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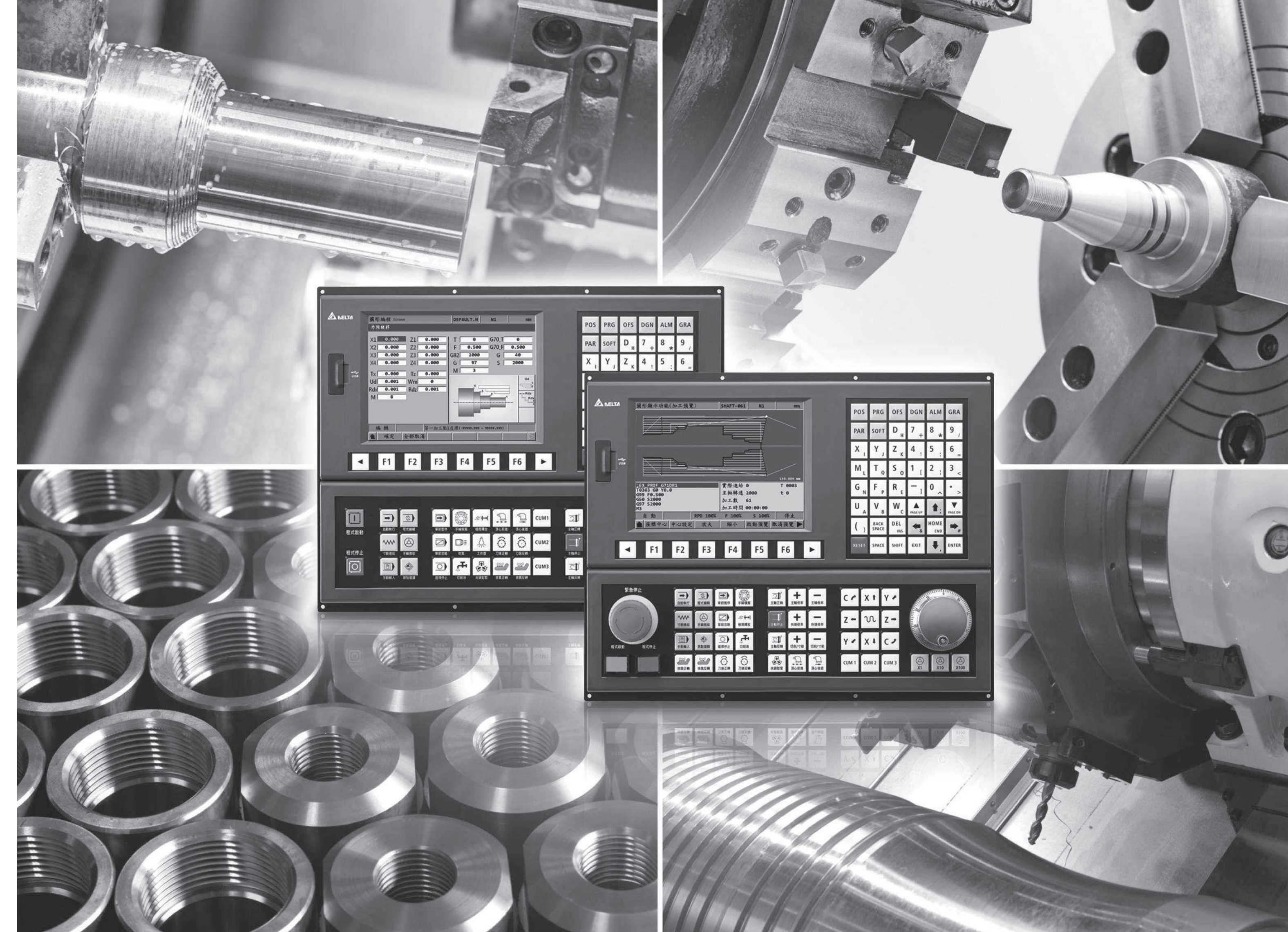
*We reserve the right to change the information in this manual without prior notice.

DELTA_IA-CNC_Lathe application_OM_MM_EN_20221228

Delta CNC Lathe Machine Solution Operation and Maintenance Manual



Delta CNC Lathe Machine Solution Operation and Maintenance Manual

www.deltaww.com

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Preface

Thank you for purchasing this product. Read this manual carefully before using the product to ensure the correct use of the product. Keep this manual handy for quick reference whenever needed.

This manual includes:

- Installation and inspection of NC controllers
- Wiring for connectors of the NC controllers
- Description of the function and operation of NC controllers
- Description of parameters
- Troubleshooting

NC controller product features:

- Built-in 32-bit high-speed dual CPU for multi-task execution, improving operating performance
- User-friendly human machine interface
- Interfaces for auto tuning and gain adjustment of the servo, meeting different machine characteristics
- CNCSoft software for configuring user-defined screens
- Front USB interface (port) for easy data access, data backup, and parameter file copying
- In Spindle mode, you can control the spindle system with DMCNET communication or analog voltage according to the requirements
- Serial I/O modules for flexible I/O configuration

How to use this manual:

Use this manual as a reference when installing, setting up, using, and maintaining the NC controller. Read this manual before using and setting this product.

Delta technical services:

Consult your Delta equipment distributors or Delta Customer Service Center if you encounter any problem.

Safety Precautions

- Refer to the pin assignments when wiring. Ensure the product is properly grounded.
- Do not disassemble the controller, change the wiring, or touch the power supply when the power is on to avoid electric shock.

Pay special attention to the following safety precautions at all times during installation, wiring, operation, maintenance, and examination of the controller.

The symbols of “DANGER”, “WARNING” and “STOP” indicate:

Danger. May cause severe or fatal injuries to personnel if the instructions are not followed.

Warning. May cause moderate injury to personnel, or lead to severe damage or even malfunction of the product if the instructions are not followed.

Absolute prohibited activities. May cause serious damage or even malfunction of the product if the instructions are not followed.

Installation

- Follow the installation instructions in the manual, or it may result in damage to the equipment.
- Do not expose the product to an environment containing vapor, corrosive gas, inflammable gas, or other foreign matter to reduce the risk of electric shock or fire.

Wiring

- Connect the ground terminal to class-3 ground system. Ground resistance should not exceed 100 Ω. Improper grounding may result in electric shock or fire.

Operation

- Correctly plan the I/O configuration with the MLC editor software, or abnormal operation may occur.
- Before operating the machine, properly adjust the parameter settings, otherwise it may cause abnormal operation or malfunction.
- Ensure you can activate the emergency stop at any time, and avoid operating the machine in unprotected condition.

- Do not change the wiring when the power is on, or it may lead to personal injury caused by electric shock.
- Do not use a sharp-pointed object to touch the panel. Doing this may dent the screen and lead to malfunction of the controller.

Maintenance and Inspection

- When the power is on, do not disassemble the controller panel or touch the internal parts of the controller, or it may cause electric shock.
- Do not touch the wiring terminal within 10 minutes after turning off the power since the residual voltage may cause electric shock.
- Turn off the power before replacing the battery, and check the system settings after the replacement.
- Do not block the ventilation holes when operating the controller since poor ventilation may cause malfunction of the controller.

Wiring Method

- Power supply: use a 24 V_{DC} power supply for the controller and comply with the wire specification when wiring to avoid danger.
- Wire selection: use stranded wires and shielded multi-core stranded wires for signal cables.
- Cable length: the maximum cable length of the signal cable for remote I/O and DMCNET communication is 20 m and the maximum cable length of other signal cables is 10 m.
- The local I/O and remote I/O require an additional 24 V_{DC} power for signal input and output.

Wiring of Communication Circuit

- DMCNET wiring: the wiring materials should comply with the standard specification.
- Make sure the controller and servo drive are firmly connected, or loose cables may cause abnormal operation.

Note: the content of this manual may be revised without prior notice. Download the latest version from Delta's website.

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Before Operation

1 Product Inspection and Model Explanation

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9 Diagnosis (DGN) Group

Customized Function

13 Software (SOFT) Group

How to Check Device Status

14 MLC Special M Relay and Special D Register

15 Troubleshooting

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Product Inspection and Model Explanation

1

Before using the NC series products, read this chapter for information about the model explanation and product interface.

1

1.1 Product inspection

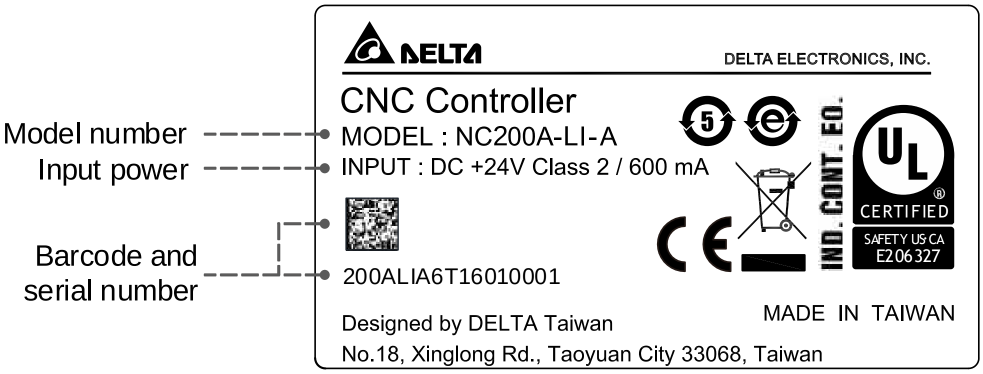
In case of packaging mistakes or damages during shipping, check the items listed in the following table carefully. If any issue occurs, contact the distributor for service.

Item	Content
Purchased product	Check the model number on the nameplate of the controller. Refer to Section 1.2 and Section 1.4 for Model explanations.
Buttons	Press the buttons to check if the operation is smooth*.
Appearance	Visually check if there are any damages on the exterior of the product.
Connectors	Check if there are any loose connectors.

Note: check the buttons for all models except for the NC30E(H) series, which does not have operation panels.

1.2 Model explanation - A series

■ Nameplate information



■ Model explanation

NC series controller (MOP integrated)

NC2 0 0 A – L I – A E
(1) (2) (3) (4) (5) (6) (7) (8)

No.	Item	Description
(1)	Series name	NC2: 2 series controller
(2)	Display	0: 8” screen
(3)	Screen orientation	0: horizontal
(4)	Series type	A: MPG not included on machine operation panel B P: MPG included on machine operation panel B
(5)	Model	L: lathe
(6)	Type	I: integrated (machine operation panels integrated)
(7)	Version	A: standard
(8)	Language	Blank: Traditional Chinese S: Simplified Chinese E: English

OPENCNC series controller

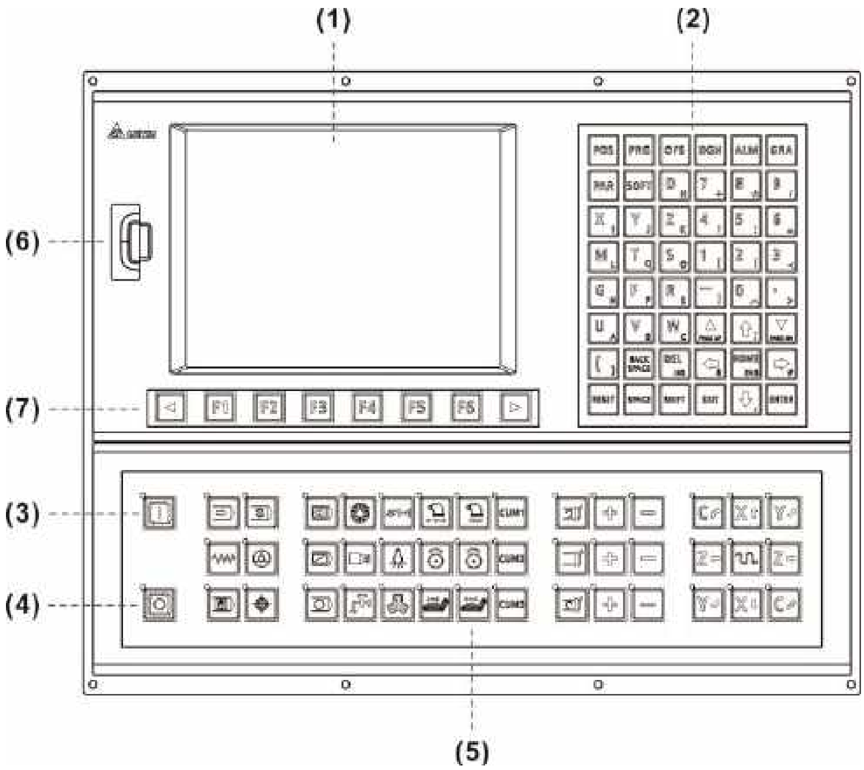
NC30 E
(1) (2)

No.	Item	Description
(1)	Series name	NC30: 3 series controller
(2)	Series type	E: embedded A series EH: embedded multi-axis A series

1

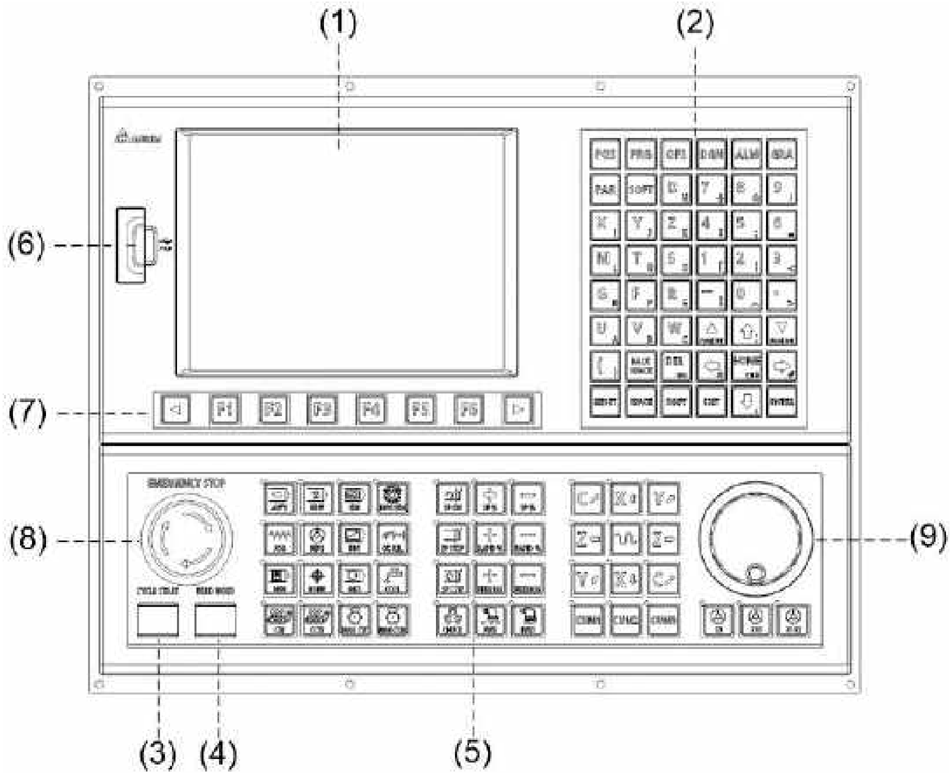
1.3 Product interface of NC controller – A series

NC200A-LI-A□



No.	Item	No.	Item
(1)	Screen	(5)	Machine operation panel B
(2)	Machine operation panel A	(6)	USB port
(3)	CYCLE START	(7)	Function keys
(4)	FEED HOLD	-	-

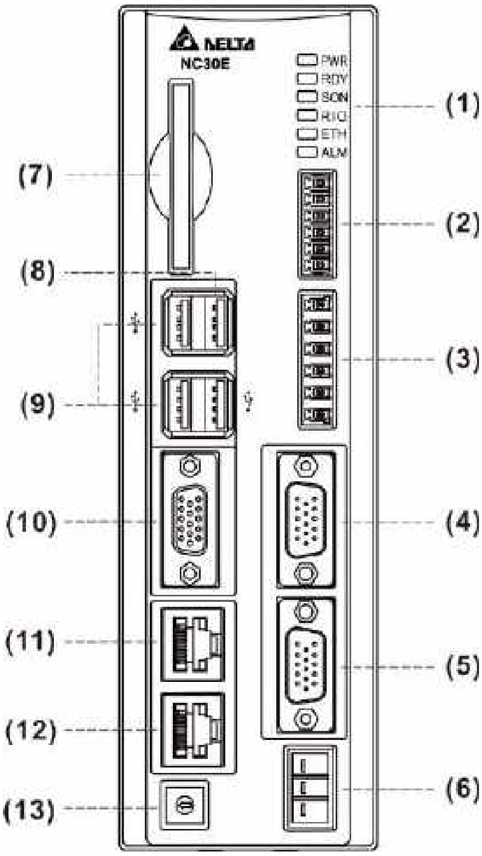
NC200P-LI-A□



No.	Item	No.	Item
(1)	Screen	(6)	USB port
(2)	Machine operation panel A	(7)	Function keys
(3)	CYCLE START	(8)	Emergency stop
(4)	FEED HOLD	(9)	MPG
(5)	Machine operation panel B	-	-

NC30E(H)

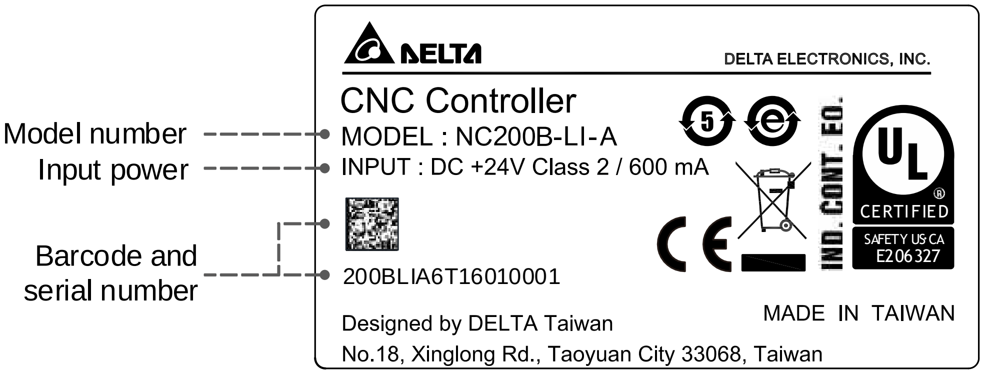
1



No.	Item
(1)	Indicators
(2)	Remote I/O module connector (high-speed serial I/O)
(3)	HSI connector (high-speed input)
(4)	MPG (handwheel) connector
(5)	Spindle connector
(6)	24 V_{DC} power input for the controller
(7)	CF card slot
(8)	PAN interface (USB port for connecting to machine operation panel B)
(9)	USB ports (for connecting to the mouse, keyboard and USB drive)
(10)	VGA connector (for connecting to a screen)
(11)	Ethernet connector
(12)	DMCNET connector
(13)	Mode switch

1.4 Model explanation - B series

■ Nameplate information



■ Model explanation

NC series controller (MOP integrated)

NC2 0 0 B□ - L I - □ □
(1) (2)(3) (4) (5)(6) (7) (8)

No.	Item	Description
(1)	Series name	NC2: 2 series controller NC3: 3 series controller
(2)	Display	0: 8” screen 1: 10” screen
(3)	Screen orientation	0: horizontal 1: vertical
(4)	Series type	B: B series BH: multi-axis B series
(5)	Model	L: lathe
(6)	Type	I: integrated (machine operation panels integrated) P: split (machine operation panels not integrated) S: split (machine operation panel A integrated)
(7)	Version	A: MPG not included on machine operation panel B P: MPG included on machine operation panel B
(8)	Language	Blank: Traditional Chinese S: Simplified Chinese E: English

1

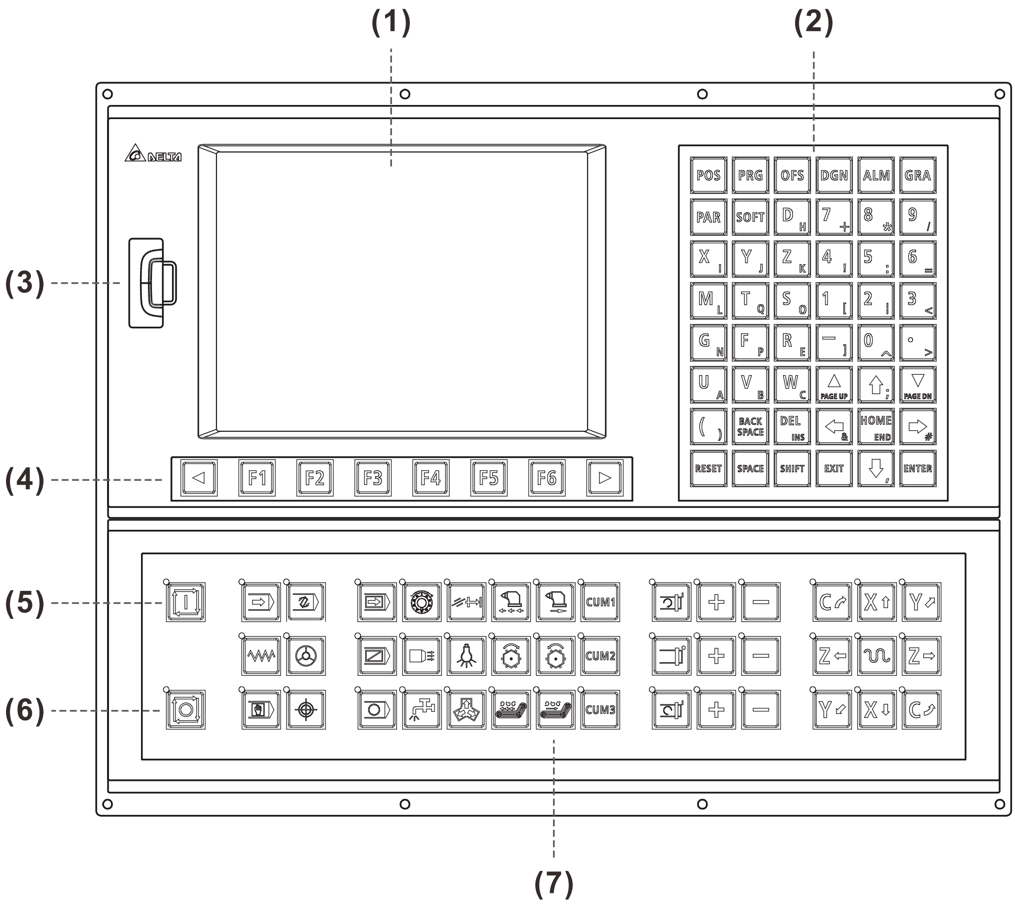
OPENCNC series controller

NC30 EB□
(1) (2)

No.	Item	Description
(1)	Series name	NC30: 3 series controller
(2)	Series type	EB: embedded B series EBH: embedded multi-axis B series

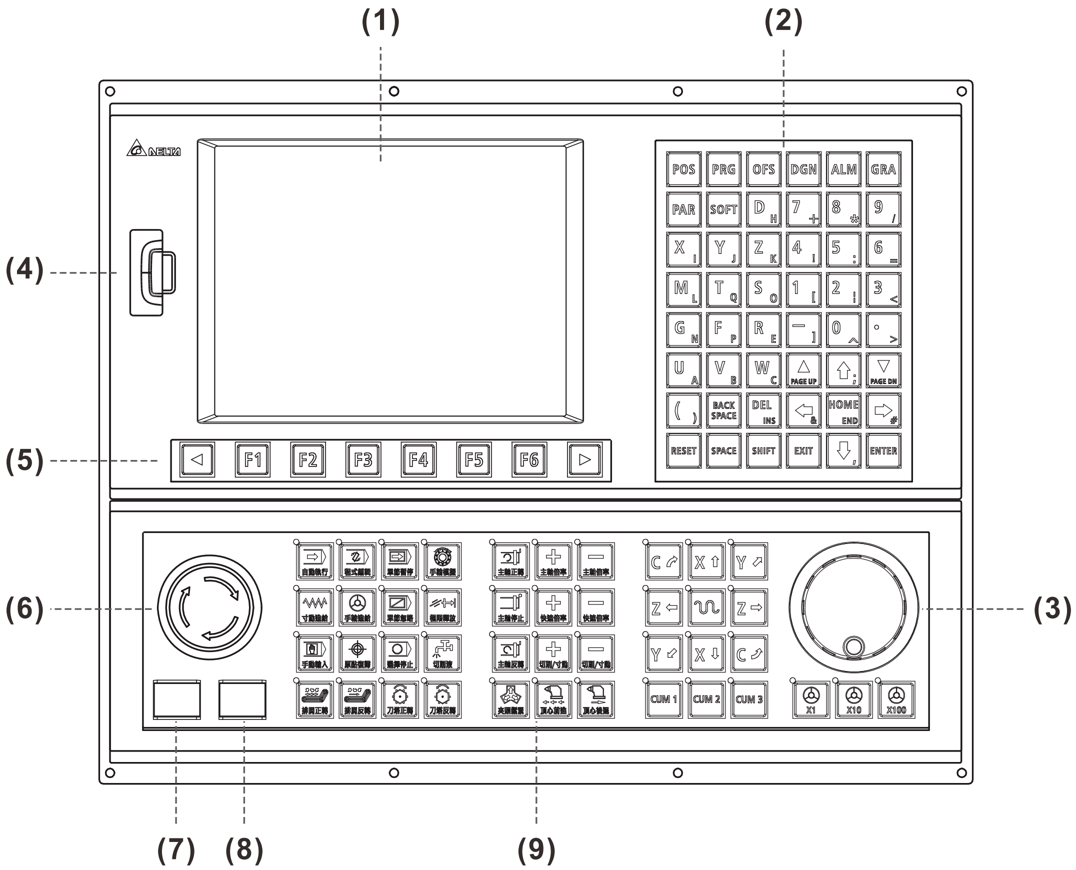
1.5 Product interface of NC controller – B series

NC200B□-LI-A□



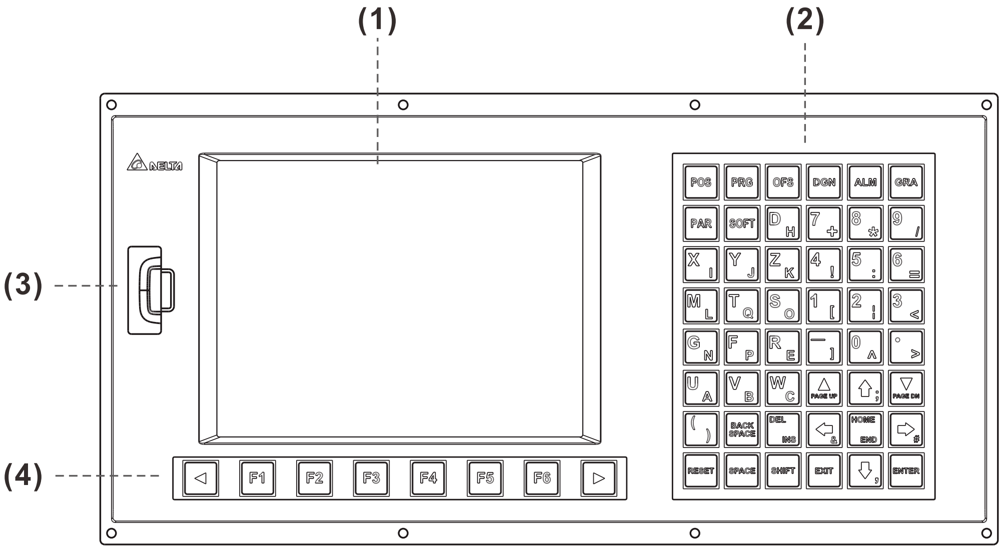
No.	Item
(1)	Screen
(2)	Machine operation panel A
(3)	USB port
(4)	Function keys
(5)	CYCLE START
(6)	FEED HOLD
(7)	Machine operation panel B

NC200B□-LI-P□



No.	Item
(1)	Screen
(2)	Machine operation panel A
(3)	MPG
(4)	USB port
(5)	Function keys
(6)	Emergency stop
(7)	CYCLE START
(8)	FEED HOLD
(9)	Machine operation panel B

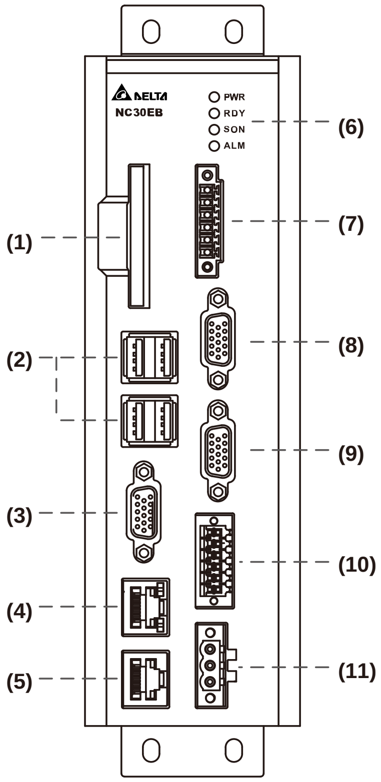
NC200B□-LS-A□

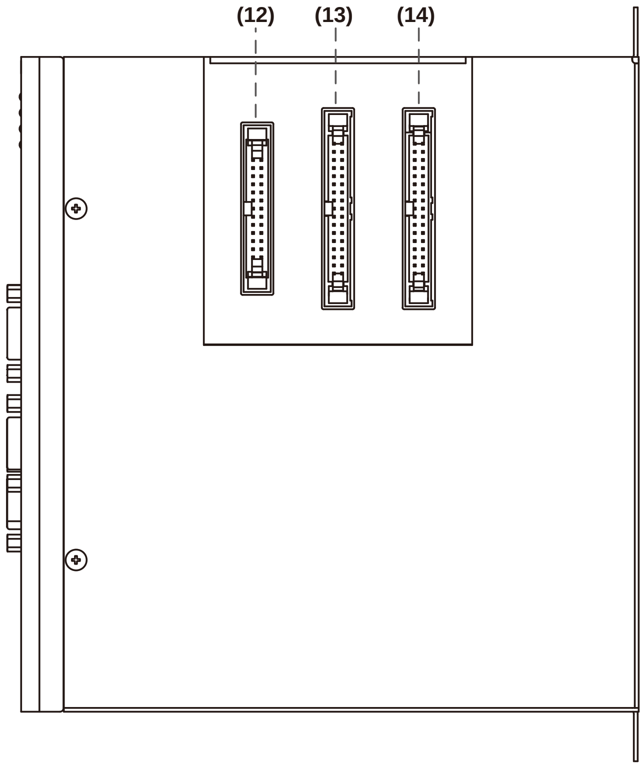


No.	Item
(1)	Screen
(2)	Machine operation panel A
(3)	USB port
(4)	Function keys

1

NC30EB□





No.	Item	No.	Item
(1)	CF card slot	(8)	MPG connector
(2)	USB ports (for connecting to the mouse, keyboard and USB drive)	(9)	Spindle connector
(3)	VGA connector (for connecting to a screen)	(10)	CN1 connector
(4)	Ethernet connector	(11)	24 V_{DC} power input for the controller
(5)	DMCNET connector	(12)	Keypad I/O module connector
(6)	Indicators	(13)	I/O 1 module connector
(7)	Remote I/O module connector	(14)	I/O 2 module connector

Installation 2

This chapter provides the outline dimensions, mounting dimensions, and hardware specifications of the products. Follow the precautions of voltage, current, temperature, or other conditions for installation. Otherwise, personnel injury or equipment damage may occur.

2

2.1 A series product installation

2.1.1 Ambient storage conditions

Before installation, this product must be kept in the shipping carton. To retain the warranty coverage and ensure future maintenance, follow these instructions for storage. While the product is temporarily not in use:

- Store the product in a dust-free and dry location.
- Store the product in an ambient temperature range of -20°C to +60°C (-4°F to +140°F).
- Store the product in a relative humidity range of 10% to 95% RH (non-condensing).
- Avoid storing the product in an environment containing corrosive gas and liquids.
- The environment should be free of devices that generate excessive heat; no water, vapor, dust, and oily dust; no corrosive and inflammable gas or liquids; no airborne dust or metal particles; the environment should be solid without vibration and interference of electromagnetic noise.

2.1.2 Ambient installation conditions

Operating temperature for the NC series controller: 0°C to 55°C (32°F to 131°F). During long-term operation, it is advisable to keep the temperature of the operating environment below 45°C (113°F). If the temperature is above 45°C, install the product in a distribution board which is well-ventilated without overheating risks. Also check if the vibration of the machine affects the electrical devices in the distribution board.

In addition, follow these precautions when selecting the installation site to retain the warranty coverage and ensure future maintenance for the Delta NC controller.

- The environment should be free of devices that generate excessive heat; no water, vapor, dust, and oily dust; no corrosive and inflammable gas or liquids; no airborne dust or metal particles; the environment should be solid without vibration and interference of electromagnetic noise.
- The temperature and humidity of the installation site for the NC controller should be within the specification range.
- Avoid storing the NC controller in an environment where the vibration exceeds the specification range.

2

2.1.3 Mounting method and space

Important:

- The NC series controller must be mounted vertically on a dry and solid platform which complies with the requirement of NEMA.
- For better ventilation and cooling, allow sufficient clearance space (50 mm (1.97”) is recommended) between the NC controller and the adjacent objects or wall, or it may cause malfunction of the controller.
- Do not block the ventilation holes of the NC controller, or it may cause malfunction of the controller.

2.1.4 Hardware specifications

NC200 A series lathe controller

Model	NC200A-LI-A_	NC200P-LI-A_
Operating environment	10% to 95% RH [0°C to +55°C (32°F to 131°F)]	
Storage environment	10% to 95% RH [-20°C to +60°C (-4°F to +140°F)]	
Cooling method	Natural cooling	
Voltage	+24 V_{DC} (-10% to +15%) (built-in isolated circuit)	
Dielectric withstanding voltage	Between 24 V_{DC} and FG terminals: 500 V_{AC} for 1 minute	
Power consumption	15 W (24V; 0.6 A)	
Battery	3V lithium battery (CR2032) × 1 Battery life varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F)	
Weight (kg)	4.5	4.7

OPENCNC A series controller

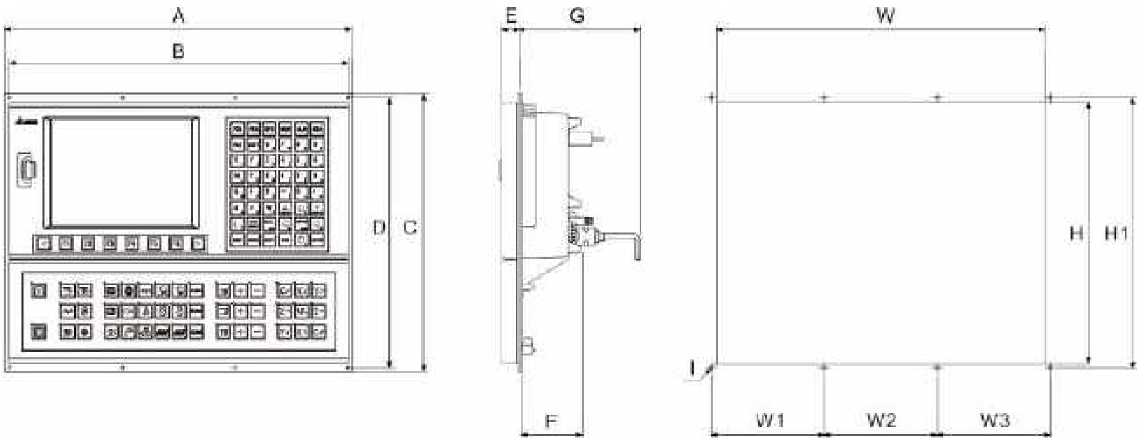
Model	NC30E(H)
Operating environment	10% to 95% RH [0°C to +55°C (32°F to 131°F)]
Storage environment	10% to 95% RH [-20°C to +60°C (-4°F to +140°F)]
Cooling method	Natural cooling
Voltage	+24 V_{DC} (-10% to +15%) (built-in isolated circuit)
Dielectric withstanding voltage	Between 24 V_{DC} and FG terminals: 500 V_{AC} for 1 minute
Power consumption	15 W (24V; 0.6 A)
Battery	3V lithium battery (CR2032) × 1 Battery life varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F)
Weight (kg)	0.8

2

2.1.5 Outline and mounting dimensions

NC200 A series lathe controller - appearance and dimension tables

NC200-A-LI-A_ dimension drawing



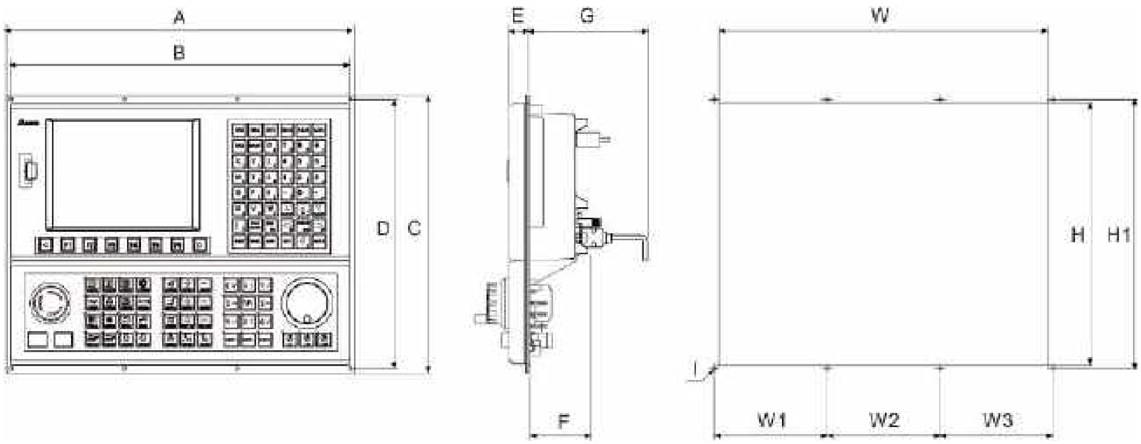
Outline dimension table

Symbol	Dimensions
A	400 mm
B	390 mm
C	320 mm
D	310 mm
E	22 mm
F	70 mm
G	130 mm (Min. required distance for installation)

Mounting dimension table

Symbol	Dimensions
H	302 ± 0.3 mm
H1	310 mm
W	378 ± 0.3 mm
W1	130 mm
W2	130 mm
W3	130 mm
I	Φ4 mm

NC200P-LI-A_ dimension drawing



Outline dimension table

Symbol	Dimensions
A	400 mm
B	390 mm
C	320 mm
D	310 mm
E	22 mm
F	70 mm
G	130 mm (Min. required distance for installation)

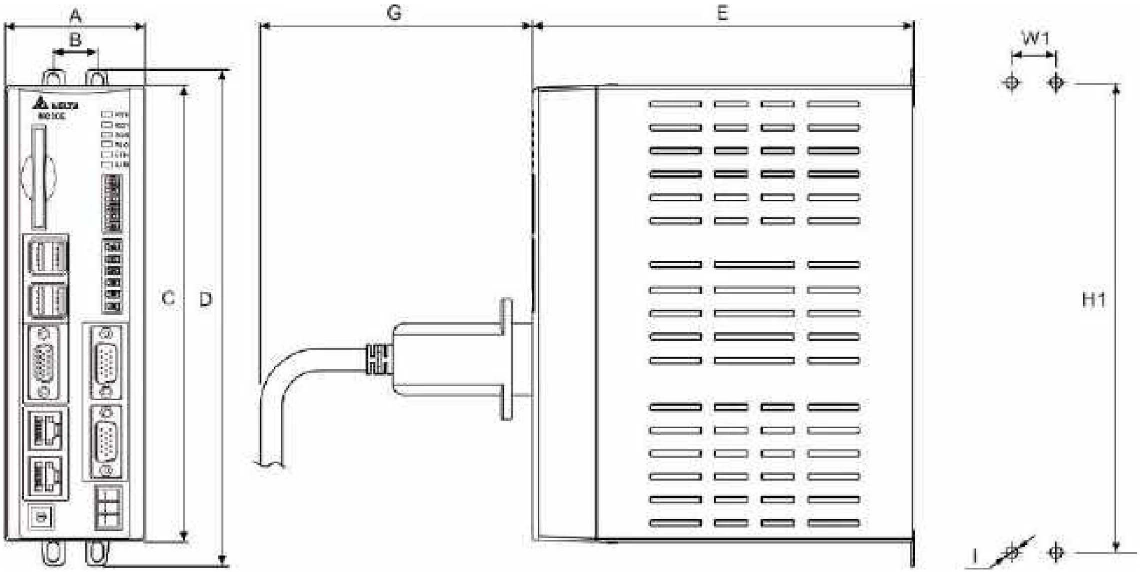
Mounting dimension table

Symbol	Dimensions
H	302 ± 0.3 mm
H1	310 mm
W	378 ± 0.3 mm
W1	130 mm
W2	130 mm
W3	130 mm
I	Φ4 mm

2

A series OPENCNC - appearance and dimension tables

NC30E(H) dimension drawing



Outline dimension table

Symbol	Dimensions
A	60 mm
B	19 mm
C	196 mm
D	213 mm
E	164 mm
G	70 mm

Mounting dimension table

Symbol	Dimensions
H1	201 ± 0.3 mm
W1	19 ± 0.3 mm
I	M5

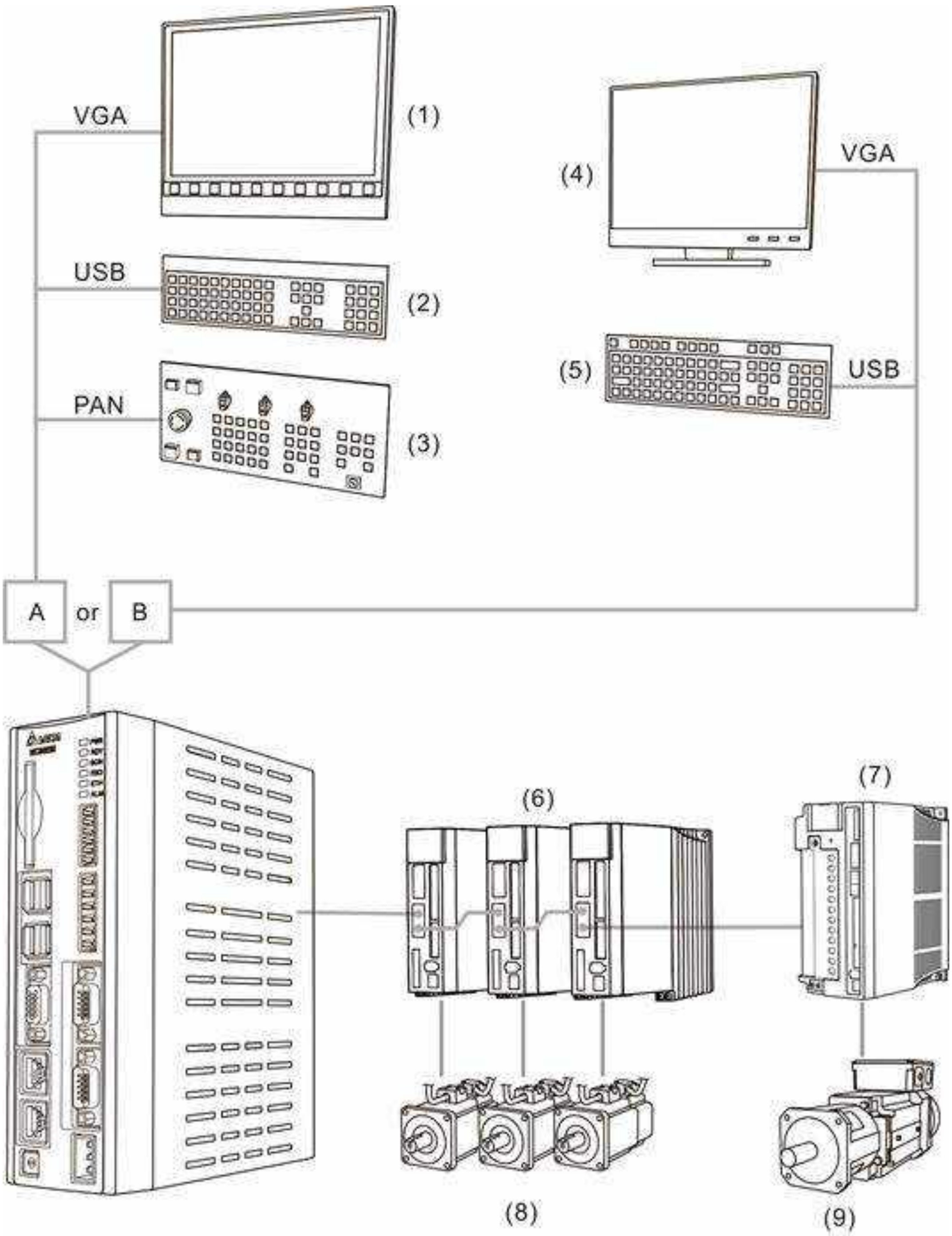
2

2.1.6 Operating interface installation (for OPENCNC models)

- Operating interface installation

A. Connect the OPENCNC series controller to standard operating interfaces, including (1) Delta HMI screen, (2) keyboard (functions the same as machine operation panel A), and (3) machine operation panel B.

B. Connect the OPENCNC series controller to non-Delta operating interfaces, including (4) screen and (5) keyboard.

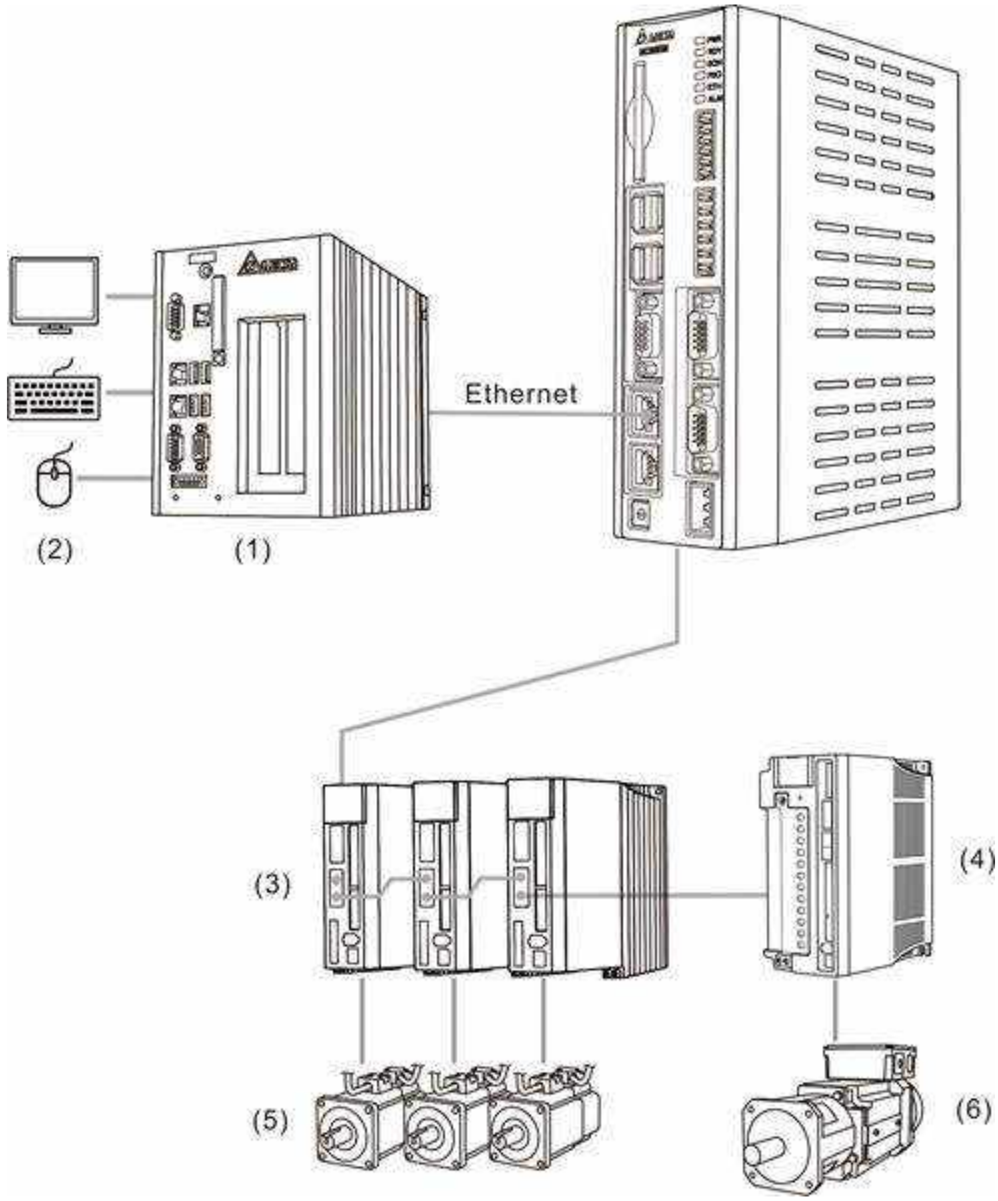


The NC series controller can connect to (6) ASDA series AC servo drives, (7) ASDA-S spindle servo drive, (8) ECMA series servo motors, and (9) ECMS series spindle servo motor.

2

■ Connection through computer and network

Connect the OPENCNC series controller to (3) ASDA series AC servo drives, (4) ASDA-S spindle servo drive, (5) ECMA series servo motors, and (6) ECMS series spindle servo motor through the computer and network, including (1) PC-based controller and (2) mouse and the public software for Delta OPENCNC.



2.2 B series product installation

2.2.1 Ambient storage conditions

Before installation, this product must be kept in the shipping carton. To retain the warranty coverage and ensure future maintenance, follow these instructions for storage. While the product is temporarily not in use:

- Store the product in a dust-free and dry location.
- Store the product in an ambient temperature range of -20°C to +60°C (-4°F to +140°F).
- Store the product in a relative humidity range of 10% to 95% RH (non-condensing).
- Avoid storing the product in an environment containing corrosive gas and liquids.
- The environment should be free of devices that generate excessive heat; no water, vapor, dust, and oily dust; no corrosive and inflammable gas or liquids; no airborne dust or metal particles; the environment should be solid without vibration and interference of electromagnetic noise.

2.2.2 Ambient installation conditions

Operating temperature for the NC series controller: 0°C to 50°C (32°F to 131°F). During long-term operation, it is advistable to keep the temperature of the operating environment below 45°C (113°F). If the temperature is above 45°C, install the product in a distribution board which is well-ventilated without overheating risks. Also, check if the vibration of the machine affects the electrical devices in the distribution board.

In addition, follow these precautions when selecting the installation site to retain the warranty coverage and ensure future maintenance for the Delta NC controller.

- The environment should be free of devices that generate excessive heat; no water, vapor, dust, and oily dust; no corrosive and inflammable gas or liquids; no airborne dust or metal particles; the environment should be solid without vibration and interference of electromagnetic noise.
- The temperature and humidity of the installation site for the NC controller should be within the specification range.
- Avoid storing the NC controller in an environment where the vibration exceeds the specification range.

2.2.3 Mounting method and space

Important:

- The NC series controller must be mounted vertically on a dry and solid platform which complies with the requirement of NEMA.
- For better ventilation and cooling, allow sufficient clearance space (50 mm (1.97") is recommended) between the NC controller and the adjacent objects or wall, or it may cause malfunction of the controller.
- Do not block the ventilation holes of the NC controller, or it may cause malfunction of the controller.

2.2.4 Hardware specifications

NC200 B series lathe controller

Model	NC200B□-LI-A□	NC200B□-LI-P□	NC200B□-LS-A□
Operating environment	10% to 95% RH [0 to +50°C (32°F to 122°F)]		
Storage environment	10% to 95% RH [-20 to +60°C (-4°F to +140°F)]		
Cooling method	Natural cooling		
Voltage	+24 V_{DC} (-10% to +15%) (built-in isolated circuit)		
Dielectric withstanding voltage	Between 24 V_{DC} and FG terminals: 500 V_{AC} for 1 minute		
Power consumption	21.6 W (24V; 0.9 A)		
Battery	3V lithium battery (CR2032) × 1 Battery life varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F)		
Supported USB drive format	FAT16 / FAT32		
Supported CF card format	FAT16 / FAT32 / EXT4 (only for Linux)		
Weight (kg)	4.5	4.7	3.7

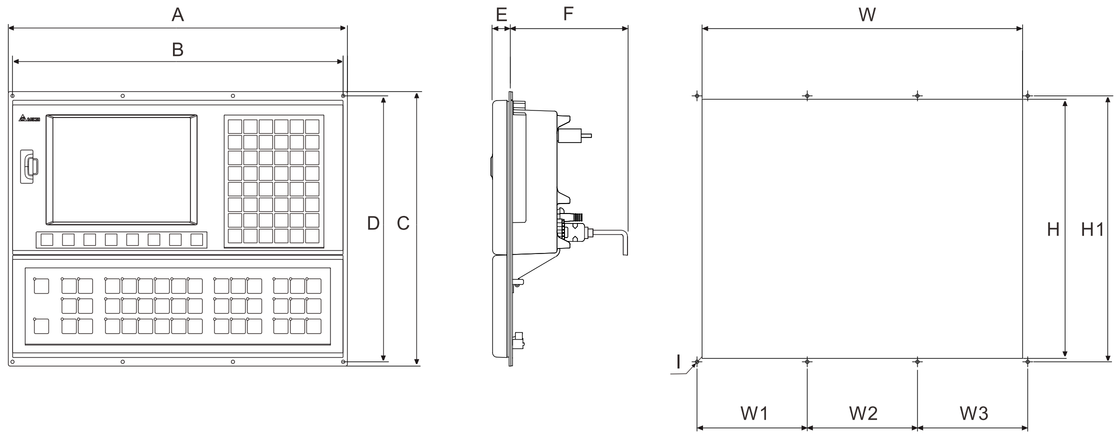
OPENCNC B series controller

Model	NC30EB□
Operating environment	10% to 95% RH [0°C to +50°C (32°F to 122°F)]
Storage environment	10% to 95% RH [-20°C to +60°C (-4°F to +140°F)]
Cooling method	Natural cooling
Voltage	+24 V_{DC} (-10% to +15%) (built-in isolated circuit)
Dielectric withstanding voltage	Between 24 V_{DC} and FG terminals: 500 V_{AC} for 1 minute
Power consumption	19.2 W (24V; 0.8 A)
Battery	3V lithium battery (CR2032) × 1 Battery life varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F)
Supported USB drive format	FAT16 / FAT32
Supported CF card format	FAT16 / FAT32 / EXT4 (only for Linux)
Weight (kg)	1.8

2.2.5 Outline and mounting dimensions

NC200 B series lathe controller - appearance and dimension tables

NC200B□-LI-A□ dimension drawing



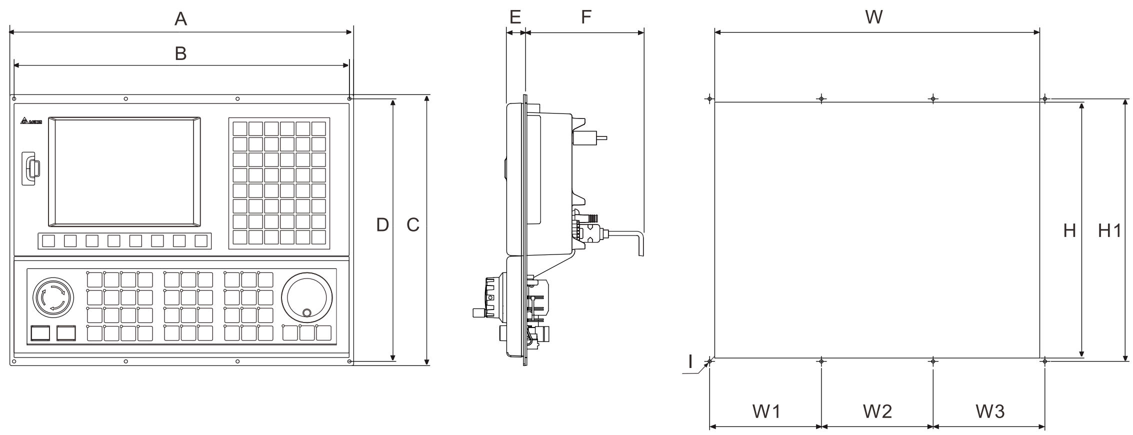
Outline dimension table

Symbol	Dimensions
A	400 mm
B	390 mm
C	320 mm
D	310 mm
E	22 mm
F	70 mm

Mounting dimension table

Symbol	Dimensions
H	302 ± 0.3 mm
H1	310 mm
W	378 ± 0.3 mm
W1	130 mm
W2	130 mm
W3	130 mm
I	Φ4 mm

NC200B□-LI-P□ dimension drawing



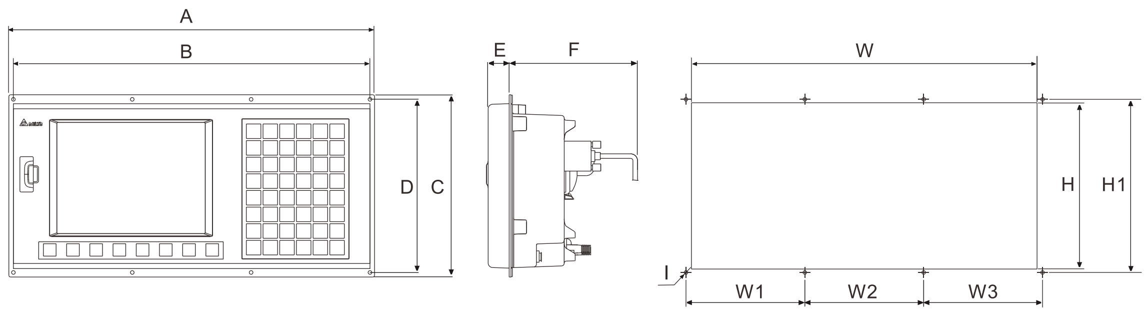
Outline dimension table

Symbol	Dimensions
A	400 mm
B	390 mm
C	320 mm
D	310 mm
E	22 mm
F	70 mm

Mounting dimension table

Symbol	Dimensions
H	302 ± 0.3 mm
H1	310 mm
W	378 ± 0.3 mm
W1	130 mm
W2	130 mm
W3	130 mm
I	Φ4 mm

NC200B□-LS-A□ dimension drawing



Outline dimension table

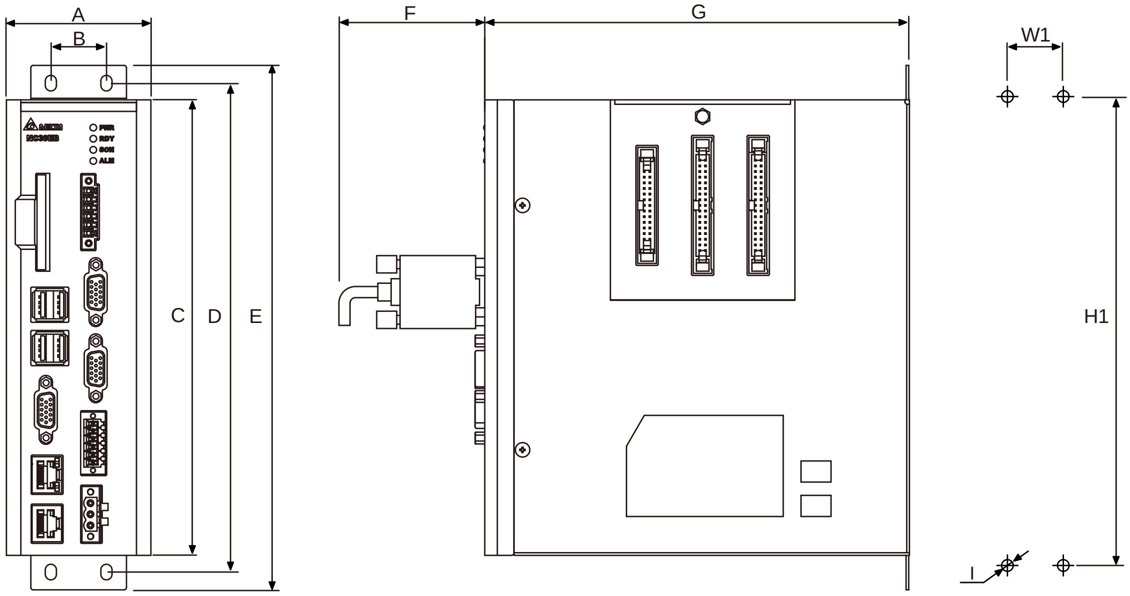
Symbol	Dimensions
A	400 mm
B	390 mm
C	200 mm
D	190 mm
E	22 mm
F	70 mm

Mounting dimension table

Symbol	Dimensions
H	182 ± 0.3 mm
H1	190 mm
W	378 ± 0.3 mm
W1	130 mm
W2	130 mm
W3	130 mm
I	Φ4 mm

B series OPENCNC - appearance and dimension tables

NC30EB□ dimension drawing



Outline dimension table

Symbol	Dimensions
A	65 mm
B	25 mm
C	205 mm
D	220 mm
E	236 mm
F	70 mm
G	191 mm

Mounting dimension table

Symbol	Dimensions
H1	220 ± 1.0 mm
W1	25 ± 0.3 mm
I	M4

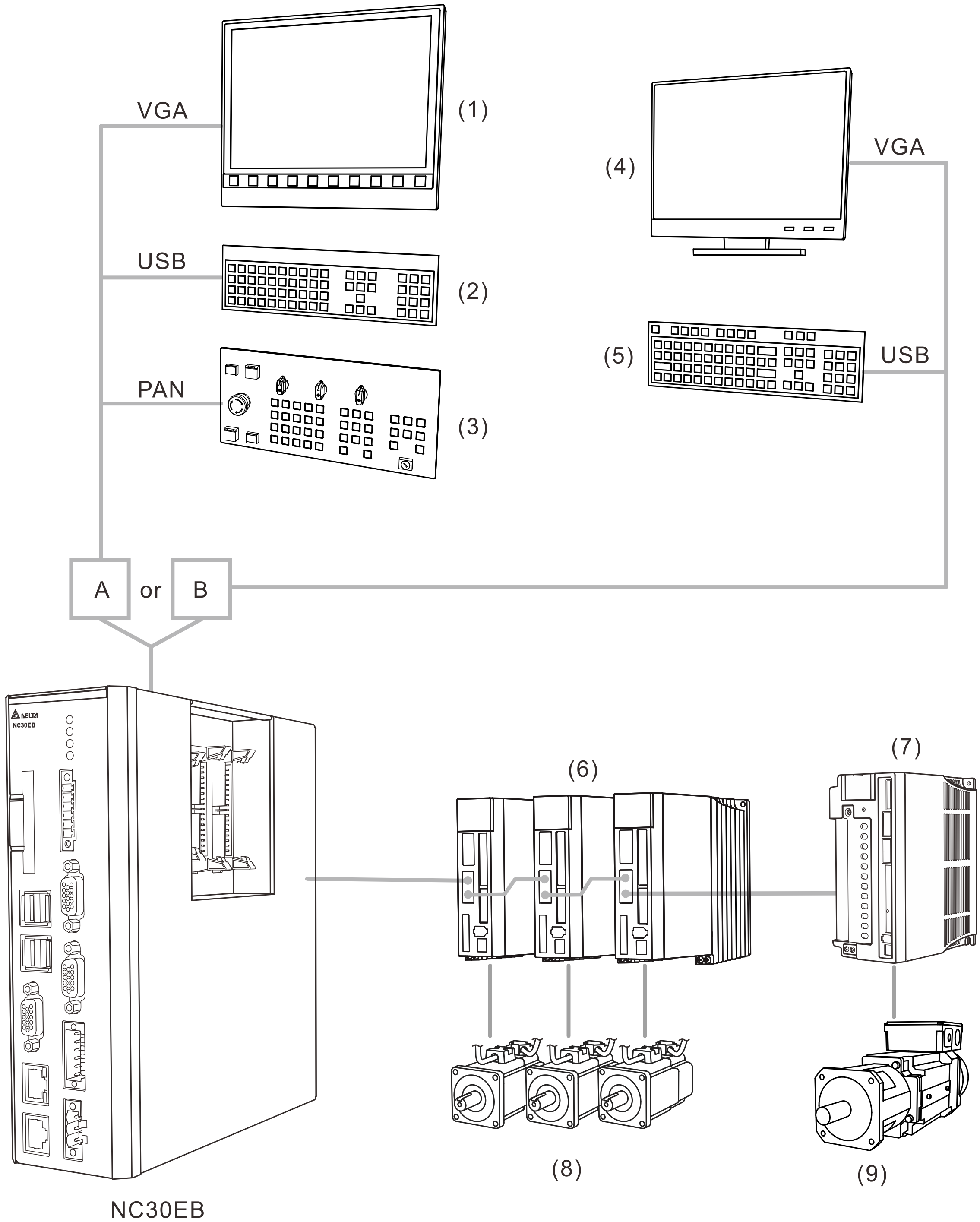
2.2.6 Operating interface installation (for OPENCNC models)

■ Operating interface installation

A. Connect the OPENCNC series controller to standard operating interfaces, including (1) Delta HMI screen, (2) keyboard (functions the same as machine operation panel A), and (3) machine operation panel B.

B. Connect the OPENCNC series controller to non-Delta operating interfaces, including (4) screen and (5) keyboard.

2

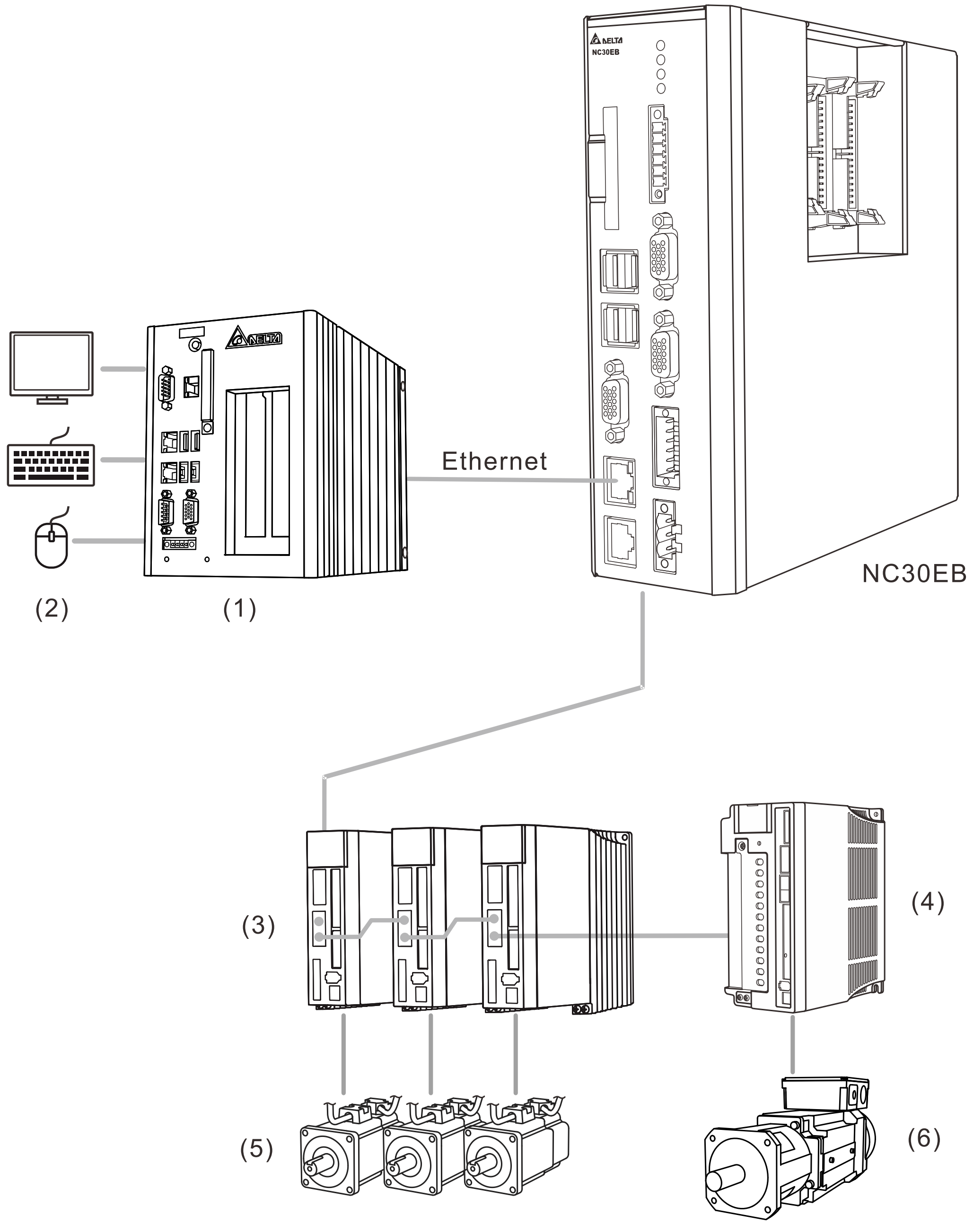


The NC series controller can connect to (6) ASDA series AC servo drives, (7) ASDA-S spindle servo drive, (8) ECMA series servo motors, and (9) ECMS series spindle servo motor.

2

■ Connection through computer and network

Connect the OPENCNC series controller to (3) ASDA series AC servo drives, (4) ASDA-S spindle servo drive, (5) ECMA series servo motors, and (6) ECMS series spindle servo motor through the computer and network, including (1) PC-based controller and (2) mouse and the public software for Delta OPENCNC.



Wiring 3

This chapter illustrates the wiring and connectors of the controller, and provides the wiring diagrams for each function.

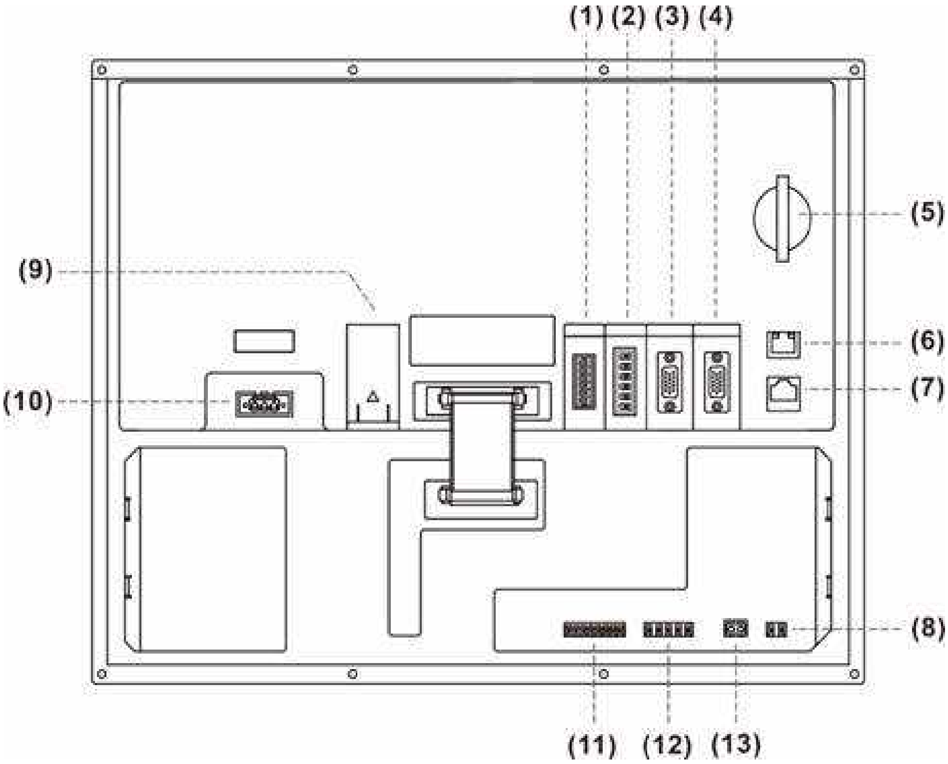
3

3.1 Wiring for A series products

3.1.1 A series product interface

■ NC200 series

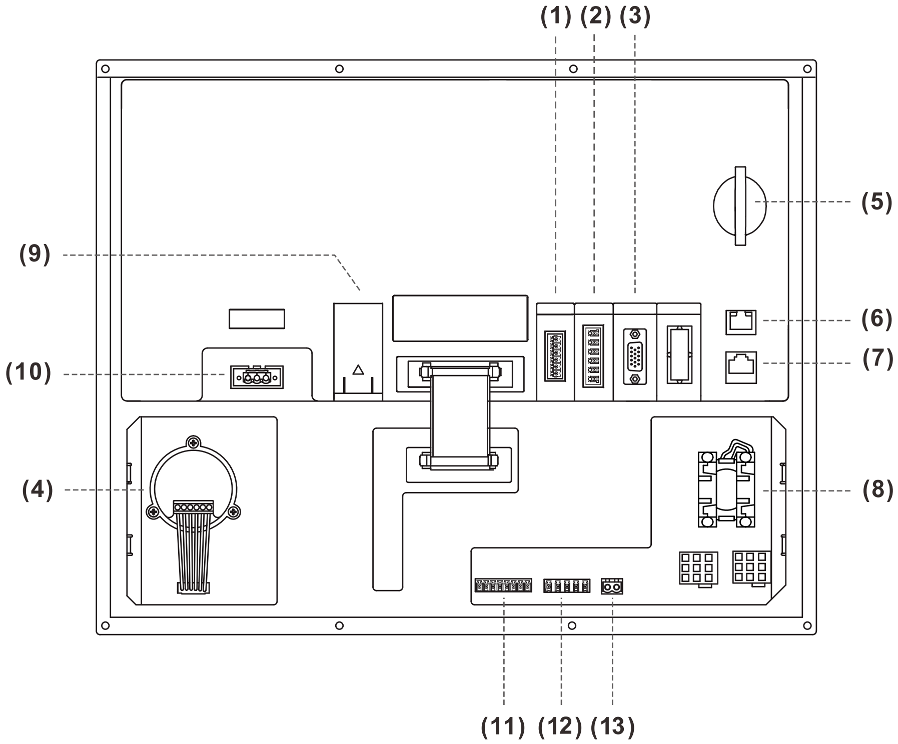
NC200A-LI-A_



No.	Connector	Description
(1)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 input and 32 output points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(2)	HSI connector	Connects to high-speed counter and emergency stop inputs.
(3)	Spindle connector	One set of spindle encoder signal input.
		One set of analog signal output.
		One set of RS-485 serial communication signal.
(4)	MPG connector	Connects to an external MPG handwheel (powered by the built-in 5 V_{DC} power). 7 input and 1 output points are available.
(5)	CF card slot	For storing G-code programs.
(6)	Ethernet connector	For DNC control and system monitoring.
(7)	DMCNET connector	High-speed communication network interface.
(8)	Emergency stop switch	Press the switch to open the circuit and have the system stop in an emergency.
(9)	Battery	Battery holder.
(10)	24 V_{DC} power	24 V_{DC} power input; for supplying power to the controller.
(11)	Local I/O input terminal	8 input points.
(12)	Local I/O output terminal	5 output points.
(13)	24 V_{DC} power	For supplying power to the local I/O.

3

NC200P-LI-A_



No.	Connector	Description
(1)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 input and 32 output points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(2)	HSI connector	Connects to high-speed counter and emergency stop inputs.
(3)	Spindle connector	One set of spindle encoder signal input.
		One set of analog signal output.
		One set of RS-485 serial communication signal.
(4)	MPG	Embedded MPG on machine operation panel B.
(5)	CF card slot	For storing G-code programs.
(6)	Ethernet connector	For DNC control and system monitoring.
(7)	DMCNET connector	High-speed communication network interface.
(8)	Emergency stop switch	-
(9)	Battery	Battery holder.
(10)	24 V_{DC} power	24 V_{DC} power input; for supplying power to the controller.
(11)	Local I/O input terminal	8 input points.
(12)	Local I/O output terminal	5 output points.
(13)	24 V_{DC} power	For supplying power to the local I/O and the lights for CYCLE START and FEED HOLD buttons.

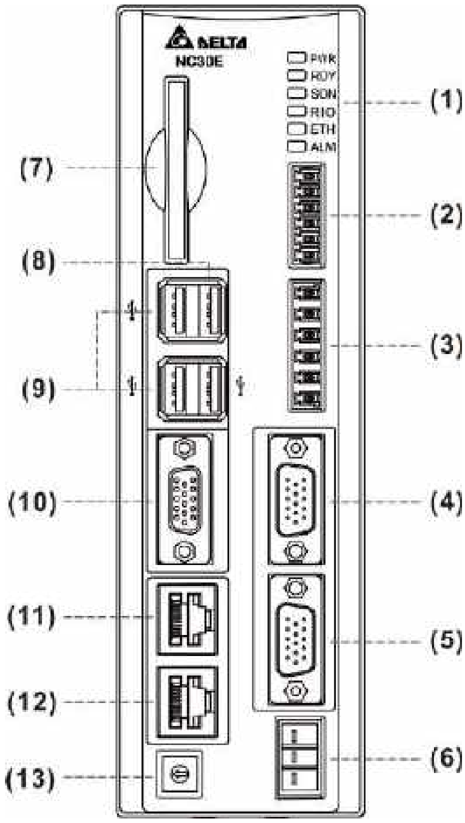
Safety precautions for installation:

1. Check if the wiring for 24 V_{DC} power is correct.
2. The local I/O requires an additional 24 V_{DC} power supply to drive X inputs and Y outputs.
3. Short-circuit the IES (input contact of emergency stop signal) to have the controller ready for use.
4. If an alarm occurs or the emergency stop signal is On, power off the servo drive by disconnecting the power at the magnetic contactor (MC) with Y outputs.

3

- OPENCNC series

NC30E(H)



No.	Connector	Description
(1)	-	Indicators.
(2)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 input and 32 output points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(3)	HSI connector	Connects to high-speed counter and emergency stop inputs.
(4)	MPG connector	Connects to an external MPG handwheel (powered by the built-in 5 V_{DC} power). 8 input points are available.
(5)	Spindle connector	One set of spindle encoder signal input.
		One set of analog signal output.
		One set of RS-485 serial communication signal.
(6)	24 V_{DC} power	24 V_{DC} power input; for supplying power to the controller.
(7)	CF card slot	For storing G-code programs.
(8)	PAN interface	One USB connector for connecting to machine operation panel B.
(9)	USB ports	Three USB host connectors for connecting to the mouse, keyboard, and flash drive.
(10)	VGA connector	For connecting to a screen.
(11)	Ethernet connector	Ethernet interface.
(12)	DMCNET connector	High-speed communication network interface.
(13)	-	Rotary switch for switching the debugging mode.

Description of setting the rotary switch for switching the debugging mode:

<table>
<tr><th>Setting value</th><th colspan="2">Mode</th></tr>
<tr><td rowspan="7">0</td><td colspan="2">Standard mode
Description of the indicator lights:</td></tr>
<tr><td>PWR</td><td>Green: system power is on</td></tr>
<tr><td>RDY</td><td>Flashing green: system is ready
Orange: in modes 1 - 3</td></tr>
<tr><td>SON</td><td>Green: servo is ready</td></tr>
<tr><td>RIO</td><td>Green: remote I/O connection is normal</td></tr>
<tr><td>ETH</td><td>Green: network communication is normal</td></tr>
<tr><td>ALM</td><td>Red: system alarm occurs
Flashing green: software is updating</td></tr>
<tr><td>1</td><td colspan="2">System update mode</td></tr>
<tr><td>2</td><td colspan="2">Default mode</td></tr>
<tr><td rowspan="4">3</td><td colspan="2">Reset IP to default setting.
Default IP addresses:</td></tr>
<tr><td>Controller IP</td><td>192.168.1.11</td></tr>
<tr><td>Subnet mask</td><td>255.255.255.0</td></tr>
<tr><td>Remote PC IP</td><td>192.168.1.10</td></tr>
</table>

Safety precautions for installation:

1. Check if the wiring for 24 V_{DC} power is correct.
2. The remote I/O requires an external 24 V_{DC} power supply to drive X inputs and Y outputs.
3. If an alarm occurs or the emergency stop signal is On, power off the servo drive by disconnecting the power at the magnetic contactor (MC) with Y outputs.

3

3.1.2 Connectors of A series controller

3.1.2.1 NC200 series connectors

<table>
<tr><th>Symbol</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">0V, +24V, ⏚</td><td rowspan="5">Power input for controller</td><td colspan="2">Connects to 24 V_{DC} power (15 W at 0.6 A).</td></tr>
<tr><td>Symbol</td><td>Description</td></tr>
<tr><td>+24V</td><td>+24 V_{DC} power</td></tr>
<tr><td>0V</td><td>0 V_{DC} power</td></tr>
<tr><td>⏚</td><td>Power ground</td></tr>
<tr><td rowspan="4">0V, +24V</td><td rowspan="4">Power input for machine operation panel B</td><td colspan="2">Connects to 24 V_{DC} power (15 W at 0.6 A).</td></tr>
<tr><td>Symbol</td><td>Description</td></tr>
<tr><td>+24V</td><td>+24 V_{DC} power</td></tr>
<tr><td>0V</td><td>0 V_{DC} power</td></tr>
<tr><td rowspan="6">I/O</td><td rowspan="3">DI</td><td colspan="2">Power specifications for DI points:
voltage < 24 V_{DC}, current: 8 - 25 mA.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>X112 - X119</td><td>8 input points in total.</td></tr>
<tr><td rowspan="3">DO</td><td colspan="2">Power specifications for DO points:
voltage < 24 V_{DC}, current < 120 mA.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>Y112 - Y116</td><td>5 output points in total.</td></tr>
<tr><td rowspan="17">SPINDLE</td><td rowspan="17">Spindle connector</td><td colspan="2">Includes signals of spindle feedback, analog output, and 1 set of RS-485 serial communication.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>RS485_GND</td></tr>
<tr><td>2</td><td>RS485_D+</td></tr>
<tr><td>3</td><td>RS485_D-</td></tr>
<tr><td>4</td><td>SP_OUT</td></tr>
<tr><td>5</td><td>SP_GND</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>EMG_IN; connects to +24 V_{DC}</td></tr>
<tr><td>8</td><td>SP_A+</td></tr>
<tr><td>9</td><td>SP_A-</td></tr>
<tr><td>10</td><td>DC +5V_OUT</td></tr>
<tr><td>11</td><td>SP_B+</td></tr>
<tr><td>12</td><td>SP_B-</td></tr>
<tr><td>13</td><td>SP_Z+</td></tr>
<tr><td>14</td><td>SP_Z-</td></tr>
<tr><td>15</td><td>GND</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td rowspan="12">MPG</td><td rowspan="12">MPG (Handwheel) connector</td><td colspan="2">7 DI points, 1 DO point, and 1 set of differential type MPG input signal.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>DI_COM; connects to +24 V_{DC} or 0 V_{DC}</td></tr>
<tr><td>2 - 7</td><td>DI (X28 - X33)</td></tr>
<tr><td>8</td><td>DI (X26)</td></tr>
<tr><td>9</td><td>DO (Y27)</td></tr>
<tr><td>10</td><td>5V_{DC}_OUT (< 200 mA)</td></tr>
<tr><td>11</td><td>XA+</td></tr>
<tr><td>12</td><td>XA-</td></tr>
<tr><td>13</td><td>XB+</td></tr>
<tr><td>14</td><td>XB-</td></tr>
<tr><td>15</td><td>5V_{DC}_GND</td></tr>
<tr><td rowspan="8">HSI</td><td rowspan="8">High-speed counter and emergency stop signal input connector</td><td colspan="2">2 sets of high-speed and 1 set of emergency stop signal inputs.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>EMG_IN</td></tr>
<tr><td>2</td><td>EMG_GND</td></tr>
<tr><td>3</td><td>HSI_1</td></tr>
<tr><td>4</td><td>HSI_COM; connects to +24 V_{DC} or 0V</td></tr>
<tr><td>5</td><td>HSI_2</td></tr>
<tr><td>6</td><td>HSI_COM; short-circuit Pin 4 and Pin 6.</td></tr>
<tr><td rowspan="8">REMOTE I/O</td><td rowspan="8">Remote I/O module connector</td><td colspan="2">The remote I/O module communication connector can connect to 8 modules. Each module has 32 input and 32 output points. The input points range from X256 - X511 and the output points range from Y256 - Y511.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>TX+</td></tr>
<tr><td>2</td><td>TX-</td></tr>
<tr><td>3</td><td>RX-</td></tr>
<tr><td>4</td><td>RX+</td></tr>
<tr><td>5</td><td>GND</td></tr>
<tr><td>6</td><td>SHIELD</td></tr>
<tr><td rowspan="10">ETHERNET</td><td rowspan="10">Ethernet connector</td><td colspan="2">The Ethernet connector is an RJ45 connector. You can use a network cable to connect to the PC.
Pin definition of both ends:</td></tr>
<tr><td>Pin No. / color of end A</td><td>Pin No. / color of end B</td></tr>
<tr><td>1: orange & white</td><td>1: orange & white</td></tr>
<tr><td>2: orange</td><td>2: orange</td></tr>
<tr><td>3: green & white</td><td>3: green & white</td></tr>
<tr><td>4: blue</td><td>4: blue</td></tr>
<tr><td>5: blue & white</td><td>5: blue & white</td></tr>
<tr><td>6: green</td><td>6: green</td></tr>
<tr><td>7: brown & white</td><td>7: brown & white</td></tr>
<tr><td>8: brown</td><td>8: brown</td></tr>
<tr><td>DMCNET</td><td>DMCNET connector</td><td colspan="2">Connects to Deltas DMCNET servo drive . The DMCNET connector is a standard RJ45 connector and the wiring method is the same as that of the Ethernet connector.</td></tr>
</table>

Symbol	Function	Description
EMG	Emergency stop switch	A normally-closed contact. Press the switch to open the circuit in an emergency.
CYCLE START	CYCLE START button	Contact of the CYCLE START button.
FEED HOLD	FEED HOLD button	Contact of the FEED HOLD button.
IES	Emergency stop contact	The emergency stop contact. The EMG flag is enabled when the circuit is open. (Wire this contact to the normally-closed contact of the emergency stop switch.)

Pay special attention to the following when wiring:

1. The IES connector is the input contact of the emergency stop signal. The EMG flag is enabled when the circuit is open.
2. The power for the lights of CYCLE START and FEED HOLD buttons is 24 V_{DC}.

3

3.1.2.2 OPENCNC series connectors

<table>
<tr><th>Symbol</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">0V, +24V, ⏚</td><td rowspan="5">Power input for controller</td><td colspan="2">Connects to 24 V_{DC} power (15 W at 0.6 A).</td></tr>
<tr><td>Symbol</td><td>Description</td></tr>
<tr><td>+24V</td><td>+24 V_{DC} power</td></tr>
<tr><td>0V</td><td>0 V_{DC} power</td></tr>
<tr><td>⏚</td><td>Power ground</td></tr>
<tr><td rowspan="17">SPINDLE</td><td rowspan="17">Spindle connector</td><td colspan="2">Includes signals of spindle feedback, analog output, and 1 set of RS-485 serial communication.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>RS485_GND</td></tr>
<tr><td>2</td><td>RS485_D+</td></tr>
<tr><td>3</td><td>RS485_D-</td></tr>
<tr><td>4</td><td>SP_OUT</td></tr>
<tr><td>5</td><td>SP_GND</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>Reserved</td></tr>
<tr><td>8</td><td>SP_A+</td></tr>
<tr><td>9</td><td>SP_A-</td></tr>
<tr><td>10</td><td>DC +5V_OUT</td></tr>
<tr><td>11</td><td>SP_B+</td></tr>
<tr><td>12</td><td>SP_B-</td></tr>
<tr><td>13</td><td>SP_Z+</td></tr>
<tr><td>14</td><td>SP_Z-</td></tr>
<tr><td>15</td><td>GND</td></tr>
<tr><td rowspan="10">MPG</td><td rowspan="10">MPG (Handwheel) connector</td><td colspan="2">8 DI points and 1 set of differential type MPG signal input.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>DI_COM; connects to +24 V_{DC} or 0 V_{DC}</td></tr>
<tr><td>2 - 9</td><td>DI (X28 - X35)</td></tr>
<tr><td>10</td><td>5V_{DC}_OUT (< 200 mA)</td></tr>
<tr><td>11</td><td>XA+</td></tr>
<tr><td>12</td><td>XA-</td></tr>
<tr><td>13</td><td>XB+</td></tr>
<tr><td>14</td><td>XB-</td></tr>
<tr><td>15</td><td>5V_{DC}_GND</td></tr>
</table>

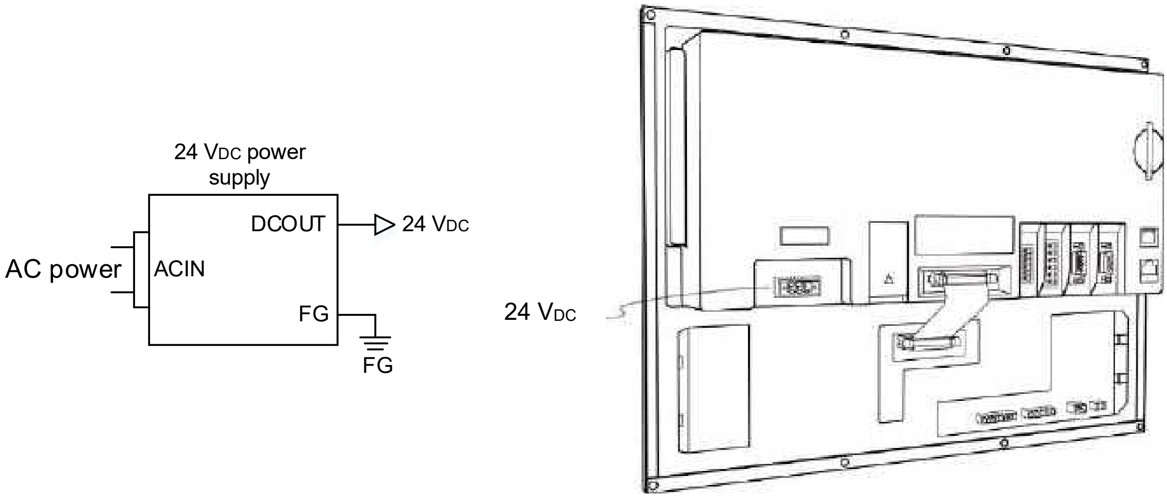
<table>
<tr><th>Symbol</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td rowspan="8">HSI</td><td rowspan="8">High-speed counter and emergency stop signal input connector</td><td colspan="2">2 sets of high-speed and 1 set of emergency stop input signal.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>EMG_IN (+5 V_{DC} voltage output)</td></tr>
<tr><td>2</td><td>MODE_ENABLE (+5 V_{DC} voltage output)</td></tr>
<tr><td>3</td><td>HSI_1</td></tr>
<tr><td>4</td><td>GND_COM (EMG_IN / MODE_ENABLE)</td></tr>
<tr><td>5</td><td>HSI_2</td></tr>
<tr><td>6</td><td>HSI_COM; connects to +24 V_{DC} or 0V</td></tr>
<tr><td rowspan="8">REMOTE I/O</td><td rowspan="8">Remote I/O module connector</td><td colspan="2">The remote I/O module communication connector can connect to 8 modules. Each module has 32 input and 32 output points. The input points range from X256 - X511 and the output points range from Y256 - Y511.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>1</td><td>TX+</td></tr>
<tr><td>2</td><td>TX-</td></tr>
<tr><td>3</td><td>RX-</td></tr>
<tr><td>4</td><td>RX+</td></tr>
<tr><td>5</td><td>GND</td></tr>
<tr><td>6</td><td>SHIELD</td></tr>
<tr><td>PAN2</td><td>Connector for machine operation panel B</td><td colspan="2">The USB host connector for connecting to the machine operation panel B. Do not connect any USB devices to this connector.</td></tr>
<tr><td>USB</td><td>USB connector</td><td colspan="2">USB connectors for connecting to USB devices, such as a USB flash drive, a mouse, or a keyboard. This connector does not support connecting multiple USB devices in series.</td></tr>
<tr><td>VGA</td><td>VGA connector</td><td colspan="2">Connects to an external monitor (only monitors with the refresh rate of 60 Hz are supported).</td></tr>
<tr><td rowspan="10">ETHERNET</td><td rowspan="10">Ethernet connector</td><td colspan="2">The Ethernet connector is an RJ45 connector. You can use a network cable to connect to the PC.
Pin definition of both ends:</td></tr>
<tr><td>Pin No. / color of end A</td><td>Pin No. / color of end B</td></tr>
<tr><td>1: orange & white</td><td>1: orange & white</td></tr>
<tr><td>2: orange</td><td>2: orange</td></tr>
<tr><td>3: green & white</td><td>3: green & white</td></tr>
<tr><td>4: blue</td><td>4: blue</td></tr>
<tr><td>5: blue & white</td><td>5: blue & white</td></tr>
<tr><td>6: green</td><td>6: green</td></tr>
<tr><td>7: brown & white</td><td>7: brown & white</td></tr>
<tr><td>8: brown</td><td>8: brown</td></tr>
<tr><td>DMCNET</td><td>DMCNET connector</td><td colspan="2">Connects to Deltas DMCNET servo drive . The DMCNET connector is a standard RJ45 connector and the wiring method is the same as that of the Ethernet connector.</td></tr>
<tr><td>MODE</td><td>Debugging mode</td><td colspan="2">The rotary switch for switching to the debugging mode.</td></tr>
</table>

3

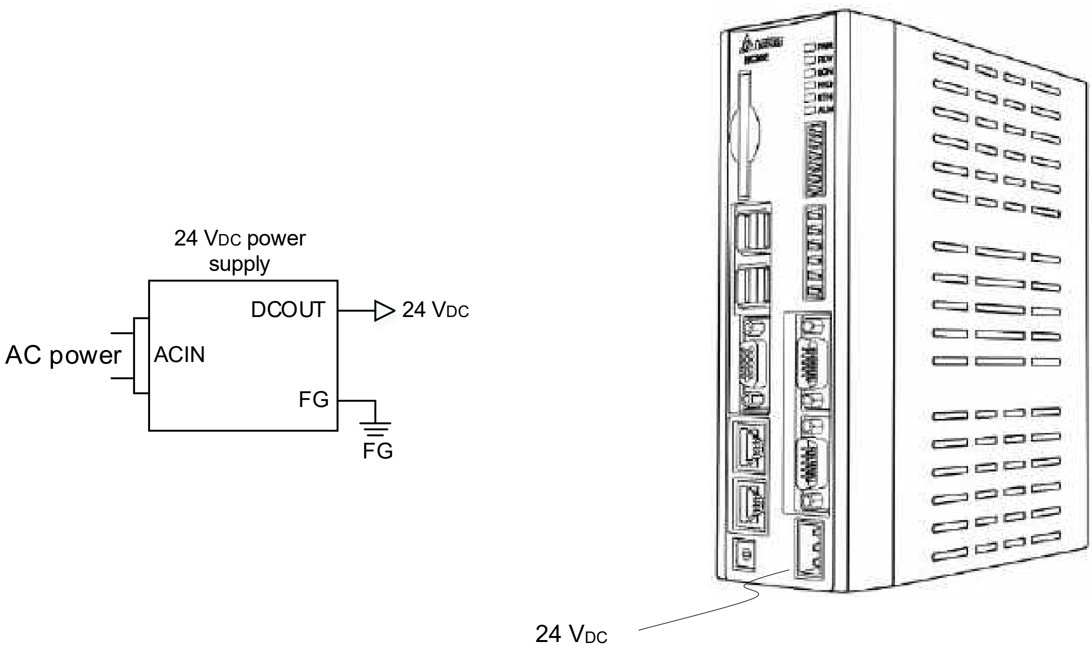
3.1.3 Wiring for power connector

The power supply is directly connected to the 24 V_{DC} connector on the NC series controller.

- NC200 series models



- OPENCNC series models

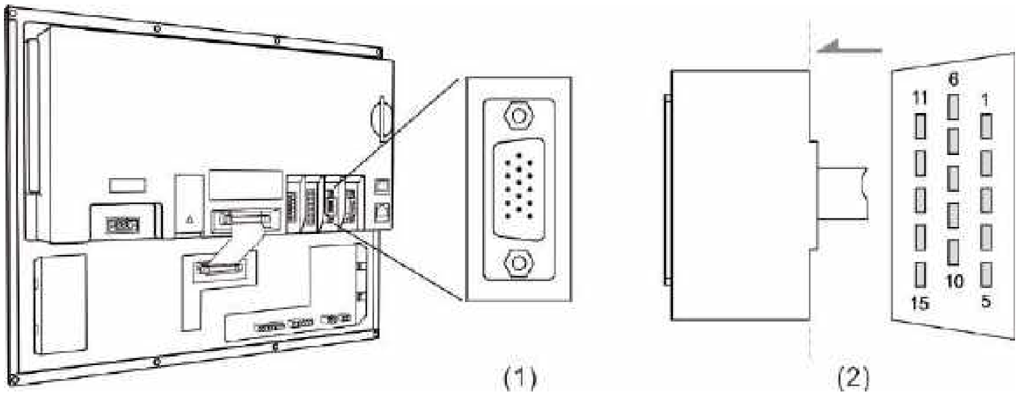


3

3.1.4 Wiring for RS-485

The NC series controller has one set of RS-485 communication signal for serial communication with external devices.

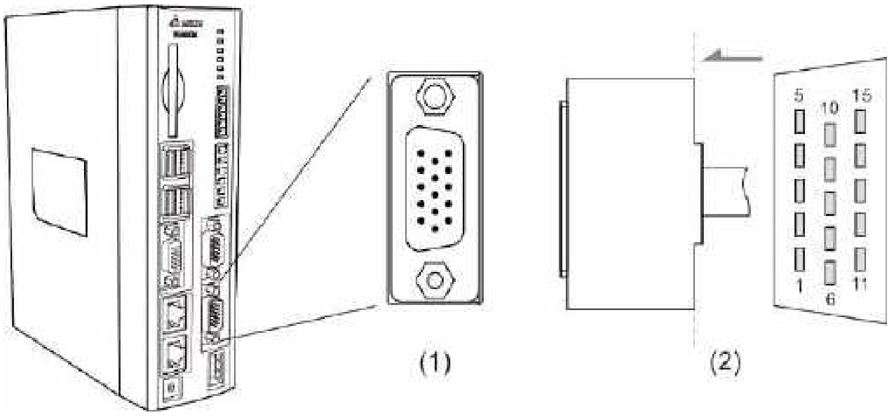
Pin assignment for NC200 series models



(1) RS-485 pins (female); (2) RS-485 pins (male)

Model	Symbol	Pin No.	Function description
NC200	SPINDLE	2	D+
		3	D-

Pin assignment for OPENCNC series models



(1) RS-485 pins (female); (2) RS-485 pins (male)

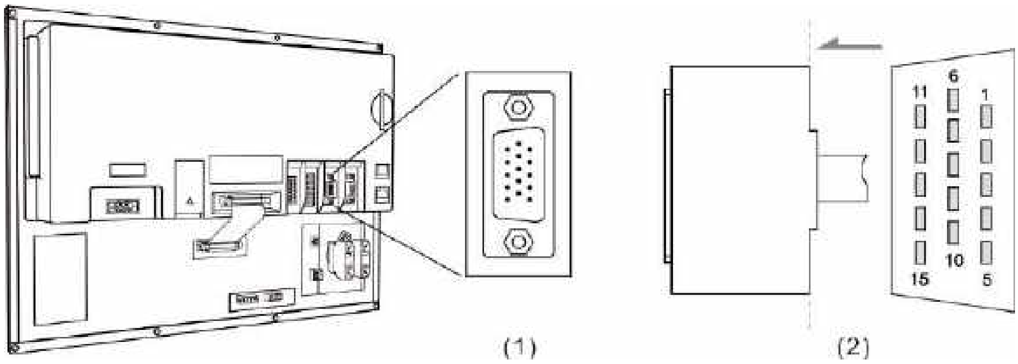
Model	Symbol	Pin No.	Function description
NC30E(H)	SPINDLE	2	D+
		3	D-

3

3.1.5 Wiring for spindle feedback input

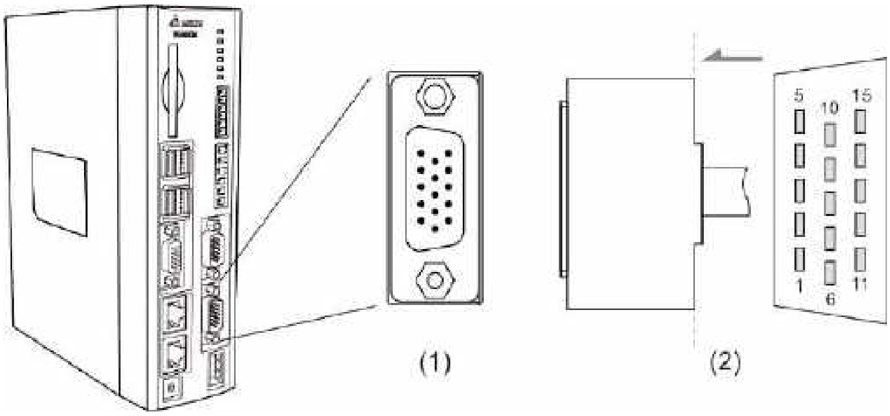
The NC series controller has one set of spindle feedback input.

Pin assignment for NC200 series models



(1) Spindle feedback input pins (female); (2) Spindle feedback input pins (male)

Pin assignment for OPENCNC series models



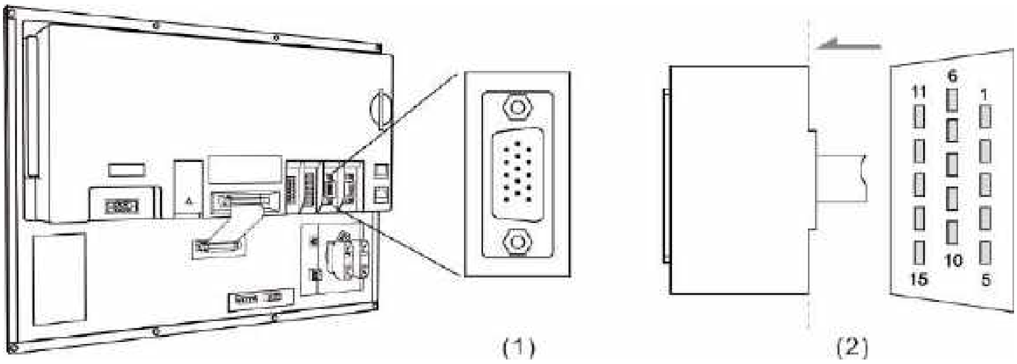
(1) Spindle feedback input pins (female); (2) Spindle feedback input pins (male)

Model	Symbol	Pin No.	Function description	
All	SPINDLE	8	SP_A+	Spindle encoder A+ pulse input
		9	SP_A-	Spindle encoder A- pulse input
		10	DC +5V_OUT	Spindle encoder +5 V_{DC} power output
		11	SP_B+	Spindle encoder B+ pulse input
		12	SP_B-	Spindle encoder B- pulse input
		13	SP_Z+	Spindle encoder Z+ pulse input
		14	SP_Z-	Spindle encoder Z- pulse input
		15	GND	Power ground for spindle encoder

3.1.6 Wiring for spindle analog output

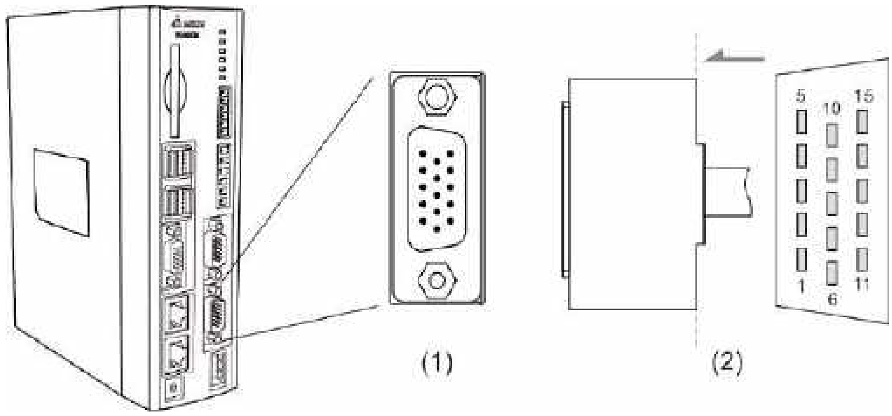
The NC series controller has one set of spindle analog output which controls the spindle speed.

