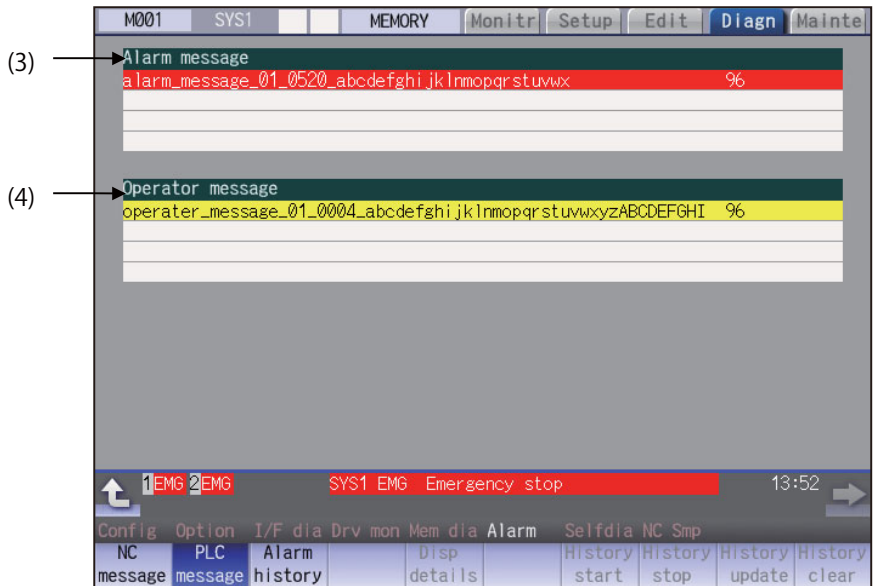


A list of currently occurring alarms or messages can be displayed on this screen. The displayed messages include the NC alarms, stop codes, alarm messages, operator messages, etc. A history of alarm information can be displayed also.

■ NC message



■ PLC message



Display Items

Display Items	Description
(1) NC message	This displays the operation alarms, program errors, MCP alarms, servo alarms, system alarms, etc. Up to 10 messages are displayed in order of priority.
(2) Stop code	This displays the automatic operation status or stop status during automatic operation. Up to 4 messages are displayed in order of priority.
(3) Alarm message	Using the PLC programs, this displays messages such as details of machine abnormalities. This varies depending on the MTB specifications. Up to 4 messages are displayed.
(4) Operator message	Using the PLC programs, this displays operator information messages. This varies depending on the MTB specifications. Macro alarm messages are also displayed in this field. Up to 4 messages are displayed.

Note

(1) When the 2nd line of the operator message cannot be displayed, only the 1st line is displayed.

Message display colors

The messages are color-coded in the following manner:

Message type	Character color	Background color
NC message	Alarm	White
	Warning	Black
Stop code	Black	Yellow
Alarm message	White	Red
Operator message	Black	Yellow
NC alarm message at the background check	White	Orange

Axis name display

The axis name is displayed in messages for each axis. The axis name is displayed as shown below according to the axis type.

Axis type	Axis name display	Display example	Remarks
NC axis	Control axis name (Name of axis in part system)	XYZ	If the same message occurs for each part system, several NC axes are displayed together.
Spindle	'S' + spindle No.	S1S2	If the same message occurs, several spindles are displayed together.
PLC axis	'P' + PLC axis No.	P1P2	If the same message occurs, several PLC axes are displayed together.
Auxiliary axis	'A' + auxiliary axis No.	A1A2	If the same message occurs, several auxiliary axes are displayed together.

If the same message occurs for different axis types, they will appear as separate messages.

Part system display

The part system name is also displayed if the message is output for each part system. The part system name set in "#1169 system name" is displayed. The part system name does not appear for the 1-part system.

11.1.1 Alarm History

Time	Alarm Type	Description	Code	System
1012 09:43:11	EMG	Emergency stop	STOP	SYS1
1012 09:43:11	EMG	Emergency stop	STOP	SYS2
1012 09:43:11	M01	Rot axis parameter error	0127	SYS1
1012 09:43:11	M01	No operation mode	0101	SYS2
1012 09:43:11	EMG	Emergency stop	SPIN	SYS1
1012 09:43:11	EMG	Emergency stop	SPIN	SYS2
1012 09:43:09	M01	H/W stroke end axis exists	0006	XYZA
1012 09:43:09	M01	H/W stroke end axis exists	0006	UVWB
1012 09:42:30	EMG	Emergency stop	STOP	SYS1
1012 09:42:30	EMG	Emergency stop	STOP	SYS2
1012 09:42:30	M01	Rot axis parameter error	0127	SYS1
1012 09:42:30	M01	No operation mode	0101	SYS2
1012 09:42:30	EMG	Emergency stop	SPIN	SYS1
1012 09:42:30	EMG	Emergency stop	SPIN	SYS2
1012 09:42:28	M01	H/W stroke end axis exists	0006	XYZA
1012 09:42:28	M01	H/W stroke end axis exists	0006	UVWB

1RDY 2RDY SYS2 M01 No operation mode 09:54

Config	Option	I/F dia	Drv mon	Mem dia	Alarm	Selfdia	NC Smp
message	message	history		Disp details		History start	History stop
						History update	History clear

When an alarm occurs, the alarm information is recorded. When the NC power is ON, an alarm is automatically recorded in alarm history. Alarm information is recorded from the latest alarm to 512.

Alarm information recorded in the history is NC message displayed on "NC message" screen and alarm messages displayed on "PLC message" screen.

The range etc. of record are shown as follows:

Record condition: When an alarm occurs (When two or more alarms occur at the same time, up to five alarms are recorded.)
 With multi-part system, 1st part system is given priority and recorded. (Following 2nd part system, 3rd part system...)

Number of history: 512 alarms (Whole)



Range of record: NC alarm (alarm, warning), PLC alarm message

Note

(1) The following alarms are not recorded on the alarm/warning screen.

- Operation alarm
 - External interlock axis exists (M01 0004)
 - Cutting override zero (M01 0102)
 - External feed rate zero (M01 0103)
 - Block start interlock (M01 0109)
 - Cutting block start interlock (M01 0110)
 - Interference check invalidated (M01 0200)
 - Rapid override zero (M01 0125)
 - Sp-Sp polygon (G51.2) cut interlock (M01 1033)
- "U50 PLC stopped" before the HMI screen starts up

Menus

Menus	Description
Alarm history	This displays the first page of the alarm history. The history sequentially displays 16 alarms per page from the latest alarm. If there are two or more NC alarms of same day and time, the alarms are sequentially displayed from the alarm and warning of the 1st part system. To display the old history, press the  key. To display the new history, press the  key.
History start	The data collection of the alarm history is started (restarted). The operation message "The collection begin? (Y/N)" appears. When the [Y] or [INPUT] key is pressed, the data collection is started after the operation message "The collection begin" appears. Press the [N] or other than [INPUT] key when the data collection will be not started/restarted.
History stop	The data collection of the alarm history is stopped. The operation message "The collection stop? (Y/N)" appears. When the [Y] or [INPUT] key is pressed, the data collection is stopped after the operation message "The collection stop" appears. Press the [N] or other than [INPUT] key when the data collection will be not stopped.
History update	The alarm information of history is updated. When the history is updated, the page with latest alarm information (first page) is displayed. The history is updated even if changing to another screen, and returning to the alarm history screen.
History clear	The alarm information of history is cleared. The operation message "Execute the collection data clear? (Y/N)" appears. When the [Y] or [INPUT] key is pressed, the alarm information of history is cleared after the operation message "Data clear complete" appears. The first page is displayed when the history is cleared.

Note

- (1) The menus [History start], [History stop], [History update] and [History clear] are valid when the alarm history function is valid and the menu [Alarm history] is selected.
- (2) When the alarm history function is used for the first time, clear the alarm history contents by pressing the menu [History clear]. Unnecessary data may be recorded in the alarm history.

Precautions

- (1) If the recording of the alarms is stopped with the menu [History stop] in the alarm history screen, alarms are not recorded in the history even after the NC power is turned OFF and ON. In this case, the recording of the alarms must be started with the menu [History start] in the alarm history screen.
- (2) If the time and date are changed, the change is not reflected to the time and date of the history data recorded before the change. Therefore, if the time and date are changed, clear the history with the menu [History clear].
- (3) If an alarm occurs while the alarm history is displayed, the display is not updated. Update the history by switching the screen with the menu [History update].
- (4) Depending on the part system setting of "Sampling spec" in the maintenance diagnostic data collection setting, the part systems to be recorded in the alarm history vary. If "0" is set, alarms of all part systems are recorded.
- (5) The alarm history data collection start/stop operation is switched using the menu [Start] or [Stop] of data collection regardless of whether "Alarm history" is set to "0" or "1" in "Collecting data select" in the maintenance diagnostic data collection setting.

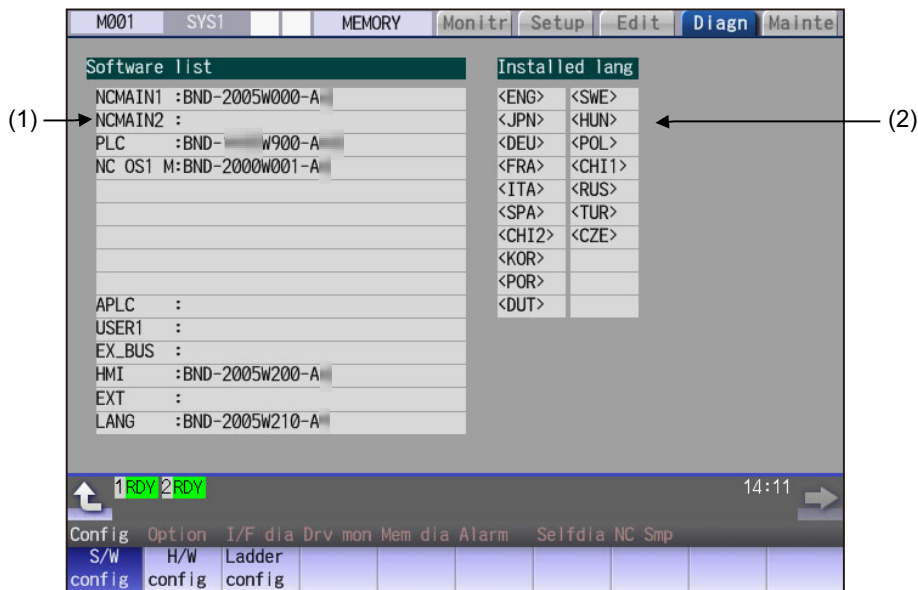
11.2 Checking Machine Status

11.2.1 System Configuration Screen

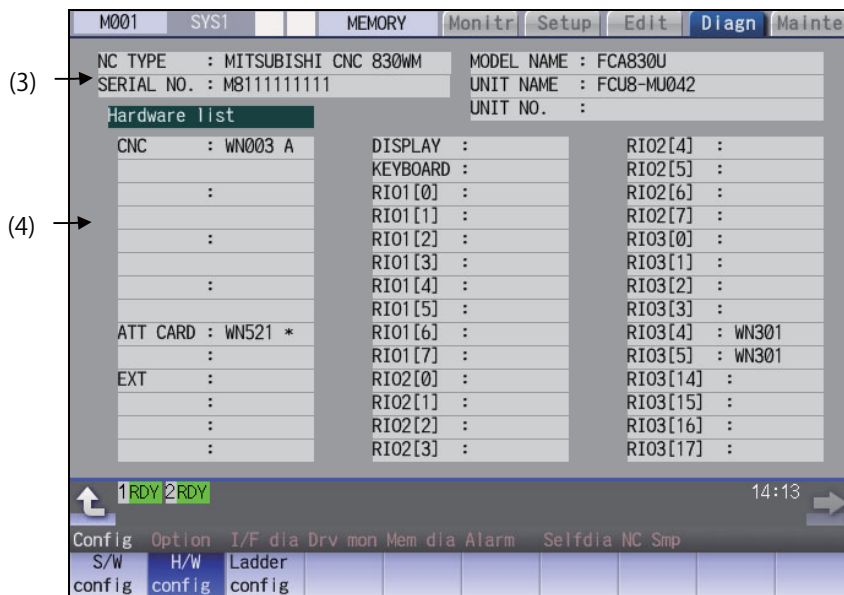


Select the menu [Config] on the diagnosis (Diagn) screen to display the hardware configuration (card name and sub-number), software configuration (software number and sub-number), and PLC program configuration (file name, file label, and execution type).

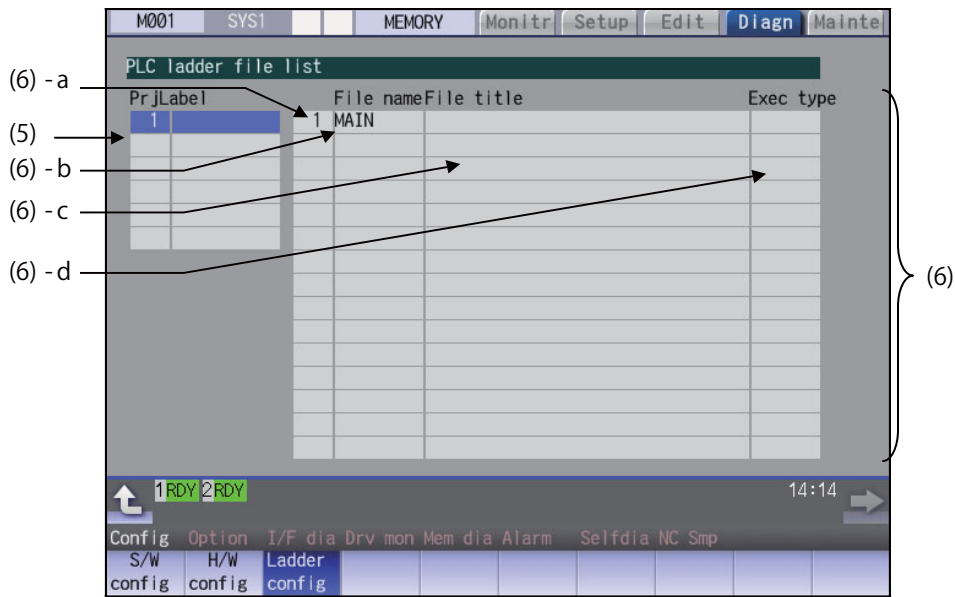
■ Software configuration



■ Hardware configuration







■ PLC program configuration

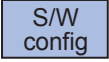
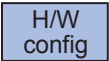
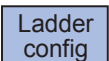


Display Items

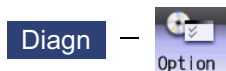
Display Items	Description	Remarks
(1) Software list	This displays a list of the software being used.	
(2) Installed lang	This displays a list of installed languages. <ENG>: English <SWE>: Swedish <JPN>: Japanese <HUN>: Hungarian <DEU>: German <POL>: Polish <FRA>: French <CHI1>: Simplified Chinese <ITA>: Italian <RUS>: Russian <SPA>: Spanish <TUR>: Turkish <CHI2>: Traditional Chinese <CZE>: Czech <KOR>: Korean <POR>: Portuguese <DUT>: Dutch	
(3) NC serial No.	This displays the NC model name, serial No, system type, and unit type.	
	NC TYPE:	NC type
	MODEL NAME:	System type name
	SERIAL NO.:	Serial No.
	UNIT NAME:	Unit type

Display Items	Description	Remarks										
(4) Hardware list	<p>The hardware names are displayed.</p> <p>Use  /  keys to change the pages and refer it.</p> <p>The following display is an example.</p>											
	<table border="0"> <tr> <td>CNC</td> <td>:WN111</td> <td>Main card</td> <td rowspan="3">A single unit of CNC unit is formed with a maximum of 4 PCBs. All of these cards are connected by bus.</td> </tr> <tr> <td></td> <td>:WN891</td> <td>Back panel card</td> </tr> <tr> <td></td> <td>:WN091</td> <td>7SEG-RSW card ♦Existing cards are displayed from the top in the above order.</td> </tr> </table>	CNC	:WN111	Main card	A single unit of CNC unit is formed with a maximum of 4 PCBs. All of these cards are connected by bus.		:WN891	Back panel card		:WN091	7SEG-RSW card ♦Existing cards are displayed from the top in the above order.	
CNC	:WN111	Main card	A single unit of CNC unit is formed with a maximum of 4 PCBs. All of these cards are connected by bus.									
	:WN891	Back panel card										
	:WN091	7SEG-RSW card ♦Existing cards are displayed from the top in the above order.										
	<table border="0"> <tr> <td>ATT CARD</td> <td>:WN521</td> <td>Front-side SD IF card</td> <td></td> </tr> <tr> <td>:</td> <td>:</td> <td></td> <td></td> </tr> </table>	ATT CARD	:WN521	Front-side SD IF card		:	:					
ATT CARD	:WN521	Front-side SD IF card										
:	:											
	<table border="0"> <tr> <td>EXT</td> <td>:EX561</td> <td>CC-Link expansion unit</td> <td rowspan="2">The extension unit is a hardware additional specification. It connects the PLC high-speed engine, Profibus card, etc. The back panel and maximum of 3 cards are displayed.</td> </tr> <tr> <td></td> <td>:EX563</td> <td>PROFIBUS-DP expansion unit ♦Existing expansion units are displayed from the top in the above order.</td> </tr> </table>	EXT	:EX561	CC-Link expansion unit	The extension unit is a hardware additional specification. It connects the PLC high-speed engine, Profibus card, etc. The back panel and maximum of 3 cards are displayed.		:EX563	PROFIBUS-DP expansion unit ♦Existing expansion units are displayed from the top in the above order.				
EXT	:EX561	CC-Link expansion unit	The extension unit is a hardware additional specification. It connects the PLC high-speed engine, Profibus card, etc. The back panel and maximum of 3 cards are displayed.									
	:EX563	PROFIBUS-DP expansion unit ♦Existing expansion units are displayed from the top in the above order.										
	<table border="0"> <tr> <td>DISPLAY</td> <td>:DU191</td> <td>Display unit</td> <td>The unit type varies by model.</td> </tr> </table>	DISPLAY	:DU191	Display unit	The unit type varies by model.							
DISPLAY	:DU191	Display unit	The unit type varies by model.									
	<table border="0"> <tr> <td>KEYBOARD</td> <td>:KB046</td> <td>Keyboard unit</td> <td>The unit type varies by the keyboard unit being connected.</td> </tr> </table>	KEYBOARD	:KB046	Keyboard unit	The unit type varies by the keyboard unit being connected.							
KEYBOARD	:KB046	Keyboard unit	The unit type varies by the keyboard unit being connected.									
	<table border="0"> <tr> <td>ECOMON1</td> <td>:EMU4-BD1</td> <td rowspan="3">EcoMonitorLight unit</td> <td rowspan="3">The unit type varies depending on the connected EcoMonitor Light unit. The status for up to 16 part systems is displayed.</td> </tr> <tr> <td>to</td> <td>:EMU4-HD1</td> </tr> <tr> <td>ECOMON16</td> <td></td> </tr> </table>	ECOMON1	:EMU4-BD1	EcoMonitorLight unit	The unit type varies depending on the connected EcoMonitor Light unit. The status for up to 16 part systems is displayed.	to	:EMU4-HD1	ECOMON16				
ECOMON1	:EMU4-BD1	EcoMonitorLight unit	The unit type varies depending on the connected EcoMonitor Light unit. The status for up to 16 part systems is displayed.									
to	:EMU4-HD1											
ECOMON16												
	<table border="0"> <tr> <td>RIO1[n]</td> <td>:WN301</td> <td>Remote IO unit 1 (n = 1 to 64)</td> <td rowspan="3">The unit type varies by the remote I/O unit being connected. Maximum of 3 channels are displayed.</td> </tr> <tr> <td>RIO2[n]</td> <td>:WN301</td> <td>Remote IO unit 2 (n = 1 to 64)</td> </tr> <tr> <td>RIO3[n]</td> <td>:WN301</td> <td>Remote IO unit 3 (n = 1 to 64)</td> </tr> </table>	RIO1[n]	:WN301	Remote IO unit 1 (n = 1 to 64)	The unit type varies by the remote I/O unit being connected. Maximum of 3 channels are displayed.	RIO2[n]	:WN301	Remote IO unit 2 (n = 1 to 64)	RIO3[n]	:WN301	Remote IO unit 3 (n = 1 to 64)	
RIO1[n]	:WN301	Remote IO unit 1 (n = 1 to 64)	The unit type varies by the remote I/O unit being connected. Maximum of 3 channels are displayed.									
RIO2[n]	:WN301	Remote IO unit 2 (n = 1 to 64)										
RIO3[n]	:WN301	Remote IO unit 3 (n = 1 to 64)										
(5) Project	<p>The list of project Nos. is displayed.</p> <p>If the selected project is switched with [↑] or [↓] key, the list of ladder files that belong to the project is displayed.</p>	Maximum of 10 single-byte alphanumeric characters for the label										
(6) PLC ladder file list	<p>This displays the file name, file label, execution type for each PLC ladder program.</p> <p>Use  /  keys to change the pages and refer it.</p>											
	<table border="0"> <tr> <td>(a) Registration No.</td> <td>This displays the registration No. of each PLC program file.</td> <td>The total number of registration size and target file to be executed for all projects is as follows: M800W/M800S: 120 M80/M80W: 60</td> </tr> </table>	(a) Registration No.	This displays the registration No. of each PLC program file.	The total number of registration size and target file to be executed for all projects is as follows: M800W/M800S: 120 M80/M80W: 60								
(a) Registration No.	This displays the registration No. of each PLC program file.	The total number of registration size and target file to be executed for all projects is as follows: M800W/M800S: 120 M80/M80W: 60										
	<table border="0"> <tr> <td>(b) File name</td> <td>This displays the file name of PLC program file. (data of GX Developer)</td> <td>Max. 8 characters</td> </tr> </table>	(b) File name	This displays the file name of PLC program file. (data of GX Developer)	Max. 8 characters								
(b) File name	This displays the file name of PLC program file. (data of GX Developer)	Max. 8 characters										
	<table border="0"> <tr> <td>(c) File label</td> <td>This displays this file label of PLC program file. (data of GX Developer)</td> <td>Max. 32 characters</td> </tr> </table>	(c) File label	This displays this file label of PLC program file. (data of GX Developer)	Max. 32 characters								
(c) File label	This displays this file label of PLC program file. (data of GX Developer)	Max. 32 characters										
	<table border="0"> <tr> <td>(d) Execution type</td> <td>This displays the execution type of PLC program. HIGH: High-speed PLC program MIDDLE: Middle-speed PLC program INITIAL: Initial state of PLC program WAIT: Standby PLC program LOW: Low-speed PLC program (blank): Not the target of the execution.</td> <td></td> </tr> </table>	(d) Execution type	This displays the execution type of PLC program. HIGH: High-speed PLC program MIDDLE: Middle-speed PLC program INITIAL: Initial state of PLC program WAIT: Standby PLC program LOW: Low-speed PLC program (blank): Not the target of the execution.									
(d) Execution type	This displays the execution type of PLC program. HIGH: High-speed PLC program MIDDLE: Middle-speed PLC program INITIAL: Initial state of PLC program WAIT: Standby PLC program LOW: Low-speed PLC program (blank): Not the target of the execution.											

Menus

Menus	Description
	This displays the software list.
	This displays the hardware list.
	This displays the PLC program list (file name, file label, and execution type).

11.2.2 Option Display Screen



Select the menu [Option] on the diagnosis (Diagn) screen to display the contents of the additional specifications registered in the NC.

The additional specification items are displayed by name. If all of the additional specifications cannot be seen in one screen, the rest of items can be displayed by pressing the page changeover key.

Display Items

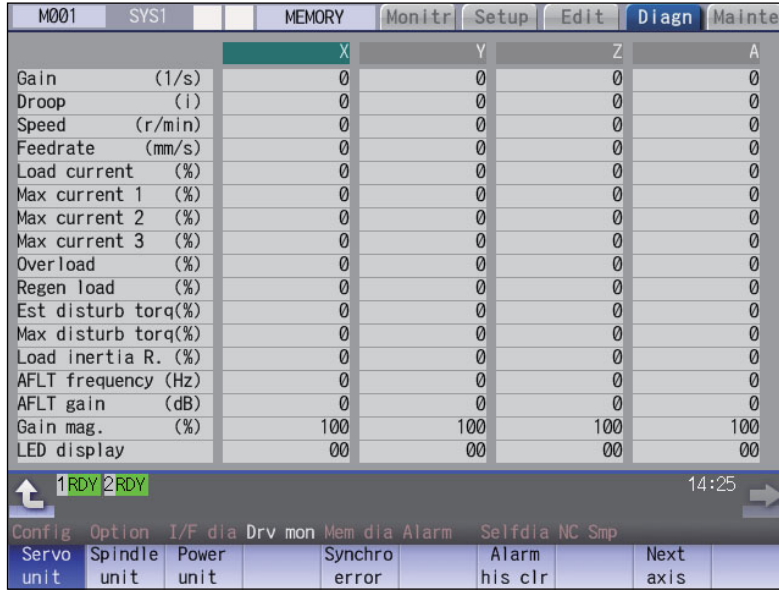
Display Items	Description
(1) Option items	The list of currently usable additional specifications is displayed. As for the currently usable items, the background color is displayed in blue. The items set when the power supply was turned ON can be currently used.

11.2.3 Display Items for the Servo Axis Unit (Drive Monitor Screen)



The various data related to the servo axis (NC axis, PLC axis) can be monitored by selecting the menus [Drv mon] -> [Servo unit] on the diagnosis (Diagn) screen.

Change the display item with or .



The axis name set in the base axis specification parameter "#1022 axname2" appears at the axis name.

Display Items

Display Items	Description
Gain (1/s)	This displays the position loop gain. The position loop gain is obtained by the following formula: $\frac{\text{Feedrate (mm/s)}}{\text{Tracking delay error (mm)}}$
Droop (i)	The error of the actual machine position to the command position is called droop. This error is proportional to command speed value. This follows the setting and display unit (#1003 iunit).
Speed (r/min)	This displays the actual rotation speed of motor.
Feedrate (mm/s)	This displays the feedrate on the machine end.
Load current (%)	This displays the FB value of the motor current in terms of continuous current during stalling.
Max current 1 (%)	This displays the motor current command in terms of continuous current during stalling. An absolute value of the current command peak value sampled after the power ON is displayed.
Max current 2 (%)	This displays the motor current command in terms of continuous current during stalling. An absolute value of the current command peak value sampled in most recent 2 seconds is displayed.

