Digitized Automation for a Changing World

# Delta CNC Machine Solution NC5 Series – User Manual for Operation and Maintenance

www.deltaww.com

# Preface

Thank you for choosing this product. Before using the product, please read through this manual carefully in order to ensure the correct use of the product. In addition, please place the manual safely for quick reference whenever is needed.

This manual includes:

- Product Inspection and Model Explanation
- Product installation
- Introduction of NC System Operation
- System Parameters
- Application Examples

Features of NC5 series controllers

- Built-in 32-bit highspeed dual CPU for multi-task execution and performance improvement
- Friendly HMI Interface
- Auto tuning interface are provided for optimizing the machine's performance efficiency
- CNC Soft software tools to facilitate the development of customized images
- USB interface to facilitate data access, data backup, and parameters copy
- Spindle forms for users to choose between communication type and analog voltage type
- Serial I/O modules for flexible I/O contacts configuration

How to use this manual:

This manual can be used as reference while learning NC controllers. It lists series of CNC product, installation, system parameters, as well as instructs application examples. Before using and setting this product, please read through this manual carefully.

DELTA technical services

Please consult the distributors or DELTA customer service center if any problem occurs.

## Safety Precautions

- Please follow the instruction of pin definition when wiring. Ground is a must.
- When the power is being supplied, do not disconnect the controller, change the wiring, or touch the power supply.

Please pay close attention to the following safety precautions during inspecting, installation, operating, maintenance and troubleshooting.

The symbols of "**DANGER**", "**WARNING**" and "**STOP**" represent:

| | |
|---|---|
| DANGER | **It indicates the potential hazards. It is possible to cause severe injury or fatal harm if not follow the instructions.** |
| WARNING | **It indicates the potential hazards. It is possible to cause minor injury or lead to serious damage of the product or even malfunction if not follow the instructions.** |
| STOP | **It indicates the absolute prohibited activity. It is possible to damage the product or cannot be used due to malfunction if not follow the instructions.** |

### Installation

| | |
|---|---|
| DANGER | ■ Please follow the installation instructions in this manual; otherwise it may cause damage to the equipment.<br>■ It is prohibited to expose the product to the environment containing water, corrosive gas, inflammable gas etc. Otherwise, electric shock or fire may occur. |

### Wiring

| | |
|---|---|
| DANGER | ■ Connect the ground terminals to a Class 3 ground system. Ground resistance should not exceed 100 Ω. Improper grounding may result in communication error, electric shock, or fire. |

### Operation

| | |
|---|---|
| WARNING | ■ Use the MLCEditor software to correctly configure the I/O functions, or it may cause abnormal operation.<br>■ Properly set the parameters before operating the machine, or it may cause abnormal operation or malfunction.<br>■ Ensure the emergency stop works properly and avoid operating the machine without protection. |

| | |
|---|---|
| STOP | ■ Do not change the wiring when the power is on, or it may cause electric shock or personnel injury. |

## Maintenance and Inspection

- Do not touch the internal part of the controller when the power is on, or it may cause electric shock.
- Do not touch the wiring terminals within 10 minutes after turning off the power, or the residual voltage may cause electric shock.
- Cut off the power before replacing the backup battery. Ensure to check the system settings again after replacing the battery.
- Do not block the ventilation holes when operating the controller, or poor heat dissipation may lead to controller malfunction.

## Wiring Method

- Power: connect a 24 $V_{DC}$ power to the controller and do the wiring according to the specifications to avoid danger.
- Wire selection: use stranded wires and multi-core shielded-pair wires for all signal cables.
- The local I/O and remote I/O of the controller require an external 24 $V_{DC}$ power supply to output and input signals normally.

## Wiring of Communication Circuit

- Ensure the wiring between the controller and the servo drive is firmly connected, or loose connection may result in abnormal operation.

For the differences among the various versions, please refer to DELTA's website for the latest information (https://downloadcenter.deltaww.com/en-US/DownloadCenter).

(This page is intentionally left blank.)

# Table of Contents

## 1 Product Inspection and Model Explanation



## 2 Installation

# 3 Introduction of NC System Operation

# 4 System Parameters



# 5 MLC Special M Relay and Special D Register

# A CNC Alarm Information



# B Special Memory

# 1

# Product Inspection and Model Explanation

This chapter provides explanations for the NC5 series product models, and the introductions to the product interface of the NC controllers.

1

# 1.1 Product inspection

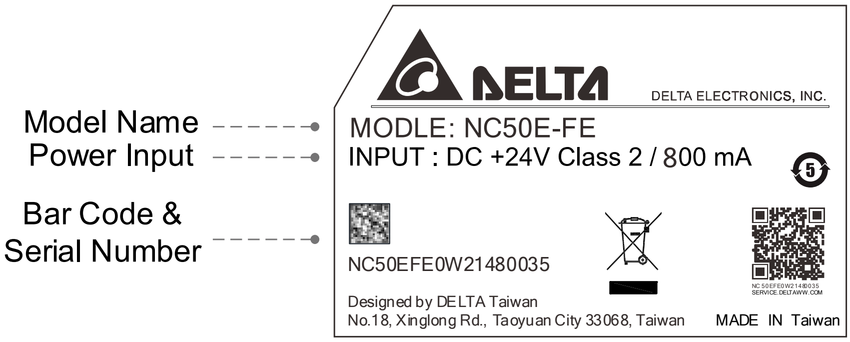
In case of packaging mistakes or damages during shipping, check the items listed in the following table carefully. If any issue occurs, contact the distributor for service.

| Item | Content |
| --- | --- |
| Purchased product | Check the model number on the nameplate of the controller. Refer to Sections 1.2 and 1.4 for the model explanation. |
| 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 or untightened connectors. |

Note: this is applicable to all models except for the OPENCNC models.

## 1.2 NC5 series product model explanation

■ Nameplate information




■ Model explanation

NC series controller (MOP integrated)

NC500E□-F I E-□S

(1) (2)(3)(4)(5) (6) (7) (8) (9) (10)(11)

| No. | Item | Description |
|---|---|---|
| (1) | Series name | NC: Numeric Controller |
| (2) | Generation | 5 : 2nd Generation CNC |
| (3) | Display | 0: 8” screen<br>1: 10.4” screen<br>2: 15” screen |
| (4) | Screen orientation | 0: Horizontal<br>1: Vertical |
| (5) | Series type | E: Economic<br>S: Standard |
| (6) | Interpolate axes | Blank: Below 4 axes interpolation<br>H: 5 axes interpolate |
| (7) | Field type | L: Lathe<br>F: General purpose |
| (8) | Model type | I: Integrated<br>P: Integrated with MPG<br>S: Separated |
| (9) | Communication field bus | E: EtherCAT field bus |
| (10) | Screen Type | Blank: Non-touch screen<br>C: Capacitance type touch screen<br>R: Resistance type touch screen |
| (11) | Language | T: Traditional Chinese<br>S: Simplified Chinese<br>E: English |

1

OPNCNC series controller

NC50E□- FE
(1) (2)(3)(4)(5) (6)(7)

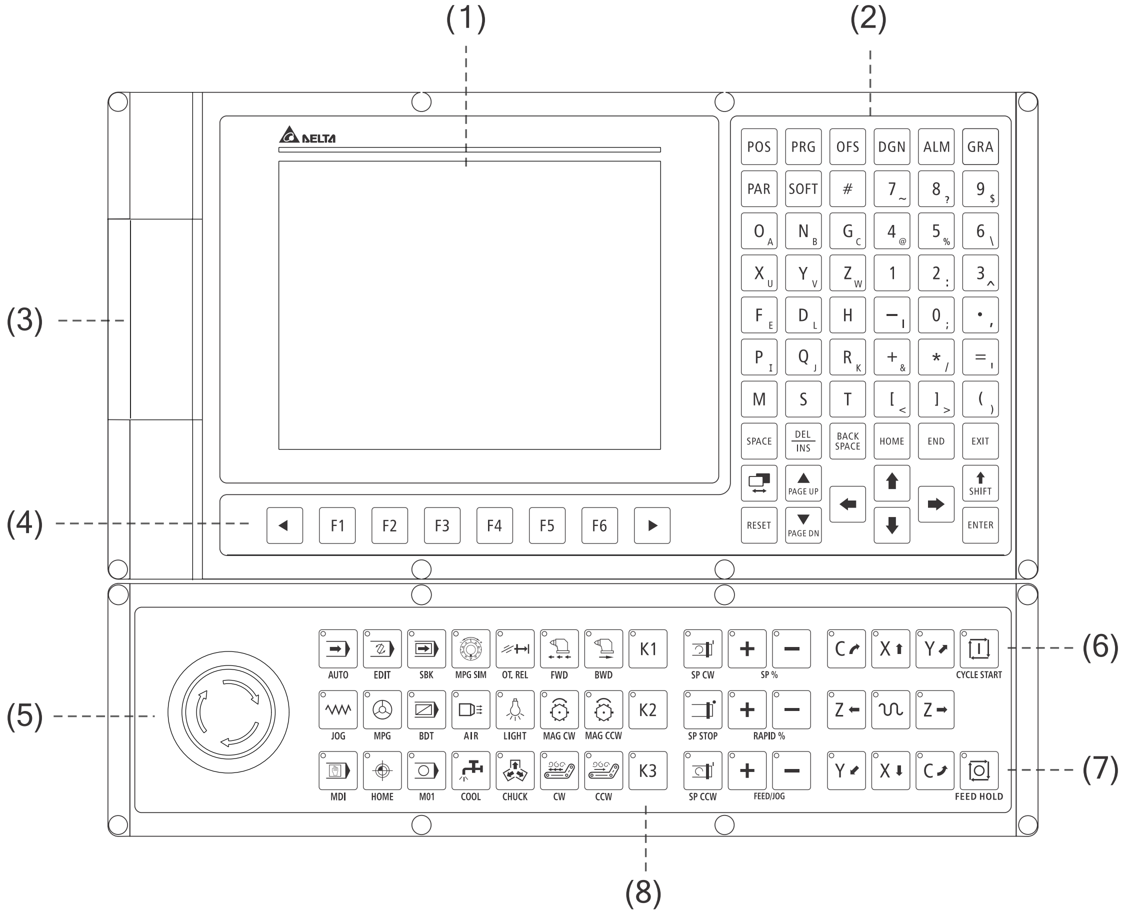
| No. | Item | Description |
|---|---|---|
| (1) | Series name | NC: Numeric Controller |
| (2) | Generation | 5：2nd Generation CNC |
| (3) | Model type | 0：Open-CNC |
| (4) | Series type | E: Economic<br>S: Standard |
| (5) | Interpolate axes | Blank: Below 4 axes interpolation<br>H: 5 axes interpolate |
| (6) | Model | F: General purpose<br>W: Wood working |
| (7) | Communication field bus | E: EtherCAT field bus |

# 1.3 Product interface of NC controller

1

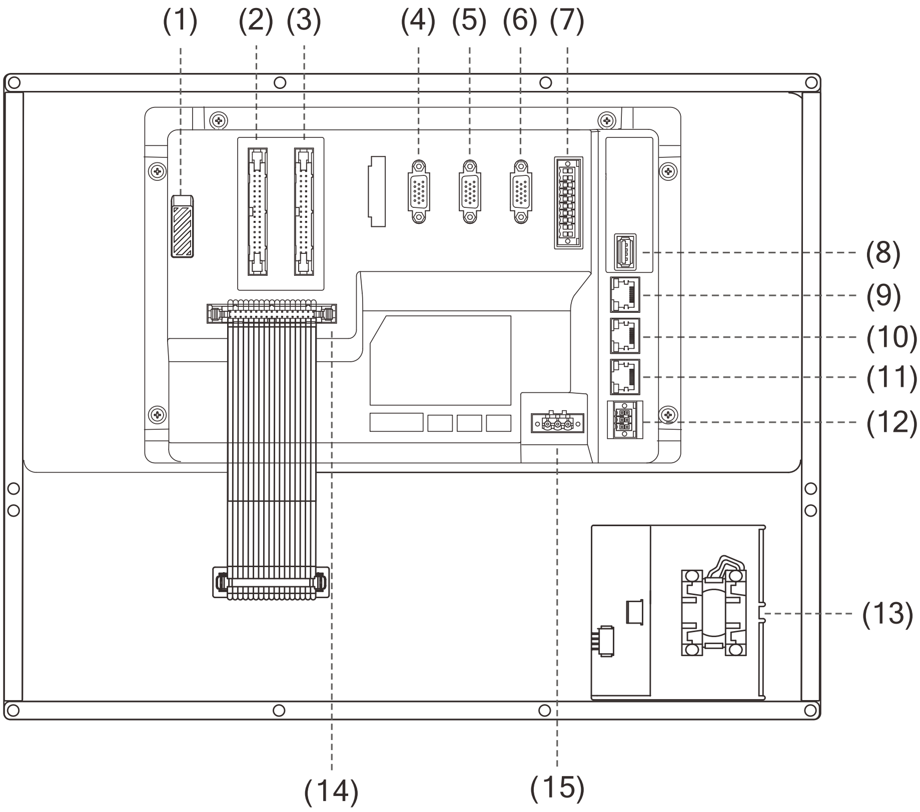
## NC500E series

### Front interface




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

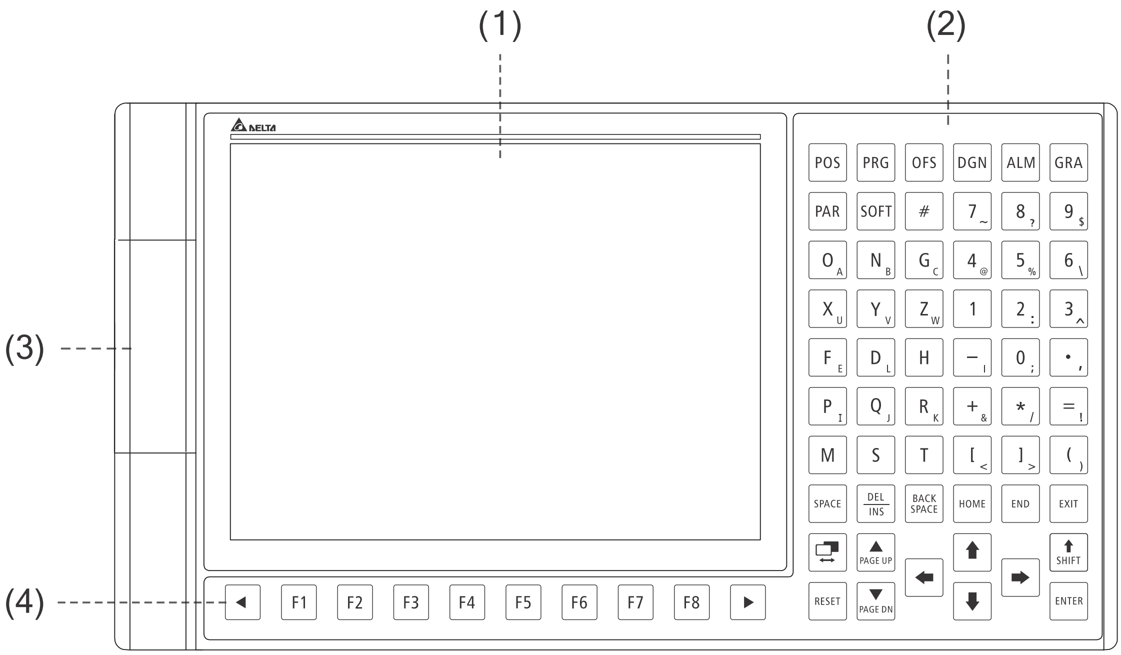
## Rear interface




| No. | Item | NC500E-LIE | NC500E-FIE |
|---|---|---|---|
| (1) | Micro SD card slot | ● | ● |
| (2) | I/O 1 connector | N/A | ● |
| (3) | I/O 2 connector | N/A | ● |
| (4) | MPG connector | ● | ● |
| (5) | Spindle 1 | ● | ● |
| (6) | Spindle 2 | N/A | ● |
| (7) | CN1 function connector | ● (Without Endat and only one analog output) | ● |
| (8) | USB port (connect mouse, keyboard or USB drive) | ● | ● |
| (9) | Ethernet 1 | ● | ● |
| (10) | Ethernet 2 | ● | ● |
| (11) | EtherCAT master connector | ● | ● |
| (12) | RS485 connector | ● | ● |
| (13) | Emergency stop | ● | ● |
| (14) | 2nd Machine operation panel cable connector | ● | ● |
| (15) | 24 $V_{DC}$ power | ● | ● |

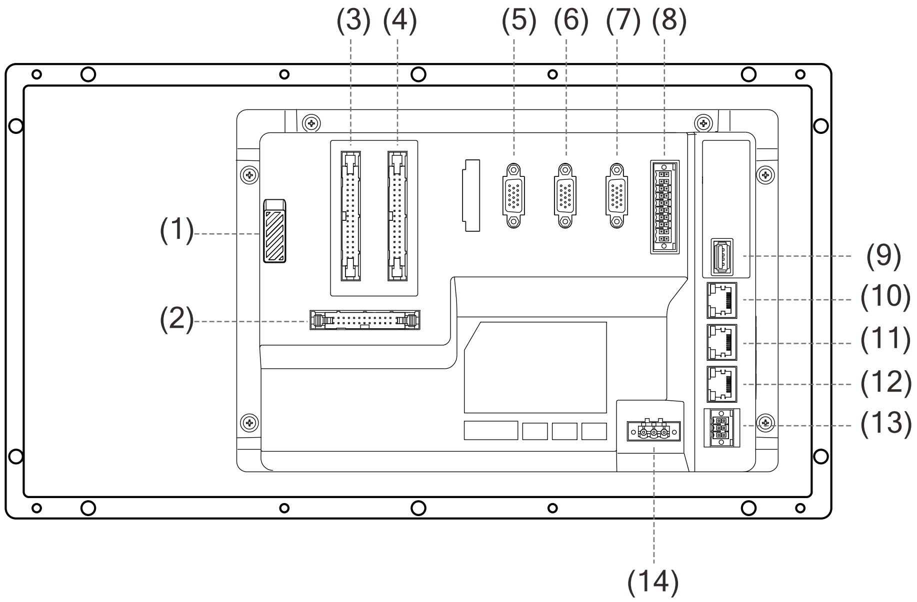
## NC510E series

### Front interface



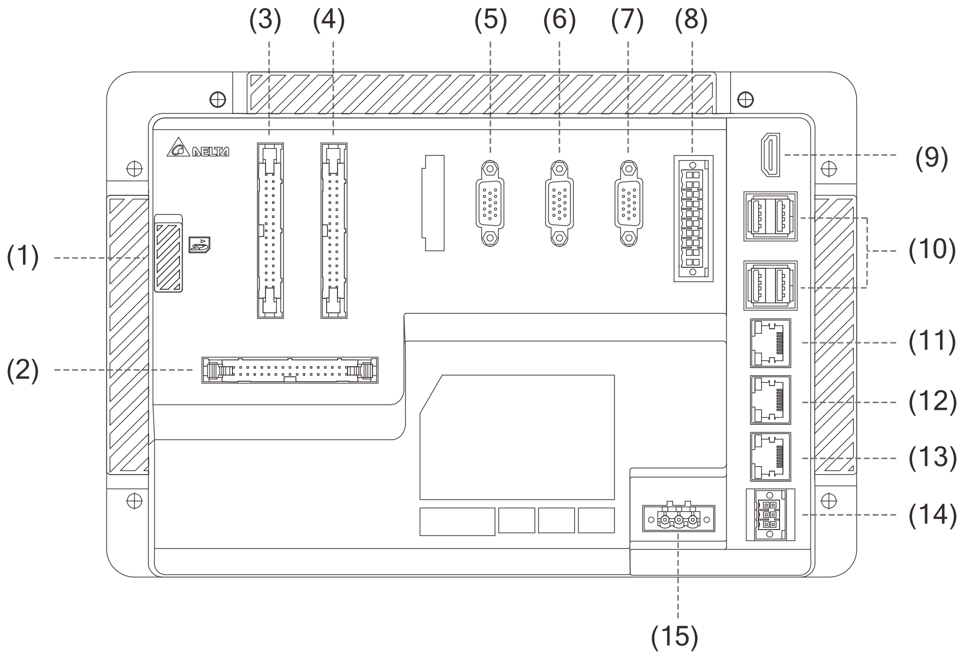

| No. | Item | No. | Item |
|---|---|---|---|
| (1) | Screen | (3) | USB port (connect mouse, keyboard or USB drive) |
| (2) | 1st Machine operation panel | (4) | Function keys |

## Rear interface




| No. | Item | NC510E-CSE | NC510E-FSE | NC510EH-FSE |
|---|---|---|---|---|
| (1) | Micro SD card slot | ● | ● | ● |
| (2) | 2nd Machine operation panel cable connector | ● | ● | ● |
| (3) | I/O 1 connector | ● | ● | ● |
| (4) | I/O 2 connector | ● | ● | ● |
| (5) | MPG connector | ● | ● | ● |
| (6) | Spindle 1 | N/A | ● | ● |
| (7) | Spindle 2 | N/A | ● | ● |
| (8) | CN1 function connector | ● (without Endat) | ● | ● |
| (9) | USB port (connect mouse, keyboard or USB drive) | ● | ● | ● |
| (10) | Ethernet 1 | ● | ● | ● |
| (11) | Ethernet 2 | ● | ● | ● |
| (12) | EtherCAT master connector | ● | ● | ● |
| (13) | RS485 connector | ● | ● | ● |
| (14) | 24 $V_{DC}$ power | ● | ● | ● |

## NC50E series




| No. | Item | NC50E-WE | NC50E-FE | NC50EH-FE |
|---|---|---|---|---|
| (1) | Micro SD card slot | ● | ● | ● |
| (2) | 2nd Machine operation panel cable connector | N/A | ● | ● |
| (3) | I/O 1 connector | ● | ● | ● |
| (4) | I/O 2 connector | ● | ● | ● |
| (5) | MPG connector | ● | ● | ● |
| (6) | Spindle 1 | N/A | ● | ● |
| (7) | Spindle 2 | N/A | ● | ● |
| (8) | CN1 function connector | ● (Without Endat and only one analog output) | ● | ● |
| (9) | HDMI connector | ● | ● | ● |
| (10) | USB port (connect mouse, keyboard or USB drive) | ● | ● | ● |
| (11) | Ethernet 1 | ● | ● | ● |
| (12) | Ethernet 2 | ● | ● | ● |
| (13) | EtherCAT master connector | ● | ● | ● |
| (14) | RS485 connector | ● | ● | ● |
| (15) | 24 $V_{DC}$ power | ● | ● | ● |

# 1.4 Controller support connector list

■ NC5xxE series

<table>
<tr><th>Item</th><th>Function</th><th>NC500E-LIE</th><th>NC500E-FIE</th><th>NC510E-CSE</th><th>NC510E-FSE</th><th>NC510EH-FSE</th><th>NC511E-FSE</th><th>NC511EH-FSE</th></tr>
<tr><td rowspan="4">CN1</td><td>Endat<br>Encoder input</td><td>N/A</td><td>1</td><td>N/A</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>HSI<br>High speed input</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td></tr>
<tr><td>EMG input</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Analog output</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td rowspan="5">Spindle 1</td><td>OA/OB/OZ<br>Encoder pulse input</td><td>1</td><td>1</td><td rowspan="5">N/A</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>A/B phase<br>Pulse output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Servo on output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Alarm input</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>$5V_{DC}$ output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td rowspan="5">Spindle 2</td><td>OA/OB/OZ<br>Encoder pulse input</td><td rowspan="5">N/A</td><td>1</td><td rowspan="5">N/A</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>A/B phase<br>Pulse output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Servo on output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Alarm input</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>$5V_{DC}$ output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td rowspan="3">MPG</td><td>A/B phase<br>pulse input</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Digital input</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td></tr>
<tr><td>$+5V_{DC}$ output</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td rowspan="2">I/O 1</td><td>Digital input</td><td>N/A</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td>Digital output</td><td>N/A</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td rowspan="2">/O 2</td><td>Digital input</td><td>N/A</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td>Digital output</td><td>N/A</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td>I/O SCAN</td><td>2nd Machine operation panel cable connector<br>Supports 56 keys</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>USB</td><td>USB port</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>RS485</td><td>Modbus communication</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>

■ NC50E series

| Item | Function | NC50E-WE | NC50E-FE | NC50EH-FE |
|---|---|---|---|---|
| CN1 | Endat<br>Encoder input | N/A | 1 | 1 |
| | HSI<br>High speed input | 8 | 8 | 8 |
| | EMG input | 1 | 1 | 1 |
| | Analog output | 1 | 2 | 2 |
| Spindle 1 | OA/OB/OZ<br>Encoder pulse input | N/A | 1 | 1 |
| | A/B phase<br>Pulse output | 1 | 1 | 1 |
| | Servo on output | 1 | 1 | 1 |
| | Alarm input | 1 | 1 | 1 |
| | $5V_{DC}$ output | 1 | 1 | 1 |
| Spindle 2 | OA/OB/OZ<br>Encoder pulse input | N/A | 1 | 1 |
| | A/B phase<br>Pulse output | | 1 | 1 |
| | Servo on output | | 1 | 1 |
| | Alarm input | | 1 | 1 |
| | $5V_{DC}$ output | | 1 | 1 |
| MPG | A/B phase<br>pulse input | 1 | 1 | 1 |
| | Digital input | 8 | 8 | 8 |
| | $+5V_{DC}$ output | 1 | 1 | 1 |
| I/O 1 | Digital input | 16 | 16 | 16 |
| | Digital output | 16 | 16 | 16 |
| I/O 2 | Digital input | 16 | 16 | 16 |
| | Digital output | 16 | 16 | 16 |
| I/O SCAN | $2^{nd}$ Machine operation panel cable connector<br>Supports 56 keys | N/A | 1 | 1 |
| USB | USB port | 4 | 4 | 4 |
| RS485 | Modbus communication | 1 | 1 | 1 |
| HDMI | HDMI output | 1 | 1 | 1 |

# Installation 2

This chapter provides descriptions of the outline dimensions and hardware specifications of the product. Before installing the product, refer to the items detailed in this chapter, such as voltage, current, temperature, or other conditions. Otherwise, it may result in personal injuries or equipment damages.

# 2.1 NC5 series product installation explanation



## 2.1.1 Ambient storage conditions

This product must be kept in the shipping carton before installation. 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.

## 2.1.2 Ambient installation conditions

Operating temperature for the NC series controller: 0°C - 50°C (32°F - 122°F). During long-term operation, the suggested temperature of the operating environment should be below 45°C (113°F). If the temperature is above 45°C, place the product in a distribution board which is well-ventilated and 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 choosing 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 range specified in the specification.

## 2.1.3 Mounting direction and space

**Important:**

- The NC controller must be installed vertically on a dry and solid platform.
- For better ventilation and cooling, allow sufficient clearance space between the NC controller and the adjacent objects and the wall (the clearance is suggested to be 50 mm (around 2 inches)), or it may cause malfunction of the machine.
- Do not block the ventilation holes of the NC controller, or it may cause malfunction of the machine.

## 2.1.4 Hardware specifications

NC500E / NC510E series controller



| Model | NC500E | NC510E |
|---|---|---|
| Operating environment | 10% ~ 90% RH (0°C ~ 50°C) | |
| Storage environment | 10% ~ 90% RH (-20°C ~ +60°C) | |
| Cooling method | Natural cooling | |
| Voltage | +24 VDC (-10% ~ +15%) (built-in isolated circuit) | |
| Dielectric withstanding voltage | Between 24 $V_{DC}$ and FG terminals: 500$V_{AC}$ for 1 minute | |
| Power consumption | 36 W (24 V; 1.5 A) | |
| Digital input type | 24$V_{DC}$ / 5mA; frequency 1K Hz | |
| Digital input activate level | Off→On: above 15 $V_{DC}$<br>On→Off: below 5 $V_{DC}$ | |
| Digital output type | 24 $V_{DC}$ optical coupling interface, frequency 1K Hz<br>Load: < 100 mA / 1 point (25°C), < 50 mA / 1 point (85°C) | |
| Digital output response time | Off→On < 300 μs<br>On→Off < 100 μs | |
| Battery | 3V lithium battery (CR2032) × 1<br>Varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F) | |
| Vibration withstanding | IEC 60068-2-6<br>Continuously vibration 5 Hz ~ 8.3 Hz 3.5 mm, 8.3 Hz ~ 150 Hz 1G | |
| Shock withstanding | IEC 60068-2-27<br>Shock withstanding 11 ms, 15G peak<br>on X, Y, Z positive and negative direction 3 times | |
| USB format | FAT32 | |
| Micro SD card format | FAT32 / EXT4 (Only for Linux) | |
| File format | ANSI / UTF-8 / UTF-8 BOM | |
| Dimensions<br>W x H x D (mm) | 400 x 320 x 121 | 400 x 220 x 92 |
| Weight (kg) | 4.4 | 3 |

2

NC50E series controller

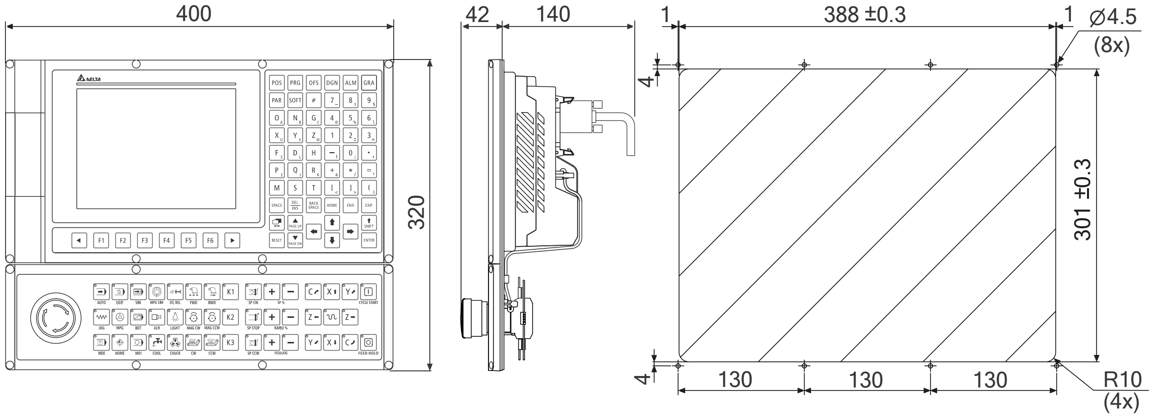
| Model | NC50E-FE / NC50EH-FE / NC50E-WE |
|---|---|
| Operating environment | 10% ~ 90% RH (0 ~ +50°C) |
| Storage environment | 10% ~ 90% RH (-20 ~ +60°C) |
| Cooling method | Natural cooling |
| Voltage | +24 VDC (-10% ~ +15%) (built-in isolated circuit) |
| Dielectric withstanding voltage | Between 24 $V_{DC}$ and FG terminals: 500$V_{AC}$ for 1 minute |
| Power consumption | 24 W (24V；1 A) |
| Digital input type | 24$V_{DC}$ / 5mA; frequency 1K Hz |
| Digital input activate level | Off→On: above 15 $V_{DC}$<br>On→Off: below 5 $V_{DC}$ |
| Digital output type | 24 $V_{DC}$ optical coupling interface, frequency 1K Hz<br>Load: < 100 mA / 1 point (25°C), < 50 mA / 1 point (85°C) |
| Digital output response time | Off→On < 300 μs<br>On→Off < 100 μs |
| Battery | 3V lithium battery (CR2032) × 1<br>Varies according to the ambient temperature and operating conditions; approximately 3 years in room temperature of 25°C (77°F) |
| Vibration withstanding | IEC 60068-2-6<br>Continuously vibration 5 Hz ~ 8.3 Hz 3.5 mm, 8.3 Hz ~ 150 Hz 1G |
| Shock withstanding | IEC 60068-2-27<br>Shock withstanding 11 ms, 15G peak on X, Y, Z positive and negative direction 3 times |
| USB format | FAT32 |
| Micro SD card format | FAT32 / EXT4 (Only for Linux) |
| File format | ANSI / UTF-8 / UTF-8 BOM |
| Dimensions W x H x D (mm) | 270 x 183 x 60 |
| Weight (kg) | 1.5 |

2

## 2.1.5 Outline and mounting dimensions

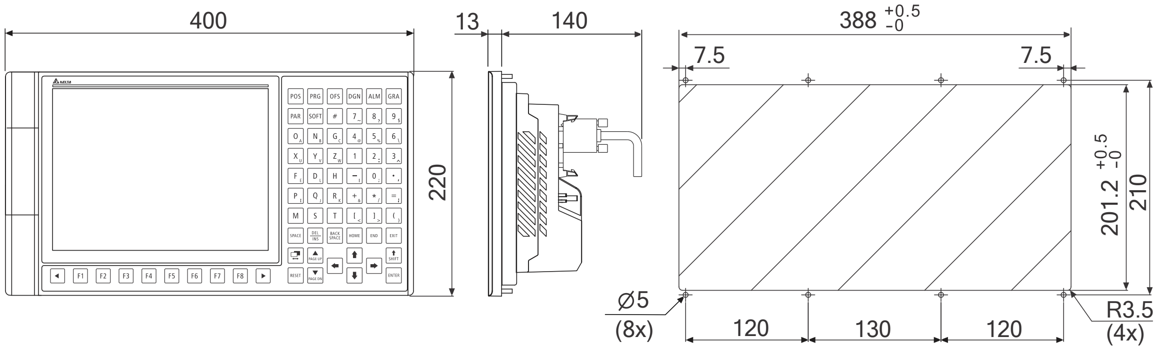
NC500E series

- Front side and mounting dimensions.



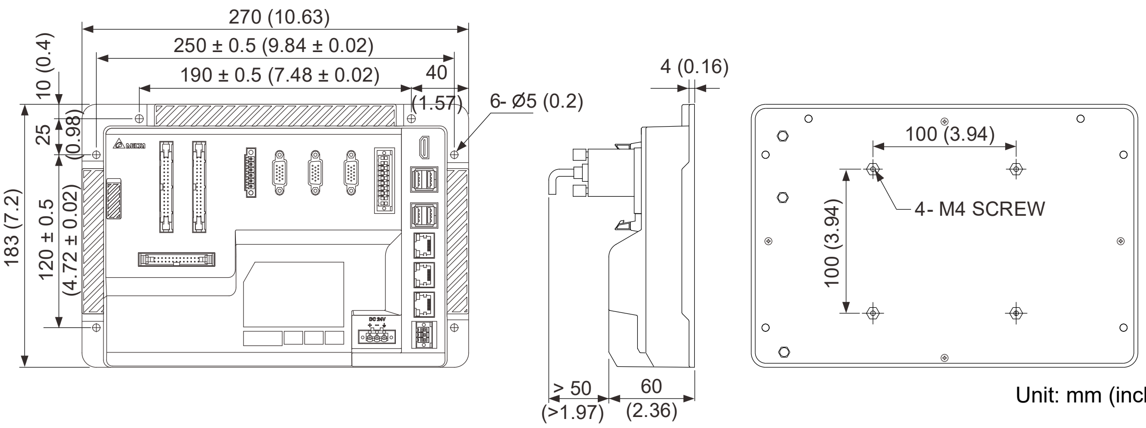

NC510E series

- Front side and mounting dimensions.




NC50E series

- Front side and mounting dimensions.




Unit: mm (inch)

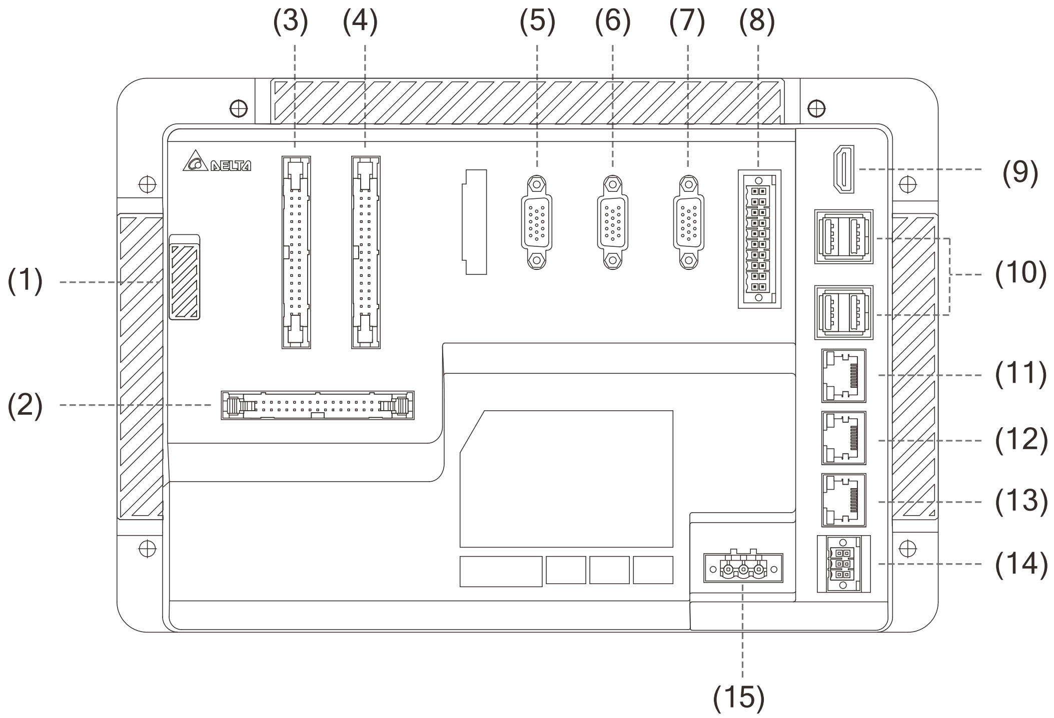
# 2.2 NC5 series product



## 2.2.1 NC5 series connector interfaces

NC5 series CNC controller provides two types of solution include integrated type NC5xxE which is build-in monitor and operation panel and NC5xE which is OpenCNC type product and only provides controller its selves. Users can freely integrate third party monitor or operation panel on the OpenCNC type controller. No matter which type of controller, those connector interfaces on board are designed as same specification but only mounted or not which based on different type of model name.

- NC5 series connector's introduction




Introduction of each connector

| No. | connector | Description |
|---|---|---|
| (1) | SD CARD | Storage for NC program or other purpose file. |
| (2) | I/O SCAN | Communication connector for 2nd operation panel. |
| (3) | I/O 1 | 16 sets NPN / PNP 24V digital input interface.<br>16 sets NPN 24V digital output interface. |
| (4) | I/O 2 | 16 sets NPN / PNP 24V digital input interface.<br>16 sets NPN 24V digital output interface. |
| (5) | MPG | MPG device connector.<br>Provides 5 $V_{DC}$ power output.<br>8 sets NPN / PNP digital input interface. |
| (6) | SPINDLE 1 | The 1st spindle encoder pulse feedback input.<br>The 1st spindle pulse control output. |
| (7) | SPINDLE 2 | The 2nd spindle encoder pulse feedback input.<br>The 2nd spindle pulse control output. |

| No. | connector | Description |
|---|---|---|
| (8) | CN1* | 8 sets NPN / PNP 24V high speed digital input interface.<br>2 sets analog voltage output.<br>1 set ENDAT communication.<br>1 set Emergency stop digital input.<br>*This connector will provide different specification according to the different model's name. Please refers to section CH1.4. |
| (9) | HDMI* | For connecting to a screen with HDMI cable.<br>*This connector ONLY support on OpenCNC type NC5xE series products. |
| (10) | USB* | USB host connectors for connecting to the mouse, keyboard, and flash drive.<br>*NC5xxE series module support 1 set connector.<br>*NC5xE series OpenCNC module support 4 sets connectors. |
| (11) | Ethernet 1 | 1st ethernet connector.<br>Provides TCP Modbus and FTP function. Users can also use VNC remote desktop tool or use C# API to remote CNC from the other PC. |
| (12) | Ethernet 2 | 1st ethernet connector. As Same functions as 1st ethernet connector only with different IP address. |
| (13) | EtherCAT | High-speed EtherCAT communication network connector. |
| (14) | RS485 | RS-485 serial port for Modbus communication. |
| (15) | DC 24V | 24 $V_{DC}$ power input for supplying 24 $V_{DC}$ power to the controller. |

Safety precautions for installation:

1. Check if the wiring for 24 VDC power is correct.
2. The emergency signal EMG on CN1 connector must be release and status is ON, so the CNC controller will be in ready status to operate all the other actions.
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.

## 2.2.2 NC5 series connectors

<table>
<tr><th>Symbol</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">0V<br>+24V<br>⏚</td><td rowspan="5">Power input for controller</td><td colspan="2">Connects to the 24 $V_{DC}$ power.</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 $V_{DC}$ ground</td></tr>
<tr><td>⏚</td><td>Noise signal grounding</td></tr>
<tr><td rowspan="6">I/O 1</td><td rowspan="6">1st set local I/O</td><td colspan="2">DI/DO range: X0 - X15, Y0 - Y15.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>P1 ~ P16</td><td>DI points X0 - X15, 16 points in total</td></tr>
<tr><td>P19 ~ P34</td><td>DO points Y0 - Y15, 16 points in total<br>(Maximum current < 0.150 A on each point)</td></tr>
<tr><td>P18</td><td>DI COM point; connects to +24 $V_{DC}$ or $0V_{DC}$</td></tr>
<tr><td>P17</td><td>DO COM point; fixed at $0V_{DC}$ (NPN type)</td></tr>
<tr><td rowspan="6">I/O 2</td><td rowspan="6">2nd set local I/O</td><td colspan="2">DI/DO range: X16 – X31, Y16 – Y31.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>P1 ~ P16</td><td>DI points X16 – X31, 16 points in total</td></tr>
<tr><td>P19 ~ P34</td><td>DO points Y16 – Y31, 16 points in total<br>(Maximum current < 0.150 A on each point)</td></tr>
<tr><td>P18</td><td>DI COM point; connects to +24 $V_{DC}$ or $0V_{DC}$</td></tr>
<tr><td>P17</td><td>DO COM point; fixed at $0V_{DC}$ (NPN type)</td></tr>
<tr><td rowspan="18">CN1</td><td rowspan="18">CN1 connector</td><td colspan="2">This connector will provide different specification according to the different model’s name. Please refers to section CH1.4.</td></tr>
<tr><td>Pin No.</td><td>Description</td></tr>
<tr><td>P1</td><td>EnDat_Data+</td></tr>
<tr><td>P2</td><td>EnDat_Data-</td></tr>
<tr><td>P3</td><td>EnDat_SCL-</td></tr>
<tr><td>P4</td><td>EnDat_SCL+</td></tr>
<tr><td>P5</td><td>SGND</td></tr>
<tr><td>P6</td><td>SGND</td></tr>
<tr><td>P7</td><td>High speed counter input; HSI 1</td></tr>
<tr><td>P8</td><td>High speed counter input; HSI 2</td></tr>
<tr><td>P9</td><td>High speed counter input; HSI 3</td></tr>
<tr><td>P10</td><td>High speed counter input; HSI 4</td></tr>
<tr><td>P11</td><td>High speed counter input; HSI 5</td></tr>
<tr><td>P12</td><td>High speed counter input; HSI 6</td></tr>
<tr><td>P13</td><td>High speed counter input; HSI 7</td></tr>
<tr><td>P14</td><td>High speed counter input; HSI 8</td></tr>
<tr><td>P15</td><td>EMG; Emergency signal input. (+5 $V_{DC}$ output)</td></tr>
<tr><td>P16</td><td>HSI_COM; connects to +24 $V_{DC}$ or 0V</td></tr>
</table>

| | | | |
|---|---|---|---|
| CN1 | CN1 connector | P17 | 1st analog output; -10V ~ 10V |
| | | P18 | analog output ground connects with pin P20 |
| | | P19 | 2nd analog output; -10V ~ 10V |
| | | P20 | analog output ground connects with pin P18 |
| Spindle 1 | 1st spindle connector | Pin No | Description |
| | | P1 | 5V differential pulse feedback signal; A+ |
| | | P2 | 5V differential pulse feedback signal; A- |
| | | P3 | 5V differential pulse feedback signal; B+ |
| | | P4 | 5V differential pulse feedback signal; B- |
| | | P5 | 5V differential pulse feedback signal; Z+ |
| | | P6 | 5V differential pulse feedback signal; Z- |
| | | P7 | $24V_{DC}$ |
| | | P8 | Spindle alarm input |
| | | P9 | Spindle alarm output |
| | | P10 | $5V_{DC}$ |
| | | P11 | 5V differential pulse control output signal; A+ |
| | | P12 | 5V differential pulse control output signal; A- |
| | | P13 | 5V differential pulse control output signal; B+ |
| | | P14 | 5V differential pulse control output signal; B- |
| | | P15 | SGND |
| Spindle 2 | 2nd spindle connector | Pin No | Description |
| | | P1 | 5V differential pulse feedback signal; A+ |
| | | P2 | 5V differential pulse feedback signal; A- |
| | | P3 | 5V differential pulse feedback signal; B+ |
| | | P4 | 5V differential pulse feedback signal; B- |
| | | P5 | 5V differential pulse feedback signal; Z+ |
| | | P6 | 5V differential pulse feedback signal; Z- |
| | | P7 | $24V_{DC}$ |
| | | P8 | Spindle alarm input |
| | | P9 | Spindle alarm output |
| | | P10 | $5V_{DC}$ |
| | | P11 | 5V differential pulse control output signal; A+ |
| | | P12 | 5V differential pulse control output signal; A- |
| | | P13 | 5V differential pulse control output signal; B+ |
| | | P14 | 5V differential pulse control output signal; B- |
| | | P15 | SGND |
| MPG | MPG connector | 8 DI points for axes and ration switching.<br>1 set of differential type MPG pulse signal input. | |
| | | Pin No. | Description |
| | | P1 | DI_COM; connects to +24 $V_{DC}$ or 0V |

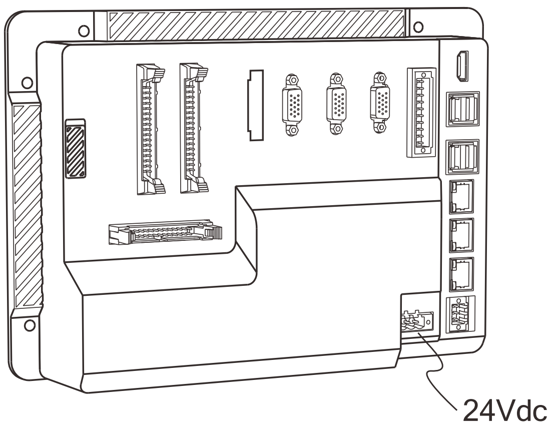
| | | | |
|---|---|---|---|
| MPG | MPG connector | P2 ~ P9 | 8 sets digital input. Range X32 ~ X39 |
| | | P10 | $5V_{DC}$ (< 200 mA) |
| | | P11 | MPG pulse input; XA+ |
| | | P12 | MPG pulse input; XA - |
| | | P13 | MPG pulse input; XB+ |
| | | P14 | MPG pulse input; XB - |
| | | P15 | $0V_{DC}$ GND |
| RS485 | RS-485 port | P1 | RS485 signal; D+ |
| | | P3 | RS485 signal; D- |
| | | P5 | SGND |

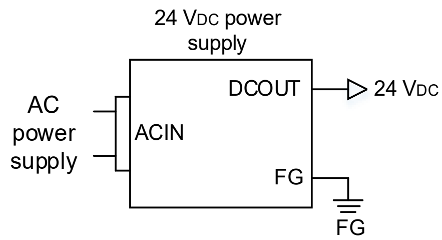
Note:

1. MPG A/B pulse inputs provides two types of input. The differential type is only available for 5 VDC and the single-end type is available for both 5 VDC and 24 VDC.
2. Pulse input signal bandwidth is 4M.

## 2.2.3 Wiring for power connector

The wiring for the power of the NC series controller is direct power supply.

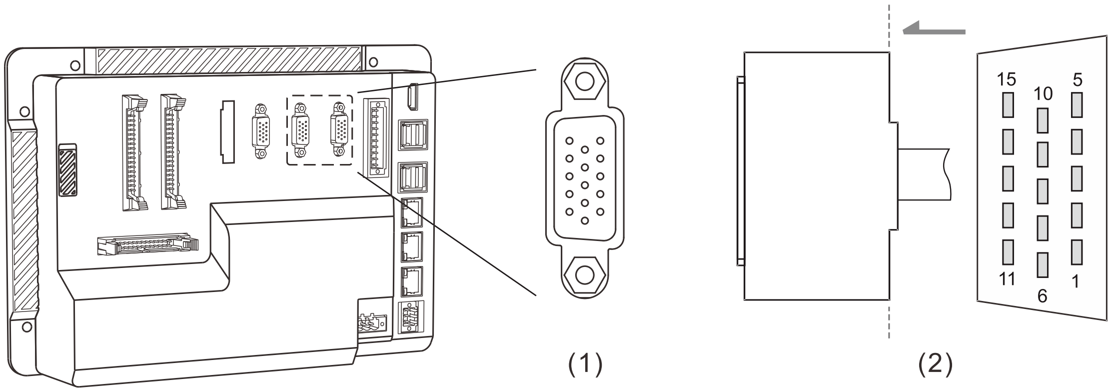



| Symbol | Pin No. | Description |
|---|---|---|
| DC 24V | +24V | +24 VDC power |
| | 0V | 0 VDC ground |
| | ⏚ | Noise signal grounding |

### 2.2.4 Wiring for spindle connector

The NC 5 series controller provides two sets of spindle interfaces, which are Spindle 1 and Spindle 2. Users can use these interfaces control pulse type spindle.

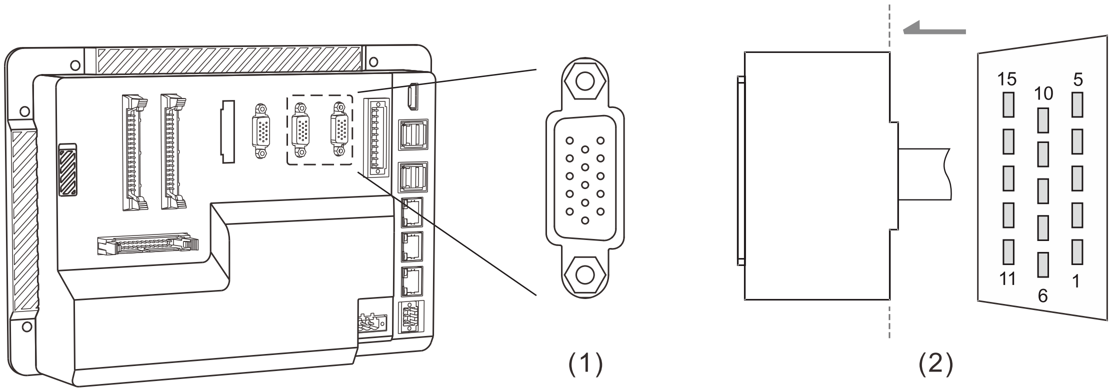



(1) Spindle connector (2) Spindle connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| Spindle 1 / Spindle 2 | 1 | Feedback A+ | 5V differential pulse feedback signal; A+ |
| | 2 | Feedback A- | 5V differential pulse feedback signal; A- |
| | 3 | Feedback B+ | 5V differential pulse feedback signal; B+ |
| | 4 | Feedback B- | 5V differential pulse feedback signal; B- |
| | 5 | Feedback Z+ | 5V differential pulse feedback signal; Z+ |
| | 6 | Feedback Z- | 5V differential pulse feedback signal; Z- |
| | 7 | +24V_IN | $24V_{DC}$ |
| | 8 | ALM_DI_IN | Spindle alarm input |
| | 9 | SERVO_ON_DO | Spindle alarm output |
| | 10 | +5 $V_{DC}$_OUT | $5V_{DC}$ |
| | 11 | Command A+ | 5V differential pulse control output signal; A+ |
| | 12 | Command A- | 5V differential pulse control output signal; A- |
| | 13 | Command B+ | 5V differential pulse control output signal; B+ |
| | 14 | Command B- | 5V differential pulse control output signal; B- |
| | 15 | SGND | SGND |

### 2.2.4.1 Wiring for spindle pulse output control

The NC 5 series controller provides 5V differential pulse signal control interface on the spindle connector. The maximum bandwidth is 1M HZ which can be able to control the speed of 1st spindle or 2nd spindle.



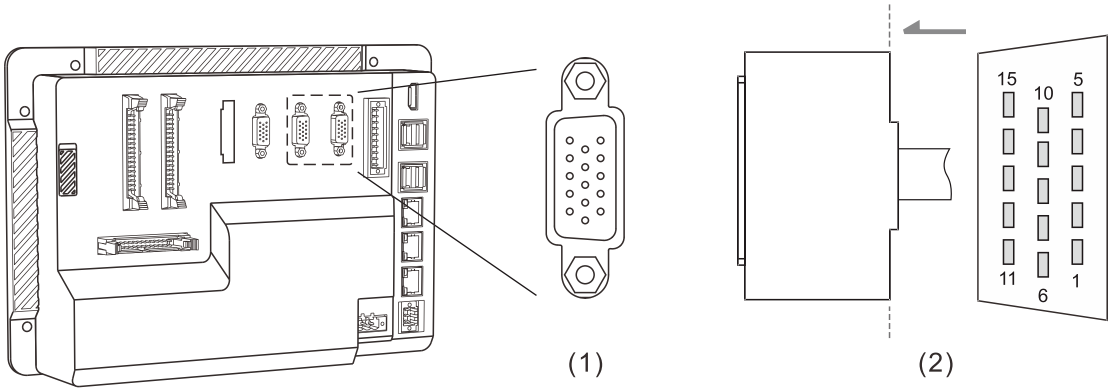

(1) Spindle connector (2) Spindle pulse output connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| Spindle 1 / Spindle 2 | 7 | +24V_IN | $24V_{DC}$ |
| | 11 | Command A+ | 5V differential pulse control output signal; A+ |
| | 12 | Command A- | 5V differential pulse control output signal; A- |
| | 13 | Command B+ | 5V differential pulse control output signal; B+ |
| | 14 | Command B- | 5V differential pulse control output signal; B- |
| | 15 | SGND | SGND |

2

### 2.2.4.2 Wiring for spindle pulse feedback input connector

The NC 5 series controller provides 5V differential pulse feedback signal. The maximum bandwidth can be up to 1M HZ and if setting as 4 times frequency the feedback signal can be result as 4M HZ.

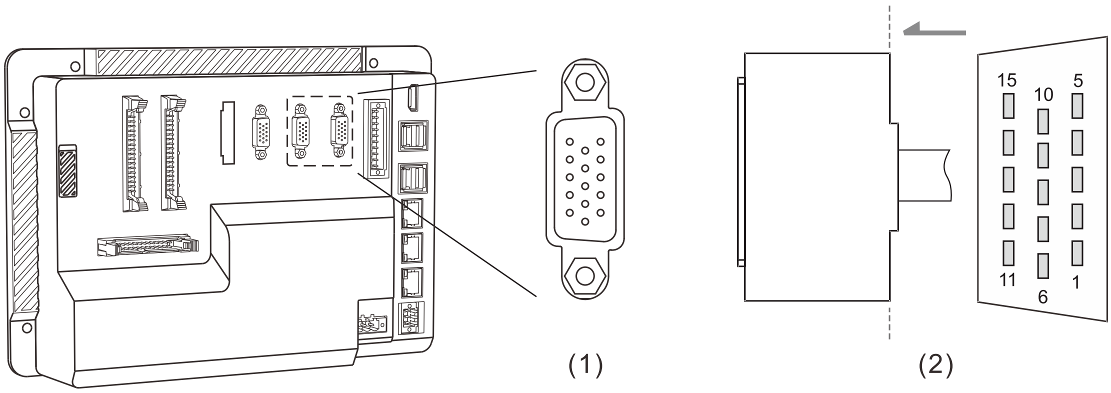



(1) Spindle connector (2) Spindle pulse feedback connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| Spindle 1 / Spindle 2 | 1 | Feedback A+ | 5V differential pulse feedback signal; A+ |
| | 2 | Feedback A- | 5V differential pulse feedback signal; A- |
| | 3 | Feedback B+ | 5V differential pulse feedback signal; B+ |
| | 4 | Feedback B- | 5V differential pulse feedback signal; B- |
| | 5 | Feedback Z+ | 5V differential pulse feedback signal; Z+ |
| | 6 | Feedback Z- | 5V differential pulse feedback signal; Z- |
| | 7 | +24V_IN | $24V_{DC}$ |
| | 15 | SGND | SGND |

### 2.2.4.3 Wiring for spindle status connector

The NC 5 series controller provides not only pulse control and pulse feedback but also spindle status including alarm input and motor enable.

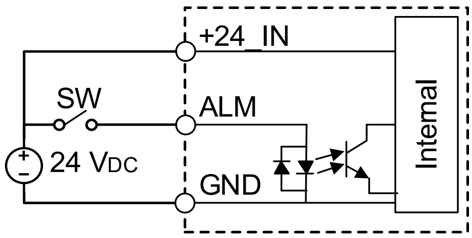



(1) Spindle connector (2) Spindle status connector pin definition

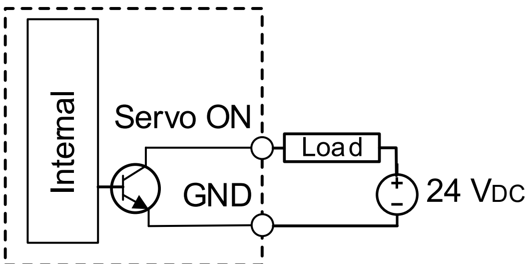
| Symbol | Pin No. | Description | |
|---|---|---|---|
| Spindle 1 / Spindle 2 | 7 | +24V_IN | $24V_{DC}$ |
| | 8 | ALM_DI_IN | Spindle alarm input |
| | 9 | SERVO_ON_DO | Spindle Servo ON output Status |
| | 10 | +5 $V_{DC}$_OUT | $5V_{DC}$ |
| | 15 | GND | SGND |

- Spindle alarm status input

  Due to the spindle control can be perform in many ways, such as pulse, analog or communication, therefore, the controller system will not indicate the spindle alarm signal directly into the system. This means this connector is only for digital signal input, but users can utilize the MLC to trigger the special M relay, such as M2x711, M2x727, M2x743, M2x759, M2x775, M2x791, M2x807 and M2x823 to trigger the alarm of 1st spindle to 8th spindle. After the special M triggered, the system will return alarm code 0x0C0A and then stop NC process.



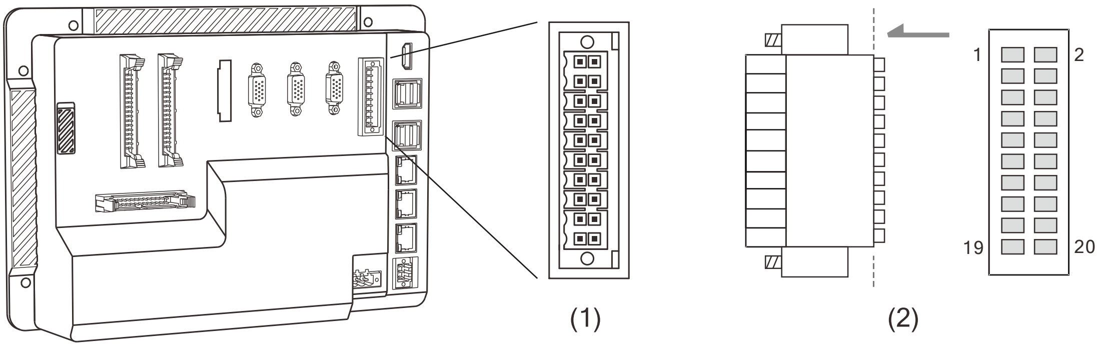

- Spindle motor enable status output



2

## 2.2.5 Wiring for CN1 connector

The NC 5 series controller provides several function connectors such as EnDat encoder communication, emergency signal input, high speed digital input and analog output on the CN1 connector.



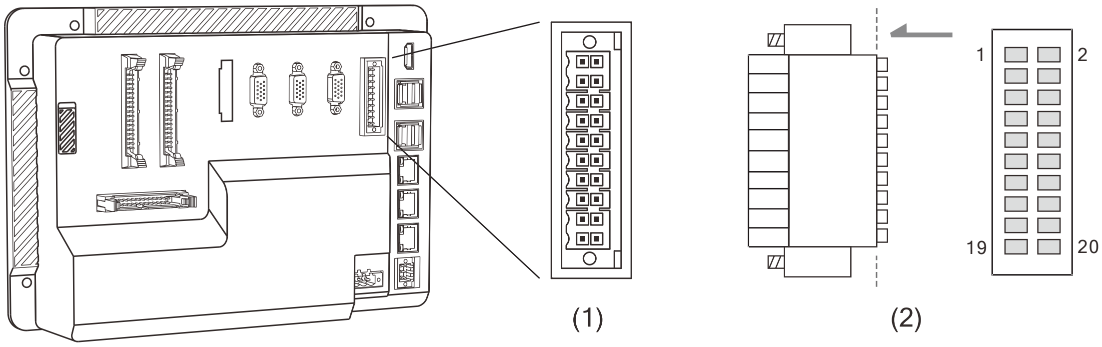

(1) (2)

(1) CN1 connector (2) CN1 connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| CN1 | 1 | EnDat_Data+ | EnDat_Data+ |
| | 2 | EnDat_Data- | EnDat_Data- |
| | 3 | EnDat_SCL- | EnDat_SCL- |
| | 4 | EnDat_SCL+ | EnDat_SCL+ |
| | 5 | SGND | SGND |
| | 6 | SGND | SGND |
| | 7 | HSI_1 | High speed counter input; HSI 1 |
| | 8 | HSI_2 | High speed counter input; HSI 2 |
| | 9 | HSI_3 | High speed counter input; HSI 3 |
| | 10 | HSI_4 | High speed counter input; HSI 4 |
| | 11 | HSI_5 | High speed counter input; HSI 5 |
| | 12 | HSI_6 | High speed counter input; HSI 6 |
| | 13 | HSI_7 | High speed counter input; HSI 7 |
| | 14 | HSI_8 | High speed counter input; HSI 8 |
| | 15 | EMG | EMG; Emergency signal input. (+5 $V_{DC}$ output) |
| | 16 | HSI_COM | HSI_COM; connects to +24 $V_{DC}$ or 0V |
| | 17 | DAC_CH1 + | 1st analog output; -10V ~ 10V |
| | 18 | DAC_CH1 - | analog output ground connects with pin P20 |
| | 19 | DAC_CH2 + | 2nd analog output; -10V ~ 10V |
| | 20 | DAC_CH2 - | analog output ground connects with pin P18 |

### 2.2.5.1 Wiring for analog output connector

The NC 5 series controller provides two sets of 16-bits analog output channel. The range is between -10V~10V.

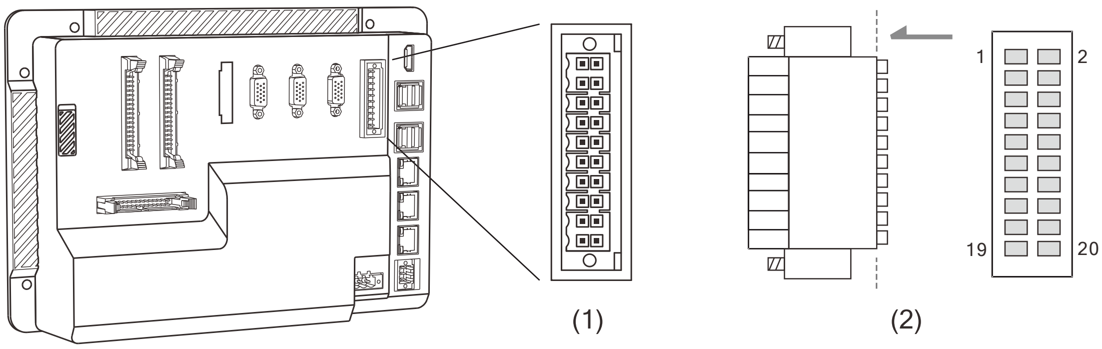



(1) CN1 connector (2) CN1 analog output connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| CN1 | 17 | DAC_CH1 + | 1st analog output; -10V ~ 10V |
| | 18 | DAC_CH1 - | analog output ground connects with pin P20 |
| | 19 | DAC_CH2 + | 2nd analog output; -10V ~ 10V |
| | 20 | DAC_CH2 - | analog output ground connects with pin P18 |

### 2.2.5.2 Wiring for EMG emergency connector

The NC 5 series controller provides one set of EMG connector, which is for users to emergency stop controller. Users can define whether to use the EMG button on the 2nd operation panel or EMG signal on the CN1 connector by system parameter.



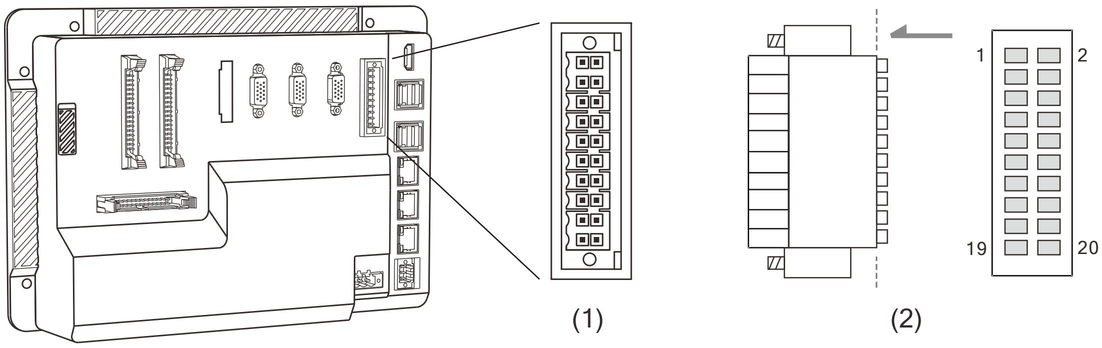

(1) CN1 connector (2) CN1 emergency connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| CN1 | 5 or 6 | SGND | SGND |
| | 15 | EMG | EMG; Emergency signal input. (+5 $V_{DC}$ output) |

Note: EMG connector is with +5V voltage output, which is available to directly connect with SGND to activate EMG function.

### 2.2.5.3 Wiring for HSI high speed counter connector

The NC 5 series controller provides 8 sets HSI high speed inputs. The HSI inputs is PNP/NPN two-way optical coupling wiring design and can be up to 100K frequency. The activate voltage is between 22 $V_{DC}$ ~ 26$V_{DC}$, current limitation is between 8 ~ 20 mA and peak current is below 50 mA.

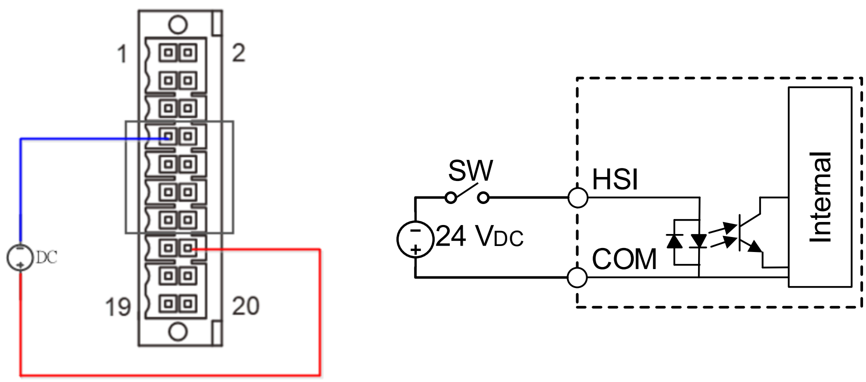



(1) CN1 connector (2) CN1 HSI connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| HSI | 7 | HSI_1 | High speed counter input; HSI 1 |
| | 8 | HSI_2 | High speed counter input; HSI 2 |
| | 9 | HSI_3 | High speed counter input; HSI 3 |
| | 10 | HSI_4 | High speed counter input; HSI 4 |
| | 11 | HSI_5 | High speed counter input; HSI 5 |
| | 12 | HSI_6 | High speed counter input; HSI 6 |
| | 13 | HSI_7 | High speed counter input; HSI 7 |
| | 14 | HSI_8 | High speed counter input; HSI 8 |
| | 16 | HSI_COM | HSI_COM; connects to +24 $V_{DC}$ or 0V |

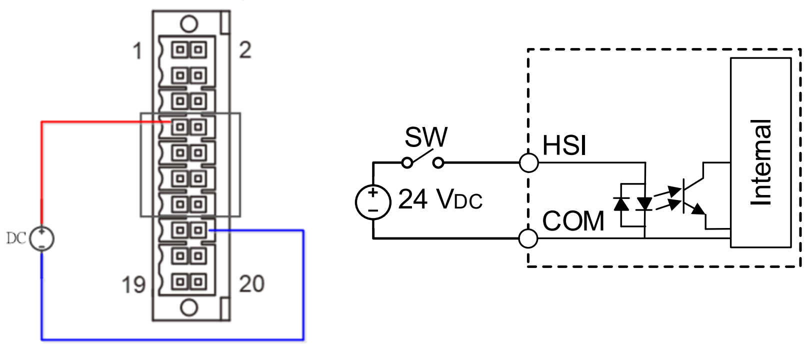
■ HIS for NPN wiring

HSI_COM connect to +24 $V_{DC}$ and 0 $V_{DC}$ ground connect to each HSI connector. After the circuit activated, the corresponding M30016 ~ M30023 in the MLC will be ON as well.



- HSI for PNP wiring

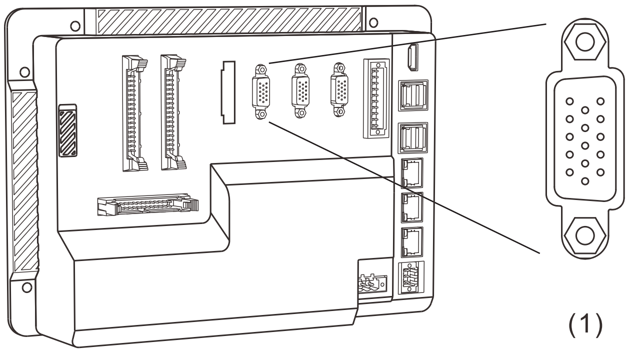
HSI_COM connect to the ground 0 $V_{DC}$ and +24 $V_{DC}$ connect to each HSI connector. After the circuit activated, the corresponding M30016 ~ M30023 in the MLC will be ON as well.



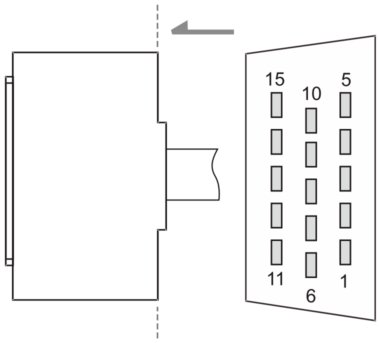
## 2.2.6 Wiring for MPG connector

2

The NC 5 series controller provides MPG connector for MPG devices, which can receive pulse from MPG and then control different axes. In this connector also provides a +5 $V_{DC}$ voltage output interface for MPG device.



(1)




(2)

(1) MPG connector (2) MPG connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| MPG | 1 | EXT_24 | DI_COM; connects to +24 VDC or 0V |
| | 2 | DI_1 | X32; recommend connect to X axis selection |
| | 3 | DI_2 | X33; recommend connect to Y axis selection |
| | 4 | DI_3 | X34; recommend connect to Z axis selection |
| | 5 | DI_4 | X35; recommend connect to x1 ratio selection |
| | 6 | DI_5 | X36; recommend connect to x10 ratio selection<br>This connector will be the 3rd MPG's XA+ when 3 set MPG enabled |
| | 7 | DI_6 | X37; recommend connect to x100 ratio selection<br>This connector will be the 3rd MPG's XB+ when 3 set MPG enabled |
| | 8 | DI_7 | X38; recommend connect to A axis selection<br>This connector will be the 2nd MPG's XA+ when 3 set MPG enabled |
| | 9 | DI_8 | X39; recommend connect to B axis selection<br>This connector will be the 2nd MPG's XB+ when 3 set MPG enabled |
| | 10 | 5V_OUT | 5VDC (< 200 mA) |
| | 11 | XA+ | MPG pulse input; XA+ |
| | 12 | XA- | MPG pulse input; XA - |
| | 13 | XB+ | MPG pulse input; XB+ |
| | 14 | XB- | MPG pulse input; XB - |
| | 15 | 5V_GND | SGND |

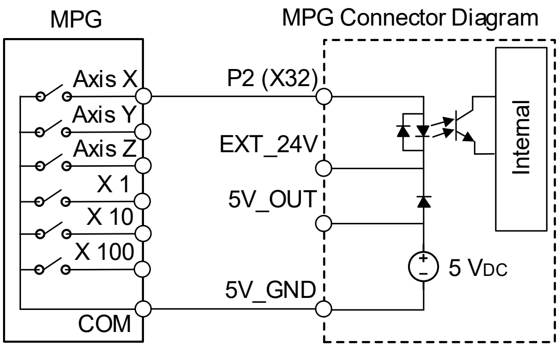
The MPG can be available for different wiring type, which are single-end (EHDW-BA6SI) and differential (EHDW-BE6SI).

- The NC50E and NC500E support 5 $V_{DC}$ or 24 $V_{DC}$ single-end MPG pulse input wiring.
- The NC510E and NC511E only support 5 $V_{DC}$ single-end MPG pulse input wiring.
- Differential MPG pulse input wiring. This wiring can only be available for 5 $V_{DC}$ input.

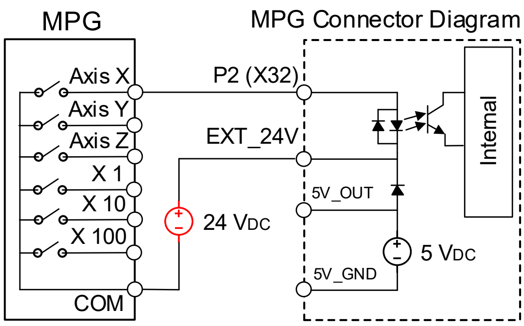
| CNC MPG Connector | | MPG Device |
|---|---|---|
| 5V_OUT | P10 | DC 5V |
| XA+ | P11 | A |
| XA- | P12 | A- |
| XB+ | P13 | B |
| XB- | P14 | B- |
| 5V_GND | P15 | DC 0V |

Wiring for MPG digital signal.

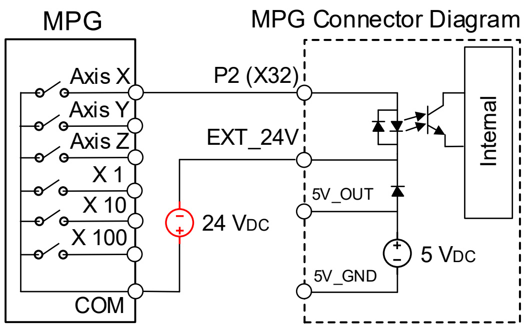
- MPG connector provides 5$V_{DC}$ output directly.




- MPG device power source from power supply as 24$V_{DC}$. The EXT_24 can connect +24V as NPN type or 0V as PNP type wiring.



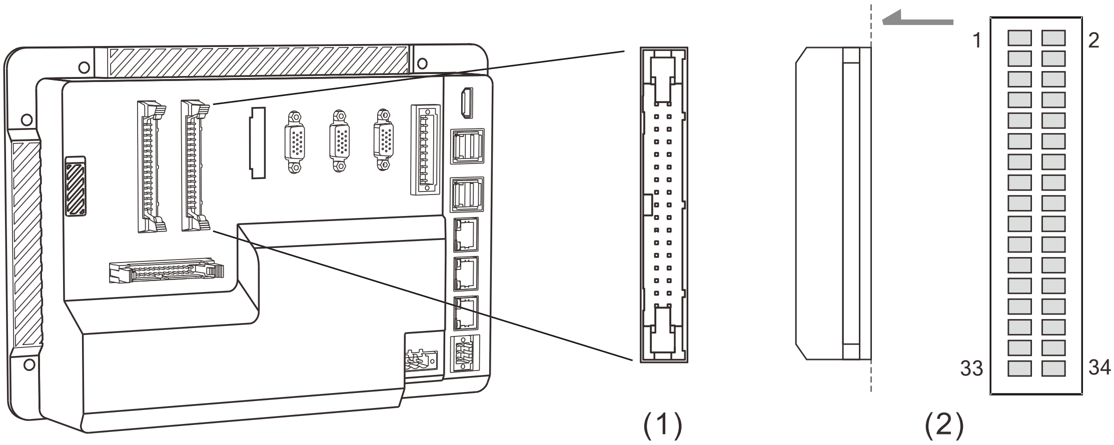

NPN wiring




PNP wiring

## 2.2.7 Wiring for local I/O connector

The NC 5 series controller provides local I/Os for digital signal control.

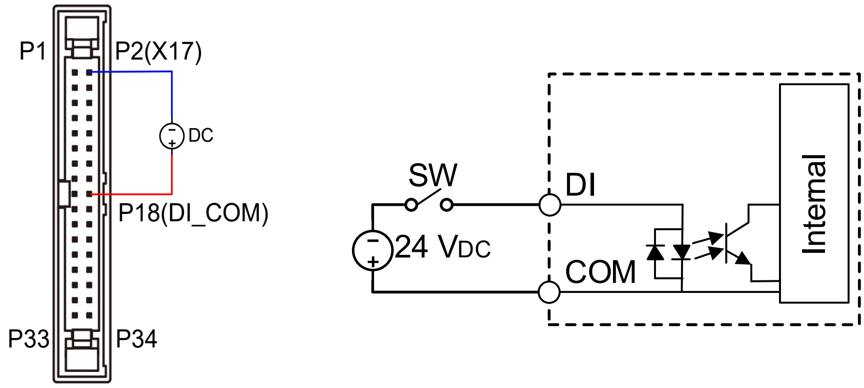



(1) Local I/O connector (2) Local I/O connector pin definition

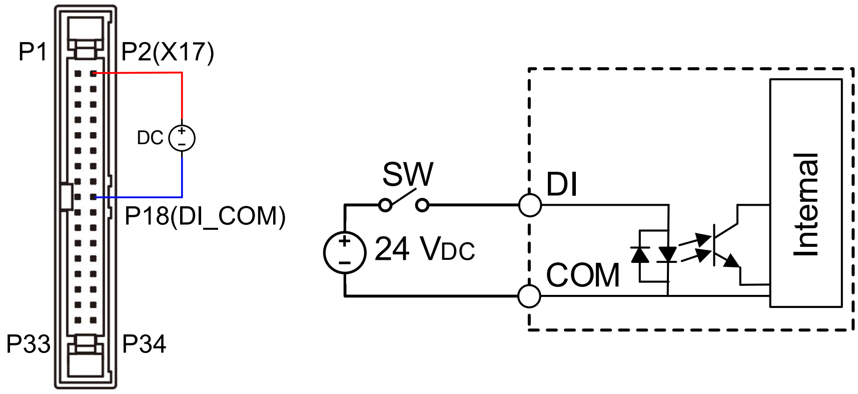
| I/O 1 | | | |
|---|---|---|---|
| Pin 1 | X0 | Pin 2 | X1 |
| Pin 3 | X2 | Pin 4 | X3 |
| Pin 5 | X4 | Pin 6 | X5 |
| Pin 7 | X6 | Pin 8 | X7 |
| Pin 9 | X8 | Pin 10 | X9 |
| Pin 11 | X10 | Pin 12 | X11 |
| Pin 13 | X12 | Pin 14 | X13 |
| Pin 15 | X14 | Pin 16 | X15 |
| Pin 17 | DO_COM | Pin 18 | DI_COM |
| 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 |

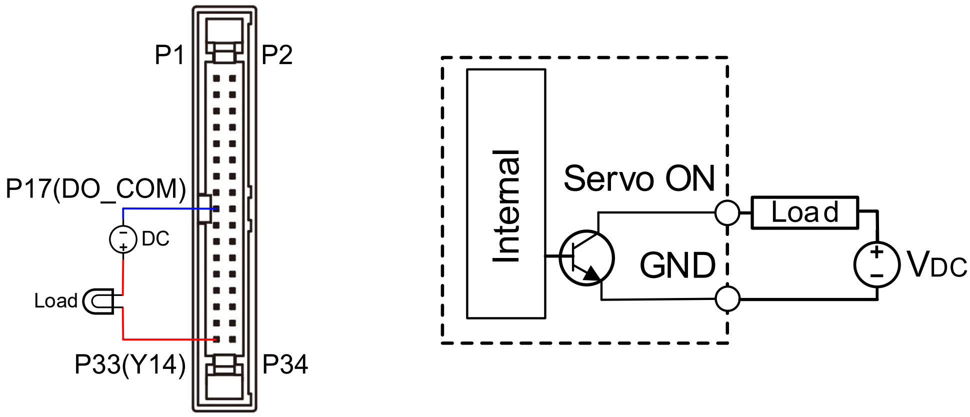
- DI signal for NPN wiring: COM connector connect to +24 $V_{DC}$ all the other digital input connects to ground 0 $V_{DC}$.




- DI signal for PNP wiring: COM connector connect to ground 0 $V_{DC}$ all the other digital input connects to +24 $V_{DC}$.



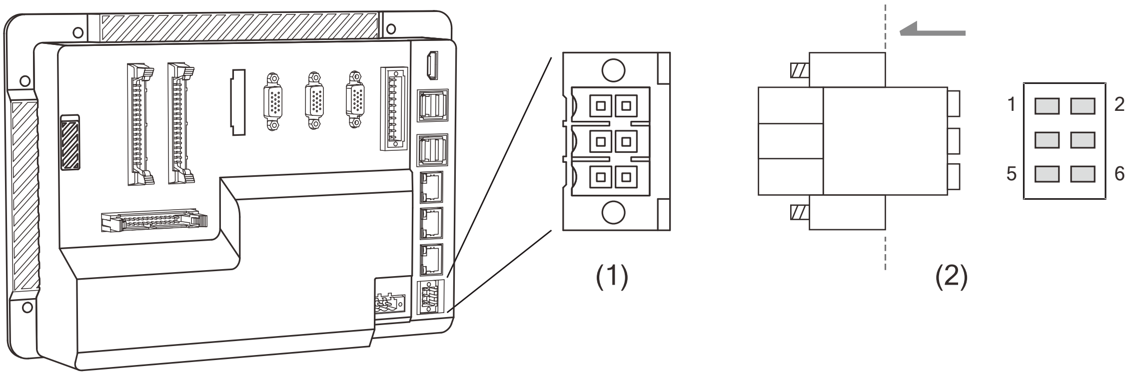

- DO signal only support for NPN wiring: COM connector connect to ground 0 $V_{DC}$ all the other digital output connects to +24 $V_{DC}$.



## 2.2.8 Wiring for RS485 connector

2

The NC 5 series controller provides one RS-485 series communication port for other devices communication with CNC via Modbus protocol.




(1) RS485 connector (2) RS-485 connector pin definition

| Symbol | Pin No. | Description | |
|---|---|---|---|
| RS485 | 1 | D+ | RS485 signal; D+ |
| | 2 | - | Reserve |
| | 3 | D- | RS485 signal; D- |
| | 4 | - | Reserve |
| | 5 | GND | SGND |
| | 6 | - | Reserve |

# 2.3 EtherCAT remote module

## 2.3.1 Remote power module R1-EC5500

R1-EC5500 Model explanation

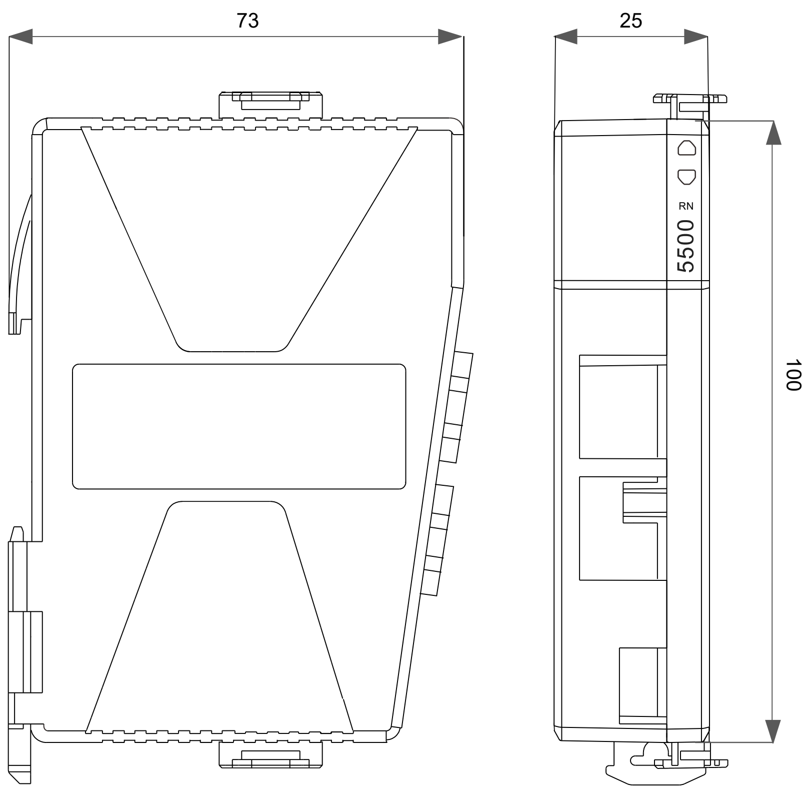
R 1 – EC 5 5 00
(1)(2) (3) (4)(5)(6)

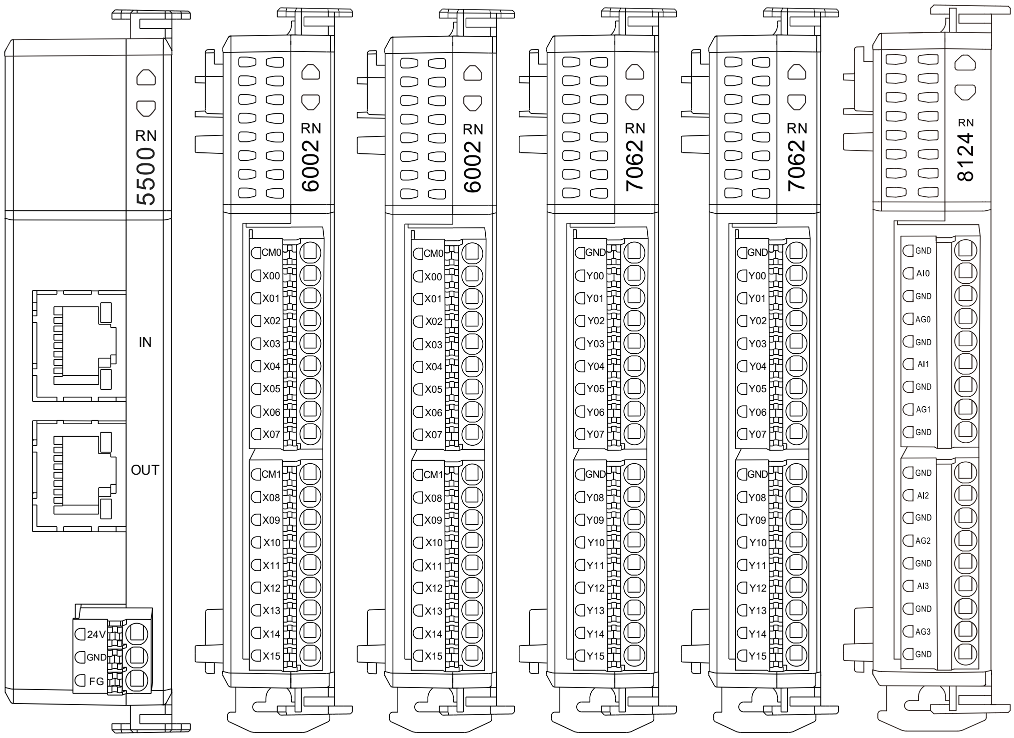
| No. | Item | Description |
|---|---|---|
| (1) | Product Type | R: Remote |
| (2) | Product Category | 1: type 1 – slim |
| (3) | Bus Type | EC: EtherCAT |
| (4) | Module Type | 5: Gateway Special Module |
| (5) | Module Subtype | 500: EtherCAT to E-Bus Interface |

Attention:

1. The R1-EC product is a gateway type module, which can serial connect with E-BUS to other R1-EC products to combinate for solution need. The first module of the series connection must be this R1-EC5500D0.
2. Please do not disassemble the connection when the power is on in case of damage.

R1-EC5500 module dimension: 100 x 73 x 25 mm

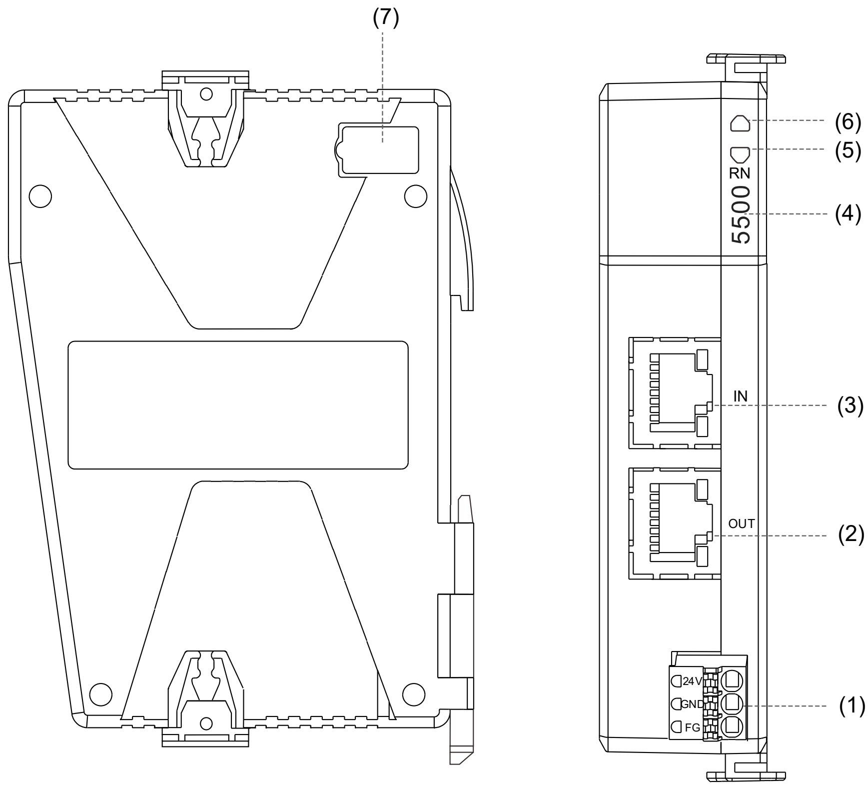





| Module Type | Module Name | Power Supply | Consumption |
|---|---|---|---|
| Remote power module | R1-EC5500 | 2.0A (2000mA) | |
| Remote digital input module | R1-EC6xx2 | | 120mA |
| Remote digital output module | R1-EC7062<br>R1-EC70A2 | | 120mA |
| Remote digital output module | R1-EC70E2<br>R1-EC70F2 | | 200mA |
| Remote analog input module | R1-EC8124 | | 300mA |

*Note: the R1-EC5500 power module can only support up to 2A current. Therefore, users need to double check the total current consumption whether over the limitation. Once the current consumption is not enough for one R1-EC5500, please find another power module for use.