Pin assignment for NC200 series models



(1) Spindle analog output pins (female); (2) Spindle analog output pins (male)

Pin assignment for OPENCNC series models



(1) Spindle analog output pins (female); (2) Spindle analog output pins (male)

Model	Symbol	Pin No.	Function description	
All	SPINDLE	4	SP_OUT	Spindle analog output
		5	SP_GND	Ground for spindle analog output

Spindle settings

1. Pr.399 settings

Parameter description	Spindle control mode	
	Communication	Analog
Spindle function 0: off; 1: on	1	1
Closed-loop control flag 0: off 1: on (feedback encoder is required)	1	0 or 1
Spindle output mode 0: communication (DMCNET); 1: pulse (B series); 2: analog voltage	0	2
Speed control mode 1: PUU	1	1
Spindle encoder magnification 0: 1000 times; 1: 4 times	0	1
Analog spindle speed source 0: system command; 1: encoder feedback	0	1
Analog spindle feedback encoder source 0: spindle; 1: motor	0	0
Spindle voltage output mode 0: -10V to +10V 1: 0V to +10V (effective only under open-loop control)	0	0 or 1

2. In the [CONFIG] (channel setting) screen, enable SP1 and set its port number to 10 (dedicated port for analog output).
   Pins 4 and 5 of the SPINDLE connector are used for spindle analog output.
   The analog voltage resolution is 14-bit.
   When Pr.399 [Spindle voltage output mode] = 0, the analog voltage output ranges from -10V to +10V.*

Output voltage	Corresponding speed
+10 V_{DC}	Maximum speed (forward)
0 V_{DC}	Zero speed
-10 V_{DC}	Maximum speed (reverse)

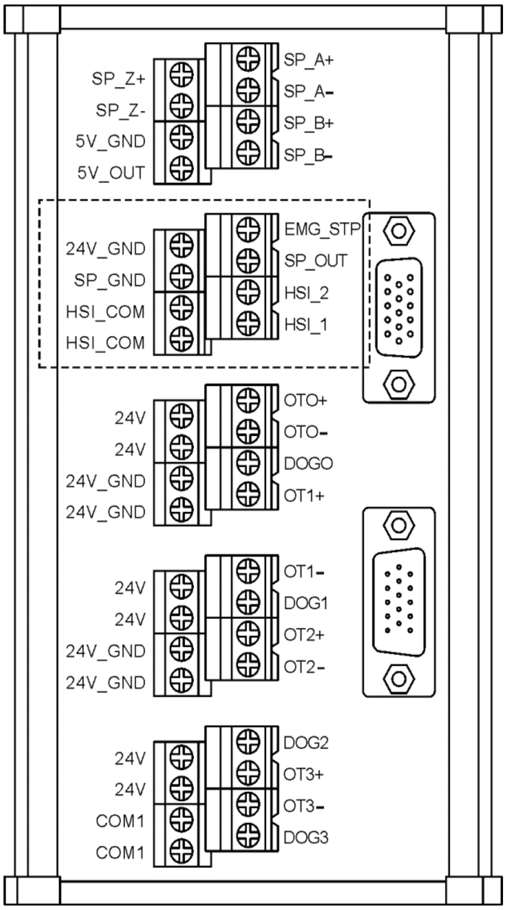
Note: applicable to closed-loop and open-loop control; meeting the application requirements for tapping and threading functions.

When Pr.399 [Spindle voltage output mode] = 1, the analog voltage output ranges from 0V to +10V.*

Output voltage	Corresponding speed
+10 V_{DC}	Maximum speed
0 V_{DC}	Zero speed

Note: only applicable to open-loop control.

If the encoder feedback signal is received, the threading function is available, but the tapping function is not available. The spindle connector conversion card (NC-EXM-S01) is as follows.



3.1.7 Wiring for high-speed counter input (HSI)

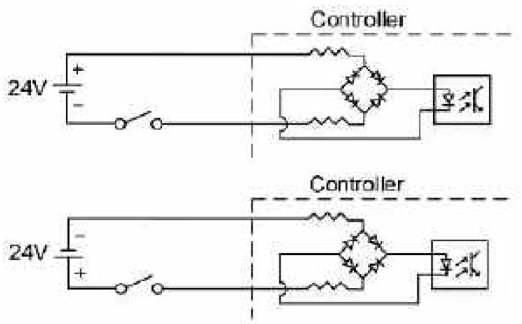
3

The NC series controller has two sets of hardware high-speed counter signal inputs. For the wiring of high-speed counter input (bi-directional coupling), the maximum input bandwidth is up to 5 MHz; the operating voltage ranges from 22 to 26V; the permissible current ranges from 8 to 20 mA; and the surge current is below 50 mA.

- When a signal is input to HSI_1, the corresponding special M, M2142, is On. If there is a G31 Skip command in the block, the system skips the block and jumps to the next block.
- When a signal is input to HSI_2, the corresponding special M, M2143, is On. If there is a G31 Skip command in the block, the system skips the block and jumps to the next block.

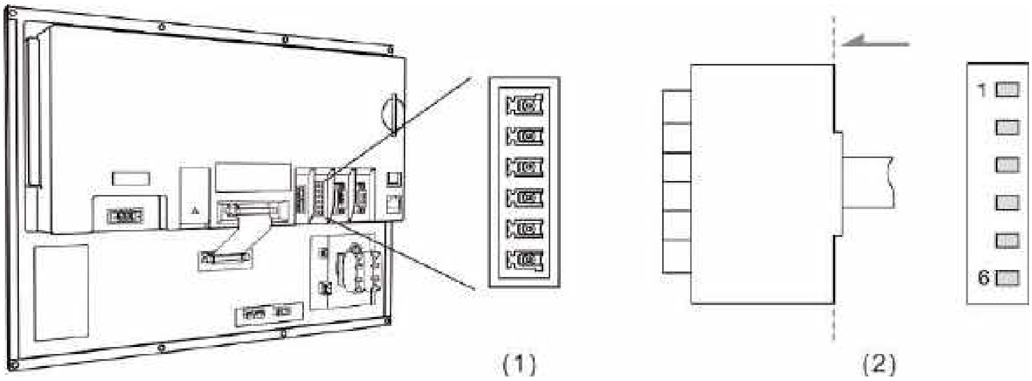
Relevant parameters:

Parameter address	Name	Function
Pr.25	G31 high speed input 1	0: NC; 1: NO
	G31 high speed input 2	0: NC; 1: NO
Pr.46	Switch for G31 high speed input 1	0: off; 1: on
	Switch for G31 high speed input 2	0: off; 1: on
Pr.307	G31 input source	0: off; 1: HSI 1; 2: HSI 2; 3: HSI 1 & 2



Note: the connection direction of the external power input for HSI does not affect the operation.

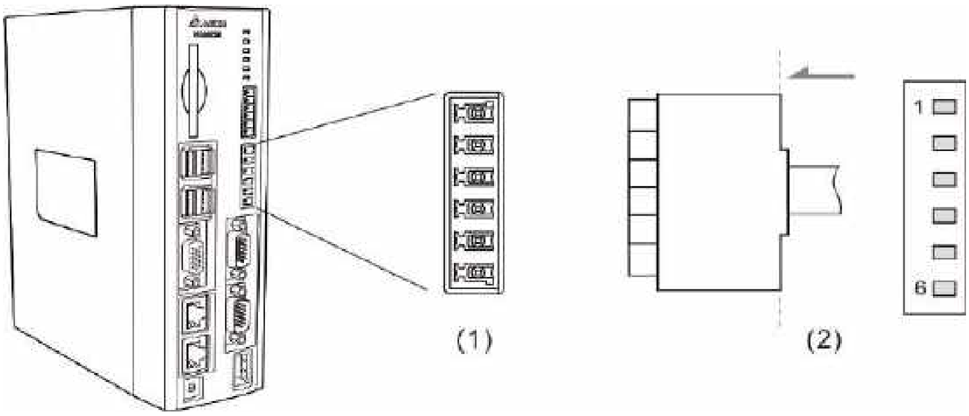
Pin assignment for NC200 series models



(1) High-speed counter input pins (female); (2) High-speed counter input pins (male)

Model	Symbol	Pin No.	Function description	
NC200	HSI	3	HSI_1	High-speed counter input 1 (10 mA)
		4	HSI_COM	High-speed counter COM; connects to +24 V_{DC} or 0V
		5	HSI_2	High-speed counter input 2 (10 mA)
		6	HSI_COM	High-speed counter COM; short-circuit Pin 4 and Pin 6.

Pin assignment for OPENCNC series models



(1) High-speed counter input pins (female); (2) High-speed counter input pins (male)

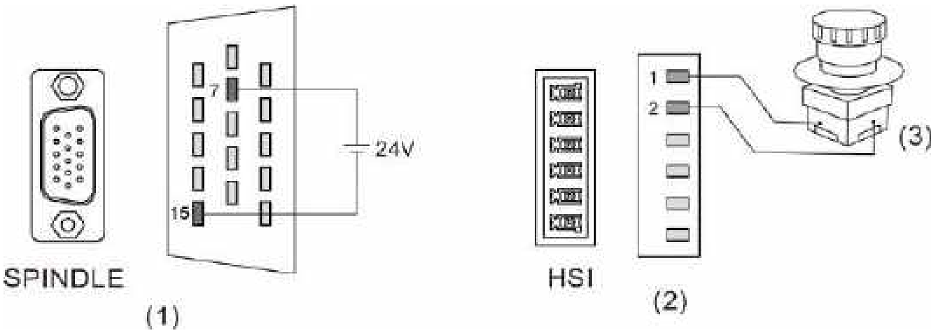
Model	Symbol	Pin No.	Function description	
NC30E(H)	HSI	3	HSI_1	High-speed counter input 1 (10 mA)
		4	GND	GND
		5	HSI_2	High-speed counter input 2 (10 mA)
		6	HSI_COM	High-speed counter COM; connects to +24 V_{DC} or 0V

Note: HSI_1 and HSI_2 can output +5V power, so either HSI_1 or HSI_2 can form a circuit with GND.

3.1.8 Wiring for emergency stop

The NC series controller has one set of emergency stop signal input.

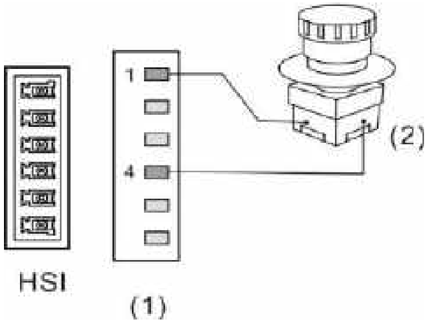
Pin assignment for NC200 series models



(1) & (2) EMG pins; (3) Emergency stop button

Model	Symbol	Pin No.	Function description	
NC200	SPINDLE	7	EMG_IN	Emergency stop power input (+24 V_{DC})
		15	GND	Emergency stop power input (0 V_{DC})
	HSI	1	EMG_IN	Emergency stop signal input
		2	EMG_GND	Emergency stop signal input

Pin assignment for OPENCNC series models



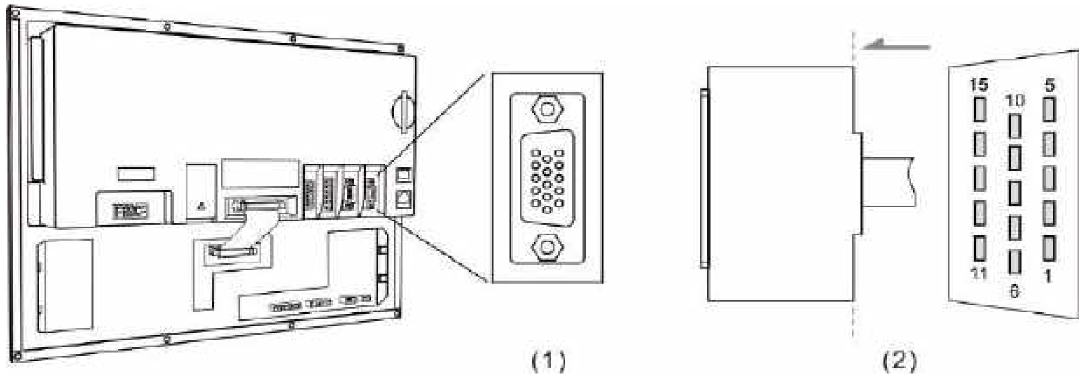
(1) EMG pins; (2) Emergency stop button

Model	Symbol	Pin No.	Function description	
NC30E(H)	HSI	1	EMG_IN	EMG (+5 V_{DC} output)
		4	GND	GND

3.1.9 Wiring for MPG connector

The NC series controller has one MPG connector for receiving pulses generated by the MPG handwheel. This connector can directly supply +5 V_{DC} power to the MPG handwheel.

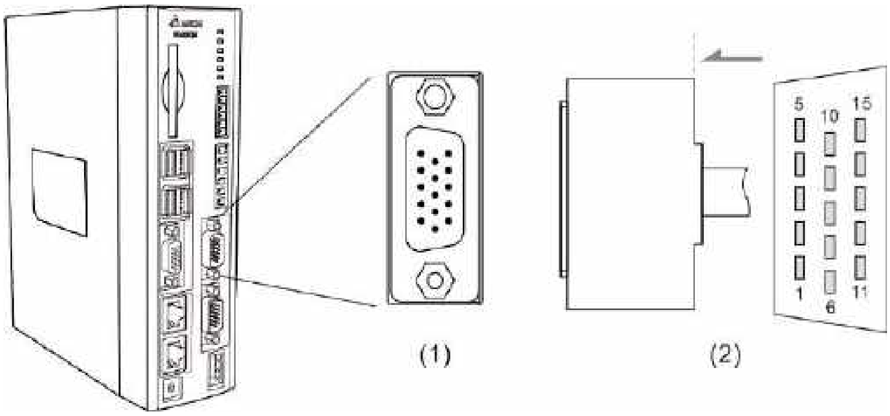
Pin assignment for NC200 series models



(1) MPG connector (female); (2) MPG connector (male)

Model	Symbol	Pin No.	Function description	
NC200	MPG	1	EXT_24	DI COM point; connects to +24 V_{DC} or 0 V_{DC}
		2	DI_1	X28
		3	DI_2	X29
		4	DI_3	X30
		5	DI_4	X31
		6	DI_5	X32
		7	DI_6	X33
		8	DI_7	X26
		9	DO_8	Y27
		10	5V_OUT	5V_{DC}_OUT
		11	XA+	XA+
		12	XA-	XA-
		13	XB+	XB+
		14	XB-	XB-
		15	5V_GND	5V_{DC}_GND

Pin assignment for OPENCNC series models

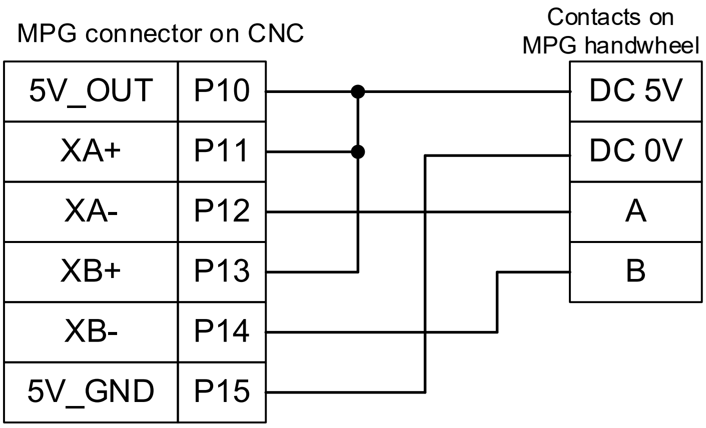


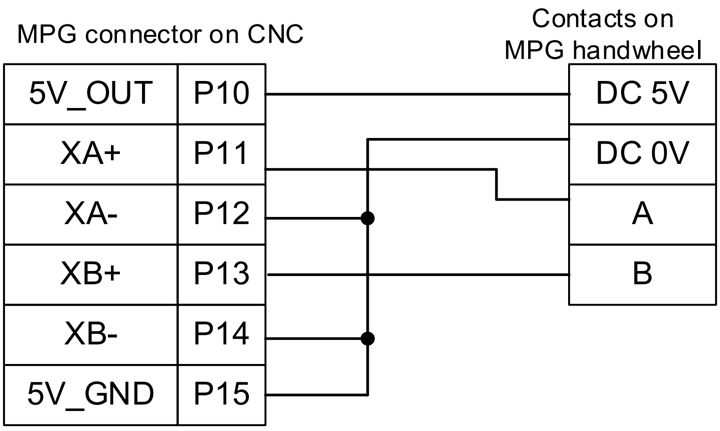
(1) MPG connector (female); (2) MPG connector (male)

Model	Symbol	Pin No.	Function description	
NC30E_	MPG	1	EXT_24	DI COM point; connects to +24 V_{DC} or 0 V_{DC}
		2	DI_1	X28
		3	DI_2	X29
		4	DI_3	X30
		5	DI_4	X31
		6	DI_5	X32
		7	DI_6	X33
		8	DI_7	X34
		9	DI_8	X35
		10	5V_OUT	$5V_{DC}$_OUT
		11	XA+	XA+
		12	XA-	XA-
		13	XB+	XB+
		14	XB-	XB-
		15	5V_GND	$5V_{DC}$_GND

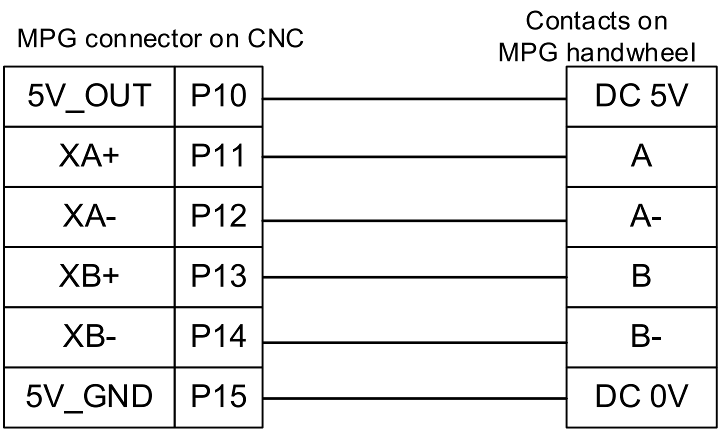
Depending on the signal types, the wiring of MPG handwheel can be divided into single-ended type (EHDW-BA6SI) and differential type (EHDW-BE6SI).

Wiring diagram for the pulse signals of the single-ended type MPG handwheel (EHDW-BA6SI):



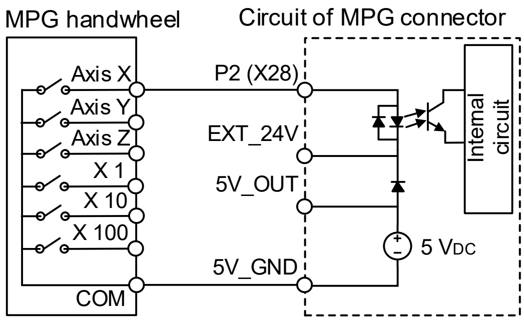


Wiring diagram for the pulse signals of the differential type MPG handwheel (EHDW-BE6SI):

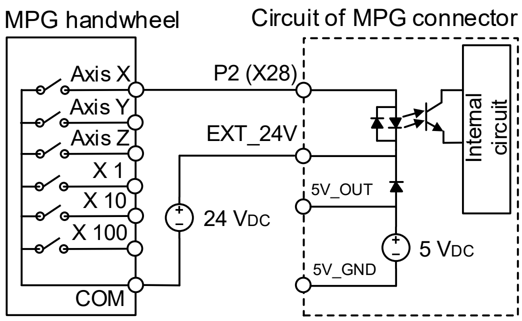


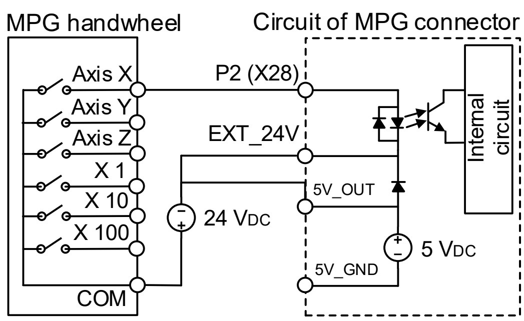
Wiring diagram for the MPG switch:

- The MPG connector on the controller supplies 5V power to the MPG.



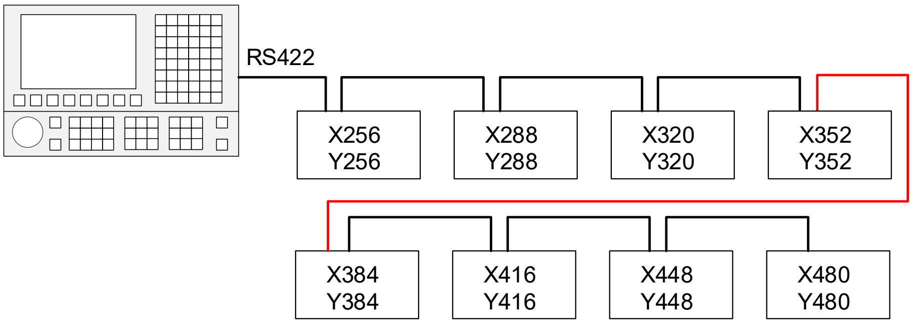
- External 24V power supply: EXT_24 can connect to +24V or 0V.

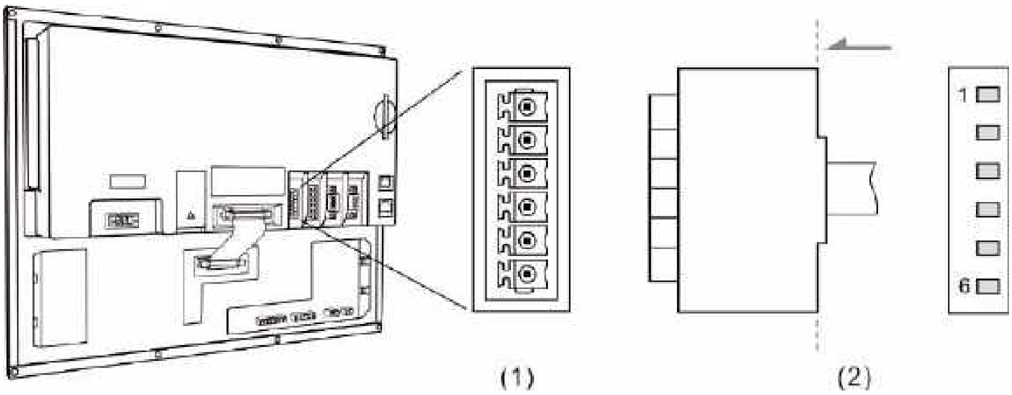




3.1.10 Wiring for remote I/O connector

The NC series controller can connect to 8 remote I/O modules at most. There is an offset of 32 points for the I/O address of every additional station. Thus, up to 256 input points and 256 output points are available for use.

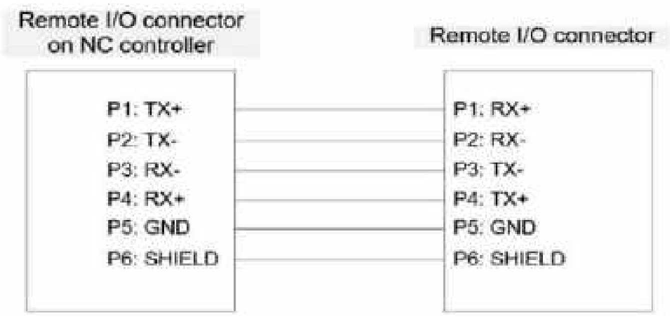




(1) Remote I/O connector (female); (2) Remote I/O connector (male)

Pin No.	Function description
1	TX+
2	TX-
3	RX-
4	RX+
5	GND
6	SHIELD

Wiring diagram for the remote I/O connector:



There are two types of remote I/O module: opto-isolated type and relay type. The model name explanation is as follows.

NC - EIO - T 32 32 _

(1) (2) (3) (4) (5) (6)

(1) Series name

(2) Product name

(3) Type:

T: opto-isolated type (permissible current: below 50 mA; surge current: below 100 mA)

R: relay type (the permissible current can be 5A or 16A according to the relay specification)

(4) Number of inputs

(5) Number of outputs

(6) Permissible current:

None: 5A (G2R relay)

A: 16A (G2R relay)

B: 16A (IDEC relay)

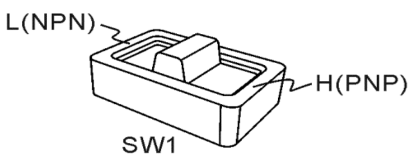
The remote I/O module models are as follows.

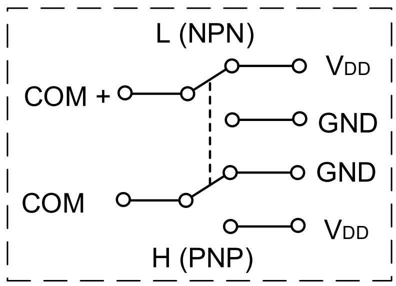
Model	Description	Note
NC-EIO-R2010	Relay type I/O module with 20 input points and 10 output points.	G2R relay Permissible current: 5A
NC-EIO-R2010A	Relay type I/O module with 20 inputs points and 10 output points.	G2R relay Permissible current: 16A
NC-EIO-R2010B	Relay type I/O module with 20 inputs points and 10 output points.	IDEC relay Permissible current: 16A
NC-EIO-R3216	Relay type I/O module with 32 input points and 16 output points.	G2R relay Permissible current: 5A
NC-EIO-R3216A	Relay type I/O module with 32 input points and 16 output points.	G2R relay Permissible current: 16A
NC-EIO-R3216B	Relay type I/O module with 32 input points and 16 output points.	IDEC relay Permissible current: 16A
NC-EIO-R3232	Relay type I/O module with 32 input points and 32 output points.	Permissible current: 5A
NC-EIO-T3232	Opto-isolated type I/O module with 32 input points and 32 output points.	Permissible current: 50 mA

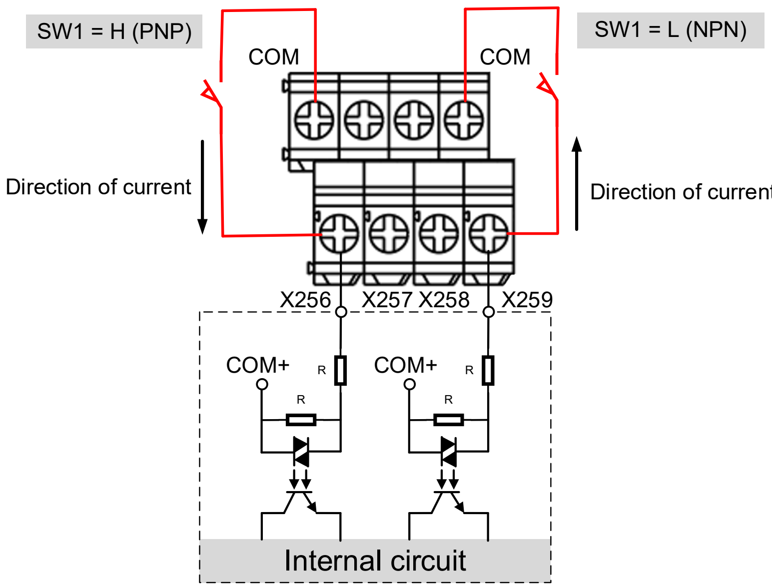
Precautions for wiring the remote I/O module are as follows.

(1) The COM input point is used for signal current. Do not connect DC24V or 0V power to the COM point.

(2) You can select the H (PNP) or L (NPN) signal with the H / L switch according to the specification of the external sensor. When H (PNP) is selected, the COM point is +24V; when L (NPN) is selected, the COM point is 0V.

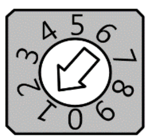






(3) Up to 8 modules can be connected to the remote I/O module connector simultaneously. Turn the rotary switch on the PCB to switch the station number. 0 = Station 1, 1 = Station 2, 2 = Station 3, and so on to 7, which is Station 8.

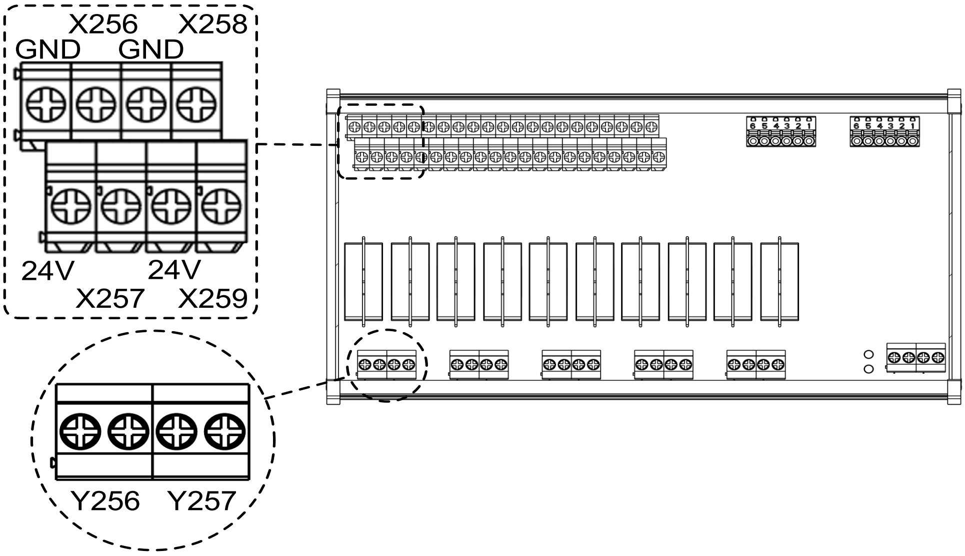
When you turn the rotary switch to 8 and 9 to set the remote I/O modules as Stations 9 and 10, the system regards Station 9 (position: 8) as Station 1 (position: 0) and Station 10 (position: 9) as Station 2 (position: 1), so do not turn the rotary switch to 0 and 1 at the same time.



Rotary switch for station number

3

3.1.10.1 NC-EIO-R2010

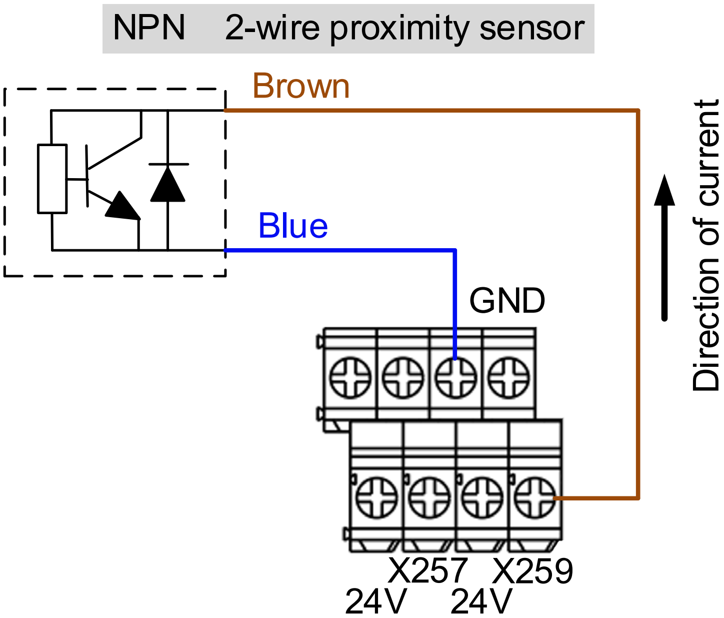


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN), and short-circuit the GND (commonly a blue wire) of the sensor and the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.

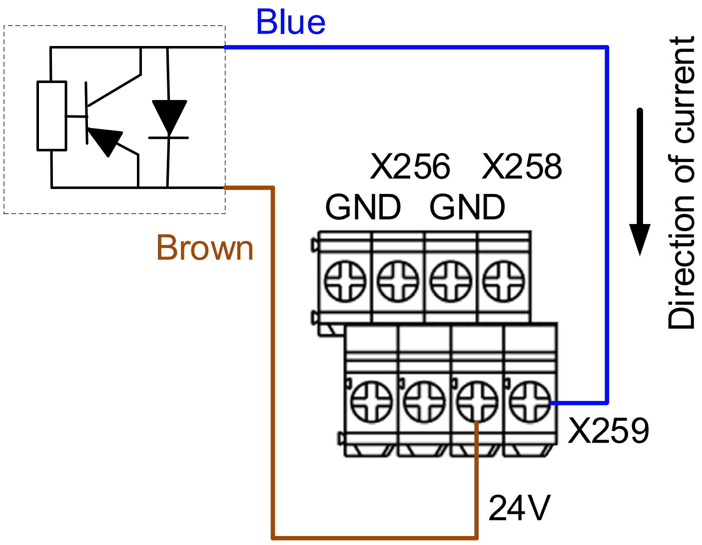


PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and short-circuit the Vcc (commonly a brown wire) of the sensor and the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.

PNP 2-wire proximity sensor



NPN 3-wire proximity sensor with polarity:

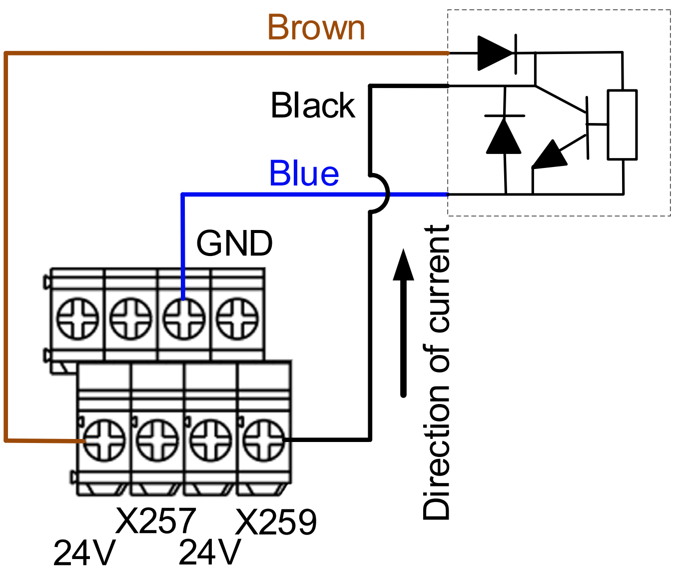
(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to GND (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

NPN 3-wire proximity sensor



3

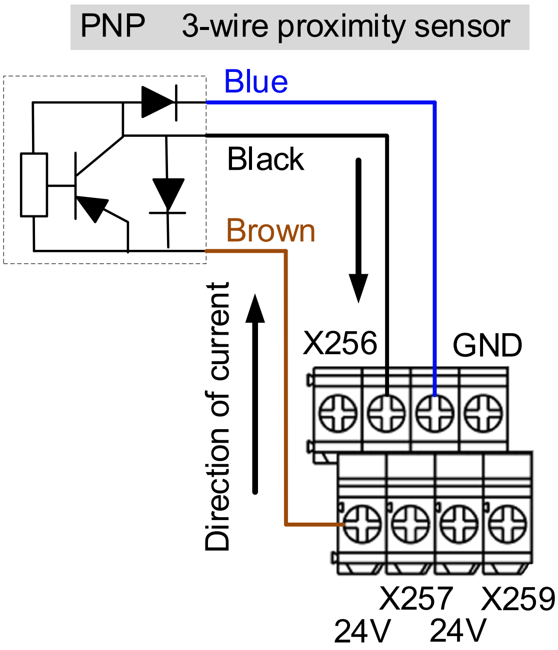
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to GND (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

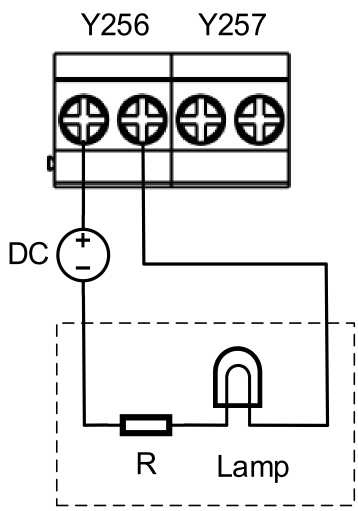


DO wiring example

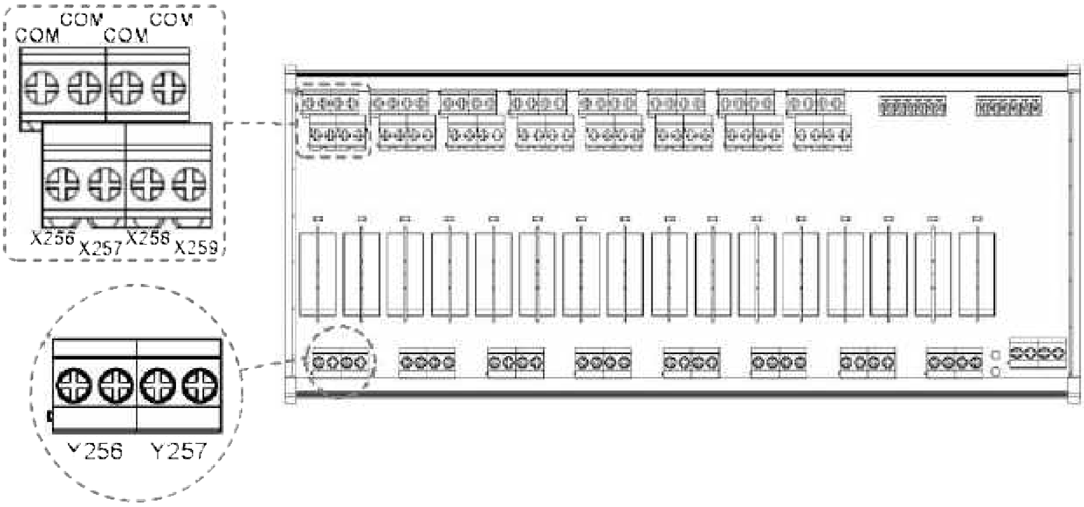
(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3.1.10.2 NC-EIO-R3216

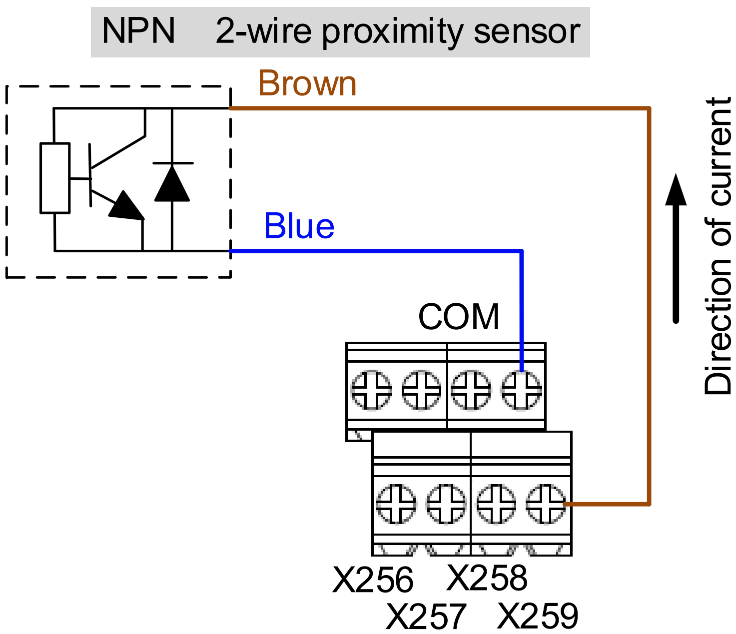


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN), and the COM point is 0V. Connect the GND (commonly a blue wire) of the sensor to the COM point or short-circuit the GND of the sensor to the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.

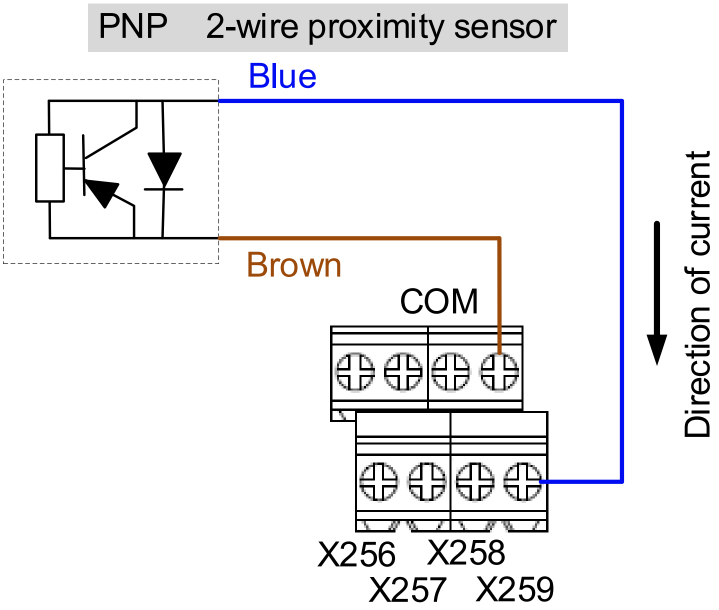


3

PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and the COM point is +24V. Connect the Vcc (commonly a brown wire) of the sensor to the COM point or short-circuit the Vcc of the sensor to the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



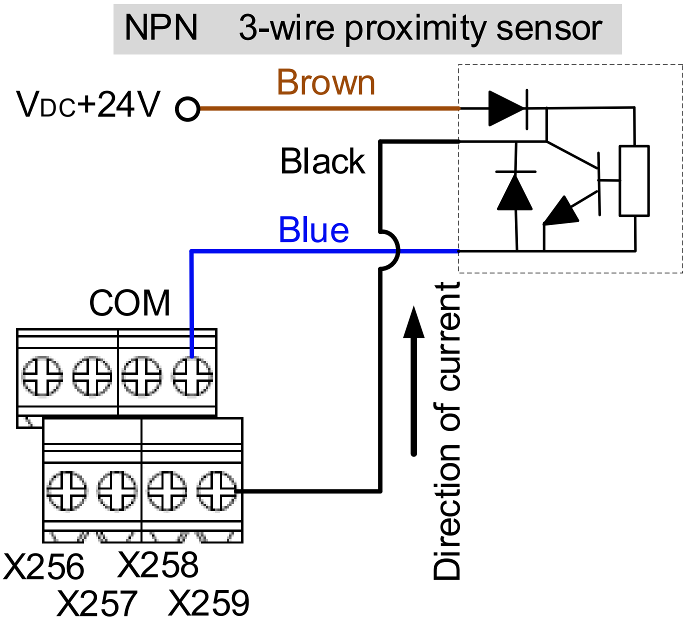
NPN 3-wire proximity sensor:

(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to COM (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.



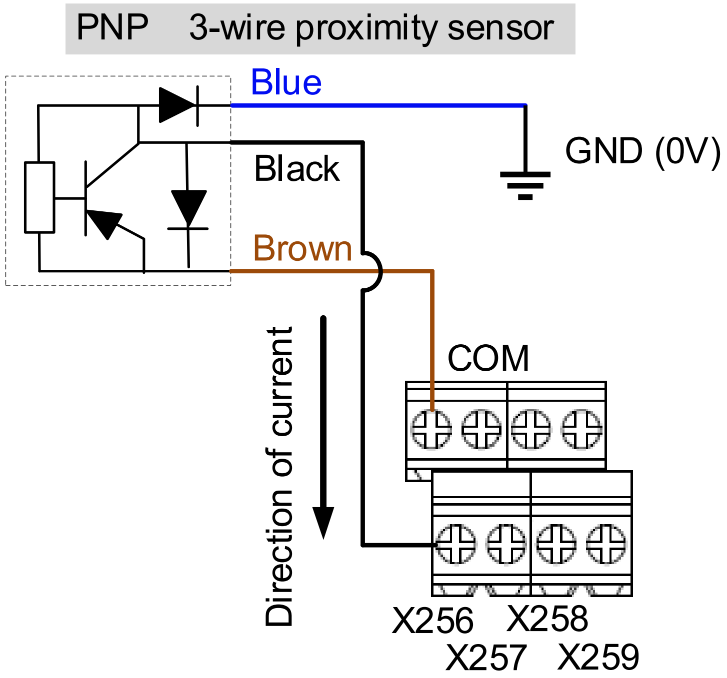
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

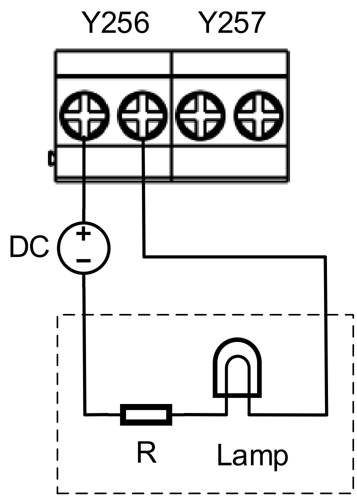


DO wiring example

(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

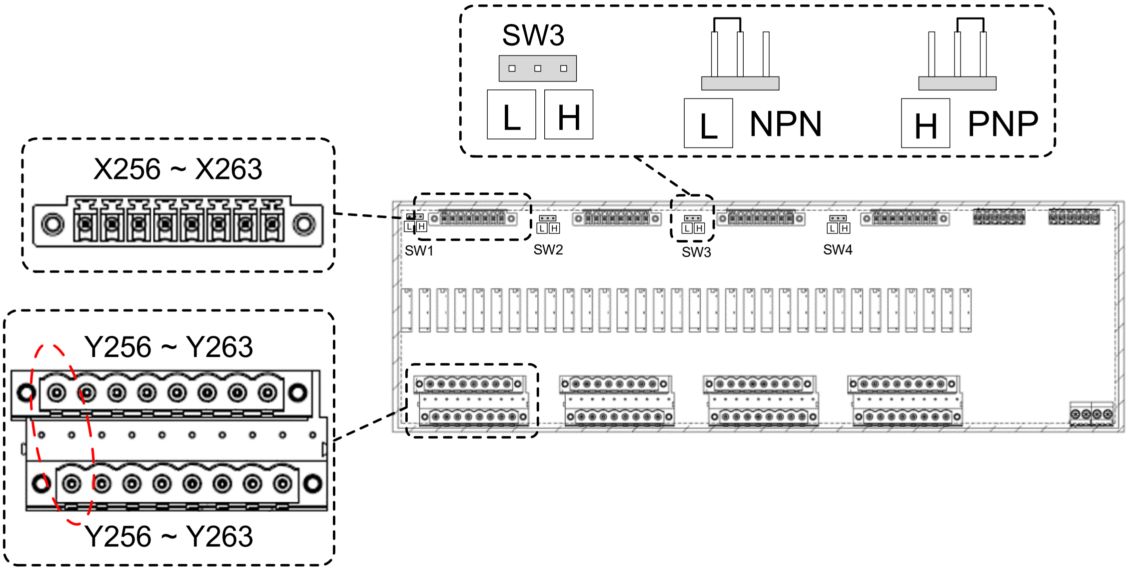
(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3

3.1.10.3 NC-EIO-R3232

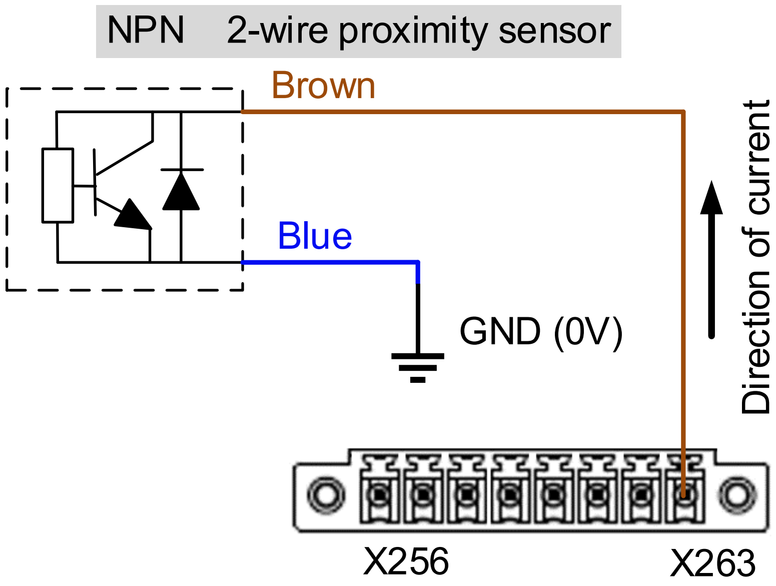


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Switch the short circuit jumper to L (NPN), and short-circuit the GND (commonly a blue wire) of the sensor and the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.

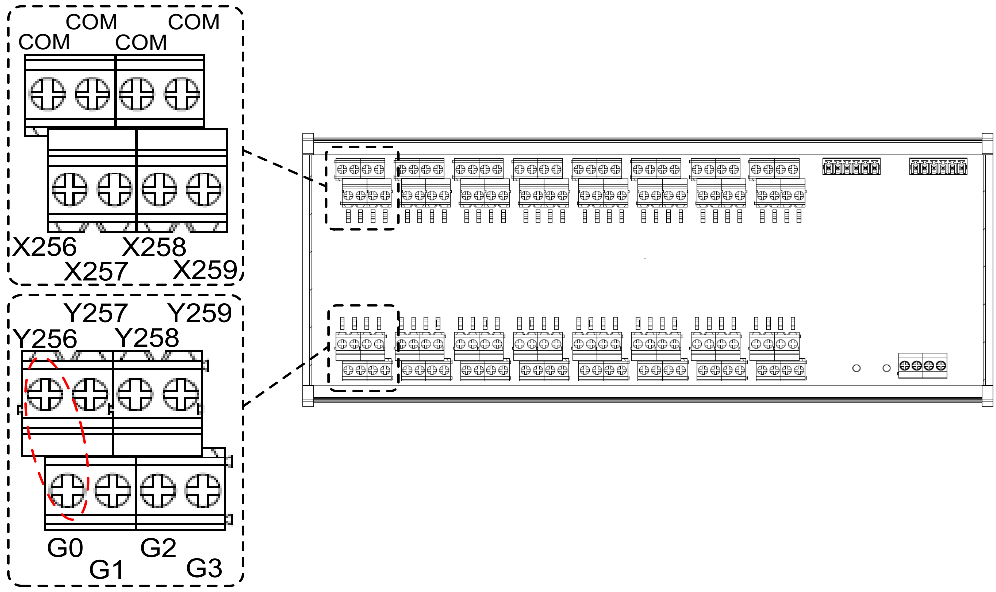


3

PNP 2-wire system proximity sensor with polarity:

(1) Switch the short circuit jumper to H (PNP), and short-circuit the Vcc (commonly a brown wire) of the sensor and the +24V of the same power system.

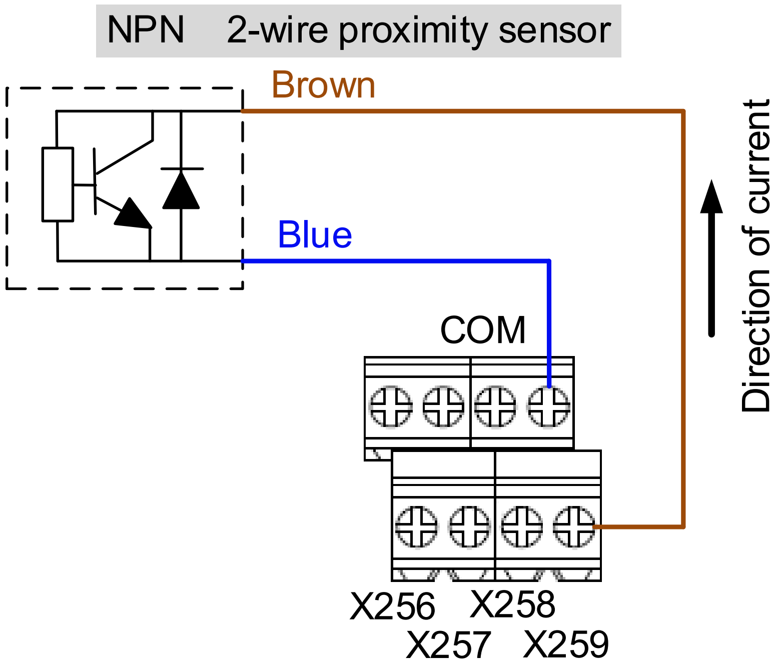
(2) Connect GND (commonly a blue wire) to the input contact.



NPN 2-wire proximity switch with polarity:

(1) Set the H / L switch to L (NPN), and the COM point is 0V. Then, connect the GND (commonly a blue wire) of the sensor to the COM, or short-circuit the GND of the sensor and the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.

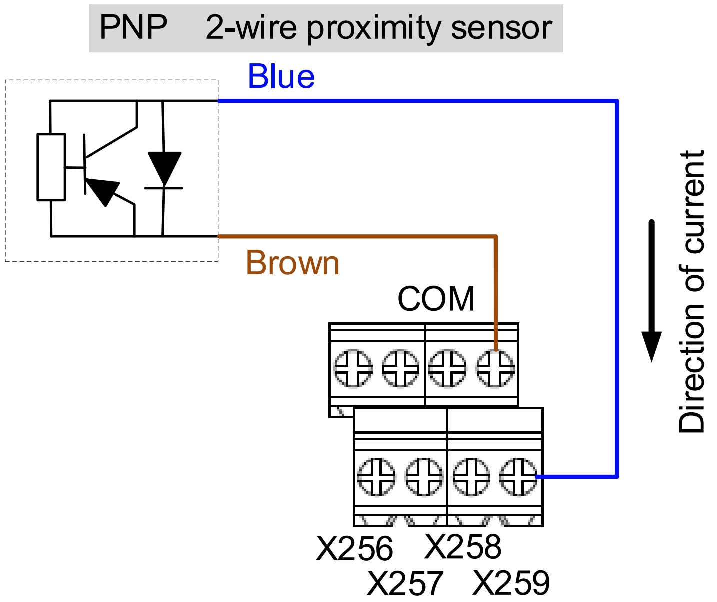


3

PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and the COM point is +24V. Then, connect Vcc (commonly a brown wire) of the sensor to the COM point or short-circuit the Vcc and the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



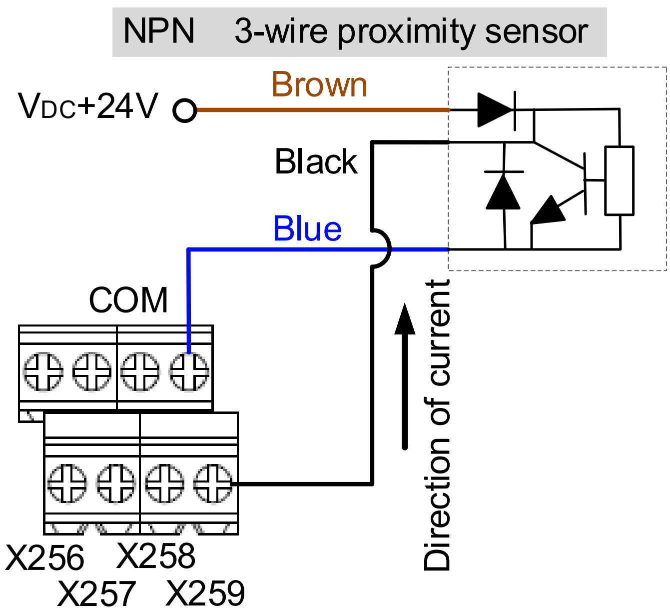
NPN 3-wire proximity sensor:

(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.



3

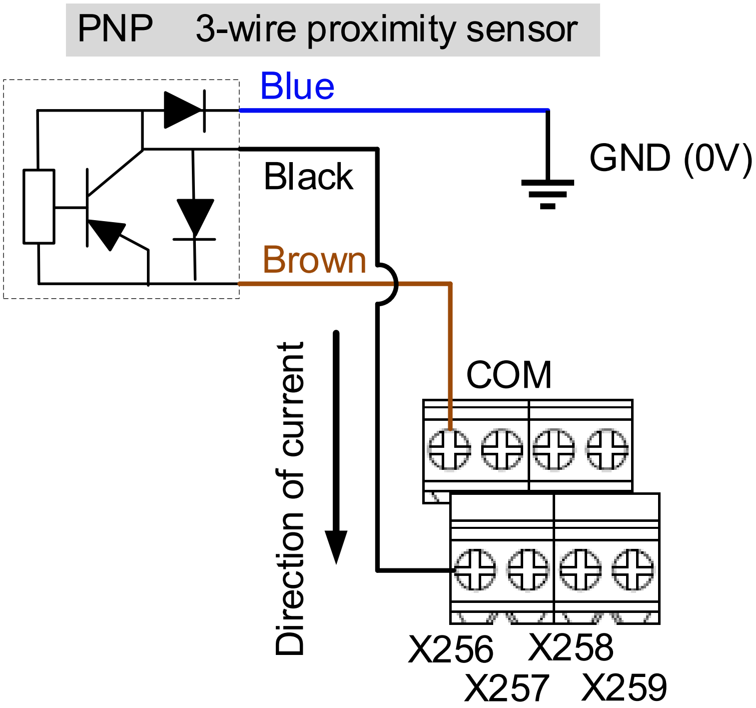
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

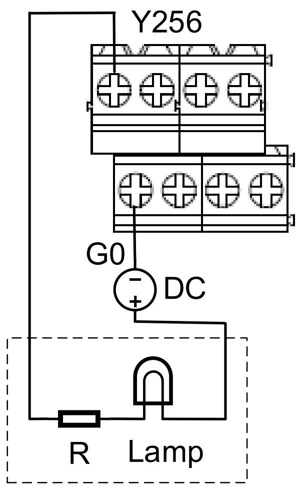


DO wiring example

(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.

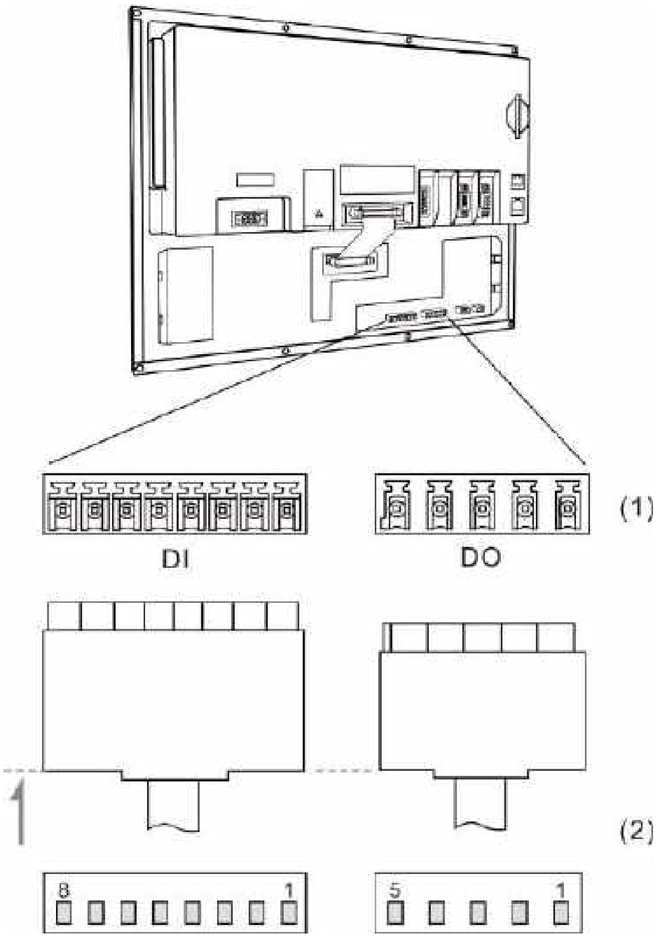


3

3.1.11 Wiring for local I/O connector

The pin assignment for the local I/O connector of the NC200 series controllers is as follows.

Note: NC30E(H) series models do not have the local I/O connector.

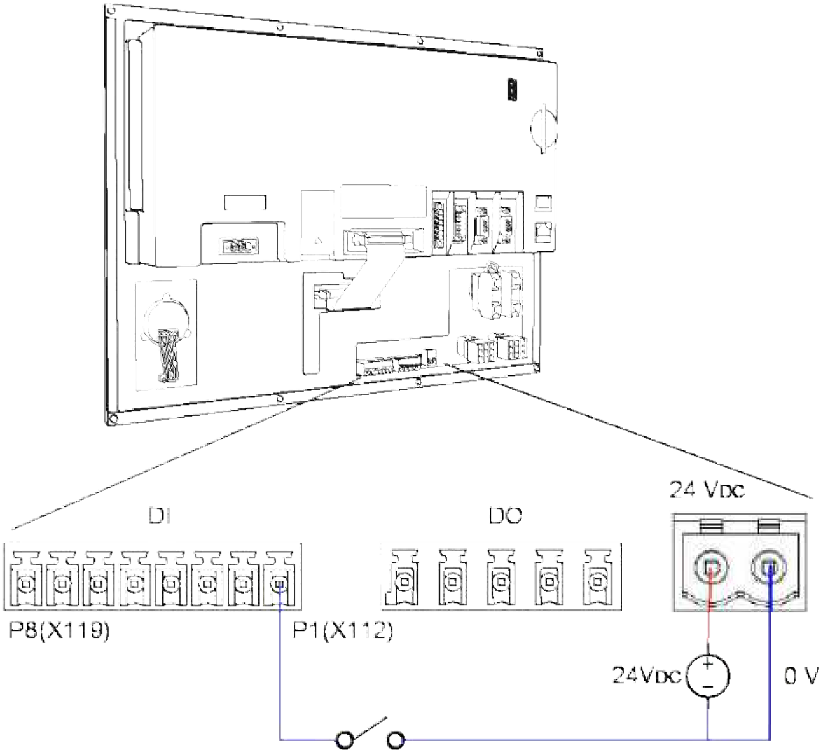


(1) Local I/O connector (female); (2) Local I/O connector (male)

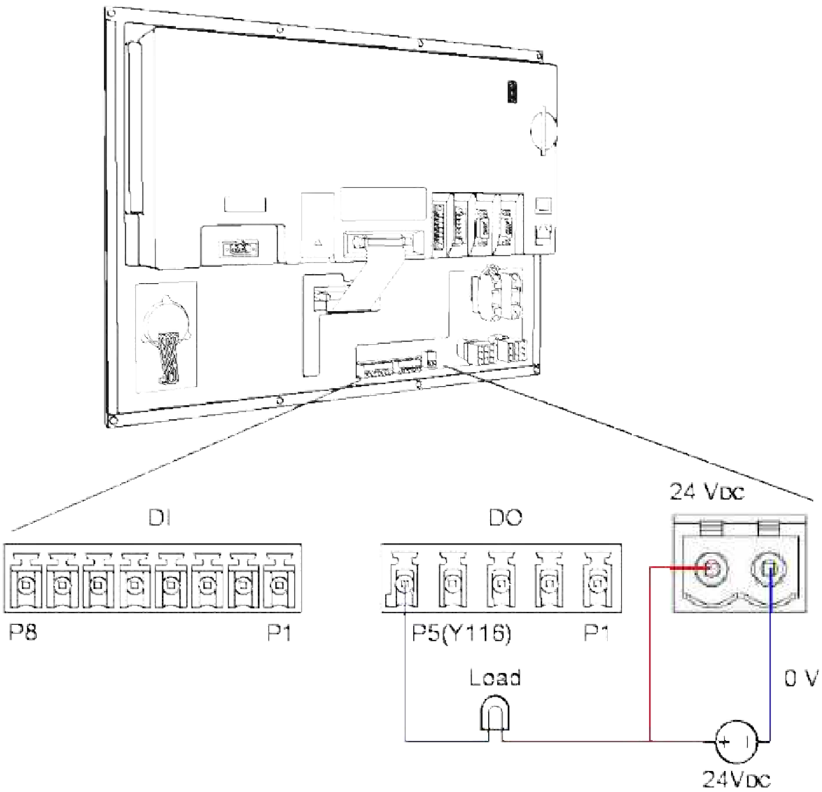
DI			
Pin 1	X112	Pin 2	X113
Pin 3	X114	Pin 4	X115
Pin 5	X116	Pin 6	X117
Pin 7	X118	Pin 8	X119

DO			
Pin 1	Y112	Pin 2	Y113
Pin 3	Y114	Pin 4	Y115
Pin 5	Y116	-	-
-	-	-	-

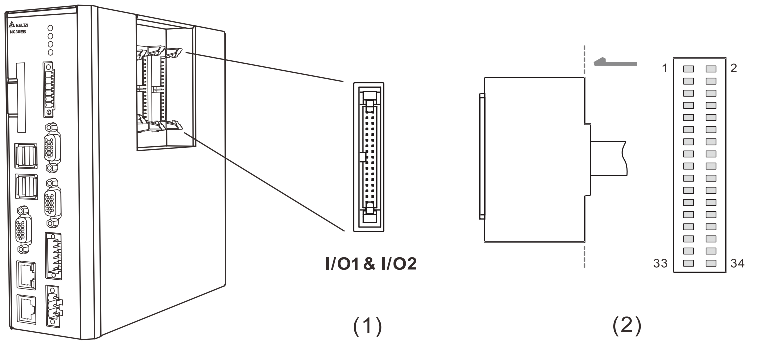
DI wiring (24V power is supplied from machine operation panel B)



DO wiring (24V power is supplied from machine operation panel B)

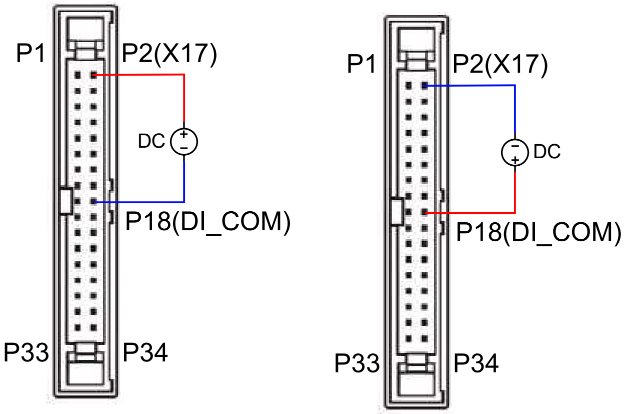


Pin assignment for OPENCNC series models

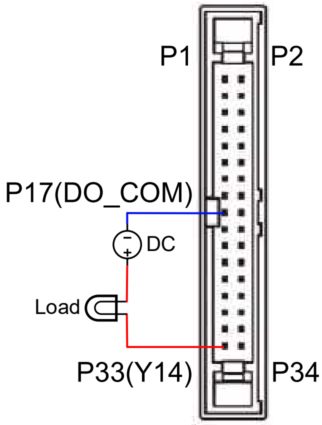


(1) Local I/O connector (female); (2) Local I/O connector (male)

I/O 1				I/O 2			
Pin 1	X0	Pin 2	X1	Pin 1	X16	Pin 2	X17
Pin 3	X2	Pin 4	X3	Pin 3	X18	Pin 4	X19
Pin 5	X4	Pin 6	X5	Pin 5	X20	Pin 6	X21
Pin 7	X6	Pin 8	X7	Pin 7	X22	Pin 8	X23
Pin 9	X8	Pin 10	X9	Pin 9	X24	Pin 10	X25
Pin 11	X10	Pin 12	X11	Pin 11	X26	Pin 12	X27
Pin 13	X12	Pin 14	X13	Pin 13	X28	Pin 14	X29
Pin 15	X14	Pin 16	X15	Pin 15	X30	Pin 16	X31
Pin 17	DO_COM	Pin 18	DI_COM	Pin 17	DO_COM	Pin 18	DI_COM
Pin 19	Y0	Pin 20	Y1	Pin 19	Y16	Pin 20	Y17
Pin 21	Y2	Pin 22	Y3	Pin 21	Y18	Pin 22	Y19
Pin 23	Y4	Pin 24	Y5	Pin 23	Y20	Pin 24	Y21
Pin 25	Y6	Pin 26	Y7	Pin 25	Y22	Pin 26	Y23
Pin 27	Y8	Pin 28	Y9	Pin 27	Y24	Pin 28	Y25
Pin 29	Y10	Pin 30	Y11	Pin 29	Y26	Pin 30	Y27
Pin 31	Y12	Pin 32	Y13	Pin 31	Y28	Pin 32	Y29
Pin 33	Y14	Pin 34	Y15	Pin 33	Y30	Pin 34	Y31



Local I/O - DI wiring



Local I/O - DO wiring

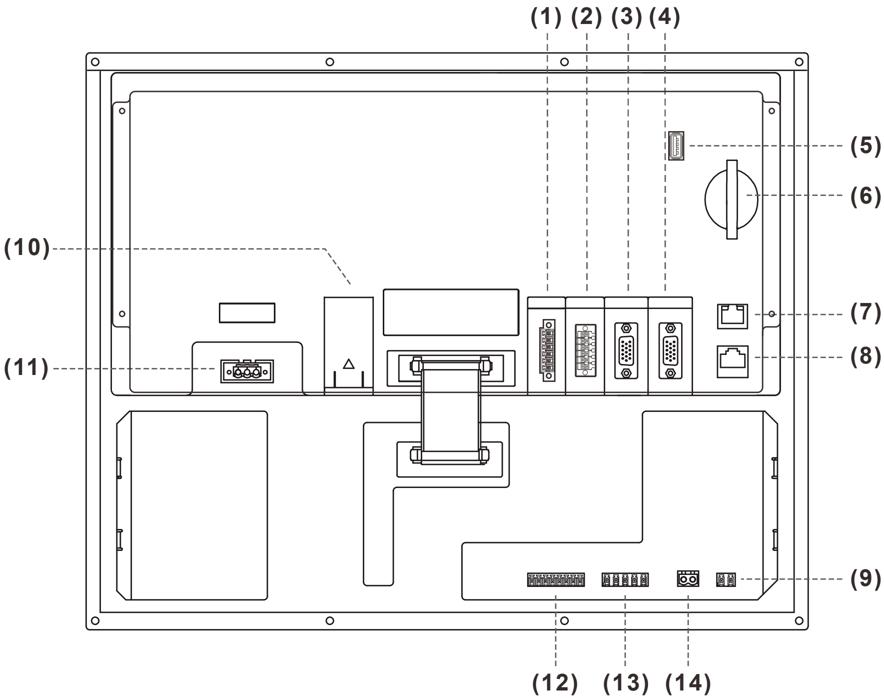
3.2 Wiring for B series products

3.2.1 B series product interface

3

- NC200B series

NC200B□-LI-A□

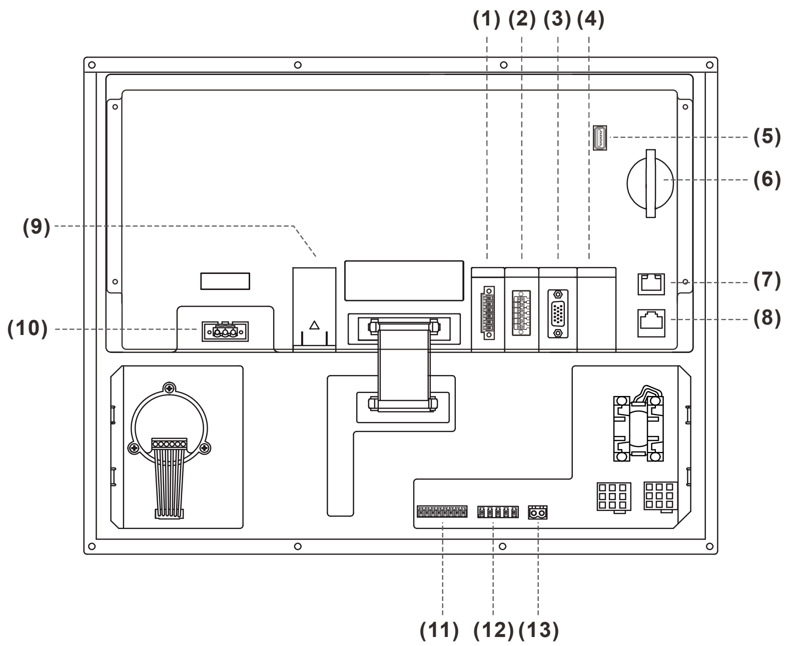


No.	Connector	Description
(1)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 DI and 32 DO points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(2)	CN1	An RS-485 connector for communication with external devices.
		2 sets of DA analog voltage output.
		2 sets of high-speed counter input.
		Emergency stop contact.
(3)	Spindle connector	One set of spindle encoder signal input.
		One set of spindle pulse signal output.
(4)	MPG connector	Connects to an external MPG handwheel (powered by the built-in 5 V_{DC} power). 8 DI points are available.
(5)	USB port	Connects to the mouse, keyboard, or flash drive.
(6)	CF card	CF card slot: for storing files and programs.
(7)	Ethernet connector	For DNC control and system monitoring.
(8)	DMCNET connector	High-speed communication network interface.
(9)	IES	Connects to an external emergency stop switch. When the circuit is open, the system stops immediately.
(10)	Battery	Battery holder.
(11)	24 V_{DC} power	24 V_{DC} power input for supplying power to the controller.
(12)	Local I/O input terminal	8 input points.
(13)	Local I/O output terminal	5 output points.
(14)	24 V_{DC} power	For supplying power to the local I/O.

Safety precautions for installation:

1. Check if the wiring for 24 V_{DC} power is correct.
2. The local I/O requires an additional 24 V_{DC} power supply to drive X inputs and Y outputs.
3. Short-circuit the IES (input contact of emergency stop signal) to have the NC system ready for use.
4. If an alarm occurs or the emergency stop signal is On, power off the servo drive by disconnecting the power at the magnetic contactor (MC) with Y outputs.

NC200B□-LI-P□

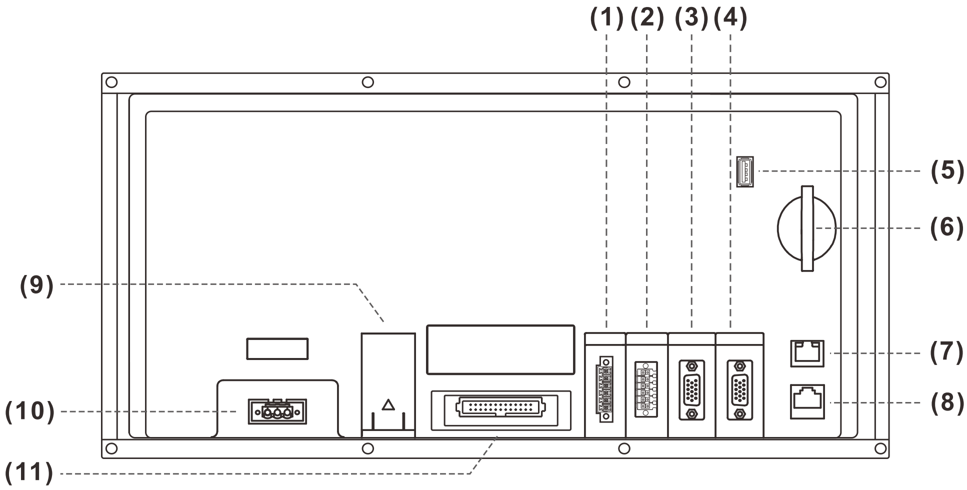


No.	Connector	Description
(1)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 DI and 32 DO points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(2)	CN1	An RS-485 connector for communication with external devices.
		2 sets of DA analog voltage output.
		2 sets of high-speed counter input.
		Emergency stop contact.
(3)	Spindle connector	One set of spindle encoder signal input.
		One set of spindle pulse signal output.
(4)	-	The NC200B□-LI-P□ series model does not have the MPG connector.
(5)	USB port	Connects to the mouse, keyboard, or flash drive.
(6)	CF card	CF card slot: for storing files and programs.
(7)	Ethernet connector	Ethernet connector; for DNC control and system monitoring.
(8)	DMCNET connector	High-speed communication network interface.
(9)	Battery	Battery holder.
(10)	24 V_{DC} power	24 V_{DC} power input for supplying power to the controller.
(11)	Local I/O input terminal	8 input points.
(12)	Local I/O output terminal	5 output points.
(13)	24 V_{DC} power	24 V_{DC} power input. For supply power to local I/O and the lights for CYCLE START and FEED HOLD buttons.

Safety precautions for installation:

1. Check if the wiring for 24 V_{DC} power is correct.
2. The local I/O requires an additional 24 V_{DC} power supply to drive X inputs and Y outputs.
3. Short-circuit the IES (input contact of emergency stop signal) to have the NC system ready for use.
4. If an alarm occurs or the emergency stop signal is On, power off the servo drive by disconnecting the power at the magnetic contactor (MC) with Y outputs.

NC200B□-LS-A□



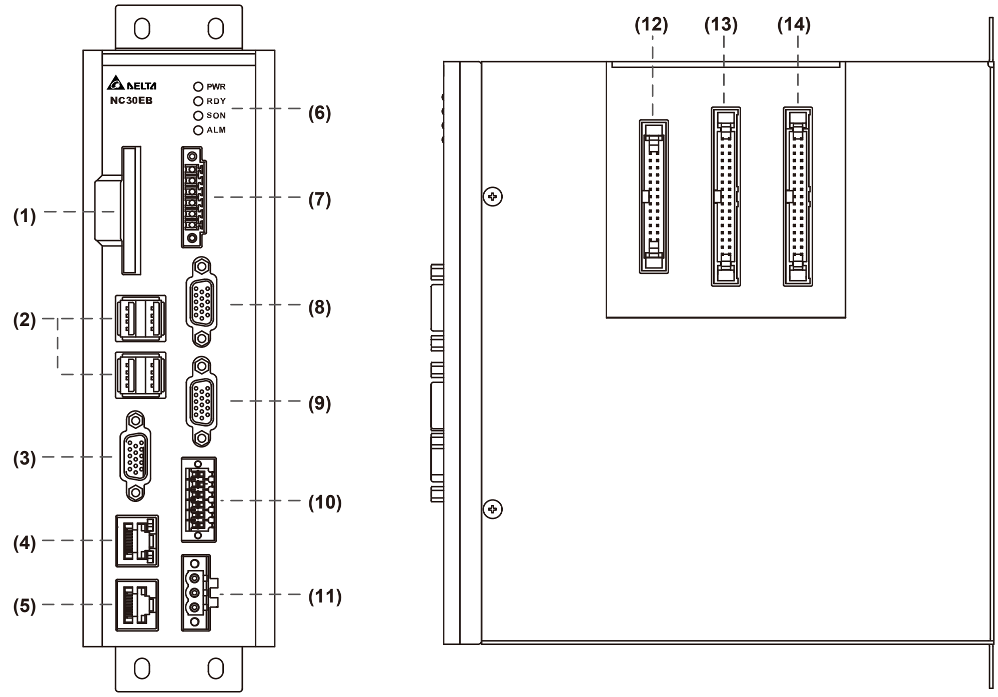
No.	Connector	Description
(1)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 DI and 32 DO points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.
(2)	CN1	An RS-485 connector for communication with external devices.
		2 sets of DA analog voltage output.
		2 sets of high-speed counter input.
		Emergency stop contact.
(3)	Spindle connector	One set of spindle encoder signal input.
		One set of spindle pulse signal output.
(4)	MPG connector	Connects to an external MPG handwheel (powered by the built-in 5 V_{DC} power). 8 DI points are available.
(5)	USB port	Connects to the mouse, keyboard, or flash drive.
(6)	CF card	CF card slot: for storing files and programs.
(7)	Ethernet connector	For DNC control and system monitoring.
(8)	DMCNET connector	High-speed communication network interface.
(9)	Battery	Battery holder.
(10)	24 V_{DC} power	24 V_{DC} power input for supplying power to the controller.
(11)	Keypad I/O	Flat cable connector on machine operation panel B.

Safety precautions for installation:

1. Check if the wiring for 24 V_{DC} power is correct.

■ OPENCNC series

NC30EB(H)



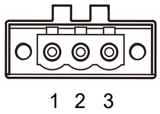
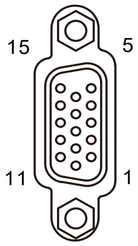
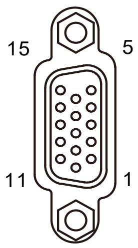
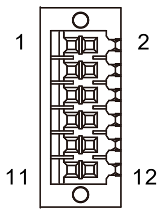
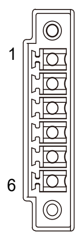
No.	Connector	Description	
(1)	CF card	CF card slot: for storing files and programs.	
(2)	USB port	Three USB host connectors for connecting to the mouse, keyboard, and flash drive.	
(3)	VGA connector	For connecting to a screen.	
(4)	Ethernet connector	Ethernet connector; for DNC control and system monitoring.	
(5)	DMCNET connector	High-speed communication network interface.	
(6)	Indicators	PWR	Green: system power is on
		RDY	Flashing green: system is ready
		SON	Flashing green: servo is ready
		ALM	Red: system alarm occurs
(7)	Remote I/O	Connects to high-speed serial I/O module: each module has 32 DI and 32 DO points. The maximum distance between stations is 20 m (65.62 ft) and up to 8 remote I/O modules can be connected.	
(8)	MPG connector	Connects to an external MPG handwheel (powered by the built-in 5 V_{DC} power). 8 DI points are available.	
(9)	Spindle connector	One set of spindle encoder signal input.	
		One set of spindle pulse signal output.	
(10)	CN1	An RS-485 connector for communication with external devices.	
		2 sets of DA analog voltage output.	
		2 sets of high-speed counter input.	
		Emergency stop contact.	
(11)	24 V_{DC} power	24 V_{DC} power input for supplying power to the controller.	
(12)	Keypad I/O	Connects to machine operation panel B.	
(13)	I/O 1	16 input / 16 output points.	
(14)	I/O 2	16 input / 16 output points.	

Safety precautions for installation:

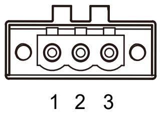
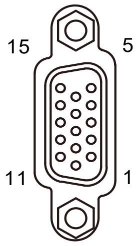
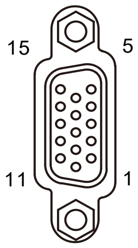
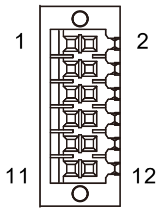
1. Check if the wiring for 24 V_{DC} power is correct.
2. Remote I/O requires an additional 24 V_{DC} power supply to drive X inputs and Y outputs.
3. If an alarm occurs or the emergency stop signal is on, power off the servo drive by disconnecting the power at the magnetic contactor (MC) with Y output.

3.2.2 Connectors of B series controller

3.2.2.1 NC200B series connectors

<table>
<tr><th>Connector</th><th>Diagram / Function</th><th>Description</th></tr>
<tr><td>DC 24V
(Power input for controller)</td><td>
</td><td>Connects to the 24 V_{DC} power (24 W at 1 A).
<table>
<tr><th>Pin 1</th><th>Symbol</th><th>Description</th></tr>
<tr><td>1</td><td>+24 V</td><td>+24 V_{DC}</td></tr>
<tr><td>2</td><td>0 V</td><td>0 V_{DC}</td></tr>
<tr><td>3</td><td>⏚</td><td>Power grounding; FGND</td></tr>
</table></td></tr>
<tr><td>MPG
(Handwheel)</td><td>
</td><td>8 DI points and 1 set of differential type MPG input signal.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>DI_COM</td><td>9</td><td>DI7</td></tr>
<tr><td>2</td><td>DI0</td><td>10</td><td>+5 V_{DC} OUT</td></tr>
<tr><td>3</td><td>DI1</td><td>11</td><td>A</td></tr>
<tr><td>4</td><td>DI2</td><td>12</td><td>A#</td></tr>
<tr><td>5</td><td>DI3</td><td>13</td><td>B</td></tr>
<tr><td>6</td><td>DI4</td><td>14</td><td>B#</td></tr>
<tr><td>7</td><td>DI5</td><td>15</td><td>GND</td></tr>
<tr><td>8</td><td>DI6</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>SPINDLE</td><td>
</td><td>Includes spindle pulse output and pulse feedback signals.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>FBK_OA</td><td>9</td><td>SERVO_ON_OUT</td></tr>
<tr><td>2</td><td>FBK_OA#</td><td>10</td><td>+5 V_{DC} OUT</td></tr>
<tr><td>3</td><td>FBK_OB</td><td>11</td><td>CMD_A</td></tr>
<tr><td>4</td><td>FBK_OB#</td><td>12</td><td>CMD_A#</td></tr>
<tr><td>5</td><td>FBK_OZ</td><td>13</td><td>CMD_B</td></tr>
<tr><td>6</td><td>FBK_OZ#</td><td>14</td><td>CMD_B#</td></tr>
<tr><td>7</td><td>+24V_IN</td><td>15</td><td>GND</td></tr>
<tr><td>8</td><td>ALM</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>CN1</td><td>
</td><td>Includes RS-485 communication, spindle analog output, HSI high-speed counter input, and emergency stop signals.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>RS485_ D+</td><td>7</td><td>EMG</td></tr>
<tr><td>2</td><td>RS485_ D-</td><td>8</td><td>GND</td></tr>
<tr><td>3</td><td>RS485 GND</td><td>9</td><td>DAC1</td></tr>
<tr><td>4</td><td>HSI_1</td><td>10</td><td>DAC1_GND</td></tr>
<tr><td>5</td><td>HSI_2</td><td>11</td><td>DAC2</td></tr>
<tr><td>6</td><td>HSI_COM</td><td>12</td><td>DAC2_GND</td></tr>
</table></td></tr>
<tr><td>Remote I/O module
(Remote I/O module serial communication)</td><td>
</td><td>The remote I/O module communication connector can connect to 8 modules. Each module has 32 input and 32 output points. The input points range from X256 to X511 and the output points range from Y256 to Y511.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>T+</td><td>4</td><td>R+</td></tr>
<tr><td>2</td><td>T-</td><td>5</td><td>GND</td></tr>
<tr><td>3</td><td>R-</td><td>6</td><td>SHIELD</td></tr>
</table></td></tr>
<tr><td rowspan="2">Local IO
(Note: machine operation panel B supplies 24V power to the local I/O connector)</td><td>Digital input</td><td>Power specifications for DI points:
voltage < 24 V_{DC}, current: 8 - 25 mA.
DI points X112 - X119(NPN). 8 points in total.</td></tr>
<tr><td>Digital output</td><td>Power specifications for DO points:
voltage < 24 V_{DC}, current < 120 mA.
DO points Y112 - Y116. 5 points in total.</td></tr>
</table>

3.2.2.2 OPENCNC series connectors

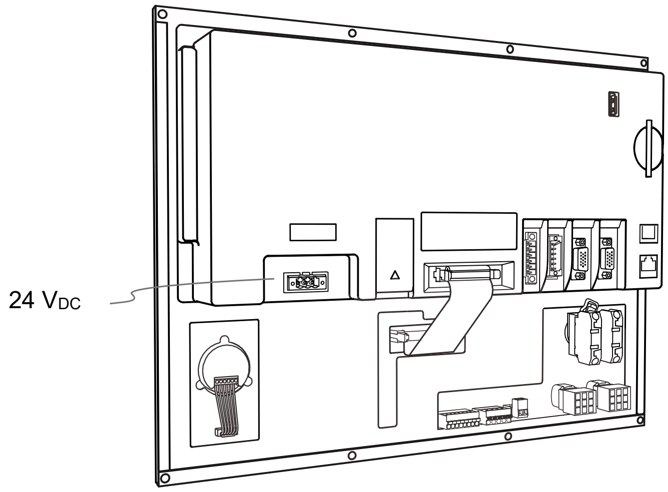
<table>
<tr><th>Connector</th><th>Diagram / Function</th><th>Description</th></tr>
<tr><td>DC 24V
(Power input for controller)</td><td></td><td>Connects to the 24 VDC power (24 W at 1 A).
<table>
<tr><th>Pin</th><th>Symbol</th><th>Description</th></tr>
<tr><td>1</td><td>+24V</td><td>+24 V_{DC}</td></tr>
<tr><td>2</td><td>0V</td><td>0 V_{DC}</td></tr>
<tr><td>3</td><td>⏚</td><td>Power grounding; FGND</td></tr>
</table></td></tr>
<tr><td>MPG
(Handwheel)</td><td></td><td>8 DI points and 1 set of differential type MPG input signal.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>DI_COM</td><td>9</td><td>DI7</td></tr>
<tr><td>2</td><td>DI0</td><td>10</td><td>+5 V_{DC} OUT</td></tr>
<tr><td>3</td><td>DI1</td><td>11</td><td>A</td></tr>
<tr><td>4</td><td>DI2</td><td>12</td><td>A#</td></tr>
<tr><td>5</td><td>DI3</td><td>13</td><td>B</td></tr>
<tr><td>6</td><td>DI4</td><td>14</td><td>B#</td></tr>
<tr><td>7</td><td>DI5</td><td>15</td><td>GND</td></tr>
<tr><td>8</td><td>DI6</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>SPINDLE</td><td></td><td>Includes spindle pulse output and pulse feedback signals.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>FBK_OA</td><td>9</td><td>SERVO_ON_OUT</td></tr>
<tr><td>2</td><td>FBK_OA#</td><td>10</td><td>+5 V_{DC} OUT</td></tr>
<tr><td>3</td><td>FBK_OB</td><td>11</td><td>CMD_A</td></tr>
<tr><td>4</td><td>FBK_OB#</td><td>12</td><td>CMD_A#</td></tr>
<tr><td>5</td><td>FBK_OZ</td><td>13</td><td>CMD_B</td></tr>
<tr><td>6</td><td>FBK_OZ#</td><td>14</td><td>CMD_B#</td></tr>
<tr><td>7</td><td>+24V_IN</td><td>15</td><td>GND</td></tr>
<tr><td>8</td><td>ALM</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>CN1</td><td></td><td>Includes RS-485 communication, spindle analog output, HSI high-speed counter input, and emergency stop signals.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>RS485_ D+</td><td>7</td><td>EMG</td></tr>
<tr><td>2</td><td>RS485_ D-</td><td>8</td><td>GND</td></tr>
<tr><td>3</td><td>RS485 GND</td><td>9</td><td>DAC1</td></tr>
<tr><td>4</td><td>HSI_1</td><td>10</td><td>DAC1_GND</td></tr>
<tr><td>5</td><td>HSI_2</td><td>11</td><td>DAC2</td></tr>
<tr><td>6</td><td>HSI_COM</td><td>12</td><td>DAC2_GND</td></tr>
</table></td></tr>
<tr><td>Remote I/O module
(Remote I/O module serial communication)</td><td></td><td>The remote I/O module communication connector can connect to 8 modules. Each module has 32 input and 32 output points. The input points range from X256 - X511 and the output points range from Y256 - Y511.
<table>
<tr><th>Pin</th><th>Definition</th><th>Pin</th><th>Definition</th></tr>
<tr><td>1</td><td>T+</td><td>4</td><td>R+</td></tr>
<tr><td>2</td><td>T-</td><td>5</td><td>GND</td></tr>
<tr><td>3</td><td>R-</td><td>6</td><td>SHIELD</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Connector</th><th>Diagram / Function</th><th>Description</th></tr>
<tr><td rowspan="2">Local IO</td><td>I/O1</td><td>DI/DO range: X0 - X15, Y0 - Y15.
Power specifications: voltage < 24 V_{DC}, current < 60 mA.
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1 - 16</td><td>DI points X0 - X15. 16 points in total. (8 - 25 mA)</td></tr>
<tr><td>17</td><td>Output COM point. The voltage is 0V.</td></tr>
<tr><td>18</td><td>Input COM point. Connects to +24 VDC or 0V.</td></tr>
<tr><td>19 - 34</td><td>DO points Y0 - Y15. 16 points in total. (< 120 mA)</td></tr>
</table></td></tr>
<tr><td>I/O2</td><td>DI/DO range: X16 - X31, Y16 - Y31.
Power specifications: voltage < 24 V_{DC}, current < 60 mA.
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1 - 16</td><td>DI points X16 - X31. 16 points in total. (8 - 25 mA)</td></tr>
<tr><td>17</td><td>Output COM point. The voltage is 0V.</td></tr>
<tr><td>18</td><td>Input COM point. Connects to +24 VDC or 0V.</td></tr>
<tr><td>19 - 34</td><td>DO points Y16 - Y31. 16 points in total. (< 120 mA)</td></tr>
</table></td></tr>
</table>

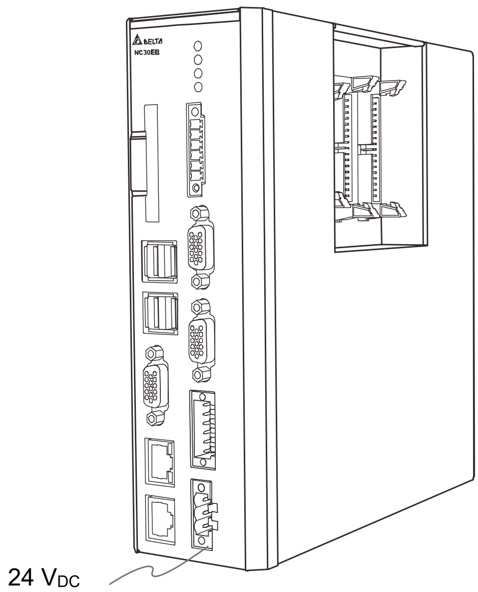
3

3.2.3 Wiring for power connector

- NC200B series models



- NC30EB series models

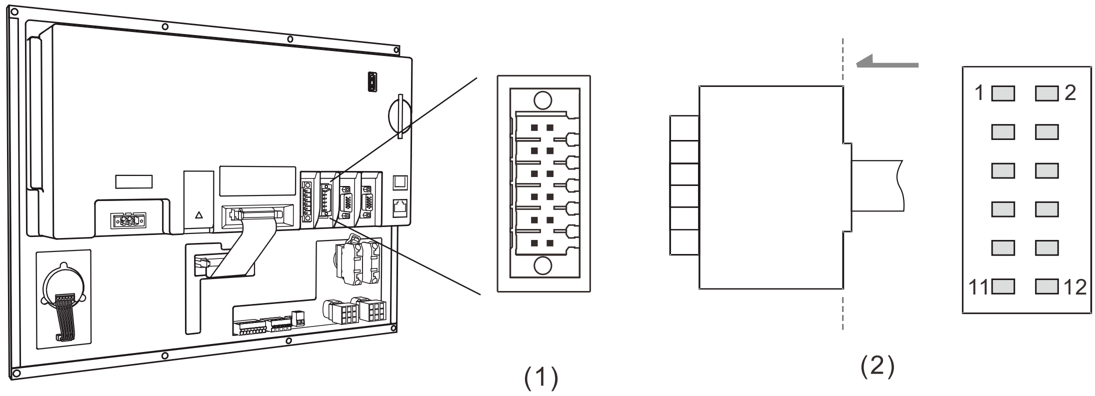


3

3.2.4 Wiring for RS-485 (CN1)

The B series controller has one set of RS-485 signal for serial communication with external devices.

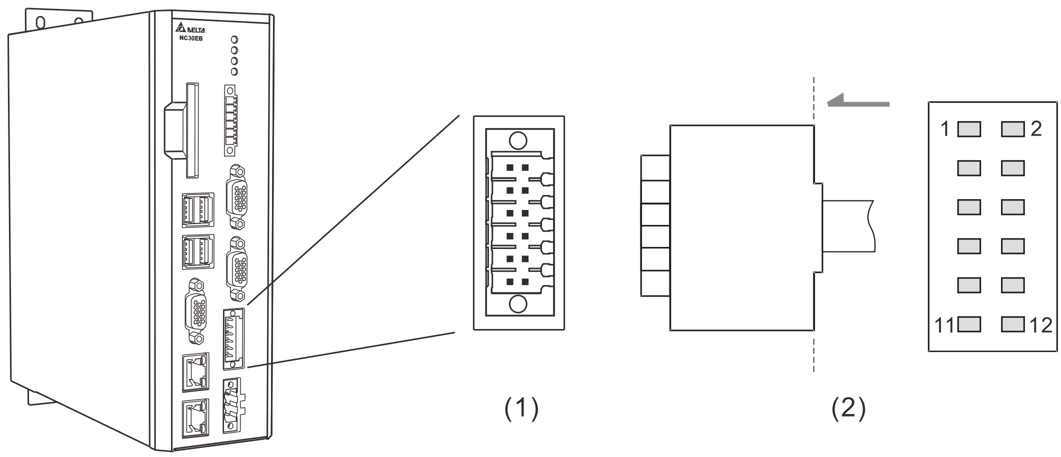
Pin assignment for NC200B series models



(1) CN1 connector (female); (2) RS-485 pins (male)

Model	Symbol	Pin No.	Function description
NC200B	CN1	1	D+
		2	D-
		3	RS485_GND

Pin assignment for OPENCNC series models



(1) CN1 connector (female); (2) RS-485 pins (male)

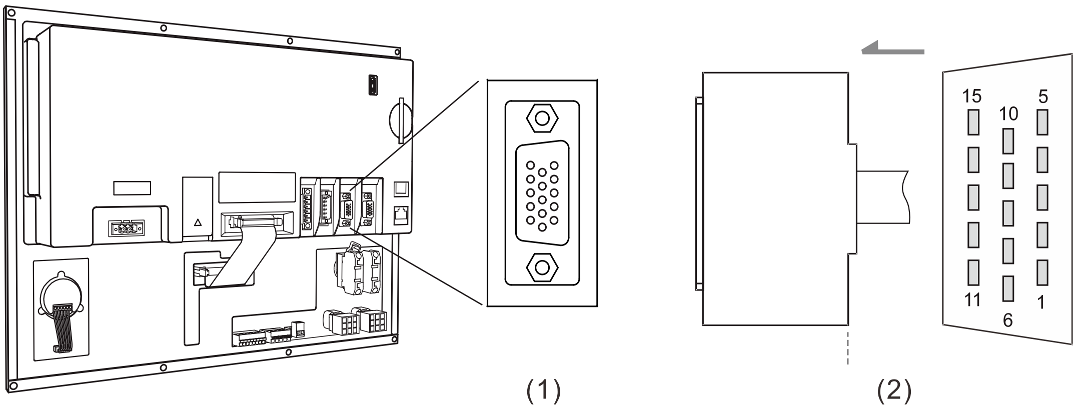
Model	Symbol	Pin No.	Function description
NC30EB□	CN1	1	D+
		2	D-
		3	RS485_GND

3.2.5 Wiring for spindle pulse output connector (SPINDLE)

The B series NC controller has one set of spindle pulse output for controlling the spindle speed.

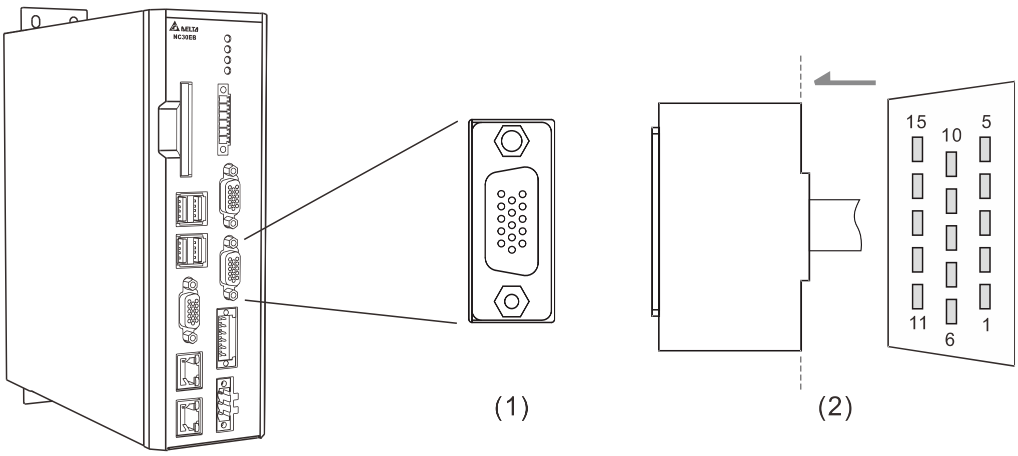
Note: the NC3□□ series models have 2 spindle pulse output ports while the NC200 and OPENCNC models have only 1 spindle pulse output port.

Pin assignment for NC200B series models



(1) Spindle pulse output connector (female); (2) Spindle pulse output connector (male)

Pin assignment for OPENCNC series models



(1) Spindle pulse output connector (female); (2) Spindle pulse output connector (male)

3

Model	Symbol	Pin No.	Function description	
All	Spindle	1	Feedback A+	Pulse feedback signal A+
		2	Feedback A-	Pulse feedback signal A-
		3	Feedback B+	Pulse feedback signal B+
		4	Feedback B-	Pulse feedback signal B-
		5	Feedback Z+	Pulse feedback signal Z+
		6	Feedback Z-	Pulse feedback signal Z-
		7	+24V_IN	24V input
		8	ALM_DI_IN	Alarm signal input
		9	SERVO_ON_DO_OUT	Servo On signal output
		10	+5 V_{DC} _OUT	5V voltage output
		11	Command A+	Pulse command A+
		12	Command A-	Pulse command A-
		13	Command B+	Pulse command B+
		14	Command B-	Pulse command B-
		15	GND	GND

Spindle pulse output settings:

1. Pr.399 settings

Description	Pulse control
Spindle function 0: off; 1: on	1
Closed-loop control flag 0: off 1: on (feedback encoder is required)	1
Spindle output mode 0: communication (DMCNET); 1: pulse (B series); 2: analog voltage	1
Speed control mode 1: PUU	1
Spindle encoder magnification 0: 1000 times; 1: 4 times	1
Analog spindle speed source 0: system command; 1: encoder feedback	0
Analog spindle feedback encoder source 0: spindle; 1: motor	0
Spindle voltage output mode 0: -10V to +10V 1: 0V to +10V (only effective in open-loop control)	0

2. In the [CONFIG] (channel setting) screen, set the Port numbers of the pulse spindles SP1 and SP2 to 10 and 11 respectively.

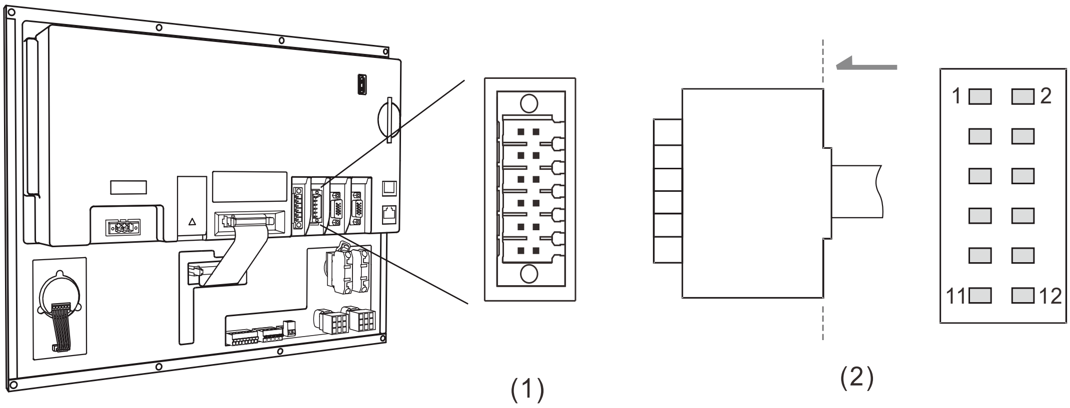
3.2.6 Wiring for spindle analog output (CN1)

The B series NC controllers have 2 sets of analog voltage outputs, and you can use the following methods to control the spindle speed.

Control method 1: controls the spindle speed with the S code with the acceleration / deceleration planning.