Display Items	Description
Max current 3 (%)	This displays the FB value of the motor current in terms of continuous current during stalling. An absolute value of the current FB peak value sampled in most recent 2 seconds is displayed.
Overload(%)	This is the data used to monitor the overload of motor and drive unit.
Regen load (%)	This is the data used to monitor the resistance overload state when the resistance regenerative power supply is connected.
Est disturb torq (%)	This displays the estimated disturbance torque in terms of stall rated torque when the disturbance observer is valid.
Max disturb torq (%)	This displays the estimated disturbance torque in terms of stall rated torque when the collision detection function is adjusted. An absolute value of the estimated disturbance torque peak value sampled in most recent 2 seconds is displayed.
Load inertia R. (%)	This displays the estimated load inertia ratio when the collision detection function is adjusted. The ratio is displayed according to the parameter settings of "#1251 set23/bit0" and "#2235 V035/bitF".
AFLT frequency (Hz)	This displays the current operation frequency of the adaptive filter.
AFLT gain (dB)	This displays the current filter depth of the adaptive filter.
Gain mag. (%)	While Real-time tuning 1 is valid, the currently applied speed control gain is displayed with the magnification for the setting value of speed loop gain 1 (parameter "#2205 SP005 VGN1").
LED display	This displays the 7-segment LED of the driver.
Alarm	This displays the alarms and warnings other than the LED display (displayed on drive unit side).
Cycle counter (p)	This displays the position within one rotation of the encoder detector. The position is displayed within one rotation in the range of "0" to "RNG (movement units) × 1000" using the grid point value as "0".
Grid space	This displays the grid space for the reference position return. (Command unit)
Grid amnt	This displays the distance from the dog-off point to the grid point when the dog-type reference position return is displayed. The grid mask amount is not included. (Command unit)
Machine position	This displays the NC basic machine coordinate system position. (Command unit)
Motor end FB	This displays the feedback value of the speed detector. (Command unit)
Machine end FB	This displays the feedback position of the machine end position detector. (Command unit)
FB error (i)	This displays the error of the motor end FB and machine end FB. This follows the setting and display unit (#1003 iunit).
DFB compen amnt (i)	This displays the compensation pulse amount during dual feedback control. This follows the setting and display unit (#1003 iunit).
Remain command	The remaining movement distance of one block is displayed. (Command unit)
Currnt posn (2)	The value of the tool compensation amount subtracted from the current position is displayed. (Command unit)
Man int amt	The amount of interrupt movement in the manual absolute OFF state is displayed. (Command unit)
Abs pos command	The absolute position that does not include the machine error compensation amount is displayed. (Command unit)
Superimp syn er (mm)	This displays the current value of the synchronous error between the basic axis and the synchronous axis during control axis synchronization between part systems, control axis superimposition, or arbitrary axis superimposition.
Superimp err +P (mm)	This displays the maximum value of the distance in which the synchronous axis advances beyond the basic axis during control axis synchronization between part systems, control axis superimposition, or arbitrary axis superimposition.
Superimp err -P (mm)	This displays the maximum value of the distance in which the synchronous axis lags behind the basic axis during control axis synchronization between part systems, control axis superimposition, or arbitrary axis superimposition.

Display Items	Description
Superimp errP-P (mm)	This displays the synchronous error width between the basic axis and the synchronous axis during control axis synchronization between part systems, control axis superimposition, or arbitrary axis superimposition.
Motor temp. (°C)	This displays the motor temperature.
Power cycles (p)	This displays the power cycle counter. (Number of times)
Insul resist. (MOhm)	The insulation degradation status is displayed.
FAN1 rot. state (%)	The detected rotation speed of the unit cooling FAN1 is displayed by converting it into percentage format.
FAN2 rot. state (%)	The detected rotation speed of the unit cooling FAN2 is displayed by converting it into percentage format.
Battery voltage (V)	This displays the voltage of the connected battery.
AUX current sta No. (*1)	This displays the current station No.
AUX current posn (*1)	This displays the current coordinates position.
AUX inst station No. (*1)	This displays the command station No. of automatic operation or the nearest station No. to stop by manual operation etc.
AUX inst posn (*1)	This displays the coordinates position corresponding to target station No.
Mach err comp val	This displays the machine error compensation amount. (Command unit)
Control input 1L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: READY ON command Bit1: Servo ON command Bit4: Position loop gain changeover command Bit6: Excessive error detection width changeover command Bit7: Alarm reset command
Control input 1H	This indicates the control signal input from NC. (bit8 to bitF) Bit8: Current limit selection command
Control input 2L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 2H	This indicates the control signal input from NC. (bit8 to bitF) Bit9: Speed monitor command valid BitA: In door closed (controller) BitB: In door closed (all drive units)
Control input 3L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: Control axis detachment command
Control input 3H	This indicates the control signal input from NC. (bit8 to bitF)
Control input 4L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 4H	This indicates the control signal input from NC. (bit8 to bitF)
Control input 5L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 5H	This indicates the control signal input from NC. (bit8 to bitF)
Control input 6L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: OMR-FF control request
Control input 6H	This indicates the control signal input from NC. (bit8 to bitF) Bit8: Drivers communication control request
Control output 1L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: In READY ON Bit1: In Servo ON Bit4: In position loop gain changeover Bit6: In excessive error detection width changeover Bit7: In alarm
Control output 1H	This indicates the control signal input from NC. (bit8 to bitF) Bit8: In current limit selection BitE: In-position BitD: In current limit BitE: In absolute position data loss BitF: In warning

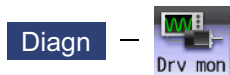
Display Items	Description
Control output 2L	This indicates the control signal input from NC. (bit0 to bit7) BitD: Z-phase passed Bit3: In zero speed Bit7: In external emergency stop
Control output 2H	This indicates the control signal input from NC. (bit8 to bitF) Bit9: In speed monitor BitA: In door closed (controller) BitB: In door closed (self drive unit)
Control output 3L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: In control axis detachment
Control output 3H	This indicates the control signal input from NC. (bit8 to bitF)
Control output 4L	This indicates the control signal input from NC. (bit0 to bit7)
Control output 4H	This indicates the control signal input from NC. (bit8 to bitF)
Control output 5L	This indicates the control signal input from NC. (bit0 to bit7)
Control output 5H	This indicates the control signal input from NC. (bit8 to bitF)
Control output 6L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: In OMR-FF control
Control output 6H	This indicates the control signal input from NC. (bit8 to bitF) Bit8: In drivers communication control
Detection system	This displays the detector type symbol of the absolute position detection system. ES: Semi-closed encoder EC: Ball screw end encoder LS: Linear scale MP: MP scale ESS: Semi-closed high-speed serial encoder ECS: Ball screw end INC: Incremental
Power OFF posn	This displays the coordinate at NC power OFF in the basic machine coordinate system. (Command unit)
Power ON posn	This displays the coordinate at NC power ON in the basic machine coordinate system. (Command unit)
Current posn	This displays the current coordinate in the basic machine coordinate system. (Command unit)
R0	This displays the multi-rotation counter value of the detector stored in the memory during basic point setting.
P0	This displays the position within one rotation of the detector stored in the memory during basic point setting.
E0	This displays the absolute position error stored in the memory during basic point setting.
Rn	This displays the multi-rotation counter value of the current detector.
Pn	This displays the position within one rotation of the detector.
En	This displays the absolute position error during NC power OFF.
ABS0	This displays the absolute position reference counter.
ABSn	This displays the current absolute position.
MPOS	This displays the offset amount of the MP scale when the power is turned ON.
Unit type	This displays the servo driver type.
Unit serial No.	This displays the servo driver serial No.
Software version	This displays the servo side software version.
Control method	SEMI: Semi-closed loop CLOSED: Closed loop DUAL: Dual feedback
Motor end detector	This displays the motor end detector type.
Motor end detect No.	This displays the motor end detector serial No.

Display Items	Description
Machine end detector	This displays the machine end detector type. The type is displayed when the control method is CLOSED or DUAL. * is displayed when the method is SEMI.
Mach. end detect No	This displays the machine end detector serial No.
Motor	This displays the motor type.
Work time	This displays the READY ON work time. (Units: 1 hr)
Alarm history 1: Time 1: Alarm } 8: Time 8: Alarm	This displays servo alarms that occurred in latest order with the following formats. Time: Work time when the alarm occurred Alarm No.: Number of the servo alarms that occurred
Maint hist 1 } Maint hist 4	This displays the maintenance dates. Year: One digit Month: 1 to 9, X (Oct.), Y (Nov.), Z (Dec.)
Maint status	This displays the maintenance status.

(*1) Data (station No./current position/command position) is displayed for axes of auxiliary axis state.

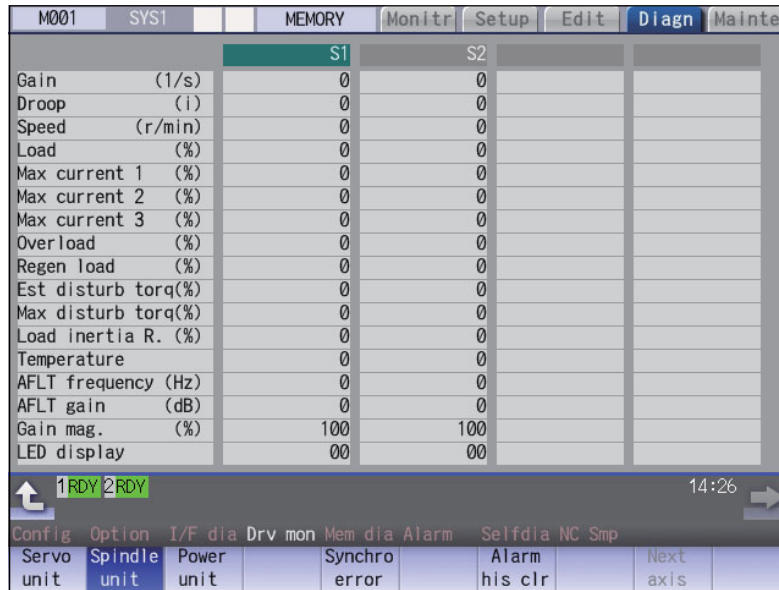
"-" is displayed for axes of non-auxiliary axis state (NC axis or during PLC axis control).

11.2.4 Display Items for the Spindle Unit (Drive Monitor Screen)



The various data related to the spindle can be monitored by selecting the menus [Drv mon] -> [Spindle unit] on the diagnosis (Diagn) screen.

Change the display item with or .



Display Items

Data name	Description
Gain (1/s)	This displays the position loop gain. The position loop gain is obtained by the following formula. $\frac{\text{Feedrate (mm/s)}}{\text{Tracking delay error (mm)}}$
Droop (i)	The error of the actual machine position to the command position is called droop. This error is proportional to command speed value. (*1)
Speed (r/min)	This displays the actual rotation speed of motor.
Load (%)	This displays the motor load.
Max current 1 (%)	This displays the motor current command in terms of continuous current during stalling. An absolute value of the current command peak value sampled after the power ON is displayed.
Max current 2 (%)	This displays the motor current command in terms of continuous current during stalling. An absolute value of the current command peak value sampled in most recent 2 seconds is displayed.
Max current 3 (%)	This displays the FB value of the motor current in terms of continuous current during stalling. An absolute value of the current FB peak value sampled in most recent 2 seconds is displayed.
Overload (%)	This is the data used to monitor the overload of drive unit.
Regen load (%)	This is the data used to monitor the resistance overload state when the resistance regenerative power supply is connected.

Data name	Description
Est disturb torq (%)	This displays the estimated disturbance torque in terms of stall rated torque when the disturbance observer is valid.
Max disturb torq (%)	This displays the estimated disturbance torque in terms of stall rated torque when the collision detection function is adjusted. An absolute value of the estimated disturbance torque peak value sampled in most recent 2 seconds is displayed.
Load inertia R. (%)	This displays the estimated load inertia ratio when the collision detection function is adjusted. The ratio is displayed according to the parameter setting of "#1251 set23/bit0".
Temperature (°C)	This displays the thermistor temperature. The temperature is displayed according to the parameter settings of "#1251 set23/bit0" and "#13225 SP225/bit2".
AFLT frequency(Hz)	This displays the current operation frequency of the adaptive filter.
AFLT gain(dB)	This displays the current filter depth of the adaptive filter.
Gain mag. (%)	While Real-time tuning 1 is valid, the currently applied speed control gain is displayed with the magnification for the setting value of speed loop gain 1 (parameter "#13005 SP005 VGN1").
LED display	This displays the 7-segment LED of the driver.
Alarm	This displays the alarms and warnings other than the LED display (displayed on drive unit side).
Cycle counter(p)	This displays the position within one rotation of the encoder detector. The position is displayed within one rotation in the range of "0" to "RNG (movement units) × 1000" using the grid point value as "0".
Grid space	This displays the grid space for the reference position return. (Command unit) (*1)
Grid amnt	This displays the distance from the dog-off point to the grid point when the dog-type reference position return is displayed. The grid mask amount is not included. (Command unit) (*1)
Machine position	This displays the NC basic machine coordinate system position. (Command unit) (*1)
Motor end FB	This displays the feedback value of the speed detector. (Command unit) (*1)
FB error (i)	This displays the error of the motor end FB and machine end FB. (*1)
DFB compen amnt (i)	This displays the compensation pulse amount during dual feedback control. (*1)
Tap error (mm) (*2)	This displays the current value of the synchronous error between the tapping spindle and the drilling axis during synchronous tapping. (When the parameter "#1041 Initial inch" is set to "1", "Tap error (inch)" is displayed.) (*1)
Tap error +P (mm) (*2)	This displays the maximum value of the distance in which the drilling axis advances beyond the tapping spindle during synchronous tapping. (When the parameter "#1041 Initial inch" is set to "1", "Tap error +P (inch)" is displayed.) (*1)
Tap error -P (mm) (*2)	This displays the maximum value of the distance in which the drilling axis lags behind the tapping spindle during synchronous tapping. (When the parameter "#1041 Initial inch" is set to "1", "Tap error -P (inch)" is displayed.) (*1)
Tap error P-P (mm) (*2)	This displays the synchronous error width between the spindle and the drilling axis during the synchronous tapping. (When the parameter "#1041 Initial inch" is set to "1", "Tap error -P (inch)" is displayed.) (*1)
Tap error (deg) (*2)	This displays the current value of the synchronous error angle between the tapping spindle and the drilling axis during synchronous tapping. (±99999.999 deg) (*1)
Tap error +P (deg) (*2)	This displays the maximum value of the angle at which the tapping spindle advances beyond the drilling axis during synchronous tapping. (±99999.999 deg) (*1)
Tap error -P (deg) (*2)	This displays the maximum value of the angle at which the tapping spindle lags behind the drilling axis during synchronous tapping. (±99999.999 deg) (*1)
Tap error P-P (deg) (*2)	This displays the synchronous error angle between the spindle and the drilling axis during the synchronous tapping. (deg) (*1)
SP sync error (deg)	This displays the current value of the synchronous error between the basic spindle and the synchronous spindle during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (±99999.999 deg)

Data name	Description
SP sync err +P (deg)	This displays the maximum value of the angle at which the synchronous spindle advances beyond the basic spindle during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
SP sync err -P (deg)	This displays the maximum value of the angle at which the synchronous spindle lags behind the basic spindle during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
SP syn err P-P (deg)	This displays the synchronous error width between the basic spindle and the synchronous spindle during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
SP syn phas er (deg)	This displays the phase difference stored in the memory by calculating the phase shift value. (± 99999.999 deg)
SP sync ph1 FB (deg)	This displays the current value of the feedback phase difference that includes the phase difference stored in the memory by calculating the phase shift value during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
SP sync ph2 FB (deg)	This displays the current value of the feedback phase difference that does not include the phase difference stored in the memory by calculating the phase shift value during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
SP syn er comp (deg)	This displays the error compensation amount during spindle synchronization I, tool spindle synchronization IA/IB, or tool spindle synchronization II. (± 99999.999 deg)
GB sync error (deg)	This displays the current value of the synchronous error between the basic spindle and the guide bushing spindle during guide bushing spindle synchronization. (± 99999.999 deg)
GB sync err +P (deg)	This displays the maximum value of the distance in which the guide bushing spindle advances beyond the basic spindle during guide bushing spindle synchronization. (± 99999.999 deg)
GB sync err -P (deg)	This displays the maximum value of the distance in which the guide bushing spindle lags behind the basic spindle during guide bushing spindle synchronization. (± 99999.999 deg)
GB sync err P-P (deg)	This displays the synchronous error width between the basic spindle and the guide bushing spindle during guide bushing spindle synchronization. (± 99999.999 deg)
Motor temp. (°C)	This displays the motor temperature.
Power cycles (p)	This displays the power cycle counter. (Number of times)
Insul resist. (MOhm)	The insulation degradation status is displayed.
FAN1 rot. state (%)	The detected rotation speed of the unit cooling FAN1 is displayed by converting it into percentage format.
FAN2 rot. state (%)	The detected rotation speed of the unit cooling FAN2 is displayed by converting it into percentage format.
Battery voltage (V)	This displays the battery voltage.
Control input 1L	This indicates the control signal input from NC. (bit0 to bit7) Bit0: READY ON command Bit1: Servo ON command Bit6: Parameter conversion command Bit7: Alarm reset command
Control input 1H	This indicates the control signal input from NC. (bit8 to bitF) Bit8 to BitA: Torque limit mode BitF: In G1 modal
Control input 2L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 2H	This indicates the control signal input from NC. (bit8 to bitF)
Control input 3L	This indicates the control signal input from NC. (bit0 to bit7) Bit0 to Bit4: Spindle control mode selection command Bit5 to Bit7: Gear selection command 0: 1st gear 1: 2nd gear 2: 3rd gear 3: 4th gear 4: 5th gear 5: 6th gear 6: 7th gear 7: 8th gear

Data name	Description
Control input 3H	This indicates the control signal input from NC. (bit8 to bitF) Bit8: Forward run start command Bit9: Reverse run start command BitA: Indexing forward run BitB: Indexing reverse run BitC: Orientation start BitD: L-coil switch command BitE to BitF: Sub-motor selection command 0: Main motor 1: Sub-motor 1 2: Sub-motor 2 3: Sub-motor 3
Control input 4L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 4H	This indicates the control signal input from NC. (bit8 to bitF)
Control input 5L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 5H	This indicates the control signal input from NC. (bit8 to bitF) BitB: Minimum excitation 2 changeover request BitC: Speed gain set 2 changeover request BitD: Door open BitE: Spindle holding force up
Control input 6L	This indicates the control signal input from NC. (bit0 to bit7)
Control input 6H	This indicates the control signal input from NC. (bit8 to bitF)
Control output 1L	This indicates the control signal output to NC. (bit0 to bit7) Bit0: In READY ON Bit1: In Servo ON Bit4: In driver warning occurrence Bit5: Absolute position basic data set completion Bit6: In parameter conversion Bit7: In alarm occurrence
Control output 1H	This indicates the control signal output to NC. (bit8 to bitF) Bit8 to BitA: Torque limit mode BitD: Z-phase passed BitE: In-position BitF: In power supply limitation
Control output 2L	This indicates the control signal output to NC. (bit0 to bit7)
Control output 2H	This indicates the control signal output to NC. (bit8 to bitF)
Control output 3L	This indicates the control signal output to NC. (bit0 to bit7) Bit0 to Bit4: Spindle control mode selected Bit5 to Bit7: Gear selected 0: 1st gear 1: 2nd gear 2: 3rd gear 3: 4th gear 4: 5th gear 5: 6th gear 6: 7th gear 7: 8th gear
Control output 3H	This indicates the control signal output to NC. (bit8 to bitF) Bit8: Forward run start command Bit9: Reverse run start command BitA: Indexing forward run BitB: Indexing reverse run BitC: Orientation start BitD: L-coil switch command BitE to BitF: Sub-motor selection command 0: Main motor 1: Sub-motor 1 2: Sub-motor 2 3: Sub-motor 3

Data name	Description
Control output 4L	This indicates the control signal output to NC. (bit0 to bit7) Bit0: Current detection Bit1: Speed detection Bit2: Up-to-speed Bit3: Zero speed detection Bit4: Orientation completion Bit5: Synchronization speed match Bit6: In coil changeover Bit7: Index positioning completion
Control output 4H	This indicates the control signal output to NC. (bit8 to bitF) BitF: 2nd position
Control output 5L	This indicates the control signal output to NC. (bit0 to bit7)
Control output 5H	This indicates the control signal output to NC. (bit8 to bitF) BitB: Minimum excitation 2 changeover request BitC: Speed gain set 2 changeover request BitD: Door open BitE: In spindle holding force up
Control output 6L	This indicates the control signal output to NC. (bit0 to bit7)
Control output 6H	This indicates the control signal output to NC. (bit8 to bitF)
Unit type	This displays the spindle type.
Unit serial No.	This displays the spindle serial No.
Software version	This displays the software No. and version on the spindle side.
Motor end detect No	This displays the motor end detector serial No.
Mach. end detect No	This displays the machine end detector serial No.
Motor	It displays the motor type which is set for the spindle specification parameter "#3138 motor_type". The maximum of 26 words are displayed with 2 lines and left aligned.
Work time	This displays the READY ON work time. (Units: 1 hr)
Alarm history 1: Time 1: Alarm } 8: Time 8: Alarm	This displays servo alarms that occurred in latest order with the following formats. Time: Work time when the alarm occurred Alarm No.: Number of the servo alarms that occurred
Maint hist 1 } 4	This displays the maintenance dates. Year: One digit Month: 1 to 9, X (Oct.), Y (Nov.), Z (Dec.)
Maint status	This displays the maintenance status.

(*1) These follow the setting and display unit (#1003 iunit) of the 1st part system.

(*2) Synchronous tapping error

This displays the maximum values of the synchronous tapping error that occur during the synchronous tapping.

The synchronous tapping error means the motor tracking delay for the commanded positions of the spindle and the tapping axis.

The positive synchronous tapping error means that the tapping axis is delayed responding to the spindle, and the negative synchronous tapping error means that the spindle is delayed responding to the tapping axis.

Data name	Description
Synchronous tapping error width (Max value)	<ul style="list-style-type: none"> ♦This outputs the data of which absolute value is the largest among the synchronous tapping error width (-99999.999 to 99999.999 mm) during the synchronous tapping modal. ♦This data will be initialized to "0" when entering the synchronous tapping modal or restoring the power. Other than that, the data continues to display the maximum value.
Synchronous tapping error angle (Max value)	<ul style="list-style-type: none"> ♦This outputs the data of which absolute value is the largest among the synchronous tapping error angle (-99999.999 to 99999.999°) during the synchronous tapping modal. ♦This data will be initialized to "0" when entering the synchronous tapping modal or restoring the power. Other than that, the data continues to display the maximum value.

11.2.5 Display Items for the Power Supply Unit (Drive Monitor Screen)



The various data related to the power supply can be monitored by selecting the menus [Drv mon] -> [Power unit] on the diagnosis (Diagn) screen.

Change the display item with or .

Unit type			
Unit serial No.			
Software version			
Connected drive			
Recovery energy(kW)	0		
Pw. sply volt(Vrms)	0		
PN bus voltage (V)	0		
Min PN bus volt (V)	0		
Min PN current (%)	0		
Bus current (%)	0		
Max current1 (%)	0		
Max current2 (%)	0		
Max rgn current1(%)	0		
Max rgn current2(%)	0		
No. of instant stop	0		
Work time	0		

1 RDY 2 RDY 14:30

Config Option I/F dia Drv mon Mem dia Alarm Self dia NC Smp

Servo unit Spindle unit Power unit Synchro error Alarm his clr Next axis

Display Items

Display Items	Description
Unit type	This displays the power supply unit type.
Unit serial No.	This displays the serial No. of the power supply unit.
Software version	This displays the software version.
Connected drive	This displays the I/F channel No. (mcp_no, smcp_no) of the drive unit connected to each power supply unit.
Recovery energy (KW)	This displays the regenerative power every two seconds. (0 to 999 kW)
Pw. sply volt (Vrms)	This displays the effective value of the power supply voltage. (0 to 999 Vrms)
PN bus voltage (V)	This displays PN bus voltage. (0 to 999V)
Min PN bus volt (V)	This displays the minimum PN bus voltage after the NC power ON. (0 to 999V)
Min PN current (%)	This displays the bus current when PN bus voltage is at minimum. (driving: +, regenerative: -) (0 to 999%)
Bus current (%)	This displays the bus current. (driving: +, regenerative: -) (0 to 999%)
Max current1 (%)	This displays the maximum driving current after the NC power ON. (0 to 999%)
Max current2 (%)	This displays the maximum driving current in most recent 2 seconds. (0 to 999%)
Max rgn current1 (%)	This displays the maximum regenerative current after the NC power ON. (0 to 999%)
Max rgn current2 (%)	This displays the maximum regenerative current in most recent 2 seconds. (0 to 999%)
No. of instant stop	This displays the number of instantaneous stop exceeding 1 cycle of the power. (0 to 9999 times)
Work time	This displays the READY ON work time. (Units: 1 hr)
Power-run pwr (kW)	The power-run power is calculated and displayed. (0.01 kW)
Regenerate pwr (kW)	The regenerated power is calculated and displayed. (0.01 kW)

Display Items	Description
Consumed power (kW)	The power consumption is calculated and its integrated value is displayed. (0.01 kWh)
Pwr. distortion (V)	The amount of power distortion (harmonic voltage value) is calculated and displayed. (V)
Supplied power (kW)	The supplied power is calculated and displayed. (kW)
Accum. power (kWh)	The accumulated power is calculated and displayed. (kWh)
Harmonic volt. (V)	The power line harmonic voltage is displayed. (V)
CV margin (%)	The CV margin is calculated and displayed. (%)
FAN1 rot. state (%)	The detected rotation speed of the unit cooling FAN1 is displayed by converting it into percentage format.
FAN2 rot. state (%)	The detected rotation speed of the unit cooling FAN2 is displayed by converting it into percentage format.
This displays servo alarms that occurred in latest order with the following formats. 1: Time 1: Alarm } 8: Time 8: Alarm	This displays servo alarms that occurred in latest order with the following formats. Time: Work time when the alarm occurred Alarm No.: Number of the servo alarms that occurred
Maint hist 1 } 4	This displays the maintenance dates. Year: One digit Month: 1 to 9, X (Oct.), Y (Nov.), Z (Dec.)
Maint status	This displays the maintenance status.

11.2.6 Display Items for the Synchronous Error (Drive Monitor Screen)



The "Synchronous error" appears only when the synchronous control axis specification is valid.

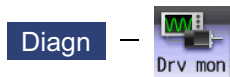
The various data related to the synchronous error can be monitored by selecting the menus [Drv mon] -> [Synchro error] on the diagnosis (Diagn) screen.



Display Items





Display Items	Description
Slave axis	This displays the slave axis name which is controlled following the master axis. The axis name corresponding to the axis No. set in the axis specification parameter "#1068 slavno" (slave axis No.) is displayed. The name set in the base axis specification parameter "#1022 axname2" (2nd axis name) is displayed for the slave axis.
Command error	This is the deviation of the slave axis machine position in respect to the master axis. The error of the commanded position to the servo control section before pitch error compensation, relative position compensation and backlash compensation is displayed. If this error occurs, the parameters that should be the same for the synchronous axes are different. Command error = Command s - command m - Δ Command s: Slave axis commanded position Command m: Master axis commanded position Δ: Command s - command m at start of synchronous control
FB error	This is the deviation of the slave axis feedback position in respect to the feedback position from the master axis servomotor. The actual error of the machine position is displayed. The synchronous error check is carried out on this error. FB error = FBs - FBm - Δ FBs: Slave axis feedback position FBm: Master axis feedback position Δ: FBs - FBm at start of synchronous control
FB error MAX1	This displays the maximum FB error after the start of the synchronous control.
FB error MAX2	This displays the maximum FB error approx. every 30 seconds after the start of the synchronous control.
Machine position	This displays the commanded machine position for the master axis.