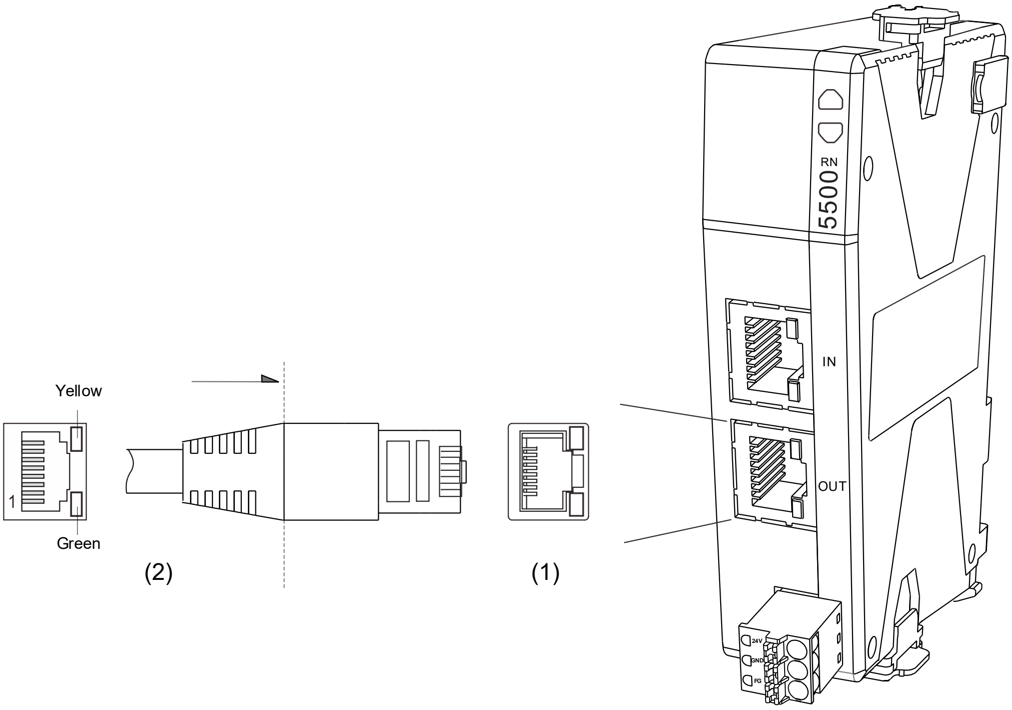
■ **R1-EC5500 interface introduction**




■ Product interface of R1-EC5500

| No. | Description |
|---|---|
| (1) | 24V power port |
| (2) | EtherCAT communications protocol output port |
| (3) | EtherCAT communications protocol input port |
| (4) | Product number |
| (5) | Status indicator |
| (6) | Power indicator |
| (7) | E-BUS transmission port |

■ R1-EC5500 EtherCAT communication port description




(1) EtherCAT connector；(2) EtherCAT cable side

EtherCAT communication port pin definition

| Pin | Description |
|---|---|
| 1 | TX + |
| 2 | TX - |
| 3 | RX + |
| 4 | NC |
| 5 | NC |
| 6 | RX - |
| 7 | NC |
| 8 | NC |

EtherCAT communication indicator description:

| | Indicator mark | Description |
|---|---|---|
| LED (Green) | Always lighting | Cable connected |
| | Blinking | Data transmission |

## 2.3.2 Remote digital input module - R1-EC6xx2

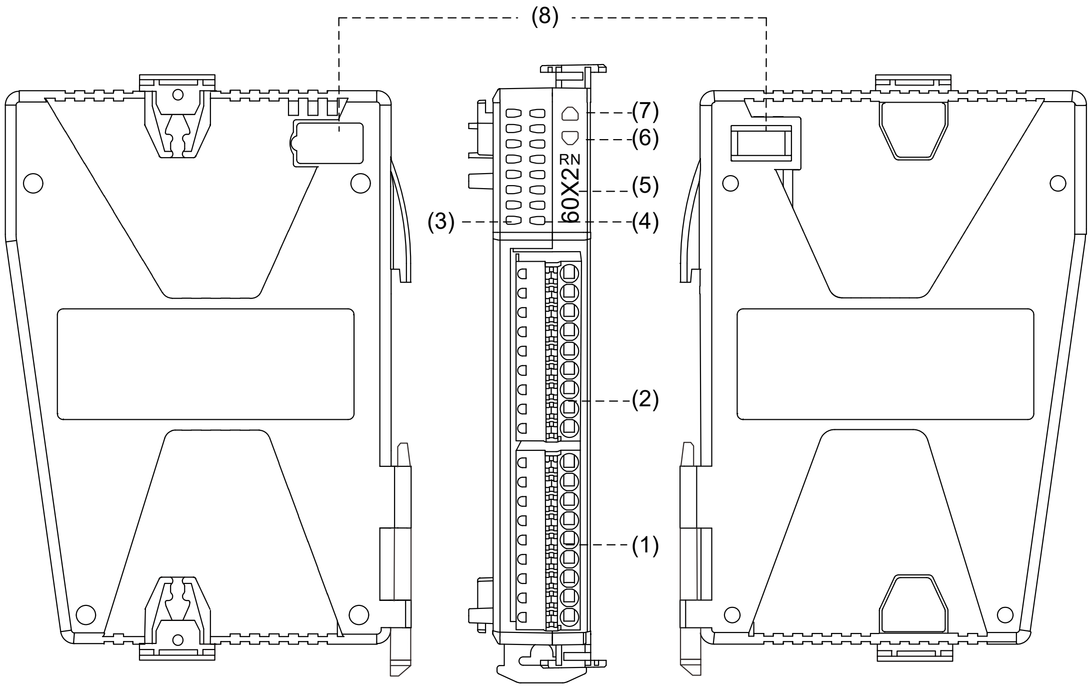


R1-EC6xx2 model name explanation

R 1 – EC 6 X X 2
(1)(2) (3) (4)(5)(6)(7)

| No. | Item | Description |
|---|---|---|
| (1) | Product Type | R: Remote |
| (2) | Product Category | 1: type 1 – slim |
| (3) | Bus Type | EC: EtherCAT |
| (4) | Module Type | 6: gateway digital input module |
| (5) | Module Subtype 1 | 0: 3.50 mm terminal connector |
| (6) | Module Subtype 2 | 0: general type / 24 $V_{DC}$ / 100 µs |
| | | 1: general type / 24 $V_{DC}$ / 1 ms |
| | | 2: general type / 24 $V_{DC}$ / 2 ms |
| | | 3: general type / 24 $V_{DC}$ / 3 ms |
| (7) | DI | 2: 16 sets |

R1-EC6xx2 device interface introduction

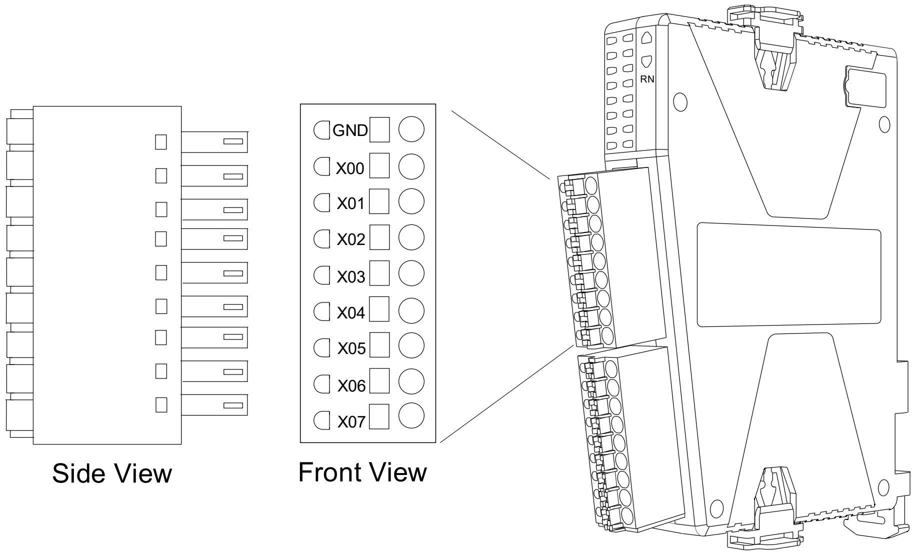



| No. | Description |
|---|---|
| (1) | Port 1 IO |
| (2) | Port 0 IO |
| (3) | X00 – X07 I/O signal display for Port 0 (from top to bottom) |
| (4) | X08 – X15 I/O signal display for Port 1 (from top to bottom) |
| (5) | Product number (6002 / 6022) |
| (6) | Status indicator |
| (7) | Power indicator |
| (8) | E-BUS transmission port |

2

R1-EC6xx2 I/O port description

- R1-EC60X2 Port 0 pin definition

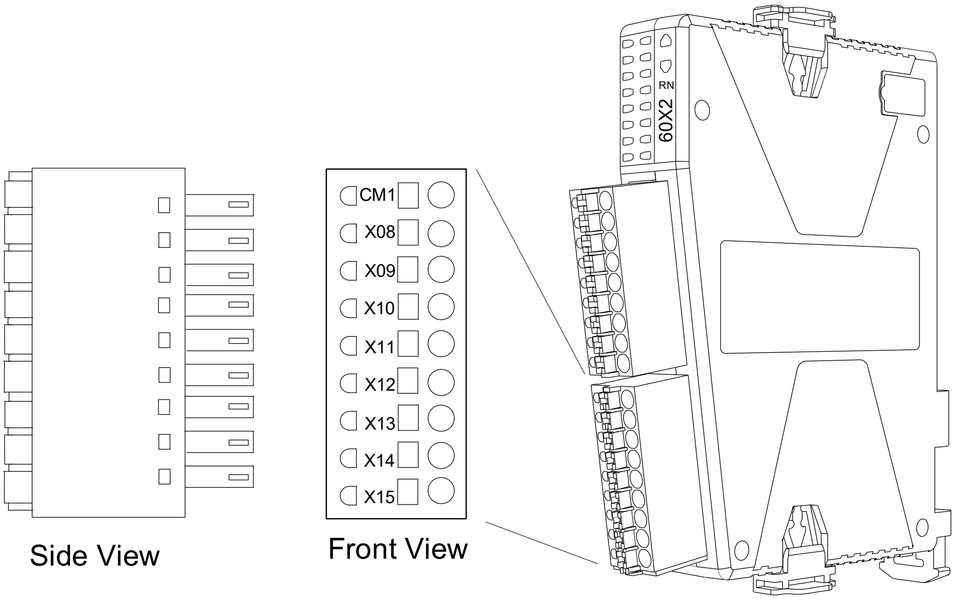



Side View Front View

| Symbol | Description |
|---|---|
| CM0 | Port 0 power / grounding common point (COM) type input |
| X00 | 1st set of input of Port 0 |
| X01 | 2nd set of input of Port 0 |
| X02 | 3rd set of input of Port 0 |
| X03 | 4th set of input of Port 0 |
| X04 | 5th set of input of Port 0 |
| X05 | 6th set of input of Port 0 |
| X06 | 7th set of input of Port 0 |
| X07 | 8th set of input of Port 0 |

2

■ R1-EC60X2 Port 1 pin definition

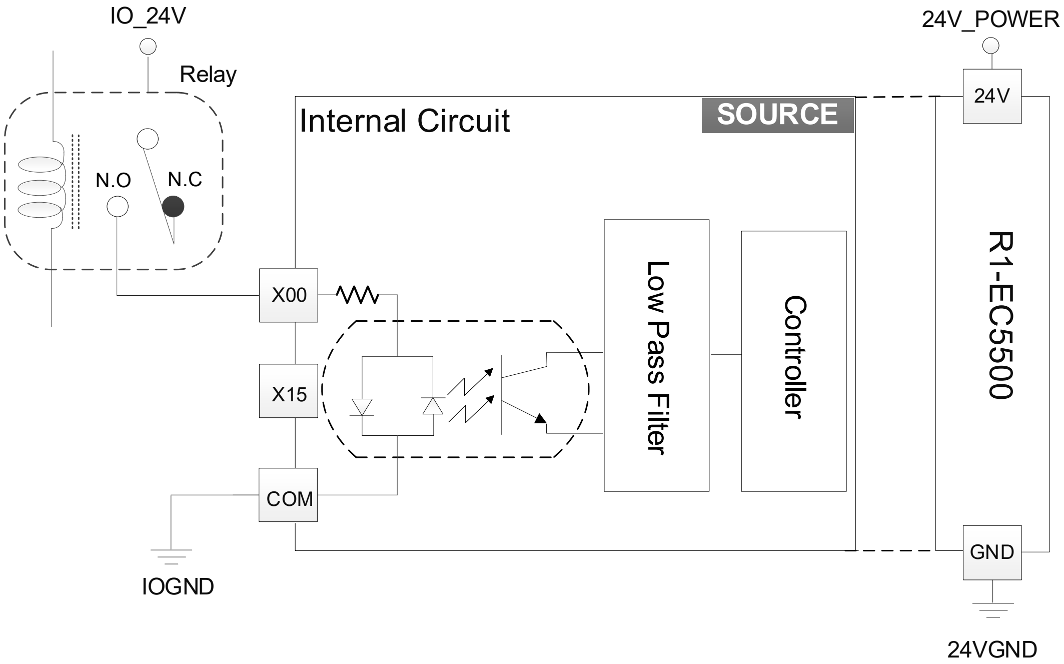



| Symbol | Description |
| --- | --- |
| CM1 | Port 1 power / grounding common point (COM) type input |
| X08 | 1st set of input of Port 1 |
| X09 | 2nd set of input of Port 1 |
| X10 | 3rd set of input of Port 1 |
| X11 | 4th set of input of Port 1 |
| X12 | 5th set of input of Port 1 |
| X13 | 6th set of input of Port 1 |
| X14 | 7th set of input of Port 1 |
| X15 | 8th set of input of Port 1 |

R1-EC6xx2 Input port wiring example

- R1-EC60X2 is connected to PNP (SOURCE) type load

VCCIO_24V / IOGND and 24V_POWER / 24VGND should be isolated power supply circuits. The example below shows a single point (X00) input schematic, and the other 15 sets (X01 - X15) have the same input structure. Port 0 / Port 1 can be different control types (NPN or PNP).



2

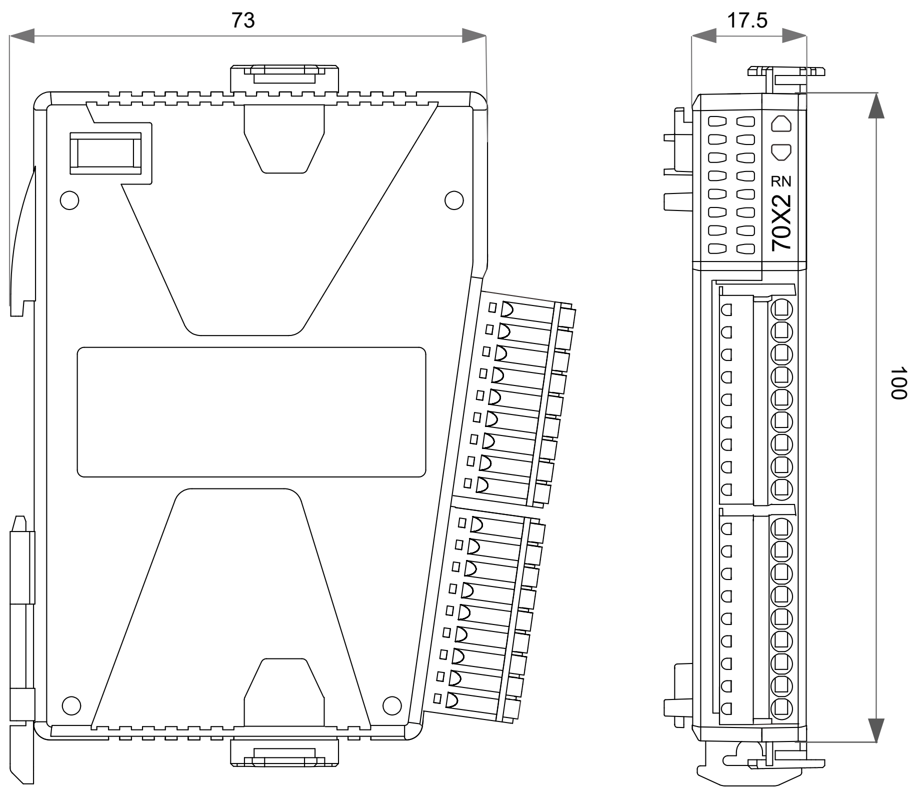
## 2.3.3 Remote digital output module - R1-EC7_ _2

R1-EC70x2 model name explanation

R 1 – EC 7 X X 2
(1)(2) (3) (4)(5)(6)(7)

| No. | Item | Description | |
|---|---|---|---|
| (1) | Product Type | R1 | Gateway remote module |
| (2) | Bus Type | EC | EC: EtherCAT |
| (3) | Module Type | 7 | 7: Gateway Digital Output Module |
| (4) | Module Subtype 1 | 0 | 0: 3.50 mm terminal connector |
| (5) | Module Subtype 2 | 6 | 6: NPN type / 24 $V_{DC}$ / 0.25 A<br>Output retentive when disconnect. |
| | | A | A: PNP type / 24 $V_{DC}$ / 0.25 A<br>Output retentive when disconnect. |
| | | E | E: NPN type / 24 $V_{DC}$ / 0.25 A<br>Configurable output retentive or not when disconnect. |
| | | F | F: PNP type / 24 $V_{DC}$ / 0.25 A<br>Configurable output retentive or not when disconnect. |
| (6) | Port Number | 2 | 2: 16 sets |

R1-EC70X2 module dimension: 100 x 73 x 17.5 mm

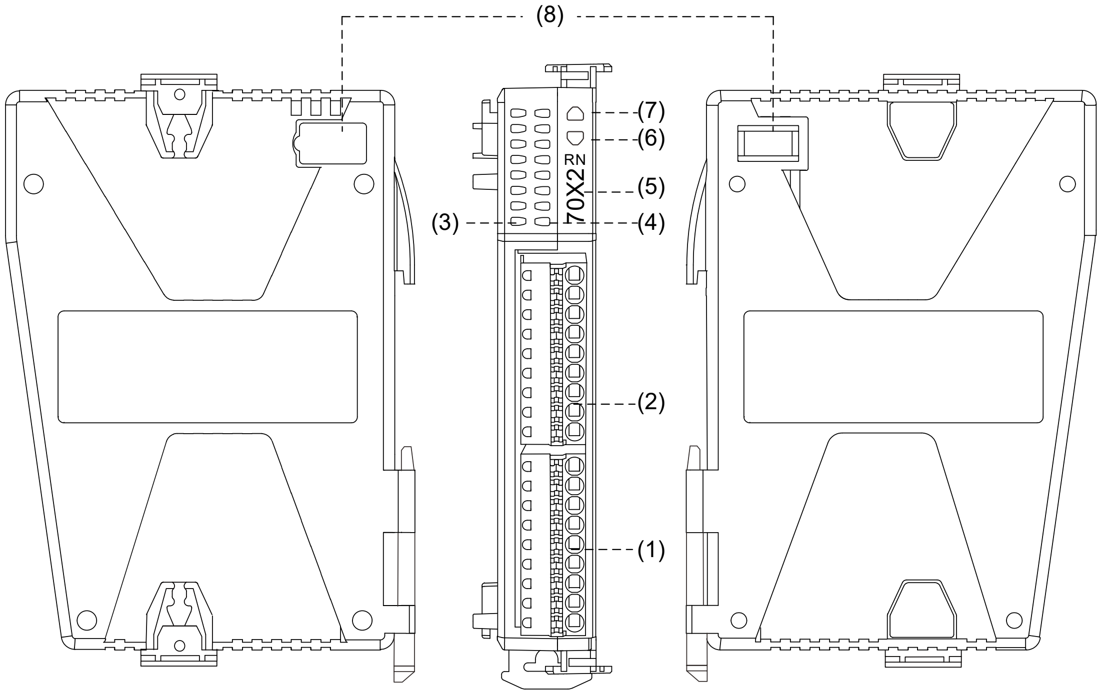


■ R1-EC70X2 electrical specifications

| Item | R1-EC7062 | R1-EC70E2 | R1-EC70A2 | R1-EC70F2 |
|---|---|---|---|---|
| Circuit type | Transistor | | | |
| Signal type | NPN (SINK) | | PNP (SOURCE) | |
| Power usage | 24 $V_{DC}$ (-15% ~ +20%) | | | |
| Output status when disconnected | Retentive | Configurable | Retentive | Configurable |
| Port output current | 0.25 A (max.) / per channel | | | |
| Reaction time / Frequency | 1 kHz | | | |
| Active (OFF > ON) | 140 us | | 160 us | |
| Active (ON > OFF) | 150 us | | 110 us | |
| E-BUS current consumption | 120 mA | 200 mA | 120 mA | 200 mA |
| Galvanic isolation | 500 Vrms (E-BUS / signal voltage) | | | |
| Weight | 55 g (0.12lb) | | | |
| Operation environment | Operating temperature: 0°C ~ 50°C (32°F ~ 122°F) ;<br>Storage temperature: -20°C ~ 70°C (-4°F ~ 158°F) | | | |
| Installation | Sliding rail type | | | |
| Vibration resistance / Shock resistance | Conforms to EN 60068-2-6 / EN 60068-2-27/29 | | | |
| Electromagnetic compatible / Noise immunity | ESD (IEC 61131-2, IEC 61000-4-2)<br>EFT (IEC 61131-2, IEC 61000-4-4)<br>RS (IEC 61131-2, IEC 61000-4-3) | | | |
| Protection level | IP20 | | | |
| Approvals | | | | |

2

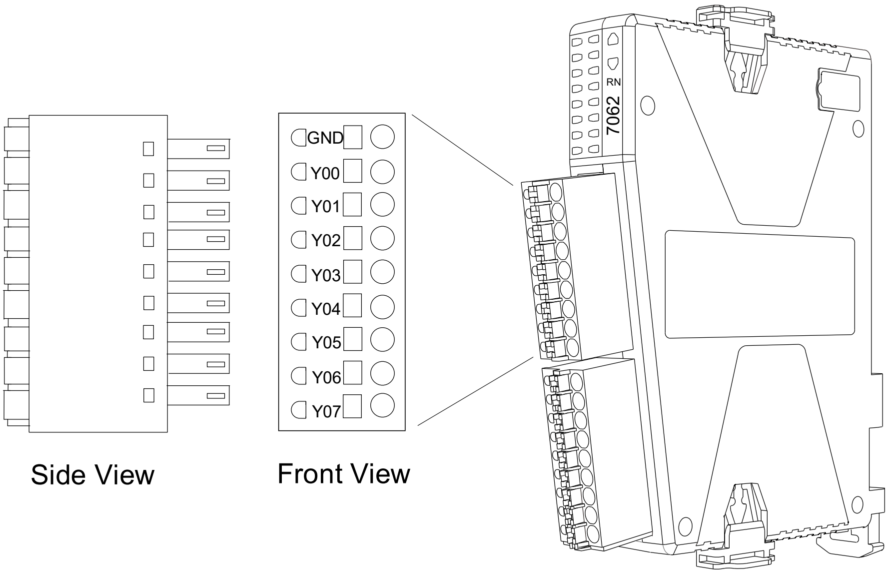
- Product interface of R1-EC70X2




| No. | Description |
|---|---|
| (1) | Port 1 |
| (2) | Port 0 |
| (3) | Y00 ~ Y07 I/O signal display for Port 0 (from top to bottom) |
| (4) | Y08 ~ Y15 I/O signal display for Port 1 (from top to bottom) |
| (5) | Product number (7062 / 70E2 / 70A2 / 70F2) |
| (6) | Status indicator |
| (7) | Power indicator |
| (8) | E-BUS transmission port |

R1-EC7XX2 Port 0

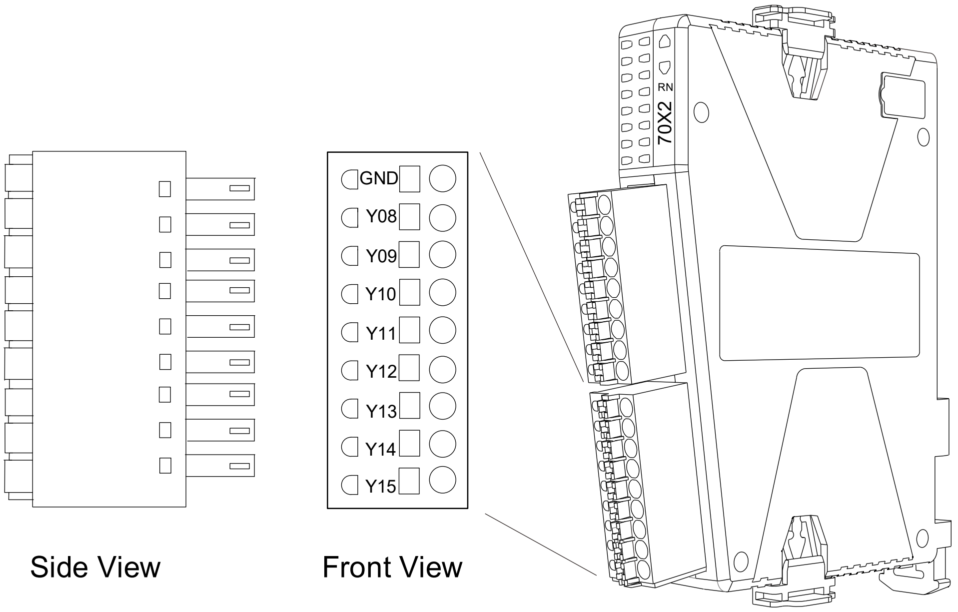
- R1-EC7062 / R1-EC70E2 Port 0 pin definition:




| Symbol | Description |
|---|---|
| GND | Power ground of Port 0 |
| Y00 | 1st set of output of Port 0 |
| Y01 | 2nd set of output of Port 0 |
| Y02 | 3rd set of output of Port 0 |
| Y03 | 4th set of output of Port 0 |
| Y04 | 5th set of output of Port 0 |
| Y05 | 6th set of output of Port 0 |
| Y06 | 7th set of output of Port 0 |
| Y07 | 8th set of output of Port 0 |

2

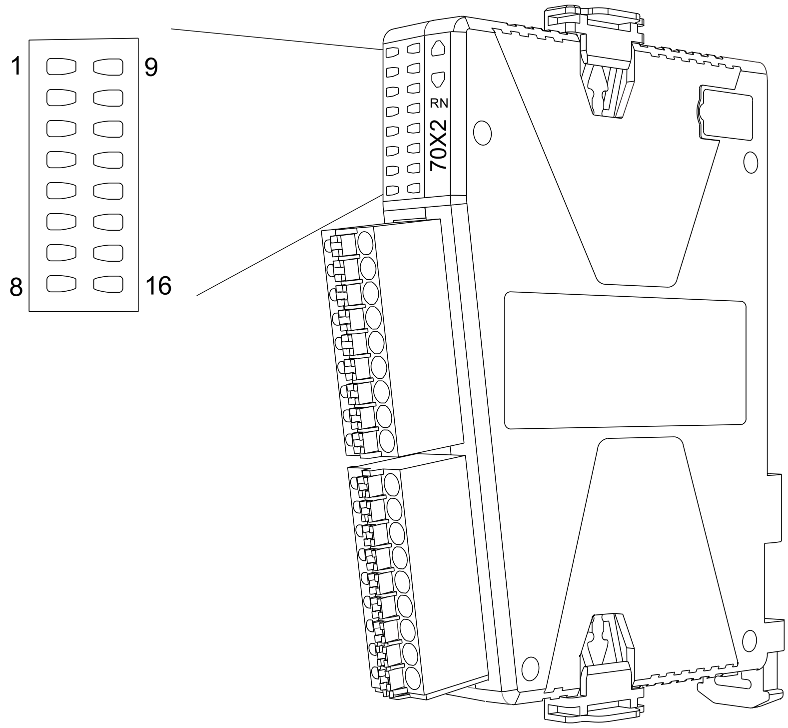
■ R1-EC70X2 Port 1 pin definition:




Side View Front View

| Symbol | Description |
|---|---|
| GND | Power ground of Port 1 |
| Y08 | 1st set of output of Port 1 |
| Y09 | 2nd set of output of Port 1 |
| Y10 | 3rd set of output of Port 1 |
| Y11 | 4th set of output of Port 1 |
| Y12 | 5th set of output of Port 1 |
| Y13 | 6th set of output of Port 1 |
| Y14 | 7th set of output of Port 1 |
| Y15 | 8th set of output of Port 1 |

R1-EC70X2 indicator definition:




| Indicator mark | Description | Indicator mark | Description |
|---|---|---|---|
| 1 | Y00 | 9 | Y08 |
| 2 | Y01 | 10 | Y09 |
| 3 | Y02 | 11 | Y10 |
| 4 | Y03 | 12 | Y11 |
| 5 | Y04 | 13 | Y12 |
| 6 | Y05 | 14 | Y13 |
| 7 | Y06 | 15 | Y14 |
| 8 | Y07 | 16 | Y15 |

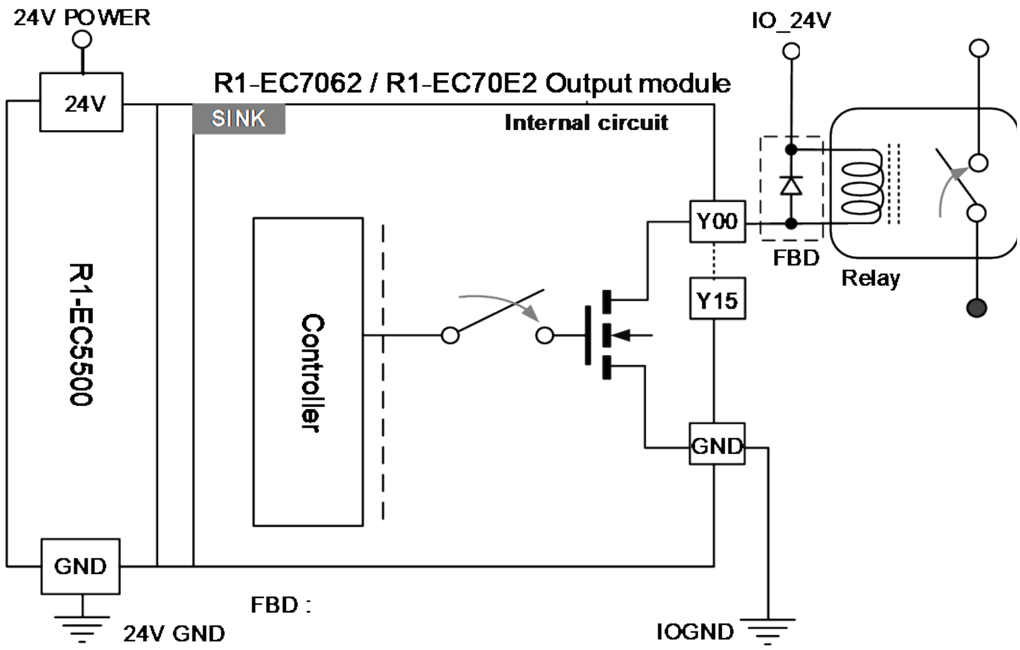
R1-EC7XX2 output port wiring example

- R1-EC7062 / R1-EC70E2 is connected to NPN (SINK) type load

2

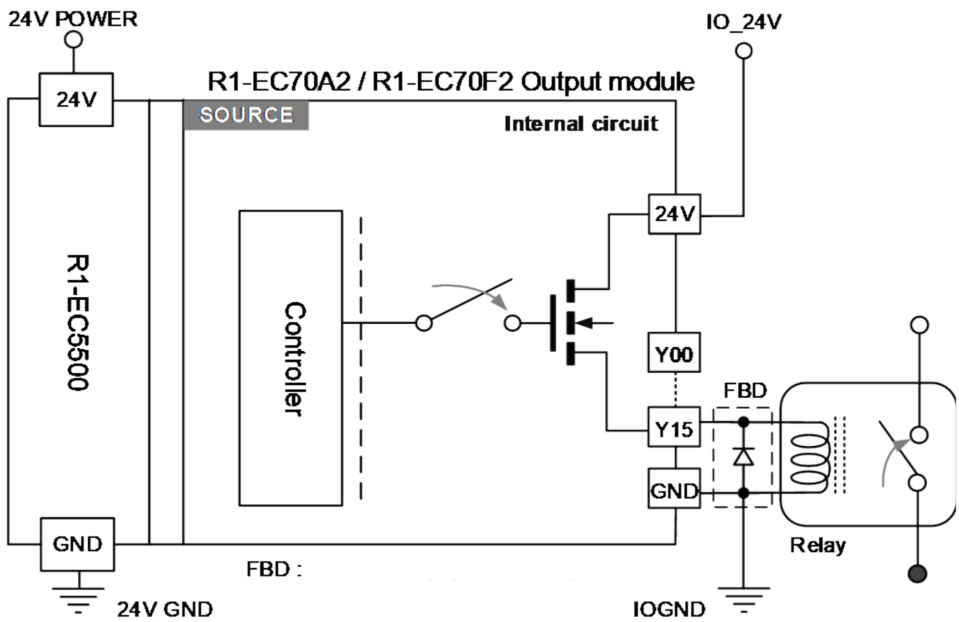
VCCIO_24V / IOGND and 24V_POWER / 24VGND should be isolated power-supply circuits. The example below shows a single point (Y00) output schematic, and the other 15 sets (Y01 - Y15) have the same output structure.

GND of Port 0 and Port 1 must be connected to IOGND to avoid abnormal output status.




- R1-EC70A2 / R1-EC70F2 is connected to PNP (SOURCE) type load

VCCIO_24V / IOGND and 24V_POWER / 24VGND should be isolated power-supply circuits. The example below shows a single point (Y00) output schematic, and the other 15 sets (Y01 - Y15) have the same output structure.



## 2.3.4 Remote analog input module - R1-EC8124

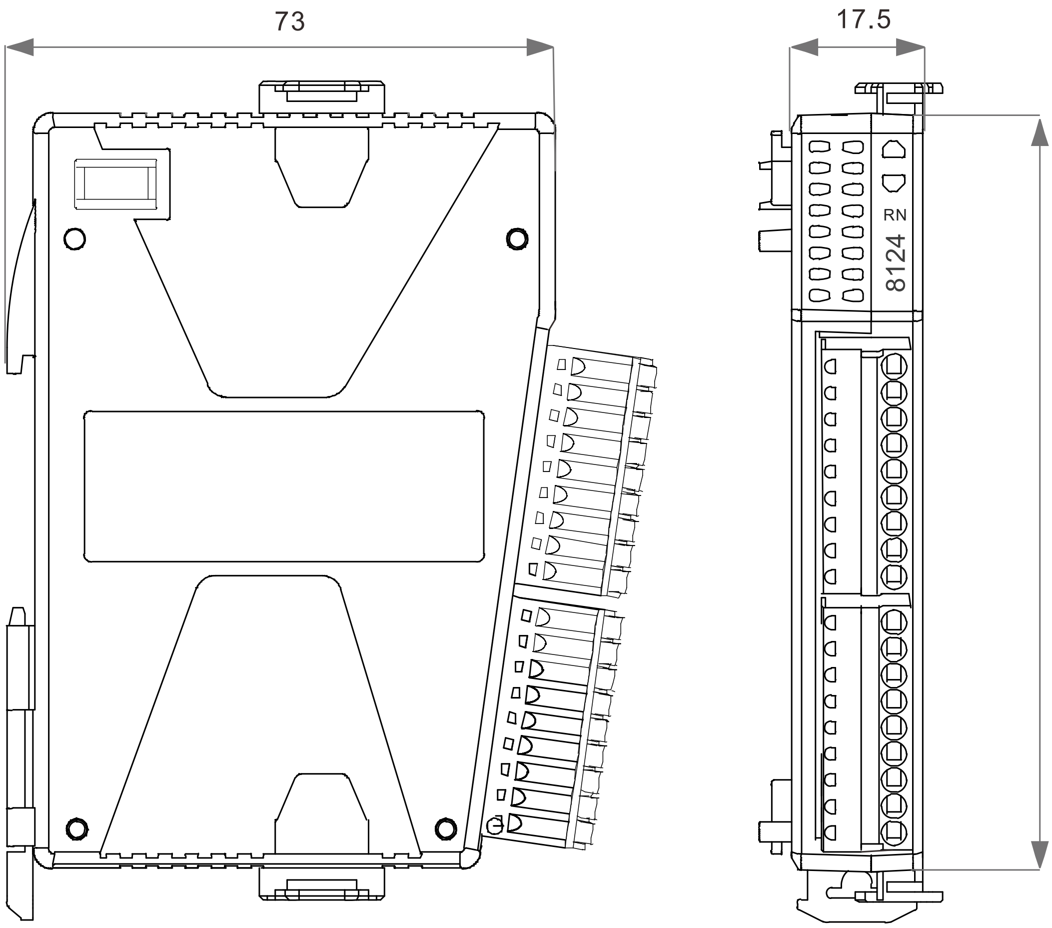


R1-EC8124 model name explanation

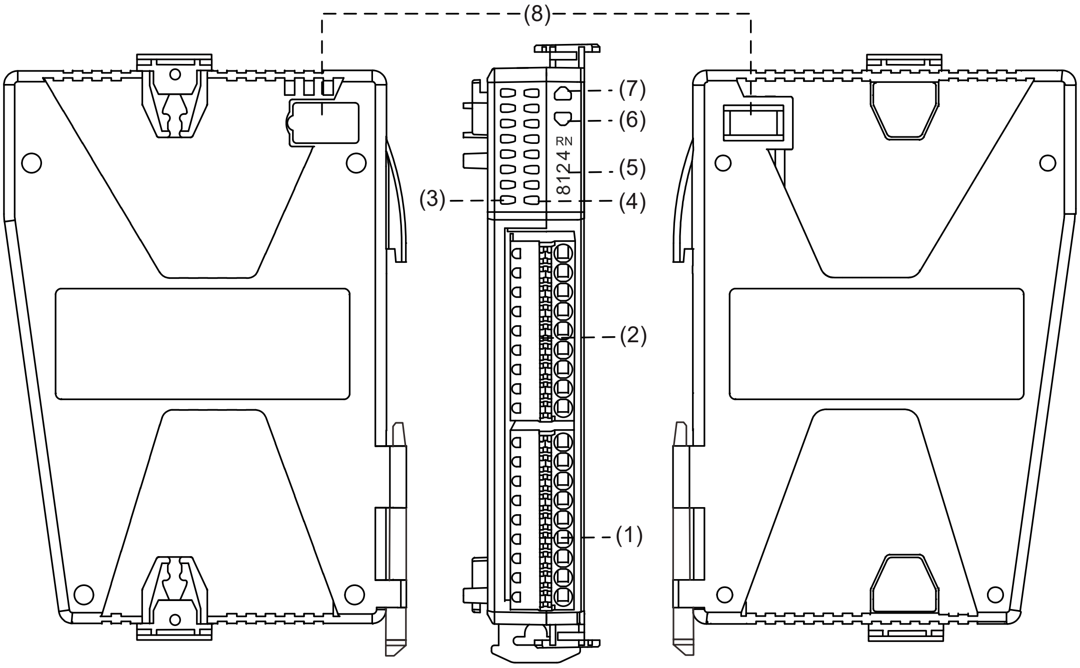
R 1 - EC – 8 1 2 4 D0
(1)(2) (3) (4)(5)(6)(7) (8)

| No. | Item | Description |
|---|---|---|
| (1) | Product Type | R: Remote |
| (2) | Product Category | 1: type 1 – slim |
| (3) | Bus Type | EC: EtherCAT |
| (4) | Module Type | 8: Gateway ADC Model (Input) |
| (5) | Module Resolution | 1: 16-bit single-ended |
| (6) | Module Sample Rate | 2: ≦ 10 KHz |
| (7) | Channel Number | 4: 4 channels |
| (8) | Module Subtype | D0: Standard Type 1 |

R1-EC8124D0 module dimension: 100 x 73 x 17.5mm (L x W x H)



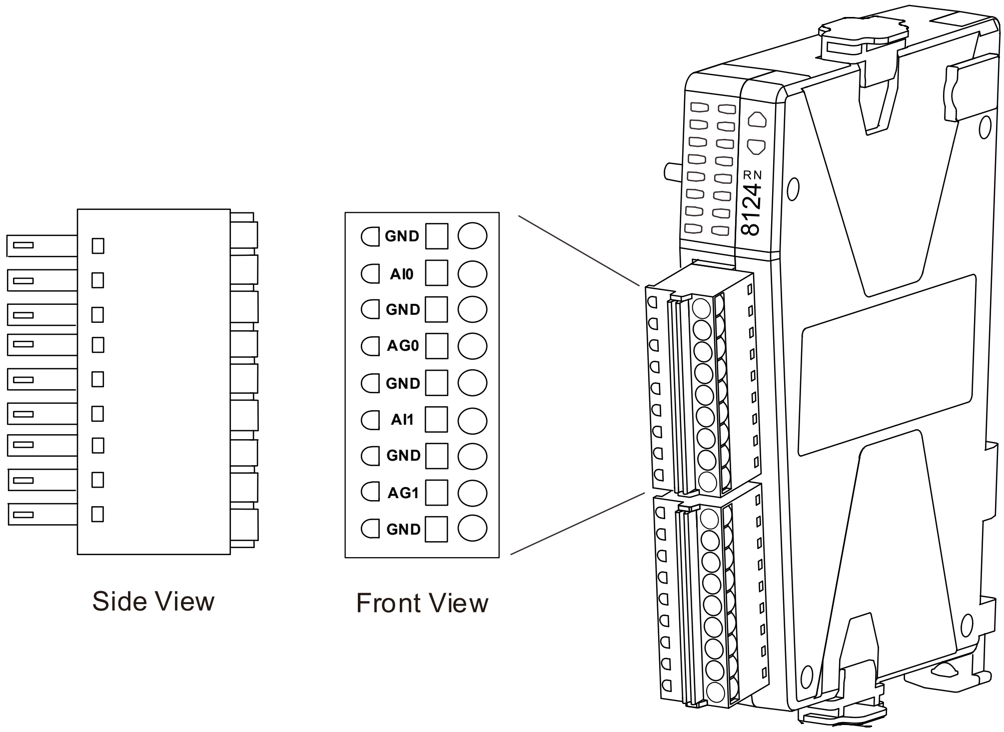
■ Product interface of R1-EC8124D0




| No. | Description |
|---|---|
| 1 | CH2 / CH3 signal port |
| 2 | CH0 / CH1 signal port |
| 3 | CH0 / CH1 signal indicator (from top to down) |
| 4 | CH2 / CH3 signal indicator (from top to down) |
| 5 | Product ID number |
| 6 | Status indicator |
| 7 | Power indicator |
| 8 | E-BUS transmission port |

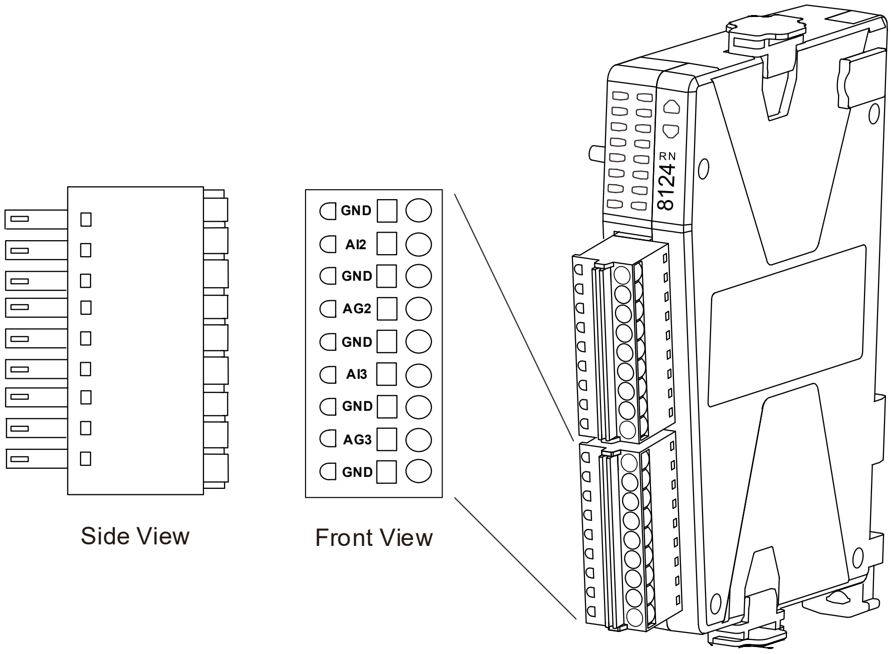
R1-EC8124D0 signal port

■ CH0 / CH1 pin definition




| Symbol | Description |
|---|---|
| GND | Analog ground |
| AI0 | CH0 voltage/current input |
| GND | Analog ground |
| AG0 | CH0 current COM |
| GND | Analog ground |
| AI1 | CH1 voltage/current input |
| GND | Analog ground |
| AG1 | CH1 current COM |
| GND | Analog ground |

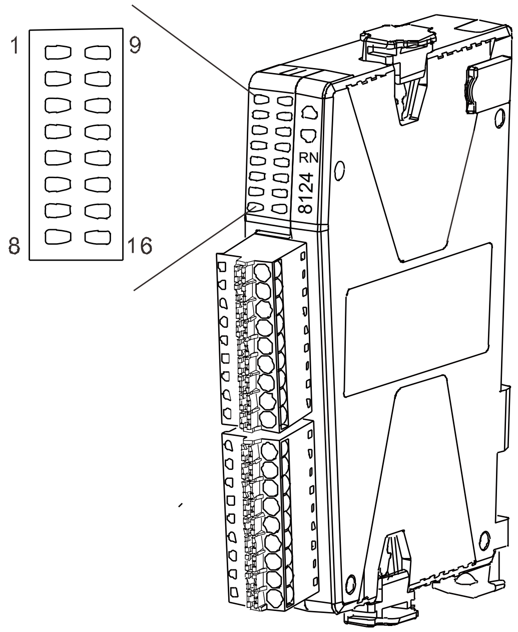
■ CH2 / CH3 pin definition




Side View Front View

| Symbol | Description |
|---|---|
| GND | Analog ground |
| AI2 | CH2 voltage/current input |
| GND | Analog ground |
| AG2 | CH2 current COM |
| GND | Analog ground |
| AI3 | CH3 voltage/current input |
| GND | Analog ground |
| AG3 | CH3 current COM |
| GND | Analog ground |

R1-EC8124 indicator definition

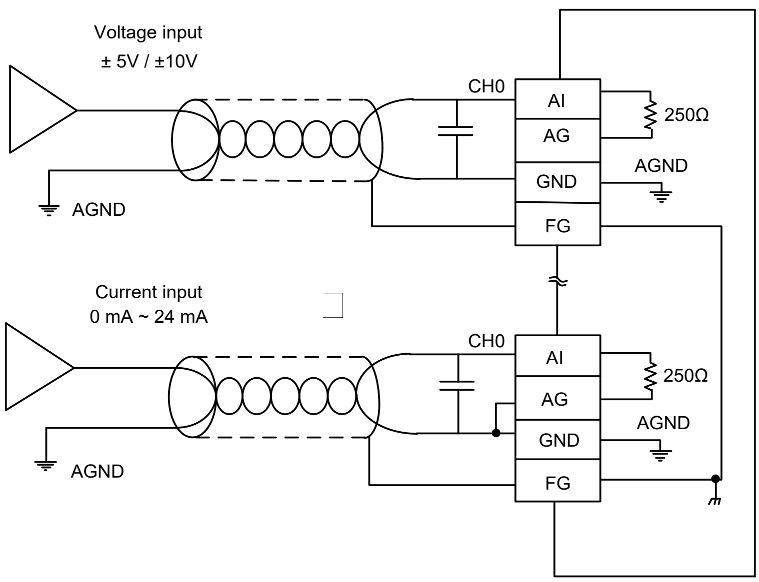



| Indicator mark | Description | Indicator mark | Description |
|---|---|---|---|
| 1 | CH0 enable | 9 | CH2 enable |
| 2 | CH0 input range ±5V | 10 | CH2 input range ±5V |
| 3 | CH0 input range ±10V | 11 | CH2 input range ±10V |
| 4 | CH0 OSCT[1] 192 us select | 12 | CH2 OSCT 192 us select |
| 5 | CH1 enable | 13 | CH3 enable |
| 6 | CH1 input range ±5V | 14 | CH3 input range ±5V |
| 7 | CH1 input range ±10V | 15 | CH3 input range ±10V |
| 8 | CH1 OSCT 192 us select | 16 | CH3 OSCT 192 us select |

Note 1: OSCT (Oversampling Conversion Time)

- R1-EC8124D0 current / voltage wiring

CH 0 wiring example. (The other 3 sets of ports such as Port1 ~ 3 are the same).



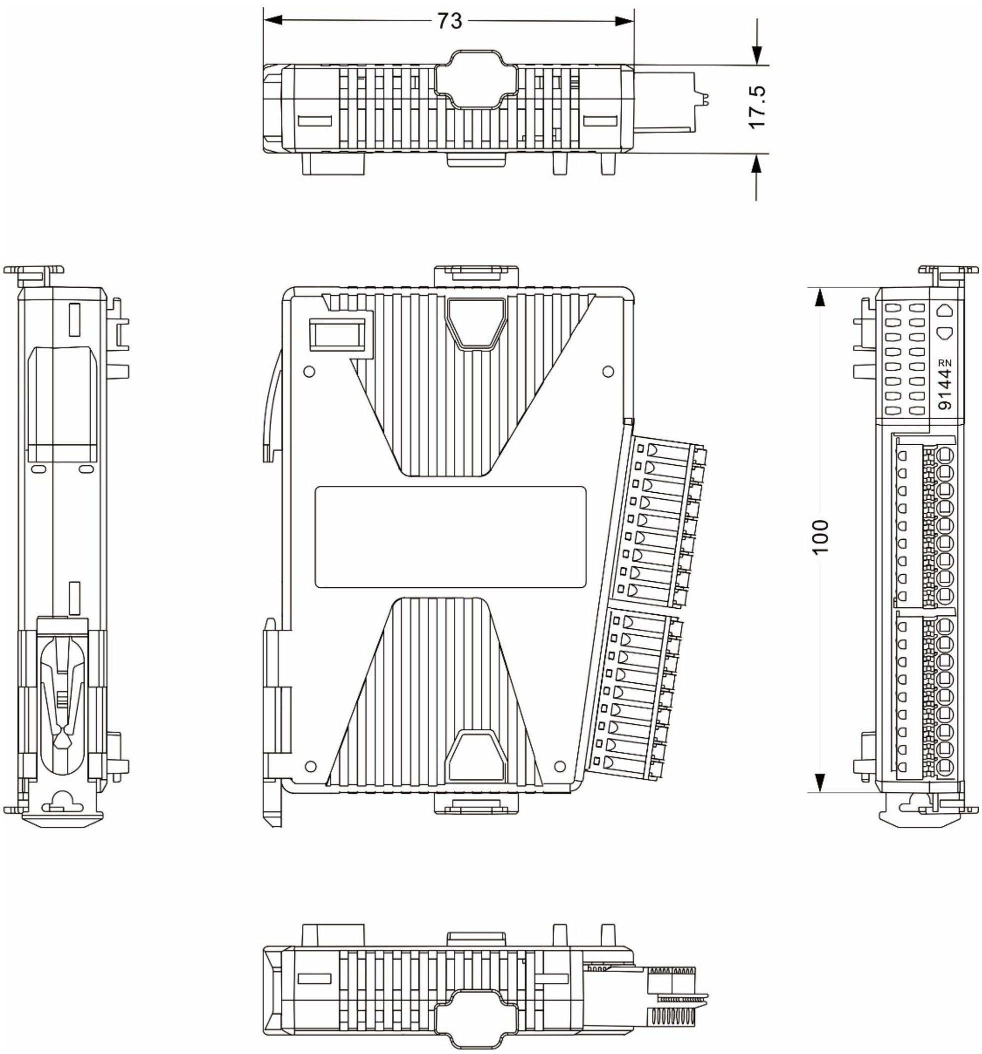
## 2.3.5 Remote analog output module - R1-EC9144

R1-EC9144 model name explanation

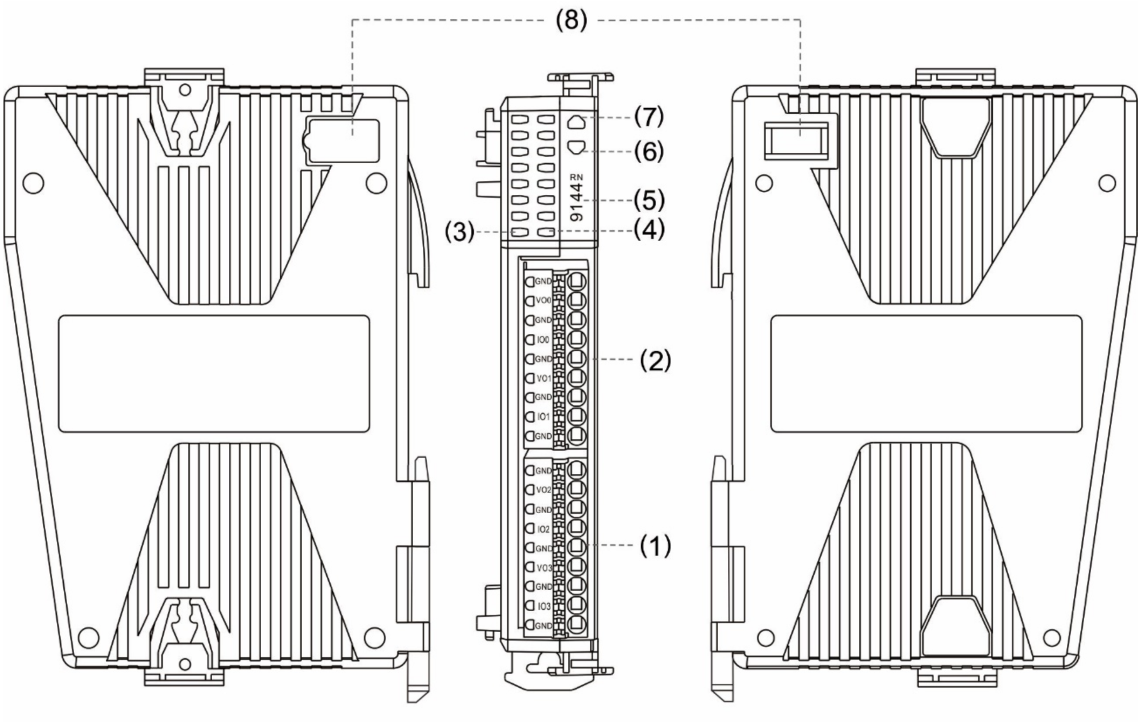
R 1 - EC – 9 1 4 4
(1)(2) (3) (4)(5)(6)(7)

| No. | Item | Description |
|---|---|---|
| (1) | Product Type | R: Remote |
| (2) | Product Category | 1: type 1 – slim |
| (3) | Bus Type | EC: EtherCAT |
| (4) | Module Type | 9: Gateway ADC Model (Output) |
| (5) | Module Resolution | 1: 16-bit Single-ended |
| (6) | Module Sample Rate | 4: ALL Type<br>Voltage: ±10V / ±5V / 0 ~ 5V / 0 ~ 10V<br>Current: 0 ~ 20 mA / 4 ~ 24 mA / 0 ~ 24 mA |
| (7) | Channel Number | 4: 4 channels |

R1-EC9144 module dimension: 100 mm x 73.2 mm x 17.5 mm

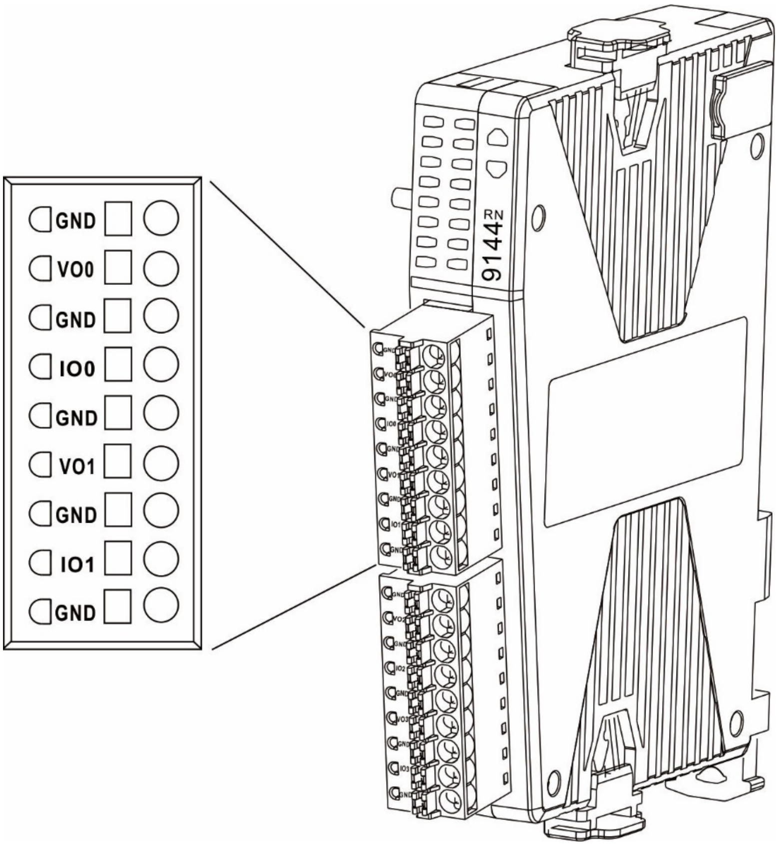


- Product interface of R1-EC9144



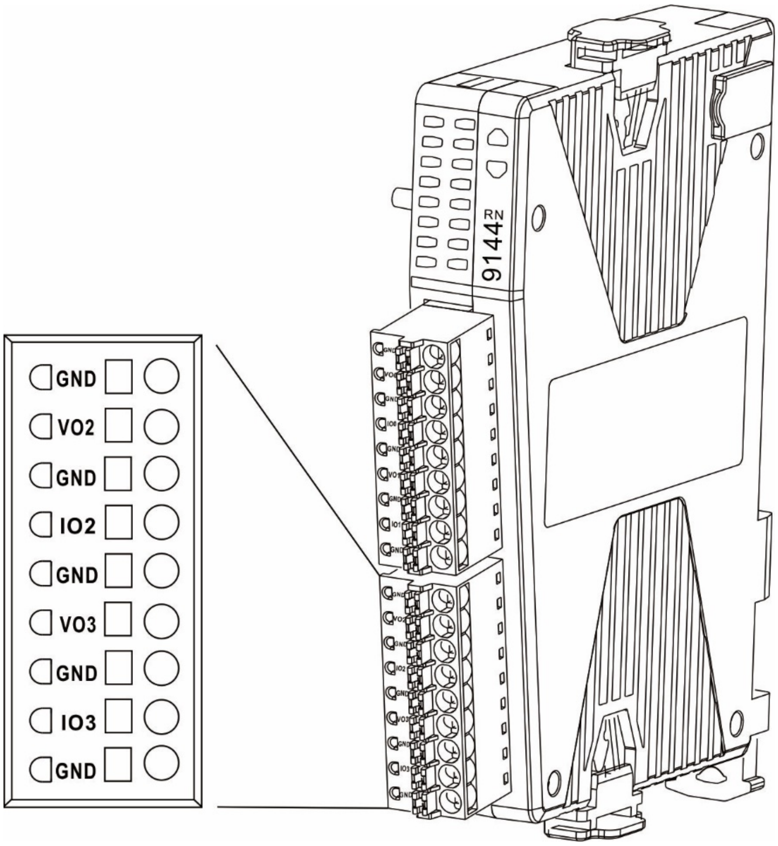

| No. | Description |
|---|---|
| (1) | CH2 / CH3 signal port |
| (2) | CH0 / CH1 signal port |
| (3) | CH0 / CH1 signal indicator (from top to down) |
| (4) | CH2 / CH3 signal indicator (from top to down) |
| (5) | Product ID number |
| (6) | Status indicator |
| (7) | Power indicator |
| (8) | E-BUS transmission port |

- Port 0 / Port 1 pin definition




| Symbol | Description |
|---|---|
| GND | Analog COM |
| VO0 | Port 0 voltage output |
| GND | Analog COM |
| IO0 | Port 0 current output |
| GND | Analog COM |
| VO1 | Port 1 voltage output |
| GND | Analog COM |
| IO1 | Port 1 current output |
| GND | Analog COM |

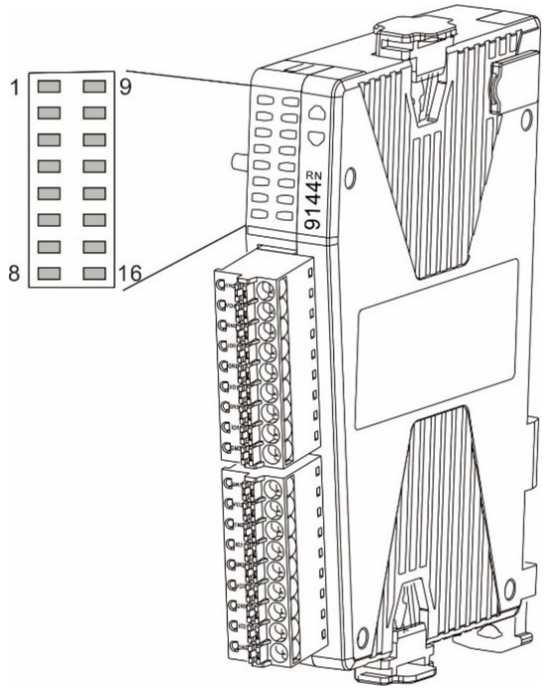
- Port 2 / Port 3 pin definition




| Symbol | Description |
|---|---|
| GND | Analog COM |
| VO2 | Port 2 voltage output |
| GND | Analog COM |
| IO2 | Port 2 current output |
| GND | Analog COM |
| VO3 | Port 3 voltage output |
| GND | Analog COM |
| IO3 | Port 3 current output |
| GND | Analog COM |

2

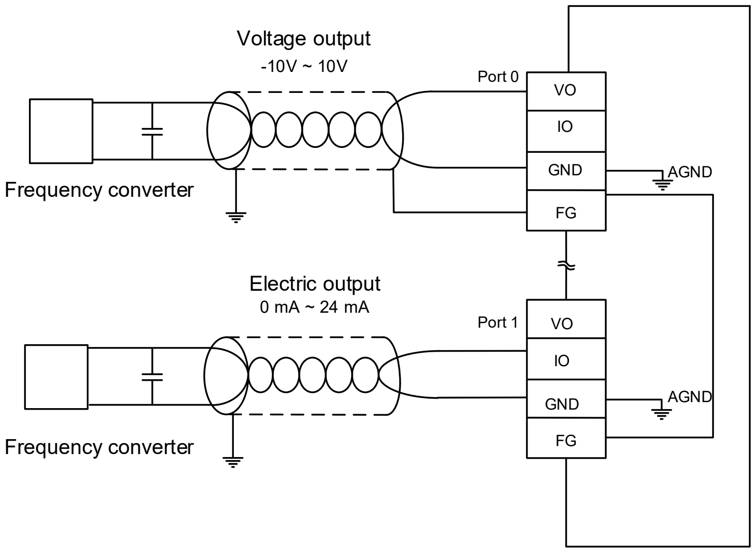
R1-EC9144 indicator definition




| Indicator mark | Description | Indicator mark | Description |
|---|---|---|---|
| 1 | CH0 enable | 9 | CH2 enable |
| 2 | CH0 voltage selection | 10 | CH2 voltage selection |
| 3 | CH0 current selection | 11 | CH2 current selection |
| 4 | CH0 error flag | 12 | CH2 error flag |
| 5 | CH1 enable | 13 | CH3 enable |
| 6 | CH1 voltage selection | 14 | CH3 voltage selection |
| 7 | CH1 current selection | 15 | CH3 current selection |
| 8 | CH1 error flag | 16 | CH3 error flag |

■ R1-EC9144D0 current / voltage wiring

Port 0 wiring example. (The other 3 sets of ports such as Port1 ~ 3 are the same).



## 2.3.6 Remote digital input/output module - R2-EC0902

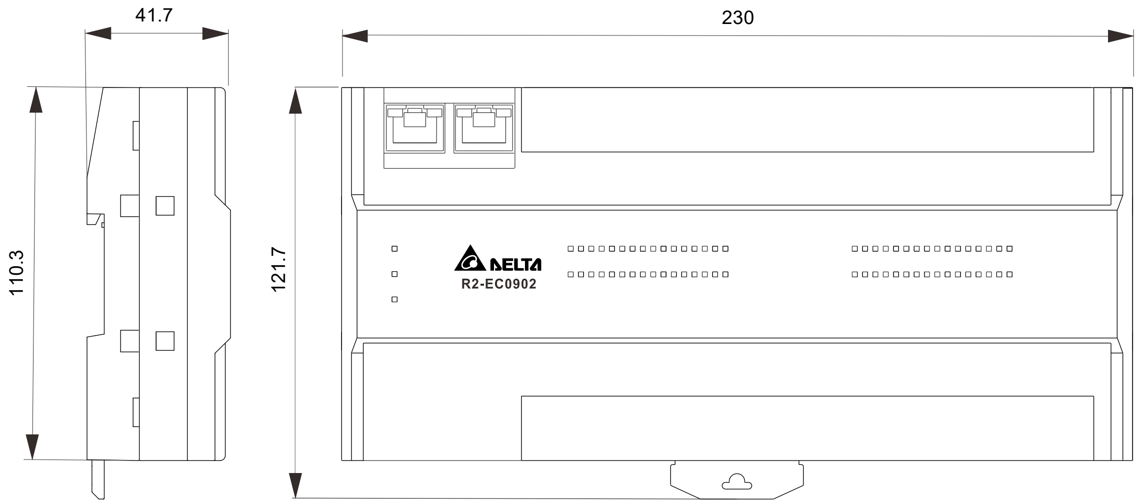
R2-EC0902 model name explanation

$\underset{(1)}{\underline{R}}\ \underset{(2)}{\underline{2}} - \underset{(3)}{\underline{EC}}\ \underset{(4)}{\underline{09}}\ \underset{(5)}{\underline{02}}$



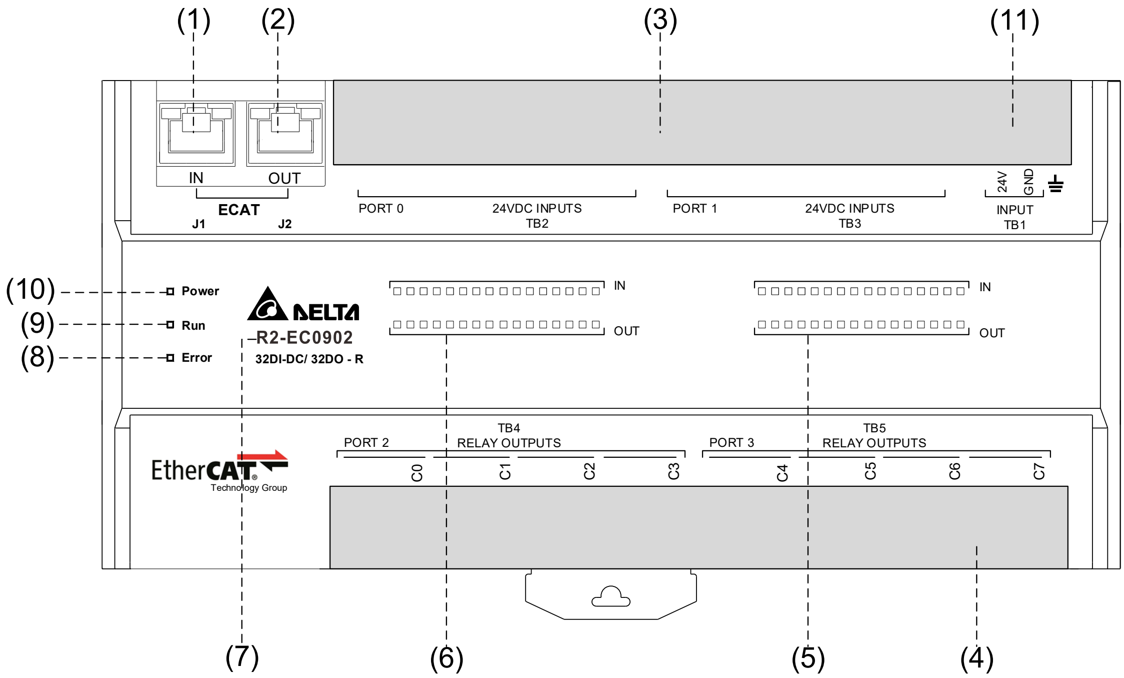
| No. | Item | Description |
|---|---|---|
| (1) | Product Type | R: Remote |
| (2) | Product Category | 2: Board type |
| (3) | Bus Type | EC: EtherCAT |
| (4) | Module Type | 09: distributed DI/DO mixed module (remote module) |
| (5) | Module Subtype | 02: 32-CH input, 24 VDC / 32-CH output, relay type, 2A |

R2-EC0902 module dimension: 230 x 121.7 x 41.7 mm (W x H x D)



2

■ Product interface of R2-EC0902



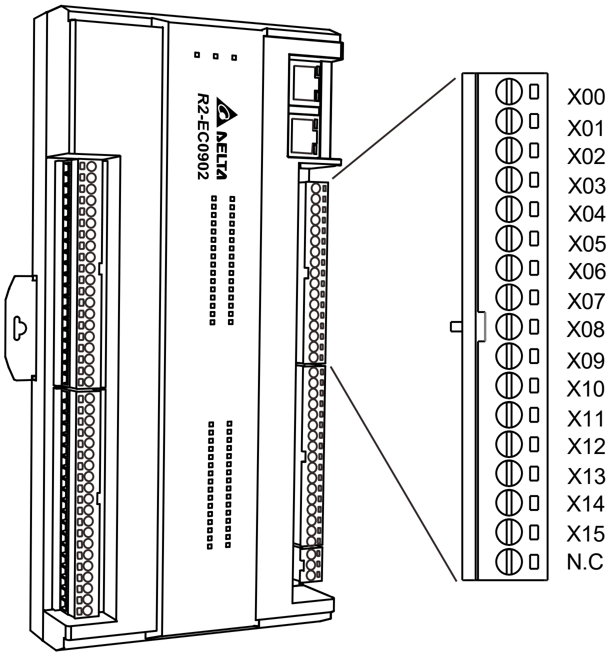

| No. | Description |
|---|---|
| (1) | EtherCAT input port (connection status indicator included) |
| (2) | EtherCAT output port (connection status indicator included) |
| (3) | GPIO input ports (Port 0 and Port 1) |
| (4) | GPIO output ports (Port 2 and Port 3) |
| (5) | Status indicators for GPIO Port 1 (input) and Port 3 (output) |
| (6) | Status indicators for GPIO Port 0 (input) and Port 2 (output) |
| (7) | Model number |
| (8) | Error indicator |
| (9) | Communication indicator |
| (10) | Power indicator |
| (11) | External power port |

I/O port description

R2-EC0902 provides total 4 sets of I/O Port such as Port 0, Port 1, Port 2 and Port 3 and pin definition as below.

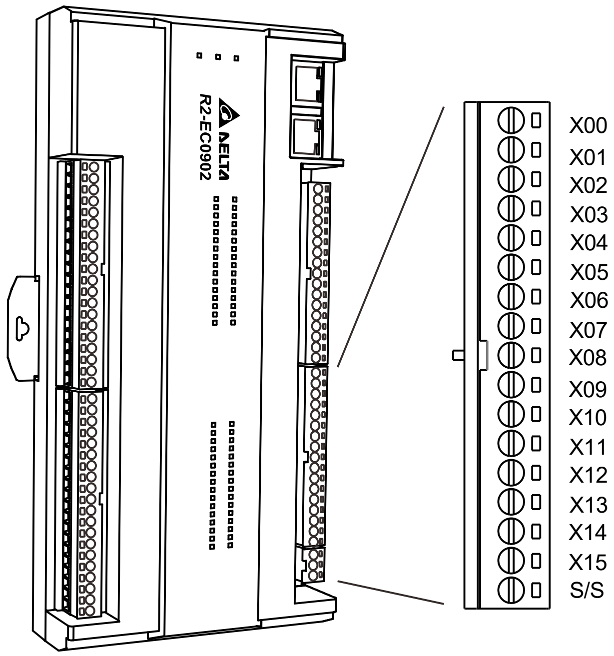


- I/O Port 0




| Symbol | Description | Symbol | Description |
|---|---|---|---|
| X00 | 1st set of input of Port 0 | X09 | 10th set of input of Port 0 |
| X01 | 2nd set of input of Port 0 | X10 | 11th set of input of Port 0 |
| X02 | 3rd set of input of Port 0 | X11 | 12th set of input of Port 0 |
| X03 | 4th set of input of Port 0 | X12 | 13th set of input of Port 0 |
| X04 | 5th set of input of Port 0 | X13 | 14th set of input of Port 0 |
| X05 | 6th set of input of Port 0 | X14 | 15th set of input of Port 0 |
| X06 | 7th set of input of Port 0 | X15 | 16th set of input of Port 0 |
| X07 | 8th set of input of Port 0 | N.C | Reserved (no connection) |
| X08 | 9th set of input of Port 0 | - | - |

■ I/O Port 1

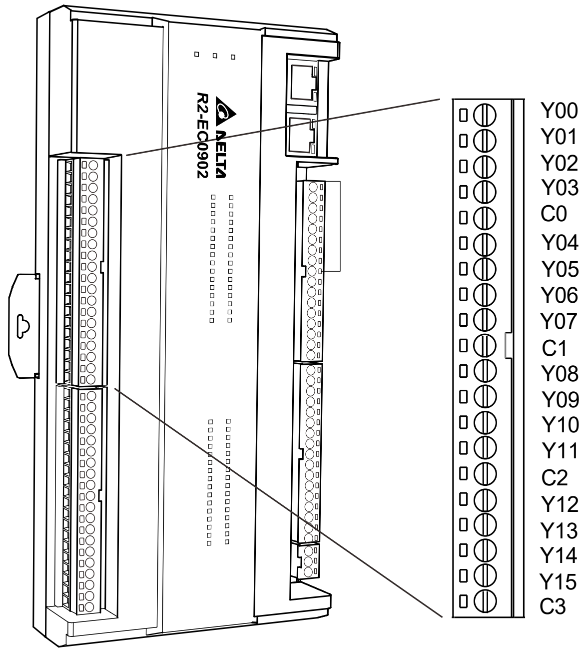



| Symbol | Description | Symbol | Description |
|---|---|---|---|
| X00 | 1st set of input of Port 1 | X09 | 10th set of input of Port 1 |
| X01 | 2nd set of input of Port 1 | X10 | 11th set of input of Port 1 |
| X02 | 3rd set of input of Port 1 | X11 | 12th set of input of Port 1 |
| X03 | 4th set of input of Port 1 | X12 | 13th set of input of Port 1 |
| X04 | 5th set of input of Port 1 | X13 | 14th set of input of Port 1 |
| X05 | 6th set of input of Port 1 | X14 | 15th set of input of Port 1 |
| X06 | 7th set of input of Port 1 | X15 | 16th set of input of Port 1 |
| X07 | 8th set of input of Port 1 | S/S* | Setting for common input port (NPN, PNP) |
| X08 | 9th set of input of Port 1 | - | - |

Note:

1. S/S: setting for common input port (NPN, PNP). (NPN = Vcc, PNP = GND)
2. This S/S is a common connector for both of Port 0 and Port 1.

■ I/O Port 2

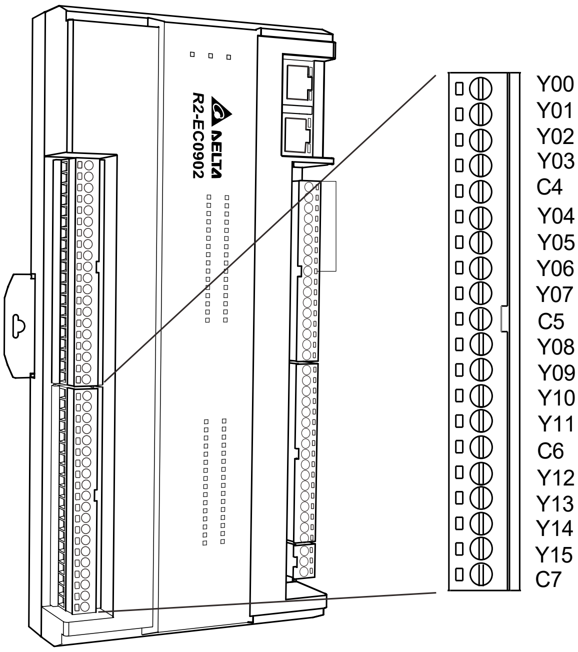



| Symbol | Description | Symbol | Description | Group Symbol |
|---|---|---|---|---|
| Y00 | 1st set of output of Port 2 | Y01 | 2nd set of output of Port 2 | C0* |
| Y02 | 3rd set of output of Port 2 | Y03 | 4th set of output of Port 2 | |
| Y04 | 5th set of output of Port 2 | Y05 | 6th set of output of Port 2 | C1* |
| Y06 | 7th set of output of Port 2 | Y07 | 8th set of output of Port 2 | |
| Y08 | 9th set of output of Port 2 | Y09 | 10th set of output of Port 2 | C2* |
| Y10 | 11th set of output of Port 2 | Y11 | 12th set of output of Port 2 | |
| Y12 | 13th set of output of Port 2 | Y13 | 14th set of output of Port 2 | C3* |
| Y14 | 15th set of output of Port 2 | Y15 | 16th set of output of Port 2 | |

Note: C0: Group 0 of relay common output port; C1: Group 1 of relay common output port; C2: Group 2 of relay common output port; C3: Group 3 of relay common output port.

■ I/O Port 3

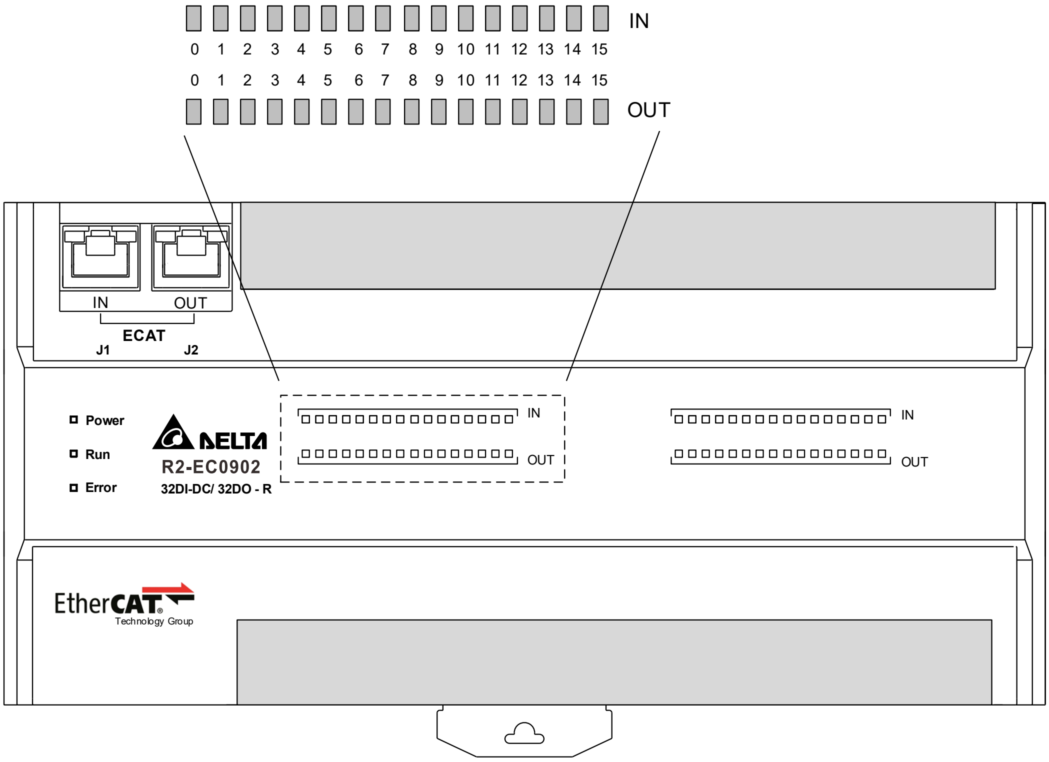
The pin definitions and descriptions of Port 3 for the R2-EC0902 model are as follows.




| Symbol | Description | Symbol | Description | Group Symbol |
|---|---|---|---|---|
| Y00 | 1st set of output of Port 3 | Y01 | 2nd set of output of Port 3 | C4* |
| Y02 | 3rd set of output of Port 3 | Y03 | 4th set of output of Port 3 | |
| Y04 | 5th set of output of Port 3 | Y05 | 6th set of output of Port 3 | C5* |
| Y06 | 7th set of output of Port 3 | Y07 | 8th set of output of Port 3 | |
| Y08 | 9th set of output of Port 3 | Y09 | 10th set of output of Port 3 | C6* |
| Y10 | 11th set of output of Port 3 | Y11 | 12th set of output of Port 3 | |
| Y12 | 13th set of output of Port 3 | Y13 | 14th set of output of Port 3 | C7* |
| Y14 | 15th set of output of Port 3 | Y15 | 16th set of output of Port 3 | |

Note: C4: Group 4 of relay common output port; C5: Group 5 of relay common output port; C6: Group 6 of relay common output port; C7: Group 7 of relay common output port.

The definitions of the IO Port 0 / Port 2 indicators for the R2-EC0902 model are as follows.



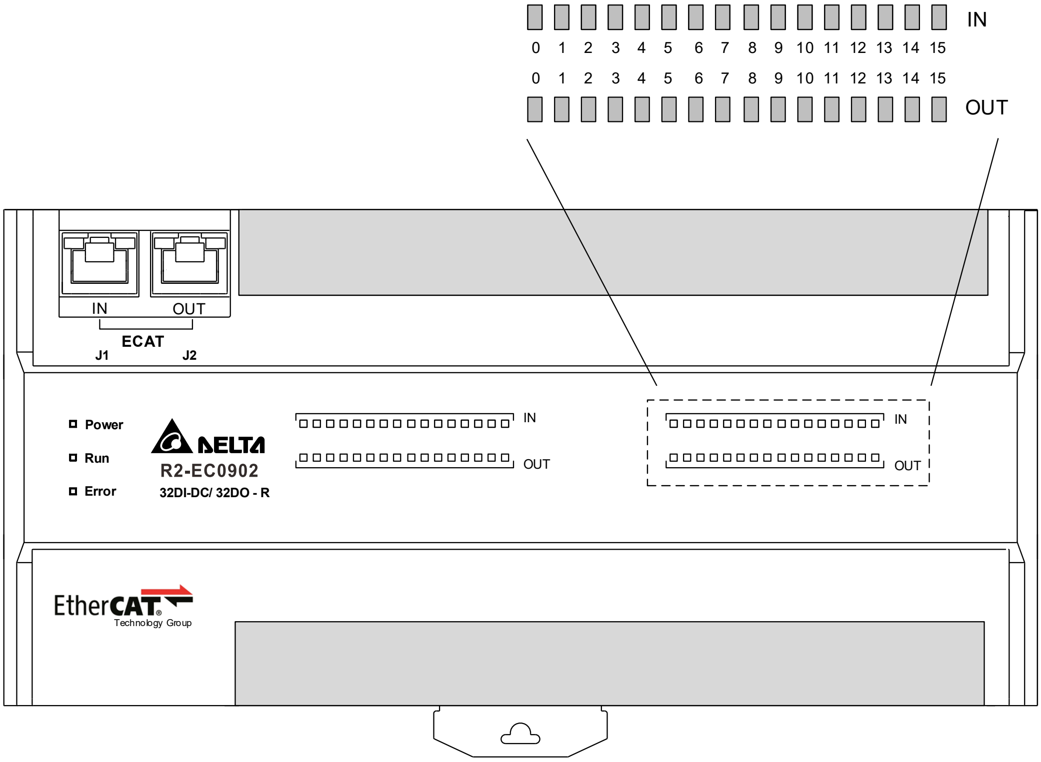

The indicator shows the status of the GPIO controller signal. A steady green light indicates the IO is activated.

| IN | | OUT | |
|---|---|---|---|
| Indicator pin | Corresponding IO port | Indicator pin | Corresponding IO port |
| 0 | X00 | 0 | Y00 |
| 1 | X01 | 1 | Y01 |
| 2 | X02 | 2 | Y02 |
| 3 | X03 | 3 | Y03 |
| 4 | X04 | 4 | Y04 |
| 5 | X05 | 5 | Y05 |
| 6 | X06 | 6 | Y06 |
| 7 | X07 | 7 | Y07 |
| 8 | X08 | 8 | Y08 |
| 9 | X09 | 9 | Y09 |
| 10 | X10 | 10 | Y10 |
| 11 | X11 | 11 | Y11 |
| 12 | X12 | 12 | Y12 |
| 13 | X13 | 13 | Y13 |
| 14 | X14 | 14 | Y14 |
| 15 | X15 | 15 | Y15 |

Note: when the output indicator is On, it only means that the output is activated by the controller. If the actual signal has no action, check whether the IO port is correctly connected.

2

The definitions of the IO Port 1 / Port 3 indicators for the R2-EC0902 model are as follows.

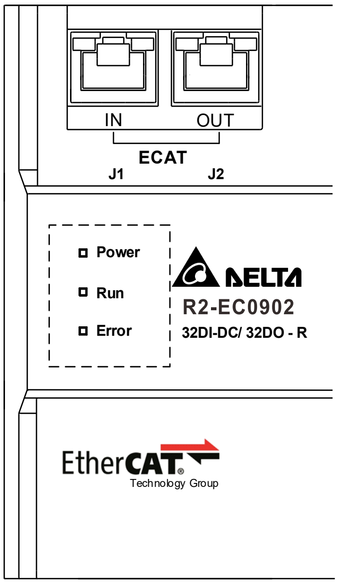



The indicator shows the status of the GPIO controller signal. A steady green light indicates the IO is activated.

| IN | | OUT | |
|---|---|---|---|
| Indicator pin | Corresponding IO port | Indicator pin | Corresponding IO port |
| 0 | X00 | 0 | Y00 |
| 1 | X01 | 1 | Y01 |
| 2 | X02 | 2 | Y02 |
| 3 | X03 | 3 | Y03 |
| 4 | X04 | 4 | Y04 |
| 5 | X05 | 5 | Y05 |
| 6 | X06 | 6 | Y06 |
| 7 | X07 | 7 | Y07 |
| 8 | X08 | 8 | Y08 |
| 9 | X09 | 9 | Y09 |
| 10 | X10 | 10 | Y10 |
| 11 | X11 | 11 | Y11 |
| 12 | X12 | 12 | Y12 |
| 13 | X13 | 13 | Y13 |
| 14 | X14 | 14 | Y14 |
| 15 | X15 | 15 | Y15 |

Note: when the output indicator is On, it only means that the output is activated by the controller. If the actual signal has no action, check whether the IO port is correctly connected.

The definitions of the module status indicators for the R2-EC0902 model are as follows. The module status indicators include the module power indicator (Power), the module communication indicator (Run), and the module error indicator (Error).

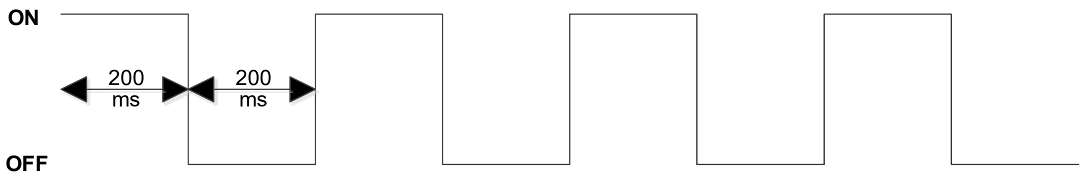



| Indicator | Status | Description |
|---|---|---|
| Power | ON | The external voltage 24 VDC of the module is normal. |
| | OFF | There is no voltage input, or the voltage is abnormal. |
| Run | OFF | Initialization status. |
| | Continuous flashing* | Safe Op mode. |
| | Single flashing* | Pre-Op mode. |
| | ON | Normal operation mode. |
| Error | Double flashing* | The connection is disconnected or abnormal. |
| | OFF | No error has occurred. |

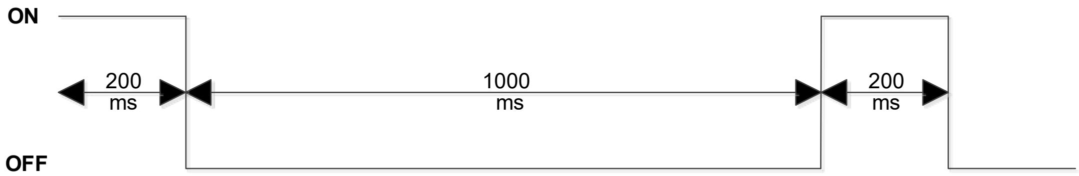
Note:

1. The Run indicator is a flashing green light.

   a. Continuous flashing: the flashing frequency is as shown in the following figure.

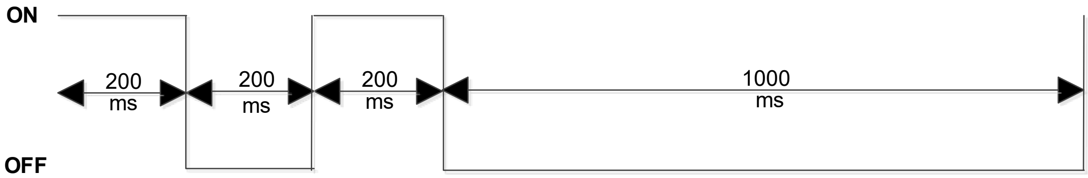



   b. Single flashing: the flashing frequency is as shown in the following figure.




2. The Error indicator is a flashing red light.

   Double flashing: the flashing frequency is as shown in the following figure.

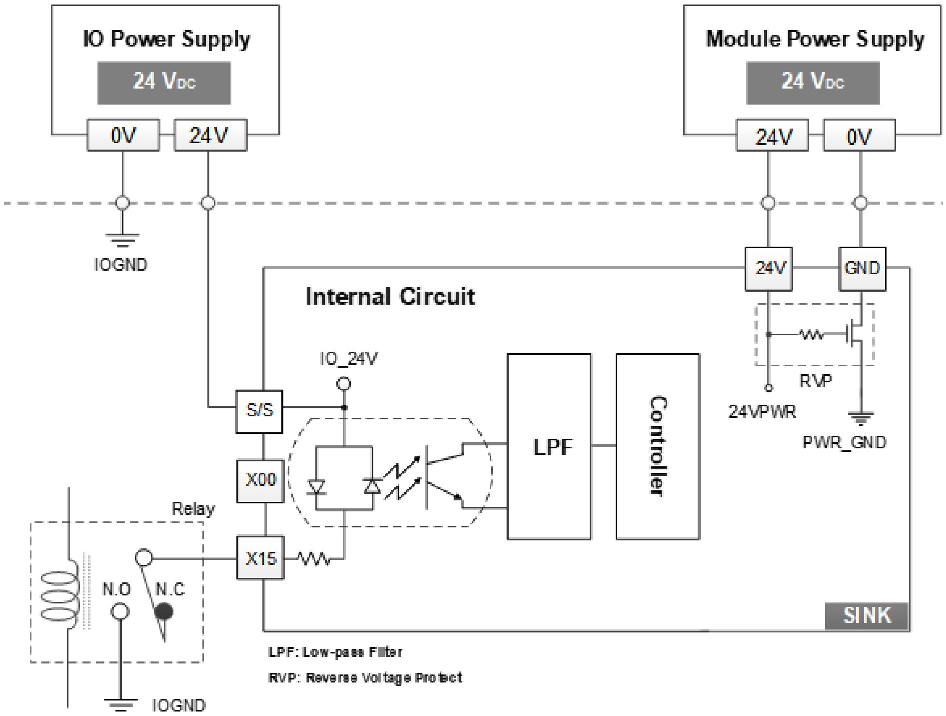


2

Input port wiring example

■ R2-EC0902 input port connected to NPN (SINK) type load

Isolate the IO power supply IO_24V / IOGND and module power supply 24V / GND circuits. The following example shows a single point (X15) input diagram, and the other 15 sets (X00 - X14) have the same input structure. Port 0 (X00 - X15) / Port 1 (X00 - X15) are the same control types (NPN or PNP). The rated voltage of the IO input port is 24 VDC @ 5.1 mA and the maximum operating power is 30 VDC. Do not input power supply exceeding 30 VDC or AC power to avoid damaging the module circuit.

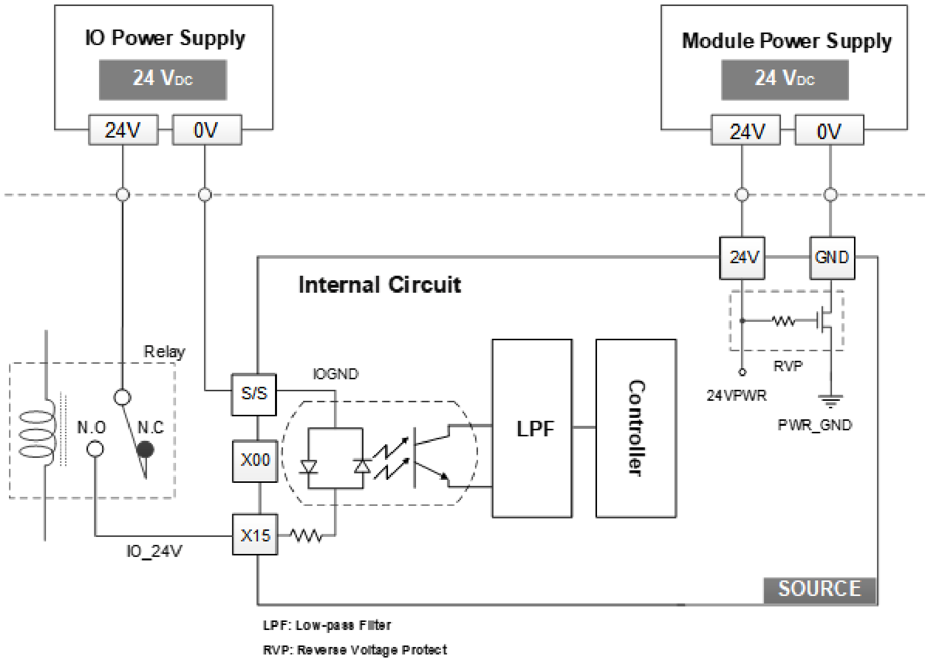


■ R2-EC0902 input port connected to PNP (SOURCE) type load

Isolate the IO power supply IO_24V / IOGND and module power supply 24V / GND circuits.

The following example shows a single point (X15) input diagram, and the other 15 sets (X00 - X14) have the same input structure. Port 0 (X00 - X15) / Port 1 (X00 - X15) are the same control types (NPN or PNP). The rated voltage of the IO input port is 24 VDC @ 5.1 mA and the maximum operating power is 30 VDC. Do not input power supply exceeding 30 VDC or AC power to avoid damaging the module circuit.