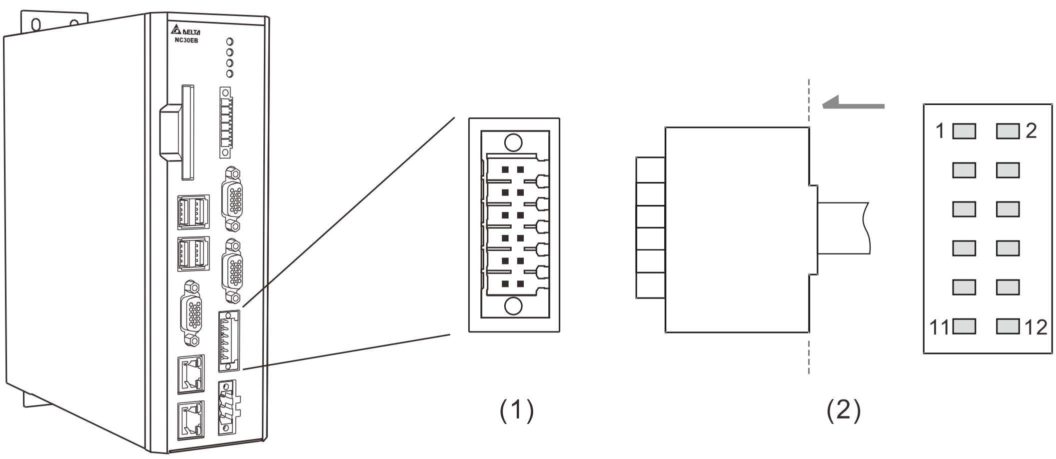
Control methods 2: controls the analog voltage output with special D without the acceleration / deceleration planning.

Pin assignment for NC200B series models



(1) CN1 connector (female); (2) Analog output pins

Pin assignment for OPENCNC series models



(1) CN1 connector (female); (2) Analog output pins

Model	Symbol	Pin No.	Function description	
All	CN1	9	DAC_1	First set of analog voltage output
		10	DAC_1_GND	First set of DAC output_GND
		11	DAC_2	First set of analog voltage output
		12	DAC_2_GND	Second set of DAC output_GND

Control method 1: spindle analog output control (set with S code or through HMI screen)

1. Pr.399 settings

Spindle control mode	Communication	Analog
Spindle function 0: off; 1: on	1	1
Closed-loop control flag 0: off 1: on (feedback encoder is required)	1	0 or 1
Spindle output mode 0: communication (DMCNET); 1: pulse (B series); 2: analog voltage	0	2
Speed control mode 1: PUU	1	1
Spindle encoder magnification 0: 1000 times; 1: 4 times	0	1
Analog spindle speed source 0: system command; 1: encoder feedback	0	1
Analog spindle feedback encoder source 0: spindle; 1: motor	0	0
Spindle voltage output mode 0: -10V to +10V 1: 0V to +10V (only effective in open-loop control)	0	0 or 1

2. In the [CONFIG] (channel setting) screen, enable SP1 and set its Port number to 10; enable SP2 and set its Port number to 11.

   Note: the DAC_2 contact of the NC200 and OPENCNC series models is only for open-loop application, which does support receiving speed feedback signals.

3. The analog voltage resolution is 14-bit.

When Pr.399 [Spindle voltage output mode] = 0, the analog voltage output ranges from -10V to +10V.

Applicable to closed-loop and open-loop control.

Output voltage	Corresponding speed
+10 V_{DC} power	Maximum speed (forward)
0 V_{DC}	Zero speed
-10 V_{DC}	Maximum speed (reverse)

When Pr.399 [Spindle voltage output mode] = 1, the analog voltage output ranges from 0V to +10V.

Only applicable to open-loop control.

Output voltage	Corresponding speed
+10 V_{DC}	Maximum speed
0 V_{DC}	Zero speed

Control method 2: controls the analog voltage with special D.

Model	Symbol	Function description		
All	CN1	DAC_1	D1125	Setting range: -1000 to +1000 (-10V to +10V) Unit: 0.01V
		DAC_2	D1114	

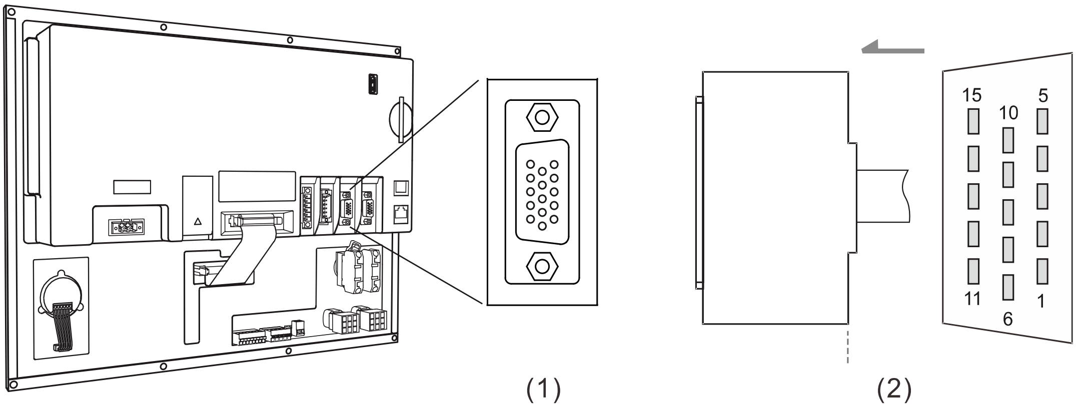
Note: the DAC_2 contact of the NC200 and OPENCNC series models is only for open-loop application, which does not support receiving speed feedback signals.

3.2.7 Wiring for spindle analog feedback connector (SPINDLE)

3

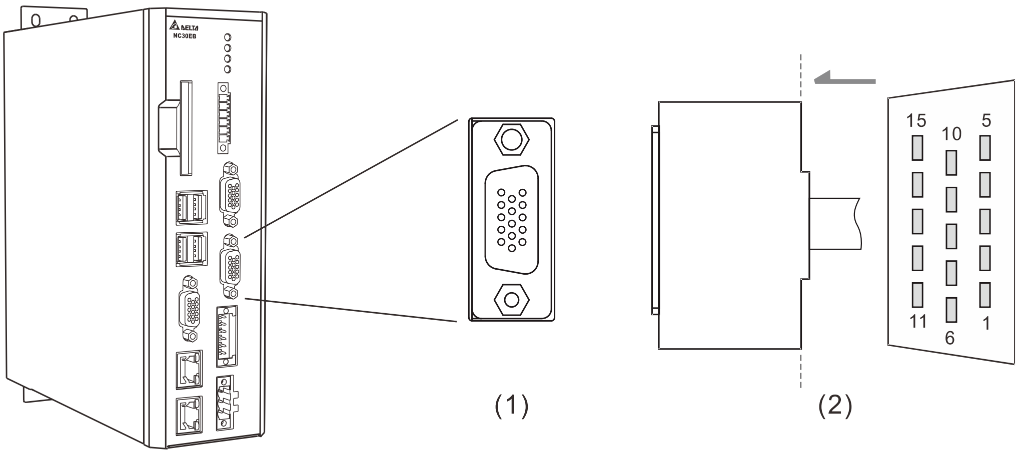
The NC3□□ series models support 2 sets of pulse feedback signals from external devices while the NC200 and OPENCNC models support only 1 set of spindle pulse feedback signal.

Pin assignment for NC200B series models



(1) Spindle feedback input connector (female); (2) Spindle feedback input connector (male)

Pin assignment for OPENCNC series models



(1) Spindle feedback input connector (female); (2) Spindle feedback input connector (male)

3

The function description of each pin is as follows.

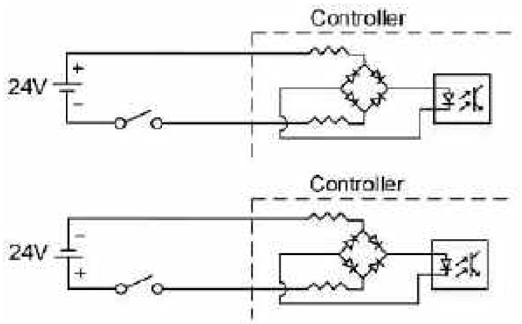
Model	Symbol	Pin No.	Function description	
All	Spindle	1	Feedback A+	Pulse feedback signal A+
		2	Feedback A-	Pulse feedback signal A-
		3	Feedback B+	Pulse feedback signal B+
		4	Feedback B-	Pulse feedback signal B-
		5	Feedback Z+	Pulse feedback signal Z+
		6	Feedback Z-	Pulse feedback signal Z-
		7	+24V_IN	24V input
		8	ALM_DI_IN	Alarm signal input
		9	SERVO_ON_DO_OUT	Servo On signal output
		10	+5 V_{DC} _OUT	5V voltage output
		11	Command A+	Pulse output signal A+
		12	Command A-	Pulse output signal A-
		13	Command B+	Pulse output signal B+
		14	Command B-	Pulse output signal B-
		15	GND	GND

3.2.8 Wiring for high-speed counter input (HSI) (CN1)

The B series NC controller has two sets of hardware high-speed counter signal inputs. For the wiring of high-speed counter input (bi-directional coupling), the maximum input bandwidth is up to 5 MHz; voltage: 22 - 26V; permissible current: 8 - 20 mA; surge current: below 50 mA.

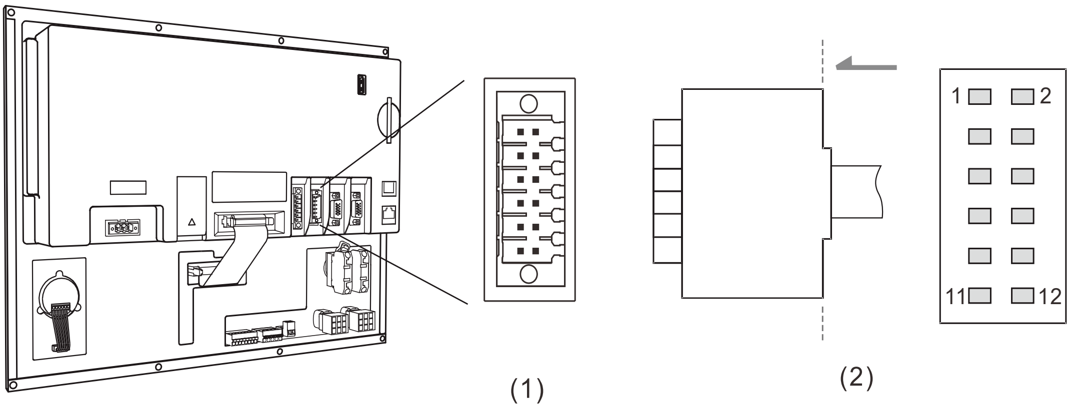
- When a signal is input to HSI_1, the corresponding special M, M2142, is On. If there is a G31 Skip command in the block, the system skips the block and jumps to the next block.
- When a signal is input to HSI_2, the corresponding special M, M2143, is On. If there is a G31 Skip command in the block, the system skips the block and jumps to the next block.

Parameter address	Name	Function
Pr.25	G31 high speed input point 1	0: NC; 1: NO
	G31 high speed input point 2	0: NC; 1: NO
Pr.46	Switch for G31 high speed input 1	0: off; 1: on
	Switch for G31 high speed input 2	0: off; 1: on
Pr.307	G31 input source	0: off; 1: HSI 1; 2: HSI 2; 3: HSI 1 & 2



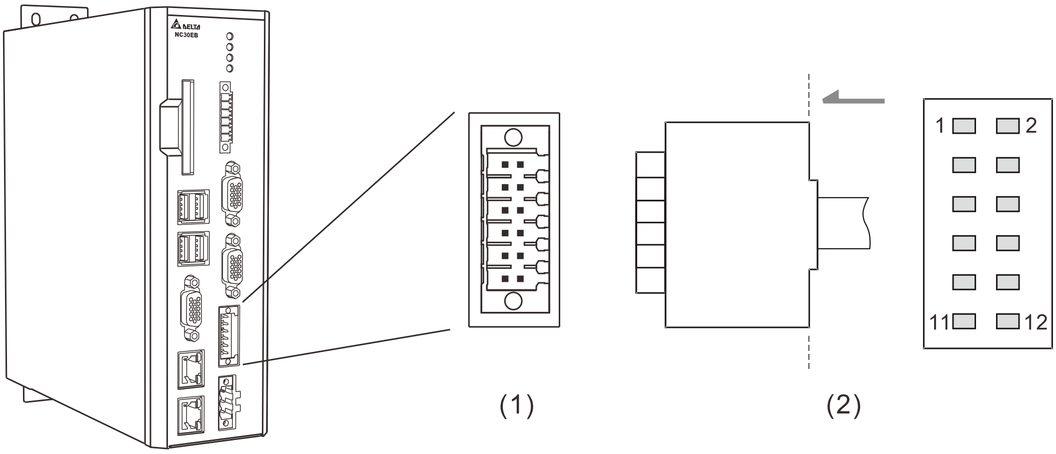
Note: the connection direction of the external power input for HSI does not affect the operation.

Pin assignment for NC200B series models



(1) CN1 connector (female); (2) HSI pins

Pin assignment for OPENCNC series models



(1) CN1 connector (female); (2) HSI pins

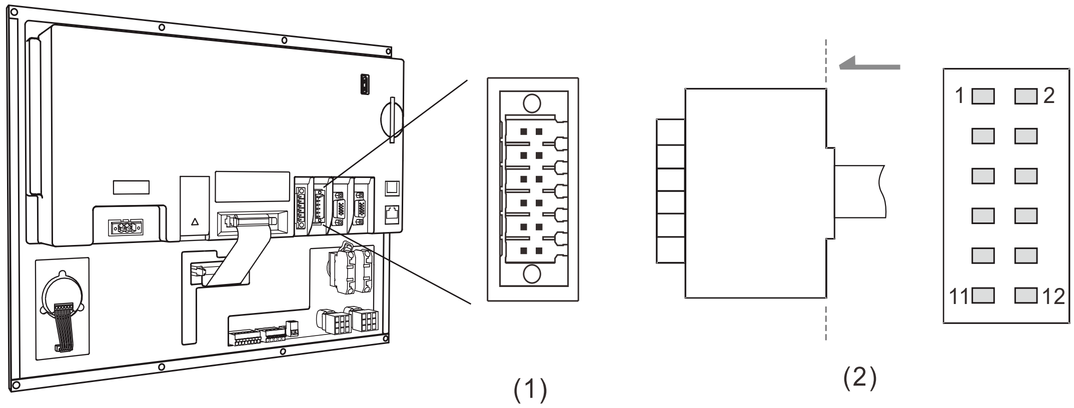
The function description of each pin is as follows.

Model	Symbol	Pin No.	Function description	
All	CN1	4	HSI_1	High-speed counter input 1 (10 mA)
		5	HSI_2	High-speed counter input 2 (10 mA)
		6	HSI_COM	High-speed counter COM; connects to +24 V_{DC} or 0V

3.2.9 Wiring for emergency stop (CN1)

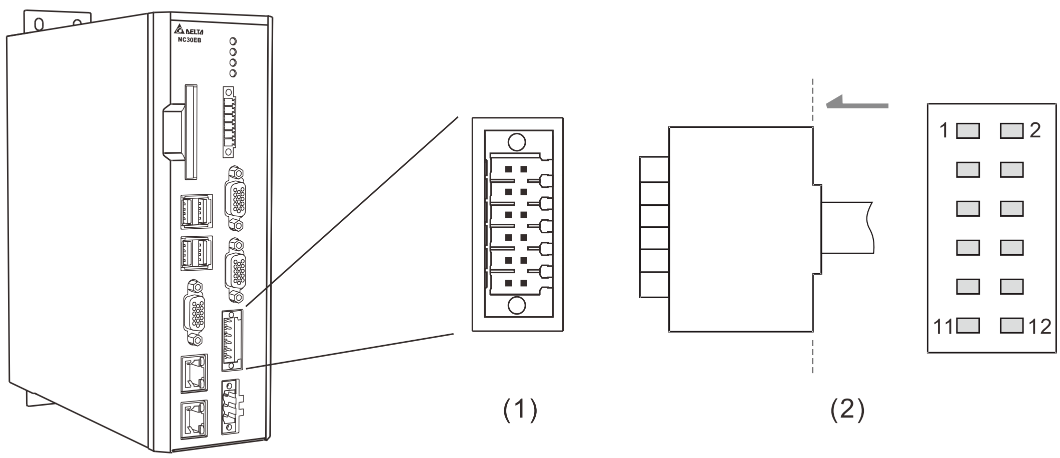
The B series NC controller has one set of emergency stop signal input.

Pin assignment for NC200B series models



(1) CN1 connector (female); (2) EMG pins

Pin assignment for OPENCNC series models



(1) CN1 connector (female); (2) EMG pins

Model	Symbol	Pin No.	Function description	
All	CN1	7	EMG	EMG (+5 V_{DC} output)
		8	GND	GND

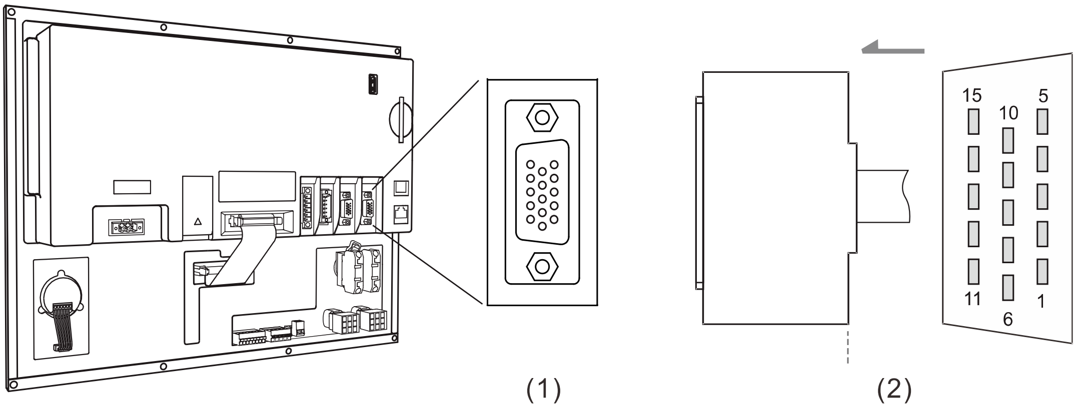
Note: EMG can output +5V power, so it can form a circuit with GND without an external power supply.

3

3.2.10 Wiring for MPG connector

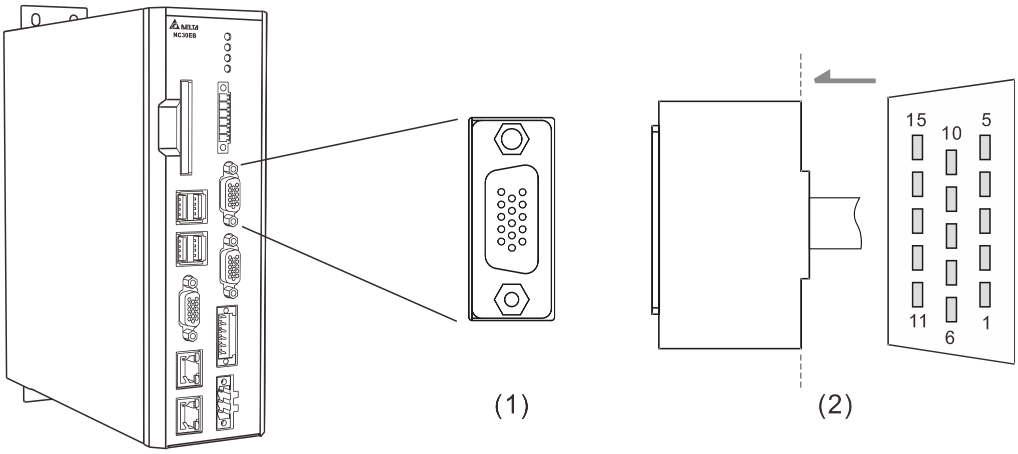
The B series NC controller has one MPG connector for receiving pulses generated by the MPG handwheel. This connector directly supplies +5 V_{DC} power to the MPG handwheel.

Pin assignment for NC200 series models



(1) MPG connector (female); (2) MPG connector (male)

Pin assignment for OPENCNC series models



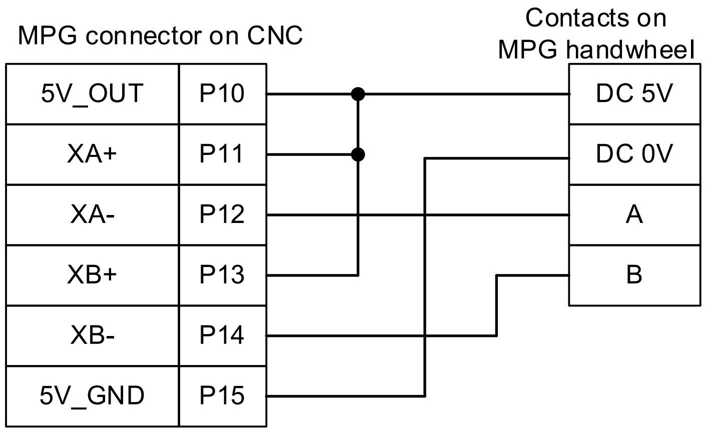
(1) MPG connector (female); (2) MPG connector (male)

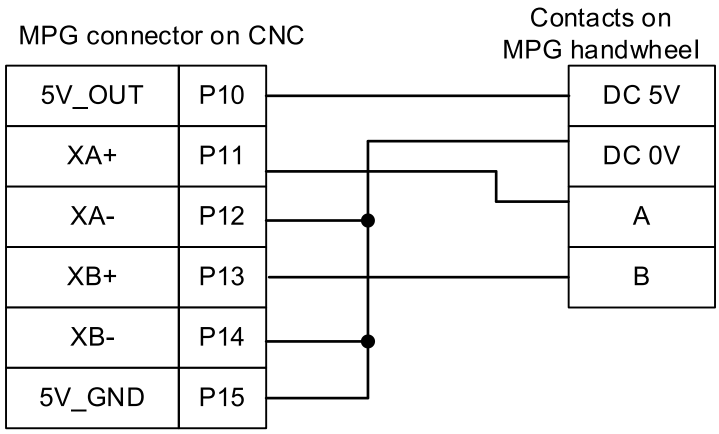
The function description of each pin is as follows.

Model	Symbol	Pin No.	Function description	
NC200 OPENCNC	MPG	1	EXT_24	DI COM point; connects to +24V or 0V.
		2	DI_1	X32
		3	DI_2	X33
		4	DI_3	X34
		5	DI_4	X35
		6	DI_5	X36
		7	DI_6	X37
		8	DI_7	X38
		9	DI_8	X39
		10	5V_OUT	$5V_{DC}$_OUT
		11	XA+	XA+
		12	XA-	XA-
		13	XB+	XB+
		14	XB-	XB-
		15	5V_GND	$5V_{DC}$_GND

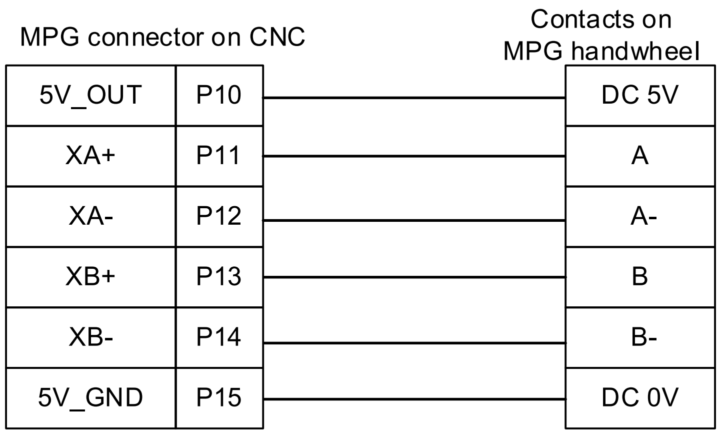
Depending on the signal type, the wiring of MPG handwheel can be divided into single-ended type (EHDW-BA6SI) and differential type (EHDW-BE6SI).

Wiring diagram for the pulse signals of the single-ended type MPG handwheel (EHDW-BA6SI):





Wiring diagram for the pulse signals of the differential type MPG handwheel (EHDW-BE6SI):



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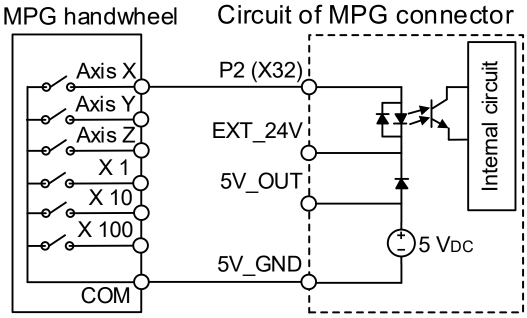
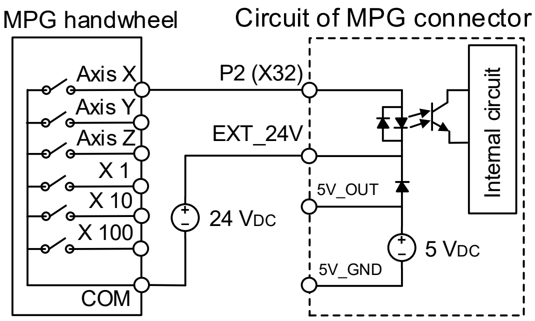
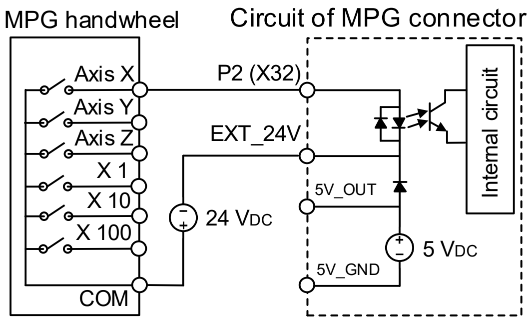
Wiring diagram for the MPG switch:

- The MPG connector on the controller supplies 5V power to the MPG.



- External 24V power supply: EXT_24 can connect to +24V or 0V.





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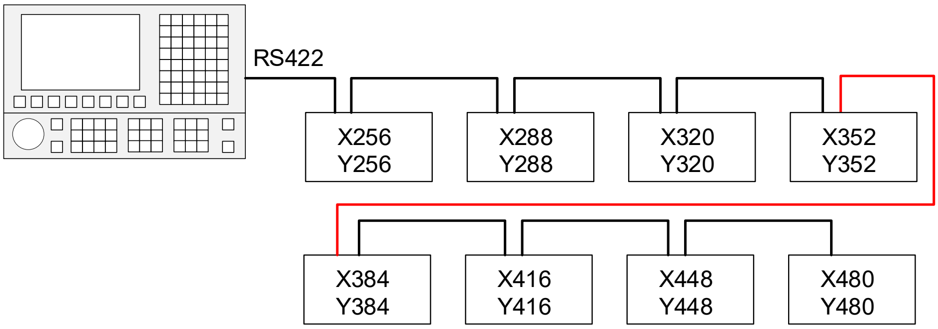
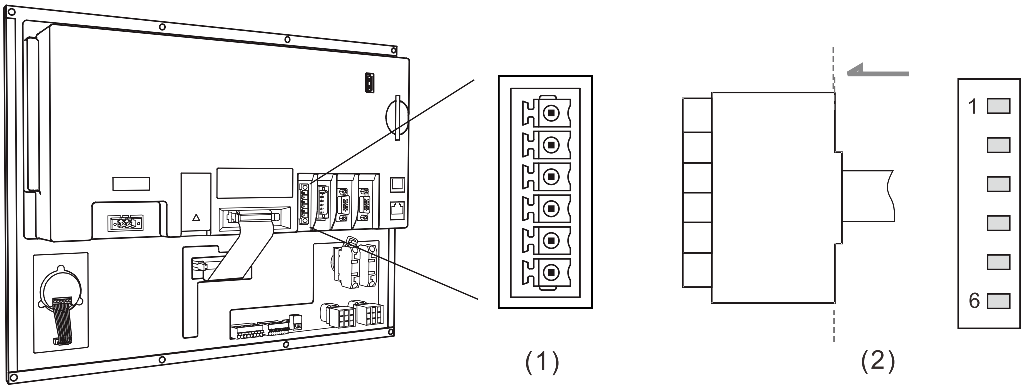
3.2.11 Wiring for remote I/O connector

The B series NC controller has a remote I/O connector which can connect to up to 8 extension modules with 256 DI and 256 DO points.



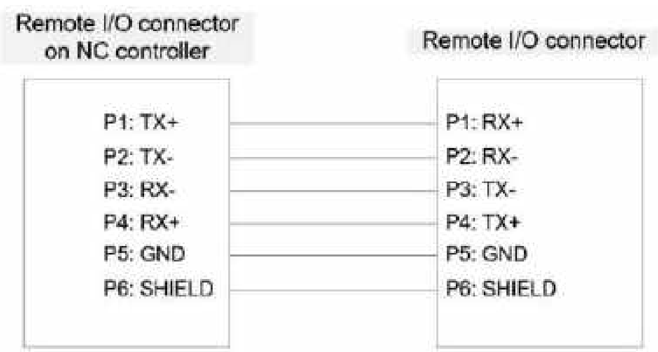
Pin assignment for the remote I/O connector is as follows.



(1) Remote I/O connector (female); (2) Remote I/O connector (male)

Pin No.	Function description
1	TX+
2	TX-
3	RX-
4	RX+
5	GND
6	SHIELD

Wiring diagram of the remote I/O connector:



There are two types of remote I/O module: opto-isolated type and relay type. The model name explanation is as follows.

NC - EIO - T 32 32 _

(1) (2) (3) (4) (5) (6)

(1) Series name

(2) Product name

(3) Type:

T: opto-isolated type (permissible current: below 50 mA; surge current: below 100 mA)

R: relay type (the permissible current can be 5A or 16A according to the relay specification)

(4) Number of inputs

(5) Number of outputs

(6) Permissible current:

None: 5A (G2R relay)

A: 16A (G2R relay)

B: 16A (IDEC relay)

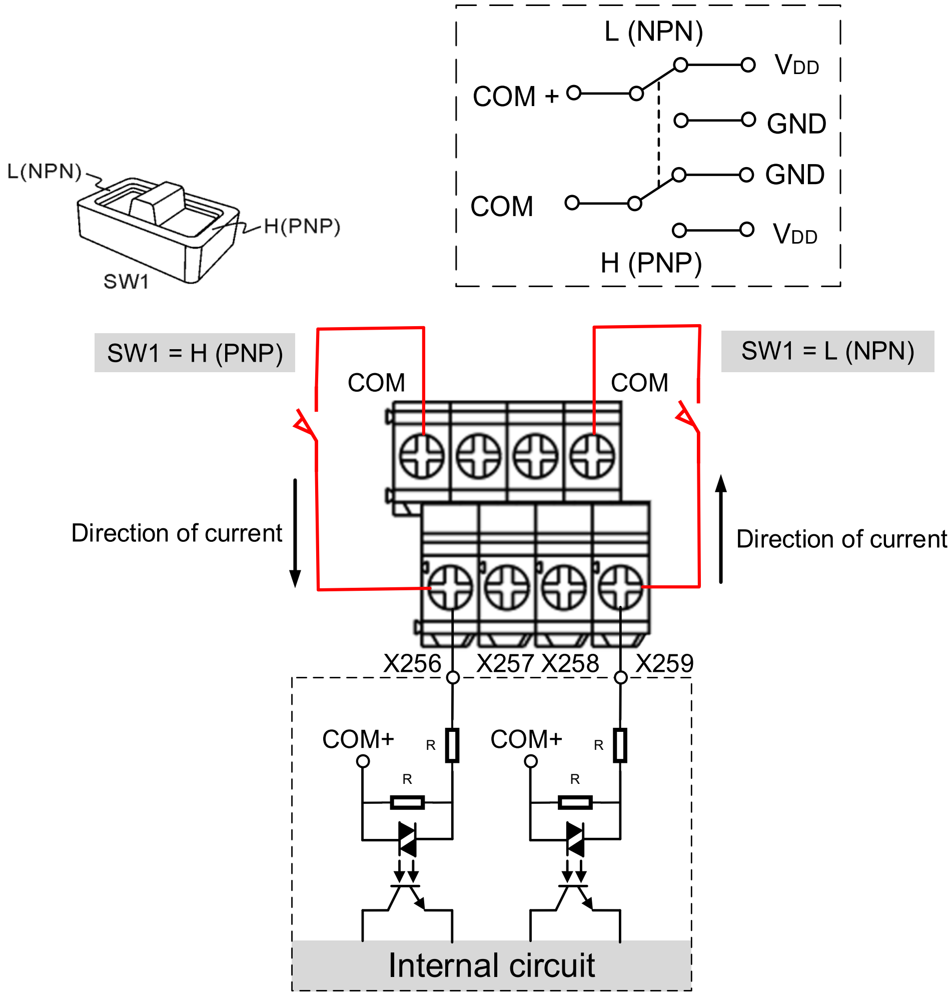
The remote I/O module models are as follows.

Model	Description	Note
NC-EIO-R2010	Relay type I/O module with 20 input points and 10 output points.	G2R relay Permissible current: 5A
NC-EIO-R2010A	Relay type I/O module with 20 input points and 10 output points.	G2R relay Permissible current: 16A
NC-EIO-R2010B	Relay type I/O module with 20 input points and 10 output points.	IDEC relay Permissible current: 16A
NC-EIO-R3216	Relay type I/O module with 32 input points and 16 output points.	G2R relay Permissible current: 5A
NC-EIO-R3216A	Relay type I/O module with 32 input points and 16 output points.	G2R relay Permissible current: 16A
NC-EIO-R3216B	Relay type I/O module with 32 input points and 16 output points.	IDEC relay Permissible current: 16A
NC-EIO-R3232	Relay type I/O module with 32 input points and 32 output points.	Permissible current: 5A
NC-EIO-T3232	Opto-isolated type I/O module with 32 input points and 32 output points.	Permissible current: 50mA

Precautions for wiring the remote I/O module are as follows.

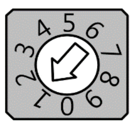
(1) The COM input point is used for signal current. Do not connect 24 V_{DC} or 0V power to the COM point.

(2) You can select the H ((PNP) or L (NPN) signal with the H / L switch according to the specification of the external sensor. When H (PNP) is selected, the COM point is +24V; when L (NPN) is selected, the COM point is 0V.



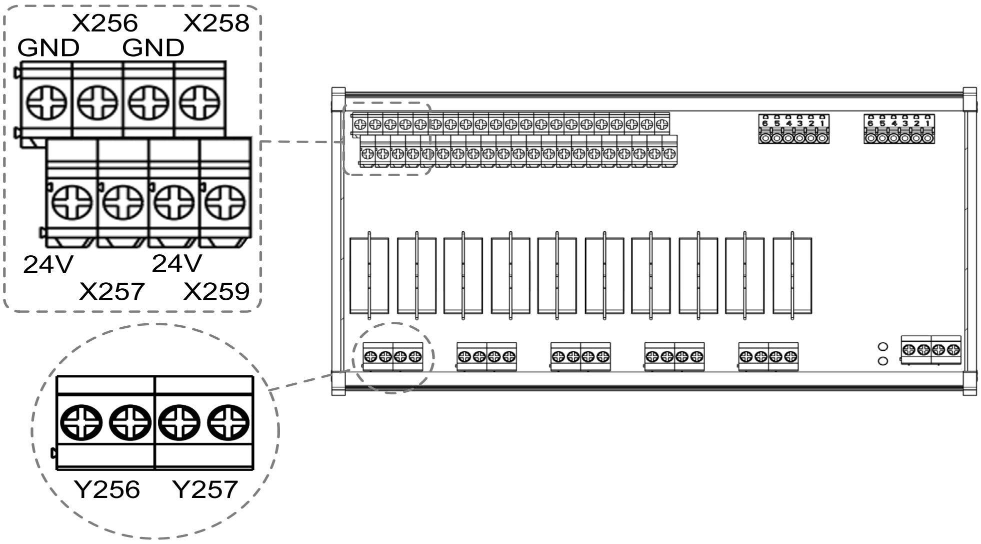
(3) Up to 8 modules can be connected to the remote I/O module connector simultaneously. Turn the rotary switch on the PCB to switch the station number. 0 = Station 1, 1 = Station 2, 2 = Station 3, and so on to 7, which is Station 8.

When you turn the rotary switch to 8 and 9 to set the remote I/O modules as Stations 9 and 10, the system regards Station 9 (position: 8) as Station 1 (position: 0) and Station 10 (position: 9) as Station 2 (position: 1), so do not turn the rotary switch to 0 and 1 at the same time.



Rotary switch for station number

3.2.11.1 NC-EIO-R2010

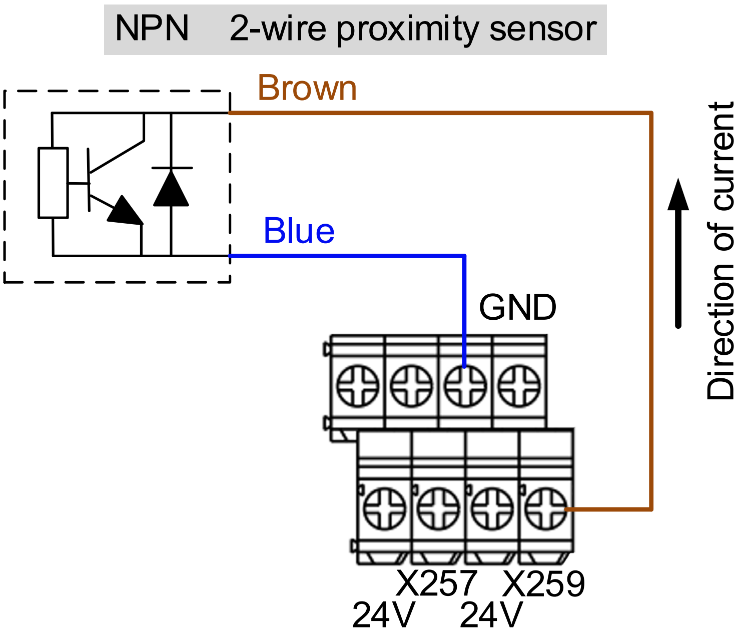


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN), and short-circuit the GND (commonly a blue wire) of the sensor and the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.



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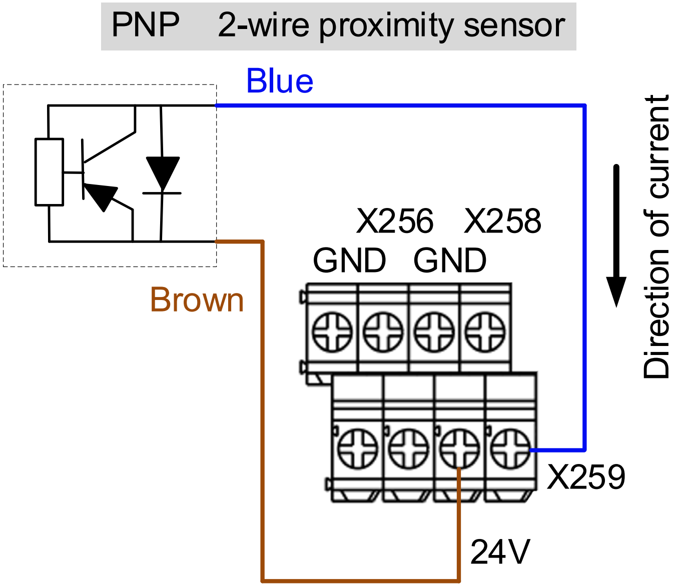
PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and short-circuit the Vcc (commonly a brown wire) of the sensor and the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



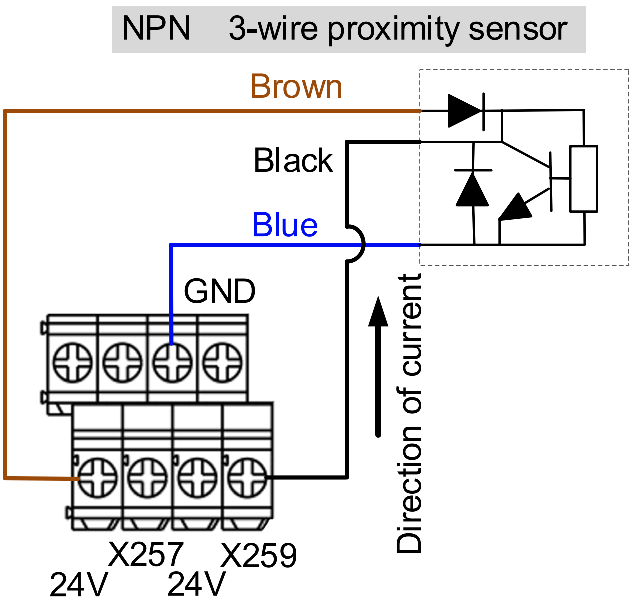
NPN 3-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to GND (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to input contact.



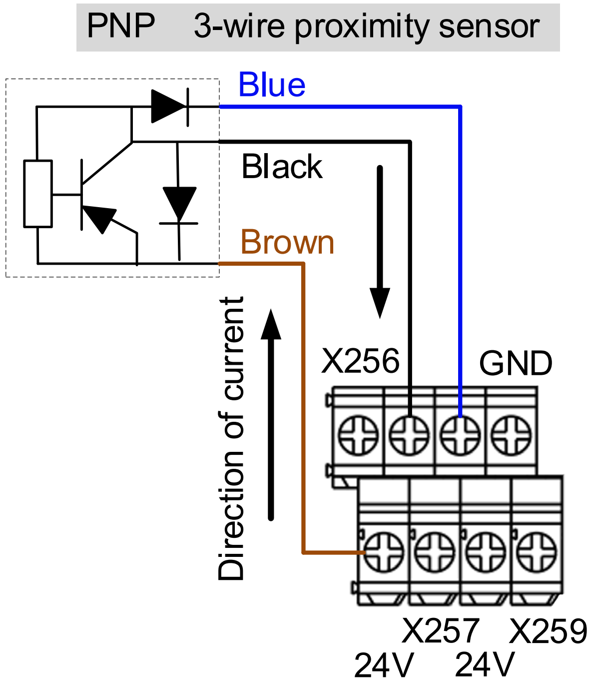
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to GND (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to input contact.

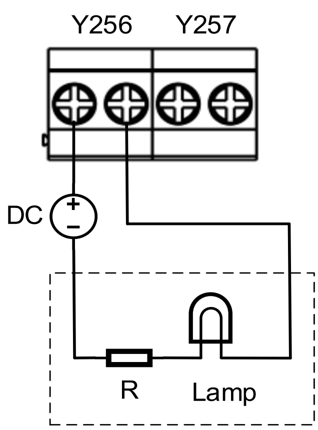


DO wiring example

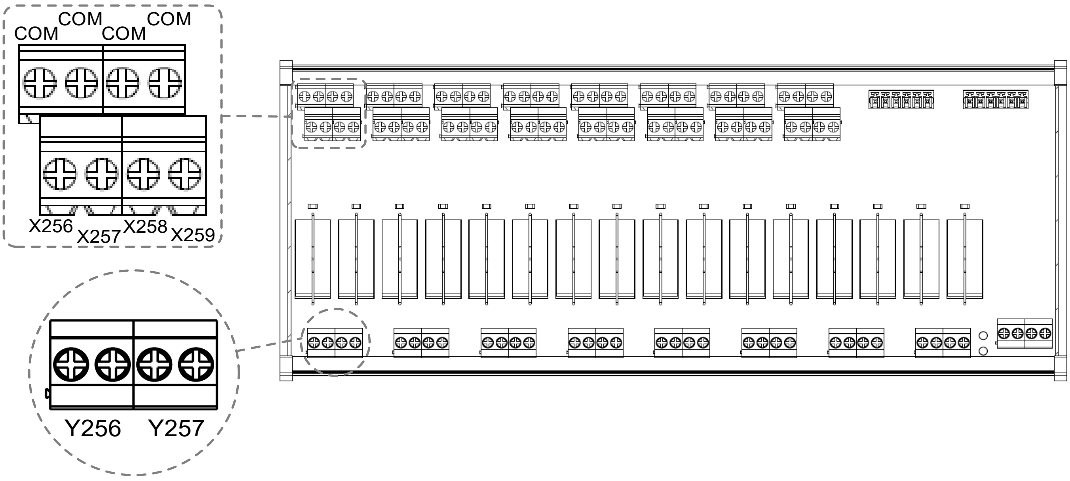
(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3.2.11.2 NC-EIO-R3216

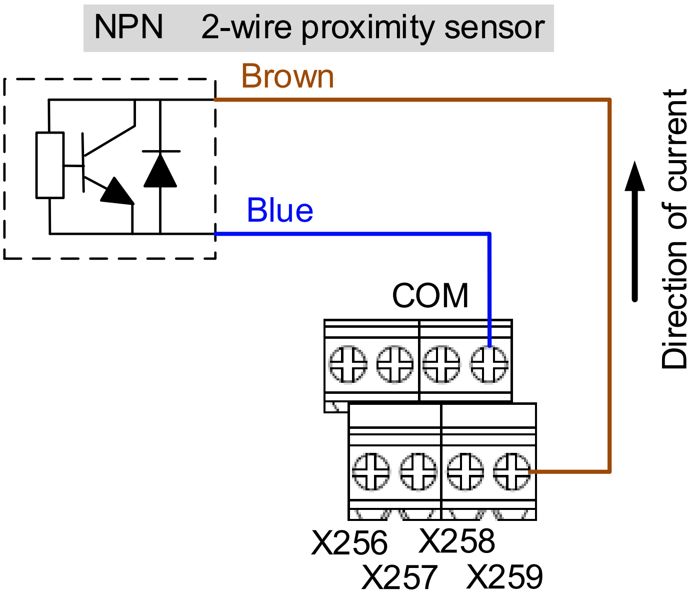


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN), and the COM point is 0V. Connect the GND (commonly a blue wire) of the sensor to the COM point or short-circuit the GND of the sensor to the GND (0V) of the same power system.

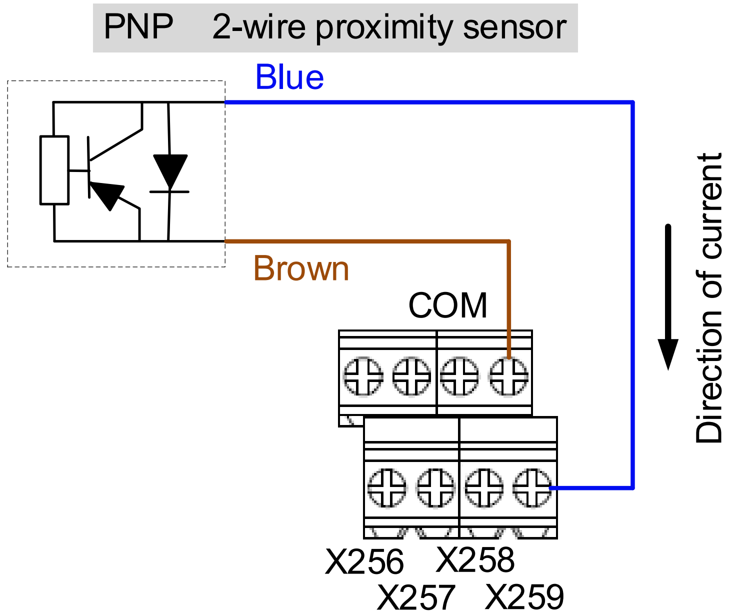
(2) Connect Vcc (commonly a brown wire) to the input contact.



PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and the COM point is +24V. Connect the Vcc (commonly a brown wire) of the sensor to the COM point or short-circuit the Vcc of the sensor to the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



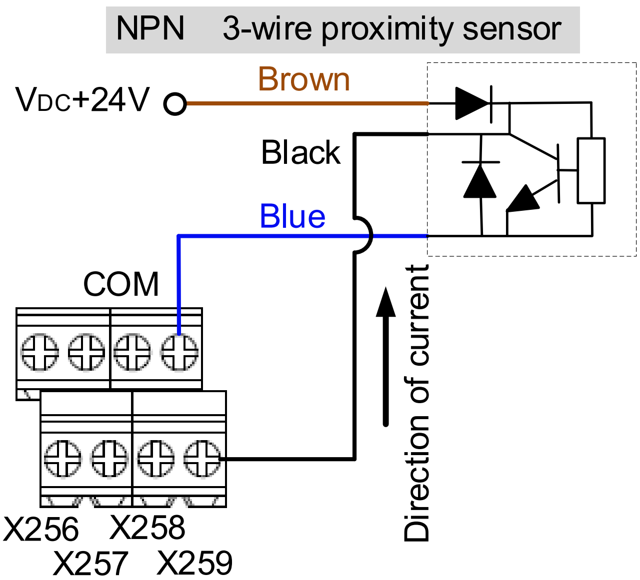
NPN 3-wire proximity sensor:

(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to COM (0V).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.



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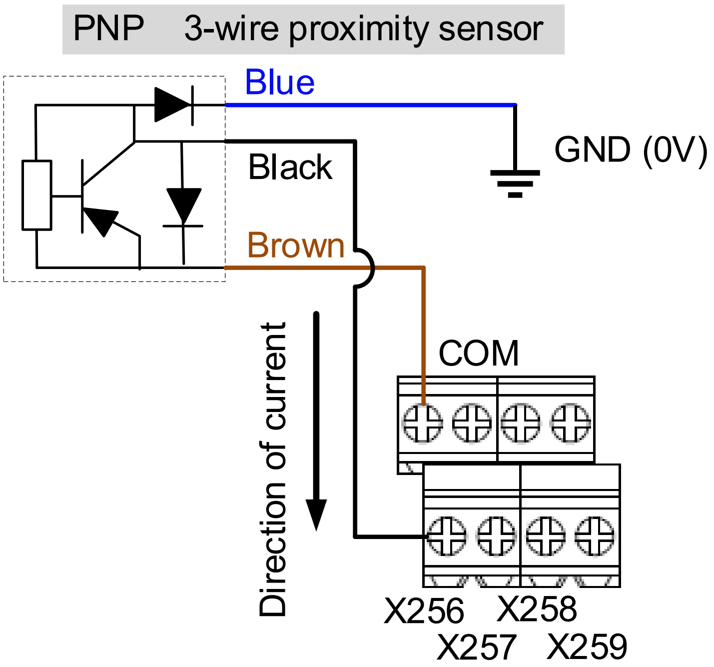
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

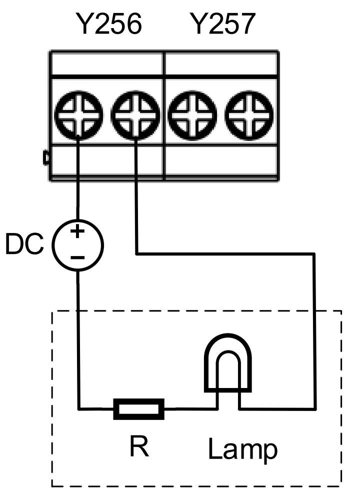


DO wiring example

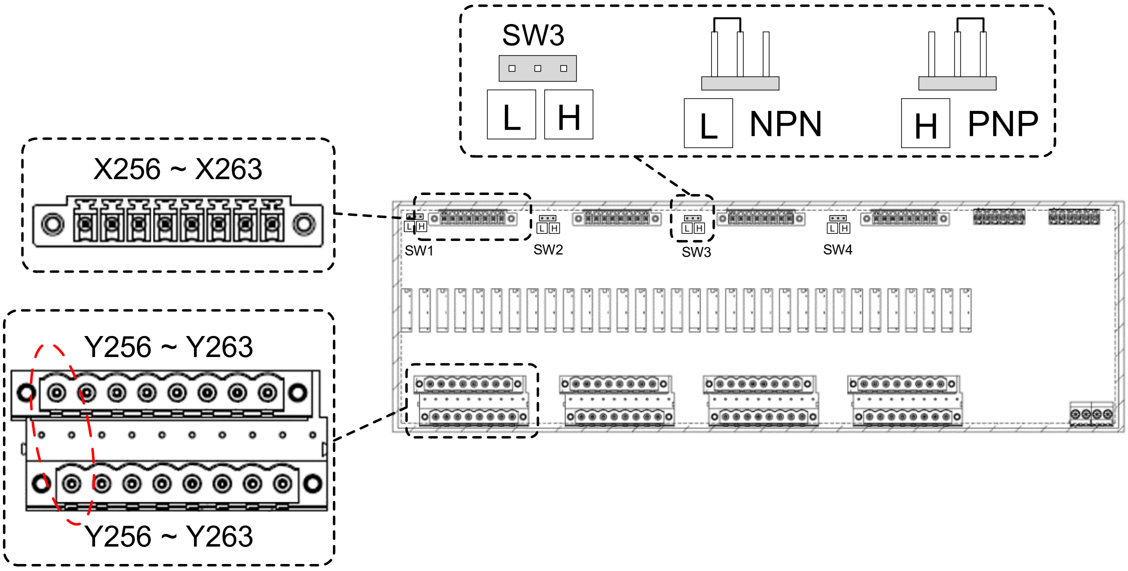
(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3.2.11.3 NC-EIO-R3232

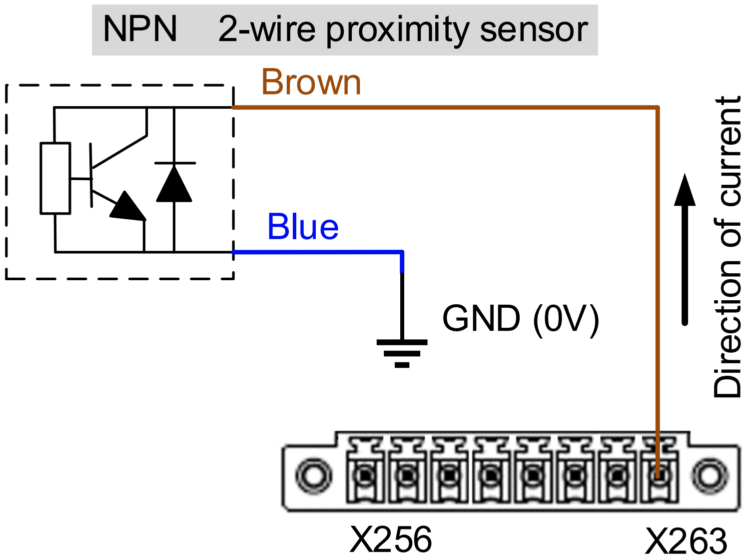


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Switch the short circuit jumper to L (NPN), and short-circuit the GND (commonly a blue wire) of the sensor and the GND (0V) of the same power system.

(2) Connect Vcc (commonly a brown wire) to the input contact.

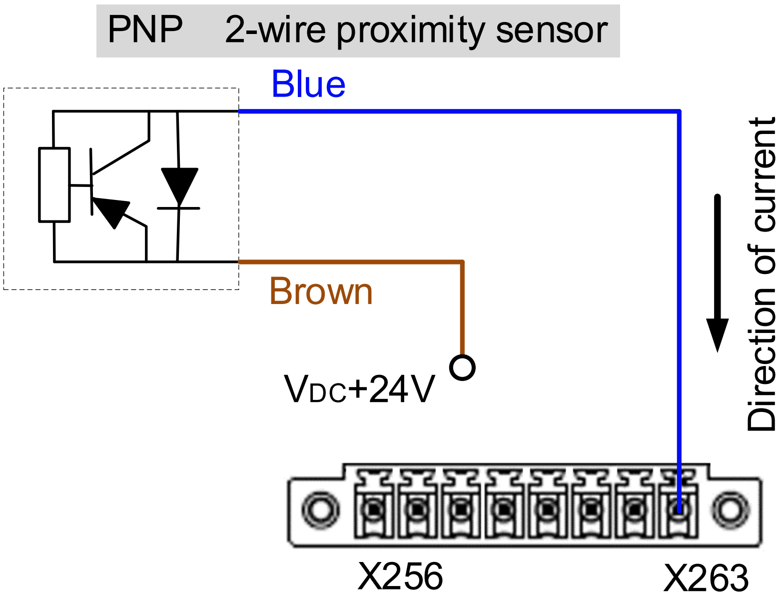


3

PNP 2-wire proximity sensor with polarity:

(1) Switch the short circuit jumper to H (PNP), and short-circuit the Vcc (commonly a brown wire) of the sensor and the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



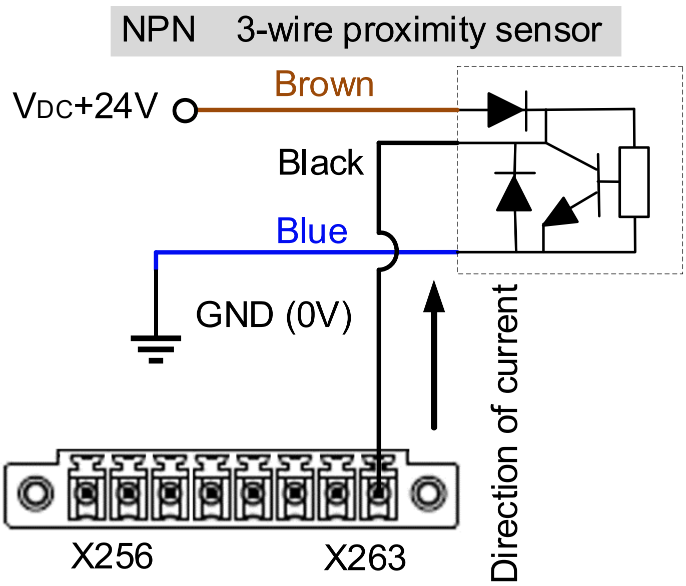
NPN 3-wire proximity sensor:

(1) Switch the short circuit jumper to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V (same power system).

(3) Connect the GND (commonly a blue wire) of the sensor to 0V (same power system).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.



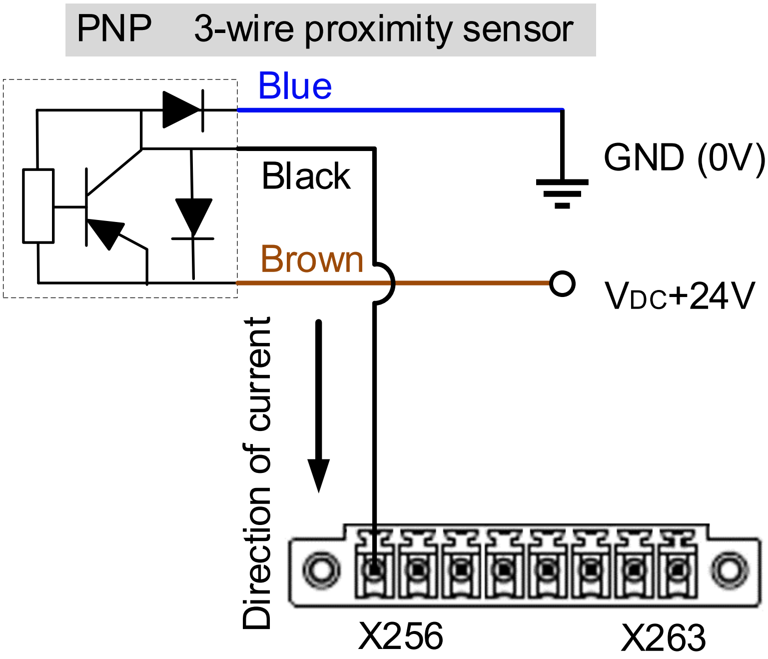
PNP 3-wire proximity sensor:

(1) Switch the short circuit jumper to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V (same power system).

(3) Connect the GND (commonly a blue wire) of the sensor to 0V (same power system).

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

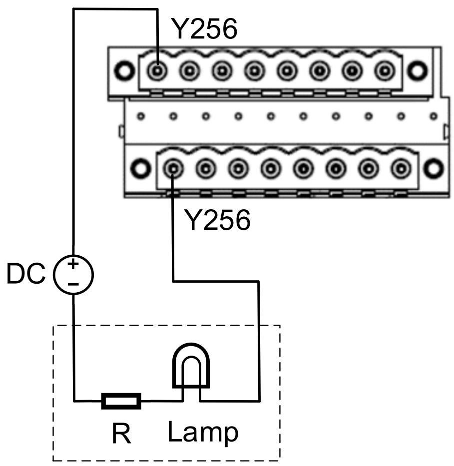


DO wiring example

(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3.2.11.4 NC-EIO-T3232

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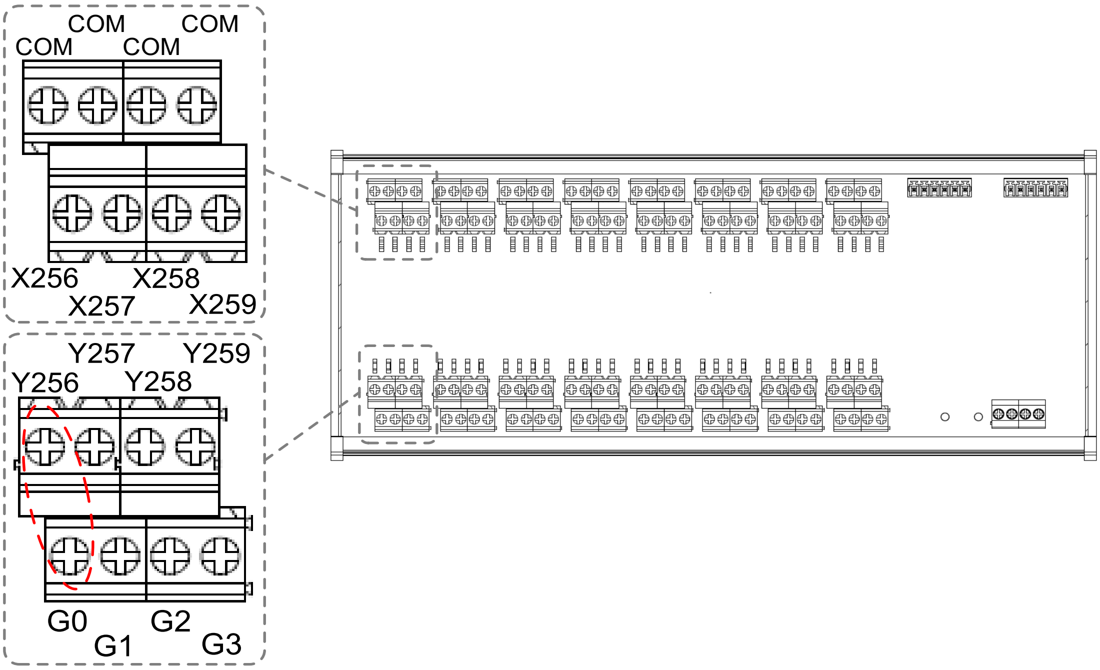
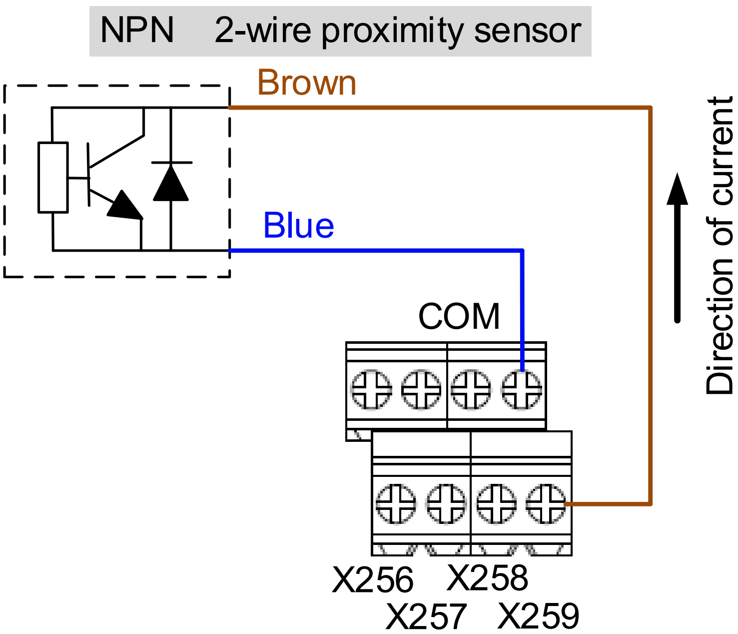


DI wiring example

NPN 2-wire proximity sensor with polarity:

(1) Set the H / L switch to L (NPN), and the COM point is 0V. Connect the GND (commonly a blue wire) of the sensor to the COM point or short-circuit the GND of the sensor to the GND (0V) of the same power system.

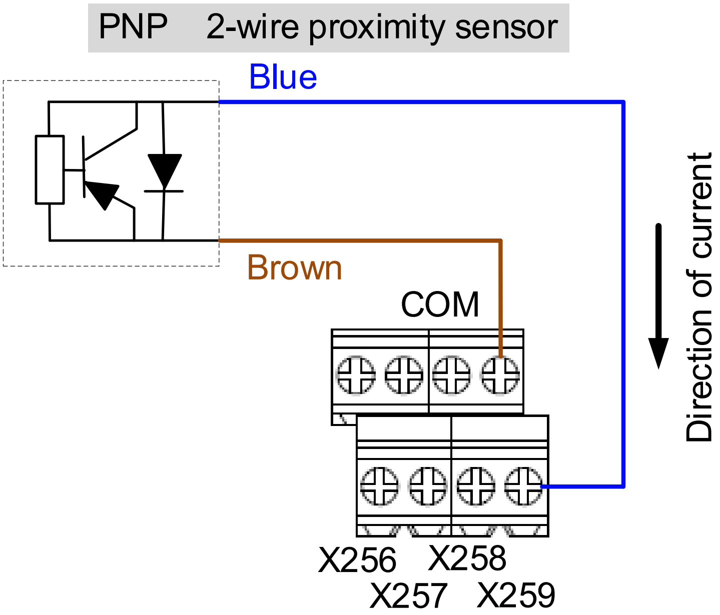
(2) Connect Vcc (commonly a brown wire) to the input contact.



PNP 2-wire proximity sensor with polarity:

(1) Set the H / L switch to H (PNP), and the COM point is +24V. Connect the Vcc (commonly a brown wire) of the sensor to the COM point or short-circuit the Vcc of the sensor to the +24V of the same power system.

(2) Connect GND (commonly a blue wire) to the input contact.



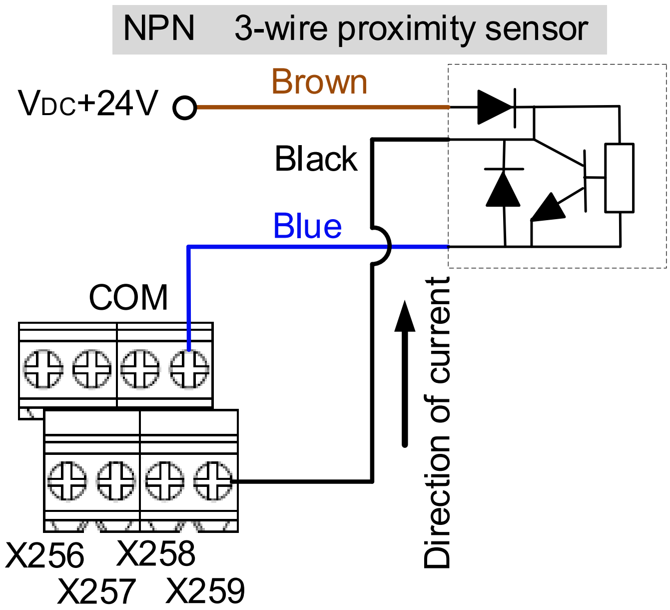
NPN 3-wire proximity sensor:

(1) Set the H / L switch to L (NPN).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.



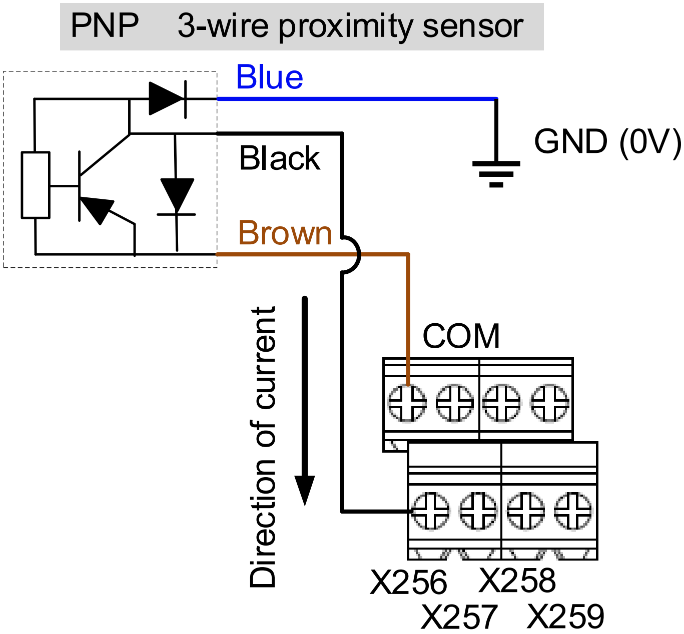
PNP 3-wire proximity sensor:

(1) Set the H / L switch to H (PNP).

(2) Connect the Vcc (commonly a brown wire) of the sensor to +24V.

(3) Connect the GND (commonly a blue wire) of the sensor to 0V.

(4) Connect the signal wire (commonly a black wire) of the sensor to the input contact.

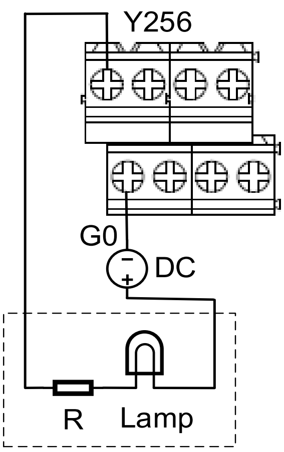


DO wiring example

(1) The output contacts of the remote I/O module are in pairs. Use these contacts as dry contacts.

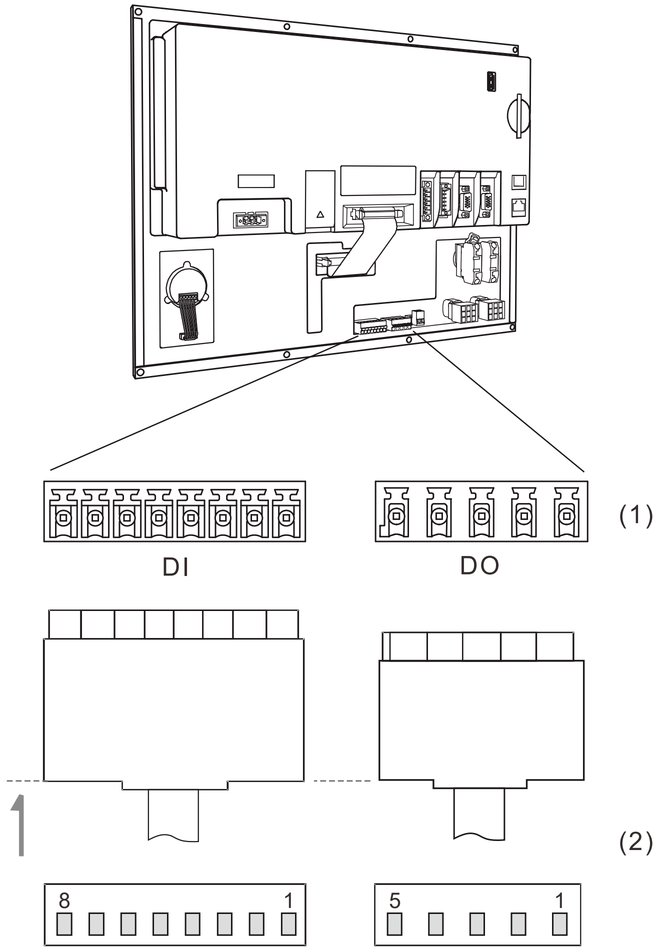
(2) The output contacts should be connected to an external power supply.

(3) After the controller sets the output contacts to On, the current circuit is closed and the Lamp is On.



3.2.12 Wiring for local I/O connector

The pin assignment for the NC200B series models is as follows.

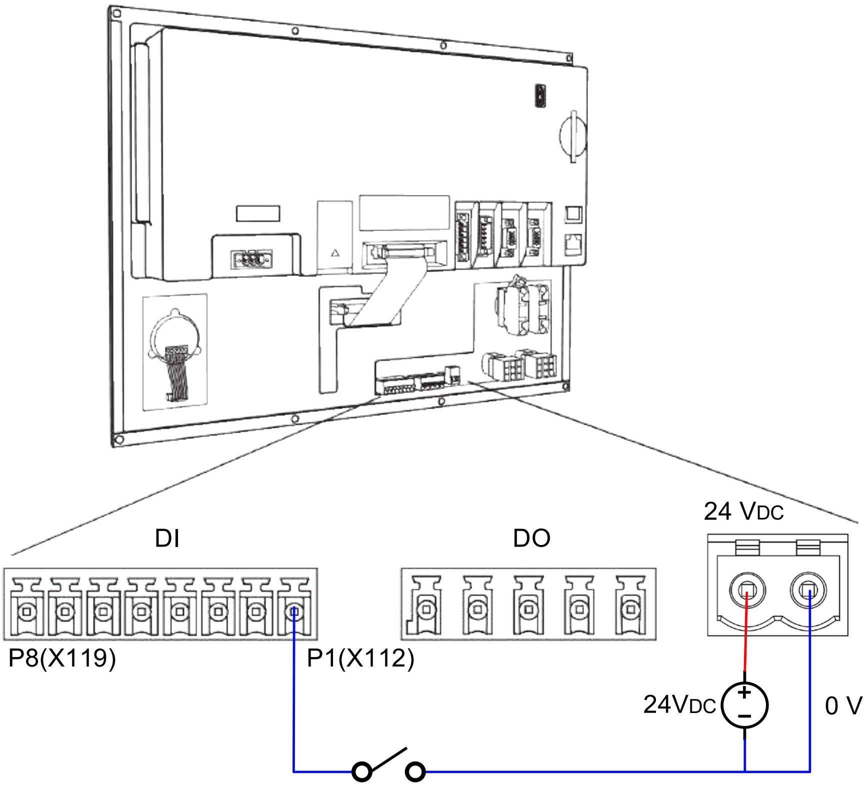


(1) Local I/O connector (female); (2) Local I/O connector (male)

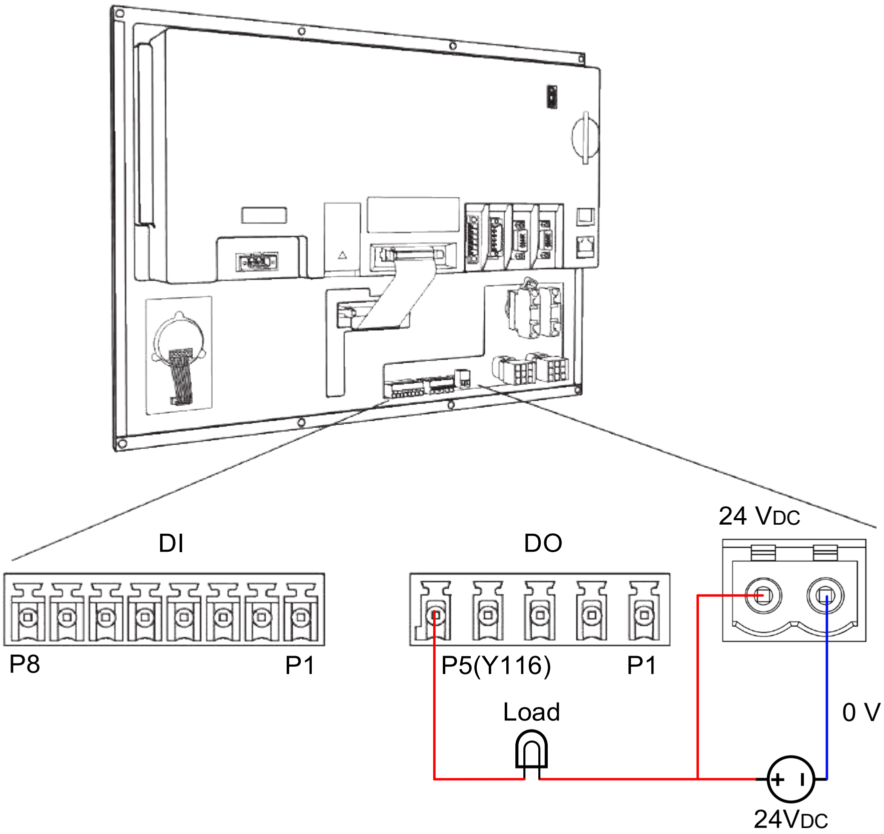
DI			
Pin 1	X112	Pin 2	X113
Pin 3	X114	Pin 4	X115
Pin 5	X116	Pin 6	X117
Pin 7	X118	Pin 8	X119

DO			
Pin 1	Y112	Pin 2	Y113
Pin 3	Y114	Pin 4	Y115
Pin 5	Y116	-	-
-	-	-	-

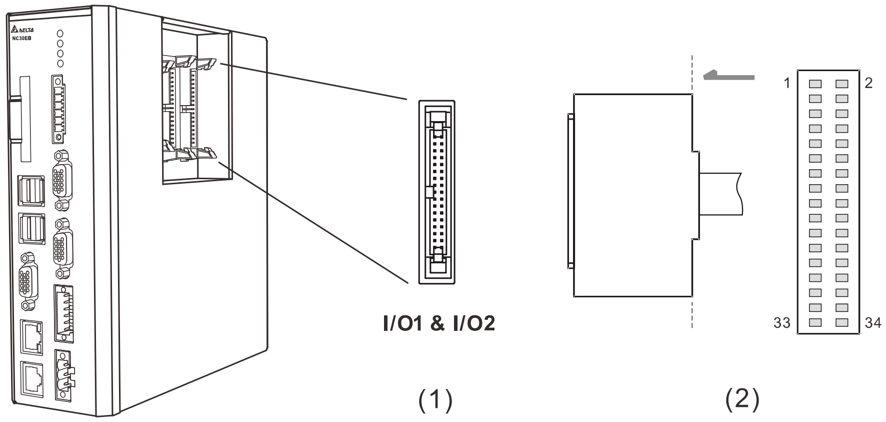
DI wiring (machine operation panel B supplies 24V power to the local I/O connector)



DO wiring (machine operation panel B supplies 24V power to the local I/O connector)



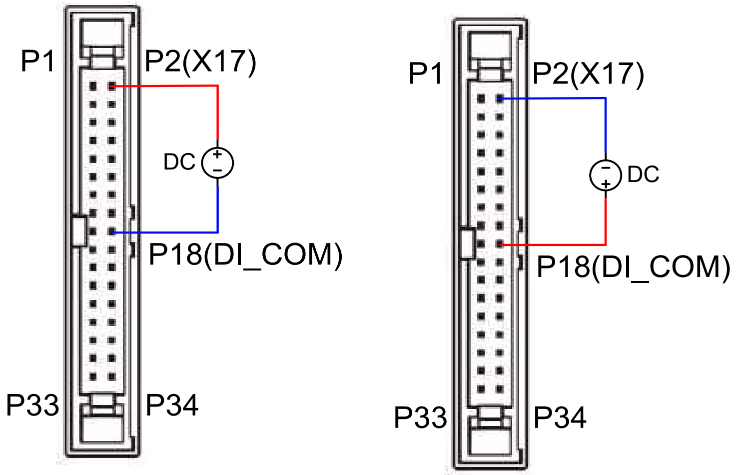
The pin assignment for the OPENCNC series models is as follows.



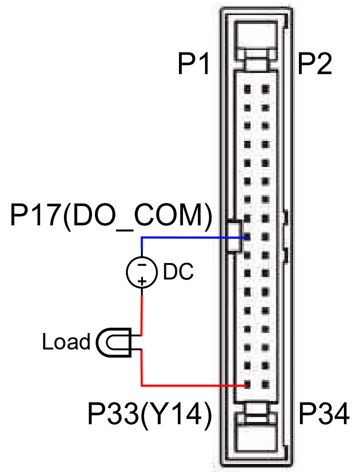
(1) Local I/O connector (female); (2) Local I/O connector (male)

I/O 1			
Pin 1	X0	Pin 2	X1
Pin 3	X2	Pin 4	X3
Pin 5	X4	Pin 6	X5
Pin 7	X6	Pin 8	X7
Pin 9	X8	Pin 10	X9
Pin 11	X10	Pin 12	X11
Pin 13	X12	Pin 14	X13
Pin 15	X14	Pin 16	X15
Pin 17	DO_COM	Pin 18	DI_COM
Pin 19	Y0	Pin 20	Y1
Pin 21	Y2	Pin 22	Y3
Pin 23	Y4	Pin 24	Y5
Pin 25	Y6	Pin 26	Y7
Pin 27	Y8	Pin 28	Y9
Pin 29	Y10	Pin 30	Y11
Pin 31	Y12	Pin 32	Y13
Pin 33	Y14	Pin 34	Y15

I/O 2			
Pin 1	X16	Pin 2	X17
Pin 3	X18	Pin 4	X19
Pin 5	X20	Pin 6	X21
Pin 7	X22	Pin 8	X23
Pin 9	X24	Pin 10	X25
Pin 11	X26	Pin 12	X27
Pin 13	X28	Pin 14	X29
Pin 15	X30	Pin 16	X31
Pin 17	DO_COM	Pin 18	DI_COM
Pin 19	Y16	Pin 20	Y17
Pin 21	Y18	Pin 22	Y19
Pin 23	Y20	Pin 24	Y21
Pin 25	Y22	Pin 26	Y23
Pin 27	Y24	Pin 28	Y25
Pin 29	Y26	Pin 30	Y27
Pin 31	Y28	Pin 32	Y29
Pin 33	Y30	Pin 34	Y31



Local I/O - DI Wiring



Local I/O - DO Wiring

3

3.2.13 External machine operation panel B for NC200B series models

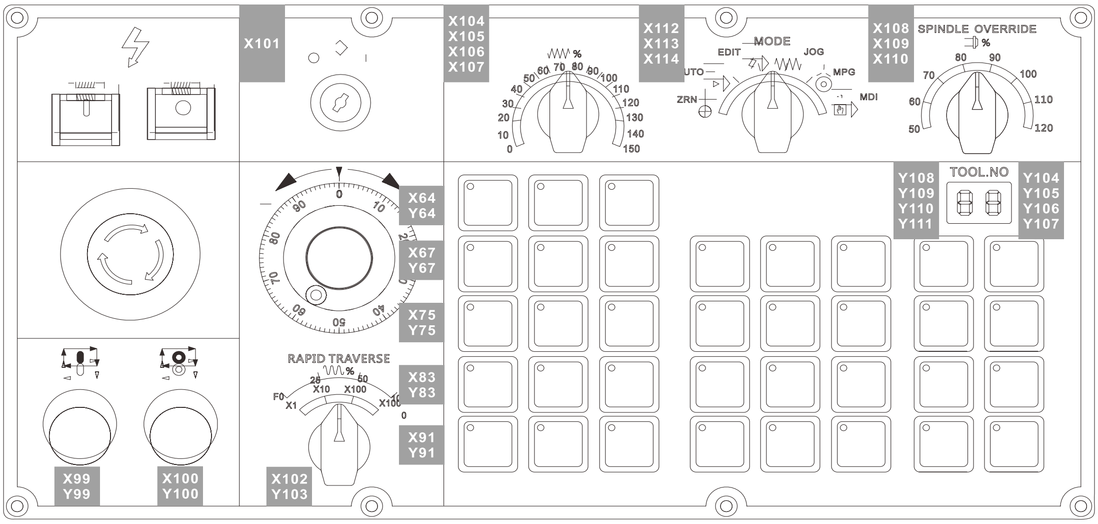
Model explanation:

NC - PAN - 300 B L - P E
(1) (2) (3) (4) (5) (6) (7)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
NC series product	Machine operation panel	300: horizontal; 8” 301: vertical; 8” 310: horizontal; 10” 311: vertical; 10”	B series	L: lathe M: milling machine	P: button type	E: English S: Simplified Chinese

NC-PAN-300BL-PE

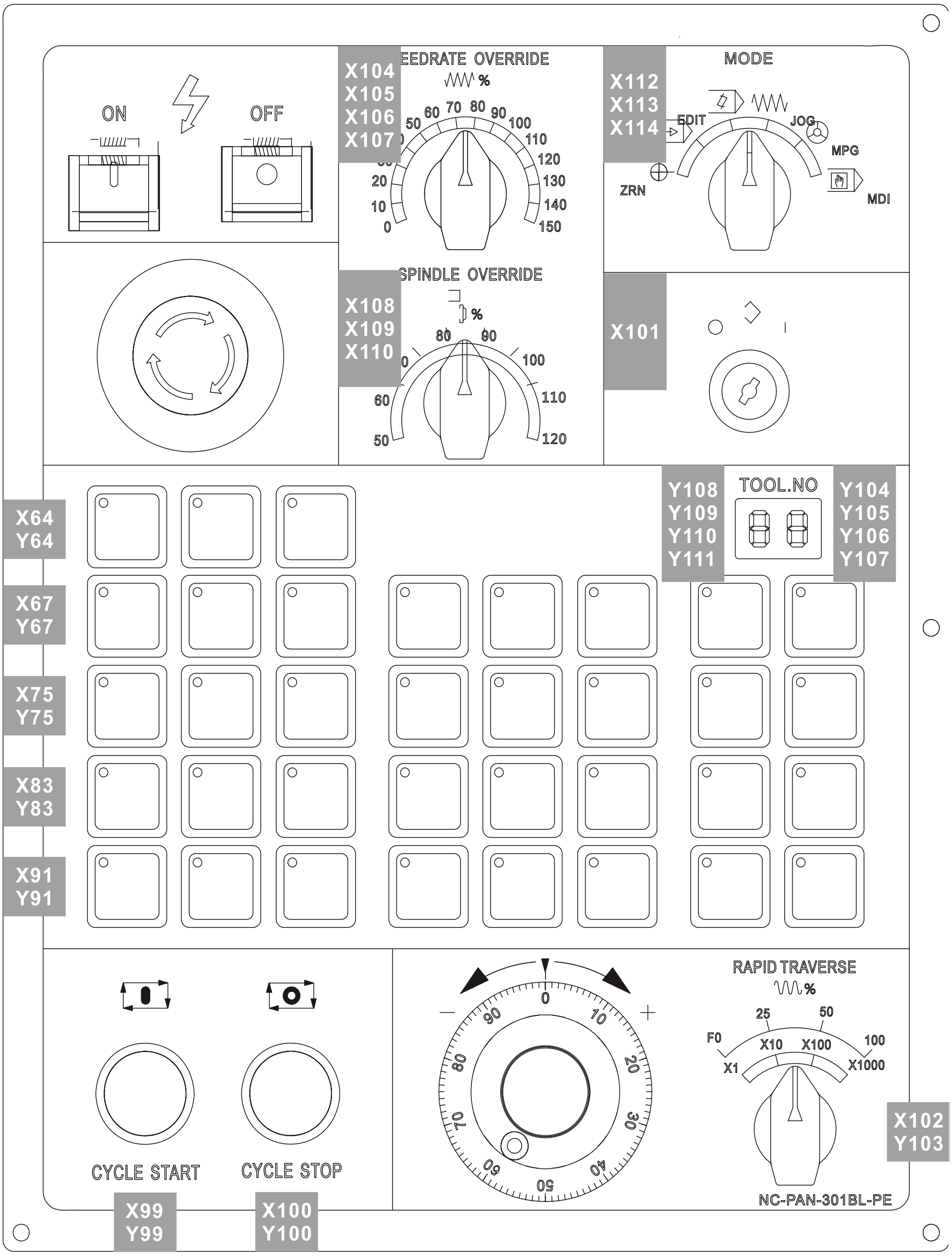
NC-PAN-300BL-PS



3

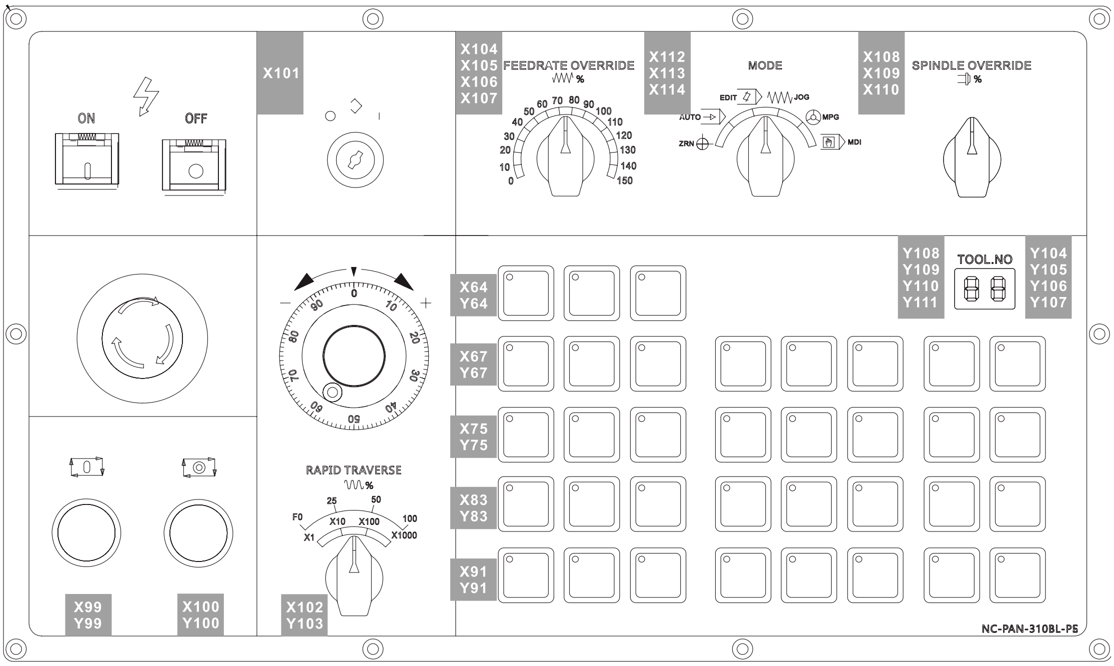
NC-PAN-301BL-PE

NC-PAN-301BL-PS



NC-PAN-310BL-PE

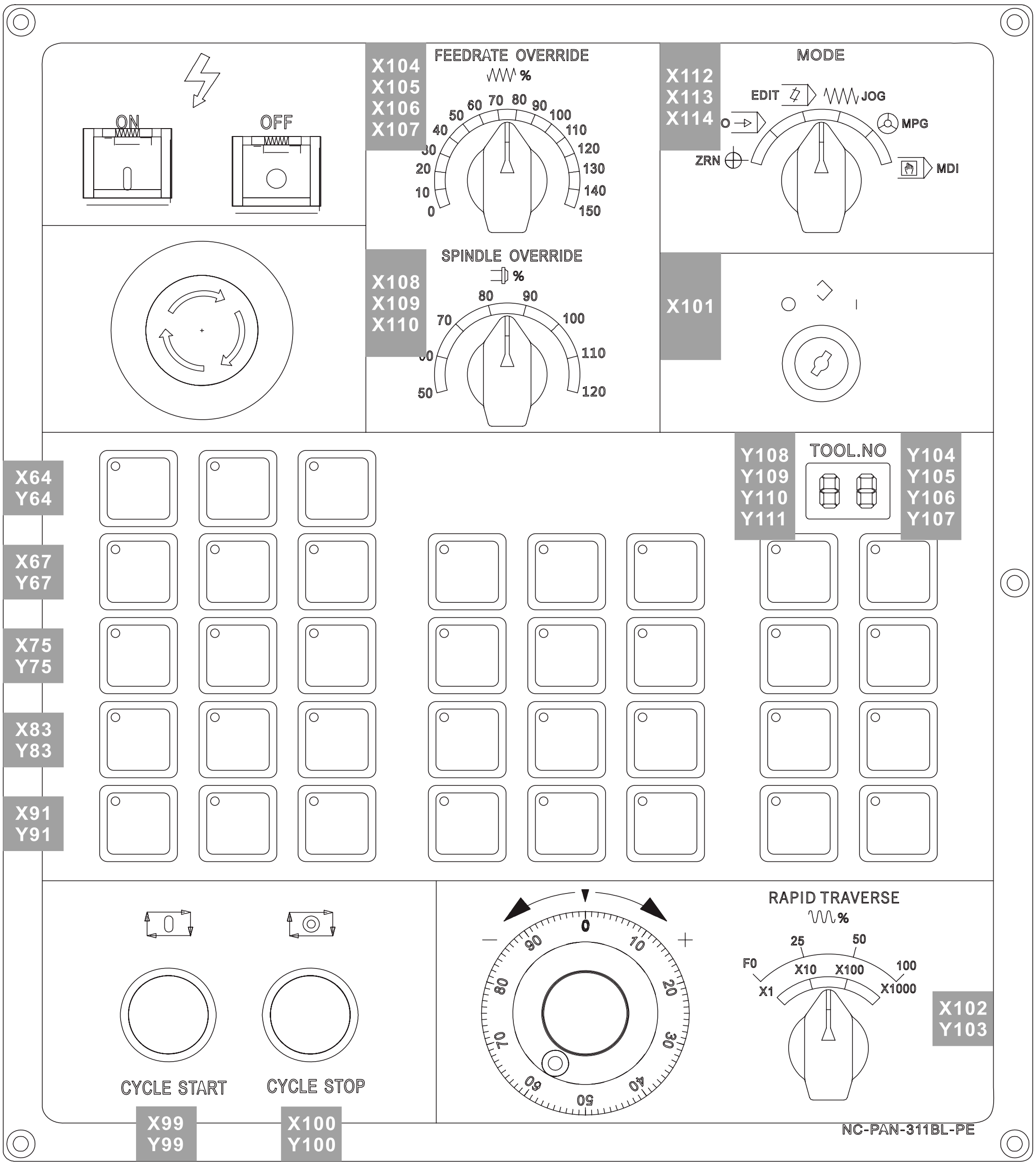
NC-PAN-310BL-PS



NC-PAN-311BL-PE

NC-PAN-311BL-PS

3



4 Table of Function Groups

This chapter provides tables of function groups for you to quickly view all the functions of the NC series controller.

4.1 Tables of function groups

Available in all modes

POS			
Layer 1	Layer 2	Layer 3	Layer 4
ABS	-	-	-
REL (the clear function of the corresponding axis is available only when you connect the axis)	CLR ALL	-	-
	CLR X	-	-
	CLR Y	-	-
	CLR Z	-	-
	CLR A	-	-
	CLR B	-	-
	CLR C	-	-
MECH	-	-	-

EDIT mode

PRG_File manage			
Layer 1	Layer 2	Layer 3	Layer 4
COPY F	-	-	-
PASTE	-	-	-
DEL (file / folder)	-	-	-
SEL TOGL / CANCEL	-	-	-
ALL SEL TOGL / CANCEL	-	-	-
File Manage	-	-	-
SORT	NAME	-	-
	SIZE	-	-
	DATE	-	-
NEW F	-	-	-
FOLDER	-	-	-
RENAME	-	-	-
FIND F	-	-	-
MERGE	-	-	-
FILE / MACRO	-	-	-
DXF	SET	-	-
	COPY F	-	-
	PASTE	-	-
	DEL	-	-
	SEL TOGL / CANCEL	-	-
	SEL ALL	-	-
	CANCEL	-	-
	RENAME	-	-
GRA EDT	ADD PRJ	-	-
	ADD PRC	-	-
	DEL	-	-
	COPY	-	-
	PASTE	-	-
	CONVERT	-	-
	MOVE UP	-	-
	MOVE DN	-	-
	RENAME	-	-
	DFT INIT	-	-
	DFT FNIH	-	-
INT MCR	-	-	-

4

EDIT mode

PRG_File edit			
Layer 1	Layer 2	Layer 3	Layer 4
COPY	-	-	-
CUT	-	-	-
PASTE	-	-	-
DEL	-	-	-
UNDO	-	-	-
B START	-	-	-
B END	-	-	-
LABLE	-	-	-
STRING	NEXT	-	-
	PREV	-	-
	REPLACE	-	-
	Replace all	-	-

AUTO mode

PRG			
Layer 1	Layer 2	Layer 3	Layer 4
SF SET	Spindle speed (S) range: 0 - Pr.409 setting range; feed rate (F) range: 0 - Pr.318 setting range		
START	RUN	-	-
BARCODE (set Pr.10053 to enable this function)	LOAD	-	-
	CLEAR	-	-
	CLEAR ALL	-	-
FILE QUEUE (Set Pr.10045 to enable or disable this function)	LOAD	-	-
	MODE CHG	-	-
	CLR ALL	-	-
	ADD FILE	-	-
	MOVE	UP	-
		DOWN	-
		Jump To	-
	DISP CHG	-	-
File Manage	←	-	-
	→	-	-
	SEL TOGL / CANCEL	-	-
	DEL	-	-
	RENAME	-	-
	FOLDER	-	-
	SORT	-	-

JOG / MPG mode

PRG			
Layer 1	Layer 2	Layer 3	Layer 4
SF SET	Spindle speed (S) range: 0 - Pr.409 setting range; feed rate (F) range: 0 - Pr.318 setting range		
TEACH (set Pr.10044 to enable this function)	POSITION	-	-
	LINEAR	-	-
	CIRCULAR	P1	-
		P2	-
		P3	-
	DEL	-	-
	SAVE	-	-
	NEW FILE	-	-
	SET	-	-

MDI mode

PRG			
Layer 1	Layer 2	Layer 3	Layer 4
LOAD	-	-	-
SAVE	-	-	-
CLEAR	-	-	-

HOME mode

PRG			
Layer 1	Layer 2	Layer 3	Layer 4
SF SET	Spindle speed (S) range: 0 - Pr.409 setting range; feed rate (F) range: 0 - Pr.318 setting range		

4

Available in all modes

OFS			
Layer 1	Layer 2	Layer 3	Layer 4
WEAR	ABS	-	-
	INC	-	-
	CLR ALL	-	-
	CLR ONE	-	-
	ABS / INC MODE	Set Pr.10059 to enable this function (1: Abs; 2: Inc).	
OFFSET	ABS	-	-
	INC	-	-
	LEN OFST	-	-
	ABS OFST	-	-
	CLR ONE	-	-
	ABS / INC MODE	Set Pr.10059 to enable this function (1: Abs; 2: Inc).	
MAGA	Maga No 1 (functions in Layer 3 are only available in JOG mode)	SET	-
		RST ALL	-
		LOCK	-
		UNLOCK	-
	Maga No 2 (functions in Layer 3 are only available in JOG mode)	SET	-
		RST ALL	-
		LOCK	-
		UNLOCK	-
MACRO (set Pr.10045 to enable this function)	LOCAL	-	-
	GLOBAL	-	-
	HOLD	-	-
	EXTEND	-	-
	MECH	WR _ (axis coordinate)	-
	ABS	WR _ (axis coordinate)	-
COORD	AUTO	CLR REL	-
		CLR ALL	-
		SET L	-
		SET L/2	Point1
			Point2
			SET
		SET P	-
	ABS	-	-
	INC	-	-

Available in all modes

GRA			
Layer 1	Layer 2	Layer 3	Layer 4
CENT SET	-	-	-
WIN RST	-	-	-
WIN SET	UP	-	-
	DOWN	-	-
	LEFT	-	-
	RIGHT	-	-
	ZM IN	-	-
	ZM OUT	-	-
	OK	-	-
	CANCEL	-	-
PV(STEP)	This function is only available in AUTO mode.		
GRAPHIC	-	-	-
PREVIEW	This function is only available in AUTO mode.		
CLEAR	-	-	-

Available in all modes

ALM			
Layer 1	Layer 2	Layer 3	Layer 4
ALARM	-	-	-
HISTORY	CLR ALL	-	-

Available in all modes

DGN			
Layer 1	Layer 2	Layer 3	Layer 4
PROCESS	SET NR	-	-
	CLR TIME	-	-
	CLR NR	-	-
USR VAR	USR VAR	DEL	-
		US DEC	-
		HEX	-
		S DEC	-
		FLOAT	-
	SYS VAR	-	-
	M VAR	DEL	-
		US DEC	-
		HEX	-
		S DEC	-
		FLOAT	-
MLC	BIT	X	-
		Y	-
		M	-
		A	-
		T	-
		C	-
	REG	T	-
		C(16)	-
		C(32)	-
		D	-
		V	-
		Z	-
		US DEC	-
		HEX	-
		S DEC	-
		FLOAT	-
	DEV MON	US DEC	-
		HEX	-
		S DEC	-
		FLOAT	-

DGN			
Layer 1	Layer 2	Layer 3	Layer 4
MLC	EDITOR (only available in EDIT mode)	LD	-
		LDI	-
		LDP	-
		LDF	-
		OUT	-
		APP	-
		—	-
		|	-
		DEL V-LN	-
		ADD LN	-
		DEL LN	-
		DEL	-
		LABEL	-
		TABLE	-
		SYMBOL	X
			Y
			M
			A
			T
			C
			D
			P
			I
			DEL
			COPY
			PASTE
		SAVE	-
		IMPORT	IMPORT
		EXPORT	EXPORT
			NEW FILE
			NAME SR
			SIZE SR
			DATE SR
		JUMP TO	-
		SELECT	-
		CUT	-
		COPY	-
		PASTE	-

<table>
<tr><th colspan="4">DGN</th></tr>
<tr><th>Layer 1</th><th>Layer 2</th><th>Layer 3</th><th>Layer 4</th></tr>
<tr><td rowspan="4">MLC</td><td rowspan="3">SET</td><td>ON</td><td>-</td></tr>
<tr><td>OFF</td><td>-</td></tr>
<tr><td>RUN / STP</td><td>-</td></tr>
<tr><td>JUMP TO</td><td>-</td><td>-</td></tr>
<tr><td rowspan="12">SYS MON</td><td>SRV MON</td><td>-</td><td>-</td></tr>
<tr><td>I/O MON</td><td>-</td><td>-</td></tr>
<tr><td>SYS VAR</td><td>-</td><td>-</td></tr>
<tr><td rowspan="9">VAR MON</td><td>SYS VAR</td><td>-</td></tr>
<tr><td>CH VAR</td><td>-</td></tr>
<tr><td>AXIS VAR</td><td>-</td></tr>
<tr><td>IF VAR</td><td>-</td></tr>
<tr><td>MLC VAR</td><td>-</td></tr>
<tr><td>US DEC</td><td>-</td></tr>
<tr><td>BIN</td><td>-</td></tr>
<tr><td>HEX</td><td>-</td></tr>
<tr><td>S DEC</td><td>-</td></tr>
<tr><td rowspan="4">STATUS</td><td>SYSTEM</td><td>-</td><td>-</td></tr>
<tr><td>FW SN</td><td>-</td><td>-</td></tr>
<tr><td>HW SN</td><td>-</td><td>-</td></tr>
<tr><td>M INFO</td><td>DEL</td><td>-</td></tr>
<tr><td rowspan="18">PWD</td><td rowspan="2">S SCP</td><td>LOCK / UNLOCK</td><td>-</td></tr>
<tr><td>SYS CHECK</td><td>-</td></tr>
<tr><td rowspan="8">M SCP</td><td>PWD CHG</td><td>-</td></tr>
<tr><td>LOCK / UNLOCK</td><td>-</td></tr>
<tr><td>RST U1</td><td>-</td></tr>
<tr><td>RST U2</td><td>-</td></tr>
<tr><td rowspan="3">FUN ENA</td><td>OK</td></tr>
<tr><td>CANCEL</td></tr>
<tr><td>DEFAULT</td></tr>
<tr><td>RESET</td><td>-</td></tr>
<tr><td rowspan="2">U1 SCP</td><td>PWD CHG</td><td>-</td></tr>
<tr><td>LOCK / UNLOCK</td><td>-</td></tr>
<tr><td rowspan="2">U2 SCP</td><td>PWD CHG</td><td>-</td></tr>
<tr><td>LOCK / UNLOCK</td><td>-</td></tr>
<tr><td rowspan="4">EXPIRE</td><td>SETTING</td><td>-</td></tr>
<tr><td>RELEASE</td><td>-</td></tr>
<tr><td rowspan="2">EXP SCP</td><td>PWD CHG</td></tr>
<tr><td>LOCK / UNLOCK</td></tr>
</table>

DGN			
Layer 1	Layer 2	Layer 3	Layer 4
TUNING (only available in JOG or MPG mode) (set Pr.10045 to enable or disable this function)	NEXT AX	-	-
	READ	-	-
	COMPUTE	-	-
	WR GAIN	-	-
	WR Notch	-	-
	RUN / STOP	-	-
	JOG←	-	-
	JOG→	-	-
	POS1	-	-
	POS2	-	-
	TAP RIV	TAP SET(1)	-
		TAP SET(2)	-
	SERVO	READ	-
TEXT WR	Set Pr.10045 to enable or disable this function.		
IMPORT	-	-	-
EXPORT	EXPORT	-	-
	SEL ALL	-	-
	CLR ALL	-	-
LOGO WR	Set Pr.10045 to enable or disable this function.		