11.2.7 Clearing the Alarm History (Drive Monitor Screen)



This operation clears the alarm history on the drive monitor screen.

Operation method

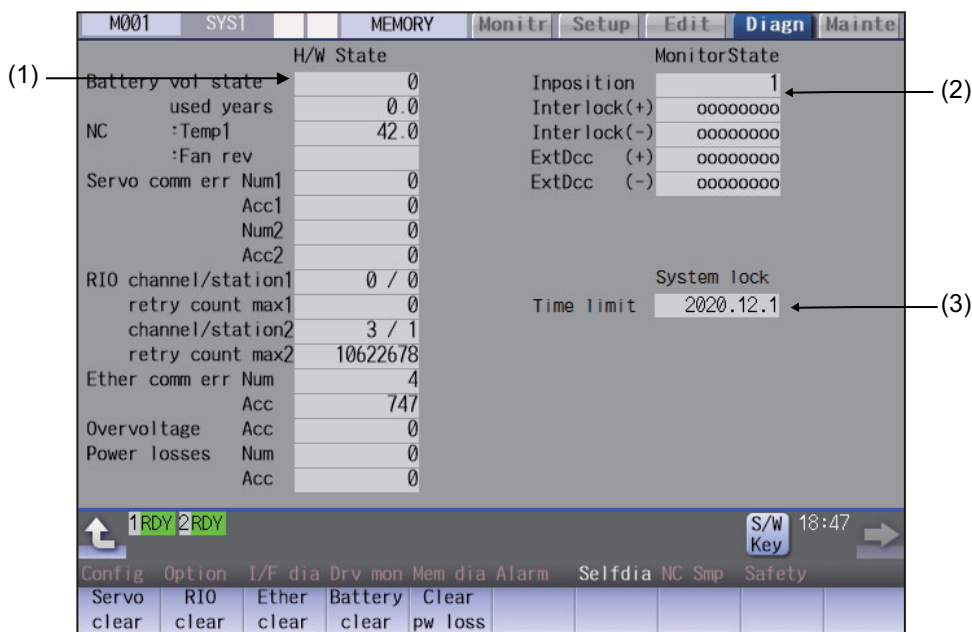
- (1) Press the menu [Servo unit] or [Spindle unit].
- (2) Using the menu [Next axis], tab keys  and , select the axis (device) from which to clear the alarm history.
- (3) Press the menu [Alarm his clr].
 The menu is highlighted, and a message appears to confirm the erasing.
The alarm history1: Time appears at the head.
- (4) Press the [Y] key.
 All alarm history data for the selected axis (device) are cleared to "0".

11.3 Diagnosis Screens

11.3.1 Self Diagnosis Screen



The hardware state and NC operation state can be confirmed by selecting the menu [Selfdia] on the diagnosis (Diagn) screen.



Display Items

Display Items	Description
(1) H/W state (common for part systems)	This displays the hardware state of the NC unit and display unit. (*1)
(2) Operation state (Depends on part system)	This displays the state when the operation seems to be stopped in spite that the alarm does not occur. (*2)
(3) System lock	This displays the valid term by the system lock when the system lock is valid. This will not displayed when the system lock specification is invalid. For details, refer to "11.4 System Lock (When an Expiry Date is Displayed)".

(*1) As for the NC unit, the contents are as follows depending on the condition:

NC

Item	Details	
Battery vol state	This displays the current state of the battery voltage as 0/1 below.	
	Condition	Class
	0 (normal state)	-
	1 (detector error) (no battery)	Warning (yellow)
Used years (years)	This displays approximate time of the battery used from the last replacement.	
	Condition	Class
	Recommended battery use (5 years) <= Time for the battery used	Warning (yellow)
Control unit temp. 1 (°C)	This displays the current temperature of the control unit.	
	Condition (M800S: Main card / M80)	Class
	78.5°C < Control unit temp. <= 81°C	Cautions (gray)
	81°C < Control unit temp.	Warning (yellow)
	Condition (M800W: Main card)	Class
	79°C < Control unit temp. <= 84.5°C	Cautions (gray)
	84.5°C < Control unit temp.	Warning (yellow)
	Condition (M80W: Main card)	Class
	79°C < Control unit temp. <= 84.5°C	Cautions (gray)
84.5°C < Control unit temp.	Warning (yellow)	
Fan rev (r/min)	This displays the current fan rotation speed of the control unit.	
	Condition	Class
	Fan rot. speed <= 4000 r/min	Warning (yellow)

Communication between NC unit and display unit

Item	Details
Servo comm err Num1	This displays the count of occurrence for "Y51 SV commu er: Recv frame No. xx04" after the power ON.
Servo comm err Acc1	This displays the cumulated count of occurrence for " Y51 SV commu er: Recv frame xx04". Press the menu [Servo clear] to clear the cumulated count to "0".
Servo comm err Num2	This displays the count of occurrence for "Y51 SV commu er: Data ID error xx03" after the power ON.
Servo comm err Acc2	This displays the cumulated count of occurrence for "Y51 SV commu er: Data ID error xx03". Press the menu [Servo clear] to clear the cumulated count to "0".
RIO channel/station1	This displays the Channel No./Station No. of occurrence for continuous error after the power ON.
RIO retry count max 1	This displays the maximum value of the continuous error after the power ON.
RIO channel/station 2	This displays the Channel No./Station No. held even if the power OFF. Press the menu [RIO clear] to clear the Channel No./Station No. to "0/0".
RIO retry count max 2	This displays the count held even if the power OFF. Press the menu [RIO clear] to clear the count to "0".
Ether comm err Num	This displays the number of Ethernet communication error after PLC program is executed once.
Ether comm err Acc	This displays the cumulated count of occurrence for " Ether communication error ". Press the menu [Ether clear] to clear the cumulated count to "0".
Overvoltage Acc	This displays the cumulated count of detection frequency of overvoltage after the power ON.
Power losses Num	This displays the count of detection frequency of power losses after the power ON.
Power losses Acc	This displays the cumulated count of detection frequency of power losses after the power ON. Press the [Clear pw loss] menu to clear the cumulated count to "0".

(*2) The following state can be confirmed.


State	Details
In-position	This displays "1" (in-position state) when the following conditions are satisfied for even one axis. ♦There is a control axis whose acceleration/deceleration is not zero. ♦There is a control axis whose servo error exceeds the range designated with the parameter.
Interlock (+)	When the auto interlock +n-th axis signal or the manual interlock +n-th axis signal is OFF, "1" appears for the n-th axis. (Explanation of the display) o o o o o 1 o ↑ ↑ 8th axis ... 1st axis In the above case, the 2nd axis is interlocked. Even when the number of usable axes is less than 8 in 1 part system, this displays 8 axes fixed.
Interlock (-)	When the auto interlock -n-th axis signal or the manual interlock -n-th axis signal is OFF, "1" appears for the n-th axis. The explanation of the display is same as for the "Interlock (+)".
ExtDcc (+)	When the control axis is moving in (+) direction, "1" appears for the axis if the external deceleration speed is valid, and the feedrate is clamped, exceeding the set value of the external deceleration speed. (Explanation of the display) o o o o o 1 o 1 ↑ ↑ 8th axis ... 1st axis In the above case, the 1st axis and the 3rd axis are in external deceleration speed. Even when the number of usable axes is less than 8 in 1 part system, this displays 8 axes fixed.
ExtDcc (-)	When the control axis is moving in (-) direction, "1" appears for the axis if the external deceleration speed is valid, and the feedrate is clamped, exceeding the set value of the external deceleration speed. The explanation of the display is same as for the "ExtDcc(+)".


Menus

Menus	Description
Servo clear	This clears the cumulated count of the servo communication error 1 and 2 to "0".
RIO clear	This clears the cumulated count of the RIO communication error to "0".
Ether clear	This clears the cumulated count of the Ether communication error to "0".
Battery clear	This clears the time the battery has been used to "0".
Clear pw loss	This clears the accumulated number of instantaneous stop detection times to "0".

Clearing the cumulated counter to zero

(Example) Clearing the cumulated count of the servo communication error

- (1) Press the menu [Servo clear].  A operation message appears.

- (2) Press the [Y] or [INPUT] key.  The cumulated count of the servo communication error 1 and 2 will be cleared to "0".
When other keys are pressed, it will not clear to "0".

This also applies to menus [RIO clear], [Ether clear], [Battery clear] and [Clear pw loss].

11.3.2 Servo Diagnosis Screen



The followings can be confirmed in the servo diagnosis screen: the number of servo alarm of servo unit/spindle unit, DA output information, PLG diagnosis (spindle), and the maintenance diagnosis information of servo/spindle unit such as alarm cause counter.

This operation is protected according to the operation level.

■ Servo unit

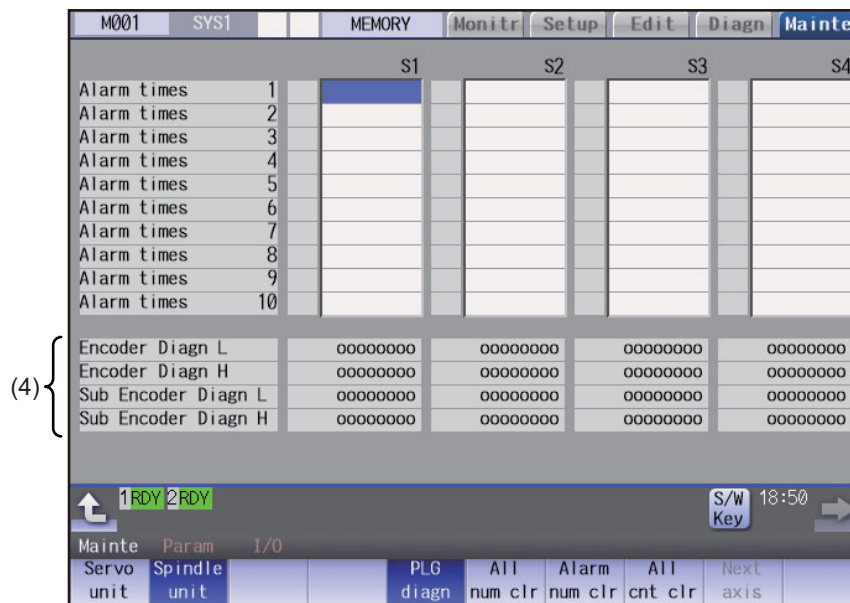
M001		SYS1	MEMORY	Monitr	Setup	Edit	Diagn	Mainte
			X	Y	Z	C1		
(1)	Alarm times	31						
	Alarm times	32						
(2)	34 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
	36 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
(3)	38 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
	39 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
(3)	DA Address	1						
	DA output	1						
	DA Address	2						
	DA output	2						
		1 RDY 2 RDY						
		S/W Key	18:48					
Mainte	Param	I/O						
Servo unit	Spindle unit		PLG diagn	All num clr	Alarm num clr	All cnt clr	Next axis	

■ Spindle unit

(1) Display of the DA output data

M001		SYS1	MEMORY	Monitr	Setup	Edit	Diagn	Mainte
			S1	S2	S3	S4		
(1)	Alarm times	31						
	Alarm times	32						
(2)	34 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
	36 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
(3)	38 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
	39 AL cause cnt	accu	0	0	0	0	0	0
		freq	0	0	0	0	0	0
(3)	DA Address	1						
	DA output	1						
	DA Address	2						
	DA output	2						
		1 RDY 2 RDY						
		S/W Key	18:49					
Mainte	Param	I/O						
Servo unit	Spindle unit		PLG diagn	All num clr	Alarm num clr	All cnt clr	Next axis	

(2) Display of the spindle PLG diagnosis information



Display Items

Display Items	Description
(1) Alarm times	This displays the data for each axis or unit. There are Alarm times 1 to 32, and there are switched with the page changeover keys. The number of times can be cleared for each axis or each column. Alarm No: Servo alarm No. (unit: ASCII) No. of times: The number of times of meeting the servo alarm condition after the servo drive unit ON. (Units: Number of times)
(2) Alarm cause counter	An alarm occurs when the specified number of conditions are met. This counter displays the number of times in which the alarm occurrence condition is met since the drive unit power was turned ON. The number of times can be cleared for each axis with [All cnt clr]. accu: Displays the number of times in which the alarm occurrence condition was met since the drive unit power was turned ON. freq: Displays the peak hold value when the alarm occurrence condition is met per constant cycle.
(3) DA output	This displays the data for each axis or unit. DA Address 1: Servo parameter sv061 set value (address) (unit: ASCII) DA output 1: Servo parameter sv061 set address data (unit: pulse) DA Address 2: Servo parameter sv062 set value (address) (unit: ASCII) DA output 2: Servo parameter sv062 set address data (unit: pulse)
(4) Spindle PLG diagnosis information (Spindle drive unit only)	Displays the data for each axis Encoder Diagn L: Displays the output signal (Low) of the motor end PLG Encoder Diagn H: Displays the output signal (High) of the motor end PLG Sub Encoder Diagn L: Displays the output signal (Low) of the machine end PLG Sub Encoder Diagn H: Displays the output signal (High) of the machine end PLG

Note

(1) PLG (pulse generator) detects the pulse signal and it is used to detect the rotation state of the motor.

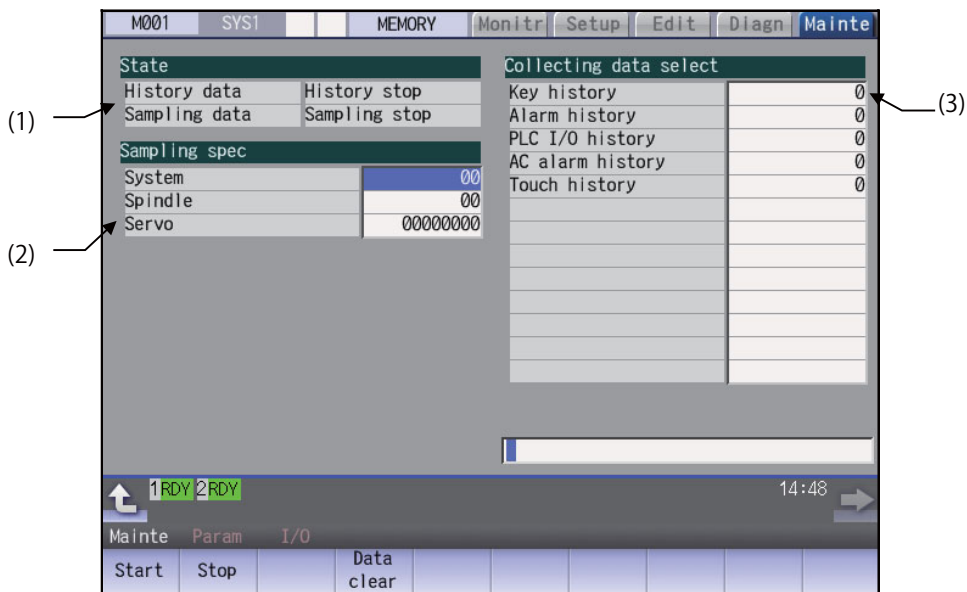
Menus

Menu	Description
Servo unit	Displays the servo unit diagnosis information in the data display area.
Spindle unit	Displays the spindle unit diagnosis information in the data display area. <Note> ♦When the parameter "#1039 spinno" is set to "0", this menu is not displayed.
PLG diagn	Switches the display between the DA output and the spindle PLG diagnosis information. Pressing this button again after this menu is highlighted, the display switches to the DA output. <Note> ♦When the parameter "#1039 spinno" is set to "0", this menu is not displayed. ♦Even when the parameter "#1039 spinno" is set to other than "0", this menu will be grayed out and non-selectable. while displaying the servo unit diagnosis information.
All num clr	This clears the number of alarms of the axis at the cursor position to "0".
Alarm num clr	This clears the number of alarms at the cursor position to "0". <Note> ♦When the cursor is on "AL cause cnt accu" or "freq", this menu is grayed out and non-selectable.
All cnt clr	Clears the all values of "AL cause cnt accu" and "freq" of the axis where the cursor is placed to 0.
Next axis	Displays the data of four axes from the next axis. This menu is displayed only when there are five or more servo axes or spindle.

11.3.3 Collecting the Data on the Diagnosis Data Collection Setting Screen



The NC automatically collects diagnosis data based on the "Sampling spec" and "Collecting data select" settings specified on the diagnosis data collection (Collect set) screen of the maintenance (Mainte) screen. This operation is protected according to the operation level.



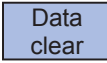


Display Items

Display Items	Description
(1) State	Display the history data and sampling data collection status.
History data	Display the history data collection status. History collecting: History data collection is in progress. History stop: History data collection is stopped.
Sampling data	Display the sampling data collection status. Sampling: Sampling data collection is in progress. Sampling stop: Sampling data collection is stopped. Sampling invalid: Sampling data collection is disabled.
(2) Sampling specifications	Specify the part system, spindle, and servo axes where sampling data is to be collected.
System	Specify the part systems where sampling data is not to be collected. Specify the part system in HEX. When "0" is set, sampling is carried out for all part systems. This setting is ignored if a non-existent part system is specified.
Spindle	Specify the spindle where sampling data is not to be collected. Specify the part system in HEX. When "0" is set, sampling is carried out for all spindles. This setting is ignored if a non-existent spindle is specified.
Servo	Specify the servo axes where sampling data is not to be collected. Specify the part system in HEX. This setting is not system-specific. When "0" is set, sampling is carried out for all axes. This setting is ignored if a non-existent servo axis is specified.

Display Items	Description
(3) Collecting data select	This selects the diagnosis data to be collected. 0: Collected. 1: Not collected.
Key history	This selects whether or not key history data is collected.
Alarm history	This selects whether or not alarm history data is collected.
PLC I/O history	This selects whether or not PLC input/output signal history data is collected.
AC alarm history	This selects whether or not AC input power error history data is collected.
Touch history	This selects whether or not touchscreen history data is collected.

Menus

Menus	Description
	This begins collecting sampling data and history data.
	This stops the sampling data and history data collection operation.
	This stops the sampling data and history data collection operation, and clears the collected data. This is not displayed when "#1263 bit1" is ON.

Note

- (1) The alarm history data collection start/stop operation is switched using the menu [Start] or [Stop] of data collection regardless of whether "Alarm history" is set to "0" or "1".

Operation method (Start of data collection)

- (1) Press the menu [Start].
- (2) Press the [Y] or [INPUT] key.

Note

- (1) Data collection starts even if "Alarm history" is set to "1" (not collected).

Operation method (Stop of data collection)

- (1) Press the menu [Stop].
- (2) Press the [Y] or [INPUT] key.

Note

- (1) Data collection stops even if "Alarm history" is set to "1" (not collected).

Operation method (Clear of collected data)

- (1) Press the menu [Data clear].
- (2) Press the [Y] or [INPUT] key.

11.4 System Lock (When an Expiry Date is Displayed)



System lock is a function with which a MTB can impose a time limit on CNC. Once the expiry date is passed, the user will be unable to activate a cycle start. If the user enters the decryption code issued by the MTB, he or she can set a new time limit or cancel the time limit.

Display of Time Limit

To check the expiry date, open the [Diagn] screen and press [Selfdia].
Then the expiry date appears.

Display of Time Limit Warning and Alarm

If the number of days remaining before expiration reaches 7 or less, the warning "Z64 Valid term soon to be expired" appears at the bottom right of the screen. This warning appears at every cycle start after power ON until the expiry date comes, but can be canceled by Reset. Cycle start operation is enabled before the expiry date.

If the expiry date is passed, the alarm message "Z65 Valid term has been expired" appears, which disables cycle start operation. Reset signal is unable to cancel this alarm. Instead, enter the decryption code issued by MTB, and then turn OFF and ON the NC power.

If the expiry date is over during a cycle start operation, the operation will continue until Reset is input.
For the display position of warning and alarm messages, refer to "2.3 Standard Screen".

While the warning is occurring, you can check the number of days remaining before the expiry date.

Open [Diagn] - [Alarm message] - [NC message] screen, then you can check the number of days. The number of remaining days reaches 0 on the expiry date.

If you open the [Alarm] screen while the alarm is occurring, "Valid term has been expired" appears. If you attempt a cycle start operation, the stop code "T01 Cycle st. prohibit (Term exp'd)" results, which disables cycle start operation.

Renewing Time Limit

For updating the time limit, the end user needs to ask the MTB to issue a decryption code. The time limit is either updated or canceled when the decryption code is entered.

A decryption code is provided by a machine builder in one of the following two forms.

- Decryption code in the form of file
- Decryption code in the form of character string

(1) Procedures when decryption code is provided in the form of character string

Follow the steps below to create a decryption code file through a personal computer. You can skip these procedures if a decryption code is provided in the form of file.

<How to create the file through a PC>

- (a) Open a text editor.
- (b) Type the decryption code in ASCII (Upper case only) in one line.
- (c) Save the text file under an arbitrary name (made up of alphanumerics) with an arbitrary extension.

(2) How to enter decryption code

- (a) Save the decryption code file on an SD card (or USB memory).
- (b) Insert the SD card into the control unit.
- (c) Open the [Mainte] screen and select [Input/Output].
- (d) In the [A:Dev] field, specify a memory card (or USB memory) in [Dev], a directory where the decryption code is stored in [Dir], and the created decryption code file name in [File].
- (e) Select "Memory" in [B:Dev] and press [Dir]. Then the menu key [Decrypt code] appears on the screen. Then the menu key [Decrypt code] appears on the screen. When [Decrypt code] is pressed, "Decryption Code" automatically appears in [Dir] and "PASSCODE.DATA" in [File].
If you enter "/RLS" in [Dir], the screen will be displayed in the same way.
- (f) Press [Trnsfr A→B].
- (g) When a confirmation message appears, press either [Y] or [INPUT].
If the decryption code has successfully been set, "Setting complete normally" appears.
 - If the warning message is on the screen, this message will be removed.
 - If the alarm message is on the screen, this message will be removed.
 - If the decryption code is wrong, the message "Can't write file for dev B" will appear. Check the decryption code file and contact the MTB.
 - The "Executing automatic operation" error occurs during program operation, and setting the code is disabled.
- (h) Turn OFF and ON the NC power.

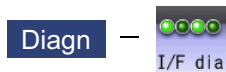
Precautions

- (1) If you turn OFF and ON the power after the time limit has expired, "EMG Emergency stop LINE" may appear at the same time.
- (2) The warning message "Z64 Valid term soon to be expired" can be erased with NC reset. Contact the MTB for details.

11.5 Advanced Diagnosis

Be sure to perform the operations in this section under the MTB instructions.

11.5.1 Displaying and Setting the PLC Device Data (I/F Diagnosis Screen)

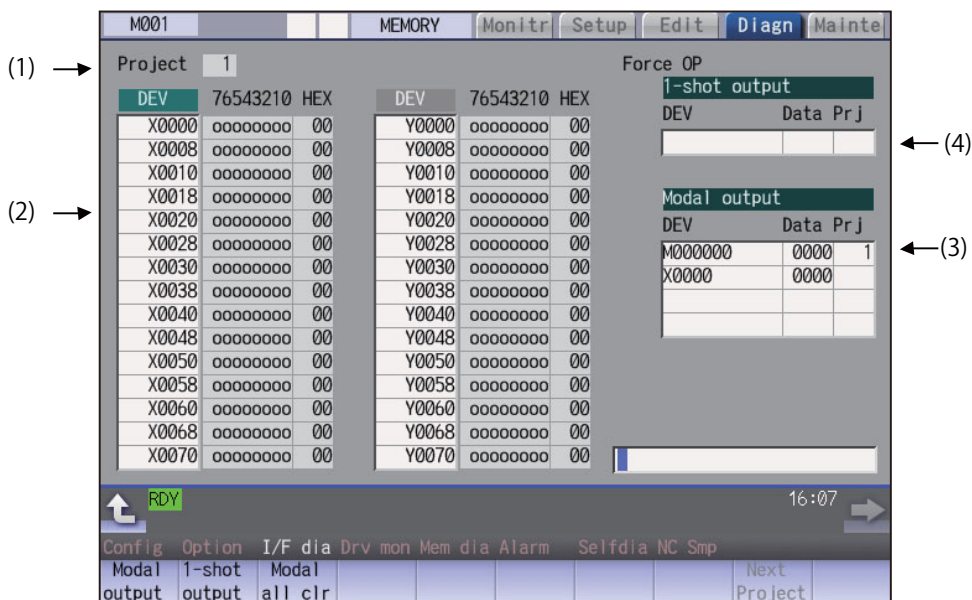


The various input/output signals for the PLC (Programmable Logic Controller) control can be displayed and set in this screen.

These signals can be used in confirmation of the machine sequence operation during PLC development, and in confirmation and forced output, etc., of the input/output data between the NC and PLC.

Note

(1) Pay close attention to the sequence operation when using these functions during machine operation.



Display Items

Display Items	Description
(1) Project	This displays the currently displayed project.
(2) Device No. and input/output signal value (binary/hexadecimal display)	This displays the data from the device Nos. designated in the setting area in numerical order. The data is displayed as binary (bit units) and hexadecimal values. Individual device Nos. can be displayed separately in the left area and right area. Select the display area with the \leftarrow and \rightarrow key when operations such as display changeover and data setting are carried out. Target device: X, Y, M, L, F, SB, B, SM, V, SW, SD, TI, TO, TS, TA, STI, STO, STS, STA, CI, CO, CS, CA, D, R, ZR, W The common devices for each project are X, Y, R, and ZR.
(3) Modal output	This displays the data and device to carry out modal output. The details to be defined are set here when carrying out the modal type forced output of PLC interface signals. For details, refer to "11.5.1.2 Carrying Out Modal Output".

Display Items	Description
(4) 1-shot output	This displays the data and device to carry out one-shot output. The details to be defined are set here when carrying out the one-shot type forced output of PLC interface signals. For details, refer to "11.5.1.3 Carrying Out One-shot Output".