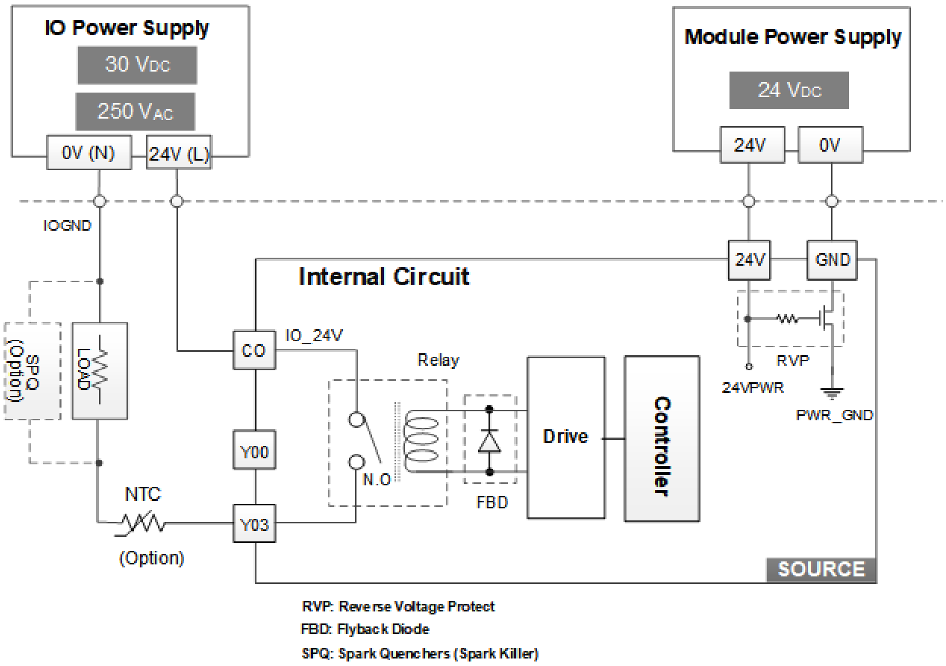


2

Output port wiring example

■ R2-EC0902 relay output port connected to the load

Isolate the IO power supply IO_24V / IOGND and module power supply 24V / GND circuits. When using a relay, connect a spark quencher (SPQ) in parallel according to the load requirements. This can prolong the life of the contacts and suppress contact sparks and surge voltage. When using an inductive load, the spark quencher can reduce the interference of the back electromotive force.

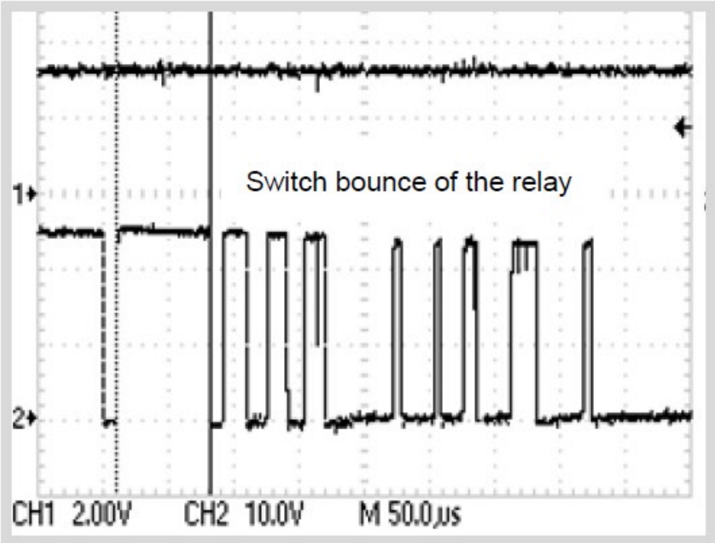



Note: use 24V & 0V wiring for VDC IO power supply; use L1 & L2 wiring for VAC IO power supply.

- Precautions for using relay output:

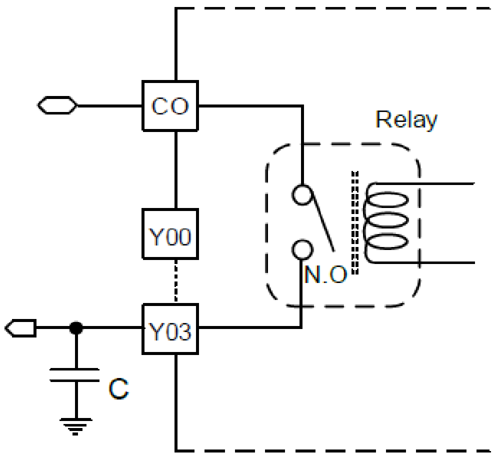
When the relay output switches to on, bouncing occurs because it is a mechanical action, as shown in the following figure.

For the load application, add a debounce circuit to avoid misoperation. For the digital logic application, add a software filter to avoid misinterpretation.




It is suggested to follow these items to avoid misoperation.

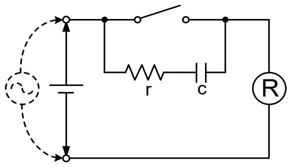
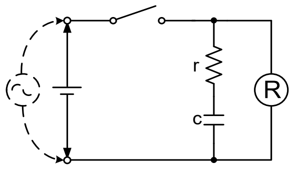
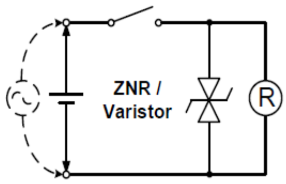
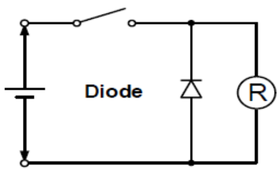
1. Set the hardware or software filter time to > 100 μs.
2. The hardware filter (debounce circuit) can use the external circuit to add an additional capacitor. The capacitance value is approximately 0.1 μF - 0.47 μF (calculated according to the current flowing through the load).
3. Use the spark quencher to reduce surge voltage shock and prevent bouncing.



■ Use of relay spark quencher

The use of spark quencher prolongs the life of the contacts, suppresses contact sparks and surge voltage, reduces interference, and reduces carbon deposition caused by contact electric arc.

The following table shows application examples of the spark quenchers. You can use these as references for modifying the corresponding circuit design.

| Simplified wiring diagram | Description |
|---|---|
|  | This circuit is included in the module.<br>(1) When in use, r should be greater than 10 ohm.<br>(2) When applying AC voltage, the load impedance ® should be smaller than the r and C impedances of the spark quencher.<br>r > 10 * ®<br>r = 33 Kohm, 1/2 W |
|  | Apply AC or DC power to the output port.<br>(1) When r is in use, it should equal the load impedance ®.<br>(2) When C is in use, its configuration should be 0.1 μF ~ 1 μF. Adjust the configuration value according to the load impedance. |
|  | Apply AC or DC power to the output port.<br>(1) When selecting a zener diode, it is suggested that the breakdown voltage is at least 2 times the applied voltage and the forward current value should be greater than the current flowing through the load impedance R.<br>VR (DIODE)_Min > 2* IO_VCC<br>(2) Or use a varistor to prevent high voltage from passing through the relay contact point from the application end. When selecting a varistor, the rating needs to be at least 1.5 times the application voltage. |
|  | Apply DC power only to the output port.<br>(1) When selecting a diode, it is suggested that the reverse withstand voltage is at least 10 times the applied voltage and the forward current value should be greater than the current flowing through the load impedance ®.<br>VR (DIODE)_Min > 3* IO_VCC<br>(2) If the applied voltage is 24V, the reverse withstand voltage of the diode should be above 75V. |

When the spark quencher is installed, it delays the release time of the relay. Check if any abnormal operation has occurred to the connected load application.

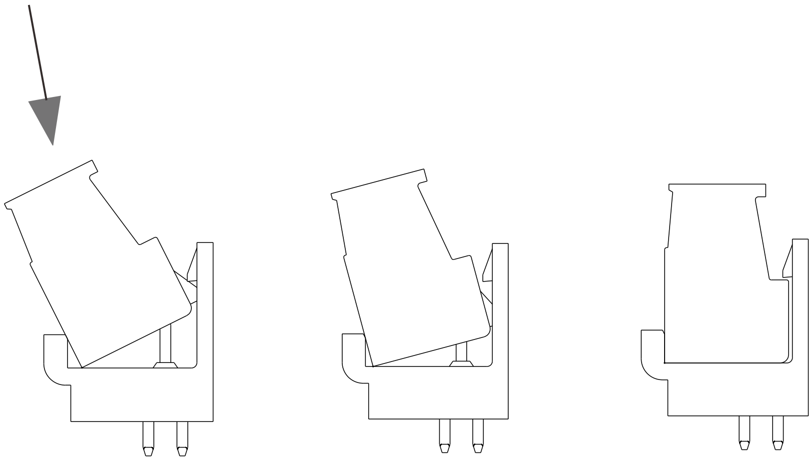
The assembly and disassembly steps for the R2-EC0902 connector are as follows.

- Assembly steps

Step 1: place the plug with a tilt angle into the socket and align the pins of the plug and the socket.

Step 2: press down the plug firmly until it snaps into place.

Step 3: make sure the plug is properly aligned with and fixed to the socket.



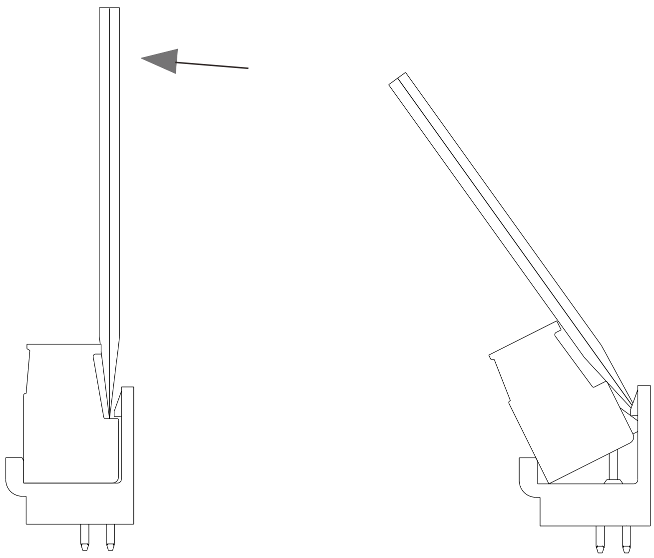
- Disassembly steps

Step 1: find the slot on top of the connector.

Step 2: insert the tip of the screwdriver to the slot.

Step 3: pry the plug gently away from the socket and the plug will loosen.

Step 4: take the plug out of the socket.



2

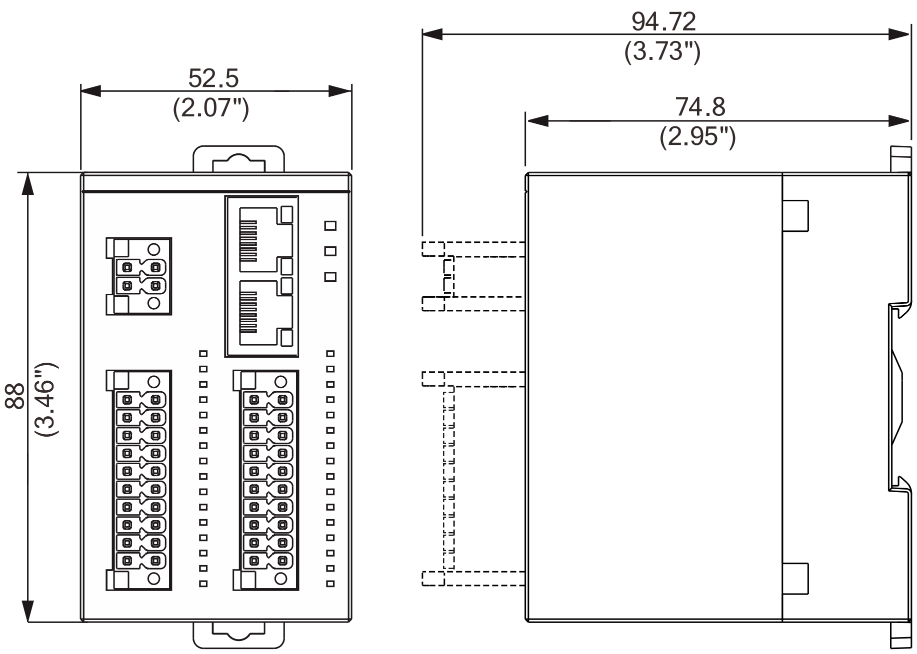
## 2.3.7 Remote digital input/output board module - R2-ECx004

R2-ECX004 model name explanation

R 2 - E C - x0 04
(1)(2) (3) (4) (5)

| No. | Item | Description | |
|---|---|---|---|
| (1) | Product type | R | Remote I/O Series |
| (2) | Product category | 2 | Board type |
| (3) | Bus type | EC | EtherCAT |
| (4) | Module type | 00 | Mixed I/O module |
| | | 10 | Input module |
| | | 20 | Output module |
| (5) | Module subtype | 04 | $24V_{DC}$ / 32-CH |

R2-ECX004 module dimension: 86 x 74.8 x 52.5 mm

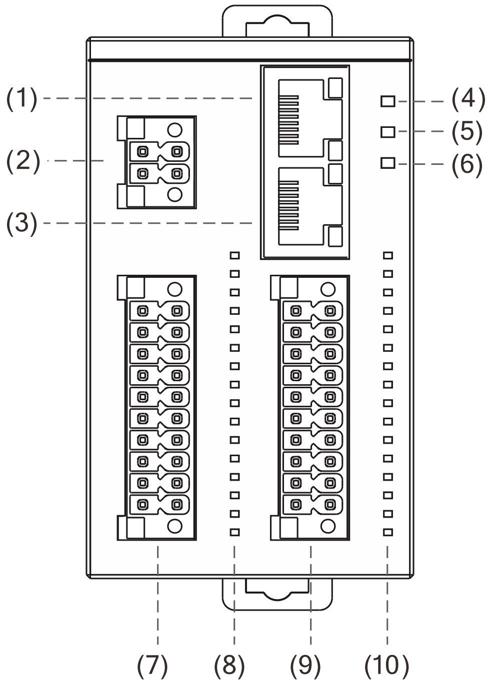



Unit: mm (inch)

■ Electrical specifications

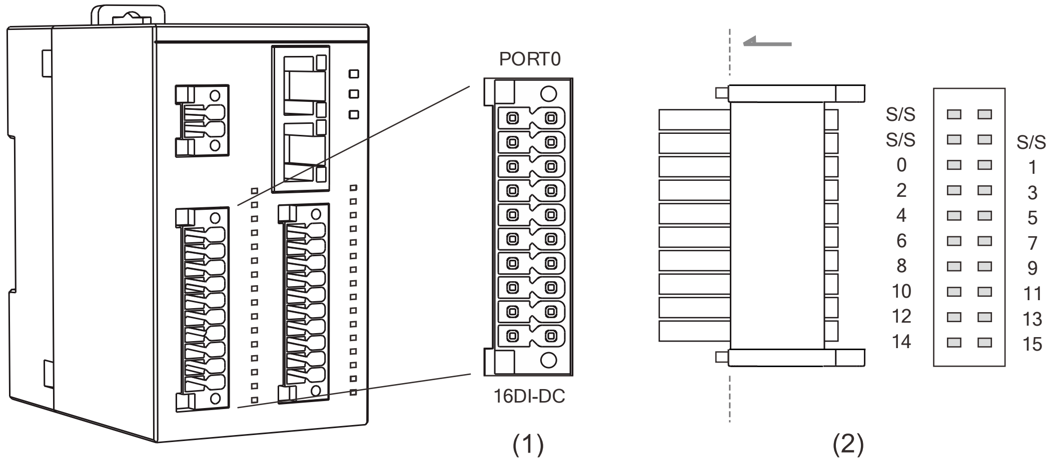
| Item | R2-EC0004 | | R2-EC1004 | R2-EC2004 |
|---|---|---|---|---|
| Power | 24 $V_{DC}$ -15% ~ +20% | | | |
| Module input current | < 1A | | | |
| Digital input / output | Digital input | Digital output | Digital input | Digital output |
| Isolation type | Optical coupling | Optical coupling | Optical coupling | Optical coupling |
| Signal type | Sink / Source | Sink | Sink / Source | Sink |
| Number of I/O points | 16-CH | 16-CH | 32-CH | 32-CH |
| I/O rated input power | 24 $V_{DC}$@5.1mA | 200 mA per CH | 24 $V_{DC}$@5.1mA | 200 mA per CH |
| I/O rated input power | 24 $V_{DC}$ | 24 $V_{DC}$ | 24 $V_{DC}$ | 24 $V_{DC}$ |
| Operating frequency | ≤ 1 kHz | ≤ 1 kHz | ≤ 1 kHz | ≤ 1 kHz |
| Operation time (OFF > ON) | 300 μs | 85 μs | 300 μs | 85 μs |
| Release time (ON > OFF) | 300 μs | 110 μs | 300 μs | 110 μs |
| Outer dimensions | 52.5 x 74.8 x 88.0 mm (W x H x D) | | | |
| Weight | 0.25kg (0.55lbs) | | | |
| Permissible atmospheric pressure | Operation: -20°C ~ 60°C (-4°F ~ 140°F) ;<br>Storage: -40°C ~ 70°C (-40°F ~ 158°F) | | | |
| Mounting type | DIN rail mounting | | | |
| Vibration resistance / Shock resistance | Conforms to EN 60068-2-6 / EN 60068-2-27/29 | | | |
| Electromagnetic compatibility / Noise immunity | ESD (IEC 61131-2, IEC 61000-4-2)<br>EFT (IEC 61131-2, IEC 61000-4-4)<br>RS (IEC 61131-2, IEC 61000-4-3) | | | |
| IP rating | IP20 | | | |
| Approvals | CE | | | |

- The following describes the product interface of the R2-ECx004 series models.




| No. | Description | | |
|---|---|---|---|
| (1) | EtherCAT input port (connection status indicator included) | | |
| (2) | Module power port | | |
| (3) | EtherCAT output port (connection status indicator included) | | |
| (4) | Module power indicator (PWR) | | |
| (5) | Module communication indicator (RUN) | | |
| (6) | Module error indicator (ERR) | | |
| (7) | Port 0 | Input port | R2-EC0004, R2-EC1004 |
| | | Output port | R2-EC2004 |
| (8) | Port 0 status indicators | | |
| (9) | Port | Input port | R2-EC1004 |
| | | Output port | R2-EC0004, R2-EC2004 |
| (10) | Port 1 status indicators | | |

■ Definitions of Port 0 for R2-EC0004 and R2-EC1004 models are as follows.



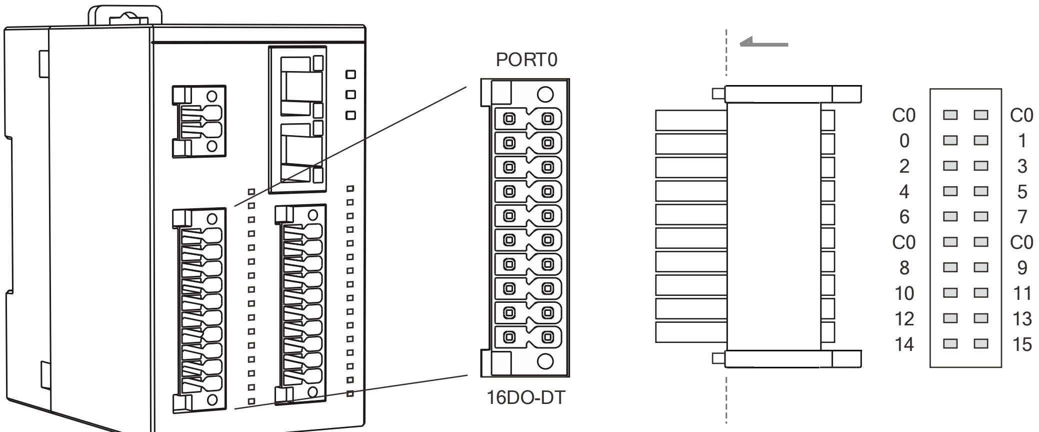

(1) (2)

| Pin | Description | Pin | Description |
|---|---|---|---|
| S/S* | Common input point (NPN / PNP type) | - | Reserved (no function) |
| S/S* | Common input point (NPN / PNP type) | S/S* | Common input point (NPN / PNP type) |
| 0 | 1st input of Port 0 | 1 | *2nd input of Port 0* |
| 2 | 3rd input of Port 0 | 3 | 4th input of Port 0 |
| 4 | 5th input of Port 0 | 5 | 6th input of Port 0 |
| 6 | 7th input of Port 0 | 7 | 8th input of Port 0 |
| 8 | 9th input of Port 0 | 9 | 10th input of Port 0 |
| 10 | 11th input of Port 0 | 11 | 12th input of Port 0 |
| 12 | 13th input of Port 0 | 13 | 14th input of Port 0 |
| 14 | 15th input of Port 0 | 15 | 16th input of Port 0 |

Note: S/S is the common input point for connecting the NPN type or PNP type load. When an NPN type load is connected, S/S functions as Vcc. When a PNP type load is connected, S/S functions as GND.

2

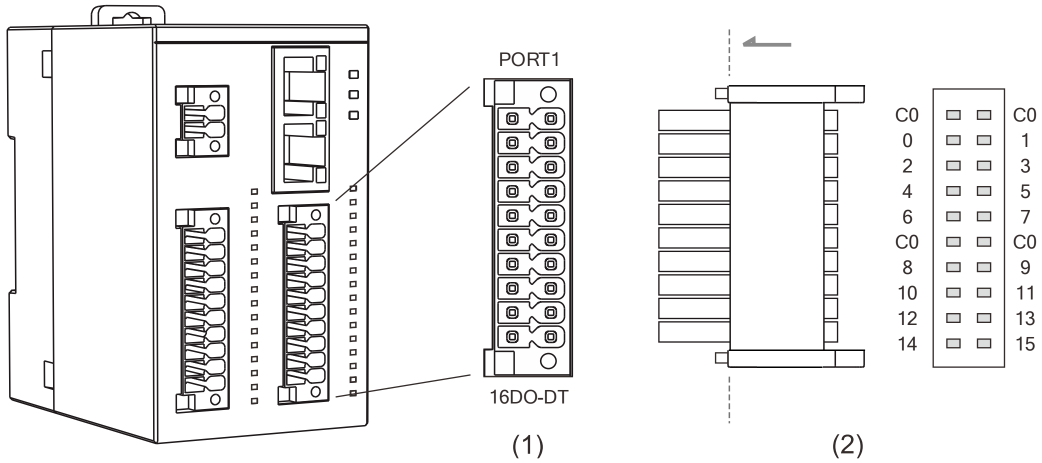
- Definitions of Port 0 for R2-EC2004 models are as follows.




(1) (2)

| Pin | Description | Pin | Description |
|---|---|---|---|
| C0 | Common output point (NPN type) | C0 | Common output point (NPN type) |
| 0 | 1st output of Port 0 | 1 | 2nd output of Port 0 |
| 2 | 3rd output of Port 0 | 3 | 4th output of Port 0 |
| 4 | 5th output of Port 0 | 5 | 6th output of Port 0 |
| 6 | 7th output of Port 0 | 7 | 8th output of Port 0 |
| C0 | Common output point (NPN type) | C0 | Common output point (NPN type) |
| 8 | 9th output of Port 0 | 9 | 10th output of Port 0 |
| 10 | 11th output of Port 0 | 11 | 12th output of Port 0 |
| 12 | 13th output of Port 0 | 13 | 14th output of Port 0 |
| 14 | 15th output of Port 0 | 15 | 16th output of Port 0 |

■ Definitions of Port 1 for R2-EC0004 and R2-EC2004 models are as follows.

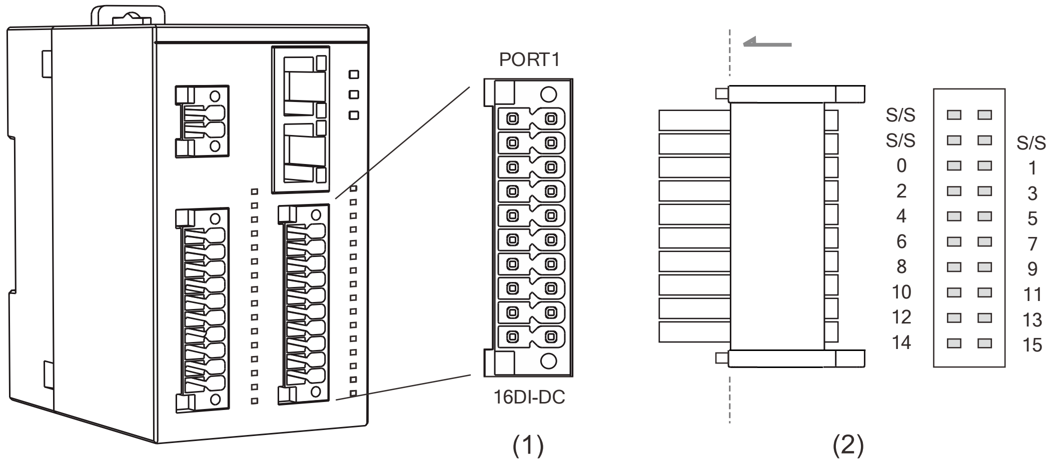



(1) (2)

| Pin | Description | Pin | Description |
|---|---|---|---|
| C0 | Common output point (NPN type) | C0 | Common output point (NPN type) |
| 0 | 1st output of Port 0 | 1 | 2nd output of Port 0 |
| 2 | 3rd output of Port 0 | 3 | 4th output of Port 0 |
| 4 | 5th output of Port 0 | 5 | 6th output of Port 0 |
| 6 | 7th output of Port 0 | 7 | 8th output of Port 0 |
| C0 | Common output point (NPN type) | C0 | Common output point (NPN type) |
| 8 | 9th output of Port 0 | 9 | 10th output of Port 0 |
| 10 | 11th output of Port 0 | 11 | 12th output of Port 0 |
| 12 | 13th output of Port 0 | 13 | 14th output of Port 0 |
| 14 | 15th output of Port 0 | 15 | 16th output of Port 0 |

2

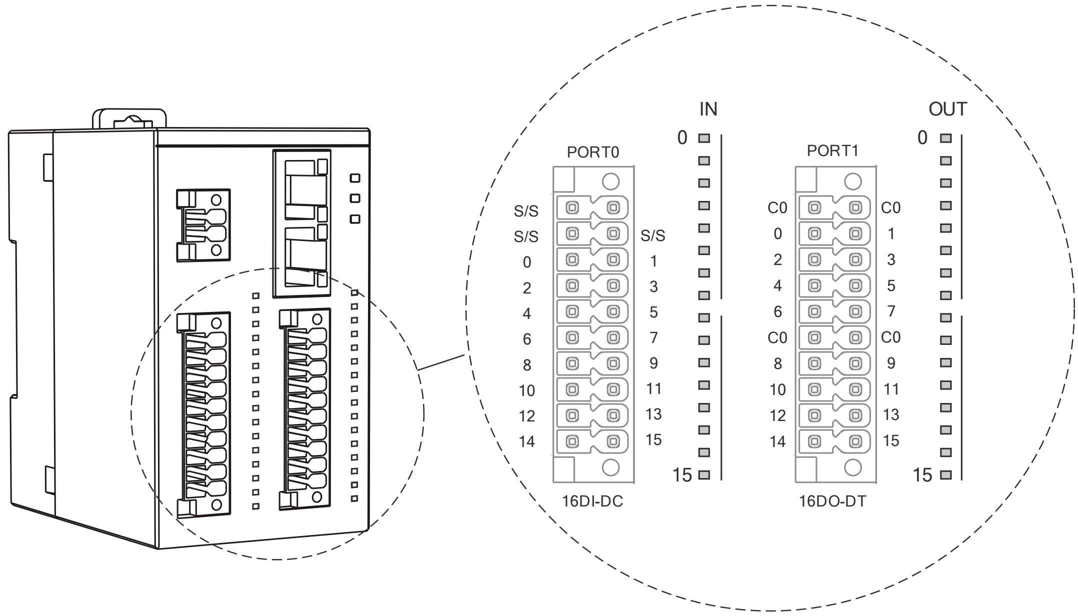
■ Definitions of Port 1 for R2-EC1004 models are as follows.




| Pin | Description | Pin | Description |
|---|---|---|---|
| S/S* | Common input point (NPN / PNP type) | - | Reserved (no function) |
| S/S* | Common input point (NPN / PNP type) | S/S* | Common input point (NPN / PNP type) |
| 0 | 1st input of Port 0 | 1 | 2nd input of Port 0 |
| 2 | 3rd input of Port 0 | 3 | 4th input of Port 0 |
| 4 | 5th input of Port 0 | 5 | 6th input of Port 0 |
| 6 | 7th input of Port 0 | 7 | 8th input of Port 0 |
| 8 | 9th input of Port 0 | 9 | 10th input of Port 0 |
| 10 | 11th input of Port 0 | 11 | 12th input of Port 0 |
| 12 | 13th input of Port 0 | 13 | 14th input of Port 0 |
| 14 | 15th input of Port 0 | 15 | 16th input of Port 0 |

Note: S/S is the common input point for connecting to the NPN type or PNP type load. When an NPN type load is connected, S/S functions as Vcc. When a PNP type load is connected, S/S functions as GND.

■ Definitions of the LED indicators for Port 0 and Port 1 of the R2-EC0004 series models are as follows.

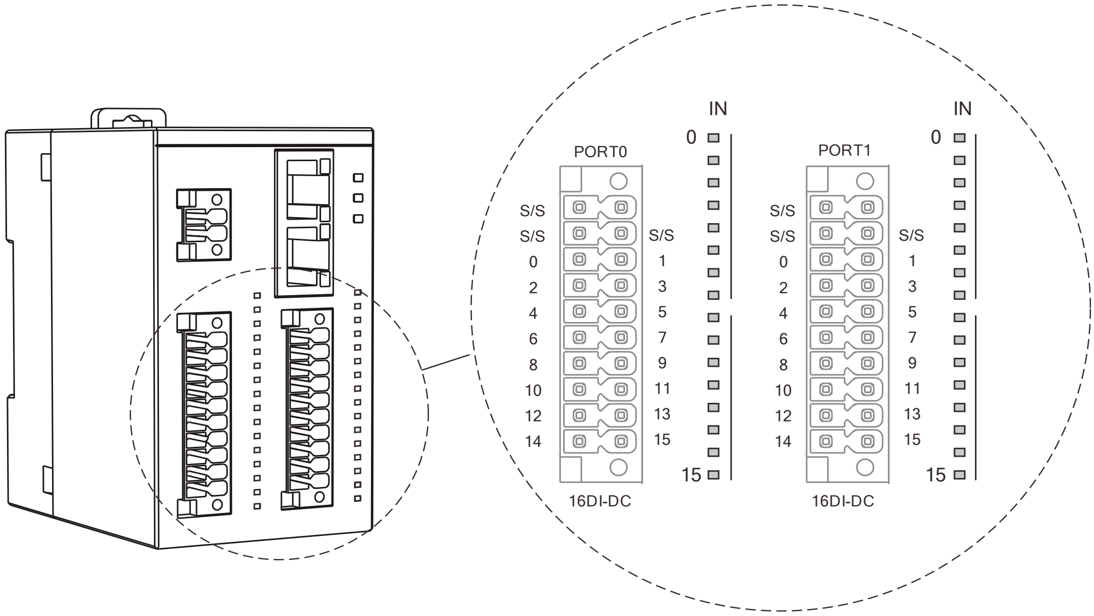



The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

| IN Port 0 | | OUT Port 1 | |
|---|---|---|---|
| Indicator No. | Corresponding IO port | Indicator No. | Corresponding IO port |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |
| 10 | 10 | 10 | 10 |
| 11 | 11 | 11 | 11 |
| 12 | 12 | 12 | 12 |
| 13 | 13 | 13 | 13 |
| 14 | 14 | 14 | 14 |
| 15 | 15 | 15 | 15 |

Note: the LED indicator turns on when the controller activates the inputs / outputs. If the actual signal is not on, check for the wiring.

- Definitions of the LED indicators for Port 0 and Port 1 of the R2-EC1004 series models are as follows.

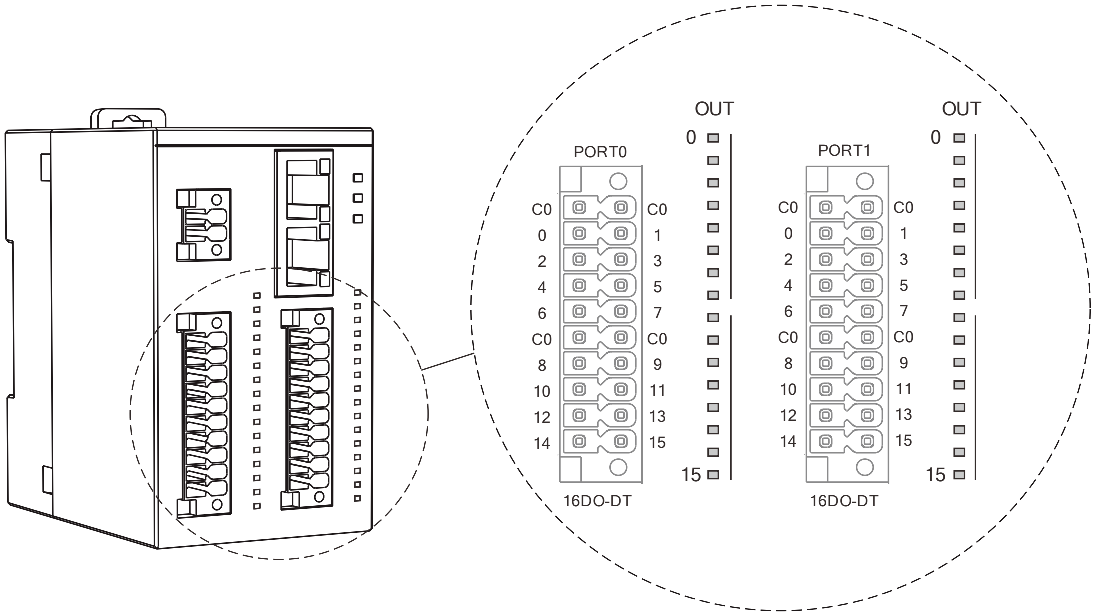



The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

| IN PORT 0 | | IN PORT 1 | |
|---|---|---|---|
| Indicator No. | Corresponding IO port | Indicator No. | Corresponding IO port |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |
| 10 | 10 | 10 | 10 |
| 11 | 11 | 11 | 11 |
| 12 | 12 | 12 | 12 |
| 13 | 13 | 13 | 13 |
| 14 | 14 | 14 | 14 |
| 15 | 15 | 15 | 15 |

Note: the LED indicator turns on when the controller activates the inputs / outputs. If the actual signal is not on, check for the wiring.

- Definitions of the LED indicators for Port 0 and Port 1 of the R2-EC2004 series models are as follows.



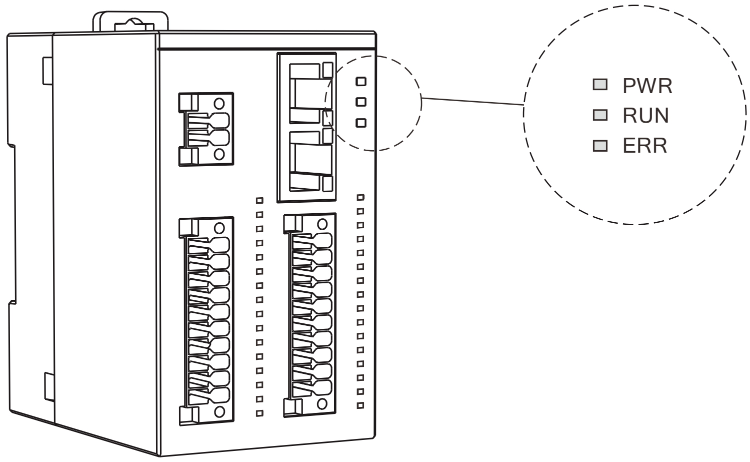

The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

| OUT Port 0 | | OUT Port 1 | |
|---|---|---|---|
| Indicator No. | Corresponding IO port | Indicator No. | Corresponding IO port |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |
| 10 | 10 | 10 | 10 |
| 11 | 11 | 11 | 11 |
| 12 | 12 | 12 | 12 |
| 13 | 13 | 13 | 13 |
| 14 | 14 | 14 | 14 |
| 15 | 15 | 15 | 15 |

Note: the LED indicator turns on when the controller activates the inputs / outputs. If the actual signal is not on, check for the wiring.

2

Definitions of the LED indicators for the module status of the R2-ECx004 series models are as follows.



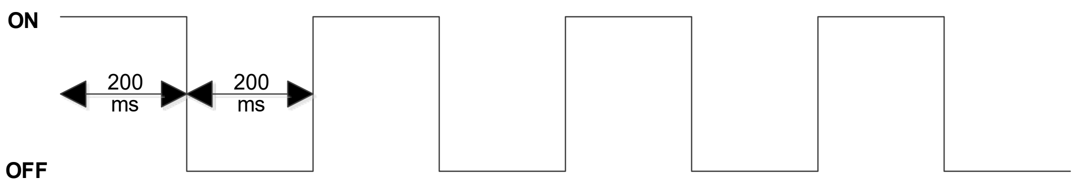

The module status indicators include module power indicator (PWR), module communication status indicator (RUN), and module error indicator (ERR).

| Indicator name | Indicator status | Description |
|---|---|---|
| PWR | ON | The external power of 24 VDC is supplied. |
| | OFF | No voltage input or voltage error. |
| RUN | OFF | Init state (initialization) |
| | Continuous flashing*1 | Safe-operational state. |
| | Single flashing*1 | Pre-operational state. |
| | ON | Operation state (normal operation) |
| ERR | Double flashing*2 | Disconnection or connection is in error. |
| | OFF | No error occurs. |

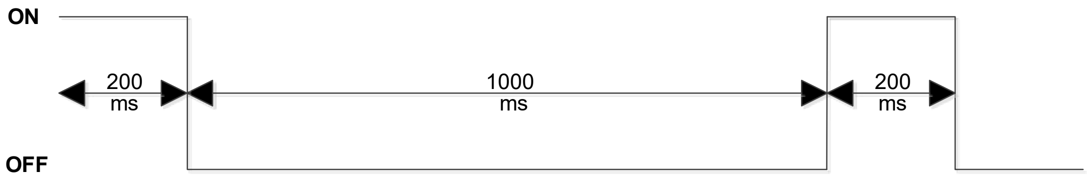
Note:

1. The Run indicator is a flashing green light.

   a. Continuous flashing: the flashing frequency is as shown in the following figure.

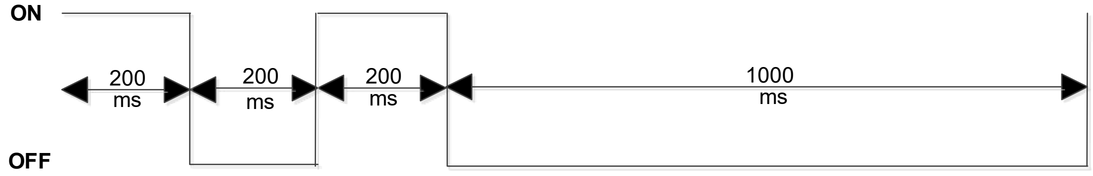



   b. Single flashing: the flashing frequency is as shown in the following figure.



2. The Error indicator is a flashing red light.

Double flashing: the flashing frequency is as shown in the following figure.



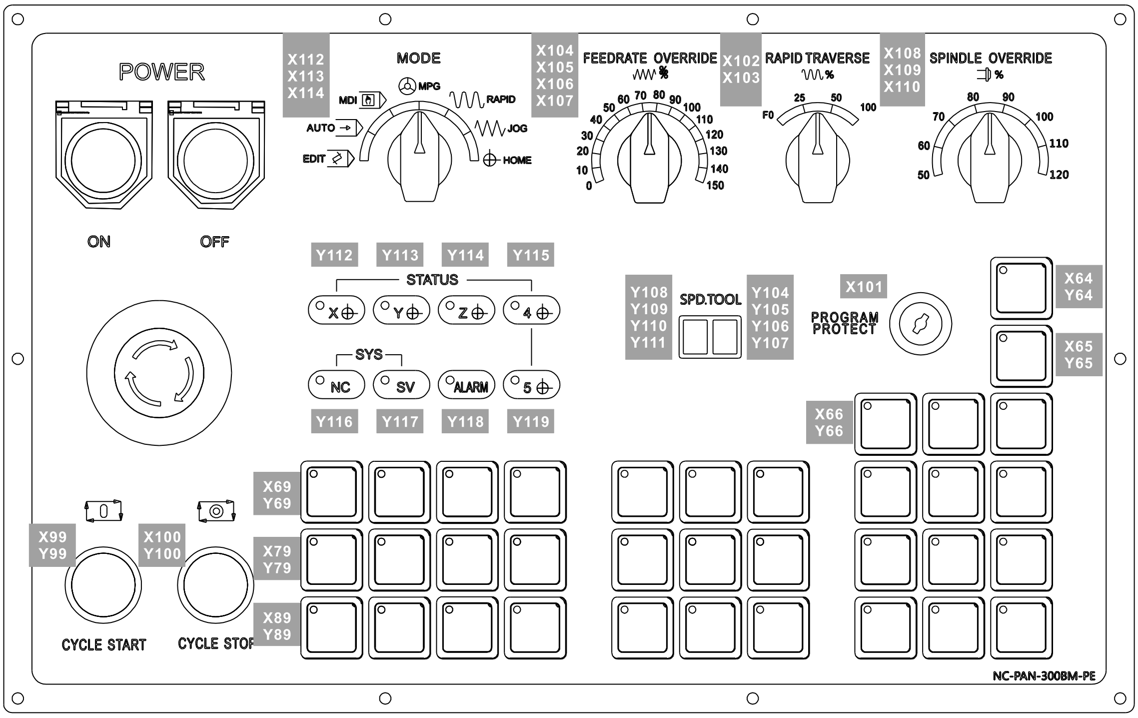
2

## 2.4 Operation panel I/O connector

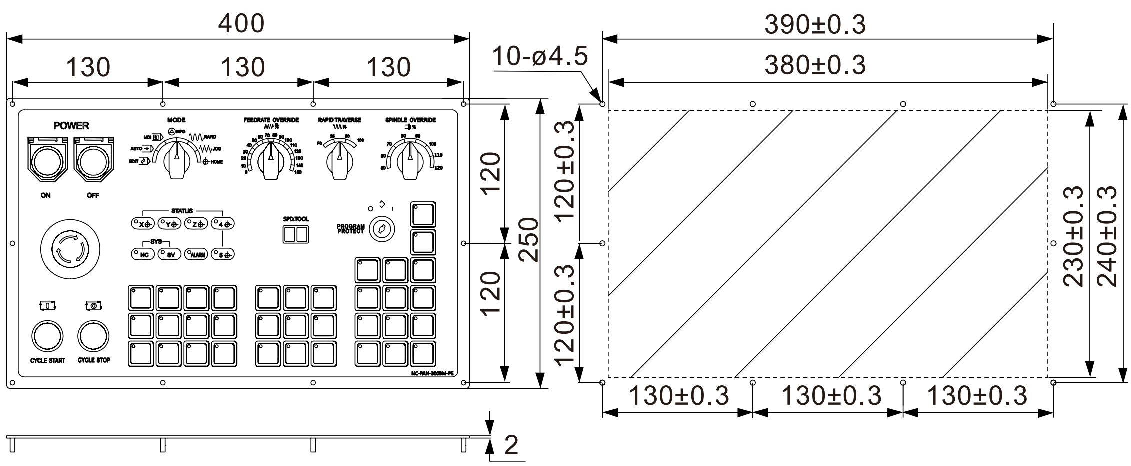
The I/O SCAN connector on the NC5 series controller can be compatible with NC3 series' 2nd operation panel. The 2nd operation panel provides horizontal and vertical two different type of model. Furthers, both of these two types of panels have 8" and 10" two different sizes for users.

- NC-PAN-300BM-PE: 2nd operation panel of horizontal type for 8" model controller.

2nd operation panel outline for 8" model and MLC relays of each button and status light.

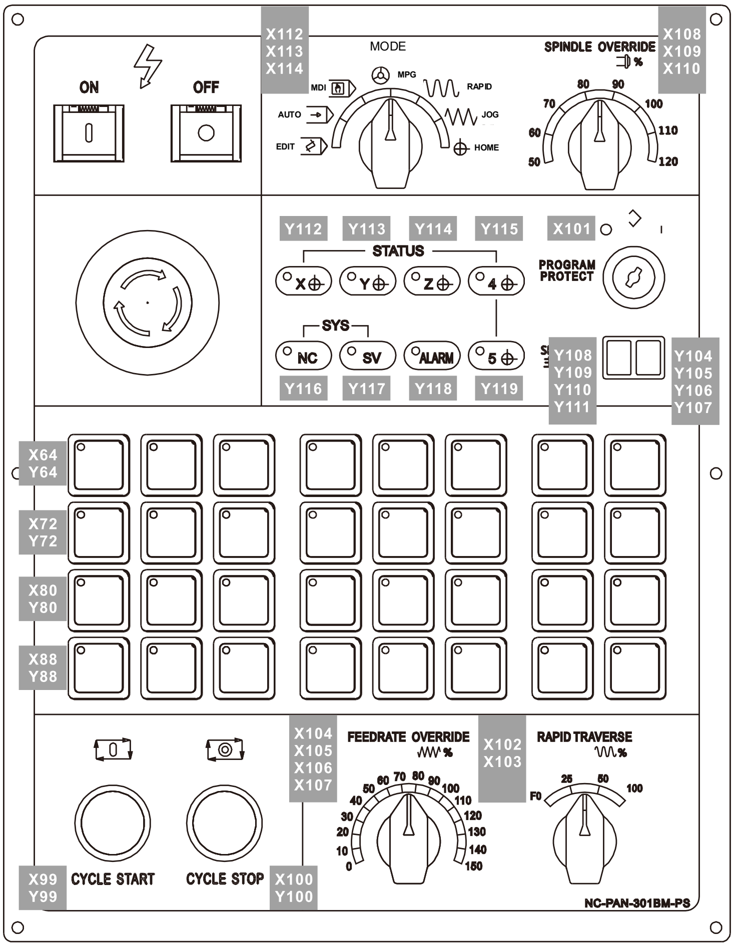



Mounting dimension of 2nd operation panel for 8" horizontal type model.

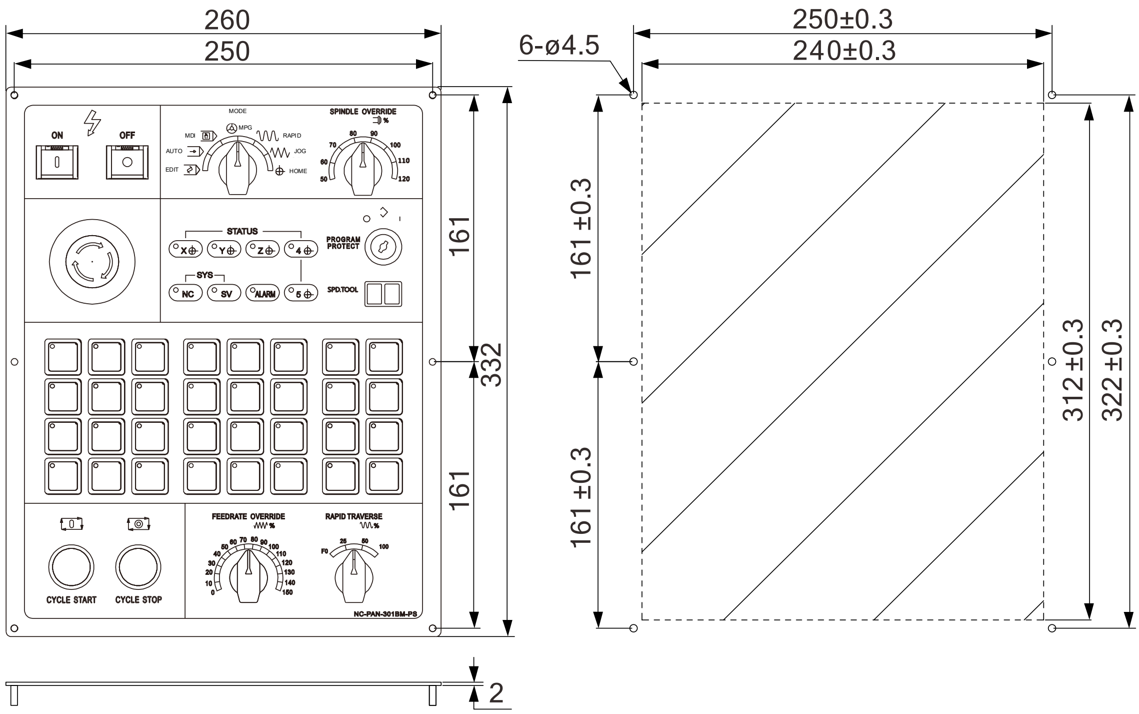


- NC-PAN-301BM-PE: 2nd operation panel of vertical type for 8” model controller.

2nd operation panel outline for 8” model and MLC relays of each button and status light.



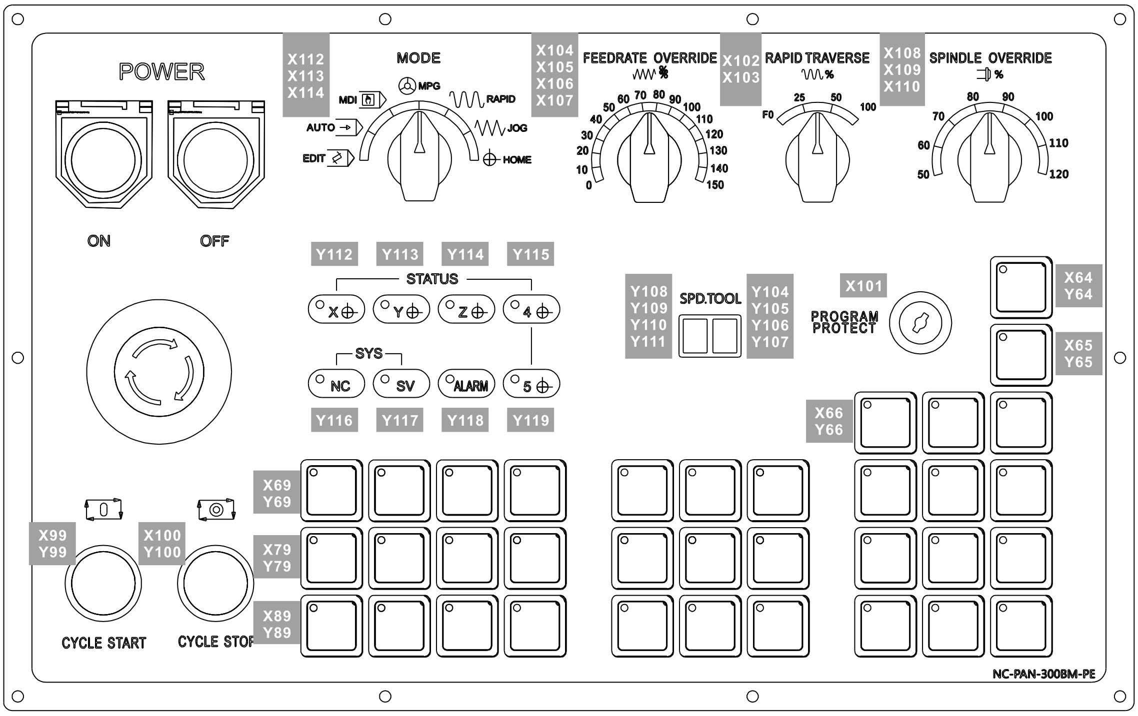

Mounting dimension of 2nd operation panel for 8” vertical type model.



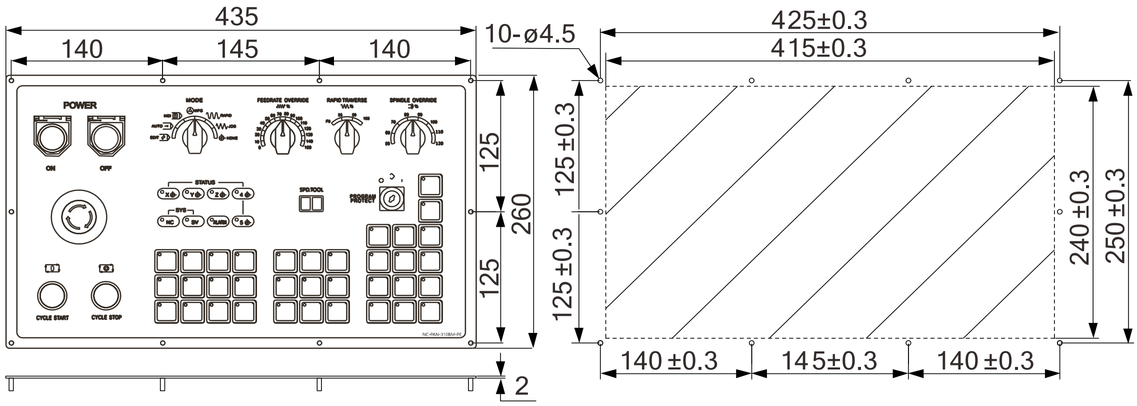
2

- NC-PAN-310BM-PE: 2nd operation panel of horizontal type for 10” model controller.

2nd operation panel outline for 10” model and MLC relays of each button and status light.

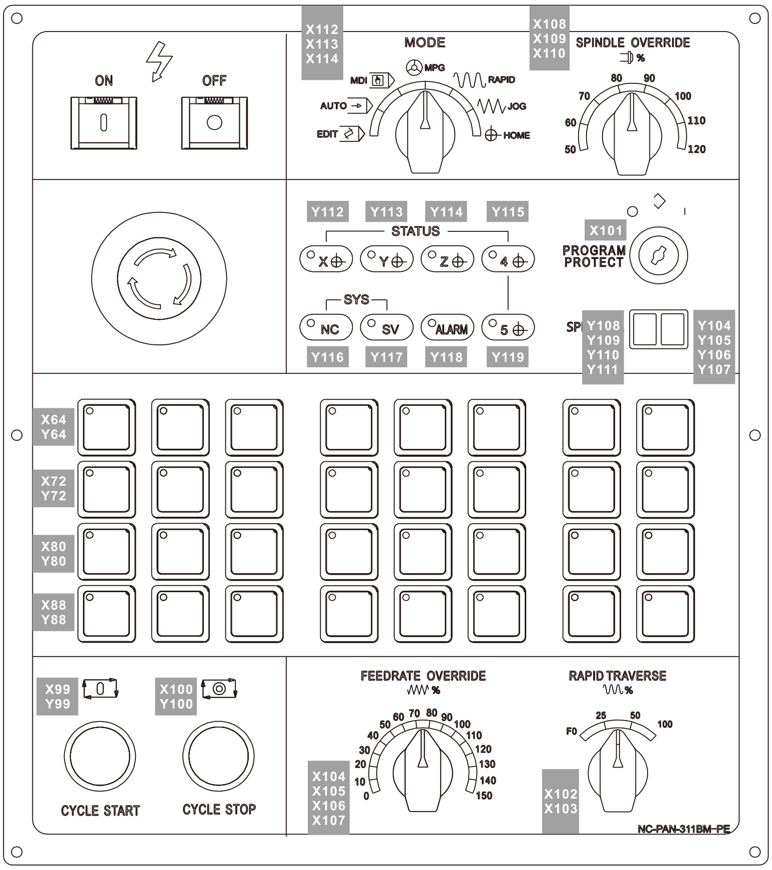



Mounting dimension of 2nd operation panel for 10” horizontal type model.

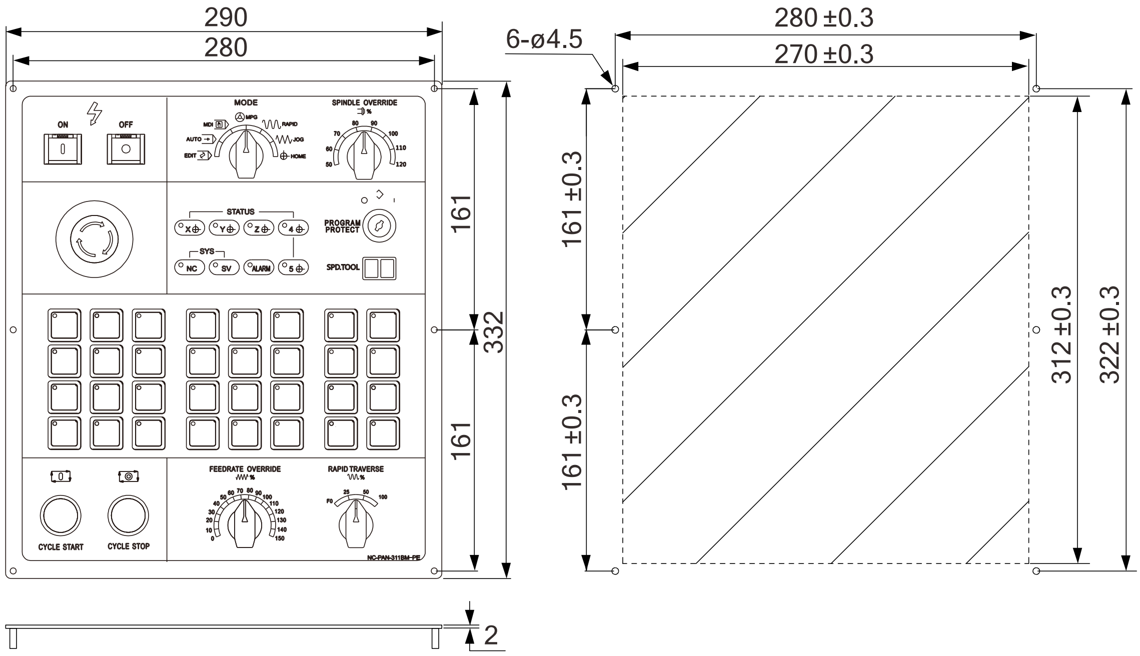


■ NC-PAN-311BM-PE: 2nd operation panel of vertical type for 10” model controller.

2nd operation panel outline for 10” model and MLC relays of each button and status light.

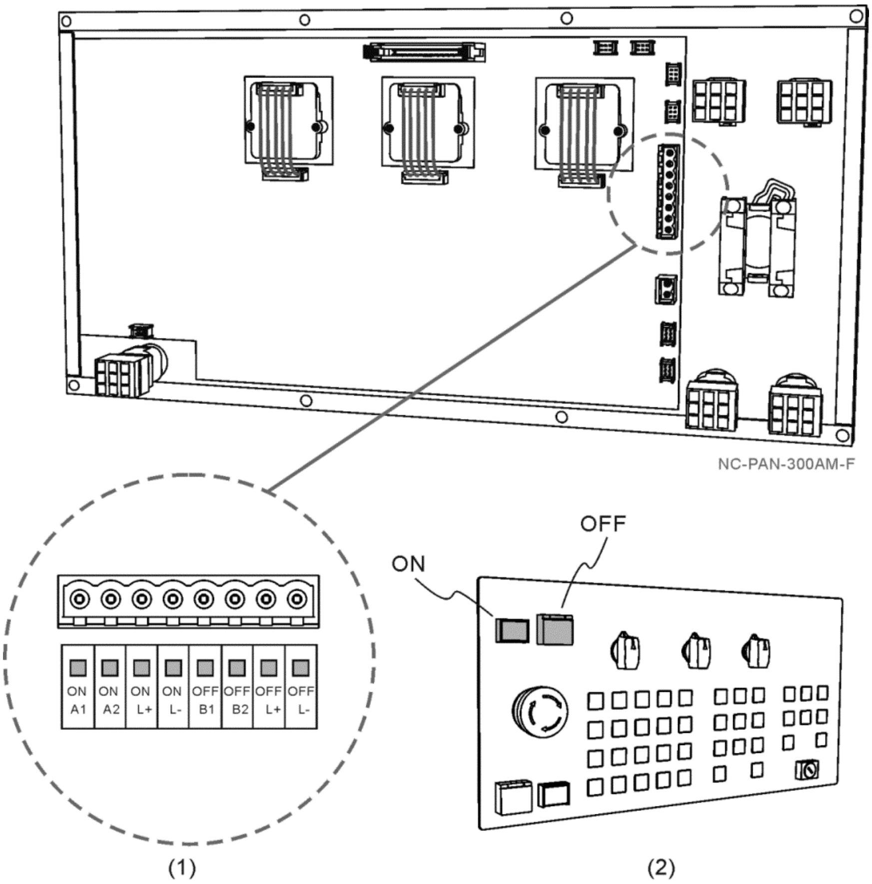



Mounting dimension of 2nd operation panel for 10” vertical type model.



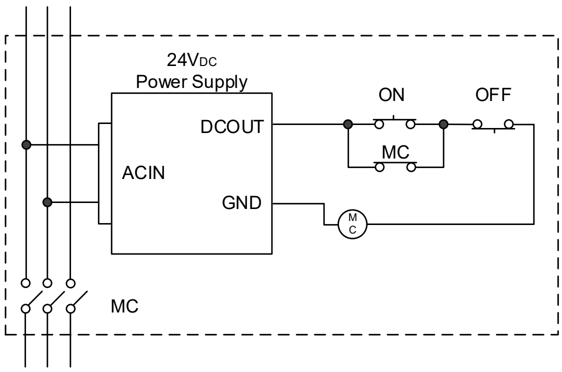
2

- Wiring of the Power On / Power Off switches




- Description of the connector

The power indicator requires a 24 VDC system; to light up the Power On indicator, +24 VDC power must be inputted to the ONL+ pin and 0V must be inputted to the ONL- pin; to light up the Power Off indicator, +24 VDC must be inputted to the OFFL+ pin and 0V must be inputted to the OFFL- pin.




When the Power On key is pressed, the circuit between ONA1 and ONA2 is closed; when the Power Off key is pressed, the circuit between OFFB1 and OFFB2 is open.

# Introduction of NC System Operation 3

This chapter introduce the operation interfaces and functions in the NC5 controller for users to quickly view all of the details.

# 3.1 System group function table

## 3.1.1 System group table list

| Position (POS) function (Ctrl + F1) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| ABS<br>(absolute coordinates) | - | - | - |
| REL<br>(the clear function of the corresponding axis is available only when the axis connected) | - | - | - |
| MECH<br>(machine coordinates) | - | - | - |
| REL. Clear<br>(the clear function of the corresponding axis is available only when the axis connected) | CLR ALL | - | - |
| | CLR X | - | - |
| | CLR Y | - | - |
| | CLR Z | - | - |
| View Switch<br>(Two channel display/<br>One channel display) | - | - | - |

| Program (PRG) function (Ctrl + F2) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Seed Setup<br>(Spindle speed setup) | - | - | - |
| File Manage | → | - | - |
| | ← | - | - |
| | Date Sort | - | - |
| | Select<br>(Select or Unselect) | - | - |
| | New File | - | - |
| | Rename | - | - |
| | Sort | - | - |
| | New Folder | - | - |
| | Copy | - | - |
| | Paste | - | - |
| | Delete | - | - |
| | All Select | - | - |
| | All Cancel | - | - |
| | Exit | - | - |

| Program (PRG) function (Ctrl + F2) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| File Edit | Save | | |
| | Undo | | |
| | Redo | - | - |
| | Copy | - | - |
| | Paste | - | - |
| | Delete | - | - |
| | Block Start | - | - |
| | Block End | - | - |
| | All Select | - | - |
| | Line Search | - | - |
| | Find String | - | - |
| Search Execute (Search and execute) | - | - | - |
| MDI Input | Clear | - | - |
| | Close | | |
| B.G. Edit (Background Edit) | File Manage | Copy | - |
| | | Paste | - |
| | | Delete | - |
| | | Select (Select or Unselect) | - |
| | | All Cancel | - |
| | | All Select | - |
| | | Sort | - |
| | | New File | - |
| | | New Folder | - |
| | | Rename | - |
| | | Close | - |
| | Load | - | - |
| | Save | - | - |
| | Copy | - | - |
| | Paste | - | - |
| | Delete | | - |
| | Block Start | | - |
| | Block End | - | - |
| | All Select | - | - |
| | Line Search | - | - |
| | Find String | - | - |
| | Undo | - | - |
| | Redo | - | - |

3

| Program (PRG) function (Ctrl + F2) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Teach Edit | G00 | - | - |
| | G01 | - | - |
| | G02/G03 | - | - |
| | Delete | - | - |
| | Save | - | - |
| | New File | - | - |
| | Setup | - | - |
| | Undo | - | - |
| DXF Convert | Date Sort | - | - |
| | Sel. /Canc.<br>(Select or Cancel) | - | - |
| | Delete | - | - |
| | All Select | - | - |
| | All Cancel | - | - |
| | Rename | - | - |
| | New Process | - | - |
| | Delete | - | - |
| | Copy | - | - |
| | Paste | - | - |
| | Convert | - | - |
| | Move Up | - | - |
| | Move Down | - | - |
| | Rename | - | - |

| Offset (OFS) Function (Ctrl + F3) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Coordinate | Set All | | |
| | Set | | |
| | Inc.Set | - | - |
| | All Clear | - | - |
| | Center | 1st Point | - |
| | | 2nd Point | - |
| | | Set | - |
| | Rectangle Center | X1 | - |
| | | X2 | - |
| | | Y1 | - |
| | | Y2 | - |
| | | Set | - |
| | | Z Input | - |
| | Circle Center | P1 | - |
| | | P2 | - |
| | | P3 | - |
| | | Set | - |
| | | Z Input | - |
| | MPG Offset | Clear | - |
| Tool | Inc. Set (Incremental Set) | - | - |
| | Set Length | - | - |
| | Clear | Geometric | - |
| | | Single (Single Axis) | - |
| | | R (Radius) | - |
| | | Wear | |
| | | Life | - |
| | | All | |
| Magazine | Reset All | - | - |
| | Lock | - | - |
| | Unlock | - | - |
| | Magazine 2 (Switching Magazine 1 or 2) | - | - |
| Macro Var. (Macro Variable) | Local Var. | - | - |
| | Global Var. | - | - |
| | Hold Var. (Retentive Variable) | - | - |

3

| Offset (OFS) Function (Ctrl + F3) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Macro Var. (Macro Variable) | Extend Var. | - | - |
| | MECH. Set (Machine Set) | - | |
| | ABS. Set (Absolute Set) | - | |

All system modes are available.

| Diagnostic (DGN) Function (Ctrl + F4) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Stock Set | Clear Time | - | - |
| | Clear Stock | - | - |
| | Close | - | - |
| User Var. | Delete | | |
| | Unsigned Decimal | | |
| | Hex | | |
| | Signed Decimal | | |
| | Floating | | |
| MLC | Relay | X | |
| | | Y | |
| | | M | |
| | | A | |
| | | T | |
| | | C | |
| | Register | T | |
| | | C(16) | |
| | | C(32) | - |
| | | D | - |
| | | V | - |
| | | Z | - |
| | | Unsigned Decimal | - |
| | | Signed Decimal | - |
| | | Hex | - |
| | | Floating | - |
| | Device Monitor | Unsigned Decimal | - |
| | | Hex | - |
| | | Signed Decimal | - |
| | | Floating | - |

| Diagnostic (DGN) Function (Ctrl + F4) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| MLC | Editor | Search | - |
| | | LD | - |
| | | LDI | - |
| | | LDP | - |
| | | LDF | - |
| | | OUT | - |
| | | APP | - |
| | | — | - |
| | | \| | - |
| | | Delete \| | - |
| | | Insert Row | - |
| | | Delete Row | - |
| | | Delete | - |
| | | Label | - |
| | | Table | - |
| | | Symbol | Search |
| | | | X |
| | | | Y |
| | | | M |
| | | | A |
| | | | T |
| | | | C |
| | | | D |
| | | | P |
| | | | I |
| | | | Delete |
| | | | Copy |
| | | | Paste |
| | | Save | - |
| | | Goto Line | - |
| | | Select | - |
| | | Cut | - |
| | | Copy | - |
| | | Paste | - |
| | Operation (Only in Edit Mode) | Force ON | - |
| | | Force OFF | - |
| | | RUN/STOP | - |
| | Find Device | - | - |

| Diagnostic (DGN) Function (Ctrl + F4) | | | |
|---|---|---|---|
| **Layer 1** | **Layer 2** | **Layer 3** | **Layer 4** |
| System Monitor | Var. Monitor | MLC Var. | |
| | | System Var. | - |
| | | Channel. Var. | - |
| | | Axis Var. | - |
| | | HMI Var. | - |
| | | Signed Decimal | - |
| | | Unsigned Decimal | - |
| | | Binary | - |
| | | Hex | - |
| | Time Analyze | - | - |
| System Info. (System Information) | System Info. | - | - |
| | Firmware Info. | Firmware Update | - |
| Authority | Login | - | - |
| | Logout | - | - |
| | Expire Lock | - | - |
| | Rel. /Exten. | - | - |
| | Authority | - | - |
| | Default | - | - |
| Export | - | - | - |
| Import | - | - | - |
| Servo Tune (JOG mode Only) | Next Axis | - | - |
| | Read Servo | - | - |
| | Calc. Gain (Calculate Gain) | - | - |
| | Gain Write | - | - |
| | Filter Write | - | - |
| | Start | - | - |
| | Position 1 | - | - |
| | Position 2 | - | - |
| Ballbar | Program | - | - |
| | Start | - | - |
| | Analyze | - | - |
| | Servo Para. (Servo Parameter) | - | - |
| | Dynamic Fir. Comp. (Dynamic Friction Compensation) | Program | - |
| | | Start | - |
| | | Servo Para. (Servo Parameter) | - |
| | Dynamic Fir. Comp. | X-Y / Y-Z / X-Z / X-Y-Z | - |
| | | Ballbar | - |

| Diagnostic (DGN) Function (Ctrl + F4) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| | Static Fir. Comp. (Static Friction Compensation) | Program | |
| | | Start | -- |
| | | Servo Para. (Servo Parameter) | - |
| | | X-Y / Y-Z / X-Z / X-Y-Z | - |
| | | Ballbar | - |
| | Zoom In | - | |
| | Zoom Out | - | |
| | X-Y / Y-Z / X-Z / X-Y-Z | - | |
| Scope | | - | - |
| Processing History | - | - | - |
| Operation History | - | - | - |

All system modes are available.

| Alarm (ALM) Function (Ctrl + F5) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| History | Clear | - | - |
| Alarm | Clear | | |

| Graphic (GRA) Function (Ctrl + F6) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Center | - | - | - |
| Plotter Reset | - | - | - |
| Plotter Adjust | Up | - | - |
| | Down | - | - |
| | Left | - | - |
| | Right | - | - |
| | Zoom In | - | - |
| | Zoom Out | - | - |
| X-Y / Y-Z / X-Z / X-Y-Z | - | - | - |
| Preview | - | - | - |
| Step View | - | - | - |
| Clear | - | - | - |

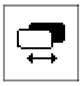
| Parameter (PAR) Function (Ctrl + F7) | | | |
|---|---|---|---|
| Layer 1 | Layer 2 | Layer 3 | Layer 4 |
| Search | - | - | - |
| Process | - | - | - |
| Operation | - | - | - |
| Magazine | OK | - | - |
| Spindle | - | - | - |
| Machine | - | - | - |
| Home | - | - | - |
| Network | Default | - | - |
| Compen. (Compensation) | Pitch com. (Pitch Compensation) | OK | - |
| | | Import Ren | - |
| | | um | - |
| | | um+ | - |
| System | Default | - | - |
| | Color Sel. (Color Selection) | - | - |
| MLC | Default | - | - |
| | Color Sel. (Color Selection) | - | - |
| Graphic | Default | - | - |
| | Color Sel. (Color Selection) | - | - |
| Servo | Read Servo | - | - |
| Channel (AUTO and MDI mode Only) | Confirm | - | - |
| | Next CH. (Next Channel) | | |
| EIO | OK | - | - |
| Para. Group (Parameter Group) | Save | - | - |
| | Delete Par. | | |
| | Delete RCP | - | - |
| | Write Par. | - | - |
| | Read Par. | - | - |
| | Sort Par. | - | - |
| | Aver. RCP (Average RCP) | - | - |
| Spindle Para. | - | - | - |
| Axis Para. | - | - | - |
| HMI Para. | - | - | - |

All system modes are available.

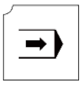
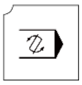
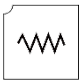
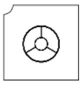
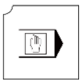
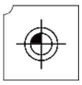
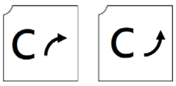
| Soft Interface (SOFT) Function (Ctrl + F8) | | | | |
|---|---|---|---|---|
| Panel functions | Program execution | MPG simulation | Tool magazine forward | Spindle forward |
| | Stop execution | Optional stop | Tool magazine backward | Spindle stop |
| | Single block execution | Light | Limit release | Spindle reverse |
| | Optional stop | Single block skip | Coolant | - |
| Operation mode | AUTO | EDIT | MDI | MPG |
| | Rapid | HOME | JOG | INC |
| Magnification adjustment | Increase progressively | - | - | - |
| | Decrease progressively | - | - | - |
| Axis operation | X+ | - | - | - |
| | X- | - | - | - |
| | Y+ | - | - | - |
| | Y- | - | - | - |
| | Z+ | - | - | - |
| | Z- | - | - | - |
| | A+ | - | - | - |
| | A- | - | - | - |
| | B+ | - | - | - |
| | B- | - | - | - |

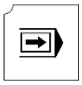
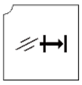
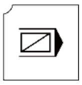
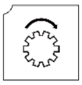
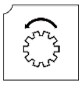
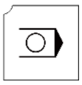
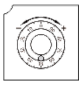
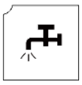
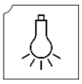
### 3.1.2 Machine operation - function of keys

| Symbol | Description | Supported mode / group |
|---|---|---|
| POS | The POS group key. Press to display the screen of coordinate setting. | All modes |
| PRG | The PRG group key. Press to display the screen of program editing. | All modes |
| OFS | The OFS group key. Press to display the screen of coordinate setting and tool offset setting. | All modes |
| DGN | The DGN group key. Press to display the screen of diagnosis, system parameter, and system status. | All modes |
| ALM | The ALM group key. Press to display the screen of alarm display. | All modes |
| GRA | The GRA group key. Press to display the screen of graphic display. | All modes |
| PAR | The PAR group key. Press to display the screen of parameter setting. | All modes |
| SOFT | The SOFT group key. Press to display the configured panel screen. | All modes |
| RESET | Reset key | All modes |
| O A ~ G C | Axis position and command code keys | PRG |
| M S T | 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 | Numeric keys (operation symbols) | PRG, OFS, DGN |
| ↑ ↓ ← → | Cursor keys (operation symbols) | PRG, OFS, DGN |
| HOME | Home key | PRG |

| Symbol | Description | Supported mode / group |
|---|---|---|
| END | End key | PRG |
| SPACE | Space key | PRG |
| SHIFT | Shift key | PRG |
| DEL / INS | Delete (insert) key | PRG |
| BACK SPACE | Back space key | PRG |
| # | # variable key | PRG |
| + & , * / , = ! | Calculating signs key | PRG |
| [ <, ] > | Brackets 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 ~ F8 | Function keys | All modes and groups |
|  | NC channel switching key | All modes |

### 3.1.3 Machine 2nd operation panel

| Symbol | Description |
|---|---|
|  | AUTO mode: for program execution |
|  | EDIT mode: for file management and program editing |
|  | JOG mode: for manual operation of the machine tool |
|  | MPG mode: for operating the axis direction of the machine tool with the MPG |
|  | MDI mode: for simple program input and execution |
|  | Home mode: for rapid homing to the machine origin |
|  | Rapid traverse mode: executes axis movements according to the set rapid override |
| X ← X → | X axis direction: in JOG mode, manually operate the X axis towards positive or negative direction |
| Y ↙ Y ↗ | Y axis direction: in JOG mode, manually operate the Y axis towards positive or negative direction |
| Z ↑ Z ↓ | Z axis direction: in JOG mode, manually operate the Z axis towards positive or negative direction |
|  | Rotation axis direction: in JOG mode, manually operate the rotation axis in forward or reverse direction |
|  | 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 |

| Symbol | Description |
|---|---|
|  | Single block execution: execute one single block at a time and then stop |
|  | Limit cancellation: the operation key for clearing the alarm when the limit protection is triggered |
|  | Single block skip: skip one single block when there is a “/” symbol in the block |
|  | Tool magazine forward: press this button to rotate the tool magazine for one position in the forward direction |
|  | Tool magazine reverse: press this button to rotate the tool magazine for one position in the reverse direction |
|  | 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 |
|  | Coolant switch: coolant ON / coolant OFF |
|  | Light switch: light ON / light OFF |

3

### 3.1.4 Table of corresponding buttons (for OPENCNC models)

| NC key | PC keyboard | Description |
|---|---|---|
| F1 ~ F8 (Function Key) | 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 group key |
| PRG | Ctrl + F2 | The PRG group key |
| OFS | Ctrl + F3 | The OFS group key |
| DGN | Ctrl + F4 | The DGN group key |
| ALM | Ctrl + F5 | The ALM group key |
| GRA | Ctrl + F6 | The GRA group key |
| PAR | Ctrl + F7 | The PAR group key |
| SOFT | Ctrl + F8 | The SOFT 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 | - |
| ↔Channel Switching | Ctrl +F11 | NC Channel Switching |

# 3.2 CNC control mode

## 3.2.1 CNC mode introduction

Delta NC5 controller provides several operation modes, and the system will limit specific functions between each mode. This is to prevent unnecessary loss or safety issue from improper operation.

- **Auto mode (AUTO)**

To execute a program, users must open the file, switch the system to AUTO mode, and then press CYCLE START. In this mode, users can verify the machining program, cutting conditions, and position coordinates before execution as well as avoid unexpected execution by accidentally pressing CYCLE START in other modes. This mode is only for program execution rather than program editing or manual axis movement.

- **Program edit mode (EDIT)**

Users can edit a program in EDIT mode. In this mode, the editing functions in PRG group are available for users to edit the program. In addition, program execution and manual axis movement are not available in this mode.

- **Manual input mode (MDI)**

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

- **MPG mode (MPG)**

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

- **Jog mode (JOG)**

In JOG mode, press the axis direction keys on machine 2nd operation panel to have the axes jog. Set the jog speed and moving distance with the JOG override key. Program execution and editing are not available in this mode.

- **Rapid mode (RAPID)**

In RAPID mode, press the axis direction keys on machine 2nd operation panel to have the axes rapid moving. Set the speed and moving distance with the Rapid override key. Program execution and editing are not available in this mode.

- **Incremental mode (INC)**

In INC mode, users can control each axis in incremental movement from axes buttons on the 2nd control panel. The special D2x014 is defined as the axes movement for each time motion triggered. Program execution and editing are not available in this mode.

### Homing mode (HOME)

In HOME mode, users 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, users should set the system to HOME mode to have each axis return to the machine origin before executing the program. If users do not perform homing after starting the controller, program execution is prohibited.

3

## 3.2.2 Group screen overview

A full range of information is provided on the screens of function groups of this controller. The following introduces some functions in the group screens.

### ■ Position (POS) group


Figure 3.2.2.1

(1) Name of current program
(2) Currently executed program line
(3) Current group function
(4) Current coordinates
(5) Machining information:
Spindle speed: command value
Cutting feedrate: command value
Spindle load rate: %
Actual speed: RPM
Actual feedrate: mm/min

(6) Current system mode
(7) Alarm display
(8) Rapid traverse override
(9) Feedrate override
(10) Spindle override
(11) System status
(12) Process information
Dwell time: G-code dwell time
Command tool number: tool number specified in G-code
Spindle tool number: number of the tool on the spindle
Standby tool number: system standby tool number

Item (11) displays the status of the system for 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:**

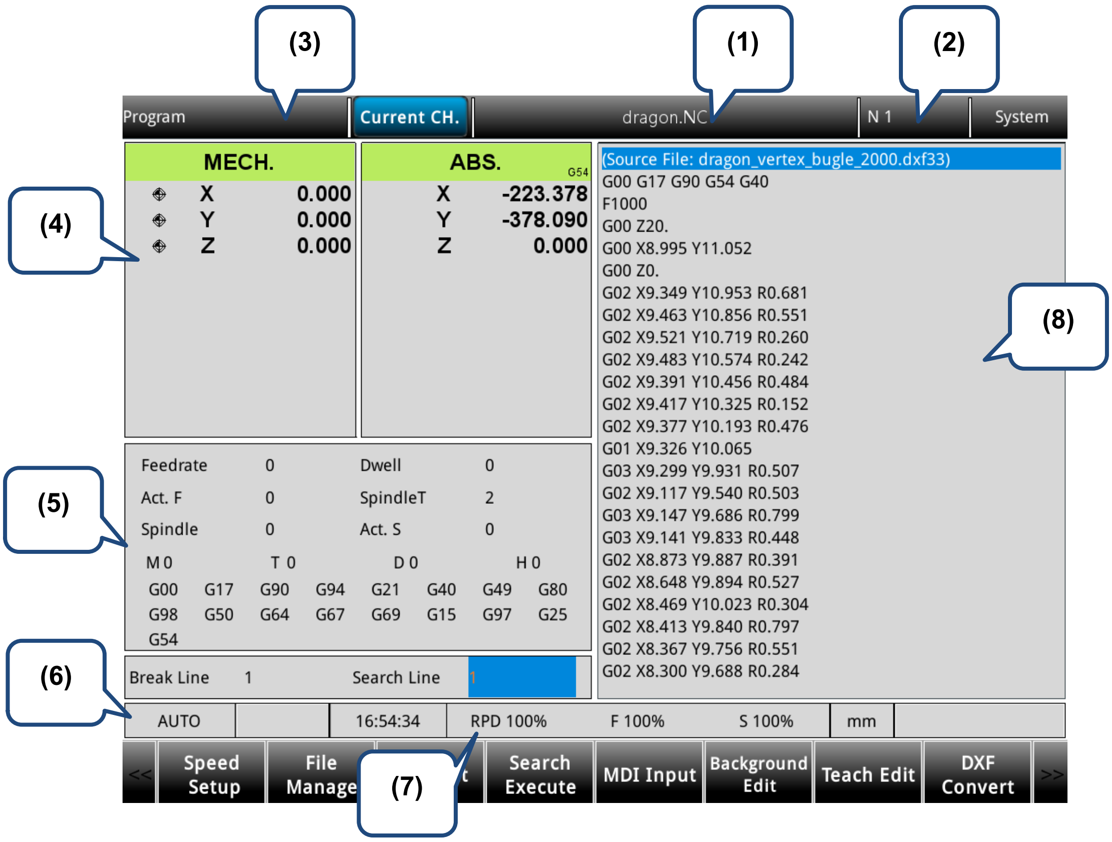



Figure 3.2.7.2

(1) Name of current program

(2) Currently executed program line

(3) Current group function

(4) Coordinate information during program execution

(5) Process information and current command status

(6) Current system mode

(7) Current override settings

(8) Currently executed program content

**EDIT mode:**

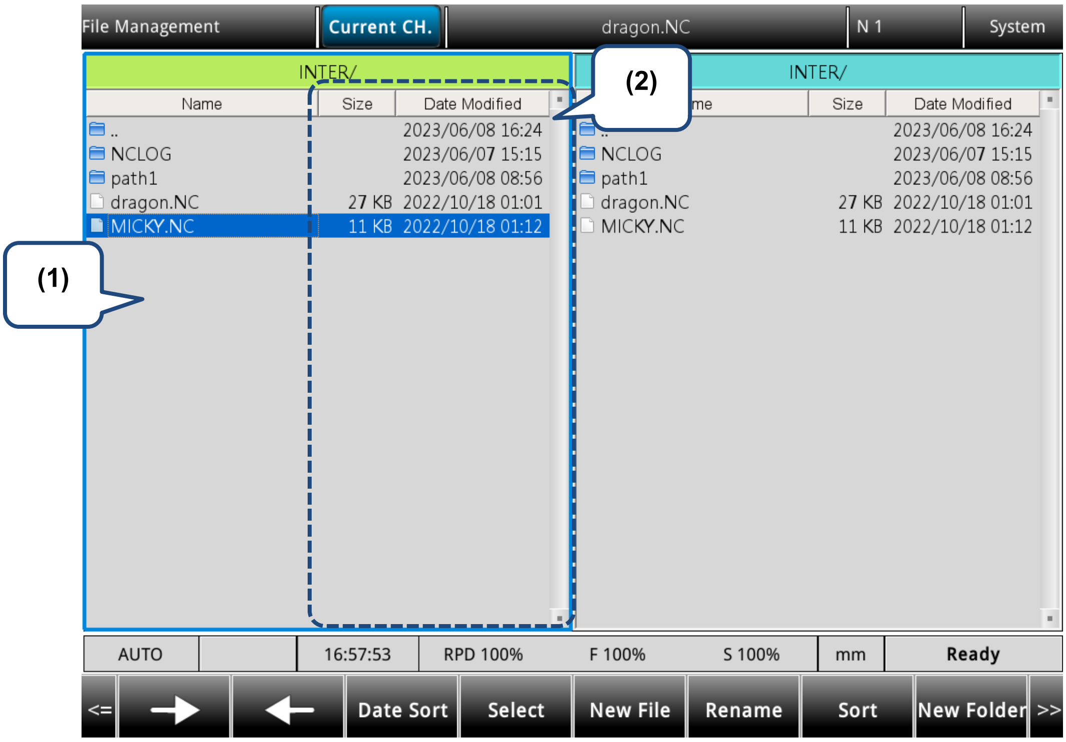



Figure 3.2.7.3

(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 3.2.7.4

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

3

**MDI mode:**


Figure 3.2.7.5

(1) Coordinate information: absolute / residual coordinates

(2) Information of cutting feedrate, spindle speed, and compensation number

(3) Status of currently executed commands

(4) MDI program

## ■ Offset (OFS) group

**Coordinate information:**


Figure 3.2.7.6

(1) Workpiece coordinate setting: offset coordinates, G54 - G59 coordinate system

(2) Coordinate information display: machine / relative / absolute coordinates

3

**Tool information:**

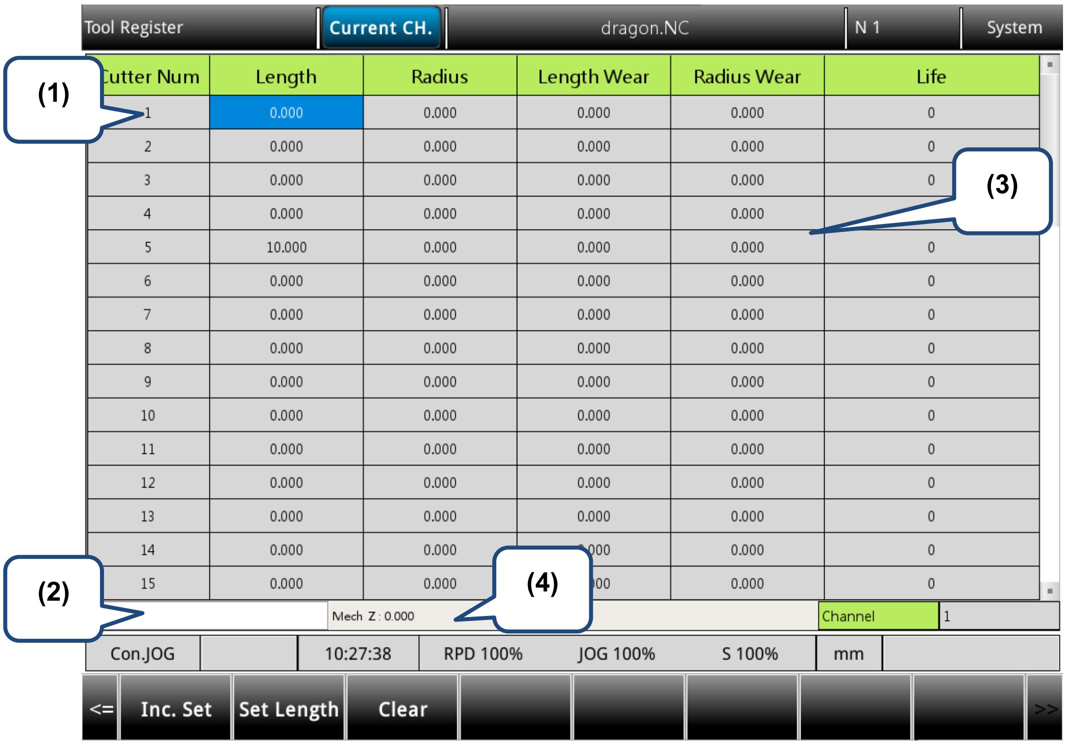



Figure 3.2.7.7

(1) Compensation number (H / D)

(2) Input field for compensation data

(3) Compensation information: tool length, tool radius, length compensation, and radius compensation

(4) Auxiliary display: actual position of the current Z axis machine coordinate

3

## ■ Diagnosis (DGN) Group

**Servo Tuning:**

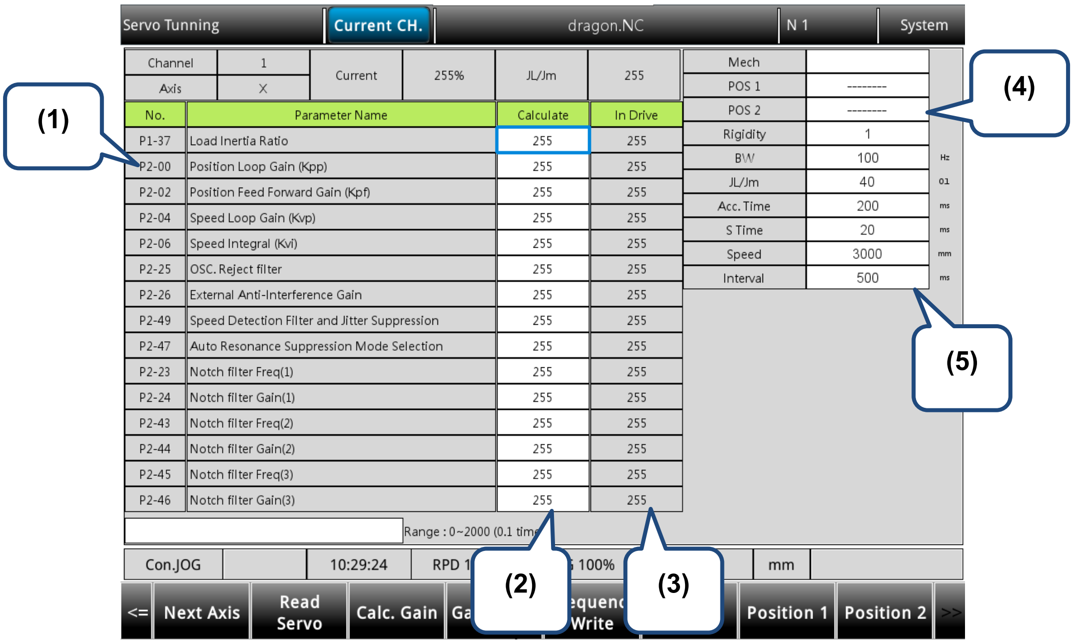



Figure 3.2.7.8

(1) Servo parameter: numbers and names of servo parameters

(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:**

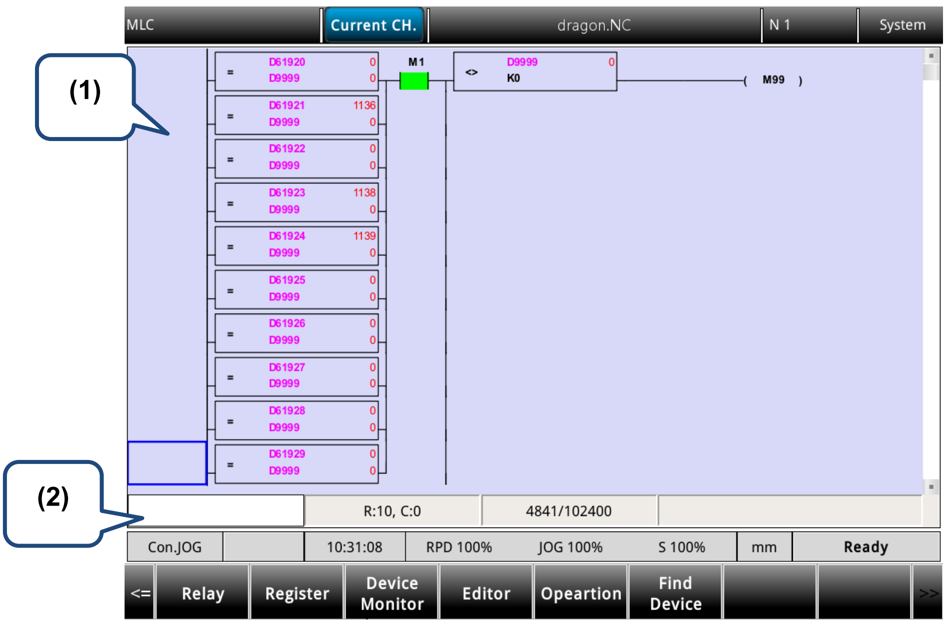



Figure 3.2.7.9

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

3

## ■ Alarm (ALM) Group


Figure 3.2.7.10

(1) Alarm message (2) Sequence of alarm occurrence (3) Alarm code

## ■ Graph (GRA) Group

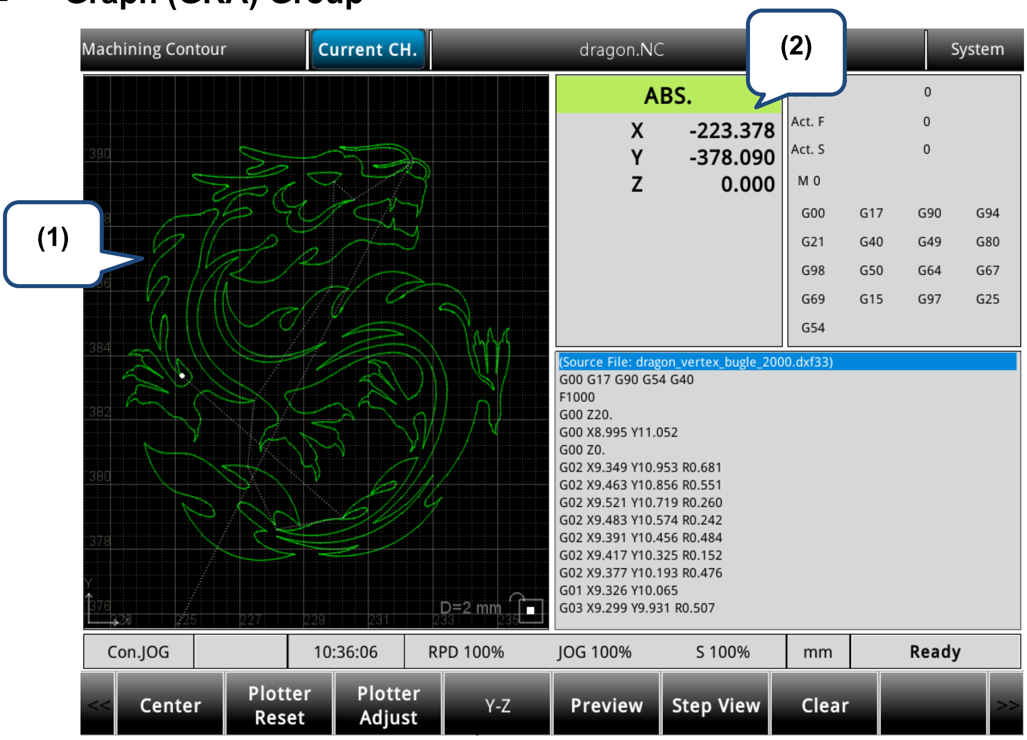



Figure 3.2.7.11

(1) Path diagram: displays the program path

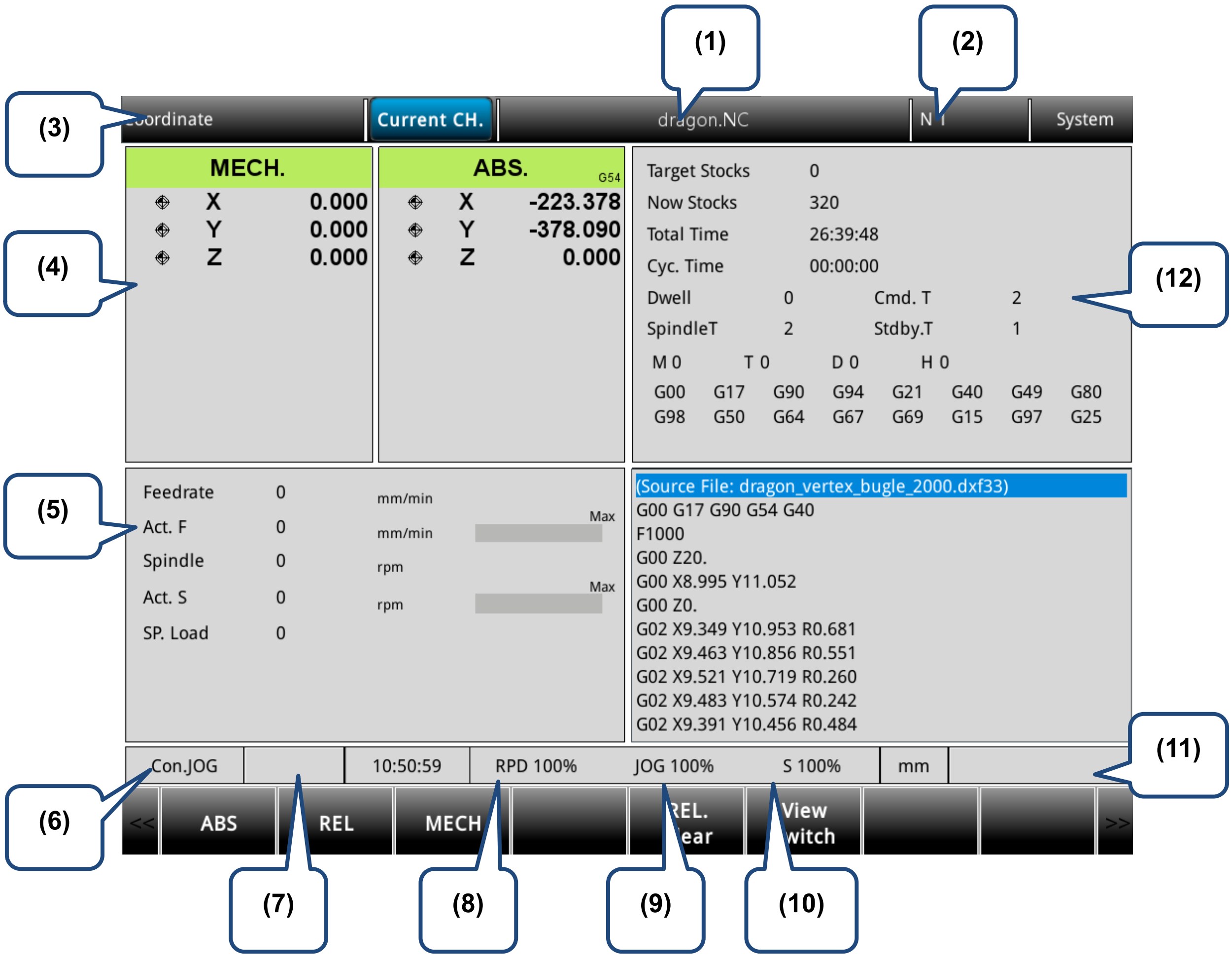
(2) Coordinate information: machine / absolute coordinates

3

## 3.3 Position (POS) Group

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 axis setting.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.