4

Available in all modes

PAR			
Layer 1	Layer 2	Layer 3	Layer 4
PROCESS	-	-	-
OPERATE	-	-	-
MAGA	-	-	-
SPINDLE	-	-	-
MACHINE	-	-	-
HOME	-	-	-
ETH.	DEFAULT	-	-
COMP	OK	-	-
	um	-	-
	um+	-	-
	IMPORT	-	-
	IMPORT+	-	-
SYSTEM	DEFAULT	-	-
	COLOR	-	-
MLC	DEFAULT	-	-
	COLOR	-	-
GRAPHIC	DEFAULT	-	-
	COLOR	-	-
SERVO	READ	-	-
SEARCH	-	-	-
CONFIG (except AUTO and MDI modes)	OK	-	-
SET RIO (except AUTO and MDI modes)	OK	-	-
PAR GRP	SAVE	-	-
	DEL GRP	-	-
	WRT PAR	-	-
	RED PAR	-	-
	SRT PAR	-	-
	AVERAGE	-	-

Available in all modes

SOFT
You can configure the panel screen with the ScreenEditor software for application needs.

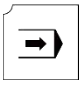
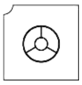
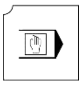
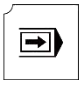
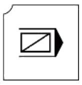
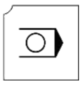
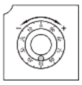
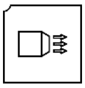
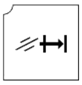
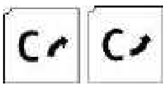
4.2 Machine operation panel A - function of keys

Key	Description	Supported mode / group
POS	The key of coordinate display.	All modes and groups
PRG	The key of program editing.	All modes and groups
OFS	The key of coordinate and tool offset settings.	All modes and groups
DGN	The key of diagnosis functions, system parameters, and system status.	All modes and groups
ALM	The key of alarm display.	All modes and groups
GRA	The key of tool path graphic display.	All modes and groups
PAR	The key of system parameter settings.	All modes and groups
SOFT	The key of panel screen configuration.	All modes and groups
RESET	Reset key	All modes and groups
X I ~ D H	Axis position and command code keys	PRG
0 ^ ~ 9 /	Numeric keys (operation symbols)	PRG, OFS, DGN
• >	Decimal point key (operation symbol)	PRG, OFS
—]	Negative sign key (operation symbol)	PRG, OFS
▲ PAGE UP ▼ PAGE DN	PAGE UP and PAGE DN (page down) keys	PRG, OFS, DGN
⬆ ; ⬇ , ⬅ & ➡ #	Cursor keys (operation symbols)	PRG, OFS, DGN
HOME END	Home (end) key	PRG
SPACE	Space key	PRG

4

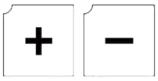
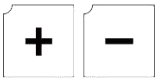
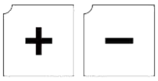
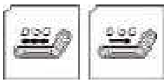
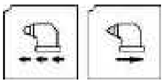
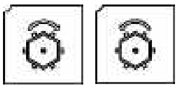
Key	Description	Supported mode / group
SHIFT	Shift key	PRG
DEL INS	Delete (insert) key	PRG
BACK SPACE	Backspace key	PRG
ENTER	Enter key	PRG, OFS, DGN
EXIT	Exit key	PRG, DGN
( )	Parentheses key	PRG
◀ ▶	Left and right function keys	All modes and groups
F1 ~ F6	Function keys	All modes and groups

4.3 Machine operation panel B - function of keys

Key	Description
	AUTO mode: for program execution.
	EDIT mode: for file management and program editing.
	JOG mode: for manual machine operation.
	MPG mode: for operating the machine axis with MPG.
	MDI mode: for simple program input and execution.
	HOME mode: for rapidly returning to the machine origin.
	Single block execution: execute one single block at a time and then stop.
	Single block skip: skip one single block when there is a "/" symbol in the block.
	Optional stop: stop at the specified block if there is an M01 command in the block.
	MPG simulation: during program execution, enable this function to control the execution speed with MPG.
	Air blow switch
	Coolant switch: coolant On / coolant Off
	Limit cancellation: when the hardware limit is triggered, press this key to clear the alarm.
	Light switch: light On / light Off
	Rapid traverse mode: execute axis movement based on the set rapid override.
X ← X →	X axis direction: in JOG mode, manually operate the X axis in forward or reverse direction.
Y ↙ Y ↗	Y axis direction: in JOG mode, manually operate the Y axis in forward or reverse direction.
Z ↑ Z ↓	Z axis direction: in JOG mode, manually operate the Z axis in forward or reverse direction.
	Rotation axis direction: in JOG mode, manually operate the rotation axis in clockwise or counterclockwise direction.

4

4

Key	Description
	Spindle forward: manually run the spindle in forward direction.
	Spindle stop: manually stop the spindle rotation.
	Spindle reverse: manually run the spindle in reverse direction.
 Feedrate / JOG	Feedrate / JOG override: increment / decrement
 Rapid override	Rapid override: increment / decrement
 Spindle override	Spindle override: increment / decrement
	Chip discharge conveyor: motor runs in forward / reverse direction.
	Tailstock center: forward / backward
	Tool turret: clockwise / counterclockwise
	Spindle hydraulic chuck: release / tighten
	MPG magnification selection: X1, X10, X100
	User-defined function keys

4.4 Table of corresponding buttons (for OPENCNC models)

NC key	PC keyboard	Description
F1 - F8 (function keys)	F1 - F8	Function keys
► (function key)	Tab	Next page (of the function bar)
◄ (function key)	Ctrl + Tab	Previous page (of the function bar)
POS	Ctrl + F1	The POS function group key
PRG	Ctrl + F2	The PRG function group key
OFS	Ctrl + F3	The OFS function group key
DGN	Ctrl + F4	The DGN function group key
ALM	Ctrl + F5	The ALM function group key
GRA	Ctrl + F6	The GRA function group key
PAR	Ctrl + F7	The PAR function group key
SOFT	Ctrl + F8	The SOFT function group key
Numeric keys	Numeric keys	-
Alphabetic keys	Alphabetic keys	-
Symbol keys	Symbol keys	-
Direction keys	Direction keys	-
PAGE UP / PAGE DN	Page Up / Page Down	-
BACKSPACE	Backspace	-
SPACE	Space	-
DEL / INS	Delete / Insert	-
SHIFT	Shift	-
HOME / END	Home / End	-
ENTER	Enter	-
EXIT	Esc	-
RESET	Ctrl + Esc	-
-	F12	Help (function descriptions for keys)
SHIFT + GRA	PrtScn	Screen capturing

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Introduction to NC System Modes

5

This chapter introduces the system modes supported by the NC controller.

5

5.1 Auto mode (AUTO)

After opening the file for execution, you have to switch the system to AUTO mode to execute the program. This procedure allows you to verify the machining program, cutting conditions, and position coordinates before execution as well as avoid mistakenly pressing **CYCLE START** in other system modes. In this mode, you can only execute the program rather than edit the program or manually move the axes.

5.2 Program edit mode (EDIT)

You can edit the program only in EDIT mode. In this mode, the editing functions in PRG group are enabled for you to edit the program. In addition, program execution and manual axis movement are not available in this mode.

5.3 Manual input mode (MDI)

In MDI mode, you can enter and execute a single block of program in the PRG group screen. In this mode, you can enter up to 14 program blocks in the PRG screen. General program editing, program execution, and manual axis operation are not available in this mode.

5.4 MPG feeding mode (MPG)

In MPG mode, you can use the external MPG handwheel to manually move the axes promptly and accurately. Program editing, program execution, and jog operation are not available in this mode.

5.5 Jog feeding mode (JOG)

In JOG mode, press the axis direction keys on machine operation panel B to have the axes jog. Set the jog speed and moving distance with the JOG override key. You can move the work platform at high speed with the rapid traverse override key and axis direction keys. The axis moving speed is determined by the rapid override setting. Program execution and editing are not available in this mode.

5.6 Rapid feeding mode (RAPID)

When you press **RAPID** in JOG mode, the jog operation refers to the speed setting of rapid feeding.

5.7 Homing mode (HOME)

In HOME mode, you can return the axes to the machine origin by simply pressing the corresponding axis direction keys on machine operation panel B. After restarting the controller, you need to set the system to HOME mode to have each axis return to the machine origin before executing the program. If you do not perform homing after starting the controller, program execution is prohibited.

5

5.8 Function group screen overview

A variety of information is provided on the function group screens of this controller. The following introduces the screens of specific functions.

■ **Position (POS) group**

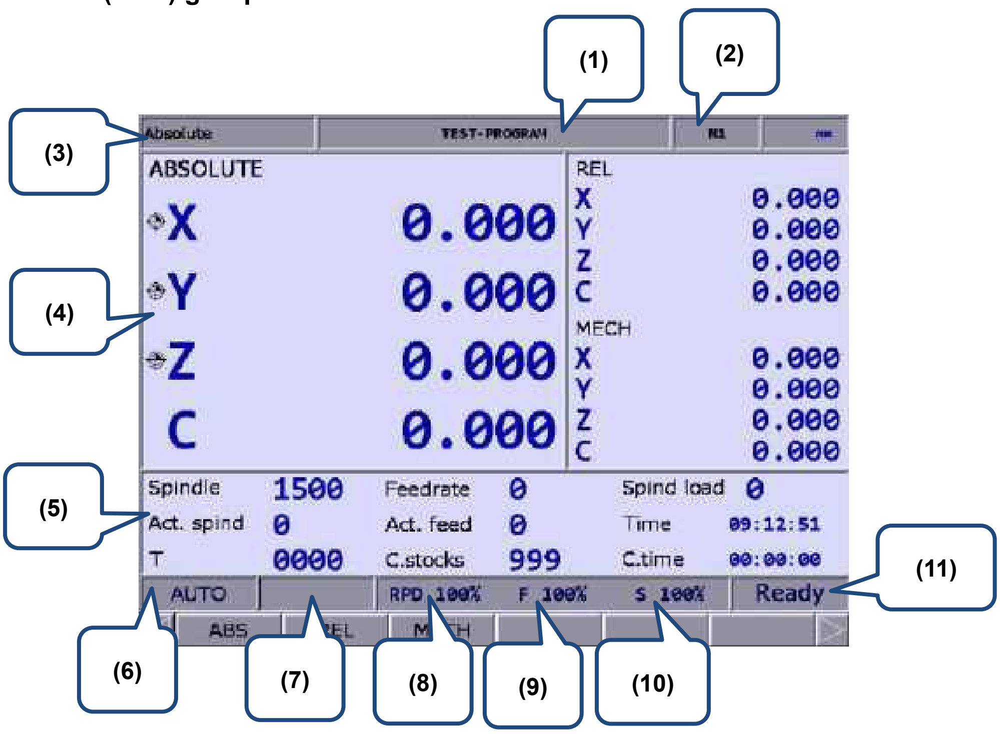

Figure 5.8.1

(1) Current program name

(2) Currently executed program line

(3) Current function group screen

(4) Current coordinate information

(5) Machining information display:
Spindle speed: command value
Cutting feed rate: command value
Spindle load rate: %
Actual speed: rpm
Actual feed rate: mm/min
System time
Tool number (T)
Count of machining operations
Cutting time

(6) Current system mode

(7) Alarm display

(8) Rapid traverse override

(9) Feed rate override

(10) Spindle override

(11) System status

In Figure 5.8.1, (11) displays the current status of the system for your reference. There are 7 system statuses with the display priority as follows: MLC stop > SV NO RDY (servo not ready) > Emg Stop (emergency stop) > PROC (in progress) > RUN (in execution) > STOP (program stops) > Ready.

- **Program (PRG) group**

AUTO mode:

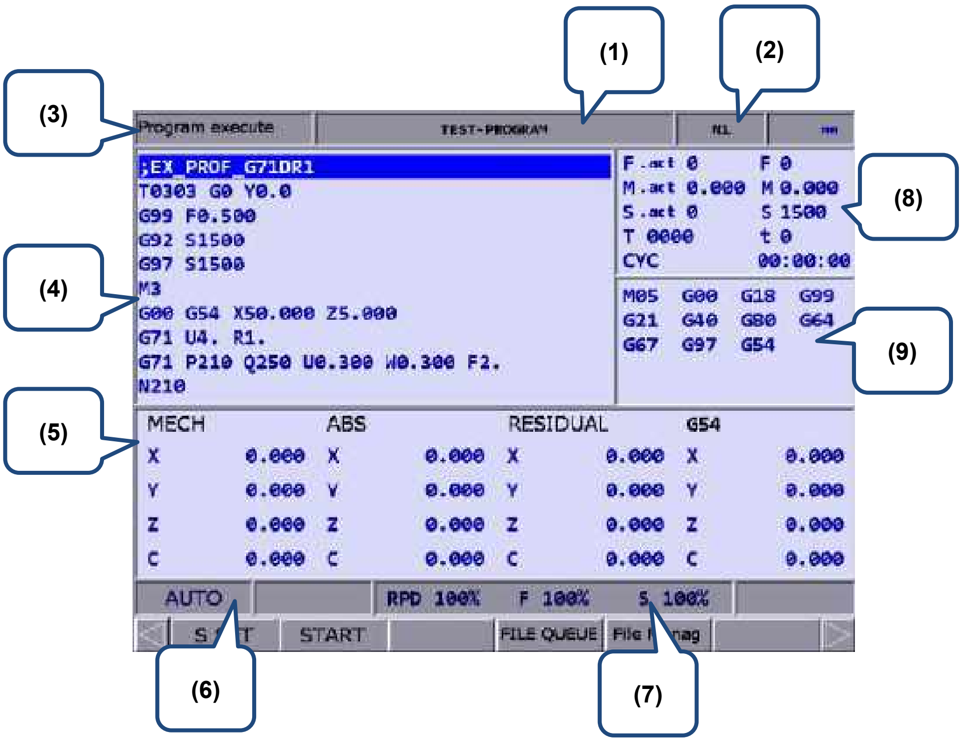

Figure 5.8.2

(1) Current program name

(2) Currently executed program line

(3) Current function group screen

(4) Currently executed program content

(5) Coordinate information during program execution

(6) Current system mode

(7) Current override settings

(8) F.act: actual feed rate per minute
M.act: actual feed rate per revolution
S.act: actual spindle speed
T: tool number
F: feed rate (command value)
M: feed rate per revolution (command value)
S: spindle speed
t: dwell time
CYC: cycle time

(9) Current command status

EDIT mode:

Figure 5.8.3

(1) File list: displays folders and program files

(2) File information: displays the size and modification date and time of the file or folder

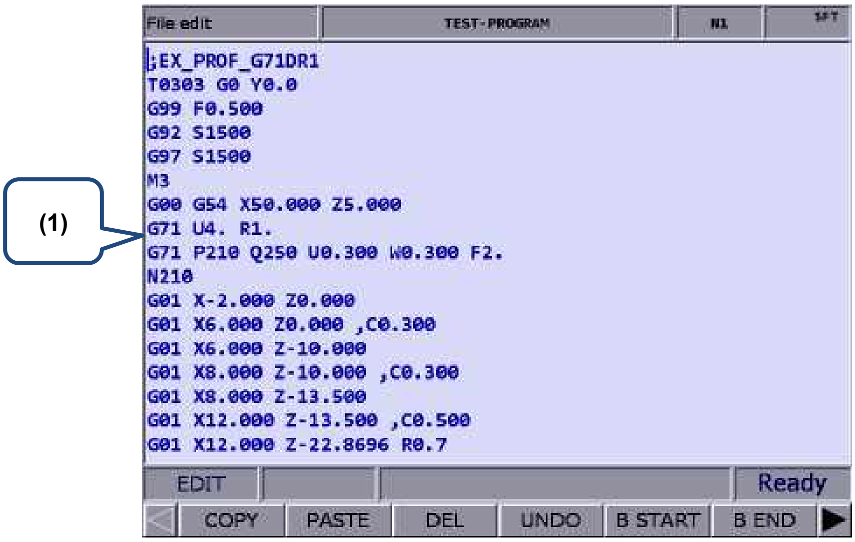

Figure 5.8.4

(1) File content: displays the program content in the file

MDI mode:

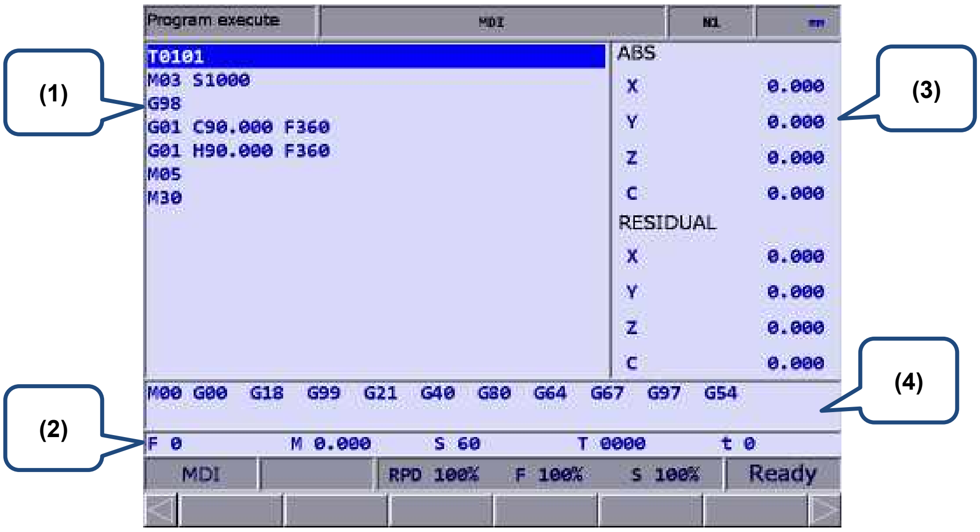

Figure 5.8.5

(1) MDI program
(2) Information of feed rate (F), feed rate per revolution (M), spindle speed (S), tool number (T), and program dwell time (t)
(3) Coordinate information: absolute (ABS) / residual coordinates
(4) Status of currently executed commands

■ **Offset (OFS) group**

Coordinate information:

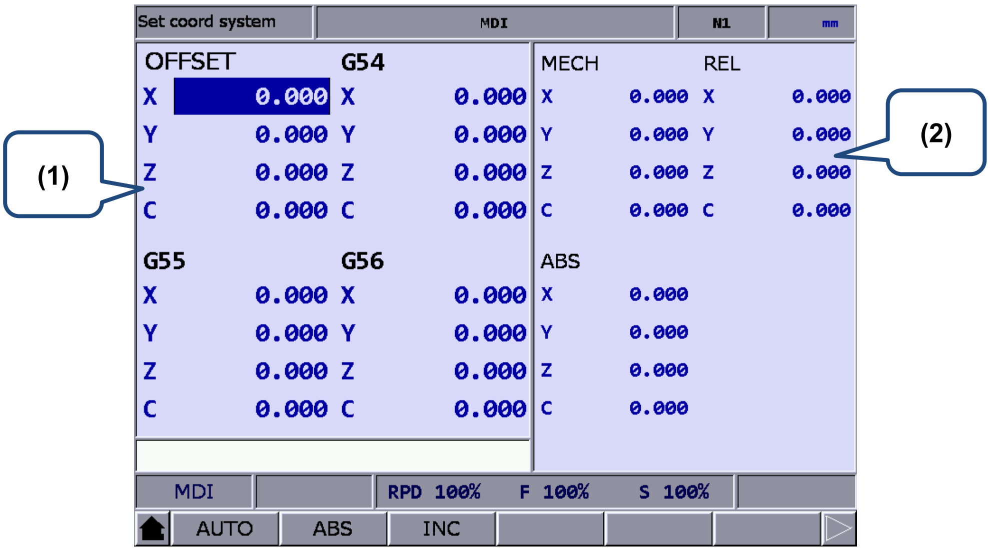

Figure 5.8.6

(1) Workpiece coordinate setting: offset coordinates, G54 - G59 coordinate system
(2) Coordinate information display: machine (MECH) / relative (REL) / absolute (ABS) coordinates

Tool Wear:

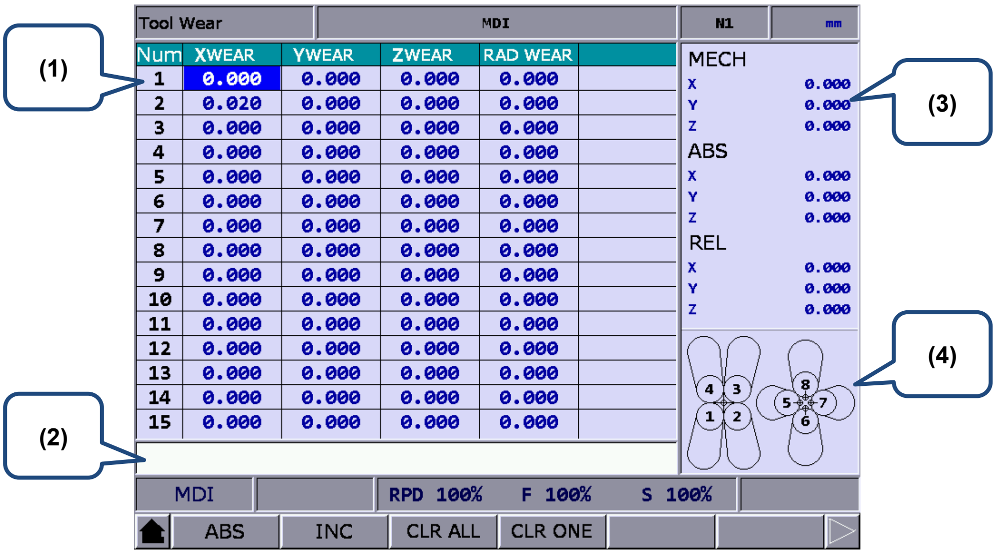

Figure 5.8.7

(1) Compensation data No.
(2) Input field for compensation data
(3) Auxiliary display: coordinate systems
(4) Auxiliary display: illustration of tool tip type

Tool length (Tool Offset):

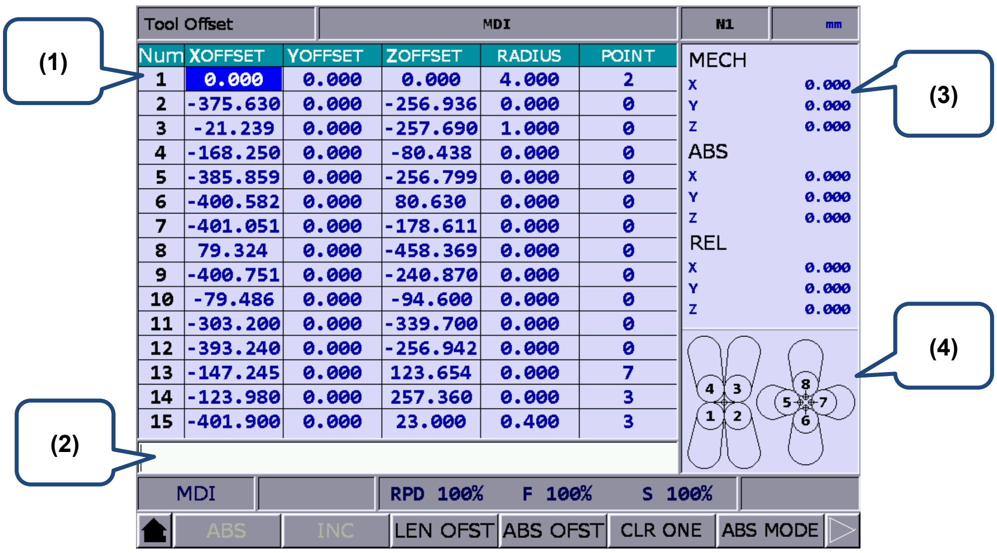

Figure 5.8.8

(1) Compensation data No.
(2) Input field for compensation data
(3) Auxiliary display: coordinate systems
(4) Auxiliary display: illustration of tool tip type

5

■ Diagnosis (DGN) group

Servo Tuning:

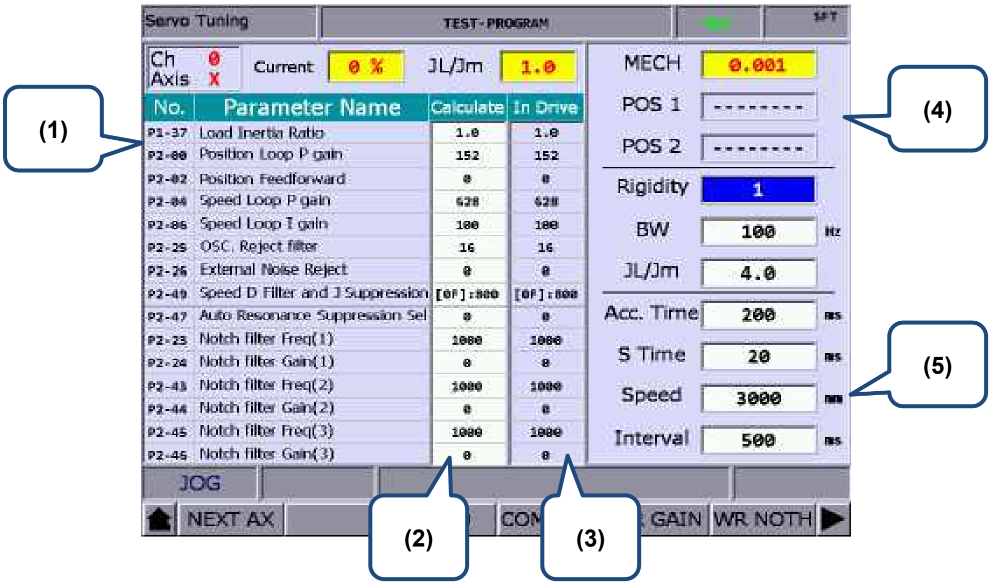

Figure 5.8.9

(1) Servo parameter: number and name of the servo parameter
(2) Results after gain tuning: displays the calculation results of auto tuning
(3) System settings: displays the current servo settings
(4) Position setting: Position 1 / Position 2
(5) Tuning conditions

MLC Operation / Edit:

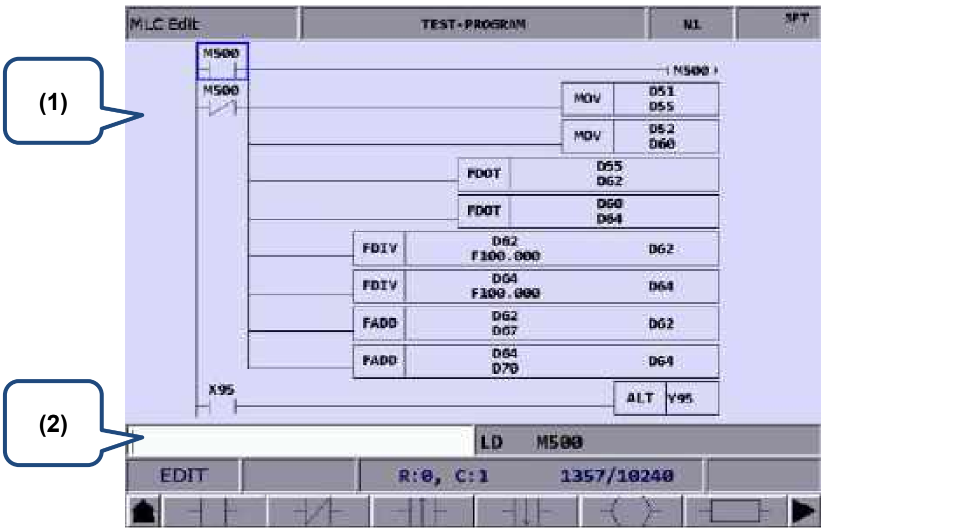

Figure 5.8.10

(1) MLC program
(2) Input field for command name

5

■ **Alarm (ALM) group**

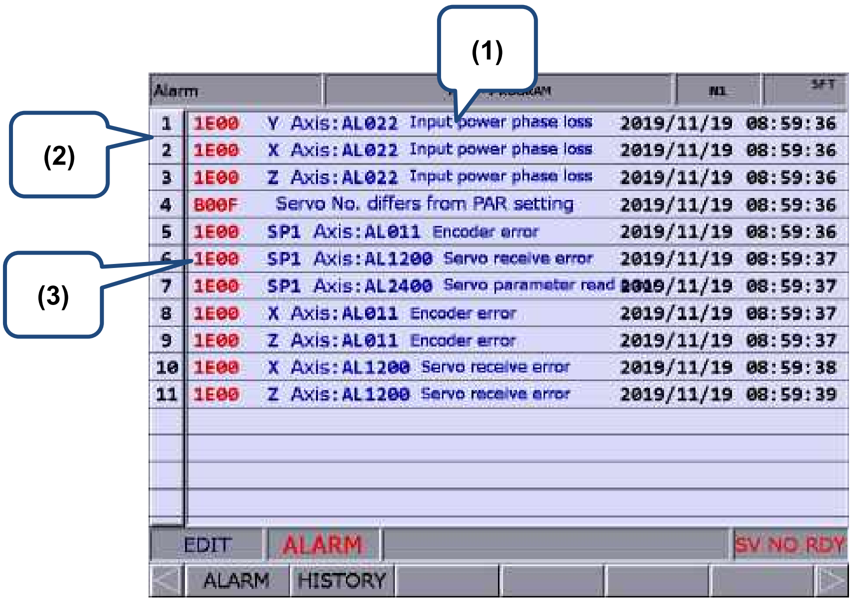

Figure 5.8.11

(1) Alarm message

(2) Sequence number of the alarm occurred

(3) Alarm code

■ **Graph (GRA) group**

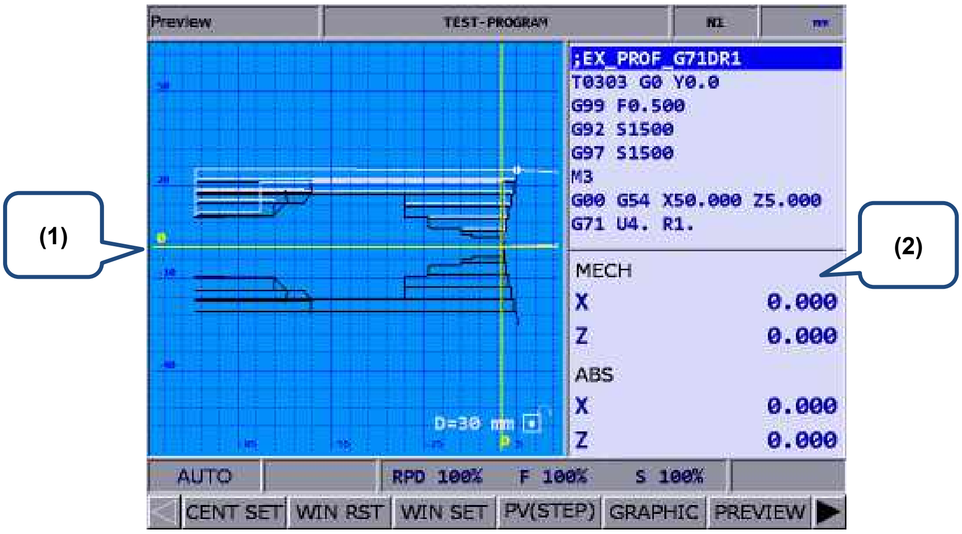

Figure 5.8.12 Screen of setting Pr.14003 to 0

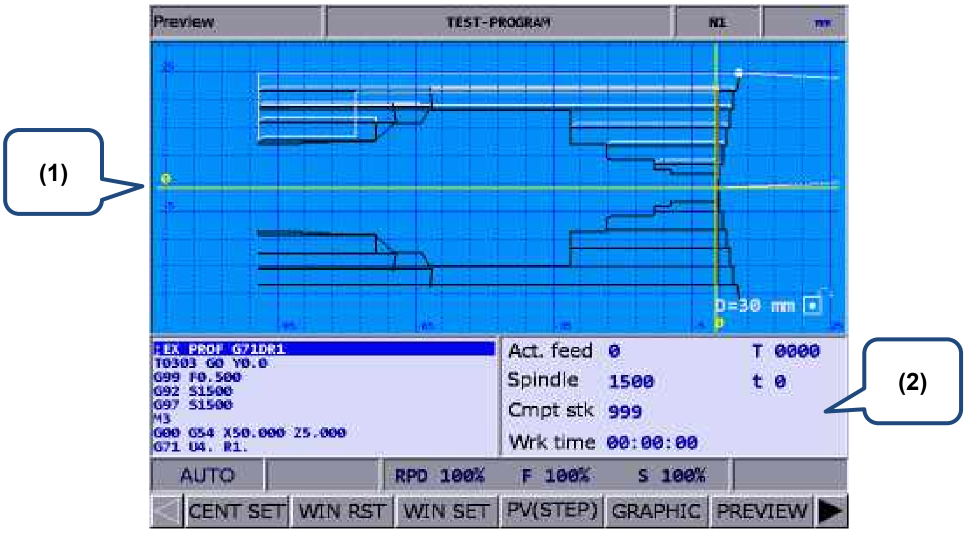

Figure 5.8.13 Screen of setting Pr.14003 to 1

(1) Trajectory display: displays the motion trajectory

(2) Displays the program in execution, system information, and coordinate information

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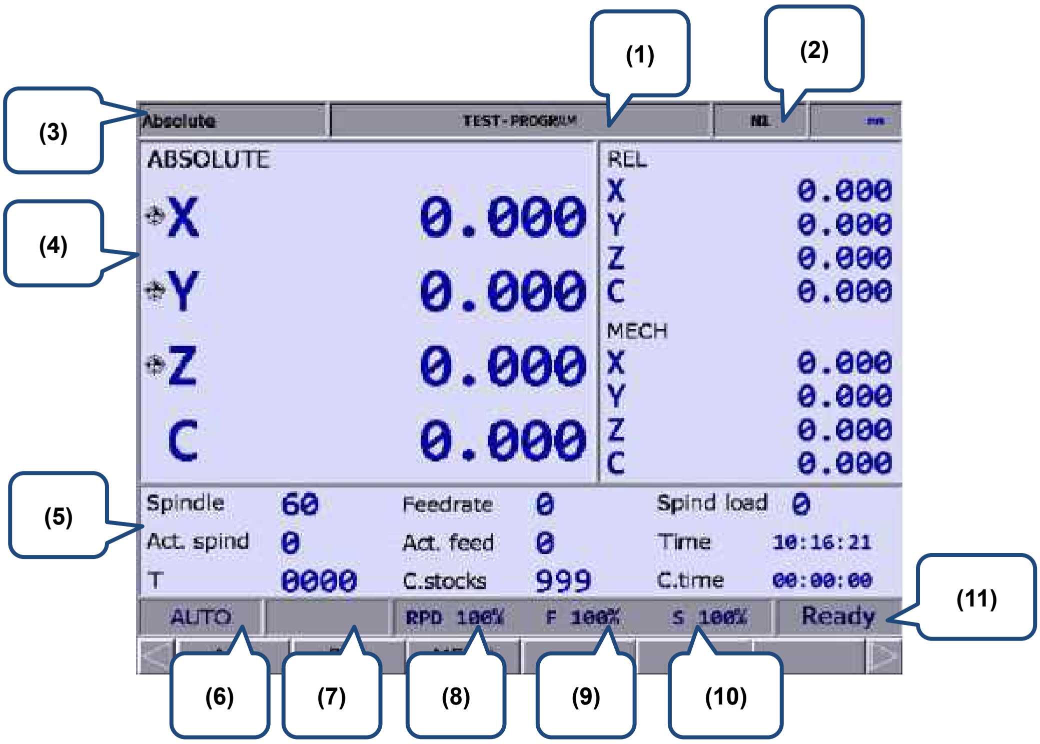
Position (POS) Group 6

POS group displays the axes positions, which are represented in absolute, relative, and machine coordinates.

6

POS group displays the axes positions, which are represented in absolute, relative, and machine coordinates. It can display the coordinates of up to three linear axes and one rotation axis according to the setting of number of axes.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) means the function keys of F1 - F6.



(1) Current program name
(2) Currently executed program line
(3) Current function group
(4) Current coordinates
(5) Machining information display:
Spindle speed: command value
Cutting feed rate: command value
Spindle load rate: %
Actual speed: rpm
Actual feed rate: mm/min
System time
Tool number (T)
Count of machining operations
Cutting time

(6) Current system mode
(7) Alarm display
(8) Rapid traverse override
(9) Feed rate override
(10) Spindle override
(11) System status

6.1 Absolute coordinates

The absolute coordinates refer to the program origin of G code, which you can use to check whether the axis movement planned in the program block matches the actual movement. The operation steps are as follows.

(1) Press **POS** to display the POS group screen and the available functions include absolute coordinates (ABS), relative coordinates (REL), and machine coordinates (MECH).
(2) Press **ABS** to enter the absolute coordinate screen.

6.2 Relative coordinates

The relative coordinates indicate the moving distance from the program zero position.
The operation steps are as follows.

(1) Press **POS** to display the POS group screen and the available functions include absolute coordinates (ABS), relative coordinates (REL), and machine coordinates (MECH).
(2) Press **REL** to enter the relative coordinate screen.
(3) The functions available in the 2nd layer function bar include:
CLR ALL: clear the relative coordinate values of all axes.
CLR X: clear the relative coordinate value of X axis.
CLR Y: clear the relative coordinate value of Y axis.
CLR Z: clear the relative coordinate value of Z axis.
CLR A: clear the relative coordinate value of A axis.
CLR B: clear the relative coordinate value of B axis.
CLR C (next page): clear the relative coordinate value of C axis.

Note: the clear functions for the axes (X, Y, Z, A, B, and C) are available only when the corresponding physical axes are connected.

6.3 Machine coordinates

The machine coordinates are defined according to the position of the mechanical part after homing. The machine coordinate data is neither removable nor changeable when a different workpiece coordinate system is selected. The operation steps are as follows.

(1) Press **POS** to display the POS group screen and the available functions include absolute coordinates (ABS), relative coordinates (REL), and machine coordinates (MECH).
(2) Press **MECH** to enter the machine coordinate screen.

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Program (PRG) group 7

The PRG group provides functions of file management and program editing for G-code and macro files. In addition, different system modes have their dedicated functions.

You can manage and edit G-code and macro files with PRG group functions. The File manage function includes 3-level function layers:

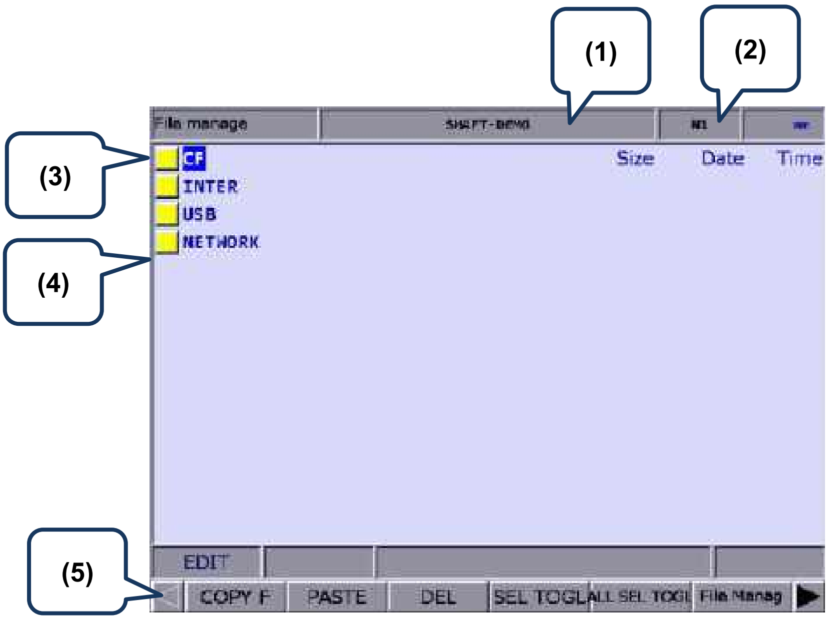
1st layer: CF (CF card), INTER (internal memory), USB (USB disk), and NETWORK

2nd layer: folders and G-code files

3rd layer: G-code files

Different system modes have their own dedicated functions. For example, you can use the function of break line search in AUTO mode or you can enter and execute a program in MDI mode.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) means the function keys of F1 - F6.



(1) Current program name

(2) Currently executed program line

(3) Current function group screen

(4) Disk options

(5) Current system mode

Set the system to EDIT mode and press **PRG** on machine operation panel A to display the PRG screen. In the File manage screen, move the cursor, press **ENTER** to enter the second or third layer, and then select a G-code file.

After selecting the G-code file, press **ENTER** to open the file and enter the edit screen. Press ⬆ and ⬇ (scroll the screen up or down by 1 line), and **PAGE UP** and **PAGE DN** (scroll the screen up or down by 20 lines) to display the file content.

Note: the suggested specifications for the USB disk is as follows.

USB disk specification	
Disk format	FAT32
Disk capacity	As required

7.1 Ethernet setting

You can connect the NC system to the PC with Ethernet to enable remote communication. Use the CNCNetwork software to manage the online files of multiple NC controllers with one PC, enabling data sharing and file management with the PC, and transmission-along-with-machining (DNC).

Set the communication protocol between the NC system and PC by referring to Section 12.7.1 before using the network function. The following gives simple instructions.

Set the protocol of the NC system by going to **PAR** > **ETH.**.

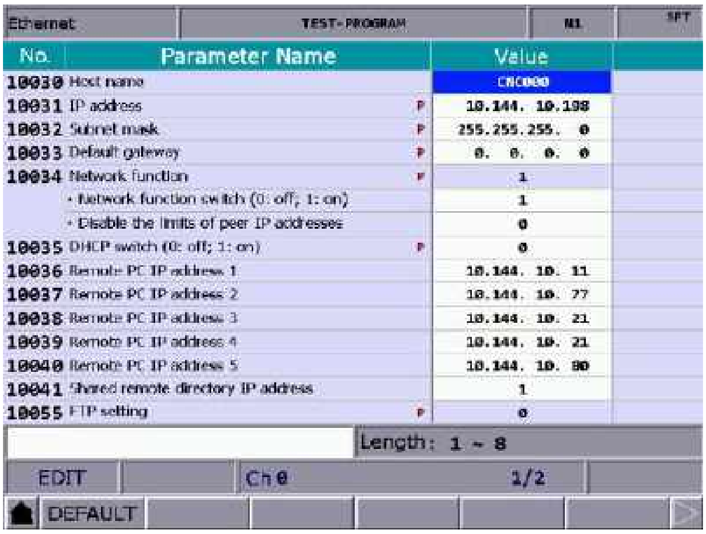


Figure 7.1.1

Network setting parameter		
Parameter No.	Parameter name	Setting range or format
10030	Host name	Character length: 1 - 8 Actual setting: 1 - 8 characters
10031	IP address	Character length: ××× · ××× · ××× · ××× Actual setting: 192 · 168 · 0 · 2
10032	Subnet mask	Character length: ××× · ××× · ××× · ××× Actual setting: 255 · 255 · 255 · 0
10033	Default gateway	Character length: ××× · ××× · ××× · ××× Actual setting: 0 · 0 · 0 · 0
10034	Network function	Character length: 0 - 1 Actual setting: 1
10035	DHCP switch	Character length: 0 - 1 Actual setting: 0
10036	Remote PC IP address 1	Character length: ××× · ××× · ××× · ××× Actual setting: 192 · 168 · 0 · 1
10037	Remote PC IP address 2	Character length: ××× · ××× · ××× · ××× Actual setting: 0 · 0 · 0 · 0
10038	Remote PC IP address 3	Character length: ××× · ××× · ××× · ××× Actual setting: 0 · 0 · 0 · 0
10039	Remote PC IP address 4	Character length: ××× · ××× · ××× · ××× Actual setting: 0 · 0 · 0 · 0

Network setting parameter		
Parameter No.	Parameter name	Setting range or format
10040	Remote PC IP address 5	Character length: ××× · ××× · ××× · ××× Actual setting: 0 · 0 · 0 · 0
10041	Shared remote directory IP address	Character length: 0 - 5 Actual setting: 0
10055	FTP setting	
	FTP function switch	0: off; 1: on
	FTP anonymous user	0: off; 1: on Users without an account can connect to the CNC FTP.
	Set as main file after loaded	0: off; 1: on
10057	FTP username	Character length: 1 - 32. The first character must be an English letter in lower case.
10058	FTP password	Character length: 1 - 8

Set the protocol of the PC by setting Internet Protocol (TCP/IP) Properties of the PC operating system (as shown in Figure 7.1.2) or going to **CNCNetwork** > **Options**.

Network settings on PC:

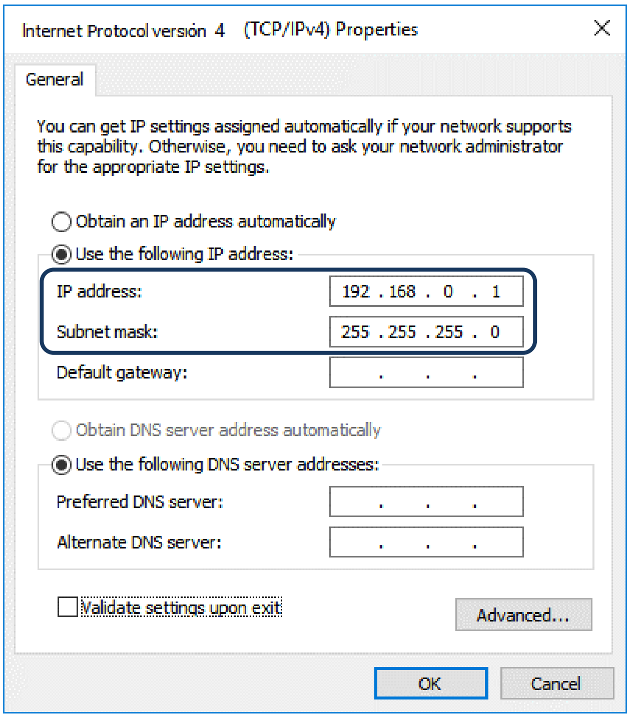


Figure 7.1.2

Steps:

(1) Select the radio button for **Use the following IP address** and enter the following in sequence:

IP address: **192 . 168 . 0 . 1**

Subnet mask: **255 . 255 . 255 . 0**

(2) Click **OK** to finish the settings.

Network settings on CNCNetwork:

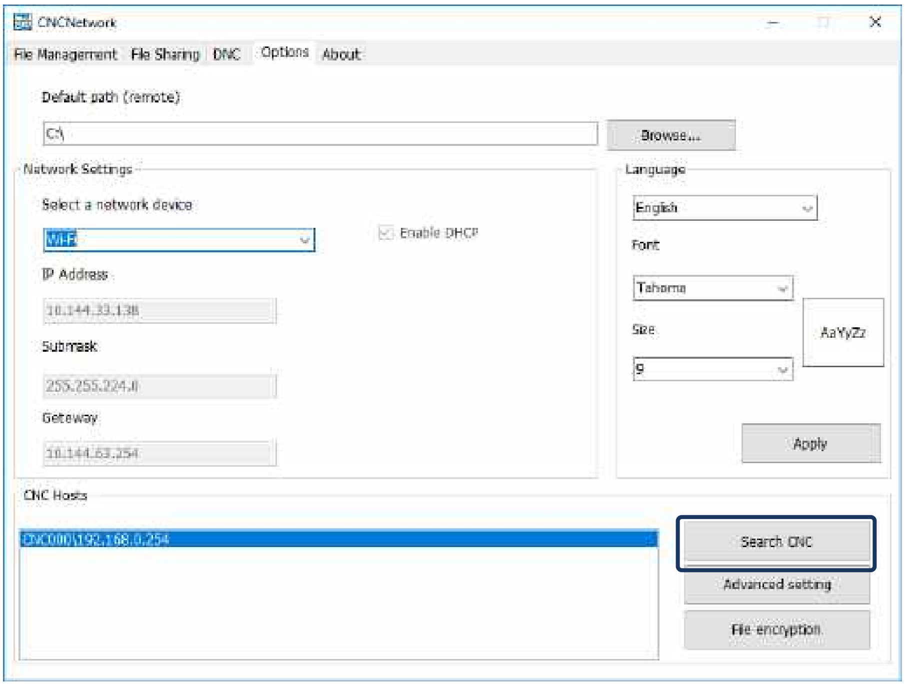


Figure 7.1.3

Steps:

(1) Execute CNCNetwork software and go to the **Options** screen.

(2) Click **Search CNC** to connect to the CNC according to the setting in Figure 7.1.3.

DNC operation:

Execute CNCNetwork, open the file to be shared in the **File Sharing** screen, and then you can execute the G-code file while it is being processed (DNC operation) using Ethernet. No additional disk space is required to store the file as only the path of the shared files is recorded. The connection steps are as follows.

(1) Use Ethernet communication to set the Internet connection between PC and NC.

(2) Execute CNCNetwork.

(3) Click the **DNC** tab and select the host (NC controller) to connect to.

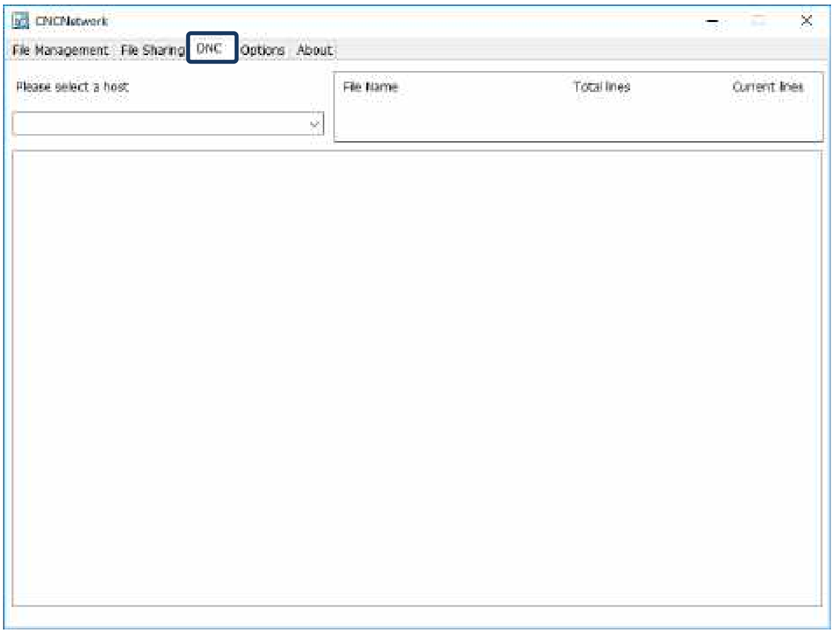


Figure 7.1.4

(4) After the host is connected, click the **File Sharing** tab and set the file to be shared.

(5) Set the NC system to EDIT mode and go to **File manage** > **NETWORK**.

Figure 7.1.5

(6) The shared file(s) is displayed in the NETWORK folder.

(7) Set the NC system to AUTO mode, press **CYCLE START**, and the system executes the G-code file by DNC operation. The execution method is the same as that for general files.

(8) During DNC operation, file information is displayed in the **DNC** screen of CNCNetwork. The information includes the name of the connected host, name of the file undergoing DNC operation, total number of lines, the line number being executed, and file content (the content is scrolled down along with the execution progress, as shown in Figure 7.1.6).

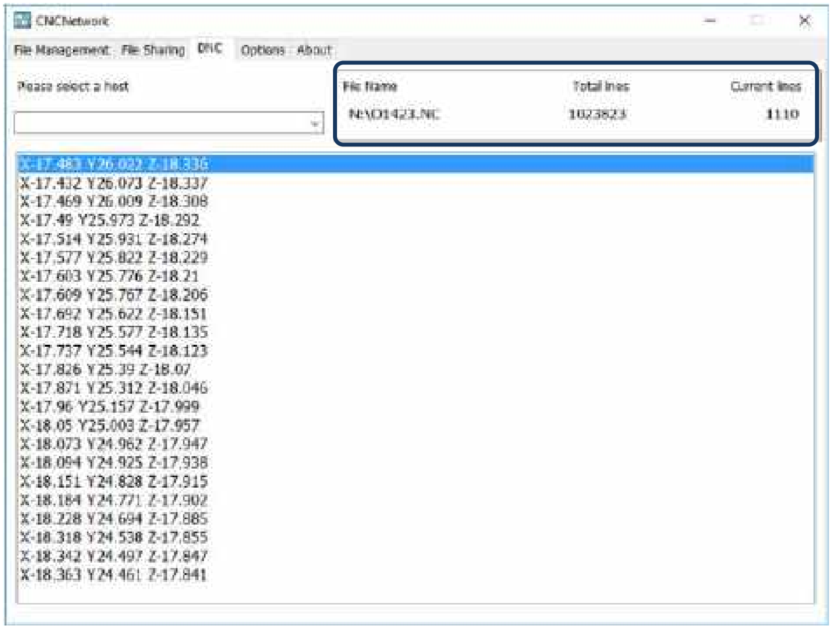


Figure 7.1.6

7.2 Create a new file (NEW F)

In EDIT mode, you can use this function to create a new G-code file on the controller. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) In the File manage screen, move the cursor to the folder of the disk where the file is to be created (for example, the 2nd or 3rd layer of CF or USB directory).

(4) Press ▶ to display the function bar on the next page.

(5) Press **NEW F** and a dialog box appears for you to enter the file name.

(6) Enter alphanumeric characters (no symbols) in the dialog box, press **ENTER**, and a new file is created.

Filename format requirements	
Format of machining file name (G-code)	No restrictions on the format of main file names (no duplicate file names under the same directory)
	O + 0001 to 8999 (for calling subprograms)
Format of macro file name (O macro)	O + 9000 to 9999
Notes in file name	Suffix '-' and alphanumeric characters in sequence to the file name
Valid file extension	.NC .ANC .CNC .PIM .TAP .PTP .UOO .DEMO
Format of M macro file name	M + 10000 to 29999
Format of G macro file name	G + 30000 to 49999
Maximum number of characters in the file name	31
Storage location	2nd or 3rd layer of File manage
Invalid symbols in file name	* / \	< > ? " :

Note:

1. No duplicate file names are allowed under the same directory. For example, O0001 and O1 are regarded as the same.
2. The File manage screen only displays general machining files. Macro files can be displayed by setting the parameter Pr.50 Macro file display.
3. Multiple dots can be used in the file name of a G-code file whereas the last one should come with a valid file extension, such as "1.1.1.1.**NC**".

7.3 Copy files (COPY F)

You can use this function to batch copy all the existing files in the disk drives of the system.

The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) In the File manage screen, move the cursor to the folder of the disk where the files are to be copied (for example, the 2nd or 3rd layer of CF or USB directory).

(4) Move the cursor to the file to be copied.

(5) Press **COPY F** and then **PASTE**, so the copy action is complete.

7.4 Paste files (PASTE)

As described in Section 7.3, you should use the paste function together with the copy function to complete file copying. The paste function is also a function of File manage in PRG group, so you can refer to Steps (1) and (2) in Section 7.3.

(1) Move the cursor to the disk, directory, or folder where the file is to be pasted.

(2) Enter the folder, press **PASTE**, and a dialog box appears for you to enter a new file name or use the original one. Press **ENTER** to complete the actions of file copying and pasting.

Note:

1. The specification of file naming for this function is the same as that of the file creation function. That is, duplicate file names are not allowed.
2. If you do not execute **COPY F** before using the **PASTE** function, an error dialog box appears to remind you to copy a file first, and thus the current pasting action failed.
3. To copy the files from the USB disk to the CF card, you can follow the same operation steps.

7.5 Delete files and directories (DEL)

You can use this function to delete the G-code files and directories in the second layer of File manage.

The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) In the File Manage screen, move the cursor and press **ENTER** to enter the second or third layer of the disk.

(4) Move the cursor to the directory or file to be deleted.

(5) Press **DEL** and a dialog box appears for you to confirm the execution. Enter “Y” and press **ENTER** to delete.

Note: the file or directory cannot be recovered once being deleted.

7

7.6 Select / cancel selection of multiple files & select / cancel selection of all files (SEL TOGL / CANCEL & ALL SEL TOGL / CANCEL)

In addition to the functions of copying and deleting a single file, you can use SEL TOGL / CANCEL or ALL SET TOGL / CANCEL to select multiple files or cancel the selection of multiple files, and then use the copy, paste, or delete function.

The operation steps for copying and pasting multiple files are as follows.

(1) Set the system to EDIT mode.

(2) Press PRG to switch to the PRG screen.

(3) Enter the directory where you desire to select the files.

(4) In the File Manage screen, move the cursor to the location of the file(s) to be selected. To select multiple files, repeat the action of selecting a file and pressing **SEL TOGL** (as shown in Figure 7.6.1). To cancel the selection, press **CANCEL**. To select all files, press **ALL SEL TOGL**. To cancel the selection of all files, press **CANCEL**.

Figure 7.6.1

(5) After selecting the files, press **COPY F**.

(6) Go to another directory and press **PASTE** to paste the selected files, as shown in Figure 7.6.2.

Figure 7.6.2

The operation steps for deleting multiple files are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Enter the directory where you desire to select the files.

(4) In the File manage screen, move the cursor to the location of the file(s) to be selected.
To select multiple files, repeat the action of selecting a file and pressing **SEL TOGL**.
To cancel the selection, press **CANCEL**. To select all files, press **ALL SEL TOGL**.
To cancel the selection of all files, press **CANCEL**.

(5) After selecting the files, press **DEL,** and a dialog box appears for you to confirm the execution (as shown in Figure 7.6.3). Enter “Y” and press **ENTER** to delete.

Figure 7.6.3

Note:

1. After copying multiple files, you should paste them to another directory. If you paste the files in the same directory, a dialog box appears to remind you to select another directory, and the current paste action is invalid.
2. When the pasted file names and the existing file names are duplicated, a dialog box appears for you to decide whether to overwrite the existing files. Enter “Y” to replace the existing files with the new ones; enter “N” or press **EXIT** to keep the existing files.

7.7 Rename files (RENAME)

You can use this function to rename the created files. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) In the File manage screen, move the cursor to the folder of the disk where the file is located (for example, the 2nd or 3rd layer of CF or USB directory).

(4) Press ▶ to display the function bar on the next page.

(5) Move the cursor to the file to be renamed, press **RENAME**, and a dialog box appears for you to enter the new file name.

(6) Enter a name that is not identical to the names of the files in the directory, and press **ENTER** to complete renaming the file.

Note:

1. You can create G-code files only in the 2nd and 3rd layers of File manage.
2. The filename format requirement is the same for both file renaming and file creation. If you enter a name that is already used for another file in the directory when renaming, an error dialog box appears, and the renaming action is invalid.

7.8 Create directories (FOLDER)

This function is for creating a directory to store G-code files in the 2nd layer of File manage. This function is available only in the 2nd layer of File manage. Accordingly, the 2nd layer of File manage can contain both directories and G-code files. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Press ▶ to display the function bar on the next page.

(4) In the 2nd layer of File manage, press **FOLDER**, and a dialog box appears for you to enter the directory name.

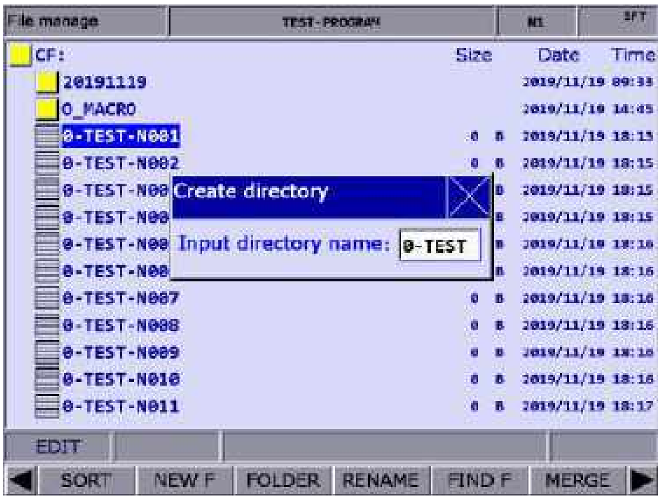


Figure 7.8.1

(5) After entering the directory name, press **ENTER** to complete creating the directory.

By following the preceding steps, you can create a new directory in the 2nd layer of File manage, and you can also create and edit G-code files in this directory (the 3rd layer).

Directory format requirements	
Format of directory name	Alphanumeric characters
Maximum number of characters for directory name	31
Storage location	2nd layer of File manage

7

7.9 Search for files (FIND F)

When there are a number of G-code files in the directory, if the file name is known, you can use this function to quickly search for and open the target file. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press PRG to switch to the PRG screen.

(3) In the File manage screen, move the cursor and press ENTER to enter the 2nd or 3rd layer of the disk.

(4) Press ▶ to display the function bar on the next page.

(5) Press **FIND F** and a dialog box appears for you to enter the name of the file to be searched. After entering the file name, press ENTER to search for and open the file.

Note:

1. You can only search for files in the same directory with this function.
2. Enter the complete file name to accurately search for and open the file.

7.10 File merging (MERGE)

You can use this function together with the file copying function to merge the program content of two different G-code files. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press PRG to switch to the PRG screen.

(3) In the File manage screen, move the cursor and press ENTER to enter the 2nd or 3rd layer of the disk.

(4) Select the G-code file to be copied.

(5) Press **COPY F** and the content is saved to the system's clipboard.

(6) Move the cursor to the directory which contains the file to be merged.

(7) Press ▶ to display the function bar on the next page.

(8) Press **MERGE** and a dialog box appears for you to enter the name of the merged file. After entering the name, press ENTER to open the file.

(9) Move the cursor to the line where you desire to paste the copied program content, and press **PASTE**.

(10) To save the merged file, switch to different system modes, open another file, or press RESET.

7.11 Sorting (SORT)

This function is for sorting the directories or files in a directory by a specified order, facilitating the operation of file search or management.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) In the File manage screen, move the cursor and press **ENTER** to enter the 2nd or 3rd layer of the disk.

(4) Press ▶ to display the function bar on the next page.

(5) Press **SORT** to display the function bar in the 2nd layer.

(6) When you press **NAME**, the directories and files are sorted in the order of numbers > English letters from top to bottom. When you press **NAME** again, they are sorted in the order of English letters > numbers from top to bottom.

(7) When you press **SIZE**, the directories and files are sorted by the file size from small to large from top to bottom. When you press **SIZE** again, they are sorted by the file size from large to small from top to bottom.

(8) When you press **DATE**, the directories and files are sorted by the date from most recent to earlier from top to bottom. When you press **DATE** again, they are sorted by the date from earlier to most recent from top to bottom.

7.12 Convert DXF files (DXF)

In the DXF file manage screen, you can select the DXF file, enter relevant parameter settings, and convert the DXF file into an executable G-code file.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Press ▶ twice to display the function bar on the third page.

(4) Press **DXF** to display the DXF file manage screen.

(5) In the DXF file manage screen, move the cursor and press **ENTER** to select the DXF file to be converted.

(6) After selecting the DXF file, you are redirected to the screen for setting the relevant parameters, as shown in the following figure.

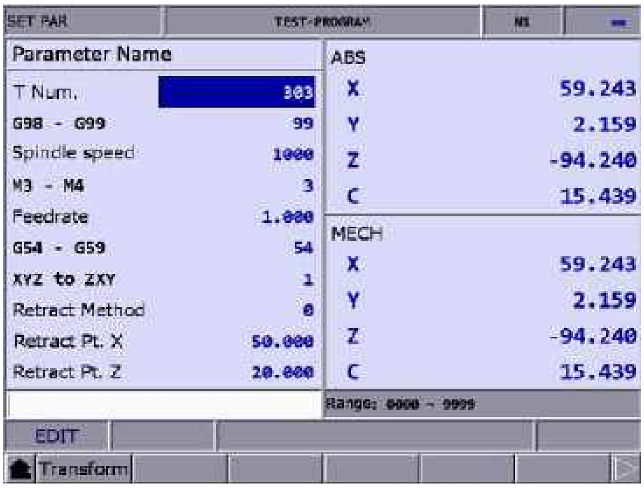


Figure 7.12.1

(7) After finishing setting the parameters, press **Transform**, and a dialog box appears for you to enter the new file name.

(8) After entering the file name, press **ENTER** to convert the DXF file into a G-code file, and the G-code file is stored under the CF directory.

(9) Then, you can execute the G-code file in AUTO mode.

7.13 Macro files (FILE / MACRO)

In response to the application requirements, this function is for managing the equipment-specific macro files. Upon accessing the security authorization, you can use all the editing functions described in Section 7.14. Otherwise, you can only browse the existing macro files rather than open and edit them. Contact the local distributor for authorization settings.

Note: this is a dual-function key. When you press **MACRO**, the system screen switches to the Macro file screen, and the key is displayed as FILE. When you press **FILE**, the system switches back to the File Manage screen, and the key is displayed as MACRO.

7.14 File editing (File edit)

With the file edit functions, you can modify or delete the content of the G-code files. When you open the file in the File manage screen, the system switches to the File edit screen. Move the cursor to any position in the program and use the alphabetic, numeric, and editing keys on machine operation panel A to edit the program. To save the file after editing the program, switch to different system modes, press **RESET**, or open another file. The operation steps for entering the File edit screen are as follows.

(1) Set the system to EDIT mode.
(2) Press **PRG** to switch to the PRG screen.
(3) Move the cursor and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(4) Select the G-code file to be edited and press **ENTER** to open the file and enter the edit screen.
(5) Move the cursor to any position in the program.
(6) Edit the content by pressing the alphabetic, numeric, and editing keys on machine operation panel A.
(7) To save the file after editing the program, switch to different system modes, press **RESET**, or open another file.

Requirements for editing	
Maximum number of characters in a single line	255
Supported system mode	EDIT mode
Allowable file size	Below 3 MB

Note:

1. When using the File manage or File edit function, you have to set the system to EDIT mode to display the corresponding function bar. Otherwise, the PRG screen is only for viewing the currently opened program file and displays the coordinate information.
2. You can insert “( )” (parentheses) at the end of each program block in the G-code file for adding notes. Do not insert parentheses in the beginning of the program block, or the block may be regarded as a note and be skipped.

7.14.1 Line search (LABEL)

This function is to search for the specific line of program in the G-code file. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Move the cursor and press **ENTER** to enter the 2nd or 3rd layer of the disk.

(4) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

(5) Press ▶ to display the function bar on the next page.

(6) Press **LABEL** and a dialog box appears for you to enter the line number (by pressing the numeric keys 0 - 9).

(7) Enter the line number and press **ENTER**. Then, the cursor jumps to the specified line, and the search action is complete.

Requirements for line search	
Maximum number of input digits	62
Search format	The specific line number

7.14.2 String search (STRING)

The line search function is only used to search for a specific line while you can use this string search function to search for a specific string. The accuracy of the searching result depends on how precise the input string is. The string search function includes the function of string replacement. You can determine whether to replace a string when searching for a string, which enables you to directly replace the string on the panel screen. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Move the cursor and press **ENTER** to enter the 2nd or 3rd layer of the disk.

(4) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

(5) Press ▶ to display the function bar on the next page.

(6) Press **STRING** and a dialog box appears for you to enter the string to be searched, as shown in the following figure.

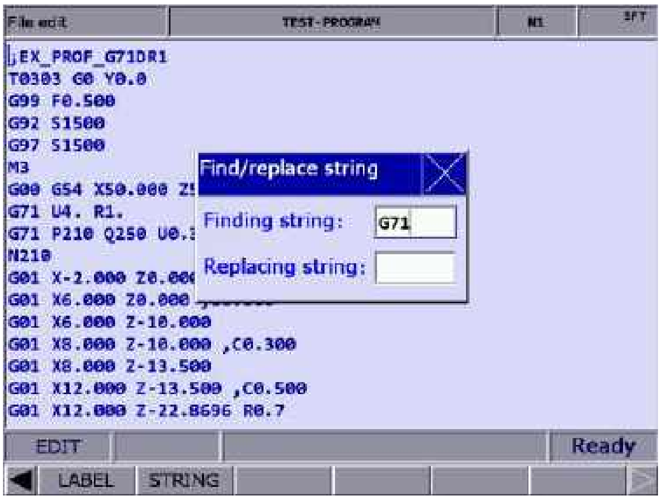


Figure 7.14.2.1

(7) After entering the string to be searched and the string to be replaced, press **ENTER** to search the string.

(8) When the search is complete, the searched string becomes highlighted. At the same time, the function bar displays the functions of NEXT, PREV, REPLACE, and Replace all.

(9) Press **NEXT** to search the next match or press **PREV** to search the previous match.

(10) Press **REPLACE** when you desire to replace one single string. You can also press **Replace all** to batch replace the matches with the new string.

(11) Press ◄ to exit the string search function and go back to the function bar of File edit.

(12) After replacing the string, ensure to save the results (by switching to different system modes, opening another file, or pressing **RESET**).

Requirements for string replacement	
Supported system mode	EDIT mode
Allowable file size for editing and replacement	Below 3 MB

7

7.14.3 Specify the start and end of highlighted area (B START / B END)

To edit a section of a program, you can use cursor and press **B START** and **B END** to specify the start and end of the content to be edited. Then, you can delete, copy, and paste the selected program content as required, which simplifies the editing process. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Move the cursor and press **ENTER** to enter the 2nd or 3rd layer of the disk.

(4) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

(5) Move the cursor to the start of the section to be edited and press **B START**.

(6) Move the cursor to the end of the section to be edited and press **B END**. See the following figure for the selected section.

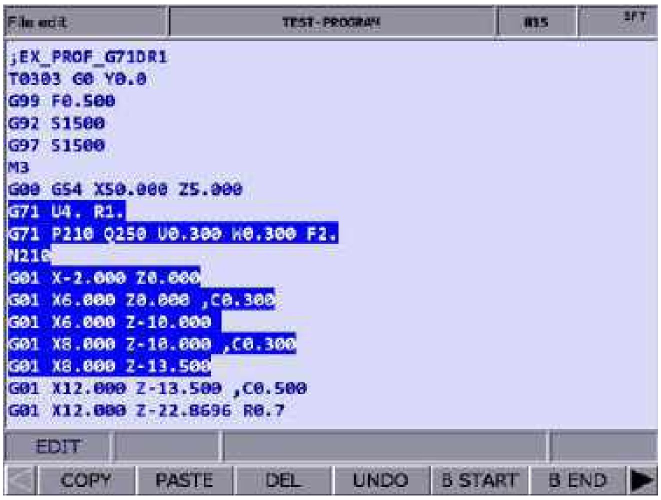


Figure 7.14.3.1

(7) By following Steps (5) - (6) and then pressing **DEL**, you can delete the selected content.

(8) By following Steps (5) - (6) and then pressing **COPY**, you can copy the selected content. Then, move the cursor to where you desire to paste the copied content and press **PASTE** to insert the content.

7.14.4 Delete lines / sections (DEL)

You can use this function to delete a single line of program where the cursor is located. Besides, you can use this function with B START and B END to delete a whole section of the program. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Move the cursor and press **ENTER** to enter the 2^{nd} or 3^{rd} layer of the disk.

(4) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

(5) Move the cursor to the line to be deleted and press **DEL** to delete the line of program.

(6) To delete a whole section of a program, refer to Step (8) in Section 7.14.3 for operation.

7.14.5 Copy and paste lines / sections (COPY & PASTE)

You can move the cursor to a specific line and press **COPY** to copy the line of the program, but this action only takes effect when it is used with the PASTE function. When using the COPY function with B START and B END, you can copy a section of the program content. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Press **PRG** to switch to the PRG screen.

(3) Move the cursor and press **ENTER** to enter the 2^{nd} or 3^{rd} layer of the disk.

(4) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

(5) Move the cursor to the line of program to be copied and press **COPY**.

(6) Move the cursor to the position to paste the copied content, and press **PASTE** to paste the line of program to that position.

(7) To copy a whole section of a program, refer to Step (8) in Section 7.14.3 for operation.

7.14.6 Undo the action (UNDO)

During program editing, use this function to undo the previous edit. You can repeatedly use this function for undoing up to 7 previous steps. The operation steps are as follows.

(1) Set the system to EDIT mode.

(2) Move the cursor and press **ENTER** to enter the 2^{nd} or 3^{rd} layer of the disk.

(3) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.

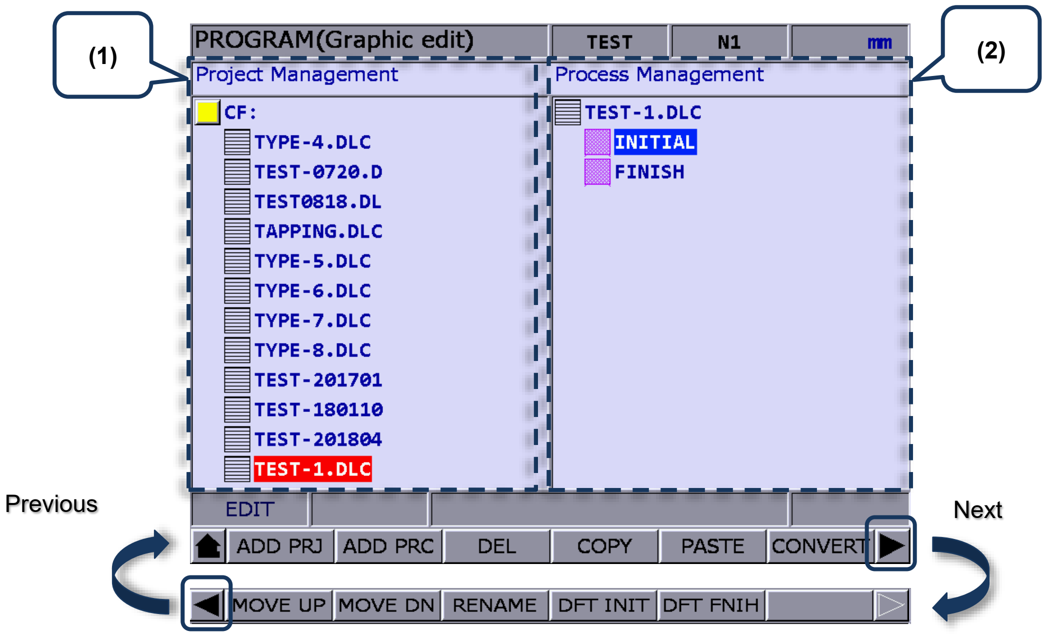
(4) After editing the program, press **UNDO** to undo the previous edit.

7.15 Graphic edit (lathe system)

7.15.1 Objective

The Graphic edit function of the lathe system provides a graphical user interface for you to select the machining procedure and enter relevant machining parameters to generate a tool path program, which replaces manual programming and calculation as well as machining path planning with CAM.

7.15.2 Project management



(1) Project Management screen; (2) Process Management screen

- **ADD PRJ (Add a new project)**

Enter the Graphic edit screen, press **ADD PRJ**, and a dialog box appears for you to enter the file name. Press **ENTER**, and a new project file is added with the file extension as **.DLC**. You can repeatedly use the project file. Simply open the **.DLC** project file in the Project Management screen, and you can get all the previously set procedures, or you can modify and generate the machining program.

If you press **ADD PRJ** in the Process Management screen, a dialog box appears to remind you to return to the Project Management screen. Press to return to the Project Management screen for operation.

■ **ADD PRC (Add a new procedure)**

Open a project file before you add a new procedure. If no project file is selected, a dialog box displaying "Please open a file!" appears when you press **ADD PRC**.

Select a project file and press **ENTER** to enter its corresponding Process Management screen. The system automatically generates two default machining procedures for each created project file, **INITIAL** and **FINISH**, which start and end the program respectively. You can add or modify procedures between the two default procedures.

To select another project file, press to exit the Process Management screen.

■ **DEL (Delete a file or procedure)**

Press this key to delete the selected project file or procedure, except **INITIAL** and **FINISH**. Move the cursor to the project file or procedure to be deleted, press **DEL**, and a dialog box appears. Enter "Y" to confirm the deletion.

■ **COPY & PASTE (Copy and paste a file or procedure)**

These two functions are for copying and pasting the project file or procedure. Move the cursor to the file to be copied, press **COPY** and then **PASTE**, and a dialog box appears. Enter the new file name and press **ENTER** to complete the action.

■ **CONVERT (Convert a file)**

Press this key to convert the selected .DLC project file into an .NC file. After the conversion, the system automatically switches to the corresponding Program Management screen of the converted file.

Important:

(1) If you press **CONVERT** without selecting the disk in the File manage screen, a dialog box appears to remind you to return to the File manage screen. In this case, you need to press to return to the File manage screen to select the disk to store the file. Then, you can start the conversion.

(2) Select a .DLC file and press **ENTER** to open that file. If no project file is selected, a dialog box displaying "Please open one DLC file!" appears on the screen.

■ **MOVE UP & MOVE DN (Change the sequence of procedures)**

The two functions are only available in the Process Management screen. To change the sequence of a specific procedure, you need to select a project file, enter its corresponding Process Management screen, and move the cursor to the procedure. Then, press **MOVE UP** or **MOVE DN** to change its sequence. Note that the MOVE UP and MOVE DN functions cannot change the sequence of **INITIAL** and **FINISH**.

- **RENAME (Rename a file or procedure)**

Press this key to rename the selected project file or procedure, except **INITIAL** and **FINISH**. Move the cursor to the project file or procedure to be renamed, press **RENAME**, and a dialog box appears. Enter a new file name and press **ENTER** to rename the file.

- **DFT INIT & DFT FNIH (Edit the content of default procedures)**

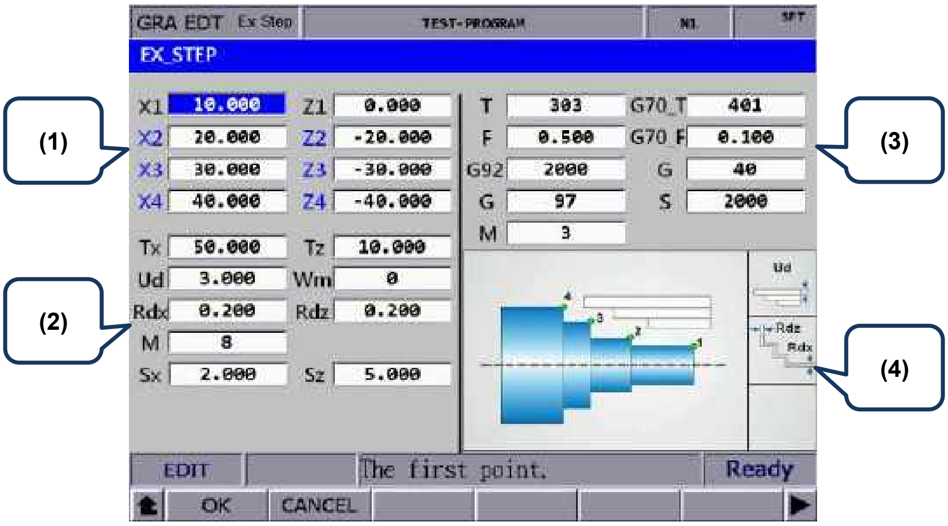
Press **DFT INIT** to edit the default content of **INITIAL** and press **DFT FNIH** to edit the default content of **FINISH**. The changed content of **INITIAL** and **FINISH** will be displayed in the project that is added next time. The content in the existing projects remains unchanged.

7.15.3 Description of graphic edit procedures for lathe system

Categorization of currently available procedures

- Graphic edit for lathe
  - Step turning
    - 1. External step turning [EX_STEP]
    - 2. Internal step turning [IN_STEP]
    - 3. Face step turning [FC_STEP]
  - Taper turning
    - 1. External taper turning [EX_TAPER]
    - 2. Internal taper turning [IN_TAPER]
  - Threading
    - 1. External threading [EX_THRD]
    - 2. Internal threading [IN_THRD]
  - Grooving
    - 1. External grooving [EX_GRV]
    - 2. Internal grooving [IN_GRV]
    - 3. Face grooving [FC_GRV]
  - Arc turning
    - 1. Outer convex turning [EX_ROUT]
    - 2. Inner convex turning [IN_ROUT]
    - 3. Outer concave turning [EX_RIN]
    - 4. Inner concave turning [IN_RIN]
  - Profile turning
    - 1. External profile turning [EX_PROF]
    - 2. Internal profile turning [IN_PROF]

■ External step turning [EX_STEP]



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	4th point	X4_, Z4_

These 8 input fields are for setting the three-step contour machining. If the application requires less than three steps, you can leave the fields of items in blue blank. To delete the values in the input fields, press **BACK SPACE** or **DEL** and then press **ENTER** to confirm the action. Refer to section (4) in the preceding figure for the position of each point.

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (absolute coordinate of X axis)	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rdx_	Allowance of finish turning (absolute coordinate of X axis)	Rdz_	Allowance of finish turning (absolute coordinate of Z axis)
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

- The input values for Ud, Rdx, and Rdz must be greater than 0.
- Wm is for setting the cutting mode. Set Wm to 0 to perform a complete turning process including rough and finish turning. Set Wm to 1 to perform rough turning and reserve the allowance of finish turning. Set Wm to 2 to perform finish turning once according to the given path.
- Tx and Tz are for setting the tool change position. After completing a machining procedure, the system moves the tool to the position specified by Tx and Tz to perform tool change for the next machining procedure.

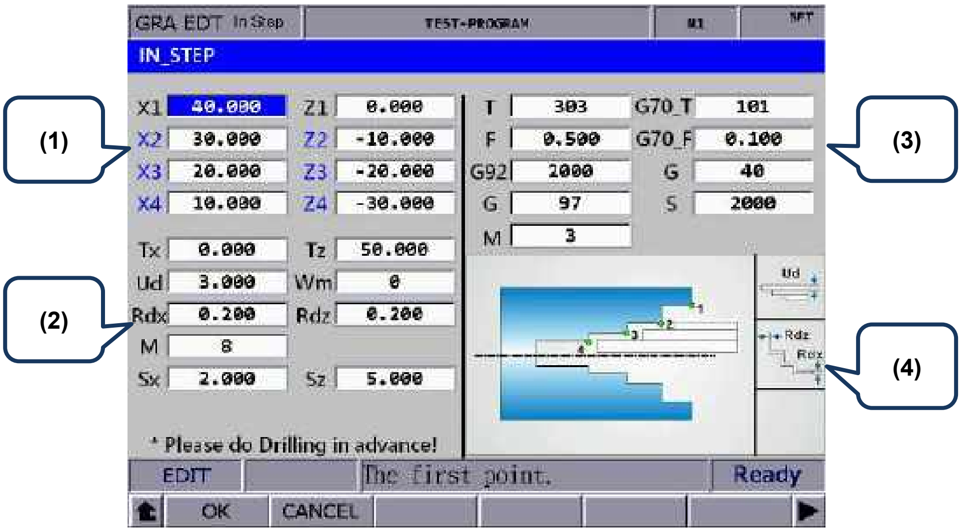
(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Item	Description	Item	Description
T_	Tool number + tool compensation number Format: TXXXX	G70_T	Tool for executing G70 Finish turning cycle
F_	Axis feed rate Unit: mm/min or mm/rev	G70_F	Feed rate for executing G70 Finish turning cycle
G92_	Maximum spindle speed	G_	Tool nose radius compensation (40 = disabled; 41 = left; 42 = right)
G_	Spindle speed control mode (G96 = constant; G97 = fixed)	S_	Spindle speed
M_	Spindle control (3 = forward; 4 = reverse; 5 = stop)	-	-

- T is for selecting the machining tool. Enter numbers in this field with the first two (or the first one if the number is a one-digit number) as the tool number and the last two as the compensation number. As shown in the preceding figure, 303 means tool No.3 is used and tool compensation No.3 is enabled.
- G70_T is for specifying the tool number for executing G70 Finish turning cycle. The format is the same as that for item T.
- G70_F is for specifying the tool feed rate for executing G70 Finish turning cycle.
- Tool nose compensation (G_): G40 / G41 / G42
  G40 means the function is disabled, G41 is tool nose radius left compensation, and G42 is tool nose radius right compensation. You have to fill the correct tool nose type and tool radius value in the tool compensation table before using this function.
- Spindle speed control mode (G_): G96 / G97
  Set this field to G96 to enable constant surface speed control and the S field is for setting the cutting speed in units of m/min or feed/min.
  Set this field to G97 to enable fixed spindle speed control and the S field is for setting the speed per minute in units of rpm.
- G92 is for setting the maximum spindle speed. If the command speed exceeds this setting, the spindle runs with this setting.

(4) Illustration

■ Internal step turning [IN_STEP]



(1) Input fields for coordinates of each step point (You can leave the fields of items in blue blank, which means the points do not exist.)

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	4th point	X4_, Z4_

Refer to section (4) in the preceding figure for the position of each point.

(2) Parameter settings for contour machining

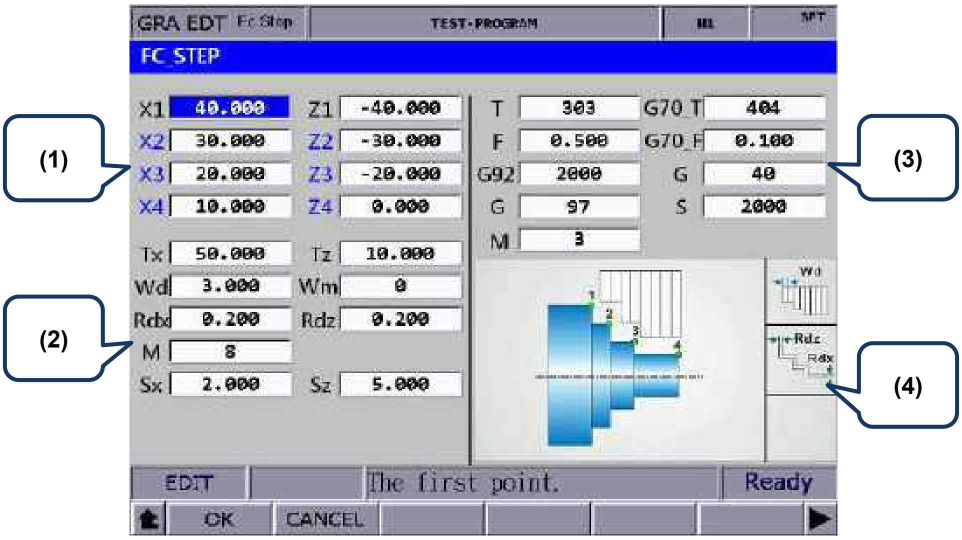
Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (absolute coordinate of X axis)	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rdx_	Allowance of finish turning (absolute coordinate of X axis)	Rdz_	Allowance of finish turning (absolute coordinate of Z axis)
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Item	Description	Item	Description
T_	Tool number + tool compensation number Format: TXXXX	G70_T	Tool for executing G70 Finish turning cycle
F_	Axis feed rate Unit: mm/min or mm/rev	G70_F	Feed rate for executing G70 Finish turning cycle
G92_	Maximum spindle speed	G_	Tool nose radius compensation (40 = disabled; 41 = left; 42 = right)
G_	Spindle speed control mode (G96 = constant; G97 = fixed)	S_	Spindle speed
M_	Spindle control (3 = forward; 4 = reverse; 5 = stop)	-	-

(4) Illustration

■ Face step turning [FC_STEP]



(1) Input fields for coordinates of each step point (You can leave the fields of items in blue blank, which means the points do not exist.)

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	4th point	X4_, Z4_

Refer to section (4) in the preceding figure for the position of each point.

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (absolute coordinate of X axis)	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rdx_	Allowance of finish turning (absolute coordinate of X axis)	Rdz_	Allowance of finish turning (absolute coordinate of Z axis)
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

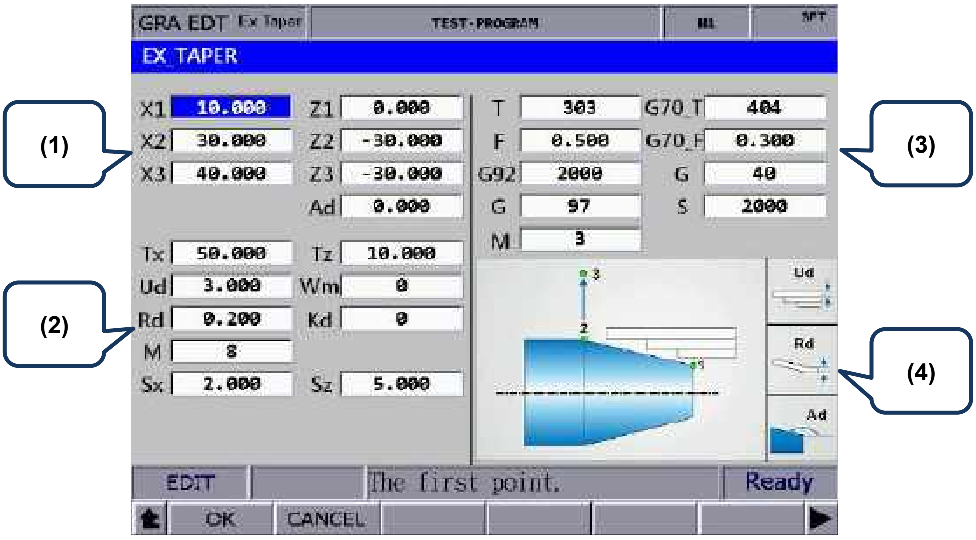
(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Item	Description	Item	Description
T_	Tool number + tool compensation number Format: TXXXX	G70_T	Tool for executing G70 Finish turning cycle
F_	Axis feed rate Unit: mm/min or mm/rev	G70_F	Feed rate for executing G70 Finish turning cycle
G92_	Maximum spindle speed	G_	Tool nose radius compensation (40 = disabled; 41 = left; 42 = right)
G_	Spindle speed control mode (G96 = constant; G97 = fixed)	S_	Spindle speed
M_	Spindle control (3 = forward; 4 = reverse; 5 = stop)	-	-

(4) Illustration

7

■ External taper turning [EX_TAPER]



(1) Input fields for coordinates of each step point (You can leave the fields of items in blue blank, which means the points do not exist.)

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	Ad	Taper angle

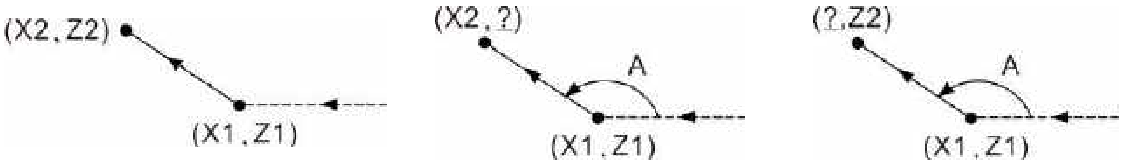
Refer to section (4) in the preceding figure for the position of each point.

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (absolute coordinate of X axis)	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	Kd_	Taper type (0 = XZ; 1 = XA; 2 = ZA)
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

Kd: taper type

0: XZ type 1: XA type 2: ZA type

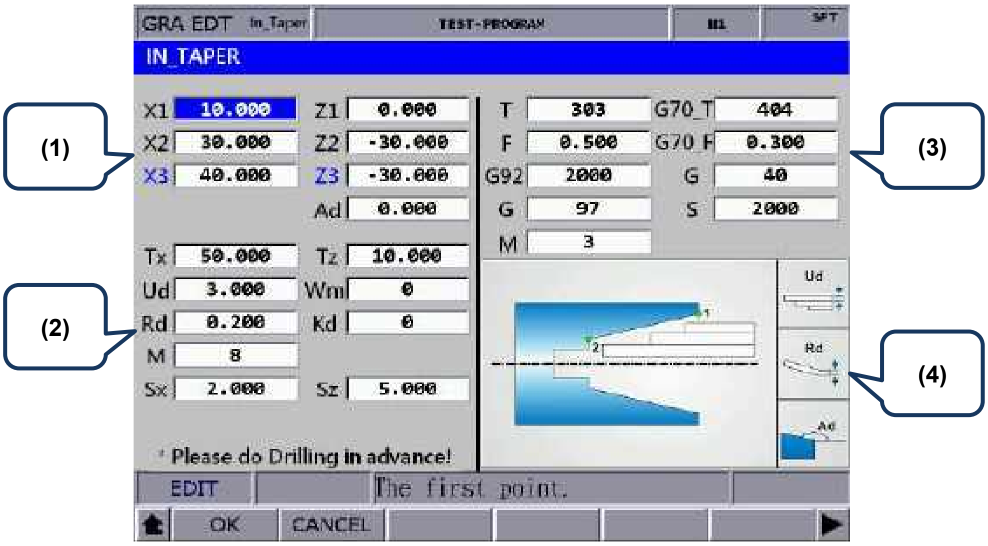


(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Internal taper turning [IN_TAPER]**



(1) Input fields for coordinates of each step point (You can leave the fields of items in blue blank, which means the points do not exist.)

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	Ad	Taper angle

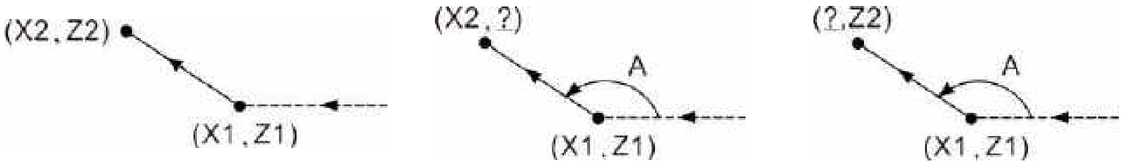
Refer to section (4) in the preceding figure for the position of each point.

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (absolute coordinate of X axis)	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	Kd_	Taper type (0 = XZ; 1 = XA; 2 = ZA)
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

Kd: taper type

0: XZ type 1: XA type 2: ZA type

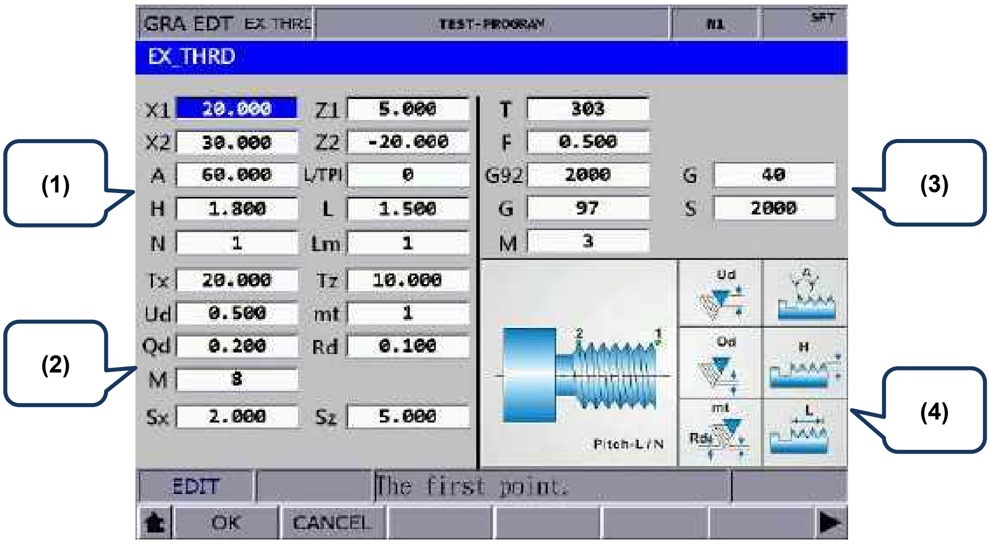


(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ External threading [EX_THRD]



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
A	Thread angle	L/TPI	0 = thread lead 1 = number of threads per inch
H	Total thread cutting depth	L	Unit for L/TPI L = thread lead in units of mm/pitch TPI = number of threads per inch
N	Number of threads	Lm	Threading infeed (0: right; 1: middle; 2: left; 3: right-left shift)

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Depth of the first cut	mt	Number of finish turning
Qd_	Minimum cutting depth	Rd_	Allowance of finish turning
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

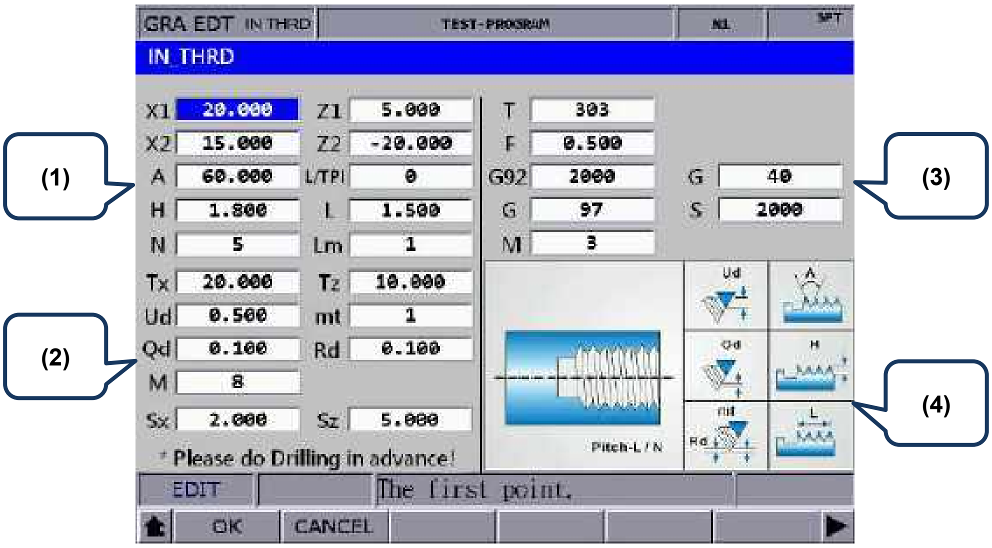
- ■ Ud is for specifying the depth of the first cut. Depth of the n cut (n >= 2) is automatically calculated by the system with the formula $\mathrm{Ud}\left[\sqrt{n}-\sqrt{(n-1)}\right]$.
- ■ Qd is for specifying the minimum cutting depth. When the cutting amount of the n cut is smaller than the amount set by Qd, the system sets the value of Qd as the feed amount.
- ■ Rd is the allowance of finish turning and mt is the number of finish turning, so the amount of each finish turning is Rd/mt.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Internal threading [IN_THRD]**



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
A	Thread angle	L/TPI	0 = thread lead 1 = number of threads per inch
H	Total thread cutting depth	L	Unit for L/TPI L = thread lead in units of mm/pitch TPI = number of threads per inch
N	Number of threads	Lm	Threading infeed (0: right; 1: middle; 2: left; 3: right-left shift)

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Depth of the first cut	mt	Number of finish turning
Qd_	Minimum cutting depth	Rd_	Allowance of finish turning
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

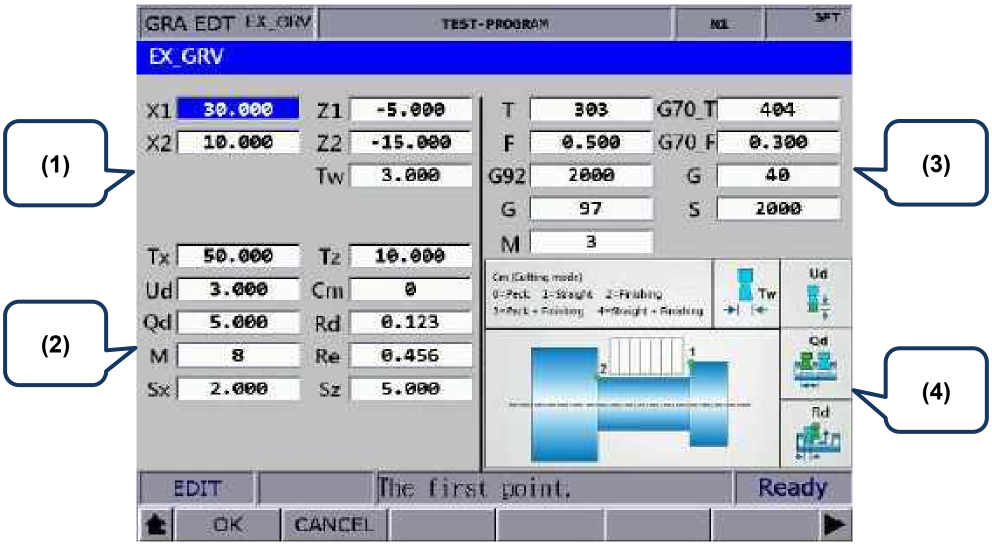
- Ud is for specifying the depth of the first cut. Depth of the n cut (n >= 2) is automatically calculated by the system with the formula $\mathrm{Ud}\left[\sqrt{n}-\sqrt{(n-1)}\right]$.
- Qd is for specifying the minimum cutting depth. When the cutting amount of the n cut is smaller than the amount set by Qd, the system sets the value of Qd as the feed amount.
- Rd is the allowance of finish turning and mt is the number of finish turning, so the amount of each finish turning is Rd/mt.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ External grooving [EX_GRV]



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
Tw	Groove width	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	X axis feeding amount of each peck turning	Cm_	Cutting mode setting (0 = peck; 1 = straight; 2 = finish)
Qd_	Z axis feeding amount of each cut	Rd_	Retraction amount of Z axis after the cutting in X-axis direction is finished
M_	Coolant switch (8 = on; 9 = off)	Re_	Retraction amount of X axis after each peck turning
Sx, Sz	Safe retraction position (coordinates)	-	-

■ The input values for Ud, Qd, and Rd must be greater than 0.

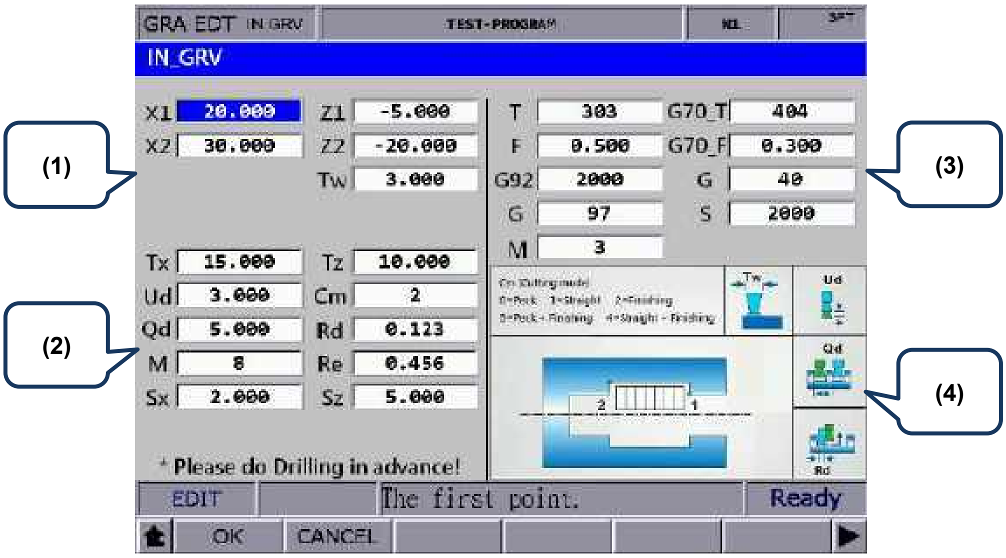
■ Cm is for setting the cutting mode. Set Cm to 0 to have the system perform peck turning. Set Cm to 1 to perform straight cutting. Set Cm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ Internal grooving [IN_GRV]



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
Tw	Groove width	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	X axis feeding amount of each peck turning	Cm	Cutting mode setting (0 = peck; 1 = straight; 2 = finish)
Qd_	Z axis feeding amount of each cut	Rd_	Retraction amount of Z axis after the cutting in X-axis direction is finished
M_	Coolant switch (8 = on; 9 = off)	Re_	Retraction amount of X axis after each peck turning
Sx, Sz	Safe retraction position (coordinates)	-	-

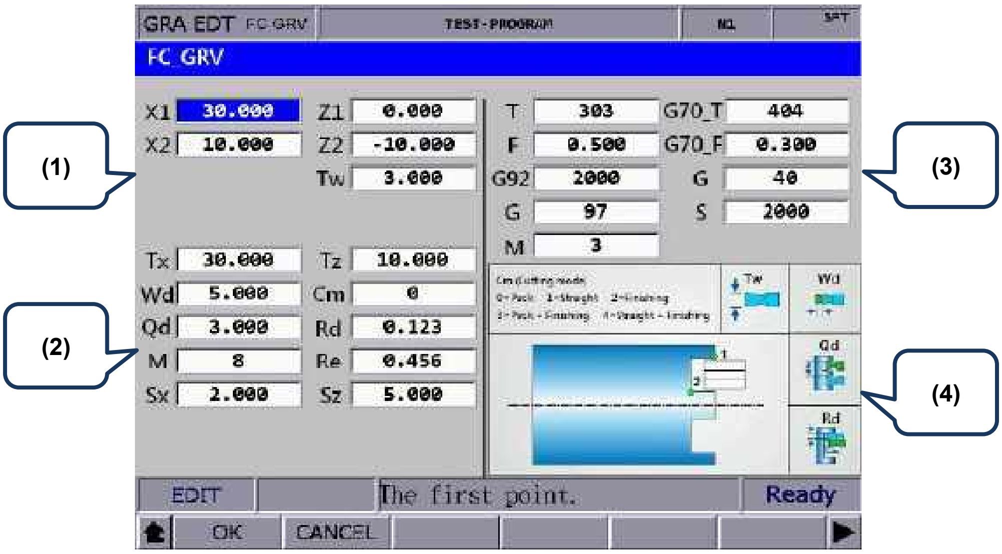
- ■ The input values for Ud, Qd, and Rd must be greater than 0.
- ■ Cm is for setting the cutting mode. Set Cm to 0 to have the system perform peck turning. Set Cm to 1 to perform straight cutting. Set Cm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Face grooving [FC_GRV]**



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
Tw	Groove width	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Wd_	Z axis feeding amount of each peck turning	Cm_	Cutting mode setting (0 = peck; 1 = straight; 2 = finish)
Qd_	X axis feeding amount of each cut	Rd_	Retraction amount of X axis after the cutting in Z-axis direction is finished
M_	Coolant switch (8 = on; 9 = off)	Re_	Retraction amount of Z axis after each peck turning
Sx, Sz	Safe retraction position (coordinates)	-	-

■ The input values for Wd, Qd, and Rd must be greater than 0.