Menus

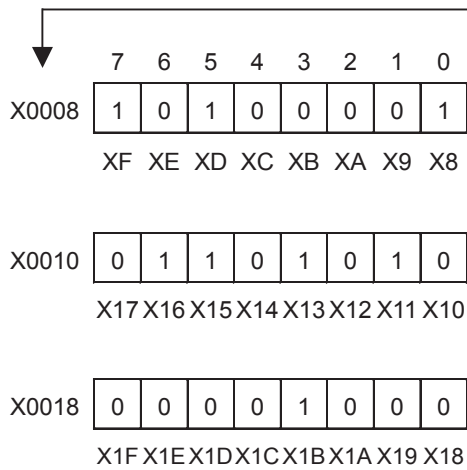
Menus	Description
Modal output	This changes the setting area to an input standby status. The signal is forcibly output (modal).
1-shot output	This changes the setting area to an input standby status. The signal is forcibly output (one-shot).
Modal all clr	A confirmation message appears, and the machine turns into standby status. The force OP (one-shot output) of all I/O signals are canceled. (*1)
Next Project	The device and I/O signal of the next project are displayed. If the last project is displayed, the top project is displayed.

(*1) These menus are grayed out ordinarily, and cannot be operated.

How to read the device No. and display data

A device is an address for classifying a signal handled in the PLC. A device No. is a series of numbers attached to that device.

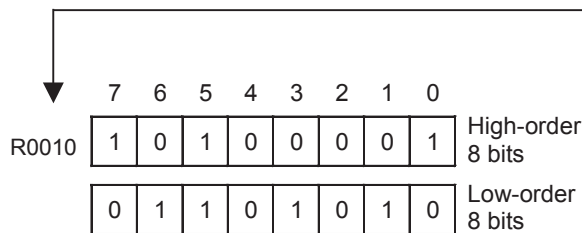
Device No. (bit-type)



DEV	76543210	HEX	DEV	76543210	HEX
X0000	00000000	00	Y0000	00000000	00
X0008	10100001	A1	Y0008	00000000	00
X0010	01101010	6A	Y0010	10100000	A0
X0018	00001000	08	Y0018	00000001	01
X0020	01111100	7C	Y0020	00000000	00
X0028	00001111	0F	Y0028	00000000	00
X0030	00000010	02	Y0030	00000000	00

Signal status display corresponding to each device No. (I/O)

Device No. (word-type)



DEV	76543210	HEX
R00010	10100001	A1
	01101010	6A
R00011	00001001	09
	00000101	05
R00012	00010010	12
	00000110	06
R00013	00001010	0A
	00010101	15

11.5.1.1 Displaying the PLC Device Data

The various status signals and register data used in the PLC can be monitored and displayed.

When this screen is first selected, the respective 16-byte amounts of input/output data are displayed from device "X0000" on the left display area, and from device "Y0000" on the right side.

This screen constantly monitors and displays the PLC signal statuses. Consequently, when signals are changed in the PLC, the display is changed according to the changes.

Note that because time differences occur between the PLC signal change and the signal display, there may be a delay in the display. The machine may also not be able to correspond to extremely brief signal changes.

Displaying the data of a arbitrary device No. "X0020"

- (1) Press the menu [Next Project]. The display is switched to the I/O signal of the next project. (Press the menu key to switch the project in order. Note that only projects are switched, but the device number currently displayed is not switched.)

Project	6		
DEV	76543210	HEX	
X0008	00000000		00
X0010	00000000		00

The device number in the top is not switched.

- (2) Press the menu tab key / , and select the area to display the data.
- (3) Set the device No. (X0020), and press the [INPUT] key. The device "X0020" appears at the head of the valid display area.

DEV	76543210	HEX	DEV	76543210	HEX
X0020	11111111	FF	Y0000	00000000	00
X0028	01000000	40	Y0008	00000001	01
X0030	00001110	0E	Y0010	00000000	00
X0038	00000000	00	Y0018	00000000	00

Note

- (1) When setting the device No., an error will occur if a number exceeding the specifications or an illegal address is set.
- (2) The input/output signals of X, Y, R, and ZR are the same for all projects.

Changing the display with the page keys

The valid area device Nos. change in page units when / is pressed. Changing of the pages stops within the range of device numbers of which the device has.

- (1) Press the key. The data is displayed from the next number currently displayed.

DEV	76543210	HEX	DEV	76543210	HEX
X0000	10000001	81	Y0000	00000000	00
X0008	00000010	02	Y0008	00000001	01
X0010	00001111	0F	Y0010	00000000	00
X0018	10011111	9F	Y0018	00000000	00



DEV	76543210	HEX	DEV	76543210	HEX
X0080	11111111	FF	Y0000	00000000	00
X0088	01000000	40	Y0008	00000001	01
X0090	00001111	0F	Y0010	00000000	00
X0098	00000000	00	Y0018	00000000	00



11.5.1.2 Carrying Out Modal Output



Modal type forced output of PLC interface signals is carried out. Once set, this data is held until cancelled, the power is turned ON/OFF, or other data is overwritten. There are four sets of devices that modally output. If this number is exceeded, the previously existing data is overwritten.

Menus used in modal output

Menus	Description
Modal clear	This releases the modal output for the device at the cursor position in the modal output area. The released data is erased from this area.

Modally outputting data "1" to device "X0048"





- (1) Press the menu [Modal output].  The mode changes to the modal output mode, and the cursor appears at the modal output area.
- (2) Using the [↑] and [↓] keys, move the cursor to the setting position.
- (3) Set the device and data, and press the [INPUT] key.  Modal output is executed, and the cursor disappears. The data that was in the cursor position is overwritten by the input data, and is invalidated.
 X0048/1 [INPUT]


The modal output mode is canceled by pressing the  key or the  key.

Note

- (1) The data of the modally output device is displayed in order in the selected area. This modal output is held until the output is canceled or the power is turned OFF.
- (2) (When no data is set (Example: "X0048/", "X0048"), the operation message "Setting Data not found" is displayed.
- (3) The X, Y, R, and ZR devices are modally output for all projects.
- (4) The devices other than X, Y, R, and ZR are modally output for the currently displayed project.

Releasing the modal output

- (1) Press the menu [Modal output].  The mode changes to the modal output mode, and the cursor appears at the modal output area.
- (2) Using the [↑] and [↓] keys, move the cursor to the data to be released.
- (3) Press the menu [Modal clear].  The data that was in the cursor position is released from modal output. The "DEV" and "Data" columns become blank.
 The modal output mode is canceled by pressing the  key or the  key.

 **CAUTION**

Pay close attention to the sequence operation when carrying out forced data setting (forced output) in the I/F diagnosis screen during machine operation.

11.5.1.3 Carrying Out One-shot Output

The one-shot type PLC interface signal forced output is forcibly output only once during the screen operations. Thus, it may not be possible to confirm the PLC interface signals updated with the PLC on the screen.

One-shot outputting data "1" to device "X0042"

- (1) Press the menu [Next Project].



The display is switched to the I/O signal of the next project.
(Press the menu key to switch the project in order.)

Project	6	
DEV	76543210	HEX
X0008	00000000	00
X0010	00000000	00

- (2) Press the menu [1-shot output].

- (3) Set the device and data, and press the [INPUT] key.
X0042/1 [INPUT]



The input data is overwritten in the one-shot output area, and is one-shot output.
The cursor in the one-shot output area disappears.
The data of the one-shot output device is displayed in order in the selected area.
The one-shot output mode is canceled by pressing the key or the key.

Note

- (1) Because the input signal (X, etc.) to the PLC is updated at the head of each PLC cycle, the machine immediately returns to the normal state, even if one-shot type forced output is carried out.
- (2) (When no data is set (Example: "X0048/", "X0048"), the operation message "Setting Data not found" is displayed.
- (3) The X, Y, R, and ZR devices are one-shot output for all projects.
- (4) The devices other than X, Y, R, and ZR are one-shot output for the currently displayed project.

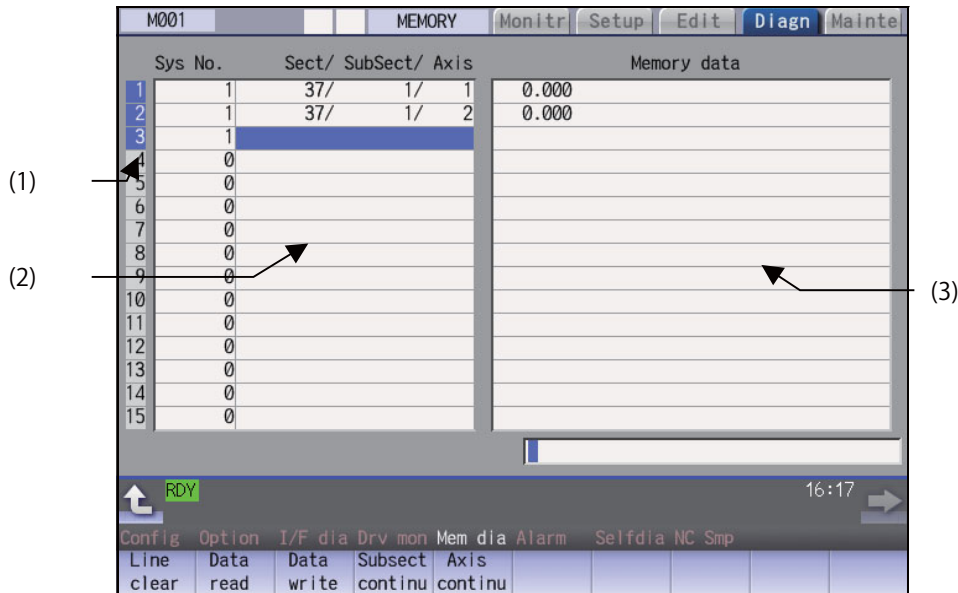
**CAUTION**

Pay close attention to the sequence operation when carrying out forced data setting (forced output) in the I/F diagnosis screen during machine operation.

11.5.2 Writing and Reading the Data Using the NC Data Designation (NC Memory Diagnosis Screen)



The NC internal data can be displayed and rewritten on the NC memory diagnosis (Mem dia) screen of the diagnosis (Diagn) screen. The custom API library's NC data read/write interface is used to display and rewrite the NC's internal data. The contents of the NC data can be displayed by designating the part system No., section No., sub-section No. and axis No. on this screen.



Display Items

Display Items	Description
(1) Index No.	This displays the registration No. of the NC memory data. When one of the "2. Data contents" is set, the number is highlighted indicating that the normal display of the data contents has stopped.
(2) Data contents	Part system No. Designate the part system No. (1: 1st part system). Designate "0" to designate the data common for the part systems. Section/sub-section/axis: Designate the section No., sub-section No. and axis No. of the data to be set and displayed. The setting format is, section No./sub-section No./axis No. <Note> •The axis No. "1" is handled as the first axis. Designate "0" for the data which does not require an axis designation.
(3) Memory data	This displays the contents of the data.

Menus

Menus	Description
Line clear	This erases the information in the line where the cursor is. (One entire line becomes blank.) The cursor does not move at this time.
Data read	The contents of the set address data (Part system No, Section/sub-section/axis) for all the lines are constantly displayed. The Index No. highlight (indicating data is being set) is released. The cursor appears in "Part system No" of that line.
Data write	This writes the data in the setting area to the NC memory indicated by address data at the cursor position. (*1) The Data No. highlight (indicating data is being set) is released, and constant display is started. After writing, the cursor moves to "Part system No" of the next line.
Subsect continu	Based on the data of the address data where the cursor is, this displays the continuous data to which the sub-section No. has been added to the address data from the line where the cursor is. The cursor moves to "Part system No " of that line.
Axis continu	Based on the data of the address data where the cursor is, this displays the continuous data to which the axis No. has been added to the address data from the line where the cursor is. The cursor moves to "Part system No " of that line.

(*1) Decimal, hexadecimal, floating point data and character string data writing is possible. Note that hexadecimal, floating point data and character strings may not be settable depending on the data.

Decimal: Integers without decimal points (Example) -1234

Hexadecimal: An "H" is necessary at the end (Example) 1234H

Floating point data: Data with a decimal point (Example) -12.3

Character string data: Character string (Example) X

11.5.3 Collecting the NC Data (Data Sampling Screen)



Sampling start/stop, sampling state display, setting the sampling parameters necessary for sampling are performed in the data sampling screen. The NC internal data (speed output from NC to the drive unit, or feedback data from the drive unit, etc.) can be sampled.

Also, the sampling data can be output externally on the I/O screen on the maintenance (Mainte) screen.

Sampling specifications

Sampling cycle	1.776 ms x Setting value
Number of sampled axes	NC axis: Maximum number of usable axes Spindle: Maximum number of usable spindles
Number of sampled channels	1 to 16 points
Number of sampled data items	Max. 2,620,416 points

Note

- (1) The maximum number of sampled data items is the total number of data. When the number of sampled channels is increased, the number of data per channel will decrease.
- (2) If the free capacity of DRAM is insufficient, the maximum number of data items decreases.

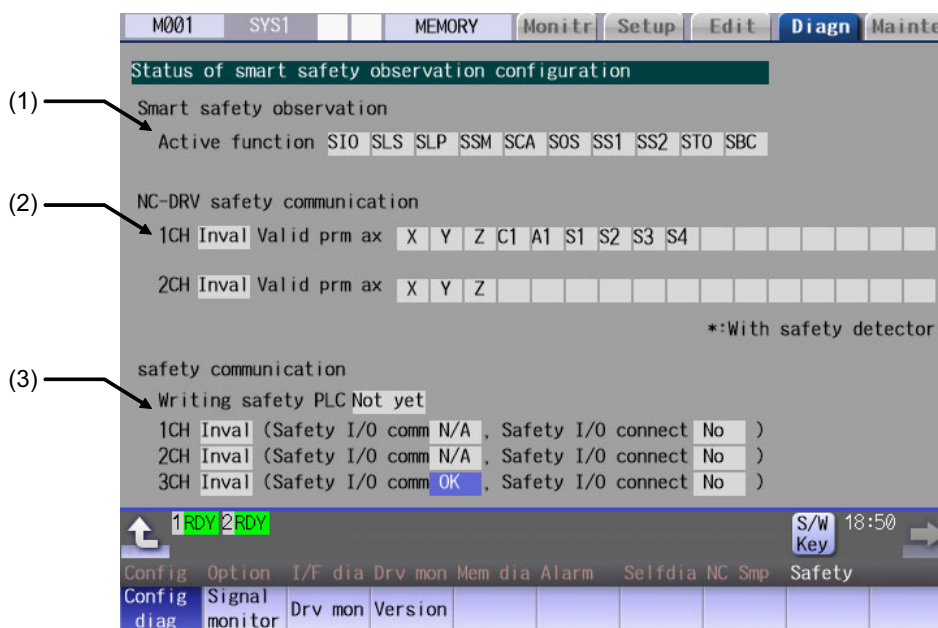
11.5.4 Safety Observation Screen



The configuration, signal status, drive status and version in use of the smart safety observation function are displayed on the safety observation screen.

11.5.4.1 Configuration Diagnosis Screen

The available/unavailable states of the smart safety observation function are displayed on the configuration diagnosis screen.



Display Items

Display Items	Description
(1) Active function	The drive safety functions which are enabled with the parameters are highlighted. SIO: Safety-related I/O observation, emergency stop observation SLS: Safety-limited speed observation SLP: Safety-limited position observation SSM: Safe speed monitor SCA: Safe cam SOS: Safe operating stop observation SS1: Safe stop 1 SS2: Safe stop 2 STO: Safe torque OFF SBC: Safe brake control
(2) NC-DRV safety communication display	This displays the safety communication status of the drive unit. To perform the safety drive communication, the smart safety observation target axis needs to be set by the parameter, and the connected channel with the drive unit needs to be optical communication and configured only with drive units MDS-E Series. Valid prm ax: Out of the axes connected to each channel, the axes that the parameter "#51101 SF_Disable" (Disable smart safety observation) is OFF are highlighted. For the axis with safety detector, "*" appears at the top of the axis name.

Display Items	Description
(3) NC-I/O safety communication display	<p>This displays the communication status of the safety I/O communication. To perform the safety I/O communication, at least one of remote I/O channels needs to be configured with the safety I/O devices (safety remote I/O unit, operation panel equipped with safety I/Os) and RIO2.0 unit alone.</p> <p>Writing safety PLC: This displays the status (Done/Not yet) whether the PLC ladder for safety is written.</p> <p>Safety I/O comm: "OK" is displayed when the channel is configured only with RIO2.0 units.</p> <p>Safety I/O connect: "Yes" is displayed when connected to the safety I/O devices (safety RIO unit, operation panel equipped with safety I/O).</p>

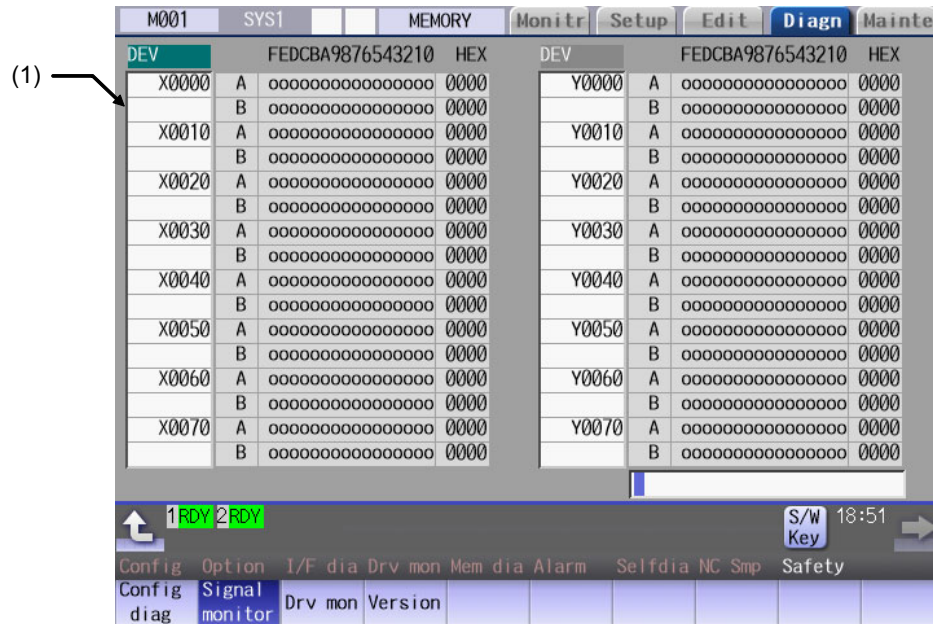
Menus

Menus	Description
Config diag	This switches the screen to the configuration diagnosis display of the smart safety observation.
Signal monitor	This switches the screen to the signal monitor display of the smart safety observation.
Drive monitor	This switches the screen to the drive monitor display of the smart safety observation.
Version	This switches the screen to the version display of the smart safety observation.
Servo unit	This switches the drive monitor diagnosis information to the servo unit information. Only when the drive monitor is displayed, the menu appears, and the operation can be performed.
Spindle unit	This switches the drive monitor diagnosis information to the spindle unit information. Only when the drive monitor is displayed, the menu appears, and the operation can be performed.
Next axis	This switches the axis to be displayed on the drive monitor. Only when the number of axes is five or more on the drive monitor screen, the menu appears, and the operation can be performed.

11.5.4.2 Signal Monitor Screen

The signal monitor screen displays the safety PLC signal status. The safety PLC signal displays both of the duplex PLC signals to identify the incongruous state. With the initial display, the input/output signal status from the device "X0000" is displayed on the left side and the input/output signals from the device "Y0000" is displayed on the right side.

Note that because time differences occur between the PLC signal change and the signal display, there may be a delay in the display. The machine may also not be able to correspond to extremely brief signal changes.



Display Items

Display Items	Description
(1) Device No. and input/output signal value (binary/hexadecimal display)	<p>This displays the duplex safety PLC signals from the designated device No. in order. The input/output signal is displayed in binary and hexadecimal (bitwise). The device to be displayed can be switched individually for the left area and right area. The operation target (right or left) can be switched with the <input type="button" value="←"/> and <input type="button" value="→"/> keys. The head device and the operation target area are held until the power OFF.</p> <p>The displayable devices are X, Y, and ZR.</p> <p>If there is a comparison error with duplex safety PLC signals, the background color becomes yellow.</p> <p>The operation of the signal where a comparison error occurs (either A or B) varies depending on ladder.</p>



List of displayable PLC devices

Devices	Device No.	No. of points	Units	Description
X	X0 to X1FF	512	1-bit	Input signals to PLC. Machine input, etc.
Y	Y0 to Y1FF	512	1-bit	Output signals from PLC. Machine output, etc.
ZR	ZR0 to ZR3071	3072	16-bit	File register, CNC word I/F

Displaying the PLC device input/output signal

To refer the arbitrary input/output signal status, enter the target device No. to the input area, and the display will be switched.

(Example) For displaying the input/output signal of the arbitrary device No. "X0020"

- (1) Press the tab key  or  to select the area where the data is displayed.
- (2) Set the device No. (X0020), and press the [INPUT] key.

Note

- (1) Setting a device No. which exceeds the specification or setting an illegal address causes a setting error.

Changing the display with the page keys

The operation target device Nos. change in page unit when  /  is pressed. Changing of the pages stops within the range of device numbers of which the device has.

11.5.4.3 Drive Monitor Screen

The safety communication state with servo drive (NC axis, PLC axis) and spindle drive can be monitored. Only the safety drive communication parameter enabled axes are displayed on this screen.



Display Items

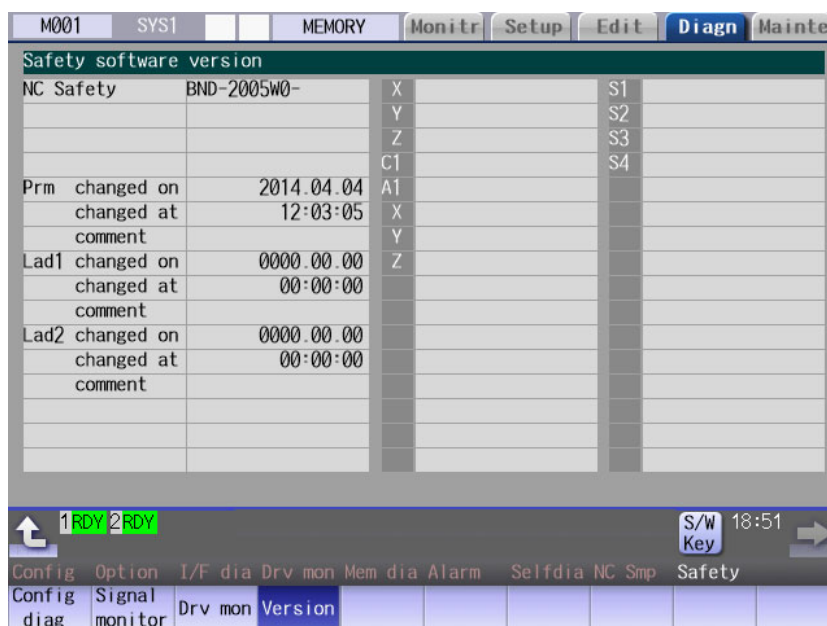
Display Items	Description																																					
Safety command 1L	This displays the data sent to the drive. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="7">1L</td> <td>0</td> <td>STO command (0: No command, 1: With command)</td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>3</td> <td></td> </tr> <tr> <td>4</td> <td></td> </tr> <tr> <td>5</td> <td></td> </tr> <tr> <td>6</td> <td></td> </tr> <tr> <td rowspan="9">1H</td> <td>7</td> <td></td> </tr> <tr> <td>8</td> <td></td> </tr> <tr> <td>9</td> <td></td> </tr> <tr> <td>A</td> <td></td> </tr> <tr> <td>B</td> <td></td> </tr> <tr> <td>C</td> <td></td> </tr> <tr> <td>D</td> <td></td> </tr> <tr> <td>E</td> <td></td> </tr> <tr> <td>F</td> <td></td> </tr> </tbody> </table>		Bit	Description	1L	0	STO command (0: No command, 1: With command)	1		2		3		4		5		6		1H	7		8		9		A		B		C		D		E		F	
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Safety command 2L	This displays the data sent to the drive. <table border="1"> <thead> <tr> <th></th> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="5">2L</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>SBC command (0: No command, 1: With command)</td> </tr> <tr> <td>3</td> <td>SBC command for SBT (1CH side) (0: No command, 1: With command)</td> </tr> <tr> <td>4</td> <td>SBC command for SBT (2CH side) (0: No command, 1: With command)</td> </tr> <tr> <td></td> <td>5</td> <td></td> </tr> <tr> <td></td> <td>6</td> <td></td> </tr> <tr> <td></td> <td>7</td> <td></td> </tr> <tr> <td rowspan="8">2H</td> <td>8</td> <td></td> </tr> <tr> <td>9</td> <td></td> </tr> <tr> <td>A</td> <td></td> </tr> <tr> <td>B</td> <td></td> </tr> <tr> <td>C</td> <td></td> </tr> <tr> <td>D</td> <td></td> </tr> <tr> <td>E</td> <td></td> </tr> <tr> <td>F</td> <td></td> </tr> </tbody> </table>		Bit	Description	2L	0		1		2	SBC command (0: No command, 1: With command)	3	SBC command for SBT (1CH side) (0: No command, 1: With command)	4	SBC command for SBT (2CH side) (0: No command, 1: With command)		5			6			7		2H	8		9		A		B		C		D		E		F	
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Safe position FB	This displays the encoder position information from the drive to NC.																																																			
Saf detector connect	This displays the safety encoder connection status. 0: No connection 1: With connection																																																			
Safety status 2L	This displays the data received from the drive.																																																			

11.5.4.4 Version Display Screen

Software version about smart safety observation is displayed on the version display screen.



Display Items

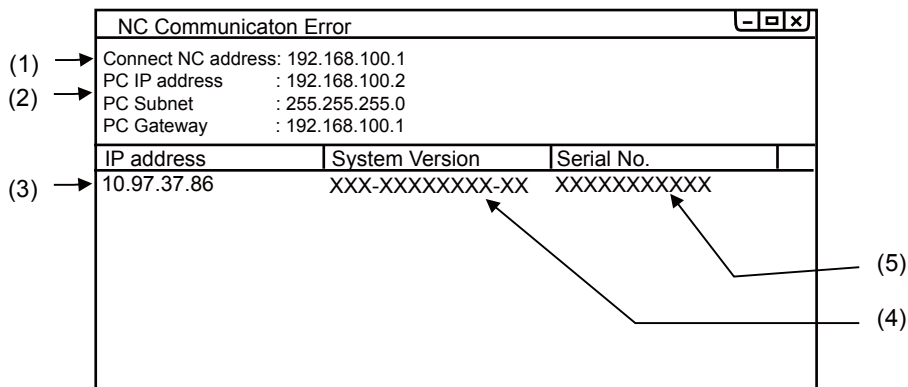
Display Items	Description
NC Safety	This displays the smart safety observation software version of the NC system.
Parameters	This displays the safety parameter changed date and time, and comment.
Lad 1, 2	This displays the safety PLC ladder 1, 2 changed date and time, and comment.
Servo axis (up to 32 axes)	This displays the safety software version of servo axis. The version only for axis of the safety servo unit is displayed. Change the display item with  or  .
Spindle (up to 8 spindles)	This displays the safety software version of spindle. The version only for spindle of the safety spindle unit is displayed.