(1) Name of current program
(2) Currently executed program line
(3) Current group function
(4) Current coordinates
(5) Spindle & feed information:
  Spindle speed: command value
  Cutting feedrate: command value
  Spindle load rate: %
  Actual speed: RPM
  Actual feedrate: mm/min
(6) Current system mode
(7) Alarm display
(8) Rapid traverse override
(9) Feedrate override
(10) Spindle override
(11) System status
(12) Machining information:
  Dwell time: G-code dwell time
  Command tool number: tool number in G-code
  Tool number: number of the tool on the spindle
  Standby tool number: system standby tool number

## 3.3.1 Absolute coordinates

Absolute coordinates refer to the program origin of G-code, which users can use to check whether the movement specified in a program block is identical to 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.

## 3.3.2 Relative coordinates

Relative coordinates indicate the moving distance from the reference coordinates. 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.

## 3.3.3 Machine coordinates

Machine coordinates are defined according to the mechanism. The coordinate data is neither removable nor changeable due to the selected workpiece coordinate system. 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.

## 3.3.4 Relative Clear

Clear relative coordinates information. The system will clear the reference coordinates setting and utilize the current machine coordinates as new reference coordinates. In addition, the corresponding axis' relative coordinates will be updated as new value.

(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. Clear** to enter the relative coordinate screen and clear buttons.
(3) The functions available in the 2nd layer function bar include:
**CLR ALL**: clears the relative coordinate values of all axes.
**CLR X**: clears the relative coordinate value of X axis.
**CLR Y**: clears the relative coordinate value of Y axis.
**CLR Z**: clears the relative coordinate value of Z axis.

Note: the clear functions for the axes X, Y and Z are available only when users connect the axes.

## 3.4 Program (PRG) group

Users can manage and edit G-code and macro files with PRG group functions. File manage includes three layers: (1) INTER (internal memory), USB (USB disk), and NETWORK; (2) folders and G-code files; (3) G-code files.

Some dedicated functions are available in particular system modes. For example, users can use the function of break line search in AUTO mode or users can enter and execute a program in MDI mode.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.


(1) Name of current program
(2) Currently executed program line
(3) Current group function
(4) Disk options
(5) Current system mode

Set the system to EDIT mode and press **PRG** on machine 1st operation panel to display the PRG screen. In the File manage screen, users can press ↑ and ↓ or **PAGE UP** and **PAGE DN** to 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 format for the USB drive is FAT32.

## 3.4.1 Create a new file

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

(1) Set the system to EDIT mode.

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

(3) Press **File Manage** to switch to the file manage screen.

(4) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the destination of the disk for file creation (for example, the 2nd or 3rd layer of USB directory).

(5) Press **New File** and a dialog box appears for users to enter the file name.

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

<table>
<tr><th colspan="2">File format specifications</th></tr>
<tr><td rowspan="2">Format of machining file name (G-code)</td><td>No restrictions on the format of main program names (names of each file should be unique in the same directory)</td></tr>
<tr><td>O + 0001 to 8999 (for subprogram call)</td></tr>
<tr><td>Format of macro file name (O macro)</td><td>O + 9000 - 9999</td></tr>
<tr><td>Remarks in file name</td><td>Suffix ‘-’ and alphanumeric characters in sequence to the file name</td></tr>
<tr><td>Valid format of file extension</td><td>.NC .ANC .CNC .PIM .TAP .PTP .UOO .DEMO</td></tr>
<tr><td>Format of M macro file name</td><td>M + 10000 - 29999</td></tr>
<tr><td>Format of G macro file name</td><td>G + 30000 - 49999</td></tr>
<tr><td>Maximum allowable character length of file name</td><td>31</td></tr>
<tr><td>Storage location</td><td>2nd or 3rd management layer</td></tr>
<tr><td>Invalid symbols in file name</td><td>* / \ | < > ? “</td></tr>
</table>

Note:

1. Names of each file should be unique in 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 Pr50 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 format of file extension, such as “1.1.1.1**.NC**”.

## 3.4.2 Copy files

Users can use this function to copy the existing files from all disk drives.
The operation steps are as follows.

(1) Set the system to EDIT mode.

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

(3) Press **File Manage** to switch to the file manage screen.

(4) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the destination of the disk for file copying (for example, the 2nd or 3rd layer of USB directory).

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

(6) Press **Copy** and then **Paste** to validate the execution.

## 3.4.3 Paste files

As described in Section 3.4.2, users should use this function together with the copy function to complete file copying. It is one of the functions of File manage in PRG group. The operation steps follow the descriptions in Section 3.4.2.

(1) Press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the location of the disk, directory, or layer for pasting the file.

(2) Enter the directory, press **Paste**, and a dialog box appears for users to enter the file name. Enter a new file name or use the original one, and press **ENTER** to complete the execution 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, file names of each file should be unique.
2. If users do not execute **Copy** before using the **Paste** function, an error dialog box appears to remind users to copy a file first, and thus the paste execution is invalid.

## 3.4.4 Delete files and directories



Users 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) Press **File Manage** to switch to the file manage screen.

(4) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2$^{nd}$ or 3$^{rd}$ layer of the disk.

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

(6) Press **Delete** and a dialog bx appears for users to confirm the execution. Enter “Y” and press **ENTER** to delete the file or directory.

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

## 3.4.5 Select / cancel selection of multiple files

In addition to copying or deleting a single file, users can use **All Select** / **All Cancel** to select or cancel the selection of multiple files for copying, pasting, or deleting the files.

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) Press **File Manage** to switch to the file manage screen.

(4) Enter the directory where users want to select the files.

(5) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the file to be selected. To select a file, press **Select** (as shown in Figure 3.4.5.1). To cancel the selection, press **Select** again. If there is only one item selected, it will not be able to cancel the selection. To select all files, press **All Select**. To cancel the selection of all files, press **All Cancel**.

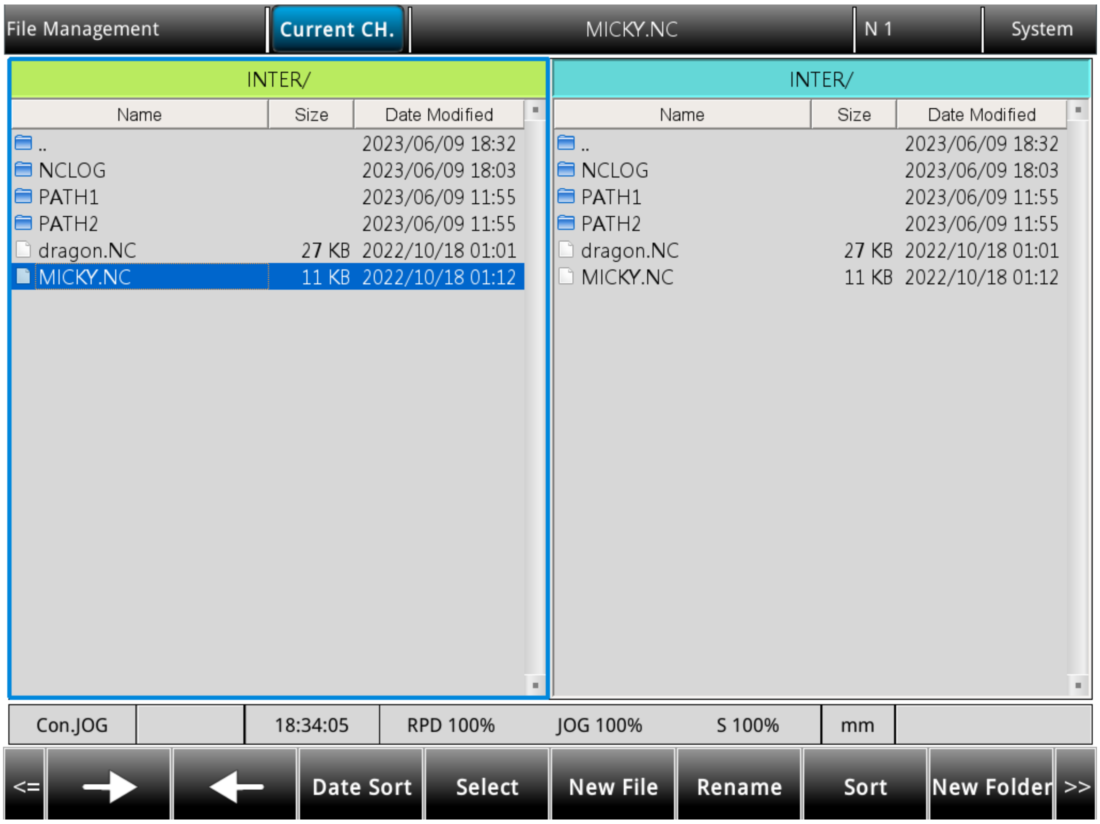



Figure 3.4.5.1

(6) After completing the selection, press **Copy**.

(7) Go to another directory and press **Paste** to paste the selected files, as shown in Figure 3.4.5.2.

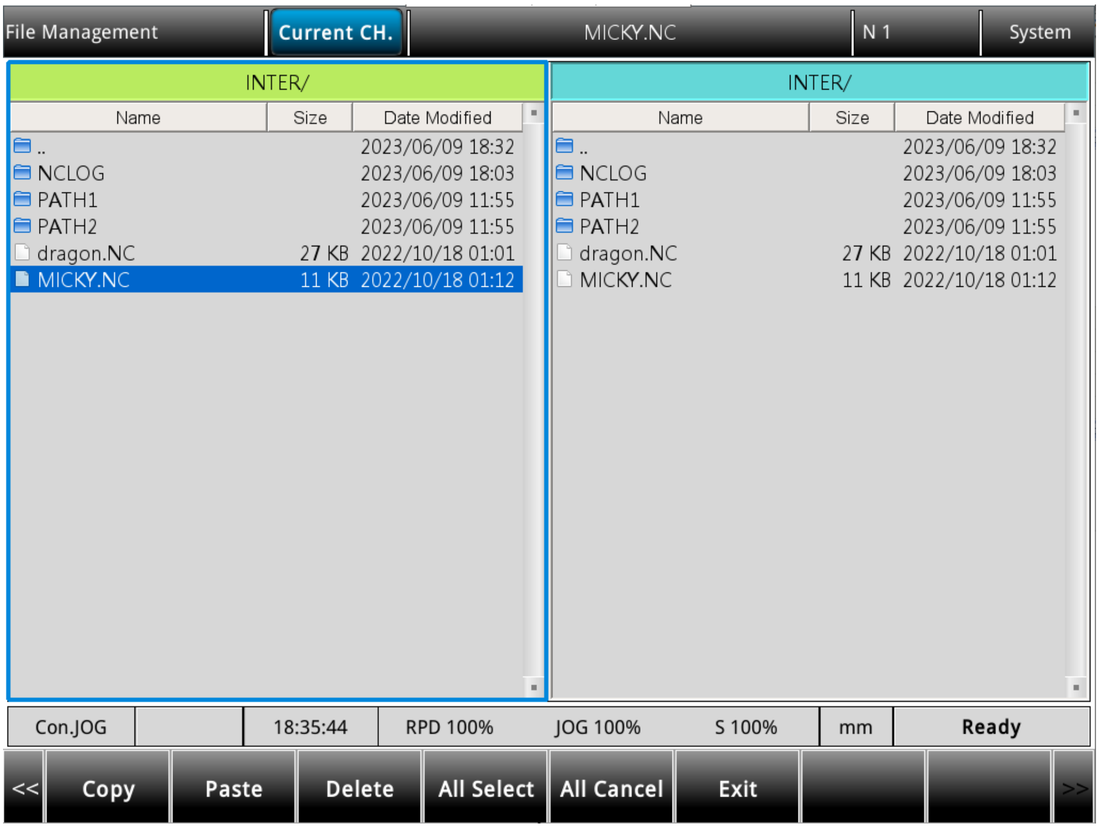



Figure 3.4.5.2

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) Press **File Manage** to switch to the file manage screen.

(4) Enter the directory where users want to select the files.

(5) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the file to be selected. To select a file, press **Select**. To cancel the selection, press **Select** again. If there is only one item selected, it will not be able to cancel the selection. To select all files, press **All Select**. To cancel the selection of all files, press **All Cancel**.

(6) After selecting multiple files, press **Delete** to delete. (As shown in Figure 3.4.5.3).

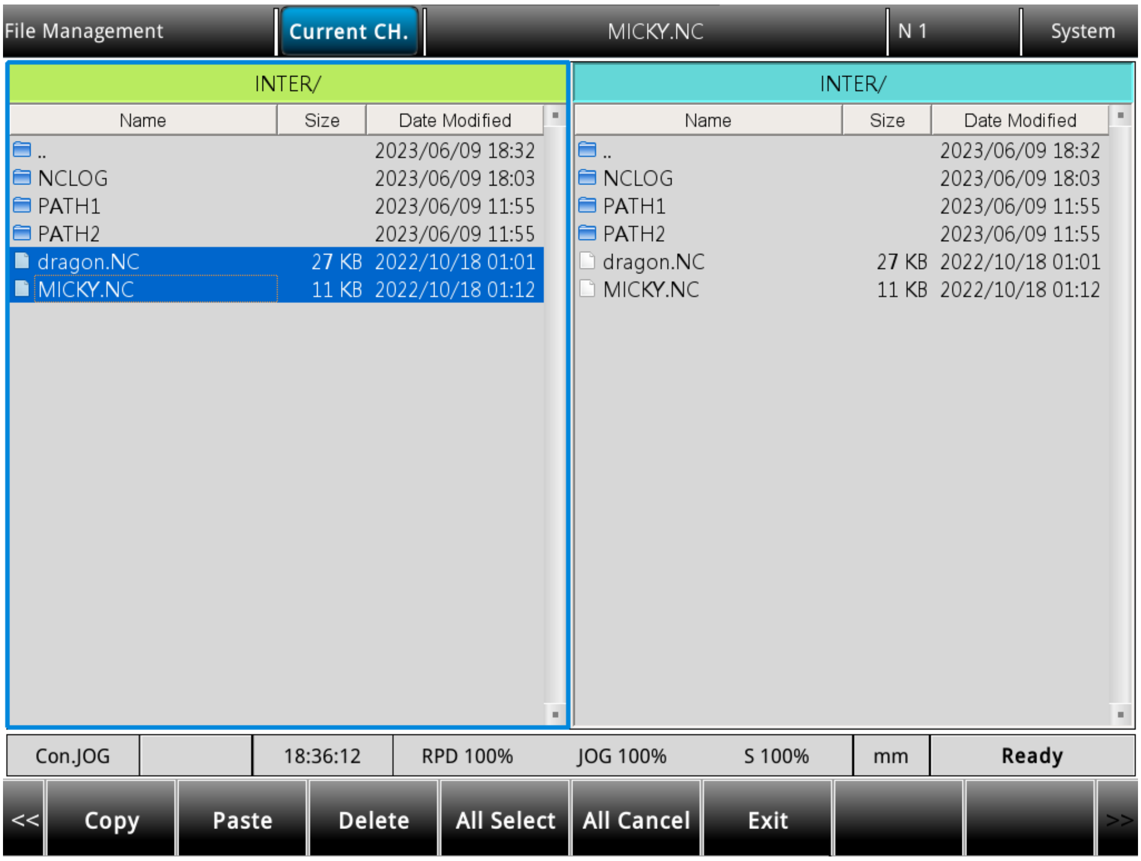



Figure 3.4.5.3

Note:

1. After copying multiple files, users should paste them to another directory. If users paste the files in the same directory, a dialog box appears to remind users to select another directory, and the execution is invalid.

2. When the names of the files to be pasted are identical to those of the original files, a dialog box appears for users to decide whether to overwrite the original files. Enter “Y” to replace the original files with the new ones; enter “N” or press **Exit** to keep the original files.

### 3.4.6 Rename files

Users can use this function to rename the file after creating the file. The operation steps are as follows.

(1) Set the system to EDIT mode.

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

(3) Press **File Manage** to switch to the file manage screen.

(4) In the File manage screen, press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor to the destination of the disk (for example, the $2^{nd}$ or $3^{rd}$ layer of USB directory).

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

(6) Move the cursor to the file to be renamed, press **Rename**, and a dialog box appears for users to enter the file name.

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

Note:

1. Users can only create G-code files in the $2^{nd}$ and $3^{rd}$ layers of File manage but not in the $1^{st}$ layer.
2. The format specification of file name for file renaming is the same as that of file creation. If users enter a name that is already used for another file in the directory when renaming, an error dialog box appears, and the execution is invalid.

## 3.4.7 Create directories

This function is for creating a directory for G-code files in the 2nd layer of File manage, which is only available 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 **File Manage** to switch to the file manage screen.

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

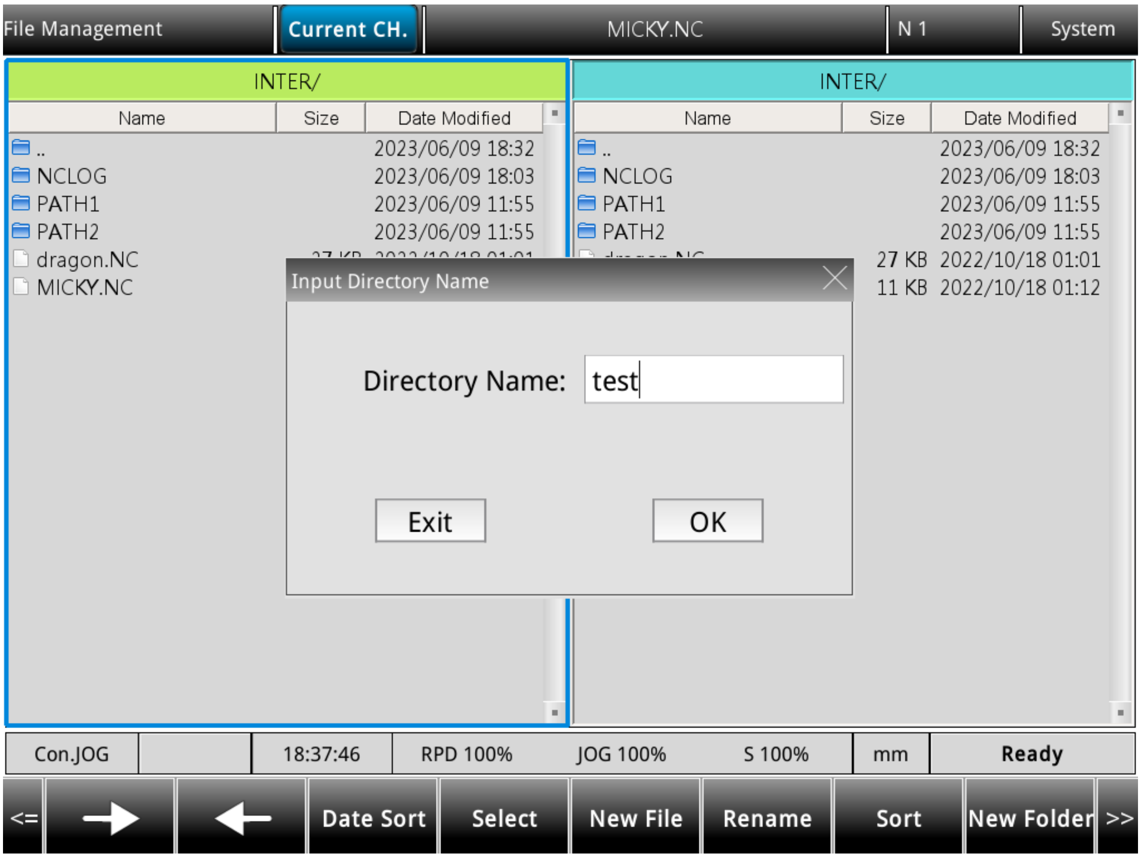



Figure 3.4.7.1

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

By following the steps above, users can create a new directory in the 2nd layer of File Manage and create or edit G-code files in this directory (the 3rd layer).

| Directory format specifications | |
|---|---|
| Format of directory name | Not limited to alphanumeric characters |
| Maximum number of characters of directory name | 31 |
| Storage location | 2nd management layer |

### 3.4.8 Sorting

This function is for sequencing 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) Press **File Manage** to switch to the file manage screen.

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

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

(6) Press **By Name**, and the directories and files are displayed by the sequence of number > English letters (from top to bottom). Press **By Name** again, and they are displayed by the sequence of English letters > number (from top to bottom).

(7) Press **By Size** to display the directories and files by the file size from small to large (from top to bottom). Press **By Size** again to display them by the file size from large to small (from top to bottom).

(8) Press **By Type** to display the directories and files by the type of files (from top to bottom).

(9) Press **By Date** to display the directories and files by the date from most recent to earlier (from top to bottom). Press **By Date** again to display them by the date from earlier to most recent (from top to bottom).

### 3.4.9 Macro files

In response to the application requirements, this is a dedicated function of managing the macro files for the equipment. Upon accessing the security authorization, users can use all the editing functions described in Section 3.4.10. Otherwise, users can only browse the existing macro files rather than open and edit them. Contact the local distributor for authorization settings.

### 3.4.10 File editing

Users can use this function to modify or delete the content of the G-code files. After users 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) Press **File Manage** to switch to the file manage screen.
(4) Press ⇧ and ⇩ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(5) Select the G-code file to be edited, and press **ENTER** to open the file and enter the edit screen.
(6) Press ⇧, ⇩, ⇦, and ⇨ to move the cursor to any position in the program.
(7) Edit the content by pressing the alphabetic, numeric, and editing keys on machine 1st operation panel.
(8) To save the file after editing, switch to different system modes, open another file, or press **RESET**.

| Specifications for editing | |
|---|---|
| Maximum number of characters of a single line | 255 |
| Supported mode | EDIT mode |
| Allowable file size | Below 3 MB |

Note:

1. When using the File manage or File edit function, users 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. Users can insert “( )” (parentheses) at the end of each program block in the G-code file for making notes. Do not insert parentheses in the beginning of the program block, or the block may be taken as a note and be skipped.

### 3.4.10.1 Line search

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

3

(1) Set the system to EDIT mode.
(2) Press **PRG** to switch to the PRG screen.
(3) Press **File Manage** to switch to the file manage screen.
(4) Press ⇧ and ⇩ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(5) Select the G-code file to be edited, and press **ENTER** to open the file and then press **File Edit** to enter the edit screen.
(6) Press ▶ to display the function bar on the next page.
(7) Press **Line Search** and a dialog box appears for users to enter the line number (by pressing the numeric keys 0 - 9).
(8) After entering the line number, press **ENTER**, and the cursor jumps to the specified line, completing the action.

| Requirements for line search | |
|---|---|
| Maximum number of characters of searching string | 62 |
| Format of searching string | Specify the program line number |

### 3.4.10.2 String search

The line search function is only for searching the specific line while users can use this function to search for specific strings. The accuracy of the searching result depends on how precise the input string is. The string search function contains the function of string replacing. Users can determine whether to replace a string when searching for a string, which enables users 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) Press **File Manage** to switch to the file manage screen.
(4) Press ⇧ and ⇩ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(5) Select the G-code file to be edited, and press **ENTER** to open the file and then press **File Edit** to enter the edit screen Press ▶ to display the function bar on the next page.
(6) Press **Find String** and a dialog box appears for users to enter the string to be searched, as shown in the following figure.

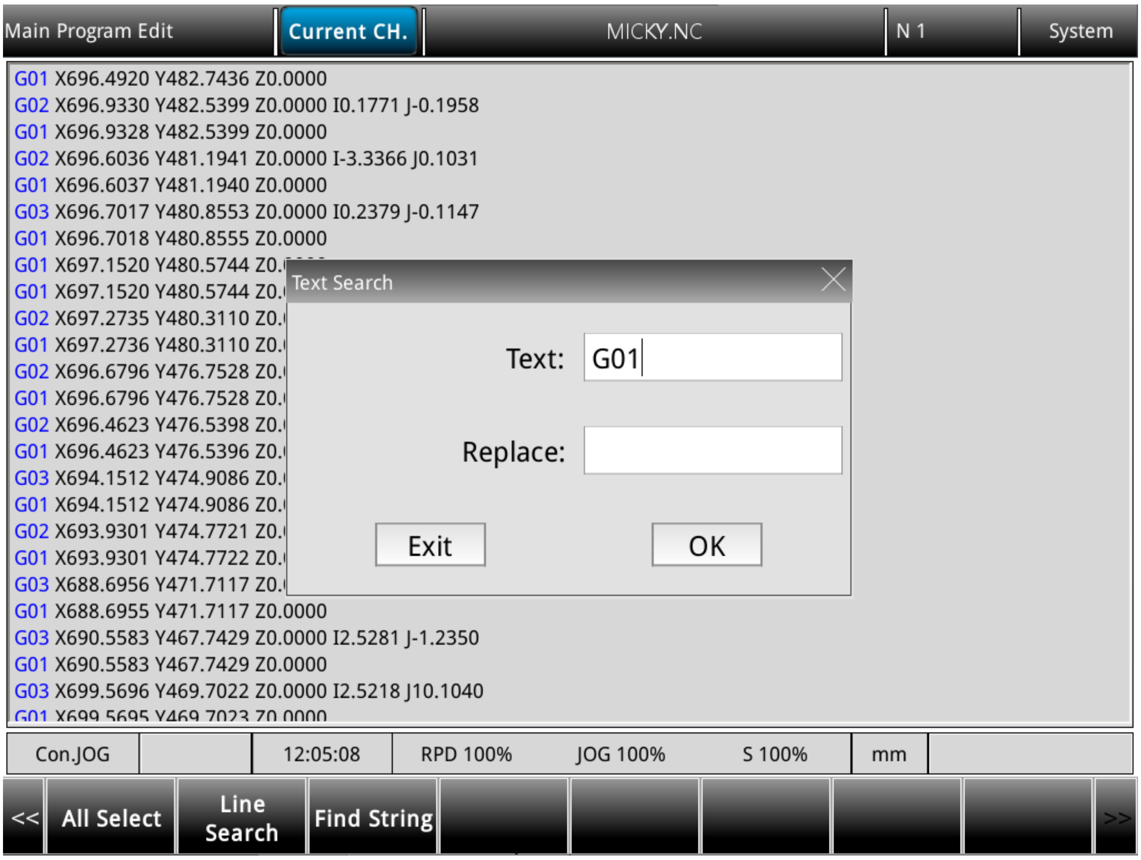



Figure 3.4.10.2.1

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

(8) After that, the searched string is highlighted. At the same time, “Forward”, “Backward”, “Replace”, and “Replace All” are displayed on the function bar.

(9) Press **Forward** to search for the next match or press **Backward** to search for the previous match.

(10) Press **Replace** when users want to replace one single string. Users can 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 replacing | |
|---|---|
| Modes that allow the string replacement function | EDIT mode |
| Allowable file size for editing and replacing | Below 3 MB |

### 3.4.10.3 Edit a section of program

To edit a section of a program, users can use the Block Start / Block End functions to specify the start and end of the content to be edited. Then, users 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) Press **File Manage** to switch to the file manage screen.

(4) Press and or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.

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

(6) Press , , , and to move the cursor to the start of the section to be edited and press **Block Start**.

(7) Move the cursor to the end of the section to be edited and press **Block End**. See the following figure for the selected section.

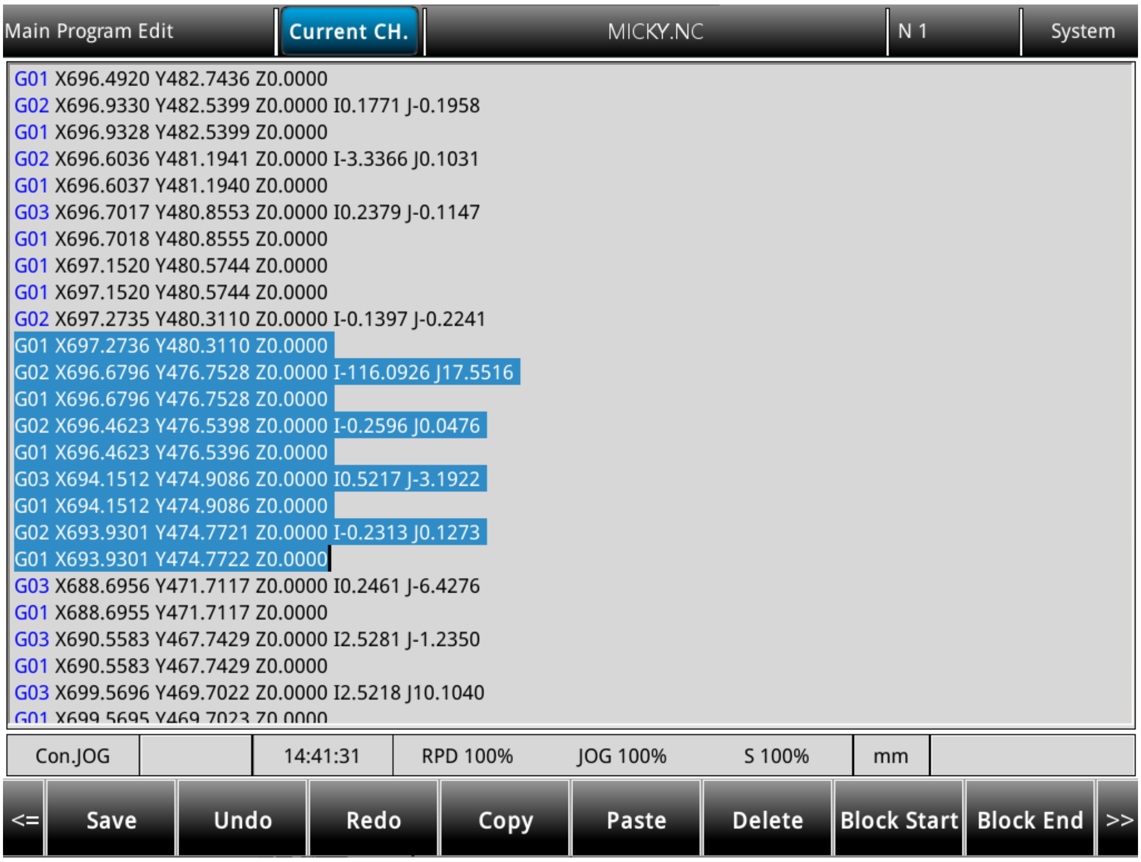



Figure 3.4.10.3.1

(8) Follow Steps (6) - (7) then press **Delete**, and users can delete the selected content.

**(9)** Follow Steps (6) - (7) then press **Copy** to copy the selected content. Move the cursor to where users wish to paste the copied content and press **Paste** to insert the content.

### 3.4.10.4 Delete lines and sections

Users can use this function to delete a single line of program where the cursor is located. And Users can use this function with Block Start and Block 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) Press **File Manage** to switch to the file manage screen.
(4) Press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(5) Select the G-code file to be edited, and press **ENTER** to open the file and enter the **Edit** screen.
(6) Move the cursor to the line to be deleted and press **Delete** to delete the line of program.
(7) Follow Step (8) in Section 3.4.10.3 to delete a whole section of a program.

### 3.4.10.5 Copy lines and sections and paste

Move the cursor to the specified line and press **Copy**, which takes effect when used with the PASTE function. Users can use this function to copy a single line or 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) Press **File Manage** to switch to the file manage screen.
(4) Press ↑ and ↓ or **PAGE UP** and **PAGE DN** to move the cursor, and press **ENTER** to enter the 2nd or 3rd layer of the disk.
(5) Select the G-code file to be edited, and press **ENTER** to open the file and enter the **Edit** screen.
(6) Move the cursor to the line of program to be copied and press **Copy**.
(7) Move the cursor to the position to paste the copied content, and press **Paste** to paste the line of program to that position.
(8) Follow Step (9) in Section 3.4.10.3 to copy a whole section of a program.

### 3.4.10.6 Undo

During program editing, use this function to undo the previous edit. Users 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) Press **File Manage** to switch to the file manage screen.
(3) Press ↑ and ↓ or **PAGE UP** and **PAGE DN** to 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) After editing the program, press **Undo** to undo the previous edit one time.

### 3.4.11 Program function in other modes

**AUTO mode:**

The PRG screen displays the content of the opened G-code file. In the screen, users can view the status information about the opened or executed file and the block being executed. The PRG screen in AUTO mode 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. Refer to the following figure.

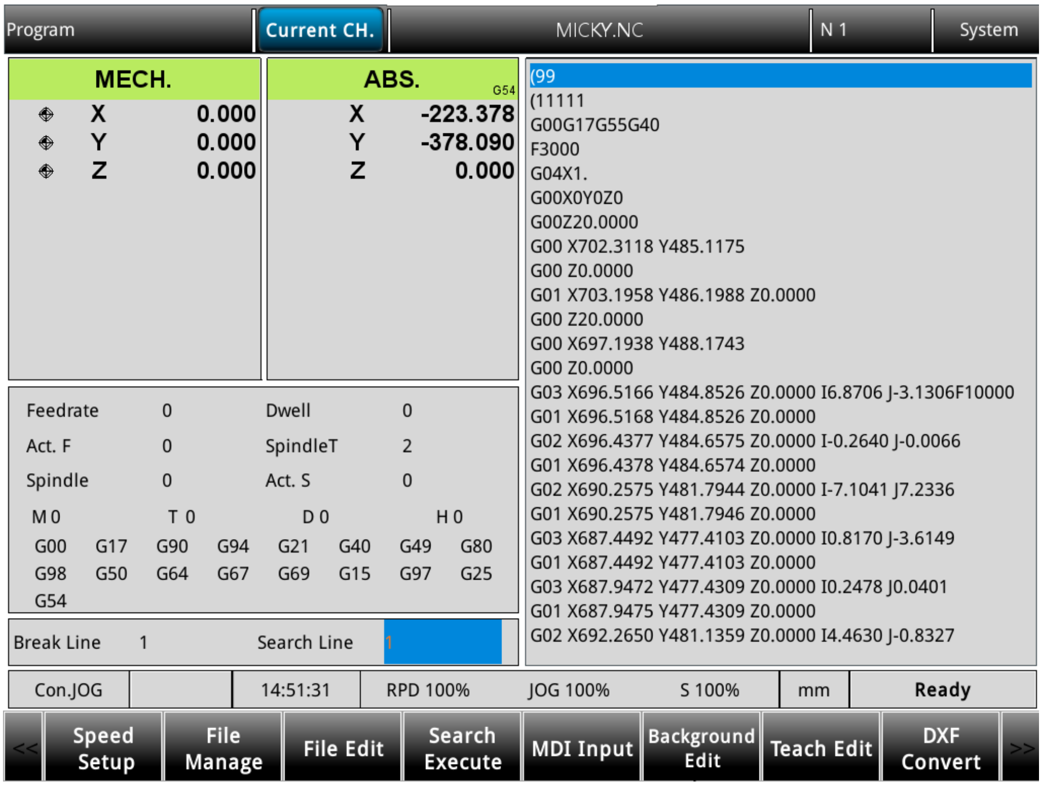



Figure 3.4.11.1

AUTO mode also includes the **Search Execute** function. When the program execution is interrupted, the system records the line number where it is interrupted (break line). Users can go to the PRG screen in AUTO mode to enable the break line search function.

When the system searches the break line, the cursor quickly moves to the line/label number users searched for and the system quickly computes and executes the program before the specified block to ensure the machining status is ready (including the spindle speed, feedrate, M code, and coordinates) when the execution resumes.

The operation steps are as follows.

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

(2) Press **Search Execute** to display the corresponding screen.

(3) Refer to the information of break line number, enter the line or label number of the program to be searched, and then press **ENTER** to complete the setting.

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

(5) The controller executes and records the execution status of the program blocks prior to the specified line. Then the controller stops at the break line for execution.

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

Note:

1. When finding the target block, the system stops and remains unexecuted. Press **CYCLE START** to resume executing the program.
2. Supported formats for searching: line number and label (N number) of the program.
3. During program execution or the break line search function is used, any request for break line search will be ignored as the system regards it is in execution.

When the G-code program is executed, users can use the **Speed Setup** set function to change the spindle speed (S command) specified in the G-code program, as shown in Figure 3.4.11.2. Enter a new command value in the **Speed Setup** set dialog box to change the speed command during execution.

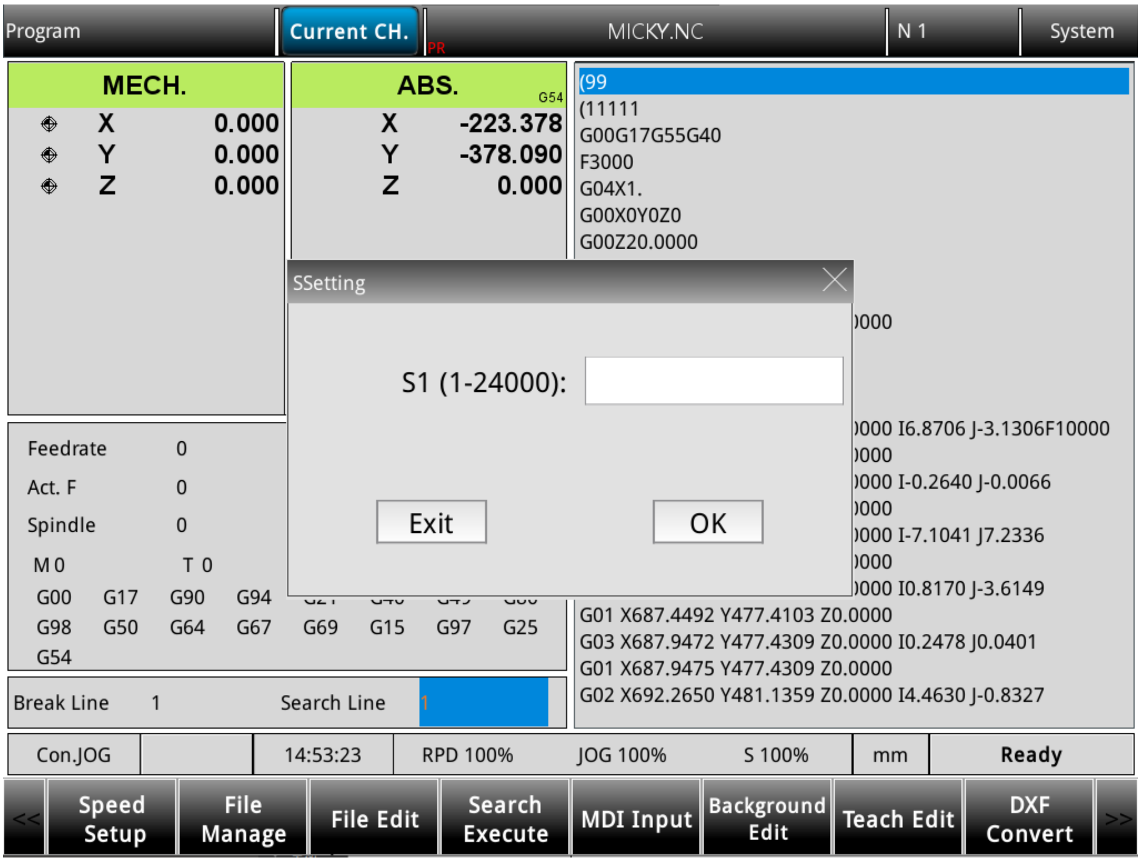



Figure 3.4.11.2

The operation steps are as follows.

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

(2) Press **Speed Setup** and a dialog box appears for users to enter the command value.

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

Note:

1. The **Speed Setup** function is a one-shot function with the **Speed Setup** effective for one time in a single execution, which do not change the command settings in the G-code program.
   If requiring to execute this **Speed Setup** for multiple times, users are suggested to 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.
3. If there is no S command in the G-code program, users cannot use this function to change the speed command.

**JOG and MPG modes:**

The operation steps for **Speed Setup** are as follows.

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

(2) Press **Speed Setup** and a dialog box appears for users to enter the command value.

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

**MDI mode:**

In MDI mode, users can enter simple programs and save, delete, or execute the content in the PRG screen, as shown in the following figure. The screen below is specific designed for MDI mode.

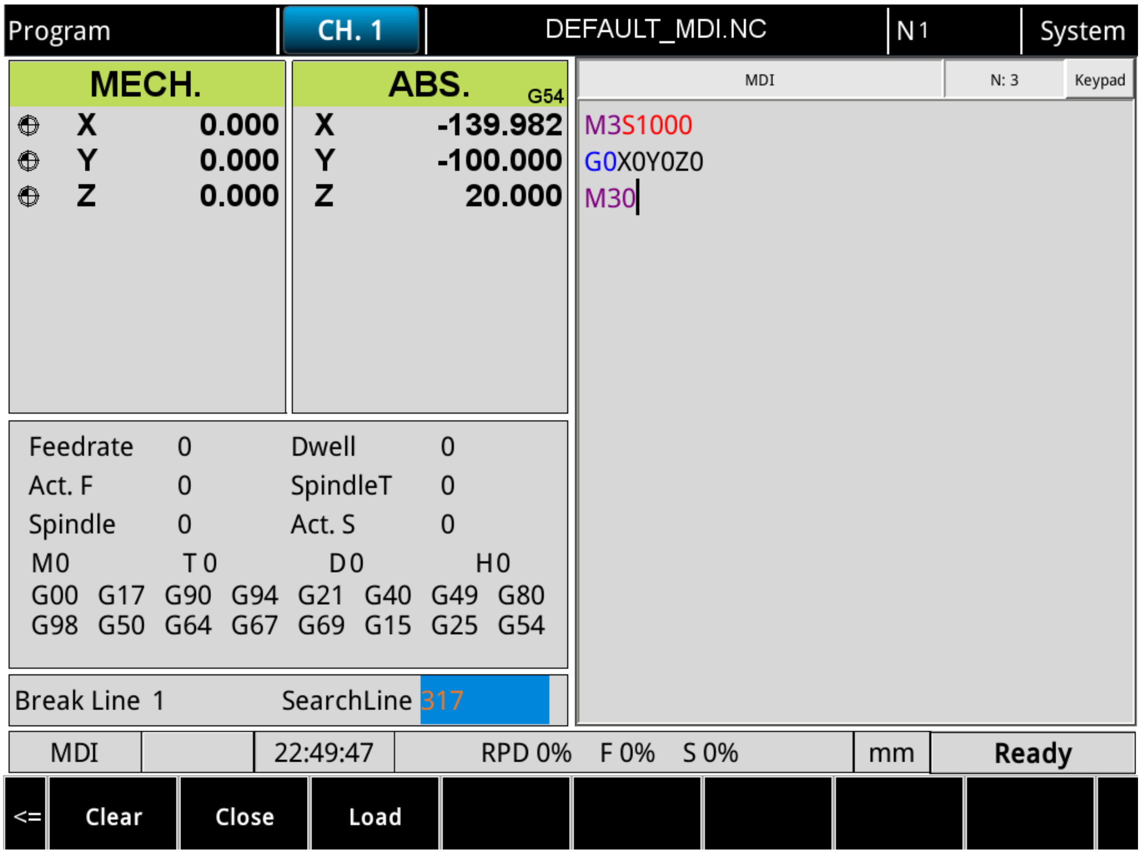



Figure 3.4.11.3

In addition, the save function is for saving the program content entered in MDI mode as a file in the Path1/2/3/4 directory of current channel. The naming method is the same as that in Section 3.4.1 Create a new file. That is, the file name has to follow the naming convention and be unique. The CLR function is for deleting all the program content in the screen in MDI mode.

Note:

1. In MDI mode, after M30 is executed, the cursor returns to the first line of the program. Users can resume the execution without reloading the program.
2. In MDI mode, if there is no M30 (Program end) command, the program runs to the last line. To resume the execution, press **Load** to reload the program. This function is determined by [N0.10] (MDI automatically return to 1st line after finished)

3

# 3.5 Offset (OFS) group

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

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.

## 3.5.1 Coordinate setting

G54 - G59 allow users to set multiple workpiece coordinate systems. With commands G54 - G59, users can simplify the calculation of coordinates during programming as well as change the coordinate values at any time, achieving more flexible machining process. Users 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 3.5.1.1

(1) Workpiece coordinate setting: offset coordinates, G54 - G59 coordinate systems

(2) Coordinate information: machine (MECH) / relative (REL) / absolute coordinates (ABS)

The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Coordinate** 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 users press **FEED HOLD** during program execution, the system status remains “RUN”. If users press  (Single block execution) during program execution, the execution stops after the current block is finished, and the system status becomes “Ready”.

### 3.5.1.1 Coordinate setting

This function is for automatically entering the current position of each axis to the coordinate system (G54 - G59) where the cursor is located. The auto set function includes three options: setting single axis (SET), setting multiple axes (Set All), and setting coordinate system center (Center). The function of clearing coordinate values of a coordinate system (All Clear) is also provided.

- CLR ALL (all clear): clears all the axis values of the current coordinate system to 0 while the values in other systems remain unchanged.
  The operation steps are as follows.
  (1) Press **OFS** to enter the OFS screen.
  (2) Press **Coordinate** to display the corresponding function bar.
  (3) Press ↑, ↓, ←, and → to move the cursor to a specific coordinate system.
  (4) Press **All Clear** to delete all the data of the coordinate system.

- Center (set center): this function is for setting the central position of an object as the center of a coordinate system. The NC system automatically calculates and enters the central position coordinates to the field, so users 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) Press **OFS** to enter the OFS screen.
  (3) Press **Coordinate** to display the corresponding function bar.
  (4) Press ↑, ↓, ←, and → to move the cursor to the X-coordinate field of a specific coordinate system.
  (5) Press **Center** to enter its setting screen.
  (6) Press **1st Point** and the circle on the left side of the rectangle becomes red, as shown in Figure 3.5.1.1.1, meaning the machine coordinates of the first point is recorded.

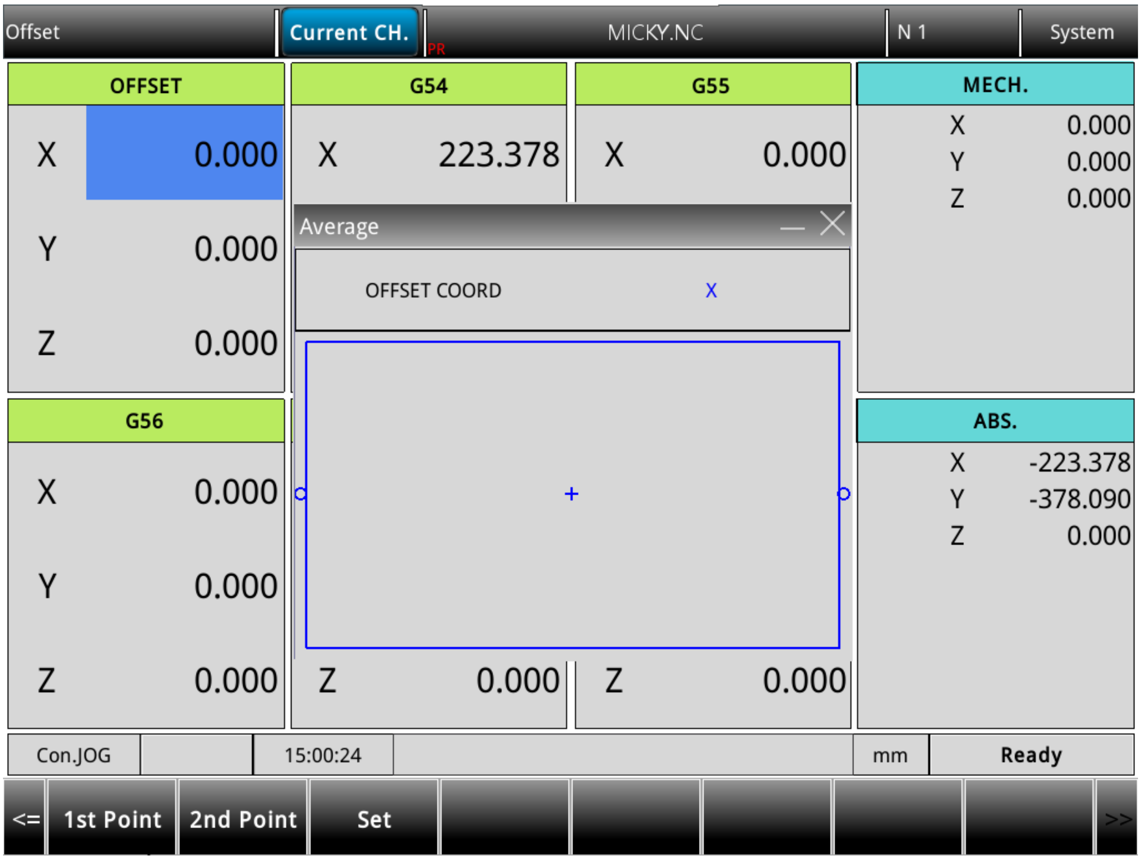



Figure 3.5.1.1.1

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

(8) Press **2nd Point** and the circle on the right side of the rectangle becomes red in Figure 3.5.1.1.1, meaning the machine coordinates of the second point is recorded.

(9) Press **Set** and the system automatically calculates the central point between the machine origin and the workpiece position 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.

- **Set (set single axis):** this function is for automatically entering the current machine coordinate of a single axis. When users move the cursor to the X, Y, or Z field of a specific coordinate system and press **Set**, the current machine coordinate is automatically entered to the field where the cursor is located. This function is for entering the data of a single axis at one time. The operation steps are as follows.

(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) Press **OFS** to enter the OFS screen.

(3) Press **Coordinate** to display the corresponding function bar.

(4) Press ↑, ↓, ←, and → to move the cursor to the X-coordinate field of a specific coordinate system.

(5) Press **Set** to automatically enter the axis coordinate value in the field where the cursor is located.

Example of setting single axis

This example illustrates setting the X-axis value by moving the machine axis to a specific position (workpiece origin in X-axis direction as shown in Figure 3.5.1.1.2).

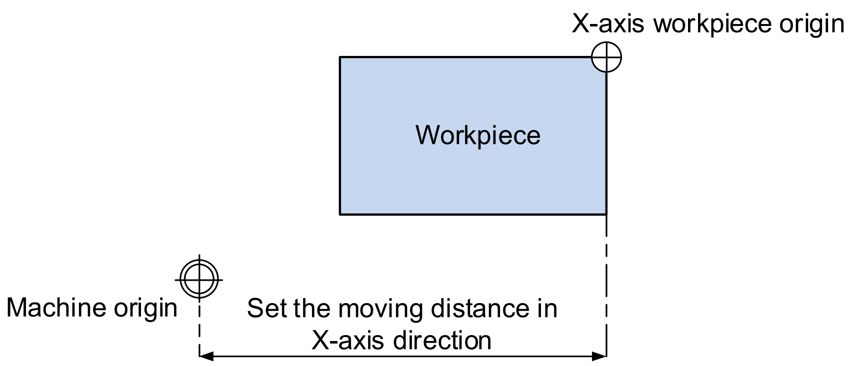



Figure 3.5.1.1.2

Then, the coordinate values are displayed in the machine coordinate fields as shown in Figure 3.5.1.1.3. Move the cursor to a specific coordinate system such as G54 as shown in Figure 3.5.1.1.3 and press **Set** to automatically enter the X-axis value of the machine coordinates to the X-axis field in G54 coordinate system, completing the data entry for single axis.


Figure 3.5.1.1.3

- **Set All (set multiple axes):** this function is for automatically entering the coordinates of multiple axes. After completing the calibration of workpiece center, users can use this function to enter the machine coordinates of multiple axes (including X, Y, Z, and other axes) simultaneously. The operation steps are as follows.
  (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) Press **OFS** to enter the OFS screen.

(3) Press **Coordinate** to display the corresponding function bar.

(4) Press , , , and to move the cursor to a specific coordinate system.

(5) Press **Set All** to automatically enter the coordinate values of multiple axes in the coordinate system field where the cursor is located.

Note: if users have set the coordinates of other axes, do not press **All Clear** to clear the axis values, or the coordinate values are all cleared.

Example of setting multiple axes

Move the machine axis to the specified position as the workpiece origin shown in Figure 3.5.1.1.4 (the figure illustrates the position of X and Y axes except Z axis).

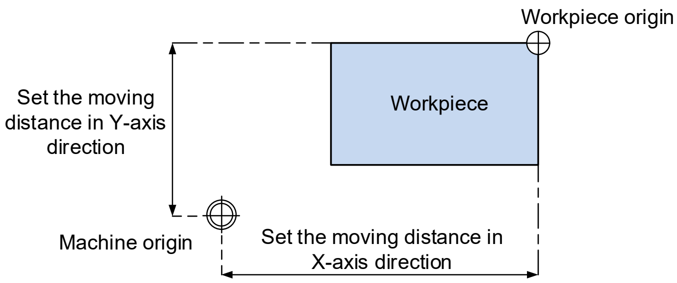



Figure 3.5.1.1.4

After completing the calibration of workpiece origin, the coordinate values are displayed in the machine coordinate fields as shown in Figure 3.5.1.1.5. Move the cursor to the G54 coordinate system and press **Set All** to automatically enter the values of X-, Y-, and Z-axis of the machine coordinate to the X-, Y-, and Z-axis fields in G54 coordinate system, completing the data entry for multiple axes.

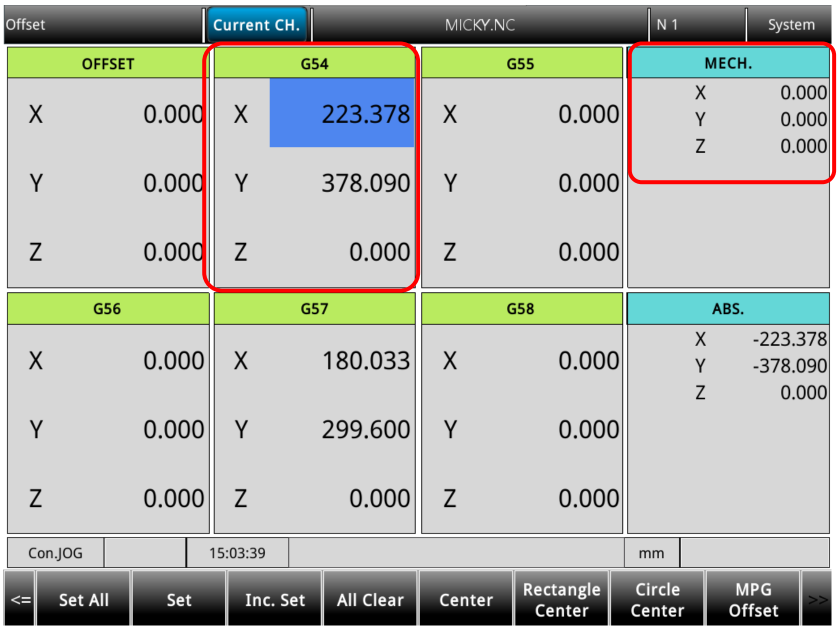



Figure 3.5.1.1.5

### 3.5.1.2 Absolute input

One of the manual input function for coordinate values, which includes absolute and incremental settings. The following operation steps illustrate the absolute setting.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Coordinate** to display the corresponding function bar.

(3) Press ↑, ↓, ←, and → to move the cursor to a specific coordinate system.

(4) To enter positive values, simply press **0** - **9**; to enter negative values, users have to press before using the numeral keys. After entering the values, press to determine the number of decimal places.

(5) Press **ABS** to enter absolute coordinates to the coordinate system.

Note:

1. The displayed values are in the unit of mm. If users enter values without specifying the decimal points, they are in the unit of μm. For example: when users enter 123456, it refers to 123456 μm, so the result is 123.456 mm.
2. In Step (5), users can press either **ABS** or **ENTER** to enter the coordinates.

Example of absolute setting

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

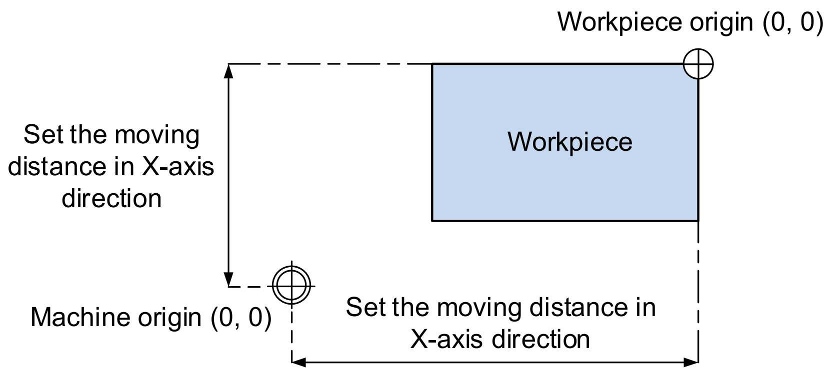



Figure 3.5.1.2.1

3

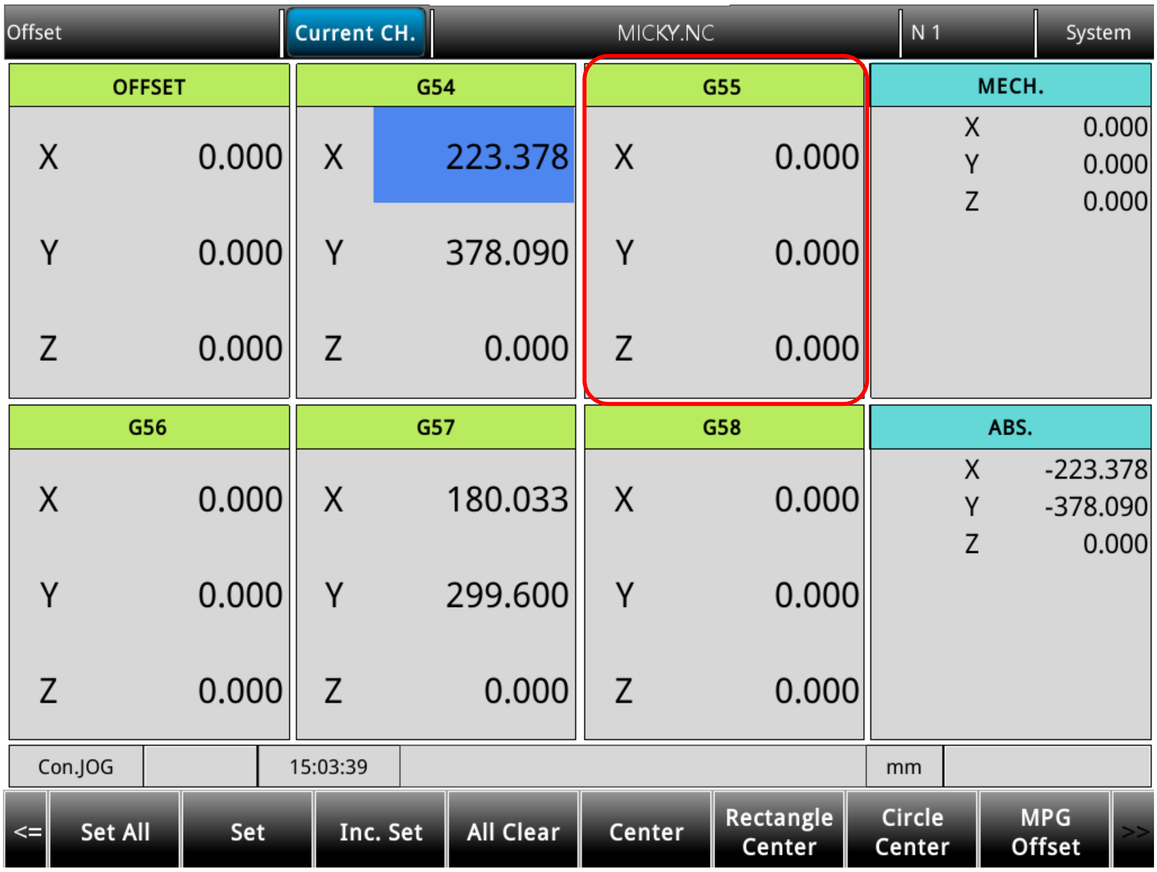



Figure 3.5.1.2.2

### 3.5.1.3 Incremental input

One of the manual input function for coordinate values, usually used for fine adjustment of the original value. That is, users change the values incrementally. For example, when the original value is 150.000, if users enter 5.000 by incremental setting, the newly-set value is 155.000. The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Coordinate** to display the corresponding function bar.

(3) Press ↑, ↓, ←, and → to move the cursor to the X, Y, or Z axis field of a specific coordinate system.

(4) To enter positive values, simply press **0** - **9**; to enter negative values, users have to press before using the numeral keys. After entering the values, press to determine the number of decimal places.

(5) Press **INC** to increment the coordinate values.

Note: make sure users use the correct mode (ABS or INC) and enter the correct coordinates to avoid danger caused by incorrect axis movement.

### 3.5.1.4 Center of rectangle

The rectangular diagram on the screen can guide users in setting the coordinates for the center of rectangular objects. After the system converts the data of the four set endpoints, it calculates the coordinates for the actual center of the object. The function screen is as shown in the following figure.

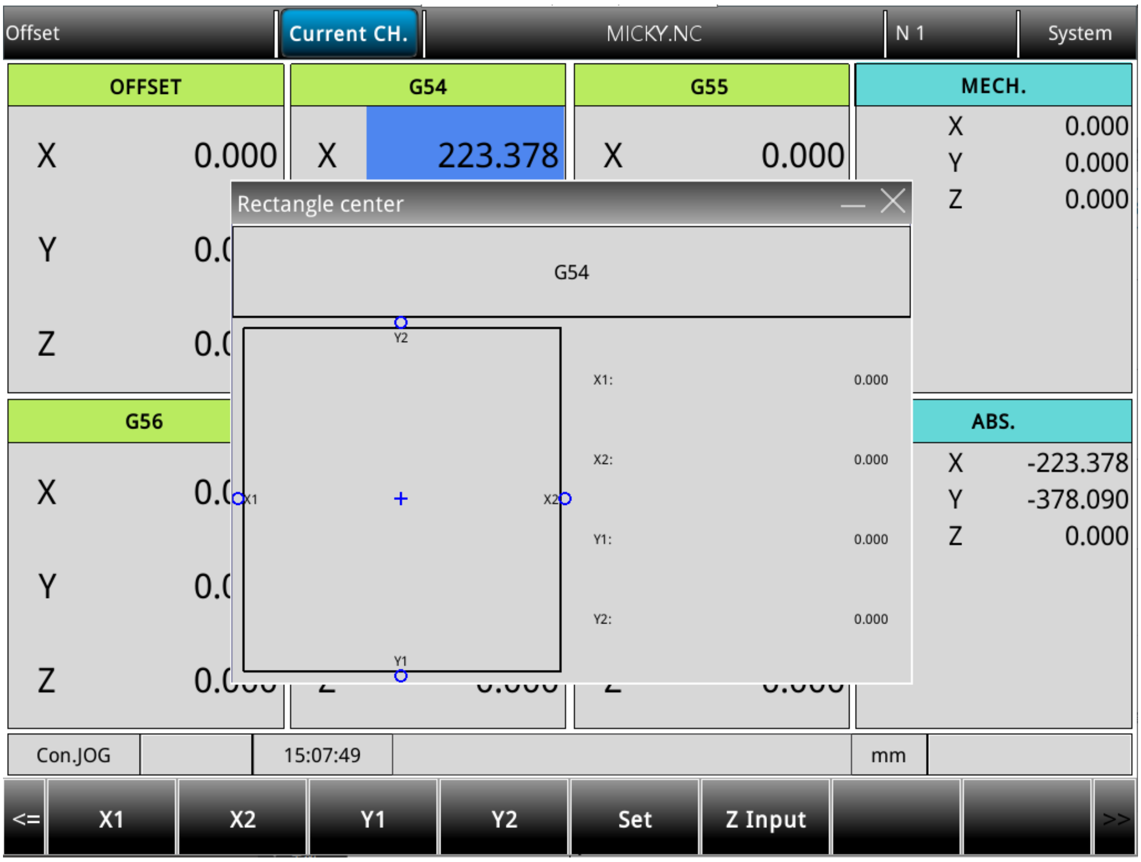



Figure 3.5.1.4.1

The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Coordinate** to display the corresponding function bar.

(3) Press ↑, ↓, ←, and → to move the cursor to the data field of a specific coordinate system.

(4) Press **Rectangle Center** to display the corresponding function screen.

(5) Follow the instructions on the schematic and move the center of the spindle to the mechanical positions of X1, X2, Y1, and Y2. Press the **X1, X2, Y1, and Y2** function keys to set the coordinates of each point.

(6) After setting the coordinates of the 4 points on the rectangle, press **Set** and the system will calculate the coordinate data for the center of the rectangle, and enter it into the coordinate system automatically.

(7) Move the Z axis and confirm the coordinate position, and then press **Z Input** to complete the Z axis coordinate settings for that workpiece coordinate group.

3

Center of rectangle application examples

First, specify the coordinate group field; move the spindle to the 4 endpoint positions of the object manually, and enter the X and Y data for the 4 positions respectively using the corresponding function keys as shown in below figure.

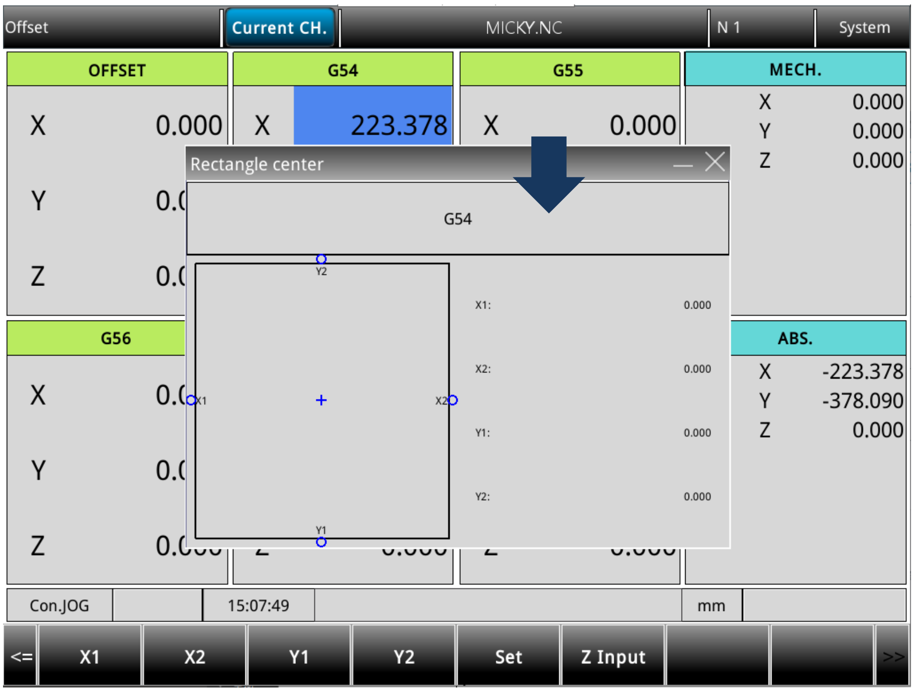



Figure 3.5.1.4.2

After completing the coordinate settings for the 4 endpoints of the rectangle, press **Set**, and the system will calculate the actual machine coordinate values that corresponds to the center of the rectangular object automatically and complete the data setting for the specified coordinate system automatically as shown in Figure 3.5.1.4.3.

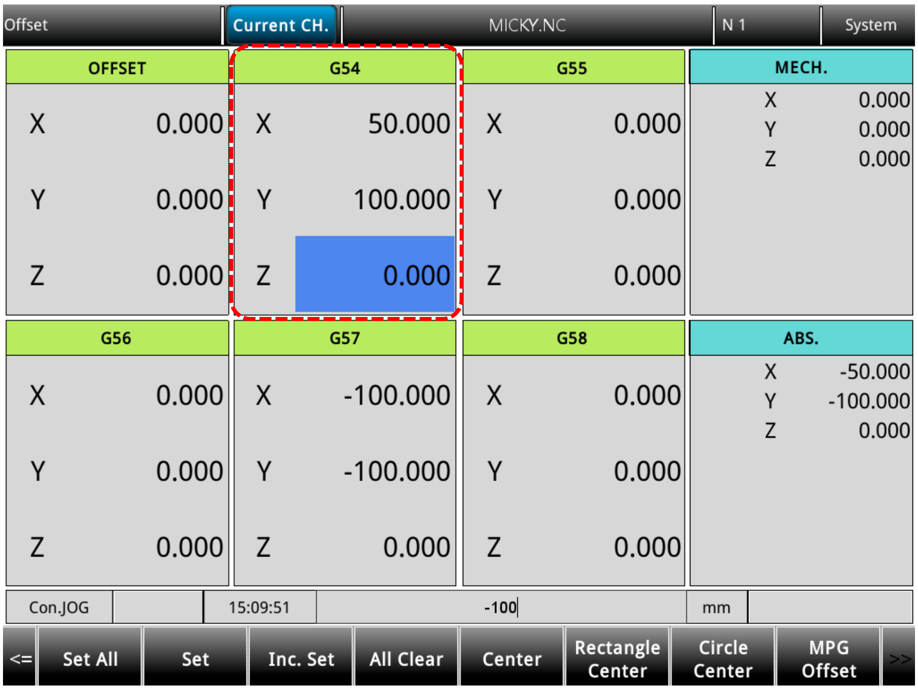



Figure 3.5.1.4.3

### 3.5.1.5 Center of circle



This function can set the coordinate data for the center of a round object. Users can use this function to select any three positions on a round object and set the coordinate data of those three points at the same time; then the coordinates for the center of that object are calculated automatically. The function screen is as shown in the following figure.

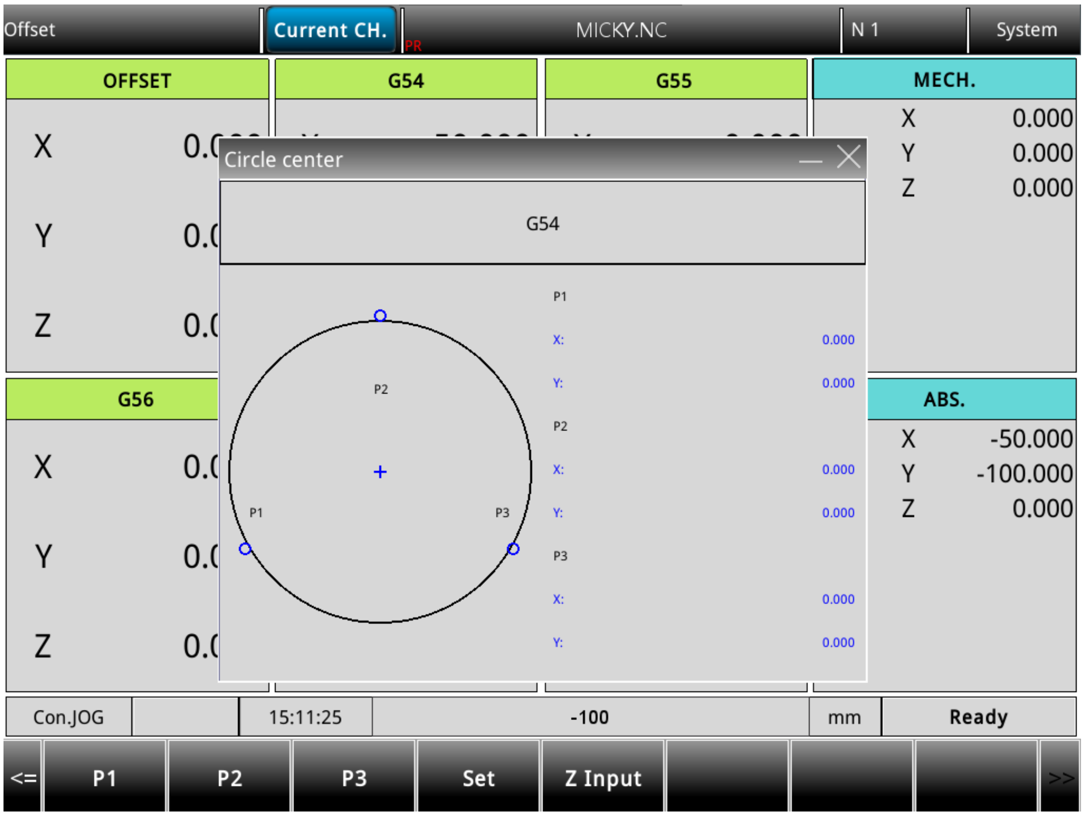



Figure 3.5.1.5.1

The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Coordinate** to display the corresponding function bar.

(3) Press ↑, ↓, ←, and → to move the cursor to the data field of a specific coordinate system.

(4) Press **Circle Center** to display the corresponding function screen.

(5) Follow the schematic and move the center of the spindle to the mechanical positions of P1, P2, and P3 in sequence, and then press **P1**, **P2**, and **P3** function keys to set them in sequence.

(6) After setting the coordinates of the three points on the circle, press **Set**, and the system will calculate the coordinate data for the center of the circle and enter it into the coordinate system automatically.

(7) Move the Z axis and confirm the coordinate position, press **Z Input** to complete the Z axis coordinate settings for that workpiece coordinate group.

3

Center of circle application examples

Users can use the CIRCLE function when the workpiece is a round object. Operate the spindle manually to touch any 3 points on the circumference and set the coordinates of these 3 points individually using the corresponding function keys as shown in below figure.

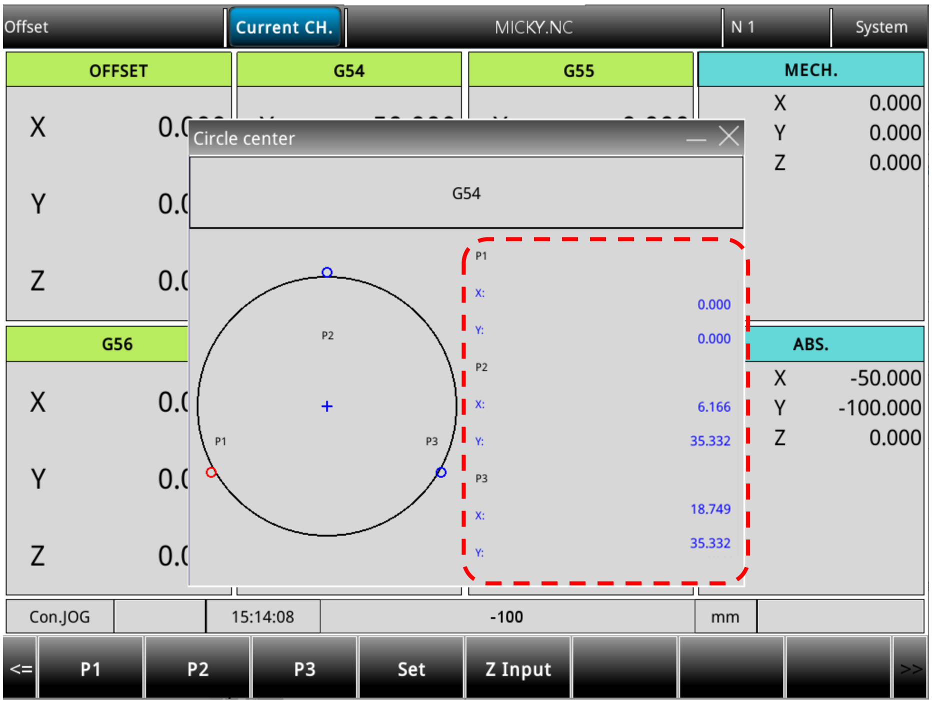



Figure 3.5.1.5.2

After entering the coordinates of any 3 points on the circumference, press **Set**, and the system will calculate the machine coordinates for the center of the circle automatically and enter this data into the specific coordinate system group as shown in Figure 3.5.1.5.3.

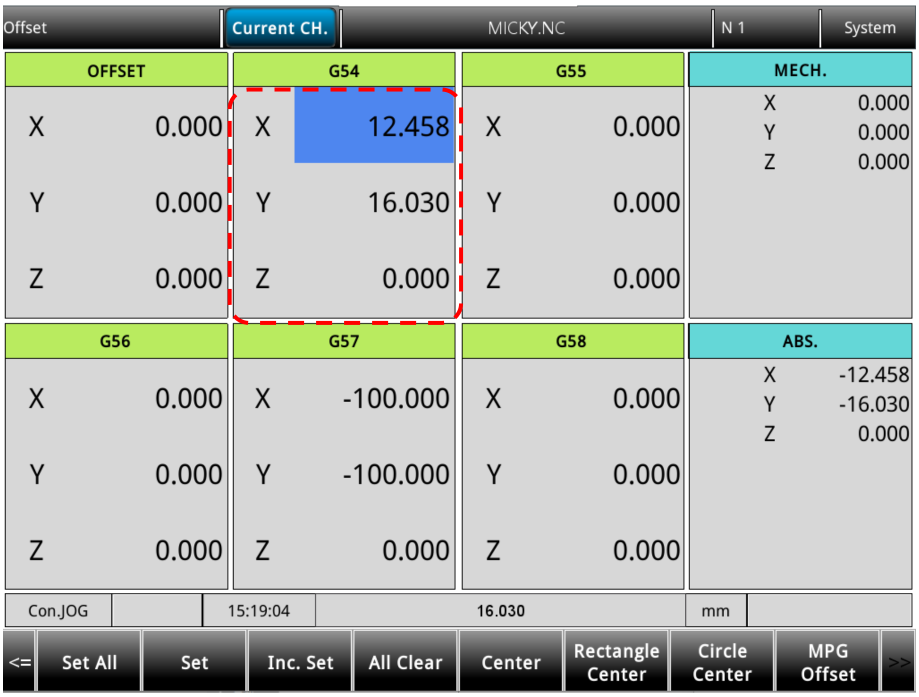



Figure 3.5.1.5.3

## 3.5.2 Tool setting

### 3.5.2.1 Milling machine system

3

The tool setting function must be used with G code command to specify whether to compensate the tool length (compensate with G43 or G44; cancel with G49) or whether to compensate the tool radius (compensate with G41 or G42; cancel with G40). Functions of tool setting for the milling machine system include tool length compensation, tool radius compensation, tool length wear compensation, tool radius wear compensation, and tool life management.

The data fields correspond to the H and D numbers specified in the machining program. H represents tool length compensation and D represents tool radius compensation. With the tool setting function, users can specify the tool length or tool radius data freely and generate the planned machining path and dimensions without modifying the program path. The value setting functions include Inc. Set, Set Length, and Clear. The tool compensation function screen is as shown in the following figure.

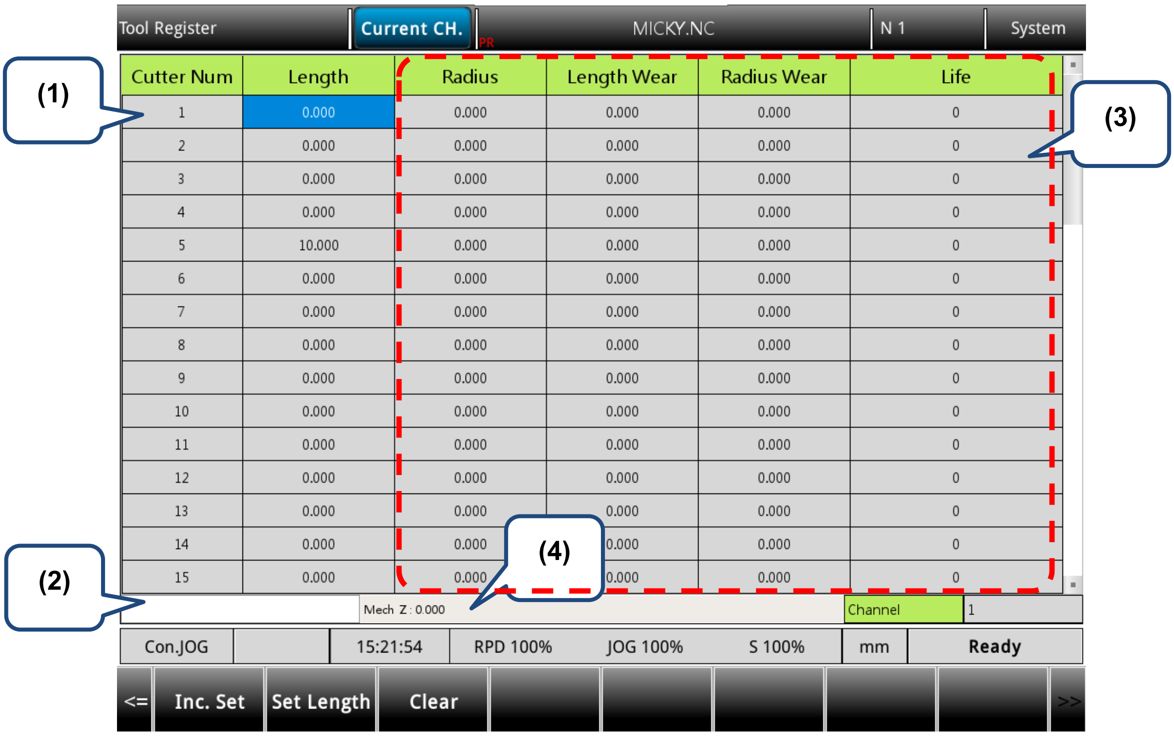



Figure 3.5.2.1.1

(1) Compensation number (H / D)
(2) Input field for compensation data
(3) Compensation information: tool length, tool radius, length wear compensation, radius wear compensation, and tool life
(4) Auxiliary display: current machine coordinates of the Z axis

| Tool setting data value range | |
|---|---|
| Tool length data | -2000.0 to +2000.0 mm |
| Tool radius data | -150.0 to +150.0 mm |
| Compensation data for tool length wear | -2000.0 to +2000.0 mm |
| Compensation data for tool radius wear | -150.0 to +150.0 mm |
| Tool life data | 0 to 65535 times |

- ABS (absolute input): one of the manual input functions for coordinate values. User can use this function to set absolute values for tool length, tool radius, tool wear compensation, or tool life to set absolute values. The operation steps are as follows.
  (1) Press **OFS** to enter the OFS screen.
  (2) Press **Tool** to enter the corresponding function screen.
  (3) Use , , and to move the cursor to specific data field of tool length, tool radius, tool wear, or tool life.
  (4) Click and then enter the value in the input field as shown in the Figure 3.5.2.1.1 item (2). To enter positive values, simply press **0** - **9**; to enter negative values, users have to press before using the numeral keys. After entering the values for the tool compensation data, press to confirm the unit of the values. If it is the data value for tool life, the set value must be positive integers.
  (5) Press **ENTER** to set the value using absolute data.

  Note: the tool data fields correspond to different compensation data. For example: when the cursor is on the length field, the data entered is the tool length compensation data.

- INC (incremental input): one of the manual input functions for coordinate values. Users can use this function to set incremental values for tool length, tool radius, tool wear compensation, and tool life.
  (1) Press **OFS** to enter the OFS screen.
  (2) Press **Tool** to enter the corresponding function screen.
  (3) Use , , and to move the cursor to specific data field of tool length, tool radius, tool wear, or tool life.
  (4) Click and then enter the value in the input field as shown in the Figure 3.5.2.1.1 item (2). To enter positive values, simply press **0** - **9**; to enter negative values, users have to press before using the numeral keys. After entering the values for the tool compensation data, press to confirm the unit of the values. If it is the data value for tool life, the set value must be positive integers.
  (5) Press **Inc. Set** to increase or decrease the value of that field.

- CLEAR**:** the clear function is used to clear the tool compensation data. The clear function includes options such as Geometric, Wear, Life, and All.

Geometric: clears all tool length and radius data.

Wear: clears all length wear and radius wear data.

Life: clears all tool life data.

All (clear all): clears all tool setting data.

The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Tool** to enter the corresponding function screen.

(3) Press **Clear** to display the corresponding function bar.

(4) Press **Geometric** to clear tool length and tool radius data. Press **Wear** to clear the tool wear compensation data. Press **Life** to clear all tool life data. Press **All** to clear all data fields.

### 3.5.3 Tool magazine management

This function is for managing 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.

Users can view the recorded tool number corresponding to the tool pot positions and also change the sequence of the tool number in the tool magazine data table. With parameter settings, users can enable the multi-magazine management function. The function of tool magazine management is only available in JOG mode, as shown in the following figure.

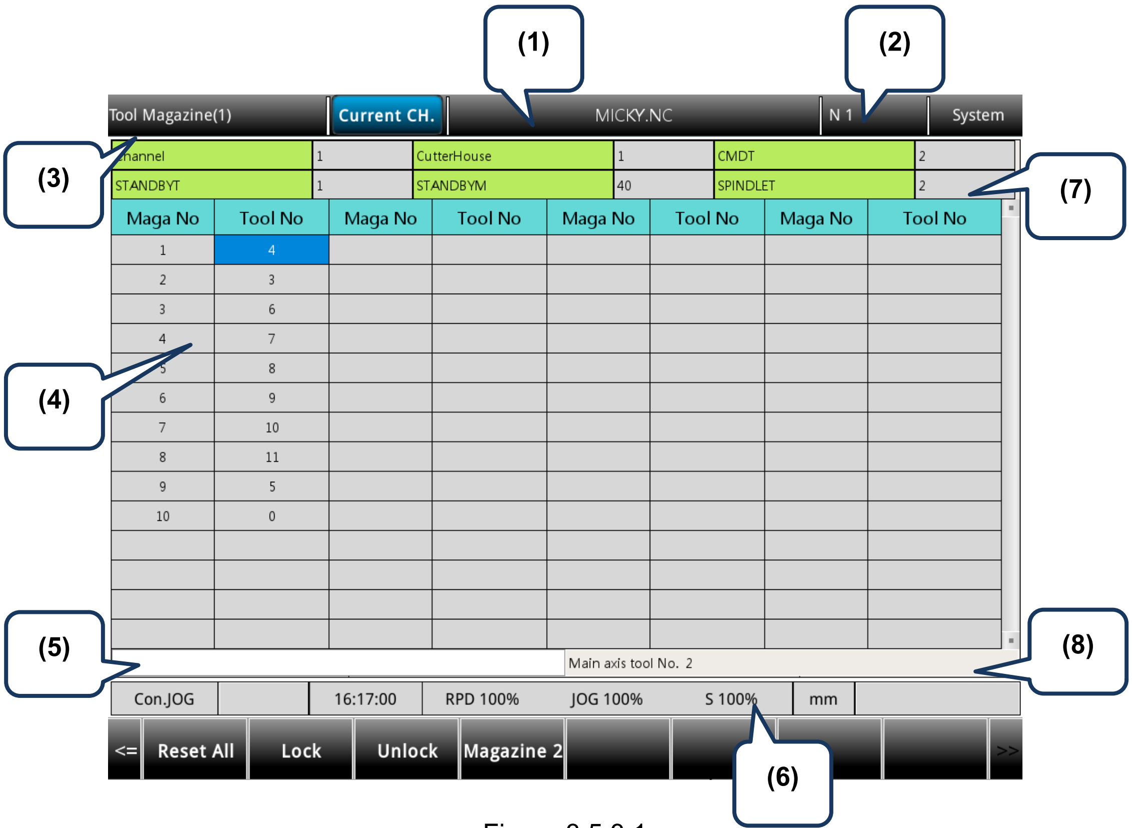



Figure 3.5.3.1

(1) Name of current program

(2) Currently executed program line

(3) Current group function

(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 setting are as follows.

(1) Set the system to JOG mode.

(2) Press **OFS** to enter the OFS screen.

(3) Press **Magazine** to enter the tool magazine data setting screen.

(4) Press ↑, ↓, ←, and → to move the cursor to a specific field.

(5) Enter the tool number and press **ENTER** to change its corresponding tool pot.

3

Example of changing tool number

When users specify a number that already exists in the data table, the system automatically exchanges the one to be replaced with the one that is repeated. This is for ensuring that the tool numbers in each address of the tool magazine do not overlap, preventing the tool call error.

**Workflow description:**

1. Initial status of the tool magazine. Tool numbers are arranged in sequence in accordance with the tool pot numbers.


Figure 3.5.3.2

2. If users set the tool number of tool pot 1 to 2, then the tool number of tool pot 2 becomes 1. That is, the tool numbers for tool pots 1 and 2 are exchanged.


Figure 3.5.3.3

3. If users set the tool number of tool pot 3 to 5, then the tool number of tool pot 5 becomes 3. That is, the tool numbers for tool pots 3 and 5 are exchanged.