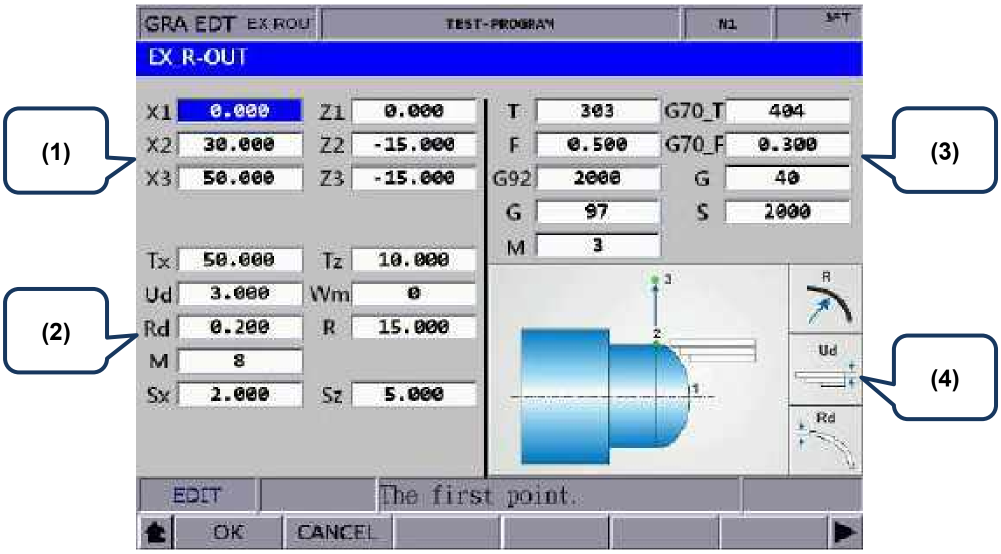
■ Cm is for setting the cutting mode. Set Cm to 0 to have the system perform peck turning. Set Cm to 1 to perform straight cutting. Set Cm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Outer convex turning [EX_ROUT]**



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning in X-axis direction	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	R_	Arc radius
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

■ R is for specifying the arc radius. Set R according to the X1-, Z1-, X2-, and Z2-coordinates to ensure the center of the arc and circle is the same. If the R value is inappropriate, an alarm occurs when you press **CYCLE START**.

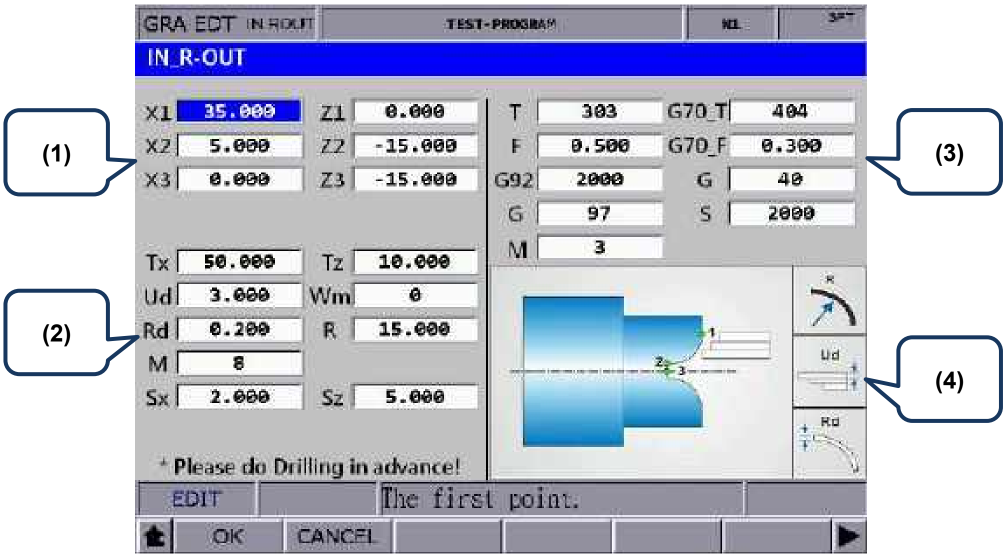
■ Wm is for setting the cutting mode. Set Wm to 0 to perform a complete turning process including rough and finish turning. Set Wm to 1 to perform rough turning and keep the allowance of finish turning. Set Wm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Inner convex turning [IN_ROUT]**



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning in X-axis direction	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	R_	Arc radius
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safety retraction position (coordinates)

■ R is for specifying the arc radius. Set R according to the X1-, Z1-, X2-, and Z2-coordinates to ensure the center of the arc and circle is the same. If the R value is inappropriate, an alarm occurs when you press **CYCLE START**.

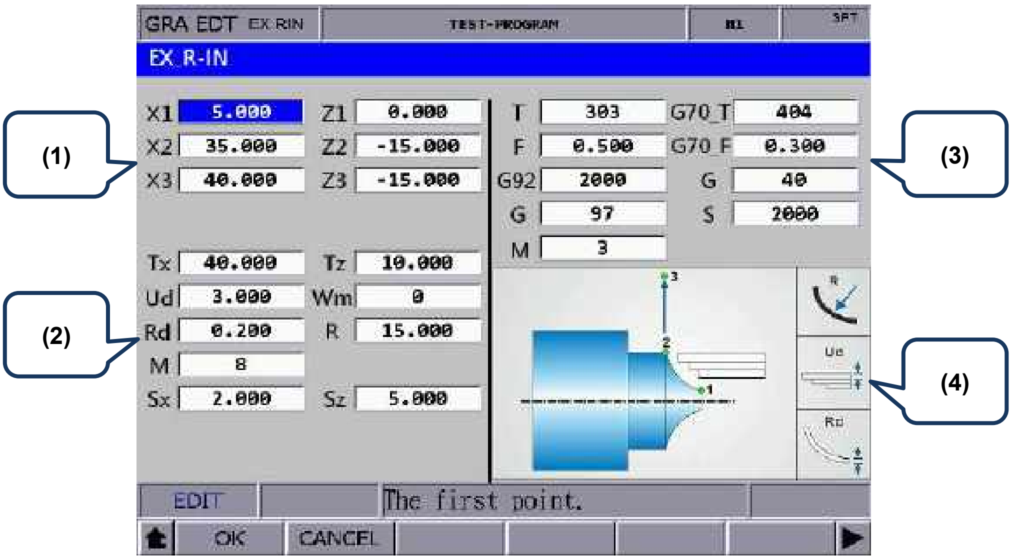
■ Wm is for setting the cutting mode. Set Wm to 0 to perform a complete turning process including rough and finish turning. Set Wm to 1 to perform rough turning and keep the allowance of finish turning. Set Wm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **Outer concave turning [EX_RIN]**



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning in X-axis direction	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	R_	Arc radius
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

■ R is for specifying the arc radius. Set R according to the X1-, Z1-, X2-, and Z2-coordinates to ensure the center of the arc and circle is the same. If the R value is inappropriate, an alarm occurs when you press **CYCLE START**.

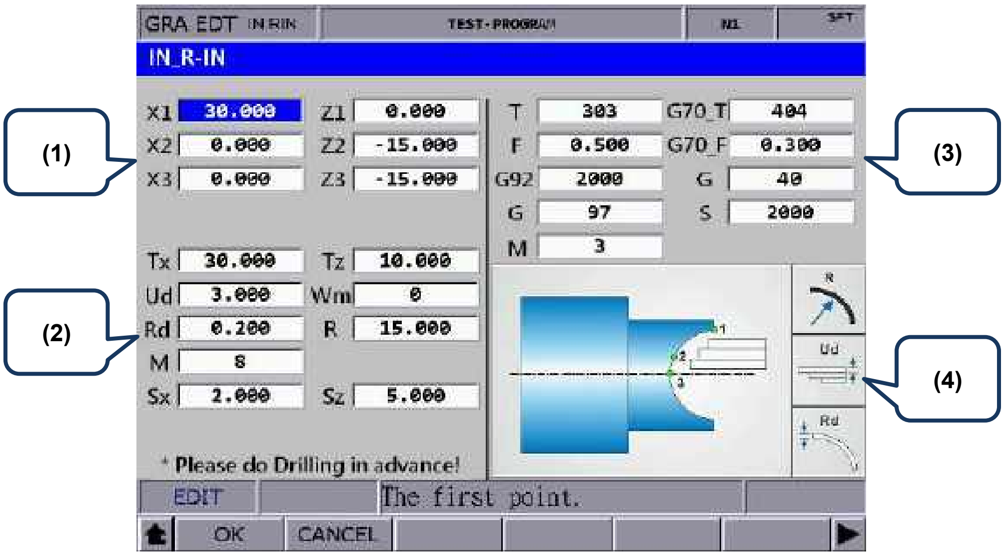
■ Wm is for setting the cutting mode. Set Wm to 0 to perform a complete turning process including rough and finish turning. Set Wm to 1 to perform rough turning and keep the allowance of finish turning. Set Wm to 2 to perform finish turning once according to the given path.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ Inner concave turning [IN_RIN]



(1) Input fields for coordinates of each step point

Item	Description	Item	Description
1st point	X1_, Z1_	2nd point	X2_, Z2_
3rd point	X3_, Z3_	-	-

(2) Parameter settings for contour machining

Item	Description	Item	Description
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning in X-axis direction	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Rd_	Allowance of finish turning	R_	Arc radius
M_	Coolant switch (8 = on; 9 = off)	Sx, Sz	Safe retraction position (coordinates)

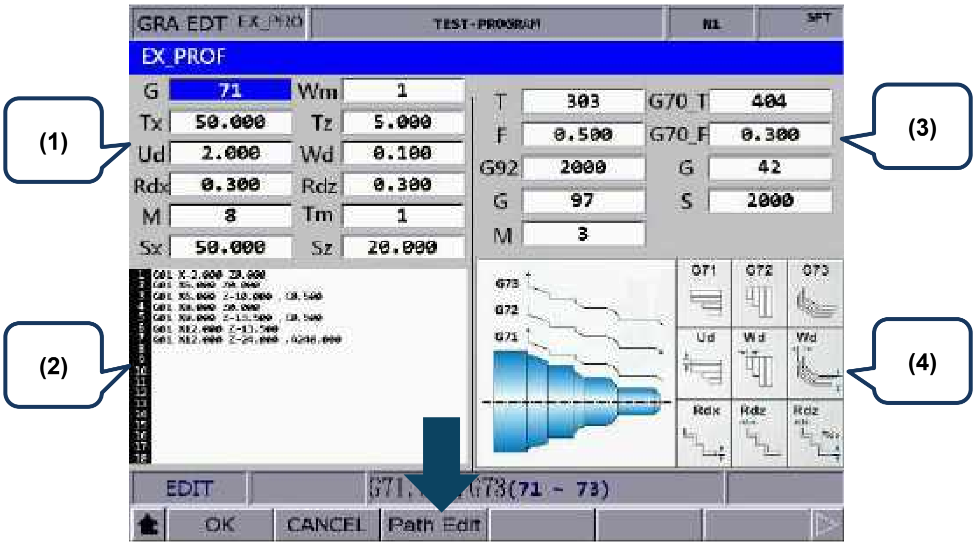
- ■ R is for specifying the arc radius. Set R according to the X1-, Z1-, X2-, and Z2-coordinates to ensure the center of the arc and circle is the same. If the R value is inappropriate, an alarm occurs when you press **CYCLE START**.
- ■ Wm is for setting the cutting mode. Set Wm to 0 to perform a complete turning process including rough and finish turning. Set Wm to 1 to perform rough turning and keep the allowance of finish turning. Set Wm to 2 to perform finish turning once according to the given path.

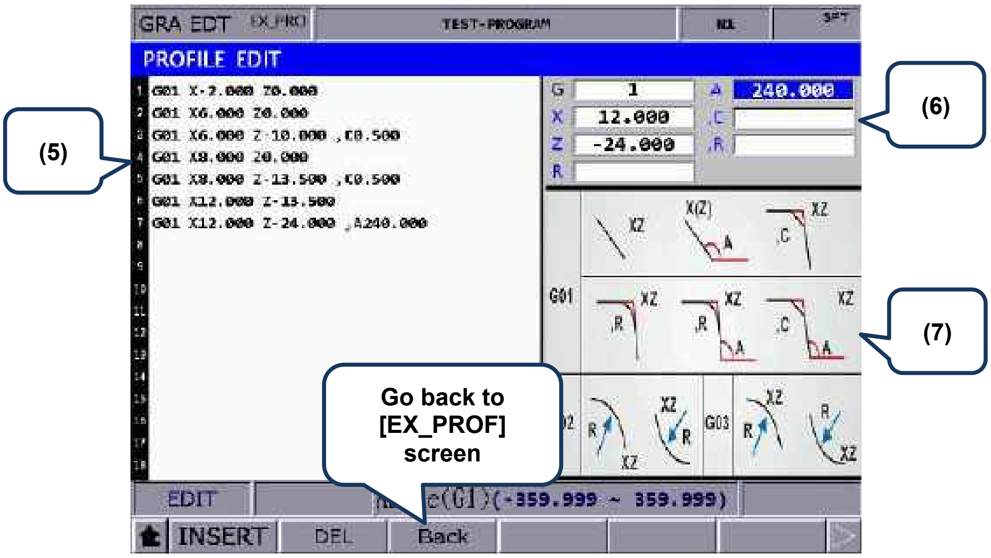
(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

■ **External profile turning [EX_PROF]**





(1) Settings of machining parameters

Item	Description	Item	Description
G_	G71 / G72 / G73	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (X-axis direction)	Wd_	Feeding amount of rough turning (Z-axis direction)
Rdx_	Allowance of finish turning (X-axis direction)	Rdz_	Allowance of finish turning (Z-axis direction)
M_	Coolant switch (8 = on; 9 = off)	Tm_	Number of cutting in a cycle
Sx, Sz	Safe retraction position (coordinates)	-	-

- Profile turning type (G_): G71 / G72 / G73

  G71 is suitable for machining of longer and thinner bars in Z-axis direction. G72 is suitable for machining of shorter and thicker bars in X-axis direction. G73 is suitable for workpiece that has been machined (such as forging or roughing).

- Ud is available for G71 or G73 command. It specifies the feeding amount of each rough turning in X-axis direction in a G71 command or specifies the total cutting depth in X-axis direction in a G73 command.

- Wd is available for G72 or G73 command. It specifies the feeding amount of each rough turning in Z-axis direction in a G72 command or specifies the total cutting depth in Z-axis direction in a G73 command.

- Tm is only available for G73 command, specifying the number of cutting in a cycle. The feeding amount of each cut is dividing the total feeding amount specified in Ud and Wd by Tm.

(2) Profile edit screen
The program generated in the PROFILE EDIT screen is displayed in this section. Or you can directly enter program in this section and move the cursor to the line to be edited.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate
Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

(5) Profile edit screen. The function is the same as that of section (2).

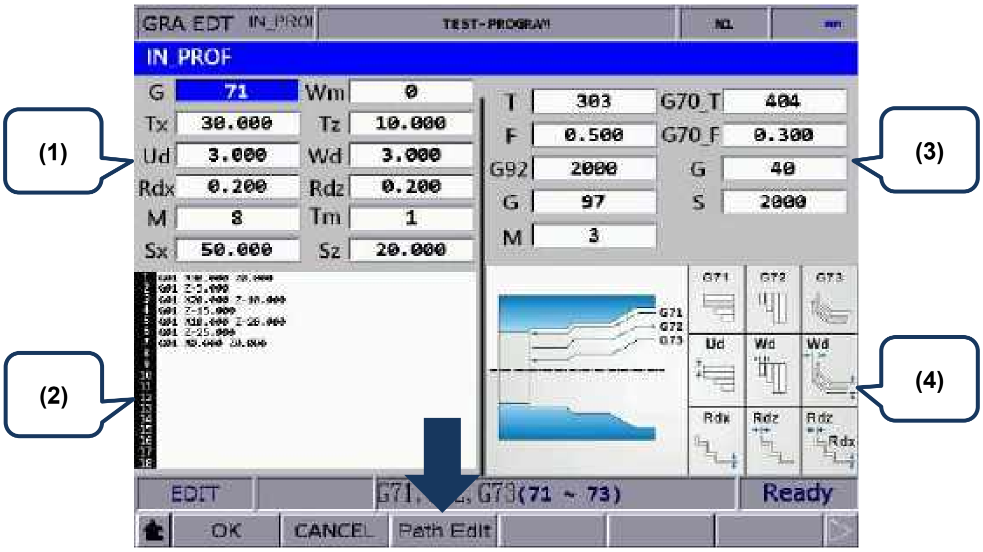
(6) Program edit screen
Enter the parameters of the G-code in this section and press **INSERT** to insert the program.

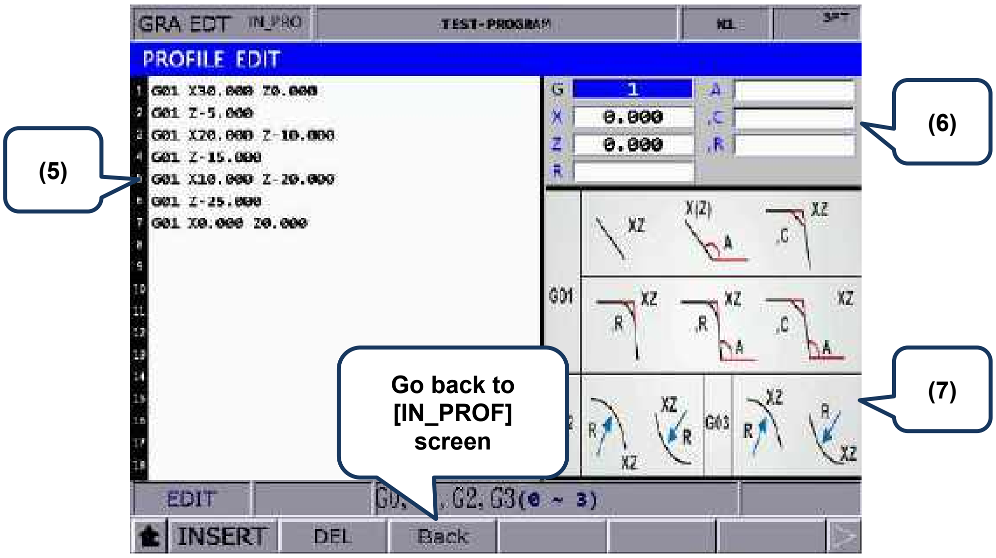
(7) Illustration for each command format
When editing the path, you can create the path according to the command formats shown in the preceding table. The three types in this section are G01, G02, and G03.

There are nine formats for the G01 command, including G01X_Z_, G01X_,A_, G01Z_,A_, G01X_Z_,C_, G01X_Z_,R_, G01X_,A_,R_, G01Z_,A_,R_, G01X_,A_,C_, and G01Z_,A_,C_.

The G02 format is G02X_Z_R_ and the G03 format is G03X_Z_R_. “,C” represents automatic chamfer and “,R” represents automatic corner rounding.

■ **Internal profile turning [IN_PROF]**





(1) Settings of machining parameters

Item	Description	Item	Description
G_	G71 / G72 / G73	Wm_	Cutting mode setting (0 = rough & finish; 1 = rough; 2 = finish)
Tx_	X-coordinate of tool change position	Tz_	Z-coordinate of tool change position
Ud_	Feeding amount of rough turning (X-axis direction)	Wd_	Feeding amount of rough turning (Z-axis direction)
Rdx_	Allowance of finish turning (X-axis direction)	Rdz_	Allowance of finish turning (Z-axis direction)
M_	Coolant switch (8 = on; 9 = off)	Tm_	Number of cutting in a cycle
Sx, Sz	Safe retraction position (coordinates)	-	-

- Profile turning type (G_): G71 / G72 / G73

  G71 is suitable for machining of longer and thinner bars in Z-axis direction. G72 is suitable for machining of shorter and thicker bars in X-axis direction. G73 is suitable for workpiece that has been machined (such as forging or roughing).

- Ud is available for G71 or G73 command. It specifies the feeding amount of each rough turning in X-axis direction in a G71 command or specifies the total cutting depth in X-axis direction in a G73 command.

- Wd is available for G72 or G73 command. It specifies the feeding amount of each rough turning in Z-axis direction in a G72 command or specifies the total cutting depth in Z-axis direction in a G73 command.

- Tm is only available for G73 command, specifying the number of cutting in a cycle. The feeding amount of each cut is dividing the total feeding amount specified in Ud and Wd by Tm.

(2) Profile edit screen

The program generated in the PROFILE EDIT screen is displayed in this section. Or you can directly enter program in this section and move the cursor to the line to be edited.

(3) Parameter settings for tool compensation, tool nose radius compensation, speed, and feed rate

Refer to [EX_STEP] for the parameter settings in section (3).

(4) Illustration

(5) Profile edit screen. The function is the same as that of section (2).

(6) Program edit screen

Enter the parameters of the G-code in this section and press **INSERT** to insert the program.

(7) Illustration for each command format

When editing the path, you can create the path according to the command formats shown in the preceding table. The three types in this section are G01, G02, and G03.

There are nine formats for the G01 command, including G01X_Z_, G01X_,A_, G01Z_,A_, G01X_Z_,C_, G01X_Z_,R_, G01X_,A_,R_, G01Z_,A_,R_, G01X_,A_,C_, and G01Z_,A_,C_.

The G02 format is G02X_Z_R_ and the G03 format is G03X_Z_R_. “,C” represents automatic chamfer and “,R” represents automatic corner rounding.

7

7.15.4 Operation steps for graphic programming

(1) Set the controller to EDIT mode to enter the Graphic edit (GRA EDT) screen.

(2) **GRA EDT** is on the last page of the function bar in the File manage screen.

(3) Enter the Graphic edit screen and then select the disk type (CF or USB).

(4) After entering the disk, press **ADD PRJ**, enter the file name, and press **ENTER** to generate a project file.

(5) Move the cursor to one of the project files and press **ENTER** to enter the file.

(6) After entering the project file, press **ADD PRC** to enter the screen of procedure selection.

(7) There are 18 procedures available. Every 6 procedures are in a row, respectively corresponding to the function keys. Press ↑ and ↓ to shift the cursor to another row. When you shift to another row of procedures, the corresponding function keys change as well.

(8) Select the required procedure and press the corresponding function key to enter the screen for procedure editing.

(9) After setting the parameters, press **OK**, name the procedure, and press **ENTER** to finish the editing.

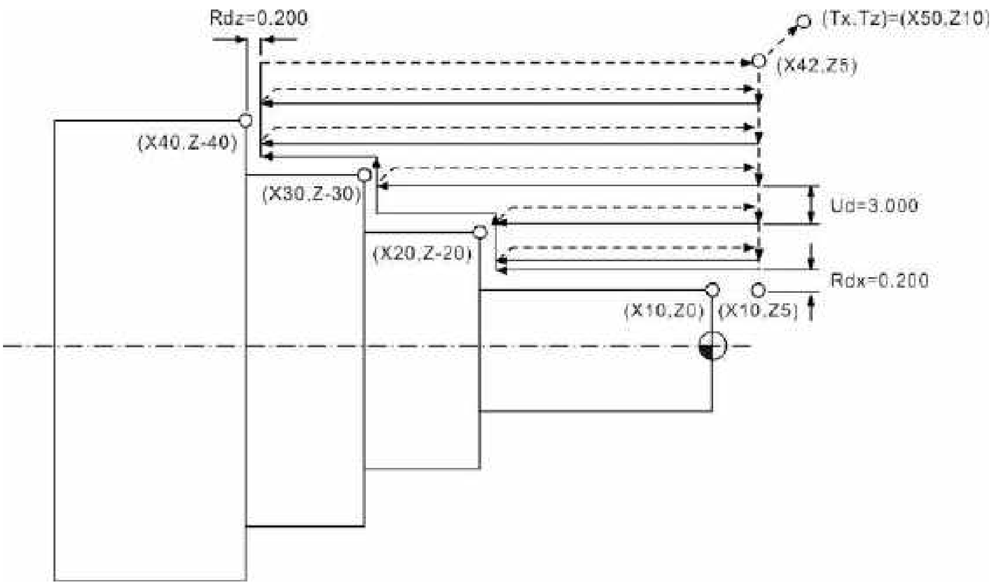
(10) To continue with other procedures, press **ADD PRC** again.

(11) After finishing editing the procedures, press **CONVERT** to convert the files into G-code format.

(12) The system jumps to the File edit screen after file conversion, and you can verify the program in the screen. Then, switch to the GRA (graphic display) screen, press **PREVIEW** to check if the generated graph is correct, and then you can perform MPG simulation or actual machining.

[File conversion example - External step turning]

The following illustrates the G-code file generated by the parameters for the external step turning.



O0000 //The string set in the **INITIAL** file, which is automatically added to the beginning of the program.
;EXstep_DR0
T0303 //Tool number and compensation number
G95 F0.500 //0.5 mm/feeding amount per revolution
G92 S2000 //Maximum spindle speed
G97 S1000 //Fixed spindle speed
M3 //Spindle On - forward
M8 //Coolant On
G00 X42.000 Z5.000
G42 //Tool nose radius compensation On
G71 U3.000 R0.5 //Feeding amount of rough turning in X-axis direction
G71 P210 Q250 U0.200 W0.200 //Allowance of finishing turning in X- and Z-axis directions
N210 G00 X10.000 Z5.000
G01 X10.000 Z0.000 //1st point
G01 Z-20.000
G01 X20.000 Z-20.000 //2nd point
G01 Z-30.000
G01 X30.000 Z-30.000 //3rd point
G01 Z-40.000
G01 X40.000 Z-40.000 //4th point
N250 G01 U2.0 //U2.0
G00 X42.000 Z5.000
T0404 //Tool for finish turning
G70 P210 Q250 F0.100 //Program block for finish turning
G00 Z5.000
G40
G00 X50.000 Z10.000 //Coordinates of tool change point
M09
M05
M30 //The string set in the **FINISH** file, which is automatically added to the end of the program.

7.16 Program functions in other modes

AUTO mode:

The PRG screen displays the content of the opened G-code file. In the screen, you can view the status information about the currently opened or executed file and the block being executed. The PRG screen in AUTO mode only displays information about the program and the coordinates of motion trajectory during program execution. The operation steps are as follows.

(1) In AUTO mode, press **PRG** to display the program execution screen, as shown in the following figure.

Figure 7.16.1

(2) Continued from Step (1), press **PRG** again, and the screen displays the information of program content and coordinates simultaneously, as shown in the following figure.

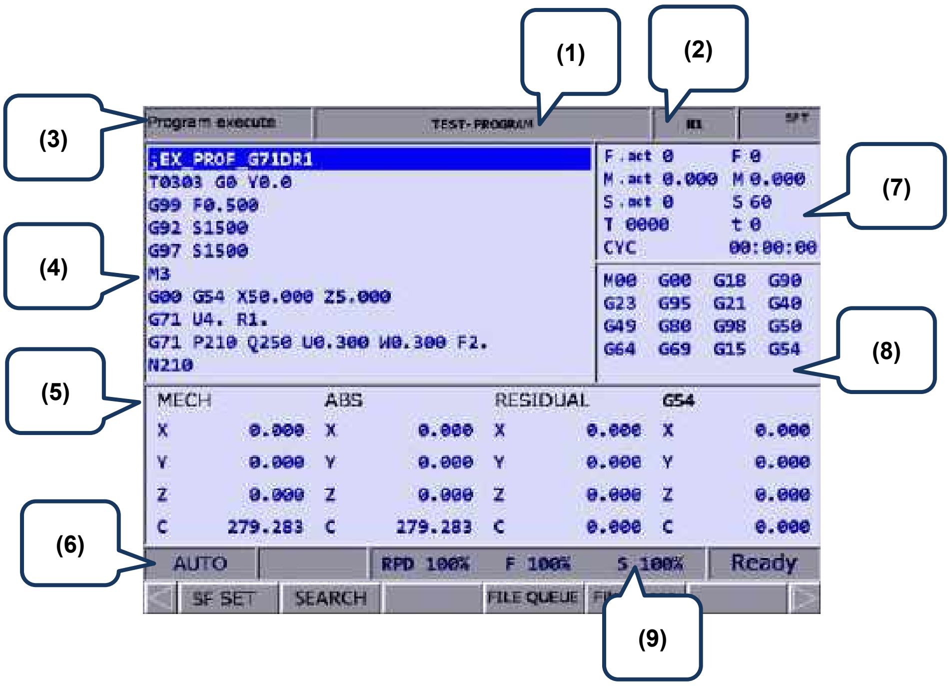


Figure 7.16.2

(1) Current program name
(2) Currently executed program line
(3) Current function group screen
(4) Currently executed program content
(5) Coordinate information during program execution
(6) Current system mode
(7) F.act: actual feed rate
M.act: actual feed rate per revolution
S.act: actual spindle speed
T: tool number
F: feed rate
M: feed rate per revolution (mm/rev)
S: spindle speed
t: dwell time
CYC: cycle time
(8) Current command status
(9) Current override settings

■ Breakpoint search (START)

The function of breakpoint search is available in AUTO mode. When the program execution is interrupted, the system records the line number where the program is interrupted (breakpoint). You can go to the PRG screen in AUTO mode to enable the breakpoint search function.

When the system searches for the breakpoint, the cursor quickly moves to the line number or label you specified. The system executes the program before the specified block and quickly computes the machining status (including the spindle speed, feed rate, M code, and coordinates), ensuring the system is ready when the execution resumes, as shown in the following figure.

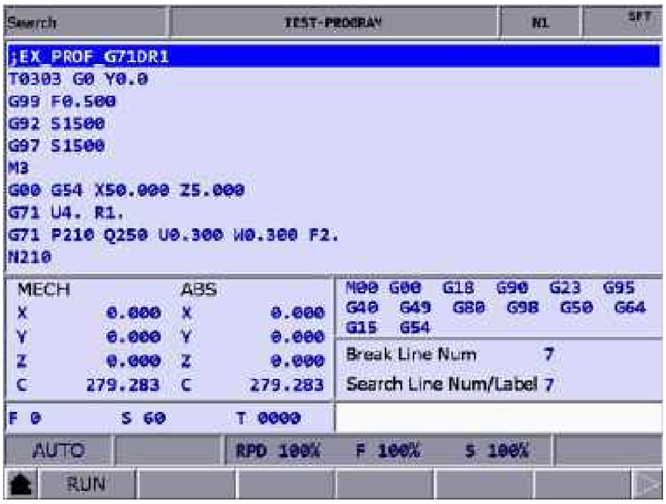


Figure 7.16.3

The operation steps are as follows.

(1) In AUTO mode, press PRG to enter the program execution screen.

(2) Press **START** to display the Search screen.

(3) Refer to the information of the breakpoint (Break Line Num), enter the line number or label to be searched, and then press ENTER to complete the setting.

(4) Press **RUN**, and the system executes the program until reaching the set line or label.

(5) The controller executes and records the execution status of the program blocks prior to the specified line or label. Then the controller stops at the block and is ready for execution.

(6) Press **CYCLE START** to execute the program.

Note:

1. After finding the target block, the program stops at the target block and this block remains unexecuted. Press **CYCLE START** to start executing the program.
2. Supported formats for searching: program line number or program label (N label).
3. When the program is being executed or after the breakpoint search function is used, you cannot execute the breakpoint search function again.

■ SF setting (SF SET)

When the G-code program is in execution, you can use the SF set function to change the cutting feed rate (F command) and spindle speed (S command) specified in the G-code program, as shown in Figure 7.16.4. Enter a new command value in the SF set dialog box to change the speed command during execution.

Figure 7.16.4

The operation steps are as follows.

(1) In AUTO mode, press **PRG** to enter the program execution screen.

(2) Press **SF SET** and a dialog box appears for you to set the command value.

(3) Enter the S value or F value and press **ENTER** to complete changing the speed command setting.

Note:

1. The SF set function is a one-shot function with the S and F settings effective for one time in a single execution, which do not change the commands in the G-code program.
   If requiring to execute this SF setting for multiple times, it is recommended that you edit the command in EDIT mode to ensure the speed command is correct.
2. After the S value is set, the current spindle speed in the G-code program is changed immediately. After the F value is set, the system executes with the new feed rate (F command) after the data in the system buffer is completely processed.
3. If there is no S or F command in the G-code program, you cannot use this function to change the speed command.
4. Set Pr.10017 [SF speed setting] to enable or disable the F setting for the SF set function.

■ Barcode reading (BARCODE)

The Barcode reading function is for using the barcode scanner to load the machining files named by barcode into the file queue for execution, which greatly saves the time for file searching. You can connect the barcode scanner to the USB slot in the front side of the controller.

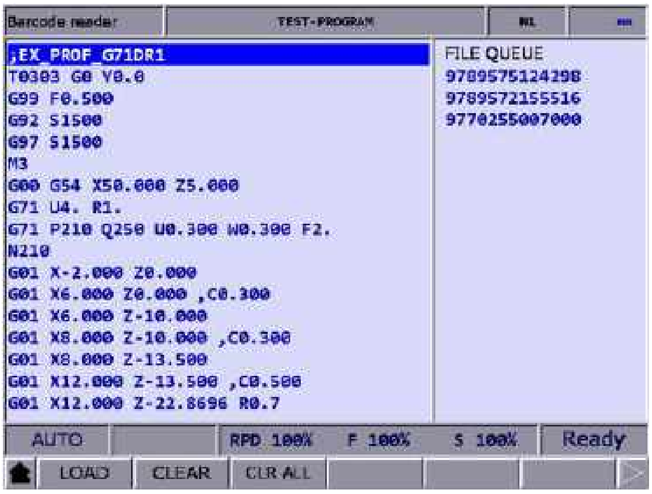


Figure 7.16.5

The operation steps are as follows.

(1) In AUTO mode, press **PRG** to enter the program execution screen.

(2) Press **BARCODE** to enter the screen as shown in Figure 7.16.5.

(3) Use the barcode scanner to scan the barcode to obtain the name of the machining file.

(4) To load the file content, press **LOAD**. To delete the file which is on the top of the FILE QUEUE list, press **CLEAR**. To delete all the files on the FILE QUEUE list, press **CLR ALL.**

Note:

1. To use this function, you must first create the machining files in the CF card and the file names have to be consistent with their barcodes.
2. When loading multiple files, the system executes each file in sequence. It automatically removes the file name from the list once completing the execution.

JOG and MPG modes:

- SF setting (SF SET)

The operation steps for SF setting are as follows.

(1) In JOG or MPG mode, press **PRG** to enter the program execution screen.
(2) Press **SF SET** and a dialog box appears for you to set the command value.
(3) Enter the S value or F value and press **ENTER** to complete changing the speed command setting.

- Teach programming (TEACH)

With the TEACH function, you can manually move the axis to any position and use the programming function keys to have the system convert the final position (coordinates of the three axes) into a motion block with coordinates specified. Set the system to JOG or MPG mode, and you can use the TEACH function in the PRG screen for programming the existing or new files. The TEACH function includes: rapid traverse (POSITION), linear interpolation (LINEAR), circular interpolation (CIRCULAR), delete (DEL), file creating (NEW FILE), file saving (SAVE), and absolute / machine coordinates (ABS / MECH). This programming function automatically generates corresponding command formats according to the different functions. See the following table for the generated command formats.

Function	Format of the auto-generated command
NEW FILE (generate a new file when teach programming is enabled)	G90 G40 G49 G98 G50 G64 G80 G17 G69 G21 G54 G15 S3000 M03 F1000 Note: this function generates the corresponding G21 or G20 command according to the parameter setting of size unit.
POSITION (rapid traverse)	G00 + X_Y_Z_
LINEAR (linear interpolation)	G01 + X_Y_Z_
CIRCULAR (circular interpolation)	G02 + X_Y_Z_ + I_ J_ or G03 + X_Y_Z_ + I_ J_ Note: this function generates G17+I_ J_, G18+K_ I_, or G19+J_K_ corresponding to the X-Y, Z-X, or Y-Z plane.
ABS (absolute coordinates)	G90 G00 (or G01 / G02 / G03) + X_Y_Z_
MECH (machine coordinates)	G53 G00 (or G01 / G02 / G03) + X_Y_Z_

The operation steps for the TEACH function are as follows.

(1) In JOG or MPG mode, press **PRG** to enter the program execution screen.
(2) Press **TEACH** to enter the teach screen.
(3) Select the file to be programmed from the existing files or create a new file. To do programming in the existing file, open the file in EDIT mode. To do programming in a new file, press **NEW FILE**, and a dialog box appears for you to enter the file name. Press **ENTER** after entering the file name, and you can create a new file in the current directory.

(4) Specify the data type of the coordinates. For example, if you desire to display absolute coordinates, press **ABS** on the second page of the function bar. Or press **MECH** to switch to machine coordinates.

(5) Move the axis to the specified position in JOG or MPG mode, press **POSITION** or **LINEAR** according to the requirement of the mode, and the coordinate command is inserted to the position where the cursor is located. The coordinate command is generated according to the data type of the coordinate values.

(6) Continued from Step (5), to specify a circular motion, press **CIRCULAR** to display the corresponding function bar.

(7) Continued from Step (6), to specify the plane of the arc, press **PLANE** to select X-Y, Y-Z, or Z-X.

(8) Move the axes in sequence and set the start, intermediate, and end points of the arc by pressing **P1**, **P2**, and **P3** respectively. After P3 is set, the values are automatically converted into a circular cutting command. The system determines the direction of the arc (G02 or G03) and the radius according to the trajectory of P1 - P3.

(9) If the coordinate command is incorrect, move the cursor to the block containing the coordinate command and press **DEL** (on the function bar of the 1st layer in the teach screen) to delete the block.

(10) After completing the programming, in addition to the given auto-saving procedure (press **RESET**, switch to different system modes, or open another file), you can press **SAVE** to save the programming results.

Note:

1. The TEACH function is only available in JOG or MPG mode. It is not displayed in other modes.
2. The allowable file size for the teach function is the same as that for file editing (below 3 MB).
3. The name of the file created for the teach function must comply with the file name requirements.
4. If you repeatedly enter two sets of coordinate with the same values, the system ignores the 2nd coordinate command to avoid generating an invalid motion block.
5. Set the coordinates of P1, P2, and P3 for the arc command in sequence. The direction and radius for the circular command is determined by the positions of P1, P2, and P3.
6. If you enter the teach screen without opening a file, the system automatically generates a blank file named “TEACH.NC” in the directory where the cursor is located (the default setting is to generate a file in the root directory of CF), so you can directly use the teach function.
7. Set Pr.10017 [SF speed setting] to enable or disable the F setting for the SF set function.

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MDI mode:

In MDI mode, you can enter simple programs and save, delete, or execute the program content in the PRG screen, as shown in the following figure, which is only available in MDI mode. You can enter up to 14 program blocks in the screen. After finishing editing the program, press **LOAD** to reload and then execute the program. Otherwise, the program cannot be executed.

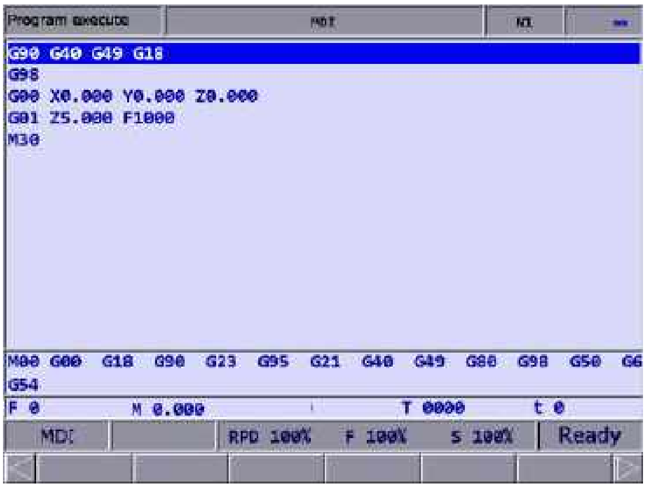

Figure 7.16.6

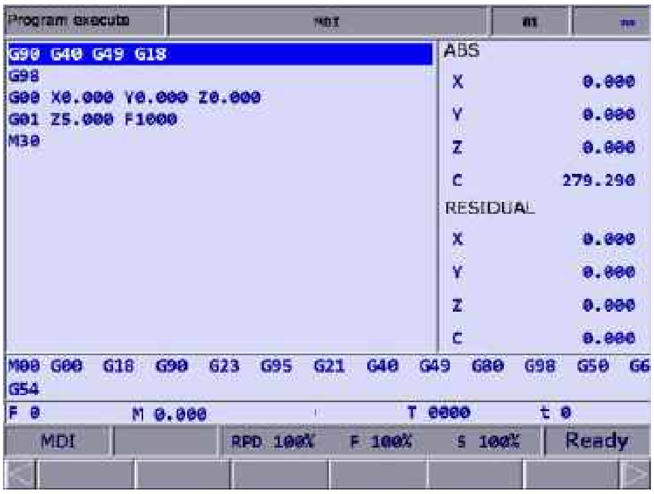

Figure 7.16.7

In addition, the SAVE function is for saving the program content entered in MDI mode as a file in the current directory. The naming method is the same as that in Section 7.2 Create a new file. That is, the file name has to follow the naming convention and should not be duplicated. The CLR function is for deleting all the program content in the screen in MDI mode, which functions the same as pressing and holding **RESET** for 3 seconds.

Note:

1. In MDI mode, the **RESET** key has a two-stage function. Press **RESET** once to return to the first line of the manual input program after program interruption. Press and hold **RESET** for 3 seconds to clear all the manual input program contents.
2. In MDI mode, after M30 is executed, the cursor returns to the first line of the program. You can run the program again without reloading the program.
3. In MDI mode, if there is no M30 (Program end) command, the program runs to the last line. To run the program again, press **LOAD** to reload the program.
4. After M02 is executed, the cursor stops at the block of M02 and the program status restores to the default. Then, you can resume the execution from the block of M02 without reloading the program.

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Offset (OFS) Group 8

The OFS group provides functions of setting the workpiece coordinates, tool length, tool radius compensation, and macro variables.

The OFS group provides functions of setting the workpiece coordinates, tool length, tool radius compensation, and macro variables.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.

8.1 Coordinate setting (COORD)

G54 - G59 are the set workpiece coordinate systems for you to select. With commands G54 - G59, you can simplify the calculation of coordinates during programming as well as change the coordinate data at any time, achieving more flexible machining process. You can specify the coordinate values in the coordinate setting screen with one of the workpiece coordinate commands (G54 - G59), as shown in the following figure.

Figure 8.1.1

(1) Workpiece coordinate setting: offset coordinates, G54 - G59 coordinate systems
(2) Coordinate information display: machine (MECH) / relative (REL) / absolute (ABS) coordinates

The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.
(2) Press **COORD** to display the corresponding function bar.

Note:

1. Set the coordinate systems only when there is no machining program being executed. Otherwise, data entry is prohibited.
2. If you press **FEED HOLD** during program execution, the system status displays “STOP” (Program stops). If you press (Single block execution) during program execution, the execution stops after the current block is finished, and the system status displays “Ready”.

8.1.1 Auto set (AUTO)

This function is used to automatically enter the current position of each axis to the coordinate system (G54 - G59) where the cursor is located. The auto set function includes five options: clear all data (CLR ALL), clear relative coordinates (CLR REL), setting the coordinate system center (SET L/2), setting a single axis (SET), and setting multiple axes (SET P).

- **CLR ALL** (clear all data): clears all the axis values of the current coordinate system to 0 while the values in other systems remain unchanged.
- **CLR REL** (clear relative coordinates): clears the relative coordinate of the axis where the cursor is located at while the coordinate data of other axes remain unchanged. This function only clears the displayed relative coordinate instead of the actual workpiece coordinate.
- **SET L/2** (set the coordinate system center): sets the central position of a specific object as the center of a coordinate system. The NC system automatically calculates and enters the central position coordinates to the fields, so you do not need to do it manually. The following operation steps take the X axis as an example.

  (1) Set the system to JOG or MPG mode and move the machine axis to the initial contact point of the workpiece in X-axis direction.

  (2) Go to the SET L/2 setting page.

  (3) Press **Point1** and the circle on the left side of the rectangle becomes red, as shown in Figure 8.1.1.1, meaning the machine coordinates of the first point is recorded.

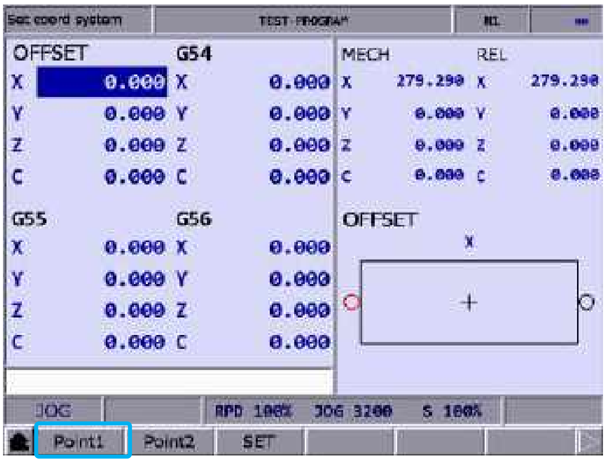

Figure 8.1.1.1

  (4) Continue to move the machine axis to the other contact point of the workpiece in X-axis direction.

  (5) Press **Point2** and the circle on the right side of the rectangle becomes red, meaning the machine coordinates of the second point is recorded.

  (6) Press **SET** and the system automatically finds the midpoint between the two contact points of the workpiece in X-axis direction and sets this point as the center of X axis in the coordinate system, which is the workpiece origin of X axis.

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- **SET L** (set a single axis): automatically enters the current machine coordinate of a single axis. When you move the cursor to the X, Y, or Z field of a specific coordinate system and press **SET L**, the current machine coordinate is automatically entered to the field where the cursor is located. This function only enters the data of a single axis at a time.

Example of setting a single axis

This example illustrates setting the X-axis value by moving the machine axis to the specified position (workpiece origin in X-axis direction as shown in Figure 8.1.1.2).

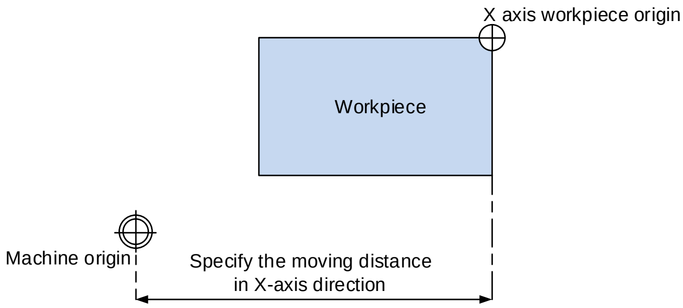


Figure 8.1.1.2

Then the machine coordinates are shown as in Figure 8.1.1.3. Move the cursor to a specific coordinate system (such as G54 as shown in Figure 8.1.1.3) and press **SET L** to automatically enter the X-axis value of the machine coordinate to the X-axis field in G54 coordinate system, completing the data entry for a single axis.

Figure 8.1.1.3

- **SET P** (set multiple axes): automatically enters the coordinates of multiple axes. After completing the calibration of workpiece center, you can use this function to enter the machine coordinates of multiple axes (including X, Y, Z, and other axes) simultaneously.

Example of setting multiple axes

Move the machine axis to the specified position, shown as the workpiece origin in Figure 8.1.1.4 (the figure illustrates the position of X and Y axes except Z axis).

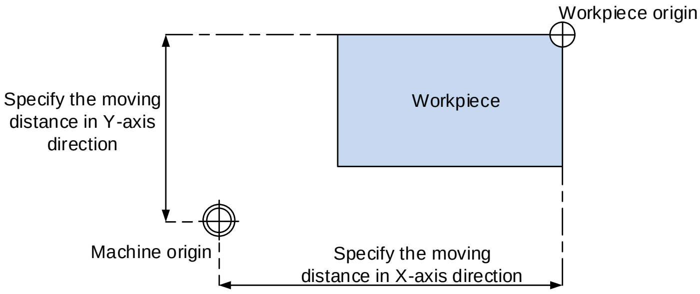


Figure 8.1.1.4

After completing the calibration of workpiece origin, the machine coordinates are shown as in Figure 8.1.1.5. Move the cursor to the G54 coordinate system and press **SET P** to automatically enter the X-, Y-, Z-, and C-axis machine coordinates to the X-, Y-, Z-, and C-axis fields in G54 coordinate system, completing the data entry for multiple axes.

Figure 8.1.1.5

8.1.2 Absolute input (ABS)

This function is used to enter the absolute coordinate of a single axis to the offset coordinate system or workpiece coordinate system.

Note:

1. The displayed values are in units of mm. If you enter values without specifying the decimal points, the values are in units of μm. For example, “123456” = 123456 μm = 123.456 mm.
2. You can also press **ENTER** to enter the absolute coordinates.

Example of absolute setting

Move the tool center from the machine origin to the workpiece origin (X, Y). Then, enter the X- and Y-axis machine coordinates to the coordinate system (G54 - G59) in the OFS group.

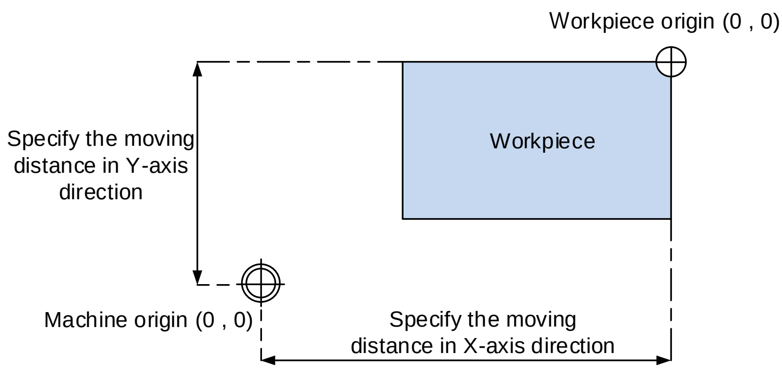


Figure 8.1.2.1

Figure 8.1.2.2

8.1.3 Incremental input (INC)

This function is used to enter the coordinate value to the offset coordinate system or workpiece coordinate system by incremental settings.

8.2 Tool setting

- The tool setting function of the lathe system includes tool length compensation, tool wear compensation, tool nose radius, tool radius wear, and tool nose type. During program editing, you need to specify the tool radius compensation number which corresponds to the number in the compensation data table. Before using the compensation functions, go to the tool setting screen of the OFS group to enter the compensation values.

- Command format of tool compensation:

  T0204: 02 represents tool number 2 and 04 represents the 4th set of the tool length and tool wear compensation settings in the compensation data table.

  T02: if only one set of number is specified, it means you use tool number 2 and the 2nd set of tool length and tool wear compensation settings in the compensation data table, which is the same as T0202.

8.2.1 Tool length setting (OFFSET)

The tool length (Tool Offset) setting screen is as shown in the following figure.

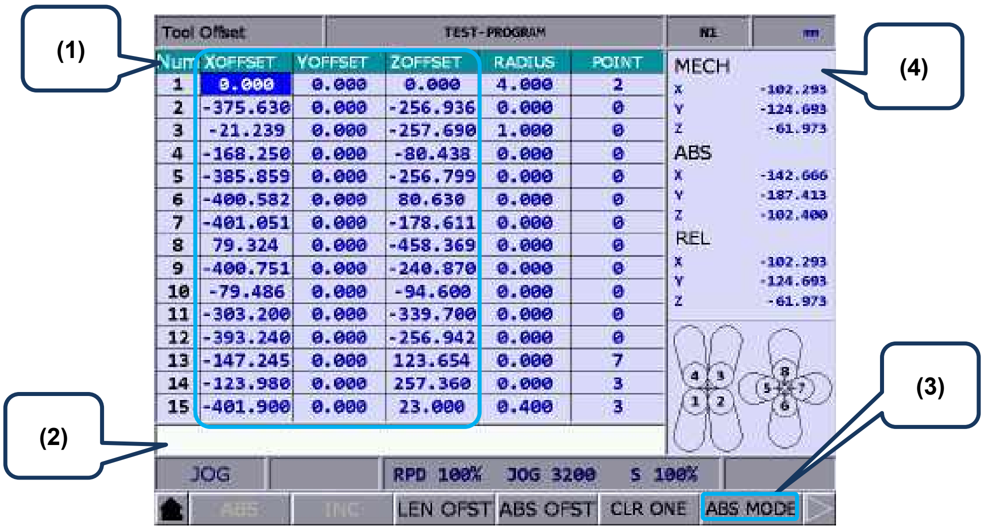
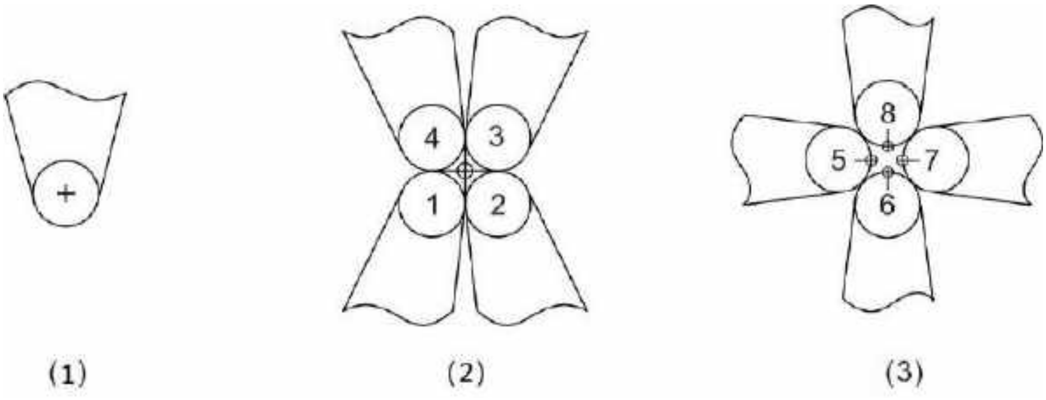


Figure 8.2.2.1

(1) Compensation number, tool length compensation value, tool nose radius compensation value, and tool nose type
(2) Data input field
(3) Input mode selection
(4) Auxiliary display: machine (MECH), absolute (ABS), and relative (REL) coordinates

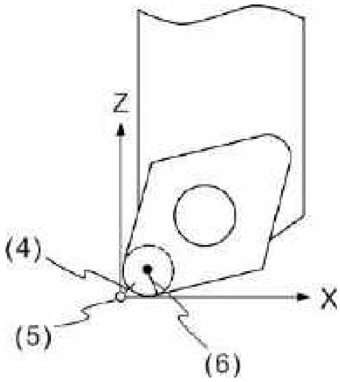
Data setting range	
Tool length compensation	-9000.0 to 9000.0 mm
Tool nose radius compensation	-9000.0 to 9000.0 mm
Tool nose type	0 to 9

Tool nose types:



(1) Tool nose type 0 or 9 (2) Tool nose types 1 - 4 (3) Tool nose types 5 - 8

Illustration of tool nose position and tool nose radius compensation:



(4) Actual tool nose position; (5) Hypothetical tool nose position when calibration;

(6) R value of tool nose radius compensation

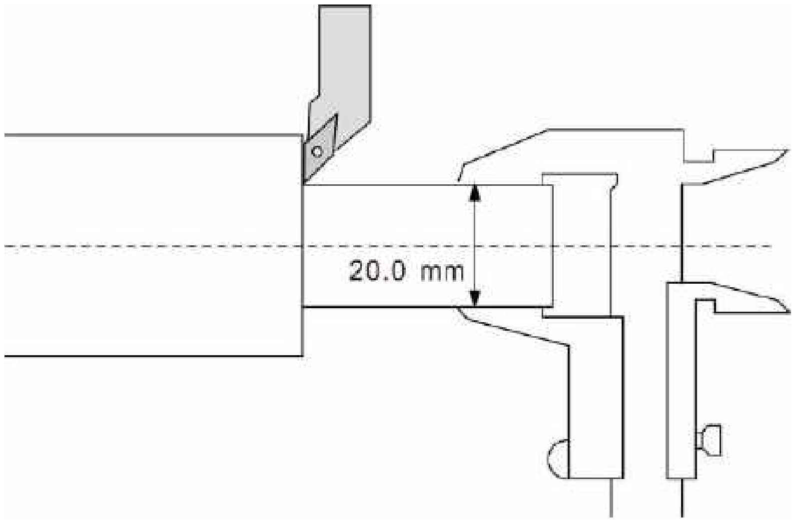
Options of the OFFSET function:

- **ABS** (absolute setting): sets absolute values for tool length, tool radius, tool wear compensation, and tool life. You can press **ENTER** to set absolute values.
- **INC** (incremental setting): sets incremental values for tool length, tool radius, tool wear compensation, and tool life.
- **LEN OFST** (tool length offset): automatically calculates the corresponding tool length compensation values (current machine coordinate – the input absolute coordinate) after the absolute coordinates of each axis are entered. Note that the input absolute coordinate is a signed value. This function avoids the risk of entering incorrect values and shortens the setting time.
- **ABS OFST** (write absolute coordinates): writes the current absolute coordinates to the tool table.
- **CLR ONE** (clear single-axis data): clears all the offset data of one single axis.
- **ABS** / **INC MODE** (absolute / incremental mode): when you set Pr10059 to 1 (absolute) or 2 (incremental), the ABS/INC function key displays. When you set Pr10059 to 0, the function key disappears. After pressing the ABS/INC function key to set the input mode as absolute or incremental, enter the value and press **ENTER** to complete the setting.

Example of tool length compensation for X axis

Enter 20.0 (the measured diameter of X axis in units of mm after cutting) to the input field of compensation value for X axis, press **LEN OFST**, and the system automatically calculates the tool length compensation value.

Important: when you press **LEN OFST** after the cutting is complete, do not move the X axis (do not change its machine coordinate).



8

8.2.2 Tool wear setting (WEAR)

The tool wear setting screen is as shown in the following figure.

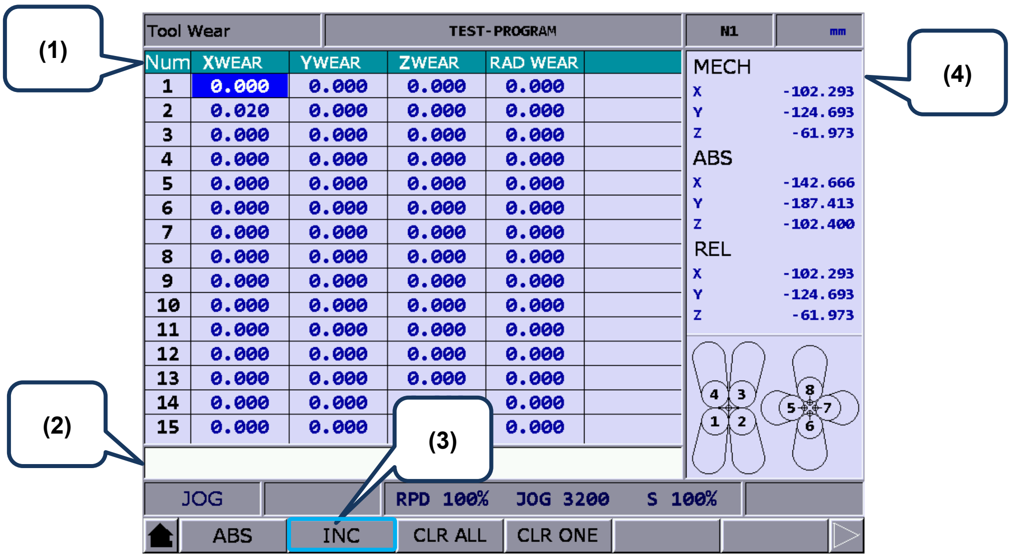


Figure 8.2.1.2

(1) Compensation number for tool wear, wear values of corresponding axes, and compensation values for tool radius wear

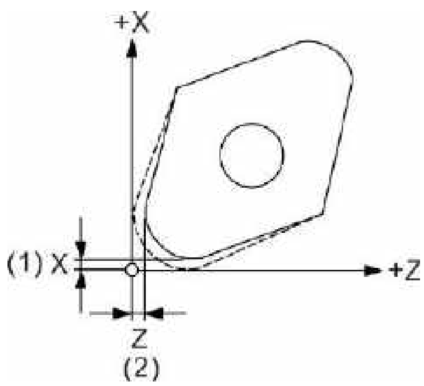
(2) Data input field

(3) Input mode selection

(4) Auxiliary display: machine (MECH), absolute (ABS), and relative (REL) coordinates

Data setting range	
Tool wear for each axis	-2000.0 to 2000.0 mm
Tool radius wear compensation	-2000.0 to 2000.0 mm

Illustration of tool wear:



(1) Compensation amount of the tool nose wear for X axis

(2) Compensation amount of the tool nose wear for Z axis

8.3 Tool magazine management (MAGA)

This function is used to manage the tool positions and their corresponding tool pot numbers after tool change. When a different tool is used, the tool pot positions and the corresponding tool numbers are recorded in the tool magazine data table.

You can view the recorded tool pot positions corresponding to the tool numbers and also change the sequence of the tool numbers in the tool magazine data table. With parameter settings, you can enable the multi-magazine management function. The functions of tool magazine management are only available in JOG mode, as shown in the following figure.

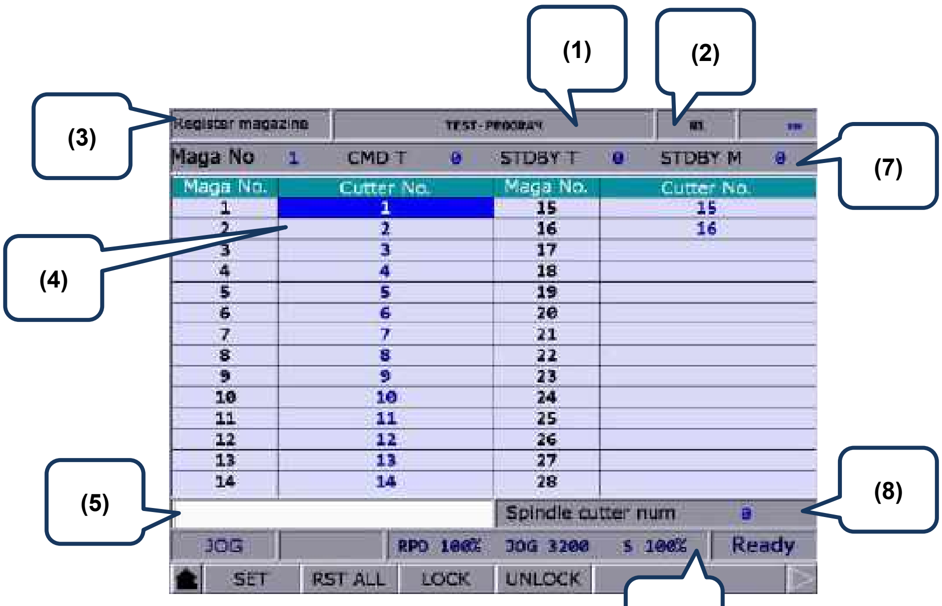


Figure 8.3.1

(1) Current program name
(2) Currently executed program line
(3) Current function group screen
(4) Sequence of tool number
(5) Tool number input field
(6) Current override settings
(7) Number of tool magazine system
Tool number for current command
Current standby tool number
Current standby tool pot number
(8) Spindle tool number

The operation steps for tool magazine management are as follows.

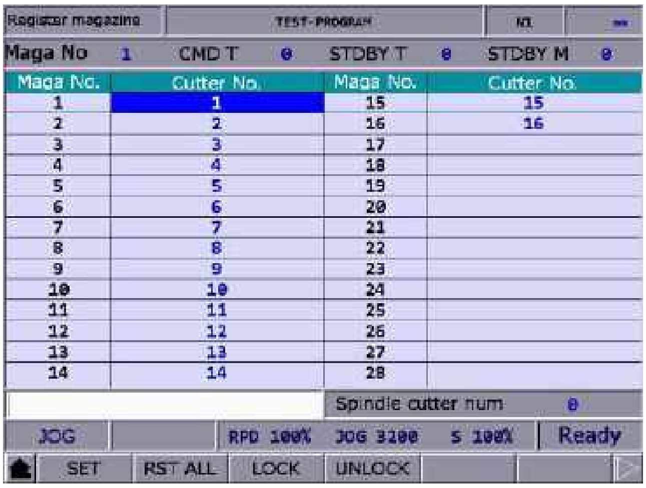
(1) Set the system to JOG mode.
(2) Press **OFS** to enter the OFS screen.
(3) Press **MAGA** to enter the tool magazine data setting screen.
(4) Move the cursor to a specific field.
(5) Enter the tool number and press **SET** (or **ENTER**) to change the tool position.

8

Example of exchanging tool numbers

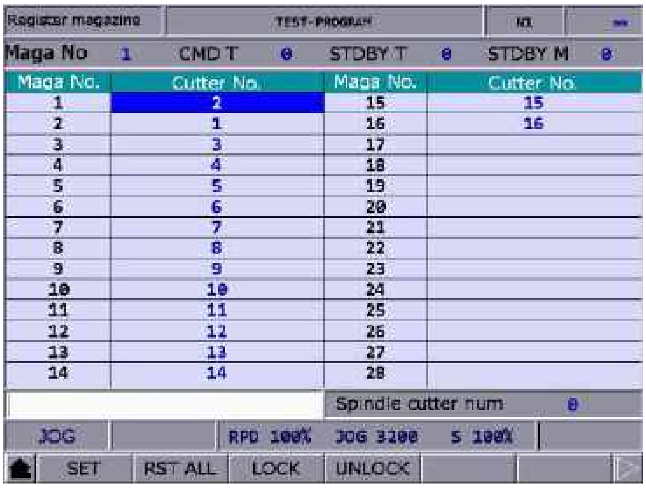
When you specify a number that has already existed in the data table, the system automatically exchanges the number to be replaced with the one that is repeated. This ensures the tool numbers in each address of the tool magazine do not overlap, preventing the tool call error.

Workflow description:



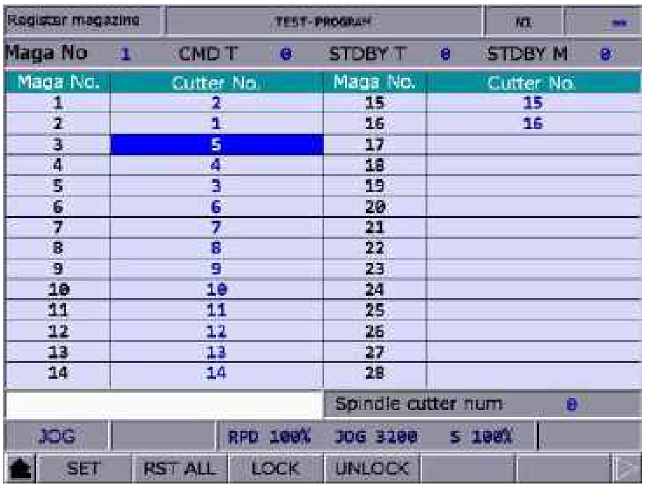
Maga No.	Cutter No.	Maga No.	Cutter No.
1	1	15	15
2	2	16	16
3	3	17	
4	4	18	
5	5	19	
6	6	20	
7	7	21	
8	8	22	
9	9	23	
10	10	24	
11	11	25	
12	12	26	
13	13	27	
14	14	28	

(1) Initial status of the tool magazine. Tool numbers are arranged in sequence in accordance with the tool pot numbers.



Maga No.	Cutter No.	Maga No.	Cutter No.
1	2	15	15
2	1	16	16
3	3	17	
4	4	18	
5	5	19	
6	6	20	
7	7	21	
8	8	22	
9	9	23	
10	10	24	
11	11	25	
12	12	26	
13	13	27	
14	14	28	

(2) If you set the tool number to 2 for tool pot 1, then the tool number of tool pot 2 becomes 1. That is, the tool numbers of tool pots 1 and 2 are exchanged.



Maga No.	Cutter No.	Maga No.	Cutter No.
1	2	15	15
2	1	16	16
3	5	17	
4	4	18	
5	3	19	
6	6	20	
7	7	21	
8	8	22	
9	9	23	
10	10	24	
11	11	25	
12	12	26	
13	13	27	
14	14	28	

(3) If you set the tool number to 5 for tool pot 3, then the tool number of tool pot 5 becomes 3. That is, the tool numbers of tool pots 3 and 5 are exchanged.

According to the preceding examples, the procedure of tool number change can avoid the possibility of mistakenly calling the incorrect tool number.

- **RST ALL** (reset all tool numbers): resets the tool numbers in the tool magazine. After resetting, the records of changes in tool numbers and tool pots are cleared, and the tool numbers are arranged in sequence according to the tool pot numbers. With this function, you can restore the data to the default setting for troubleshooting tool number misplacement or resetting the tool numbers.
- **LOCK** (lock the tool pot): locks the spare tool pots. Tool numbers of the locked pots cannot be called. If you use a command in the program to call a locked tool, the system enables the protection procedure and displays an error message to stop the execution. This function further checks the tool for program execution, which is a prevention of errors caused by incorrect tool call, such as damages to the latch of the tool pot or the interference with the tool pot due to adjacent tools of large diameter. The data fields of the locked pots are highlighted with a different color, as shown in Figure 8.3.2.

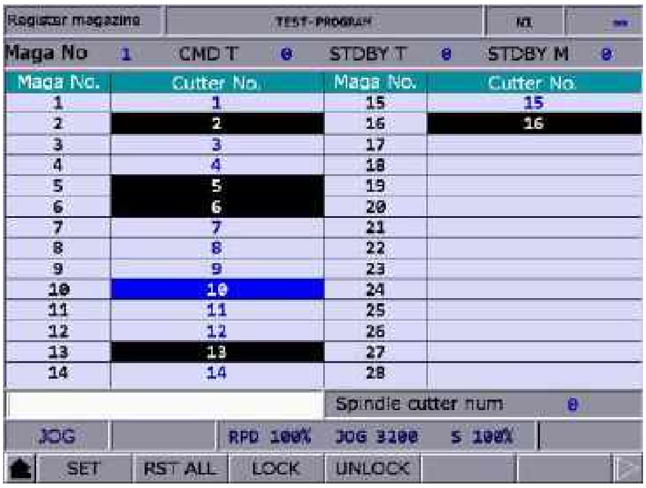


Figure 8.3.2

8

Example of locking the tool pot

Use the lock function to lock the tool pots adjacent to the tool pot carrying a tool with large diameter, which prevents damages to the mechanical parts caused by misoperation. By blocking the pots adjacent to the pot which carries a tool of large diameter, you can avoid executing inappropriate tool call programs and thus prevent the possible collision caused by placing tools into the adjacent tool pots.

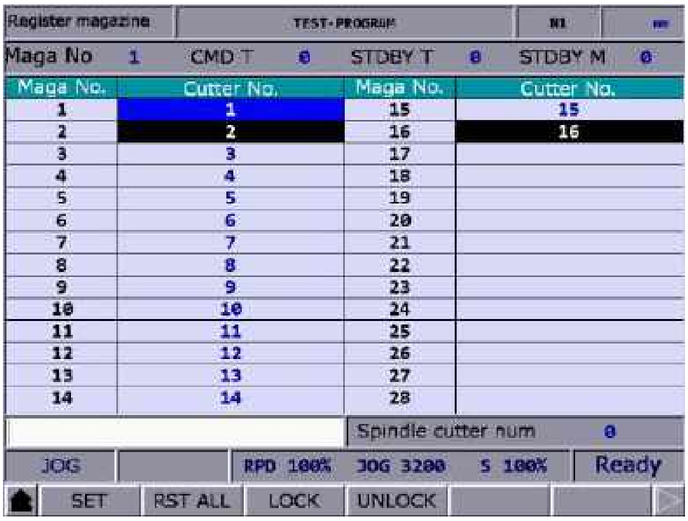


Figure 8.3.3

Assuming that T1 is a tool of large diameter and the adjacent tools are T2 and T16, you can avoid the interference with the adjacent tools by locking T2 and T16, as shown in the preceding figure.

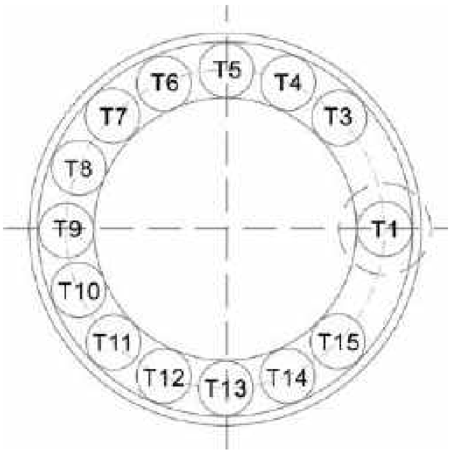


Figure 8.3.4

When T1 is a tool of large diameter, its interference with adjacent tools is as shown in Figure 8.3.4. With T2 and T16 locked, you cannot call tools in the two tool pots.

- **UNLOCK** (unlock the tool pot): unlocks the tool pots. Or you can enter the corresponding tool number of the locked pot to the data field and press $\boxed{\textbf{ENTER}}$ to unlock the tool pot.

8.3.1 Multi-magazine management

8

In response to the application needs for multiple tool magazines, you can enable this function with tool magazine parameters after obtaining the permission. You can specify the amount of tool pots and the corresponding tool numbers of each tool pot for individual tool magazines after reset according to the magazine specifications. The items [Maga No 1] and [Maga No 2] on the function bar are used to switch to the management screen of the corresponding tool magazine systems. Contact the distributors for the multi-magazine management function.

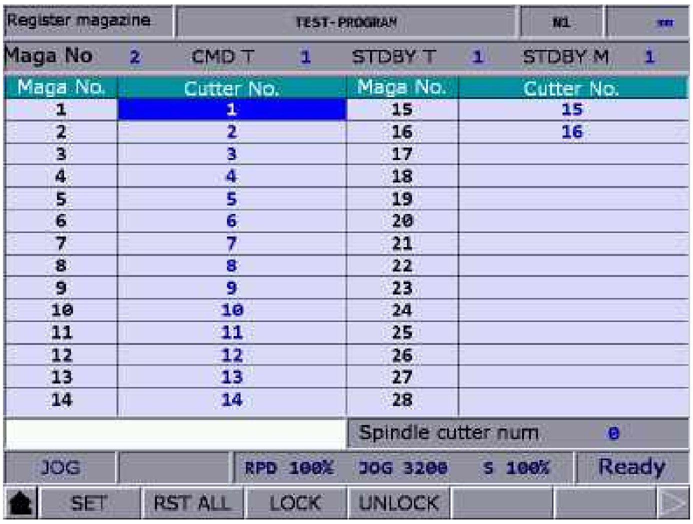


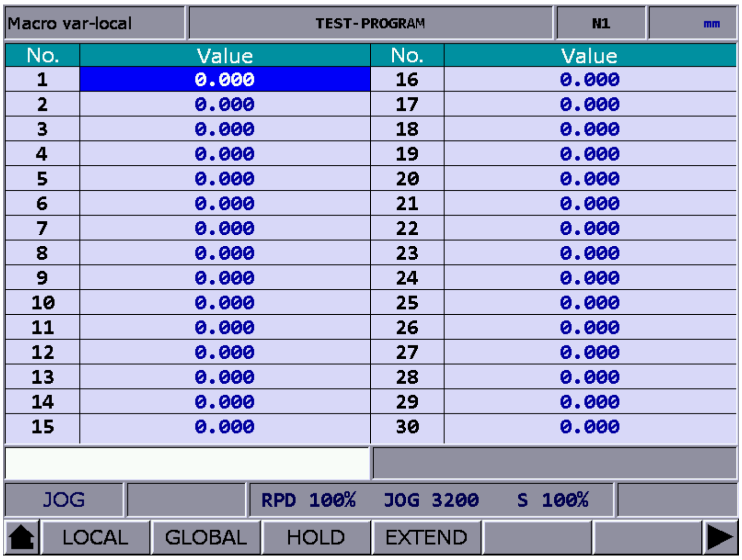
Figure 8.3.1.1

Note:

1. You can set the tool numbers only when the system is in JOG mode. Otherwise, the corresponding function bar is not displayed.
2. You have to obtain the permission in advance before setting or resetting the tool numbers.
3. Tool numbers in the same tool magazine system cannot be repeated. If you specify a number which already exists in the magazine, the system automatically changes the existing number with a non-repeating one. This ensures the tool numbers in each address of the tool magazine do not overlap, preventing the tool call error.
4. The default spindle tool number is T0. Once tool T0 is placed into the tool magazine, the tool position in the magazine is recorded as T0 and cannot be locked. That is, when the displayed tool number is “0”, the LOCK function is disabled for the corresponding tool pot, and a dialog box showing “T0 can’t be locked!” is displayed.

8.4 Macro variables (MACRO)

With commands using variables, you can modify values, perform conditional operations, and input or output MLC data during program execution. There are four types of macro variables: local, global, non-volatile, and extended variables, with the data type as double word.


Macro var-local TEST-PROGRAM N1 mm

No.	Value	No.	Value
1	0.000	16	0.000
2	0.000	17	0.000
3	0.000	18	0.000
4	0.000	19	0.000
5	0.000	20	0.000
6	0.000	21	0.000
7	0.000	22	0.000
8	0.000	23	0.000
9	0.000	24	0.000
10	0.000	25	0.000
11	0.000	26	0.000
12	0.000	27	0.000
13	0.000	28	0.000
14	0.000	29	0.000
15	0.000	30	0.000

JOG RPD 100% JOG 3200 S 100%
LOCAL GLOBAL HOLD EXTEND

Figure 8.4.1

8.4.1 Local variables (LOCAL)

The system can call up to 8 layers of macro programs and each program has an individual set of local variables. Thus, there are 8 sets of local variables and each set of local variables ranges from No. 1 to 50.

The operation steps are as follows.

(1) Press OFS to enter the OFS screen.

(2) Press **MACRO** to display the variable entry screen.

(3) Press **LOCAL** and the screen is automatically switched to display the variable table starting with No. 1.

(4) Move the cursor to a specific field.

(5) Enter the value and press ENTER to complete the setting.

8.4.2 Global variables (GLOBAL)

Global variables are shared by main programs, subprograms, and macro programs, which range from No. 51 to 250.

8.4.3 Non-volatile variables (HOLD)

Non-volatile variables are for retaining the system status when power is off, which range from No. 1601 to 1800.

8.4.4 Extension variables (EXTEND)

Up to 1000 extension variables are available in the system, which range from No. 10001 to 11000.

Note: the default EXTEND screen displays 450 extension variables (#10001 - #10450). You can set Pr.10016 EXTEND display to display 1000 extension variables (#10001 - #11000).

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Diagnosis (DGN) Group 9

The DGN group provides functions of machining information, user variables, system monitoring, and parameter importing / exporting for system optimization.

The DGN group includes a variety of functions. Machining information, user variables, system monitoring, gain adjustment, and system information are for optimizing the system. The MLC diagnosis is for monitoring the current status of the MLC devices in the system. Password setting allows you to assign different permission levels to the system functions. In addition, system parameters can be imported and exported.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.

9.1 Machining information (PROCESS)

In the PROCESS screen, you can set the number of machining targets and complete pieces as well as clear the total machining time and the number of complete pieces. Refer to the following figure.

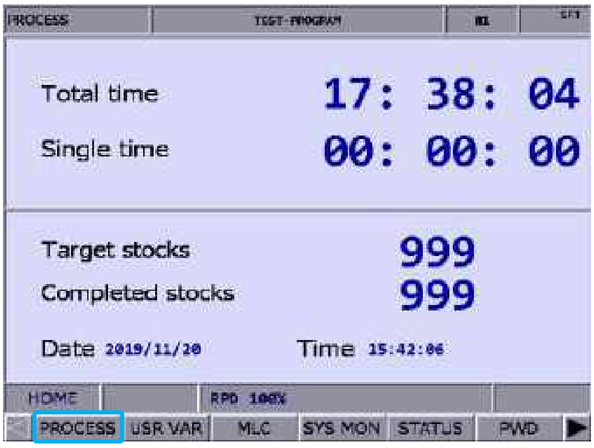

Figure 9.1.1

The operation steps for setting the number of complete and target pieces are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PROCESS** to enter the machining information screen.

(3) Press **SET NR** and a dialog box appears for you to set the numbers. Refer to the following figure.

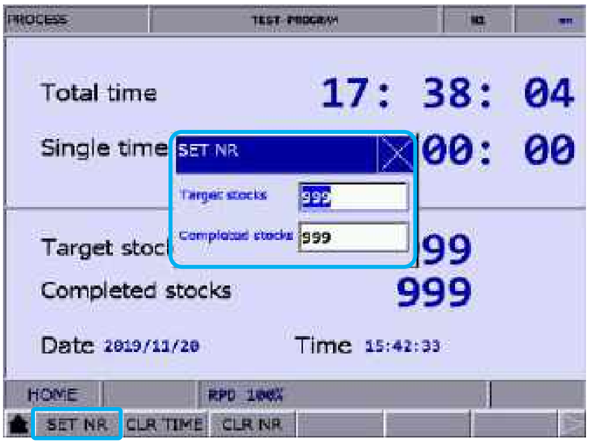

Figure 9.1.2

(4) Enter a value within the range of 0 - 9999 and press **ENTER** to complete the setting.

The operation steps for clearing the total machining time are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PROCESS** to enter the machining information screen.

(3) Press **CLR TIME** and a dialog box appears for confirmation.

(4) Enter “Y” and press **ENTER** to clear the total machining time on the screen.

The operation steps for clearing the number of complete pieces are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PROCESS** to enter the machining information screen.

(3) Press **CLR NR** and a dialog box appears for confirmation.

(4) Enter “Y” and press **ENTER** to clear the number of complete pieces on the screen.

9.2 User variable (USR VAR)

The functions of user variable include system variable (SYS VAR), user variable (USR VAR), and machine variable (M VAR). The function of system variable is used to monitor specific variables. The functions of user variable and machine variable are used to monitor or set the registers (D512 - D1023) of the system.

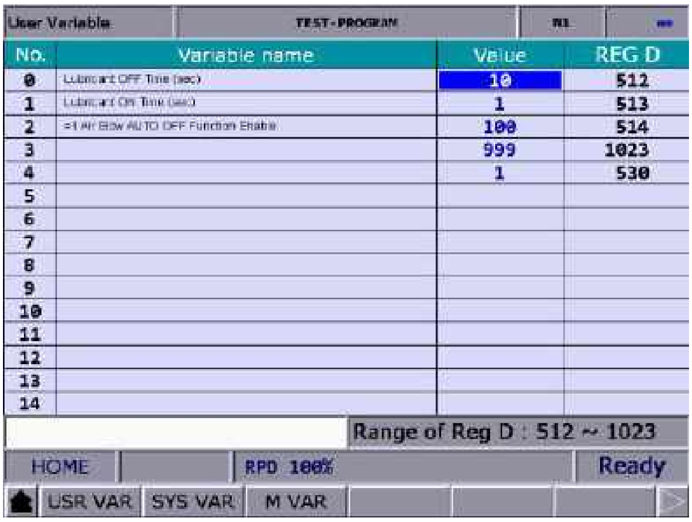

Figure 9.2.1

The operation steps for User variable and Machine variable are as follows:

(1) Press **DGN** to enter the DGN screen.

(2) Press **USR VAR** to enter the variable monitoring screen.

(3) Press **USR VAR** or **M VAR** on the function bar in the second layer to enter the corresponding setting screen.

(4) Move the cursor to a specific field.

(5) Enter the specified register number (512 - 1023) and press **ENTER** to load the data and variable name of the specific register. The variable name has to be edited with the MLC Editor software.

(6) Move the cursor to the Value field of the specific register, enter a valid value (range: 0 - 65535), and press **ENTER** to complete the setting.

(7) Press **US DEC**, **HEX**, **S DEC**, or **FLOAT** to set the data display format.

(8) Move the cursor to the data in the Value or REG D field to be cleared and press **DEL**.

9.3 MLC

In the MLC screen, you can monitor the status of all MLC devices and force switch the devices On or Off, as shown in Figure 9.3.1. MLC-related diagnostic functions include bit device status, register status, device monitoring, MLC status switching, and MLC editing. The operation steps for these functions are described in the following sections.

Figure 9.3.1

9.3.1 Bit device (BIT)

MLC programs require a number of commands to trigger the devices to On or Off. The status of these devices is shown in the MLC Bit Device screen. This function is used to monitor, search for, and force On / Off the bit type MLC devices.

The following operation steps take the M devices as an example.

(1) Press **DGN** to enter the DGN screen.

(2) Press **MLC** to display the function bar in the second layer.

(3) Press **BIT** to enter the screen which displays the status of bit devices.

(4) Press **M** to display the M device status as follows. Move the cursor to a specific field or directly search for a specific device by referring to Step (5).

Figure 9.3.1.1

(5) To search for a specific device, such as M107, enter “107” and then press **M**.

(6) To change the status of a specific device, set the system to non-AUTO mode first. Then, select the device, enter “1” or “0”, and then press **ENTER** to force the device On or Off according to the current status of the device.

9

9.3.2 Register (REG)

Most of the CNC system functions are triggered by MLC programs. MLC devices are divided into bit type and word type. The following describes the operation steps for the T registers (word type device).

(1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.

(2) Press **MLC** to display the function bar in the second layer.

(3) Press **REG** to enter the register device screen.

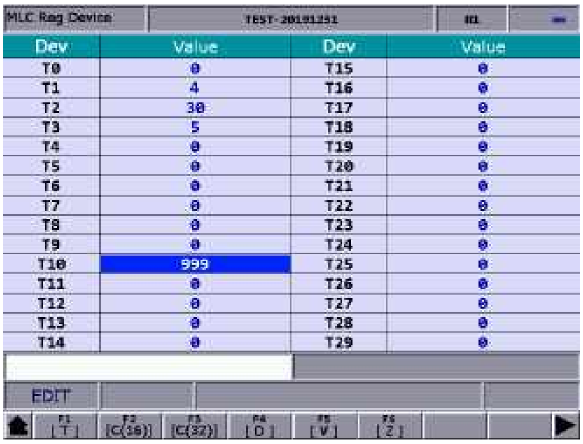

Figure 9.3.2.1

(4) Press **T** to enter the T register setting screen.

(5) Enter the device name, such as 10, and press **T** to search for the device, T10.

(6) Enter the value in the input field and press $\boxed{\textbf{ENTER}}$ to complete the setting.

(7) Go to the last page of the function bar and press **US DEC**, **HEX**, **S DEC**, or **FLOAT** to set the data display format.

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9.3.3 Device monitoring (DEV MON)

This function can be used to monitor up to 45 sets of device data. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **MLC** to display the function bar in the second layer.

(3) Press **DEV MON** to display the screen for device name entry as shown in Figure 9.3.3.1.

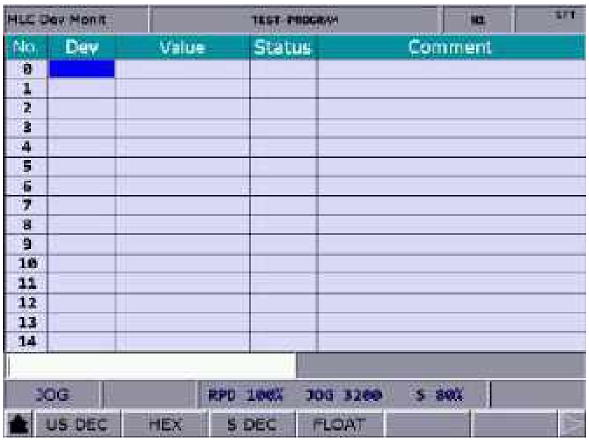

Figure 9.3.3.1

(4) Enter the name of the device to be monitored as shown in Figure 9.3.3.2. You can enter up to 45 device names.

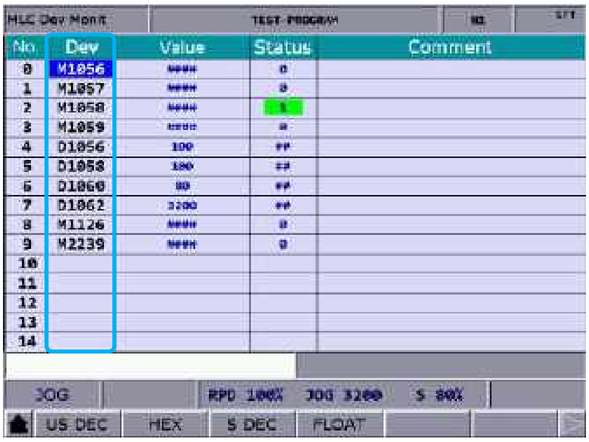

Figure 9.3.3.2

Dev (device): when the cursor is located in this field, you can enter the name of the device to be monitored.

Value: move the cursor to this field to set the data of the device.

Status: enter “0” or “1” to set the device status.

9

In addition, you can use the functions of US DEC, HEX, S DEC, and FLOAT to set the data display format according to the requirements. The data in Figure 9.3.3.3 are in hexadecimal format and the data in Figure 9.3.3.4 are in floating format.

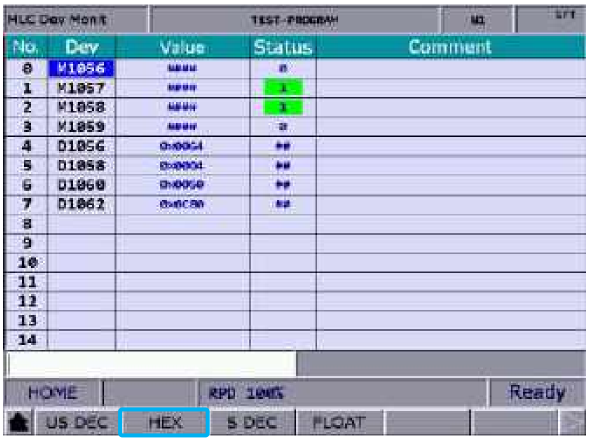

Figure 9.3.3.3

Figure 9.3.3.4

9

9.3.4 Line search (JUMP TO)

Use this function to search for a specific line of the MLC program according to the entered line number.

(1) Press DGN to enter the DGN screen.

(2) Press **MLC** to display the function bar in the second layer.

(3) Enter a specific line number of the MLC program and press **JUMP TO** to go to the target line.

9.3.5 Program editing (EDITOR)

You can directly edit the MLC programs with these editing functions on the controller interface in EDIT mode.

■ Basic MLC commands

You can use the LD, LDI, LDP, LDF, OUT, APP, —, and ︱ functions to create the corresponding commands. See Figure 9.3.5.1 for the MLC screen.

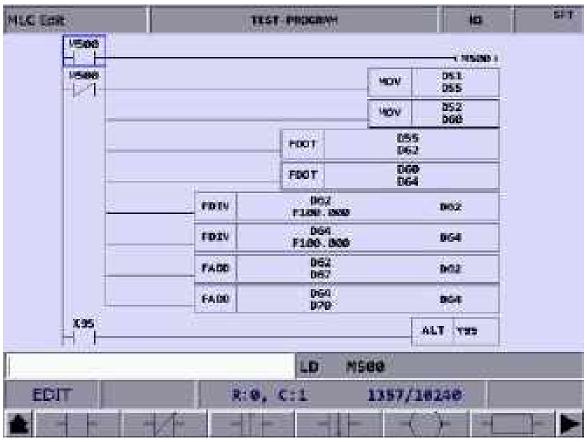

Figure 9.3.5.1

The following operation steps take the LD function for example.

(1) Press DGN to enter the DGN screen.

(2) Press **MLC** to display the function bar in the second layer.

(3) Press **EDITOR** to enter the MLC Edit screen as shown in Figure 9.3.5.1.

(4) Move the cursor to the field to be edited.

(5) Enter the device name and press **LD** to complete creating the command.

The preceding steps are also applicable in creating the LDI, LDP, LDF, OUT, APP, — and ︱ commands.

9

In addition, to specify the values for the Table command in the MLC ladder diagram, press **TABLE** to display the MLC table as follows.

No.	Value	No.	Value
0	0	15	12600
1	20		
2	32		
3	50		
4	79		
5	126		
6	200		
7	320		
8	500		
9	790		
10	1260		
11	2000		
12	3200		
13	5000		
14	7900		

Figure 9.3.5.2

- Editing (SELECT, DEL, CUT, COPY, PASTE, ADD LN, DEL LN)

  With these functions, you can delete, cut, or copy a single line of the program. Or you can use these functions with the SELECT function to delete, cut, or copy a certain section of the MLC program. After completing the editing, use the SAVE function to recompile and save the MLC program. The operation steps for editing MLC programs are as follows.

  (1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.

  (2) Press **MLC** to display the function bar in the second layer.

  (3) Press **EDITOR** to enter the MLC Edit screen as shown in Figure 9.3.5.1.

  (4) Move the cursor to the field to be edited.

  (5) Repeatedly press ▶ to display the function bar on the last page in this layer.

  (6) Press the corresponding function key for editing. For example, press **CUT** to delete a certain line of the program.

- Symbol

  Use this function to delete, copy, and paste the MLC devices. The MLC devices are represented with the symbols X, Y, M, A, T, C, D, P, and I. The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.
  (2) Press **MLC** to display the function bar in the second layer.
  (3) Press **EDITOR** to enter the MLC Edit screen as shown in Figure 9.3.5.1.
  (4) Move the cursor to the field to be edited.
  (5) Press ▶ to display the function bar on the third page.
  (6) Press **SYMBOL** to display the corresponding function bar.
  (7) Press the corresponding function key, such as **X**, to display the list of corresponding devices and use the functions of delete, copy, or paste as required.

  Note: the preceding steps are applicable to other device symbols.

- Save, import, and export MLC program

  After editing the MLC program, use the SAVE function to recompile and save the program. Then restart the system to update the MLC program. In addition, use the corresponding function keys (IMPORT / EXPORT) to import or export MLC files.

9.3.6 Status switching (SET)

The system runs the MLC program right after starting. To manually switch the execution status, use this function to stop the MLC program. This function switches the MLC program status to On or Off, which is usually used to test or check the MLC devices in the system. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **MLC** to display the function bar in the second layer.
(3) Press **SET** to switch to the screen of MLC execution status.
(4) Press **RUN** / **STP** to force switch the MLC program status.

Note: after stopping the MLC program, you can see the status of “MLC Stop” in the system status field.

In addition, you can force the MLC device On or Off using the corresponding functions.

- The operation steps for forcing the device On are as follows.
  (1) Press **DGN** to enter the DGN screen.
  (2) Press **MLC** to display the function bar in the second layer.
  (3) Press **SET** to switch to the screen of MLC execution status.
  (4) Move the cursor to a specific field.
  (5) Press **ON** to switch the device status to On.

- The operation steps for forcing the device Off are as follows.
  (1) Press **DGN** to enter the DGN screen.
  (2) Press **MLC** to display the function bar in the second layer.
  (3) Press **SET** to switch to the screen of MLC execution status.
  (4) Move the cursor to a specific field.
  (5) Press **OFF** to switch the device status to Off.

9.4 System monitoring (SYS MON)

The various calculation results of the system are displayed in categories with this function.

9.4.1 Servo monitoring (SRV MON)

The function of servo monitoring allows users to check information such as the channel port number and servo status of each axis on the system screen. As shown in Figure 9.4.1.1, both the spindle and Z axis are in the Off status and both X and Y axes are in the On status.

Figure 9.4.1.1

The operation steps are as follows.

(1) Press DGN to enter the DGN screen.

(2) Press **SYS MON** to switch to the system monitoring screen.

(3) Press **SRV MON** to display the servo monitoring screen.

9.4.2 I/O monitoring (I/O MON)

The control switches for external devices can be added to the NC series system with the I/O extension modules. You can monitor the status of the I/O extension control board connected to the system on the I/O monitoring screen. The operation steps are as follows.

(1) Press DGN to enter the DGN screen.

(2) Press **SYS MON** to switch to the system monitoring screen.

(3) Press **I/O MON** to display the status monitoring screen for the I/O extension module.

9

9.4.3 System variables (SYS VAR)

In the System Var screen, you can check the following system information.

(1) MPG pulse counter: the original MPG pulse number which is not multiplied by the magnification (D1042).

(2) Maximum axis number: the maximum number of controllable NC axes of the system.

(3) Tapping error: each time the tapping is finished, you can check the tapping result with this variable. The value of this variable is the maximum difference between the command position and feedback position during tapping.

(4) Spindle position: the offset rotation angle of the 1st spindle. If the encoder does not go through the Z phase point, the value of this variable is 0 and the rotation angle of the spindle is not updated.

(5) Spindle speed: the current speed of the 1st spindle. This is a signed value. When the value is positive, it means the spindle rotates in forward direction. When the value is negative, it means the spindle rotates in reverse direction.

(6) 2nd spindle tapping error / 2nd spindle position / 2nd spindle speed: refer to the descriptions in (3), (4), and (5).

(7) MLC scan time: the average MLC scan time.

(8) The minimum of MLC scan time.

(9) The maximum of MLC scan time.

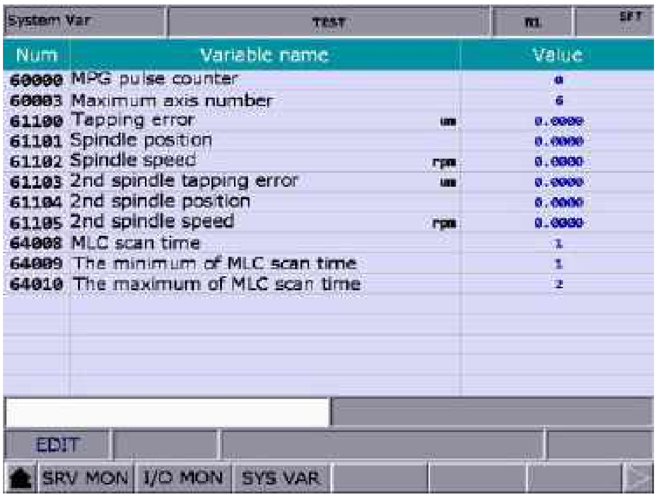

Figure 9.4.3.1

9.4.4 Variable monitoring (VAR MON)

- SYS VAR: the system variables include VS0 - VS31 and VS100 - VS131.

  The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press **SYS MON** to switch to the system monitoring screen.

  (3) Press ▶ to display the function bar on the second page.

  (4) Press **VAR MON** to display the variable monitoring screen.

  (5) Press **SYS VAR** to display the system variable screen.

  (6) Switch to the page of a specific variable.

  (7) To search for a specific system variable, directly enter the full name of the variable (such as VS15) and press **ENTER**, or simply enter the variable number and press **SYS VAR**.

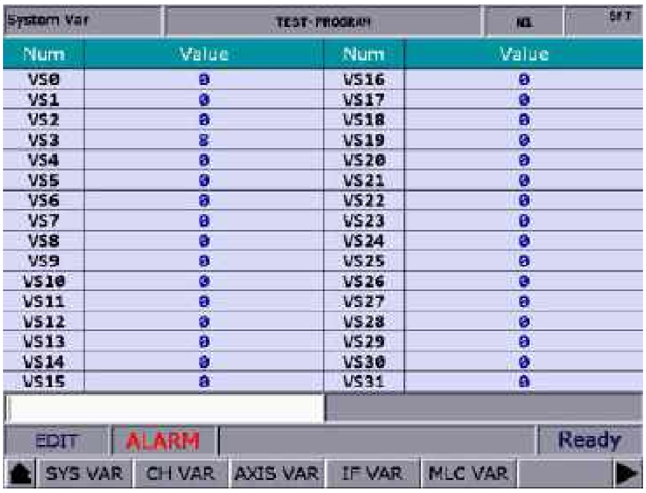

Figure 9.4.4.1

- CH VAR: the channel variables include VC0 - VC31, VC100 - VC131, and VC200 - VC231.

  The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press **SYS MON** to switch to the system monitoring screen.

  (3) Press ▶ to display the function bar on the second page.

  (4) Press **VAR MON** to display the variable monitoring screen.

  (5) Press **CH VAR** to display the channel variable screen.

  (6) Switch to the page of a specific variable.

  (7) To search for a specific channel variable, directly enter the full name of the variable and press **ENTER**, or simply enter the variable number and press **CH VAR**.

- AXIS VAR: the axis variables include VA0 - VA31, VA100 - VA131, and VA200 - VA231. The operation steps are as follows.
  (1) Press DGN to enter the DGN screen.
  (2) Press **SYS MON** to switch to the system monitoring screen.
  (3) Press ▶ to display the function bar on the second page.
  (4) Press **VAR MON** to display the variable monitoring screen.
  (5) Press **AXIS VAR** to display the axis variable screen.
  (6) Switch to the page of a specific variable.
  (7) To search for a specific axis variable, directly enter the full name of the variable and press ENTER, or simply enter the variable number and press **AXIS VAR**.

- IF VAR: the interface variables include VH0 - VH31, VH200 - VH231, VH400 - VH431, and VH800 - VH863. The operation steps are as follows.
  (1) Press DGN to enter the DGN screen.
  (2) Press **SYS MON** to switch to the system monitoring screen.
  (3) Press ▶ to display the function bar on the second page.
  (4) Press **VAR MON** to display the variable monitoring screen.
  (5) Press **IF VAR** to display the interface variable screen.
  (6) Switch to the page of a specific variable.
  (7) To search for a specific interface variable, directly enter the full name of the variable and press ENTER, or simply enter the variable number and press **IF VAR**.

- MLC VAR: the MLC variables include VM0 - VM49. The operation steps are as follows.
  (1) Press DGN to enter the DGN screen.
  (2) Press **SYS MON** to switch to the system monitoring screen.
  (3) Press ▶ to display the function bar on the second page.
  (4) Press **VAR MON** to display the variable monitoring screen.
  (5) Press **MLC VAR** to display the MLC variable screen.
  (6) Switch to the page of a specific variable.
  (7) To search for a specific MLC variable, directly enter the full name of the variable and press ENTER, or simply enter the variable number and press **MLC VAR**.

9.5 Password setting (PWD)

To effectively manage the system operation permissions, use this function to assign different permission levels to the functions of system (system maintenance), machine (mechanical devices), and user (operation). This prevents users without permissions from changing the system settings and thus affecting the system operation.

9.5.1 System permissions (S SCP)

This function includes the options of denying the permission (LOCK), granting the permission (UNLOCK), and checking the system (SYS CHECK). The 4-digit password may contain four numbers, four letters, or a mix of numbers and letters (no symbols).

The operation steps for granting and denying the system permission are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **S SCP** to display the corresponding function bar.
(4) When the system permission is granted, press **LOCK** to immediately deny the permission to all system-related functions.
(5) When the system permission is denied, press **UNLOCK**, and a dialog box appears for you to enter the valid permission password.
(6) After entering the password, press **ENTER** to grant the permission.

The operation steps for checking the system are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **S SCP** to display the corresponding function bar.
(4) When the system permission is granted, press **SYS CHECK** to check the status of the function items. If the check box for a specific item is selected, it means some parameter settings of the specific item are incorrect.