11.6 IP Address Resetting Procedure at Disabled Network Communication [M800W/M80W Series Only]

11.6.1 Connectable Control Unit IP Address List Screen

After NC starts, when the communication between the control unit and the display unit cannot be established even after the time-out time passes, the connectable control unit IP address list screen appears. The contents of IP address list screen is displayed in English.

If no IP address is displayed, check whether there are any loose or disconnected cables, hardware breakdowns, etc.





Display Items

Display Items	Description
(1) Connect NC address	This displays IP address of the connection destination control unit.
(2) PC IP address PC Subnet PC Gateway	This displays IP address, subnet mask, gateway settings.
(3) IP address	This displays IP address of the connectable control unit. (*1)
(4) System Version	This displays system version of the connectable control unit. (*1)
(5) Serial No.	This displays serial No. of the connectable control unit. (*1)

(*1) Up to ten lines are displayed at a time. When the display item exceeds ten lines, the following lines can be displayed with the Page down key.

11.6.2 Resetting Procedure

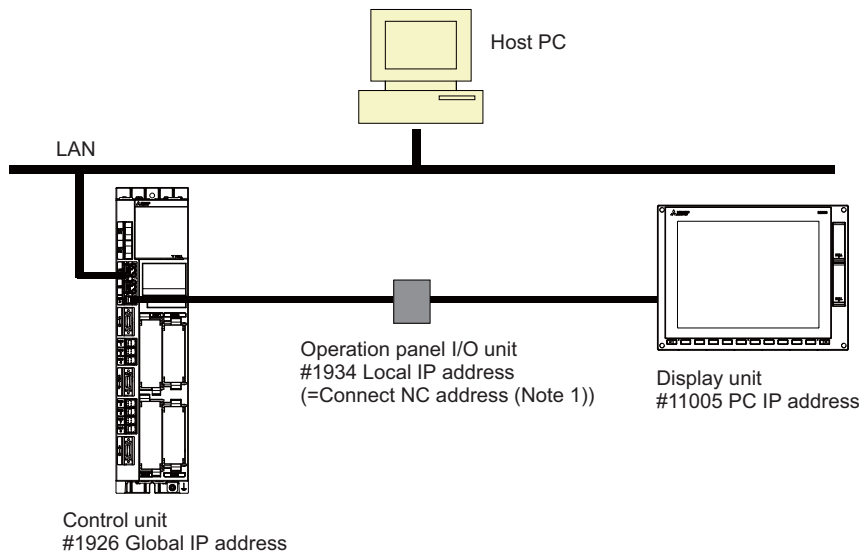
Operation method

- (1) Select the IP address of the connection destination control unit by using the [↑], [↓],  and  keys from IP address list, and press the [INPUT] key. ➔ The dialog which notifies the change of the network setting is displayed.
To establish the communication between the selected control unit and the display unit, the Ethernet parameter is temporarily changed.

- (2) Press the [INPUT] key. ➔ After a while, the NC screen is displayed.
(If the NC screen is not displayed, remove the control unit from external network, and carry out the procedure (1) again.)
<Note>
 - ◆In the step, the communication between the control unit and the display unit is temporarily established. Therefore, unless the parameter is reset (in the procedure (3)), the system will be returned to the state of procedure (1) at the next NC startup.

- (3) Set the Ethernet parameter by referring to the following example of the network connection, and restart NC. ➔ The NC screen is normally displayed.

<Example of the network connection>



Note

- (1) "Connect NC address" is the same as the setting of "[HOSTS] TCP1" in setting file "melcfg.ini".
The setting file "melcfg.ini" is in the following directory.
 - <FCU7-DA3xx-xx, FCU7-DA4xx-xx>
 - C:\WINDOWS\melcfg.ini
 - <FCU7-DA2xx-xx>
 - \ncsys\melcfg.ini

- (2) When the control unit is added in user's network environment, match and change the parameters "#1926(PR) Global IP address", "#1927(PR) Global Subnet mask" and "#1928(PR) Global Gateway" to the user environment. Normally, the parameters "#1934 Local IP address", "#1935 Local Subnet mask" and "Connect NC address" need not be changed from the default setting value.

- (3) When the display's IP address is automatically searched, it is searched from among up to 254 IP addresses whose upper 3 bytes coincide with those of the local IP address (#1934 Local IP address). However, depending on the setting of the 4th byte of the PC subnet mask (PC Subnet), the search range may be limited.

(Example 1) General setting

<Setting example>

NC IP address: 10.97.12.16

PC subnet mask: 255.255.255.0

<Search range>

From between 10.97.12.1 and 10.97.12.254, the smallest free address is searched.

(Example 2) When the search range is limited up to 254 addresses

<Setting example>

NC IP address: 10.97.12.16

PC subnet mask: 255.255.0.0

<Search range>

From between 10.97.12.1 to 10.97.12.254, the smallest free address is searched.

(Example 3) When the search range is limited to 254 addresses or less

<Setting example>

NC IP address: 10.97.12.16

PC subnet mask: 255.255.255.128

<Search range>

From between 10.97.12.1 to 10.97.12.126, the smallest free address is searched.

11.6.3 Message

The following messages display when IP address is reset.

Message	Description
Searching	- The system is searching the connectable NC control unit to establish the communication between the control unit and the display unit. Please wait until the search is completed.
Socket error	- The system could not find the connectable control unit because of the network interference. Turn OFF the NC power supply, and review the wiring for the network connection.
Setting error- Connect NC address	- The automatic connection with the control unit failed because the setting file to set and save the unit's IP address was not found/is read-only/is of an illegal format. Review "[HOSTS] TCP1" setting in the setting file "melcfg.ini".
Searching IP address	- The system is automatically searching the appropriate IP address because IP address of the display unit is inapposite. Please wait until the search is completed.
Review the setting of the Ethernet parameter after the screen starts.	- The IP address setting of connected control unit and display unit was completed. Please review the setting of the Ethernet parameter after the screen starts.
Searching PC IP address failed.	- No empty IP address was found by the automatic search for the IP address of the display unit. Please remove the control unit from the network, and turn ON the NC power supply again.

Performing a Backup Operation



The Input/Output screen of the maintenance (Mainte) screen is used to carry out NC data input/output between the NC internal memory and the external input/output devices. Here, the hard disk built into the NC device is also treated as external devices.

When the multi-part system program management is valid (#1285 ext21/bit0 =1) and the selected device is the NC memory, a program input and output will be executed across all part systems in batch if a parameter "#1285 ext21/bit2" (Multi-part system program management) is set to "0". When it is set to "1", the program input and output will be executed for the program of displayed part system.

However, when the machining program is transferred from the NC memory to the device other than the NC memory, the transfer will be executed across all part systems in batch if "#1286 ext22/bit5 Selection of multi-part system program input/output method" is set to "0". If it is set to "1", only displayed part system's program will be transferred.



Display Items

Display Items	Description
(1) Number of programs registered and remainder (*1)	This displays the registration information of machining program of the selected device. Number of programs registered : This displays the number of programs previously registered as user machining programs. Remain: This displays the remaining number of programs that can be registered. When memory is selected as the device, the total of the number of programs registered and the remainder is the maximum number of registrations set in the specifications.
(2) Number of memory characters and remainder (*1)	This displays the number of characters of the machining program of the selected device. Number of memory characters: This displays the number of characters previously registered as user machining programs. Remain: This displays the remaining number of characters that can be registered. The total of the number of memory characters and the remainder is the maximum number of memory characters set in the specifications.

Display Items	Description
(3) List (*2)	<p>This displays a contents list (directory and file name) of the directory in the setting column (file setting column A or B) where the cursor is currently located.</p> <p>Program: When "Memory" is selected for the device, this displays the file name (program No.) of the machining programs already registered.</p> <p>The file names are displayed in order from the smallest number, from 1 to 99999999.</p> <p>When a device other than memory is selected, this displays the file name and directory to be included in the directory that is set in the current setting column.</p> <p>When they exceed the displayable number of characters (12 characters), the excess is abbreviated and displayed (*).</p> <p>Character: The size of each file (when memory is selected for the device, the number of characters in the machining program).</p> <p>When directory is selected, this displays "DIR".</p> <p>Comment: This displays the comment (up to 17 alphanumeric characters and symbols) of each file.</p> <p>The date which the file is updated is displayed for the HD, memory card, DS, USB memory or Ethernet.</p> <p>When the number of characters exceeds 17, the excess is not displayed.</p>
(4) File setting column A	<p>This sets the device, directory, and file name for which the transmission, compare, and erase functions are used.</p> <p>When transferring, the file name of the transfer origin file is set. When renaming, the file name before renaming is set. When erasing, the erasing range is set.</p> <p>When the number of characters exceeds 28, the excess is not displayed.</p> <p>As for the device and directory, the setting values are retained even when the power is turned OFF. (*3)</p>
(5) File setting column B	
(6) Input data	This displays the data being transferred.
(7) Comparison data	This displays the data being compared. If an error occurs while comparing data, the block for which the error occurred is displayed.

(*1) Some items may not be displayed depending on the device.

○: Displayed ×: Not displayed

Display item/Device	Memory	HD	Serial	Memory card	DS/USB memory	Ethernet
Number of programs registered	○	○	×	○	○	○
Remain	○	×	×	×	×	×
Number of memory characters	○	○	×	○	○	○*
Remain	○	○	×	○	○	×
List	○	○	×	○	○	○

* When the parameter "#97*1 Host n no total siz" is set to "1", the number of host memory characters will not appear.

(*2) When the device is serial, an empty list is displayed.

(*3) When the number of characters in the directory path (full path) from the root directory exceeds 100, the directory path is not retained, but a previously set directory path containing 100 characters or less retained.

When the device is "Memory", the initial directory display is "Program".

When the device is "Ethernet", the initial directory display is "/" (root).

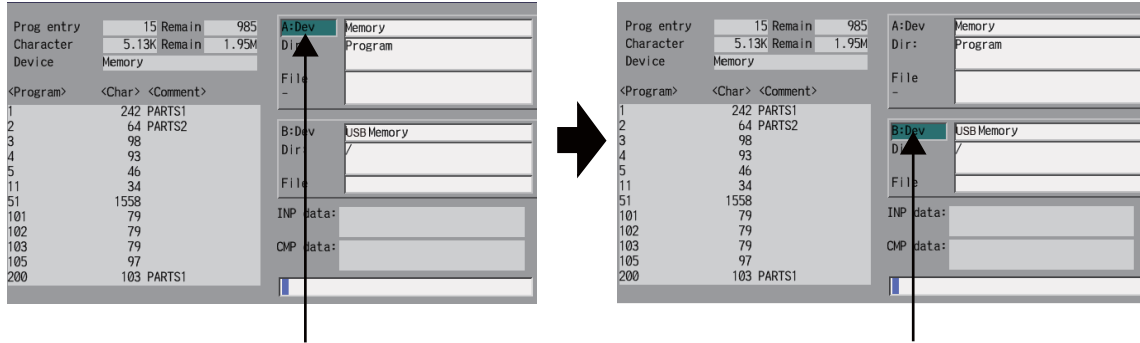
Menus

Menus	Description
Area change	This changes the setting area to file setting column A (transfer origin) or file setting column B (transfer destination). The display of the valid area (A or B) is highlighted.
Device select	This displays the sub-menu of the machining program storage area. When the sub-menu is selected, the device is confirmed, and if a directory exists it is set in the root. The memory is selected as the default.
Dir	This menu sets the directory that carries out input/ output operations, and is on standby for input. Note that when memory is selected for the device, the directory can be selected from the sub-menu.
File name	This menu sets the file name that carries out input/ output operations, and is on standby for input. When memory is selected for the device, setting is not necessary if the directory is not the program.
List update	This updates the list. The list of the directly selected in the currently valid file setting column (A/B) is updated.
Transfr A→B	This copies the file in file setting column A (transfer origin) to the file setting column B (transfer destination). (The transfer origin file is not changed.) A message appears during transfer and when the transfer is completed.
Compare A:B	This compares the files in file setting column A (transfer origin) and file setting column B (transfer destination).
Erase A	This erases the file in file setting column A. <Note> ♦The NC memory (excluding programs), serial and Ethernet (host file) cannot be erased.
Erase B	This erases the file in file setting column B. <Note> ♦The NC memory (excluding programs), serial and Ethernet (host file) cannot be erased.
Rename A→B	This changes the name of the file in file setting column A (transfer origin) to the name of the file in file setting column B (transfer destination). <Note> ♦The same device must be selected for A and B. The NC memory (excluding programs) and serial cannot be renamed.
Comment nondisp	This changes whether to show or hide the comment field.
Dir create	This creates a new directory in the directory of the currently valid file setting column (A/B). The directory can be created when HD, memory card or USB memory is selected for the device.
Merge B→A	This adds the contents of the file in file setting column B to that of in file setting column A. (The file in file setting column B is not changed.) <Note> ♦The NC memory (excluding programs), serial and Ethernet (host file) cannot be merged.
Warning cancel	This cancels a warning from network service.
Stop	This interrupts the process (transfer, compare, etc.) during its execution.

When setting the file setting field A or B device, directory and file name on this screen, the area containing these must be valid.

The display area can be changed by pressing the menu key ([Area change]) or the cursor key [↑] and [↓].

After changing, the data setting operation is valid in that area.



File setting column A is valid.

File setting column B is valid.

Changing the valid file setting field

When file setting column A (top) is valid

- (1) Press the menu [Area change].



The file setting column B (bottom) is validated.

This can also be changed with the cursor key [↓].

12.1 Selecting a Device, Directory and File



File selection sequence

Designate the device where the target file is located. → Select from the sub menu.



Designate the directory with a full path. → Input the full path or select from the list.



Designate the file name. → Input the file name or select from the list.

Menus

Sub-menus of [Device select]

Menus	Description
Memory	This selects the NC memory (program, parameter, PLC program, NC data).
HD	This selects the hard disk. (This menu is not displayed for M800S and M80 Series, and it cannot be selected.)
Serial	This selects the RS-232C device (PC, tape, etc.).
Memory card	This selects the front-side SD card.
DS	[M800W/M80W] This selects the SD card in the control unit. [M800S/M80] This selects the back-side SD card of the display unit.
Ethernet	This selects the Ethernet-connected host computer.
USB Memory	This selects USB memory.

Sub-menus of [Dir] (other than memory) and [File name]

Menus	Description
From list	The cursor appears in the list display. The list contents can be selected with the [INPUT] key. When a directory is selected, the contents of the selected directory are displayed in the list. Continued selection is possible. When a file name is selected, the file name is temporarily displayed in the input area. When the [INPUT] key is pressed again, it is fixed.
Top jump	[In normal mode] The contents of the first page in the list are displayed. [When importing data from the list] The contents of the first page in the list are displayed, and the cursor moves to the top row.
Bottom jump	[In normal mode] The contents of the last page in the list are displayed. [When importing data from the list] The contents of the last page in the list are displayed, and the cursor moves to the bottom row.

Sub-menus of [Dir] (memory)

Menus	Description
Program	"Program" appears in the directory. The "File" column is blank.
Program all	"Program all" is displayed in the "Dir" column. The "File" column is blank.
Tool offset	"Tool offset" is displayed in the "Dir" column. "TOOL.OFS" is displayed in the "File" column.
Variabl	"Variable" is displayed in the Dir column. "COMMON.VAR" is displayed in the "File" column.
Coord offset	"Workpiece offset" is displayed in the "Dir" column. "WORK.OFS" is displayed in the "File" column.
All T data	"All tool data" is displayed in the "Dir" column. "TOOLALL.DAT" is displayed in the "File" column.
Param	"Parameter" is displayed in the "Dir" column. "ALL.PRM" is displayed in the "File" column.
System config	"System config" is displayed in the "Dir" column. "ASSEMBLY.INF" is displayed in the "File" column.
Safety param	"Safety parameter" is displayed in the "Dir" column. "SAFE PARA.BIN" is displayed in the "File" column.
Smp data	"Smp data" is displayed in the "Dir" column. "NCSAMP.CSV" is displayed in the "File" column.
Open SRAM	"Open SRAM" is displayed in the "Dir" column. "SRAMOPEN.DAT" is displayed in the "File" column.
Open device	"Open device" is displayed in the "Dir" column. "DEVOPEN.DAT" is displayed in the "File" column.
WorkSet ErrComp	"WorkSetErrComp" is displayed in the "Dir" column. "WKPOS.OFS" is displayed in the "File" column.
Device Net	"DeviceNet" is displayed in the "Dir" column. "DEVICENT.PRM" is displayed in the "File" column.
Surface Data	"Surface Data" is displayed in the "Dir" column. "RNAVI.DAT" is displayed in the "File" column.
Interfr data	"Interference data" is displayed in the "Dir" column. "OBSTACL.DAT" is displayed in the "File" column.
System param	"System parameter" is displayed in the "Dir" column. "SYSTEM.PRM" is displayed in the "File" column.
Option	"Option" is displayed in the "Dir" column. "OPTION" is displayed in the "File" column.

Selecting methods for device, directory, and file name



Device	Designation target file	Designation method		
		Device	Directory	File name
NC memory	•Machining program •User macro •Fixed cycle	Select from the sub-menu	- (Default)	Key input in the input area, then press the [INPUT] key. Select from the list
	Other than the machining program	Select from the sub-menu	Key input in the input area, then press the [INPUT] key. Select from the sub-menu	- (Fixed)
Other than the NC memory	All	Select from the sub-menu	Key input in the input area, then press the [INPUT] key.	Key input in the input area, then press the [INPUT] key.
			Select from the list	Select from the list.

The device can be selected from the sub-menu. (The devices that can be used will differ depending on the specifications.) One of the following methods can be used to designate the directory (for devices other than the NC memory) and file name.

- Designate the directory path (full path) or file name in the input area and press the [INPUT] key.
- Press sub-menu [From list] of the menu [Dir] or [File name]. Move the cursor to the target directory or file name, and press the [INPUT] key.

A wildcard (*) can be used when selecting a file name.

Notes when selecting a file

- (1) During directory and file name setting, the designated directory, path or file name will be set, even if it does not actually exist. This will not cause an error. Note that the previously set directory is overwritten.
- (2) When a file in the NC memory other than a machining program is designated, it is not necessary to set the file name. (The file name is fixed.)
- (3) When a file name is selected from the menu, it first is displayed in the input area. However, at this time the file name has not yet been fixed. Press the [INPUT] key again to fix the file name.
- (4) If you press the  key or the  key when setting a file name, the file name in the input area is erased.
- (5) When selecting a fixed cycle program, it is necessary to set the basic common parameter "#1166 fixpro". Furthermore, select "Memory" for the device, and "Program" for the directory.

Initial directory when the Ethernet is selected

An initial directory is specified at turning the power ON by the following parameter.

- #9706 Host No.
- #9714 Host1 directory
- #9734 Host2 directory
- #9754 Host3 directory
- #9774 Host4 directory

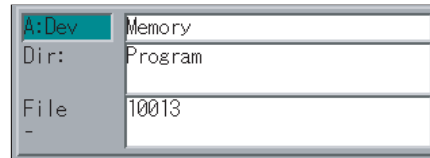
Selecting a NC memory program

- (1) Press the menu [Device select].
- (2) Press the menu [Memory].
- (3) Press the menu [File name].

- (4) Input the file name.
 <When inputting the file name from the input area>
 Input the file name.
 10013 [INPUT]



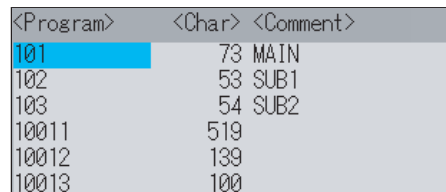
The selected file name appears.



- <When selecting the file name from the list>
 Press the menu [From list].



The cursor appears in the list.



- (5) Move the cursor to the file name to be selected, and set.
 [↑], [↓] [INPUT]



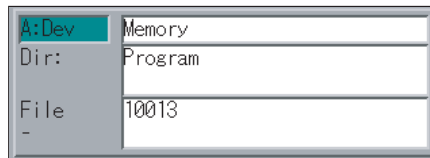
Selected file name is displayed in the input area.



- (6) Press the [INPUT] key.



The selected file name appears.



Designating multiple files

<Designating multiple serial files>

Multiple serial files can be transferred, compared and erased in the file setting column A. Set as follows in this case.

File name:
(Upper row) First file name
(Lower row) Last file name



A:Dev	Memory
Dir:	Program
File	10013
-	10050

<Using a wildcard>

A wildcard (*) can be used for the file name.

Note

(1) When serial or Anshin-net server is used, multiple files cannot be compared.

File: *
-



All files will be selected.

A:Dev	Memory
Dir:	Program
File	*
-	

Selecting a file other than a program in NC memory

- (1) Press the menu [Device select].
- (2) Press the menu [Memory].
- (3) Select the menu [Dir].
- (4) Press the menu [Tool offset].



The directory and file name appear.

A:Dev	Memory
Dir:	Tool offset
File	TOOL.OFS
-	

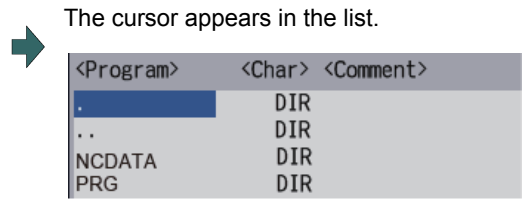
Note



- (1) The file name for each directory is fixed. For the file name, refer to "12.8.2 List of File Names".
- (2) When the menu [Program] or [Program all] is selected, the setting of "File name" column is cleared.

Selecting a device file other than the NC memory (When separately selecting the directory and file name.)

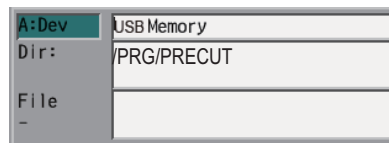
- (1) Press the menu [Device select].
- (2) Select the device.
- (3) Select the menu [Dir].
- (4) Select a file.
 <When inputting the directory from the input area>
 Input the directory path as a full path.
 /PRG/PRECUT [INPUT]

<When selecting the directory from the list>
 Press the menu [From list].



- (5) Move the cursor to the directory to be selected and set.
 [↑], [↓] [INPUT]
 Repeat this operation until the cursor arrives at the target directory.
 When the target directory is reached, press the  key or the  key and quit the mode for inputting the directory.

➔ The selected directory appears in the data setting column.
 The contents of the selected directory appear in the list.



Note

- (1) Refer to next section "Selecting a device file other than the NC memory (When simultaneously selecting the directory and file name.)" procedure (3) or later for method of file designation.

Selecting a device file other than the NC memory (When simultaneously selecting the directory and file name.)

(1) Press the menu [Device select].

(2) Select the device.

(3) Press the menu [File name].

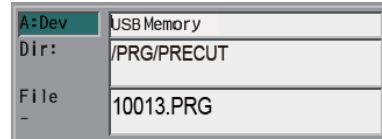
(4) Select a file.

<When inputting the file name from the input area>

Input the file name.

10013 [INPUT]

The selected file name appears.



<When selecting the file name from the list>

Press the menu [From list].

The cursor appears in the list.

<Program>	<Char>	<Comment>
.	DIR	
..	DIR	
10011.PRG	240	Jun 08 13:13 2015
10012.PRG	67	Mar 02 10:45 2012
10013.PRG	100	Jun 08 16:12 2015
10014.PRG	96	Jun 21 18:35 2012
10015.PRG	48	Apr 02 11:11 2015

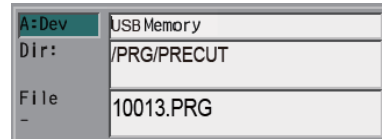
(5) Move the cursor to directory and file name to be selected, and fix.

[↑], [↓] [INPUT]

This operation is repeated until the cursor reaches the file. When only the directory is selected and key is pressed, select the file name separately.

(6) Press the [INPUT] key.

The selected file name appears.



Canceling the input mode

(1) Press the [Device Select], [Dir] or [File name].

(2) Press the [Left Arrow] key or the [Up Arrow] key.


12.2 Transferring a File



Operation method

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the transfer source device, directory and file name.
 - ➔ The designated file appears.
Multiple files can be designated in the file setting column A. Designate the first and last file name of the target range. A wildcard "*" can be designated for the file name.
- (3) Press the menu [Area change] to select file setting column B.
- (4) Designate the transfer destination device, directory and file name.
- (5) Press the menu [Transfr A→B].
- (6) Press the [Y] or [INPUT] key.

CAUTION

 " ; ", "EOB", "%", and "EOR" are symbols used for explanation. The actual codes for ISO are "CR, LF" ("LF") and "%". "%" and "EOR" are represented by "%" in ISO. The programs created on the edit screen are stored in the NC memory in a "CR, LF" format, however, the programs created with external devices may be stored in an "LF" format. The actual codes for EIA are "EOB (End of Block)" and "EOR (End of Record)".

 To prevent influence from data omission and data transformation in the communication circuit, always verify the data after inputting and outputting machining programs.

Precautions

■Notes related to transferring in general

- (1) Depending on the type of file, some data cannot be transferred during automatic operation. Do not transfer during automatic operation.
- (2) When the capacity of the transfer destination is reached during file transfer, only the data transferred up to that point is registered as a file, and an error will result.
- (3) During input to the NC memory or comparison, if the file format size on the NC memory side differs from the other side file format size (when the maximum number of registrations differs between the NC memory and the other side), processing is carried out matched to the smaller size.
(Example 1) If a format size of 200 files is input for a format size of 1000 NC files, 200 files are registered.
(Example 2) If 1000 files are input to the NC that formatted for 200 files, the files up to the 200th file can be registered and an error message appears. (The remaining files are not registered.)
- (4) Do not perform any file operation on the transfer source and destination files during the file transfer. The file may be damaged with the file operation.

■Notes when transferring machining program files

- (1) For the serial, always set both ends of the "EOR" code at the head and end to feed (Null). If "EOB" etc., is directly after "EOR", the operation may not execute normally due to the input buffer influence during the next input operation.
- (2) The transfer speed is slower if there are many registrations.
- (3) The size of one block of the machining program should be 250 characters or less.
- (4) The characters that can be used for the file name and directory path are 1-byte number, 1-byte capital alphabetical letters, and 1-byte symbols recognized by the system.
Note that the following characters cannot be used.
|, /, :, ", " (comma), *, ?, ", <, >, a to z (small letters), space
Up to 32 characters are allowed for the file name to create in or transfer to NC memory.
- (5) If the file whose name includes lower case alphabet is transferred to NC memory, the lower case letter will be converted into the capital letter.
- (6) When using tape, carry out parity V adjustment to improve the reliability of the tape format. Then use with the input/output parameter "Parity V" validated.
- (7) When the MTB macro and fixed cycle program are input to NC memory, change the program type with the parameter "#1166 fixpro". Also, set in the Input/Output screen as follows:
Device: Memory, Directory: Program
- (8) Transferring or verifying the multiple files between the external device connected serially and that other than the serial connection.
- (9) With machining program created before the MELDAS500 Series, "EOB" is registered as "LF". However, "EOB" will be converted to "CR LF", and the number of characters will increase in this Series. Thus, when all of the machining programs output from an MELDAS500 Series or earlier NC, having the same specifications as the maximum memory capacity, are stored in this Series, the memory capacity may be exceeded.
- (10) When the file to be transferred (input) is running or in "program restarting" mode, "program checking", the operation message "Executing automatic operation" or "Program restarting" or "Program checking" is displayed and file will not be transferred (input).
- (11) If the file to be transferred (input) is being edited in the custom screen, the operation message "Can't write into being edited file" appears and may not be transferred (input).
- (12) When the parameter "#8936 Delete leading 0" is set to "1", the file consisting only of numerical figures will be transferred with the "0" at the head deleted. For details, refer to "5.8.6 Leading Zero".
- (13) When the multi-part system program management is valid (#1285 ext21/bit0 =1) and "#1285 ext21/bit2" (Multi-part system program generation and operation) is set to "0", a machining program's transfer to the NC memory will be executed across all part systems in batch. When it is set to "1", only displayed part system's machining program will be transferred.
- (14) When the multi-part system program management is valid (#1285 ext21/bit0 =1) and "#1285 ext22/bit5" (Selection of multi-system program input/output method) is set to "0", the machining program's transfer from the NC memory to the device other than the NC memory will be executed across all part systems in batch. When it is set to "1", only displayed part system's machining program will be transferred.