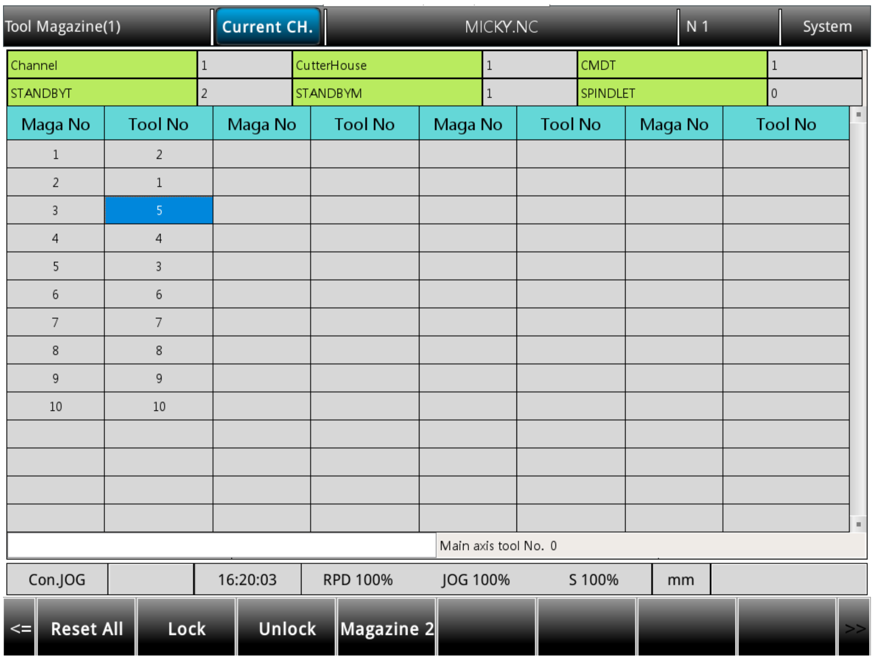



Figure 3.5.3.4

According to the above examples, the mechanism of tool number change can avoid the possibility of mistakenly calling the incorrect tool number.

- **Reset All:** the tool magazine management provides the function of resetting the tools by rearranging the tool numbers. After resetting, the records of changes in tool number are cleared. The tool numbers are arranged in sequence according to the tool pot numbers. With this function, users can restore the data to default setting for troubleshooting tool number misplacement or for tool number resetting. The operation steps are as follows.
  (1) Set the system to JOG mode.
  (2) Press **OFS** to enter the OFS screen.
  (3) Press **Magazine** to enter the tool magazine data setting screen.
  (4) Press **Reset All** to reset the tool magazine data table.

- **Lock (tool pot lock):** use this function to lock the spare tool pots. Tools in the locked pots cannot be called. If users use a command in the program to call a locked tool, the system enables the protection mechanism and displays an error message to stop the execution. This function is a preventive mechanism for checking the tool status during program execution, avoiding errors caused by incorrect tool call, such as damage to the latch of the tool magazine or interference to the magazine due to adjacent tools of large diameter. The data fields of the locked pots are highlighted with different colors. The operation steps are as follows.
  (1) Set the system to JOG mode.
  (2) Press **OFS** to enter the OFS screen.
  (3) Press **Magazine** to enter the tool magazine data setting screen.

(4) Press ↑, ↓, ←, and → to move the cursor to a specific tool number of data field.
(5) Press **Lock** to lock that pot, as shown in Figure 3.5.3.5.

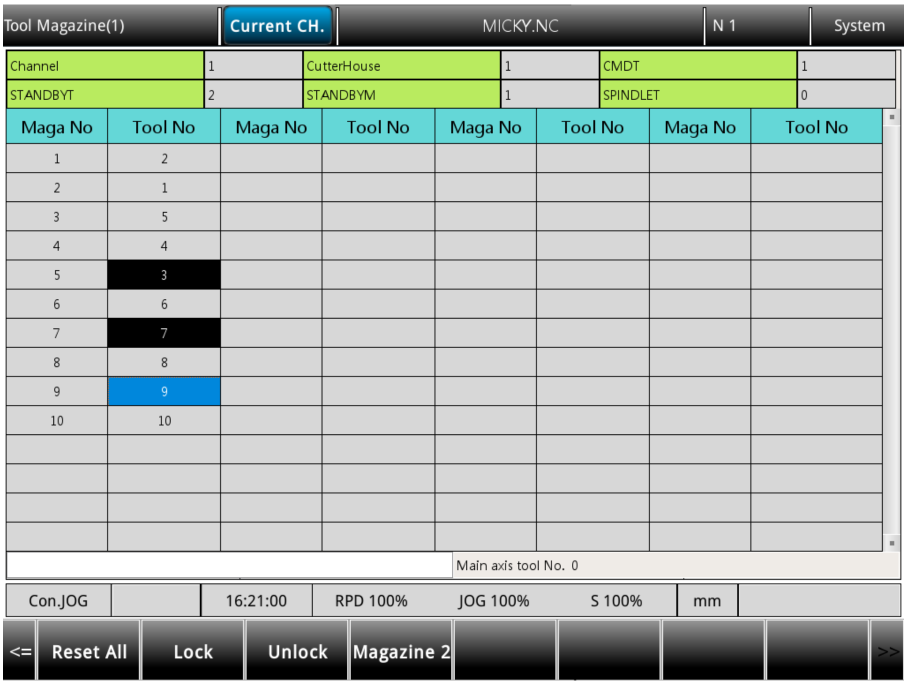



Figure 3.5.3.5

Example of locking the tool pot

This function is used for preventing the tool of large diameter from damaging its adjacent tools by blocking the adjacent pots, ensuring the machine will not be damaged due to misoperation by personnel. By blocking the pots adjacent to the pot which carries a tool of large diameter, users can avoid executing inappropriate tool call program and thus prevent the possible collision caused by placing tools into the adjacent pots.

Assume that T1 is a tool of large diameter, and the adjacent tools are T2 and T16, users can prevent T1 from interfering with the adjacent tools by locking T2 and T16, as shown in the above figure.

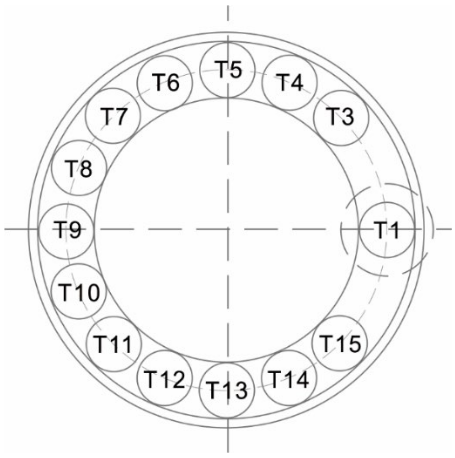



Figure 3.5.3.7

If T1 is a tool of large diameter, its interference with adjacent tools is as shown in the figure above. With T2 and T16 locked, users cannot call tools in the two tool pots.

3

- **Unlock (tool pot unlock):** users can use this function to unlock the pots. The operation steps are as follows.

(1) Set the system to JOG mode.

(2) Press **OFS** to enter the OFS screen.

(3) Press **Magazine** to enter the tool magazine data setting screen.

(4) Press ↑, ↓, ←, and → to move the cursor to the tool pot data field which has been locked.

(5) Press **Unlock** to unlock the tool pot. Or users can enter the same tool number to the data field of the locked pot and press **ENTER** to unlock.

### 3.5.3.1 Multi-magazine management

3

In response to the application needs for managing multiple tool magazines, users can enable this function with tool magazine parameters after accessing the security authorization. Users can specify the number of tool pots for each tool magazine system according to the tool magazine specification as well as the tool numbers after resetting the tool magazine. The items Magazine 1 and Magazine 2 on the function bar are for dividing the management of the two different tool magazine systems. Contact the distributors for services of the multi-magazine management function.


Figure 3.5.3.1.1

Note:

1. Tool numbers in the same tool magazine system cannot be repeated. If users specify a number which already exists in the magazine, the system automatically changes the existing one with a non-repeating number. This is for ensuring the tool numbers in each address of the magazine do not overlap, preventing the tool call error.
2. The default spindle tool number is T0. Once tool T0 is placed into the tool magazine, its 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, and a dialog box appears and displays “T0 can’t be locked!”.

## 3.5.4 Macro variables

Using commands with variables, users 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 extension variables, with the data type as double word.


Figure 3.5.4.1

### 3.5.4.1 Local variables

In macro programs, local variables (#1 - #99) are available in the current program.
The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.

(2) Press **Macro Var.** to display the variable entry screen.

(3) Press **Local Var.** and the screen is automatically switched to display the variable table starting with number 1.

(4) Press , , , and to move the cursor to a specific variable data field.

(5) Enter the value and press **ENTER** to complete the setting.

### 3.5.4.2 Global variables

Global variables (#100 - #999) are shared by main programs, subprograms, and macro programs. The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.
(2) Press **Macro Var.** to display the variable entry screen.
(3) Press **Global Var.** and the screen is automatically switched to display the variable table starting with number 100.
(4) Press ↑, ↓, ←, and → to move the cursor to a specific variable data field.
(5) Enter the value and press **ENTER** to complete the setting.

### 3.5.4.3 Retentive variables

Retentive variables (#2000 - #3999) are for retaining the system status when power is off. The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.
(2) Press **Macro Var.** to display the variable entry screen.
(3) Press **Hold Var.** and the screen is automatically switched to display the variable table starting with number 2000.
(4) Press ↑, ↓, ←, and → to move the cursor to a specific variable data field.
(5) Enter the value and press **ENTER** to complete the setting.

### 3.5.4.4 Extension variables

Up to 500 extension variables (#4000 - #11999) are available for the system.
The operation steps are as follows.

(1) Press **OFS** to enter the OFS screen.
(2) Press **Macro Var.**to display the variable entry screen.
(3) Press **Extend Var.** and the screen is automatically switched to display the variable table starting with number 4000.
(4) Press ↑, ↓, ←, and → to move the cursor to a specific variable data field.
(5) Enter the value and press **ENTER** to complete the setting.

3

## 3.6 Diagnosis (DGN) Group

The DGN group includes a variety of functions. Machining information, user variables, system monitoring, gain adjustment, and system information are for optimizing the system. MLC diagnosis is for monitoring the current status of the MLC devices in the system. Password setting allows users to assign security authorization for different system functions. In addition, system parameters can be imported and exported.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.

### 3.6.1 Machining information

Users can set the number of machined workpiece and number of workpieces to be machined, as well as clear the machining time and number of machined workpieces. The screen of PROCESS is as shown in the following figure.


Figure 3.6.1.1

The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Stock Set** and a dialog box appears for users to enter the number of machining workpiece as shown in the following figure.

(3) Press and to move the cursor to a specific field.

(4) Enter a value within the range of 0 - 9999. Press **ENTER** to complete the setting.

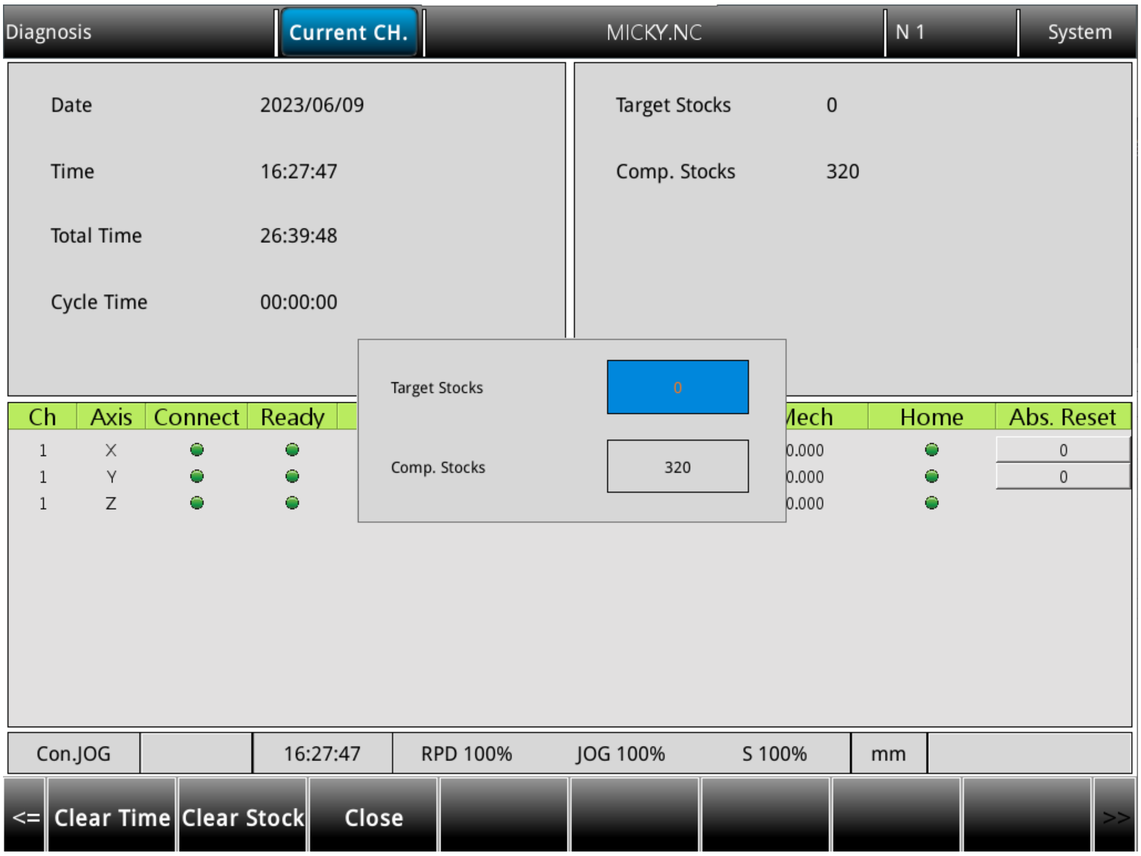



Figure 3.6.1.2

In addition, users can clear the current machining time and number of machined workpieces on the machining information screen. The operation steps for clearing the machining time are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **Stock Set** to enter the machining information screen.
(3) Press **Clear Time** and a dialog box appears for confirmation.
(4) Enter "Y" and press **ENTER** to clear the machining time for a single workpiece on the screen.

The operation steps for clearing the number of machined workpieces are as follows.

(1) Press **DGN** to enter the DGN screen.
(2) Press **Stock Set** to enter the machining information screen.
(3) Press **Clear Stock** and a dialog box appears for confirmation.
(4) Enter "Y" and press **ENTER** to clear the number of machined workpieces on the screen.

3

### 3.6.2 User variable

The functions of user variable include system variable, user variable, and machine variable. Users can use the function of system variable to monitor specific variables and use the functions of user variable and machine variable to enter the names of registers (D60000 – D61999) and display the corresponding data on the screen. With the displayed types of registers, users can easily control the corresponding devices by monitoring and changing the setting values of the registers (D60000 - D61999).


Figure 3.6.2.1

The operation steps for user variable and machine variable are as follows:

(1) Press DGN to enter the DGN screen.

(2) Press **User Var.** to enter the variable monitoring screen.

(3) Press ↑ and ↓ or PAGE UP and PAGE DN to move the cursor to a specific field.

(4) Enter the specified register number (D60000 – D61999) and press ENTER to load the data in the register of the specified number.

(5) Move the cursor to the value field of the specified register, enter a value, and press ENTER to complete the value setting for that register device.

(6) Press **Unsigned Decimal**, **HEX**, **Signed Decimal** or **Floating** to select the data format display.

(7) To delete data, move the cursor to the data field and press **Delete** to delete the data.

## 3.6.3 MLC

This function displays the current status of each MLC device, so users can monitor and force On or Off each device. Users can also check the system status, drive a certain MLC device, or edit the MLC. See Figure 3.6.3.1 for the MLC screen. MLC-related diagnostic functions include bit status, register status, device monitoring, MLC status switching, and MLC editing. The operation steps for these functions are described in the following sections.

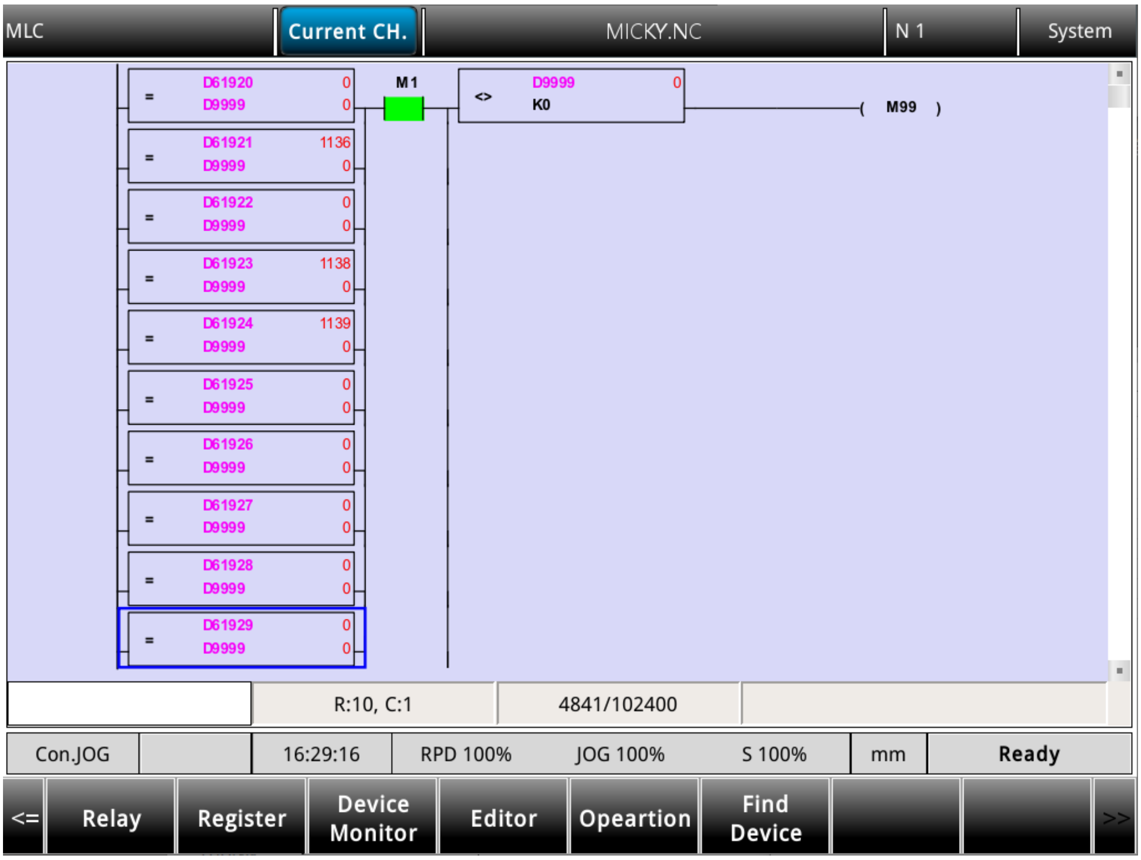



Figure 3.6.3.1

### 3.6.3.1 Bit

MLC programs require a number of commands to trigger the devices On / Off. Status of these devices is shown on the MLC Bit Device screen. This function is for displaying the bit type MLC devices, searching the device, and forcing the device to On or Off. 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 **Relay** to enter the bit device status display screen.

(4) Press **M** to switch to the status display for M devices as shown in the following figure. Move the cursor to a specific device field or search for the device. by following Step (5).

3


| | +0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 |
|---|---|---|---|---|---|---|---|---|---|---|
| X0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Figure 3.6.3.1.1

(5) Enter the device name, such as 107, and press **M** to search for the specified device, M107. To change the status of this device, set the system to non-AUTO mode. Refer to Step (6) for the operation steps.

(6) Specify the device which status is to be changed. Depending on its current status, enter “1” to force it to On and press **ENTER**, or “0” to force it to Off and then press **ENTER**.

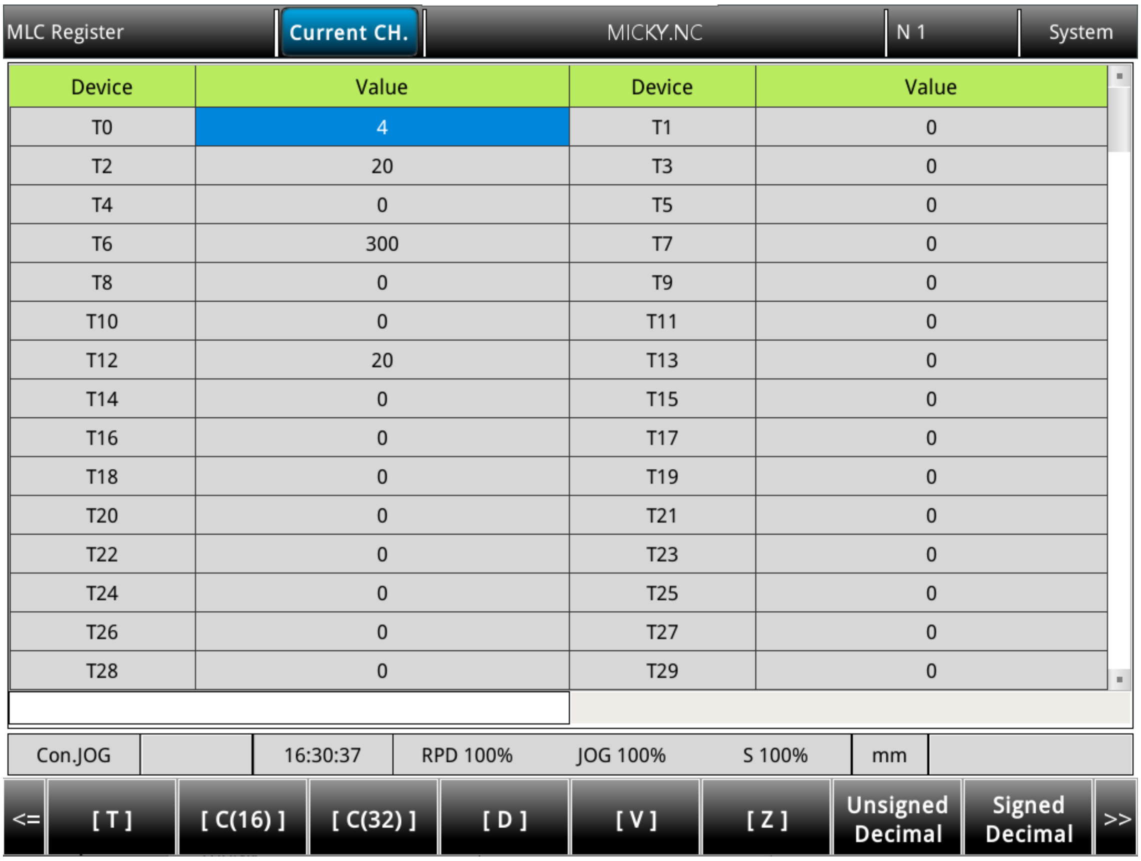
### 3.6.3.2 Register

Most of the CNC system functions are enabled by MLC programs. MLC devices are divided into bit type and word type. The following operation steps take the word type MLC device and T registers 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 **Register** to enter the register device screen.




| Device | Value | Device | Value |
|---|---|---|---|
| T0 | 4 | T1 | 0 |
| T2 | 20 | T3 | 0 |
| T4 | 0 | T5 | 0 |
| T6 | 300 | T7 | 0 |
| T8 | 0 | T9 | 0 |
| T10 | 0 | T11 | 0 |
| T12 | 20 | T13 | 0 |
| T14 | 0 | T15 | 0 |
| T16 | 0 | T17 | 0 |
| T18 | 0 | T19 | 0 |
| T20 | 0 | T21 | 0 |
| T22 | 0 | T23 | 0 |
| T24 | 0 | T25 | 0 |
| T26 | 0 | T27 | 0 |
| T28 | 0 | T29 | 0 |

Figure 3.6.3.2.1

(4) Press **T** to enter the register T 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 ENTER to complete the setting.

(7) Go to the last page of the function bar and press **Unsigned Decimal**, **HEX**, **Signed Decimal** or **Floating** to select the data format display.

### 3.6.3.3 Device monitoring



Up to 45 sets of device data can be monitored with this function. 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 **Device Monitor** to display the device name input screen.


Figure 3.6.3.3.1

(4) Enter the name of the device to be monitored as shown below. Users can enter up to 45 device names.


Figure 3.6.3.3.2

**Device:** when the cursor is located in this field, users 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.

In addition, users can switch the data format display according to the requirements by using the functions of Unsigned Decimal, HEX, Signed Decimal or Floating. The data in Figure 3.6.3.3.3 are in hexadecimal format and the data in Figure 3.6.3.3.4 are in floating format.


Figure 3.6.3.3.3


Figure 3.6.3.3.4

### 3.6.3.4 Line search



Use this function to search for a specific line according to the entered line number of the MLC program.

(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.

(4) Press ▶ repeatedly to display the function bar on the last page in this layer.

(5) Enter a specific line number of the MLC program and press **Goto Line** to go to the target line.

### 3.6.3.5 Editor

Use this function to manage and edit the MLC programs. Users can directly edit the MLC programs on the controller interface with the system set to EDIT mode.

■ Basic MLC commands

Including LD, LDI, LDP, LDF, OUT, APP, —, and ｜, are created with the function of MLC editing.

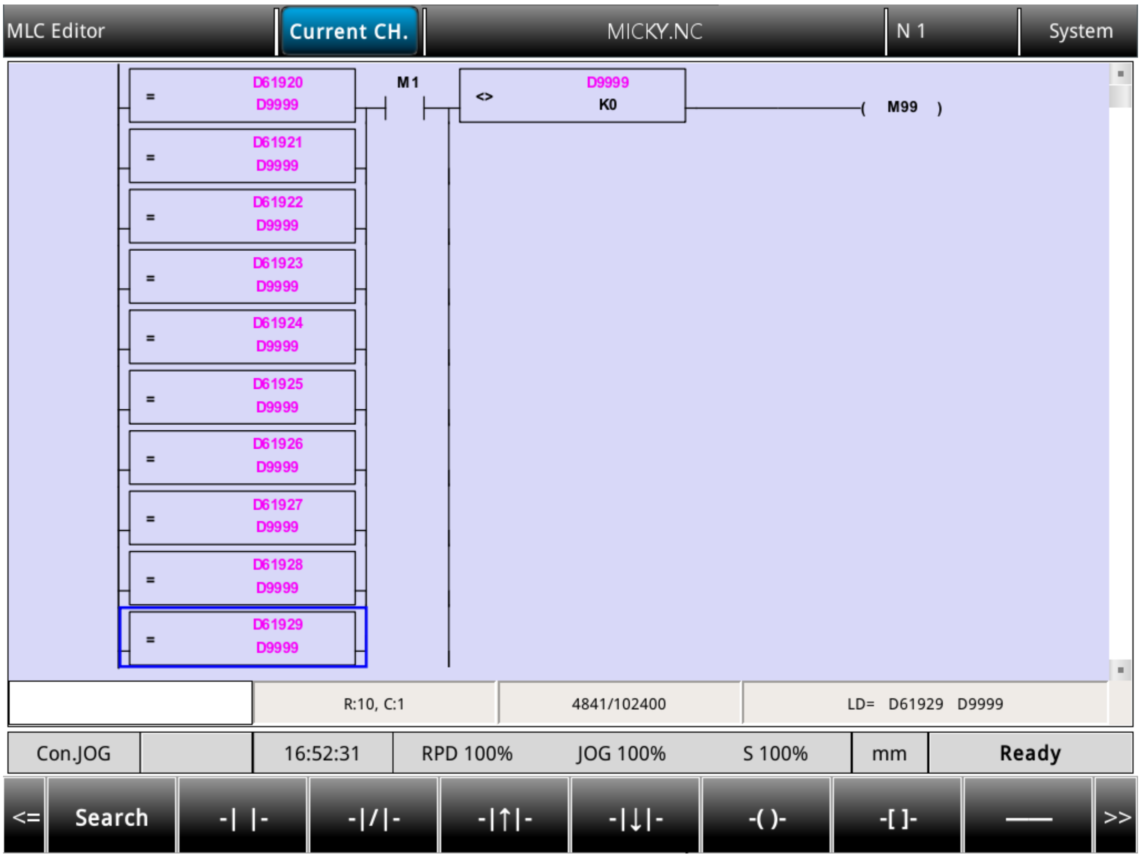



Figure 3.6.3.5.1

The operation steps for creating command LD 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.

(4) Press ↑, ↓, ←, and → to move the cursor to the field to be edited.

(5) Enter the device name and press **LD** to complete creating the device.

The above steps are also applicable for creating LDI, LDP, LDF, OUT, and APP commands.

To specify the values for the basic commands, press TABLE to display the MLC table as shown in the following figure.

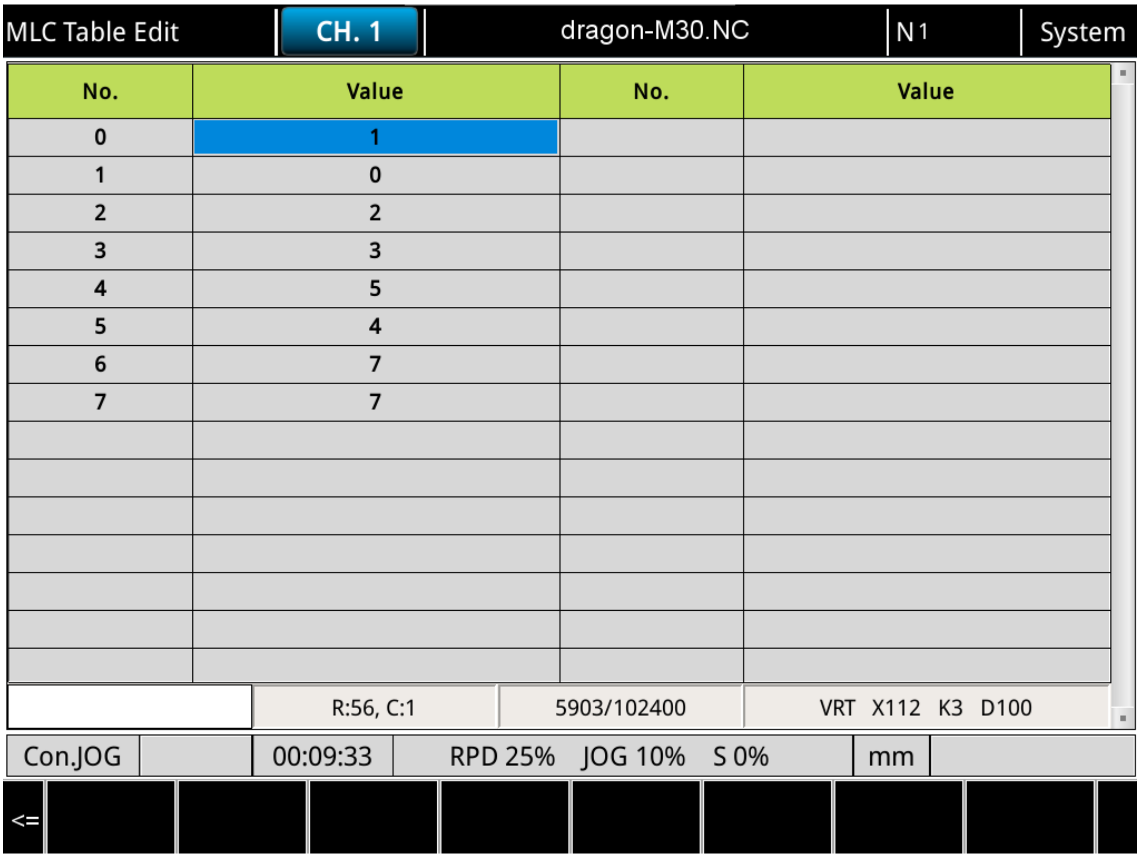



Figure 3.6.3.5.2

■ Editing (Cut, Copy, Paste)

These editing functions are MLC-specific, with which users can delete, cut, or copy a single line of program. Or users can use 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 edited MLC program. The operation steps for editing MLC programs 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.

(4) Press ↑, ↓, ←, and → to move the cursor to the field to be edited.

(5) Press ▶ repeatedly to display the function bar on the last page in this layer.

(6) Press the corresponding function key. For example, press **CUT** to perform related edit operations. When editing MLC programs, press the corresponding function keys according to the editing requirements, including **Select**, **Delete**, **Cut**, **Copy**, **Paste**, **Insert Row**, and **Delete Row**.

- SYMBOL

  Use this function to search, delete, copy, and paste the MLC devices. MLC program 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.
  (4) Press ↑, ↓, ←, and → to move the cursor to the field to be edited.
  (5) Press ▶ to display the function bar on the second page.
  (6) Press **Symbol** to display the corresponding function bar.
  (7) Press the 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 above steps are applicable to other device symbols.

### 3.6.3.6 Operation

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 is for switching the MLC program status to ON or OFF, which is usually used for testing or checking 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 **Operation** to switch to the screen of MLC execution status.
(4) Press **RUN/STOP** to force switch the MLC program execution status.

Note: after stopping the MLC program, users can see the status of “MLC Stop” in the system status field.

In addition, users can force the MLC device to ON or OFF using the corresponding functions.

- The operation steps for forcing the device status to 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 **Operation** to switch to the screen of MLC execution status.
  (4) Press ↑, ↓, ←, and → to move the cursor to a specific device.
  (5) Press **Force ON** to switch the device status to ON.

- The operation steps for forcing the device status to 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 **Operation** to switch to the screen of MLC execution status.
  (4) Press ↑, ↓, ←, and → to move the cursor to a specific device.
  (5) Press **Force OFF** to switch the device status to OFF.

## 3.6.4 System monitoring

This **system monitoring** function categorizes the various calculation results of the system and displays them according to their types for users' reference.

3

### 3.6.4.1 Servo monitoring

This function displays the servo drive status on the screen of the system, from which users can check the information about the channel port number and servo status of each axis.


Figure 3.6.4.1.1

The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Display the servo monitoring screen.

### 3.6.4.2 Variable monitoring

- System variables: VS0 – VS19, VS100 – VS119 and VS200 - VS219. The operation steps are as follows:
  (1) Press **DGN** to enter the DGN screen.
  (2) Press **System Monitor** to switch to the system monitoring screen.
  (3) Press **Var. Monitor** to display the variable monitoring screen.
  (4) Press **System Var**. to display the system variable monitoring screen.
  (5) Press **PAGE UP** and **PAGE DN** to scroll to the page with the specified variable.
  (6) Users can also enter the full name of a specific system variable and press **ENTER** or enter the variable number and press **System Var** to search for and display the specified system variable.

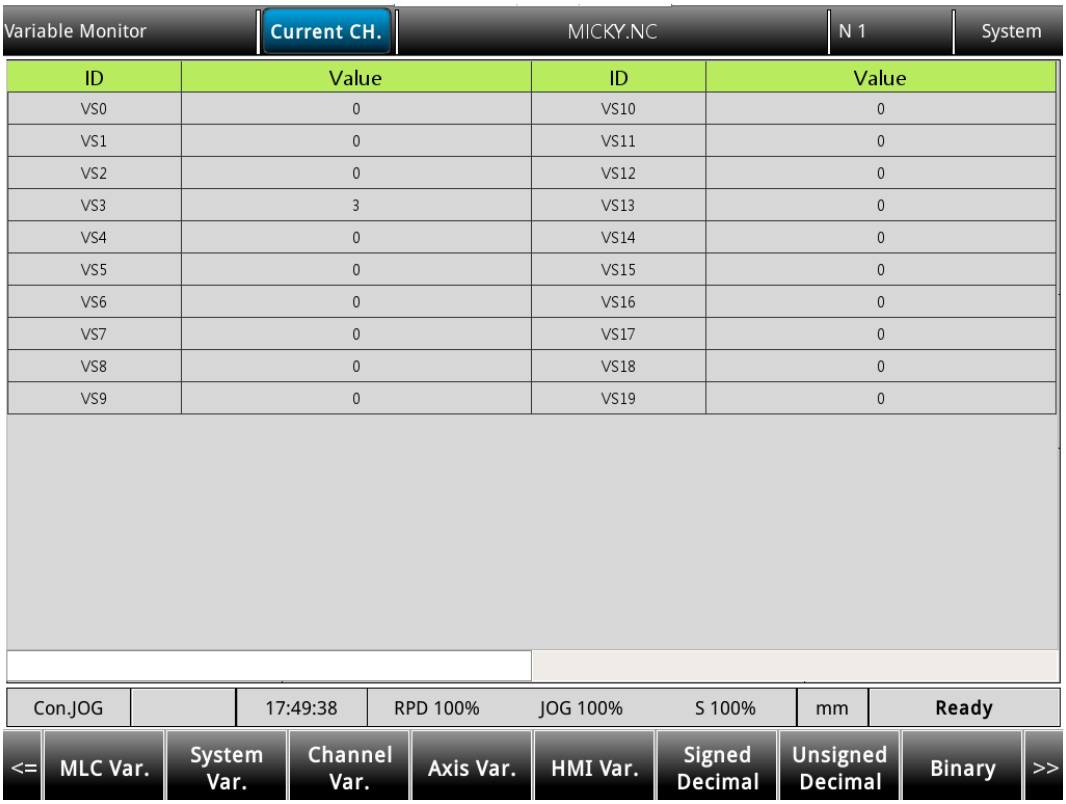



Figure 3.6.4.2.1

- Channel variables: the variable range include VC0 – VC9, VC10 - VC19, VC100 – VC109, VC110 - VC119, VC200 - VC209 and VC210 - VC219.
  The operation steps are as follows:
  (1) Press **DGN** to enter the DGN screen.
  (2) Press **System Monitor** to switch to the system monitoring screen.
  (3) Press **Var. Monitor** to display the variable monitoring screen.
  (4) Press **Channel Var**. to display the system variable monitoring screen.
  (5) Press **PAGE UP** and **PAGE DN** to scroll to the page with the specified variable.

(6) Users can also enter the full name of a specific channel variable and press **ENTER** or enter the variable number and press **Channel Var**. to search for and display the specified channel variable.



- Axis variables: variable range includes VA0 - VA9, VA10 - VA19, VA100 - VA109, VA110 - VA119, VA200 - VA209 and VA210 - VA219.

  The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press **System Monitor** to switch to the system monitoring screen.

  (3) Press **Var. Monitor** to display the variable monitoring screen.

  (4) Press **Axis Var**. to display the system variable monitoring screen.

  (5) Press **PAGE UP** and **PAGE DN** to scroll to the page with the specified variable.

  (6) Users can also enter the full name of a specific axis variable and press **ENTER** or enter the variable number and press **Axis Var**. to search for and display the specified axis variable.

- Interface variables: variable range includes VH0 - VH19, VH20 - VH31, VH200 - VH219, VH220 - VH239, VH240 - VH259 and VH260 - VH263.

  The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press **System Monitor** to switch to the system monitoring screen.

  (3) Press **Var. Monitor** to display the variable monitoring screen.

  (4) Press **HMI Var**. to display the system variable monitoring screen.

  (5) Press **PAGE UP** and **PAGE DN** to scroll to the page with the specified variable.

  (6) Users can also enter the full name of a specific axis variable and press **ENTER** or enter the variable number and press **HMI Var**. to search for and display the specified interface variable.

- MLC variables: variable range include VM0 ~ VM49。The operation steps are as follows.

  (1) Press **DGN** to enter the DGN screen.

  (2) Press **System Monitor** to switch to the system monitoring screen.

  (3) Press **Var. Monitor** to display the variable monitoring screen.

  (4) Press **MLC Var**. to display the system variable monitoring screen.

  (5) Press **PAGE UP** and **PAGE DN** to scroll to the page with the specified variable.

  (6) Users can also enter the full name of a specific MLC variable and press **ENTER** or enter the variable number and press **MLC Var**.to search for and display the specified MLC variable.

3

## 3.6.5 Password setting

To effectively control the operation security of the system functions, users can use this function to assign different levels of authorization for the system (system maintenance), machine (mechanical devices), and user (operation). This prevents unauthorized users from changing the system settings and thus affecting the system operation.

### 3.6.5.1 System security

This function includes security lock, security unlock, and system check. The operation steps for locking and unlocking the system security are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to switch to the function bar of authority setting.

(3) Press **Login** to display the corresponding function bar.

(4) Check the **Security Login** and then key in the correct **Password**.

(5) After entering the password, press **ENTER** to unlock the system.

### 3.6.5.2 Machine security

This function includes system check and system setting.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to switch to the function bar of authority setting.

(3) Press **Login** to display the corresponding function bar.

(4) Key in the **Account** and it's correct **Password**.

(5) After entering the password, press **ENTER** to unlock the system.

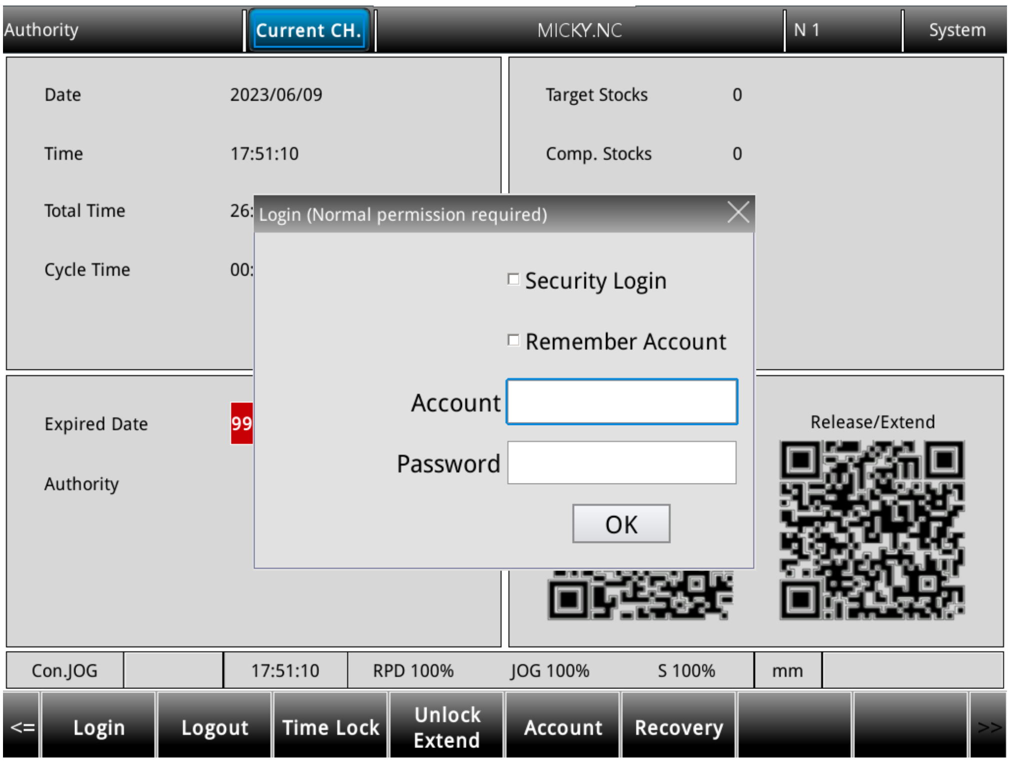



Figure 3.6.5.2.1

The operation steps for locking the machine security are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to switch to the function bar of authority setting.

(3) Press **Logout** to immediately lock all machine-related functions.

The function of restoring to default allows users to restore the system with the system backup file when the system is in error, or the system data is seriously damaged. In the Default screen, if the check box is selected, it means the data of that item is damaged. Users can use this function to restore the data of that item. This function is available only when users have the proper authorization. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to switch to the function bar of authority setting.

(3) Press **Login** to display the corresponding function bar.

(4) Check the **Security Login** and then key in the correct **Password**.

(5) Press **Recovery** to enter the recover screen.

(6) Select items to recover and then press **Confirm** to execute the recovery.

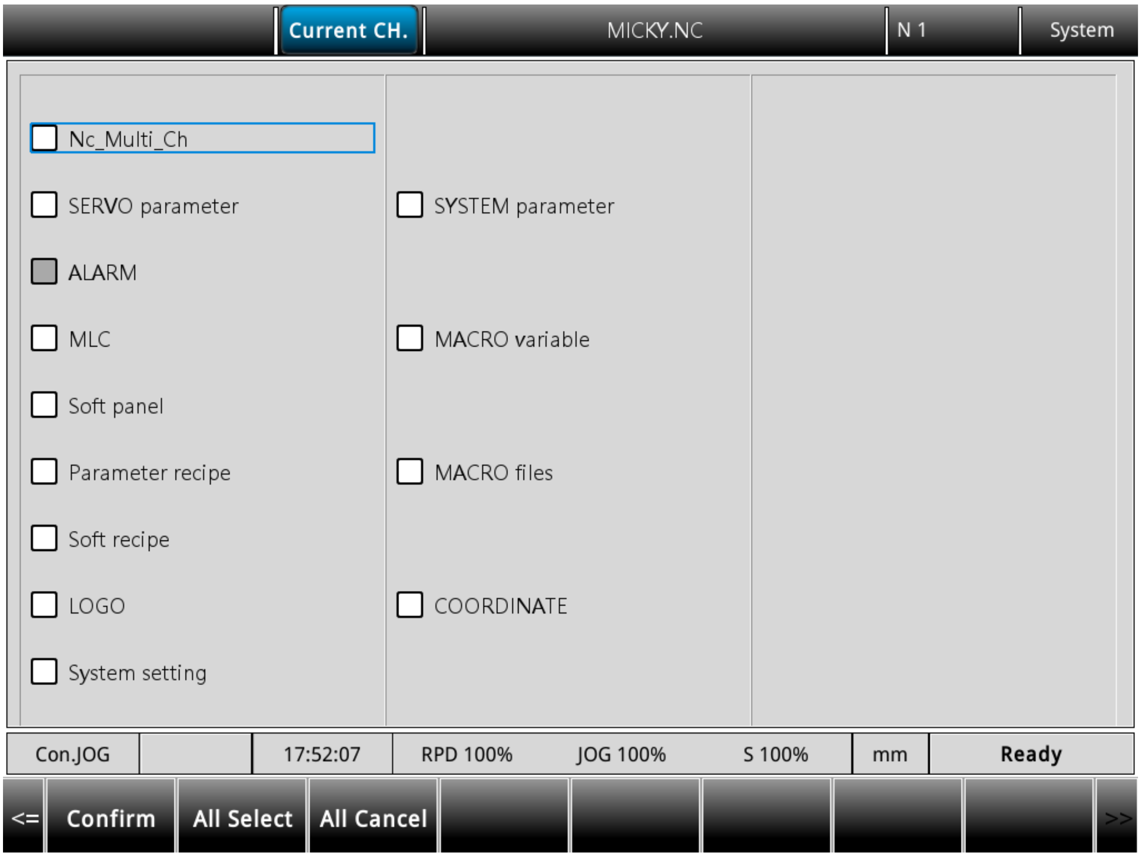



Figure 3.6.5.2.2

3

### 3.6.5.3 User security

This function includes Normal, User1, User2 and Devices. Users are available to manage their user account by add and delete. The operation steps are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to switch to the function bar of authority setting.

(3) Press **Login** to display the corresponding function bar.

(4) Check the **Security Login** and then key in the correct **Password**.

(5) Select the user level and then press **Add** or **Del** to edit user account list.

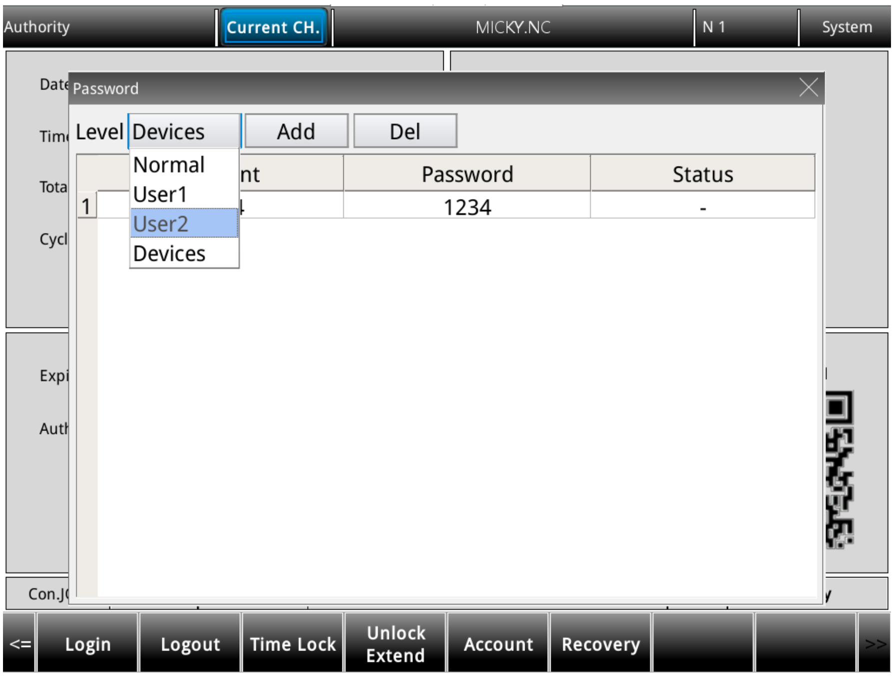



Figure 3.6.5.3.1

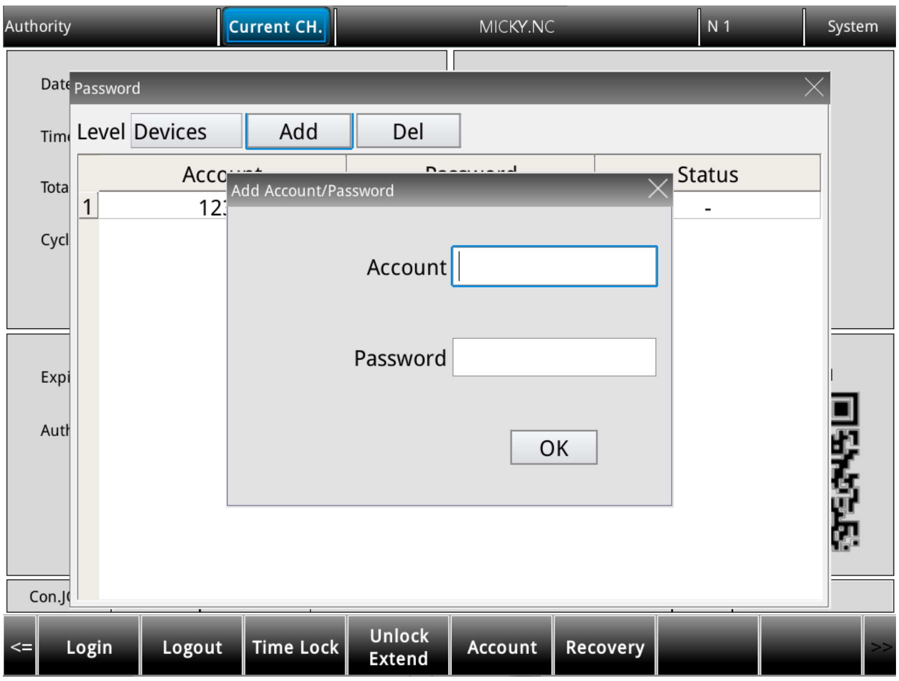



Figure 3.6.5.3.2

### 3.6.5.4 Time lock

For specific situations that require a time limit on usage, users can set the operation time for the controller by security authorization. After the time limit is set, the available duration (hours / days) is automatically controlled by the system. When this function is enabled, users can only remove or reset the time limit with the proper authorization. When the time limit is not set or disabled, the **Expiration Date** is displayed 9999/12/31 on the screen, as shown in Figure 3.6.5.4.1. Once the T**ime limit** has set and not expired, the **expiration date** will display the deadline date, as shown in Figure 3.6.5.4.2.

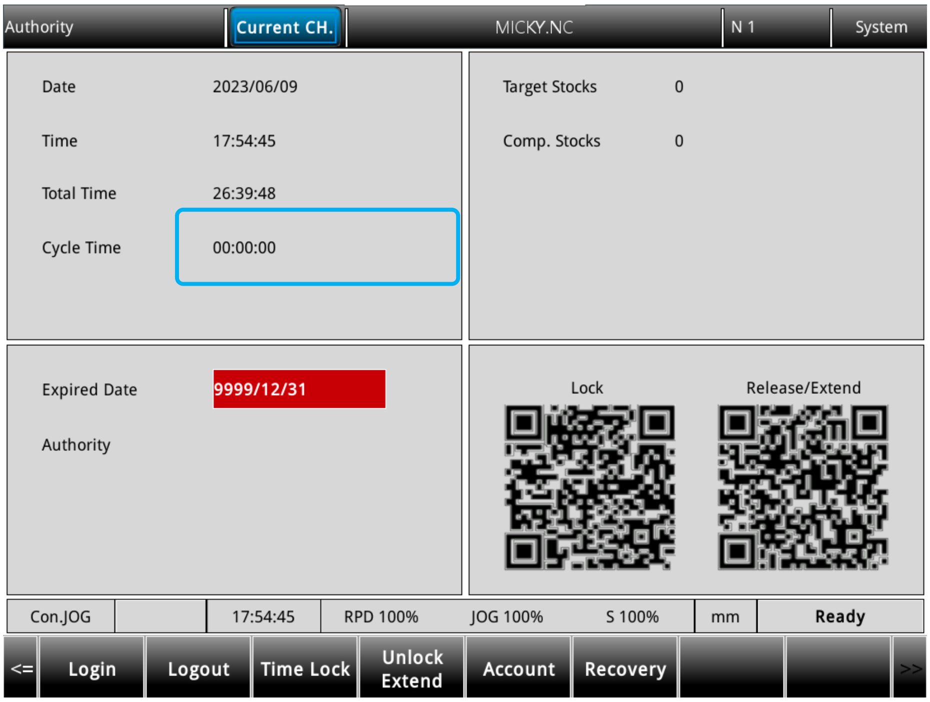



Figure 3.6.5.4.1

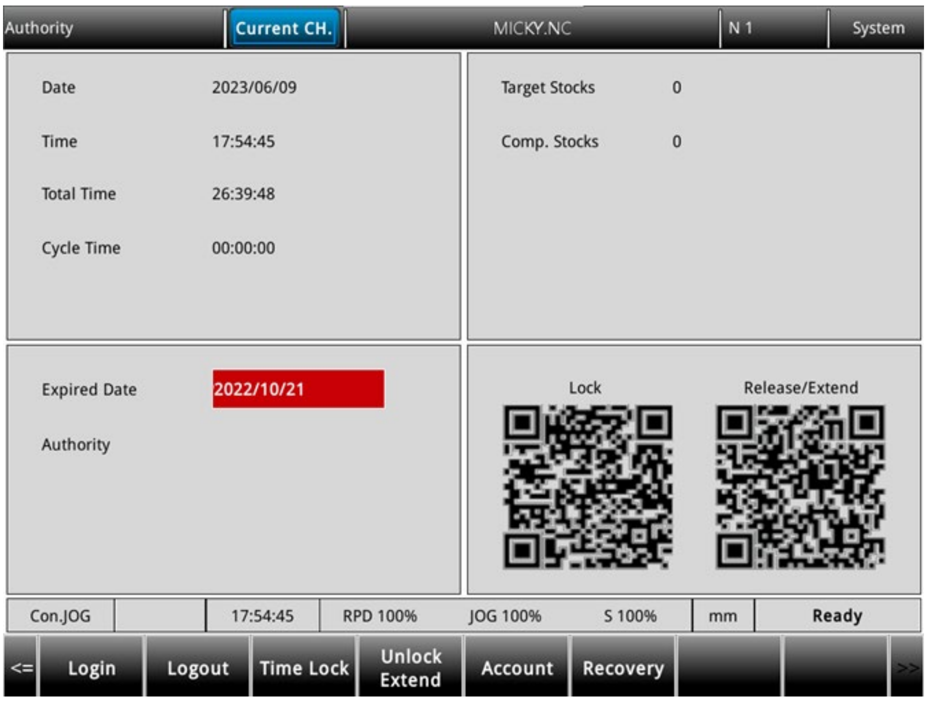



Figure 3.6.5.4.2

3

Users can see the controller's operation expiration date and time on this screen. When the duration is up, the 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 time limit setting is disabled or extended. If the time limit expires, contact the distributor or equipment supplier for entering the valid password to remove the time limit.

Users can set the time limit only when the function is not enabled. The operation steps for setting the time limit are as follows:

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to display the expiration information.

(3) Press **Time Lock** to enter a valid **LockCode** to set the time limit for the controller's operating duration.

The operation steps for removing the time limit are as follows (contact the distributor or equipment supplier for services).

(1) Press **DGN** to enter the DGN screen.

(2) Press **Authority** to display the expiration information.

(3) Press **Unlock Extend** to open dialog box for users to enter the **LockCode**, as shown in Figure 3.6.5.4.3.

(4) After being authorized legally, enter the **LockCode**, press **ENTER** to reconnect power to the NC system to remove the time limit or extend time limit.

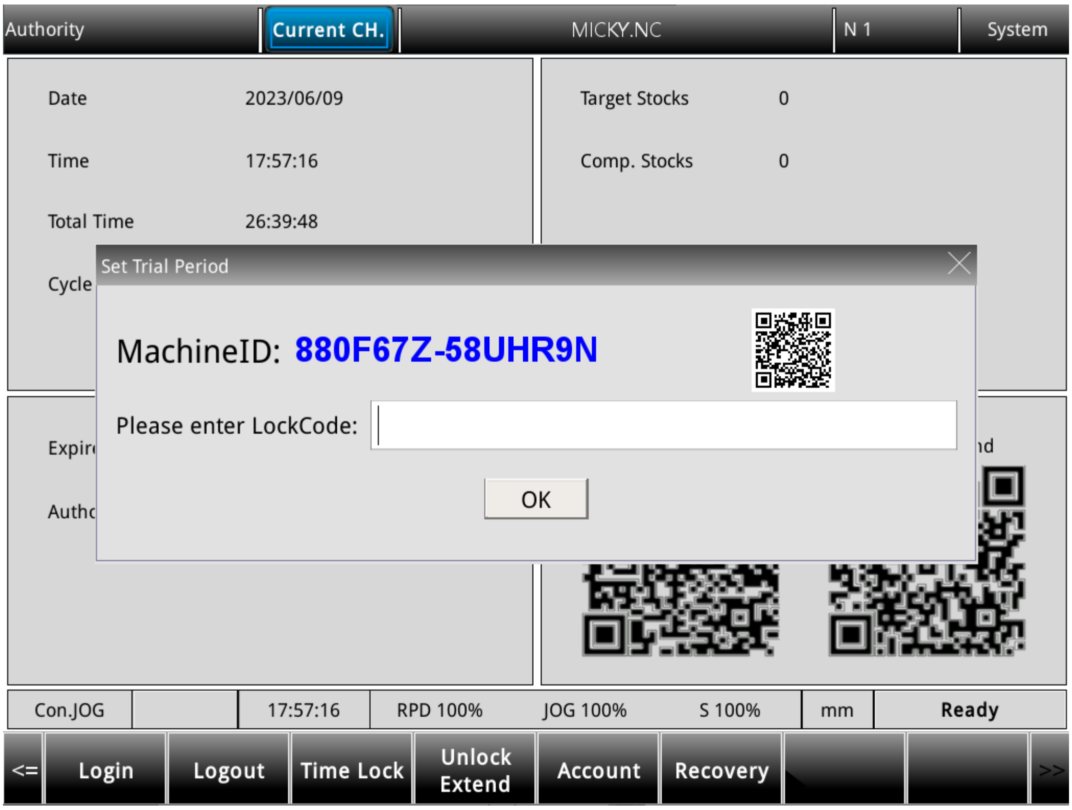



Figure 3.6.5.4.3

Note: after the time limit is removed, the expiration date is displayed the **9999/12/31** as shown in Figure 3.6.5.4.1, which means no time limit is set for the system.

### 3.6.6 System information

This function provides information about the firmware and hardware versions of the system. Users can maintain and optimize the system according to the version information displayed on the screen. The functions include system status, firmware serial number, hardware serial number, and equipment information.

The operation steps for system status display are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **System Info.** to enter the system information screen.

The firmware serial number display includes the firmware version of the system. The operation steps for displaying the firmware serial number are as follows.

(1) Press **DGN** to enter the DGN screen.

(2) Press **Firmware Info.** to enter the firmware versions screen.


| Number | System Item | Status |
|---|---|---|
| 1 | Last O Macro | 115536 |
| 2 | Last Line | 1 |
| 3 | Battery Capacity | 88 |
| 4 | Micro SD (TF) Card Capacity | 1951.8 |
| 5 | IP Appress1 | 192.168.1.199 |
| 6 | Subnet Mask1 | 255.255.255.0 |
| 7 | Default Gateway1 | 0.0.0.0 |
| 8 | MAC 1 Address | 00:18:23:02:08:04 |
| 9 | IP Appress2 | 0.0.0.0 |
| 10 | Subnet Mask2 | 0.0.0.0 |
| 11 | Default Gateway2 | 0.0.0.0 |
| 12 | MAC 2 Address | 00:18:23:02:08:05 |
| 13 | Ethernet Status | OK |
| 14 | System Serial Number | NC50EFE220208N002 |
| 15 | Screen version | 1.0 |

Figure 3.6.6.1

### 3.6.7 Servo gain tuning



The auto tuning function enables the NC system and servo drive to provide optimized motion control for meeting different machine characteristics. The NC series controller reads the initial servo parameters and calibrates the motion control with the gain tuning function. 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 shown in the following figure and the operation steps for each subordinate function are as follows.

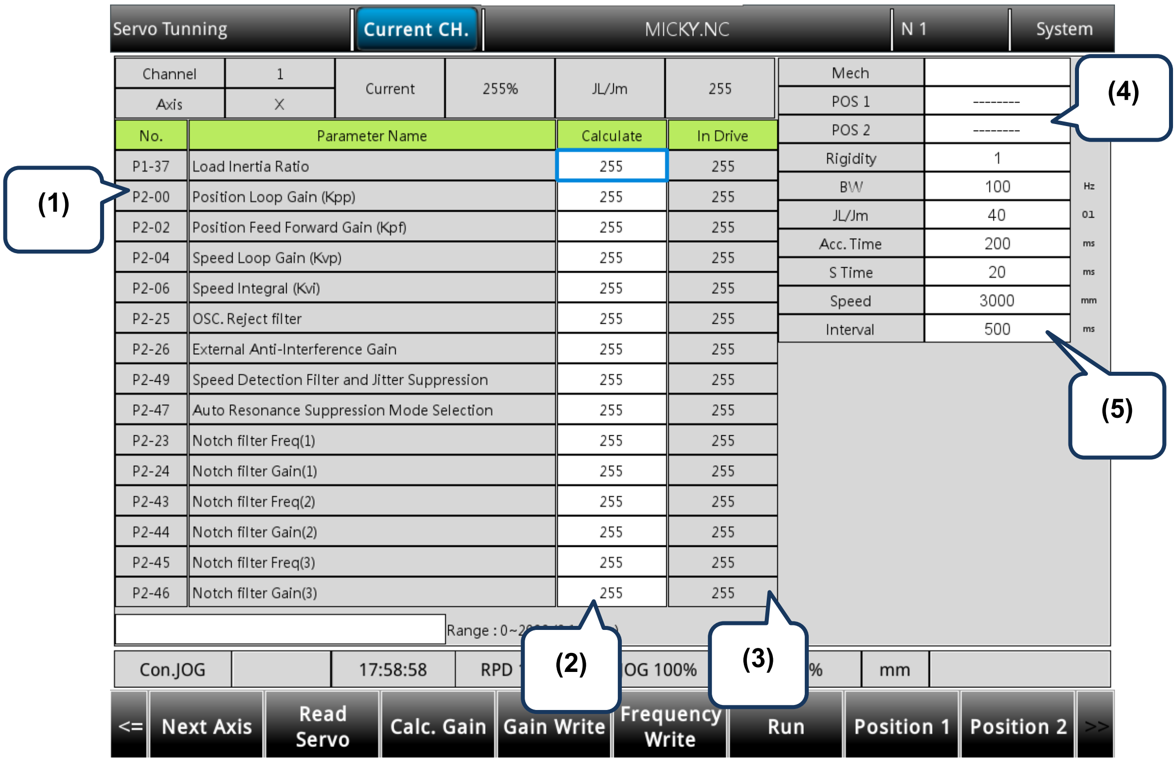



Figure 3.6.7.1

(1) Servo parameter: number and name of servo parameters

(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 Axis:** for switching to another axis for gain tuning setting. Users need to perform auto tuning for each axis separately, so after completing the setting of one axis, use this function to switch to another axis and continue auto tuning. The operation steps are as follows.
  (1) Switch system to **JOG** mode.
  (2) Press **DGN** to enter the DGN screen.
  (3) Press ▶ to display the function bar on the next page.
  (4) Press **Servo Tune** to enter the auto tuning setting screen.
  (5) If users need to set the gain parameters for other axes, press **Next Axis** to switch to the specified axis.

- **Read Servo:** Accesses the parameter values from the servo and writes them in the Calculate fields. The operation steps are as follows.
  (1) Switch system to **JOG** mode.
  (2) Press **DGN** to enter the DGN screen.
  (3) Press ▶ to display the function bar on the next page.
  (4) Press **Servo Tune** to enter the auto tuning setting screen.
  (5) Press **Read Servo** to read the servo parameters back to the controller.

- **Run, Position 1, Position 2:** These functions are for setting the operation of auto tuning. Use these functions to enable auto tuning, set and operate the positioning direction. The operation steps for the continuous operation of a single axis are as follows.
  (1) Switch system to **JOG** mode.
  (2) Press **DGN** to enter the DGN screen.
  (3) Press ▶ to display the function bar on the next page.
  (4) Press **Servo Tune** to enter the auto tuning setting screen.
  (5) Press ▶ to display the function bar on the next page.
  (6) Press **JOG←** to move to the left positioning point.
  (7) Press **Position 1** to set the left positioning point.
  (8) Press **JOG→** to move to the right positioning point.
  (9) Press **Position 2** to set the right positioning point. The movement is now limited to between Position 1 and Position 2.
  (10) Press **Run** to start auto tuning and the **Run** button will change to **Stop** button.
  (11) During auto tuning, press **Stop** to compete tuning. The system automatically calculates the best gain value.

- **Gain calculation (Calc. Gain):** To change the parameter values of rigidity, bandwidth, or inertia to accommodate the machine characteristics, users can 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) Switch system to **JOG** mode.
  (2) Press **DGN** to enter the DGN screen.
  (3) Press ▶ to display the function bar on the next page.
  (4) Press **Servo Tune** to enter the auto tuning setting screen.
  (5) Press ⬆ and ⬇ to move the cursor to the fields of Rigidity, BW, and JL/Jm to set the parameters.
  (6) Press **Calc. Gain** to calculate the tuning results.

- **Gain value writing (Gain Write), resonance value writing (Frequency Write):** The system automatically calculates the gain values after auto tuning is finished and the motion stops. If the values after auto tuning meet the expectation, users can use these functions to write the new parameter values to the servo. The operation steps are as follows.
  (1) Switch system to **JOG** mode.
  (2) Press **DGN** to enter the DGN screen.
  (3) Press ▶ to display the function bar on the next page.
  (4) Press **Servo Tune** to enter the auto tuning setting screen.
  (5) After tuning, the results are automatically calculated.
  (6) Press **Gain Write** to write the corresponding gain parameters to the servo. Press **Frequency Write** to write the parameter values for resonance suppression to the servo.

Note:

1. Users have to write the results of auto tuning to the servo drive for the values to take effect.
2. After writing the gain values and resonance values, the servo parameters are updated, and the previous settings cannot be restored. Thus, double check before writing the values.

## 3.6.8 Import

Users can use this function to import the backup parameters to the NC system with security authorized. The operation steps for importing parameters are as follows:

(1) Press **DGN** to enter the DGN screen.

(2) Press **Import** to display the file manager (FILE) window as shown in Figure 3.6.8.1. Press ↑ and ↓, select the directory for importing, and press **ENTER** to read the files in the folder.

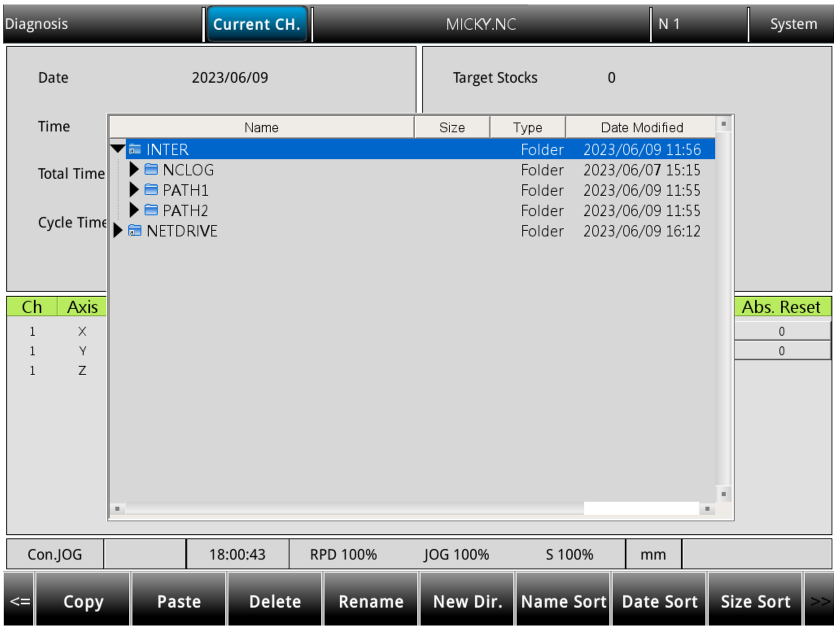



Figure 3.6.8.1

(3) After entering the parameter selection screen, press ↑, ↓, ← and → to move the cursor to the system parameter to be imported, press **ENTER** to select it or cancel selection.

(4) To select all the check boxes, press **All Select**. To clear all the selected check boxes, press **All Cancel**.

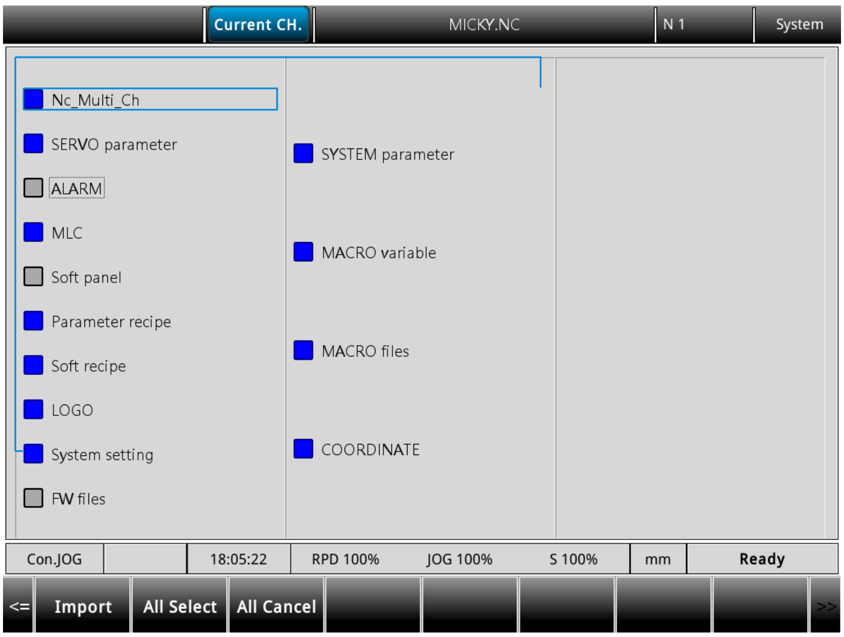



Figure 3.6.8.2

Press **Import** and a dialog box for confirmation appears. Press **YES** to import the data of the files to the system. Then, a progress bar of the importing process is displayed. Cycle power to the system after completing importing the files.

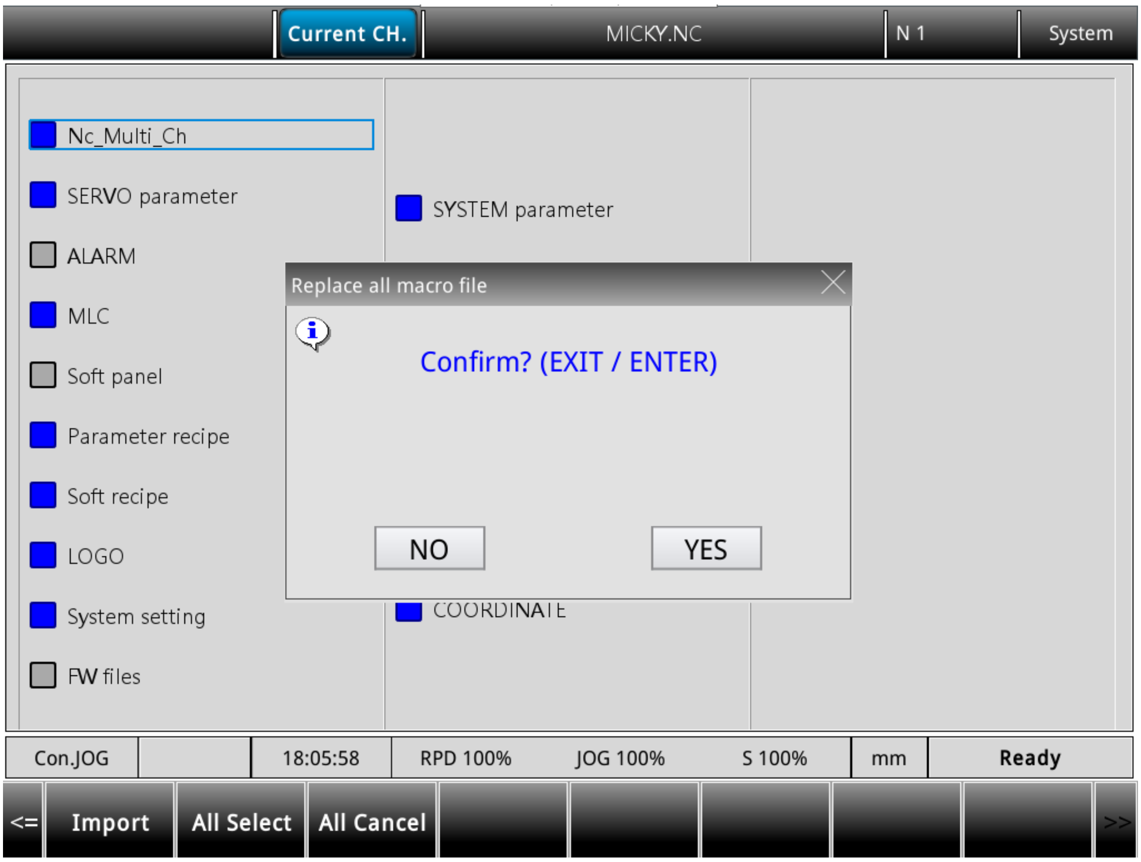



Figure 3.6.8.3

## 3.6.9 Export

Use this function to back up the parameters of the system. The exported files are divided into three types: parameter files, MLC, and software panel. Users have to access the security authorization to use this function.

The operation steps for exporting parameters are as follows:

(1) Press **DGN** to enter the DGN screen.

(2) Press **Export** to enter the parameter export selection screen.

(3) After entering the parameter selection screen, press ↑, ↓, ← and → to move the cursor to the system parameter to be exported, press **ENTER** to select it or cancel selection. To select all the check boxes, press **All Select**. To clear all the selected check boxes, press **All Cancel**.

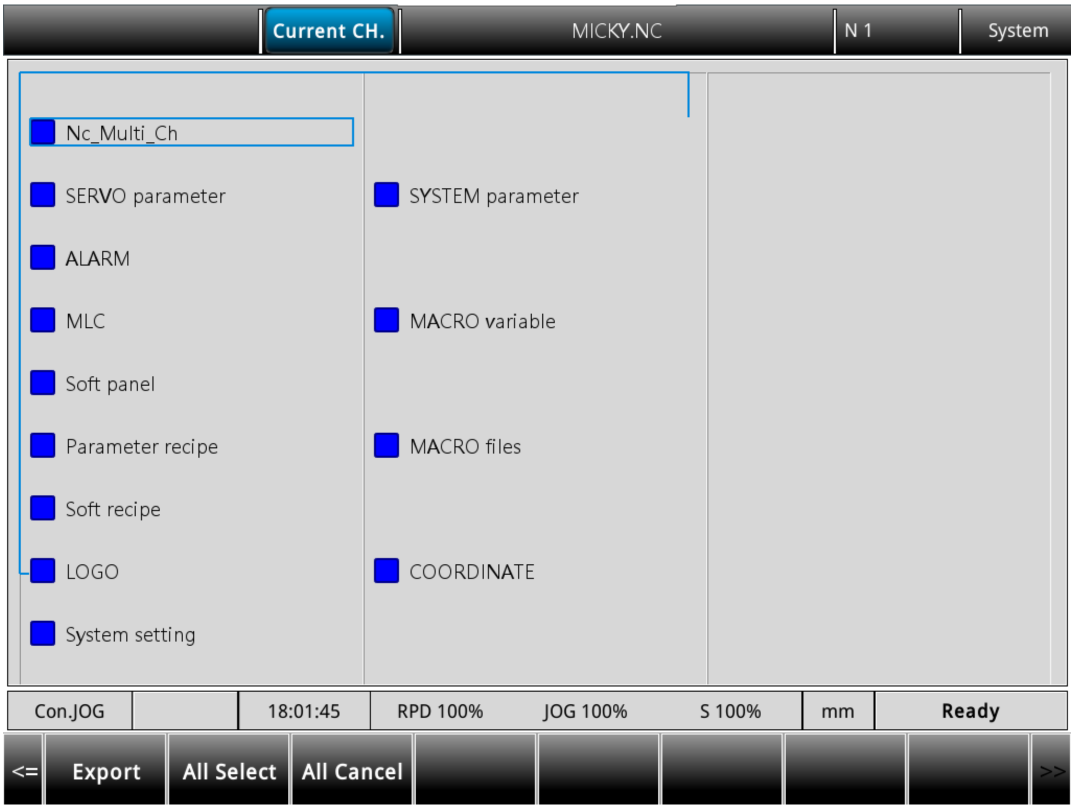



Figure 3.6.9.1

(4) Press **Export** and the file manager window appears as shown in Figure 3.6.9.2. Press ⬆ and ⬇ to select the directory for saving the exported files, or directly enter the folder name and press **ENTER** to save the exported files to the specified folder.

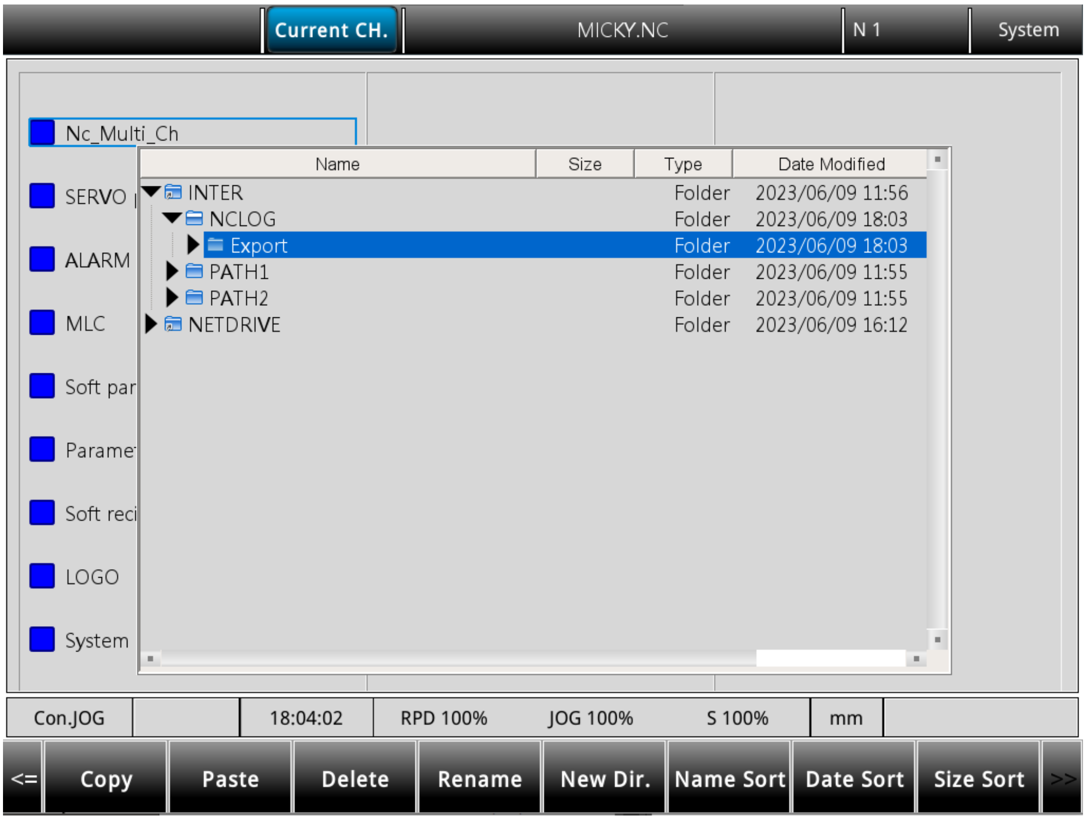



Figure 3.6.9.2

(5) Then, the screen displays a progress bar showing the exporting process until the exporting is finished.

(6) If users want to save the exported file to a new created folder, name the folder, then press **New Folder** to save the exported file in the folder, as shown in Figure 3.6.9.2.

(7) If users save the exported file to a folder where an exported file already exists, a confirmation window appears. Enter **YES** to replace the existing file with the newly exported file.

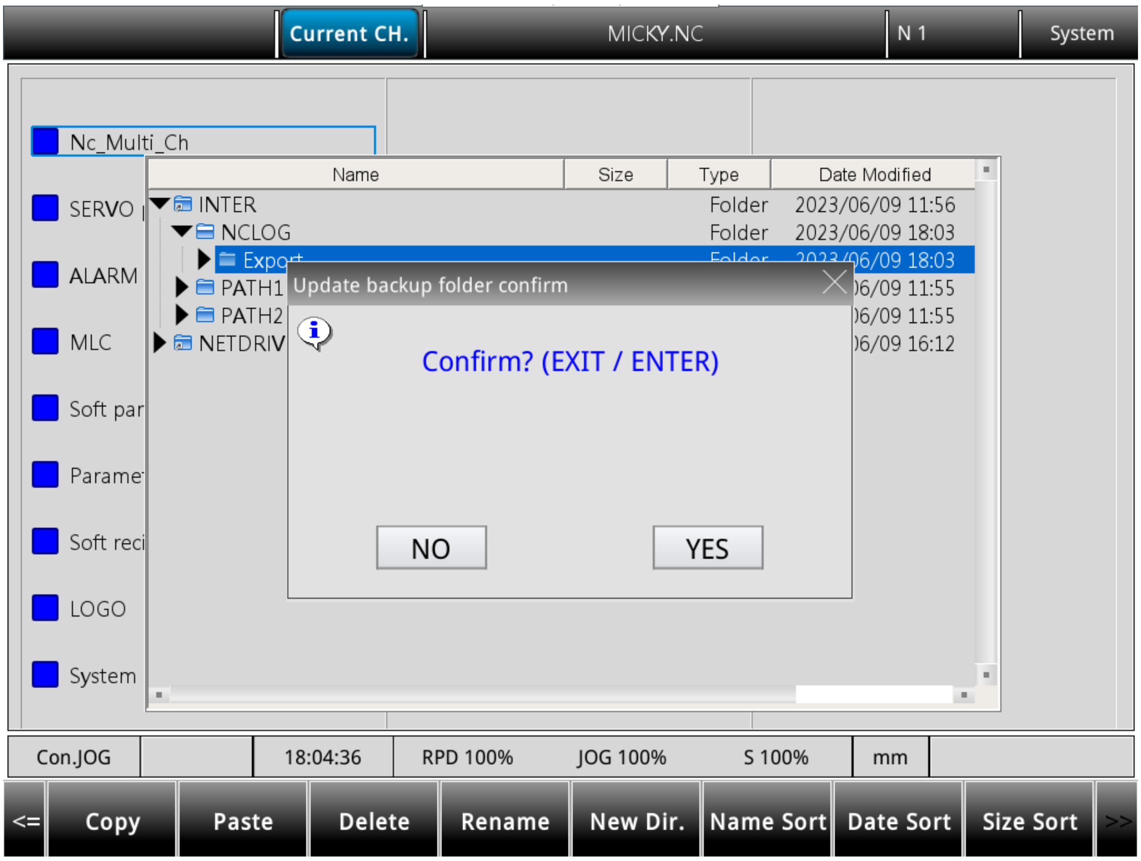



Figure 3.6.9.3

# 3.7 Alarm (ALM) Group

3

When an alarm occurs due to execution error or incorrect command format, the Alarm screen is automatically displayed.

This group shows the alarm messages issued by the system in real time for users to troubleshoot the errors according to the displayed alarm information. In addition to displaying the current alarms, the ALM group also records the previous alarms.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.

## 3.7.1 Alarm

When an alarm occurs, troubleshoot the issue first, and then press **RESET** to clear the alarm and set the system to the initial status. The alarm display screen is as shown in the following figure and the sections with indicators show information about the alarms.

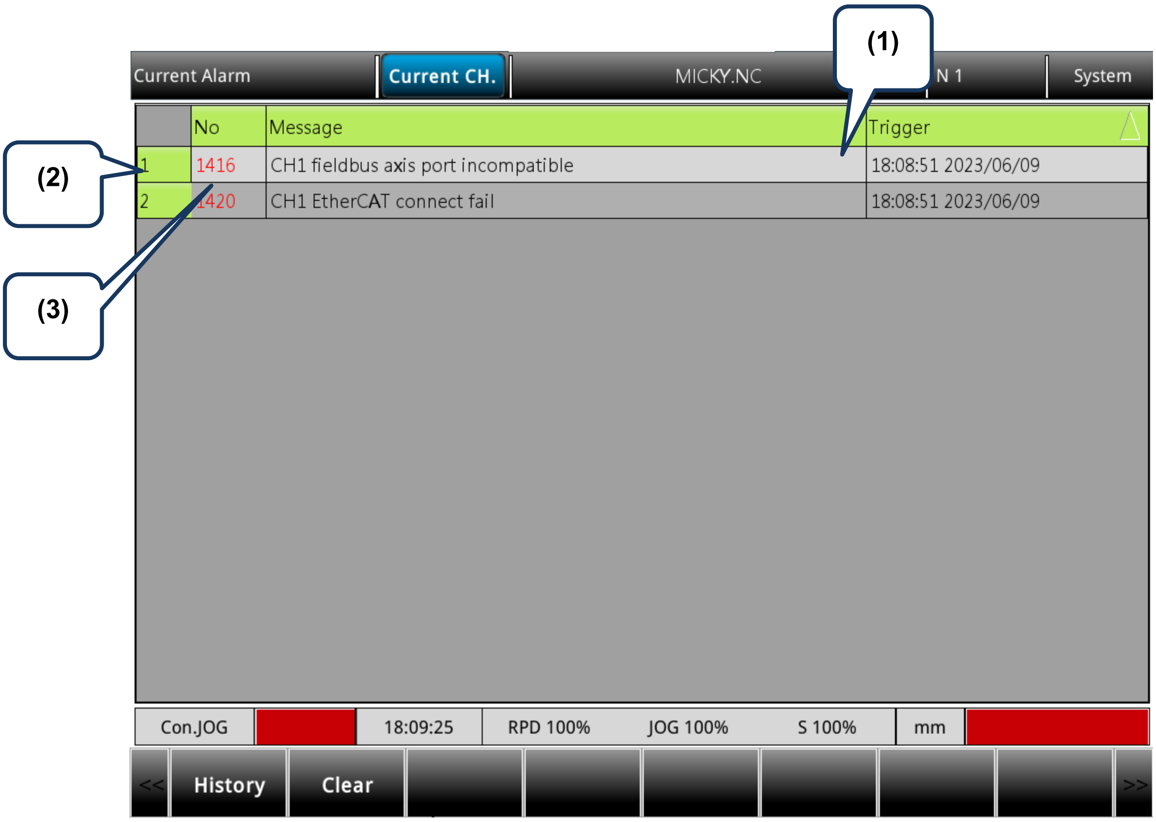



Figure 3.7.1.1

(5) Alarm message (3) Alarm code

(6) Sequence of alarm occurrence

The operation steps for displaying and clearing the alarm messages are as follows.

(1) Press **ALM** to enter the ALM screen.

(2) Press **Alarm** to enter the alarm message screen.

(3) Press **Clear** to clear the alarm messages shown on the screen.

3

## 3.7.2 Alarm history

This function records all the issued alarm messages and history information. In the History screen, users can access the error history during system execution as well as 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. It can record up to 512 sets of data. In addition to displaying the alarm information, users can also delete the alarm history with this function.


Figure 3.7.2.1

The operation steps for clearing all the alarm history are as follows.

(1) Press **ALM** to enter the ALM screen.

(2) Press **History** to enter the alarm history screen.

(3) Press **Clear** and a confirmation window appears.

# 3.8 Graph (GRA) Group

The GRA group provides three functions, trajectory display, single block preview and program simulation (preview). Trajectory display: displays the current processing trajectory during processing. Program simulation: for checking whether the program format and path are correct before processing.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.

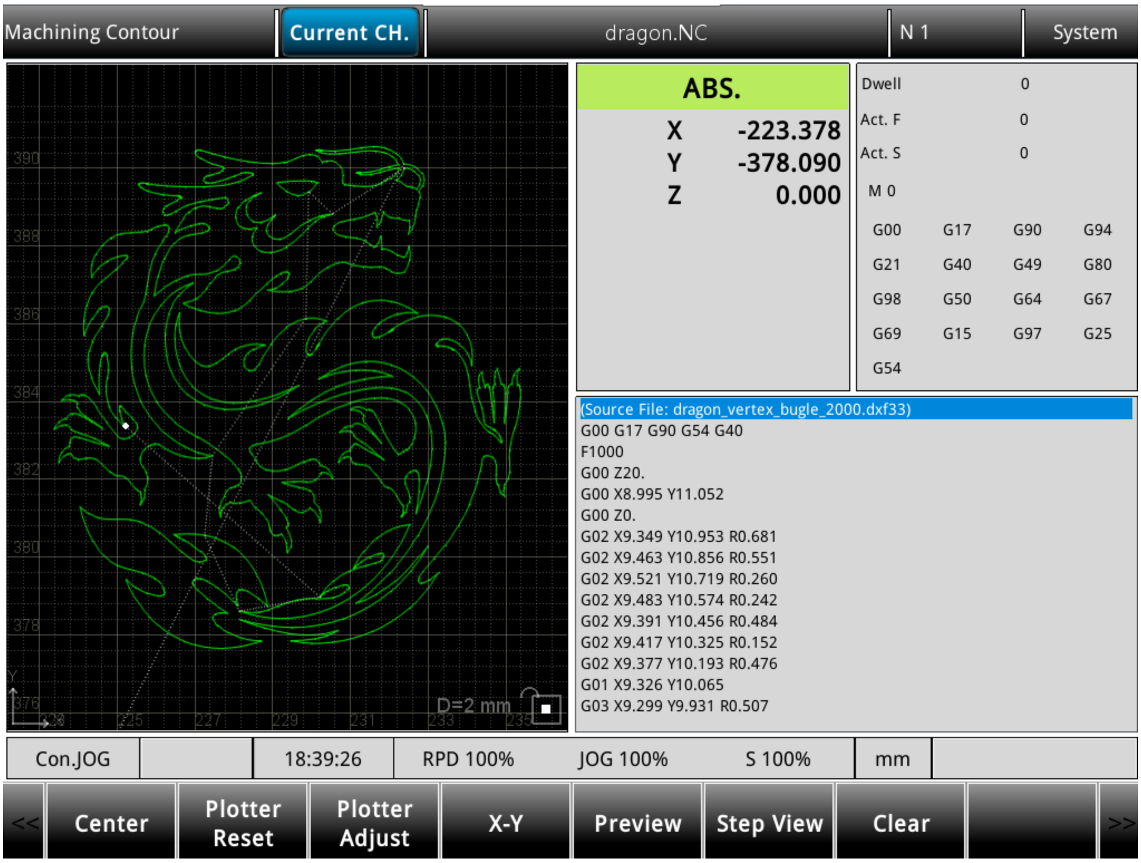



Figure 3.8.1

3

### 3.8.1 Trajectory display

When a machining program is executing, switch the system to GRA mode, and the system automatically draws the motion trajectory of the current program on the screen, with which users can check if the actual machining path is correct.

Function descriptions of the keys are as follows.

(1) Press **GRA** to enter the GRA screen.

(2) **Center**: displays the current motion trajectory in the center of the display area.

(3) **Plotter Reset**: scales the graph to a moderate size and locate it in the middle of the screen.

(1) **Plotter Adjust**: press **Up**, **Down**, **Left**, **Right**, **Zoom In**, and **Zoom Out** to adjust the display of the path graph.

(2) **Preview**: checks the program format by referring to the software limit. The settings of the coordinate system and the tool compensation should match the actual application so the complete path can be correctly drawn.

(3) **Step Preview**: draws the path of one single block when this key is pressed.

(4) **Clear**: clears the content of the tool path display area.