9.5.2 Machine permissions (M SCP)

This function includes the options of changing the password (PWG CHG), granting the permission (LOCK), denying the permission (UNLOCK), resetting the password (RST U1 & RST U2), enabling the function (FUN ENA), and resetting (RESET). The 4-digit password may contain four numbers, four letters, or a mix of numbers and letters (no symbols).

The operation steps for changing the password are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PWD** to display the function bar of password setting.

(3) Press **M SCP** to switch to the function bar of machine permission.

(4) Press **PWD CHG** and a dialog box appears as shown in Figure 9.5.2.1. Enter the old password and the new password. Then, enter the new password again for confirmation.

(5) Press **ENTER** to complete changing the password.

Figure 9.5.2.1

The operation steps for granting the machine permission are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PWD** to display the function bar of password setting.

(3) Press **M SCP** to switch to the function bar of machine permission.

(4) When the machine permission is denied, press **UNLOCK** and a dialog box appears for you to enter the valid password.

(5) Enter the valid password and press **ENTER** to grant the machine permission.

Note: the default password for machine permission is 0000 which is not assigned to any permission level, meaning that users of any level can access the machine-related functions. You need to change the default password of 0000 to enable the machine permission, and only users granted with the permission can access the machine-related functions.

The operation steps for denying the machine permission are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **M SCP** to switch to the function bar of machine permission.
(4) When the machine permission is granted, press **LOCK** to deny the permission to all machine-related functions.

The RST U1 / RST U2 (password resetting) function allows the equipment supplier to reset the user's password. If you forget the password, contact the equipment supplier and request a reset for the password. This function is available only when you are not using the default password. The operation steps are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **M SCP** to switch to the function bar of machine permission.
(4) Press **RST U1** or **RST U2** to reset the user's password.

The FUN ENA (function enabling) function is designed for the equipment supplier to enable or disable certain function groups. Once the check box for a specific function group is cleared, that function group is not available after the system is restarted.

The operation steps are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **M SCP** to switch to the function bar of machine permission.
(4) Press **FUN ENA** to enter the setting screen to enable or disable the function groups.
(5) Move the cursor to the check box to be cleared, and then press ENTER to cancel the selection. Then press **OK** and restart the system for the changes to take effect.
(6) Continued from Step (5), to keep the original settings, press **CANCEL** to exit the screen and discard the previous settings.
(7) To restore to the system default setting, press **DEFAULT**.

Figure 9.5.2.2

The RESET (system reset) function allows users to restore the system with the system backup file when the system is in error or the system data is corrupted. In the Default screen, if the check box for a specific item is selected, it means the data of this specific item is corrupted. You can use this function to restore the data of the specific item. This function is available only with the proper permission level.

The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PWD** to display the function bar of password setting.

(3) Press **M SCP** to switch to the function bar of machine permission.

(4) Press **RESET** to enter the corresponding screen and move the cursor to a specific item. Press **ENTER** to select the item to be restored.

(5) To clear the check box, move the cursor to the selected item and press **ENTER**.

(6) Press **OK** to restore the system.

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9.5.3 User permissions (U1 SCP & U2 SCP)

This function is divided into U1 SCP and U2 SCP, including the options of changing the password (PWD CHG), denying the permission (LOCK), and granting the permission (UNLOCK). The 4-digit password may contain four numbers, four letter, or a mix of numbers and letters (no symbols). The following takes U1 SCP for example.

The operation steps for changing the user password are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) When the permission of User 1 (U1 SCP) is denied, press **U1 SCP** and a dialog box appears for you to enter the permission password.
(4) Enter the correct permission password and press **ENTER**, and then the permission of User 1 is granted and the corresponding function bar is displayed.
(5) Press **PWD CHG** and a dialog box appears. Enter the old password and the new password. Then, enter the new password again for confirmation.
(6) Press **ENTER** to complete changing the password.

The operation steps for granting the user permission are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) When the permission of User 1 (U1 SCP) is denied, press **U1 SCP** and a dialog box appears for you to enter the permission password.
(4) Enter the correct permission password and press **ENTER**, and then the permission of User 1 is granted and the corresponding function bar is displayed.

The operation steps for denying the user permission are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) When the permission of User 1 (U1 SCP) is granted, press **U1 SCP**, and a dialog box appears for you to enter the permission password.
(4) Press **LOCK** to deny the permission of User 1.

Note: like the function of machine permission, the default password for user permission is 0000 which is not assigned to any permission level. You need to change the default password of 0000 to enable the user permission.

9.5.4 Usage duration (EXPIRE)

For specific situations, you can set the usage duration for the controller with the permission to this function granted. After the usage duration is set, the available time (hours or days) is automatically counted. When the setting of usage duration is effective, you can disable or reset the setting only with the proper permission. When the setting of usage duration is not set or disabled, no expiration date is displayed in the Deadline field on the screen, as shown in Figure 9.5.4.1. Once you set the usage duration and do not disable the setting, the expiration date is displayed in the Deadline field, as shown in Figure 9.5.4.2.

Figure 9.5.4.1

Figure 9.5.4.2

You can see the controller's operation expiration date on this screen. When the usage duration has expired, the NC system will be locked, meaning that any execution of G-code program (in both AUTO and MDI modes) is prohibited. The execution will not resume until the setting of usage duration is disabled or extended. If the usage duration has expired, contact the distributor or equipment supplier for entering the valid password to disable the setting.

You can use the SETTING function only when the usage duration is not set.

The operation steps for setting the usage duration are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **PWD** to display the function bar of password setting.

(3) Press **EXPIRE** to display the expiration information.

(4) Press **SETTING** to display the setting screen of usage duration.

(5) Enter a valid password to set the usage duration for the controller.

The operation steps for disabling the setting of usage duration are as follows (contact the distributor or equipment supplier for services).

(1) Press **DGN** to enter the DGN screen.

(2) Press **PWD** to display the function bar of password setting.

(3) Press **EXPIRE** to display the expiration information.

(4) Press **RELEASE** and a dialog box appears as shown in Figure 9.5.4.3.

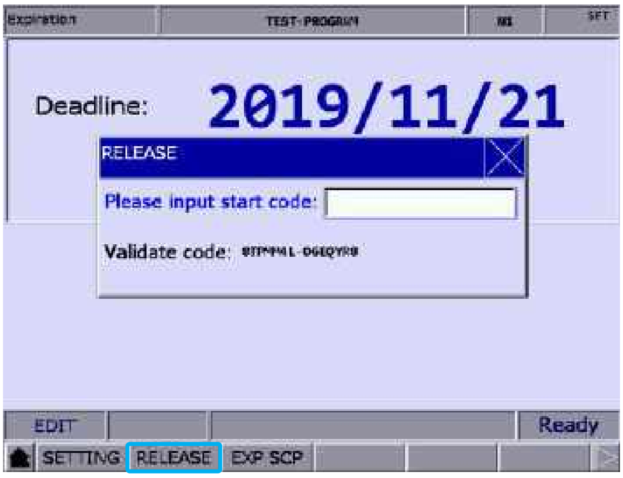

Figure 9.5.4.3

(5) Enter the activation code, press **ENTER**, and cycle power to the system to disable the setting of usage duration.

Note: after the setting of usage duration is disabled, no expiration date is displayed in the Deadline field as shown in Figure 9.5.4.1, which means no usage duration is set for the system.

You can grant or deny the permission to the EXP SCP function only with the proper permission level. When the permission to the EXP SCP function is denied, you need to enter the correct permission password to grant the permission. When the permission is granted, you can use all the functions under EXP SCP. This function includes the options of changing the password (PWD CHG), denying the permission (LOCK), and granting the permission (UNLOCK). The 4-digit password may contain four numbers, four letters, or a mix of numbers and letters (no symbols). The operation steps are as follows.

The operation steps for changing the password for EXP SCP are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **EXPIRE** to display the expiration information.
(4) When the permission is denied, press **EXP SCP** and a dialog box appears for you to enter the password for EXP SCP.
(5) Enter the valid password, press **ENTER**, and the permission is granted and the corresponding function bar is displayed.
(6) Press **PWD CHG** and a dialog box appears. Enter the old password and the new password. Then, enter the new password again for confirmation.
(7) Press **ENTER** to complete changing the password.

The operation steps for granting the permission to the EXP SCP function are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **EXPIRE** to display the expiration information.
(4) When the permission is denied, press **EXP SCP** and a dialog box appears for you to enter the password for EXP SCP.
(5) Enter the valid password, press **ENTER**, and the permission is granted and the corresponding function bar is displayed.

The operation steps for denying the permission to the EXP SCP function are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **PWD** to display the function bar of password setting.
(3) Press **EXPIRE** to display the expiration information.
(4) When the permission is granted, press **EXP SCP** to display the corresponding function bar.
(5) Press **LOCK** to deny the permission.

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9.6 System information (STATUS)

This function provides information about the firmware and hardware versions of the system. You can maintain and optimize the system according to the version information displayed on the screen. This function includes the options of system status (SYSTEM), firmware serial number (FW SN), hardware serial number (HW SN), and equipment information (M INFO).

The operation steps for displaying the system status are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **STATUS** to enter the system information screen.
(3) Press **SYSTEM** to display the system status screen.

The operation steps for displaying the firmware serial number are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **STATUS** to enter the system information screen.
(3) Press **FW SN** to display the firmware versions of the system as shown in the following figure.

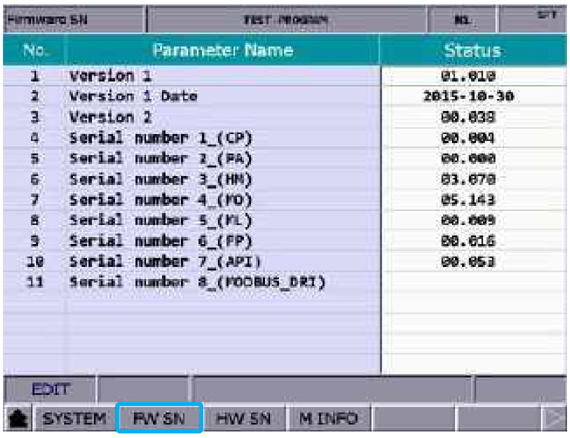


Figure 9.6.1

The operation steps for displaying the hardware serial number are as follows.

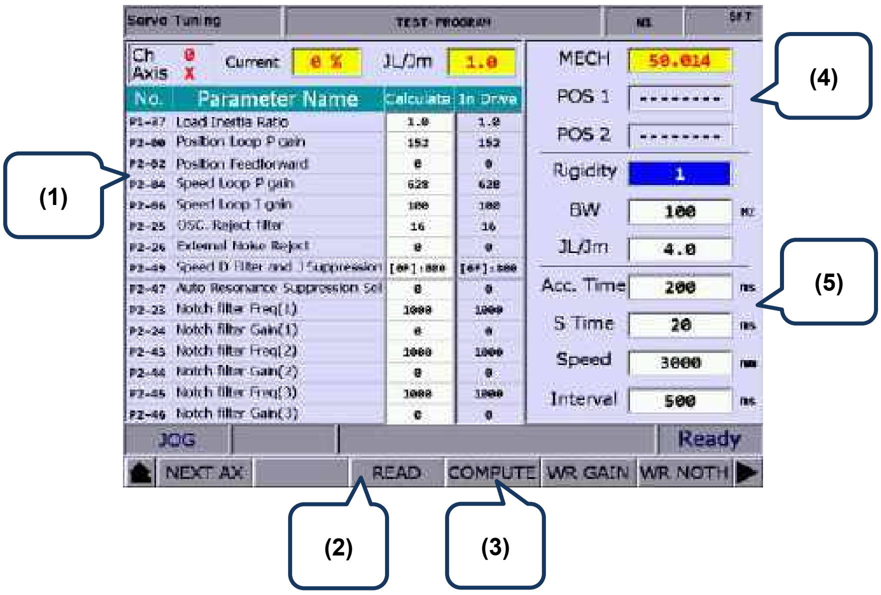
(1) Press DGN to enter the DGN screen.
(2) Press **STATUS** to enter the system information screen.
(3) Press **HW SN** to display the hardware version.

The operation steps for displaying the equipment information are as follows.

(1) Press DGN to enter the DGN screen.
(2) Press **STATUS** to enter the system information screen.
(3) Press **M INFO** to display the equipment information screen.
(4) In the screen of equipment information, you can enter the descriptions or notes for a specific equipment using numbers or letters; or press **DEL** to delete the information in the field where the cursor is located.

9.7 Gain tuning (TUNING)

The auto tuning function enables the NC system and servo drive to perform optimized motion control for meeting different machine characteristics. With this function, the NC system reads the servo parameters and then adjusts the gain values. The results of gain tuning are returned to the servo drive, so the control parameters of the controller and drive are consistent. This facilitates the gain tuning procedure and maintains high-precision control of the system. The Servo Tuning screen is as follows and the following are the operation steps for each subordinate function.



(1) Servo parameter: number and name of the servo parameter

(2) Results after gain tuning: displays the calculation results of auto tuning

(3) System settings: displays the current servo settings

(4) Position setting: Position 1 / Position 2

(5) Tuning conditions

- **NEXT AX** (next axis): switches to another axis for gain tuning. You need to perform auto tuning for each axis separately, so after completing setting one axis, use this function to switch to another axis and continue auto tuning.

  The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press ▶ to display the function bar on the next page.

  (3) Press **TUNING** to enter the auto tuning setting screen.

  (4) To set the gain parameters for another axis, press **NEXT AX** to switch to the specific axis.

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- **READ** (read servo parameters): accesses the parameter values from the servo and writes the values in the Calculate fields.

  The operation steps are as follows.

  (1) Press DGN to enter the DGN screen.

  (2) Press ▶ to display the function bar on the next page.

  (3) Press **TUNING** to enter the auto tuning setting screen.

  (4) Press **READ** to read the servo parameters back to the controller.

- **RUN / STOP, JOG←, JOG→, POS1, POS2**: operating functions for auto tuning. Use these functions to enable auto tuning, set the positioning point, and move the axis.

  The operation steps for the continuous operation of a single axis are as follows.

  (1) Press DGN to enter the DGN screen.

  (2) Press ▶ to display the function bar on the next page.

  (3) Press **TUNING** to enter the auto tuning setting screen.

  (4) Press ▶ to display the function bar on the next page.

  (5) Press **JOG←** to move the axis to the left positioning point.

  (6) Press **POS1** to set the left positioning point.

  (7) Press **JOG→** to move the axis to the right positioning point.

  (8) Press **POS2** to set the right positioning point. The movement is now limited within Position 1 and Position 2.

  (9) Press **RUN** to start auto tuning.

  (10) During auto tuning, press **STOP** to compete tuning. Then, the system automatically calculates and generates the optimal gain values.

- **COMPUTE** (gain calculation): if you changed the parameter values of low-frequency rigidity, bandwidth, or inertia to accommodate to the machine characteristics, use this function to calculate and generate the results of gain tuning. The operation steps for calculating the gain value of a single axis are as follows.

  (1) Press DGN to enter the DGN screen.

  (2) Press ▶ to display the function bar on the next page.

  (3) Press **TUNING** to enter the auto tuning setting screen.

  (4) Move the cursor to the fields of Rigidity, BW, and JL/Jm to set the parameters.

  (5) Press **COMPUTE** to calculate the tuning results.

- **WR GAIN** & **WR Notch** (write the gain and resonance values): the system automatically calculates the gain values after auto tuning is finished and the motion stops. If the calculated gain values are as required, you can use the WR GAIN and WR Notch functions to write the new parameter values to the servo. The operation steps are as follows.
  (1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.
  (2) Press ▶ to display the function bar on the next page.
  (3) Press **TUNING** to enter the auto tuning setting screen.
  (4) After tuning, the results are automatically calculated.
  (5) To write the corresponding gain parameters to the servo, press **WR GAIN**. To write the parameter values for resonance suppression to the servo, press **WR Notch**.

  Note:
  1. You have to write the results of auto tuning to the servo for the values to take effect.
  2. After you use the WR GAIN and WR Notch functions to write the gain and resonance values, the servo parameters are updated and the previous settings cannot be restored. Thus, double check before using these functions.

- **TAP RIV** (calibration for tapping): in tapping applications, calibrate the machine and servo with this function.
  The operation steps for **TAP SET(1)** are as follows. (This function is available when you are using a Delta servo product to drive the spindle.)
  (1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.
  (2) Press ▶ to display the function bar on the next page.
  (3) Press **TUNING** to enter the auto tuning setting screen.
  (4) Complete tuning the servo axes (X, Y, and Z) and the spindle.
  (5) Repeatedly press ▶ to switch to the function bar on the last page.
  (6) Press **TAP RIV** to switch to the corresponding screen.
  (7) Press **TAP SET(1)** and a dialog box appears for confirmation. Enter “Y” and press $\boxed{\textbf{ENTER}}$ to complete calibrating the machine for tapping applications.

  The operation steps for **TAP SET(2)** are as follows. (This function is available when you are using Delta’s AC inverter or a 3rd party servo product to drive the spindle.)
  (1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.
  (2) Press ▶ to display the function bar on the next page.
  (3) Press **TUNING** to enter the auto tuning setting screen.
  (4) Complete tuning the servo axes (X, Y, and Z) and the spindle.
  (5) Repeatedly press ▶ to switch to the function bar on the last page.
  (6) Press **TAP RIV** to switch to the corresponding screen.
  (7) Press **TAP SET(2)** and a dialog box appears for confirmation. Enter “Y”, press $\boxed{\textbf{ENTER}}$, and a dialog box appears for you to enter the spindle control gain. Enter the correct value and then press $\boxed{\textbf{ENTER}}$, and the system adjusts the tapping settings for the machine according to the set value.

- **SERVO** (servo parameters): for displaying and setting servo parameters in the Servo Tuning screen.

  The operation steps are as follows.

  (1) Press $\boxed{\textbf{DGN}}$ to enter the DGN screen.

  (2) Press ▶ to display the function bar on the next page.

  (3) Press **TUNING** to enter the auto tuning setting screen.

  (4) Repeatedly press ▶ to switch to the function bar on the last page.

  (5) Press **SERVO** to display the servo parameter screen.

  (6) Move the cursor to the field of the parameter to be edited, enter the value, and press $\boxed{\textbf{ENTER}}$ to complete the setting.

9.8 Import data (IMPORT)

You can use this function to import the backup parameters to the NC system with the permission to this function granted. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press ▶ to display the function bar on the next page.

(3) Press **IMPORT** to display the file manager (FILE) window as shown in Figure 9.8.1. Select the directory to import the file, press **ENTER**, and the system accesses the files in the folder.

Figure 9.8.1

(4) In the screen of the parameters, move the cursor to the system parameter to be imported. Then, press **ENTER** to select or clear the check boxes.

(5) To select all the check boxes, press **SEL ALL**. To clear all the selected check boxes, press **CLR ALL**.

Figure 9.8.2

(6) Press **IMPORT** and a dialog box appears for confirmation. Enter "Y" and press **ENTER** to import the data in the file to the system. Then, a progress bar of the importing process is displayed. Cycle power to the system after the importing is complete.

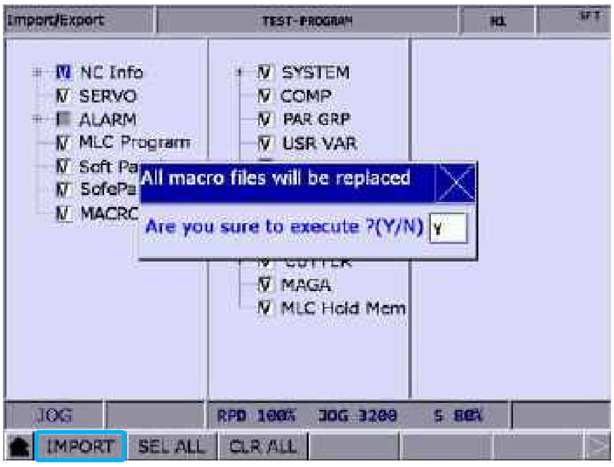

Figure 9.8.3

9.9 Export data (EXPORT)

Use this function to back up the parameter data of the system. The exported files include three types: parameter files, MLC, and software panel. You have to access the permission to this function for operation.

Type	Filename	Description
Parameter files	PAR.ncp	NC information, servo parameters, and alarms
MLC	MLC.gmc	MLC programs
MLC	MLC.lad	Image codes for MLC Ladder
MLC	MLC.lcm	Notes for MLC Ladder
Software panel	HMI.cin	Screen information and element properties for software panel
Software panel	HMI.img	Graphic files for software panel
Software panel	HMI.sci	Project files for software panel

The operation steps for exporting parameters are as follows:

(1) Press **DGN** to enter the DGN screen.

(2) Press ▶ to display the function bar on the next page.

(3) Press **EXPORT** to enter the parameter export screen.

(4) In the screen of the parameters, move the cursor to the system parameter to be exported. Press **ENTER** to select or clear the check boxes. To select all the check boxes, press **SEL ALL**. To clear all the selected check boxes, press **CLR ALL.**

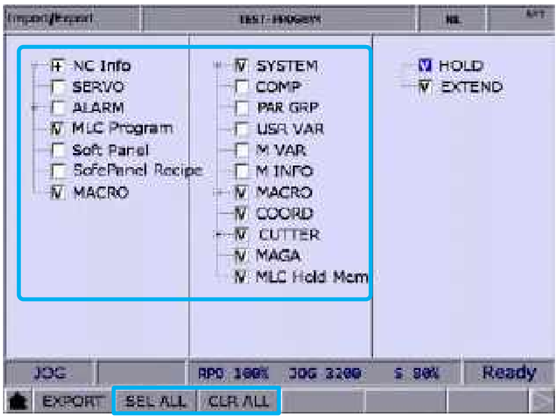

Figure 9.9.1

(5) Press **EXPORT** and the file manage (FILE) window appears as shown in Figure 9.9.2. Select the directory to save the exported files, or directly enter the folder name and press **ENTER** to save the exported files to the specified folder.

Figure 9.9.2

(6) Then, the screen displays a progress bar showing the exporting process until the exporting is finished.

(7) If you want to save the exported file to a new folder, name the folder, then press **FOLDER** to save the exported file in the folder, as shown in Figure 9.9.2.

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(8) If you save the exported file to a folder where an exported file already exists, a confirmation window appears as shown in Figure 9.9.3. Enter “Y” and press **ENTER** to replace the existing file with the newly exported file.

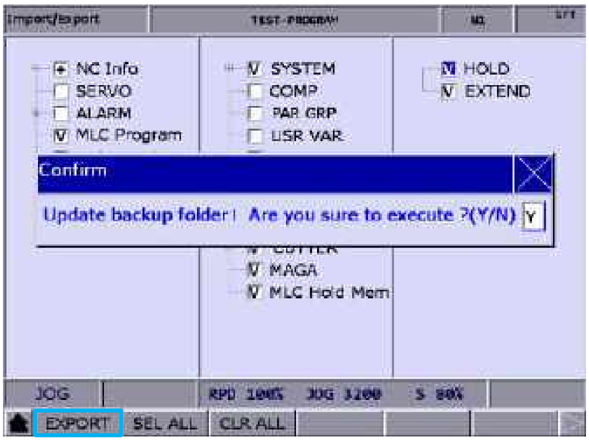

Figure 9.9.3

9.10 Multi-language display (TEXT WR)

The default display languages for the function group screens and corresponding function bars are Traditional Chinese, Simplified Chinese, and English. If there is a need for other languages, use this function to switch the interface to other languages. Contact the distributors or equipment suppliers for related information.

9.11 LOGO (LOGO WR)

Use this function to set the startup screen of the NC system with user-defined pictures for displaying the trademark or for other purposes. You can use this function only when the permission to this function is granted. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Repeatedly press ▶ to display the function bar on the last page.

(3) Ensure the correct startup screen file (SYSLOGO.bin) is in the USB disk and insert the USB disk to the controller.

(4) Press **LOGO WR** and a dialog box appears for confirmation.

(5) Enter “Y”, press **OK**, and the system automatically reads and loads the startup screen file from the USB disk.

(6) After the file is uploaded to the system, restart the system to display the updated startup screen.

Alarm (ALM) Group 10

The ALM group screen displays information about the alarms issued by the system in real time.

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When an alarm occurs due to execution error or incorrect command format, the Alarm screen is automatically displayed. This function group screen shows information about the alarms issued by the system in real time, so you can troubleshoot the errors according to the displayed alarm information. In addition to displaying the current alarms, the ALM group provides the error log function.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.

10.1 Current alarms (ALARM)

When an alarm occurs, troubleshoot the issue first, and then press **RESET** to clear the alarm and restore the system to the initial state. The alarm display screen is as follows and the sections with indicators show information about the alarms.

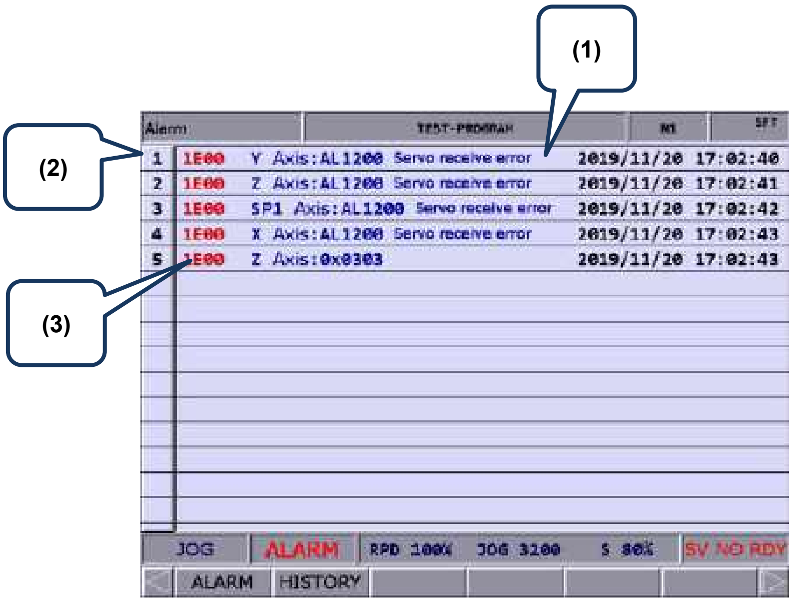

Figure 10.1.1

(1) Alarm message
(2) Sequence number of the alarm occurred
(3) Alarm code

The operation steps for displaying and clearing the current alarm message(s) are as follows.

(1) Press **ALM** to enter the ALM screen.
(2) Press **ALARM** to display the current alarm(s).
(3) Press **RESET** to clear the alarm message(s) shown on the screen.

10.2 Alarm history (HISTORY)

This function records all the issued alarm messages and history information. In the History screen, you can access information of all the alarms occurred during system execution. In addition, you can troubleshoot and analyze the errors according to the occurrence time and types of alarms. The alarm history records the occurrence time and names of the alarms.
Up to 512 sets of alarm data can be recorded. Besides, you can delete all the alarms with the CLR ALL (clear all data) function.

Figure 10.2.1

The operation steps for clearing all the alarms are as follows.

(1) Press **ALM** to enter the ALM screen.

(2) Press **HISTORY** to display the screen of alarm history log.

(3) Press **CLR ALL** and a confirmation window appears on the screen.

(4) Enter “Y” in the confirmation window and then press **ENTER** to clear all the alarms.

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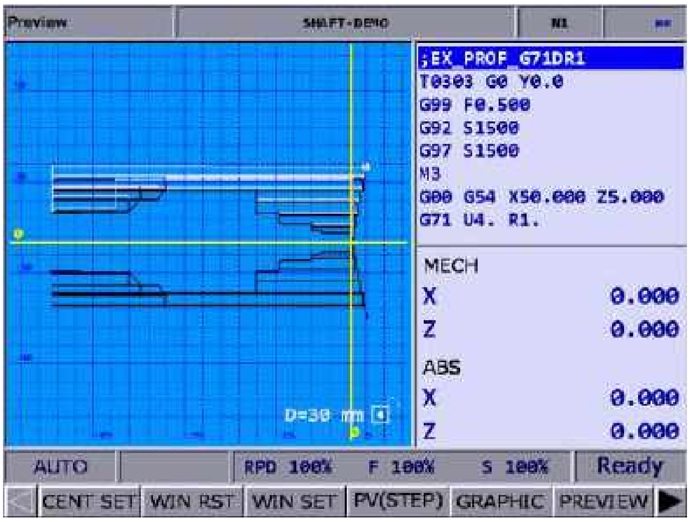
Graph (GRA) Group 11

The GRA group displays the real-time motion trajectory when the program is executing or checks the machining program when the program is not executing.

The GRA group provides two functions, trajectory display and program simulation.

Trajectory display: displays the real-time motion trajectory during machining.

Program simulation: checks the accuracy of the program format and machining path before machining.



Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.

11.1 Trajectory display

When a machining program is executed, switch the system to GRA mode, and the system automatically draws the motion trajectory of the current program on the screen, through which you can check if the actual machining path is correct.

Function descriptions of the keys are as follows.

(1) **GRA**: press this key to enter the Preview screen.

(2) **CENT SET**: displays the current position of the tool in the center of the display area.

(3) **WIN RST**: scales the graphic to a moderate size and centers it in the screen.

(4) **WIN SET**: press **UP**, **DOWN**, **LEFT**, **RIGHT**, **ZM IN**, and **ZM OUT** under the WIN SET function to adjust the displayed path graphic.

(5) **CLEAR**: clears the content in the display area.

11.2 Program simulation

This function checks the program format and draws the complete path of the G-code program before the machining starts. This function includes the options of PV(STEP), GRAPHIC, and PREVIEW.

Function descriptions of the keys are as follows.

(1) $\boxed{\textbf{GRA}}$: press this key to enter the Preview screen.

(2) **CENT SET**: displays the current position of the tool in the center of the display area.

(3) **WIN RST**: scales the graphic to a moderate size and centers it in the screen.

(4) **WIN SET**: press **UP**, **DOWN**, **LEFT**, **RIGHT**, **ZM IN**, and **ZM OUT** under the WIN SET function to adjust the displayed path graphic.

(5) **PV(STEP)**: press this key to draw the path of a single block.

(6) **GRAPHIC**: checks the program format without referring to the software limits. This function draws the complete path of the program.

(7) **PREVIEW**: checks the program format by referring to the software limits. The settings of the coordinate system and tool compensation should match the actual application so the complete path can be correctly drawn.

(8) **CLEAR**: clears the content in the display area.

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Pay attention to the following when using the functions of GRA:

1. When you enable the function of program simulation, the system does not actually perform machining.
2. Switching the system mode during program simulation will force disable the simulation.
3. If the program simulation is canceled while operating, the simulation will start from the initial block when you execute this function again.
4. Graphics drawn by the function of GRAPHIC or PREVIEW may exceed the display area because of the setting values of the workpiece coordinate. If so, press **GRAPHIC** or **PREVIEW** again, and the system automatically fits and centers the graphic in the display area.
5. The function of program simulation in the lathe system only displays graphics from the view of the X-Z plane.
6. Set the default screen of graphic display with the graphic parameter Pr.14003.

Parameter (PAR) Group 12

This chapter introduces functions and settings for all of the parameters.

Parameters in the PAR group can be divided into machining parameters, operation parameters, tool magazine parameters, spindle parameters, machine parameters, homing parameters, Ethernet settings, compensation parameters, system parameters, MLC settings, graph parameters, servo parameters, channel settings, RIO settings, and parameter group.

The steps to change the parameters are as follows.

(1) Press **PAR** to enter the PAR screen.

(2) Press F1 - F6 (F8) to enter the corresponding parameter setting screen.

(3) Press ↑ and ↓ to move the cursor to the specified field, and enter an appropriate value by referring to the range and unit displayed beside the field on the right.

(4) Press **ENTER** to complete the setting.

The timing for parameters to take effect is divided into three types according to their properties: after cycling power to the servo drive (S), after cycling power to the system (P), or after pressing **RESET** (R). After changing the parameters, you can check the (P), (R), and (S) in red in the upper right corner of the screen to do the corresponding operation.

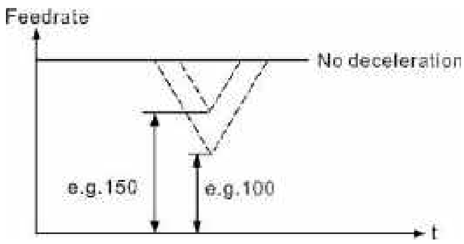
Note:

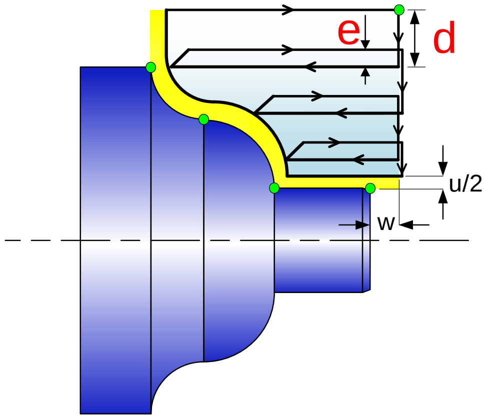
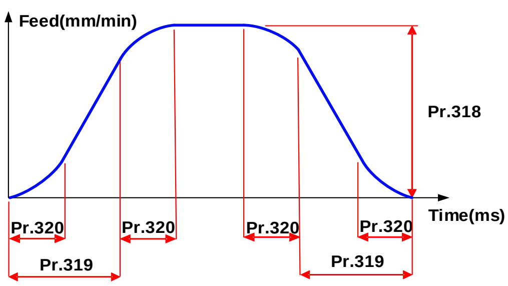
1. Bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.
2. In the PAR screen, enter **"S + parameter number"** and you are directed to the specified parameter immediately.
3. In this document, 【L】 indicates the parameters for the lathe system, 【M】 indicates the parameters for the milling system, and parameters without 【L】 or 【M】 marking are shared by both systems.

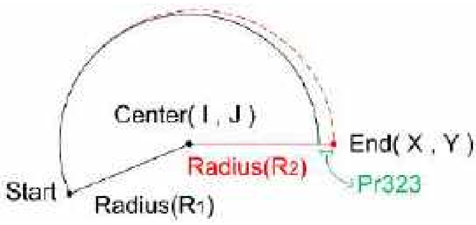
12.1 Machining parameter (PROCESS)

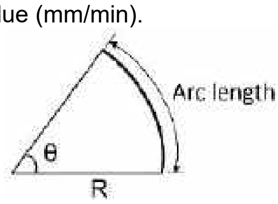
The PROCESS group includes most of the motion control parameters used during machining, which determine most of the machining results, such as machining time duration and surface finish of the workpiece.

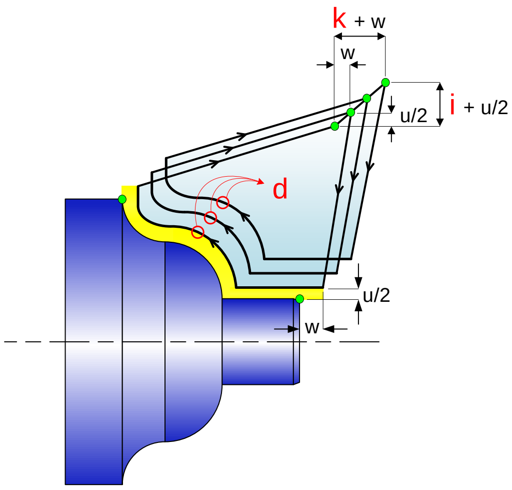
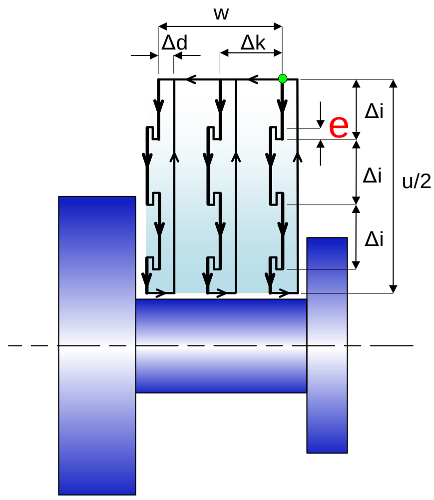
12.1.1 Machining parameter descriptions

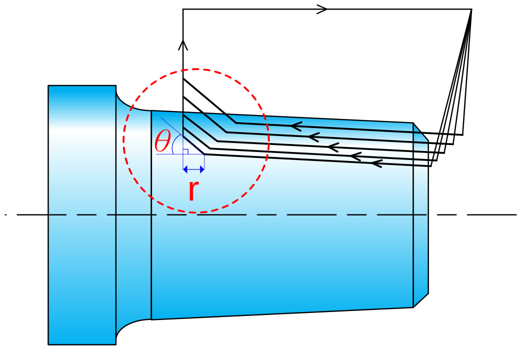
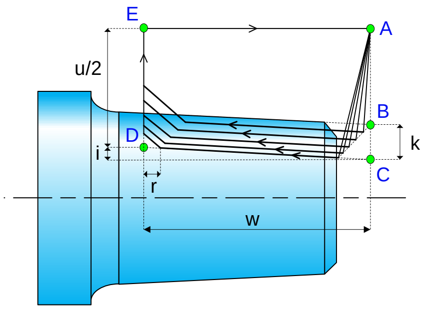
Par. No.	Item	Description	Default value	Setting range	Pro-perty
309	Arc cutting reference feed rate	This parameter changes the maximum feed rate during circular interpolation based on the arc radius. During circular interpolation, the higher the parameter value, the higher the feed rate, the greater the amount shifting inward, and the lower the machining precision. During circular interpolation, the lower the parameter value, the lower the feed rate, the smaller the amount shifting inward, and the higher the machining precision. (During circular interpolation, the arc shifts inward because of the delayed following of the servo.) Unit: mm/min	1000	10 to 50000	R
310	Min. arc reference feed rate	Sets the minimum feed rate for executing circular interpolation. The higher the feed rate, the less precise the machining and the more the contouring error, while it shortens the machining time. Unit: mm/min	500	10 to 50000	R
311	Max. corner reference feed rate	Sets the maximum corner feed rate. The higher the value, the easier to keep the high speed at corners for restoring to the feed rate before deceleration. Setting the value too high or improper setting may cause vibration of the machine at the corners. Unit: mm/min 	100	0 to 50000	R

Par. No.	Item	Description	Default value	Setting range	Pro-perty
312	Cutting depth in G71/G72 turning cycle【L】	Pr.312: the default cutting depth. Refer to the *d* value in the following figure. Pr.313: the default retraction amount. Refer to the *e* value in the following figure. 【G71】 G71 U(d) R(e) G71 P_ Q_ U(u) W(w) F_ S_ T_ 	1000	0 to 50000	R
313	Retraction amount in G71/G72 turning cycle【L】		1000	0 to 50000	R
314	Default cutting feed rate	Sets the default cutting speed. When you set this parameter without specifying the F value in the cutting command, the cutting speed is the speed set by this parameter. Unit: mm/min, inch/min	0	0 to 20000	P
315	G00 feed rate at 0%	The default speed when the rapid traverse adjustment rate (D1058) is 0% in RAPID mode. Unit: mm/min, inch/min	100	10 to 10000	R
316	G00 feed rate	Sets the maximum speed of **each axis** in RAPID mode and for G00. Unit: mm/min, inch/min	5000	1 to 60000	R
317	G00 ACC/DEC time constant	Sets the acceleration and deceleration time for rapid traverse. Unit: msec	200	1 to 2000	R
318	Max. cutting feed rate	Sets the maximum cutting feed rate. Unit: mm/min, inch/min	5000	1 to 60000	R
319	Cutting – ACC/DEC time constant	Sets the acceleration and deceleration time for cutting speed. Unit: msec (acceleration and deceleration time before interpolation)	200	1 to 2000	R
320	Cutting – S-curve time constant	Sets the S-curve time for cutting speed. Unit: msec (acceleration and deceleration time before interpolation) 	20	1 to 2000	R

Par. No.	Item	Description	Default value	Setting range	Pro-perty
321	Cutting – ACC/DEC time constant after interpolation	Sets the acceleration and deceleration time of the cutting speed after interpolation. The higher the value, the greater the contouring error. Unit: msec (acceleration and deceleration time after interpolation)	50	1 to 500	R
322	Threading – ACC/DEC time constant after interpolation 【L】	The time required for accelerating or decelerating to the target speed when threading. Target speed = number of revolution / min x thread pitch The smaller the parameter value, the shorter the ineffective threads, but the vibration is more violent. The greater the parameter value, the longer the ineffective threads, but the vibration is less violent.	10	1 to 100	R
	Cutting – S-curve time constant after interpolation 【M】	Sets the after-interpolation acceleration and deceleration time. Unit: msec (ACC / DEC after interpolation) ※ This setting is not available on the lathe system.	10	1 to 100	
323	Arc radius tolerance	 When the circular path is specified in center format (I, J, K), the controller calculates the radius R_1 (the distance from the start point to the circle center) and the radius R_2 (the distance from the end point to the circle center). The absolute difference between R_1 and R_2 should be smaller than Pr.323 ($\lvert R_1-R_2 \rvert$ < Pr.323), or alarm B00D Arc radius error occurs. Unit: μm	1	1 to 60000	R
329	Max. block length of path smoothing	When the system performs curve fitting, if the block length of G01 exceeds the setting in Pr.329, the curve fitting for the block is automatically canceled and the linear interpolation remains effective. Unit: 0.1 mm	20	0 to 10000	R
330	Min. corner angle of path smoothing	When the angle specified by a single block exceeds the angle of curve fitting, the curve fitting for the corner is automatically canceled and the sharpness is kept. Unit: degree	15	0 to 90	R
331	Length for corner detection 【M】	Sets the minimum length for corner detection. If the corner is formed of paths that are too short, the system keeps looking for the adjacent paths that are long enough and then starts calculating the corner angle. Unit: 0.0001 mm	100	0 to 10000	R
332	Tolerance of single-block path smoothing 【M】	To have a smoother machining path, this smoothing function automatically adjusts the coordinates specified in a single block with the adjustable distance set by Pr.332. The greater the value, the smoother the path in the block, but the path is less likely to go through the coordinates set in the block. The smaller the value, the closer the curve fitting path to the coordinates specified in the original program. Unit: 0.0001 mm	0	0 to 10000	R

Par. No.	Item	Description	Default value	Setting range	Pro-perty
333	Contour tolerance of path smoothing	Cosine error for curve fitting. The greater the value, the smoother the curve. But if the tolerance is set too great, it results in contouring error. The smaller the value, the more likely the machining contour is close to the programmed path for linear interpolation, but the curve is less smooth. It is suggested that the parameter value and the error value set in the CAM software should be consistent so as to make the path smoother without affecting the precision. Unit: 0.0001 mm	100	0 to 50000	R
344	Radius of rotation axis	Sets the radius for the rotation axis. The greater the value, the slower the rotation speed and vice versa. When you set Pr.344 to 0, this function is disabled and the rotation axis feed rate is determined by the F value (deg/min). When you set Pr.344 to a non-zero value, the system defines this value as the radius of the rotation axis to calculate the arc length and performs interpolation based on the arc length. Meanwhile, the feed rate for the rotation axis is determined by the F value (mm/min).  $Arc\ length\ (mm) = \frac{\theta}{180} R\pi$ The default unit of feed rate for the linear axis is mm/min and that for the rotation axis is deg/min. If the rotation axis used in the application requiring the feed rate to be consistent with the tangential velocity (mm/min), you can set Pr.344 with the setting value as close as the distance between the cutting point and the rotation center (rotation radius). The smaller the value of Pr.344, the faster the cutting speed; the greater the value of Pr.344, the slower the cutting speed. Unit: 0.1 mm	0	0 to 65535	R

Par. No.	Item	Description	Default value	Setting range	Property
345	X axis cutting amount in G73 turning cycle 【L】	Pr.345: total removal amount in X-axis direction. Refer to the *i* value in the following figure. Pr.346: total removal amount in Z-axis direction. Refer to the *k* value in the following figure. Pr.347: number of cutting times in a cycle. Refer to the *d* value in the following figure. 【G73】 G73 U(i) W(k) R(d) G73 P_ Q_ U(u) W(w) F_ S_ T_  	1000	0 to 50000	
346	Z axis cutting depth in G73 turning cycle 【L】		1000	0 to 50000	R
347	Number of cutting times in G73 turning cycle 【L】		3	1 to 99	
348	Retraction amount in G74/G75 turning cycle 【L】	The default retraction amount *e* for executing G74/G75 peck turning cycle. 【G75】 G75 R(e) G75 X/U_ Z/W_ P(△i) Q(△k) R(△d) F_  	1000	0 to 50000	R

Par. No.	Item	Description	Default value	Setting range	Pro-perty
349	Chamfer angle in G76/G92 threading 【L】	Pr.349: chamfer angle *θ* for G76/G92 thread turning cycle, as shown in the following figure. Pr.380: chamfer length *r* for G76/G92 thread turning cycle. Chamfer length = parameter value x (0.1 x lead). Assuming that the pitch is L, then the chamfer length for thread turning can be 0L - 12.7L. 【G76】 G76 P(m)(r)(a) Q(△dmin) R(d) G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_	45	1 to 89	R
380	Chamfer length in G76/G92 threading 【L】		3	0 to 127	R
381	Number of finishing counts in G76 threading cycle 【L】	Pr.381: the set number of finishing counts (m) for threading. Pr.382: the set tool nose angle (a) of the threading tool. Pr.383: the set minimum cutting depth (△dmin). 【G76】	1	1 to 99	R
382	Tool nose angle in G76 threading cycle 【L】	G76 P(m)(r)(a) Q(△dmin) R(d) G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_	60	0 to 80	R
383	Min. cutting depth in G76 threading cycle 【L】		1000	0 to 50000	R
510	Block No. to check in tool comp. interference	Sets the number of blocks to check in tool compensation interference: Pr.510 = 0: number of blocks = 3 Pr.510 < 3: number of blocks = Pr.510	0	0 to 3	P
511	G00 S-curve time constant	The acceleration and deceleration S-curve time constant for executing the G00 movement. Unit: msec	1	0 to 2000	R

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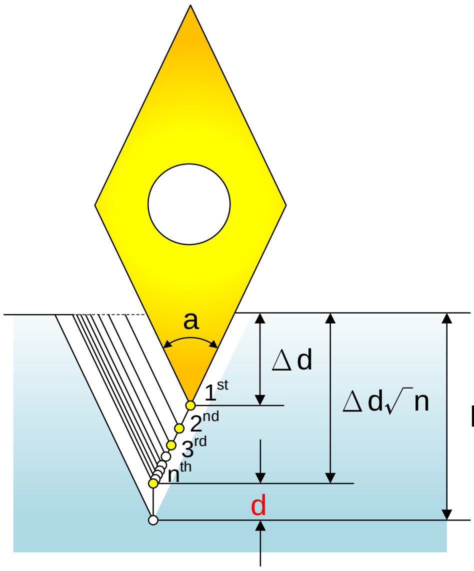
Par. No.	Item	Description	Default value	Setting range	Pro-perty
515	Finishing allowance in G76 threading cycle 【L】	Finishing allowance for executing G76 thread turning cycle. 【G76】 G76 P(m)(r)(a) Q(△dmin) R(d) G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_ 	200	0 to 50000	R

12.2 Operating parameter (OPERATE)

12.2.1 Operating parameter descriptions

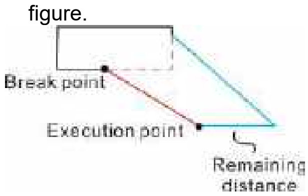
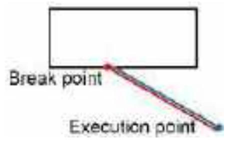
Par. No.	Item	Description	Default value	Setting range	Pro-perty
3	G-code macro call - O9010 to O9019	G-code macro call-O9010 Set these parameters to 0 to disable macro call.	0	0 to 1000	R
4		G-code macro call-O9011			
5		G-code macro call-O9012			
6		G-code macro call-O9013			
7		G-code macro call-O9014			
8		G-code macro call-O9015			
9		G-code macro call-O9016			
10		G-code macro call-O9017			
11		G-code macro call-O9018			
12		G-code macro call-O9019			
13	M-code macro call - O9020 to O9029	M-code macro call-O9020 Set these parameters to 0 to disable macro call.	0	0 to 1000	R
14		M-code macro call-O9021			
15		M-code macro call-O9022			
16		M-code macro call-O9023			
17		M-code macro call-O9024			
18		M-code macro call-O9025			
19		M-code macro call-O9026			
20		M-code macro call-O9027			
21		M-code macro call-O9028			
22		M-code macro call-O9029			
23	T-code macro call - O9000	T-code macro call-O9000 0: off 1: the system calls the macro program when reading the T-code.	0	0 to 1	R
24	Call O9030 after breakpoint search	Call O9030 after breakpoint search. 0: function disabled. After finding the breakpoint, the system continues executing the program without calling a macro. 1: function enabled. After finding the breakpoint, the system first calls and executes O9030 once **CYCLE START** is pressed, and then it returns to the main program and carries on the machining program from the line with the breakpoint.	0	0 to 1	R
25	System DIO setting	Sets G31 input polarity. 0: NC; 1: NO Name / Range: G31 high speed input point 1 / 0 to 1 G31 high speed input point 2 / 0 to 1	0	0 to 1	P

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>46</td><td>System application setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Output control mode
0: DMCNET</td><td>0</td></tr>
<tr><td>Homing before machining
0: Y; 1: N</td><td>0 to 1</td></tr>
<tr><td>Screw unit
0: metric; 1: imperial</td><td>0 to 1</td></tr>
<tr><td>Switch for G31 high speed input 1
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>Switch for G31 high speed input 2
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>Hardware limit check
0: on; 1: off</td><td>0 to 1</td></tr>
<tr><td>Software limit check
0: on; 1: off</td><td>0 to 1</td></tr>
<tr><td>Omit decimal places of the floating-point number in the motion command
0: do not omit
(input 1 in the program to indicate 0.001 mm)
1: omit
(input 1 in the program to indicate 1.000 mm)</td><td>0 to 1</td></tr>
<tr><td>G00 operation mode
0: multiple axes perform synchronous interpolation and reach the positioning point at the same time
1: each axis performs individual interpolation and reaches the positioning point separately at different speeds</td><td>0 to 1</td></tr>
<tr><td>Macro look-ahead
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>G00 path blending mode
0: same axis
1: different axes
The greater the setting value of Pr.334, the larger the chamfer angle of the path.</td><td>0 to 1</td></tr>
<tr><td>Return mode of one-key macro call
0: go to the next line
1: return to the interrupted line</td><td>0 to 1</td></tr>
<tr><td>Pre-warning for software limit
0: off; 1: on</td><td>0 to 1</td></tr>
</table>
</td><td>96</td><td>0 to 0xFFFF</td><td>P</td></tr>
<tr><td>47</td><td>MGP gain</td><td>MPG filter gain. For setting the MPG response. The greater the value, the faster the response, but the machine is subject to vibration.
Unit: 0.0001</td><td>100</td><td>1 to 60000</td><td>R</td></tr>
<tr><td>48</td><td>MPG filter</td><td>Sets the MPG filter level.
0: disabled
<table>
<tr><td>Level</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>kHz</td><td>31</td><td>10</td><td>5</td><td>2.5</td><td>1.6</td><td>1.2</td></tr>
</table>
</td><td>0</td><td>0 to 6</td><td>R</td></tr>
<tr><td>49</td><td>Axis port input setting</td><td>
<table>
<tr><th>Pin</th><th>Pr.49 = 0</th><th>Pr.49 = 1</th></tr>
<tr><td>1</td><td>Axis 1 Positive limit</td><td>Axis 1 Positive limit</td></tr>
<tr><td>2</td><td>Axis 1 Negative limit</td><td>Axis 1 Negative limit</td></tr>
<tr><td>3</td><td>Axis 1 Home</td><td>Axis 1 Home</td></tr>
<tr><td>4</td><td>Axis 2 Positive limit</td><td>Axis 2 Positive limit</td></tr>
<tr><td>5</td><td>Axis 2 Negative limit</td><td>Axis 2 Negative limit</td></tr>
<tr><td>6</td><td>Axis 2 Home</td><td>Axis 2 Home</td></tr>
<tr><td>7</td><td>Axis 3 Positive limit</td><td>Axis 3 Positive limit</td></tr>
<tr><td>8</td><td>Axis 3 Negative limit</td><td>Axis 3 Negative limit</td></tr>
</table>
</td><td>0</td><td>0 to 1</td><td>R</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="3">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td rowspan="7"></td><td rowspan="7"></td><td>9</td><td>Axis 3 Home</td><td>Axis 3 Home</td><td rowspan="7"></td><td rowspan="7"></td><td rowspan="7"></td></tr>
<tr><td>10</td><td>Axis 4 Positive limit</td><td>Axis 4 Home</td></tr>
<tr><td>11</td><td>Axis 4 Negative limit</td><td>Axis 5 Home</td></tr>
<tr><td>12</td><td>Axis 4 Home</td><td>Axis 6 Home</td></tr>
<tr><td>13</td><td>COM</td><td>COM</td></tr>
<tr><td>14</td><td>COM</td><td>COM</td></tr>
<tr><td>15</td><td>COM</td><td>COM</td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">Macro file display</td><td colspan="2">Name</td><td>Range</td><td rowspan="3">0</td><td rowspan="3">0 to 3</td><td rowspan="3">-</td></tr>
<tr><td colspan="2">Display O macro file</td><td>0 to 1</td></tr>
<tr><td colspan="2">Display G/M macro file</td><td>0 to 1</td></tr>
<tr><td rowspan="14">51</td><td rowspan="14">System auxiliary tool</td><td colspan="2">Name</td><td>Range</td><td rowspan="14">0</td><td rowspan="14">0 to 1</td><td rowspan="14">P</td></tr>
<tr><td colspan="2">Spindle check before cutting: when this function is enabled, if a cutting command is executed but the spindle is not in operation, the system displays an alarm.
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td colspan="2">Enable non-volatile setting for #10450 - #10500
0: on; 1: off</td><td>0 to 1</td></tr>
<tr><td colspan="2">Radius compensation mode for the first point
0: type B; perform compensation when the first point is convex.
1: type A; do not perform compensation when the first point is convex.</td><td>0 to 1</td></tr>
<tr><td colspan="2">G54 - G59 offset coordinate
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td colspan="2">Stroke protection
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td colspan="2">1st spindle OA/OB signal sequence
0: AB; 1: BA</td><td>0 to 1</td></tr>
<tr><td colspan="2">Spindle speed percentage reference during threading
0: spindle override register; 1: 100%</td><td>0 to 1</td></tr>
<tr><td colspan="2">Spindle speed check during cutting
0: off; 1: on
When M03/M04/M05, S, or G00 is set in the G-code, the first following cutting command (G01/G02/G03) will be executed only after the spindle reaches the target speed.</td><td>0 to 1</td></tr>
<tr><td colspan="2">Return mode after triggering M96
0: go to the next line; 1: return to the interrupted line</td><td>0 to 1</td></tr>
<tr><td colspan="2">Tapping mode
0: open-loop; 1: following</td><td>0 to 1</td></tr>
<tr><td colspan="2">G98 / G99 default setting
0: program; 1: Pr.306</td><td>0 to 1</td></tr>
<tr><td colspan="2">Handwheel reverse function
(Can reverse back for 30 blocks that have been executed)
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td colspan="2">Feedback check (feed axis)
0: on; 1: off</td><td>0 to 1</td></tr>
<tr><td>301</td><td>Unit decimal places</td><td colspan="3">Unit setting for coordinate display.
For example, when you set this parameter to 3, the coordinates are displayed with three decimal places, such as -99999.999 to +99999.999.</td><td>3</td><td>0 to 4</td><td>P</td></tr>
</table>

Par. No.	Item	Description: Name	Description: Range	Default value	Setting range	Pro-perty
305	Channel auxiliary setting	EMG stop source 0: system (+ M1079); 1: M1079	0 to 1	0	362	P
		G00 / G01 transition speed 0: decelerate to zero speed 1: no deceleration (refers to Pr.334)	0 to 1			
		Machine coordinates recording after HSI is triggered (#2148 - #2156) 0: command; 1: feedback	0 to 1			
		MLC axis positioning command type: 0: floating-point number 1: integer; converts values in the register by referring to the decimal place setting in Pr.301. MLC axis positioning commands (D registers): D1064 - D1080	0 to 1			
		Jog speed mode: When enabled, this parameter changes the unit of D1062 (Speed setting for jog feeding and dry run) from speed (F) to percentage (%), with a maximum limit of 100%. So, the JOG speed is Pr.640 × D1062(%). 0: speed; 1: %	0 to 1			
		Display range of the special D rotation axis coordinates 0: the display range is -360 to +360. 1: the display range is 0 to 360.	0 to 1			
		Whether to refer to speed override setting for look ahead function 0: the look ahead function does not refer to the speed override setting. For linear interpolation, the look ahead speed refers to the highest speed setting. For arc cutting, the look ahead speed refers to the setting of D1150. When the speed in D1150 is lower than 80000 mm/min, the system performs the look ahead function at 80000 mm/min. 1: refer to the speed override setting when performing the look ahead function. When speed override ≧ 100%, for linear interpolation, the look ahead speed refers to the highest speed setting; for arc cutting, the look ahead speed refers to the setting in D1150. When 0% < speed override setting < 100%, the look ahead speed for both linear interpolation and arc cutting refers to [Pr.316* Speed override]. When speed override = 0%, the look ahead speed for both linear interpolation and arc cutting refers to the F value specified in the G-code.	0 to 1			
		Whether to check if the X coordinate of the start point in the G71/G72 turning cycle is lower than the maximum X coordinate of the contour profile. 【L】 0: check 1: do not check	0 to 1			
		Maximum speed limit setting of RAPID mode: In RAPID mode, this parameter allows you to set the maximum speed reference source for each axis. 0: refer to Pr.621. 1: refer to Pr.638.	0 to 1			

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="2">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td rowspan="9">306</td><td rowspan="9">G-code programming parameter</td><td>Name</td><td>Range</td><td rowspan="9">532</td><td rowspan="9">0 to 0xFFFF</td><td rowspan="9">P</td></tr>
<tr><td>Default unit
0: metric; 1: imperial</td><td>0 to 1</td></tr>
<tr><td>Default programming mode
0: absolute; 1: incremental</td><td>0 to 1</td></tr>
<tr><td>Default feed mode
0: feed/min; 1: feed/rev</td><td>0 to 1</td></tr>
<tr><td>Default plane
0: G17; 1: G18; 2: G19</td><td>0 to 2</td></tr>
<tr><td>Lathe G-code type
0: A; 1: B; 2: C</td><td>0 to 3</td></tr>
<tr><td>Set the X axis to diameter / radius mode
0: diameter; 1: radius</td><td>0 to 1</td></tr>
<tr><td>Chamfer/fillet format setting<table><tr><th>Value</th><th>0</th><th>1</th></tr><tr><td>Chamfer</td><td>,C_</td><td>,C_ / C_</td></tr><tr><td>Fillet</td><td>,R_</td><td>,R_ / R_</td></tr><tr><td>Linear angle function</td><td>,A_</td><td>,A_ / A_</td></tr></table>Note: when the parameter is set to 1, this setting is effective only when the C axis and A axis are disabled.</td><td>0 to 1</td></tr>
<tr><td>Default workpiece coordinates<table><tr><th>Value</th><th>Default workpiece coordinates</th></tr><tr><td>0</td><td>G54</td></tr><tr><td>1</td><td>G55</td></tr><tr><td>2</td><td>G56</td></tr><tr><td>3</td><td>G57</td></tr><tr><td>4</td><td>G58</td></tr><tr><td>5</td><td>G59</td></tr></table></td><td>0 to 5</td></tr>
<tr><td rowspan="6">307</td><td rowspan="6">Channel application setting</td><td>Name</td><td>Range</td><td rowspan="6">0xD4</td><td rowspan="6">0 to 0xFFFF</td><td rowspan="6">P</td></tr>
<tr><td>Tool length compensation mode
0: when the block has a tool length compensation execution or cancellation command without a Z-axis command, Z axis moves.
1: when the block has a tool length compensation execution or cancellation command without a Z-axis command, Z axis does not move.</td><td>0 to 1</td></tr>
<tr><td>Spindle speed after reset
0: command speed remains after reset
1: command speed becomes 0 after reset</td><td>0 to 1</td></tr>
<tr><td>Software limit check mode
0: machine coordinates of the programmed path
1: machine coordinates of the tool path (with tool compensation calculated)</td><td>0 to 1</td></tr>
<tr><td>Tool length input mode
0: absolute; 1: incremental</td><td>0 to 1</td></tr>
<tr><td>G31 input source
0: disable
1: HSI 1
2: HSI 2
3: HSI 1&2</td><td>0 to 1</td></tr>
</table>

Par. No.	Item	Description		Default value	Setting range	Pro-perty
		Name	Range			
307	Channel application setting	Running mode after interruption 0: during the execution of a block, if you manually move the tool from its original position and then resumes the program execution, the tool moves the remaining distance first and then returns to the original path in the next motion block, as shown in the following figure.  1: during the execution of a block, if you manually move the tool from its original position and then resumes the program execution, the tool returns to the original path first and then moves the remaining distance, as shown in the following figure. 	0 to 1	0xD4	0 to 0xFFFF	P
		Software limit check method 0: greater than; the target machine coordinate value is greater than the soft limit setting 1: greater than or equal to; the target machine coordinate value is greater than or equal to the soft limit setting	0 to 1			
		EMG stop mode 0: after the controller stops, the servo switches to Servo Off 1: after the controller stops, the servo decelerates to a stop and switches to Servo Off 2: after the controller stops, the servo decelerates to a stop and remains Servo On	0 to 2			
		MLC variable type 0: Word type 1: Double word type Set this bit to 1 to change the interface input / output registers to 8 sets (32-bit) from 16 sets (16-bit).	0 to 1			
		G00/G01 max. feed rate reference 0: resultant velocity G00: Pr.316 & Pr.621 G01: Pr.318 & Pr.625 1: individual velocity G00: Pr.621 G01: Pr.625	0 to 1			
		Return mode after interruption 0: G00; 1: G01 You can use this parameter to restore the motion mode when the machining was interrupted in the following condition: you press **FEED HOLD** during machining, set the system to MDI mode, move the machine, and then set the system back to AUTO mode and resume the machining without resetting.	0 to 1			

Par. No.	Item	Description		Default value	Setting range	Pro-perty
		Synchronous execution for M / S / T-code and G00 (Only M03/M04/M05 and S codes are supported) 0: off; 1: on	0 to 1			
		Cancel tool radius compensation for G00 block 0: off; perform tool radius compensation when running G00 block 1: on; cancel tool radius compensation when running G00 block	0 to 1			
308	Channel auxiliary setting	Name	Range	0	0 to 0xFFFF	P
		Feed rate reference 0: program; 1: Pr.314	0 to 1			
		Set local variable to null 0: off, #1 - #50 are 0 1: on, #1 - #50 are null	0 to 1			
		Current monitoring function 0: off; 1: on	0 to 1			
		MPG offset 0: off; 1: on	0 to 1			
		Tool compensation interference check 0: on; 1: off	0 to 1			
		Motion speed remains when coordinate system switches 0: off; 1: on	0 to 1			
		Motion speed remains when macro call 0: disable 1: enable Note: when this function is enabled, the G-code motion does not slow down when the main program runs M99.	0 to 1			
		Dynamic axis compensation function 0: disable Disables the isocline filter compensation and retains the filter output value. This is to prevent the motor from suddenly rotating to the position it was before the compensation was enabled. 1: enable Enables the isocline filter compensation, with each axis corresponding to the special D registers, D1126 to D1146.	0 to 1			
		System halts when running to M99 0: off; returns to the main program when running to M99 1: on: halts when running to M99	0 to 1			
		ABS coordinate changes after tool length / wear modification 0: remain; 1: change	0 to 1			
		Coordinate system setting after system reset and M30 execution 0: Pr.306 default 1: continue to use the G-code setting	0 to 1			
		Tool ID display source Set to use the G-code or MLC special D register to control the spindle tool ID in POS screen. 0: G-code; 1: D1115	0 to 1			
		Spindle speed reference in feed/rev mode0: command; in the feed-per-revolution mode, the calculation of the cutting speed refers to the spindle's command speed. 1: feedback; in the feed-per-revolution mode, the calculation of the cutting speed refers to the spindle's feedback speed.	0 to 1			

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td></td><td></td><td><table><tr><td>C axis mode
0: turning; 1: lathe</td><td>0 to 1</td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td>324</td><td>Peck-drilling escape amount</td><td>Sets the retraction amount for performing peck drilling. Unit: μm</td><td>100</td><td>1 to 50000</td><td>R</td></tr>
<tr><td>326</td><td>Cycle parameter</td><td><table><tr><th>Name</th><th>Range</th></tr><tr><td>Tool withdraw direction (for G76 / G87 cycle command)
0: +X; 1: -X; 2: +Y; 3: -Y</td><td>0 to 3</td></tr><tr><td>Drilling / tapping mode
0: general
1: deep-pecking (feed amount = Q, retraction amount = R)
2: pecking (feed amount = Q, retraction amount = D)
3: deep-pecking P (feed amount = Q, retraction amount = R, dwell time = Pr.513)</td><td>0 to 3</td></tr></table></td><td>0</td><td>0 to 0xFFFF</td><td>R</td></tr>
<tr><td>327</td><td>EMG stop time constant</td><td>Sets the time for the servo motor to decelerate to zero speed when the emergency stop is pressed in AUTO mode.
Unit: msec</td><td>50</td><td>5 to 500</td><td>R</td></tr>
<tr><td>328</td><td>EMG stop delay time</td><td>Sets the delay time for the special M relay M2114 System emergency stop when the system is stopped and in Servo Off status. Unit: msec</td><td>35</td><td>0 to 2000</td><td>R</td></tr>
<tr><td>334</td><td>G00 blending ratio</td><td>The speed does not decelerate to zero when G00 is executed between blocks with this parameter set. Use this parameter to set the blending ratio. The greater the value, the less the deceleration at block transitions and the faster the speed; the smaller the value, the more the deceleration at block transitions and the slower the speed. Unit: %</td><td>0</td><td>0 to 100</td><td>R</td></tr>
<tr><td>350 to 357</td><td>Halt M-code 1 - 8</td><td>Halt M-code 1 (0: no setting)
Halt M-code 2
Halt M-code 3
Halt M-code 4
Halt M-code 5
Halt M-code 6
Halt M-code 7
Halt M-code 8</td><td>0</td><td>0 to 1000</td><td>P</td></tr>
<tr><td>358</td><td>Spindle-to-C axis mode switch M-code 【L】</td><td>M-code for switching the spindle to C axis for the lathe system. This M-code can be used as a halt M-code.</td><td>0</td><td>0 to 1000</td><td>P</td></tr>
<tr><td>359</td><td>C axis-to-Spindle mode switch M-code 【L】</td><td>M-code for switching the C axis to spindle for the lathe system. This M-code can be used as a halt M-code.</td><td>0</td><td>0 to 1000</td><td>P</td></tr>
<tr><td>360</td><td>Synchronization direction control</td><td>Bit 0 - 5: synchronous direction control of X - C axes
0: same direction
1: different directions<table><tr><th>Name</th><th>Range</th></tr><tr><td>Synchronous direction for X axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for Y axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for Z axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for A axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for B axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for C axis</td><td>0 to 1</td></tr></table></td><td>0</td><td>0 to 0x3F</td><td>P</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro-perty
361	Synchronous control X	Specifies the master axis for X axis (slave) to follow. For example, to have the X axis follow the Y axis for synchronous motion control, set this parameter to 2. Value / Master axis: 0 / 0: disable synchronous motion control 1 / X 2 / Y 3 / Z 4 / A 5 / B 6 / C 0: disabled; 1 - 6: X - C	0	0 to 6	P
362	Synchronous control Y	Specifies the master axis for Y axis (slave) to follow.	0	0 to 6	P
363	Synchronous control Z	Specifies the master axis for Z axis (slave) to follow.	0	0 to 6	P
364	Synchronous control A	Specifies the master axis for A axis (slave) to follow.	0	0 to 6	P
365	Synchronous control B	Specifies the master axis for B axis (slave) to follow.	0	0 to 6	P
366	Synchronous control C	Specifies the master axis for C axis (slave) to follow.	0	0 to 6	P
367	Synchronous control U	Specifies the master axis for U axis (slave) to follow.	0	0 to 6	P
368	Synchronous control V	Specifies the master axis for V axis (slave) to follow.	0	0 to 6	P
369	Synchronous control W	Specifies the master axis for W axis (slave) to follow.	0	0 to 6	P
371	Transfer control X	Sets the master axis of which command is sent for X axis (slave) to execute. Under the transfer control, the master axis' control command is transferred to the slave axis for execution. For example, to transfer Y axis' (master's) control command to X axis to execute, set this parameter to 2. Value / Master axis: 0 / 0: disable the transfer function 1 / X 2 / Y 3 / Z 4 / A 5 / B 6 / C	0	0 to 6	P
372	Transfer control Y	Sets the master axis of which command is sent for Y axis (slave) to execute.	0	0 to 6	P
373	Transfer control Z	Sets the master axis of which command is sent for Z axis (slave) to execute.	0	0 to 6	P
374	Transfer control A	Sets the master axis of which command is sent for A axis (slave) to execute.	0	0 to 6	P
375	Transfer control B	Sets the master axis of which command is sent for B axis (slave) to execute.	0	0 to 6	P
376	Transfer control C	Sets the master axis of which command is sent for C axis (slave) to execute.	0	0 to 6	P

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="2">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>377</td><td>Transfer control U</td><td colspan="2">Sets the master axis of which command is sent for U axis (slave) to execute.</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>378</td><td>Transfer control V</td><td colspan="2">Sets the master axis of which command is sent for V axis (slave) to execute.</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>379</td><td>Transfer control W</td><td colspan="2">Sets the master axis of which command is sent for W axis (slave) to execute.</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td rowspan="7">485</td><td rowspan="7">Channel application setting</td><td>Name</td><td>Range</td><td rowspan="7">0</td><td rowspan="7">0 to 65535</td><td rowspan="7">P</td></tr>
<tr><td>Handwheel reverse mode for M, S, T-code execution:
Sets whether to skip the M, S, and T-codes execution when the handwheel reverses.
0: stop; execution for M, S, and T codes is stopped when the handwheel reverses.
1: skip (function enabled); skip the M, S, T-codes when the handwheel reverses.</td><td>0 to 1</td></tr>
<tr><td>Homing speed refers to the speed override setting.
0: disable
1: the speed for searching for the sensor and homing refers to D1056 (applicable to homing modes 1, 2, 4, 5, and 8.)</td><td>0 to 1</td></tr>
<tr><td>Homing function supports MPG simulation.
When the MPG simulation is enabled, you can use the handwheel for returning to the origin (optional function).
(applicable to homing modes 1, 2, and 5)
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Lock axis moving direction in AUTO mode.
When the special M relays (M1344 - M1361) corresponding to the axes are triggered, the operation in JOG or MPG mode is locked based on the current operating direction. In HOME mode, the homing motion is stopped whenever any of the special M relays for axis movement is triggered. When performing arc commands, the system also checks whether to lock the operation in positive/negative direction based on the arc path.
0: disable
1: lock the axis moving direction in AUTO mode</td><td>0 to 1</td></tr>
<tr><td>G31 Feed mode setting.
0: mm/min
1: refers to the feed mode currently used by the system</td><td>0 to 1</td></tr>
<tr><td>Enable the register for handwheel pulse input.
D1175 (int16): input the handwheel pulse (increment)
D1352 (int32): read the handwheel pulse
0: disable
1: enable</td><td>0 to 1</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>485</td><td>Channel application setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Tilt axis function (optional).
※ Pr.497: tilt axis angle setting
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Clear local variables after M99 is executed.
0: keep the local variables
1: clear the local variables</td><td>0 to 1</td></tr>
<tr><td>Tool length compensation after M30 is executed.
0: cancel the tool length compensation
1: keep the tool length compensation</td><td>0 to 1</td></tr>
<tr><td>Tool length compensation after M02 is executed.
0: cancel the tool length compensation
1: keep the tool length compensation</td><td>0 to 1</td></tr>
<tr><td>Tool length compensation after system reset and powered on.
0: cancel the tool length compensation
1: keep the tool length compensation</td><td>0 to 1</td></tr>
<tr><td>Tool life calculation.
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Reference source for tool life calculation.
0: tool compensation ID
1: tool ID</td><td>0 to 1</td></tr>
</table>
</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>498</td><td>Peck-tapping escape amount【M】</td><td>Escape amount setting for peck tapping.
※ If this parameter is 0, the escape amount refers to the Pr.324 setting.
Unit: μm</td><td>0</td><td>0 to 50000</td><td>R</td></tr>
<tr><td>501</td><td>Axis movement protection</td><td>If there is a motion command in the program, the [Axis limit] special M relay is set to On. In this case, you must set the [Allow axis movement] special M relay to On to have this program block executed.
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>X axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>Y axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>Z axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>A axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>B axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>C axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>U axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>V axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
<tr><td>W axis movement protection (0: on; 1: off)</td><td>0 to 1</td></tr>
</table>
Relevant special M relays:
<table>
<tr><td>X axis movement limit</td><td>M2400</td><td>Allow X axis movement</td><td>M1312</td></tr>
<tr><td>Y axis movement limit</td><td>M2401</td><td>Allow Y axis movement</td><td>M1313</td></tr>
<tr><td>Z axis movement limit</td><td>M2402</td><td>Allow Z axis movement</td><td>M1314</td></tr>
<tr><td>A axis movement limit</td><td>M2403</td><td>Allow A axis movement</td><td>M1315</td></tr>
<tr><td>B axis movement limit</td><td>M2404</td><td>Allow B axis movement</td><td>M1316</td></tr>
<tr><td>C axis movement limit</td><td>M2405</td><td>Allow C axis movement</td><td>M1317</td></tr>
<tr><td>U axis movement limit</td><td>M2406</td><td>Allow U axis movement</td><td>M1318</td></tr>
<tr><td>V axis movement limit</td><td>M2407</td><td>Allow V axis movement</td><td>M1319</td></tr>
<tr><td>W axis movement limit</td><td>M2408</td><td>Allow W axis movement</td><td>M1320</td></tr>
</table>
</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>508</td><td>Polygon cutting axis setting</td><td>The polygon cutting operation requires one spindle and one rotation axis. Use this parameter to set the rotation axis (tool axis) to use.
<table>
<tr><th>Value</th><th>Axis No.</th></tr>
<tr><td>0</td><td>Function disabled</td></tr>
<tr><td>4</td><td>A</td></tr>
<tr><td>5</td><td>B</td></tr>
<tr><td>6</td><td>C</td></tr>
<tr><td>7</td><td>U</td></tr>
<tr><td>8</td><td>V</td></tr>
<tr><td>9</td><td>W</td></tr>
</table></td><td>0</td><td>0, 4 to 9</td><td>P</td></tr>
<tr><td>509</td><td>Torque limit for each axis</td><td>Torque limit switch for each servo axis (required with MLC)
<table>
<tr><th>Axis No.</th><th>Bit</th><th>Decimal</th></tr>
<tr><td>X</td><td>0</td><td>1</td></tr>
<tr><td>Y</td><td>1</td><td>2</td></tr>
<tr><td>Z</td><td>2</td><td>4</td></tr>
<tr><td>A</td><td>3</td><td>8</td></tr>
<tr><td>B</td><td>4</td><td>16</td></tr>
<tr><td>C</td><td>5</td><td>32</td></tr>
<tr><td>U</td><td>6</td><td>64</td></tr>
<tr><td>V</td><td>7</td><td>128</td></tr>
<tr><td>W</td><td>8</td><td>256</td></tr>
</table>
For example, to enable the torque limit of X and Z axes, you must add the decimal values of these axes, so set Pr.509 to 5.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>513</td><td>Drilling/tapping cycle dwell time above hole bottom</td><td>The dwell time at the top of the hole refers to this parameter setting when the drilling / tapping mode is set as follows.
(1) Pr.326 (drilling/tapping mode) is set to 3
(2) Variable L in drilling / tapping command = 3</td><td>0</td><td>0 to 50000</td><td>R</td></tr>
<tr><td>514</td><td>Feedback check time</td><td>After the system sends a motion command, and the time set by Pr.514 passes while the position feedback value remains the same, alarm 4FFD occurs. Unit: ms</td><td>0</td><td>0 to 65535</td><td>R</td></tr>
<tr><td>2006</td><td>Input source setup</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Operation panel filter time (ms)</td><td>1 to 3</td></tr>
<tr><td>Home / limit input point planning
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>EMG stop source
0: IES
1: HSI on OPENCNC</td><td>0 to 1</td></tr>
<tr><td>Enable RIO as the HSI contact
0: off; 1: on
<table>
<tr><th>DI</th><th>Special M</th><th>DI</th><th>Special M</th></tr>
<tr><td>X280</td><td>M2128</td><td>X284</td><td>M2132</td></tr>
<tr><td>X281</td><td>M2129</td><td>X285</td><td>M2133</td></tr>
<tr><td>X282</td><td>M2130</td><td>X286</td><td>M2134</td></tr>
<tr><td>X283</td><td>M2131</td><td>X287</td><td>M2135</td></tr>
</table></td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 49152</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>2010</td><td>High speed input trigger setting</td><td>0: rising-edge triggered
1: falling-edge triggered<table><tr><th>Name</th><th>Range</th></tr><tr><td>HSI 1 trigger setting</td><td>0 to 1</td></tr><tr><td>HSI 2 trigger setting</td><td>0 to 1</td></tr></table>Setting Pr.2010 to 0 for the counter to count when it is rising-edge triggered; setting Pr.2010 to 1 for the counter to count when it is falling-edge triggered.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2049</td><td>Signal conversion card output setting</td><td>Signal conversion card (for converting motion commands to pulses) output setting
0: general (connect to the servo drive)
1: bridge (connect the physical wiring of the command end to the feedback end)<table><tr><th>Name</th><th>Range</th></tr><tr><td>1st axis feedback source</td><td>0 to 1</td></tr><tr><td>2nd axis feedback source</td><td>0 to 1</td></tr><tr><td>3rd axis feedback source</td><td>0 to 1</td></tr><tr><td>4th axis feedback source</td><td>0 to 1</td></tr><tr><td>5th axis feedback source</td><td>0 to 1</td></tr><tr><td>6th axis feedback source</td><td>0 to 1</td></tr><tr><td>7th axis feedback source</td><td>0 to 1</td></tr><tr><td>8th axis feedback source</td><td>0 to 1</td></tr><tr><td>9th axis feedback source</td><td>0 to 1</td></tr><tr><td>10th axis feedback source</td><td>0 to 1</td></tr><tr><td>11th axis feedback source</td><td>0 to 1</td></tr><tr><td>12th axis feedback source</td><td>0 to 1</td></tr><tr><td>Pulse command type
0: A/B phase
1: CW/CCW
2: Pulse/direction
3: A/B phase</td><td>0 to 3</td></tr><tr><td>Pulse logic
0: positive; 1: negative</td><td>0 to 1</td></tr></table></td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2050</td><td>Encoder resolution of the signal conversion card for 1st axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2051</td><td>Encoder resolution of the signal conversion card for 2nd axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2052</td><td>Encoder resolution of the signal conversion card for 3rd axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2053</td><td>Encoder resolution of the signal conversion card for 4th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2054</td><td>Encoder resolution of the signal conversion card for 5th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
</table>

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<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>2055</td><td>Encoder resolution of the signal conversion card for 6th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2056</td><td>Encoder resolution of the signal conversion card for 7th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2057</td><td>Encoder resolution of the signal conversion card for 8th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2058</td><td>Encoder resolution of the signal conversion card for 9th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2059</td><td>Encoder resolution of the signal conversion card for 10th axis (single-phase)</td><td>The motor single-frequency pulse number.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>601</td><td>The parallel axis of the rotation axis that executes cylinder interpolation
(1 - 3: X - Z)</td><td>When performing cylinder interpolation with the plane specified (by G-code), set Pr.601 as the linear axis parallel to the rotation axis on this plane.<table><tr><th>Value</th><th>Parallel axis</th></tr><tr><td>0</td><td>Function disabled</td></tr><tr><td>1</td><td>X</td></tr><tr><td>2</td><td>Y</td></tr><tr><td>3</td><td>Z</td></tr></table></td><td>0</td><td>0 to 3</td><td>P</td></tr>
<tr><td>621</td><td>G00/manual maximum speed</td><td>Sets the maximum movement speed for G00 and manual motion modes (JOG, MPG, RAPID, and HOME).
When you set this parameter to 0, the axis is not restricted by the maximum feed speed of G00; its speed is determined by Pr.316.
Unit: mm/min, inch/min, rpm</td><td>5000</td><td>0 to 60000</td><td>R</td></tr>
<tr><td>622</td><td>G00/manual ACC/DEC time</td><td>Sets the acceleration and deceleration time for G00 and manual motion modes (JOG, MPG, RAPID, and HOME).
Unit: msec</td><td>50</td><td>0 to 10000</td><td>R</td></tr>
<tr><td>623</td><td>G00/manual S-curve time</td><td>Sets the S-curve time constant for G00 and manual motion modes (JOG, MPG, RAPID, and HOME).
Unit: msec</td><td>5</td><td>1 to 2000</td><td>R</td></tr>
<tr><td>625</td><td>G01 maximum speed</td><td>Sets the maximum speed for G01 of each axis.
When you set this parameter to 0, the axis is not restricted by the maximum feed speed of G01; its speed is determined by Pr.318.
Unit: mm/min, inch/min, rpm</td><td>0</td><td>0 to 60000</td><td>R</td></tr>
<tr><td>638</td><td>Maximum speed of RAPID mode</td><td>Maximum speed limit of RAPID mode.
Unit: mm/min, inch/min, rpm</td><td>10</td><td>0 to 65535</td><td>R</td></tr>
<tr><td>640</td><td>Jog speed at 100%</td><td>The maximum speed when the jog override is at 100%.
Note:
1. To enable the function, set the parameter Pr.305 (JOG speed mode).
2. The speed limit refers to Pr.621 (G00/manual maximum speed).</td><td>0</td><td>0 to 65535</td><td>R</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro-perty
642	Synchronous tolerance	During synchronous control, if the following error between the master and slaves exceeds the value set by Pr.642, B645 [Excessive synchronous following error] occurs. Unit: 0.1 mm	50	0 to 1000	R
643	Feedback following error	If the following error exceeds the setting of Pr.643 in any movement, B630 [Excessive following error] occurs. This parameter is for setting the tolerance for the servo following command. Unit: μm (linear axes); 0.1 degree (rotation axes)	30000	1 to 60000	R
646	Range for defining as position reached	The function of checking whether the position is reached for G00, G09, and G61 blocks. This parameter sets the range for defining "position reached" (linear axis: 0.001 mm; rotation axis: 0.1 degree). When this setting is not 0, this position reached check function is enabled. When the position reached check function is on, the system will not execute the following block unless the error between the command and the feedback is lower than the setting of Pr.646 for the axis (Cmd - Fbk < Pr.646).	0	0 to 6000	R
648	Feedback position check after startup	When starting, the system checks the error between the command and the feedback from the servo. If the error exceeds the setting of Pr.648, the servo cannot switch to Servo on. Unit: μm (linear axes), 0.1 degree (rotation axes)	20	1 to 6000	R

12.3 Tool magazine parameter (MAGA)

With the tool magazine parameters, you can specify the type and number of magazines and determine whether to enable the tool magazine functions.
Contact the distributors or equipment suppliers for settings of hardware parameters.

12.3.1 Tool magazine parameter descriptions

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>336</td><td>Tool magazine control</td><td><table><tr><th>Name</th><th>Range</th></tr><tr><td>Switch for lathe tool No. check: when the tool ID is greater than the maximum tool number in the magazine, the alarm B00E Tool No. selection error occurs.
0: off
1: on</td><td>0 to 1</td></tr><tr><td>Spindle tool No. after magazine reset
0: 0
1: continue numbering</td><td>0 to 1</td></tr><tr><td>Types of ATC
0: exchanger
1: non-exchanger</td><td>0 to 1</td></tr></table></td><td>0x0800</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>337</td><td>Tool magazine enabling</td><td>0: off (tool magazine data table is not updated instantly)
1: on (tool magazine data table is updated instantly)<table><tr><th>Name</th><th>Range</th></tr><tr><td>Tool magazine 1</td><td>0 to 1</td></tr><tr><td>Tool magazine 2</td><td>0 to 1</td></tr></table></td><td>1</td><td>0 to 3</td><td>P</td></tr>
<tr><td>338</td><td>Tool magazine 1 total tool No.</td><td>Sets the number of tool stations of tool magazine 1 (in response to the mechanical differences of tool magazines, you can use this parameter to set the number of the placeable tools).</td><td>10</td><td>2 to 255</td><td>P</td></tr>
<tr><td>339</td><td>Tool magazine 1 standby tool pocket No. after reset</td><td>Sets the standby tool pocket index when the reset function is used for tool magazine 1.</td><td>1</td><td>1 to 100</td><td>P</td></tr>
<tr><td>340</td><td>Tool magazine 1 start tool No.</td><td>Sets the tool number of the start tool pocket when the reset function is used for tool magazine 1.</td><td>1</td><td>1 to 100</td><td>P</td></tr>
<tr><td>341</td><td>Tool magazine 2 total tool No.</td><td>Sets the number of tool stations of tool magazine 2 (in response to the mechanical differences of tool magazines, you can use this parameter to set the number of the placeable tools).</td><td>10</td><td>2 to 255</td><td>P</td></tr>
<tr><td>342</td><td>Tool magazine 2 standby tool No. after reset</td><td>Sets the standby tool pocket number when the reset function is used for tool magazine 2.</td><td>1</td><td>1 to 100</td><td>P</td></tr>
<tr><td>343</td><td>Tool magazine 2 start tool No.</td><td>Sets the tool number of the start tool pocket when the reset function is used for tool magazine 2.</td><td>1</td><td>1 to 100</td><td>P</td></tr>
<tr><td>2012</td><td>1st DMCNET servo magazine</td><td>Supported station numbers are 10 to 12.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>2013</td><td>2nd DMCNET servo magazine</td><td>Supported station numbers are 10 to 12.</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro-perty
2014	3rd DMCNET servo magazine	Supported station numbers are 10 to 12.	0	0 to 65535	P

12.4 Spindle parameter (SPINDLE)

12.4.1 Spindle parameter descriptions

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>37</td><td>Spindle voltage output offset</td><td>Calibrates the spindle voltage output. When the controller has the spindle stopped (sets the spindle to zero speed), but the spindle is still rotating, set this parameter to adjust the voltage output to have the spindle come to a stop. Unit: 0.001V</td><td>0</td><td>-1000 to +1000</td><td>R</td></tr>
<tr><td>398</td><td>Spindle default speed</td><td>The default spindle speed when power is on.</td><td>0</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>399</td><td>Spindle application setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Spindle function
0: off
1: on</td><td>0 to 1</td></tr>
<tr><td>Closed-loop control flag
0: off
1: on (feedback encoder is required)</td><td>0 to 1</td></tr>
<tr><td>Spindle output mode
0: communication (DMCNET)
1: pulse (B series)
2: analog voltage</td><td>0 to 2</td></tr>
<tr><td>Speed control mode
1: PUU</td><td>1</td></tr>
<tr><td>Spindle encoder magnification
0: 1000 times
1: 4 times</td><td>0 to 1</td></tr>
<tr><td>Analog spindle speed source
0: command
1: encoder</td><td>0 to 1</td></tr>
<tr><td>Analog spindle feedback encoder source
0: spindle
1: motor</td><td>0 to 1</td></tr>
<tr><td>Spindle speed reference
0: program
1: Pr.398</td><td>0 to 1</td></tr>
<tr><td>Spindle Max. speed command check
0: off
1: on</td><td>0 to 1</td></tr>
<tr><td>Spindle speed D1380 display mode
0: command speed (S-code)
1: instant speed
Closed-loop = instant speed from spindle feedback
Open-loop = instant speed from spindle command</td><td>0 to 1</td></tr>
<tr><td>Spindle voltage output mode
0: -10V to +10V
1: 0V to +10V (only effective in open-loop control)</td><td>0 to 1</td></tr>
<tr><td>Multi-stage spindle feedback encoder switch
0: off
1: on</td><td>0 to 1</td></tr>
</table>
</td><td>0</td><td>0 to 0xFFFF</td><td>P</td></tr>
<tr><td>401</td><td>Spindle encoder port No.</td><td>Sets the feedback channel of spindle encoder.</td><td>8</td><td>0 to 8</td><td>P</td></tr>
<tr><td>402</td><td>Spindle encoder resolution</td><td>Sets the encoder resolution (single-phase).
Unit: pulse/rev</td><td>1280</td><td>2 to 60000</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>403</td><td>Spindle integral gain</td><td>Sets the analog speed integral gain of the spindle. The greater the value, the faster the response. But if the gain is too large, it may cause machine jitter.
Unit: 0.001 rad/s</td><td>50</td><td>1 to 1000</td><td>P</td></tr>
<tr><td>404</td><td>Spindle high positioning speed</td><td>Sets the maximum speed for spindle positioning.
If the current speed exceeds the setting of Pr.404, the system decreases the spindle speed to the speed set in Pr.404 and then performs spindle positioning.
If the spindle speed is lower than the setting of Pr.404, it refers to Pr.420 Spindle low positioning speed.
Unit: rpm</td><td>100</td><td>1 to 20000</td><td>R</td></tr>
<tr><td>405</td><td>Spindle positioning offset</td><td>Sets the Z-phase offset for spindle positioning.
Unit: 0.01 degree</td><td>0</td><td>0 to 36000</td><td>R</td></tr>
<tr><td>406</td><td>Spindle target speed error</td><td>Sets the allowable error between the target speed and actual speed for the spindle.
Unit: rpm</td><td>10</td><td>0 to 300</td><td>P</td></tr>
<tr><td>407</td><td>Spindle positioning error</td><td>Sets the spindle positioning error. If the actual positioning error exceeds the setting, the spindle positioning fails.<table><tr><th>Position error</th><th>M2258</th></tr><tr><td>Error > Pr.407</td><td>0</td></tr><tr><td>Error ≦ Pr.407</td><td>1</td></tr></table>Unit: 0.01 degree</td><td>100</td><td>0 to 36000</td><td>P</td></tr>
<tr><td>408</td><td>Spindle zero speed error</td><td>If the spindle speed is lower or equal to this parameter value, the zero speed signal is on.<table><tr><th>Spindle speed</th><th>M2257</th></tr><tr><td>Spindle speed > Pr.408</td><td>0</td></tr><tr><td>Spindle speed ≦ Pr.408</td><td>1</td></tr></table></td><td>5</td><td>0 to 1000</td><td>P</td></tr>
<tr><td>409</td><td>Spindle maximum speed</td><td>Sets the maximum speed for the spindle.
Unit: rpm</td><td>20000</td><td>0 to 600000</td><td>P</td></tr>
<tr><td>410</td><td>Spindle minimum speed</td><td>Sets the minimum speed for spindle. Unit: rpm</td><td>10</td><td>0 to 10000</td><td>P</td></tr>
<tr><td>411</td><td>Spindle ACC/DEC time constant</td><td>Sets the acceleration and deceleration time for the spindle. The greater the value, the longer the acceleration and deceleration time.
Unit: msec</td><td>20</td><td>1 to 20000</td><td>R</td></tr>
<tr><td>412</td><td>Spindle S-curve time constant</td><td>Sets the S-curve time constant of the spindle.
Unit: msec</td><td>10</td><td>1 to 2000</td><td>R</td></tr>
<tr><td>413</td><td>Spindle 2nd Kpp gain</td><td>When the spindle is under closed-loop voltage control, switch M1127 to instantly change the spindle Kpp gain.<table><tr><th>M1127</th><th>Spindle Kpp gain</th></tr><tr><td>0</td><td>Pr.419</td></tr><tr><td>1</td><td>Pr.413</td></tr></table>When the spindle performs positioning at low speed, it requires a higher gain value, while a high gain value may lead to vibration during high-speed rotation. Use D1380 Spindle actual speed and this parameter to instantly change the spindle Kpp gain value.</td><td>0</td><td>1 to 1000</td><td>R</td></tr>
<tr><td>416</td><td>Tapping ACC/DEC time constant</td><td>Sets the acceleration and deceleration time for the tapping operation of the 1st spindle.
Unit: msec</td><td>2000</td><td>1 to 20000</td><td>R</td></tr>
<tr><td>417</td><td>Tapping S-curve time constant</td><td>Sets the S-curve time constant for the tapping operation of the 1st spindle.
Unit: msec</td><td>100</td><td>1 to 2000</td><td>R</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro-perty
419	Spindle Kpp gain	When the spindle is under closed-loop voltage control, use this parameter to adjust the spindle position loop bandwidth. The greater the gain, the lower the following error, and the more precise the positioning. However, if the value is set too high, it may cause vibration. The parameter value is relevant to the bandwidth of the inverter. It is recommended that you start from a lower gain and then gradually increase the value.	0	0 to 1000	R
420	Spindle low positioning speed	If the spindle speed is slower than the setting of Pr.404 or the spindle is stopped, and the system performs spindle positioning, the spindle applies the speed set in Pr.420. Unit: rpm	100	1 to 20000	R
421	Tapping retraction speed ratio	Tapping retraction setting. The tapping retraction speed is F multiply by the value of Pr.421. The higher the value, the faster the retraction. Unit: 0.1 times	10	10 to 50	R
422	Gear ratio numerator 1	Sets the numerator of the first set of spindle gear ratio.	1	0 to 60000	P
423	Gear ratio denominator 1	Sets the denominator of the first set of spindle gear ratio.	1	0 to 60000	P
424	Gear ratio numerator 2	Sets the numerator of the second set of spindle gear ratio.	1	0 to 60000	P
425	Gear ratio denominator 2	Sets the denominator of the second set of spindle gear ratio.	1	0 to 60000	P
426	Gear ratio numerator 3	Sets the numerator of the third set of spindle gear ratio.	1	0 to 60000	P
427	Gear ratio denominator 3	Sets the denominator of the third set of spindle gear ratio.	1	0 to 60000	P
428	Gear ratio numerator 4	Sets the numerator of the fourth set of spindle gear ratio.	1	0 to 60000	P
429	Gear ratio denominator 4	Sets the denominator of the fourth set of spindle gear ratio.	1	0 to 60000	P
430	Tool retraction distance adjustment rate for tapping operation (feed axis follows the spindle)	Adjusts the pre-calculated stop distance for the tapping operation (feed axis follows the spindle). (Unit: 0.1%) The default value for the parameter is 1000 (100%) and the maximum limit is 200%.	1000	0 to 2000	P
434	Tap-learning setting value	The manual setting value after the tap-learning operation is complete.	0	0 to 65535	P
435	Default value for tap-learning operation	The tap-learning default value can improve the efficiency for the tap-learning process.	0	0 to 65535	P
436	1st spindle error checking time	When the error between the 1st spindle command and the feedback speed is greater than the value of Pr.406 and the duration exceeds the error checking time (msec) set in Pr.436, the alarm B646 (Excessive spindle speed error) occurs and this will stop the feed axis and spindle. When Pr.436 is set to 0, the system does not check whether the spindle target speed is reached.	0	0 to 65535	R

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="2">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td rowspan="8">437</td><td rowspan="8">Spindle auxiliary function</td><td>Name</td><td>Range</td><td rowspan="8">0</td><td rowspan="8">0 to 3</td><td rowspan="8">P</td></tr>
<tr><td>Spindle positioning turn for proximity switch:
When using the proximity switch for positioning function, use this parameter to set the number of rotations of the spindle during Z-phase searching.</td><td>0 to 3</td></tr>
<tr><td>Feedback encoder setting for multi-stage spindle
0: absolute encoder
1: incremental encoder</td><td>0 to 1</td></tr>
<tr><td>Unit switch for spindle target speed error
0: the unit of spindle target speed error (Pr.406) is rpm.
1: the unit of spindle target speed error (Pr.406) is 0.1%.
Note: the maximum setting is 50%.</td><td>0 to 1</td></tr>
<tr><td>1st spindle gear maximum speed limit
0: disable
1: enable
You can set the maximum speed for the four gears of the 1st spindle in the POS screen.</td><td>0 to 1</td></tr>
<tr><td>Reference for [Spindle speed reached] when threading
0: the condition for “speed reached” is that the speed is lower than 10 rpm.
1: the condition for “speed reached” refers to M2256.</td><td>0 to 1</td></tr>
<tr><td>G97 maximum speed of 1st spindle
0: enable; both G96 and G97 are restricted by G50.
1: disable; G96 is restricted by G50. G97 is not restricted by G50.</td><td>0 to 1</td></tr>
<tr><td>Switch of spindle polarity check:
When the spindle output mode is analog voltage or pulse, the spindle command is opposite to the feedback direction and the alarm [431C: spindle polarity error] occurs.
0: enable (default)
1: disable</td><td>0 to 1</td></tr>
<tr><td>438</td><td>2nd spindle default speed</td><td colspan="2">The default spindle speed when power is on.</td><td>0</td><td>0 to 60000</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>439</td><td>2nd spindle application setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Spindle function
0: off
1: on</td><td>0 to 1</td></tr>
<tr><td>Closed-loop control flag
0: off
1: on (feedback encoder is required)</td><td>0 to 1</td></tr>
<tr><td>Spindle output mode
0: communication (DMCNET)
1: pulse (B series)
2: analog voltage</td><td>0 to 2</td></tr>
<tr><td>Speed control mode
1: PUU</td><td>1</td></tr>
<tr><td>Spindle encoder magnification
0: 1000 times
1: 4 times</td><td>0 to 1</td></tr>
<tr><td>Analog spindle speed source
0: command
1: encoder</td><td>0 to 1</td></tr>
<tr><td>Analog spindle feedback encoder source
0: spindle
1: motor</td><td>0 to 1</td></tr>
<tr><td>Spindle speed reference
0: program
1: Pr.438</td><td>0 to 1</td></tr>
<tr><td>Spindle Max. speed command check
0: off
1: on</td><td>0 to 1</td></tr>
<tr><td>Spindle speed D1458 display mode
0: command speed (S-code)
1: instant
Closed loop = instant spindle feedback speed
Open loop = instant spindle command speed</td><td>0 to 1</td></tr>
<tr><td>Spindle voltage output mode
0: -10V to +10V
1: 0V to +10V (available under open loop control)</td><td>0 to 1</td></tr>
</table>
</td><td>0</td><td>0 to 0xFFFF</td><td>P</td></tr>
<tr><td>441</td><td>2nd spindle encoder port No.</td><td>Sets the feedback channel of the spindle encoder.</td><td>8</td><td>0 to 8</td><td>P</td></tr>
<tr><td>442</td><td>2nd spindle encoder resolution</td><td>Sets the encoder resolution (single-phase).
Unit: pulse/rev</td><td>1280</td><td>2 to 60000</td><td>P</td></tr>
<tr><td>443</td><td>2nd spindle integral gain</td><td>The analog speed integral gain of the spindle. The greater the value, the faster the response. But if the gain is too large, it may cause machine jitter.
Unit: 0.001 rad/s</td><td>50</td><td>1 to 1000</td><td>P</td></tr>
<tr><td>444</td><td>2nd spindle high positioning speed</td><td>Sets the maximum speed for spindle positioning. If the current speed exceeds the setting of Pr.444, the spindle decelerates to the speed set in Pr.444 and then performs positioning.
If the spindle speed is lower than the setting of Pr.444, it refers to Pr.460 Spindle low positioning speed.
Unit: rpm</td><td>100</td><td>1 to 20000</td><td>P</td></tr>
<tr><td>445</td><td>2nd spindle positioning offset</td><td>Sets the Z-phase offset for spindle positioning.
Unit: 0.01 degree</td><td>0</td><td>0 to 36000</td><td>R</td></tr>
<tr><td>446</td><td>2nd spindle target speed error</td><td>Sets the allowable error between the target speed and actual speed of the spindle.
Unit: rpm</td><td>10</td><td>0 to 300</td><td>P</td></tr>
<tr><td>447</td><td>2nd spindle positioning error</td><td>Sets the spindle positioning error. If the actual positioning error exceeds the setting, the spindle positioning fails.
Unit: 0.01 degree
<table>
<tr><th>Position error</th><th>M2263</th></tr>
<tr><td>Error > Pr.447</td><td>0</td></tr>
<tr><td>Error < Pr.447</td><td>1</td></tr>
</table>
</td><td>100</td><td>0 to 36000</td><td>P</td></tr>
</table>

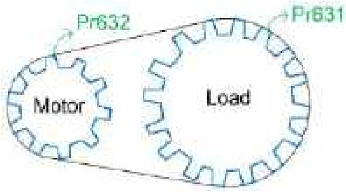
<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>448</td><td>2nd spindle zero speed error</td><td>If the spindle speed is lower or equal to this parameter value, the zero speed signal is on. (NC > MLC M2262)</td><td>5</td><td>0 to 1000</td><td>P</td></tr>
<tr><td>449</td><td>2nd spindle maximum speed</td><td>Sets the maximum speed for the spindle.
Unit: rpm</td><td>20000</td><td>0 to 600000</td><td>P</td></tr>
<tr><td>450</td><td>2nd spindle minimum speed</td><td>Sets the minimum speed for the spindle.
Unit: rpm</td><td>10</td><td>0 to 10000</td><td>P</td></tr>
<tr><td>451</td><td>2nd spindle ACC/DEC time constant</td><td>Sets the acceleration and deceleration time for the spindle. The greater the value, the longer the acceleration and deceleration time.
Unit: msec</td><td>20</td><td>1 to 20000</td><td>R</td></tr>
<tr><td>452</td><td>2nd spindle S-curve time constant</td><td>Sets the S-curve time constant of the spindle.
Unit: msec</td><td>10</td><td>1 to 2000</td><td>R</td></tr>
<tr><td>453</td><td>2nd spindle
2nd Kpp gain</td><td>When the spindle is under closed-loop voltage control, switch M1143 to instantly change the spindle Kpp gain.
<table>
<tr><th>M1143</th><th>Spindle Kpp gain</th></tr>
<tr><td>0</td><td>Pr.459</td></tr>
<tr><td>1</td><td>Pr.453</td></tr>
</table>
When the spindle performs positioning at low speed, it requires a higher gain value, while a high gain value may lead to vibration during high-speed rotation. Use D1380 Spindle actual speed and this parameter to instantly change the spindle Kpp gain value.</td><td>0</td><td>1 to 1000</td><td>R</td></tr>
<tr><td>456</td><td>2nd spindle tapping ACC/DEC time constant</td><td>Sets the acceleration and deceleration time for the tapping operation of the 2nd spindle.
Unit: msec</td><td>2000</td><td>1 to 20000</td><td>R</td></tr>
<tr><td>457</td><td>2nd spindle tapping S-curve time constant</td><td>Sets the S-curve time constant for the tapping operation of the 2nd spindle.
Unit: msec</td><td>100</td><td>1 to 2000</td><td>R</td></tr>
<tr><td>459</td><td>2nd spindle Kpp gain</td><td>When the spindle is under closed-loop voltage control, use this parameter to adjust the spindle position loop bandwidth. The greater the gain, the lower the following error, and the more precise the positioning. However, if the value is set too high, it may cause vibration. The parameter value is relevant to the bandwidth of the inverter. It is recommended that you start from a lower gain and then gradually increase the value.</td><td>0</td><td>0 to 1000</td><td>R</td></tr>
<tr><td>460</td><td>2nd spindle low positioning speed</td><td>If the current spindle speed is slower than the setting of Pr.444 or is zero, and the system performs spindle positioning, the spindle applies the speed set in Pr.460. Unit: rpm</td><td>100</td><td>1 to 20000</td><td>P</td></tr>
<tr><td>461</td><td>2nd spindle tapping retraction speed ratio</td><td>Tapping retraction setting. The tapping retraction speed is F multiply by the value of Pr.461. The higher the value, the faster the retraction.
Unit: 0.1 times</td><td>10</td><td>10 to 50</td><td>R</td></tr>
<tr><td>462</td><td>2nd spindle gear ratio numerator 1</td><td>Sets the numerator of the first set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>463</td><td>2nd spindle gear ratio denominator 1</td><td>Sets the denominator of the first set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>464</td><td>2nd spindle gear ratio numerator 2</td><td>Sets the numerator of the second set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>465</td><td>2nd spindle gear ratio denominator 2</td><td>Sets the denominator of the second set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>466</td><td>2nd spindle gear ratio numerator 3</td><td>Sets the numerator of the third set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>467</td><td>2nd spindle gear ratio denominator 3</td><td>Sets the denominator of the third set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>468</td><td>2nd spindle gear ratio numerator 4</td><td>Sets the numerator of the fourth set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>469</td><td>2nd spindle gear ratio denominator 4</td><td>Sets the denominator of the fourth set of the 2nd spindle gear ratio.</td><td>1</td><td>0 to 60000</td><td>P</td></tr>
<tr><td>476</td><td>2nd spindle speed error checking time</td><td>When the error between the 2nd spindle command and the feedback speed is greater than the value of Pr.446 and the duration exceeds the error checking time (msec) set in Pr.476, the alarm B646 (Excessive spindle speed error) occurs and this will stop the feed axis and spindle. When Pr.476 is set to 0, the system does not check whether the spindle target speed is reached.</td><td>0</td><td>0 to 65535</td><td>R</td></tr>
<tr><td>477</td><td>2nd spindle auxiliary function</td><td><table><tr><th>Name</th><th>Range</th></tr><tr><td>Unit switch for spindle target speed error
0: the unit of spindle target speed error (Pr.446) is rpm.
1: the unit of spindle target speed error (Pr.446) is 0.1%.
Note: the maximum setting is 50%.</td><td>0 to 1</td></tr></table></td><td>0</td><td>0 to 3</td><td>P</td></tr>
<tr><td>512</td><td>Spindle feedback speed
filter time</td><td>Pr.512 sets the filter time for the spindle feedback speed.
In the feed-per-revolution mode in the lathe system, this parameter is used to alleviate the fluctuation of feed rate caused by the noise from the spindle speed feedback, thus it can avoid affecting the surface finish during processing.
※ You must set Pr.399 spindle speed source to 1 (encoder).<table><tr><th>Pr.512</th><th>Spindle feedback filter value</th></tr><tr><td>Pr.512 = 0</td><td>4 ms</td></tr><tr><td>0 < Pr.512 < 200</td><td>Pr.512 (ms)</td></tr><tr><td>200 < Pr.512</td><td>200 ms</td></tr></table></td><td>0</td><td>0 to 65525</td><td>R</td></tr>
</table>

12.5 Machine parameter (MACHINE)

12.5.1 Machine parameter descriptions

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>602</td><td>1st software positive limit</td><td>Sets the machine coordinates for the 1st software positive limit.
Set this parameter to 0 to disable the function.
Unit: mm
1. An overtravel will cause the software positive limit error.
2. You can cancel the software limit by triggering the special M relay.
<table>
<tr><th>Axis</th><th>Cancel the software limit</th></tr>
<tr><td>X</td><td>M1248</td></tr>
<tr><td>Y</td><td>M1249</td></tr>
<tr><td>Z</td><td>M1250</td></tr>
<tr><td>A</td><td>M1251</td></tr>
<tr><td>B</td><td>M1252</td></tr>
<tr><td>C</td><td>M1253</td></tr>
<tr><td>U</td><td>M1254</td></tr>
<tr><td>V</td><td>M1255</td></tr>
<tr><td>W</td><td>M1256</td></tr>
</table></td><td>10^5</td><td>-10^5 to +10^5</td><td>R</td></tr>
<tr><td>603</td><td>1st software negative limit</td><td>Sets the machine coordinates for the 1st software negative limit.
Set this parameter to 0 to disable the function.
Unit: mm
1. An overtravel will cause the software negative limit error.
2. You can cancel the software limit by triggering the special M relay.</td><td>-10^5</td><td>-10^5 to +10^5</td><td>R</td></tr>
<tr><td>604</td><td>2nd software positive limit</td><td>Sets the machine coordinates for the 2nd software positive limit.
Set this parameter to 0 to disable the function. An overtravel will cause the software positive limit error. Unit: mm</td><td>10^5</td><td>-10^5 to +10^5</td><td>R</td></tr>
<tr><td>605</td><td>2nd software negative limit</td><td>Sets the machine coordinates for the 2nd software negative limit.
Set this parameter to 0 to disable the function. An overtravel will cause the software negative limit error. Unit: mm</td><td>-10^5</td><td>-10^5 to +10^5</td><td>R</td></tr>
<tr><td>627</td><td>Decimals of lead screw pitch</td><td>When the function of decimal places for the lead screw pitch (Pr.634) is enabled, you can input the decimals for the pitch value with Pr.627.
Unit: 0.1 μm
Lead screw pitch for the axis:
Pr.633 + Pr.627 x 0.0001 (mm).</td><td>0</td><td>0 to 9999</td><td>P</td></tr>
<tr><td>628</td><td>Sensor setting</td><td>Sets the input polarity of positive / negative hardware limits and the home sensor.
Sets to 0 as an active Low NC switch.
Sets to 1 as an active High NO switch.
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Positive limit sensor setting</td><td>0 to 1</td></tr>
<tr><td>Negative limit sensor setting</td><td>0 to 1</td></tr>
<tr><td>Home sensor setting</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 3F</td><td>P</td></tr>
<tr><td>630</td><td>Encoder resolution</td><td>Sets the motor resolution per revolution (single-phase).</td><td>1280</td><td>10 to 50000</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>631</td><td>Shaft gear number</td><td>Sets the gear number of the counter shaft.