- (15) The transfer range from the external device other than serial to NC memory will change depending on the value set in the parameter "#19006 EOR Disable".
- <When the parameter "#19006 EOR disable" is set to "0">
 The head line will not be transferred.
 Up to "%" in the second line onward will be transferred, and data after "%" will not be transferred.
 If there is no "%", all data will be transferred.
- <When the parameter "#19006 EOR disable" is set to "1">
 All file contents will be transferred.
- (16) If the file to be transferred (input) is targeted for edit lock (edit lock B: 8000 to 9999 or edit lock C: 9000 to 9999), the message "Edit lock B" or "Edit lock C" is displayed, causing a transfer failure.
 If the program name is input with only numbers when the parameter "#8936 Delete leading 0" is set to "1", the program is checked with the leading zero deleted. (Example: If the file name to be transferred (input) is designated by "008000" while edit lock B is enabled, the message "Edit lock B" is displayed, causing a transfer failure.)
- (17) Multiple successive files or wildcard (*), if designated, is transferred, excluding the programs to be edit-locked, to suit the status of edit lock B or C.
- (18) If the device shown below and the directory are designated for the destination to transfer a file, the following operation is performed depending on conditions.
- When an existing file is designated: The file is transferred with a temporary file name, and changed to the designated file name after transfer processing has been completed.
 - When a new file is designated: A new file is transferred with a temporary file name, and changed to the designated file name after transfer processing has been completed.
- (1) B: Transfer destination device: Memory
 Directory: Machining program
- (2) B: Device DS, memory card (M800S/M80), USB memory (M800S/M80)
- A temporary file is designated by the file name that consists of 11 digits, beginning with the symbol "~".
- After transfer is terminated properly, the temporary file is changed to the designated file name.
 A temporary file remains in the cases below, but can be deleted in the same way as for a normal file.
- Transfer has terminated abnormally, for example, because the destination's capacity became full.
 - When the transfer has been interrupted.

■Notes when transferring tool offset data files

- (1) If an error occurs during offset data transfer, an error message appears on the screen, and the transfer operation is interrupted.
- (2) Tool offset data file cannot be transferred from the serial to the memory.

■Notes when transferring parameter files

- (1) In the same manner as when setting in the Parameter screen, there are parameters validated immediately after input, and parameters validated after a restart. Restart when a parameter file has been transferred to the NC memory.
- (2) When a parameter file is transferred to the NC memory, the setting value of the input/output parameters is also changed. Before transferring next time, set the parameters again.
- (3) When a protected parameter file (user parameter, machine parameter or pitch error compensation amount is protected) is transferred to NC memory, the message "Transfer skipping protected data? (Y/N)" appears. Pressing the [Y] key enables you to input the parameters except for protected data. If all parameters are protected, the message "Data protect" appears, no parameter can be input.
- (4) When a protected parameter file (user parameter, machine parameter or pitch error compensation amount is protected) is transferred to an external device from NC memory, the message "Data protect" appears and the parameter cannot be output.

■Notes when transferring common variable data files

- (1) If the variable value is 100000 or more or less than 0.0001 when transferring common variable data, it is expressed with an exponential expression.
- (2) When the common variable protection is set with the parameter #12111 to #12114, the message "Transfer skipping protected data? (Y/N)" appears. Pressing [Y] skips the protected variables, so they are not written to NC memory.
- (3) When common variable protection is set with the parameter #12111 to #12114, the protected variables are not written to NC memory, even if the part system-based common variables included in the common variable data file are handled as the variables common to part systems by the NC.

■Notes when transferring all tool data files

- (1) When tool life data is output from the NC memory, the tool information data, tool compensation data, and custom data allocation information are output per section.
Tool information data section: [TOOLINF_L1] (Tool life management I), [TOOLINF_L2] (Tool life management II), [TOOLINF_M] (Tool life management M system)
Tool compensation data section: [TOOLOFS]
Custom data allocation section: [CUSTOM]
- (2) When all tool data is transferred to NC memory with either tool data or workpiece shift data protected, the message "Transfer skipping protected data? (Y/N)" appears. Pressing the [Y] key allows you to transfer the data with the protected data skipped. If both data are protected, the message "Data protect" appears and no data can be input.
- (3) When all tool data is transferred to an external device from NC memory with either tool data or workpiece shift data protected, the message "Data protect" appears and the data cannot be output.

■Notes when transferring sampling data file

- (1) When the output form is set as 8-digit hexadecimal number and the parameter "#1004 ctrlunit" is set to "E (1nm)", accurate data can be output just within 1 m. When the output data length exceeds 1 m, lower 32 bits of the sampling data will be output.
- (2) Sampling data file can be transferred from NC memory to an external device (output) but cannot be transferred from an external device to NC memory (input).

■Notes when transferring workpiece offset data files

- (1) Tool offset data file cannot be transferred from the serial to the memory.

12.3 Comparing Files (Compare)



Operation method

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the device, directory and file name to be compared.
- (3) Press the menu [Area change] to select file setting column B.
- (4) Designate the other device, directory and file name to be compared.
- (5) Press the menu [Compare A:B].

➔ The file comparison starts.
 The verifying data is displayed.
 A message appears when the comparison is completed.
 If a comparison error occurs, the block with the error is displayed in the comparison data display column on the screen.

```
INP data: (MAIN);G28XYZ;G00X10.;N1X20.
          ;X30.;X40.;N2X50.;M98P102H1;
CMP data: (MAIN);G28XYZ;G00X10.;N1X20.
          ;X30.;X40.;N2X50.;M98P103H1;
```

Note

- (1) Files that can be compared are text files only. Correct outcome will not be obtained through binary file comparison.
- (2) Designating "*" for the compared file name causes "Setting error" when the comparison is executed with serial. Designate no file name or designate a target file name.
- (3) "0" at the head of the file name will not be deleted when checking the individual file which consists of one program in one file even the parameter "#8936 Delete leading 0" is set to "1". Designating the file name is required. However, in the case of serial/batch file, comparison is carried out with a leading zero in the program name deleted.
- (4) When multiple successive files or wildcard (*) are/is designated as the transfer source, the comparison is executed excluding the programs which are subject to the edit lock according to the status of Edit lock B and C.
- (5) If you attempt the file comparison during the tool data sorting, the operation message "Can't open file for dev A (or B)" appears, which disables the comparison.

12.4 Erasing a File



Erasing a file [Erase A]

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the device, directory and file name to be erased.
- (3) Press the menu [Erase A].
- (4) Press the [Y] or [INPUT] key.

➔ The file is erased.
 A message appears when the erasing is completed.
 The number of programs registered, number of memory characters and remainder reappear.
 Press the menu [List update] to update the list.

Note

- (1) If the file to be erased is running or in "program restarting" mode, the operation message "Executing automatic operation" or "Program restarting" is displayed, and the file will not be erased.
- (2) If the file to be erased is being edited in the custom screen, the operation message "Can't erase designated file" appears and may not be erased.
- (3) When a wildcard "*" is designated for the file to be erased, the erasing is executed excluding the programs which are subject to the edit lock according to the status of Edit lock B and C.

Erasing a file [Erase B]

The operations are the same as method "Erasing a file [Erase A]" above. Designate the target device, directory and file name in the file setting column B, and press the menu [Erase B].

12.5 Changing a File Name (Rename)



Operation method

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the original device, directory and file name.
- (3) Press the menu [Area change] to select file setting column B.
- (4) Designate the new device, directory and file name.
- (5) Press the menu [Rename A→B].
- (6) Press the [Y] or [INPUT] key.

Note

- (1) Make sure the original and new devices are the same.
- (2) If the file to be renamed is running or in "program restarting" mode, the operation message "Executing automatic operation" or "Program restarting" is displayed, and the name will not be changed.
- (3) If the file to be renamed is being edited in the custom screen, the operation message "Can't rename designated file" appears and may not be changed.
- (4) If a file that does not exist is designated for the original file, or if an existing file name is designated for the new file selection, an error occurs, and the name is not changed.
- (5) The directory where the file in operation search/check search is stored cannot be renamed. The operation message "Can't rename designated file" appears.

12.6 Creating a Directory



Operation method

- (1) Press the menu [Area change] to select the file setting column A.
- (2) Designate the device.
- (3) Designate the directory where the new directory is to be created.
- (4) Set the new directory in file setting column A.
- (5) Press the menu [Dir create].



The designated details appear.

The devices that can create a directory are HD, memory card, DS, and USB memory.

The directory can also be created in file setting column B.

12.7 Restrictions

- (1) For Ethernet input-output, you can insert only one LAN card into the PC side. If multiple LAN cards are inserted simultaneously, no operations are assured.
- (2) When multiple files are transferred to NC memory, a file in edit lock mode is not transferred, and other files are transferred.

12.7.1 Device Definition

- (1) Removable disks in drive E and after are used as memory card devices. (Drive name advanced by the value of "#1390 BackUSBUseNum" from drive E. (Example: When #1390: 2, drive G is set as the drive name.) (*1))
- (2) Removable disks in drive F and after are used as USB memory devices. (Drive name advanced by the value of "#1390(BackUSBUseNum)" from drive F. (Example: When #1390 :2, drive H is set as the drive name.) (*1))
- (3) If a USB memory device formatted over FAT32 is used, it may cause a file reading and writing failure. Use a USB memory device that is formatted with FAT32.
- (4) If a USB memory device is removed or inserted while data is being transferred to it, data integrity cannot be guaranteed. While message "Now, transferring data" or "Now, formatting data" is being displayed, do not remove or insert the USB memory device. After message "Transfer completed" or "Formatting completed" has been displayed, remove or insert the USB memory device.

(*1) Targeted only for the M800W/M80W Series.

12.7.2 List Display

- (1) If the number of full path characters exceeds 128 when the directory is being moved, it results in a movement failure.
- (2) In the NC memory, you cannot use the cursor movement key or [INPUT] key to move the directory.
- (3) The directory name must be designated using less than 100 characters. If the directory name is designated using 100 or more characters, it will not be recognized as the directory name.
- (4) If a directory that contains a double-byte code file name such as a Japanese file name is displayed in list view, such a double-byte code file name is not displayed correctly. In addition, the number of file characters, comments, and number of stored characters is not displayed correctly.

12.7.3 Program Name

The following restrictions are applied to the file name that can be created and transferred in NC memory.

- (1) The file name must be designated using up to 32 characters, including an extension.
- (2) Single-byte digits, single-byte uppercase alphabet characters, and Windows-recognizable single-byte symbols are available for the file name or directory name. Therefore, a double-byte code file name such as a Japanese file name cannot be used.
- (3) Edit lock B, edit lock C, and program display lock are available only for files that have the file name designated only by single-byte digits in the NC memory.

Example: When edit lock B (8000 to 9999) is enabled:

File name	Feature	Change
8000	Single-byte digits only	Disabled
8000.PRG	With extension	Enabled
08000	Single-byte digits only, beginning with "0"	Enabled
8000A	With characters other than digits	Enabled

- (4) The following names cannot be used as file names.
 - File name with extension "\$\$\$", "\$\$0", "\$\$1", "\$\$2", "\$\$3", "\$\$4", "\$\$5", "\$\$6", "\$\$7", "\$\$8", or "\$\$9"
 - "0" (File named "single-byte zero")

12.7.4 M2 Macro Converter

- (1) The M2 macro converter runs only when data is transferred or compared through a serial connection. However, a conversion is carried out only when a serial connection is used in the M800W/M80W Windows-based display unit. This converter does not run in the M800S or M80 serial device.
- (2) This converter runs only when the G code format is set to the M2 format.
- (3) When the M2 macro converter is enabled, the serial transfer time may be delayed compared to the time when it is disabled.

12.7.5 ALL.PRM Input

- (1) ALL.PRM data is assumed as a comment by adding a semicolon (;) at the head of the data, and it can be excluded from being input. However, the message "Compare error" appears when it is compared.
- (2) When ALL.PRM data which has header information (output date, CNC name, unit name, serial number and NC system information) is input to the older version device, the operation message "Can't write file for dev B" appears.
- (3) Output format can be changed with the parameter "1218 aux02/bit3" (Parameter input/output format), but the format of header information is unchanged.
- (4) When the parameter files (ALL.PRM) output from NC memory to the device (HD, DS or USB memory etc.) are compared, the message "Compare error" appears because of the discrepancy of the header information.

12.8 Other Functions

12.8.1 Merging a File



Operation method

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the merge destination device, directory, and file name.
- (3) Press the menu [Area change] to select file setting column B.
- (4) Designate the merge source device, directory, and file name.
- (5) Press the menu [Merg B→A].
- (6) Press the [Y] or [INPUT] key.

➔ A message appears when the merge is completed. The details of the file in file setting column A will be as follows when the merge is completed.

(FILE A) G28 XYZ; G90 F800; G00 X100. Y100.;	}	Details of file in file setting column A before merge.		
(FILE B) G91 G28 XYZ; F1000; G01 X200. Y200.;			}	Details of file in file setting column B before merge.
M02;				
%				

The details of the file in file setting column B do not change.

Note

- (1) If the merge destination file (file in file setting column A) is running or in "program restarting" mode, the operation message "Executing automatic operation" or "Program restarting" is displayed, and the files will not be merged.
- (2) If the merge destination file (file in file setting column A) is being edited in the custom screen, the operation message "Can't write into being edited file" appears and may not be merged.
- (3) When the parameter "#19006 EOR Disable" is set to "1", a file is merged as it is. But the terminal character of the merge destination file (file in file setting column A) is "%", a line feed code is added and then merged.
- (4) The devices that can be merged are the memory, HD, memory card, DS and USB memory.
- (5) Do not perform the file operation on the merge source and destination files during the merge. The file may be damaged with the file operation.

12.8.2 List of File Names

There is a directory for each type of data in the NC memory.

Each directory and file name (fixed) in the NC memory is shown below.

Do not change the extensions (.XXX) when storing in a device other than the NC memory.

Data type	NC memory directory path	Fixed file name
Machining program	/PRG/USER	(Program No.)
Fixed cycle program	/PRG/FIX	(Program No.)
MTB macro	/PRG/MMACRO	(Program No.)
User macro	/PRG/UMACRO	(Program No.)
Parameters Parameters [User, machine] (Text format) DeviceNet Safety parameter file	/PRM	ALL.PRM DEVICENT.PRM SAFEPARA.BIN
PLC program PLC program file for each project Own station safety PLC program file Other station safety PLC program file	/LAD	PROJECTxx.LAD (xx: 01 to Usable project No.) SAFEPLC1.LAD SAFEPLC2.LAD
NC data Tool compensation amount data All tool data Common variable data SRAM data Workpiece offset data Option file SRAM open data Device open data Machining surface data Interference data	/DAT	TOOL.OFS TOOLALL.DAT COMMON.VAR SRAM.BIN WORK.OFS OPTION-ADD.OPT SRAMOPEN.DAT DEVOPEN.DAT RNAVI.DAT OBSTACL.DAT
System configuration data	/DGN	ASSEMBLY.INF
Decryption code	/RLS	PASSCODE.DAT
Sampling data (binary) History data All history Key history Alarm history Touch history	/LOG	NCSAMP.CSV NCSAMP.BIN ALLLOG.LOG KEYLOG.LOG ALMLOG.LOG TOUCHLOG.LOG

12.8.3 Edit Lock B and C

This function prohibits editing, erasing, etc., of the machining programs B and C, and protects the machining programs in NC memory.

Machining program	Edit Lock B	Edit Lock C
A 1 to 7999 10000 to 99999999	---	---
B (user standard program) 8000 to 8999	Editing prohibited	---
C (MTB custom) 9000 to 9999	Editing prohibited	Editing prohibited

The operations below in the Edit MDI and the Input/Output screens are influenced by the edit lock setting.

An error will occur if operations that are not possible are attempted.

When the edit lock is valid, processing is executed (except the edit lock target program) by the input/output function.

○: Operation possible ×: Operation not possible

Screen	Operation	Edit Lock B			Edit Lock C		
		Machining program			Machining program		
		A	B	C	A	B	C
Edit	Search	○	○	×	○	○	×
	Edit	○	×	×	○	○	×
	MDI registration	○	×	×	○	○	×
Input/Output	Transfer	○	×	×	○	○	×
	Compare	○	×	×	○	○	×
	Copy	○	×	×	○	○	×
	Merge	○	×	×	○	○	×
	Rename	○	×	×	○	○	×
	Erase	○	×	×	○	○	×
Position display2	Buffer Correction	○	×	×	○	○	×

Note

- (1) When the multiple part system specification is valid, the machining programs of all the part systems are protected by edit lock B and C.
- (2) When multiple serial files or a wildcard (*) is designated for input/output function, programs except subject to edit lock will be processed.
- (3) When a multiple programs are input to the memory without designating the file name like serial input or program batch input, the message "Edit lock B" or "Edit lock C" appears and the input is interrupted if the program which is subject to edit lock is detected.
- (4) A machining program in the USB memory is assumed as machining program A whatever its file name is, it is not subject to the protection of Edit Lock B or C.

12.8.4 Data Protection Keys

Data protection key prevents various data from being set or erased.
 The key name differs according to the MTB. Refer to the instruction manual issued by the MTB for details.

The following data can be protected with the data protection key:

- All tool data and the coordinate system preset data using the origin set
- User parameters and common variables
- Machining programs
- Files in the memory card
- Files in the DS

The data protection key is enabled to prohibit the setting, erasing, etc. while the PLC signal is OFF (B contact).
 Data protection key has higher protection level than that of Data protection by user's level.

12.8.5 The Batch Input/Output the Machining Program of NC Memory

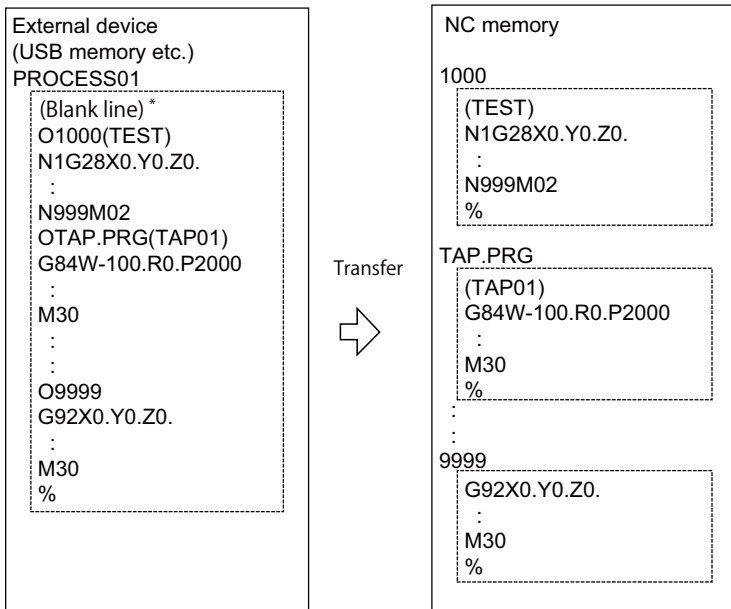


One file which consists of two or more machining program can be transferred to NC memory by dividing the file. The machining programs united with one file can be transferred to the external device.

The targets are the machining programs of the user.

Batch input and verify to NC memory

Example of "the external device -> NC memory" of machining program batch transfer



When the external device is serial, the top line is %.

When the transfer direction file name is designated, the top program name of transfer source can be omitted ("O1000" can be omitted in above example). ("O1000" can be omitted in above example.)

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the transfer source device and directory.
- (3) Designate the file which consists of two or more machining programs.
- (4) Press the menu [Area change] to select file setting column B.
- (5) Designate the transfer direction device (memory).
- (6) Press the menu [Dir] - [Program all].
When the file name is designated, only the top program of transfer source is stored in the designated file.
For example of "Example of "the external device -> NC memory" of machining program batch transfer", when "TEST-CUT" is designated as the transfer direction file name, the top program is transferred as not "1000" but "TESTCUT".
- (7) Press the menu [Transfr A→B].
- (8) Press the [Y] or [INPUT] key.
When the same machining program already exists in transfer direction device, the operation message "Overwrite this file?(Y/N)" appears.
The transferring the following program is continued by selecting [Y] or [N] key.
- (9) Press the menu [Compare A:B].

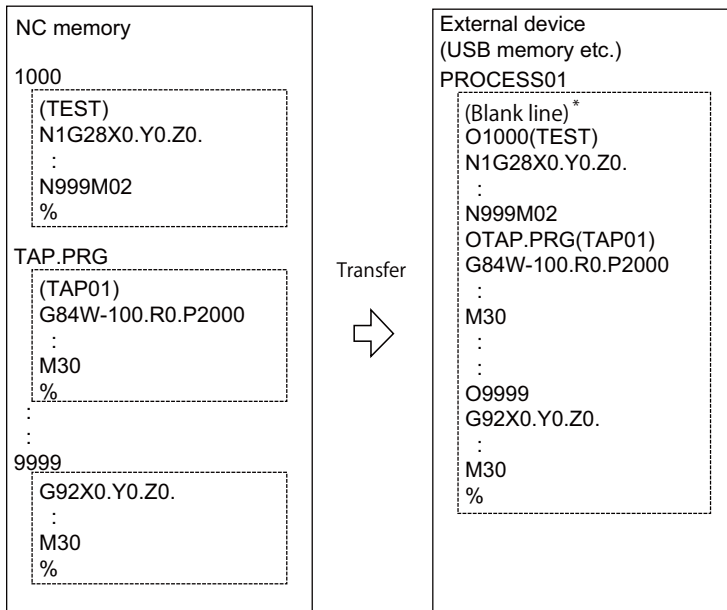
Note

- (1) When programs are input in a batch to NC memory, always specify "Program batch" to NC memory directory as transfer direction. If "Program batch" is not specified, one file is transferred (No batch).
- (2) When the program which is subject to edit lock exists in transfer source, the message "Edit lock B" or "Edit lock C" appears, and transfer is interrupted. When the program which is not subject to edit lock is transferred, delete the program which is subject to edit lock in transfer source. (Refer to "12.8.3 Edit Lock B and C".)
- (3) When the protection of the machining program is valid, the program cannot be transferred/verified. (Refer to "12.8.4 Data Protection Keys".)
- (4) The program during automatic operation, program restart or program checking cannot be overwritten. The operation message "Executing automatic operation", "Program restarting" or "Program checking" appears, and transfer is interrupted.
- (5) If the transfer destination includes the file being edited in the custom screen, the operation message "Can't write into being edited file" appears and the transfer may be interrupted.
- (6) The first line of the transfer source file is ignored.
- (7) When the transfer source is serial, the program is similarly transferred even if direction of following case 1 and case 2 is set.

	Case 1	Case 2
Device name	Memory	Memory
Directory	Program batch	Program
File name	(Null or file designation)	(Null or file designation)

Batch output and verify from NC memory

Example of "NC memory -> the external device" of machining program batch transfer



When the external device is serial, the top line is %.

- (1) Press the menu [Area change] to select file setting column A.
- (2) Designate the transfer source device (memory).
- (3) Press the menu [Dir] - [Program all].
Do not specify the file name. If the name is specified, an error will occur.
- (4) Press the menu [Area change] to select file setting column B.
- (5) Designate the transfer direction device and directory.
- (6) Designate the transfer direction file to input multiple machining programs.
When the file name is not designated, output to the file "ALL.PRG" of the designated directory.
- (7) Press the menu [Transfr A→B].
- (8) Press the [Y] or [INPUT] key.
When the same machining program already exists in transfer direction device, the operation message "Overwrite this file?(Y/N)" appears.
The transferring the following program is continued by selecting [Y] or [N] key.
- (9) Press the menu [Compare A:B].

Note

- (1) When programs are output in a batch from NC memory, always specify "Program batch" to NC memory directory as transfer source. If "Program batch" is not specified, the program is transferred by one program per one file.
- (2) When the programs which are subject to edit lock exists in NC memory, those file is not transferred. (The files are transferred excluding those files.) The verification is executed excluding the programs which are subject to edit lock. (Refer to "12.8.3 Edit Lock B and C".)
- (3) When the protection of the machining program is valid, the program cannot be transferred/verified. (Refer to "12.8.4 Data Protection Keys".)
- (4) When the transfer direction is serial, the program is similarly transferred even if source of following case 1 and case 2 is set.

	Case 1	Case 2
Device name	Memory	Memory
Directory	Program batch	Program
File name	(Null)	* (Wildcard)

Precautions

- (1) When the machining program batch input/output function of NC memory is used, "(" cannot be used for the machining program name. It is recognized that the inside of "(" is a comment.
- (2) The file name of file which consists of two or more machining program can have up to 32 characters, including the extension as well as the machining program.
- (3) When the "Program batch" is designated to NC memory directory, it is not possible to delete, rename and merge files. When the files are deleted in a batch, use "Program" for directory, and a wildcard (*) for file name.
- (4) For other precautions, refer to "12.2 Transferring a File".

12.8.6 Application Error Detection

With the application error detection function, applications using the custom API library are automatically detected from all applications that are operated in the display unit of M800 Series, and the presence and absence of responses are observed at fixed intervals. Applications which give no response and remain unchanged for a period of time are detected as abnormal and the log is saved.

The application error detection function does not particularly display the error message etc. when an error is detected, but it saves information and data log to investigate the cause easily. On the input/output screen, saved log can be transferred to SD card.

If the screen operation is disabled due to an error such as screen lock, turn the NC power OFF, then turn it ON again, and output the log files to an SD card on the input/output screen.