Pay attention to the following when using the functions of GRA:

1. When the Preview function is enabled, machining execution is prohibited.
2. When the Preview function is enabled, switching the system mode will force close this function.
3. If users cancel the preview during previewing, users need to start from the initial block if desiring to preview again.
4. Graphs drawn by the function of GRAPHIC or PREVIEW may exceed the display area because of the workpiece coordinate settings. If so, press **GRAPHIC** or **PREVIEW** again, and the system automatically displays a moderate preview graph in the center of the display area.

# 3.9 Parameter (PAR) Group

The PAR group is distinguished according to the functions into machining parameters, operation parameters, tool magazine parameters, spindle parameters, machine parameters, home parameters, network settings, compensation parameters, system parameters, MLC settings, graphic parameters, servo parameters, channel settings, EIO settings and parameter group functions. Please refers to chapter 4 for all of the parameter group details.


Figure 3.9.1

The operation steps for modifying parameters are as follows:

(1) Press **PAR** to enter the Parameter (Group) screen.

(2) Press the function buttons F1 - F6 to enter the setting screen of the parameter to modify.

(3) Press ↑ and ↓ to move the cursor to the specified field and enter a value within the range specified in the lower right corner of the screen.

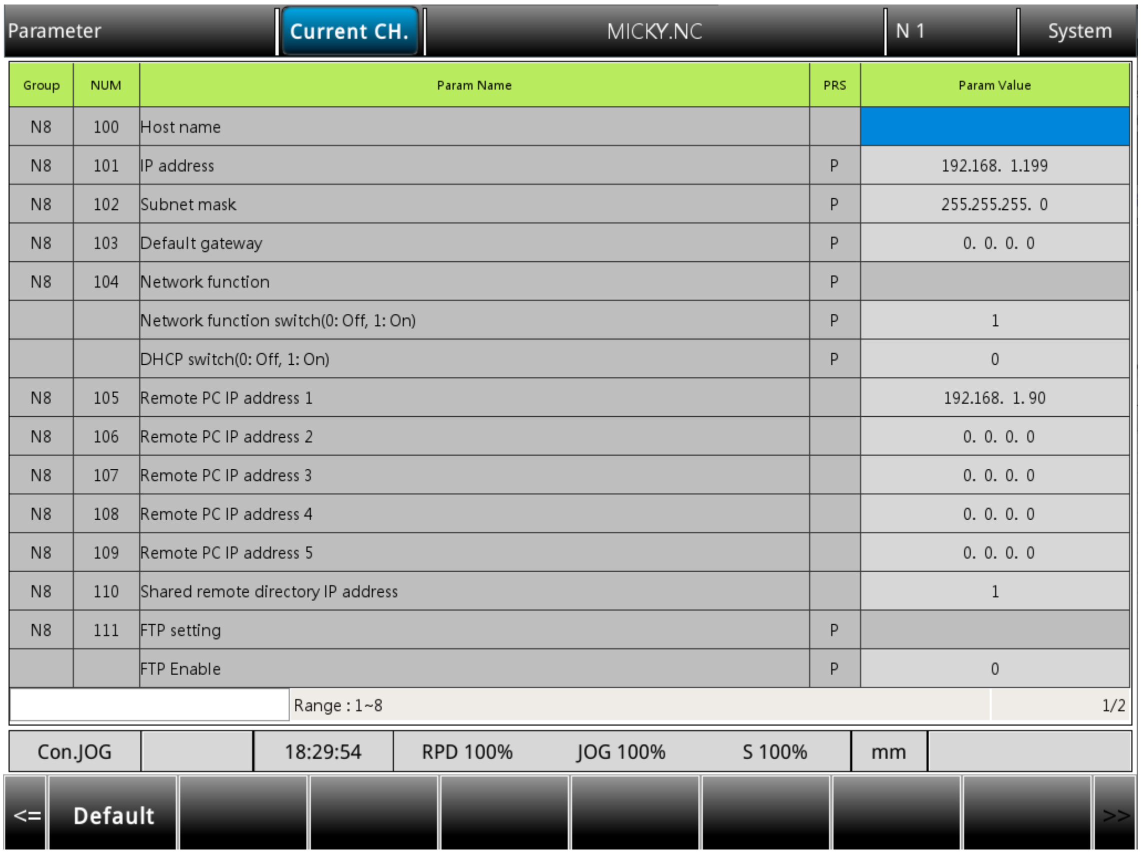
(4) Press **ENTER** to complete the setting.

3

## 3.9.1 Ethernet setting

Users can use Ethernet to connect the system to the PC to enable remote communication. The CNCNetwork software is to manage the online files of multiple NC controllers with one PC, enabling data sharing and file management with the PC.

Set the communication protocol between the NC system and PC before using the network connection function. The following gives simple instructions.




| Group | NUM | Param Name | PRS | Param Value |
|---|---|---|---|---|
| N8 | 100 | Host name | | |
| N8 | 101 | IP address | P | 192.168. 1.199 |
| N8 | 102 | Subnet mask | P | 255.255.255. 0 |
| N8 | 103 | Default gateway | P | 0. 0. 0. 0 |
| N8 | 104 | Network function | P | |
| | | Network function switch(0: Off, 1: On) | P | 1 |
| | | DHCP switch(0: Off, 1: On) | P | 0 |
| N8 | 105 | Remote PC IP address 1 | | 192.168. 1. 90 |
| N8 | 106 | Remote PC IP address 2 | | 0. 0. 0. 0 |
| N8 | 107 | Remote PC IP address 3 | | 0. 0. 0. 0 |
| N8 | 108 | Remote PC IP address 4 | | 0. 0. 0. 0 |
| N8 | 109 | Remote PC IP address 5 | | 0. 0. 0. 0 |
| N8 | 110 | Shared remote directory IP address | | 1 |
| N8 | 111 | FTP setting | P | |
| | | FTP Enable | P | 0 |

Figure 3.9.1.1

| Name | Setting range or format |
|---|---|
| Host name | Character length: 1 ~ 8<br>Example setting: 12345678 |
| IP address | Character length: ×××. ×××. ×××. ×××<br>Example setting: 192. 168. 0. 2 |
| Subnet mask | Character length: ×××. ×××. ×××. ×××<br>Example setting: 255. 255. 255. 0 |
| Default gateway | Character length: ×××. ×××. ×××. ×××<br>Example setting: 0. 0. 0. 0 |
| Network function switch | Character length: 0 ~ 1<br>Example setting: 1 |
| DHCP switch | Character length: 0 ~ 1<br>Example setting: 0 |
| Remote PC IP address 1 | Character length: ×××. ×××. ×××. ×××<br>Example setting: 192. 168. 0. 1 |

| Name | Setting range or format |
| --- | --- |
| Remote PC IP address 2 | Character length: ×××. ×××. ×××. ×××<br>Example setting: 0. 0. 0. 0 |
| Remote PC IP address 3 | Character length: ×××. ×××. ×××. ×××<br>Example setting: 0. 0. 0. 0 |
| Remote PC IP address 4 | Character length: ×××. ×××. ×××. ×××<br>Example setting: 0. 0. 0. 0 |
| Remote PC IP address 5 | Character length: ×××. ×××. ×××. ×××<br>Example setting: 0. 0. 0. 0 |
| Shared remote directory IP address | Character length: 0 ~ 5<br>Example setting: 0 |

Set the protocol of PC by setting Internet Protocol (TCP/IP) Properties on the PC operating system (as shown in Figure 3.4.11.2) or going to **CNCNetwork** > **Options**.

Network setting on PC:

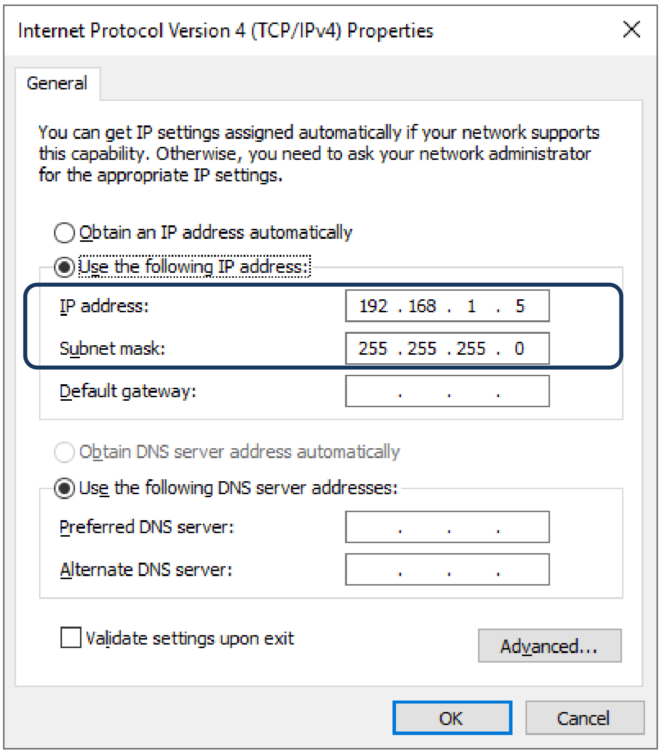



Figure 3.9.1.2

Steps:

(1) Select the check box 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 setting.

Network settings with CNCNetwork:

3

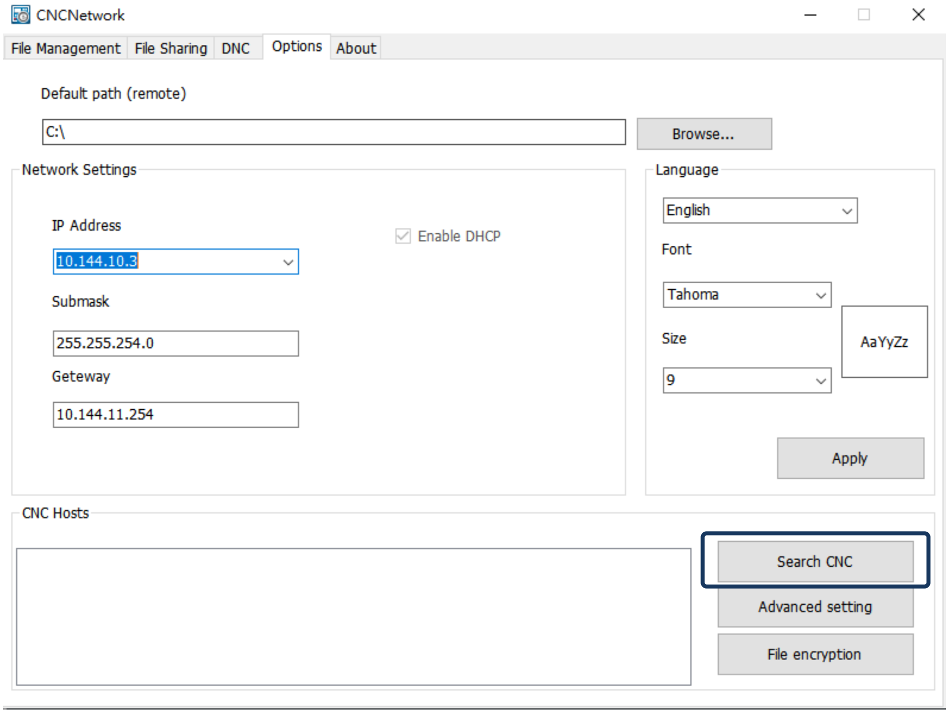



Figure 3.9.1.3

Steps:

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

(2) Click **Search CNC** to connect to the CNC with the above settings.

**NETDRIVE internet drive**：

Utilizing the NETDRIVE function as the internet remote folder, users can transfer the NC program file through the Ethernet by specified the shared file from file selection list. Connect steps as below:

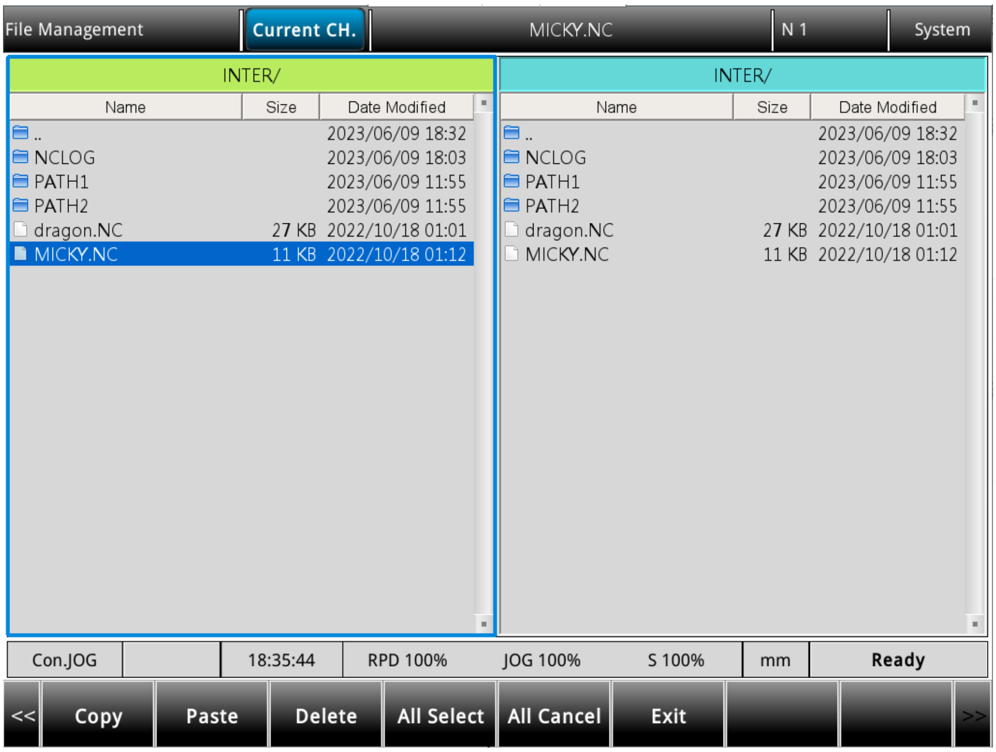



Figure 3.9.1.4

(1) Finish Ethernet connections and then connect PC to the NC controller.
(2) Enable the public shared folder function in the PC for the NC controller.
(3) Switch to DNC operation page.
(4) Switch NC system into EDIT mode and move the file manager to the top layer as NETDRIVE root path.
(5) Display shared files. Open and select shared G code file.
(6) Switch NC to the AUTO mode and then execute Cycle Start. The selected G code file will start execution as normal program procedure.

3

# 3.10 Software (SOFT) Group

With the SOFT group function, users can use DOPSoft to configure the screens, which can replace the function of the machine 2nd operation panel or add customized extension functions.

Note: bold function names in a box (such as **Function**) mean the keys on machine 1st operation panel; bold function names (such as **Function**) mean the function keys.

- DOPSOFT software

  Users can edit the screens of the controller with DOPSoft which users can enter from the CNC portal on the main page of the Delta CNCSoft software,
  as shown in Figure 3.10.1.1.


Figure 3.10.1.1

- After entering ScreenEditor, users can see the operation interface as shown in Figure 3.10.1.2.

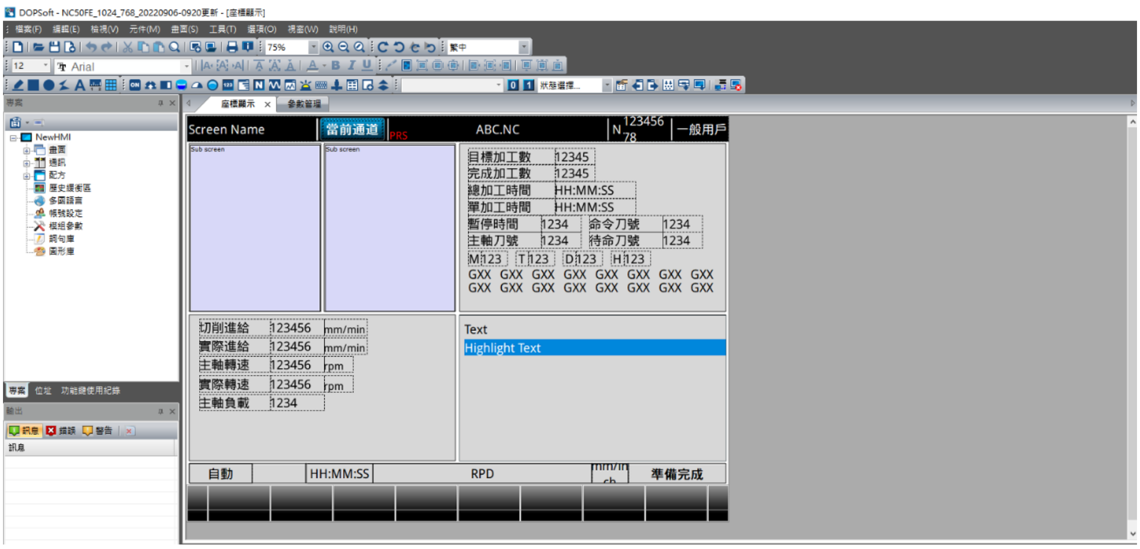



Figure 3.10.1.2

- After compiling the screens and creating the screen data files, users can import the files to the controller using the USB disk or the Internet, as shown in Figure 3.10.1.3.

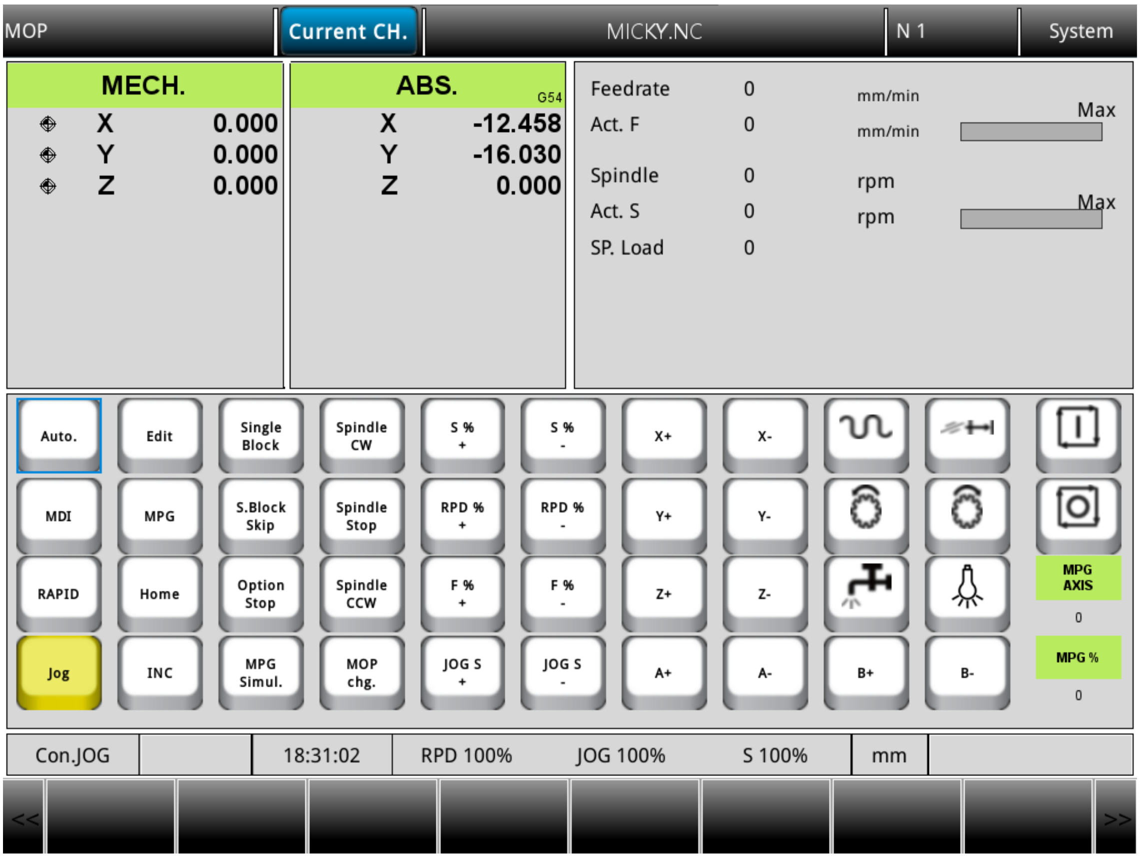



Figure 3.10.1.3

# System Parameters 4

In the PAR group page, the controller provides different types of parameters for the system to control the machine's functions. This manual describes the settings, operations, and functions of all types of parameters for users to reference when setting parameters.

4

# 4.1 Definition of parameter groups

| Group | Name | Range |
|---|---|---|
| N0 | System parameter | 0~2047 |
| N1 | Path parameter | 0~1023 |
| N2 | Axes parameter | 0~511 |
| N3 | Compensation parameter | 0~127 |
| N5 | MLC parameter | 0~255 |
| N6 | HMI and MLC parameter | 0~127 |
| N8 | HMI system parameter | 0~1023 |
| N9 | HMI path parameter | 0~1023 |

| Property | Description |
|---|---|
| P | The new setting of parameter needs to restart the controller to activated. |
| R | The new setting of parameter needs to press RESET to activated. |
| S | The new setting of parameter needs to restart the servo drive to activated. |

# 4.2 N0 – System parameter

| N0.010 | System application settings | | R |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 3: Program index when MDI execution is finished.
  0: Return to first line
  1: Stop at last line
- Bit 4: Display initial macro and O9000 during plotter preview.
  0: Not display (default)
  1: Display
- Bit 5: Axes station address mode.
  0: User define address (default)
  Addresses defined according to device address settings. For example, Delta servo drive is P3-00.
  1: Physical address
  Addresses defined according to device physical connection sequence settings.

| N0.020 | Analog output offset of 1st path | | | | P |
|---|---|---|---|---|---|
| N0.021 | Analog output offset of 2nd path | | | | |
| Default | 0 | Range | -2,000 ~ 2,000 | | |
| Data Type | Dword | Unit | 0.0001V | Output range | -2V ~ +2V |

- Analog voltage output offset.
  The actual voltage output will be according to the following formula.
  V(actual) = V(command) x Gain + Offset.
- N0.020 provides the configuration for the 1st path analog output on CN1 PIN17&18.
- N0.021 provides the configuration for the 1st path analog output on CN1 PIN19&20.
- For example, when the spindle is controlled in voltage analog mode, when the system commands the spindle to stop, if the spindle is still rotating, then users can adjust this parameter to correct the output voltage and stop the spindle.

| N0.022 | Analog output gain of 1st path | | | | P |
|---|---|---|---|---|---|
| N0.023 | Analog output gain of 2nd path | | | | |
| Default | 1,000 | Range | 500 ~ 2,000 | | |
| Data Type | Dword | Unit | 0.001 | Output range | 0.5 ~ 2.0 |

- Analog voltage output gain.
  The actual voltage output will be according to the following formula.
  V(actual) = V(command) x Gain + Offset.
- N0.022 provides the configuration for the 1st path analog output on CN1 PIN17&18.
- N0.023 provides the configuration for the 1st path analog output on CN1 PIN19&20.

| N0.030 | Pulse feedback mode of Spindle 1 | | | P |
|---|---|---|---|---|
| N0.035 | Pulse feedback mode of Spindle 2 | | | |
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Pulse feedback mode of spindle connector.
- The controller can be used to connect the optical encoder or regular encoder to obtain the pulse feedback as the spindle axis position reference. The system will utilize relate parameters to calculate the coordinate positions based on the pulse feedback and then save them in the special D register.
- N0.030 provides the pulse feedback mode of the Spindle1 connector and then returns the coordinate position to the D30174.
- N0.035 provides the pulse feedback mode of the Spindle1 connector and then returns the coordinate position to the D30176.
- Bit 0: Monitoring spindle position pulse feedback. (The calculated position is written to the D register)

  0: Disable, 1: Enable
- Bit 1: Coordinate display mode.

  0: Linear axis

  1: Rotary axis (0~360 degrees)
- Special D and M registers are as below:

| Register | Name | Unit | Data type |
|---|---|---|---|
| D30000 | Spindle 1 pulse feedback | Pulse | U16 |
| D30174 | Spindle 1 coordinate position feedback | Linear unit: mm/inch<br>Rotary unit: 0 ~ 359.999 degrees | F32 |
| D30001 | Spindle 2 pulse feedback | Pulse | U16 |
| D30176 | Spindle 2 coordinate position feedback | Linear unit: mm/inch<br>Rotary unit: 0 ~ 359.999 degrees | F32 |

- Pulse feedback of Spindle 1 is set as N0.030 ~ N0.032.
- Pulse feedback of Spindle 2 is set as N0.035 ~ N0.037.

| N0.031 | Distance per revolution of Spindle 1 feedback | | | P |
|---|---|---|---|---|
| N0.036 | Distance per revolution of Spindle 2 feedback | | | |
| Default | 10 | Range | 1 ~ 10,000 | |
| Data Type | Dword | Unit | mm / inch | |

- Distance per revolution of Spindle 1 or Spindle 2 connectors.
- Pulse feedback of Spindle 1 is set as N0.030 ~ N0.032.
- Pulse feedback of Spindle 2 is set as N0.035 ~ N0.037.

| N0.032 | Pulse per revolution of Spindle 1 feedback | | | P |
| --- | --- | --- | --- | --- |
| N0.037 | Pulse per revolution of Spindle 2 feedback | | | |
| Default | 10,000 | Range | 1 ~ 4,294,967,294 | |
| Data Type | Dword | Unit | Pulse | |

- Pulse per revolution of Spindle 1 or Spindle 2 connectors.
- Pulse feedback of Spindle 1 is set as N0.030 ~ N0.032.
- Pulse feedback of Spindle 2 is set as N0.035 ~ N0.037.

| N0.050 | Number of public common variables | | | P |
| --- | --- | --- | --- | --- |
| Default | 0 | Range | 0 ~ 900 | |
| Data Type | Dword | Unit | - | |

- Number of public # variables.
- When **[N1.010 Bit1]** is set to 1, the common variables of each path can be shared with each other.
- Common variables start at #100, and this setting can be used to calculate the range of common variables.

| N0.051 | Number of public retentive variables | | | P |
| --- | --- | --- | --- | --- |
| Default | 0 | Range | 0 ~ 3,000 | |
| Data Type | Dword | Unit | - | |

- Number of public # retentive variables.
- When **[N1.010 Bit2]** is set to 1, the retentive variables of each path can be shared with each other.
- Retentive variables start at #2000, and this setting can be used to calculate the range of common variables.

| N0.408 | Maximum tool number of $1^{st}$ NC path | | | P |
| --- | --- | --- | --- | --- |
| N0.409 | Maximum tool number of $2^{nd}$ NC path | | | |
| N0.410 | Maximum tool number of $3^{rd}$ NC path | | | |
| N0.411 | Maximum tool number of $4^{th}$ NC path | | | |
| N0.412 | Maximum tool number of $5^{th}$ NC path | | | |
| N0.413 | Maximum tool number of $6^{th}$ NC path | | | |
| N0.414 | Maximum tool number of $7^{th}$ NC path | | | |
| N0.415 | Maximum tool number of $8^{th}$ NC path | | | |
| Default | 60 | Range | 0 ~ 512 | |
| Data Type | Dword | Unit | - | |

- Maximum tool number in the $N^{th}$ NC path.
- The maximum number of total tools is 512, which are allocated to each path through this parameter.
- When using the dual tool magazine function in one path, this maximum tool number will be the sum of the $1^{st}$ and $2^{nd}$ tool magazines.

4

| N0.1000 | Configuration of 1st spindle | | | P |
|---|---|---|---|---|
| N0.1050 | Configuration of 2nd spindle | | | |
| N0.1100 | Configuration of 3rd spindle | | | |
| N0.1150 | Configuration of 4th spindle | | | |
| N0.1200 | Configuration of 5th spindle | | | |
| N0.1250 | Configuration of 6th spindle | | | |
| N0.1300 | Configuration of 7th spindle | | | |
| N0.1350 | Configuration of 8th spindle | | | |
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 2: Analog close loop control.

  0: Disable, 1: Enable
- Bit 3: Speed command source of analog spindle.

  0: Command

  1: Encoder
- Bit 5: Analog output mode.

  0: -10V ~ +10V

  1: 0V ~ 10V
- Bit 6: Spindle speed reference.

  0: Program speed

  1: Default speed
- Bit 7: Spindle maximum speed check.

  0: Disable, 1: Enable
- Bit 8: Spindle speed display mode on D register.

  0: S code command

  1: Actual feedback
- Bit 9: Virtual encoder of spindle multi-section feedback.

  0: Disable, 1: Enable

  When the spindle is not connected to an encoder and the gear ratio is not 1: 1, users can enable this virtual encoder function and the system will reference the motor position feedback as spindle feedback.
- Bit 11: Virtual axes

  0: Disable, 1: Enable

  When the axis is not connected, users can set this axis as a virtual axis and the controller can still execute the program virtually. When the real axis is connected this parameter must be disabled.

- Bit 12: Spindle command G97 ignores the G92 maximum speed limitation.
  0: Disable, 1: Enable
  For example, when configured as lathe machining type C.
  When set as 0, the spindle will be limited to the G92 maximum speed when executing G97 constant spindle speed.
  When set as 1, the spindle will only be limited to the G92 maximum speed when executing G96 constant surface cutting speed.

| N0.1005 | Encoder resolution of 1st spindle | | P |
|---|---|---|---|
| N0.1055 | Encoder resolution of 2nd spindle | | |
| N0.1105 | Encoder resolution of 3rd spindle | | |
| N0.1155 | Encoder resolution of 4th spindle | | |
| N0.1205 | Encoder resolution of 5th spindle | | |
| N0.1255 | Encoder resolution of 6th spindle | | |
| N0.1305 | Encoder resolution of 7th spindle | | |
| N0.1355 | Encoder resolution of 8th spindle | | |
| Default | 1,024 | Range | 1 ~ 4,294,967,294 |
| Data Type | Dword | Unit | - |

- Spindle encoder resolution. (4 times frequency)

| N0.1006 | Start speed of 1st spindle | | R |
|---|---|---|---|
| N0.1056 | Start speed of 2nd spindle | | |
| N0.1106 | Start speed of 3rd spindle | | |
| N0.1156 | Start speed of 4th spindle | | |
| N0.1206 | Start speed of 5th spindle | | |
| N0.1256 | Start speed of 6th spindle | | |
| N0.1306 | Start speed of 7th spindle | | |
| N0.1356 | Start speed of 8th spindle | | |
| Default | 0 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | RPM |

- Spindle starts speed.

4

| | | | | |
|---|---|---|---|---|
| **N0.1008** | **Maximum speed of 1st spindle** | | | **R** |
| **N0.1058** | **Maximum speed of 2nd spindle** | | | |
| **N0.1108** | **Maximum speed of 3rd spindle** | | | |
| **N0.1158** | **Maximum speed of 4th spindle** | | | |
| **N0.1208** | **Maximum speed of 5th spindle** | | | |
| **N0.1258** | **Maximum speed of 6th spindle** | | | |
| **N0.1308** | **Maximum speed of 7th spindle** | | | |
| **N0.1358** | **Maximum speed of 8th spindle** | | | |
| Default | 10,000 | Range | 1 ~ 600,000 | |
| Data Type | Dword | Unit | RPM | |

■ Spindle maximum speed.

| | | | | |
|---|---|---|---|---|
| **N0.1009** | **Acc. and dec. time of 1st spindle** | | | **R** |
| **N0.1059** | **Acc. and dec. time of 2nd spindle** | | | |
| **N0.1109** | **Acc. and dec. time of 3rd spindle** | | | |
| **N0.1159** | **Acc. and dec. time of 4th spindle** | | | |
| **N0.1209** | **Acc. and dec. time of 5th spindle** | | | |
| **N0.1259** | **Acc. and dec. time of 6th spindle** | | | |
| **N0.1309** | **Acc. and dec. time of 7th spindle** | | | |
| **N0.1359** | **Acc. and dec. time of 8th spindle** | | | |
| Default | 20 | Range | 1 ~ 20,000 | |
| Data Type | Dword | Unit | ms | |

■ Spindle acceleration and deceleration time.

■ The time is defined as the period from 0 speed to maximum speed **[N0.1008 Maximum speed of 1st spindle]**, and the system will apply this slope as the acceleration and deceleration reference during the spindle machining process.

■ The larger the value of the setting, the slower the acceleration and deceleration time.

| | | | |
|---|---|---|---|
| **N0.1010** | **S curve time of 1st spindle** | | **R** |
| **N0.1060** | **S curve time of 2nd spindle** | | |
| **N0.1110** | **S curve time of 3rd spindle** | | |
| **N0.1160** | **S curve time of 4th spindle** | | |
| **N0.1210** | **S curve time of 5th spindle** | | |
| **N0.1260** | **S curve time of 6th spindle** | | |
| **N0.1310** | **S curve time of 7th spindle** | | |
| **N0.1360** | **S curve time of 8th spindle** | | |
| Default | 10 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

- Spindle S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the spindle vibration.

| | | | |
|---|---|---|---|
| **N0.1011** | **Low speed positioning of 1st spindle** | | **R** |
| **N0.1061** | **Low speed positioning of 2nd spindle** | | |
| **N0.1111** | **Low speed positioning of 3rd spindle** | | |
| **N0.1161** | **Low speed positioning of 4th spindle** | | |
| **N0.1211** | **Low speed positioning of 5th spindle** | | |
| **N0.1261** | **Low speed positioning of 6th spindle** | | |
| **N0.1311** | **Low speed positioning of 7th spindle** | | |
| **N0.1361** | **Low speed positioning of 8th spindle** | | |
| Default | 100 | Range | 1 ~ 20,000 |
| Data Type | Dword | Unit | RPM |

- Spindle low speed positioning.
- If the number of spindle positioning turns in **[N0.1394 Spindle positioning turns]** is bigger than 1 and **[current speed]** is smaller than **[high speed positioning]** during the positioning procedure, the system will apply this low-speed setting to search the command degree and then finish the positioning.

4

| | | | | |
|---|---|---|---|---|
| **N0.1012** | **High speed positioning of 1st spindle** | | | **R** |
| **N0.1062** | **High speed positioning of 2nd spindle** | | | |
| **N0.1112** | **High speed positioning of 3rd spindle** | | | |
| **N0.1162** | **High speed positioning of 4th spindle** | | | |
| **N0.1212** | **High speed positioning of 5th spindle** | | | |
| **N0.1262** | **High speed positioning of 6th spindle** | | | |
| **N0.1312** | **High speed positioning of 7th spindle** | | | |
| **N0.1362** | **High speed positioning of 8th spindle** | | | |
| Default | 100 | Range | 1 ~ 20,000 | |
| Data Type | Dword | Unit | RPM | |

- Spindle high speed positioning.
- If the number of spindle positioning turns in **[N0.1044 ~ N0.1394 Spindle positioning turns]** is bigger than 1 and **[current speed]** is bigger than this parameter setting during positioning procedure, the system will apply this high-speed setting to search the command degree and then finish the positioning.

| | | | | |
|---|---|---|---|---|
| **N0.1013** | **Z phase positioning offset of 1st spindle** | | | **R** |
| **N0.1063** | **Z phase positioning offset of 2nd spindle** | | | |
| **N0.1113** | **Z phase positioning offset of 3rd spindle** | | | |
| **N0.1163** | **Z phase positioning offset of 4th spindle** | | | |
| **N0.1213** | **Z phase positioning offset of 5th spindle** | | | |
| **N0.1263** | **Z phase positioning offset of 6th spindle** | | | |
| **N0.1313** | **Z phase positioning offset of 7th spindle** | | | |
| **N0.1363** | **Z phase positioning offset of 8th spindle** | | | |
| Default | 0 | Range | 1 ~ 36,000 | |
| Data Type | Dword | Unit | 0.01 degrees | |

- Spindle Z phase positioning offset. The system will apply this parameter as offset degree between the Z phase and spindle zero degree.

| | | | |
|---|---|---|---|
| **N0.1014** | **Tapping acc. and dec. time of 1st spindle** | | **R** |
| **N0.1064** | **Tapping acc. and dec. time of 2nd spindle** | | |
| **N0.1114** | **Tapping acc. and dec. time of 3rd spindle** | | |
| **N0.1164** | **Tapping acc. and dec. time of 4th spindle** | | |
| **N0.1214** | **Tapping acc. and dec. time of 5th spindle** | | |
| **N0.1264** | **Tapping acc. and dec. time of 6th spindle** | | |
| **N0.1314** | **Tapping acc. and dec. time of 7th spindle** | | |
| **N0.1364** | **Tapping acc. and dec. time of 8th spindle** | | |
| Default | 2,000 | Range | 1 ~ 20,000 |
| Data Type | Dword | Unit | ms |

- Spindle tapping acceleration and deceleration time.
- The time definition of period is from 0 speed to maximum speed such as **[N0.1008 Maximum speed of 1st spindle]** and the system will apply this slop as acceleration and deceleration reference during spindle tapping process.
- The larger the value of the setting, the slower the acceleration and deceleration time.

| | | | |
|---|---|---|---|
| **N0.1015** | **Tapping S curve time of 1st spindle** | | **R** |
| **N0.1015** | **Tapping S curve time of 2nd spindle** | | |
| **N0.1065** | **Tapping S curve time of 3rd spindle** | | |
| **N0.1115** | **Tapping S curve time of 4th spindle** | | |
| **N0.1165** | **Tapping S curve time of 5th spindle** | | |
| **N0.1215** | **Tapping S curve time of 6th spindle** | | |
| **N0.1265** | **Tapping S curve time of 7th spindle** | | |
| **N0.1315** | **Tapping S curve time of 8th spindle** | | |
| Default | 100 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

- Spindle tapping S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the spindle vibration.

| | | | | |
|---|---|---|---|---|
| **N0.1016** | **Tapping return speed rate of 1st spindle** | | | **R** |
| **N0.1066** | **Tapping return speed rate of 2nd spindle** | | | |
| **N0.1116** | **Tapping return speed rate of 3rd spindle** | | | |
| **N0.1166** | **Tapping return speed rate of 4th spindle** | | | |
| **N0.1216** | **Tapping return speed rate of 5th spindle** | | | |
| **N0.1266** | **Tapping return speed rate of 6th spindle** | | | |
| **N0.1316** | **Tapping return speed rate of 7th spindle** | | | |
| **N0.1366** | **Tapping return speed rate of 8th spindle** | | | |
| Default | 10 | Range | 10 ~ 50,000 | |
| Data Type | Dword | Unit | 0.01% | |

- Spindle tapping return speed rate.
- The tapping return speed is based on the following formula.

  [Tapping return speed] = [Tapping speed] x [Tapping return speed rate]

| | | | | |
|---|---|---|---|---|
| **N0.1017** | **Zero speed reach tolerance of 1st spindle** | | | **R** |
| **N0.1067** | **Zero speed reach tolerance of 2nd spindle** | | | |
| **N0.1117** | **Zero speed reach tolerance of 3rd spindle** | | | |
| **N0.1167** | **Zero speed reach tolerance of 4th spindle** | | | |
| **N0.1217** | **Zero speed reach tolerance of 5th spindle** | | | |
| **N0.1267** | **Zero speed reach tolerance of 6th spindle** | | | |
| **N0.1317** | **Zero speed reach tolerance of 7th spindle** | | | |
| **N0.1367** | **Zero speed reach tolerance of 8th spindle** | | | |
| Default | 5 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | RPM | |

- When the command spindle has stopped and the spindle slows down until it falls below this parameter, the system will notify that the spindle has reached the zero speed.

| N0.1018 | Target speed reach tolerance of 1st spindle | | R |
|---|---|---|---|
| N0.1068 | Target speed reach tolerance of 2nd spindle | | |
| N0.1118 | Target speed reach tolerance of 3rd spindle | | |
| N0.1168 | Target speed reach tolerance of 4th spindle | | |
| N0.1218 | Target speed reach tolerance of 5th spindle | | |
| N0.1268 | Target speed reach tolerance of 6th spindle | | |
| N0.1318 | Target speed reach tolerance of 7th spindle | | |
| N0.1368 | Target speed reach tolerance of 8th spindle | | |
| Default | 10 | Range | 0 ~ 300 |
| Data Type | Dword | Unit | RPM |

- Spindle target speed reach tolerance.
- When the difference between the spindle's current speed and the command speed is less than this parameter setting, the system will notify that the spindle has reached the target speed.

| N0.1019 | Positioning tolerance of 1st spindle | | R |
|---|---|---|---|
| N0.1069 | Positioning tolerance of 2nd spindle | | |
| N0.1119 | Positioning tolerance of 3rd spindle | | |
| N0.1169 | Positioning tolerance of 4th spindle | | |
| N0.1219 | Positioning tolerance of 5th spindle | | |
| N0.1269 | Positioning tolerance of 6th spindle | | |
| N0.1319 | Positioning tolerance of 7th spindle | | |
| N0.1369 | Positioning tolerance of 8th spindle | | |
| Default | 100 | Range | 0 ~ 36,000 |
| Data Type | Dword | Unit | 0.01 degree |

- Spindle positioning target reach tolerance.
- When the spindle stops the positioning procedure and the current degree is less than this parameter setting, the system will notify that the spindle has reached the target position.

4

| | | | | |
|---|---|---|---|---|
| **N0.1020** | **$1^{st}$ gain proportion of $1^{st}$ spindle** | | | **R** |
| **N0.1070** | **$1^{st}$ gain proportion of $2^{nd}$ spindle** | | | |
| **N0.1120** | **$1^{st}$ gain proportion of $3^{rd}$ spindle** | | | |
| **N0.1170** | **$1^{st}$ gain proportion of $4^{th}$ spindle** | | | |
| **N0.1220** | **$1^{st}$ gain proportion of $5^{th}$ spindle** | | | |
| **N0.1270** | **$1^{st}$ gain proportion of $6^{th}$ spindle** | | | |
| **N0.1320** | **$1^{st}$ gain proportion of $7^{th}$ spindle** | | | |
| **N0.1370** | **$1^{st}$ gain proportion of $8^{th}$ spindle** | | | |
| Default | 5 | Range | 1 ~ 1,000 | |
| Data Type | Dword | Unit | rad/s | |

- This parameter is for the spindle 1st gain proportion, when the spindle is an analog spindle and closed loop feedback control is enabled.
- Set the special M2x709 to OFF to enable this parameter.

| | | | | |
|---|---|---|---|---|
| **N0.1021** | **$2^{nd}$ gain proportion of $1^{st}$ spindle** | | | **R** |
| **N0.1071** | **$2^{nd}$ gain proportion of $2^{nd}$ spindle** | | | |
| **N0.1121** | **$2^{nd}$ gain proportion of $3^{rd}$ spindle** | | | |
| **N0.1171** | **$2^{nd}$ gain proportion of $4^{th}$ spindle** | | | |
| **N0.1221** | **$2^{nd}$ gain proportion of $5^{th}$ spindle** | | | |
| **N0.1271** | **$2^{nd}$ gain proportion of $6^{th}$ spindle** | | | |
| **N0.1321** | **$2^{nd}$ gain proportion of $7^{th}$ spindle** | | | |
| **N0.1371** | **$2^{nd}$ gain proportion of $8^{th}$ spindle** | | | |
| Default | 1 | Range | 1 ~ 1,000 | |
| Data Type | Dword | Unit | rad/s | |

- This parameter is for the spindle 2nd gain proportion, when the spindle is an analog spindle and closed loop feedback control is enabled.
- Set the special M2x709 to ON to enable this parameter.

| | | | | |
|---|---|---|---|---|
| **N0.1022** | **Integral gain of $1^{st}$ spindle** | | | **R** |
| **N0.1072** | **Integral gain of $2^{nd}$ spindle** | | | |
| **N0.1122** | **Integral gain of $3^{rd}$ spindle** | | | |
| **N0.1172** | **Integral gain of $4^{th}$ spindle** | | | |
| **N0.1222** | **Integral gain of $5^{th}$ spindle** | | | |
| **N0.1272** | **Integral gain of $6^{th}$ spindle** | | | |
| **N0.1322** | **Integral gain of $7^{th}$ spindle** | | | |
| **N0.1372** | **Integral gain of $8^{th}$ spindle** | | | |
| Default | 50 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | 0.001 rad/s | |

- This parameter is for the spindle integral gain, when the spindle is an analog spindle and closed loop feedback control is enabled.

| | | | |
|---|---|---|---|
| **N0.1025** | **Positioning check time of 1st spindle** | | **R** |
| **N0.1075** | **Positioning check time of 2nd spindle** | | |
| **N0.1125** | **Positioning check time of 3rd spindle** | | |
| **N0.1175** | **Positioning check time of 4th spindle** | | |
| **N0.1225** | **Positioning check time of 5th spindle** | | |
| **N0.1275** | **Positioning check time of 6th spindle** | | |
| **N0.1325** | **Positioning check time of 7th spindle** | | |
| **N0.1375** | **Positioning check time of 8th spindle** | | |
| Default | 10 | Range | 1 ~ 6,000 |
| Data Type | Dword | Unit | sec |

■ After the spindle stop command is triggered, the spindle will need to finish the positioning procedure within this parameter time configuration. Otherwise, the system will return the system alarm 0x0C01.

| | | | |
|---|---|---|---|
| **N0.1034** | **1st set gear numerator of 1st spindle** | | **R** |
| **N0.1084** | **1st set gear numerator of 2nd spindle** | | |
| **N0.1134** | **1st set gear numerator of 3rd spindle** | | |
| **N0.1184** | **1st set gear numerator of 4th spindle** | | |
| **N0.1234** | **1st set gear numerator of 5th spindle** | | |
| **N0.1284** | **1st set gear numerator of 6th spindle** | | |
| **N0.1334** | **1st set gear numerator of 7th spindle** | | |
| **N0.1384** | **1st set gear numerator of 8th spindle** | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear numerator for the 1st set gear in the 1st to 8th spindles.

| | | | |
|---|---|---|---|
| **N0.1035** | **1st set gear denominator of 1st spindle** | | **R** |
| **N0.1085** | **1st set gear denominator of 2nd spindle** | | |
| **N0.1135** | **1st set gear denominator of 3rd spindle** | | |
| **N0.1185** | **1st set gear denominator of 4th spindle** | | |
| **N0.1235** | **1st set gear denominator of 5th spindle** | | |
| **N0.1285** | **1st set gear denominator of 6th spindle** | | |
| **N0.1335** | **1st set gear denominator of 7th spindle** | | |
| **N0.1385** | **1st set gear denominator of 8th spindle** | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear denominator for the 1st set gear in the 1st to 8th spindles.

| | | | |
|---|---|---|---|
| **N0.1036** | **2nd set gear numerator of 1st spindle** | | **R** |
| **N0.1086** | **2nd set gear numerator of 2nd spindle** | | |
| **N0.1136** | **2nd set gear numerator of 3rd spindle** | | |
| **N0.1186** | **2nd set gear numerator of 4th spindle** | | |
| **N0.1236** | **2nd set gear numerator of 5th spindle** | | |
| **N0.1286** | **2nd set gear numerator of 6th spindle** | | |
| **N0.1336** | **2nd set gear numerator of 7th spindle** | | |
| **N0.1386** | **2nd set gear numerator of 8th spindle** | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear numerator for the 2nd set gear in the 1st to 8th spindles.

| | | | |
|---|---|---|---|
| **N0.1037** | **2nd set gear denominator of 1st spindle** | | **R** |
| **N0.1087** | **2nd set gear denominator of 2nd spindle** | | |
| **N0.1137** | **2nd set gear denominator of 3rd spindle** | | |
| **N0.1187** | **2nd set gear denominator of 4th spindle** | | |
| **N0.1237** | **2nd set gear denominator of 5th spindle** | | |
| **N0.1287** | **2nd set gear denominator of 6th spindle** | | |
| **N0.1337** | **2nd set gear denominator of 7th spindle** | | |
| **N0.1387** | **2nd set gear denominator of 8th spindle** | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear denominator for the 2nd set gear in the 1st to 8th spindles.

| | | | |
|---|---|---|---|
| **N0.1038** | **3rd set gear numerator of 1st spindle** | | **R** |
| **N0.1088** | **3rd set gear numerator of 2nd spindle** | | |
| **N0.1138** | **3rd set gear numerator of 3rd spindle** | | |
| **N0.1188** | **3rd set gear numerator of 4th spindle** | | |
| **N0.1238** | **3rd set gear numerator of 5th spindle** | | |
| **N0.1288** | **3rd set gear numerator of 6th spindle** | | |
| **N0.1338** | **3rd set gear numerator of 7th spindle** | | |
| **N0.1388** | **3rd set gear numerator of 8th spindle** | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear numerator for the 3rd set gear in the 1st to 8th spindles.

| | | | |
|---|---|---|---|
| N0.1039 | $3^{rd}$ set gear denominator of $1^{st}$ spindle | | R |
| N0.1089 | $3^{rd}$ set gear denominator of $2^{nd}$ spindle | | |
| N0.1139 | $3^{rd}$ set gear denominator of $3^{rd}$ spindle | | |
| N0.1189 | $3^{rd}$ set gear denominator of $4^{th}$ spindle | | |
| N0.1239 | $3^{rd}$ set gear denominator of $5^{th}$ spindle | | |
| N0.1289 | $3^{rd}$ set gear denominator of $6^{th}$ spindle | | |
| N0.1339 | $3^{rd}$ set gear denominator of $7^{th}$ spindle | | |
| N0.1389 | $3^{rd}$ set gear denominator of $8^{th}$ spindle | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear denominator for the $3^{rd}$ set gear in the $1^{st}$ to $8^{th}$ spindles.

| | | | |
|---|---|---|---|
| N0.1040 | $4^{th}$ set gear numerator of $1^{st}$ spindle | | R |
| N0.1090 | $4^{th}$ set gear numerator of $2^{nd}$ spindle | | |
| N0.1140 | $4^{th}$ set gear numerator of $3^{rd}$ spindle | | |
| N0.1190 | $4^{th}$ set gear numerator of $4^{th}$ spindle | | |
| N0.1240 | $4^{th}$ set gear numerator of $5^{th}$ spindle | | |
| N0.1290 | $4^{th}$ set gear numerator of $6^{th}$ spindle | | |
| N0.1340 | $4^{th}$ set gear numerator of $7^{th}$ spindle | | |
| N0.1390 | $4^{th}$ set gear numerator of $8^{th}$ spindle | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear numerator for the $4^{th}$ set gear in the $1^{st}$ to $8^{th}$ spindles.

| | | | |
|---|---|---|---|
| N0.1041 | $4^{th}$ set gear denominator of $1^{st}$ spindle | | R |
| N0.1091 | $4^{th}$ set gear denominator of $2^{nd}$ spindle | | |
| N0.1141 | $4^{th}$ set gear denominator of $3^{rd}$ spindle | | |
| N0.1191 | $4^{th}$ set gear denominator of $4^{th}$ spindle | | |
| N0.1241 | $4^{th}$ set gear denominator of $5^{th}$ spindle | | |
| N0.1291 | $4^{th}$ set gear denominator of $6^{th}$ spindle | | |
| N0.1341 | $4^{th}$ set gear denominator of $7^{th}$ spindle | | |
| N0.1391 | $4^{th}$ set gear denominator of $8^{th}$ spindle | | |
| Default | 1 | Range | 1 ~ 60,000 |
| Data Type | Dword | Unit | - |

■ Spindle gear denominator for the $4^{th}$ set gear in the $1^{st}$ to $8^{th}$ spindles.

4

| | | | |
|---|---|---|---|
| **N0.1044** | **Positioning turns number of 1st spindle** | | **R** |
| **N0.1094** | **Positioning turns number of 2nd spindle** | | |
| **N0.1144** | **Positioning turns number of 3rd spindle** | | |
| **N0.1194** | **Positioning turns number of 4th spindle** | | |
| **N0.1244** | **Positioning turns number of 5th spindle** | | |
| **N0.1294** | **Positioning turns number of 6th spindle** | | |
| **N0.1344** | **Positioning turns number of 7th spindle** | | |
| **N0.1394** | **Positioning turns number of 8th spindle** | | |
| Default | 0 | Range | 0 ~ 10 |
| Data Type | Dword | Unit | - |

- Spindle positioning turns number.
- If the setting value is greater than 0, the spindle will perform positioning action with the speed settings of parameters **[N0.1011]** or **[N0.1012]**, which will be completed after reaching the set number of turns.

# 4.3 N1 – Path parameter



| N1.008 | G code command type in lathe mode | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 2 | |
| Data Type | Dword | Unit | - | |

■ In the lathe programming, the system supports A, B and C types of NC commands. Users can configure the command types as preferred.

0: Type A

1: Type B

2: Type C

For instance, in inch type commands, different modes will have different command codes.

| Type | | | Group | Function |
|---|---|---|---|---|
| A | B | C | | |
| G20 | G20 | G70 | 06 | Programming in inches |
| x | G90 | G90 | 03 | Absolute programming |

| N1.010 | NC path application setting - 1 | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

■ Bit 1: Enable public # variable functions.

0: Disable, 1: Enable

After enabling this function, the system will allow users to exchange data through regular # variables as public variables in different channels. The public regular variables start from #100 and the amount is defined in parameter **[N0.050]**.

■ Bit 2: Enable public retentive # variable functions.

0: Disable, 1: Enable

After enabling this function, the system will allow users to exchange data through retentive # variables in static memory as public variables in different channels. The public retentive variables start from #2000 and the amount is defined in parameter **[N0.051]**.

■ Bit 3: Look-ahead stop of macro call command.

0: Disable, 1: Enable

When this function is disabled, the system will not stop look-ahead when macro call commands such as M98, G65, or G/M/S/T call the macro code, and will continue with the look-ahead for subsequent program commands. This allows for different macro codes to be called without stopping motion.

When this function is enabled, the system will stop look-ahead when macro call commands are called, and motion will be stopped because there are no interpolation path result to execute.

- Bit 4: Enable look-ahead of judgment command.

  0: Disable, 1: Enable

  When this function is disabled, the system will stop look-ahead when judgment command such as IF, WHILE, or GOTO are encountered, and then it will utilize the status at that moment to judge the sentence conditions.

  When this function is enabled, the system will not stop look-ahead when a judgment command is encountered, thus the judgment will take place when the machine is in motion.

- Bit 7: MLC variable type.

  0: Integer (Word)

  1: Floating point (Double Word)

  The MLC D registers provided by the system can exchange data with the # variables of the macro. This parameter defines system whether to use integer or floating point data types.

  - When set to integer, the system will apply 16 bit signed data for D registers and # variables, which can be address mapped one to one.

    For example, the system will move the data in D21128 to #25128 and D21129 to #25129. Furthermore, the data in D21128 and D21129 will be moved as signed integer types to the # variables, so #25128 and #25129 will be a range between -32767 to 32767 as signed integer data.

  - When set to floating point, the system will apply 32 bit floating point data for D registers and # variables and the system will move two D registers to one # variable. The high-bit memory address will be forbidden from use.

    For example, the system will move the data in D21128 and D21129 as floating point data to #25128. Furthermore, D21129 and #25129 cannot be used because they are occupied as high-bit memory addresses.

- Bit 8: Emergency signal source.

  0: System and M2x013

  1: M2x013

  When set to 0, the system will refer to the settings in parameter **[N5.011 Bit15 Emergency stop signal source]** and then use the configured signal to monitor the emergency event. Once the emergency signal is triggered, the system will stop all the NC procedures of all NC channels. Users can also use M2x013 to trigger the emergency event in each single NC channel.

  When set to 1, users can only use M2x013 to trigger the emergency event in each single NC channel.

- Bit 9: Position record resource of G31 skip command.

  0: Command

  1: Feedback

  When the G31 skip command is stopped by a triggered HSI signal, the NC system will record the current machine position to #21048 to #21063.

  When set to 0, the NC system will record the machine command position to the # variable.

  When set to 1, the NC system will record the machine feedback position to the # variable.

- Bit 11: Hardware limit switch check.

  0: Enable, 1: Disable

- Bit 12: Software limit check.

  0: Enable, 1: Disable

- Bit 13: Software limit advance check.

  0: Disable, 1: Enable

  When this function is disabled, the system will only trigger the limit alarm when the machine reaches the software limit position.

  When this function is enabled, the system will trigger the limit alarm during the previewing NC program once the system calculates the tool path is over the limitation setting.

- Bit 15: Software limit judgement mode.

  0: >=

  1: >

  When set to 0, the limitation check may include the limit threshold.

  When set to 1, the limitation check must be within the limitation range.

- Bit 16: Tool compensation type.

  0: Type A

  1: Type B

- Bit 17: Ignore tool compensation and path interfere check.

  0: Enable, 1: Disable

  When set to 0, the NC system will check the interfere between the original program path and the path with tool compensation.

  When set to 1, the NC system will ignore the interference between the original program path and the path with tool compensation. However, the product may be damaged due to the compensation path going over the origin path.

- Bit 18: Cancel tool compensation on G00 rapid command.

  0: Disable, 1: Enable

  When set to 0, the NC system will execute tool compensation on the whole machining path.

  When set to 1, the NC system will cancel the tool compensation on the G00 rapid command as the program command path until the next G01 command is executed.

4

- Bit 19: G43 tool compensation command mode.

  0: Compensate immediately

  1: Only change coordinates

  When set to 0, after executing the G43 H_ command, the NC system will update the compensation coordinates and then move the tool to the new position.

  When set to 1, after executing the G43 H_ command, the NC system will only update the compensation coordinates and the tool will stay at the original position.

  However, when the program command is G43 H_ Z_, the NC system will move the tool to the compensation coordinates regardless.

- Bit 20: Tool length command type.

  0: Absolute

  1: Incremental

  When set to 0, the NC system will compensate the tool length based on the setting in the tool table.

  When set to 1, the NC system will compensate the tool length based on the result of **[command tool length]** minus **[tool length setting]**.

- Bit 22: T code call macro O9000.

  0: Disable, 1: Enable

- Bit 23: Axes servo on mode.

  0: Automatic

  1: Manual

  When set to 0, after system starts up and there are no abnormalities, all the axes will be enabled automatically.

  When set to 1, users need to use M2x012 to enable all the axes in each NC channel.

- Bit 24: Look-ahead stop of # variable assignment command.

  0: Disable, 1: Enable

  When this function is disabled, the NC system will continue to preview the program when it encounters a # variable assignment command such as #100=1.

  When this function is enabled, the NC system will stop previewing the program when it encounters the # variable assignment command. The NC system will continue to process look ahead until it finishes executing the # variable assignment command.

| **N1.011** | **NC path application setting - 2** | | **P** |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 3: Return to origin before NC start.

  0: Yes, 1: No

- Bit 4: Command blocks ignore decimal point.
  0: Disable, 1: Enable
  When set to enable, the NC system will take the value in the position command as an integer number if there is no decimal point. For example, if the command is G01 X20, the system will move the X axis to the 20.000 absolute coordinate position.
  When set to disable, the NC system will take the value in the position command as a basic unit if there is no decimal point. For example, if the command is G01 X20, the system will move X axis to the 0.020 absolute coordinate position.
- Bit 5: MPG path retrace.
  0: Disable, 1: Enable
  When set to enable, the NC system will retrace back according to the original path with the MPG backward command when MPG simulation is enabled.
- Bit 8: Spindle enables check before cutting command.
  0: Disable, 1: Enable
  When set to enable, the NC system will check if the spindle is enabled and rotating before executing a cutting command such as G01/G02/G03. Otherwise, the system will return an alarm.
- Bit 9: Spindle zero speed after system reset.
  0: Disable, 1: Enable
  When set to enable, the NC system will automatically set the spindle to zero speed after the Reset command is triggered.
- Bit 10: Reference feed speed of spindle revolution.
  0: Command
  1: Feedback
- Bit 16: Recovery mode after command interrupt.
  0: Interrupt position
  1: Interrupt command position
  When set to 0, when a feed hold is triggered, and the spindle is manually repositioned, after the user resumes the process, the NC system will move the axes back to the recorded position, then move them to the interrupt command position.
  When set to 1, the NC system will move the axes directly to the interrupt command position.
- Bit 17: Recovery speed.
  0: G00
  1: G01
  When set to 0, when a feed hold is triggered, after the user resumes the process, the NC system will move the axes to the recovery position at the speed set in G00.
  When set to 1, the NC system will move the axes to the recovery position at the speed set in G01.

- Bit 24: Reference feed speed.

  0: Program

  1: As parameter N1.042

  When set to 0, the NC system will use the F command in the program as the cutting speed.

  When set to 1, the NC system will use parameter **[N1.042 Default cutting feed]** as the cutting speed instead of the F command.

- Bit 26: JOG speed reference.

  0: %

  1: Feedrate

  When set to 0, the JOG speed will take the below formula.

  JOG speed = **[N2.030 Axis JOG maximum speed]** x **D2x006 (Speed Override)** x 0.01

  When set to 1, the JOG speed will refer to D2x006 (Speed Override), and the unit will be defined in parameter **[N2.001 Axis configuration]**.

| N2.001 | | Unit |
|---|---|---|
| Bit 2~4 (Linear axis) | | mm/min |
| Bit 2~4 (Rotary axis) | Bit 11 = 0 | Deg/min |
| | Bit 11 = 1 | RPM |

| **N1.013** | **NC path application setting - 4** | | **P** |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Spindle speed rate reference during tapping.

  0: Speed rate

  1: 100%

  When set to 0, the NC system will take the spindle speed rate before the machining tapping function, and it will no longer be changed after the tapping procedure.

  When set to 1, the NC system will always use the 100% spindle speed rate for the tapping function.

- Bit 1: Cancel beginning check of G71 or G72 X coordinate position.

  0: Enable, 1: Disable

  When set to 0, the NC system will check the beginning of the X position command as it cannot be smaller than its end position command in the G71 or G72 repetitive cycles command. Otherwise, the system will return an error.

- Bit 5: Chamfer and fillet format setting.

  0: ,C_/,R_

  1: C_/,C_/R_/,R_

- Bit 10: G31 rapid command speed.

  0: mm/min

  1: Current system mode

- Bit 11: G28/G30 remaining tool length compensation.

  0: Cancel

  1: Retaining
- Bit 12: Tool length compensation after M30 command.

  0: Cancel

  1: Retaining
- Bit 13: Tool length compensation after M02 command.

  0: Cancel

  1: Retaining
- Bit 14: Tool length compensation after Reset command or restart.

  0: Cancel

  1: Retaining
- Bit 15: Tool lifetime counting.

  0: Disable, 1: Enable
- Bit 16: Tool lifetime count source.

  0: Tool compensation number. It is incremented by 1 when the tool compensate command applies a different tool number.

  1: Tool change number. It is incremented by 1 when the tool change command applies a different tool number.

  This parameter is only available in lathe mode, if it is set to milling mode, the system will calculate according to the tool changes directly.
- Bit 17: Tool life advance alarm.

  0: Disable, 1: Enable

  Based on the percentage setting on the parameter **[N1.183]**, the system will return an alarm when the lifetime increments to the point where it goes over the setting. However, the process will not stop when this advance alarm occurs.
- Bit 18: Feed rate in dry run mode.

  0: Not apply feed rate

  1: Apply feed rate

  When the NC system enable the dry run mode through set the M2x005 as ON, it will use feed speed refer to parameter **[N1.066 Dry run feed speed]** instead of F command.

  Set as 0, the system will use **[N1.066 Dry run feed speed]** as feed speed directly in dry run mode.

  Set as 1, the system will take feed rate as below formula.

  Feed speed = N1.066 * D2x002 (Feed rate) * 0.01.
- Bit 19: Positioning mode in the single thread turning.

  0: G00

  1: G01

- Bit 21: The initial recorded value of # variable for G31 function.

  0: Initial value is 0.

  1: End-point position.



| N1.020 | G code application setting | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 0: System initial unit.

  0: mm (G21)

  1: inch (G20)

  If the initial unit is set to mm as default, and the unit is set to inch G20 through the command during execution of G code. The NC system will be changed to inch unit, until processing stops, it will be changed back to mm unit.

- Bit 1: System initial programming mode.

  0: Absolute

  1: Incremental

- Bit 2: System initial speed unit.

  0: Feedrate per min

  1: Feedrate per revolution

- Bit 3~4: System initial working plane.

  0: G17

  1: G18

  2: G19

- Bit 5~7: System initial working coordinate system.

  0: G54

  1: G55

  2: G56

  3: G57

  4: G58

  5: G59

- Bit 8: Initial setting of G94 or G95.

  0: System initial setting

  1: Program

  When set to 0, the NC system will apply G94 or G95 according to the configuration in **[N1.020 bit2 System initial speed unit]** when the Reset is triggered or the M30 command is encountered.

  When set to 1, the NC system will keep the G94 or G95 status when the Reset is triggered or M30 is encountered.

- Bit 18: G00 interpolation mode.

  0: all axes interpolation.

  1: axes independent interpolation

  Each of axes in the same command will start simultaneously but stop independently with different time because of acceleration and deceleration could be different.

  When set to 0, all axes will start and end at the same time.

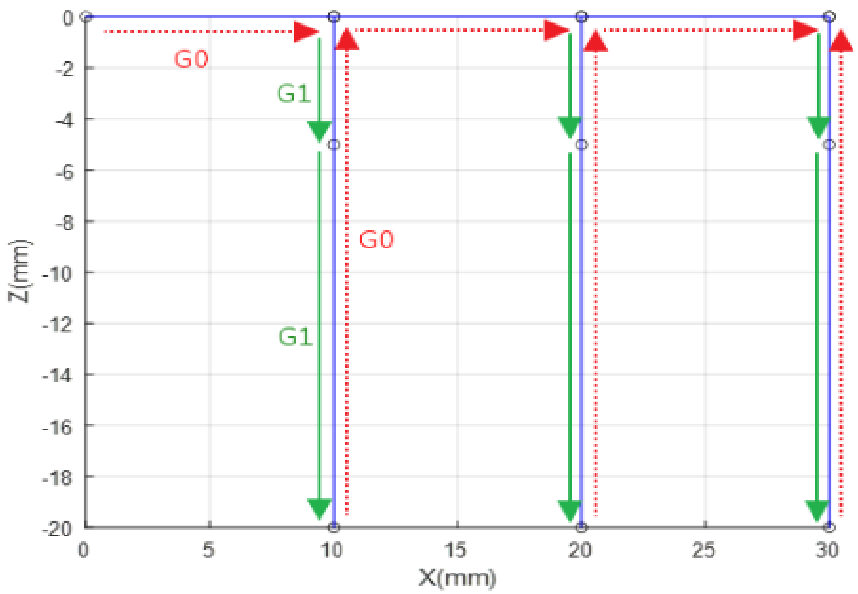
  When set to 1, all the axes in the G00 command will calculate speed and acceleration independently, therefore, they will start together but may end differently.

- Bit 22: Call O9030 before execute break and search.

  0: Disable, 1: Enable

| N1.021 | Rapid speed blending mode | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

In the regular G00 rapid command, the NC system will finish and reach each target position command. In this way, all the axes will stop at the G00 rapid command target position to ensure the exact positioning. However, some different applications may demand time optimization for better efficiency, so the NC system provides the G00 command for speed blending. This can optimize command path and shorten the machining time. Different blending settings are provided for different requirements. These settings include G00 to G00, G00 to G01, and G01 to G00.




- Bit 0-1: Speed blending mode.

  0: Disable

  1: Speed mode

  2: Interpolation position mode

  3: Axes position mode

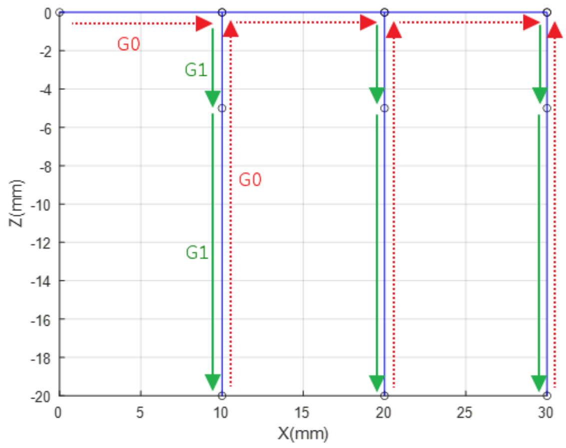
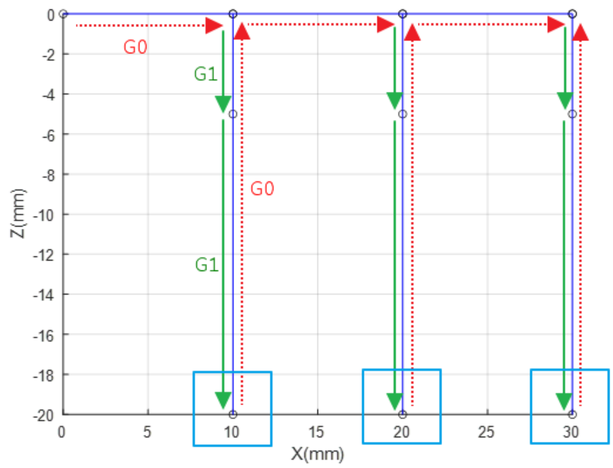
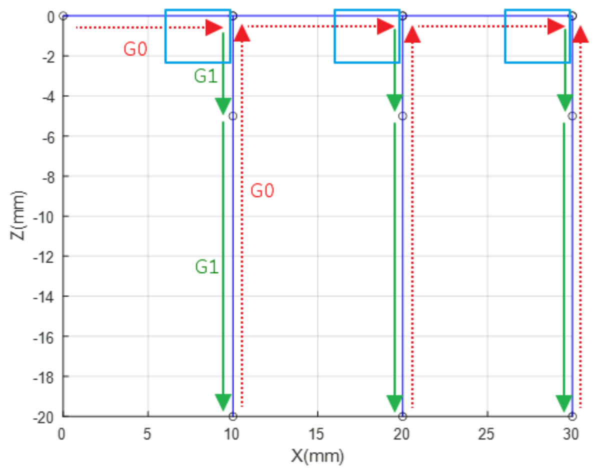
When set to 0, the speed blending function of G00 rapid command will be turned off.
When set to 1, the NC system will use the speed percentage mode. When the feed speed decreases to below the percentage setting in parameter **[N1.097, N1.098, N1.099 speed blending percentage]**, the NC system will start to move the next motion command.
When set to 2, the NC system will start to move the next motion command when the remaining distance of the current interpolation command is equal or less than the distance setting in the parameter **[N1.096 Target reach distance]**.
When set to 3, the NC system will start to move the next motion command after every interpolate axis's remaining distance is equal or less than the distance setting in the parameter **[N2.027 Axes target reach distance]**.

- Bit 2: Enable G00 to G00 speed blending.
  0: Disable, 1: Enable
- Bit 3: Enable G00 to G01 speed blending.
  0: Disable, 1: Enable
- Bit 4: Enable G01 to G00 speed blending.
  0: Disable, 1: Enable
- Bit 5: Position command reference of position mode.
  0: Feedback position
  1: Command position

When bits 0 to 1 are set to 2 or 3, which enables the blending position mode, the NC system will determine whether to use the feedback position or command position as reference.
The following describes all combinations of different setting of bits 0–1 and bits 2–4.
Sample NC program as follows.

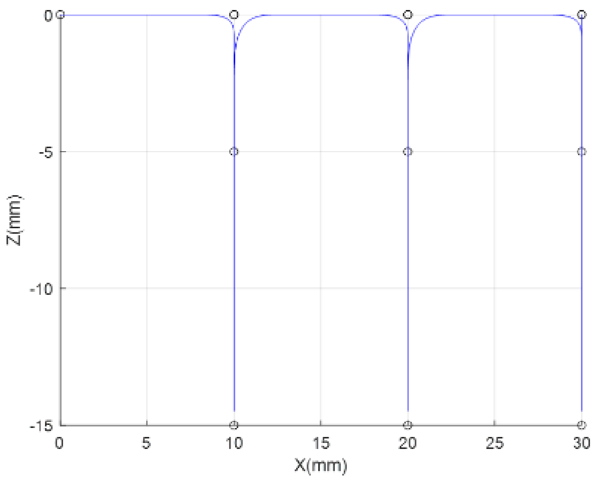
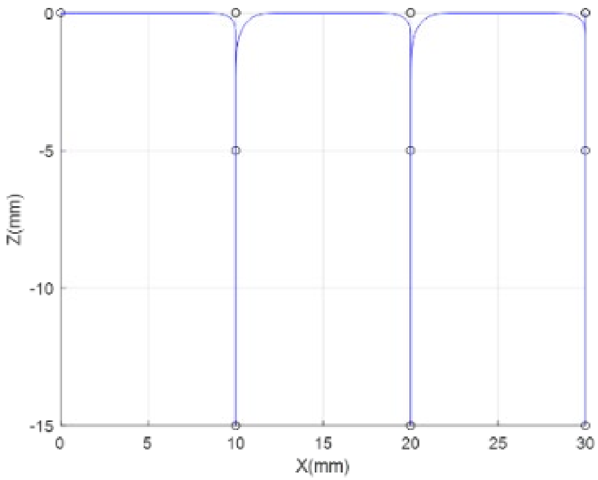
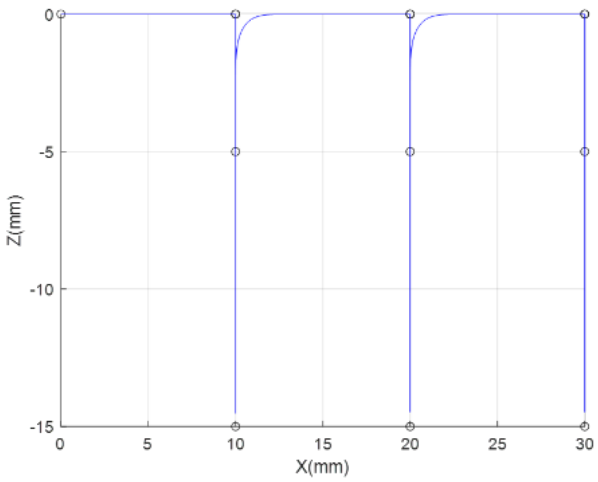
```
G91
G00  X0.  Y0.  Z0.
G00  X10.
G01  Z-5.      F12000
G01  Z-15.     F12000
G00  Z20.
G00  X10.
G01  Z-5.      F12000
G01  Z-15.F12000
G00  Z20.
G00  X10.
G01  Z-5.      F12000
G01  Z-15.F12000
G00  Z20.
M30
```

- Mode 1 (Bit 0~1 as 0), disable blending function.

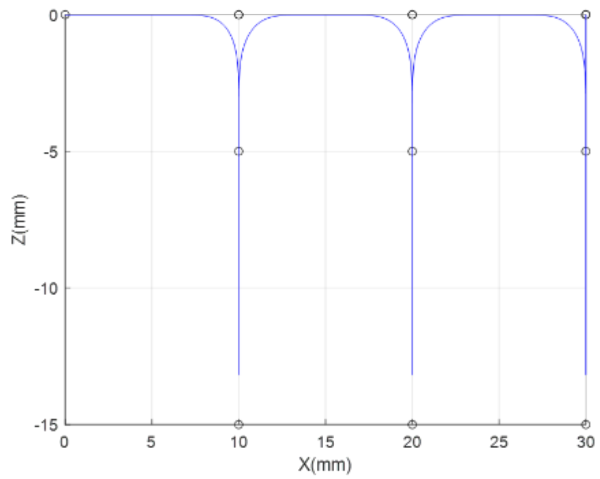
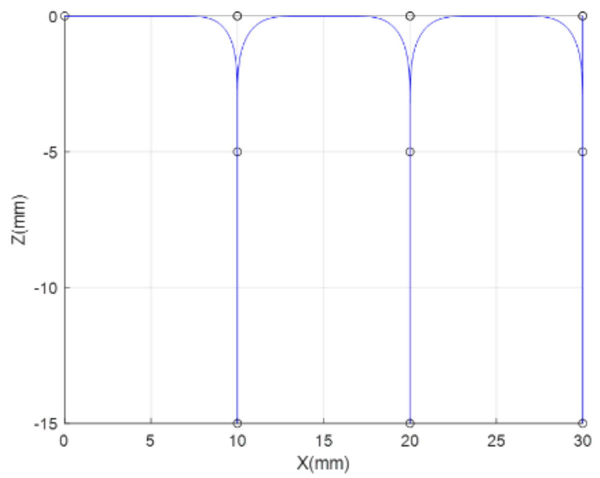
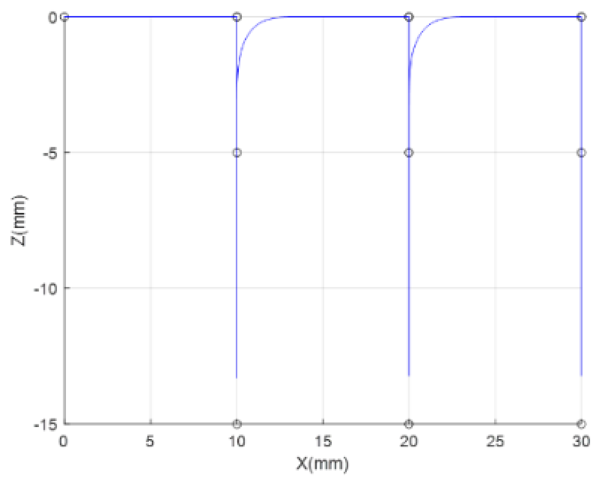
| N1.021 (Bit 2~4) | Result diagram |
|---|---|
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>Disable G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>Disable G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |

4

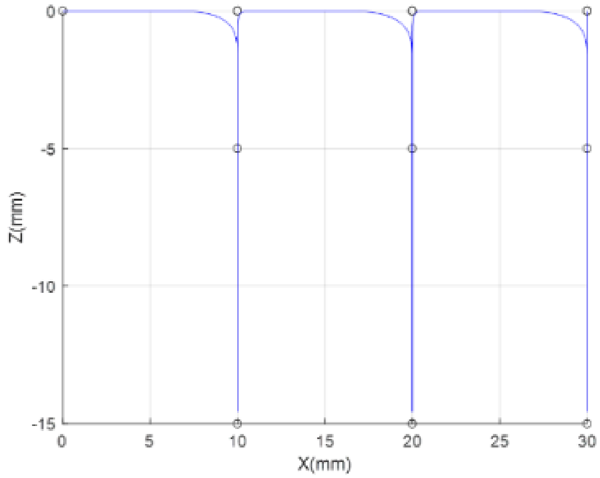
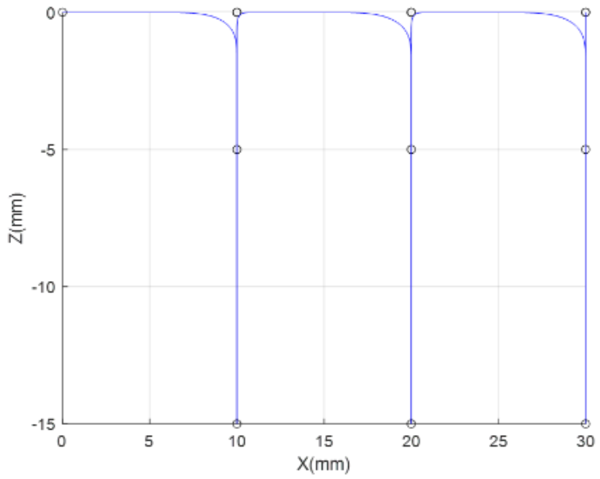
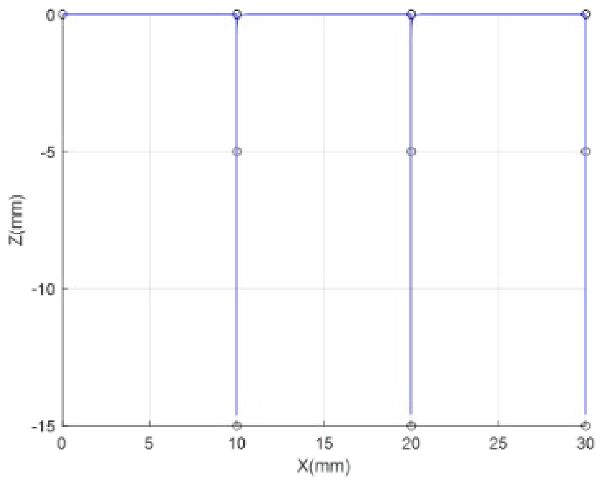
- Mode 2 (Bit 0~1 as 1), speed mode.

| N1.021 (Bit 2~4) | Result diagram |
|---|---|
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>Disable G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>Disable G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |

- Mode 3 (Bit 0~1 as 2), interpolation position mode.

| N1.021 (Bit 2~4) | Result diagram |
|---|---|
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>Disable G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>Disable G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |

- Mode 4 (Bit 0~1 as 3), axes position mode.

| N1.021 (Bit 2~4) | Result diagram |
|---|---|
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>**Enable** G00 to G01 speed blending.<br>Disable G01 to G00 speed blending. |  |
| **Enable** G00 to G00 speed blending.<br>Disable G00 to G01 speed blending.<br>**Enable** G01 to G00 speed blending. |  |

| N1.026 | Skip function average times | | R |
|---|---|---|---|
| Default | 3 | Range | 1 ~ 3 |
| Data Type | Dword | Unit | - |



- The NC system will be recording the machine coordinate position in # variables when the G31 skip function is triggered. This parameter defines the measurement average times of the system to obtain the record coordinate data.

| Record coordinate type | Axis X ~ Axis W | 10th Axis ~ 16th Axis |
|---|---|---|
| Machine coordinate | #21048~#21056 | #21057~#21063 |
| Absolute coordinate | #21064~#21072 | #21073~#21079 |

| N1.027 | Skip function default speed | | R |
|---|---|---|---|
| Default | 100 | Range | 0 ~ 600,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

- G31 skip command default feed speed. Once the feed speed doesn't program in the skip command instruction, the NC system will refer to this parameter as feed speed.

| N1.028 | Skip function acc. and dec. time | | R |
|---|---|---|---|
| Default | 100 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | msec |

- G31 Skip command's acceleration and deceleration time.
- The time is defined as the period from 0 speed to maximum speed **[N0. 1033 Cutting command maximum speed]**, and the system will apply this slope as the acceleration and deceleration reference during the machining process.
- The larger the value of the setting, the slower the acceleration and deceleration time.

| N1.029 | Skip function S curve time | | R |
|---|---|---|---|
| Default | 100 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | msec |

- G31 skip command's S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.030 | G00 rapid command maximum speed | | R |
|---|---|---|---|
| Default | 5,000 | Range | 1 ~ 600,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

- Rapid command maximum speed when executing G00 command or system in RAPID mode.

| N1.031 | G00 rapid command acc. and dec. time | | R |
|---|---|---|---|
| Default | 200 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | 1ms |

- System acceleration and deceleration time when executing G00 command or system in RAPID mode.
- The time is defined as the period from 0 speed to maximum speed **[N0.1030 G00 rapid command maximum speed]**, and the system will apply this slope as the acceleration and deceleration reference during the machining process.
- The larger the value of the setting, the slower the acceleration and deceleration time.

| N1.032 | G00 rapid command S curve time | | R |
|---|---|---|---|
| Default | 10 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | 1ms |

- G00 rapid command's S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.033 | Cutting command maximum feed | | R |
|---|---|---|---|
| Default | 5,000 | Range | 1 ~ 600,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

- The maximum axes interpolation speed when executing cutting command.

| N1.034 | Cutting command acc. and dec. time | | R |
|---|---|---|---|
| Default | 100 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | 1ms |

- System acceleration and deceleration time when executing cutting command.
- The time is defined as the period from 0 speed to maximum speed **[N0.1033 Cutting command maximum speed]**, and the system will apply this slope as the acceleration and deceleration reference during the machining process.
- The larger the value of the setting, the slower the acceleration and deceleration time.

| N1.035 | Cutting command S curve time | | R |
|---|---|---|---|
| Default | 20 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | 1ms |

- G01 cutting command's S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.036 | Look-ahead filter time | | R |
|---|---|---|---|
| Default | 50 | Range | 1 ~ 500 |
| Data Type | Dword | Unit | 1ms |

- The cutting path's final acceleration and deceleration times are used for smoothing the acceleration and deceleration of the commands for each axis.
- Generally, the higher the setting the smoother the cutting command, but the actual tool path will go out of the programmed path. A smaller value will cause rapid speed change, which may cause machine vibrations, but the tool path will be more precise.

| N1.037 | Look-ahead S curve time | | R |
|---|---|---|---|
| Default | 10 | Range | 1 ~ 100 |
| Data Type | Dword | Unit | 1ms |

- The S curve time of the look-ahead function, which will add another smoothing acceleration on the cutting path.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.038 | Arc command reference feed | | R |
|---|---|---|---|
| Default | 1,000 | Range | 10 ~ 50,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

- During a machining arc command, the system will use a 2mm radius and this reference feed to calculate a reference interpolation speed, then compare it to the F programed feed. The system will apply the lower speed as the actual machining feed on the arc. Because of the following error of the servo drive, the arc command will usually have an issue with shrinking. A bigger value can speed up the process time, but it will cause arc radius deflation and decrease the precision of the process.

| N1.039 | Arc command minimum feed | | | R |
|---|---|---|---|---|
| Default | 500 | Range | 10 ~ 50,000 | |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min | |



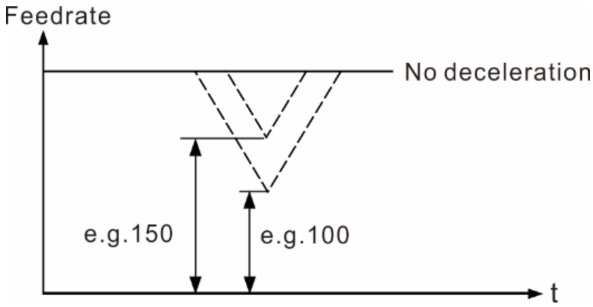
- Arc command minimum feed limitation. The NC system will limit interpolation with this parameter setting as the minimum speed when performing arc commands.
- A bigger value can speed up the process time, but it will cause arc radius deflation and decrease the precision of the process.

| N1.040 | Arc command radius tolerance | | | R |
|---|---|---|---|---|
| Default | 20 | Range | 0 ~ 60,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

- Usually, the end position of the arc command is not precise. The distance from the target command position to the arc command center does not match the command radius, and this difference is called the radius tolerance. The NC system will return an alarm when it detects that the command exceeds the tolerance.
- Set value to 0 to disable the function.
- Users can set this parameter to 0 or higher to avoid tolerance checks, but it will decrease the precision of the process.

| N1.041 | Turn on speed | | | R |
|---|---|---|---|---|
| Default | 100 | Range | 0 ~ 50,000 | |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min | |

- Interpolation corner turning reference speed. The NC system will take the speed on a 60-degree corner as reference and then calculate a reference speed according to the actual degree. This reference speed will again be compared with the F command speed, and the lower result will be applied as the actual turning interpolation speed.
- A lower value will decrease the corner speed and machine vibrations, which can improve precision, but will increase the process time. However, a higher value could cause machine vibrations during path turning.



| N1.042 | Default cutting feed | | R |
|---|---|---|---|
| Default | 100 | Range | 0 ~ 600,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

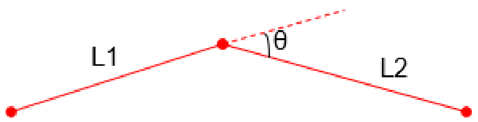
■ Default cutting interpolation feed speed. If the value is not 0, the NC system will apply this as the default speed if the NC program doesn't indicate any F command.

| N1.050 | Max command distance of curve fitting | | R |
|---|---|---|---|
| Default | 20 | Range | 0 ~ 10,000 |
| Data Type | Dword | Unit | 0.1 mm / 0.01 inch |

■ The NC system has a curve fitting function to deal with short line commands. This parameter defines the length of short lines. If the length of the cutting command G01 is longer then this parameter, the NC system will not apply curve fitting on this command.

| N1.051 | Min command degree of curve fitting | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 90 |
| Data Type | Dword | Unit | degree |

■ When the corner degree between two interpolation commands is over this parameter setting, the NC system will not apply curve fitting on this corner.



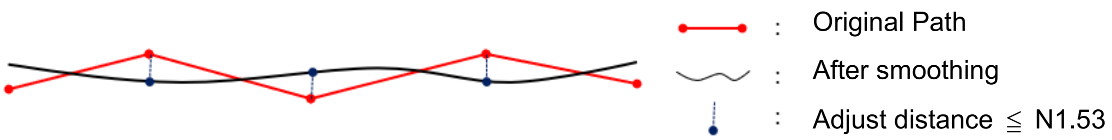

| N1.052 | Minimum command length of turning | | R |
|---|---|---|---|
| Default | 100 | Range | 0 ~ 10,000 |
| Data Type | Dword | Unit | 0.1 μm / 0.00001 inch |

■ When the cutting interpolation command length is smaller than this parameter setting, the system will ignore this command as an extremely short command and find the next command that has a long enough command to calculate the turning command.

| N1.053 | Path smoothing deviation | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 10,000 |
| Data Type | Dword | Unit | 0.1 μm / 0.00001 inch |

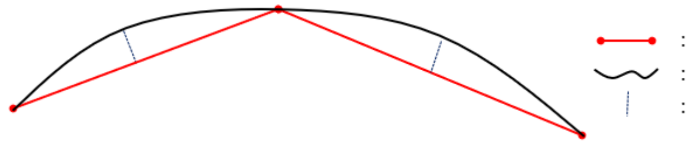
■ When the NC system calculates the curve fitting function, it will adjust the original position command to enhance the smoothness of the process. This parameter defines the maximum position change of the adjustment.

■ A larger value will result in a smoother path command, but the curve fitting result will move far away from the original command position and decrease the precision.



| **N1.054** | **Path smoothing command error** | | **R** |
|---|---|---|---|
| Default | 100 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | 0.1 μm / 0.00001 inch |

- When the NC system calculates the curve fitting path, the new interpolation path will turn a linear command into a curve path to enhance the smoothness of the process. This parameter defines the maximum command error.