</td><td>1</td><td>1 to 65535</td><td>P</td></tr>
<tr><td>632</td><td>Motor gear number</td><td>Sets the number of gear teeth for the motor.</td><td>1</td><td>1 to 65535</td><td>P</td></tr>
<tr><td>633</td><td>Lead screw pitch</td><td>Sets the corresponding lead screw pitch for the axis.
This parameter is only effective for linear axes (i.e., ineffective for rotation axes). Unit: mm</td><td>10</td><td>2 to 100</td><td>P</td></tr>
<tr><td>634</td><td>Axis control variables</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Magnification (using G50 command is required)
0: off
1: on</td><td>0 to 1</td></tr>
<tr><td>Rotation axis feed mode (available for A, B, and C axes but not for X, Y, and Z axes.)
0: the rotation axis rotates to the specified position (degree) through a non-shortest path.
1: the rotation axis rotates to the specified position (degree) through the shortest path.
2: shows the position (degree) of the rotation axis in linear representation.
5: sets the rotation axis as a linear axis.</td><td>0 to 5</td></tr>
<tr><td>Encoder magnification
0: 1000 times (Pr.630×1000)
1: 4 times (Pr.630×4)</td><td>0 to 1</td></tr>
<tr><td>Rotation axis unit selection
(available for Pr.618, Pr.619, Pr.620, Pr.621, and Pr.625)
0: rpm
1: deg/min</td><td>0 to 1</td></tr>
<tr><td>Decimal places of lead screw pitch
0: off
1: on
(Lead screw pitch = Pr.633 + Pr.627*0.0001)</td><td>0 to 1</td></tr>
<tr><td>Handwheel reverse motion setting
0: when you operate the handwheel in the positive direction, the machine coordinates move in the positive direction.
1: when you operate the handwheel in the reverse direction, the machine coordinates move in the negative direction.</td><td>0 to 1</td></tr>
<tr><td>Calculate the corresponding angle of the rotation axis when the MLC axis is switched to the NC axis (only when Pr.616 = 2, 5)
0: off
1: on</td><td>0 to 1</td></tr>
</table>
</td><td>5</td><td>0 to 65535</td><td>P</td></tr>
</table>

Par. No.	Item	Description		Default value	Setting range	Property
		Lathe rotation axis reverse motion (valid in AUTO mode) 0: rotates to the specified angle in the original direction. 1: rotates to the specified angle in the reverse direction.	0 to 1			

12.6 Homing parameter (HOME)

12.6.1 Homing parameter descriptions

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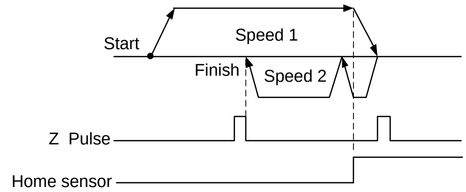
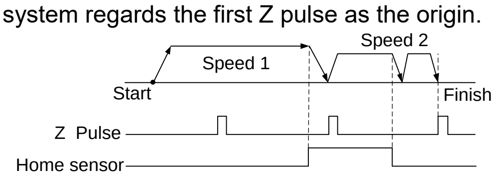
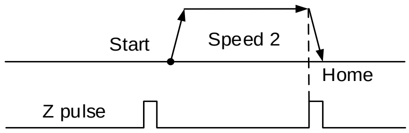
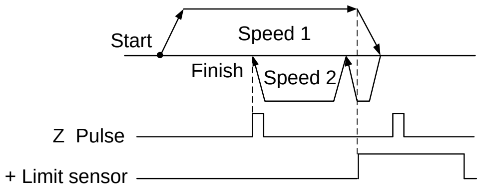
Par. No.	Item	Description	Default value	Setting range	Pro-perty
606	Machine origin coordinates	After performing homing and finding the Z pulse, the system has the axis offset by the value of Pr.606 and refers to the offset position as the machine origin. Unit: mm	0	-10^5 to +10^5	R
607	2nd reference coordinates	Sets the machine coordinates for the 2nd reference point. (Sets the 2nd reference point in the G30 command.) Unit: mm	0	-10^5 to +10^5	R
608	3rd reference coordinates	Sets the machine coordinates for the 3rd reference point. (Sets the 3rd reference point in the G30 command.) Unit: mm	0	-10^5 to +10^5	R
609	4th reference coordinates	Sets the machine coordinates for the 4th reference point. (Sets the 4th reference point in the G30 command.) Unit: mm	0	-10^5 to +10^5	R
610	Reference position tolerance	Sets the position error for the 2nd, 3rd, and 4th reference points. For example, when Pr.610 = 0.2, it means when the position error between the machine coordinate and the 2nd reference point is within ±0.2 mm, the axis is regarded as reaching the 2nd reference point.	0	-10^8 to +10^8	R
613	Calibration value for synchronous motion	The homing operation refers to this parameter setting to fine-tune the position of the slave axis. The setting steps are as follows: 1. Enable Pr.617 synchronous motion calibration function for the slave axis. Make sure that the origin parameters of the master and slave axes are consistent. 2. After confirming the mechanical positions of the master and slave axes are correct, activate the synchronous motion function (M1088). 3. HMI operation steps: DGN > System Monitoring > Synchronous Motion Monitoring. 4. In the Synchronous Motion Monitoring screen, when the synchronous motion calibration is set to 1, the system calculates the synchronous motion calibration value and automatically writes the results to Pr.613. Note: you must enable Pr.617 synchronous motion calibration function, so that the calibration field appears. 5. Cycle power on the controller, perform the homing procedure, and then you can perform the calibration.	0	-2147483647 to 2147483647	P

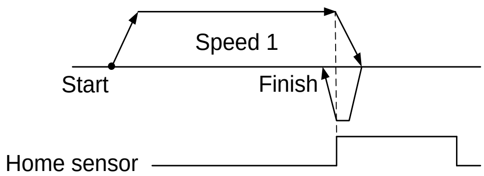
<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>616</td><td>Origin search mode</td><td>0: define current position as the origin
1: mode 1
When homing, once the servo reaches the home sensor, it reverses and the system regards the first Z pulse as the origin.


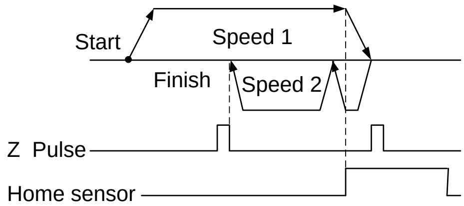
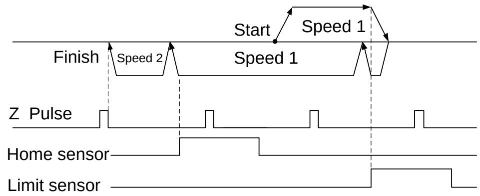
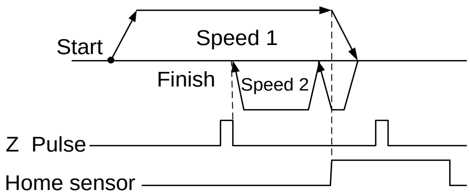
2: mode 2
When homing, after the servo reaches the home sensor, it carries on in the same direction to leave the home sensor, and the system regards the first Z pulse as the origin.


3: mode 3
The servo looks for the Z pulse at the 2nd homing speed (Pr.619) and the system regards it as the origin.


4: mode 4 (OT mode)
When homing, the system regards the positive limit as the home sensor. When the positive limit is triggered, the servo reverses and the system regards the first Z pulse as the origin.


5: mode 5
Absolute motor.

6: mode 6
When homing, once the servo reaches the home sensor, it reverses and decelerates to a stop, and the system regards the stop point as the origin.

</td><td>1</td><td>0 to 24</td><td>P</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro- perty
616	Origin search mode	7: mode 7 (the function is exclusive to Renishaw's BiSS C type single-turn absolute motors) After the servo performs homing for the absolute motor, if the system triggers the special M relays for homing (M1236 - M1241), the system regards the current position as the origin without clearing the machine coordinates. 8: mode 8 There are two possible conditions when homing. One is that the servo first reaches the home sensor and the other is that the servo first reaches the limit sensor. Condition 1: the servo first reaches the home sensor and reverses to find the Z pulse.  Condition 2: the servo first reaches the limit sensor and reverses to find the home sensor, and then it carries on in the same direction to find the Z pulse.  24: mode 24 Using this mode to perform homing is recommended when there is a home sensor on the mechanical part and an absolute motor is used. The servo first finds the origin in the way as mode 4 does and the the system uses the absolute reset (Abs Rst) function in the DGN screen. After resetting the origin of the absolute motor, cycle power to the system. The homing mode is automatically switched to mode 5 after power cycling.  	1	0 to 24	P

Par. No.	Item	Description: Name	Description: Range	Default value	Setting range	Pro-perty
617	Origin search setting	Origin search direction 0: reverse 1: forward	0 to 1	1	0 to 31	P
		Search home sensor when homing 0: off 1: on	0 to 1			
		Homing mode of rotation axis 0: single-turn After the system calculates the corresponding angle, the axis only moves by the remaining angular distance. 1: absolute The homing procedure refers to the machine coordinates and returns the axis to the machine origin. No processing for the corresponding angle.	0 to 1			
		Return mode after reaching home sensor 0: return to the machine origin After finding the Z pulse, the axis offsets by the value set in Pr.606. Then, the system regards the current position as the machine origin, completing the homing procedure. 1: return to the Z pulse After finding the Z pulse, the servo no longer moves, completing the homing procedure.	0 to 1			
		Homing option for sync. motion 0: when the synchronous control function is enabled, the slave axes and the master axis return to the origin synchronously. 1: when the synchronous control function is enabled, each axis can return to the origin individually with the synchronous protection function (Pr.642) remaining enabled.	0 to 1			
		Distance for ignoring the Z pulse 0: off When the servo leaves the sensor and stops, it regards the first found Z pulse as the reference Z pulse for homing. 1: on After the servo leaves the sensor and travels more than the fixed distance set in Pr.645, it regards the first found Z pulse as the reference Z pulse for homing.	0 to 1			

Par. No.	Item	Description	Default value	Setting range	Pro-perty
617	Origin search setting	Name: Synchronous motion calibration function 0: off 1: on The homing procedure refers to Pr.613 (calibration value for synchronous motion) to fine-tune the slave axis position. You need to use this parameter to enable the calibration function for the slave axis. Make sure the mechanical positions of the master and slave axes are correct. Go to the screen for setting synchronous motions on the HMI. Calculate the Z pulse difference between the master and slave axes (Pr.613 calibration value for synchronous motion) for the slave to calibrate the position based on this Z pulse difference and Pr.613 the next time the homing is executed. Range: 0 to 1	1	0 to 31	P
618	1st homing speed	Sets the speed for searching the home sensor (Home Dog protector). Unit: mm/min	2000	0 to 10000	R
619	2nd homing speed	Sets the speed for searching the Z pulse. Unit: mm/min	200	0 to 2000	R
620	Speed for moving to reference point	Sets the speed for the first homing after system starting with Pr.618 and Pr.619. After the first homing, the servo refers to the set value of Pr.620 for the following homing procedures. ※The homing speed setting range is as follows: Pr.618 (Min.) ≦ Pr.620 ≦ Pr.621 (Max.) Unit: mm/min	10	0 to 20000	R
624	Homing origin protection distance	During homing, when the home sensor is triggered (On), the motor reverses until the signal is Off. If the moving distance exceeds the setting of this parameter but the home sensor signal remains On, the system sends the alarm [B636 Home sensor error]. Unit: mm	20	1 to 2000	R
645	Distance for ignoring the Z pulse (0 to 100%)	Linear axis: after the servo leaves the sensor, it travels more than the given distance (Pitch*Pr.645%) to look for the Z pulse. If the nearest Z pulse is within this given distance, then it looks for the next Z pulse. Rotation axis: after the servo leaves the sensor, it travels more than the given distance (Pr.645%*360-degree of the motor) to look for the Z pulse. If the nearest Z pulse is within this given distance, then it looks for the next Z pulse.	100	0% to 100%	R

12.7 Ethernet setting (ETH.)

The CNC system can use Ethernet to remotely connect to a PC.

12.7.1 Ethernet parameter descriptions

Par. No.	Item	Description	Default value	Setting range	Pro-perty
10030	Host name	System's host name.	CNC000	1 to 8	R
10031	IP address	Sets the system IP address.	0.0.0.0	0 to 255	P
10032	Subnet mask	Sets the subnet mask of the system.	0.0.0.0	0 to 255	P
10033	Default gateway	Sets the system default gateway.	0.0.0.0	0 to 255	P
10034	Network function	Name / Range: Remote network function switch 0: disable 1: enable — 0 to 1 Remote PC IP limitation 0: specified address Looks for the remote computer IP addresses set in Pr.10036 to Pr.10040. 1: domain The computers in the same domain of the CNC can directly connect to the CNC. — 0 to 1	0	0 to 1	P
10035	DHCP switch	Enable the DHCP function. 0: disable 1: enable	0	0 to 1	P
10036	Remote PC IP address 1	IP address 1	0	255	P
10037	Remote PC IP address 2	IP address 2	0	255	P
10038	Remote PC IP address 3	IP address 3	0	255	P
10039	Remote PC IP address 4	IP address 4	0	255	P
10040	Remote PC IP address 5	IP address 5	0	255	P
10041	Shared remote directory IP address	Specifies an IP address from Pr.10036 - Pr.10040 for the NETWORK folder under [File manage]. 0: do not specify an IP address. 1 - 5: specifies the corresponding IP addresses in Pr.10036 - Pr.10040.	0	0 to 5	P
10055	FTP setting	Name / Range: FTP function switch — 0 to 1 FTP anonymous user Users without an account can connect to the CNC FTP. — 0 to 1 Set as main file after loaded — 0 to 1 0: off; 1: on	0	0 to 11	P
10057	FTP username	Sets the username with 1 - 32 characters. The first character must be an English letter in lower case.	CNCFTP	-	P
10058	FTP password	Sets the password with 1 - 8 characters.	12345678	-	P

12.8 Compensation parameter (COMP)

During the operation of machine tool, differences in mechanical parts may lead to motion error, and thus affect the machining result.

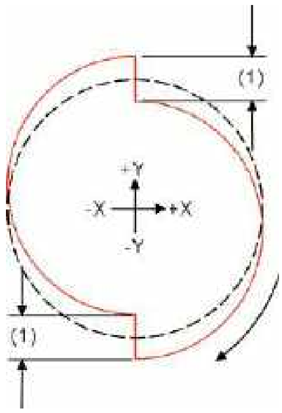
Set the relevant compensation parameters to have the controller compute the appropriate compensation amount according to the machine characteristics.

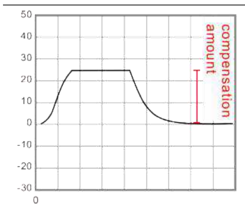
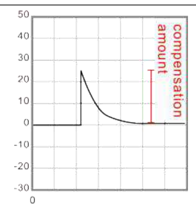
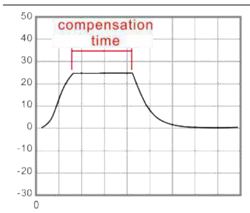
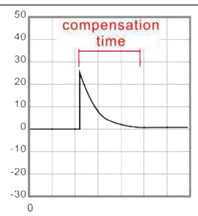
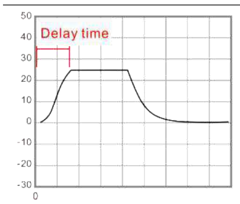
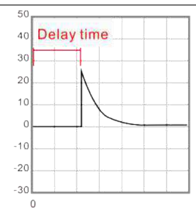
(1) When entering values in the length compensation fields, press **um** to enter absolute values, or press **um+** to enter incremental values.

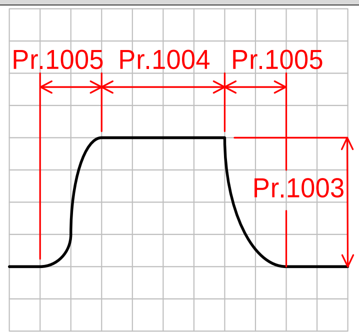
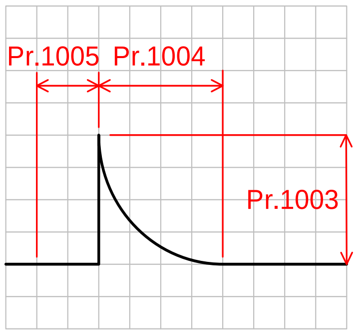
(2) Use the CNCSoft to convert the compensation data measured by the calibration equipment into compensation parameter files. Then, press **IMPORT** on the function bar in the next page to import the data in absolute format. You can also press **IMPORT+** to import and add the data to the existing values.

(3) Press **OK** to confirm the update.

12.8.1 Compensation parameter descriptions

Par. No.	Item	Description	Default value	Setting range	Pro-perty
1000	Backlash compensation amount	There is backlash in the lead pitch for most of the mechanical systems. Set this parameter with a positive value to compensate for backlash in positive direction, and vice versa. Set this parameter to 0 to disable the backlash compensation function. Unit: mm, inch  (1) Backlash in Y axis	0	-2 to +2	R
1001	Backlash compensation time	Sets the time constant of backlash compensation. When the backlash compensation time is 0, the backlash compensation function is disabled. Unit: 0.1 msec	0	0 to 10000	R
1002	Backlash compensation delay time	Sets the delay time before enabling the backlash compensation function. Unit: 0.1 msec	0	0 to 10000	R

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>1003</td><td>Friction compensation amount</td><td>Sets the friction compensation amount.
Unit: mm
<table>
<tr><th colspan="2">Friction compensation mode</th></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>
</td><td>
</td></tr>
</table></td><td>0</td><td>0 to 1</td><td>R</td></tr>
<tr><td>1004</td><td>Friction compensation time</td><td>Sets the friction compensation time.
Unit: 0.1 msec
<table>
<tr><th colspan="2">Friction compensation mode</th></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>
</td><td>
</td></tr>
</table></td><td>0</td><td>0 to 10000</td><td>R</td></tr>
<tr><td>1005</td><td>Friction compensation delay time</td><td>Sets the friction compensation delay time.
Unit: 0.1 msec
<table>
<tr><th colspan="2">Friction compensation mode</th></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>
</td><td>
</td></tr>
</table></td><td>0</td><td>0 to 10000</td><td>R</td></tr>
<tr><td>1006</td><td>Thread pitch compensation setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Absolute or incremental input.
0: absolute input (actual value of the measuring point)
1: incremental input (the difference between the current and previous measuring points)</td><td>0 to 1</td></tr>
<tr><td>Friction compensation in positive direction.
Timing: compensates when the machine moves in positive direction.
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Friction compensation in negative direction.
Timing: compensates when the machine moves in reverse direction.
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Friction compensation mode
0: pulse width</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 0xFFFF</td><td>R</td></tr>
</table>

Par. No.	Item	Description	Default value	Setting range	Pro-perty
		 1: exponential  Measuring direction (of the start point) 0: positive; positive direction from machine coordinates 1: negative: negative direction from machine coordinates — 0 to 1 Bi-directional thread pitch compensation 0: disable 1: enable — 0 to 1			
1007	Measuring point number	Sets the number of the measuring points for the lead screw pitch compensation with the maximum as 128. Set this parameter to 0 to disable the compensation function.	0	0 to 128	R
1008	Measuring interval	Sets the interval between each measuring point on the lead screw. Unit: mm	0	0 to 300	R
1009	Measuring offset	Sets the offset between the measuring point and machine origin. For example, when you set this parameter to 0, there will be no offset from the origin; when you set this parameter to 10, there will be an offset of 10 mm from the origin. Note: the direction of the offset should be identical to the direction specified in Pr.1006 Measuring direction.	0	-1000 to +1000	R
1010 to 1137	Data 1 - Data 128	Sets the lead screw pitch compensation in positive direction for the 1st to 128th points. The first point is usually the origin of the machine coordinates. Unit: mm (linear axes), deg (rotation axes)	0	-20 to +20	R
1138 to 1265	Reverse data 1 - Reverse data 128	Sets the lead screw pitch compensation in negative direction for the 1st to 128th points. Enable Pr.1006 Bi-directional thread pitch compensation to have this parameter group take effect. Unit: mm (linear axes), deg (rotation axes)	0	-20 to +20	R

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12.9 System parameter (SYSTEM)

In the system parameter setting screen, you can change the settings of the system's working environment, such as system date, system time, background color, function bar text color, and label text color. You can set each of these items individually as required.

12.9.1 System parameter descriptions

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>10000</td><td>System date</td><td>Sets the system date (format: yyyy/mm/dd).</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>10001</td><td>System time</td><td>Sets the system time (format: hh:mm:ss).</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>10002</td><td>System language</td><td>Sets the system language.
0: English
1: Traditional Chinese
2: Simplified Chinese
Note: this parameter is only available for A series models.</td><td>1</td><td>0 to 2</td><td>-</td></tr>
<tr><td>10003</td><td>Screen brightness</td><td>Sets the screen brightness.</td><td>50</td><td>1 to 99</td><td>-</td></tr>
<tr><td>10004</td><td>User-defined language</td><td>Set this parameter to change the language of the software screens. The setting range varies according to the number of languages set by the user.
※For the B series system, you must use this parameter to change the language.</td><td>0</td><td>0 to 10</td><td>-</td></tr>
<tr><td>10005</td><td>External device setting</td><td><table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Mouse sensitivity</td><td>0 to 100</td></tr>
<tr><td>HID-compliant mouse
(0: off; 1: on)</td><td>0 to 1</td></tr>
<tr><td>Automatically enable the keyboard NumLock
(0: off; 1: on)</td><td>0 to 1</td></tr>
<tr><td>Cursor display time (second)</td><td>1 to 15</td></tr>
<tr><td>Touch IO (0: off; 1: on)
When the screen element is triggered, M1153 is on for a short period of time.
This feature is typically used to control the touch buzzer of the touch panel.
Note: this parameter is only available for B-series models.</td><td></td></tr>
<tr><td>Keyboard pop-up mode
(0: double-click; 1: single-click)</td><td>0 to 1</td></tr>
<tr><td>Enable USB port for connecting to machine operation panel B
(0: off; 1: on)
Note: this function requires a dedicated USB conversion card.</td><td>0 to 1</td></tr>
</table></td><td>256</td><td>256 to 36708</td><td>R</td></tr>
<tr><td>10007</td><td>Initial macro program</td><td>Execute the macro program specified by this parameter before pressing CYCLE START.
Note: this program has to be stored in the O_Macro folder and the naming rule is O+Pr.10007.</td><td>0</td><td>9000 to 9999</td><td>P</td></tr>
<tr><td>10008</td><td>System length unit</td><td>Sets the unit system for length display on the NC system.
0: metric
1: imperial</td><td>0</td><td>0 to 1</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>10009</td><td>Sync axis coordinate setting</td><td>Sets the coordinate display of the synchronous axes.
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Sync axis coordinate display
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Sync axis workpiece coordinate display
0: disable
1: enable</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 65535</td><td>-</td></tr>
<tr><td>10010</td><td>Screensaver</td><td>Enable the screensaver.
0: disable
1: enable</td><td>0</td><td>0 to 1</td><td>-</td></tr>
<tr><td>10011</td><td>Screensaver time 1</td><td>Sets the first wait time for the screensaver.</td><td>10</td><td>1 to 60</td><td>-</td></tr>
<tr><td>10012</td><td>Screen brightness 1</td><td>Sets the first level of brightness for the screensaver.</td><td>30</td><td>0 to 99</td><td>-</td></tr>
<tr><td>10013</td><td>Screensaver time 2</td><td>Sets the second wait time for the screensaver.</td><td>30</td><td>1 to 60</td><td>-</td></tr>
<tr><td>10014</td><td>Screen brightness 2</td><td>Sets the second level of brightness for the screensaver.</td><td>10</td><td>0 to 99</td><td>-</td></tr>
<tr><td rowspan="2">10015</td><td rowspan="2">Account setting</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Account permission activation method
0: by system
1: by external I/O
M2934 = 1 (lock)
M2934 = 0 (unlock)</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>
<table>
<tr><td>Auto open the previous file: after enabling this function, when you insert the USB drive or CF card to the controller, the system automatically opens the last executed file.
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Auxiliary input window
(This function should be used with the mouse. With the mouse connected to the system, when you click the upper right corner of the screen, a list appears; when you click the input field, a keyboard appears.)
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Machining count display format
0: Word
1: Double word</td><td>0 to 1</td></tr>
<tr><td>No pop-up window display
0: displays the pop-up window
1: do not display the pop-up window</td><td>0 to 1</td></tr>
<tr><td>Automatically divide the value without decimal points by 1000.
0: divide by 1000. In the OFS screen, the entered value is automatically divided by 1000.
1: do not divide by 1000. In the OFS screen, the entered value is not automatically divided by 1000.</td><td>0 to 1</td></tr>
<tr><td>SEARCH method
0: line number or label number
1: label number</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 65535</td><td>P</td></tr>
</table>

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Par. No.	Item	Description		Default value	Setting range	Pro-perty
		Set the opened file as the main file 0: yes 1: no ※When the parameter is set to 1, if the system switches to AUTO mode, the main file you set with the auxiliary key [Main] is opened. ※When the parameter is set to 1, if the system switches to AUTO mode, but it cannot find the main file, then the main file switches to Default.NC.	0 to 1			
10016	System setting	**Name**	**Range**	4	0 to 65535	P
		Reset system after EMG release: sets whether to automatically generate a Reset signal after the emergency stop is released. 0: disable 1: enable	0 to 1			
		[SOFT] display after startup: Sets whether to display the SOFT screen as the default screen after system startup. 0: disable 1: switch to SOFT screen after startup	0 to 1			
		Alarm screen settings 0: do not display the alarm screen when an alarm occurs. 1: display the alarm screen when an alarm occurs.	0 to 1			
		System parameter auto backup: when this function is enabled, the system automatically makes a backup of the parameter data and stores it to the CF card. Once any of the parameters is modified, the backup data in the CF card is updated as well. 0: disable 1: enable	0 to 1			
		Hidden axis display: If you set not to display an axis in the CONFIG screen, the system refers to this parameter setting to determine whether the OFS screen hides the specific axis coordinate. 0: display axis coordinate 1: do not display axis coordinate	0 to 1			
		O macro file protection: 0: off 1: on When the parameter is enabled, O_macro_ECP appears in the INTER folder, and the O Macros moved into that folder can neither be copied nor read. In this case, you can set Pr.10017 (Macro call file source) to internal memory to protect the macro content.	0 to 1			
		EXTEND (extension variable) display 0: 450 extension variables (#10001 - #10450) 1: 1000 extension variables (#10001 - #11000)	0 to 1			

Par. No.	Item	Description		Default value	Setting range	Pro-perty
		Write protection for parameters 0: disable write protection 1: enable write protection	0 to 1			
		[POS] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[PRG] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[OFS] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[DGN] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[ALM] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[GRA] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[PAR] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[SOFT] screen display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
10017	G-code edit setting	Name	Range	1	0 to 65535	-
		G-code editing: sets whether to allow G-code editing. 0: editing is not allowed 1: editing is allowed	0 to 1			
		Macro call file source 0: CF card 1: internal memory	0 to 1			
		SF speed setting: sets whether you can use the SF SET function to set the cutting feed rate (F). 0: disable 1: enable	0 to 1			
		Program auto reset after editing: sets whether the cursor will automatically return to the program starting line after file editing. 0: disable 1: enable	0 to 1			
		Subprogram call file source 0: program (same disk as the main program) 1: USB disk	0 to 1			

Par. No.	Item	Description	Default value	Setting range	Pro-perty
10017	G-code edit setting	**Name** / **Range** Subprogram file name display: The current program title field displays the currently running subprogram. 0: enable 1: disable — 0 to 1 Support .txt file 0: disable 1: enable — 0 to 1 Path of test program for friction compensation: The location where the program files generated by the friction compensation function are stored. 0: CF card 1: O_Macro — 0 to 1 System macro command function 0: disable 1: enable — 0 to 1	1	0 to 65535	-
10018	Background color	Sets the background color.	LIGHTGRAY	0 to 65535	-
10019	Title bar text color	Sets the text color for the title bar.	BLACK	0 to 65535	-
10020	Mode bar text color	Sets the text color for the mode bar.	DARKBLUE	0 to 65535	-
10021	Function bar text color	Sets the text color for the function bar.	BLACK	0 to 65535	-
10022	Label text color	Sets the text color for the labels.	BLACK	0 to 65535	-
10023	Numeric value color	Sets the text color for numeric values.	BLUE	0 to 65535	-
10024	Table gridline color	Sets the color of table gridline.	BLACK	0 to 65535	-
10025	System cursor color	Sets the cursor color in the system.	COLOR_ S07	0 to 65535	-
10026	System text highlight color	Sets the text highlight color in the system.	WHITE	0 to 65535	-
10027	Software panel cursor color	Sets the cursor color in the software panel.	YELLOW	0 to 65535	-
10028	System alarm color	Sets the color of system alarms.	RED	0 to 65535	-
10029	User-defined alarm color	Sets the color of user-defined alarms.	BLUE	0 to 65535	-
10042	Software panel text highlight color	Sets the text highlight color in the software panel.	COLOR_ S07	0 to 65535	-

Par. No.	Item	Description		Default value	Setting range	Pro-perty
		Name	Range			
10043	[PAR] group item display	[OPERATE] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1	0	0 to 65535	P
		[MAGA] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[SPINDLE] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[MACHINE] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[HOME] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[COMP] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[SYSTEM] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[MLC] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[GRAPHIC] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[SERVO] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[CONFIG] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			
		[SET RIO] display 0: on; 1: off Note: this parameter is only available for A series models.	0 to 1			

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>10044</td><td>Channel 0 - axis teaching setting</td><td>Enable the TEACH function for the corresponding axis. The TEACH function of the PRG group is only available in JOG or MPG mode.
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>X axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>Y axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>Z axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>A axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>B axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>C axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>U axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>V axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>W axis teaching
0: off; 1: on</td><td>0 to 1</td></tr>
<tr><td>Teaching G-code generation
0: only for moving axes; 1: for all axes</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>10045</td><td>[PRG]/[OFS]/[DGN] group item display</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>[TUNING] display
0: on; 1: off
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
<tr><td>[TEXT WR] display
0: on; 1: off
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
<tr><td>[LOGO WR] display
0: on; 1: off
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
<tr><td>[MACRO] display
0: on; 1: off
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
<tr><td>[FILE QUEUE] display
0: on; 1: off
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 65535</td><td>P</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>10053</td><td>Barcode setting</td><td><table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Barcode file reading
0: disable
1: file scan (the PRG screen shows the option of [BARCODE], and you can use the LOAD function to load the file to the main file).
2: special M trigger (scan the barcode to load the corresponding file to the main file).</td><td>0 to 2</td></tr>
<tr><td>The special M relay for triggering barcode reading</td><td>0 to 1023</td></tr>
<tr><td>Barcode reading file source
0: CF card; 1: internal memory</td><td>0 to 1</td></tr>
<tr><td>Barcode input mode
0: element; 1: system</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 8190</td><td>P</td></tr>
<tr><td>10054</td><td>Auto logout time</td><td>Sets the time duration for automatically logging out the permission account. Unit: min</td><td>0</td><td>0 to 1440</td><td>-</td></tr>
<tr><td>10059</td><td>OFS input mode</td><td><table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>OFFSET
0: auxiliary key; 1: absolute; 2: incremental</td><td>0 to 2</td></tr>
<tr><td>WEAR
0: auxiliary key; 1: absolute; 2: incremental</td><td>0 to 2</td></tr>
<tr><td>COORD
0: auxiliary key; 1: absolute; 2: incremental</td><td>0 to 2</td></tr>
<tr><td>Coordinate system auto setting mode
0: write the machine coordinates to the coordinate system
1: write the machine coordinates corresponding to 0 point of absolute coordinates to the coordinate system</td><td>0 to 1</td></tr>
<tr><td>Clear offset coordinates after setting the workpiece coordinates
0: disable
1: enable</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 42</td><td>-</td></tr>
<tr><td>10060</td><td>Maximum tool wear for a single cut</td><td>Sets the maximum tool wear for a single cut to avoid machining size error.
Unit: 0.001 mm</td><td>0</td><td>0 to 65535</td><td>-</td></tr>
<tr><td>10061</td><td>Barcode setting</td><td>Sets the maximum reading length.
0: 64 characters (maximum)
1 - 63: 1 - 63 characters</td><td>0</td><td>0 to 63</td><td>P</td></tr>
<tr><td>10063</td><td>System default main file</td><td>Sets to have the system read the specific NC main file after each startup.
0: off; 1: on
Note: this parameter is only available for models dedicated to CAD/CAM applicaitons.</td><td>0</td><td>0 to 1</td><td>P</td></tr>
</table>

12.10 MLC setting (MLC)

12.10.1 MLC parameter descriptions

Par. No.	Item	Description	Default value	Setting range	Pro-perty
2000	MLC scan time	When you set this value and enable Pr.2001 control flag, the MLC ladder scanning is available at a fixed time interval (ms). Setting this value too large can cause delays in updating the MLC devices.	2	2 to 1000	P
2001	Control flag	MLC fixed scan time 0: off 1: on (leaves more process resource for the HMI)	0	0 to 1	P
2003	Local I/O filter time	Sets the filter time for local I/O. Unit: msec	0	0 to 20	P
12000	Program title	Sets the program title.	-	-	-
12001	Company name	Enter the company name.	-	-	-
12002	Designer name	Enter the designer name.	-	-	-
12003	Show comment	Sets whether to show the comments. 0: off 1: on	0	0 to 1	-
12004	Show symbol	Sets whether to show the symbols. 0: disable 1: on	0	0 to 1	-
12005	Ladder color	Sets the ladder color.	BLACK	0 to 65535	-
12006	Ladder text color	Sets the text color for the ladder.	BLACK	0 to 65535	-
12007	Ladder symbol color	Sets the symbol color for the ladder.	BLACK	0 to 65535	-
12008	Ladder cursor color	Sets the cursor color for the ladder.	LIGHT BLUE	0 to 65535	-
12009	Ladder monitoring status display color	Sets the monitoring status display color for the ladder.	LIGHT GREEN	0 to 65535	-
12010	Ladder device comment color	Sets the comment color of the device for the ladder.	BROWN	0 to 65535	-
12011	Ladder segment comment color	Sets the comment color of the section for the ladder.	BROWN	0 to 65535	-
12012	Ladder row comment color	Sets the comment color of the ladder row.	BROWN	0 to 65535	-
12013	Ladder monitoring value color	Sets the color of the monitoring values for the ladder.	LIGHT RED	0 to 65535	-
12014	NC special device color	Sets the color of NC special devices.	COLOR_ S2B	0 to 65535	-
12015	MLC special device color	Sets the color of MLC special devices.	MAGENTA	0 to 65535	-
12016	MLC protection	Name / Range: MLC edit protection: when this function is enabled, you can only edit the MLC programs in EDIT mode. 0: off 1: on — Range: 0 to 1 MLC display 0: on 1: off Note: this parameter is only available for A series models. — Range: 0 to 1	1	0 to 65535	P

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="2">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>MLC auto backup: when this function is enabled, the system automatically makes a backup of the MLC data and store it to the CF card.
0: off
1: on
Note: this parameter is only available for A series models.</td><td>0 to 1</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>EMG protection for MLC file saving
0: on
1: off</td><td>0 to 1</td></tr>
<tr><td>Show MLC file-saving reminder upon group switch
0: off
1: on
Note: this parameter is only available for A series models.</td><td>0 to 1</td></tr>
<tr><td rowspan="4">12017</td><td rowspan="4">MLC setting</td><td>Name</td><td>Range</td><td rowspan="4">0</td><td rowspan="4">0 to 65535</td><td rowspan="4">P</td></tr>
<tr><td>MLC file immediately takes effect after loaded: when this function is enabled, MLC files take effect right after being loaded without a system restart.
0: disable
1: enable</td><td>0 to 1</td></tr>
<tr><td>Record system data in special D registers
0: disable
1: enable

D1102: main file name
Name range: O0000 - O9999
D1103, D1104:
Total machining time (sec.)
D1105, D1106:
Single machining time (sec.)
D1107: year, month
D1108: day, hour
D1109: minute, second
Note: set hexadecimal format to access the D registers and then convert the data into decimal format for use.
Example:
Year 2020 February 28th, PM06:45:59
D1107 = 14 02
14 (HEX) = 20 (DEC)
Year 2000 + 20
02 (HEX) = 02 (DEC)
D1108=1C 12
1C (HEX) = 28 (DEC)
12 (HEX) = 18 (DEC)
D1109 = 2D 3B
2D (HEX) = 45 (DEC)
3B (HEX) = 59 (DEC)</td><td>0 to 1</td></tr>
<tr><td>Keyboard shortcuts for triggering M device
0: off
1: on</td><td>0 to 1</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th colspan="2">Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>MLC user-defined keypad
0: off
1: on</td><td>0 to 1</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>MLC user-defined keypad mode
0: single point
1: multiple points</td><td>0 to 1</td></tr>
<tr><td>12019</td><td>[SPACE]+[POS]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12020</td><td>[SPACE]+[PRG]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12021</td><td>[SPACE]+[OFS]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12022</td><td>[SPACE]+[DGN]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12023</td><td>[SPACE]+[ALM]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12024</td><td>[SPACE]+[GRA]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12025</td><td>[SPACE]+[PAR]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12026</td><td>[SPACE]+[SOFT]
M device triggered with keyboard shortcuts</td><td colspan="2">0: function disabled
1 to 3071: sets the device M1 to M3071</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td rowspan="17">12027</td><td rowspan="17">Enable user alarm 0</td><td>Name</td><td>Range</td><td rowspan="17">0</td><td rowspan="17">0 to 65535</td><td rowspan="17">P</td></tr>
<tr><td>Enable A0 - A15 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A16 - A31 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A32 - A47 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A48 - A63 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A64 - A79 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A80 - A95 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A96 - A111 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A112 - A127 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A128 - A143 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A144 - A159 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A160 - A175 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A176 - A191 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A192 - A207 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A208 - A223 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A224 - A239 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A240 - A255 alarms</td><td>0 to 1</td></tr>
</table>

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Pro-perty</th></tr>
<tr><td>12028</td><td>Enable user alarm 1</td><td>
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Enable A256 - A271 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A272 - A287 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A288 - A303 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A304 - A319 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A320 - A335 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A336 - A351 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A352 - A367 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A368 - A383 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A384 - A399 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A400 - A415 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A416 - A431 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A432 - A447 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A448 - A463 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A464 - A479 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A480 - A495 alarms</td><td>0 to 1</td></tr>
<tr><td>Enable A496 - A511 alarms</td><td>0 to 1</td></tr>
</table>
</td><td>0</td><td>0 to 65535</td><td>P</td></tr>
<tr><td>12029</td><td>System / user-defined keypad
Switch the M device number</td><td>1. If this M device is on, the default key combination function is disabled.
2. If this M device is off, the default key combination function is enabled.
Note:
1. This function only takes effect when Pr.12017 [MLC user-defined keypad] is 1.
2. This parameter is only available for the OPENCNC system.</td><td>0</td><td>0 to 3071</td><td>-</td></tr>
<tr><td>12030</td><td>Value of the user-defined keypad key
Corresponded D device number</td><td>1. Writes the key code received by the keypad to the corresponding D register.
2. When the key is pressed, the value is written to the D register. When the key is released, the D register value is cleared to 0.
Note:
1. This function only takes effect when Pr.12017 [MLC user-defined keypad] is 1.
2. This parameter is only available for the OPENCNC system.</td><td>0</td><td>0 to 1535</td><td>-</td></tr>
</table>

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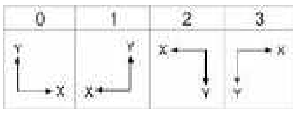
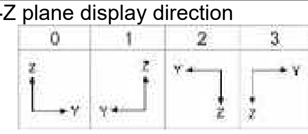
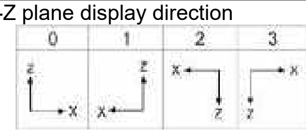
12.11 Graph parameter (GRAPHIC)

12.11.1 Graph parameter descriptions

Par. No.	Item	Description	Default value	Setting range	Pro-perty
14000	Line color	Sets the line color.	0	0 to 65535	-
14001	Background color	Sets the background color.	1183	0 to 65535	-
14002	Graphic display setting	Sets the graphic display. Name / Range Line width: 0 to 4 Enable the auxiliary line display: 0 to 1	1	0 to 65535	-
14003	Graphic setting	Name / Range Graphic default screen: 0 to 1 X-Y plane display direction: 0 to 3  Y-Z plane display direction: 0 to 3  X-Z plane display direction: 0 to 3 	0	0 to 65535	P
14004	X-Y plane graphic dimension	The graphic dimension of the X-Y plane. Unit: mm	200	5 to 100000	-
14005	Y-Z plane graphic dimension	The graphic dimension of the Y-Z plane. Unit: mm	200	5 to 100000	-
14006	X-Z plane graphic dimension	The graphic dimension of the X-Z plane. Unit: mm	200	5 to 100000	-
14007	X-Y-Z plane graphic dimension	The graphic dimension of the X-Y-Z plane. Unit: mm	200	5 to 100000	-
14008	Graphic setting	Name / Range Auto preview: When this function is enabled and you press **AUTO**, the CNC quickly scans the NC programs one time and calculates the appropriate plot range on the GRA screen. 0: do not execute auto preview 1: execute auto preview Range: 0 to 1 Reserve graphics after M30: When this function is enabled, the graphics are automatically reserved after M30 is executed. 0: off 1: on Range: 0 to 1	0	0 to 65535	P
14010	Grid color	Sets the grid color.	46516	0 to 65535	-
14011	Subgrid color	Sets the subgrid color.	46516	0 to 65535	-
14012	Coordinate axis color	Sets the color of the coordinate axes.	65504	0 to 65535	-
14013	Auxiliary line color	Sets the color of the auxiliary lines.	2016	0 to 65535	-

12.12 Servo parameter (SERVO)

12.12.1 Servo parameter descriptions

<table>
<tr><th>Group</th><th>No.</th><th>Name</th><th>Description</th><th>Default value</th><th>Setting range</th></tr>
<tr><td>P0</td><td>0</td><td>Firmware version</td><td>Displays the firmware version of the servo.</td><td>-</td><td>0</td></tr>
<tr><td>P1</td><td>1</td><td>Input for control mode and control command</td><td>Sets the control mode.<table><tr><th>Name</th><th>Range</th></tr><tr><td>Torque output direction</td><td>0 to 1</td></tr></table></td><td>0</td><td>0x00 to 0x110F (HEX)</td></tr>
<tr><td>P1</td><td>8</td><td>Position command smoothing constant</td><td>The low-pass filter for position commands is usually used for eliminating undesired high-frequency response or noise and smoothing the commands. Unit: 10 msec</td><td>0</td><td>0</td></tr>
<tr><td>P1</td><td>32</td><td>Motor stop mode</td><td>Motor stop mode.</td><td>0</td><td>0 to 20</td></tr>
<tr><td>P1</td><td>36</td><td>S-curve ACC/DEC constant</td><td>The low-pass filter for S-curve is usually used for eliminating undesired high-frequency response or noise and smoothing the commands. Unit: msec</td><td>0</td><td>0</td></tr>
<tr><td>P1</td><td>37</td><td>Load inertia ratio</td><td>Load inertia ratio of servo motor. Unit: 0.1 times</td><td>10</td><td>0 to 2000</td></tr>
<tr><td>P1</td><td>44</td><td>E-gear ratio numerator (N1)</td><td>E-gear ratio numerator. Do not change the setting in the Servo On state. Unit: pulse</td><td>1</td><td>1 to (2^{29}-1)</td></tr>
<tr><td>P1</td><td>45</td><td>E-gear ratio denominator (M1)</td><td>E-gear ratio denominator. Do not change the setting in the Servo On state. Unit: pulse</td><td>1</td><td>1 to (2^{31}-1)</td></tr>
<tr><td>P1</td><td>52</td><td>Regenerative resistor value</td><td>Regenerative resistor value Unit: ohm</td><td>Depends on models</td><td>Depends on models</td></tr>
<tr><td>P1</td><td>53</td><td>Regenerative resistor capacity</td><td>Regenerative resistor capacity Unit: Watt</td><td>Depends on models</td><td>Depends on models</td></tr>
<tr><td>P1</td><td>55</td><td>Maximum speed limit</td><td>Sets the maximum speed of the servo motor. The default is the rated speed. Unit: rpm</td><td>0</td><td>0 to 65535</td></tr>
<tr><td>P1</td><td>62</td><td>Percentage of friction compensation (%)</td><td>Sets the percentage of friction compensation. Unit: %</td><td>0</td><td>0 to 100</td></tr>
<tr><td>P1</td><td>63</td><td>Constant of friction compensation (ms)</td><td>Sets the smoothing constant of friction compensation. Unit: ms</td><td>4</td><td>4</td></tr>
<tr><td>P1</td><td>68</td><td>Position command - moving filter</td><td>The moving filter smooths the beginning and end of the step command, but it also delays the command. Unit: ms</td><td>4</td><td>0 to 100</td></tr>
<tr><td>P2</td><td>0</td><td>Position control gain</td><td>Increasing the position control gain can enhance the position response and reduce the deviation in position control. If you set the value too high, it may cause vibration and noise. Unit: rad/s</td><td>35</td><td>0 to 2047</td></tr>
<tr><td>P2</td><td>1</td><td>Rate of change for position control gain</td><td>Adjusts the rate of change for the position control gain according to the gain switching condition. This parameter is usually used for adjusting the gain of the feed axis for it to be in accordance with that of the spindle when tapping. Unit: %</td><td>100</td><td>10 to 500</td></tr>
<tr><td>P2</td><td>2</td><td>Position feed forward gain</td><td>If the position control command changes position smoothly, increasing the gain value can reduce the position following errors. If the command does not change smoothly, decreasing the gain value can reduce the mechanical vibration during operation. Unit: %</td><td>50</td><td>0 to 100</td></tr>
</table>

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Group	No.	Name	Description	Default value	Setting range
P2	3	Position feed forward gain smoothing constant	If the position control command changes position smoothly, decreasing the smoothing constant value can reduce the position following errors. If the command does not change smoothly, increasing the smoothing constant value can reduce the mechanical vibration during operation. Unit: msec	5	2 to 100
P2	4	Speed control gain	Increasing the speed control gain can enhance the speed response. If you set the value too high, it may cause vibration and noise. Unit: rad/s	500	0 to 8191
P2	5	Rate of change for speed control gain	Adjusts the rate of change for the speed control gain according to the gain switching condition. Unit: %	100	10 to 500
P2	6	Speed integral compensation	Increasing the value of the integral speed control can enhance the speed response and reduce the deviation in speed control. If you set the value too high, it may cause vibration and noise. Unit: rad/s	100	0 to 1023
P2	7	Speed feed forward gain	If the speed control command changes speed smoothly, increasing the gain value can reduce the speed following errors. If the command does not change smoothly, decreasing the gain value can reduce mechanical vibration. Unit: %	0	0 to 100
P2	9	DI response filter time	Digital input response filter time. Unit: 2 msec	2	0 to 20
P2	10	DI1 functional planning	DI1 functional planning	-	-
P2	11	DI2 functional planning	DI2 functional planning	-	-
P2	12	DI3 functional planning	DI3 functional planning	-	-
P2	13	DI4 functional planning	DI4 functional planning	-	-
P2	14	DI5 functional planning	DI5 functional planning	-	-
P2	15	DI6 functional planning	DI6 functional planning	-	-
P2	16	DI7 functional planning	DI7 functional planning	-	-
P2	17	DI8 functional planning	DI8 functional planning	-	-
P2	23	Notch filter frequency (1)	The first setting for mechanical resonance frequency. Unit: Hz	1000	50 to 1000
P2	24	Notch filter attenuation level (1)	The first Notch filter attenuation level. The Notch filter is disabled when this parameter is set to 0. Unit: dB	0	0 to 32
P2	25	Resonance suppression low-pass filter	Sets the time constant for the low-pass filter for resonance suppression. The low-pass filter is disabled when this parameter is set to 0. Unit: 0.1 msec	2	0 to 1000
P2	26	Anti-interference gain	Increasing this parameter can increase the damping of the speed loop. Setting the value of P2-26 to equal P2-06 is recommended. In Position mode, decrease the value of this parameter to reduce position overshoot. Unit: 0.001	0	0

Group	No.	Name	Description	Default value	Setting range
P2	27	Gain switching condition and method selection	When the signal of gain switching is on, the rate of change for the speed control gain is changed to the setting of P2-05.	0	0 to 4 (HEX)
P2	28	Gain switching time constant	Controls the switching of smoothing gain. Unit: 10 msec	10	0 to 1000
P2	43	Notch filter frequency (2)	The second setting for mechanical resonance frequency. Unit: Hz	1000	50 to 2000
P2	44	Notch filter attenuation level (2)	The second Notch filter attenuation level. The Notch filter is disabled when this parameter is set to 0. Unit: dB	0	0 to 32
P2	45	Notch filter frequency (3)	The third setting for mechanical resonance frequency. Unit: Hz	1000	50 to 2000
P2	46	Notch filter attenuation level (3)	The third Notch filter attenuation level. The Notch filter is disabled when this parameter is set to 0. Unit: dB	0	0 to 32
P2	47	Auto resonance suppression mode	0: fixed parameter settings 1: automatically saves the parameter settings after resonance suppression 2: continuous suppression of resonance	1	0 to 2
P2	49	Speed detection filter and jitter suppression	Sets the filter for speed estimation. Unit: sec	0	0 to 1F
P2	52	Rotary axis position scale	Sets the total number of pulses required for one turn of the rotation axis.	0	0 to 1,000,000,000
P2	53	Position integral compensation	Increasing the position control integral compensation to reduce the position steady-state errors. Unit: rad/s	0	0 to 1023
P2	69	Absolute encoder	Sets the operation mode of the motor. Cycle power to the servo to have the setting take effect. 0: incremental type 1: absolute type	0	0 to 1
P3	12	CANopen / DMCNET support setting	CANopen / DMCNET support setting	0	0 to 111
P4	0	Fault record (N)	The last abnormal status record.	0	-
P4	1	Fault record (N-1)	The second to last abnormal status record.	0	-
P4	2	Fault record (N-2)	The third to last abnormal status record.	0	-
P4	3	Fault record (N-3)	The fourth to last abnormal status record.	0	-
P4	4	Fault record (N-4)	The fifth to last abnormal status record.	0	-
P5	0	Firmware subversion	Displays the firmware subversion of the servo.	0	-

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12.13 Channel setting (CONFIG)

You can enable the axes and define their attributes with this function as shown in Figure 12.13.1. This function is not available in AUTO and MDI modes.

Figure 12.13.1

The operation steps are as follows.

(1) Press **PAR** to enter the PAR screen.

(2) Press ▶ to display the function bar on the third page.

(3) Press **CONFIG** to enter the channel setting screen.

(4) The attribute setting fields of an axis that is not enabled are grayed-out. Select the check box of Enable for the axis to set its attributes.

(5) NC/MLC axis selection: select either NC or MLC axis.

(6) Port number: port number of the axis should be identical to the station number in the servo system. No. 1 is compulsory while other numbers can be arranged randomly.

(7) After defining all the axes, press **OK**.

(8) Restart the NC system.

Note:

1. To enable an axis, firstly select the check box of the corresponding Enable field. Then, you can set the axis as either an NC axis or MLC axis and set its port number which cannot be identical to other port numbers.
2. To disable an axis, move the cursor to the corresponding Enable field and press **ENTER** to cancel the selection. Then, the axis is disabled.
3. When you change the value of the parameter with a P marked in the Parameter Name field, you have to restart the NC system to have the changed value take effect. When you change the value of the parameter without a P marked in the Parameter Name field, it takes effect immediately without power cycling of the system.

12.14 RIO setting (SET RIO)

The NC system can add the control switches for external devices with the I/O extension modules. You can enable the I/O module in the RIO Setting screen as shown in Figure 12.14.1.

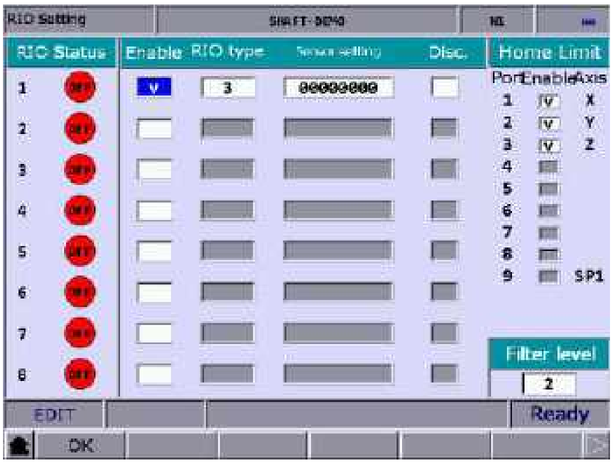


Figure 12.14.1

The operation steps are as follows.

(1) Press **PAR** to enter the PAR screen.

(2) Press ▶ to display the function bar on the third page.

(3) Press **SET RIO** to enter the RIO Setting page.

(4) Press ↑ and ↓ to move the cursor to the corresponding Enable field of the specified RIO port, and press **ENTER** to select the check box and enable its corresponding settings.

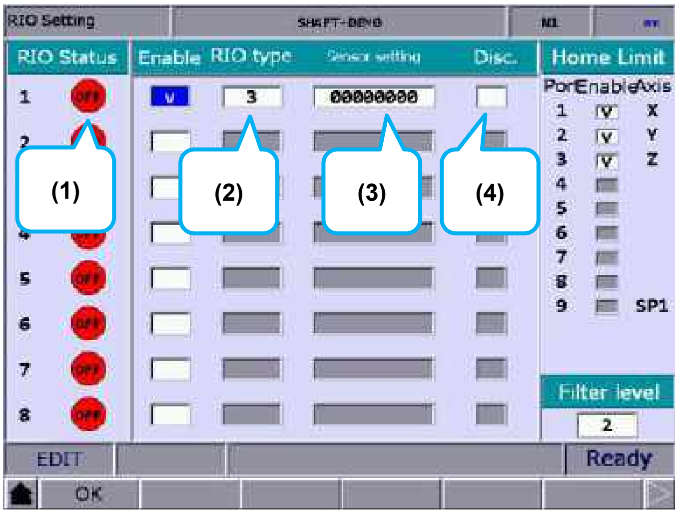
(5) Press ← and → to move the cursor to the Sensor setting field, press **ENTER**, and an input window appears. After entering the value, press **ENTER** to complete the setting.

(6) Press ← and → to move the cursor to the Disc. field, and press **ENTER** to select or cancel the selection.

(7) After enabling and setting all the I/O modules, press **OK** to complete the setting.

12.14.1 Details of RIO setting

RIO: press **OK** after completing the settings.



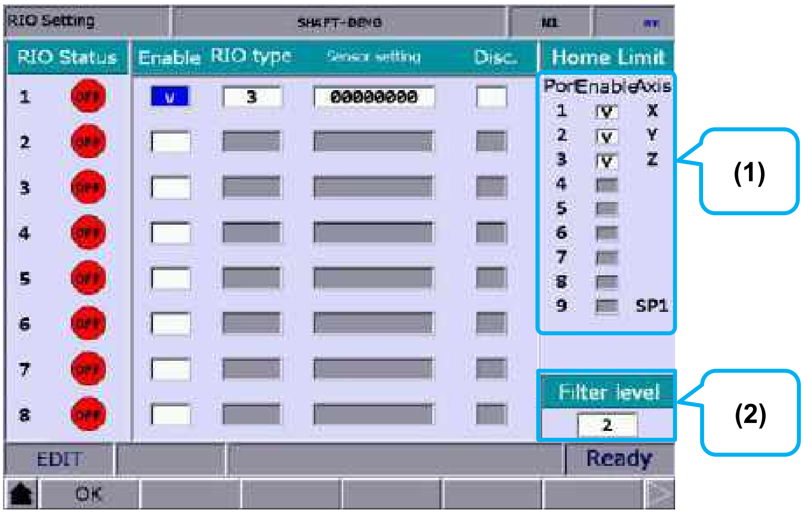
(1) Displays the status of the RIO ports in sequence according to the station numbers.

(2) Select the check box of the corresponding Enable field and set the RIO type to 0 as AD/DA, 1 as DA, 2 as AD, or 3 as DIO.

(3) DI input of the RIO can be set as the positive limit, negative limit, and home sensor of each axis, while only the DIs of Station 0 (the first RIO board) can be set. DIs on other RIO boards cannot be set. You can set 32 points in total from DI0 to DI31.

(4) Select the Disc. Field to have the DO remain its status when it is disconnected from the controller.

Home Limit: press **OK** after completing the setting.



(1) Axis selection: positive limit DI, negative limit DI, and home DI of X - A axes are input from the AXIS 1~4 connector on the controller (this connector is only available on NC3XX series models). According to the selected axes, each axis takes three DI points from X256, which are positive limit DI, negative limit DI, and home limit DI respectively.

For example, if you select Y and Z axes, the positive limit, negative limit, and home limit for each axis are as shown in the following table.

Signal \ Axis	X axis	Y axis	Z axis
Positive limit	AXIS_P1	X256	X259
Negative limit	AXIS_P2	X257	X260
Home	AXIS_P3	X258	X261

The special M relay code corresponding to the DI signal of each axis does not change regardless of the signal source.

Signal \ Axis	X axis	Y axis	Z axis
Positive limit	M2144	M2148	M2152
Negative limit	M2145	M2149	M2153
Home	M2146	M2150	M2154

(2) Sets the filter level of the DI on the RIO board.

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
200 μs	200 μs	400 μs	600 μs	800 μs	1 ms

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12.14.2 Setting DAC module (NC-EIO-DAC04)

The following steps illustrate how to set the DAC (Digital to analog converter) module.

(1) In the RIO Setting screen, enable the 5th port. You can only set the 5th to 8th ports of the DAC module.

(2) Set its RIO type to 1, and then D1464 - D1467 correspond to the output points 0 - 3 on the module card.

(3) Turn the rotary switch of the DAC module to 4.

(4) Connect the DAC module to the controller in the same way as connecting the RIO.

(5) After completing the previous four steps, cycle power to the system. Then, set the value 1024 to D1464, and you can measure 1.25V at the output point 0 on the DAC module (-/+10V correspond to -8191 to +8192).

Refer to the following table for the RIO port numbers and their corresponding MLC special register addresses.

DAC / Port No.	5	6	7	8
Output point 0	D1464	D1472	D1480	D1488
Output point 1	D1465	D1473	D1481	D1489
Output point 2	D1466	D1474	D1482	D1490
Output point 3	D1467	D1475	D1483	D1491

12.15 Search (SEARCH)

You can use the Search function to find the specified parameter field by entering the parameter number. The operation steps are as follows.

(1) Press PAR to enter the PAR screen.

(2) Use ▶ to turn the page and switch the function bar to the **Search** function page.

(3) Enter the parameter number to be searched to the input field in the lower left corner of the screen.

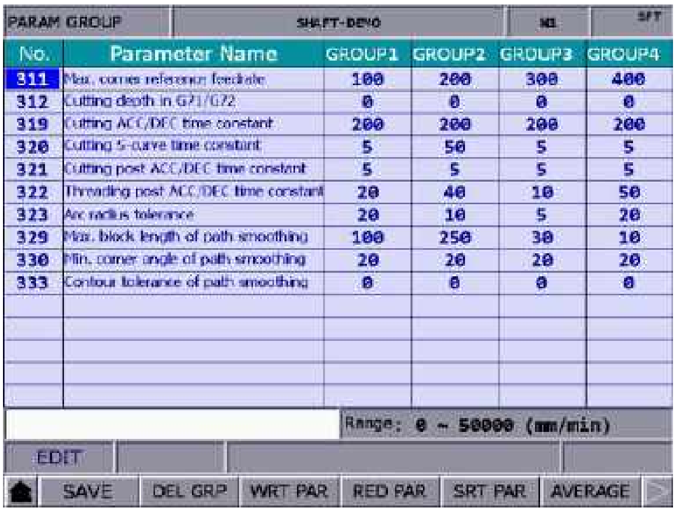
(4) Press **SEARCH** to search for the specified parameter.

Note: in addition to using the Search function, you can also search for the parameter in the PAR screen by entering “S + parameter number” and pressing ENTER.

12.16 Parameter group (PAR GRP)

Various types of parameters are available in the NC system. Equipment distributors can use the parameter group function to provide users with the most appropriate combination of parameters according to industrial requirements for machining, which simplifies the complicated parameter adjustments.

With this function, you can use G05P_ to switch the parameter groups during machining as shown in Figure 12.16.1.



No.	Parameter Name	GROUP1	GROUP2	GROUP3	GROUP4
311	Max. corner reference feedrate	100	200	300	400
312	Cutting depth in G71/G72	0	0	0	0
319	Cutting ACC/DEC time constant	200	200	200	200
320	Cutting S-curve time constant	5	50	5	5
321	Cutting post ACC/DEC time constant	5	5	5	5
322	Threading post ACC/DEC time constant	20	40	10	50
323	Arc radius tolerance	20	10	5	20
329	Max. block length of path smoothing	100	250	30	10
330	Min. corner angle of path smoothing	20	20	20	20
333	Contour tolerance of path smoothing	0	0	0	0

Figure 12.16.1

The operation steps are as follows.

(1) Press PAR to enter the PAR screen.

(2) Use ▶ to turn the page and switch the function bar to the **PAR GRP** function page.

(3) Press **PAR GRP** to enter the parameter group setting page.

(4) Enter the specified parameter number in the No. field and press ENTER to display the corresponding parameter name.

(5) Press **SRT PAR** to display the parameters by numbers in ascending or descending order.

(6) Press and to move the cursor to the Group field, enter the value, and press ENTER to complete setting the parameter group. You can also stop the cursor at the Group field, press **RED PAR**, and a confirmation window appears. Enter “Y” and press ENTER to access the current parameter values and write them to the corresponding fields.

(7) To delete a group, press and to move the cursor to any of the fields of the group to be deleted, press **DEL GRP**, and a confirmation window appears. Enter “Y” and press ENTER to delete the group.

(8) After enabling multiple groups, press **AVERAGE** and a confirmation window appears. Enter “Y” and press ENTER, and the system divides the maximum of the setting parameter by the number of currently enabled groups and defines the quotient as the first term, assigning values to each group field in arithmetic progression with the common difference the same as the first term.

(9) Press **SAVE**, and a confirmation window appears. Enter “Y” and press ENTER to save the settings.

(10) After setting the groups, press and to move the cursor to the specified group field, then press **WRT PAR**, and a confirmation window appears. Enter “Y” and press ENTER to write the values to corresponding parameters.

Note:

1. The WRT PAR (parameter write) function overwrites the original values, so ensure the new values are correct before using this function.
2. The parameter group function supports up to 20 parameters and 20 groups.

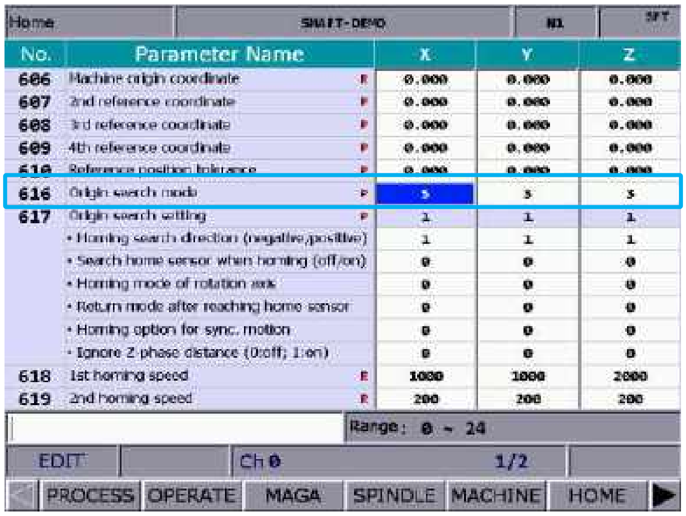
12.17 Other settings

12.17.1 Setting for absolute motor

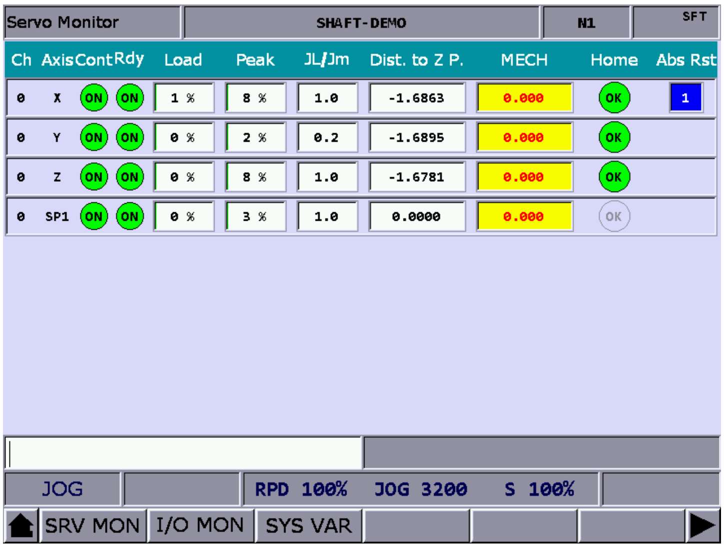
Follow these steps to set the system when using the NC series controller with an absolute motor.

(1) In the homing parameter screen, set Pr.616 Origin search mode to 5 (either an incremental or absolute encoder can be used. When you use an absolute motor for the first time, cycle power to the servo and controller after setting the parameter.)

Refer to the following figure.



(2) After setting the parameter, to reset the absolute encoder, go to **DGN** > **SYS MON** > **SRV MON** as shown in the following figure.



(3) Set the system to JOG or MPG mode to use the absolute reset function. In JOG or MPG mode, move the axis to the position to be defined as the origin, enter “1” and press **ENTER** to complete the setting. Meanwhile, the Home indicator is on, meaning that this axis has completed homing.

Note:

1. When a servo alarm occurs, the special M relay for absolute reset (Abs Rst) becomes 0, meaning that the absolute origin is lost. The following are the relevant alarms for absolute reset.

   AL060: absolute position is lost. Perform absolute reset.

   AL061: battery undervoltage. Replace the battery of the encoder.

   AL069: wrong encoder. Ensure an absolute encoder is connected.

2. In MPG mode, the absolute reset function is only applicable to the currently selected axis. For example, when you select X axis in MPG mode, enter “**1**” and press **ENTER** to complete the absolute reset.

12.17.2 Setting synchronous motion control

Application description: the A axis (slave axis) is required to follow the Z axis (master axis) in the same direction. Assuming that M13 is to enable the synchronous function and M14 is to disable it, the settings are as follows.

1. Set Pr.350 to 13.
2. Set Pr.351 to 14.
3. Set Pr.364 Synchronous control A to 3.

When M13 is executed, the MLC triggers M1088 (Trigger for synchronous control) and M1092 (A slave axis follows the master axis) at the same time. When the system commands the Z axis to move, the A axis moves synchronously. If there is a command to move A axis when the synchronous function is enabled, an alarm occurs since the slave axis (A axis) cannot receive a motion command from the system. Execute M14 to turn off M1088 to disable the synchronization function.

The synchronous control function is effective in AUTO, MDI, JOG, MPG, and HOME modes.

Important:

(1) Once you set an axis as a master axis, you cannot set it as a slave axis.
(2) Once you set an axis as a slave axis, you cannot set it as a master axis.
(3) Multiple slave axes can follow the same master axis.
(4) To perform homing when the synchronous control function is enabled, moves the master axis.
(5) When you press **RESET**, the system does not disable the synchronous control function.

Sample code:

```
G98
G90 G54 G00 X0.000 Y0.000 Z0.000
G00 Z50.000 (Z axis moves individually)
G00 A0.000 (A axis moves individually)
M13 (Synchronous motion function enabled)
G01 Z100.000 F100 (A axis synchronously moves with the Z axis)
G4X2.000
G01 Z150.000
M14 (Synchronous motion function disabled)
G00 A100.000 (A axis moves individually)
M30
```

Relevant parameters:

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Property</th></tr>
<tr><td rowspan="8">350 - 357</td><td rowspan="8">Halt M-code 1 - 8</td><td>Halt M-code 1 (0: no setting)</td><td rowspan="8">0</td><td rowspan="8">0 to 1000</td><td rowspan="8">P</td></tr>
<tr><td>Halt M-code 2</td></tr>
<tr><td>Halt M-code 3</td></tr>
<tr><td>Halt M-code 4</td></tr>
<tr><td>Halt M-code 5</td></tr>
<tr><td>Halt M-code 6</td></tr>
<tr><td>Halt M-code 7</td></tr>
<tr><td>Halt M-code 8</td></tr>
<tr><td>360</td><td>Synchronization direction control</td><td>Sets the synchronization direction.
0: same direction
1: different directions
<table><tr><th>Name</th><th>Range</th></tr><tr><td>Synchronous direction for X axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for Y axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for Z axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for A axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for B axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for C axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for U axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for V axis</td><td>0 to 1</td></tr><tr><td>Synchronous direction for W axis</td><td>0 to 1</td></tr></table></td><td>0</td><td>0 to 0x3F</td><td>P</td></tr>
<tr><td>361</td><td>Synchronous control X</td><td>Specifies the master axis when X axis is the slave axis. For example, set this parameter to 2 if desiring to set Y axis as the master axis for synchronous control.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>362</td><td>Synchronous control Y</td><td>Specifies the master axis when Y axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>363</td><td>Synchronous control Z</td><td>Specifies the master axis when Z axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>364</td><td>Synchronous control A</td><td>Specifies the master axis when A axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>365</td><td>Synchronous control B</td><td>Specifies the master axis when B axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>366</td><td>Synchronous control C</td><td>Specifies the master axis when C axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>367</td><td>Synchronous control U</td><td>Specifies the master axis when U axis is the slave axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 9</td><td>P</td></tr>
<tr><td>368</td><td>Synchronous control V</td><td>Specifies the master axis when V axis is the slave axis.
0: disable
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 9</td><td>P</td></tr>
<tr><td>369</td><td>Synchronous control W</td><td>Specifies the master axis when W axis is the slave axis.
0: disable
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 9</td><td>P</td></tr>
</table>

Special M relays for enabling synchronous control function:

Function description	Special relay code
Trigger for synchronous control	M1088
X slave axis follows the master axis	M1089
Y slave axis follows the master axis	M1090
Z slave axis follows the master axis	M1091
A slave axis follows the master axis	M1092
B slave axis follows the master axis	M1093
C slave axis follows the master axis	M1094
U slave axis follows the master axis	M1095
V slave axis follows the master axis	M1096
W slave axis follows the master axis	M1097

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12.17.3 Command transfer

Application description: transfer the command for Z axis to A axis (transfer axis).

Assuming that M20 is to enable transfer and M21 is to disable it, the settings are as follows.

1. Set Pr.350 to 20.
2. Set Pr.351 to 21.
3. Set Pr.374 Transfer control A to 3.

After executing M20 to trigger M1098 (Trigger for transfer command) and M1102 (A axis receives command from master axis), the system transfers the command that moves Z axis to A axis (that is, Z axis does not move). If a command that moves the A axis is executed, an alarm occurs since the transfer axis (A axis) cannot receive a motion command. Execute M21 to turn off M1098 to disable the command transfer control function. Enabling (M20) and disabling (M21) this function are only available in AUTO and MDI modes. Execute M21 to end the program. The command transfer function is not available in JOG, MPG, and HOME modes.

Important:

(1) Once you set an axis as a transfer axis, you cannot set it as a master axis.
(2) Once you set an axis as a master axis, you cannot set it as a transfer axis.
(3) Multiple transfer axes can refer to the same master axis.
(4) The transfer function is not available in HOME mode.
(5) When you press **RESET**, the system does not disable the command transfer function.
(6) When the command is transferred from Z axis to A axis, the tool length compensation function is available.
(7) A cutting cycle command for Z axis can be transferred.

Sample code:

```
G98
G54 G00 X10.000 Y10.000 Z10.000
G00 Z50.000
G00 A0.000
M20 (The controller pre-reads M20 and then enables command transfer control.)
G01 Z0. 000 F100 (The Z-axis command actually moves the A axis.)
G01 Z100.000
G4X2.
G01 Z150.000
M21 (The controller pre-reads M21 and then disables command transfer control.)
G00 A100.000
M30
```

Relevant parameters:

<table>
<tr><th>Par. No.</th><th>Item</th><th>Description</th><th>Default value</th><th>Setting range</th><th>Property</th></tr>
<tr><td rowspan="8">350 - 357</td><td rowspan="8">Halt M-code 1 - 8</td><td>Halt M-code 1 (0: no setting)</td><td rowspan="8">0</td><td rowspan="8">0 to 1000</td><td rowspan="8">P</td></tr>
<tr><td>Halt M-code 2</td></tr>
<tr><td>Halt M-code 3</td></tr>
<tr><td>Halt M-code 4</td></tr>
<tr><td>Halt M-code 5</td></tr>
<tr><td>Halt M-code 6</td></tr>
<tr><td>Halt M-code 7</td></tr>
<tr><td>Halt M-code 8</td></tr>
<tr><td>370</td><td>Transfer control direction</td><td>Sets the transfer control direction.
Bit 0 - 8: transfer direction of X - W axes
0: same direction
1: different directions
<table>
<tr><th>Name</th><th>Range</th></tr>
<tr><td>Transfer direction X</td><td>0 to 1</td></tr>
<tr><td>Transfer direction Y</td><td>0 to 1</td></tr>
<tr><td>Transfer direction Z</td><td>0 to 1</td></tr>
<tr><td>Transfer direction A</td><td>0 to 1</td></tr>
<tr><td>Transfer direction B</td><td>0 to 1</td></tr>
<tr><td>Transfer direction C</td><td>0 to 1</td></tr>
<tr><td>Transfer direction U</td><td>0 to 1</td></tr>
<tr><td>Transfer direction V</td><td>0 to 1</td></tr>
<tr><td>Transfer direction W</td><td>0 to 1</td></tr>
</table></td><td>0</td><td>0 to 0x3F</td><td>P</td></tr>
<tr><td>371</td><td>Transfer control X</td><td>Specifies the X axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the X axis move while the originally commanded axis does not move. For example, set this parameter to 2 if desiring to transfer the control command from the Y axis.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>372</td><td>Transfer control Y</td><td>Specifies the Y axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the Y axis move while the originally commanded axis does not move.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>373</td><td>Transfer control Z</td><td>Specifies the Z axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the Z axis move while the originally commanded axis does not move.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>374</td><td>Transfer control A</td><td>Specifies the A axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the A axis move while the originally commanded axis does not move.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
<tr><td>375</td><td>Transfer control B</td><td>Specifies B axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the B axis move while the originally commanded axis does not move.
0: disabled; 1 - 9: X - W</td><td>0</td><td>0 to 6</td><td>P</td></tr>
</table>

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Par. No.	Item	Description	Default value	Setting range	Property
376	Transfer control C	Specifies the C axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the C axis move while the originally commanded axis does not move. 0: disabled; 1 - 9: X - W	0	0 to 6	P
377	Transfer control U	Specifies the U axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the U axis move while the originally commanded axis does not move. 0: disabled; 1 - 9: X - W	0	0 to 9	P
378	Transfer control V	Specifies the V axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the V axis move while the originally commanded axis does not move. 0: disabled; 1 - 9: X - W	0	0 to 9	P
379	Transfer control W	Specifies the W axis as the axis to receive the transfer command. When transfer control function is enabled, the command is transferred to have the W axis move while the originally commanded axis does not move. 0: disabled; 1 - 9: X - W	0	0 to 9	P

Relevant special M relays for transfer control function:

Function description	Special relay code
Trigger for transfer command	M1098
X axis receives command from master axis	M1099
Y axis receives command from master axis	M1100
Z axis receives command from master axis	M1101
A axis receives command from master axis	M1102
B axis receives command from master axis	M1103
C axis receives command from master axis	M1104
U axis receives command from master axis	M1105
V axis receives command from master axis	M1106
W axis receives command from master axis	M1107
Transfer function in execution	M2228

Software (SOFT) Group 13

The SOFT group function is for customizing the operation screens with the CNCSoft software. This chapter provides the example screens.

With the ScreenEditor, you can design your own operation screen to replace the machine operation panel B or add customized functions.

Note: bold function names in a box (such as **POS**) mean the keys on machine operation panel A; bold function names (such as **CLR ALL**) mean the function keys of F1 - F6.

13.1 ScreenEditor software

■ ScreenEditor

Go to the main page of the Delta CNCSoft software to open the ScreenEditor software for screen editing, as shown in Figure 13.1.1.

Figure 13.1.1

■ Enter ScreenEditor, and you can see the operation interface as shown in Figure 13.1.2.

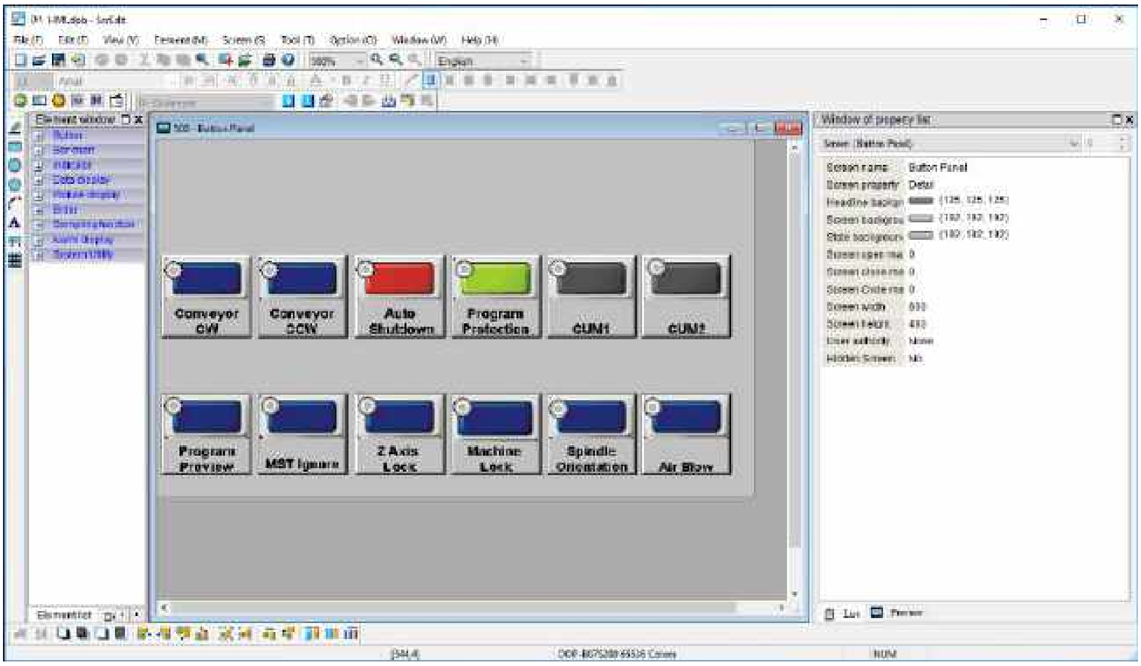

Figure 13.1.2

- After compiling the screens and creating the screen data files, you can import the files to the controller using the USB disk or through the Internet, as shown in Figure 13.1.3.

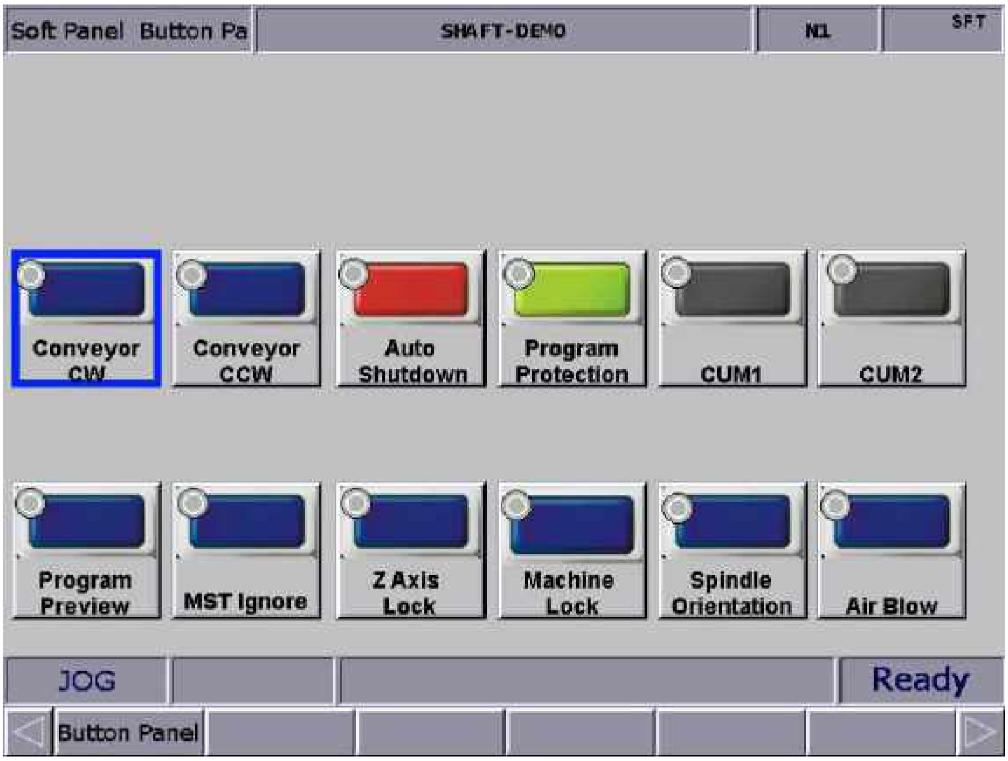

Figure 13.1.3

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MLC Special M Relay and Special D Register 14

This chapter provides detailed descriptions for the dedicated controlling devices of the NC system, through which you can quickly check the MLC status in the NC system. For more advanced control functions, refer to the NC Series MLC Application Manual.

14.1 Introduction to MLC special M relay and special D register

The MLC (Motion Logic Control) and NC are two independent systems. The MLC system performs button triggering controls, MLC axis movements, and other logic controls, while the NC system manages the system and servo axis related functions. The MLC special M relays and special D registers serve as the I/O interface between these two systems for data exchange and signal transmission.

The outputs mentioned in this chapter refer to the signals sent from the MLC special M relays and special D registers to the NC system. On the other hand, the inputs refer to the signals sent from the NC system to the MLC special M relays and special D registers. The M letter prefixed codes are in bit format referring to signal 0 (Off) or 1 (On). The D prefixed codes are in word format referring to numerical values such as 1000. The MLC special M relays and special D registers are all represented in the form of M- and D- suffixed with four digits.

Data exchanges between the two systems are categorized into four groups.
1: MLC bit output from MLC to NC (special M, bit output)
2: MLC bit input from NC to MLC (special M, bit input)
3: MLC word output from MLC to NC (special D, word output)
4: MLC word input from NC to MLC (special D, word input)

14.2 List of special M

Function name	Special M	Description	Device type
HMI output point 1	M1024	Sends the special M status to the system variable (#_). The corresponding system variable is #1801.	R/W
HMI output point 2	M1025	Sends the special M status to the system variable (#_). The corresponding system variable is #1802.	R/W
HMI output point 3	M1026	Sends the special M status to the system variable (#_). The corresponding system variable is #1803.	R/W
HMI output point 4	M1027	Sends the special M status to the system variable (#_). The corresponding system variable is #1804.	R/W
HMI output point 5	M1028	Sends the special M status to the system variable (#_). The corresponding system variable is #1805.	R/W
HMI output point 6	M1029	Sends the special M status to the system variable (#_). The corresponding system variable is #1806.	R/W
HMI output point 7	M1030	Sends the special M status to the system variable (#_). The corresponding system variable is #1807.	R/W
HMI output point 8	M1031	Sends the special M status to the system variable (#_). The corresponding system variable is #1808.	R/W
HMI output point 9	M1032	Sends the special M status to the system variable (#_). The corresponding system variable is #1809.	R/W
HMI output point 10	M1033	Sends the special M status to the system variable (#_). The corresponding system variable is #1810.	R/W
HMI output point 11	M1034	Sends the special M status to the system variable (#_). The corresponding system variable is #1811.	R/W
HMI output point 12	M1035	Sends the special M status to the system variable (#_). The corresponding system variable is #1812.	R/W
HMI output point 13	M1036	Sends the special M status to the system variable (#_). The corresponding system variable is #1813.	R/W
HMI output point 14	M1037	Sends the special M status to the system variable (#_). The corresponding system variable is #1814.	R/W
HMI output point 15	M1038	Sends the special M status to the system variable (#_). The corresponding system variable is #1815.	R/W
HMI output point 16	M1039	Sends the special M status to the system variable (#_). The corresponding system variable is #1816.	R/W
HMI output point 17	M1040	Sends the special M status to the system variable (#_). The corresponding system variable is #1817.	R/W
HMI output point 18	M1041	Sends the special M status to the system variable (#_). The corresponding system variable is #1818.	R/W
HMI output point 19	M1042	Sends the special M status to the system variable (#_). The corresponding system variable is #1819.	R/W
HMI output point 20	M1043	Sends the special M status to the system variable (#_). The corresponding system variable is #1820.	R/W
HMI output point 21	M1044	Sends the special M status to the system variable (#_). The corresponding system variable is #1821.	R/W
HMI output point 22	M1045	Sends the special M status to the system variable (#_). The corresponding system variable is #1822.	R/W
HMI output point 23	M1046	Sends the special M status to the system variable (#_). The corresponding system variable is #1823.	R/W
HMI output point 24	M1047	Sends the special M status to the system variable (#_). The corresponding system variable is #1824.	R/W
HMI output point 25	M1048	Sends the special M status to the system variable (#_). The corresponding system variable is #1825.	R/W
HMI output point 26	M1049	Sends the special M status to the system variable (#_). The corresponding system variable is #1826.	R/W

<table>
<tr><th>Function name</th><th>Special M</th><th>Description</th><th>Device type</th></tr>
<tr><td>HMI output point 27</td><td>M1050</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1827.</td><td>R/W</td></tr>
<tr><td>HMI output point 28</td><td>M1051</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1828.</td><td>R/W</td></tr>
<tr><td>HMI output point 29</td><td>M1052</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1829.</td><td>R/W</td></tr>
<tr><td>HMI output point 30</td><td>M1053</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1830.</td><td>R/W</td></tr>
<tr><td>HMI output point 31</td><td>M1054</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1831.</td><td>R/W</td></tr>
<tr><td>HMI output point 32</td><td>M1055</td><td>Sends the special M status to the system variable (#_). The corresponding system variable is #1832.</td><td>R/W</td></tr>
<tr><td>System mode selection:
0: auto execution (AUTO)
1: program edit (EDIT)
2: manual input (MDI)
3: MPG feeding (MPG)
4: jog feeding (JOG)
5: rapid feeding (RAPID)
6: homing (HOME)</td><td>M1056
M1057
M1058
M1059</td><td>You can control the statuses of M1056 - M1059 to switch between the system modes.
<table>
<tr><th colspan="4">Binary</th><th rowspan="2">Decimal</th><th rowspan="2">System mode</th></tr>
<tr><th>M1059 (Bit 3)</th><th>M1058 (Bit 2)</th><th>M1057 (Bit 1)</th><th>M1056 (Bit 0)</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>AUTO</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>EDIT</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td><td>MDI</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>3</td><td>MPG</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td><td>JOG</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>5</td><td>RAPID</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>6</td><td>HOME</td></tr>
</table></td><td>R/W</td></tr>
<tr><td>Single block execution</td><td>M1060</td><td>In AUTO mode, the program stops after one block is executed.</td><td>R/W</td></tr>
<tr><td>Cycle Start</td><td>M1061</td><td>The system executes Cycle Start.</td><td>R/W</td></tr>
<tr><td>NC stop</td><td>M1062</td><td>The NC controller pauses immediately after the special M is triggered.</td><td>R/W</td></tr>
<tr><td>System stop</td><td>M1063</td><td>The system stops operating.</td><td>R/W</td></tr>
<tr><td>System reset</td><td>M1064</td><td>When M1076 or the Reset signal of machine operation panel A is triggered, the system resets, and this special M is triggered.</td><td>R</td></tr>
<tr><td>Dummy execution</td><td>M1065</td><td>When the special M is triggered, the feed rate F of G01 in AUTO mode refers to the feed rate specified in the D1062 register.</td><td>R/M</td></tr>
<tr><td>Optional stop (M01 Pause)</td><td>M1066</td><td>The Optional stop key. When M01 is executed, the controller immediately stops.</td><td>R/W</td></tr>
<tr><td>Single block skip (‘/’)</td><td>M1067</td><td>When this function is enabled, the program skips the block with the symbol ‘/’.</td><td>R/W</td></tr>
<tr><td>Lock all axes movements</td><td>M1068</td><td>Locks the X, Y, and Z axes movements of the machine.</td><td>R/W</td></tr>
<tr><td>Lock Z axis movement</td><td>M1069</td><td>Locks the Z axis movement of the machine.</td><td>R/W</td></tr>
<tr><td>Ignore axis limit</td><td>M1070</td><td>When this function is enabled, the limit signal of each axis is ignored.</td><td>R/W</td></tr>
<tr><td>Lock M, S, and T-codes</td><td>M1071</td><td>The program skips M, S, and T-codes in the execution.</td><td>R/W</td></tr>
<tr><td>DMCNET connection successful</td><td>M1072</td><td>The MLC sends this signal after the system confirms that the DMCNET connection is successful. Note that this signal signifies the connection is successful instead of the Servo On status.</td><td>R</td></tr>
<tr><td>Trigger G31 Skip</td><td>M1073</td><td>This function is not affected by the setting of Pr.307 [G31 input source].</td><td>R/W</td></tr>
</table>

Function name	Special M	Description	Device type
Macro call initial preparation	M1074	Macro call initialization (only works in AUTO mode and with correct macro ID).	R/W
Macro call activation	M1075	Macro program activation (only works in AUTO mode and with correct macro ID).	R/W
System reset	M1076	When the special M is triggered, the MLC sends the signal to the NC to reset the system.	R/W
Main program stops at M99	M1077	When the special M is On, the NC system stops operating when the main program reads M99. You need to set Pr.308 [System halts when running to M99].	R/W
M96 Program interruption	M1078	When the special M is triggered, the system executes M96 Program interruption.	R/W
MLC emergency stop	M1079	According to the setting of Pr.305 [EMG stop source], when the special M is On, the system immediately stops.	R/W
Handwheel (MPG) simulation	M1080	During program execution, the movement speed is controlled by the speed you rotate the handwheel (MPG).	R/W
Disable inhibit zone protection	M1085	The inhibit zone protection is disabled after this special M is triggered.	R/W
Trigger for synchronous control	M1088	To use the synchronous function, you need to set this special M to On to have the system activate the synchronous function.	R/W
X slave axis follows the master axis	M1089	Have the X axis follow the master axis when the synchronous function is used.	R/W
Y slave axis follows the master axis	M1090	Have the Y axis follow the master axis when the synchronous function is used.	R/W
Z slave axis follows the master axis	M1091	Have the Z axis follow the master axis when the synchronous function is used.	R/W
A slave axis follows the master axis	M1092	Have the A axis follow the master axis when the synchronous function is used.	R/W
B slave axis follows the master axis	M1093	Have the B axis follow the master axis when the synchronous function is used.	R/W
C slave axis follows the master axis	M1094	Have the C axis follow the master axis when the synchronous function is used.	R/W
U slave axis follows the master axis	M1095	Have the U axis follow the master axis when the synchronous function is used.	R/W
V slave axis follows the master axis	M1096	Have the V axis follow the master axis when the synchronous function is used.	R/W
W slave axis follows the master axis	M1097	Have the W axis follow the master axis when the synchronous function is used.	R/W
Trigger for transfer command	M1098	To use the transfer function, you need to set this special M to On to have the system activate the transfer function.	R/W
X axis receives command from the master axis	M1099	Have the X axis receive the command when the transfer function is used.	R/W
Y axis receives command from the master axis	M1100	Have the Y axis receive the command when the transfer function is used.	R/W
Z axis receives command from the master axis	M1101	Have the Z axis receive the command when the transfer function is used.	R/W
A axis receives command from the master axis	M1102	Have the A axis receive the command when the transfer function is used.	R/W

<table>
<tr><th>Function name</th><th>Special M</th><th>Description</th><th>Device type</th></tr>
<tr><td>B axis receives command from the master axis</td><td>M1103</td><td>Have the B axis receive the command when the transfer function is used.</td><td>R/W</td></tr>
<tr><td>C axis receives command from the master axis</td><td>M1104</td><td>Have the C axis receive the command when the transfer function is used.</td><td>R/W</td></tr>
<tr><td>U axis receives command from the master axis</td><td>M1105</td><td>Have the U axis receive the command when the transfer function is used.</td><td>R/W</td></tr>
<tr><td>V axis receives command from the master axis</td><td>M1106</td><td>Have the V axis receive the command when the transfer function is used.</td><td>R/W</td></tr>
<tr><td>W axis receives command from the master axis</td><td>M1107</td><td>Have the W axis receive the command when the transfer function is used.</td><td>R/W</td></tr>
<tr><td>Panel MPG pulse +</td><td>M1118</td><td>The handwheel (MPG) function is executed with the keys on machine operation panel B, and this is a forward pulse signal. Refer to D1040 for the enabling method.</td><td>R/W</td></tr>
<tr><td>Panel MPG pulse -</td><td>M1119</td><td>The handwheel (MPG) function is executed with the keys on machine operation panel B, and this is a reverse pulse signal. Refer to D1040 for the enabling method.</td><td>R/W</td></tr>
<tr><td>1st spindle forward rotation</td><td>M1120</td><td>The special M for 1st spindle forward rotation.</td><td>R/W</td></tr>
<tr><td>1st spindle reverse rotation</td><td>M1121</td><td>The special M for 1st spindle reverse rotation.</td><td>R/W</td></tr>
<tr><td>1st spindle gear ratio selection</td><td>M1122
M1123</td><td>Change the statuses of M1122 and M1123 to switch the gear ratio of the 1st spindle.
<table>
<tr><th>M1123</th><th>M1122</th><th></th></tr>
<tr><td>0</td><td>0</td><td>1st gear ratio</td></tr>
<tr><td>0</td><td>1</td><td>2nd gear ratio</td></tr>
<tr><td>1</td><td>0</td><td>3rd gear ratio</td></tr>
<tr><td>1</td><td>1</td><td>4th gear ratio</td></tr>
</table>
1st gear ratio = Pr.422 / Pr.423
2nd gear ratio = Pr.424 / Pr.425
3rd gear ratio = Pr.426 / Pr.427
4th gear ratio = Pr.428 / Pr.429</td><td>R/W</td></tr>
<tr><td>1st spindle positioning control</td><td>M1124</td><td>The special M for 1st spindle positioning.</td><td>R/W</td></tr>
<tr><td>1st spindle retraction after tapping</td><td>M1125</td><td>The special M for retracting the 1st spindle after tapping.</td><td>R/W</td></tr>
<tr><td>Lathe spindle switch between C / S axis</td><td>M1126</td><td>Trigger this special M to switch the lathe spindle between the C axis and S axis.
Note: this is a dedicated function for lathe.</td><td>R/W</td></tr>
<tr><td>1st spindle analog voltage proportional gain</td><td>M1127</td><td>Select the parameter to refer to for the analog voltage proportional gain of the 1st spindle with this special M.
Refer to Pr.413 when M1127 is On.
Refer to Pr.419 when M1127 is Off.</td><td>R/W</td></tr>
<tr><td>2nd spindle forward rotation</td><td>M1136</td><td>The special M for 2nd spindle forward rotation.</td><td>R/W</td></tr>
<tr><td>2nd spindle reverse rotation</td><td>M1137</td><td>The special M for 2nd spindle reverse rotation.</td><td>R/W</td></tr>
</table>

<table>
<tr><th>Function name</th><th>Special M</th><th>Description</th><th>Device type</th></tr>
<tr><td>2^{nd} spindle gear ratio selection</td><td>M1138
M1139</td><td>Change the statuses of M1138 and M1139 to switch the gear ratio of the 2^{nd} spindle.
<table>
<tr><th>M1138</th><th>M1139</th><th></th></tr>
<tr><td>0</td><td>0</td><td>1^{st} gear ratio</td></tr>
<tr><td>0</td><td>1</td><td>2^{nd} gear ratio</td></tr>
<tr><td>1</td><td>0</td><td>3^{rd} gear ratio</td></tr>
<tr><td>1</td><td>1</td><td>4^{th} gear ratio</td></tr>
</table>
1^{st} gear ratio = Pr.462 / Pr.463
2^{nd} gear ratio = Pr.464 / Pr.465
3^{rd} gear ratio = Pr.466 / Pr.467
4^{th} gear ratio = Pr.468 / Pr.469</td><td>R/W</td></tr>
<tr><td>2^{nd} spindle positioning control</td><td>M1140</td><td>The special M for 2^{nd} spindle positioning.</td><td>R/W</td></tr>
<tr><td>2^{nd} spindle retraction after tapping</td><td>M1141</td><td>The special M for retracting the 2^{nd} spindle after tapping.</td><td>R/W</td></tr>
<tr><td>2^{nd} spindle analog voltage proportional gain</td><td>M1143</td><td>Select the parameter to refer to for the analog voltage proportional gain of the 2^{nd} spindle with this special M.
Refer to Pr.453 when M1143 is On.
Refer to Pr.459 when M1143 is Off.</td><td>R/W</td></tr>
<tr><td>MST code execution complete</td><td>M1152</td><td>When this special M is On, the MLC sends the signal to inform the NC system that the M, S, or T-code execution is complete.</td><td>R/W</td></tr>
<tr><td>Screen element trigger I/O</td><td>M1153</td><td>When the screen element is triggered, M1153 is On.</td><td>R</td></tr>
<tr><td>Tool magazine 1 moves forward</td><td>M1168</td><td>Tool magazine 1 moves forward. When this special M is On, the value of D1372 (Rotation increment) increases by 1.</td><td>R/W</td></tr>
<tr><td>Tool magazine 1 moves backward</td><td>M1169</td><td>Tool magazine 1 moves backward. When this special M is On, the value of D1372 (Rotation increment) decreases by 1.</td><td>R/W</td></tr>
<tr><td>Tool change in tool magazine 1</td><td>M1170</td><td>Exchange the data of D1371 (Standby tool number) and D1374 (Spindle tool number).</td><td>R/W</td></tr>
<tr><td>Tool magazine 1 reset</td><td>M1171</td><td>When this special M is On, the tool data in tool magazine 1 is reset.</td><td>R/W</td></tr>
<tr><td>Tool magazine 2 moves forward</td><td>M1172</td><td>Tool magazine 2 moves forward. When this special M is On, the value of D1377 (Tool magazine 2 tool pot number (standby)) increases by 1.</td><td>R/W</td></tr>
<tr><td>Tool magazine 2 moves backward</td><td>M1173</td><td>Tool magazine 2 moves backward. When this special M is On, the value of D1377 (Tool magazine 2 tool pot number (standby)) decreases by 1.</td><td>R/W</td></tr>
<tr><td>Tool change in tool magazine 2</td><td>M1174</td><td>Exchange the data of D1375 (Standby tool number) and D1378 (Spindle tool number).</td><td>R/W</td></tr>
<tr><td>Tool magazine 2 reset</td><td>M1175</td><td>When this special M is On, the tool data in tool magazine 2 is reset.</td><td>R/W</td></tr>
<tr><td>Activate X axis (MLC axis)</td><td>M1184</td><td>The special M for activating the MLC X axis.</td><td>R/W</td></tr>
<tr><td>Activate Y axis (MLC axis)</td><td>M1185</td><td>The special M for activating the MLC Y axis.</td><td>R/W</td></tr>
<tr><td>Activate Z axis (MLC axis)</td><td>M1186</td><td>The special M for activating the MLC Z axis.</td><td>R/W</td></tr>
<tr><td>Activate A axis (MLC axis)</td><td>M1187</td><td>The special M for activating the MLC A axis.</td><td>R/W</td></tr>
<tr><td>Activate B axis (MLC axis)</td><td>M1188</td><td>The special M for activating the MLC B axis.</td><td>R/W</td></tr>
<tr><td>Activate C axis (MLC axis)</td><td>M1189</td><td>The special M for activating the MLC C axis.</td><td>R/W</td></tr>
</table>