List of the log to be saved

No.	Information	Timing for saving (*1)	What you understand from the information	Narrow the cause by combining the information		
				NC side	PC side	Application side
1	Application name in which the error occurred. ♦Application name ♦Process ID	A	Application name in which the error occurred.	○	○	○
2	The time the error detection function started.	C	The elapsed time from when the NC power is turned ON to the error occurrence.	○	○	○
3	The time error occurred ♦The time error occurred ♦The time of error canceling	A	By comparing with the time of various data, it can search the information on when the error occurred.	○	○	○
4	Connection state between PC and NC (Whether NC is working, and confirming the cable disconnection) ♦Result from confirming the connection state to NC.	A	It can confirm the connection state when the connection error has occurred between PC and NC.	○	○	-
5	History of key and touch screen. ♦The name of application which is active. ♦Key code of the key which is held down. ♦Coordinate which the touch screen is touched.	B	It can confirm the operation when the error has occurred.	-	-	○

(*1) The timing to save the log.

A: When error is detected.

Observation application saves the log when the error has occurred.

B: Constant

It saves the given amount of log constantly.

It keeps saving logs even after the error detection, so presume the time when the error has occurred from the time in the log.

C: When the error detection is started

12.9 Performing Batch Backups of NC Memory Data

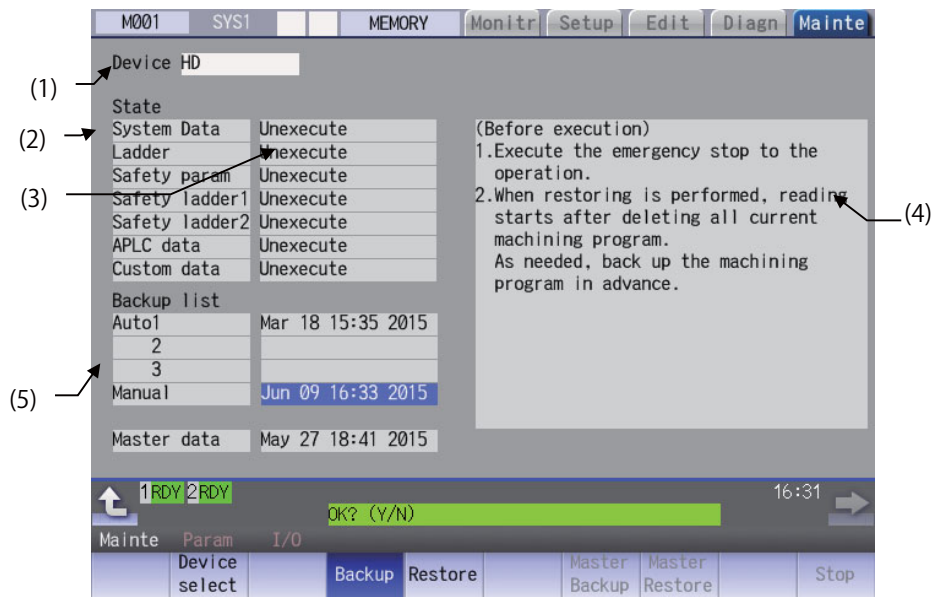


The All backup screen of the maintenance (Mainte) screen is used to perform batch backups of the NC memory data to an external device. Also, the data can be restored from the external device to the NC memory in a batch.

Data backed up by the automatic backup function can also be restored.

Data which has been automatically backed up can be selected only when the device set by the "#8919 Auto backup device" parameter setting is selected.

This operation is protected according to the operation level.



Display Items

Display Items	Description														
(1) Device name	This displays the selected device name.														
(2) Data name	This displays the data name being backed up/restored. The following items are displayed starting from the top. "System Data", "Ladder", "Safety param", "Safety ladder1", "Safety ladder2", "APLC data", "Custom data"														
(3) Execution status	This displays the status being executed. Processing is executed in the "System Data", "Ladder", "Safety param", "Safety ladder1", "Safety ladder2", and "APLC data" order. (*1)														
(4) Warning message	This displays messages at the start and end of backup/restore processing.														
(5) Backup list	This displays the backup date list. This date is the system data time stamp. <table border="1"> <thead> <tr> <th>Backup list</th> <th>Details</th> <th>Backup format</th> </tr> </thead> <tbody> <tr> <td>Auto 1</td> <td rowspan="3">Data that was automatically backed up. Display in the backup date descending order. The latest 3 generations of data are displayed.</td> <td rowspan="3">Auto</td> </tr> <tr> <td>Auto 2</td> </tr> <tr> <td>Auto 3</td> </tr> <tr> <td>Manual</td> <td>Data that was backed up on this screen.</td> <td>Manual</td> </tr> <tr> <td>Master data (internal memory)</td> <td>Data that was backed up on this screen. Generally, this is the factory settings data.</td> <td>Manual</td> </tr> </tbody> </table> <p>The above data can be selected at restore processing. (*2)</p>	Backup list	Details	Backup format	Auto 1	Data that was automatically backed up. Display in the backup date descending order. The latest 3 generations of data are displayed.	Auto	Auto 2	Auto 3	Manual	Data that was backed up on this screen.	Manual	Master data (internal memory)	Data that was backed up on this screen. Generally, this is the factory settings data.	Manual
Backup list	Details	Backup format													
Auto 1	Data that was automatically backed up. Display in the backup date descending order. The latest 3 generations of data are displayed.	Auto													
Auto 2															
Auto 3															
Manual	Data that was backed up on this screen.	Manual													
Master data (internal memory)	Data that was backed up on this screen. Generally, this is the factory settings data.	Manual													

(*1) "APLC data" cannot be backed up/restored if the additional specification "APLC" is disabled.

(*2) The "Auto 1 to 3" data is displayed when the device set by the parameter "#8919 Auto backup device" is selected.

Menus

Menus	Description
Device select	This displays the sub-menu for "Device" selection.
Backup	This executes backup processing.
Restore	This executes restore processing.
Master Backup	This backs up NC data to the built-in memory.
Master Restore	This restores NC data to the built-in memory.
Stop	This stops processing.

Operation method for backup

- (1) Press the menu [Backup].
- (2) Move the cursor to select the area. Press the [INPUT] key.
- (3) Press the [Y] or [INPUT] key.

Operation method for restoring

- (1) Press the menu [Restore].
- (2) Move the cursor to select the file. Press the [INPUT] key.
- (3) Press the [Y] or [INPUT] key.

Daily Maintenance

Some parts will not function in a hardware manner when the life is reached, so these should be replaced before the life is reached.

For details of the inspection and maintenance of the drive section, refer to the instruction manuals for each drive unit.

Class	Name	Life	Inspection/replacement
Daily Maintenance	Touchscreen		When needed (when poor sensitive or dirty)
	Escutcheon (display unit area, keyboard etc.)		Once/two months (Accordingly when dirty)
Periodic Maintenance	Battery (lithium battery)	Cumulative data holding time: 45,000 hrs	When battery voltage drop caution alarm occurs (Guideline: approx. 5 years)

Note

- (1) Replace the battery within one month after the alarm "Z52 Battery fault 0001" appears on the NC screen.
- (2) The internal data may have been damaged if the alarm "Z52 Battery fault 0003" appears.

Touchscreen



CAUTION

Always keep the touchscreen surface clean. When it gets dirty, remove the dirt immediately. Do not perform any operation on the dirty touchscreen.

(1) Cleaning the touchscreen

- When metal powder or sand dust is on the touchscreen, remove it to prevent the scratches.
- Wipe the screen gently with a soft and clean cloth.

(2) Precautions for use

- The touchscreen may become poor sensitive, or even may not react when it gets dirty.
- Operate the touchscreen with fingers. The touchscreen does not react with nails.
- The use of gloves, work gloves, etc. will have effects such as the deterioration of the operation feeling depending on the material and thickness of the gloves.
- The polarizing plate (display surface) of the touchscreen surface can be easily scratched, so be careful during handling.
- Glass is used in the touchscreen. Be careful not to drop the touchscreen or allow it to hit hard objects, as the glass may chip or break.
- The polarizing plate may be stained or discolored if drops of water, etc., adhere to it for long periods, so be sure to wipe off any moisture immediately.
- Wipe off any dirt, dust, etc., on the polarizing plate using absorbent cotton or other soft cloth.
- Electronic parts are used in the touchscreen, so be careful of static electricity when handling.
- Never disassemble the Touchscreen. Doing so will damage the panel.

(3) Precautions for storage

- Do not store the card in locations having a high temperature or humidity. (Store within the storage temperature range.)
- When storing the touchscreen as an individual unit, be sure that other objects do not touch or hit the polarizing plate (display surface).
- When storing the touchscreen for long periods, be sure to store in a dark place away from exposure to direct sunlight or fluorescent light.

Cleaning the escutcheon

- (1) Prepare the rear side of the escutcheon to clean.
- (2) Wipe the escutcheon with a soft, clean, dry cloth. If cleaning is still required, put some neutral detergent on a cloth and wipe. Do not use alcohol, thinner, etc.

Appx.1: List of Function Codes

Function code	Control unit recognition	PARITY V	Screen display	Setting and display unit	In memory	Punch-output	Internal NC system function
		V count		Key-in	Store	ISO	
0 to 9	Yes	Counted	Displayed	Key-in	Stored	0 to 9	Numerical data
A to Z	Yes	Counted	Displayed	Key-in	Stored	A to Z	Addresses
+	Yes	Counted	Displayed	Key-in	Stored	+	Sign, variable operator (+)
-	Yes	Counted	Displayed	Key-in	Stored	-	Sign, variable operator (-)
.	Yes	Counted	Displayed	Key-in	Stored	.	Decimal point
,	Yes	Counted	Displayed	Key-in	Stored	,	
/	Yes	Counted	Displayed	Key-in	Stored	/	Block delete (optional block skip) Variable operator (÷)
%	Yes	Counted	Displayed (%)	No Key-in (automatically inserted)	Stored	%	End of record (tape storage end) Rewind start & stop during tape search
LF/NL	Yes	Counted	Displayed (;)	Key-in ;/EOB	Stored	LF	End of block
(	Yes	Counted	Displayed	Key-in ;/EOB	Stored	(	Control out (comment start)
)	Yes	Counted	Displayed	Key-in ;/EOB	Stored	)	Control in (comment end)
:	Yes	Counted	Displayed	No Key-in	Stored	:	Program number address (instead of O.)
#	Yes	Counted	Displayed	Key-in	Stored	#	Variable number
*	Yes	Counted	Displayed	Key-in	Stored	*	Variable operator (X)
=	Yes	Counted	Displayed	Key-in	Stored	=	Variable definition
[	Yes	Counted	Displayed	Key-in	Stored	[	Variable operator
]	Yes	Counted	Displayed	Key-in	Stored	]	Variable operator
BS	No		Not displayed	No Key-in	Stored		
HT	No		Not displayed	No Key-in	Stored		
SP	No		Not displayed	Key-in	Stored	SP (T-V) Automatic adjustment	
CR	No		Not displayed	No Key-in	Stored		
DEL	No	Not Counted	Not displayed	No Key-in	Not Stored		
NULL	No	Not Counted	Not displayed	No Key-in	Not Stored		
Any other	No	Counted	(*1)	No Key-in	Stored		

(*1) This denotes characters (including blanks) which are stored inside and which correspond to the command codes. "@" is not displayed.

Note

(1) Codes not listed in the above table are stored on tape, but an error will result during operation if they are not comments.

Appx.2: Table of Command Value Ranges

<Table of command values and setting value ranges>

(1) Linear axis: Input increment [mm]

(M system)

Least command increment	0.001	0.0001	0.00001	0.000001
Maximum stroke (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Maximum programmable dimension	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Rapid traverse rate (including dry run)	1 to 1000000 mm/min	1 to 1000000 mm/min	1 to 1000000 mm/min	1 to 1000000 mm/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.001 to 1000000.000 mm/min	0.0001 to 1000000.0000 mm/min	0.00001 to 1000000.00000 mm/min	0.000001 to 1000000.000000 mm/min
Synchronous feed (feed per revolution)	0.001 to 999.999 mm/rev	0.0001 to 999.9999 mm/rev	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Tool compensation amount (Shape)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Tool compensation amount (Wear)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Incremental feed amount	0.001 mm/pulse	0.0001 mm/pulse	0.00001 mm/pulse	0.000001 mm/pulse
Handle feed amount	0.001 mm/pulse	0.0001 mm/pulse	0.00001 mm/pulse	0.000001 mm/pulse
Soft limit range (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Dwell time	0 to 99999.999 s	0 to 99999.9999 s	0 to 99999.99999 s	0 to 99999.999999 s
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse
Thread lead (F)	0.001 to 999.999 mm/rev	0.0001 to 999.9999 mm/rev	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev
Thread lead (precision E)	0.0001 to 999.9999 mm/rev	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev	0.0000001 to 999.9999999 mm/rev
Thread lead (ridges/inch)	0.03 to 999.99	0.026 to 222807.017	0.0255 to 224580.0000	0.02541 to 224719.00000

(2) Linear axis: Input increment [inch]

(M system)

Least command increment	0.0001	0.00001	0.000001	0.0000001
Maximum stroke (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Maximum programmable dimension	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Rapid traverse rate (including dry run)	1 to 100000 inch/min	1 to 100000 inch/min	1 to 100000 inch/min	1 to 100000 inch/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.0001 to 100000.0000 inch/min	0.00001 to 100000.00000 inch/min	0.000001 to 100000.000000 inch/min	0.0000001 to 100000.0000000 inch/min
Synchronous feed (feed per revolution)	0.0001 to 999.9999 inch/rev	0.00001 to 999.99999 inch/rev	0.000001 to 999.999999 inch/rev	0.0000001 to 999.9999999 inch/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Tool compensation amount (Shape)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Tool compensation amount (Wear)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Incremental feed amount	0.0001 inch/pulse	0.00001 inch/pulse	0.000001 inch/pulse	0.0000001 inch/pulse
Handle feed amount	0.0001 inch/pulse	0.00001 inch/pulse	0.000001 inch/pulse	0.0000001 inch/pulse
Soft limit range (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Dwell time	0 to 99999.999 s	0 to 99999.9999 s	0 to 99999.99999 s	0 to 99999.999999 s
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse
Thread lead (F)	0.0001 to 39.3700 inch/rev	0.00001 to 39.37007 inch/rev	0.000001 to 39.370078 inch/rev	0.0000001 to 39.3700787 inch/rev
Thread lead (precision E)	0.00001 to 39.37007 inch/rev	0.000001 to 39.370078 inch/rev	0.0000001 to 39.3700787 inch/rev	0.00000001 to 39.37007873 inch/rev
Thread lead (ridges/inch)	0.025 to 9999.999	0.0255 to 9999.9999	0.02541 to 9999.99999	0.025401 to 9999.999999

(3) Rotary axis: degree [°]

(M system)

Least command increment	0.001	0.0001	0.00001	0.000001
Maximum stroke (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Maximum programmable dimension	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Rapid traverse rate (including dry run)	1 to 1000000 °/min	1 to 1000000 °/min	1 to 1000000 °/min	1 to 1000000 °/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.001 to 1000000.000 °/min	0.0001 to 1000000.0000 °/min	0.00001 to 1000000.00000 °/min	0.000001 to 1000000.000000 °/min
Synchronous feed (feed per revolution)	0.001 to 999.999 °/rev	0.0001 to 999.9999 °/rev	0.00001 to 999.99999 °/rev	0.000001 to 999.999999 °/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Incremental feed amount	0.001 °/pulse	0.0001 °/pulse	0.00001 °/pulse	0.000001 °/pulse
Handle feed amount	0.001 °/pulse	0.0001 °/pulse	0.00001 °/pulse	0.000001 °/pulse
Soft limit range (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse

<Table of command values and setting value ranges>

(1) Linear axis: Input increment [mm]

(L system)

Least command increment	0.001	0.0001	0.00001	0.000001
Maximum stroke (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Maximum programmable dimension	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Rapid traverse rate (including dry run)	1 to 1000000 mm/min	1 to 1000000 mm/min	1 to 1000000 mm/min	1 to 1000000 mm/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.001 to 1000000.000 mm/min	0.0001 to 1000000.0000 mm/min	0.00001 to 1000000.00000 mm/min	0.000001 to 1000000.000000 mm/min
Synchronous feed (feed per revolution)	0.0001 to 999.9999 mm/rev	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev	0.0000001 to 999.9999999 mm/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Tool compensation amount (Shape)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Tool compensation amount (Wear)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Incremental feed amount	0.001 mm/pulse	0.0001 mm/pulse	0.00001 mm/pulse	0.000001 mm/pulse
Handle feed amount	0.001 mm/pulse	0.0001 mm/pulse	0.00001 mm/pulse	0.000001 mm/pulse
Soft limit range (value with machine coordinate system)	±99999.999 mm	±99999.9999 mm	±99999.99999 mm	±99999.999999 mm
Dwell time	0 to 99999.999 s	0 to 99999.9999 s	0 to 99999.99999 s	0 to 99999.999999 s
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse
Thread lead (F)	0.0001 to 999.9999 mm/rev	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev	0.0000001 to 999.9999999 mm/rev
Thread lead (precision E)	0.00001 to 999.99999 mm/rev	0.000001 to 999.999999 mm/rev	0.0000001 to 999.9999999 mm/rev	0.00000001 to 999.99999999 mm/rev
Thread lead (ridges/inch)	0.03 to 999.99	0.026 to 222807.017	0.0255 to 224580.0000	0.02540 to 224719.00000

(2) Linear axis: Input increment [inch]

(L system)

Least command increment	0.0001	0.00001	0.000001	0.0000001
Maximum stroke (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Maximum programmable dimension	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Rapid traverse rate (including dry run)	1 to 100000 inch/min	1 to 100000 inch/min	1 to 100000 inch/min	1 to 100000 inch/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.0001 to 100000.0000 inch/min	0.00001 to 100000.00000 inch/min	0.000001 to 100000.000000 inch/min	0.0000001 to 100000.0000000 inch/min
Synchronous feed (feed per revolution)	0.00001 to 99.99999 inch/rev	0.000001 to 99.999999 inch/rev	0.0000001 to 99.9999999 inch/rev	0.00000001 to 99.99999999 inch/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Tool compensation amount (Shape)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Tool compensation amount (Wear)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Incremental feed amount	0.0001 inch/pulse	0.00001 inch/pulse	0.000001 inch/pulse	0.0000001 inch/pulse
Handle feed amount	0.0001 inch/pulse	0.00001 inch/pulse	0.000001 inch/pulse	0.0000001 inch/pulse
Soft limit range (value with machine coordinate system)	±9999.9999 inch	±9999.99999 inch	±9999.999999 inch	±9999.9999999 inch
Dwell time	0 to 99999.999 s	0 to 99999.9999 s	0 to 99999.99999 s	0 to 99999.999999 s
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse
Thread lead (F)	0.00001 to 39.37007inch/rev	0.000001 to 39.370078inch/rev	0.0000001 to 39.3700787inch/rev	0.00000001 to 39.37007873inch/rev
Thread lead(precision E)	0.000001 to 39.370078 inch/rev	0.0000001 to 39.3700787 inch/rev	0.00000001 to 39.37007873 inch/rev	0.000000001 to 39.370078736 inch/rev
Thread lead (ridges/ inch)	0.025 to 9999.999	0.0254 to 9999.9999	0.02540 to 9999.99999	0.025400 to 9999.999999

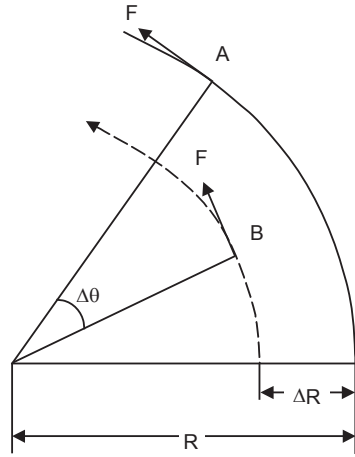
(3) Rotary axis: degree [°]

(L system)

Least command increment	0.001	0.0001	0.00001	0.000001
Maximum stroke (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Maximum programmable dimension	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Rapid traverse rate (including dry run)	1 to 1000000 °/min	1 to 1000000 °/min	1 to 1000000 °/min	1 to 1000000 °/min
Cutting feed rate (including dry run) Asynchronous feed (feed per minute)	0.001 to 1000000.000 °/min	0.0001 to 1000000.0000 °/min	0.00001 to 1000000.00000 °/min	0.000001 to 1000000.000000 °/min
Synchronous feed (feed per revolution)	0.0001 to 999.9999 °/rev	0.00001 to 999.99999 °/rev	0.000001 to 999.999999 °/rev	0.0000001 to 999.9999999 °/rev
2nd to 4th reference position compensation (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Incremental feed amount	0.001 °/pulse	0.0001 °/pulse	0.00001 °/pulse	0.000001 °/pulse
Handle feed amount	0.001 °/pulse	0.0001 °/pulse	0.00001 °/pulse	0.000001 °/pulse
Soft limit range (value with machine coordinate system)	±99999.999 °	±99999.9999 °	±99999.99999 °	±99999.999999 °
Backlash compensation amount	±9999999 pulse	±9999999 pulse	±9999999 pulse	±9999999 pulse
Pitch error compensation amount	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse	-32768 to 32767 pulse

Appx.3: Circular Cutting Radius Error

When circular cutting is performed, an error is caused between the command coordinate and the tracking coordinate due to the tracking delay in the smoothing circuit and servo system, and the workpiece ends up with a radius smaller than the commanded value. The method for obtaining this error (radius error) is shown below.



- A : Command coordinate
- B : Tracking coordinate
- R : Command radius (mm)
- ΔR : Radius error (mm)
- Δθ : Angle error (rad)
- F : Cutting feed rate (m/min)

The radius error ΔR and angle error Δθ are calculated from the following formula.

Exponential acceleration/deceleration	$\Delta R = \frac{1}{R} \cdot \left(\frac{1}{2} T_s^2 + \frac{1}{2} T_p^2 \right) \cdot \left(\frac{F \times 10^3}{60} \right)^2 \text{ (mm)}$
Linear acceleration/deceleration	$\Delta R = \frac{1}{R} \cdot \left(\frac{1}{24} T_s^2 + \frac{1}{2} T_p^2 \right) \cdot \left(\frac{F \times 10^3}{60} \right)^2 \text{ (mm)}$

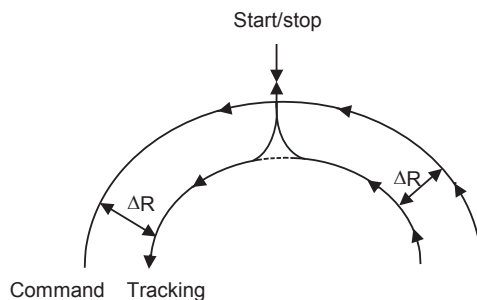
$$\Delta \theta = \tan^{-1} \left(T_s \cdot \frac{F}{R} \right) + \tan^{-1} \left(T_p \cdot \frac{F}{R} \right) \text{ (rad)}$$

Ts: Time constant (s) of specified smoothing circuit

Tp: Position loop time constant

Note

- (1) When the ΔR radius error applying with circular cutting does not come within the allowable value, proceed to reduce the cutting feed rate F, set Ts to a lower value or review the program.
- (2) In the steady state, ΔR is constant. However, it is not constant with command start and stop transitions. Under command start and stop conditions, therefore, the tracking coordinate should be as shown in the figure below.



Appx.4: RS-232C I/O Device Parameter Setting Examples

Parameter setting examples	Cable connection					Follows communication protocol. (NC side) 2:SD 3:RD 4:RS 5:CS 6:DR 20:ER 7:GND
	Parameter setting examples					
	NC I/O	NC I/O	NC I/O	NC I/O	NC I/O	
	1 — 1 2 × 2 3 × 3 4 × 4 5 × 5 6 × 6 20 × 20 7 — 7	1 — 1 2 × 2 3 × 3 14 × 14 5 × 5 6 × 6 20 × 20 7 — 7	1 — 1 2 × 2 3 × 3 4 4 5 8 6] 20] 8] 7 — 7	1 — 1 2 × 2 3 × 3 4] 4 5] 5 6] 6 20] 20 8] 8 7 — 7	1 — 1 2 × 2 3 × 3 4 × 4 5 × 5 6] 6 20] 20 8] 8 7 — 7	
Device name						Follows communication software.
BAUD RATE	2	2	2	2	2	
STOP BIT	3	3	3	3	3	
PARITY EFFECTIVE	0	0	0	0	0	
EVEN PARITY	0	0	0	0	0	
CHR. LENGTH	3	3	3	3	3	
HAND SHAKE	3	2	3	3	3	
DC CODE PARITY	1	0	1	1	1	
DC2/DC4 OUTPUT	0	0	1	0	1	
CR OUTPUT	0	0/1	0	0	0	
FEED CHR.	0	0	0	0	0	
PARITY V	0	0	0	0/1	0/1	
TIME-OUT SET	100	100	100	100	100	

Appx.5: Other Functions for Reference

18.1 Computer Link B

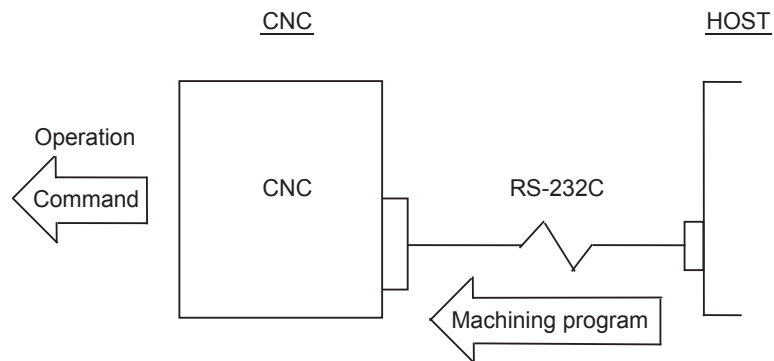
Computer link B is a function to receive/send data between the HOST computer (hereafter "HOST") and CNC.

This function sends transmission control character [DC1] to the host computer at the CNC cycle start, and it enables operation to be performed while the machining programs are received from the HOST.

The computer link has a reception buffer so that operation will be less susceptible to the effects of the data transfer status at the HOST end.

The additional specification of the high-speed machining mode is required for high-speed fine-segment machining.