: Original Path
: After smoothing
: Command error ≦ N1.54

- A larger value will result in a smoother path command, but the curve fitting result will decrease the precision. This parameter can be set to the same as the CAM tool, so the precision will stay the same without affecting smoothness.

| **N1.055** | **Reference length of single block combination** | | **R** |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 2,000 |
| Data Type | Dword | Unit | 0.1 μm / 0.00001 inch |

- Reference length of single block combination.

| **N1.060** | **JOG maximum speed** | | **R** |
|---|---|---|---|
| Default | 5,000 | Range | 0 ~ 600,000 |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min |

- JOG maximum speed limitation. When executing JOG command, the system will limit axes speed based on this parameter setting.

| **N1.061** | **JOG acc. and dec. time** | | **R** |
|---|---|---|---|
| Default | 100 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

- JOG acceleration and deceleration time.
- The time is defined as the period from 0 speed to maximum speed **[N0.1060 JOG maximum speed]**, and the system will apply this slope as the acceleration and deceleration reference during the machining process.
- The larger the value of the setting, the slower the acceleration and deceleration time.

| N1.062 | JOG S curve time | | | R |
|---|---|---|---|---|
| Default | 20 | Range | 1 ~ 2,000 | |
| Data Type | Dword | Unit | ms | |

- JOP speed S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.064 | MPG acc. and dec. time | | | P |
|---|---|---|---|---|
| Default | 100 | Range | 1 ~ 2,000 | |
| Data Type | Dword | Unit | ms | |

- MPG simulation acceleration and deceleration time.
- The time definition of period is from 0 speed to maximum speed **[N0.1030 Cutting command maximum speed]** and the system will apply this slop as acceleration and deceleration reference during machining process.
- The bigger value setting will prolong the acceleration and deceleration time.

| N1.065 | MPG S curve time | | | R |
|---|---|---|---|---|
| Default | 20 | Range | 1 ~ 2,000 | |
| Data Type | Dword | Unit | ms | |

- MPG speed S curve time.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N1.066 | Dry run feed | | | R |
|---|---|---|---|---|
| Default | 5,000 | Range | 1 ~ 600,000 | |
| Data Type | Dword | Unit | mm/min or 0.1 inch/min | |

- The interpolation speed of dry run mode in the NC system AUTO mode.

| N1.067 | G00 rapid command speed rate at 0% | | | R |
|---|---|---|---|---|
| Default | 10 | Range | 0 ~ 100 | |
| Data Type | Dword | Unit | % | |

- When the G00 rapid command is applying 0% of the speed rate, the NC system will perform a specific speed ratio based on this configuration.

| N1.086 | EMG dec time | | | R |
|---|---|---|---|---|
| Default | 50 | Range | 5 ~ 500 | |
| Data Type | Dword | Unit | ms | |

■ The deceleration time to stop when the emergency signal is triggered.

| N1.090 | Initial Macro number | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 9,999 | |
| Data Type | Dword | Unit | - | |

■ Initial macro number. After the NC start is triggered and before executing the main NC program, the NC system will execute the configured O macro as the system initial macro program. When this parameter is set to 9100, the O9100 will be the initial macro.

| N1.096 | Blending – distance before next block | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 60,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

■ This parameter defines the distance before the block command target position to start the blending function, when the **[N1.021 Rapid speed blending mode]** is configured to interpolation position mode.

| N1.097 | Blending – velocity percentage between rapid command | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 100 | |
| Data Type | Dword | Unit | % | |

■ This parameter defines the speed blending percentage between two G00 rapid commands, when the **[N1.021 Rapid speed blending mode]** is configured to speed mode.

| N1.098 | Blending – velocity percentage between rapid and cutting command | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 100 | |
| Data Type | Dword | Unit | % | |

■ This parameter defines the speed blending percentage between the G00 rapid command and G01 cutting command, when the **[N1.021 Rapid speed blending mode]** configured to speed mode.

| N1.099 | Blending – velocity percentage between cutting command | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 100 | |
| Data Type | Dword | Unit | % | |

■ This parameter defines the speed blending percentage between two G01 cutting commands, when the **[N1.021 Rapid speed blending mode]** is configured to speed mode.

| N1.118 | Beginning M code of halt function | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 999 |
| Data Type | Dword | Unit | - |

- The system refers this parameter as the beginning M code and **[N1.119]** as the M code amount to define a group of halt function M codes.
- The NC system provides a look-ahead function, which can preview a large number of NC blocks to develop a better and smoother path interpolation during NC execution. However, in some applications, users will need this halt M function for the NC system to stop look-ahead to perform processing or judgment at a specific path or position.

| N1.119 | Amount of halt M code | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 999 |
| Data Type | Dword | Unit | - |

- Amount of halt function M code. For a detailed description, please see parameter **[N1.118]**.

| N1.120 | Beginning G code of G macro call | | R |
|---|---|---|---|
| Default | 100 | Range | 0 ~ 1,000 |
| Data Type | Dword | Unit | - |

- Specified the 1st G code number for the G macro call.
- When this parameter is set to 111, the G macro call function will start from G111.

| N1.121 | Beginning macro number of G macro call | | R |
|---|---|---|---|
| Default | 8,000 | Range | 8,000 ~ 9,999 |
| Data Type | Dword | Unit | - |

- Specified the 1st O macro number for the G macro call.
- When this parameter is set to 8000, the 1st G macro call function will execute the O macro from the O8000.

| N1.122 | Amount of G macro call | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 200 |
| Data Type | Dword | Unit | - |

- Specified the G code amount of the G macro call function.
- When N1.120 is set to 111, N1.121 is set to 8000 and this parameter is set to 2, then G111 will call macro O8000 and G112 will call macro O8001, but the G113 will stay as a regular command without executing any O macro program.

| N1.123 | Beginning M code of M macro call | | | R |
|---|---|---|---|---|
| Default | 100 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | - | |

- Specified the 1st M code number for the M macro call.
- When this parameter is set to 222, the 1st M macro call function will start from M222.

| N1.124 | Beginning macro number of M macro call | | | R |
|---|---|---|---|---|
| Default | 8,500 | Range | 8,000 ~ 9,999 | |
| Data Type | Dword | Unit | - | |

- Specified the 1st O macro number for the M macro call.
- When this parameter is set to 8100, the 1st M macro call function will execute the O macro from the O8100.

| N1.125 | Amount of M macro call | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 200 | |
| Data Type | Dword | Unit | - | |

- Specified the M code amount of the M macro call function.
- When the N1.123 is set to 222, N1.124 is set to 8100 and this parameter is set to 2, then M222 will call macro O8100 and M223 will call macro O8101, but the M224 will stay as a regular M code without executing any of the O macro program.

| N1.126 | Beginning M code of NC path interact | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 9,999 | |
| Data Type | Dword | Unit | - | |

- The NC system uses N1.126 as the 1st M code number and N1.127 as the last M code number to define the range of the NC channel interact M code function.
- When the NC channel executes the interact M code, the NC system will keep the hold status, even if the interact M has been released by the MLC, until all the other enabled NC channels also finish and release the same interact M. Through this, the interact M codes can realize process holds and then start at the same time between different NC channels.
- For example, if the N1.126 is set to 300 and N1.127 is set to 302, the M300 to M302 will be allocated as the interact M. When channel 1 executes M300, channel 2 must also include M300, otherwise the channel 1 will continue to hold on the M300. When one channel executes the M300, it will hold until the other executes and finishes the M300. After both channels release the M300, they will resume the process at the same time.

| N1.127 | Last M code of NC path interact | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 9,999 | |
| Data Type | Dword | Unit | - | |



- The NC system uses N1.126 as the 1st M code number and N1.127 as the last M code number to define the range of the NC channel interact M code function.
- For a detailed description, please see parameter N1.126.

| N1.128 | M code to enable the motion transfer function | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 200 | |
| Data Type | Dword | Unit | - | |

- This parameter defines the M code number for enabling the motion transfer function.

| N1.129 | M code to disable the motion transfer function | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 200 | |
| Data Type | Dword | Unit | - | |

- This parameter defines the M code number for disabling the motion transfer function.

| N1.150 | Cycle command parameter | | | R |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 0~Bit 1: Setting the direction of Q distance in G76 cycle command.
  0: +X
  1: -X
  2: +Y
  3: -Y
- Bit 2~Bit 3: Tapping mode.
  0: Normal
  1: Deep hole peck
  2: Peck
- Bit 4~Bit 5: Lathe drilling mode.
  0: Peck
  1: Deep hole peck

| N1.151 | Peck-drilling withdraw distance | | | R |
|---|---|---|---|---|
| Default | 100 | Range | 1 ~ 50,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

- The default withdraw relative distance for every peck drilling cycle.

| N1.152 | Pecking withdraw distance | | | R |
|---|---|---|---|---|
| Default | 100 | Range | 1 ~ 50,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

■ The default withdraw relative distance for every pecking cycle.

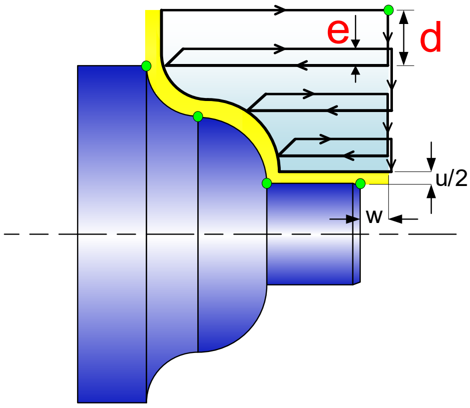
| N1.170 | Cutting depth in G71 / G72 turning cycle | | | R |
|---|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

■ The default cutting depth of each G71/G72 rough turning cycle. Cutting depth command as below parameter [d] value.

[G71]

G71 U(d) R(e)

G71 P_ Q_ U(u) W(w) F_ S_ T_



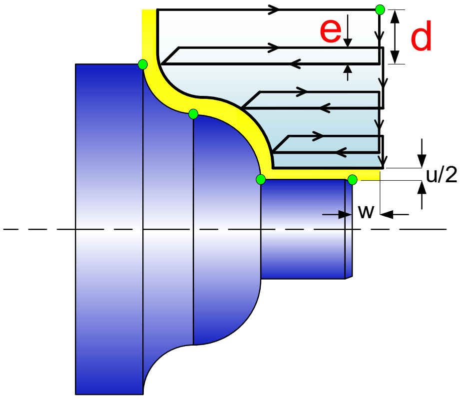

| N1.171 | Withdraw amount in G71 / G72 turning cycle | | | R |
|---|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 | |
| Data Type | Dword | Unit | um / 0.0001 inch | |

■ The default withdraw amount of each G71/G72 rough turning cycle. Withdraw amount command as below parameter [e] value.

[G71]

G71 U(d) R(e)

G71 P_ Q_ U(u) W(w) F_ S_ T_



| N1.172 | Thread look-ahead time | | R |
|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | 0.001 sec |

- The acceleration or deceleration time for axis to reach target speed when executing the threading function.

  Target speed = [turning number] / [minute] x [thread pitch]

  The smaller value, the shorter useless screw thread but it will cause machine vibration. The bigger value, the longer useless screw thread but it can reduce machine vibration.

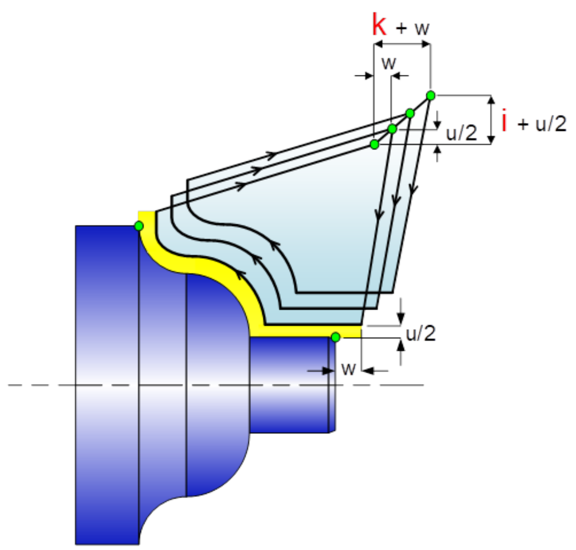
| N1.173 | X axis cutting amount in G73 turning cycle | | R |
|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

- X direction cutting amount in G73 turning cycle. Parameter as below [i] value.

  [G73]

  G73 U(i) W(k) R(d)

  G73 P_ Q_ U(u) W(w) F_ S_ T_



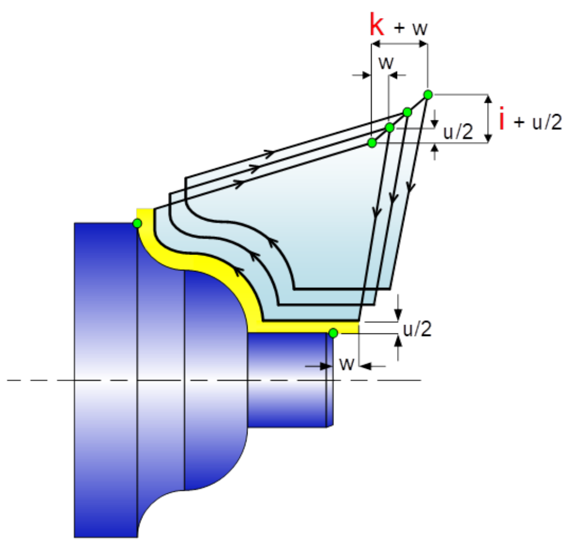

| N1.174 | Z axis cutting depth in G73 turning cycle | | R |
|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

- Z direction cutting amount in G73 turning cycle. Parameter as below [k] value.

  [G73]

  G73 U(i) W(k) R(d)

  G73 P_ Q_ U(u) W(w) F_ S_ T_



4

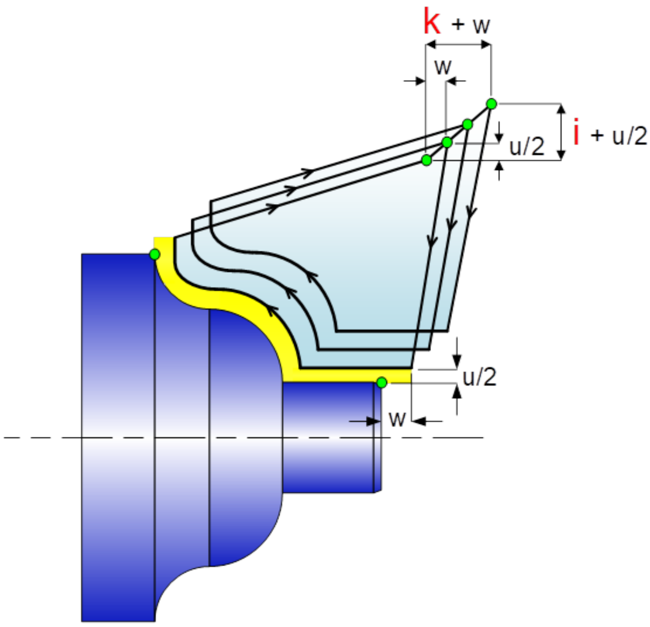
| N1.175 | Number of cutting times in G73 turning cycle | | R |
|---|---|---|---|
| Default | 3 | Range | 1 ~ 99 |
| Data Type | Dword | Unit | - |

■ Number of cutting times in G73 turning cycle. Parameter as below [d] value.

[G73]

G73 U(i) W(k) R(d)

G73 P_ Q_ U(u) W(w) F_ S_ T_



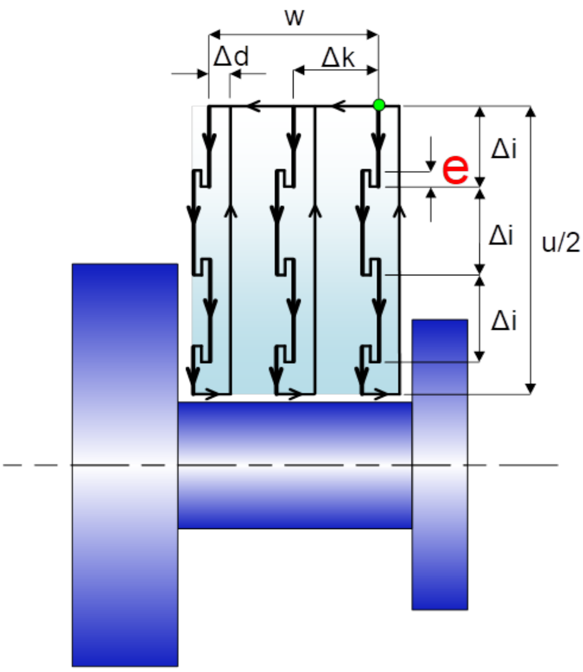

| N1.176 | Withdraw amount in G74 / G75 turning cycle | | R |
|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

■ The default withdraw amount of each G74/G75 turning cycle. Withdraw amount command as below parameter [e] value.

[G75]

G75 R(e)

G75 X/U_ Z/W_ P(△i) Q(△K) R(△d) F_



| N1.177 | Chamfer angle in G76 / G92 threading | | R |
|---|---|---|---|
| Default | 45 | Range | 1 ~ 89 |
| Data Type | Dword | Unit | degree |

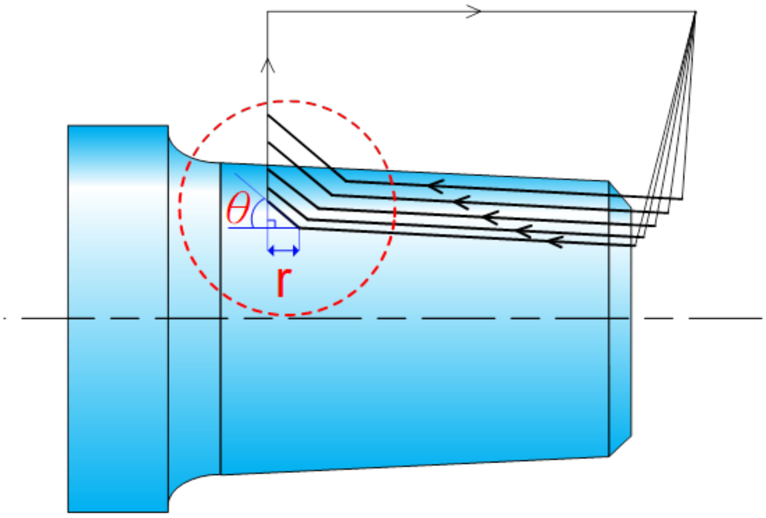


■ The chamfer angle in G76 / G92 threading command. Degree θ as shown below.

[G76]

G76 P(m)(r)(a) Q(△dmin) R(d)

G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_



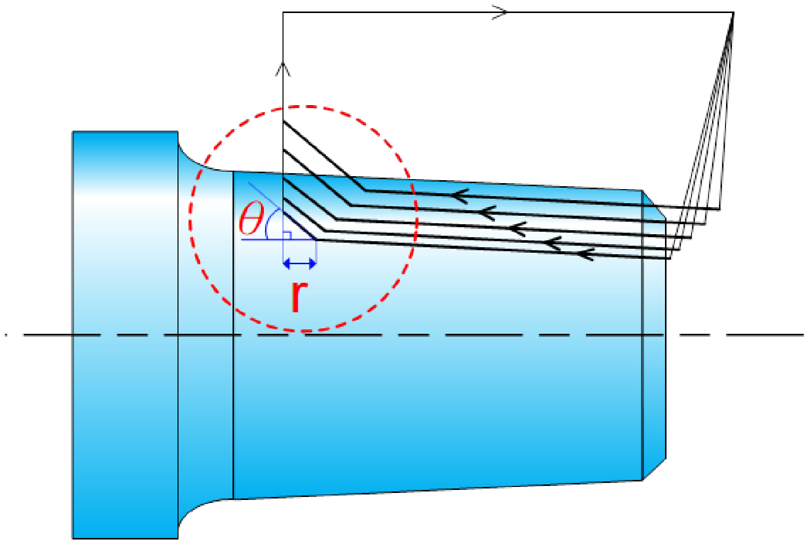

| N1.178 | Chamfer length in G76 / G92 threading | | R |
|---|---|---|---|
| Default | 3 | Range | 0 ~ 127 |
| Data Type | Dword | Unit | 0.1 pitch |

■ The chamfer length [r] in G76 / G92 threading cycle. The chamfer length will multiply by 0.1 times of screw thread pitch. Assume the pitch is L, the chamfer length can be 0L to 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_



4

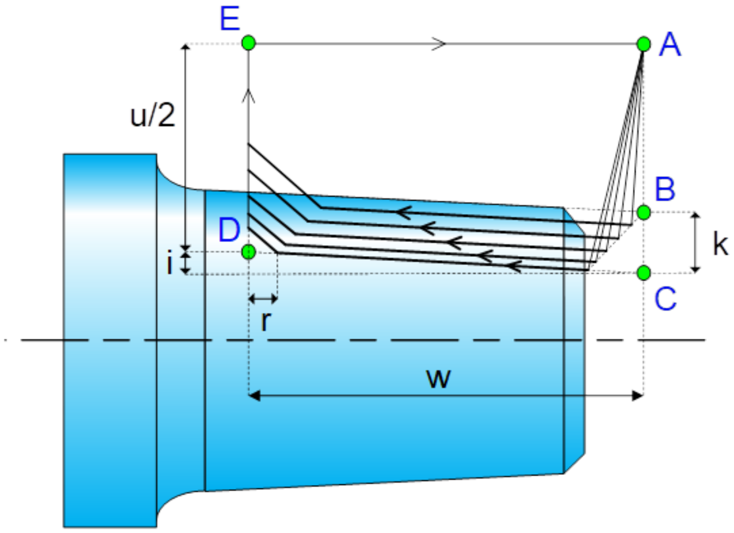
| N1.179 | Number of finishing counts in G76 threading cycle | | R |
|---|---|---|---|
| Default | 1 | Range | 1 ~ 99 |
| Data Type | Dword | Unit | - |

■ Number of finishing counts in G76 threading cycle. Parameter as below [m] value.

[G76]

G76 P(m)(r)(a) Q(△dmin) R(d)

G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_



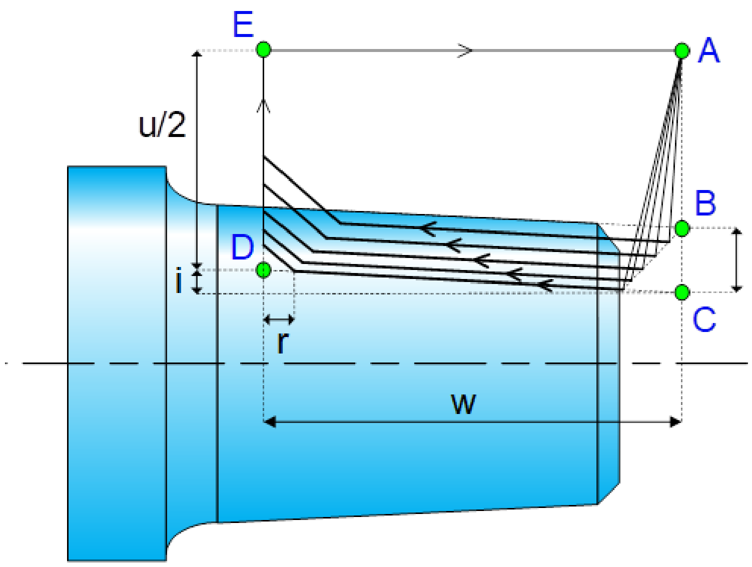

| N1.180 | Tool nose angle in G76 threading cycle | | R |
|---|---|---|---|
| Default | 60 | Range | 0 ~ 80 |
| Data Type | Dword | Unit | degree |

■ Tool nose angle in G76 threading cycle. Parameter as below [a] value.

[G76]

G76 P(m)(r)(a) Q(△dmin) R(d)

G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_



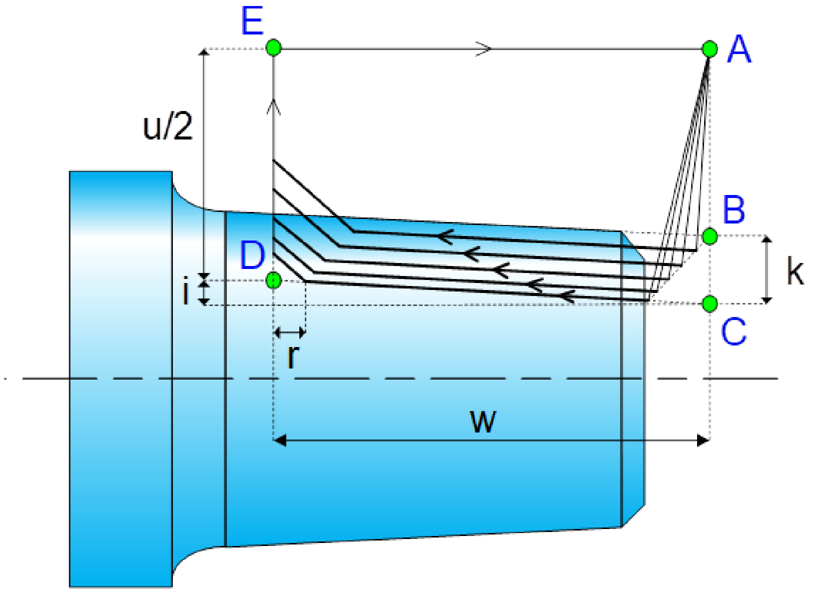
| N1.181 | Minimum cutting depth in G76 threading cycle | | R |
|---|---|---|---|
| Default | 1,000 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

■ Minimum cutting depth in G76 threading cycle. Parameter as below [△dmin] value.

[G76]

G76 P(m)(r)(a) Q(△dmin) R(d)

G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_



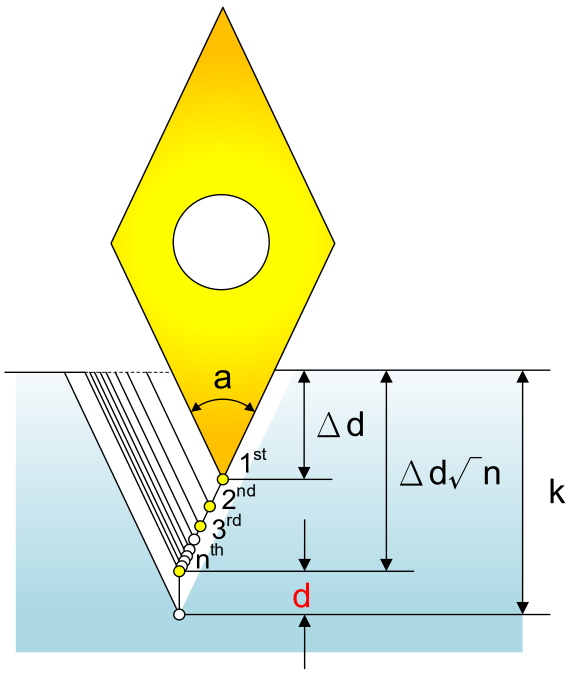

| N1.182 | Finishing allowance in G76 threading cycle | | R |
|---|---|---|---|
| Default | 200 | Range | 0 ~ 50,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

■ The finishing allowance in G76 threading cycle.

[G76]

G76 P(m)(r)(a) Q(△dmin) R(d)

G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_



4

| N1.183 | Tool life advance alarm percentage | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 100 | |
| Data Type | Dword | Unit | % | |

- When the parameter **[N1.013 Bit17]** is set to 1 enable the tool life advance alarm, the system will determine whether the **[Tool actual lifetime]** is larger than or equal to the **[Tool life count]** x **[Tool life advance alarm percentage]**. If the actual lifetime is larger than the result, the system will return an advance alarm 0x1903, though the NC system will not stop the process.
- If the value is 0, this advance alarm will be disabled.
- In lathe mode, the system will take parameter **[N1.013 Tool lifetime count resource]** as a reference to determine whether to calculate by tool change or tool compensation change.
- In milling mode, the system will calculate tool changes directly.

| N1.200<br>~<br>N1.249 | G code number for calling macro O9100<br>~<br>G code number for calling macro O9149 | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | - | |

- G code number for calling a specific O macro.
- Example:

  N1.200=100, the NC system will call the O9100 macro when executing the G100 command.
  N1.201=110, the NC system will call the O9101 macro when executing the G110 command.
  N1.249=120, the NC system will call the O9102 macro when executing the G120 command.

| N1.250<br>~<br>N1.299 | M code number for calling macro O9150<br>~<br>M code number for calling macro O9199 | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | - | |

- M code number for calling a specific O macro.
- Example:

  N1.250=100, the NC system will call the O9150 macro when executing the M100 command.
  N1.251=110, the NC system will call the O9151 macro when executing the M110 command.
  N1.299=120, the NC system will call the O9199 macro when executing the M120 command.

| N1.321 | Monitoring data 1 – main category | | | R |
|---|---|---|---|---|
| N1.326 | Monitoring data 2 – main category | | | |
| N1.331 | Monitoring data 3 – main category | | | |
| N1.336 | Monitoring data 4 – main category | | | |
| Default | 0 | Range | 0 ~ 65,535 | |
| Data Type | Dword | Unit | - | |

- Sets the displayed content for the special D for the monitoring data 1 to 4.
- N1.321 defines the displayed content for the monitoring data 1 (D3x096, D3x098, D3x100, D3x102).
- N1.326 defines the displayed content for the monitoring data 2 (D3x104, D3x106, D3x108, D3x110).
- N1.331 defines the displayed content for the monitoring data 3 (D3x112, D3x114, D3x116, D3x118).
- N1.336 defines the displayed content for the monitoring data 4 (D3x096, D3x098, D3x100, D3x102).

| Main category | Monitoring data type |
|---|---|
| 1 | Machine coordinate |
| 2 | Reserved |
| 3 | Reserved |

| N1.322 | Monitoring data 1 – sub-category 1 | | | R |
|---|---|---|---|---|
| N1.323 | Monitoring data 1 – sub-category 2 | | | |
| N1.324 | Monitoring data 1 – sub-category 3 | | | |
| N1.325 | Monitoring data 1 – sub-category 4 | | | |
| Default | 0 | Range | 0 ~ 65,535 | |
| Data Type | Dword | Unit | - | |

- The main category only supports machine coordinates; thus these sub-category parameters are defined based on the axis number.
- N1.322 defines the monitoring parameters for D3x096 and D3x097 (double word) in the monitoring data 1.
- N1.323 defines the monitoring parameters for D3x098 and D3x099 (double word) in the monitoring data 1.
- N1.324 defines the monitoring parameters for D3x100 and D3x101 (double word) in the monitoring data 1.
- N1.325 defines the monitoring parameters for D3x102 and D3x103 (double word) in the monitoring data 1.

| Sub-category type | Monitoring data type | Sub-category type | Monitoring data type |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | X | 9 | W |
| 2 | Y | 10 | AX1 |
| 3 | Z | 11 | AX2 |
| 4 | A | 12 | AX3 |
| 5 | B | 13 | AX4 |
| 6 | C | 14 | AX5 |
| 7 | U | 15 | AX6 |
| 8 | V | 16 | AX7 |

| | | | | |
|---|---|---|---|---|
| **N1.327** | **Monitoring data 2 – sub-category 1** | | | **R** |
| **N1.328** | **Monitoring data 2 – sub-category 2** | | | |
| **N1.329** | **Monitoring data 2 – sub-category 3** | | | |
| **N1.330** | **Monitoring data 2 – sub-category 4** | | | |
| Default | 0 | Range | 0 ~ 65,535 | |
| Data Type | Dword | Unit | - | |

- N1.327 defines the sub-category for D3x104 and D3x105 (double word) in the monitoring data 2.
- N1.328 defines the sub-category for D3x106 and D3x107 (double word) in the monitoring data 2.
- N1.329 defines the sub-category for D3x108 and D3x109 (double word) in the monitoring data 2.
- N1.330 defines the sub-category for D3x110 and D3x111 (double word) in the monitoring data 2.
- For details, please refer to **[N1.322]**.

| | | | | |
|---|---|---|---|---|
| **N1.332** | **Monitoring data 3 – sub-category 1** | | | **R** |
| **N1.333** | **Monitoring data 3 – sub-category 2** | | | |
| **N1.334** | **Monitoring data 3 – sub-category 3** | | | |
| **N1.335** | **Monitoring data 3 – sub-category 4** | | | |
| Default | 0 | Range | 0 ~ 65,535 | |
| Data Type | Dword | Unit | - | |

- N1.332 defines the sub-category for D3x112 and D3x113 (double word) in the monitoring data 3.
- N1.333 defines the sub-category for D3x114 and D3x115 (double word) in the monitoring data 3.
- N1.334 defines the sub-category for D3x116 and D3x117 (double word) in the monitoring data 3.
- N1.335 defines the sub-category for D3x118 and D3x119 (double word) in the monitoring data 3.
- For details, please refer to **[N1.322]**.

| N1.337 | Monitoring data 4 – sub-category 1 | | R |
|---|---|---|---|
| N1.338 | Monitoring data 4 – sub-category 2 | | |
| N1.339 | Monitoring data 4 – sub-category 3 | | |
| N1.340 | Monitoring data 4 – sub-category 4 | | |
| Default | 0 | Range | 0 ~ 65,535 |
| Data Type | Dword | Unit | - |

- N1.337 defines the sub-category for D3x120 and D3x121 (double word) in the monitoring data 4.
- N1.338 defines the sub-category for D3x122 and D3x122 (double word) in the monitoring data 4.
- N1.339 defines the sub-category for D3x124 and D3x123 (double word) in the monitoring data 4.
- N1.340 defines the sub-category for D3x126 and D3x124 (double word) in the monitoring data 4.
- For details, please refer to **[N1.322]**.

# 4.4 N2 – Axes parameter

| **N2.001** | **Axis configuration** | | | **P** |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 2~4: Axis mode.

  0: Linear axis.

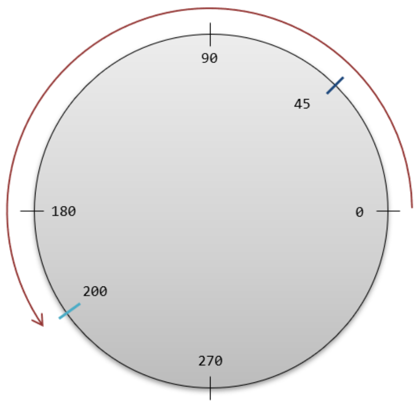
  The axis mode will display as a linear axis with normal movement, the speed unit is mm/min.

  1: Rotary axis in linear mode.

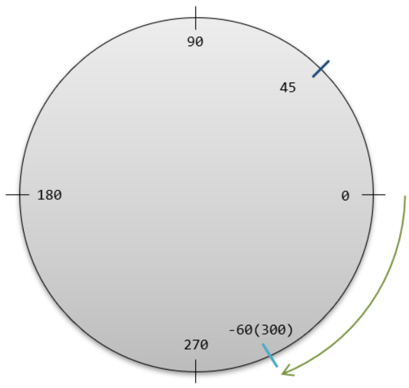
  The axis mode will display as a linear axis, the speed unit is deg/min.

  3: Rotary axis single round mode.

  This axis mode will calculate the degrees between 0 to 359 degrees as one round cycle and then determine whether to reach the target by a clockwise or counterclockwise movement based on whether there's a plus or minus in the NC command.




NC Gcode
G01 A0
G01 A560.




NC Gcode
G01 A0
G01 A-60.

  7: Rotary axis single round and shortest mode.

  This axis mode is designed to serve the tool magazine and can find the shortest rotation for tool change.

- Bit 5: Rotary axis limitation

  0: Unlimited, the rotary axis can rotate without limitation.

  1: Limited, the rotary axis can only move a half circle in either direction.

- Bit 6: MPG reverse direction

  0: Disable, 1: Enable

  This parameter can reverse the direction of MPG command. Users can enable this function when they find the MPG is moving in the wrong direction.

- Bit 7: Axis reverse direction

  0: Disable, 1: Enable

  When the axis is moving in a different direction than the NC command, users can enable this parameter or edit the servo drive's parameters to match the axis direction control.

- Bit 8: Virtual axis
  0: Disable, 1: Enable
  The virtual axis allows the controller to simulate the axis's motion and feedback even when the real axis is not connected. In this way, users can still run programs for testing and verification even if there are no real axis exist. However, if the axis number has a real axis connected, this function should be disabled. Otherwise, the system will return an error.
- Bit 10: Radius or diameter mode
  0: Radius, for normal milling machines or the Z axis of lathe machines.
  1: Diameter, for the X axis of lathe machines.
  This parameter is for the controller to automatically calculate the movement of such an X, Y or Z axis.
- Bit 11: Speed unit of rotary axis
  0: deg/min
  1: RPM
  In the JOG and MPG mode, the system can define the speed unit as deg/min or RPM according to this bit setting.
  This parameter has no function when the parameter **[N2.01 bit2–4]** set to 1 (linear axis).

| N2.002 | Lead screw pitch | | P |
|---|---|---|---|
| Default | 10 | Range | 1.0~100.0 |
| Data Type | Float | Unit | mm / inch |

- Sets the lead screw pitch for the drive shaft, the distance for each screw revolution.
- This setting is only available for linear axes (X, Y, and Z axes) or when users set a linear axis as the rotation axis.

| N2.003 | Encoder resolution | | P |
|---|---|---|---|
| Default | 16,777,216 | Range | 0 ~ 4,294,967,295 |
| Data Type | Dword | Unit | - |

- Sets the motor resolution per revolution.
- For example, the motor resolution of a Delta ASDA-A2 servo drive is 1,280,000, so users can set this parameter to 1,280,000.

| N2.004 | Shaft gear number | | P |
|---|---|---|---|
| Default | 1 | Range | 0 ~ 4,294,967,295 |
| Data Type | Dword | Unit | - |

- Sets the gear number of the shaft.
- The gear ratio formula is shaft gear / motor gear, or **[N2.004]** / **[N2.005]**
- The axis will be moving faster when this parameter is larger than the value of **[N2.005 Motor gear number]**.

4

| N2.005 | Motor gear number | | P |
|---|---|---|---|
| Default | 1 | Range | 0 ~ 4,294,967,295 |
| Data Type | Dword | Unit | - |

- Sets the gear number of the motor side.
- The gear ratio formula is shaft gear / motor gear, or **[N2.004]** / **[N2.005].**
- The axis will be moving slower when this parameter is larger than the value of **[N2.004 Shaft gear number]**.

| N2.006 | The 1st software positive limit | | R |
|---|---|---|---|
| Default | 100,000 | Range | -100,000 ~ 100,000 |
| Data Type | Dword | Unit | mm / inch / degree |

- The 1st software positive limit.
- When the parameter **[N2.006]** and **[N2.007]** are both set to 0, it means the 1st software positive limit is disabled.

| N2.007 | The 1st software negative limit | | R |
|---|---|---|---|
| Default | 100,000 | Range | -100,000 ~ 100,000 |
| Data Type | Dword | Unit | mm / inch / degree |

- The 1st software negative limit.
- When the parameter **[N2.006]** and **[N2.007]** are both set to 0, it means the 1st software positive limit is disabled.

| N2.008 | The 2nd software positive limit | | R |
|---|---|---|---|
| Default | 100,000 | Range | -100,000 ~ 100,000 |
| Data Type | Dword | Unit | mm / inch / degree |

- The 2nd software positive limit.
- When the parameter **[N2.008]** and **[N2.009]** are both set to 0, it means the 2nd software positive limit is disabled.

| N2.009 | The 2nd software negative limit | | R |
|---|---|---|---|
| Default | 100,000 | Range | -100,000 ~ 100,000 |
| Data Type | Dword | Unit | mm / inch / degree |

- The 2nd software negative limit.
- When the parameter **[N2.008]** and **[N2.009]** are both set to 0, it means the 2nd software positive limit is disabled.

| N2.010 | Sensor setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- The sensor polarity of the hardware limit switch and origin switch. Please check the polarity of each sensor first to confirm if it's normal close (NC) or normal open (NO).
- Bit 0: Polarity of positive limit switch.
  0: Normal close, 1: Normal open
- Bit 1: Polarity of negative limit switch.
  0: Normal close, 1: Normal open
- Bit 2: Polarity of origin limit switch.
  0: Normal close, 1: Normal open

| N2.012 | Positive hardware limit switch DI number | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 65,535 |
| Data Type | Dword | Unit | - |

- Defines the DI number to trigger the positive hardware limit switch signal, the controller's DI number or EtherCAT IO’s DI number can be used as the signal source.
- If the controller's DI signal is used, the range is from 0 to 31, respectively corresponding to the X0 ~ X15 of I/O connector 1 or X16 ~ X31 of I/O connector 2.
  If a remote module’s DI signal is used, the range is from 256 to 2048, which corresponds to the EtherCAT module's order, for example the modules start from X256.
- If this parameter is set to 0, it means this function is disabled.

| N2.013 | Negative hardware limit switch DI number | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 65,535 |
| Data Type | Dword | Unit | - |

- Defines the X relay number for the negative hardware limit switch signal. Local IO and EtherCAT remote module are both available.
- For details, please refer to the parameter **[N2.012]**.
- If this parameter is set to 0, it means this function is disabled.

| N2.014 | Home switch DI number | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 65,535 |
| Data Type | Dword | Unit | - |

- Defines the DI number for the home switch signal. Local IO and EtherCAT remote module are both available.
- For details, please refer to the parameter **[N2.012]**.
- If this parameter is set to 0, it means this function is disabled.

| N2.015 | Synchronize/ transfer control - master axis number | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 9 | |
| Data Type | Dword | Unit | - | |

4

- The master axis number for synchronize control or command transfer.
  0: Disable.
  1: X
  2: Y
  3: Z
  …
  9: W
- Synchronize control
  If the user wants to configure the Y axis as the master axis for the X axis to perform synchronize control, the parameter N2.015 on the X axis must be set to 2, and then use M2x256 and M2x288 to enable the synchronization function on the X axis.
- Command transfer control
  If the user wants to configure the Y axis as the master axis for the B axis to perform command transfer control, the parameter N2.015 on the B axis must be set to 2, and then use M2x257 and M2x308 to enable the command transfer function on the X axis.

| N2.020 | Axis G00 rapid command maximum speed | | | R |
|---|---|---|---|---|
| Default | 5,000 | Range | 1 ~ 60,000 | |
| Data Type | Dword | Unit | mm/min; 0.1 inch/min; RPM | |

- Each Axis maximum speed when NC system executing G00 rapid command.

| N2.021 | Axis G00 rapid command acc. and dec. time | | | R |
|---|---|---|---|---|
| Default | 50 | Range | 1 ~ 10,000 | |
| Data Type | Dword | Unit | ms | |

- Each axis acceleration and deceleration time when NC system executing G00 rapid command.
- The time definition of period is from 0 speed to maximum speed **[N2.020 Rapid command maximum speed]** and the system will apply this slop as acceleration and deceleration reference during machining process.
- The bigger value setting will prolong the acceleration and deceleration time.

| N2.022 | Axis G00 rapid command S curve time | | R |
|---|---|---|---|
| Default | 50 | Range | 1 ~ 10,000 |
| Data Type | Dword | Unit | ms |

- G00 rapid command S curve time of each axis.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.



| N2.023 | Axis cutting command maximum speed | | R |
|---|---|---|---|
| Default | 10,000 | Range | 1 ~ 600,000 |
| Data Type | Dword | Unit | mm/min; 0.1 inch/min; RPM |

- Each Axis maximum speed when NC system executing cutting command.

| N2.024 | Axis cutting command acc. and dec. time | | R |
|---|---|---|---|
| Default | 50 | Range | 1 ~ 10,000 |
| Data Type | Dword | Unit | ms |

- Each Axis acceleration and deceleration time when NC system executing cutting command.
- The time definition of period is from 0 speed to maximum speed **[N2.023 Cutting maximum speed]** and the system will apply this slop as acceleration and deceleration reference during machining process.
- The bigger value setting will prolong the acceleration and deceleration time.

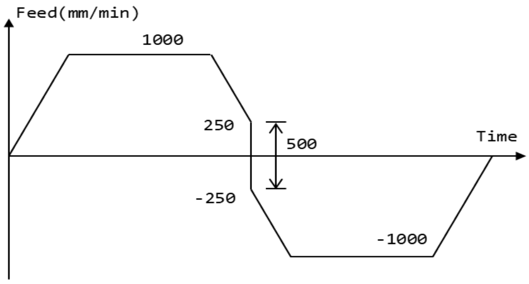
| N2.025 | Axis cutting command S curve time | | R |
|---|---|---|---|
| Default | 10 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

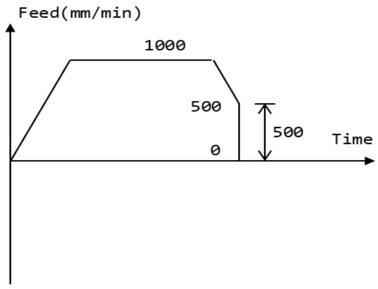
- Cutting command S curve time of each axis.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

| N2.026 | Axis maximum turn speed tolerance | | R |
|---|---|---|---|
| Default | 500 | Range | 1 ~ 100,000 |
| Data Type | Dword | Unit | mm/min; 0.1 inch/min; deg/min |

4

- Axis maximum turn speed tolerance when the axis undergoes a speed change.
- In turns on machine paths, usually some of the axes will undergo a significant speed change. This parameter limits the maximum speed change of each axis. Once the axis speed limitation is met, the NC system will interpolate a new feed speed to match the axis's limitation.
- The following diagram is an example of when this parameter is set to 500, and the axis changes speed from positive to negative and positive to stop.




| N2.027 | Blending – axis target reach distance | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 60,000 |
| Data Type | Dword | Unit | um / 0.0001 inch |

- This parameter is the distance setting to trigger the speed blending function when the parameter **[N1.021 bit0~1]** is set to 3 for the axis speed blending position mode.

| N2.029 | Axis position filter time | | R |
|---|---|---|---|
| Default | 1 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

- Set the position filter time on each axis.
- The NC system will adjust the conjunction speed between the two cutting commands. A higher value setting will slow down the machining speed and reduce machine vibrations, however this will also reduce precision.

| N2.030 | Axis JOG maximum speed | | R |
|---|---|---|---|
| Default | 1 | Range | 1 ~ 600,000 |
| Data Type | Dword | Unit | mm/min; 0.1 inch/min; RPM |

- Each Axis maximum speed when NC system executing JOG command.

| N2.031 | Axis JOG acc. and dec. time | | R |
|---|---|---|---|
| Default | 50 | Range | 1 ~ 10,000 |
| Data Type | Dword | Unit | ms |

4

- Each Axis acceleration and deceleration time when NC system executing JOG command.
- The time definition of period is from 0 speed to maximum speed **[N2.030 Jog maximum speed]** and the system will apply this slop as acceleration and deceleration reference during machining process.
- The bigger value setting will prolong the acceleration and deceleration time.

| N2.032 | Axis JOG S curve time | | R |
|---|---|---|---|
| Default | 5 | Range | 1 ~ 2,000 |
| Data Type | Dword | Unit | ms |

- JOG command S curve time of each axis.
- The system will calculate a constant acceleration according to the acceleration and deceleration time settings, and this parameter is defined as the time from 0 acceleration to constant acceleration.
- This parameter can lower the rate of acceleration and deceleration, which can reduce the vibration.

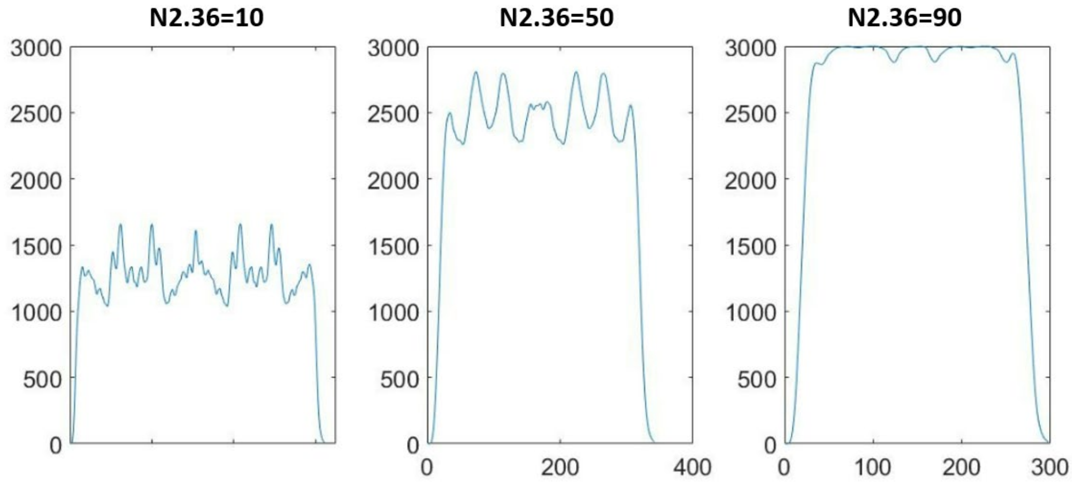
| N2.034 | MPG signal filter time | | R |
|---|---|---|---|
| Default | 50 | Range | 1 ~ 500 |
| Data Type | Dword | Unit | ms |

- Set the pulse signal filter time from MPG device. The longer the time setting, the longer the starting time and stopping time.

| N2.036 | Axis centripetal acc. ratio in G00 rapid command | | R |
|---|---|---|---|
| Default | 50 | Range | 10 ~ 90 |
| Data Type | Dword | Unit | % |

- Set the centripetal acceleration ratio of each axis when executing G00 rapid commands.
- During machining interpolation, centripetal acceleration will occur on each axis during path turns, and the NC system will limit axis acceleration in the centripetal direction according to this parameter. This parameter is designed as the ratio between centripetal acceleration and tangential acceleration. When set to a higher value (maximum 90), the centripetal acceleration will be larger, and the machining speed will be faster. On the other hand, when set to a smaller value (minimum 10), the centripetal acceleration will be smaller, and the machining speed will be limited.
- When the value is set to less than 10 or more than 90, the system will internally set the value to 50.
- A larger value may cause machine vibrations and lower precision.

■ This parameter applies to commands between G00 and G00.




| N2.037 | Axis centripetal acc. ratio in cutting command | | R |
|---|---|---|---|
| Default | 50 | Range | 10 ~ 90 |
| Data Type | Dword | Unit | % |

■ Set the centripetal acceleration ratio of each axis when executing cutting command.

■ During machining interpolation, centripetal acceleration will occur on each axis during path turns, and the NC system will limit axis acceleration in the centripetal direction according to this parameter. This parameter is designed as the ratio between centripetal acceleration and tangential acceleration. When set to a higher value (maximum 90), the centripetal acceleration will be larger, and the machining speed will be faster. On the other hand, when set to a smaller value (minimum 10), the centripetal acceleration will be smaller, and the machining speed will be limited.

■ When the value is set to less than 10 or more than 90, the system will internally set the value to 50.

■ A larger value may cause machine vibrations and lower precision.

■ This parameter applies to commands between G01 and G01.

| N2.038 | Axis centripetal acc. ratio in JOG command | | R |
|---|---|---|---|
| Default | 50 | Range | 10 ~ 90 |
| Data Type | Dword | Unit | % |



- Set the centripetal acceleration ratio of each axis when executing JOG command.
- During machining interpolation, centripetal acceleration will occur on each axis during path turns, and the NC system will limit axis acceleration in the centripetal direction according to this parameter. This parameter is designed as the ratio between centripetal acceleration and tangential acceleration. When set to a higher value (maximum 90), the centripetal acceleration will be larger, and the machining speed will be faster. On the other hand, when set to a smaller value (minimum 10), the centripetal acceleration will be smaller, and the machining speed will be limited.
- When the value is set to less than 10 or more than 90, the system will internally set the value to 50.
- A larger value may cause machine vibrations.
- This parameter applies to commands between G01 and G01.

| N2.049 | Axis type | | P |
|---|---|---|---|
| Default | 1 | Range | 0 ~ 1 |
| Data Type | Dword | Unit | - |

- Set axis type.
- This setting is used in conjunction with the parameter **[N2.050 Homing mode]**.

  0: Incremental axis

  1: Absolute axis
- Example 1:

  N2.049 set to 0; N2.050 set to 1.

  These configure the axis as incremental type and homing mode as 1, and users will need to execute homing procedure every time after system reboot.
- Example 2:

  N2.049 set to 1; N2.050 set to 1.

  These configure the axis as absolute type and homing mode as 1, which means AL06A will be shown on the controller and servo drive when initializing. The user will need to execute the homing procedure.

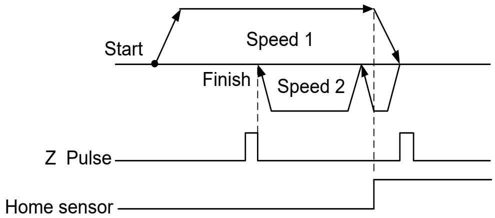
  1. After finishing the homing mode 1, the system will set the position of the servo drive as 0 point.
  2. The absolute axis will not need to execute the homing procedure anymore if the origin has been settled unless the battery on the drive is dead or the motor suffers a hardware issue.

4

| N2.050 | Homing mode | | P |
|---|---|---|---|
| Default | 1 | Range | 0 ~ 35 |
| Data Type | Dword | Unit | - |

- 0: Set current position as axis origin.
- 1: Mode 1

When homing, once the axis reaches the home sensor, it reverses, and the system will regard the first Z pulse as the origin position.

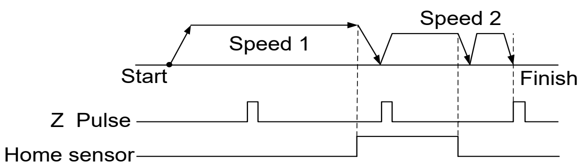



Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=1 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Find home switch and then establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Origin has been established, and N2.051 bit1 = 0 | Return to origin position. | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | Find home switch again and then re-establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Diagnose page. **[Abs.Reset]** button | - | Find home switch and then establish origin position. |

- 2: Mode 2

When homing, after the axis reaches the home sensor, it will still move in the same direction to leave the home sensor, and the system will regard the first Z pulse as the origin position.

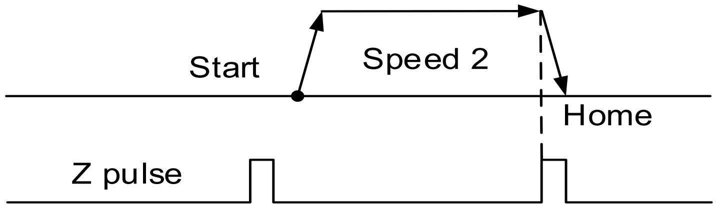



Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=2 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Find home switch and then establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Origin has been established, and N2.051 bit1 = 0 | Return to origin position. | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | Find home switch again and then re-establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Diagnose page. **[Abs.Reset]** button | - | Find home switch and then establish origin position. |

- 3: Mode 3

The axis searches for the Z pulse at the 2nd homing speed [N2.54], and the system regards it as the origin position.




Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=3 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | The axis will search the Z phase position based on the direction parameter setting in **[N2.51 bit0]** and then establish the origin position.<br>(Origin not retentive)<br>(The axis will stop on the Z phase position) | Press the [Abs.Reset] button in the DGN page.<br>The axis will search the Z phase position based on the direction parameter setting in **[N2.51 bit0]** and then establish the origin position.<br>(The axis will stop on the Z phase position)<br>(Origin is retentive) |
| Origin has been established, and N2.051 bit1 = 0 | **Linear axis:**<br>Return to origin position with 1st homing speed.<br><br>**Rotary axis:**<br>a. **[N2.051 bit2 = 1]** Closest origin<br>Based on the 1st home speed and the direction parameter setting in **[N2.51 bit0]** to return to nearest origin position and then re-establish the origin position.<br>b. **[N2.051 bit2 = 0]** Machine origin<br>Return to origin position with 1st homing speed. | **Linear axis:**<br>Return to origin position with 1st homing speed.<br><br>**Rotary axis:**<br>a. **[N2.051 bit2 = 1]** Closest origin<br>Based on the 1st home speed and the direction parameter setting in **[N2.51 bit0]** to return to nearest origin position and then re-establish the origin position.<br>b. **[N2.051 bit2 = 0]** Machine origin<br>Return to origin position with 1st homing speed. |
| Origin has been established, and N2.051 bit1 = 1 | The axis will search the Z phase position based on the direction parameter setting in **[N2.51 bit0]** and then re-establish the origin position.<br>(Origin not retentive)<br>(The axis will stop on the Z phase position) | The axis will search the Z phase position based on the direction parameter setting in **[N2.51 bit0]** and then re-establish the origin position.<br>(Origin is retentive)<br>(The axis will stop on the Z phase position) |
| Diagnose page. **[Abs.Reset]** button | - | The axis will search the Z phase position based on the direction parameter setting in [N2.51 bit0] and then establish the origin position. |

4

■ 4: Mode 4 (OT mode)

When homing, the system regards the positive/negative limit as the home switch. When the positive/negative limit is triggered, the axis reverses and the system will regard the first Z pulse as the origin position.

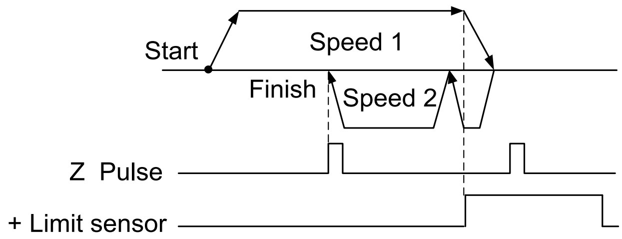
Note 1:

When **N2.51 bit0=0** (negative), the NC system will use the negative limit switch as the home switch.

When **N2.51 bit0=1** (positive), the NC system will use the positive limit switch as the home switch.

Note 2:

In accordance with Note 1, if **N2.51 bit0=1** and the negative limit is triggered, the system will still return a negative hardware limit alarm.




Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=4 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Find home switch and then establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Origin has been established, and N2.051 bit1 = 0 | Return to origin position. | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | Find home switch again and then re-establish origin position. (Origin **not** retentive) | Find home switch again and then re-establish origin position. (Origin **is** retentive) |
| Diagnose page. **[Abs.Reset]** button | - | Find home switch and then establish origin position. |

- 5: Mode 5

This mode is designed for the absolute type of axis, which will use the current position as the origin reference and then set the position of the servo drive as the 0 position when homing.

Note: This is the same action as mode 35, only this is compatible with previous CNC generations.

| N2.50=5 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | - | The axis will not move when the system is in HOME mode.<br>1. Please go to the DGN page and then press the **[Abs.Reset]** button.<br>2. Execute **[Abs.Reset]** setting. (Origin is retentive) |
| Origin has been established, and N2.051 bit1 = 0 | - | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | - | Return to origin position. |
| Diagnose page. **[Abs.Reset]** button | - | Establish origin position. |

- 6: Mode 6

This is designed for a rotary axis to find the closest zero position. The axis will not move if it is set to a linear type axis when the home procedure is triggered, and the system will return alarm AL605.

Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=6 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Move the axis to the Z phase position with the shortest distance and then establish the origin position.<br>(The axis will stop on the Z phase position) | Move the axis to the Z phase position with the shortest distance and then establish the origin position.<br>(The axis will stop on the Z phase position) |
| Origin has been established, and N2.051 bit1 = 0 | **Rotary axis:**<br>Move to closest zero position and then establish origin position. | **Rotary axis:**<br>Move to closest zero position and then establish origin position. |
| Origin has been established, and N2.051 bit1 = 1 | **Rotary axis:**<br>Move to closest zero position and then establish origin position. | **Rotary axis:**<br>Move to closest zero position and then establish origin position. |
| Diagnose page. **[Abs.Reset]** button | - | **Origin not set:**<br>Move the axis to the Z phase position with the shortest distance and then establish the origin position.<br>**Origin has established:**<br>**Rotary axis:**<br>Move to closest zero position and then establish origin position. |

■ 33: Mode 33

This mode is designed for the absolute axis therefore the parameter **[N2.49 Axis type]** must be set to 1. When homing, the system searches for the origin with **[N2.54 2nd homing speed]** in the negative direction and then regards the Z phase as the origin position.

The configuration steps are described below.

a. Switch the system mode to JOG/MPG, and then move the axis to the origin position marked by the machine maker.

b. Switch to the system monitor in the diagnose page.

c. Press the **[Abs.Reset]** button and the system will execute homing with the 2nd homing speed and negative direction to set the Z phase position as the origin position.

Note:

1. If the axis is gantry or synchronize axis, users can trigger any axis either master or slave by **[Abs.Reset]** button to execute this homing procedure.
2. This mode only performs the negative direction searching, which is not affected by the parameter **[N2.051]**.

Different type axis **[N2.49]** with different **[N2.51]** can have several combinations of actions when homing procedure triggered.

| N2.50=33 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Home mode is available to execute procedure.<br>1. Search the Z phase position in the negative direction and then set it as the origin position.<br>2. Axis will stop on the Z phase position.<br>(Origin not retentive) | The axis will not move when the system is in **HOME** mode.<br>1. Please go to the DGN page and then press the **[Abs.Reset]** button.<br>2. Search the Z phase position in the negative direction and then set it as the origin position.<br>3. Axis will stop on the Z phase position.<br>(Origin is retentive) |
| Origin has been established, and N2.051 bit1 = 0 | Return to origin position. | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | Return to origin position. | Return to origin position. |
| Diagnose page. **[Abs.Reset]** button | - | Search for the Z phase position in the negative direction and then set it as the origin position. The axis will stop on the Z phase position. |

■ 34: Mode 34

This mode is designed for the absolute axis therefore the parameter **[N2.49 Axis type]** must be set to 1. When homing, the system searches for the origin with **[N2.54 2nd homing speed]** in the positive direction and then regards the Z phase as the origin position.

The configuration steps are described below.

a. Switch the system mode to JOG/MPG, and then move the axis to the origin position marked by the machine maker.

b. Switch to the system monitor in the diagnose page.

c. Press the **[Abs.Reset]** button and the system will execute homing with the 2nd homing speed and positive direction to set the Z phase position as the origin position.

Note:

1. If the axis is gantry or synchronize axis, users can trigger any axis either master or slave by **[Abs.Reset]** button to execute this homing procedure.
2. This mode only performs the positive direction searching, which is not affected by the parameter **[N2.051]**.

Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

| N2.50=34 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | Home mode is available to execute procedure.<br>1. Search the Z phase position in the positive direction and then set it as the origin position.<br>2. Axis will stop on the Z phase position.<br>(Origin not retentive) | The axis will not move when the system is in **HOME** mode.<br>1. Please go to the DGN page and then press the **[Abs.Reset]** button.<br>2. Search the Z phase position in the positive direction and then set it as the origin position.<br>3. Axis will stop on the Z phase position.<br>(Origin is retentive) |
| Origin has been established, and N2.051 bit1 = 0 | Return to origin position. | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | Return to origin position. | Return to origin position. |
| Diagnose page. **[Abs.Reset]** button | - | Search the Z phase position in the positive direction and then set it as the origin position. The axis will stop on the Z phase position. |

■ 35: Mode 35

This mode is designed for the absolute type of axis, which will use the current position as the origin reference and then set the position of the servo drive as the 0 position when homing.

Note: This is the same action as mode 5, only this is compatible with the EtherCAT standard.

| N2.50=35 | Incremental axis N2.049 = 0 | Absolute axis N2.049 = 1 |
|---|---|---|
| Origin not set | - | The axis will not move when the system is in **HOME** mode.<br>1. Please go to the DGN page and then press the **[Abs.Reset]** button.<br>2. Execute servo homing mode 35.<br>(Origin is retentive) |
| Origin has been established, and N2.051 bit1 = 0 | - | Return to origin position. |
| Origin has been established, and N2.051 bit1 = 1 | - | Return to origin position. |
| Diagnose page. **[Abs.Reset]** button | - | Establish origin position. |

| N2.051 | Homing configuration | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

4

- Bit 0: Origin searching direction.

  0: Negative direction.

  1: Positive direction.

  Set for the origin searching direction. The system will start searching for the home position in the negative direction when it is set to 0, or in the positive direction if the value is set to 1.

  Note: This parameter and **N2.50**, **N2.51 bit1** and **N2.51 bit2** have multiple origin position combinations.

- Bit 1: Always establish origin position.

  0: Disable, 1: Enable

  Note: This parameter is related to **N2.50**, **N2.51 bit1** and **N2.51 bit2**. Please refer to **N2.50** for a detailed description.

- Bit 2: Rotary axis homing mode.

  0: Machine origin

  1: closest origin

  When set to 0, the system will move the rotary axis back to the machine origin position when homing. When set to 1, the system will move the rotary axis to the closest Z phase.

  Note: This parameter and **N2.50**, **N2.51 bit1** and **N2.51 bit2** have multiple origin position combinations.

- Bit 3: Homing procedure for synchronize axes.

  0: Synchronized. The slave axis will follow the same action as the master axis.

  1: Independent. This mode usually applies to the gantry axes, and each axis has a mounted limit switch for itself. In this mode, the system can ensure the alignment status every time the home procedure is finished.

  Note: when any one of the gantry axes reaches the limit switch, it will stop and hold until the other axis reaches its limit switch. Finally, the gantry axes will stop on the Z phase position based on the commands of the master axis.

- Bit 4: Synchronize position adjustment.

  0: Disable, 1: Enable

  This function usually applies to the gantry axes, and each axis has a mounted absolute motor for itself. When the machine manufacturer finishes the gantry alignment, the system will calculate the position error between the two axes within one motor circle and record it in the parameter **[N2.65]** as the default difference position. Users can trigger the special M to enable the gantry adjustment and the system will move the gantry axes to the default alignment position.

- Bit 5: Homing offset mode.

  0: Move to the origin position after homing is finished.

1: Not moving axis after homing is finished.

After the origin reference is found, the system will set the reference position as parameter **[2.59 Home position offset]**. This means the machine origin can be defined in other places.



When set to 0, after the home steps are finished and the reference position has been set as the offset position, the system will move the axis to the machine origin and display the current position as 0.

When set to 1, after the home steps are finished and the reference position has been set as the offset position, the system will finish the procedure and display the current position as **[2.59 Home position offset]**.

- Bit 6: Ignore Z phase within specified distance.

  0: Disable, 1: Enable

  When set to 0 to disable this function, and the system will apply the 1st Z phase as the origin reference position after the axis leaves the switch.

  When set to 1 to enable this function. The system will start to search for the 1st Z phase as the origin reference position after leaving the switch and a specified distance has been reached. The specified distance is defined in the parameter **[N2.58]**.

| N2.053 | The 1st homing speed | | R |
|---|---|---|---|
| Default | 2,000 | Range | 1 ~ 10,000 |
| Data Type | Dword | Unit | mm/min; 0.1 inch/mm; RPM |

- The 1st homing speed.

| N2.054 | The 2nd homing speed | | R |
|---|---|---|---|
| Default | 200 | Range | 1 ~ 1,000 |
| Data Type | Dword | Unit | mm/min; 0.1 inch/mm; RPM |

- The 2nd homing speed.

| N2.058 | Distance to ignore the Z phase | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 100 |
| Data Type | Dword | Unit | % |

- This parameter is defined for the distance after the axis leaves the switch after enabling the parameter **[N2.051 bit6 Ignore Z phase within specified distance]**. The system will start to search the Z phase as the origin reference position after the axis reaches this setting distance away from the switch.
- Linear axis: the actual distance formula is **[N2.02 Lead screw pitch (mm)]** x **[N2.058 Distance to ignore the Z phase (%)]**.
- Rotary axis: the actual distance formula is **360°** x **[N2.058 Distance to ignore the Z phase(%)]**.

| N2.059 | Home position offset | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -100,000 ~ 100,000 | |
| Data Type | Dword | Unit | mm / inch | |



- Home position offset, only available when the **[N2.50 Homing mode]** is set to 1 ~ 4.
- This offset parameter will be referenced by the Z phase position and the **[N2.51 bit5]** will determine whether to move the axis to the zero position.

| N2.060 | 1st reference coordinate | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -100,000 ~ 100,000 | |
| Data Type | Dword | Unit | mm / inch | |

- The 1st reference coordinate. This is for the G27, G28, G29 and G30 commands.

| N2.061 | 2nd reference coordinate | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -100,000 ~ 100,000 | |
| Data Type | Dword | Unit | mm / inch | |

- The 2nd reference coordinate. This is for the G27, G28, G29 and G30 commands.

| N2.062 | 3rd reference coordinate | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -100,000 ~ 100,000 | |
| Data Type | Dword | Unit | mm / inch | |

- The 3rd reference coordinate. This is for the G27, G28, G29 and G 30 commands.

| N2.063 | 4th reference coordinate | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -100,000 ~ 100,000 | |
| Data Type | Dword | Unit | mm / inch | |

- The 4th reference coordinate. This is for the G27, G28, G29 and G 30 commands.

| N2.065 | Synchronization position adjustment | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -2,147,483,647 ~ 2,147,483,647 | |
| Data Type | Dword | Unit | Pulse | |

- When the synchronize function is enabled, the system will calculate the position pulse feedback error between the master and slave axis and then record it in this parameter.

| N2.069 | Axis coordinate definition | | p |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 7 |
| Data Type | Dword | Unit | - |



- The NC system can support multi axes and users can configure them as parallel axes with X, Y and Z axes. This way, these axes can be used on the G17/G18/G19 plane to execute the G02 or G03 arc commands.
- In the standard X, Y and Z Cartesian coordinate system each axis moves in a different direction, and this parameter can support the other axes working as parallel axes with the X, Y and Z axes.

| Value | Description | Value | Description |
|---|---|---|---|
| 0 | Independent axis. | 5 | Axis parallel with X |
| 1 | X axis | 6 | Axis parallel with Y |
| 2 | Y axis | 7 | Axis parallel with Z |
| 3 | Z axis | | |

- For example: Apply X, Y and A, B to execute G02 arc command.

| Axis | Axis Name | Plan |
|---|---|---|
| 1 | X | N2.069=1 (X) |
| 2 | Y | N2.069=2 (Y) |
| 3 | Z | N2.069=3 (Z) |
| 4 | A | N2.069=4 (parallel to X) |
| 5 | B | N2.069=5 (parallel to Y) |
| 3 | C | N2.069=6 (parallel to Z) |

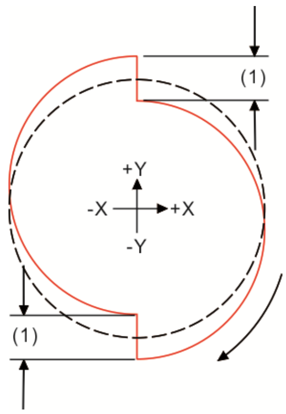
```
O0001
G17
G2X_Y_R_ (XY axes
G2A_B_R_(AB axes
M30
```

4

## 4.5 N3 – Compensation parameter

| N3.000 | Backlash compensation | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -2.0 ~ 2.0 | |
| Data Type | Float | Unit | mm / inch | |

- Setting for compensating for the value of the backlash.
- Setting this to 0 means disabling this function.




| Parameter | | Actual compensation | |
|---|---|---|---|
| N3.3 bit1 (Measurement direction) | N3.3 bit6 (Compensation mode) | Axis moves in negative direction | Axis moves in positive direction |
| 0 (Positive) | 0 (Average) | -1 x **N3.00** / 2 | **N3.00** / 2 |
| 1 (Negative) | | -1 x **N3.00** / 2 | **N3.00** / 2 |
| 0 (Positive) | 1 (One way) | -1 x **N3.00** | 0 |
| 1 (Negative) | | 0 | **N3.00** |

| N3.001 | Backlash compensation time | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1,000 | |
| Data Type | Dword | Unit | 0.001 sec | |

- Setting for backlash compensation time from the start of compensation to the time the compensation coordinates are reached. The actual time will be affected by the setting of the parameter **[N3.003 bit7 Compensate filter time]**.
- If the value is 0, it means this backlash compensation function is disabled.
- The actual compensate duration time will be the sum of the **[N3.001 Backlash compensation time]** and the **[N3.002 Backlash compensation delay time]**.

| N3.002 | Backlash compensation delay time | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 2,000 | |
| Data Type | Dword | Unit | 0.001 sec | |

- Setting for backlash compensation start delay time.
- The actual compensate duration time will be the sum of the **[N3.001 Backlash compensation time]** and the **[N3.002 Backlash compensation delay time]**.

| N3.003 | Compensation parameter | | R |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Set the pitch error compensation value as absolute or incremental input type.

  0: Absolute compensation.

  The system will apply the machine coordinate and then add the compensation value as a result of the compensation position directly.

  1: Incremental compensation.

  The system will add up all the compensation values before the compensation point as the compensation value and then add the machine coordinate as a result of the compensation position.

  Compensate table interface as below.


| Num | X | -X | Y | -Y | Z | -Z | A | -A |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 2 | 0.20000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 3 | 0.30000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 4 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 7 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 8 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 9 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 10 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 11 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 12 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 13 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 14 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 15 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

- Bit 1: Measurement direction of the backlash and pitch error. This direction must be the same as the measurement direction when the machine manufacturer is measuring the error of each axis.

  0: Positive direction.

  1: Negative direction.

- Bit 2: Two direction pitch error compensation.

  0: Disable, 1: Enable

- Bit 6: Backlash compensation mode.

  0: Average mode.

  The system will apply half the compensation value in both the positive and negative directions.

  1: One way mode.

  The system will only apply the compensation value when the axis is moving in the direction opposite the measurement direction.

4

- Bit 7: Backlash compensation type.
  0: S curve type.
  1: Exponents type.

| N3.004 | Pitch error point number | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 512 | |
| Data Type | Dword | Unit | Quantity | |

- Setting the number of the compensation points for the lead screw pitch error.

| N3.005 | Pitch error points interval | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 300 | |
| Data Type | Float | Unit | mm / inch | |

- Setting the interval distance between each compensation point for the pitch error on the lead screw.

| N3.006 | Pitch error start point offset Pitch | | | R |
|---|---|---|---|---|
| Default | 0 | Range | -1,000 ~ 1,000 | |
| Data Type | Float | Unit | mm / inch | |

- Setting the offset value of the compensation start point from the machine zero position for the pitch error compensation.
- When this parameter is 0, there will be no offset from the machine origin; when this parameter is 10mm, the beginning compensation point will be start from the 10mm coordinate.
- For other compensation functions please refer section 4.10.4.

# 4.6 N5 – MLC parameter



| N5.000 | DI 1 polarity | | | P |
|---|---|---|---|---|
| Default | 1 | Range | - | |
| Data Type | word | Unit | - | |

- Configure the polarity type of the digital inputs on the local I/O 1 connector.
- Bit 0: 1st digital input on the I/O 1.
- Bit 1: 2nd digital input on the I/O 1.
- Bit 2: 3rd digital input on the I/O 1.
- Bit 3: 4th digital input on the I/O 1.
- Bit 4: 5th digital input on the I/O 1.
- Bit 5: 6th digital input on the I/O 1.
- Bit 6: 7th digital input on the I/O 1.
- Bit 7: 8th digital input on the I/O 1.
- Bit 8: 9th digital input on the I/O 1.
- Bit 9: 10th digital input on the I/O 1.
- Bit 10: 11th digital input on the I/O 1.
- Bit 11: 12th digital input on the I/O 1.
- Bit 12: 13th digital input on the I/O 1.
- Bit 13: 14th digital input on the I/O 1.
- Bit 14: 15th digital input on the I/O 1.
- Bit 15: 16$^{th}$ digital input on the I/O 1.

  0: Normal close, 1: Normal open

| N5.001 | DI 2 polarity | | | P |
|---|---|---|---|---|
| Default | 1 | Range | - | |
| Data Type | word | Unit | - | |

- Configure the polarity type of the digital inputs on the local I/O 2 connector.
- Bit 0: 1st digital input on the I/O 2.
- Bit 1: 2nd digital input on the I/O 2.
- Bit 2: 3rd digital input on the I/O 2.
- Bit 3: 4th digital input on the I/O 2.
- Bit 4: 5th digital input on the I/O 2.
- Bit 5: 6th digital input on the I/O 2.
- Bit 6: 7th digital input on the I/O 2.
- Bit 7: 8th digital input on the I/O 2.
- Bit 8: 9th digital input on the I/O 2.
- Bit 9: 10th digital input on the I/O 2.
- Bit 10: 11$^{th}$ digital input on the I/O 2.
- Bit 11: 12$^{th}$ digital input on the I/O 2.

  0: Normal close, 1: Normal open

4

- Bit 12: 13th digital input on the I/O 2.
- Bit 13: 14th digital input on the I/O 2.
- Bit 14: 15th digital input on the I/O 2.
- Bit 15: 16th digital input on the I/O 2.

  0: Normal close, 1: Normal open

| N5.002 | DI polarity on MPG interface | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | word | Unit | - |

- Configure the polarity type of the digital inputs on the MPG connector.
- Bit 0: 1st digital input.
- Bit 1: 2nd digital input.
- Bit 2: 3rd digital input.
- Bit 3: 4th digital input.
- Bit 4: 5th digital input.
- Bit 5: 6th digital input.
- Bit 6: 7th digital input.
- Bit 7: 8th digital input.

  0: Normal close, 1: Normal open

| N5.003 | DI signal filter on MPG | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 7 |
| Data Type | word | Unit | - |

- Configure the digital input filter time for the MPG connector. The digital input signal must trigger longer than this configuration time for the system to take effect. Through this filter function, users can reduce malfunctions caused by signal noise.

| Value | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Time (us) | None | 50 | 100 | 200 | 400 | 600 | 1200 | 2000 |

| N5.006 | HSI high speed input polarity | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | word | Unit | - |

- Configure the polarity type of the HSI digital inputs on the CN1 connector.
- Bit 0: 1st digital input.
- Bit 1: 2nd digital input.
- Bit 2: 3rd digital input.
- Bit 3: 4th digital input.
- Bit 4: 5th digital input.
- Bit 5: 6th digital input.

  0: Normal close, 1: Normal open

- Bit 6: 7th digital input.
- Bit 7: 8th digital input.

  0: Normal close, 1: Normal open
- When any HSI signal is triggered, the system will also update the status to the corresponding special M relay.

  For example:

  HIS 1 will map to the M30016.

  HIS 2 will map to the M30017.



| N5.007 | HSI high speed input switch | | | P |
|---|---|---|---|---|
| Default | 1 | Range | - | |
| Data Type | word | Unit | - | |

- The system allows users to enable the HSI function on the CN1 connector independently.
- Bit 0: 1st digital input.
- Bit 1: 2nd digital input.
- Bit 2: 3rd digital input.
- Bit 3: 4th digital input.
- Bit 4: 5th digital input.
- Bit 5: 6th digital input.
- Bit 6: 7th digital input.
- Bit 7: 8th digital input.

  0: Disable, 1: Enable

| N5.008 | HSI high speed input signal filer | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 7 | |
| Data Type | word | Unit | - | |

- Configure the HSI digital input filter time on the CN1 connector. The digital input signal must trigger longer than this configuration time for the system to take effect. Through this filter function, users can reduce malfunctions caused by signal noise.

| Value | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Time (us) | None | 8 | 16 | 24 | 32 | 40 | 48 | 56 |

| N5.009 | Spindle connector configuration | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | word | Unit | - |

- Bit 0: Reverse the A/B pulse direction of the Spindle 1 connector.

  Users can use this parameter to change the direction if the wiring direction is reversed.
- Bit 1: Reverse the A/B pulse direction of the Spindle 2 connector.

  Users can use this parameter to change the direction if the wiring direction is reversed.
- Bit 4: Pulse counting method of the Spindle 1 connector.

  0: Incremental.

  The spindle position will continuously accumulate based on the pulse feedback.

  1: Absolute.

  The spindle position will be reset to 0 after encountering the Z phase signal.
- Bit 5: Pulse counting method of the Spindle 2 connector.

  0: Incremental.

  The spindle position will continuously accumulate based on the pulse feedback.

  1: Absolute.

  The spindle position will be reset to 0 after encountering the Z phase signal.

| N5.011 | Function I/O application setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | word | Unit | - |

- Bit 0: Configure the polarity type of the emergency input on the CN1 connector.

  0: Normal close

  1: Normal open

  If apply CN1 as emergency stop source signal, the **[N1.010 Bit8 Emergency signal source]** should be set to 0.
- Bit 1: Reverse the A/B pulse direction of the MPG connector. Users can use this parameter to change the direction if the wiring direction is reversed.
- Bit 2: Limit positive movement of the MPG control.

  0: Not limited.

  1: The MPG control cannot move in the positive direction.
- Bit 3: Limit negative movement of the MPG control.

  0: Not limited.

  1: The MPG control cannot move in the negative direction.
- Bit 15: Emergency stop signal source.

  0: 2nd panel emergency stop button.

  1: CN1 connector.

| N5.064 | MLC cycle time | | | P |
|---|---|---|---|---|
| Default | 2 | Range | 2 ~ 1,000 | |
| Data Type | word | Unit | msec | |

■ When the parameter **[N5.065]** is set to 1 and the switch is enabled, the system will scan the MLC program once using the time setting as the MLC cycle time. If this time setting is excessively high, the MLC device status will have a long update period.

| N5.065 | MLC cycle scan switch | | | P |
|---|---|---|---|---|
| Default | 2 | Range | 2 ~ 1,000 | |
| Data Type | word | Unit | msec | |

■ Enable MLC cycle time. This must be used in conjunction with the **[N5.064 Cycle time]**.
0: Disable.
1: Enable. The system will allocate more CPU resources for HMI to manage the display by enabling this function.

| N5.066 | DI - X register virtual address amount | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 300 | |
| Data Type | word | Unit | - | |

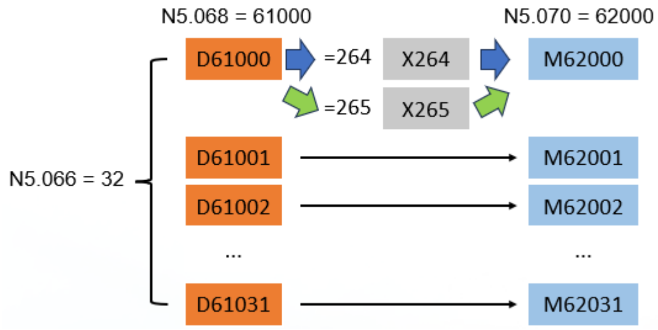
■ Configuration of the digital input signal X register's virtual address.

■ This function is designed to transfer physical signals. Therefore, when the wiring for digital input needs to be changed, users can just modify the mapping of virtual addresses, thus eliminating the need to modify all relate MLC programming.

■ Related function parameters include [N5.066, X register virtual address amount], [N5.068, First D register for virtual address define of X register] and [N5.070, First M register for mapping X register].

■ For example:
In the following diagram, N5.066=32, N5.068=61000 and N5.070=62000.
D61000 to D61031 can be defined for X register mapping addresses and M62000 to M62031 will respond with the X register's status corresponding to the X address defined in D61000 to D61031.
If D61000 = 264, when X264 is ON, M62000 will be ON.
If D61000 = 265, when X265 is ON, M62000 will be ON.

■ The X address settings in the D register cannot be duplicates. Otherwise, the same M register will be influenced by two different X registers.



| N5.067 | DO - Y register virtual address amount | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 300 |
| Data Type | word | Unit | - |

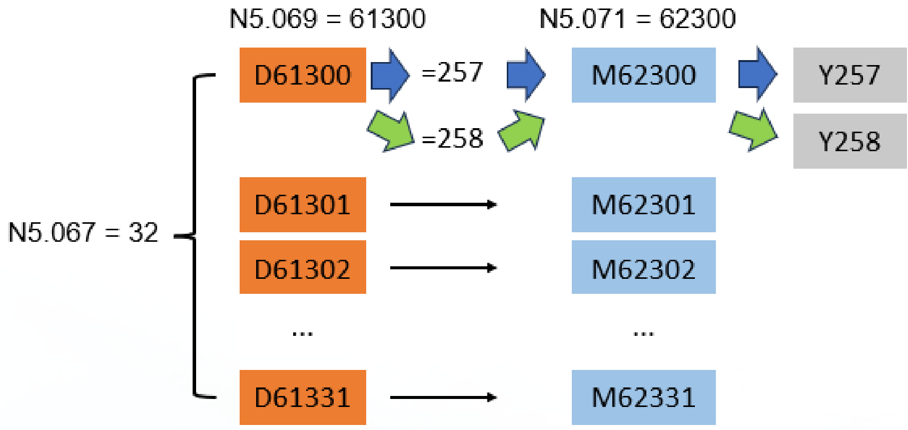
- Configuration of the digital input signal Y register's virtual address.
- This function is designed to transfer physical signals. Therefore, when the wiring for digital output needs to be changed, users can just modify the mapping of virtual addresses, thus eliminating the need to modify all relate MLC programming.
- Related function parameters include **[N5.067 Y register virtual address amount]**, **[N5.069 First D register for virtual address define of Y register]** and **[N5.071 First M register for mapping Y register]**.
- For example:

  In the following diagram, N5.067=32, N5.069=61300 and N5.071=62300.

  D61300 to D61331 can be defined for Y register mapping addresses and M62300 to M62331 will directly control the Y register's status corresponding to the Y address defined in D61300 to D61331.

  If D61300 = 257, when M62300 is ON, Y257 will be ON and will output the corresponding signal.

  If D61300 = 258, when M62300 is ON, Y258 will be ON and will output the corresponding signal.
- The Y address settings in the D register cannot be duplicates. Otherwise, two different M registers will control the same digital output at the same time.




| N5.068 | First D register for virtual address define of X register | | P |
|---|---|---|---|
| Default | 60,000 | Range | 60,000 ~ 61,999 |
| Data Type | word | Unit | - |

- Setting the first D register for the virtual address definition of the X register.
- Related function parameters include **[N5.066 X register virtual address amount]**, **[N5.068 First D register for virtual address define of X register]** and **[N5.070 First M register for mapping X register]**.

| N5.069 | First D register for virtual address define of Y register | | P |
|---|---|---|---|
| Default | 60,000 | Range | 60,000 ~ 61,999 |
| Data Type | word | Unit | - |

■ Setting the first D register for the virtual address definition of the Y register.

■ Related function parameters include **[N5.067 Y register virtual address amount]**, **[N5.069 First D register for virtual address define of Y register]** and **[N5.071 First M register for mapping Y register]**.

| N5.070 | First M register for mapping X register | | P |
|---|---|---|---|
| Default | 60,000 | Range | 60,000 ~ 61,999 |
| Data Type | word | Unit | - |

■ Setting the first M register for mapping digital input status.

■ Related function parameters include **[N5.066, X register virtual address amount]**, **[N5.068, First D register for virtual address define of X register]** and **[N5.070, First M register for mapping X register]**.

| N5.071 | First M register for mapping Y register | | P |
|---|---|---|---|
| Default | 60,000 | Range | 60,000 ~ 61,999 |
| Data Type | word | Unit | - |

■ Setting the first M register for mapping the digital input status.

■ Related function parameters include **[N5.067, Y register virtual address amount]**, **[N5.069, First D register for virtual address define of Y register]** and **[N5.071, First M register for mapping Y register]**.

4

# 4.7 N6 – HMI and MLC Parameter

| N6.000 | Program title | | | P |
|---|---|---|---|---|
| Default | - | Range | 0 ~ 20 | |
| Data Type | Text | Unit | - | |

■ Setting for program title to display on the screen.

| N6.001 | Company name | | | P |
|---|---|---|---|---|
| Default | - | Range | 0 ~ 20 | |
| Data Type | Text | Unit | - | |

■ Setting for company name.

| N6.002 | Designer name | | | P |
|---|---|---|---|---|
| Default | - | Range | 0 ~ 20 | |
| Data Type | Text | Unit | - | |

■ Setting for designer name.

| N6.003 | Show comments | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 | |
| Data Type | Uint32 | Unit | - | |

■ Setting for whether to display the comments.

0: Disable, 1: Enable

| N6.004 | Show symbols | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 | |
| Data Type | Uint32 | Unit | - | |

■ Setting for whether to display the symbols.

0: Disable, 1: Enable

| N6.005 | Ladder background color | | | P |
|---|---|---|---|---|
| Default | Light gray | Range | - | |
| Data Type | Color | Unit | - | |

■ Setting for background color of the ladder editor.

| N6.006 | Ladder color | | | P |
|---|---|---|---|---|
| Default | Black | Range | - | |
| Data Type | Color | Unit | - | |

■ Setting for ladder editor color.

| N6.007 | Ladder text color | | P |
|---|---|---|---|
| Default | Black | Range | - |
| Data Type | Color | Unit | - |

■ Setting for text font color of the ladder editor.



| N6.008 | Ladder symbol color | | P |
|---|---|---|---|
| Default | Black | Range | - |
| Data Type | Color | Unit | - |

■ Setting for symbol color of the ladder editor.

| N6.009 | Ladder cursor color | | P |
|---|---|---|---|
| Default | Light blue | Range | - |
| Data Type | Color | Unit | - |

■ Setting for ladder editor cursor color

| N6.010 | Ladder monitoring status display color | | P |
|---|---|---|---|
| Default | Light green | Range | - |
| Data Type | Color | Unit | - |

■ Setting for monitoring status display color of the ladder editor.

| N6.011 | Ladder device comment color | | P |
|---|---|---|---|
| Default | Brown | Range | - |
| Data Type | Color | Unit | - |

■ Setting for device comment color of the ladder editor.

| N6.012 | Ladder segment comment color | | P |
|---|---|---|---|
| Default | Brown | Range | - |
| Data Type | Color | Unit | - |

■ Setting for segment comment color of the ladder editor.

| N6.013 | Ladder row comment color | | P |
|---|---|---|---|
| Default | Brown | Range | - |
| Data Type | Color | Unit | - |

■ Setting for row comment color of the ladder editor.

| N6.014 | Ladder monitoring value color | | P |
|---|---|---|---|
| Default | Light red | Range | - |
| Data Type | Color | Unit | - |

■ Setting for monitoring value color of the ladder editor.

| N6.015 | NC special device color | | | P |
|---|---|---|---|---|
| Default | S2B | Range | - | |
| Data Type | Color | Unit | - | |

- Setting for special device color in the NC system.

| N6.016 | MLC special device color | | | P |
|---|---|---|---|---|
| Default | S2B | Range | - | |
| Data Type | Color | Unit | - | |

- Setting for special device color in the MLC system.

| N6.031 | MLC protection | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 0: MLC editor lock. Setting for whether the MLC can only be modified in EDIT mode.
  0: Disable.
  1: Locked and only available to edit in the EDIT mode.
- Bit 3: MLC save lock. Setting for whether the MLC can only save changes when the emergency stop has been triggered.
  0: Disable, 1: Enable

| N6.032 | MLC setting | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

**[Integrated model]**

- Bit 0: Setting for whether the MLC is activated right after the system is loaded.
  0: Disable, 1: Enable
- Bit 1: Setting for whether using the D registers are used to record the system information.
  0: Disable, 1: Enable
  Note:
  D49000 records the year and month of the system.
  D49001 records the day and hour of the system.
  D49002 records the minute and second of the system.
  D49x04 (32-bit) records the total process time in seconds.
  D49x06 (32-bit) records the single process time in seconds.

**[OpenCNC]**

- Bit 0: Setting for whether the MLC is activated right after the system is loaded.

  0: Disable, 1: Enable

- Bit 1: Setting for whether using the D registers are used to record the system information.

  0: Disable, 1: Enable

  Note:

  D49000 records the year and month of the system.

  D49001 records the day and hour of the system.

  D49002 records the minute and second of the system.

  D49x04 (32-bit) records the total process time in seconds.

  D49x06 (32-bit) records the single process time in seconds.

- Bit 3: Enable user define keyboard function.

  0: Disable, 1: Enable

  The user defined keyboard function is designed for real keyboards to operate machine functions by associating with the M relay, the functionality is similar to hot keys. This function also needs to be set up with **[N6.035]** for the M relay to switch ON/OFF user defined keyboard functions, and **[N6.036]** for the D register to store values from keys. Then, users can program their MLC logic to operate machine functions with a specific hot key button.

- Bit 4: User define keyboard function mode.

  0: Single key.

  1: Key combination.

  **Single key:**

  When key is pressed, the value of the key will be updated to the D register defined in the parameter [N6.036].

  When multiple keys are pressed at the same time, such as CTRL+Z or ALT+Z, the system will add their key values together and then update it to the D register.

  **Key combination:**

  When multiple keys are pressed at the same time, the system will update them sequentially to the D register defined in the parameter [N6.036]. A maximum of up to 6 keys can be stored at the same time.

| N6.035 | M relay No. for switching the user defined keyboard | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 65,535 | |
| Data Type | Unit32 | Unit | - | |

- Setting for the M relay number for switching user define keyboard function. Users can turn the function ON or OFF from the MLC but the parameter **[N6.032 bit3]** must be set to 1.
- Once this function is enabled, the original combination keys such as CTRL+F1 will be disabled to prevent function conflicts.

| N6.036 | D register number for the user defined keypad value | | P |
|---|---|---|---|
| Default | 0 | Range | 65,535 |
| Data Type | Unit32 | Unit | - |

- Setting for the D register number for storing the pressed key value.
- When the key button is pressed, the system will update its key values to the specific D register and then reset it to 0 after the key is released.
- This parameter is specially designed for custom keyboard functions, and users can freely develop logic in MLC.
- This function usually applies for keyboard to switch mode switch, JOG or cycle start as hot key.
- To use this function, the **[N6.032 bit3 Enable user define keyboard function]** must set as enable.

# 4.8 N8 – HMI system parameter



| N8.000 | System date | | P |
|---|---|---|---|
| Default | - | Range | - |
| Data Type | Time | Unit | - |

- Setting the system time.

| N8.001 | System time | | P |
|---|---|---|---|
| Default | - | Range | - |
| Data Type | Time | Unit | - |

- Setting the system time.

| N8.002 | Screen brightness | | P |
|---|---|---|---|
| Default | 80 | Range | - |
| Data Type | Uint32 | Unit | - |

- Setting the screen brightness for integrated models.

| N8.003 | System language | | P |
|---|---|---|---|
| Default | - | Range | - |
| Data Type | Lang | Unit | - |

- Setting the displayed language.
- The range for this parameter is depends on the configuration of the screen editor.

| N8.004 | External device setting | | P |
|---|---|---|---|
| Default | 50 | Range | - |
| Data Type | Dword | Unit | - |

**[Integrated model]**

- Bit 0~6: Mouse sensitivity.
- Bit 8~11: Cursor display maintaining time.
- Bit 14: Enable USB type 2$^{nd}$ panel.

  0: Disable, 1: Enable
- Bit 15: Enable user defined cursor.

  0: Disable, 1: Enable

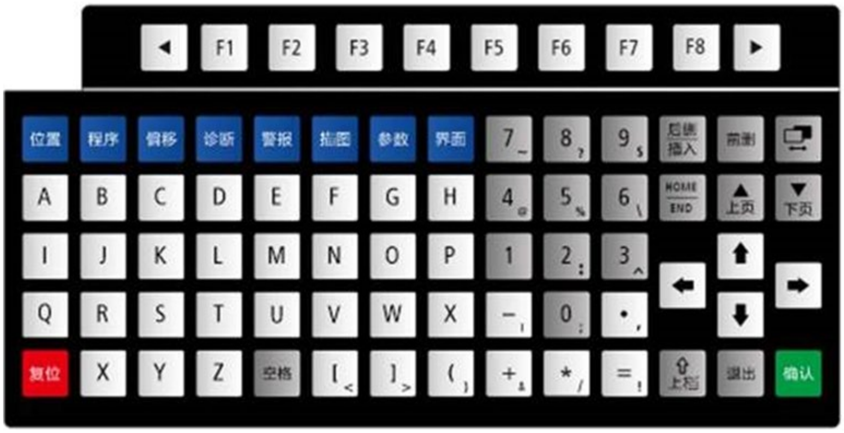
  The cursor size can be adjusted by the parameter **[N8.004 bit16~19]**.
- Bit 16~19 User defined cursor size.

  Value ranges from 0 to 5, the bigger the value the bigger the size to make the cursor easier to see and use. The setting only available when enable the **[N8.004 bit15]**.
- Bit 20~23 User defined external keypad type.

  0: Delta integrated model type keypad.

  1: User defined external keypad type 1.

  2: User defined external keypad type 2.



Users defined external keypad type 1

Users defined external keypad type 2

**[OpenCNC]**

- Bit 0~6: Mouse sensitivity.
- Bit 8~11: Cursor display maintain time.
- Bit 12: Enable touch status notify function.

  0: Disable, 1: Enable

  After enabling this function, the system will trigger the special M relay when users touch the touch screen. Machine manufacturers can design notifications such as buzzers through this function.
- Bit 13: Soft keypad popout mode.

  0: Double click.

  1: Single click.
- Bit 15: Enable user defined cursor.

  0: Disable, 1: Enable

  The cursor size can be adjusted by the parameter **[N8.004 bit16~19]**.

4

- Bit 16~19 User defined cursor size.

  Value ranges from 0 to 5, the bigger the value the bigger the size to make the cursor easier to see and use.

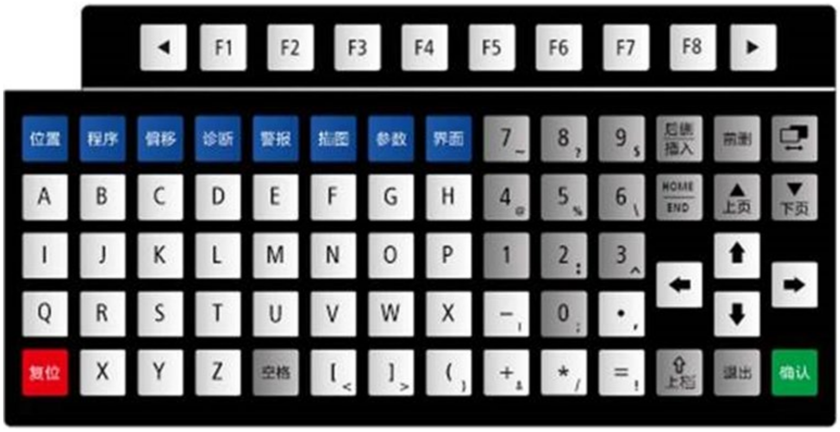
- Bit 20~23 User defined external keypad type.