Function name	Special M	Description	Device type
Activate U axis (MLC axis)	M1190	The special M for activating the MLC U axis.	R/W
Activate V axis (MLC axis)	M1191	The special M for activating the MLC V axis.	R/W
Activate W axis (MLC axis)	M1192	The special M for activating the MLC W axis.	R/W
Activate the spindle (MLC axis)	M1193	The special M for activating the MLC spindle.	R/W
MLC axis incremental motion command	M1194	The special D positioning command values specified by each MLC axis are incremental values.	R/W
NC / MLC axis switching (X axis)	M1200	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (Y axis)	M1201	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (Z axis)	M1202	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (A axis)	M1203	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (B axis)	M1204	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (C axis)	M1205	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (U axis)	M1206	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (V axis)	M1207	On: MLC axis; off: NC axis.	R/W
NC / MLC axis switching (W axis)	M1208	On: MLC axis; off: NC axis.	R/W
X axis forward jog control	M1216	Special M for triggering X axis forward jog operation.	R/W
Y axis forward jog control	M1217	Special M for triggering Y axis forward jog operation.	R/W
Z axis forward jog control	M1218	Special M for triggering Z axis forward jog operation.	R/W
A axis forward jog control	M1219	Special M for triggering A axis forward jog operation.	R/W
B axis forward jog control	M1220	Special M for triggering B axis forward jog operation.	R/W
C axis forward jog control	M1221	Special M for triggering C axis forward jog operation.	R/W
U axis forward jog control	M1222	Special M for triggering U axis forward jog operation.	R/W
V axis forward jog control	M1223	Special M for triggering V axis forward jog operation.	R/W
W axis forward jog control	M1224	Special M for triggering W axis forward jog operation.	R/W
X axis reverse jog control	M1226	Special M for triggering X axis reverse jog operation.	R/W
Y axis reverse jog control	M1227	Special M for triggering Y axis reverse jog operation.	R/W
Z axis reverse jog control	M1228	Special M for triggering Z axis reverse jog operation.	R/W
A axis reverse jog control	M1229	Special M for triggering A axis reverse jog operation.	R/W

Function name	Special M	Description	Device type
B axis reverse jog control	M1230	Special M for triggering B axis reverse jog operation.	R/W
C axis reverse jog control	M1231	Special M for triggering C axis reverse jog operation.	R/W
U axis reverse jog control	M1232	Special M for triggering U axis reverse jog operation.	R/W
V axis reverse jog control	M1233	Special M for triggering V axis reverse jog operation.	R/W
W axis reverse jog control	M1234	Special M for triggering W axis reverse jog operation.	R/W
X axis homing control	M1236	Special M for triggering X axis homing.	R/W
Y axis homing control	M1237	Special M for triggering Y axis homing.	R/W
Z axis homing control	M1238	Special M for triggering Z axis homing.	R/W
A axis homing control	M1239	Special M for triggering A axis homing.	R/W
B axis homing control	M1240	Special M for triggering B axis homing.	R/W
C axis homing control	M1241	Special M for triggering C axis homing.	R/W
U axis homing control	M1242	Special M for triggering U axis homing.	R/W
V axis homing control	M1243	Special M for triggering V axis homing.	R/W
W axis homing control	M1244	Special M for triggering W axis homing.	R/W
Cancel X axis 1st software limit	M1248	Special M for canceling the X axis 1st software limit.	R/W
Cancel Y axis 1st software limit	M1249	Special M for canceling the Y axis 1st software limit.	R/W
Cancel Z axis 1st software limit	M1250	Special M for canceling the Z axis 1st software limit.	R/W
Cancel A axis 1st software limit	M1251	Special M for canceling the A axis 1st software limit.	R/W
Cancel B axis 1st software limit	M1252	Special M for canceling the B axis 1st software limit.	R/W
Cancel C axis 1st software limit	M1253	Special M for canceling the C axis 1st software limit.	R/W
Cancel U axis 1st software limit	M1254	Special M for canceling the U axis 1st software limit.	R/W
Cancel V axis 1st software limit	M1255	Special M for canceling the V axis 1st software limit.	R/W
Cancel W axis 1st software limit	M1256	Special M for canceling the W axis 1st software limit.	R/W
Lock X axis	M1257	Special M for locking X axis.	R/W
Lock Y axis	M1258	Special M for locking Y axis.	R/W
Lock Z axis	M1259	Special M for locking Z axis.	R/W
Lock A axis	M1260	Special M for locking A axis.	R/W
Lock B axis	M1261	Special M for locking B axis.	R/W
Lock C axis	M1262	Special M for locking C axis.	R/W
Lock U axis	M1263	Special M for locking U axis.	R/W
Lock V axis	M1264	Special M for locking V axis.	R/W
Lock W axis	M1265	Special M for locking W axis.	R/W
X axis Servo Off	M1266	Special M for setting the X axis to Servo Off status.	R/W
Y axis Servo Off	M1267	Special M for setting the Y axis to Servo Off status.	R/W
Z axis Servo Off	M1268	Special M for setting the Z axis to Servo Off status.	R/W
A axis Servo Off	M1269	Special M for setting the A axis to Servo Off status.	R/W
B axis Servo Off	M1270	Special M for setting the B axis to Servo Off status.	R/W

Function name	Special M	Description	Device type
C axis Servo Off	M1271	Special M for setting the C axis to Servo Off status.	R/W
U axis Servo Off	M1272	Special M for setting the U axis to Servo Off status.	R/W
V axis Servo Off	M1273	Special M for setting the V axis to Servo Off status.	R/W
W axis Servo Off	M1274	Special M for setting the W axis to Servo Off status.	R/W
Switch MLC X axis command to incremental	M1280	The MLC X axis positioning command (D1064) is incremental.	R/W
Switch MLC Y axis command to incremental	M1281	The MLC Y axis positioning command (D1066) is incremental.	R/W
Switch MLC Z axis command to incremental	M1282	The MLC Z axis positioning command (D1068) is incremental.	R/W
Switch MLC A axis command to incremental	M1283	The MLC A axis positioning command (D1070) is incremental.	R/W
Switch MLC B axis command to incremental	M1284	The MLC B axis positioning command (D1072) is incremental.	R/W
Switch MLC C axis command to incremental	M1285	The MLC C axis positioning command (D1074) is incremental.	R/W
Switch MLC U axis command to incremental	M1286	The MLC U axis positioning command (D1076) is incremental.	R/W
Switch MLC V axis command to incremental	M1287	The MLC V axis positioning command (D1078) is incremental.	R/W
Switch MLC W axis command to incremental	M1288	The MLC W axis positioning command (D1080) is incremental.	R/W
MLC X axis control mode	M1289	When the special M is On, X axis is in speed mode. When the special M is Off, X axis is in position mode.	R/W
MLC Y axis control mode	M1290	When the special M is On, Y axis is in speed mode. When the special M is Off, Y axis is in position mode.	R/W
MLC Z axis control mode	M1291	When the special M is On, Z axis is in speed mode. When the special M is Off, Z axis is in position mode.	R/W
MLC A axis control mode	M1292	When the special M is On, A axis is in speed mode. When the special M is Off, A axis is in position mode.	R/W
MLC B axis control mode	M1293	When the special M is On, B axis is in speed mode. When the special M is Off, B axis is in position mode.	R/W
MLC C axis control mode	M1294	When the special M is On, C axis is in speed mode. When the special M is Off, C axis is in position mode.	R/W
MLC U axis control mode	M1295	When the special M is On, U axis is in speed mode. When the special M is Off, U axis is in position mode.	R/W
MLC V axis control mode	M1296	When the special M is On, V axis is in speed mode. When the special M is Off, V axis is in position mode.	R/W
MLC W axis control mode	M1297	When the special M is On, W axis is in speed mode. When the special M is Off, W axis is in position mode.	R/W
MLC X axis high-speed input triggering	M1298	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of X axis, the MLC X axis immediately stops.	R/W
MLC Y axis high-speed input triggering	M1299	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of Y axis, the MLC Y axis immediately stops.	R/W

Function name	Special M	Description	Device type
MLC Z axis high-speed input triggering	M1300	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of Z axis, the MLC Z axis immediately stops.	R/W
MLC A axis high-speed input triggering	M1301	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of A axis, the MLC A axis immediately stops.	R/W
MLC B axis high-speed input triggering	M1302	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of B axis, the MLC B axis immediately stops.	R/W
MLC C axis high-speed input triggering	M1303	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of C axis, the MLC C axis immediately stops.	R/W
MLC U axis high-speed input triggering	M1304	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of U axis, the MLC U axis immediately stops.	R/W
MLC V axis high-speed input triggering	M1305	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of V axis, the MLC V axis immediately stops.	R/W
MLC W axis high-speed input triggering	M1306	When you set the special M to On in the MLC axis mode and trigger the corresponding DI of W axis, the MLC W axis immediately stops.	R/W
Spindle speed command source	M1307	When the special M is On, the 1st and 2nd spindle speed commands refer to the settings of D1148 and D1152; when the special M is Off, the spindle speed command refers to the S-code setting in the program.	R/W
Allow X axis movement	M1312	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the X axis to move.	R/W
Allow Y axis movement	M1313	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the Y axis to move.	R/W
Allow Z axis movement	M1314	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the Z axis to move.	R/W
Allow A axis movement	M1315	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the A axis to move.	R/W
Allow B axis movement	M1316	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the B axis to move.	R/W
Allow C axis movement	M1317	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the C axis to move.	R/W
Allow U axis movement	M1318	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the U axis to move.	R/W
Allow V axis movement	M1319	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the V axis to move.	R/W
Allow W axis movement	M1320	When Pr.501 [Axis movement protection] is set to 1, you have to set this special M to On for the W axis to move.	R/W

Function name	Special M	Description	Device type
Lock machine X axis movement in positive direction	M1344	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the X axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the X axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the X axis from executing homing.	R/W
Lock machine Y axis movement in positive direction	M1345	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the Y axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the Y axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the Y axis from executing homing.	R/W
Lock machine Z axis movement in positive direction	M1346	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the Z axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the Z axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the Z axis from executing homing.	R/W
Lock machine A axis movement in positive direction	M1347	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the A axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the A axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the A axis from executing homing.	R/W
Lock machine B axis movement in positive direction	M1348	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the B axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the B axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the B axis from executing homing.	R/W
Lock machine C axis movement in positive direction	M1349	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the C axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the C axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the C axis from executing homing.	R/W
Lock machine U axis movement in positive direction	M1350	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the U axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the U axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the U axis from executing homing.	R/W

Function name	Special M	Description	Device type
Lock machine V axis movement in positive direction	M1351	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the V axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the V axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the V axis from executing homing.	R/W
Lock machine W axis movement in positive direction	M1352	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the W axis from moving in the positive direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the W axis from moving in the positive direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the W axis from executing homing.	R/W
Lock machine X axis movement in negative direction	M1353	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the X axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the X axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the X axis from executing homing.	R/W
Lock machine Y axis movement in negative direction	M1354	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the Y axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the Y axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the Y axis from executing homing.	R/W
Lock machine Z axis movement in negative direction	M1355	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the Z axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the Z axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the Z axis from executing homing.	R/W
Lock machine A axis movement in negative direction	M1356	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the A axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the A axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the A axis from executing homing.	R/W
Lock machine B axis movement in negative direction	M1357	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the B axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the B axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the B axis from executing homing.	R/W

Function name	Special M	Description	Device type
Lock machine C axis movement in negative direction	M1358	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the C axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the C axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the C axis from executing homing.	R/W
Lock machine U axis movement in negative direction	M1369	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the U axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the U axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the U axis from executing homing.	R/W
Lock machine V axis movement in negative direction	M1360	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the V axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the V axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the V axis from executing homing.	R/W
Lock machine W axis movement in negative direction	M1361	When Pr.485 [Lock axis moving direction in AUTO mode] is set to 1, in AUTO and MDI modes, setting this special M to On disables the W axis from moving in the negative direction. In JOG, MPG, and RAPID modes, setting this special M to On disables the W axis from moving in the negative direction whether Pr.485 is set or not. In HOME mode, setting this special M to On disables the W axis from executing homing.	R/W
Trigger breakpoint search function	M1567	The MLC sends this special M signal to trigger the breakpoint search function.	R/W
HMI input point 1	M2080	The status of this special M can be switched by the NC system variable #1864.	R
HMI input point 2	M2081	The status of this special M can be switched by the NC system variable #1865.	R
HMI input point 3	M2082	The status of this special M can be switched by the NC system variable #1866.	R
HMI input point 4	M2083	The status of this special M can be switched by the NC system variable #1867.	R
HMI input point 5	M2084	The status of this special M can be switched by the NC system variable #1868.	R
HMI input point 6	M2085	The status of this special M can be switched by the NC system variable #1869.	R
HMI input point 7	M2086	The status of this special M can be switched by the NC system variable #1870.	R
HMI input point 8	M2087	The status of this special M can be switched by the NC system variable #1871.	R
HMI input point 9	M2088	The status of this special M can be switched by the NC system variable #1872.	R
HMI input point 10	M2089	The status of this special M can be switched by the NC system variable #1873.	R
HMI input point 11	M2090	The status of this special M can be switched by the NC system variable #1874.	R
HMI input point 12	M2091	The status of this special M can be switched by the NC system variable #1875.	R

Function name	Special M	Description	Device type
HMI input point 13	M2092	The status of this special M can be switched by the NC system variable #1876.	R
HMI input point 14	M2093	The status of this special M can be switched by the NC system variable #1877.	R
HMI input point 15	M2094	The status of this special M can be switched by the NC system variable #1878.	R
HMI input point 16	M2095	The status of this special M can be switched by the NC system variable #1879.	R
HMI input point 17	M2096	The status of this special M can be switched by the NC system variable #1880.	R
HMI input point 18	M2097	The status of this special M can be switched by the NC system variable #1881.	R
HMI input point 19	M2098	The status of this special M can be switched by the NC system variable #1882.	R
HMI input point 20	M2099	The status of this special M can be switched by the NC system variable #1883.	R
HMI input point 21	M2100	The status of this special M can be switched by the NC system variable #1884.	R
HMI input point 22	M2101	The status of this special M can be switched by the NC system variable #1885.	R
HMI input point 23	M2102	The status of this special M can be switched by the NC system variable #1886.	R
HMI input point 24	M2103	The status of this special M can be switched by the NC system variable #1887.	R
HMI input point 25	M2104	The status of this special M can be switched by the NC system variable #1888.	R
HMI input point 26	M2105	The status of this special M can be switched by the NC system variable #1889.	R
HMI input point 27	M2106	The status of this special M can be switched by the NC system variable #1890.	R
HMI input point 28	M2107	The status of this special M can be switched by the NC system variable #1891.	R
HMI input point 29	M2108	The status of this special M can be switched by the NC system variable #1892.	R
HMI input point 30	M2109	The status of this special M can be switched by the NC system variable #1893.	R
HMI input point 31	M2110	The status of this special M can be switched by the NC system variable #1894.	R
HMI input point 32	M2111	The status of this special M can be switched by the NC system variable #1895.	R
NC system is started and ready	M2112	When the NC system is ready, it sets this special M to On.	R
System macro alarm occurs	M2113	When the macro alarm (MR____) occurs in the NC system, the system sets this special M to On.	R
System emergency stop	M2114	When you press the EMERGENCY STOP button to immediately stop the system, the system sets this special M to On.	R
Servo enabled	M2115	When the servo is ready, the system sets this special M to On.	R
X axis at the origin	M2119	When the machine coordinate of X axis is 0, the NC system sets this special M to On.	R
Y axis at the origin	M2120	When the machine coordinate of Y axis is 0, the NC system sets this special M to On.	R
Z axis at the origin	M2121	When the machine coordinate of Z axis is 0, the NC system sets this special M to On.	R

Function name	Special M	Description	Device type
A axis at the origin	M2122	When the machine coordinate of A axis is 0, the NC system sets this special M to On.	R
B axis at the origin	M2123	When the machine coordinate of B axis is 0, the NC system sets this special M to On.	R
C axis at the origin	M2124	When the machine coordinate of C axis is 0, the NC system sets this special M to On.	R
U axis at the origin	M2125	When the machine coordinate of U axis is 0, the NC system sets this special M to On.	R
V axis at the origin	M2126	When the machine coordinate of V axis is 0, the NC system sets this special M to On.	R
W axis at the origin	M2127	When the machine coordinate of W axis is 0, the NC system sets this special M to On.	R
MLC X axis high-speed input triggering feedback	M2128	When the MLC X axis high-speed input trigger (M1298) is set to On and the DI of X axis is triggered, the NC sets this special M to On.	R
MLC Y axis high-speed input triggering feedback	M2129	When the MLC Y axis high-speed input trigger (M1299) is set to On and the DI of Y axis is triggered, the NC sets this special M to On.	R
MLC Z axis high-speed input triggering feedback	M2130	When the MLC Z axis high-speed input trigger (M1300) is set to On and the DI of Z axis is triggered, the NC sets this special M to On.	R
MLC A axis high-speed input triggering feedback	M2131	When the MLC A axis high-speed input trigger (M1301) is set to On and the DI of A axis is triggered, the NC sets this special M to On.	R
MLC B axis high-speed input triggering feedback	M2132	When the MLC B axis high-speed input trigger (M1302) is set to On and the DI of B axis is triggered, the NC sets this special M to On.	R
MLC C axis high-speed input triggering feedback	M2133	When the MLC C axis high-speed input trigger (M1303) is set to On and the DI of C axis is triggered, the NC sets this special M to On.	R
MLC U axis high-speed input triggering feedback	M2134	When the MLC U axis high-speed input trigger (M1304) is set to On and the DI of U axis is triggered, the NC sets this special M to On.	R
MLC V axis high-speed input triggering feedback	M2135	When the MLC V axis high-speed input trigger (M1305) is set to On and the DI of V axis is triggered, the NC sets this special M to On.	R
MLC W axis high-speed input triggering feedback	M2136	When the MLC W axis high-speed input trigger (M1306) is set to On and the DI of W axis is triggered, the NC sets this special M to On.	R
HSI1	M2142	When the G31P1 (High-speed input contact 1) Skip signal is input to the NC, this special M is On.	R
HSI2	M2143	When the G31P2 (High-speed input contact 2) Skip signal is input to the NC, this special M is On.	R
Port 1 positive hardware limit	M2144	When the positive hardware limit of Port 1 is triggered, this special M is On.	R
Port 1 negative hardware limit	M2145	When the negative hardware limit of Port 1 is triggered, this special M is On.	R
Port 1 home signal	M2146	When the home signal of Port 1 is triggered, this special M is On.	R
Port 2 positive hardware limit	M2148	When the positive hardware limit of Port 2 is triggered, this special M is On.	R
Port 2 negative hardware limit	M2149	When the negative hardware limit of Port 2 is triggered, this special M is On.	R
Port 2 home signal	M2150	When the home signal of Port 2 is triggered, this special M is On.	R
Port 3 positive hardware limit	M2152	When the positive hardware limit of Port 3 is triggered, this special M is On.	R

Function name	Special M	Description	Device type
Port 3 negative hardware limit	M2153	When the negative hardware limit of Port 3 is triggered, this special M is On.	R
Port 3 home signal	M2154	When the home signal of Port 3 is triggered, this special M is On.	R
Port 4 positive hardware limit	M2156	When the positive hardware limit of Port 4 is triggered, this special M is On.	R
Port 4 negative hardware limit	M2157	When the negative hardware limit of Port 4 is triggered, this special M is On.	R
Port 4 home signal	M2158	When the home signal of Port 4 is triggered, this special M is On.	R
Port 5 positive hardware limit	M2160	When the positive hardware limit of Port 5 is triggered, this special M is On.	R
Port 5 negative hardware limit	M2161	When the negative hardware limit of Port 5 is triggered, this special M is On.	R
Port 5 home signal	M2162	When the home signal of Port 5 is triggered, this special M is On.	R
Port 6 positive hardware limit	M2164	When the positive hardware limit of Port 6 is triggered, this special M is On.	R
Port 6 negative hardware limit	M2165	When the negative hardware limit of Port 6 is triggered, this special M is On.	R
Port 6 home signal	M2166	When the home signal of Port 6 is triggered, this special M is On.	R
Port 7 positive hardware limit	M2168	When the positive hardware limit of Port 7 is triggered, this special M is On.	R
Port 7 negative hardware limit	M2169	When the negative hardware limit of Port 7 is triggered, this special M is On.	R
Port 7 home signal	M2170	When the home signal of Port 7 is triggered, this special M is On.	R
Port 8 positive hardware limit	M2172	When the positive hardware limit of Port 8 is triggered, this special M is On.	R
Port 8 negative hardware limit	M2173	When the negative hardware limit of Port 8 is triggered, this special M is On.	R
Port 8 home signal	M2174	When the home signal of Port 8 is triggered, this special M is On.	R
Port 9 positive hardware limit	M2176	When the positive hardware limit of Port 9 is triggered, this special M is On.	R
Port 9 negative hardware limit	M2177	When the negative hardware limit of Port 9 is triggered, this special M is On.	R
Port 9 home signal	M2178	When the home signal of Port 9 is triggered, this special M is On.	R
M-code execution	M2208	When the M-code is executed in the program, the NC sets this special M to On. After M1152 (M, S, and T-codes execution complete) is triggered, this special M is set to Off. The NC does not trigger this special M when the program executes M00, M01, M02, M30, M96, M97, M98, and M99, or an M-code that is used for macro call.	R
S-code execution	M2209	When the S-code is executed in the program, the NC sets this special M to On. After M1152 (M, S, and T-codes execution complete) is triggered, this special M is set to Off. The NC does not trigger this special M when the S-code is used for macro call.	R

Function name	Special M	Description	Device type
T-code execution	M2210	When the T-code is executed in the program, the NC sets this special M to On. After M1152 (M, S, and T-codes execution complete) is triggered, this special M is set to Off. The NC does not trigger this special M when the T-code is used for macro call. This special M is related to the station ID setting in the tool magazine. The NC triggers this special M only when the T-code value is set within the specified range of tool number for the tool magazine parameter.	R
Tool magazine 1 reset complete	M2212	After you use M1171 to reset the tool magazine, the NC sets this special M to On.	R
Tool magazine 2 reset complete	M2213	After you use M1175 to reset the tool magazine, the NC sets this special M to On.	R
M96 (Program interruption) in execution	M2216	When M96 (Program interruption) is in execution, the NC sets this special M to On.	R
G-code ready	M2223	After completing loading the G-code, the NC sets this special M to On.	R
Macro call initial preparation complete	M2224	Indicates the macro call initial preparation is complete.	R
Macro call in execution	M2225	Indicates the macro call is in execution.	R
Macro call error	M2226	Indicates the macro call is in error.	R
Synchronous function in execution	M2227	This special M is On when the synchronous function is in execution.	R
Transfer function in execution	M2228	This special M is On when the transfer function is in execution.	R
System reset complete	M2229	This special M is On when the system reset is complete.	R
Handwheel (MPG) in forward operation	M2232	When the handwheel is in forward operation, this special M is On; when the handwheel is in reverse operation or stationary, this special M is Off.	R
Handwheel (MPG) in reverse operation	M2233	When the handwheel is in reverse operation, this special M is On; when the handwheel is in forward operation or stationary, this special M is Off.	R
System stops at M99	M2238	When reading M99, the NC system sets this special M to On.	R
Lathe C / S axis switching	M2239	When the lathe system is switched from Spindle mode to C axis mode, this special M is On.	R
Channel alarm message	M2240	When an error occurs to the NC channel, this special M is On.	R
Auto execution (AUTO)	M2241	When the NC system is in AUTO mode, this special M is On.	R
Program edit (EDIT)	M2242	When the NC system is in EDIT mode, this special M is On.	R
Manual input (MDI)	M2243	When the NC system is in MDI mode, this special M is On.	R
MPG feeding (MPG)	M2244	When the NC system is in MPG mode, this special M is On.	R
Jog feeding (JOG)	M2245	When the NC system is in JOG mode, this special M is On.	R
Rapid feeding (RAPID)	M2246	When the NC system is in RAPID mode, this special M is On.	R
Homing (HOME)	M2247	When the NC system is in HOME mode, this special M is On.	R
Single block execution	M2249	When the NC system pauses after executing one single block, this special M is On.	R

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Function name	Special M	Description	Device type
Program in execution	M2250	When the NC system is executing the program, this special M is On.	R
Pause	M2251	When the NC system pauses, this special M is On.	R
M00 program stop	M2252	When the NC system reads M00, this special M is On.	R
M01 program stop (optional)	M2253	When the NC system reads M01, this special M is On.	R
M02 end of program	M2254	When the NC system reads M02, this special M is On.	R
M30 end of program and returns	M2255	When the NC system reads M30, this special M is On.	R
1st spindle reaches the target speed	M2256	When the 1st spindle speed reaches the target value, this special M is On.	R
1st spindle reaches zero speed	M2257	When the 1st spindle speed reaches zero speed, this special M is On.	R
1st spindle positioning complete	M2258	When the 1st spindle reaches the target position, this special M is On.	R
1st spindle is in rigid tapping mode	M2259	When the 1st spindle performs tapping, this special M is On.	R
1st spindle rigid tapping interruption	M2260	When the 1st spindle tapping is interrupted, this special M is On.	R
2nd spindle reaches the target speed	M2261	When the 2nd spindle speed reaches the target value, this special M is On.	R
2nd spindle reaches zero speed	M2262	When the 2nd spindle speed reaches zero speed, this special M is On.	R
2nd spindle positioning complete	M2263	When the 2nd spindle reaches the target position, this special M is On.	R
2nd spindle in rigid tapping mode	M2264	When the 2nd spindle performs tapping, this special M is On.	R
2nd spindle rigid tapping interruption	M2265	When the 2nd spindle tapping is interrupted, this special M is On.	R
Program ends	M2271	When the machining program ends, this special M is On.	R
X axis homing complete	M2272	When the X axis homing is complete, the NC system sets this special M to On.	R
Y axis homing complete	M2273	When the Y axis homing is complete, the NC system sets this special M to On.	R
Z axis homing complete	M2274	When the Z axis homing is complete, the NC system sets this special M to On.	R
A axis homing complete	M2275	When the A axis homing is complete, the NC system sets this special M to On.	R
B axis homing complete	M2276	When the B axis homing is complete, the NC system sets this special M to On.	R
C axis homing complete	M2277	When the C axis homing is complete, the NC system sets this special M to On.	R
U axis homing complete	M2278	When the U axis homing is complete, the NC system sets this special M to On.	R
V axis homing complete	M2279	When the V axis homing is complete, the NC system sets this special M to On.	R
W axis homing complete	M2280	When the W axis homing is complete, the NC system sets this special M to On.	R
X axis positioned at the 2nd reference point	M2286	When the X axis reaches the 2nd reference point, the NC system sets this special M to On.	R
Y axis positioned at the 2nd reference point	M2287	When the Y axis reaches the 2nd reference point, the NC system sets this special M to On.	R

Function name	Special M	Description	Device type
Z axis positioned at the 2nd reference point	M2288	When the Z axis reaches the 2nd reference point, the NC system sets this special M to On.	R
A axis positioned at the 2nd reference point	M2289	When the A axis reaches the 2nd reference point, the NC system sets this special M to On.	R
B axis positioned at the 2nd reference point	M2290	When the B axis reaches the 2nd reference point, the NC system sets this special M to On.	R
C axis positioned at the 2nd reference point	M2291	When the C axis reaches the 2nd reference point, the NC system sets this special M to On.	R
U axis positioned at the 2nd reference point	M2292	When the U axis reaches the 2nd reference point, the NC system sets this special M to On.	R
V axis positioned at the 2nd reference point	M2293	When the V axis reaches the 2nd reference point, the NC system sets this special M to On.	R
W axis positioned at the 2nd reference point	M2294	When the W axis reaches the 2nd reference point, the NC system sets this special M to On.	R
X axis positioned at the 3rd reference point	M2295	When the X axis reaches the 3rd reference point, the NC system sets this special M On.	R
Y axis positioned at the 3rd reference point	M2296	When the Y axis reaches the 3rd reference point, the NC system sets this special M to On.	R
Z axis positioned at the 3rd reference point	M2297	When the Z axis reaches the 3rd reference point, the NC system sets this special M to On.	R
A axis positioned at the 3rd reference point	M2298	When the A axis reaches the 3rd reference point, the NC system sets this special M to On.	R
B axis positioned at the 3rd reference point	M2299	When the B axis reaches the 3rd reference point, the NC system sets this special M to On.	R
C axis positioned at the 3rd reference point	M2300	When the C axis reaches the 3rd reference point, the NC system sets this special M to On.	R
U axis positioned at the 3rd reference point	M2301	When the U axis reaches the 3rd reference point, the NC system sets this special M to On.	R
V axis positioned at the 3rd reference point	M2302	When the V axis reaches the 3rd reference point, the NC system sets this special M to On.	R
W axis positioned at the 3rd reference point	M2303	When the W axis reaches the 3rd reference point, the NC system sets this special M to On.	R
MLC X axis positioning complete	M2304	In Position mode, this special M is On when the X axis is in MLC axis control mode and the X axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC Y axis positioning complete	M2305	In Position mode, this special M is On when the Y axis is in MLC axis control mode and the Y axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R

Function name	Special M	Description	Device type
MLC Z axis positioning complete	M2306	In Position mode, this special M is On when the Z axis is in MLC axis control mode and the Z axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC A axis positioning complete	M2307	In Position mode, this special M is On when the A axis is in MLC axis control mode and the A axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC B axis positioning complete	M2308	In Position mode, this special M is On when the B axis is in MLC axis control mode and the B axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC C axis positioning complete	M2309	In Position mode, this special M is On when the C axis is in MLC axis control mode and the C axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC U axis positioning complete	M2310	In Position mode, this special M is On when the U axis is in MLC axis control mode and the U axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC V axis positioning complete	M2311	In Position mode, this special M is On when the V axis is in MLC axis control mode and the V axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
MLC W axis positioning complete	M2312	In Position mode, this special M is On when the W axis is in MLC axis control mode and the W axis reaches the positioning point; in Speed mode, this special M is On when the target speed is reached.	R
X axis is moving	M2320	When the X axis is moving (in any modes), this special M is On.	R
Y axis is moving	M2321	When the Y axis is moving (in any modes), this special M is On.	R
Z axis is moving	M2322	When the Z axis is moving (in any modes), this special M is On.	R
A axis is moving	M2323	When the A axis is moving (in any modes), this special M is On.	R
B axis is moving	M2324	When the B axis is moving (in any modes), this special M is On.	R
C axis is moving	M2325	When the C axis is moving (in any modes), this special M is On.	R
U axis is moving	M2326	When the U axis is moving (in any modes), this special M is On.	R
V axis is moving	M2327	When the V axis is moving (in any modes), this special M is On.	R
W axis is moving	M2328	When the W axis is moving (in any modes), this special M is On.	R
X axis is moving in forward direction	M2336	This special M is On when the X axis is moving in the forward direction.	R
Y axis is moving in forward direction	M2337	This special M is On when the Y axis is moving in the forward direction.	R
Z axis is moving in forward direction	M2338	This special M is On when the Z axis is moving in the forward direction.	R
A axis is moving in forward direction	M2339	This special M is On when the A axis is moving in the forward direction.	R
B axis is moving in forward direction	M2340	This special M is On when the B axis is moving in the forward direction.	R
C axis is moving in forward direction	M2341	This special M is On when the C axis is moving in the forward direction.	R

Function name	Special M	Description	Device type
U axis is moving in forward direction	M2342	This special M is On when the U axis is moving in the forward direction.	R
V axis is moving in forward direction	M2343	This special M is On when the V axis is moving in the forward direction.	R
W axis is moving in forward direction	M2344	This special M is On when the W axis is moving in the forward direction.	R
X axis is moving in reverse direction	M2345	This special M is On when the X axis is moving in the reverse direction.	R
Y axis is moving in reverse direction	M2346	This special M is On when the Y axis is moving in the reverse direction.	R
Z axis is moving in reverse direction	M2347	This special M is On when the Z axis is moving in the reverse direction.	R
A axis is moving in reverse direction	M2348	This special M is On when the A axis is moving in the reverse direction.	R
B axis is moving in reverse direction	M2349	This special M is On when the B axis is moving in the reverse direction.	R
C axis is moving in reverse direction	M2350	This special M is On when the C axis is moving in the reverse direction.	R
U axis is moving in reverse direction	M2351	This special M is On when the U axis is moving in the reverse direction.	R
V axis is moving in reverse direction	M2352	This special M is On when the V axis is moving in the reverse direction.	R
W axis is moving in reverse direction	M2353	This special M is On when the W axis is moving in the reverse direction.	R
NC / MLC axis switching complete (X axis)	M2354	When the system switches the X axis from NC axis mode to MLC axis mode with M1200, this special M is On.	R
NC / MLC axis switching complete (Y axis)	M2355	When the system switches the Y axis from NC axis mode to MLC axis mode with M1201, this special M is On.	R
NC / MLC axis switching complete (Z axis)	M2356	When the system switches the Z axis from NC axis mode to MLC axis mode with M1202, this special M is On.	R
NC / MLC axis switching complete (A axis)	M2357	When the system switches the A axis from NC axis mode to MLC axis mode with M1203, this special M is On.	R
NC / MLC axis switching complete (B axis)	M2358	When the system switches the B axis from NC axis mode to MLC axis mode with M1204, this special M is On.	R
NC / MLC axis switching complete (C axis)	M2359	When the system switches the C axis from NC axis mode to MLC axis mode with M1205, this special M is On.	R
NC / MLC axis switching complete (U axis)	M2360	When the system switches the U axis from NC axis mode to MLC axis mode with M1206, this special M is On.	R
NC / MLC axis switching complete (V axis)	M2361	When the system switches the V axis from NC axis mode to MLC axis mode with M1207, this special M is On.	R
NC / MLC axis switching complete (W axis)	M2362	When the system switches the W axis from NC axis mode to MLC axis mode with M1208, this special M is On.	R
X axis is positioned at the 4th reference point	M2368	When the X axis reaches the 4th reference point, this special M is On.	R
Y axis is positioned at the 4th reference point	M2369	When the Y axis reaches the 4th reference point, this special M is On.	R

Function name	Special M	Description	Device type
Z axis is positioned at the 4th reference point	M2370	When the Z axis reaches the 4th reference point, this special M is On.	R
A axis is positioned at the 4th reference point	M2371	When the A axis reaches the 4th reference point, this special M is On.	R
B axis is positioned at the 4th reference point	M2372	When the B axis reaches the 4th reference point, this special M is On.	R
C axis is positioned at the 4th reference point	M2373	When the C axis reaches the 4th reference point, this special M is On.	R
U axis is positioned at the 4th reference point	M2374	When the U axis reaches the 4th reference point, this special M is On.	R
V axis is positioned at the 4th reference point	M2375	When the V axis reaches the 4th reference point, this special M is On.	R
W axis is positioned at the 4th reference point	M2376	When the W axis reaches the 4th reference point, this special M is On.	R
X axis homing complete	M2377	When the X axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
Y axis homing complete	M2378	When the Y axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
Z axis homing complete	M2379	When the Z axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
A axis homing complete	M2380	When the A axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
B axis homing complete	M2381	When the B axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
C axis homing complete	M2382	When the C axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
U axis homing complete	M2383	When the U axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
V axis homing complete	M2384	When the V axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
W axis homing complete	M2385	When the W axis origin coordinate is established in the system and the “Homing complete” symbol is displayed in the POS screen, this special M is On.	R
X axis is in Servo On / Off status	M2386	When the X axis is in the Servo On status, M2386 = 1. When the X axis is in the Servo Off status, M2386 = 0.	R
Y axis is in Servo On / Off status	M2387	When the Y axis is in the Servo On status, M2387 = 1. When the Y axis is in the Servo Off status, M2387 = 0.	R
Z axis is in Servo On / Off status	M2388	When the Z axis is in the Servo On status, M2388 = 1. When the Z axis is in the Servo Off status, M2388 = 0.	R
A axis is in Servo On / Off status	M2389	When the A axis is in the Servo On status, M2389 = 1. When the A axis is in the Servo Off status, M2389 = 0.	R
B axis is in Servo On / Off status	M2390	When the B axis is in the Servo On status, M2390 = 1. When the B axis is in the Servo Off status, M2390 = 0.	R

Function name	Special M	Description	Device type
C axis is in Servo On / Off status	M2391	When the C axis is in the Servo On status, M2391 = 1. When the C axis is in the Servo Off status, M2391 = 0.	R
U axis is in Servo On / Off status	M2392	When the U axis is in the Servo On status, M2392 = 1. When the U axis is in the Servo Off status, M2392 = 0.	R
V axis is in Servo On / Off status	M2393	When the V axis is in the Servo On status, M2393 = 1. When the V axis is in the Servo Off status, M2393 = 0.	R
W axis is in Servo On / Off status	M2394	When the W axis is in the Servo On status, M2394 = 1. When the W axis is in the Servo Off status, M2394 = 0.	R
X axis movement limit	M2400	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
Y axis movement limit	M2401	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
Z axis movement limit	M2402	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
A axis movement limit	M2403	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
B axis movement limit	M2404	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
C axis movement limit	M2405	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
U axis movement limit	M2406	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
V axis movement limit	M2407	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
W axis movement limit	M2408	When Pr.501 [Axis movement protection] is set to 1, if there is movement in the specific axis during machining, the system sets the corresponding special M to On.	R
MLC instruction operation result is 0	M2824	If the operation result is 0 when the MLC executes the ADD, DADD, FADD, SUB, DSUB, FSUB, FMUL, FDIV, FINT, FDOT, FRAD, and FDEG instructions, this special M is On.	R
MLC instruction borrow operation	M2825	If the operation result is smaller than -32,768 when the MLC executes the ADD and SUB instructions, this special M is On. If the operation result is smaller than -2,147,483,648 when the MLC executes the DADD and DSUB instructions, this special M is On.	R
MLC instruction carry operation	M2826	If the operation result is greater than 32,767 when the MLC executes the ADD and SUB instructions, this special M is On. If the operation result is greater than 2,147,483,647 when the MLC executes the DADD and DSUB instructions, this special M is On.	R

Function name	Special M	Description	Device type
MLC instruction operation error	M2828	If the dividend is 0 when the MLC executes DIV, DDIV, and FDIV instruction, this special M is On. If the conversion range exceeds K0 to K9,999 when the MLC executes the BCD instruction, this special M is On. If the conversion range exceeds K0 to K99,999,999 when the MLC executes the DBCD instruction, this special M is On.	R
RIO connection status - Station 1	M2832	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 2	M2833	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 3	M2834	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 4	M2835	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 5	M2836	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 6	M2837	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 7	M2838	Remote I/O connection status: success = 1; failure = 0.	R
RIO connection status - Station 8	M2839	Remote I/O connection status: success = 1; failure = 0.	R
DMCNET connection status - Station 1	M2864	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 2	M2865	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 3	M2866	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 4	M2867	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 5	M2868	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 6	M2869	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 7	M2870	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 8	M2871	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 9	M2872	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 10	M2873	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 11	M2874	DMCNET connection status: success = 1; failure = 0	R
DMCNET connection status - Station 12	M2875	DMCNET connection status: success = 1; failure = 0	R
IX00 interruption input	M2880	When this special M is set to On, the IX00 interruption input function is enabled. Input point: X0 contact of controller main board I/O.	R/W
IX01 interruption input	M2881	When this special M is set to On, the IX01 interruption input function is enabled. Input point: X1 contact of controller main board I/O.	R/W
IX02 interruption input	M2882	When this special M is set to On, the IX02 interruption input function is enabled. Input point: X2 conatct of controller main board I/O.	R/W

Function name	Special M	Description	Device type
IX03 interruption input	M2883	When this special M is set to On, the IX03 interruption input function is enabled. Input point: X3 conatct of controller main board I/O.	R/W
IX04 interruption input	M2884	When this special M is set to On, the IX04 interruption input function is enabled. Input point: X4 conatct of controller main board I/O.	R/W
IX05 interruption input	M2885	When this special M is set to On, the IX05 interruption input function is enabled. Input point: X5 conatct of controller main board I/O.	R/W
IX06 interruption input	M2886	When this special M is set to On, the IX06 interruption input function is enabled. Input point: X6 conatct of controller main board I/O.	R/W
IX07 interruption input	M2887	When this special M is set to On, the IX07 interruption input function is enabled. Input point: X7 conatct of controller main board I/O.	R/W
IC00 interruption input	M2888	When this special M is set to On, the IC00 interruption input function is enabled. Input point: hardware high-speed input counter HSI_1.	R/W
IC01 interruption input	M2889	When this special M is set to On, the IC01 interruption input function is enabled. Input point: hardware high-speed input counter HSI_2.	R/W
IR00 interruption input	M2896	When this special M is set to On, the IR00 interruption input function is enabled. Input point: X0 contact of remote I/O card 0.	R/W
IR01 interruption input	M2897	When this special M is set to On, the IR01 interruption input function is enabled. Input point: X1 contact of remote I/O card 0.	R/W
IR02 interruption input	M2898	When this special M is set to On, the IR02 interruption input function is enabled. Input point: X2 contact of remote I/O card 0.	R/W
IR03 interruption input	M2899	When this special M is set to On, the IR03 interruption input function is enabled. Input point: X3 contact of remote I/O card 0.	R/W
IR04 interruption input	M2900	When this special M is set to On, the IR04 interruption input function is enabled. Input point: X4 contact of remote I/O card 0.	R/W
IR05 interruption input	M2901	When this special M is set to On, the IR05 interruption input function is enabled. Input point: X5 contact of remote I/O card 0.	R/W
IR06 interruption input	M2902	When this special M is set to On, the IR06 interruption input function is enabled. Input point: X6 contact of remote I/O card 0.	R/W
IR07 interruption input	M2903	When this special M is set to On, the IR07 interruption input function is enabled. Input point: X7 contact of remote I/O card 0.	R/W
IR08 interruption input	M2904	When this special M is set to On, the IR08 interruption input function is enabled. Input point: X8 contact of remote I/O card 0.	R/W
IR09 interruption input	M2905	When this special M is set to On, the IR09 interruption input function is enabled. Input point: X9 contact of remote I/O card 0.	R/W
IR10 interruption input	M2906	When this special M is set to On, the IR10 interruption input function is enabled. Input point: X10 contact of remote I/O card 0.	R/W
IR11 interruption input	M2907	When this special M is set to On, the IR11 interruption input function is enabled. Input point: X11 contact of remote I/O card 0.	R/W

Function name	Special M	Description	Device type
IR12 interruption input	M2908	When this special M is set to On, the IR12 interruption input function is enabled. Input point: X12 contact of remote I/O card 0.	R/W
IR13 interruption input	M2909	When this special M is set to On, the IR13 interruption input function is enabled. Input point: X13 contact of remote I/O card 0.	R/W
IR14 interruption input	M2910	When this special M is set to On, the IR14 interruption input function is enabled. Input point: X14 contact of remote I/O card 0.	R/W
IR15 interruption input	M2911	When this special M is set to On, the IR15 interruption input function is enabled. Input point: X15 contact of remote I/O card 0.	R/W
IR16 interruption input	M2912	When this special M is set to On, the IR16 interruption input function is enabled. Input point: X16 contact of remote I/O card 0.	R/W
IR17 interruption input	M2913	When this special M is set to On, the IR17 interruption input function is enabled. Input point: X17 contact of remote I/O card 0.	R/W
IR18 interruption input	M2914	When this special M is set to On, the IR18 interruption input function is enabled. Input point: X18 contact of remote I/O card 0.	R/W
IR19 interruption input	M2915	When this special M is set to On, the IR19 interruption input function is enabled. Input point: X19 contact of remote I/O card 0.	R/W
IR20 interruption input	M2916	When this special M is set to On, the IR20 interruption input function is enabled. Input point: X20 contact of remote I/O card 0.	R/W
IR21 interruption input	M2917	When this special M is set to On, the IR21 interruption input function is enabled. Input point: X21 contact of remote I/O card 0.	R/W
IR22 interruption input	M2918	When this special M is set to On, the IR22 interruption input function is enabled. Input point: X22 contact of remote I/O card 0.	R/W
IR23 interruption input	M2919	When this special M is set to On, the IR23 interruption input function is enabled. Input point: X23 contact of remote I/O card 0.	R/W
IR24 interruption input	M2920	When this special M is set to On, the IR24 interruption input function is enabled. Input point: X24 contact of remote I/O card 0.	R/W
IR25 interruption input	M2921	When this special M is set to On, the IR25 interruption input function is enabled. Input point: X25 contact of remote I/O card 0.	R/W
IR26 interruption input	M2922	When this special M is set to On, the IR26 interruption input function is enabled. Input point: X26 contact of remote I/O card 0.	R/W
IR27 interruption input	M2923	When this special M is set to On, the IR27 interruption input function is enabled. Input point: X27 contact of remote I/O card 0.	R/W
IR28 interruption input	M2924	When this special M is set to On, the IR28 interruption input function is enabled. Input point: X28 contact of remote I/O card 0.	R/W
IR29 interruption input	M2925	When this special M is set to On, the IR29 interruption input function is enabled. Input point: X29 contact of remote I/O card 0.	R/W
IR30 interruption input	M2926	When this special M is set to On, the IR30 interruption input function is enabled. Input point: X30 contact of remote I/O card 0.	R/W

Function name	Special M	Description	Device type
IR31 interruption input	M2927	When this special M is set to On, the IR31 interruption input function is enabled. Input point: X31 contact of remote I/O card 0.	R/W
Lock user permission	M2934	The user permission is locked when this special M is On. You have to set Pr.10015 [Account permission activation method] to 1 to activate this special M.	R/W
Restrict program editing	M2935	Restricts program editing in the controller.	R/W
DCNT counter C64 counts down	M2944	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C65 counts down	M2945	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C66 counts down	M2946	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C67 counts down	M2947	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C68 counts down	M2948	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C69 counts down	M2949	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C70 counts down	M2950	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C71 counts down	M2951	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C72 counts down	M2952	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C73 counts down	M2953	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C74 counts down	M2954	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C75 counts down	M2955	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C76 counts down	M2956	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
DCNT counter C77 counts down	M2957	When this special M is set to On, the counter decrements by 1 every time it is triggered.	R/W
File queue auto processing	M2980	In AUTO mode, the system automatically executes the next program in the FILE QUEUE list when this special M is triggered.	R/W
G00 teaching triggered	M2992	When G00 Teaching is triggered, this special M is On.	R
G01 teaching triggered	M2993	When G01 Teaching is triggered, this special M is On.	R
G00 teaching record complete	M2994	When G00 Teaching is used and the trajectory is recorded, this special M is On.	R
G01 teaching record complete	M2995	When G01 Teaching is used and the trajectory is recorded, this special M is On.	R

14.3 List of special D

Function name	Special D	Description	Device type
Number of complete pieces (32-bit)	D1018	Set the value in the Process screen or with the MLC input. Set Pr.10015 [Machining count display format] to determine which special D is the source of the displayed data. D1019 is the high word of the 32-bit register. When Pr.10015 [Machining count display format] is 0, the source is D1022 and D1023. When Pr.10015 [Machining count display format] is 1, the source is D1018 (D1019) and D1020 (D1021).	R/W
Number of machining targets (32-bit)	D1020	Set the value in the Process screen or with the MLC input. D1021 is the high word of the 32-bit register.	R/W
Number of complete pieces	D1022	Set the value in the Process screen or with the MLC input.	R/W
Number of machining targets	D1023	Set the value in the Process screen or with the MLC input.	R/W
HMI output point 1	D1024	Sends the special D value to the system variable #1833.	R/W
HMI output point 2	D1025	Sends the special D value to the system variable #1834.	R/W
HMI output point 3	D1026	Sends the special D value to the system variable #1835.	R/W
HMI output point 4	D1027	Sends the special D value to the system variable #1836.	R/W
HMI output point 5	D1028	Sends the special D value to the system variable #1837.	R/W
HMI output point 6	D1029	Sends the special D value to the system variable #1838.	R/W
HMI output point 7	D1030	Sends the special D value to the system variable #1839.	R/W
HMI output point 8	D1031	Sends the special D value to the system variable #1840.	R/W
HMI output point 9	D1032	Sends the special D value to the system variable #1841.	R/W
HMI output point 10	D1033	Sends the special D value to the system variable #1842.	R/W
HMI output point 11	D1034	Sends the special D value to the system variable #1843.	R/W
HMI output point 12	D1035	Sends the special D value to the system variable #1844.	R/W
HMI output point 13	D1036	Sends the special D value to the system variable #1845.	R/W
HMI output point 14	D1037	Sends the special D value to the system variable #1846.	R/W
HMI output point 15	D1038	Sends the special D value to the system variable #1847.	R/W
HMI output point 16	D1039	Sends the special D value to the system variable #1848.	R/W
MPG operation mode	D1040	MPG operation mode selection. When D1040 is set to 0, an external MPG is used; when D1040 is set to 10, the keys on machine operation panel B are used for MPG operation, with M1118 and M1119 as the triggering signals.	R/W
MPG operation channel setting	D1041	Channel selection for MPG operation. The default is 0.	R/W

<table>
<tr><th>Function name</th><th>Special D</th><th>Description</th><th>Device type</th></tr>
<tr><td>MPG pulse magnification</td><td>D1042</td><td>MPG pulse magnification settings, ×1, ×10, and ×100. The movement is the minimum unit (0.001 mm) multiply by the magnification.
For example, 1 × 0.001 = 0.001 mm/cnt.</td><td>R/W</td></tr>
<tr><td>MPG axis selection</td><td>D1043</td><td>Select the axis to be operated with the handwheel (MPG).
<table>
<tr><th>Axis</th><th>Setting value</th></tr>
<tr><td>X</td><td>0</td></tr>
<tr><td>Y</td><td>1</td></tr>
<tr><td>Z</td><td>2</td></tr>
<tr><td>A</td><td>3</td></tr>
<tr><td>B</td><td>4</td></tr>
<tr><td>C</td><td>5</td></tr>
<tr><td>U</td><td>6</td></tr>
<tr><td>V</td><td>7</td></tr>
<tr><td>W</td><td>8</td></tr>
</table></td><td>R/W</td></tr>
<tr><td>DMCNET ready for HMI</td><td>D1048</td><td>When the system is ready, the number of the connected DMCNET axes is represented with decimal values converted from the binary data. For example, D1048 represents the binary data 1111 as 15 in decimal to indicate there are 4 axes connected.</td><td>R</td></tr>
<tr><td>Cutting feed rate adjustment</td><td>D1056</td><td>The setting of the cutting feed rate (F) in units of percentage in the program. For example, when F is set to 1000, if the current value of D1056 is 50, it means the actual command output is 500 mm/min (1000 x 50%).</td><td>R/W</td></tr>
<tr><td>Rapid traverse adjustment rate</td><td>D1058</td><td>The setting of the speed of G00 Rapid traverse in units of percentage. For example, when the speed set for rapid traverse is 6000, if D1058 is set to 50, the actual speed for G00 Rapid traverse is 3000 mm/min (6000 x 50%).</td><td>R/W</td></tr>
<tr><td>1st spindle speed adjustment</td><td>D1060</td><td>The setting of the S value in units of percentage specified in the program. For example, when S1000 is specified in the program, if this special D is set to 30, the actual spindle speed is 300 rpm (1000 x 30%).</td><td>R/W</td></tr>
<tr><td>Speed setting for jog feeding and dry run</td><td>D1062</td><td>The movement speed (F) setting for a dry run in JOG or AUTO mode. If this special D is set to 50, the movement speed (F) is 50 mm/min. The setting range for this 32-bit special D is 0 to 65535 mm/min.</td><td>R/W</td></tr>
<tr><td>MLC X axis positioning command</td><td>D1064</td><td>Specifies the X axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
<tr><td>MLC Y axis positioning command</td><td>D1066</td><td>Specifies the Y axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
<tr><td>MLC Z axis positioning command</td><td>D1068</td><td>Specifies the Z axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
<tr><td>MLC A axis positioning command</td><td>D1070</td><td>Specifies the A axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
<tr><td>MLC B axis positioning command</td><td>D1072</td><td>Specifies the B axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
<tr><td>MLC C axis positioning command</td><td>D1074</td><td>Specifies the C axis moving amount in the MLC axis mode.
Unit: mm, inch. This special D is a 32-bit register.</td><td>R/W</td></tr>
</table>

Function name	Special D	Description	Device type
MLC U axis positioning command	D1076	Specifies the U axis moving amount in the MLC axis mode. Unit: mm, inch. This special D is a 32-bit register.	R/W
MLC V axis positioning command	D1078	Specifies the V axis moving amount in the MLC axis mode. Unit: mm, inch. This special D is a 32-bit register.	R/W
MLC W axis positioning command	D1080	Specifies the W axis moving amount in the MLC axis mode. Unit: mm, inch. This special D is a 32-bit register.	R/W
MLC X axis positioning speed	D1082	Specifies the X axis movement speed in the MLC axis mode. Unit: mm, inch/min. This special D is a 32-bit register.	R/W
MLC Y axis positioning speed	D1084	Specifies the Y axis movement speed in the MLC axis mode. Unit: mm, inch/min. This special D is a 32-bit register.	R/W
MLC Z axis positioning speed	D1086	Specifies the Z axis movement speed in the MLC axis mode. Unit: mm, inch/min. This special D is a 32-bit register.	R/W
MLC A axis positioning speed	D1088	Specifies the A axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC B axis positioning speed	D1090	Specifies the B axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC C axis positioning speed	D1092	Specifies the C axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC U axis positioning speed	D1094	Specifies the U axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC V axis positioning speed	D1096	Specifies the V axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC W axis positioning speed	D1098	Specifies the W axis movement speed in the MLC axis mode. Unit: refer to Pr.634 [Rotation axis unit selection]. This special D is a 32-bit register.	R/W
MLC spindle positioning speed	D1100	Specifies the spindle movement speed in the MLC axis mode. Unit: rpm. This special D is a 32-bit register.	R/W
Main file name	D1102	When Pr.12017 [Record system data in special D registers] is set to 1, this special D records the file names of O0000 - O9999 which are recently used.	R
Total machining time	D1103	When Pr.12017 [Record system data in special D registers] is set to 1, the total machining time is recoded in units of seconds. This special D is a 32-bit register.	R
Single machining time	D1105	When Pr.12017 [Record system data in special D registers] is set to 1, the single machining time is recorded in units of seconds. This special D is a 32-bit register.	R
System time: year, month	D1107	When Pr.12017 [Record system data in special D registers] is set to 1, the year and month of the system time is recorded.	R

Function name	Special D	Description	Device type
System time: day, hour	D1108	When Pr.12017 [Record system time in special D registers] is set to 1, the day and hour of the system time is recorded.	R
System time: minute, second	D1109	When Pr.12017 [Record system time in special D registers] is set to 1, the minute and second of the system time is recorded.	R
Macro call file name	D1111	Specifies the macro call file name O9xxx. For example, when K9100 is written to D1111, the system calls the macro program O9100.	R/W
2nd spindle speed adjustment	D1112	Sets the adjustment rate (in percentage) of the S value specified for the 2nd spindle in the program. For example, when S1000 is specified in the program, if this special D is set to 30, the actual spindle speed is 300 rpm (1000 x 30%).	R/W
Spindle analog voltage output (Port 2)	D1114	When the spindle is in DMCNET mode, you can output analog voltage with this special D. Setting range: -1000 to +1000; unit: 0.01V. This special D is available only on B series models.	R/W
Lathe tool number selection	D1115	When Pr.308 [Tool ID display source] is set to 1, the tool number of the lathe is selected by this special D. Setting range: 0 to 65535.	R/W
Spindle analog voltage output (Port 1)	D1125	When the spindle is in DMCNET mode, you can output analog voltage with this special D. Setting range: -1000 to +1000; unit: 0.01V.	R/W
Equi-slope filter compensation for X axis	D1126	The filter compensation value for X axis. Unit: mm	R/W
Equi-slope filter compensation for Y axis	D1128	The filter compensation value for Y axis. Unit: mm	R/W
Equi-slope filter compensation for Z axis	D1130	The filter compensation value for Z axis. Unit: mm	R/W
Equi-slope filter compensation for A axis	D1132	The filter compensation value for A axis. Unit: mm or deg	R/W
Equi-slope filter compensation for B axis	D1134	The filter compensation value for B axis. Unit: mm or deg	R/W
Equi-slope filter compensation for C axis	D1136	The filter compensation value for C axis. Unit: mm or deg	R/W
Equi-slope filter compensation for U axis	D1138	The filter compensation value for U axis. Unit: mm or deg	R/W
Equi-slope filter compensation for V axis	D1140	The filter compensation value for V axis. Unit: mm or deg	R/W
Equi-slope filter compensation for W axis	D1142	The filter compensation value for W axis. Unit: mm or deg	R/W
Linear axis compensation speed	D1144	The compensation speed for the linear axis. Unit: mm/sec	R/W
Rotation axis compensation speed	D1146	The compensation speed for the rotation axis. Unit: deg/sec	R/W
1st spindle speed (written with special D)	D1148	The 1st spindle speed is written with this special D. (Must be used with M1307.)	R/W
Arc preview speed	D1150	Adjusts the preview speed of the arc block when the PREVIEW function is used. This special D is a 32-bit register.	R/W
2nd spindle speed (written with special D)	D1152	The 2nd spindle speed is written with this special D. (Must be used with M1307.)	R/W
Spindle tool number (written with special D)	D1172	The spindle tool number is written with this special D. (Pr.308 [Tool ID display source] must be set to 1.)	R/W
Standby tool number (written with special D)	D1173	The standby tool number is written with this special D. (Pr.308 [Tool ID display source] must be set to 1.)	R/W

Function name	Special D	Description	Device type
Command tool number (written with special D)	D1174	The command tool number is written with this special D. (Pr.308 [Tool ID display source] must be set to 1.)	R/W
MPG pulse input value (int16, INC)	D1175	The MPG pulse command is set with this special D. Setting Pr.485 [Enable the register for handwheel pulse input] to 1 to enable this function.	R/W
HMI input point 1	D1336	The value of the special D is specified with the system variable #1896.	R
HMI input point 2	D1337	The value of the special D is specified with the system variable #1897.	R
HMI input point 3	D1338	The value of the special D is specified with the system variable #1898.	R
HMI input point 4	D1339	The value of the special D is specified with the system variable #1899.	R
HMI input point 5	D1340	The value of the special D is specified with the system variable #1900.	R
HMI input point 6	D1341	The value of the special D is specified with the system variable #1901.	R
HMI input point 7	D1342	The value of the special D is specified with the system variable #1902.	R
HMI input point 8	D1343	The value of the special D is specified with the system variable #1903.	R
HMI input point 9	D1344	The value of the special D is specified with the system variable #1904.	R
HMI input point 10	D1345	The value of the special D is specified with the system variable #1905.	R
HMI input point 11	D1346	The value of the special D is specified with the system variable #1906.	R
HMI input point 12	D1347	The value of the special D is specified with the system variable #1907.	R
HMI input point 13	D1348	The value of the special D is specified with the system variable #1908.	R
HMI input point 14	D1349	The value of the special D is specified with the system variable #1909.	R
HMI input point 15	D1350	The value of the special D is specified with the system variable #1910.	R
HMI input point 16	D1351	The value of the special D is specified with the system variable #1911.	R
Number of received MPG pulses	D1352	Reads the MPG pulse number.	R
1st spindle command speed (32-bit)	D1364	When the program reads the S-code, the value of the S-code is stored in D1364 and D1369 simultaneously. D1364: 32-bit display. D1365 is the high word of the 32-bit register. D1369: 16-bit display. Unit: rpm.	R
M-code data	D1368	When the program reads the M-code, the value of the M-code is stored in D1368. When the M-code is used for macro call, the value in this special D does not change. The M-code here does not include M00, M01, M02, M30, M98, and M99.	R
1st spindle S-code data	D1369	When the program reads the S-code, the value of the S-code is stored in D1369. When the S-code is used for macro call, the value in this special D does not change.	R

Function name	Special D	Description	Device type
T-code data (command)	D1370	When the program reads the T-code, the value of the T-code is stored in D1370. When the T-code is used for macro call, the value in this special D does not change. The value of this register is related to the station ID setting in the tool magazine. The T-code data is displayed only when the value in the program is within the range set by Pr.338.	R
Tool magazine 1 T-code data (standby)	D1371	Records the latest T-code value read in tool magazine 1.	R
Tool magazine 1 T-code data (rotation increment)	D1372	D1372 = tool pot number of the command tool minus standby tool pot number (D1373). When M1168 (Tool magazine 1 moves forward) or M1169 (Tool magazine 1 moves backward) is On, the standby tool pot number increases or decreases. The value of D1372 is the difference between the tool pot number of the command tool and the standby tool pot number.	R
Tool magazine 1 tool pot number (standby)	D1373	The value in this special D is the standby tool pot number in tool magazine 1.	R
Tool magazine 1 spindle tool number (in use)	D1374	The spindle tool number currently used in tool magazine 1.	R
Tool magazine 2 T-code data (standby)	D1375	Records the latest T-code value read in tool magazine 2.	R
Tool magazine 2 T-code data (rotation increment)	D1376	D1376 = tool pot number of the command tool minus standby tool pot number (D1377). When M1172 (Tool magazine 2 moves forward) or M1173 (Tool magazine 2 moves backward) is On, the standby tool pot number increases or decreases. The value of D1376 is the difference between the tool pot number of the command tool and the standby tool pot number.	R
Tool magazine 2 tool pot number (standby)	D1377	The value in this special D is the standby tool pot number in tool magazine 2.	R
Tool magazine 2 spindle tool number (in use)	D1378	The spindle tool number currently used in tool magazine 2.	R
Feed rate	D1379	Accesses the cutting feed rate.	R
1st spindle actual speed (32-bit)	D1380	Accesses the spindle speed. This special D is a 32-bit register. The source of the value displayed in this special D can be changed with Pr.399 [Spindle speed D1380 display mode]. When Pr.399 [Spindle speed D1380 display mode] is 0, the source is the S-code command in the program. When Pr.399 [Spindle speed D1380 display mode] is 1, the source is the spindle current speed.	R
Current G-code (G01, G02, or G03)	D1383	When you use G01, G02, or G03, this special D displays the corresponding number of the G-code. (G01 = 1; G02 = 2; G03 = 3)	R
X axis machine coordinate	D1384	X axis machine coordinate. This special D is a 32-bit register.	R
Y axis machine coordinate	D1386	Y axis machine coordinate. This special D is a 32-bit register.	R
Z axis machine coordinate	D1388	Z axis machine coordinate. This special D is a 32-bit register.	R
A axis machine coordinate	D1390	A axis machine coordinate. This special D is a 32-bit register.	R
B axis machine coordinate	D1392	B axis machine coordinate. This special D is a 32-bit register.	R

Function name	Special D	Description	Device type
C axis machine coordinate	D1394	C axis machine coordinate. This special D is a 32-bit register.	R
U axis machine coordinate	D1396	U axis machine coordinate. This special D is a 32-bit register.	R
V axis machine coordinate	D1398	V axis machine coordinate. This special D is a 32-bit register.	R
W axis machine coordinate	D1400	W axis machine coordinate. This special D is a 32-bit register.	R
X axis absolute coordinate	D1402	X axis absolute coordinate. This special D is a 32-bit register.	R
Y axis absolute coordinate	D1404	Y axis absolute coordinate. This special D is a 32-bit register.	R
Z axis absolute coordinate	D1406	Z axis absolute coordinate. This special D is a 32-bit register.	R
A axis absolute coordinates	D1408	A axis absolute coordinate. This special D is a 32-bit register.	R
B axis absolute coordinate	D1410	B axis absolute coordinate. This special D is a 32-bit register.	R
C axis absolute coordinate	D1012	C axis absolute coordinate. This special D is a 32-bit register.	R
U axis absolute coordinate	D1414	U axis absolute coordinate. This special D is a 32-bit register.	R
V axis absolute coordinate	D1416	V axis absolute coordinate. This special D is a 32-bit register.	R
W axis absolute coordinate	D1418	W axis absolute coordinate. This special D is a 32-bit register.	R
X axis DMCNET current monitoring	D1420	X axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
Y axis DMCNET current monitoring	D1421	Y axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
Z axis DMCNET current monitoring	D1422	Z axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
A axis DMCNET current monitoring	D1423	A axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
B axis DMCNET current monitoring	D1424	B axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
C axis DMCNET current monitoring	D1425	C axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
U axis DMCNET current monitoring	D1426	U axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
V axis DMCNET current monitoring	D1427	V axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R
W axis DMCNET current monitoring	D1428	W axis DMCNET current monitoring. The data is an integer word. (The current value is not updated in HOME mode.)	R

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Function name	Special D	Description	Device type
SP1 DMCNET current monitoring	D1429	DMCNET current monitoring for the 1st spindle. The data is an integer word. (The current value is not updated in spindle positioning mode.)	R
SP2 DMCNET current monitoring	D1430	DMCNET current monitoring for the 2nd spindle. The data is an integer word. (The current value is not updated in spindle positioning mode.)	R
Workpiece coordinate system	D1450	Displays the current workpiece coordinate system. Program format: GXXPXX; display format: XXXX. For example, G55 = 5500; G54P01 = 5401.	R
2nd spindle actual speed (32-bit)	D1458	Accesses the 2nd spindle speed. D1459 is the high word of the 32-bit register. The source of the displayed value is set by Pr.439 [Spindle speed D1458 display mode]. When Pr.439 [Spindle speed D1485 display mode] is 0, the source is the S-code command in the program. When Pr.439 [Spindle speed D1485 display mode] is 1, the source is the spindle speed command.	R
2nd spindle command speed (32-bit)	D1460	When the program executes the S-code specified for the 2nd spindle, the value of the S-code is stored in D1460 and D1462 simultaneously. D1460: 32-bit display; D1461 is the high word of the 32-bit register. D1462: 16-bit display. Unit: rpm.	R
2nd spindle S-code data	D1462	When the program executes the S-code specified for the 2nd spindle, the value of the S-code is stored in D1462. When you use S-code macro call, the value of this special D does not change. Unit: rpm.	R
Use ADC, TAD, or DAC	D1464 - D1495	Functions of these special D registers differ according to the RIO setting in the NC system. When the RIO is set for ADC, the four IN ports of the ADC stations (4 - 7) correspond to the following four sets of special D codes: D1464 - D1467, D1472 - D1475, D1480 - D1483, and D1488 - D1491. When the RIO is set for TAD, the four IN ports of the TAD stations (4 - 7) correspond to the following four sets of special D codes: D1464 - D1471, D1472 - D1479, D1480 - D1487, and D1488 - 1491. When the RIO is set for DAC, the four IN ports of the DAC stations (4 - 7) correspond to the following four sets of special D codes: D1464 - D1467, D1472 - D1475, D1480 - D1483, and D1488 - D1491.	R/W
User-defined hardware signal	D1500	Setting each bit of this special D to define the positive and negative limits and the home signal of the NC system.	W
User-defined hardware signal	D1501	Setting each bit of this special D to define the positive and negative limits and the home signal of the NC system.	W
User-defined hardware signal	D1502	Setting each bit of this special D to define the positive and negative limits and the home signal of the NC system.	W
User-defined hardware signal	D1503	Setting each bit of this special D to define the positive and negative limits and the home signal of the NC system.	W
X axis residual coordinate	D1506	X axis residual coordinate. This special D is a 32-bit register.	R

Function name	Special D	Description	Device type
Y axis residual coordinate	D1508	Y axis residual coordinate. This special D is a 32-bit register.	R
Z axis residual coordinate	D1510	Z axis residual coordinate. This special D is a 32-bit register.	R
A axis residual coordinate	D1512	A axis residual coordinate. This special D is a 32-bit register.	R
B axis residual coordinate	D1514	B axis residual coordinate. This special D is a 32-bit register.	R
C axis residual coordinate	D1516	C axis residual coordinate. This special D is a 32-bit register.	R
U axis residual coordinate	D1518	U axis residual coordinate. This special D is a 32-bit register.	R
V axis residual coordinate	D1520	V axis residual coordinate. This special D is a 32-bit register.	R
W axis residual coordinate	D1522	W axis residual coordinate. This special D is a 32-bit register.	R
Servo magazine 1 command tool number	D1524	The command tool number of the 1st servo magazine.	R/W
Servo magazine 1 command character	D1525	The command character of the 1st servo magazine.	R/W
Servo magazine 1 tool number feedback	D1526	Displays the tool number in the 1st servo magazine.	R/W
Servo magazine 1 status feedback	D1527	Displays the current status of the 1st servo magazine.	R/W
Servo magazine 2 command tool number	D1528	The command tool number in the 2nd servo magazine.	R/W
Servo magazine 2 command character	D1529	The command character of the 2nd servo magazine.	R/W
Servo magazine 2 tool number feedback	D1530	Displays the tool number in the 2nd servo magazine.	R/W
Servo magazine 2 status feedback	D1531	Displays the current status of the 2nd servo magazine.	R/W
Servo magazine 3 command tool number	D1532	The command tool number of the 3rd servo magazine.	R/W
Servo magazine 3 command character	D1533	The command character of the 3rd servo magazine.	R/W
Servo magazine 3 tool number feedback	D1534	Displays the tool number in the 3rd servo magazine.	R/W
Servo magazine 3 status feedback	D1535	Displays the current status of the 3rd servo magazine.	R/W

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Troubleshooting 15

This chapter provides the information about the alarms and troubleshooting methods for the NC system. Search for the methods of handling the NC system malfunctions in this chapter.

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15.1 Alarm description

The CNC alarms can be divided into three categories, which are system alarms, user-defined alarms, and user-defined macro alarms. This chapter mainly explains the system alarms while the user-defined alarms are not covered.

Alarm category	Alarm code	Alarm description
System alarms	_ _ _ _	Alarms caused by system error or operation error.
User-defined alarms	A_	The user-defined alarms which you use with the MLC program. When the A_ device is triggered, the alarm corresponding to the A_ device occurs as well.
User-defined macro alarms	MR_	The user-defined macro alarm works with variable #6000 = _. You can have the alarm triggered and have the corresponding macro alarm displayed on the controller.

The system alarms are divided into MLC related alarms, HMI related alarms, and NC related alarms by function.

System alarm category	Alarm code range	Error type	Description
MLC related alarms	1200 - 12FF	MLC system error	-
	1300 - 13FF	Ethernet error	-
	1E00	Servo error	This alarm displays the information about the station number of the servo axis in error and the error code.
	1F00	Remote I/O error	This alarm displays the information about the remote I/O station number in error.
HMI related alarms	3010 - 3FFF	HMI error	-
NC related alarms	4200 - 4FFF	NC system error	These alarms are displayed with a dialog box. The information is added to neither the Alarm screen nor the History screen.
	B000 - EFFF	NC channel error	According to the high byte of the alarm code, you can identify which channel is in error: BXXX: CH0 CXXX: CH1 (reserved) DXXX: CH2 (reserved) EXXX: CH3 (reserved)

15.1.1 MLC errors (1200 - 13FF)

Alarm code	Name	Cause and corrective action
1200	NC memory access error	1. An error occurs when the MLC accesses the NC memory. 2. Restart the controller or send it back for servicing.
1201	NC not ready	1. The startup of the NC system is not complete. 2. Restart the controller or send it back for servicing.
1202	Memory error	1. NC memory buffer is in error or not ready. 2. Restart the controller or send it back for servicing.
1203	Output port does not exist	1. NC output port does not exist. 2. Check the axis parameter setting.
1204	MLC code clear error	1. Failed to clear the MLC codes. 2. Send the controller back for servicing.
1205	MLC flash memory error	1. Failed to write the MLC codes to the flash memory. 2. Restart the controller or send it back for servicing.
1206	SRAM error	1. SRAM write-in error. 2. Send the controller back for servicing.
1207	Host I/O channel error	1. An error occurs when the system accesses the host I/O. 2. Restart the controller or send it back for servicing.
1208	Remote I/O channel error	1. An error occurs when the system accesses the remote I/O. 2. Restart the controller or send it back for servicing.
120A	NC parameter error	1. NC parameters are not set or not initialized. 2. Re-initialize the parameters.
120B	Compensation PAR error	1. Compensation parameter write-in error. 2. Reload the compensation parameters.
120C	Compen. PAR clear error	1. An error occurs when the system clears the compensation parameter from memory. 2. Reload the compensation parameters.
120D	Compen. PAR write-in error	1. An error occurs when the system writes the compensation parameter to memory. 2. Reload the compensation parameters.
120E	PAR initialization error	1. Parameter initialization error. 2. Re-initialize the parameters.
120F	Memory clear error	1. Memory clear error. 2. Restart the controller or send it back for servicing.
1210	Memory write-in error	1. Memory write-in error or memory initialization error. 2. Restart the controller or send it back for servicing.
1211	Servo axis does not exist	1. Servo parameter setting error. 2. Check the parameter settings.
1212	Servo axis PAR setting error	1. Servo parameter setting error. 2. Check the parameter settings.
1213	DMCNET initialization error	1. DMCNET initialization error. 2. Make sure the DMCNET cable is securely connected.
1214	Non-volatile memory error	1. Non-volatile memory error. 2. Restart the controller or send it back for servicing.
1215	Internal comm. error	1. The bottom layer of communication between MLC and NC is in error. 2. Use the correct firmware version. 3. Set the correct channel parameters.

Alarm code	Name	Cause and corrective action
1216	MLC PRG error	1. The following conditions occur when the MLC is in execution: ■ The divisor of the division command is 0. ■ The target position of the CJ/CALL command is invalid. ■ The number of digits displayed in the BCD command is invalid. ■ The number of tables in the VRT command is invalid. ■ MLC code error. 2. Check and correct the MLC program. 3. Reload the MLC program.
1217	MLC PAR does not match	1. The current number of MLC parameters in the internal memory does not match the number of parameters planned in the firmware. 2. Update the firmware or send the controller back for servicing.
1300	Network com. error	1. Check the network connection. 2. Restart the controller or send it back for servicing.

15.1.2 Servo error (1E00)

Alarm code	Name	Cause and corrective action
1E00	Servo error	[1530]: alarm signal (DI) in the NC-EIO-PMC02 or NC-EIO-PMC06 conversion card (for converting motion commands to pulses) is triggered. Check the cause of the error which occurs in the connected servo drive.
		[1531]: the conversion card generates more than 24,000 pulses within 1 ms. Check the controller's encoder resolution setting and make sure the motor speed is within the specified range.
		[1532]: pulse leakage. When the motor is stopped, the conversion card compares the command pulse number with the feedback pulse number. If the pulse number difference is greater than 1% of the encoder resolution, this alarm occurs. 1. Check if the signal traces are shielded. 2. Check if the equipment is properly grounded.
		[1560]: station number repetition error. 1. Check the station number setting in the channel parameter. 2. Check the setting of the rotary switch for station number on the conversion card. 3. Check the setting of P3-00 for the drive station number.
		Refer to the relevant servo drive user manuals for the definition and troubleshooting of other related errors.

15.1.3 Remote I/O error (1F00)

Alarm code	Name	Cause and corrective action
1F00	Remote I/O error	1. Remote I/O error. 2. Check the remote I/O connection or replace the remote I/O board.

15.1.4 HMI related alarms (3010 - 3FFF)

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Alarm code	Name	Cause and corrective action
3010	HMI communication interface establishing error	1. An error occurs when the system establishes the HMI communication interface. 2. Restart the controller or send it back for servicing.
3011	HMI communication memory area creating error	1. An error occurs when the system creates the HMI communication memory area. 2. Restart the controller or send it back for servicing.
3012	HMI interface command area creating error	1. An error occurs when the system creates the HMI interface command area. 2. Restart the controller or send it back for servicing.
3013	HMI interface memory area error	1. HMI interface memory area error. 2. Restart the controller or send it back for servicing.
3014	HMI interface communication port error	1. HMI interface communication port error. 2. Restart the controller or send it back for servicing.
3015	MLC interface memory area error	1. MLC interface memory area error. 2. Restart the controller or send it back for servicing.
3016	HMI file transmission error	1. HMI file transmission error. 2. Restart the controller or send it back for servicing.
3017	HMI data transmission error	1. HMI data transmission error. 2. Restart the controller or send it back for servicing.
3018	FTP PAR setting error	1. Incorrect FTP setting. 2. Recheck the setting of FTP parameters.
3100	Invalid file name	1. The file name is invalid. 2. Modify the file name.
3101	Exceeded subroutine call LVL	1. The macro call exceeded 8 layers. 2. Check the macro program.
3102	G-code range exceeded	1. G-code range exceeded. For example, G100 is used when only G00 to G99 are supported. 2. Check the G-code and modify the program.
3103	Memory error	1. System internal memory area is in error. 2. Use the system recovery function or send the controller back for servicing.
3200	Internal PAR CRC error	1. System internal parameter memory area is in error. 2. Use the system recovery function or send the controller back for servicing.
3201	MLC PRG error	1. System MLC program memory area is in error. 2. Reload the MLC program or send the controller back for servicing.
3202	CF card read failed	1. No CF card is inserted or the inserted CF card is invalid. 2. Make sure the CF card is correctly installed or replace the CF card.
3203	PAR backup failed	Make sure the CF card is correctly inserted and the storage space is sufficient.
3204	MLC backup failed	Make sure the CF card is correctly inserted and the storage space is sufficient.
3205	Machine is locked	1. The usage duration has expired. 2. Contact the equipment manufacturer to disable or extend the setting of machine usage duration.
3206	PAR value exceeds the range	1. There are system parameters with the set values exceeding the specified range. 2. Check and modify the parameter values.

Alarm code	Name	Cause and corrective action
3207	COM port DLL load error	1. Failed to load the external device driver with the software panel. 2. Update the software panel to reload the external device driver.
3208	Machine to be locked soon	1. System usage duration expiration reminder. 2. Contact the equipment manufacturer to disable or extend the setting of machine usage duration.
3209	Sys updated, please restart the controller	1. The system update is complete and requires restarting. 2. Restart the controller.
320A	System battery is low	1. The controller battery is low. 2. Replace the controller battery.
3210	COM port disconnection	1. The connection between the software panel and the external device is disconnected. 2. Check the connection settings between the controller and the external device.
3211	COM port DLL open error	1. Failed to open the external device driver with the software panel. 2. Update the software panel to reload the external device driver.
3212	Failed to create COM port	1. An error occurs when the external device driver is loaded with the software panel. 2. Update the software panel and make sure the setting of the external link file is correct.
3213	Load TCPIP DLL Err	1. Failed to load the TCPIP driver with the software panel. 2. Update the software panel to reload the external device driver.
3214	TCPIP comm. disconnection	1. Network connection is in error. 2. Check the network wiring or connection status.
3215	Network comm. init. failed	1. Network communication initialization is in error. 2. Check the network wiring or connection status.
3216	System reset error	1. No response from the bottom layer after the system is reset. 2. Update the firmware or send the controller back for servicing.
3217	Failed to import full backup	1. Failed to remotely enable the backup import. 2. Check the operation mode. Make sure the backup storage device is correctly installed.
3218	Failed to export full backup	1. Failed to remotely enable the backup export. 2. Check the operation mode. Make sure the backup storage device is correctly installed.
3219	Auto update is set, please restart the controller	1. The firmware update function is enabled remotely. 2. Cycle power to enable the automatic firmware update function. You must put the firmware file in the [pkt] folder in the root directory of the USB disk.
3220	Sys. update failed, please restart the controller	1. Failed to update the system firmware remotely. 2. Make sure the following conditions are resolved before updating the firmware. ■ The firmware version is incorrect. ■ The file format does not match. ■ The firmware update version is not supported. ■ The emergency stop of the controller is not pressed.

15.1.5 NC system errors (4200 - 4FFF)

Alarm code	Name	Cause and corrective action
4200	Execute homing	1. Homing has not been executed for each axis before automatic operation. 2. Execute homing for each axis.
4201	Absolute origin setting	1. The origin coordinates for the absolute type motor are not established. 2. Go to [DGN] to execute **ABS RST**.
4300	MLC accessing memory error	1. An error occurs when the MLC accesses the NC memory. 2. Restart the controller, update the firmware, or send the controller back for servicing.
4301	MLC is not ready	Restart the controller, update the firmware, or send the controller back for servicing.
4302	I/O module program clearing failed	1. Failed to clear the I/O module program. 2. Send the controller back for servicing.
4303	I/O module program write-in failed	1. Failed to write the I/O module program. 2. Send the controller back for servicing.
4304	NC system program clearing failed	1. Failed to clear the NC system program. 2. Restart the controller, update the firmware, or send the controller back for servicing.
4305	NC system program installation failed	1. Failed to install the NC system program. 2. Restart the controller, update the firmware, or send the controller back for servicing.
4306	Macro clearing failed	1. Failed to clear the macro program. 2. Restart the controller and re-execute the **INT MCR** (macro internal memory) function.
4307	Macro installation failed	1. Failed to install the macro program. 2. Restart the controller and re-execute the **INT MCR** (macro internal memory) function.
4308	G-code loading error	1. An error occurs when the system loads the G-code. 2. Check the machining program.
4310	I/O module PRG not initialized	1. The I/O module program is not initialized. 2. Send the controller back for servicing.
4311	FPGA code length error	Send the controller back for servicing.
4312	FPGA code corrupted	Send the controller back for servicing.
4313	I/O module status error	1. The I/O module status is in error. 2. Check if the I/O board is firmly installed and the wiring is securely connected.
4314	I/O module PRG configuration error	1. Program configuration of the I/O module is in error. 2. Check if the I/O board is firmly installed and the wiring is securely connected.
4315	I/O board hardware interface error	Send the controller back for servicing.
4316	I/O board hardware interface reading error	Send the controller back for servicing.
4317	NC system command error	1. The NC system command is in error. 2. Check the machining program or the macro content.
4318	HMI file loading error	1. HMI initialization failed. 2. Restart the controller, update the firmware, or send the controller back for servicing.

Alarm code	Name	Cause and corrective action
4319	NC parameter error	1. The NC parameter is in error. 2. Reload the parameter file to the controller, update the firmware, or send the controller back for servicing.
431A	Tool magazine setting error	1. Undefined or duplicate tool number in the tool magazine. (1) Duplicate tool numbers (Cutter No.) in the Tool magazine management (MAGA) list. (2) The sum of the values set for Pr.339 (Tool magazine 1 standby tool pot No. after reset) and Pr.340 (Tool magazine 1 start tool No.) is greater than the maximum tool number in the system. 2. Check the setting of tool magazine parameters.
431B	NC parameter error	1. The NC parameter is in error. 2. Check for all the parameter settings. Make sure the encoder pulse number, and the gear numbers of the output shaft and motor are set to 0.
431C	Spindle polarity error	1. Spindle voltage output does not match the motor rotation direction. 2. Check if the wiring of the spindle encoder OA/OB is correct. 3. By setting Pr.51 [1^{st} spindle OA/OB signal sequence], you can adjust the phase sequence of the feedback OA/OB of the spindle encoder.
4FFC	Servo overflow protection during machining	1. When you switch the servo to On or Off in AUTO mode but position overflow occurs to the specified axis, the servo is not switched to On or Off and this alarm occurs. 2. Check the servo parameters for preventing position overflow.
4FFD	Position feedback protection during machining	1. The position feedback is not changed after the motion command is issued. 2. Check for the servo parameter settings, such as whether the setting values for the servo bandwidth, motor speed limit, and torque limit are too low. 3. Check if the servo feedback signal wiring functions normally. 4. Check if the motor rotates normally.
4FFE	Overspeed protection during machining	1. There is an overspeed motion command. 2. Make sure the parameter settings are not set too high, such as the output gear ratio and cutting speed setting.

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15.1.6 Machining related alarms (B000 - B0FF)

Alarm code	Name	Cause and corrective action
B000	Illegal G-code line number	1. The G-code line number is illegal. 2. Check the machining program.
B001	Illegal G-code length	1. The G-code length is illegal. 2. Check the machining program.
B002	G-code file not found	1. The G-code file is not found. 2. Check the file contents.
B003	Loaded file name error	1. The name of the loaded file is in error. 2. Reload the program file.
B005	Workpiece coordinates buffer access error	1. Buffer access error occurs when the system calculates the workpiece coordinates. 2. Reload the machining program or update the firmware.
B006	Workpiece coordinates command index error	1. Command index error occurs when the system calculates the workpiece coordinates. 2. Reload the machining program or update the firmware.
B007	Servo port setting conflict	1. The servo port settings are in conflict. 2. Check the parameter settings.
B008	Memory overlap	1. An error occurs when the system internal program is operating. 2. Reload the machining program or update the firmware.
B009	G-code buffer error	1. The G-code buffer is in error. 2. Reload the machining program or update the firmware.
B025	G-code format error	Check the N label in the machining program.
B00A	Interpolator cmd index Err	1. The command index of the computing interpolator in the system is in error. 2. Reload the machining program or update the firmware.
B00B	INTRPL cmd BUF access Err	1. An error occurs when the command buffer of the computing interpolator in the system accesses data. 2. Reload the machining program or update the firmware.
B00C	Undefined feed rate	1. The feed rate is undefined. 2. Check the machining program and define the feed rate.
B00D	Arc radius error	1. Arc radius calculation is in error. 2. Check the arc machining program or increase the tolerance for arc radius error.
B00E	Tool ID selection error	1. Incorrect tool ID is specified for tool change or T-code execution. 2. Check if the tool ID is within the setting range of tool change or T-code execution.
B00F	Servo connection axes Err	1. The number of the connecting axes does not match the parameter setting. 2. Check the port number in the channel setting and the station number setting of the connecting servo.
B014	Incorrect tool compen. radius	1. The system cannot correctly calculate the tool radius compensation value in the G-code. 2. Check the G-code and modify the program.

Alarm code	Name	Cause and corrective action
B015	Sync cmd error	1. This alarm occurs when the synchronous function is enabled and you specify the slave axis moving amount in the G-code. 2. Check the machining program. After the synchronous function is enabled, do not specify the slave axis moving amount in the G-code.
B017	Tool assignment error	1. The tool compensation number specified in the G-code exceeds the setting range. 2. Modify the tool compensation number setting in the G-code.
B018	Cmd transfer not allowed	1. An error occurs when the system checks for the command transfer in MDI mode. 2. Command transfer can only be done before the machining program is executed.
B019	Servo command error	1. The axis does not receive G-code motion commands when the servo is Off. 2. Check if the command axis is in the Servo Off state.
B01A	Data amount error	1. The amount of the processed interface data exceeds the range, such as tool change, magazine setting, variable writing (#_), and G10 data setting. 2. Check if the G-codes and MLC processing actions are operating normally.
B01B	Spindle not running	1. The spindle is not rotating during machining. 2. This alarm occurs when the function of Pr.51 [Spindle check before cutting] is enabled. 3. Make sure the spindle rotation command is issued.
B01C	Spindle cmd speed error	1. The spindle speed command exceeds the maximum spindle speed. 2. Redefine the spindle speed. 3. Modify the setting of Pr.409 [Spindle maximum speed].
B01D	Stroke limit error	1. The stop function is triggered when the path enters the inhibit zone. 2. AUTO mode: correct the G-code execution path. 3. MDI mode: move to the opposite direction of the inhibit zone to clear the error.
B01F	Spindle feedback error	1. The spindle is in analog voltage and closed-loop control. This alarm occurs when the spindle encoder feedback is in error. 2. The analog output voltage drops to 0V after this alarm occurs. 3. Check if the wiring for the encoder feedback cable is correct.
B020	Emergency stop	1. An emergency stop occurs. 2. Check if the EMG button is pressed. 3. Check the emergency stop status.
B021	Chamfer / rounding Err	1. The chamfer / rounding command cannot be calculated. 2. Check and modify the chamfer / rounding command in the G-code.
B023	Illegal G-code command when transfer enabled	G28 command is not allowed to use when the transfer function is enabled.

15.1.7 Tool compensation related alarms (B100 - B1FF)

Alarm code	Name	Cause and corrective action
B100	Tool compen. interference	1. Tool radius compensation is interfered or the calculation for the tool compensation coordinates is in error. 2. Check and modify the programmed machining path or modify the tool radius for compensation.
B101	Cancel radius compen. in arc	1. This alarm occurs when the block containing arc interpolation is executed and you cancel the tool radius compensation. 2. Modify the machining program to avoid disabling the tool radius compensation during circular interpolation.
B102	Enable radius compen. in arc	1. This alarm occurs when the block containing arc interpolation is executed and you enable the tool radius compensation. 2. Modify the machining program to avoid enabling the tool radius compensation during circular interpolation.
B103	Radius interference	1. The tool path is interfered after tool radius compensation. 2. Check and modify the machining program or modify the tool radius for compensation.
B104	Tool compen. amount too small	1. The tool compensation path is too short. 2. Check and modify the machining program or modify the tool radius for compensation.
B105	G41 / G42 switch error	1. An error occurs when the system switches the tool radius compensation to the right or left direction. 2. Check and modify the programmed machining path.
B106	Use G31 in tool compen.	1. This alarm occurs when the system executes G31 Skip command during tool radius compensation. 2. Check and modify the machining program.
B108	NURBS interpolation error	1. NURBS interpolation is in error. 2. Check if the G-code in the NURBS function complies with the command format. 3. Check if the coordinates of the first control point of NURBS are the same as the coordinates specified in the previous block.
B109	Insufficient 3D arc points	1. The arc interpolation points are insufficient. 2. Check and modify the machining program.
B10A	Simultaneous interpolation (G07.1) for Y and C axes not allowed	The G-code for polar coordinate interpolation cannot be executed for Y and C axes at the same time.
B10B	Tool axis setting error (G51.2)	1. This error occurs when Pr.508 [Polygon cutting axis setting] is set to 0 and the system executes G51.2. 2. This alarm occurs when Pr.508 [Polygon cutting tool axis number] is set to a linear axis and the system executes G51.2. 3. Correct the setting for Pr.508 [Polygon cutting axis setting].

Alarm code	Name	Cause and corrective action
B10C	Illegal tool axis rotation mode (G51.2)	1. This error occurs when you set Pr.634 [Axis control variables - rotation axis feed mode] to linear mode for the tool axis and the system executes G51.2. 2. Change the setting of Pr.634 [Axis control variables - rotation axis feed mode] to rotation mode.
B10D	Illegal polygon interpolation G-code (G51.2)	1. This alarm occurs when G51.2 [Polygon cutting] is enabled and you specified axis movement for the tool axis in the G-code. 2. Check the G-code and modify the machining program.
B10E	Z-axis length of arc exceeds 2A (G2.1 / G3.1)	Z-axis length of the arc exceeds 2A during the interpolation of ellipse.
B01F	End point coordinates in another quadrant (G2.1 / G3.1)	The start and end coordinates are in different quadrants during the interpolation of ellipse.
B110	Identical start and end coordinates (G2.1 / G3.1)	The start and end coordinates are identical during the interpolation of ellipse.
B111	Major (A) and minor (B) axis lengths of the ellipse must be greater than 0 (G2.1 / G3.1)	Lengths of the major axis (A) and minor axis (B) of the ellipse must be positive values during the interpolation of ellipse.
B112	Parabolic interpolation format error (G2.2 / G3.2)	The format of parabolic interpolation is in error.
B113	Parabolic path does not exist (G2.2 / G3.2)	The parabolic path does not exist or the coordinates are out of range during parabolic interpolation.
B117	ACC/DEC time too long (Pr.51 [Tapping mode] is set to following)	When the tapping is executed with the Z axis following the spindle, the acceleration or deceleration time is too long.

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15.1.8 Lathe related alarms (B300 - B3FF)

Alarm code	Name	Cause and corrective action
B301	Thread pitch error	1. The calculation result of the variable lead thread is less than 0. 2. When you use the function of variable lead thread, if the lead increment per turn (K) is a negative value, the thread pitch becomes smaller with the increment of the number of turns. When the decrement in pitch is greater than the standard lead (FK), this alarm occurs. 3. Check the G-code and modify the program.
B302	Spindle speed too fast	1. The turning feed rate for thread cutting is too fast. 2. Reduce the spindle speed.
B303	Spindle / C axis switching Err	1. You switch the system from Spindle mode to C axis mode while the C axis mode is disabled. 2. Set Pr.308 [C axis mode] to 0.
B304	Thread cutting prohibited in C axis mode	1. Thread cutting operation is prohibited in C axis mode. 2. Switch the system from C axis mode to Spindle mode to execute the thread cutting operation.
B305	Spindle output mode error in C axis mode	1. In C axis mode, Pr.399 [Spindle output mode] is set to analog voltage for SP1. 2. Adjust the setting of Pr.399 [Spindle output mode] for SP1.
B306	Breakpoint search error in Spindle mode	1. In Spindle mode, the breakpoint search is in progress and the execution pauses at the M-code for switching the system from Spindle mode to C axis mode. 2. Reset the breakpoint's line number.
B307	Breakpoint search error in C axis mode	1. In C axis mode, the breakpoint search is in progress and the execution pauses at the M-code for switching the system from C axis mode to Spindle mode. 2. Reset the breakpoint's line number.
B308	Polar coordinate interpolation error	1. Check if the G-codes of the polar coordinate interpolation function comply with the command format. 2. Check if the polar coordinate interpolation function contains any unsupported G-codes. 3. Check if the plane selection is switched when the system is executing the polar coordinate command. 4. Check if there is a tool number specified in the polar coordinate interpolation command. 5. The polar coordinate interpolation mode is available only when both of the following conditions are met: the system feed mode is feed/min (G98) and the system is in C axis mode (M2239 = 1).
B309	Spindle target speed not reached when cutting	1. This error occurs when Pr.51 [Spindle target speed check during cutting] is enabled. 2. M2256 (1st spindle reaches the target speed) is Off during cutting. Adjust the setting of Pr.406 [Spindle target speed error].

15.1.9 Command related alarms (B600 - B6FF; B64x not included)

Alarm code	Name	Cause and corrective action
B600	G-code error	1. G-code error. 2. Check the G-code and modify the program.
B601	Excessive layers in subroutine call	1. The subroutine called excessive program layers. 2. The subroutine cannot call more than 8 program layers.
B602	No G-code symbol	1. The G-code in the program contains only the number without the letter G (such as inputting **01** for **G01**). 2. Check the G-code and modify the program.
B603	Variable symbol error	1. The variable symbol is in error. 2. Check the G-code and modify the program.
B604	Illegal G-code symbol	1. Unsupported character or symbol is used in the G-code. 2. Check the G-code and modify the program.
B605	Illegal G-code command string	1. Illegal string is used in the G-code command (such as "-2.0,", "X2.0-.0", ".2.0", or "XX2.0"). 2. Check the G-code and modify the program.
B606	Subroutine call error	1. The subroutine call is in error. 2. Check the G-code and modify the program.
B607	Subroutine file name error	1. The subroutine file name is in error. 2. Check the G-code and modify the program.
B608	Subroutine layer No. error	1. The subroutine layer number is in error. 2. Check the G-code and modify the program.
B609	Cycle EXEC, no homing	1. G-code is executed without homing. 2. Execute homing for each axis first.
B60A	Dwell time cmd syntax error	1. The syntax for the dwell time command is in error. 2. Check the G-code and modify the program.
B60C	Arc magnification ratio error	1. The arc magnification ratio is in error. 2. Check the G-code and modify the program.
B60D	Homing intermediate point Err	1. An error occurs when the system performs homing through the intermediate point. 2. Check the G-code and modify the program.
B60E	Homing Err in Cyclic machining	1. G28, G29, or G30 cannot be executed during cyclic machining. 2. Check the G-code and modify the program.
B60F	G54 extension code err	1. The specified range for the extended workpiece coordinate system is in error. 2. Check the range specified in the G-code.
B610	Macro variable type error	1. The type of the macro variable is in error. 2. Check the macro and modify the program.
B611	Macro not found	1. The macro command is not found. 2. Check the macro and modify the program.
B612	Macro cmd N label error	1. After the GOTO command is compiled, the N label is not an integer. 2. Check the macro and modify the program.
B613	Macro bit setting error	1. The setting for the macro bit is in error. 2. Check the macro and modify the program.
B614	Divisor in the macro is zero	1. This error occurs when the macro performs division operation and the divisor is zero. 2. Check the macro and modify the program.
B615	Macro command too long	1. The macro command is too long. 2. Check the macro and modify the program.

Alarm code	Name	Cause and corrective action
B616	Macro Cmd operand does not exist	1. The macro command operand does not exist. 2. Check the macro and modify the program.
B617	Macro command error	1. The macro command is in error. 2. Check the macro and modify the program.
B618	Macro Cmd syntax error	1. The macro syntax usage is illegal. 2. Check the macro and modify the program.
B619	Macro operand syntax error	1. The macro operand syntax is in error. 2. Check the macro and modify the program.
B61A	Illegal macro command	1. The macro command is illegal. 2. Check the macro and modify the program.
B61C	N label specified by GOTO cmd is not found	1. No corresponding N label is found when the GOTO command is executed. 2. Check the G-code and specify the correct N label.
B620	User-defined macro alarm	1. User-defined macro alarm is triggered. 2. This user-defined macro alarm is triggered when there is a #6000 command in the G-code program.
B621	Invalid halt M-code	1. The halt M-code is invalid. (1) An axis movement is specified in the block containing the halt M-code. (2) Other G-codes are specified in the block containing the halt M-code. 2. Check the G-code and make sure the halt M-code is used individually.
B623	Feed rate is negative	1. The feed rate is set as a negative value. 2. Check the G-code and modify the feed rate.
B625	Interpolation axis error	1. Milling & lathe: do not support synchronous interpolation for the linear and rotary axes. 2. Milling: NC200 does not support tapping. 3. Use NC300 or above models.
B630	Excessive following error	1. The following error is too large. 2. Make sure the servo parameter setting is correct. 3. Check if the system parameter Pr.643 is set too small.
B631	Hardware limit error	1. The hardware limit is triggered. 2. Move the axis out of the inhibit zone. 3. Check the hardware limit wiring and sensor setting.
B632	1st software limit error	1. The axis position exceeds the 1st software limit. 2. Move the axis out of the inhibit zone.
B634	2nd software limit error	1. The axis position exceeds the 2nd software limit. 2. Move the axis out of the inhibit zone.
B636	Home sensor error	1. The home sensor is in error. 2. Check if the home sensor is installed correctly.
B637	MLC axis not stopped	1. When the system switches between the MLC and NC axis modes, the MLC axis is still in motion. 2. Modify the MLC program.
B638	1st software limit error (line No.)	1. This error occurs when Pr.46 [Pre-warning for software limit] is enabled. 2. Modify the program. 3. Check the parameter setting for the 1st software limit. 4. Exclude the factors that cause excessive following error, such as the servo gain is too low or the wiring of motor power cable UVW is in error.

Alarm code	Name	Cause and corrective action
B639	2nd software limit error (line No.)	1. This error occurs when Pr.46 [Pre-warning for software limit] is enabled. 2. Modify the program. 3. Check the parameter setting of the 2nd software limit. 4. Exclude the factors that cause excessive following error, such as the servo gain is too low or the wiring of motor power cable UVW is in error.
B650	Illegal G10 PAR definition	1. The G10 parameter definition is illegal. 2. Check if the G-code is used correctly.
B651	G10 PAR range error	1. The G10 parameter range is set incorrectly. 2. Check if the G-code parameter range is correct.
B652	No spindle speed for cycle	1. There is no spindle speed specified in the cycle command. 2. Check the G-code and specify the spindle speed (S).
B653	No feed rate for cycle	1. There is no feed rate specified in the cycle command. 2. Check the G-code and specify the feed rate (F).
B654	Illegal cycle command	1. The usage of the cycle command is illegal. 2. Check the G-code and modify the cycle command.
B655	Specific function not disabled when M96 executed	1. Illegal M-code command. 2. Check if the specific G-code command (G16, G24, G41, G42, or G51) is enabled before and after M96 execution.
B656	M96 is issued when subroutine interruption is in execution	1. The special M relay for calling subroutine is triggered during G-code execution. 2. Check if the subroutine includes an M96 command.

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15.1.10 Synchronous motion and temperature compensation related alarms (B640 - B64F)

Alarm code	Name	Cause and corrective action
B640	Overheat	1. The temperature exceeds the sensing range. 2. Check the sensor's output specification.
B642	Temperature sensor disconnected	1. The temperature sensor is disconnected. 2. Check if the wiring for the temperature sensor functions normally.
B643	Temperature detection error	1. The temperature sensor is in error. 2. Check if the temperature sensor is installed correctly.
B645	Excessive synchronous following error	1. During synchronous motion control, this alarm occurs when the following error between the master and slave axes exceeds the value set in Pr.642. 2. Check if the servo gain settings for the master and slave axes are compatible. 3. Exclude the factors that cause the following error of the slave axis.
B646	Excessive spindle speed error	1. This alarm occurs when the difference between the command speed of 1st spindle (2nd spindle) and feedback speed exceeds the value set in Pr.406 (Pr.446) and this condition lasts for more than the spindle speed error checking time set in Pr.436 (Pr.476). 2. When Pr.436 or Pr.476 is set to 0, the system does not check for the spindle speed error.

15.1.11 Lathe cycle command alarms (B6A1 - B6AF)

Alarm code	Name	Cause and corrective action
B6A1	No specific N label in G70 - G73	1. The specific N label is not found in the cycle command. 2. Check the G-code and correct the N label.
B6A2	No N label specified by G70 - G73	1. N label is not specified in the cycle command. 2. Check the G-code and add the correct N label.
B6A3	Cycle command taper error	1. The taper calculation of the thread cutting cycle command is in error. 2. Modify the G-code and check related parameters.
B6A4	Chamfer command error	1. The chamfer geometry dimension is incorrect. 2. Modify the G-code and check related parameters.
B6A5	Illegal drilling / tapping	1. Drilling / tapping cannot be executed. 2. Check the G-code and the C axis status.
B6A6	Incorrect start point (G71 / G72)	Check if the X coordinate of the G71 or G72 start point is less than the X coordinate of the cycle command end point.
B6A7	G74 / G75 cutting depth greater than cavity depth	1. The cutting depth of G74 / G75 peck drilling is greater than the depth of the cavity. 2. Check the G-code and modify the drilling depth.
B6A8	Tool life is over	1. Tool life < 0 times. 2. Reset the tool life of the specific tool.

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Revision History

Release Date	Version	Chapter	Revision contents
December, 2022	V2.0 (Second edition)	1.4	Added B series product model explanation.
		2.2	Added B series product installation description.
		3.1.10	1. Added the permissible current values of the remote I/O relay. 2. Added the remote I/O wiring diagrams.
		3.2	Added B series product wiring information.
		4.4	Updated the table of corresponding buttons for OPENCNC models.
		12.4	Added the descriptions for the 2nd spindle parameters.
		12.6.1	Updated the descriptions of the parameter Pr.616 Origin search mode.
		12.9.1	Added the function of automatically dividing the value without decimal points by 1000 to the parameter Pr.10015.
		12.10.1	1. Added Pr.12029 Switch between the system and user-defined keypad. 2. Added Pr.12030 Value of the user-defined keypad key.
April, 2020	V1.0 (First edition)		

For relevant information about [Delta CNC Lathe Machine Solution - Operation and Maintenance Manual], please refer to:

(1) Delta CNC Lathe Machine Solution - G Command Guidelines

(2) Delta CNC NC Series Solution - MLC Application Manual

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