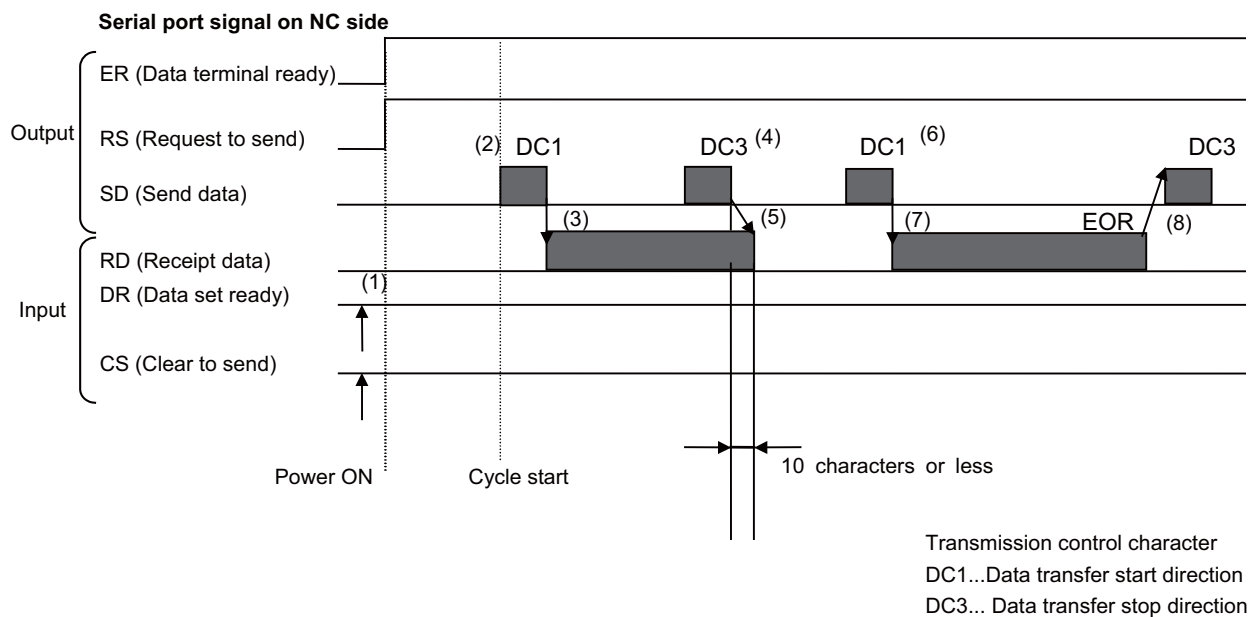
This function cannot be operated in the 2nd and following part systems.



Communication method

The communication is carried out by the following flows.

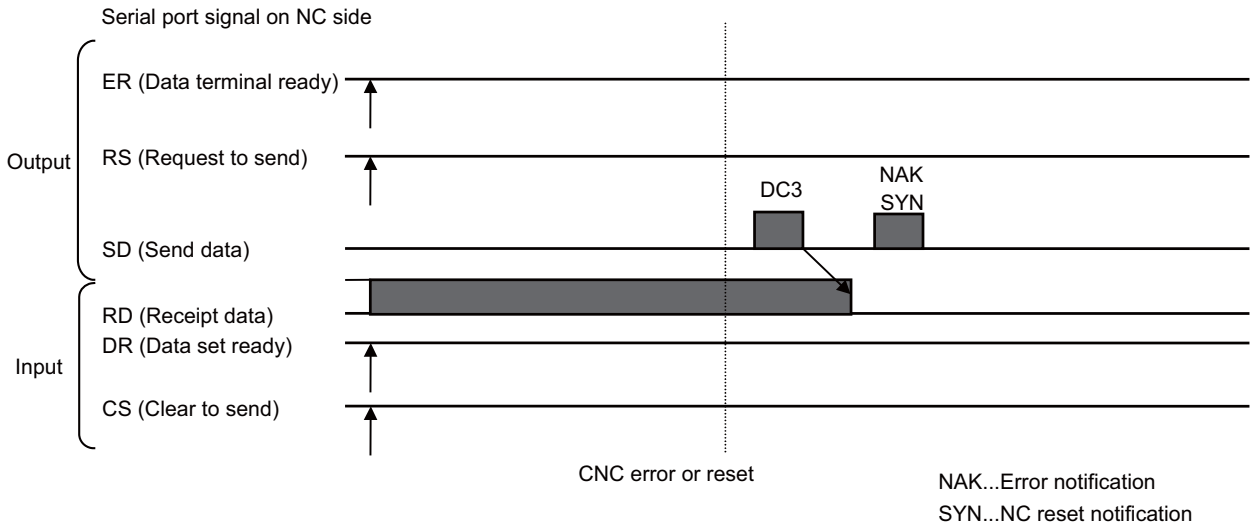
- (1) Computer link B checks whether ER (DR of CNC) signal of HOST is turning ON.
 (When the check result is OFF, the alarm "L01 Host ER signal OFF" appears.)
- (2) Computer link B sends [DC1] according to NC cycle start.
- (3) HOST starts the data transmission to computer link B after [DC1] was received.
- (4) When the receive buffer is full, computer link B sends [DC3] to HOST.
- (5) HOST stops the data transmission ten characters or less after [DC3] was received.
- (6) After the buffer process ends, Computer link B sends [DC1] to HOST again.
- (7) After receiving [DC1], HOST sends the continuation of the previous data.
- (8) Computer link B executes the end processing by the data reading completion (received EOR).
 (When the parameter "#9615 CTRL. CODE OUT" (bit3:DC3 output) is set to "1", [DC3] is sent to HOST when the communication ends.)



- ♦Computer link B always carries out the request to send (RS) to HOST.
- ♦After [DC1] is sent to HOST, computer link B ignores all receive data until the first EOB code is received, and buffering is executed from the data after EOB. The data reception is ended by EOR code reception.
- ♦When the PC side serial port is used, the serial port opening of computer link B is executed at cycle start. When the operation ends, the port is closed.

Operation when error occurring and resetting

When the error occurs in CNC (program error and communication error) or when the reset is pressed, computer link B sends [DC3] to HOST.
 When the parameter "#9615 CTRL. CODE OUT" (bit0:NAK output) is set to "1", [NAK] is sent to HOST after [DC3] is output.)
 When the parameter "#9615 CTRL. CODE OUT" (bit1:SYN output) is set to "1", [SYN] is sent to HOST.



PARITY V

When the parameter "#9610 LINK PARAM. 2" (bit3:Parity V) is set to "1", checking of parity V is executed. As a result, if there is a character omission in the machining program from the host computer at the BTR operation, the program error and the computer link error are displayed and the operation stops.

18.2 Manual Synchronous Tapping

After a synchronous tap cycle is stopped with block stop or feed hold stop, this function carries out tapping by selecting and moving the drilling axis with manual handle operation.

Command format

This function is commanded with the same format as for synchronous tapping.

Operation procedures

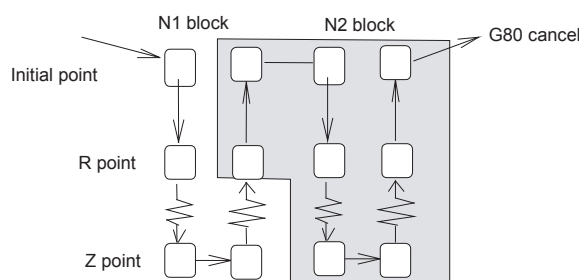
The procedures for manual synchronous tapping are described below.

- (1) When using the multiple spindle specifications, select the command spindle.
- (2) Stop the spindle and servo axis, and select the automatic operation mode.
- (3) Execute the synchronous tapping cycle program.
- (4) Apply block stop or feed hold stop.
- (5) Change to the handle mode. Select and move the drilling axis.
- (6) To cancel manual synchronous tapping, execute G80 in the same manner as the normal synchronous tap mode, or reset the program.

Precautions

- (1) When selecting the axis for the handle mode, select the same axis as that commanded in the program.
- (2) After executing the program with automatic operation, do not reset the program until manual synchronous tapping is completed. The manual synchronous tapping mode will be canceled even if reset is applied in the handle mode.
- (3) During manual synchronous tapping, the acceleration/deceleration time constant is the same as normal handle operation. The return override is also invalid.
- (4) When using the multiple spindle specifications, changes to the commanded spindle selection will be validated after G80; is executed or reset is input to cancel synchronous tapping, and then manual synchronous tapping is started.
- (5) The spindle rotation speed during manual synchronous tapping is not clamped by the program's S command or parameter "#3013 stap1" to "#3016 stap4" (tap rotation speed).
- (6) Manual synchronous tapping is valid from the point that synchronous tapping and cutting is carried out once during automatic operation, and block stop is applied.

```
<Machining program>
N1 G84 Xx Yy Zz Rr Ff Ss ;
N2 Xx Yy ;
N3 G80 M02 ;
```



Manual synchronous tapping is valid in the shaded area.

Note

- (1) To validate manual synchronous tapping without carrying out cutting, run the following type of program with no movement commands.
G91 G84 X0 Y0 Z0 R0 F2. S1000;

Revision History

Date of revision	Manual No.	Revision details
May. 2015	IB(NA)1501274-A	First edition created.
Nov. 2015	IB(NA)1501274-B	<p>Added or modified the following contents to the A4 version of the system software.</p> <p>Added the following chapters:</p> <ul style="list-style-type: none"> - 2.4.8 Changing the Screen Theme Color - 2.8 Changing the Operation Level (Protect Setting Screen) - 2.10.3 Operating the Screen by Touch Gestures - 2.12 Assigning Arbitrary Character String to User-defined Key - 3.8 Editing a Multi-part System Program - 9.2.1.6 Switching the Coordinate System Direction of a Workpiece Graphic - 9.9 Thread Recutting Function <p>Moved the following chapters:</p> <ul style="list-style-type: none"> - 3.8.2 Special Program Editing Display for Synchronization between Part Systems - 6.9 Setting Workpiece Coordinate System Shift <p>Added description to the following chapters:</p> <ul style="list-style-type: none"> - 1 Outline of Menu Items - 2.1 Display Unit and Keyboard Unit - 2.4.7 Menus - 5.3 Transferring a File - 6.9 Setting Workpiece Coordinate System Shift - 7.2 Selecting High-accuracy Control Parameters (Machining Cond I Screen) - 9.2.1 Selecting where to register a Machining Surface (Machining Surface List Screen) - 10.4 Restart Search - 11.1.1 Alarm History - 11.2.1 System Configuration Screen - 11.2.3 Display Items for the Servo Axis Unit (Drive Monitor Screen) - 11.2.4 Display Items for the Spindle Unit (Drive Monitor Screen) - 11.2.5 Display Items for the Power Supply Unit (Drive Monitor Screen) - 11.3.3 Collecting the Data on the Diagnosis Data Collection Setting Screen <p>Deleted the following chapters:</p> <ul style="list-style-type: none"> - 3.4.3 Standard Fixed Cycle Subprogram (For L system) - 3.4.4 Standard Fixed Cycle Subprogram (For M system) <p>Refer to the "Programming Manual" for details on the fixed cycle program.</p> <p>Also, corrected wrong indications.</p>
Mar. 2016	IB(NA)1501274-C	<p>Added or modified the following contents to the B2 version of the system software.</p> <p>Added the following chapters:</p> <ul style="list-style-type: none"> - 2.4 Home Screen - 3.8 Inserting Cycle Interactively - 4.3.9 Checking a Machining Program between Part Systems - 12.7.4 ALL PRM Input <p>Moved the following chapters:</p> <ul style="list-style-type: none"> - 2.3 Standard Screen - 2.5 19-type Vertical Display Unit and Home Applications <p>Also, corrected wrong indications.</p>

Date of revision	Manual No.	Revision details
Oct. 2016	IB(NA)1501274-D	<p>Added or modified the following contents in response to the C1 version of the system software.</p> <p>Added the following chapters:</p> <ul style="list-style-type: none"> - 2.4.4 Operating Applications - 7.1.4 Undoing the Parameter Change <p>Deleted the following chapters:</p> <ul style="list-style-type: none"> - 13.2 Periodic Maintenance <p>Also, corrected wrong indications.</p>

M800/M80/C80 Series Manual List

These contents are described in the presupposition that all functions of M800/M80/C80 Series are available. Some functions or screens may not be available depending on the machine or specifications set by MTB. (Confirm the specifications before use.)

The manuals issued by MTB take precedence over these manuals.

Manual	IB No.	Purpose and Contents
M800/M80 Series Instruction Manual	IB-1501274	- Operation guide for NC - Explanation for screen operation, etc.
C80 Series Instruction Manual	IB-1501453	- Operation guide for NC - Explanation for screen operation, etc.
M800/M80/C80 Series Programming Manual (Lathe System) (1/2)	IB-1501275	- G code programming for lathe system - Basic functions, etc.
M800/M80/C80 Series Programming Manual (Lathe System) (2/2)	IB-1501276	- G code programming for lathe system - Functions for multi-part system, high-accuracy function, etc.
M800/M80/C80 Series Programming Manual (Machining Center System) (1/2)	IB-1501277	- G code programming for machining center system - Basic functions, etc.
M800/M80/C80 Series Programming Manual (Machining Center System) (2/2)	IB-1501278	- G code programming for machining center system - Functions for multi-part system, high-accuracy function, etc.
M800/M80/C80 Series Alarm/Parameter Manual	IB-1501279	- Alarms - Parameters

Manuals for MTBs (NC)

Manual	IB No.	Purpose and Contents
M800/M80/C80 Series Specifications Manual	IB-1501267	- Model selection - Specifications of hardware unit - Outline of various functions
M800W/M80W Series Connection and Setup Manual	IB-1501268	- Detailed specifications of hardware unit - Installation, connection, wiring, setup (startup/adjustment)
M800S/M80 Series Connection and Setup Manual	IB-1501269	- Detailed specifications of hardware unit - Installation, connection, wiring, setup (startup/adjustment)
C80 Series Connection and Setup Manual	IB-1501452	- Detailed specifications of hardware unit - Installation, connection, wiring, setup (startup/adjustment)
M800/M80 Series PLC Development Manual	IB-1501270	- Electrical design - I/O relation (assignment, setting, connection), field network - Development environment (PLC on-board, peripheral development environment), etc.
M800/M80 Series PLC Programming Manual	IB-1501271	- Electrical design - Sequence programming - PLC support functions, etc.
M800/M80/C80 Series PLC Interface Manual	IB-1501272	- Electrical design - Interface signals between NC and PLC
M800/M80 Series Maintenance Manual	IB-1501273	- Cleaning and replacement for each unit - Other items related to maintenance
C80 Series Maintenance Manual	IB-1501454	- Cleaning and replacement for each unit - Other items related to maintenance

Manuals for MTBs (drive section)

Manual	IB No.	Contents
MDS-E/EH Series Specifications Manual	IB-1501226	- Specifications for power supply regeneration type
MDS-E/EH Series Instruction Manual	IB-1501229	- Instruction for power supply regeneration type
MDS-EJ/EJH Series Specifications Manual	IB-1501232	- Specifications for regenerative resistor type
MDS-EJ/EJH Series Instruction Manual	IB-1501235	- Instruction for regenerative resistor type
MDS-EM/EMH Series Specifications Manual	IB-1501238	- Specifications for multi-hybrid, power supply regeneration type
MDS-EM/EMH Series Instruction Manual	IB-1501241	- Instruction for multi-hybrid, power supply regeneration type
DATA BOOK	IB-1501252	- Specifications of servo drive unit, spindle drive unit, motor, etc.

Global Service Network

AMERICA

MITSUBISHI ELECTRIC AUTOMATION INC. (AMERICA FA CENTER)

Central Region Service Center (Chicago)

500 CORPORATE WOODS PARKWAY, VERNON HILLS, ILLINOIS 60061, U.S.A.

TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Minneapolis, MN Service Satellite

Detroit, MI Service Satellite

Grand Rapids, MI Service Satellite

Lima, OH Service Satellite

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1845 SATELLITE BOULEVARD STE. 450, DULUTH, GEORGIA 30097, U.S.A.

TEL: +1-678-258-4529 / FAX: +1-678-258-4519

Charleston, SC Service Satellite

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5900-B KATELLA AVE. - 5900-A KATELLA AVE. CYPRESS, CALIFORNIA 90630, U.S.A.

TEL: +1-714-699-2625 / FAX: +1-847-478-2650

San Francisco, CA Service Satellite

Seattle, WA Service Satellite

Canada Region Service Center (Toronto)

4299 14TH AVENUE MARKHAM, ONTARIO L3R 0J2, CANADA

TEL: +1-905-754-3805 / FAX: +1-905-475-7935

Edmonton, AB Service Satellite

Montreal, QC Service Satellite

Mexico Region Service Center (Querétaro)

Parque Tecnológico Innovación Querétaro, Lateral Carretera Estatal 431, Km 2+200, Lote 91 Modulos 1 y 2

Hacienda la Machorra, CP 76246, El Marqués, Querétaro, México

TEL: +52-442-153 4250

Monterrey, NL Service Satellite

Mexico City, DF Service Satellite

BRAZIL

MELCO CNC do Brasil Comércio e Serviços Ltda.

Brazil Region Service Center

AV. GISELE CONSTANTINO, 1578. PARQUE BELA VISTA, VOTORANTIM-SP, BRAZIL. CEP: 18.110-650

TEL: +55-15-3023-9000

JOVIMAQ - Joinville, SC Service Satellite

MAQSERVICE - Canoas, RS Service Satellite

EUROPE

MITSUBISHI ELECTRIC EUROPE B.V.

European Service Headquarter (Dusseldorf, GERMANY)

Mitsubishi-Electric-Platz 1 40882 RATINGEN, GERMANY

TEL: +49-2102-486-1850 / FAX: +49-2102-486-5910

South Germany Service Center (Stuttgart)

KURZE STRASSE, 40, 70794 FILDERSTADT-BONLANDEN, GERMANY

TEL: +49-711-770598-123 / FAX: +49-711-770598-141

France Service Center (Paris)

25, BOULEVARD DES BOUVETS, 92741 NANTERRE CEDEX FRANCE

TEL: +33-1-41-02-83-13 / FAX: +33-1-49-01-07-25

France Service Satellite (Lyon)

120, ALLEE JACQUES MONOD 69800 SAINT PRIEST FRANCE

TEL: +33-1-41-02-83-13 / FAX: +33-1-49-01-07-25

Italy Service Center (Milan)

VIALE COLLEONI, 7 - CENTRO DIREZIONALE COLLEONI PALAZZO SIRIO INGRESSO 1,

20864 AGRATE BRIANZA (MB), ITALY

TEL: +39-039-6053-342 / FAX: +39-039-6053-206

Italy Service Satellite (Padova)

VIA G. SAVELLI, 24 - 35129 PADOVA, ITALY

TEL: +39-039-6053-342 / FAX: +39-039-6053-206

U.K. Service Center

TRAVELLERS LANE, HATFIELD, HERTFORDSHIRE, AL10 8XB, U.K.

TEL: +49-2102-486-1850 / FAX: +49-2102-486-5910

Spain Service Center

CTRA. DE RUBI, 76-80-APDO. 420, 08173 SAINT CUGAT DEL VALLES, BARCELONA SPAIN

TEL: +34-935-65-2236 / FAX: +34-935-89-1579

Poland Service Center

UL.KRAKOWSKA 50, 32-083 BALICE, POLAND

TEL: +48-12-347-6500 / FAX: +48-12-630-4701

Hungary Service Center

MADARASZ VIKTOR 47-49, BUDAPEST XIII, HUNGARY

TEL: +48-12-347-6500 / FAX: +48-12-630-4701

MITSUBISHI ELECTRIC TURKEY A.Ş

Turkey Service Center

SERIFALI MAHALLESİ NUTUK SOKAK. NO.5 34775

UMRANIYE, ISTANBUL, TURKEY

TEL: +90-216-526-3990 / FAX: +90-216-526-3995

Czech Republic Service Center

AutoCont Control Systems s.r.o (Service Partner)

KAFKOVA 1853/3, 702 00 OSTRAVA 2, CZECH REPUBLIC

TEL: +420-59-5691-185 / FAX: +420-59-5691-199

Russia Service Center

NC-TECH (Service Partner)

213, B.NOVODMITROVSKAYA STR., 14/2, 127015 MOSCOW, RUSSIA

TEL: +7-495-748-0191 / FAX: +7-495-748-0192

Sweden Service Center

HAMMARBACKEN 14, P.O.BOX 750 SE-19127, SOLLENTUNA, SWEDEN

TEL: +46-8-6251000 / FAX: +46-8-966877

Bulgaria Service Center

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4 ANDREJ LJAPCHEV BLVD. POB 21, BG-1756 SOFIA, BULGARIA

TEL: +359-2-8176009 / FAX: +359-2-9744061

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CSC Automation Ltd. (Service Partner)

APTEKARSKIY PEREULOK 9-A, OFFICE 3, 61001 KHARKOV, UKRAINE

TEL: +380-57-732-7774 / FAX: +380-57-731-8721

Belarus Service Center

TECHNIKON Ltd. (Service Partner)

NEZAVISIMOSTI PR.177, 220125 MINSK, BELARUS

TEL: +375-17-393-1177 / FAX: +375-17-393-0081

South Africa Service Center

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TEL: +27-11-394-8512 / FAX: +27-11-394-8513

ASEAN**MITSUBISHI ELECTRIC ASIA PTE. LTD. (ASEAN FA CENTER)**

Singapore Service Center
307 ALEXANDRA ROAD #05-01/02 MITSUBISHI ELECTRIC BUILDING SINGAPORE 159943
TEL: +65-6473-2308 / FAX: +65-6476-7439

Philippines Service Center

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SOUTH SUPERHIGHWAY, ALABAMG MUNTINLUPA METRO MANILA, PHILIPPINES 1771
TEL: +63-2-807-2416 / FAX: +63-2-807-2417

VIETNAM**MITSUBISHI ELECTRIC VIETNAM CO.,LTD**

Vietnam Ho Chi Minh Service Center
UNIT 01-04, 10TH FLOOR, VINCOM CENTER 72 LE THANH TON STREET, DISTRICT 1,
HO CHI MINH CITY, VIETNAM
TEL: +84-8-3910 5945 / FAX: +84-8-3910 5946

Vietnam Hanoi Service Center

6TH FLOOR, DETECH TOWER, 8 TON THAT THUYET STREET, MY DINH 2 WARD,
NAM TU LIEM DISTRICT, HA NOI CITY, VIETNAM
TEL: +84-4-3937-8075 / FAX: +84-4-3937-8076

INDONESIA**PT. MITSUBISHI ELECTRIC INDONESIA**

Indonesia Service Center (Cikarang)
JL. KENARI RAYA BLOK G2-07A, DELTA SILICON 5, LIPPO CIKARANG - BEKASI 17550, INDONESIA
TEL: +62-21-2961-7797 / FAX: +62-21-2961-7794

MALAYSIA**MITSUBISHI ELECTRIC SALES MALAYSIA SDN. BHD.**

Malaysia Service Center (Kuala Lumpur Service Center)
LOT 11, JALAN 219, P. O BOX 1036, 46800 PETALING JAYA, SELANGOR DARUL EHSAN. MALAYSIA
TEL: +60-3-7960-2628 / FAX: +60-3-7960-2629
Johor Bahru Service satellite

THAILAND**MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO.,LTD**

Thailand Service Center
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KWAENG BANGPONGPANG, KHET YANNAWA, BANGKOK 10120,THAILAND
TEL: +66-2-682-6522 / FAX: +66-2-682-6020

INDIA**MITSUBISHI ELECTRIC INDIA PVT., LTD.**

CNC Technical Center (Bangalore)
PLOT NO. 56, 4TH MAIN ROAD, PEENYA PHASE 3,
PEENYA INDUSTRIAL AREA, BANGALORE 560058, KARNATAKA, INDIA
TEL : +91-80-4655-2121 FAX : +91-80-4655-2147
Chennai Service Satellite
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DLF PHASE-III, GURGAON- 122 002, HARYANA, INDIA
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Ludhiana Satellite
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EMERALD HOUSE, EL-3, J BLOCK, M.I.D.C., BHOSARI, PUNE - 411026, MAHARASHTRA, INDIA
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Kolhapur Service Satellite
Aurangabad Service Satellite
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PRAHALADNAGAR SATELLITE, AHMEDABAD – 380015, GUJRAT, INDIA
TEL : +91-265-2314699
Rajkot Service Satellite

CHINA**MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. (CHINA FA CENTER)**

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1-3,5-10,18-23/F, NO.1386 HONG QIAO ROAD, CHANG NING QU,
SHANGHAI 200336, CHINA
TEL: +86-21-2322-3030 / FAX: +86-21-2322-3000*8422

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China Wuxi Service Partner
China Jinan Service Partner
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China Beijing Service Center

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DONGCHENG DISTRICT, BEIJING 100005, CHINA
TEL: +86-10-6518-8830 / FAX: +86-10-6518-8030
China Beijing Service Partner

China Tianjin Service Center

UNIT 2003, TIANJIN CITY TOWER, NO 35 YOUYI ROAD, HEXI DISTRICT,
TIANJIN 300061, CHINA
TEL: +86-22-2813-1015 / FAX: +86-22-2813-1017

China Chengdu Service Center

1501-1503,15F, GUANG-HUA CENTRE BUILDING-C,NO.98 NORTH GUANG HUA 3th RD,
CHENGDU,610000,CHINA
TEL: +86-28-8446-8030 / FAX: +86-28-8446-8630

China Shenzhen Service Center

ROOM 2512-2516, 25/F., GREAT CHINA INTERNATIONAL EXCHANGE SQUARE, JINTIAN RD.S.,
FUTIAN DISTRICT, SHENZHEN 518034, CHINA
TEL: +86-755-2399-8272 / FAX: +86-755-8229-3686

China Xiamen Service Partner
China DongGuang Service Partner

China Dalian Service Center

DONGBEI 3-5, DALIAN ECONOMIC & TECHNICAL DEVELOPMENTZONE, LIAONING PROVINCE,
116600, CHINA
TEL: +86-411-8765-5951 / FAX: +86-411-8765-5952

KOREA**MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. (KOREA FA CENTER)**

Korea Service Center
8F GANGSEO HANGANG XI-TOWER A, 401 YANGCHEON-RO, GANGSEO-GU,
SEOUL 07528 KOREA
TEL: +82-2-3660-9609 / FAX: +82-2-3664-8668
Korea Daegu Service Satellite

TAIWAN**MITSUBISHI ELECTRIC TAIWAN CO., LTD. (TAIWAN FA CENTER)**

Taiwan Taichung Service Center
NO.8-1, INDUSTRIAL 16TH RD., TAICHUNG INDUSTRIAL PARK, SITUN DIST.,
TAICHUNG CITY 40768, TAIWAN
TEL: +886-4-2359-0688 / FAX: +886-4-2359-0689

Taiwan Taipei Service Center

10F, NO.88, SEC.6, CHUNG-SHAN N. RD., SHI LIN DIST., TAIPEI CITY 11155, TAIWAN
TEL: +886-2-2833-5430 / FAX: +886-2-2833-5433

Taiwan Tainan Service Center

11F-1., NO.30, ZHONGZHENG S. ROAD, YONGKANG DISTRICT, TAINAN CITY 71067, TAIWAN
TEL: +886-6-252-5030 / FAX: +886-6-252-5031

OCEANIA**MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD.**

Oceania Service Center
348 VICTORIA ROAD, RYDALMERE, N.S.W. 2116 AUSTRALIA
TEL: +61-2-9684-7269/ FAX: +61-2-9684-7245

Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible.

Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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HEAD OFFICE : TOKYO BLDG.,2-7-3 MARUNOUCHI,CHIYODA-KU,TOKYO 100-8310,JAPAN

MODEL	M800/M80 Series
MODEL CODE	100-439
Manual No.	IB-1501274