  0: USB keyboard.

  1: User defined external keypad type 1.

  2: User defined external keypad type 2.

USB keyboard




Users define external keypad type 1


Users define external keypad type 2

4

| N8.009 | Synchronization coordinates display setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0~1: Whether to display the synchronized slave axis's coordinates on the axes table of the POS page.
  0: Disable, 1: Enable
- Bit 2: Whether to display the synchronized slave axis's work coordinates on the work coordinate table of the OFFSET page.
  0: Disable, 1: Enable

| N8.011 | Screen saver | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 |
| Data Type | Uint32 | Unit | - |

- Enable screen saver function.
  0: Disable, 1: Enable

| N8.012 | Screen saver time 1 | | P |
|---|---|---|---|
| Default | 10 | Range | 1 ~ 60 |
| Data Type | Uint32 | Unit | min |

- Setting the time to wait before turning on the screen saver stage 1 when the system is not being used.

| N8.013 | Screen brightness 1 | | P |
|---|---|---|---|
| Default | 30 | Range | 0 ~ 99 |
| Data Type | Uint32 | Unit | - |

- Setting the screen brightness at the screen saver stage 1.

| N8.014 | Screen saver time 2 | | P |
|---|---|---|---|
| Default | 20 | Range | 1 ~ 60 |
| Data Type | Uint32 | Unit | min |

- Setting the time to wait before turning on the screen saver stage 2 when the system is not being used.

| N8.015 | Screen brightness 2 | | P |
|---|---|---|---|
| Default | 10 | Range | 0 ~ 99 |
| Data Type | Uint32 | Unit | - |

- Setting the screen brightness at the screen saver stage 2.

| N8.018 | Display setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 7: Canceling the pop out dialog.
  0: Disable, 1: Enable
  When applying a PC-NC system structure, since the system will not directly operate the controller screen when remotely controlling the API, it is suggested to enable this parameter to avoid the user not processing the pop out dialog promptly, which can result in abnormalities in remote control.
- Bit 10: Decimal input ignore.
  0: Disable. In the OFS page, the input value will be divided by 1000 automatically.
  1: Enable. In the OFS page, the input value will activate directly without dividing it by any value.

| N8.020 | System setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Setting for whether the system executes the RESET command after release the emergency stop status.
  0: Disable, 1: Enable
- Bit 3: Enable the automatically backup for the system parameters.
  0: Disable, 1: Enable
- Bit 4: Whether to hide the axes coordinates.
  0: Enable, 1: Disable
- Bit 5: Enable O macro file encrypt protection.
  0: Disable, 1: Enable
- Bit 7: Whether parameters can be modified.
  0: Disable. Parameters are allowed to be modified.
  1: Enable. Parameters are NOT allowed to be modified.
- Bit 16: Specifies the NC path to be reset when the RESET command is triggered.
  0: All the NC paths.
  1: Current NC path.
- Bit 17~Bit 19: Days before time lock expire.
  0: 10 days before.
  1: 3 days before.
  2: On the expiration date.

| N8.022 | G-code edit setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Setting for whether the text editor can be edited by users.

  0: Allowed.

  1: Prohibited.
- Bit 1~2: Setting for the file sources of macros and sub-programs.

  0: INTER.

  1: SD card.

  If the specified file cannot be found in the directory, the system will return an alarm.
- Bit 4: Auto focus after program edit.

  0: Disable, 1: Enable

  After enabling this function, the cursor of the main program will be on the edited line after users edit it in the EDIT mode and then switch back to the AUTO mode. Therefore, users can start running the program right after the program edit because the cursor is at the new command line automatically.
- Bit 5: Macro call program file direction.

  0: Same direction as main program.

  1: USB drive.

  Note: The program file direction is defined in the parameter **[N8.22 Bit 1~2]** as (DISK) in the below table, which describes the file search priority.

| Parameter | Macro call function and program file search priority | |
|---|---|---|
| **N8.22 Bit 5**<br>Macro call program file direction | M98 call sub-program.<br>M96 call macro.<br>G65 call macro.<br>G66 call macro. | G, M, T code macro.<br>The macro after break & search.<br>Cycle starts initial macro.<br>One button call macro. |
| 0 | (1) Same root as main program<br>(2) (DISK)/PATH_□<br>(3) (DISK)/PATH_□/O_MACRO<br>(4) (DISK)/GLOBAL<br>(5) (DISK)/GLOBAL/O_MACRO | (1) (DISK)/PATH_□<br>(2) (DISK)/PATH_□/O_MACRO<br>(3) (DISK)/GLOBAL<br>(4) (DISK)/GLOBAL/O_MACRO<br>(5) Same root as main program |
| 1 | (1) USB root path<br>(2) (DISK)/PATH_□<br>(3) (DISK)/PATH_□/O_MACRO<br>(4) (DISK)/GLOBAL<br>(5) (DISK)/GLOBAL/O_MACRO | (1) USB root path<br>(2) (DISK)/PATH_□<br>(3) (DISK)/PATH_□/O_MACRO<br>(4) (DISK)/GLOBAL<br>(5) (DISK)/GLOBAL/O_MACRO |

- Bit 6: Whether to display the sub-program name when the main program is calling.

  0: Disable, 1: Enable

- Bit 8: Path of friction compensation measurement program.
  0: O_ MACRO, 1: SD
- Bit 9: O macro protection
  0: Disable, 1: Enable
  When this function is enabled, the system will lock the O macro check button on the export page. End users will not be able to obtain related macro files.
- Bit 10: Whether to display the macro content when an O macro is executing.
  0: Hide, 1: Display.
- Bit 11: Whether to display the Global G code folder.
  0: Display, 1: Hide.
- Bit 12: Whether to display the Path G code folder.
  0: Display, 1: Hide.
- Bit 13: Whether to have a fixed paste directory when users copy files on the file management page.
  0: Disable, 1: Enable
  The system will fix the directory as the root path of the specified drive when users copy files in the two-side file management page.

| N8.026 | Barcode reading setup | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0~1: Barcode file scan mode.
  0: Disable.
  1: File list fill in.
  When users scan the barcode reader on the page that has the component **[NC File List]**, the system will apply the barcode contents as the file name and add the file into the list if the file exists.
  2: Barcode input component.
  When users scan the barcode reader on the component **[Barcode Input]**, the system will apply the barcode contents as the file name and set it as main program if the file exists. After enabling this function, users will also need to set up the parameter **[N8.026 Bit16~31]** to allocate an M relay for the system to update the scanning status. Furthermore, this M relay must avoid duplicates with other functional M relays in the MLC program to prevent conflicts.
  Note 1:
  The NC program must be stored in the directory defined in the parameter **[N8.026 Bit2]** in advance. This is so the system can find and apply the required functionality.
  Note 2:
  After configuring this parameter for barcode scan mode, users will still have to enable the function using the parameter **[N8.026 Bit3]**.

4

- Bit 2: Barcode file directory.
  0: INTER
  1: SD
- Bit 3: Enable barcode scan.
  0: Disable, 1: Enable
- Bit 4~9: Maximum barcode scan length.
  0: The maximum length that the system allows.
  More than 1: The maximum data length for input from the barcode reader.
- Bit 16~31: Barcode scan status for the barcode input component mode.
  When the parameter **[N8.026 Bit 0~1]** is set to 2 for barcode input component mode, the system will apply this configured M relay to update the scan event status.
  Range: 0~14999.

| N8.030 | Auto logout time | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1,440 | |
| Data Type | Uint32 | Unit | min | |

- When users are not using the system and the idle time goes over this time setting, the system will log out the user and return to the default authority.

| N8.031 | Scope monitors total seconds | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 30 | |
| Data Type | Uint32 | Unit | sec | |

- Scope monitors total seconds.

| N8.032 | Scope monitor setup 1 | | | P |
|---|---|---|---|---|
| N8.033 | Scope monitor setup 2 | | | |
| N8.034 | Scope monitor setup 3 | | | |
| N8.035 | Scope monitor setup 4 | | | |
| Default | 0 | Range | - | |
| Data Type | Uint32 | Unit | - | |

- Bit0 ~ Bit7: Set the NC channel number for the signal monitor channel.
  0: Disable.
  1 ~ 4: Path 1 ~ 4.

- Bit8 ~ Bit31: Signal type

  0: Disable.

  1 ~ 65535: Signal type 1 ~ signal type 65535.

  The NC controller provides 4 sets of channels for monitoring signals, named scope 1, scope 2, scope 3 and scope 4 in the scope list. Users can define different types of signals for each monitor channel such as spindle speed commands or X axis command positions based on the users' needs. This means that users can analyze the signal status from the scope.

  Note: It is suggested to set this signal selection directly on the scope page. This makes the operation much easier and more convenient.

| N8.038 | G code highlight line position | | | P |
|---|---|---|---|---|
| Default | 1 | Range | 1 ~ 10 | |
| Data Type | Uint32 | Unit | - | |

- Setting for G code highlight line position. When the program is executing, the system will fix the executing line on the same position. As shown in the example in the following picture, when the parameter is set to 3, the highlight command will stay on the line number 3.


| N8.039 | T code scan | | | P |
|---|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 | |
| Data Type | Uint32 | Unit | - | |

- This is a special design for multi head machines. Please refer to the manual for multi head machines.

| N8.100 | Host name | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Text | Unit | - | |

- Setting for machine host name.

| N8.101 | IP_1 address | | | P |
|---|---|---|---|---|
| N8.123 | IP_2 address | | | |
| Default | 192.168.1.10 | Range | XXX.XXX.XXX.XXX | |
| Data Type | IP | Unit | - | |

- N8.101 is the setting for the IP address of the 1st Ethernet port.
- N8.123 is the setting for the IP address of the 2nd Ethernet port.

  These two IP addresses cannot be allocated in the same domain.

  If [N8.102 1st Ethernet IP subnet mask] and [N8.124 2nd Ethernet IP subnet mask] are set to 255.255.255.0 and then the 1st IP address is set to 192.168.1.X, the 2nd IP address cannot be set to the range between 192.168.1.1 – 192.168.1.255.

| N8.102 | IP_1 subnet mask | | | P |
|---|---|---|---|---|
| N8.124 | IP_2 subnet mask | | | |
| Default | 255.255.255.0 | Range | XXX.XXX.XXX.XXX | |
| Data Type | IP | Unit | - | |

- N8.102 is the setting for the IP subnet mask of the 1st Ethernet port.
- N8.124 is the setting for the IP subnet mask of the 2nd Ethernet port.

| N8.103 | IP_1 default gateway | | | P |
|---|---|---|---|---|
| N8.125 | IP_2 default gateway | | | |
| Default | 0 | Range | 0 ~ 255 | |
| Data Type | IP | Unit | - | |

- N8.103 is the setting for the default gateway of the 1st Ethernet port.
- N8.125 is the setting for the default gateway of the 2nd Ethernet port.

| N8.104 | IP_1 internet function | | | P |
|---|---|---|---|---|
| N8.126 | IP_2 internet function | | | |
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 0: Enable Internet functions.

  0: Disable, 1: Enable
- Bit 2: Enable DHCP function.

  0: Disable, 1: Enable

| N8.105 | Remote folder IP address 1 | | P |
|---|---|---|---|
| N8.106 | Remote folder IP address 2 | | |
| N8.107 | Remote folder IP address 3 | | |
| N8.108 | Remote folder IP address 4 | | |
| N8.109 | Remote folder IP address 5 | | |
| Default | 0.0.0.0 | Range | XXX.XXX.XXX.XXX |
| Data Type | IP | Unit | - |

- Setting for remote folder IP address.
- The parameter **[N8.110]** must be set up to enable this function.

| N8.110 | IP address of remote folder | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 5 |
| Data Type | Uint32 | Unit | - |

- Specifies the remote IP address setting for shared folders in parameter **[N8.105]** to **[N8.109]**.
- When set to 1 the system will connect to the IP address set in the parameter **[N8.105]**. When set to 2 the system will connect to the IP address set in the parameter **[N8.106]**.
- After the two sides successfully establish a connection, the controller system will use the NETDRIVE in the file manager to access the shared folder. In addition, users can apply an NC program file directly from the remote PC. Note: it is necessary to enter a valid username and password on the remote PC.

| N8.111 | FTP setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Enable FTP function.
  0: Disable, 1: Enable
- Bit 1: Allow anonymous FTP use.
  0: Disable, 1: Enable
- Bit 3: Enable the main program to be automatically set right after file upload.
  0: Disable, 1: Enable

| N8.113 | FTP user account | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Text | Unit | - |

- Set an FTP user account name 1 ~ 6 characters in length.

4

| N8.114 | FTP password | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Password | Unit | - |

■ Set an FTP password 1 ~ 6 words in length.

| N8.115 | Printer page height | | R |
|---|---|---|---|
| Default | Defined in the DOPSoft | Range | 1 ~ 6,000 |
| Data Type | - | Unit | mm |

■ Setting the height for a printer page.

| N8.116 | Printer page width | | R |
|---|---|---|---|
| Default | Defined in the DOPSoft | Range | 1 ~ 6,000 |
| Data Type | - | Unit | mm |

■ Setting the width for a printer page.

| N8.117 | Printer page height scaling | | R |
|---|---|---|---|
| Default | Defined in the DOPSoft | Range | 1 ~ 400 |
| Data Type | - | Unit | mm |

■ Setting the height scaling for a printer page.

| N8.118 | Printer page width scaling | | R |
|---|---|---|---|
| Default | Defined in the DOPSoft | Range | 1 ~ 400 |
| Data Type | - | Unit | mm |

■ Setting the width scaling for a printer page.

| N8.119 | Printer auto page change | | R |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 |
| Data Type | - | Unit | mm |

■ Setting for printer auto page changing.

0: Disable, 1: Enable

| N8.120 | Printer page orientation | | R |
|---|---|---|---|
| Default | Defined in the DOPSoft | Range | 0 ~ 1 |
| Data Type | - | Unit | mm |

■ Setting for printer page orientation.

0: Vertical.

1: Horizontal.

| N8.121 | Printer page horizontal offset | | R |
|---|---|---|---|
| Default | 0 | Range | -6,000 ~ 6,000 |
| Data Type | - | Unit | mm |

- Setting for printer page horizontal offset.

  Positive setting: Right side offset.

  Negative setting: Left side offset.



| N8.122 | Page Vertical Offset | | R |
|---|---|---|---|
| Default | 0 | Range | -6,000 ~ 6,000 |
| Data Type | - | Unit | mm |

- Setting for printer page vertical offset.

  Positive setting: Downward offset.

  Negative setting: Upward offset.

# 4.9 N9 – HMI path parameter

4

| N9.013 | Unit Setting | | P |
| --- | --- | --- | --- |
| Default | 3 decimal digits | Range | Decimal digits (Range: 3~6)<br>Integer digits (Range: 1~5) |
| Data Type | Uint32 | Unit | - |

- Setting input component unit including integer digits and fractional digits.
- Bit 0~15: Decimal digits.
- Bit 16~31: Integer digits.

| N9.014 | System distance unit | | P |
| --- | --- | --- | --- |
| Default | 0 | Range | 0 ~ 1 |
| Data Type | Uint32 | Unit | - |

- Setting the unit of the system distance.

  0: Metric. (mm)

  1: Imperial. (inch)

| N9.015 | Teach setting | | P |
| --- | --- | --- | --- |
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0: Enable teaching function of X axis.
- Bit 1: Enable teaching function of Y axis.
- Bit 2: Enable teaching function of Z axis.
- Bit 3: Enable teaching function of A axis.
- Bit 4: Enable teaching function of B axis.
- Bit 5: Enable teaching function of C axis.
- Bit 6: Enable teaching function of U axis.
- Bit 7: Enable teaching function of V axis.
- Bit 8: Enable teaching function of W axis.

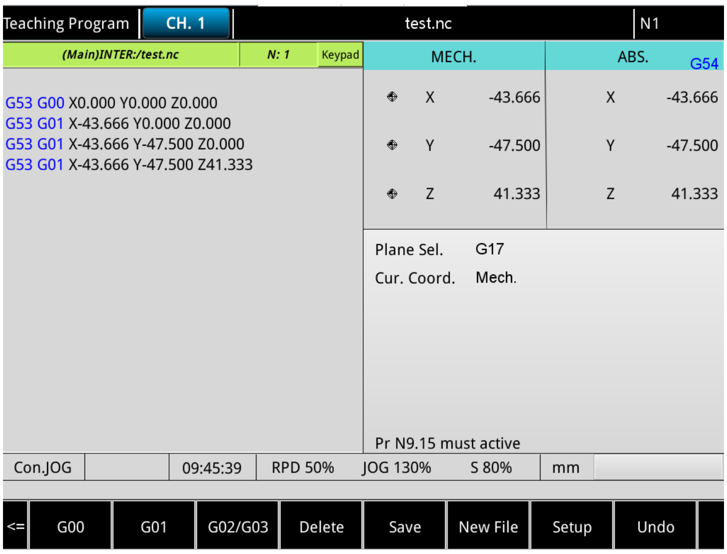
  0: Disable, 1: Enable
- Bit 31: Format for G code teaching function.

  0: Movement axes

  1: All axes.

  The teaching function is designed to help users to quick program their NC program by inserting the target position command automatically. The users can just use JOG or MPG to move the axes to each of the required positions and then decide whether to move with the G00 rapid command or the G01 cutting command, and the system will insert it into the specified NC program.

  The teaching function will only work on the teaching page after the function is enabled.




| N9.016 | System main file setup | | P |
|---|---|---|---|
| Default | 0 | Range | 0 ~ 1 |
| Data Type | Dword | Unit | - |

■ Setting for whether the system loads the specific NC program as the main program.

0: Disable, 1: Enable

| N9.030 | Wood Application Setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

■ The system provides 3 types modes for NC program schedules in the wood working system: Standard 1, Standard 2 and advance mode.

Standard 1

| | Parameter | DOPSoft setting | Cutting | Label Printing | Auto Labeling | Repeat Machining |
|---|---|---|---|---|---|---|
| Function | N9.30 Bit10 When set to 0 | NC file list. Mode display **[Standard]** | ✓ | ✓ | ✗ | ✗ |

Standard 2

| | Parameter | DOPSoft setting | Cutting | Label Printing | Auto Labeling | Repeat Machining |
|---|---|---|---|---|---|---|
| Function | N9.30 Bit10 When set to 1 | NC file list. Mode display **[Standard]** | ✓ | ✓ | ✓ | ✗ |

Advance:

| | Parameter | DOPSoft setting | Cutting | Label Printing | Auto Labeling | Repeat Machining |
|---|---|---|---|---|---|---|
| Function | N9.30 Bit0 When set to 1 | NC file list. Mode display **[Advance]** | ✓ | ✗ | ✗ | ✓ |

■ Bit 0: Enable advance file sequential scheduling function.

0: Disable, 1: Enable

The file sequential scheduling function must be set to **advance** in the component **[NC file list]** in the DOPSoft editor as well as enabled in this parameter to activate the function.

- Bit 1~3: **Advance** file sequential scheduling mode.

  0: Disable.

  1: Front naming. The NC file has the prefix “Z” for front or “F” for back production naming in the file name.

  2: Back naming. The NC file has the suffix “Z” for front or “F” for back production naming in the file name.

  3: Normal. The system will order the NC file names based on the working position 1 or 2, alternating as 1, 2, 1, 2… instead of ordering them based on the file names.

  4: Serial number. The system will order the NC file names by the number used as a prefix in the file name. Those with odd numbers will be in working position 1 and those with even numbers will be in working position 2. Users will need to order these files by modifying the file names in advance, and the system will order them in sequence according to the numerical prefixes.

  Note:

  (1) The NC file naming rule for wood applications is “Z” as front production, “F” as back production, and numbers for product numbers.

  (2) The production process order is back first and then front.

  (3) Products will the same file numbers will be set in the same working position.

  (4) The system will order the NC file names in an alternating manner based on the working position 1 or 2. Thus, users can load & unload the material more efficiently.

  (5) To expand on point 4, if the last product program has front and back process, the system will set this process in the same working position based on the logic described in point 3.

### Front naming example

Example 1:

File list:

| Product List | Back | Front |
|---|---|---|
| Product 1 | F_0001.nc | Z_0001.nc |
| Product 2 | - | Z_0002.nc |
| Product 3 | - | Z_0003.nc |
| Product 4 | F_0004.nc | Z_0004.nc |

Order result:

| NO. | NC FILE | ORK POSITI | COUNT | STATE |
|---|---|---|---|---|
| 1 | F_0001.nc | 1 | 1 | |
| 2 | Z_0002.nc | 2 | 1 | |
| 3 | Z_0001.nc | 1 | 1 | |
| 4 | Z_0003.nc | 2 | 1 | |
| 5 | F_0004.nc | 1 | 1 | |
| 6 | Z_0004.nc | 1 | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |

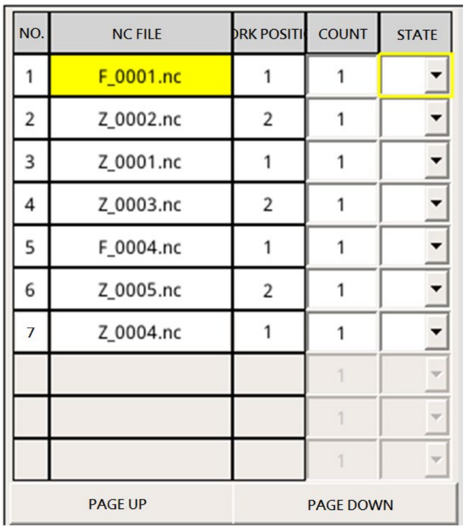
PAGE UP PAGE DOWN

Example 2:

File list:

| Product List | Back | Front |
|---|---|---|
| Product 1 | F_0001.nc | Z_0001.nc |
| Product 2 | - | Z_0002.nc |
| Product 3 | - | Z_0003.nc |
| Product 4 | F_0004.nc | Z_0004.nc |
| Product 5 | - | Z_0005.nc |

Order result:



| NO. | NC FILE | RK POSITI | COUNT | STATE |
|---|---|---|---|---|
| 1 | F_0001.nc | 1 | 1 | |
| 2 | Z_0002.nc | 2 | 1 | |
| 3 | Z_0001.nc | 1 | 1 | |
| 4 | Z_0003.nc | 2 | 1 | |
| 5 | F_0004.nc | 1 | 1 | |
| 6 | Z_0005.nc | 2 | 1 | |
| 7 | Z_0004.nc | 1 | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |

PAGE UP PAGE DOWN

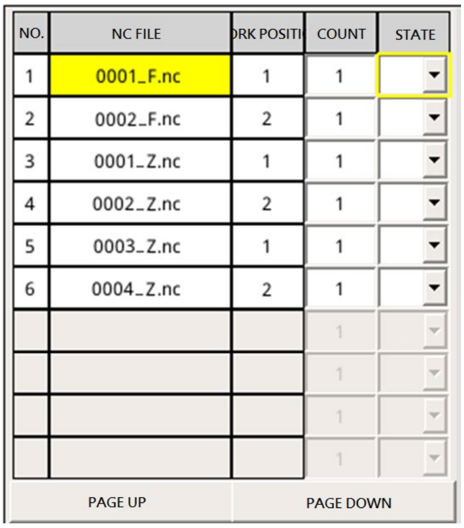
## Back naming example

Example 1:

File list:

| Product List | Back | Front |
|---|---|---|
| Product 1 | 0001_F.nc | 0001_Z.nc |
| Product 2 | 0002_F.nc | 0002_Z.nc |
| Product 3 | - | 0003_Z.nc |
| Product 4 | - | 0004_Z.nc |

Order result:



| NO. | NC FILE | RK POSITI | COUNT | STATE |
|---|---|---|---|---|
| 1 | 0001_F.nc | 1 | 1 | |
| 2 | 0002_F.nc | 2 | 1 | |
| 3 | 0001_Z.nc | 1 | 1 | |
| 4 | 0002_Z.nc | 2 | 1 | |
| 5 | 0003_Z.nc | 1 | 1 | |
| 6 | 0004_Z.nc | 2 | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |

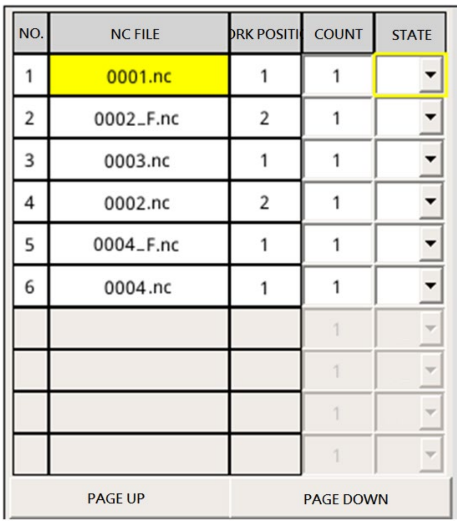
PAGE UP PAGE DOWN

Example 2:

File list:

| Product List | Back | Front |
|---|---|---|
| Product 1 | 0001.nc | - |
| Product 2 | 0002_F.nc | 0002.nc |
| Product 3 | - | 0003.nc |
| Product 4 | 0004_F.nc | 0004.nc |

Order result:



| NO. | NC FILE | RK POSITI | COUNT | STATE |
|---|---|---|---|---|
| 1 | 0001.nc | 1 | 1 | |
| 2 | 0002_F.nc | 2 | 1 | |
| 3 | 0003.nc | 1 | 1 | |
| 4 | 0002.nc | 2 | 1 | |
| 5 | 0004_F.nc | 1 | 1 | |
| 6 | 0004.nc | 1 | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |
| | | | 1 | |

PAGE UP PAGE DOWN

- Bit 4：Whether to delete the finished program automatically in [Standard/Advance] mode.
  0: Disable, 1: Enable
- Bit 8~9：Sequence store mode in the [Standard] mode.
  0: Retentive. The file queue in the file list will be retained after machine reboot.
  1: Auto reload. The file queue in the file list will be retained after machine reboot, furthermore, the system will load the previous program automatically.
  2: Not retentive. The file queue in the file list will be cleared after machine reboot.
- Bit 10：Whether to enable the auto labeling procedure in the [Standard] mode.
  0: Disable. The system will print out all the labels that defined in the XML project at once.
  1: Enable. The system will start auto labeling based on the MLC program logic and will not print out all the labels at once. Please refer to the “Delta_NC5 Woodworking user manual” for details.
- Bit 11：The directory setting of XML and NC program file in the [Standard/Advance] mode.
  The NC program file corresponding to the XML project file.
  0: Same root as XML file.
  1: One directory up from the XML file.

| **N9.100** | **Graphic line color** | | **P** |
|---|---|---|---|
| Default | Black | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic line color.

| **N9.101** | **Graphic background color** | | **P** |
|---|---|---|---|
| Default | Sea | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic background color.

| **N9.102** | **Graphic Grid Color** | | **P** |
|---|---|---|---|
| Default | Iron | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic grid color.

| **N9.103** | **Graphic sub-grid color** | | **P** |
|---|---|---|---|
| Default | Iron | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic sub-grid color.

| N9.104 | Coordinate axes color | | P |
|---|---|---|---|
| Default | Yellow | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for coordinate axes color.



| N9.105 | Graphic reference line color | | P |
|---|---|---|---|
| Default | Light Green | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic reference line color.

| N9.106 | Graphic preview line color | | P |
|---|---|---|---|
| Default | Light Green | Range | 65,535 |
| Data Type | Color | Unit | - |

- Setting for graphic preview line color.

| N9.120 | Graphic display settings | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

- Bit 0~2: Graphic line width.
- Bit 3: Display auxiliary line.
- Bit 4~5: Default display plane.

  0: XZ plane.

  1: XY plane.

  2: XZ plane.

  3: XYZ plane.
- Bit 6~7: Default auto preview speed.

  0: Full speed.

  1: Fast.

  2: Medium.

  3 Slow.

  This parameter is for the program path preview speed when the auto preview function is enabled using the parameter **[N9.121 Bit18]**.

| N9.121 | Graphic utility setting | | P |
|---|---|---|---|
| Default | 0 | Range | - |
| Data Type | Dword | Unit | - |

4

**[Lathe]**

- Bit 17: Retain the plotted graphic after M30.
- Bit 18: Enable auto preview.

  0: Disable, 1: Enable

  The system will automatically plot the main program path on the GRA page's graphic when users switch the main program after enabling this function. The preview line color can be configured in the parameter **[N9.106]**.

**[Milling]**

- Bit 1~2: Display X-Y plane.
- Bit 3~4: Display Y-Z plane.
- Bit 5~6: Display X-Z plane.
- Bit 7~8: Setting for coordinate resource when plotting the graphic path.

  0: Machine coordinate. The system will refer to axes' machine coordinates.

  1: Absolute coordinate. The system will refer to axes' absolute coordinates.

  2: Absolute + workpiece coordinate. The system will refer to axes' absolute coordinates and work piece coordinates such as G54/G55.
- Bit 17: Retain the plotted graphic after M30.
- Bit 18: Enable auto preview.

  0: Disable, 1: Enable

  The system will automatically plot the main program path on the GRA page's graphic when users switch the main program after enabling this function. The preview line color can be configured in the parameter **[N9.106]**.

| N9.130 | Graphic dimension on X-Y plane | | P |
|---|---|---|---|
| Default | 200.0 | Range | 5 ~ 100,000 |
| Data Type | Float | Unit | mm / inch |

- Setting for dimension on X-Y plane of the graphic display on the GRA page.

| N9.131 | Graphic dimension on Y-Z plane | | P |
|---|---|---|---|
| Default | 200.0 | Range | 5 ~ 100,000 |
| Data Type | Float | Unit | mm / inch |

- Setting for dimension on Y-Z plane of the graphic display on the GRA page.

| N9.132 | Graphic dimension on X-Z plane | | | P |
|---|---|---|---|---|
| Default | 200.0 | Range | 5 ~ 100,000 | |
| Data Type | Float | Unit | mm / inch | |

■ Setting for dimension on X-Z plane of the graphic display on the GRA page.



| N9.133 | Graphic dimension on X-Y-Z plane | | | P |
|---|---|---|---|---|
| Default | 200.0 | Range | 5 ~ 100,000 | |
| Data Type | Float | Unit | mm / inch | |

■ Setting for dimension on X-Y-Z plane of the graphic display on the GRA page.

# 4.10 Table parameters

The NC5 controller includes many complicated parameter definitions, which are presented in the following table to allow users to configure settings rapidly and easily.

## 4.10.1 Tool magazine parameter

| PhyMaga | Enable | ToolOffset | PotNumber | SelectPot | Channel | logicMaga | Continue |
|---|---|---|---|---|---|---|---|
| Maga1 | ☑ | 1 | 10 | 1 | 1 | 1 | 0 |
| Maga2 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga3 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga4 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga5 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga6 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga7 | ☐ | 0 | 0 | | 0 | | 0 |
| Maga8 | ☐ | 0 | 0 | | 0 | | 0 |
| No.1 tool magazine utility1 : Tool magazine(0 : off ; 1 : on) | | | | | | | |

The NC5 controller system provides 8 tool magazines in total, and users can apply each of them to NC channels. Each NC channel can be allocated up to 2 tool magazines. All settings are in the tool magazine parameter page.

Interface description as follows:

1. Enable: Whether to enable the specified tool magazine.
2. ToolOffset: The initial tool number after tool magazine reset.
3. PotNumber: Amount of tool pots.

   Note:

   The tool pot number and tool amount are not connected. The tool total amount can be set in the parameters **[N0.408]** – **[N0.415]**.
4. SelectPot: Standby tool pot number after tool magazine reset.
5. Channel: The NC channel number for this tool magazine. One NC channel has a maximum of 2 sets of tool magazines.
6. LogicMaga: The tool magazine sequence number in the NC channel.
7. Continue: This function is currently reserved.

# 4.10.2 NC path parameter

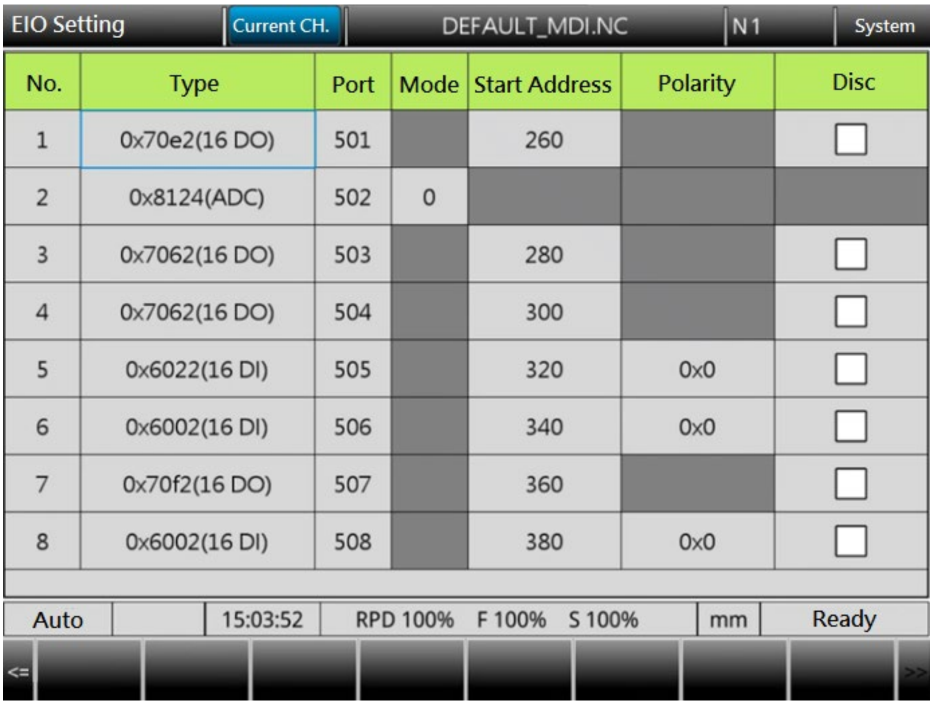
| Channel | | Axis | Enable | Type | SP ID | Port | Serial | Display | InterPret | DisplayName |
|---|---|---|---|---|---|---|---|---|---|---|
| CH 1 | | X | ☑ | 1 | | 1 | 1 | ☑ | X | X |
| | | Y | ☑ | 1 | | 2 | 2 | ☑ | Y | Y |
| | | Z | ☑ | 1 | | 3 | 3 | ☑ | Z | Z |
| | | A | ☑ | 1 | | 4 | 4 | ☑ | A | A |
| | | B | ☐ | | | | | ☐ | | |
| | | C | ☐ | | | | | ☐ | | |
| | | U | ☐ | | | | | ☐ | | |
| | | V | ☐ | | | | | ☐ | | |
| | | W | ☐ | | | | | ☐ | | |
| | | AX1 | ☐ | | | | | ☐ | | |
| | | AX2 | ☐ | | | | | ☐ | | |
| | | AX3 | ☐ | | | | | ☐ | | |
| | | SP1 | ☑ | 3 | 1 | 4 | | ☐ | | |
| | | SP2 | ☑ | 3 | 2 | 5 | | ☐ | | |
| Model | MILL | SP3 | ☑ | 3 | 3 | 6 | | ☐ | | |
| Enable | ☑ | SP4 | ☑ | 3 | 4 | 7 | | ☐ | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Con.JOG | *Alarm* | 14:26:28 | RPD 100% | JOG 100% | S 100% | mm | Servo not Ready |

The NC channel configuration page allows users to define their machine type and requirements, including control type, axes type, enabled axes, axes naming, and axes display name. The interface description is as follows:

1. Path: Display the current NC path, such as CH1/CH2/CH3/CH4.
2. Model: Set the current machine type, such as lathe, milling, woodworking or multi head. Note: If set as lathe type machine, the parameter **[N1.08 Lathe G code type]** need to configure.
3. Axis: Axis name in the NC path.
4. Enable: Whether to use this axis in the NC path.
5. Type: Set the axis to functional type or spindle type.
   1: NC axis, these axes can be switched between MLC axis or NC axis from the MLC.
   2: MLC axis, cannot be switched to NC axis.
   3: EtherCAT communication control type spindle.
   4: Analog voltage control type spindle.
   5: Pulse control type spindle.
6. SP ID: Spindle ID for NC system. (Range from 1–4, no duplicates allowed)
7. Port: Normal axis: Allocate the EtherCAT device addresses for the axis. (Such as P3-00 for Delta servo drives)
   Analog spindle: Setting for the port number on the CN1 connector. (Range 1-2)
   Pulse spindle: Setting for the port number on the SPINDLE connector. (Range 1-2)
8. Serial: The axis sequence for the NC system, it is recommended to set it as the port ID. (Range from 1–32, no duplicates allowed)
9. Display: Whether to display the axis information.
10. Interpret: Setting for the axis code for the NC system to be recognized in the NC program. (Please refers to the NC5 G Command Guidelines)
11. DisplayName: The display name on the interface.

## 4.10.3 EIO – Remote module setting




The EIO setting interface is for remote modules. The system will display the I/O modules that are connected on the EtherCAT field bus. Users can make configurations such as X or Y relay devices numbers and input/output range. The interface description is as follows:

1. NO.: The sequence number of the remote module connected on the EtherCAT field bus.
2. Type: The product code of the connected EtherCAT remote module.
3. Port: The device's port address number on the EtherCAT remote module.
   Range from 501~520.
   This address is for X or Y relays, no duplicates allowed.
4. Mode: This is for the setting ranges for analog output/input modules.
   For related settings, please see:

| R1-EC8124 | |
|---|---|
| Mode | Analog input range |
| 0 | -5 ~ +5 V |
| 1 | -10 ~ +10 V |
| 2 | 0 ~ +5 V |
| 3 | 0 ~ +10 V |
| 4 | 0 ~ +20 mA |
| 5 | 4 ~ +20 mA |
| 6 | 0 ~ +24 mA |
| 7 | -10 ~ +10 mA |
| 8 | -20 ~ +20 mA |

| R1-EC9144 | |
|---|---|
| Mode | Analog output range |
| 0 | 0 ~ +5 V |
| 1 | 0 ~ +10 V |
| 2 | -5 ~ +5 V |
| 3 | -10 ~ +10 V |
| 4 | +4 ~ +20 mA |
| 5 | 0 ~ +20 mA |
| 6 | 0 ~ +24 mA |

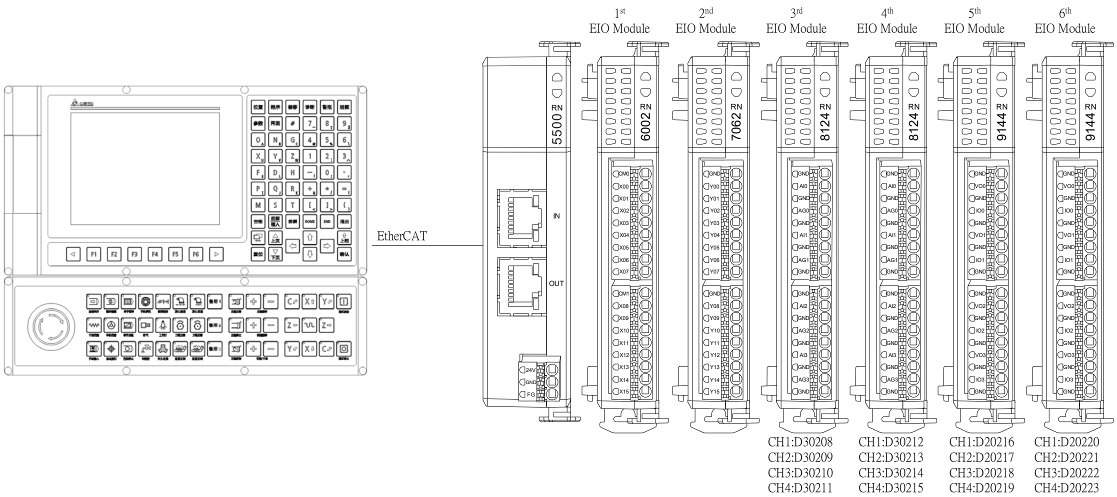
5. Start Address: Setting for the X or Y relay start number for digital input or output devices. The system will apply the X or Y relay beginning with this configuration, and the amount is based on the module's actual points (minimum of 16 points).
   The range is from 256 to 511, 256 points in total. Furthermore, the last module needs to consider whether the last point exceeds the available range.

Example 1: The user connects the R2-EC0902, which contains 32 digital inputs and 32 digital outputs, and then sets the start address to 256. The system will apply X256 to update the 1st digital input of the R2-EC0902 and X287 to update the last digital input. In addition, the Y256 will apply to control the 1st digital output and the Y287 can control the last digital output.

Example 2: The user connects the R2-EC6002, which only contains 16 digital inputs, and then sets the start address to 288. The system will apply X288 to update the 1st digital input of the R2-EC6002 and X303 to update the last digital input. However, the same range for the Y relays between Y288 to Y303 will be reserved by the system.

6. Polarity: Setting for the polarity of digital inputs.
   (The device needs to also support this function)
7. Disc: Setting for whether the digital output devices need to retain the output status.
   (The device needs to also support this function)

The station number setting of the EIO remote module is based on the connection sequence of the EtherCAT identifiable modules. If a module with analog voltage output or input functions is used, it must be connected to the 1st to 8th remote module of the NC5 connection. As shown in the figure below. The servo driver and R1-EC5500 are not included in the arrangement calculation of the EIO module.



## 4.10.4 Compensation parameter

4

This section mainly describes the relevant parameters for pitch compensation. The interface is in a table format and users can use the compensation file from Renishaw to import to the system.


| Group | NUM | Param Name | PRS | X | Y |
|---|---|---|---|---|---|
| N3 | 0 | Backlash compensation amount | R | 0.000 | 0.000 |
| N3 | 1 | Backlash compensation time | R | 0 | 0 |
| N3 | 2 | Backlash compensation delay time | R | 0 | 0 |
| N3 | 3 | compensation setting | R | | |
| | | Absolute or increment input(0: Abs, 1: Inc) | R | 0 | 0 |
| | | Measuring direction(0: positive, 1: negative) | R | 0 | 0 |
| | | Bi-directional thread pitch compensation(0: Off, 1: On) | R | 0 | 0 |
| | | BackLash Compensation mode(0: average mode, 1: oneway mode) | R | 0 | 0 |
| | | BackLash Compensation(0: S type, 1: Exponential type) | R | 0 | 0 |
| N3 | 4 | Measuring point number | R | 512 | 0 |
| N3 | 5 | Measuring interval | R | 10.000 | 0.000 |
| N3 | 6 | Measuring offset | R | 10.000 | 0.000 |

In the parameter interface, users can click the compensation (Compen.) button to enter the compensation configuration page as shown in the above figure. Then press **F1** or click **[Pitch Comp.]** to enter the pitch compensation interface as shown in the below figure.

In this pitch compensation table, the system will compensate the position error in both directions on the enabled axes. Users can fill in the pitch compensation value manually or by importing the Renishaw compensation file by pressing **F2** for **[Import Ren.]**.


| Num | X | -X | Y | -Y | Z | -Z | A | -A |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 2 | 0.20000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 3 | 0.30000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 4 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 7 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 8 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 9 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 10 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 11 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 12 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 13 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 14 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 15 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 16 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

In the below Renishaw compensation import page, users can press **F1** for **[Load Ren.]** to select the file and then obtain the compensation information including position data. Users can again to modify the measurement direction, data type, compensation mode and compensation type, and then finally select **[F4 Import +]** or **[F3 Import]** to import to the pitch compensation table automatically.

# Application Examples 5

This chapter provides commonly used MLC applications, including examples such as analog spindle gear switch, one-button macro call, MLC axes switching and synchronous control.

5

## 5.1 Mode Switch

The NC5 controller provides 8 different types of system modes, which can be switched by setting the MLC special D2x000, and the special M can be used to monitor the mode status.

### ■ MLC special D

| NC Mode Switch | Value | Mode | Mode Status |
|---|---|---|---|
| D2x000 | 0 | AUTO | M3x000 |
| | 1 | EDIT | M3x001 |
| | 2 | MDI | M3x002 |
| | 3 | MPG | M3x003 |
| | 4 | JOG | M3x004 |
| | 5 | RAPID | M3x005 |
| | 6 | INC | M3x006 |
| | 7 | HOME | M3x007 |

**[NC Mode Switch] D2x000**

The NC system uses this D2x000 to switch between different NC modes. The x in D2x000 represents different NC channels.

**[Mode Status] M3x000 ~ M3x007**

When the NC successfully switches to a different mode, the NC mode statuses M3x000 to M3x007 will respond within 4ms.

### ■ MLC Example

In the below MLC program example, a scenario is demonstrated where users use a real hardware button to switch the NC mode of channel 1 to general-purpose use. Two different types of methods are described, including button and knob.

**Button Type:**

The mode switch signal is triggered only when the user presses the button as a DI signal. Therefore, at each DI trigger, the MLC writes the corresponding decimal value to D21000 with the MOV instruction. In addition, M31000 can be used to obtain whether the system is in AUTO mode. If yes, MLC will output a DO signal.

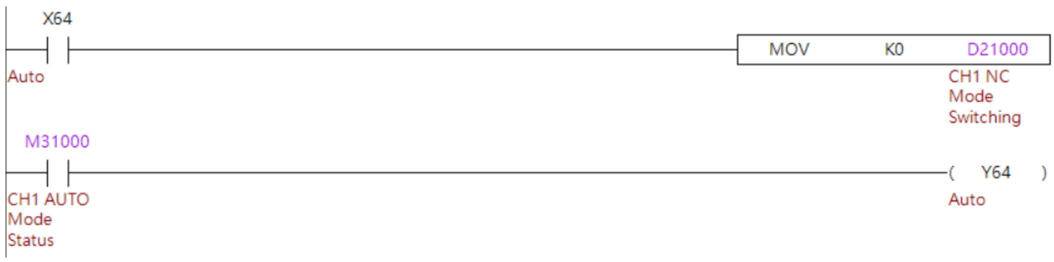



Figure 5.1.1 Mode switch by DI button

**Knob Type:**

The trigger signals input to the MLC continuously. Therefore, when users use the VRT instruction to create the table (as shown in Figure 5.1.2) and input the corresponding values to the table, the VRT instruction outputs the corresponding values to the register. Next, the MOV instruction moves the values to the D21000 to switch the system mode and the system uses the **[Mode Status]** special M to output signals.

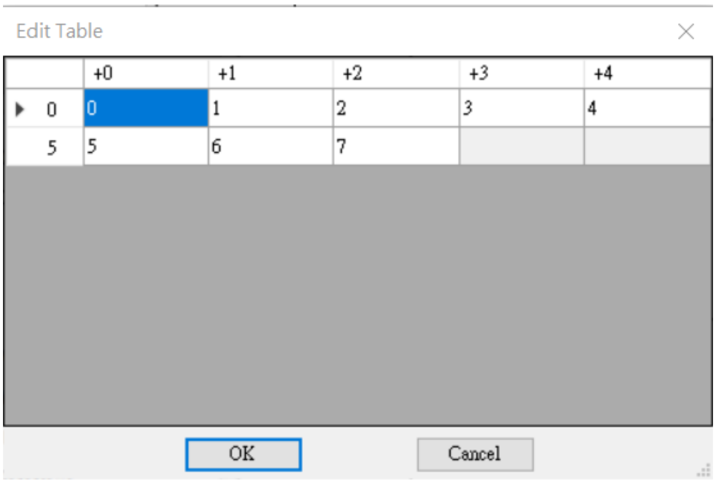



Figure 5.1.2 VRT table


Figure 5.1.3 Mode switching by knob

5

## 5.2 Machining, single block, and feed rate override

On the controller, users can use the special M relays to start and stop the machining. In addition, users can switch to single block execution mode and change the machining speed override setting.

### ■ MLC special D

| | | | |
|---|---|---|---|
| Cycle Start | M2x000 | Cycle Start Status | M3x016 |
| Feed Hold | M2x001 | Feed Hold Status | M3x017 |
| NC Reset | M2x004 | Program End Finished | M3x021 |
| Enable Dry Run | M2x005 | M02 Cycle Stop | M3x022 |
| MPG Simulation | M2x006 | M30 Cycle Stop and Index Reset | M3x023 |
| Single Block | M2x008 | Single Block Hold | M3x024 |
| Optional Stop | M2x009 | M00 System Hold | M3x037 |
| Single Block Skip ('/') | M2x010 | M01 Optional Stop | M3x038 |

| | | | |
|---|---|---|---|
| Feed Rate Percentage | D2x002 | Feed Rate for JOG, INC and Dry Run Mode | D2x006 |
| Rapid Speed Percentage | D2x004 | - | - |

**[Cycle Start, Cycle Start Status] M2x000, M3x016**

When the controller is in AUTO or MDI mode, if the **[Cycle Start]** is triggered, the system will load the main program or MDI program and then start execution. The controller will execute the NC program and the **[Cycle Start Status]** will be set to ON.

- **[Cycle Start]** This trigger must stay as ON for at least one MLC cycle to activate the function.
- **[Cycle Start Status]** After this status changes to ON, the system will automatically reset to OFF in the following situations.
  a. When the NC program is processing but **[Single Block]** is triggered. After the current block is finished this status will be OFF.
  b. When the NC program finishes the M00, M02 or M30 command.
  c. When the NC program is processing but **[NC Reset]** is triggered.
  d. When the NC program finishes the last block command.
  e. When the NC program is processing but **[NC Mode switch]** changes.

**[Feed Hold, Feed Hold Status] M2x001, M3x017**

When the controller is in AUTO or MDI mode, if **[Feed Hold]** is triggered, the system will pause the current process and then set **[Feed Hold Status]** to ON.

- **[Feed Hold]** This trigger must stay as ON for at least one MLC cycle to activate the process.
- **[Feed Hold Status]** After this status changes to ON, it will automatically reset to OFF in the following situations.
  a. After **[Cycle Start]** is triggered again, the system will continue the previous process.
  **b.** After **[NC Reset]** is triggered, the system will stop and reset all statuses.

**[Dry Run, Feed Rate] M2x005, D2x006**

When the controller is in AUTO or MDI mode, if **[Dry Run]** is triggered, the system will load the main program or MDI program and then start the execution with the **[Feed Rate]** speed.

- When **[Dry Run]** is triggered as ON, the system will take **[Feed Rate]** as the process speed.
- When the system is executing in dry run mode and the **[Dry Run]** is reset to OFF, the system will continue running but at the NC programed speed.

**[MPG Simulation] M2x006**

When the controller is in AUTO or MDI mode, if the **[MPG Simulation]** is triggered, the system will execute the entire block command with the MPG rotate speed.

- Besides motion type commands, all other NC programs will execute as normal when the **[MPG Simulation]** is set to ON.
- If the **[MPG Simulation]** is triggered and the system is executing the NC program, the controller system will pause the NC process immediately.
- After the **[MPG Simulation]** is triggered during the system executing the NC program and the system pauses the process, if the **[MPG Simulation]** is reset to OFF, the system will resume the process right away.

**[Single Block, Single Block Hold] M2x008, M3x024**

When the controller is in AUTO or MDI mode, users can switch **[Single Block]** to ON at any time as long as it is before processing or during the NC executing. The system will execute one block command each time **[Cycle Start]** is triggered.

- The **[Single Block]** is enabled before the **[Cycle Start]**. The system will execute one block command once **[Cycle Start]** is triggered, and then hold the process and set **[Single Block Hold]** to ON after each block command is finished.
- When the **[Single Block]** is enabled during NC execution, the system will finish its current block command and then hold the process and set **[Single Block Hold]** to ON.
- When the **[Single Block]** is enabled and the system holds the process, users can trigger the **[Cycle Start]** to continue to the next command block.
- The **[Single Block]** is disabled when the system is in hold status. The system will set **[Single Block Hold]** to OFF automatically after users set **[Cycle Start]** to ON and continue to the next process.

**[Optional Stop, M01 Optional Stop] M2x009, M3x038**

When the controller is in AUTO or MDI mode, if users set **[Optional Stop]** to ON, the system will pause the process or the system will set **[M01 Optional Stop]** to ON once the NC block command is M01.

- When the **[Optional Stop]** is ON and the system holds the process due to execute the M01 command, users can trigger the **[Cycle Start]** again to continue the process.
- When the system is in hold status and releases the **[Optional Stop]** to OFF, the system will continue the process after users trigger the **[Cycle Start]**.
- After the **[M01 Optional Stop]** is ON, it will automatically reset to OFF in the following situations.
  a. After the **[Cycle Start]** has been set to ON again.
  b. After the **[NC Reset]** has been triggered.

**[Single Block Skip] M2x010**

When the controller is in AUTO or MDI mode, if users set **[Single Block Skip]** to ON, the system will skip every command block that starts with the '/' symbol.

**[Program End Finished, M02 Cycle Stop, M30 Cycle Stop and Index Reset, M00 System Hold] M3x021, M3x022, M3x023, M3x037**

When the controller is in AUTO or MDI mode, these special M will be triggered when the last command block is M02, M30, M00 or there are no further blocks.

- When the system executes the last block as M02, M30 or there are no further blocks, regardless of whether it is a sub-program or main program, the **[Program End Finished]** will be ON automatically.
  When the last block is M99, the **[Program End Finished]** will NOT be ON due to the M99 being a continuous command.
- After **[Program End Finished, M02 Cycle Stop, M30 Cycle Stop and Index Reset, M00 System Hold]** are triggered, they will be reset to OFF in the following situations.
  a. After the **[Cycle Start]** has been set to ON again.
  b. After the **[NC Reset]** has been triggered.

**[Feed Rate Percentage] D2x002**

When the controller is in AUTO or MDI mode, the system will take the program speed or dry run speed as a reference to multiply this **[Feed Rate Percentage]** and derive the final process feed. For example, the program feed is 1000 mm/min and **[Feed Rate Percentage]** is 50. The system will execute the NC program as feed 1000 x 50% = F500 mm/min.

- **[Feed Rate Percentage]** this percentage is only available up to 150%.
- The final feed speed will be limit by the parameter N1.033 (Feed Maximum) (mm/min).
- The system's current process feed will activate right away when this percentage changes.

■ **Relevant Parameter**

**Feed rate setting:**

N1.033 (Feed Maximum)

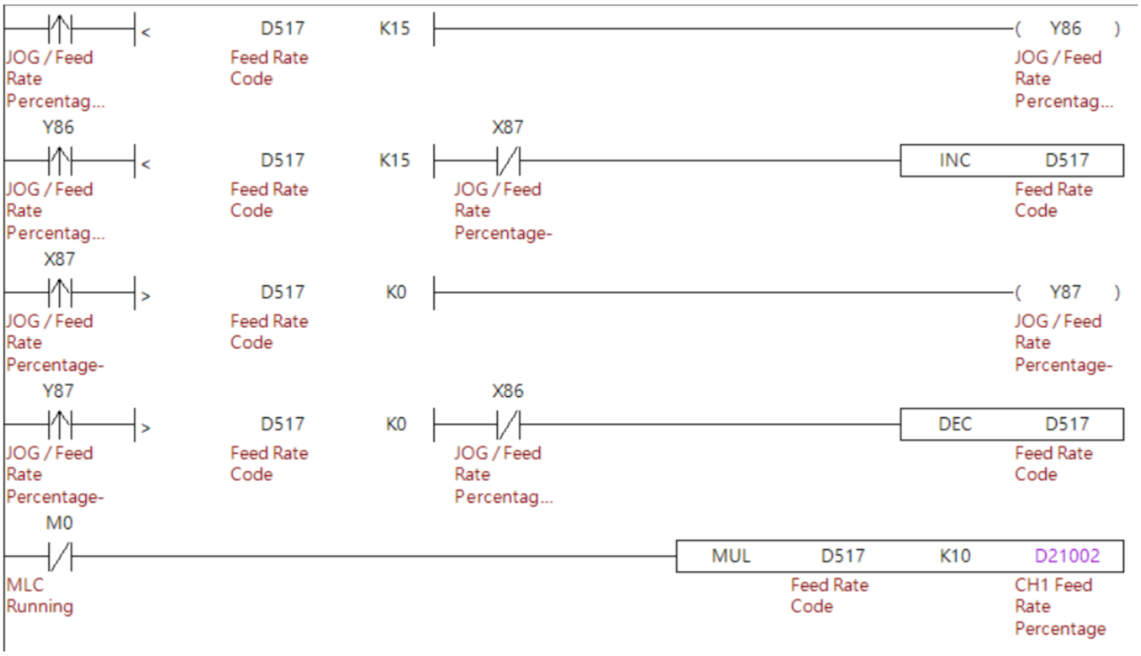
- When the controller is in AUTO or MDI mode, the system will take the program speed or dry run speed as a reference to multiply this **[Feed Rate Percentage]** as the final process feed but this final speed will be limited by the parameter N1.033.

## ■ MLC Example


**Program execution procedure (based on NC channel 1)**

1. Use the button signal to activate the machining operation and use the normally open (A) contact to limit the mode to AUTO or MDI.
2. The system sets **[Cycle Start Status]** to ON, and then sets the cycle start DO to ON.
3. The system can trigger **[Feed Hold]** only when the program is being executed.
4. When the program pauses, the program feed hold DO is set to ON.


1. Use the rising edge of the key signal to trigger ALT and to switch the special M for enabling/disabling the **[Single Block Skip]** function.
2. Use the rising edge of the key signal to trigger ALT and to switch the special M for enabling/disabling the **[Single Block]** function.
3. Use the rising edge of the key signal to trigger ALT and to switch the special M for enabling/disabling the **[Optional Hold]** function.
4. Use the rising edge of the key signal to trigger ALT and to switch the special M for enabling/disabling the **[MPG Simulation]**.




1. Use the key signal to set the cutting feed rate override, with the maximum as 15 and the minimum as 0 and write this feed rate override ratio to the register.
2. Multiply the feed rate override ratio by 10 and save the result to the **[Feed Rate Percentage]**.

# 5.3 MPG

On the NC5 controller, the axis and feed rate for MPG operation is switched with special D registers.

5

## ■ MLC special D register

| MPG Axes Selection | D2x008 | MPG Ratio Selection | D2x009 |
|---|---|---|---|

**[MPG Axes Selection] D2x008**

Users can switch the MPG axis by setting this special D to the indicated axes as below.

0 = X Axis, 1 = Y Axis, 2 = Z Axis, 3 = A Axis, 4 = B Axis, and so forth to the $16^{th}$ Axis.

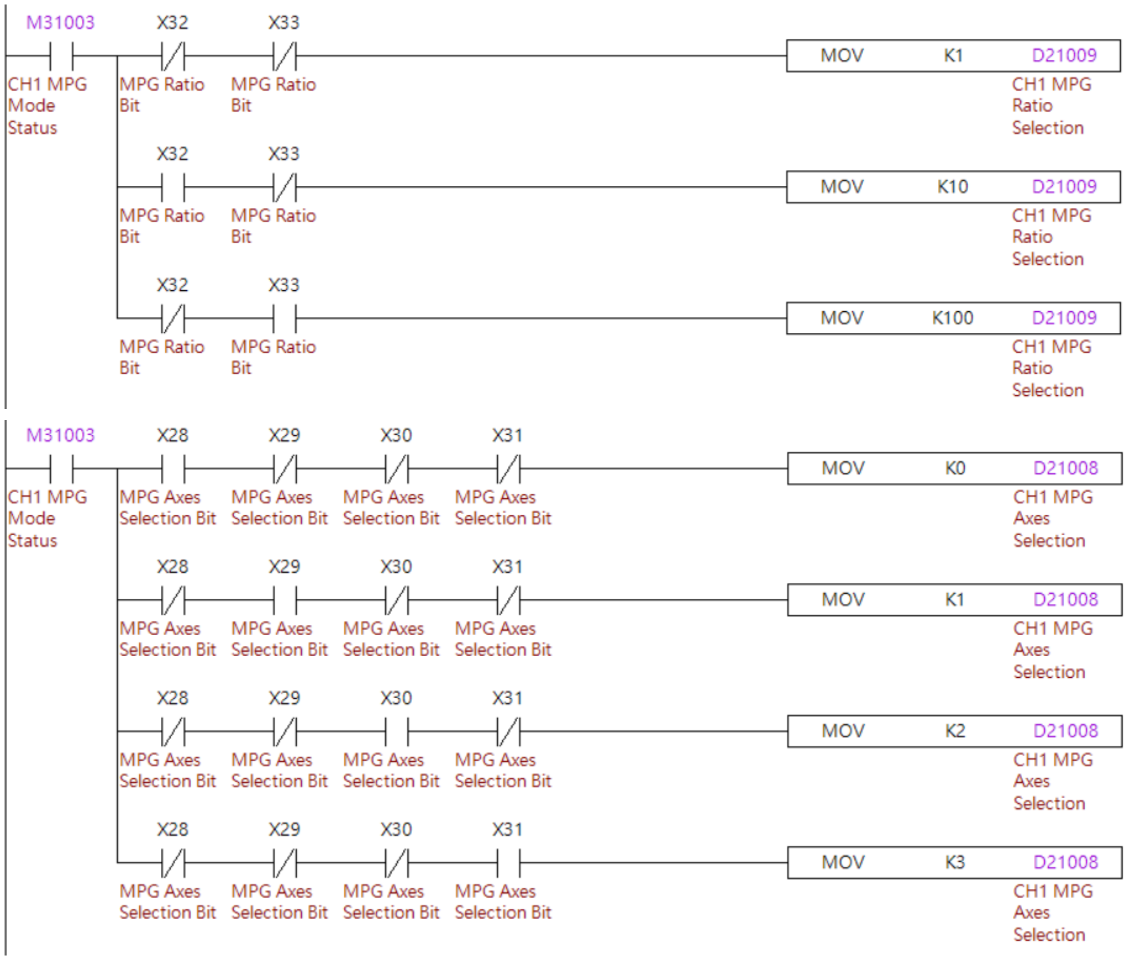
**[MPG Ratio Selection] D2x009**

This **[MPG Ratio Selection]** can be set to 1, 10 or 100. When users rotate one unit from the wheel, the system will obtain 1 pulse from the MPG device. The system will take the parameter **N9.013 (Unit Decimal Point)** as the command unit for each pulse. In addition, the system will multiply the **[MPG Ratio Selection]** as the ratio for the final command sent to a specific axis.

For example: **[MPG Ratio Selection]** is 10 and the N9.013 (Unit Decimal Point) set to 0.001mm. The minimum movement of the MPG control will be 0.001 × 10 = 0.01 mm.

5

## MLC Example




**Program execution procedure**

1. In MPG mode, use the MPG signal to choose the **[MPG Ratio Selection]** to use.
2. Use the MPG signal to select the axis to move.
3. **[MPG Axes Selection]** Operate the MPG to move the axis.

# 5.4 JOG move



On the NC5 controller, the speed and movement for JOG operation is determined by the MLC. JOG applications are as follows.

## ■ MLC special D

| Axis | JOG Forward | JOG Reverse | Lock Axis Forward Movement | Lock Axis Reverse Movement | Axis Moving | Moving in Positive Direction | Moving in Reverse Direction | Feed Rate Override |
|---|---|---|---|---|---|---|---|---|
| X Axis | M2x384 | M2x400 | M2x336 | M2x352 | M3x464 | M3x480 | M3x496 | D2x006 |
| Y Axis | M2x385 | M2x401 | M2x337 | M2x353 | M3x465 | M3x481 | M3x497 | |
| Z Axis | M2x386 | M2x402 | M2x338 | M2x354 | M3x466 | M3x482 | M3x498 | |
| A Axis | M2x387 | M2x403 | M2x339 | M2x355 | M3x467 | M3x483 | M3x499 | |
| B Axis | M2x388 | M2x404 | M2x340 | M2x356 | M3x468 | M3x484 | M3x500 | |
| C Axis | M2x389 | M2x405 | M2x341 | M2x357 | M3x469 | M3x485 | M3x501 | |
| U Axis | M2x390 | M2x406 | M2x342 | M2x358 | M3x470 | M3x486 | M3x502 | |
| V Axis | M2x391 | M2x407 | M2x343 | M2x359 | M3x471 | M3x487 | M3x503 | |
| W Axis | M2x392 | M2x408 | M2x344 | M2x360 | M3x472 | M3x488 | M3x504 | |
| $10^{th}$ Axis | M2x393 | M2x409 | M2x345 | M2x361 | M3x473 | M3x489 | M3x505 | |
| $11^{th}$ Axis | M2x394 | M2x410 | M2x346 | M2x362 | M3x474 | M3x490 | M3x506 | |
| $12^{th}$ Axis | M2x395 | M2x411 | M2x347 | M2x363 | M3x475 | M3x491 | M3x507 | |
| $13^{th}$ Axis | M2x396 | M2x412 | M2x348 | M2x364 | M3x476 | M3x492 | M3x508 | |
| $14^{th}$ Axis | M2x397 | M2x413 | M2x349 | M2x365 | M3x477 | M3x493 | M3x509 | |
| $15^{th}$ Axis | M2x398 | M2x414 | M2x350 | M2x366 | M3x478 | M3x494 | M3x510 | |
| $16^{th}$ Axis | M2x399 | M2x415 | M2x351 | M2x367 | M3x479 | M3x495 | M3x511 | |

**[JOG Forward] M2x384 ~ M2x399**

When the controller is in JOG mode, users can move any of the axes forward or stop by setting the **[JOG Forward]** to ON or OFF.

**[JOG Reverse] M2x400 ~ M2x415**

When the controller is in JOG mode, users can move any of the axes reverse or stop by setting the **[JOG Reverse]** to ON or OFF.

**[Lock Axis Forward Movement] M2x336 ~ M2x351**

When the **[Lock Axis Forward Movement]** is ON, the axis will not be able to move in the forward direction. Reset it to OFF to disable the limitation.

**[Lock Axis Reverse Movement] M2x352 ~ M2x367**

When the **[Lock Axis Reverse Movement]** is ON, the axis will not be able to move in the reverse direction. Reset it to OFF to disable the limitation.

**[Axis Moving] M3x464 ~ M3x479**

When any of the axes is in motion, no matter which direction, the system will set this **[Axis Moving]** to ON. Otherwise, this **[Axis Moving]** will be OFF when the corresponding axis is still.

5

**[Moving in Positive Direction] M3x480 ~ M3x495**

When the axis is moving forward, the system will set this **[Moving in Positive Direction]** to ON. On the other hand, when the axis is still or moving backward, this **[Moving in Positive Direction]** will be OFF.

**[Moving in Reverse Direction] M3x496 ~ M3x511**

When the axis is moving a reverse direction, the system will set this **[Moving in Reverse Direction]** to ON. On the other hand, when the axis is still or moving forward, this **[Moving in Reverse Direction]** will be OFF.

**[Feed Rate Override] D2x006**

When the controller is in JOG mode, the system will take **N2.030 (JOG Maximum Speed)** and then multiply the **[Feed Rate Override]** to derive the JOG speed. The linear axes will move in the mm/min and the rotary axes will reference the parameter N2.001 (Rotary Axes' Unit) and then move in the unit RPM or degree/min.

- **[Feed Rate Override]** value range 0 ~ 100.

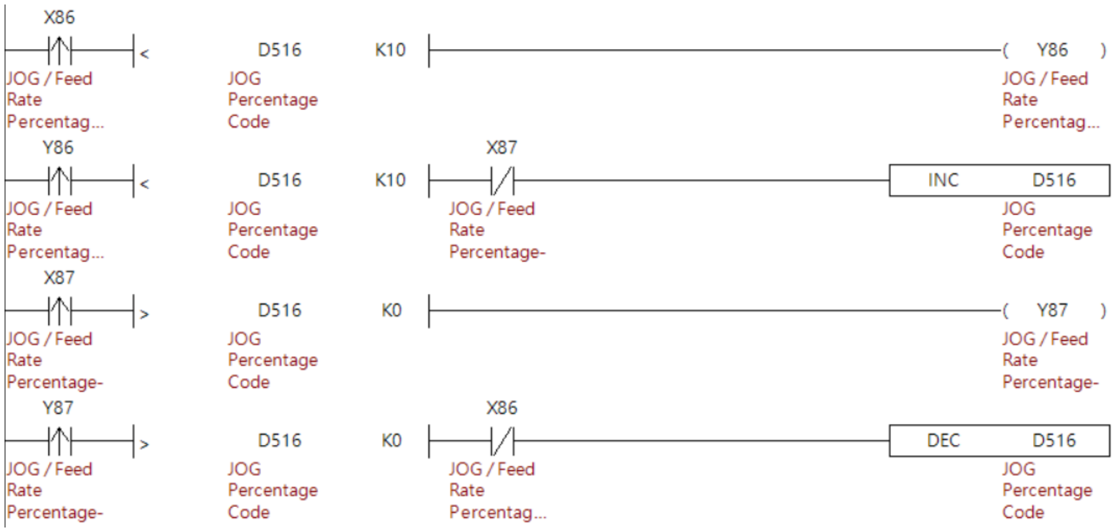
## Relevant Parameter

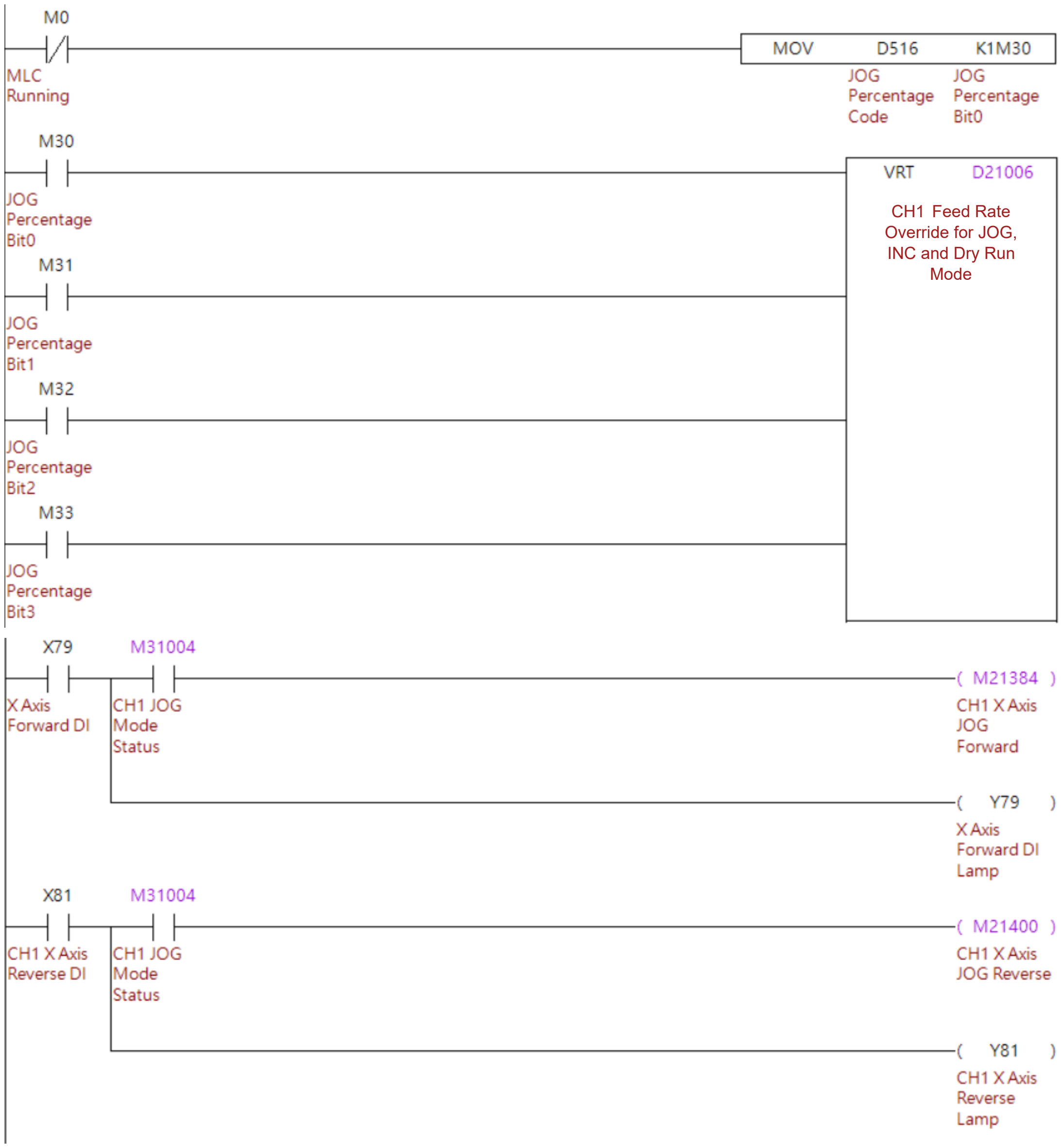
**Speed parameter setting:**

This JOG speed will be effected by N2.030 (JOG Maximum Speed), N2.031 (JOG Acc and Dec Time) and N2.032 (JOG S Curve Time).

## MLC Example

The **[Feed Rate Override]** can be edited at any time even if the axes are moving.






**Program execution procedure**

1. Use the key signal to increase or decrease the value of **[Feed Rate Override]**, with the maximum as 10 and the minimum as 0, and then write the value to the register.
2. Use the MOV instruction to move the override value of the register to the digit of K1M30.
3. Use the digit of K1M30 to input the value of the VRT table to D21006.
4. Perform the X-axis jog operation using the X-axis positive / negative JOG keys.

## 5.5 INC move

On the NC5 controller, the speed and movement for INC operations are determined by the MLC. INC applications are as follows.

■ **MLC special D**

| Axis | JOG Forward | JOG Reverse | Lock Axis Forward Movement | Lock Axis Reverse Movement | Axis Moving | Moving in Positive Direction | Moving in Reverse Direction | Feed Rate Override | Axes Movement in INC Mode |
|---|---|---|---|---|---|---|---|---|---|
| X Axis | M2x384 | M2x400 | M2x336 | M2x352 | M3x464 | M3x480 | M3x496 | D2x006 | D2x014 |
| Y Axis | M2x385 | M2x401 | M2x337 | M2x353 | M3x465 | M3x481 | M3x497 | | |
| Z Axis | M2x386 | M2x402 | M2x338 | M2x354 | M3x466 | M3x482 | M3x498 | | |
| A Axis | M2x387 | M2x403 | M2x339 | M2x355 | M3x467 | M3x483 | M3x499 | | |
| B Axis | M2x388 | M2x404 | M2x340 | M2x356 | M3x468 | M3x484 | M3x500 | | |
| C Axis | M2x389 | M2x405 | M2x341 | M2x357 | M3x469 | M3x485 | M3x501 | | |
| U Axis | M2x390 | M2x406 | M2x342 | M2x358 | M3x470 | M3x486 | M3x502 | | |
| V Axis | M2x391 | M2x407 | M2x343 | M2x359 | M3x471 | M3x487 | M3x503 | | |
| W Axis | M2x392 | M2x408 | M2x344 | M2x360 | M3x472 | M3x488 | M3x504 | | |
| 10th Axis | M2x393 | M2x409 | M2x345 | M2x361 | M3x473 | M3x489 | M3x505 | | |
| 11th Axis | M2x394 | M2x410 | M2x346 | M2x362 | M3x474 | M3x490 | M3x506 | | |
| 12th Axis | M2x395 | M2x411 | M2x347 | M2x363 | M3x475 | M3x491 | M3x507 | | |
| 13th Axis | M2x396 | M2x412 | M2x348 | M2x364 | M3x476 | M3x492 | M3x508 | | |
| 14th Axis | M2x397 | M2x413 | M2x349 | M2x365 | M3x477 | M3x493 | M3x509 | | |
| 15th Axis | M2x398 | M2x414 | M2x350 | M2x366 | M3x478 | M3x494 | M3x510 | | |
| 16th Axis | M2x399 | M2x415 | M2x351 | M2x367 | M3x479 | M3x495 | M3x511 | | |

**[JOG Forward] M2x384 ~ M2x399**

When the controller is in INC mode, users can move any of the axes forward with a movement by setting the **[JOG Forward]** to ON.

**[JOG Reverse] M2x400 ~ M2x415**

When the controller is in INC mode, users can move any of the axes reverse with a movement by setting the **[JOG Reverse]** to ON.

**[Lock Axis Forward Movement] M2x336 ~ M2x351**

When the **[Lock Axis Forward Movement]** is ON, the axis will not be able to move in the forward direction. Reset it to OFF to disable the limitation.

**[Lock Axis Reverse Movement] M2x352 ~ M2x367**

When the **[Lock Axis Reverse Movement]** is ON, the axis will not be able to move in the reverse direction. Reset it to OFF to disable the limitation.

**[Axis Moving] M3x464 ~ M3x479**

When any of the axes is in motion, no matter which direction, the system will set this **[Axis Moving]** to ON. Otherwise, this **[Axis Moving]** will be OFF when the corresponding axis is still.

**[Moving in Positive Direction] M3x480 ~ M3x495**

When the axis is moving forward, the system will set this **[Moving in Positive Direction]** to ON. On the other hand, when the axis is still or moving backward, this **[Moving in Positive Direction]** will be OFF.

**[Moving in Reverse Direction] M3x496 ~ M3x511**

When the axis is moving a reverse direction, the system will set this **[Moving in Reverse Direction]** to ON. On the other hand, when the axis is still or moving forward, this **[Moving in Reverse Direction]** will be OFF.

**[Feed Rate Override] D2x006**

When the controller is in INC mode, the system will take **N2.030 (JOG Maximum Speed)** and then multiply the **[Feed Rate Override]** to derive the INC movement speed. The linear axes will move in the mm/min and the rotary axes will reference the parameter N2.001 (Rotary Axes' Unit) and then move in the unit RPM or degree/min.

- **[Feed Rate Override]** value range 0~100.

**[Axes Movement in INC Mode] D2x014**

When the controller is in INC mode, the system will take **[Axes Movement in INC Mode]** and then multiply the parameter **N9.013 (Unit Decimal Point)** to derive the movement distance when the **[JOG Forward]** or **[JOG Reverse]** is triggered.

- The INC movement will only take place once after the move command **[JOG Forward]** or **[JOG Reverse]** is triggered until motion finished or stopped. This INC movement does not support the position change function.
- **[Axes Movement in INC Mode]** is a 32-bit data type special D. Therefore, D2x015 is occupied as high-word data.

## Relevant Parameter

**Speed parameter setting:**

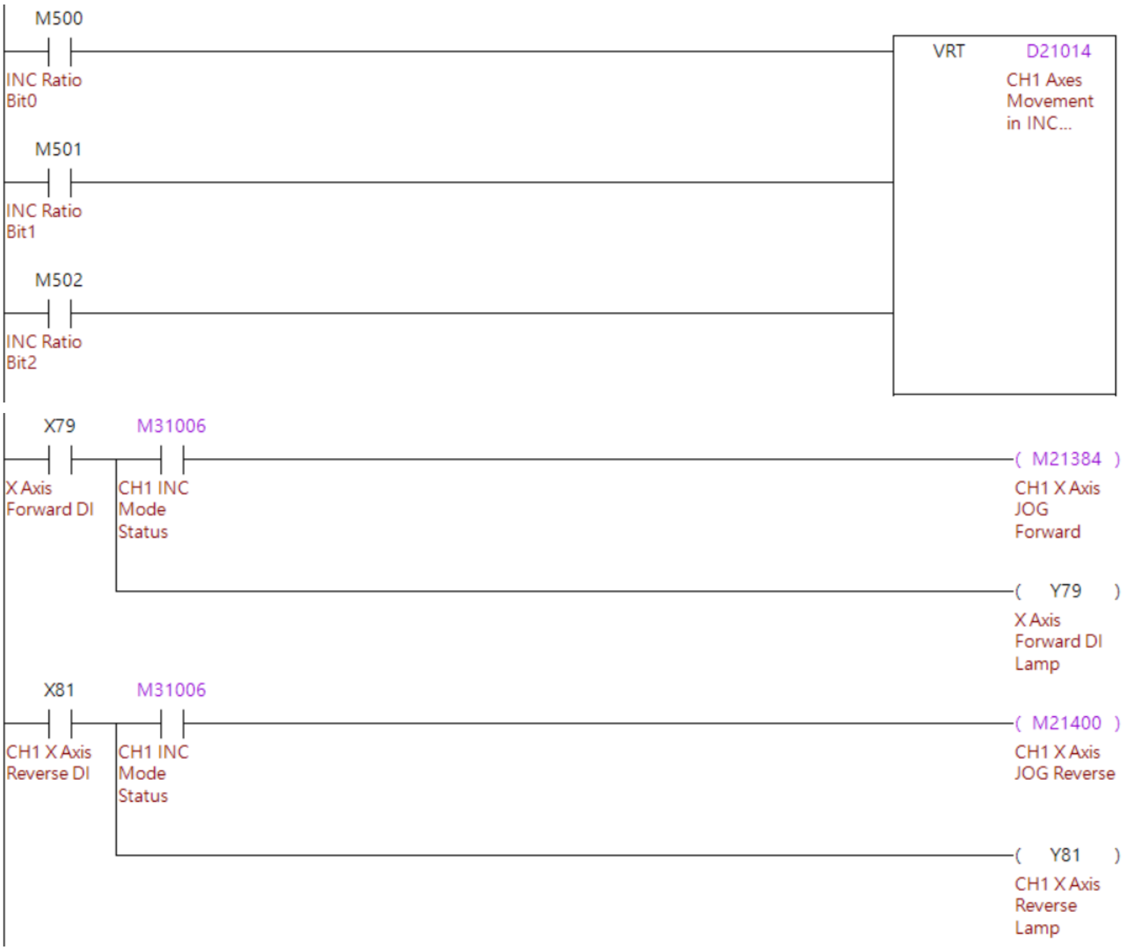
This INC speed will be effected by N2.030 (JOG Maximum Speed), N2.031 (JOG Acc and Dec Time) and N2.032 (JOG S Curve Time).

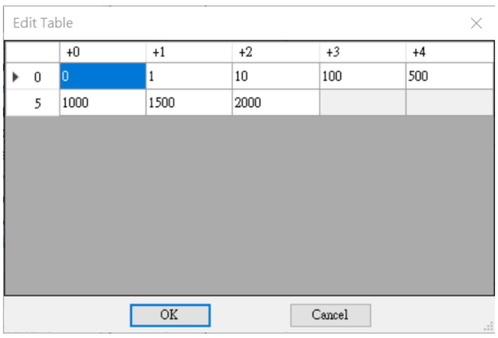
The movement takes parameter **N9.013 (Unit Decimal Point)** and the system will take **[Axes Movement in INC Mode]** and then multiply the parameter N9.013 (Unit Decimal Point) to derive the movement distance.

5

## ■ MLC Example

**[Axes Movement in INC Mode]** needs to be set before the movement command. If this **[Axes Movement in INC Mode]** is changed during motion, it will be available at the next command trigger.





Edit Table

| | +0 | +1 | +2 | +3 | +4 |
|---|---|---|---|---|---|
| 0 | 0 | 1 | 10 | 100 | 500 |
| 5 | 1000 | 1500 | 2000 | | |

OK Cancel

**Program execution procedure**

1. Use VRT table to convert M500 – M502 into decimal values and move the data into D21014 as **[Axes Movement in INC Mode]**.
2. Perform the X-axis jog operation using the X-axis positive / negative JOG keys.

## 5.6 Rapid move

There are two types of rapid traverse for the controller, manual rapid traverse and rapid traverse commands such as G00 during program execution. Both types use the same speed and override ratio. Rapid traverse applications are as follows.

### ■ MLC special D register

| Rapid Speed Percentage | D2x004 |
|---|---|

**[Rapid Speed Percentage] D2x004**

When the controller is in RAPID mode or executing the G00 command in the NC program, the system will refer to parameter **N1.030 (G00 Velocity)** and N2.020 (G00 Max Velocity) as full speed in 100%. In addition, the system will multiply this **[Rapid Speed Percentage]** as a ratio to execute the process.

- **[Rapid Speed Percentage]** is available in the range 1~100.
- During rapid command executing, the actual speed of each axis, which is multiplied by the **[Rapid Speed Percentage]**, will be limited by parameter N2.020 (G00 max velocity).
- When the value of **[Rapid Speed Percentage]** changes, the rapid actual speed will change right away.

### ■ Relevant Parameter

**Rapid speed setting in AUTO mode:**

G00 rapid command speed will refer to following parameters:

N1.030 (G00 Velocity), N1.031 (G00 Acc and Dec Time), N1.032 (G00 S Curve Time), N2.020 (Axis G00 Max Velocity), N2.021 (Axis Acc and Dec Time of G00 Command) and N2.022 (Axis S Curve Time of G00 Command).

N1.030, N1.031, N1.032 are the rapid speed configuration of all interpolation axes.

N2.020, N2.021, N2.022 are the rapid speed configuration of specific axis.

The NC5 controller will, based on these parameters, interpolate the proper path control.

**Rapid speed setting in MDI mode:**

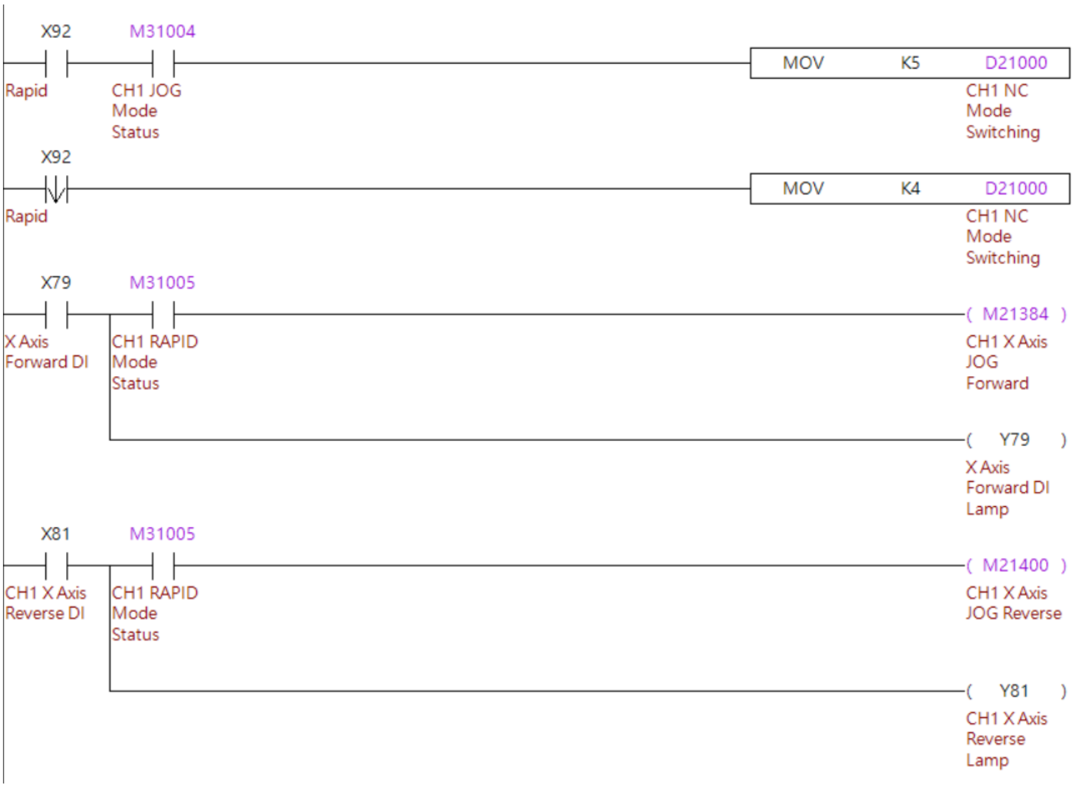
When the controller is in MDI mode, the rapid speed will refer to the following parameters:

N2.030 (Axis JOG Max Velocity), N2.031 (Axis JOG Acc and Dec Time) and N2.032 (Axis JOG S Curve Time).

5

## ■ MLC Example

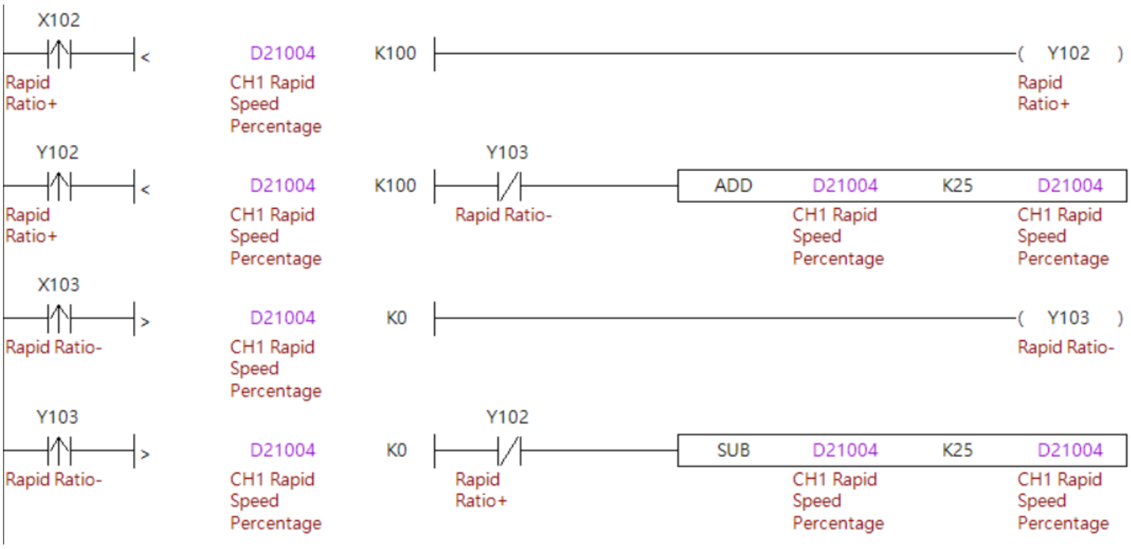
The following demonstrates the switching of RAPID mode and speed override.




**Program execution procedure**

1. Set the system to JOG mode.
2. Hold the RAPID mode button to switch to RAPID mode.
   - To general users, the manual rapid mode is not a frequently used mode. It is usually used when the system is in JOG mode, but you often need to move the axis with the speed higher than the maximum jog speed. Therefore, this mode takes effect under multiple conditions; when you release the RAPID mode button, the system returns to JOG mode.
3. When the system is in RAPID mode and users press the X axis direction key, the system moves the axis based on the setting of N2.022 (Axis S Curve Time of G00 Command).

5




**Program execution procedure**

Use the key signal to increase/decrease the override rate with the maximum as 100 and the minimum as 0. Each trigger increases/decreases the rate by 25 and writes the override rate to the **[Rapid Speed Percentage]**.

5

## 5.7 Homing

On the NC5 controller, this homing procedure needs to be triggered under HOME mode. Users will also need to use the special M to activate the specific axis execute the homing procedure.

### ■ MLC special M relays

| Axis | Axis Homing | Homing Finished | Axis Homed Status |
|---|---|---|---|
| X Axis | M2x320 | M3x336 | M3x320 |
| Y Axis | M2x321 | M3x337 | M3x321 |
| Z Axis | M2x322 | M3x338 | M3x322 |
| A Axis | M2x323 | M3x339 | M3x323 |
| B Axis | M2x324 | M3x340 | M3x324 |
| C Axis | M2x325 | M3x341 | M3x325 |
| U Axis | M2x326 | M3x342 | M3x326 |
| V Axis | M2x327 | M3x343 | M3x327 |
| W Axis | M2x328 | M3x344 | M3x328 |
| 10$^{th}$ Axis | M2x329 | M3x345 | M3x329 |
| 11$^{th}$ Axis | M2x330 | M3x346 | M3x330 |
| 12$^{th}$ Axis | M2x331 | M3x347 | M3x331 |
| 13$^{th}$ Axis | M2x332 | M3x348 | M3x332 |
| 14$^{th}$ Axis | M2x333 | M3x349 | M3x333 |
| 15$^{th}$ Axis | M2x334 | M3x350 | M3x334 |
| 16$^{th}$ Axis | M2x335 | M3x351 | M3x335 |

**[Axis Homing] M2x320 ~ M2x335**

When the controller is in HOME mode, users can set **[Axis Homing]** to ON to activate the homing procedure.

**[Homing Finished] M3x336 ~ M3x351**

When the controller finishes the homing procedure, the system will set **[Homing Finished]** to ON automatically.

- After **[Homing Finished]** is set to ON, the system will reset it to OFF automatically in the following situations.
  a. When axes are moving in JOG or MPG mode.
  b. When the system is executing the NC program in AUTO or MDI mode.
  c. When a non-absolute motor is used and the parameter N2.050 (Homing Mode) is not set to mode 5, and the controller is powered on again.
  d. Once an axis loses its origin, this **[Homing Finished]** will reset automatically.

**[Axis Homed Status] M3x320 ~ M3x335**

After axes have finished the homing procedure and the origin position has been defined, the system will set **[Axis Homed Status]** permanently. However, the system will still reset it to OFF in the following situations.

- After **[Axis Homed Status]** is set to ON, the system will reset it to OFF automatically in the following situations.
  a. When a non-absolute motor is used and the parameter N2.050 (Homing Mode) is not set to mode 5, and the controller is powered on again.
  b. Once an axis loses its origin, this **[Homing Finished]** will reset automatically.

## ■ Relevant Parameter

**Homing mode setting:**

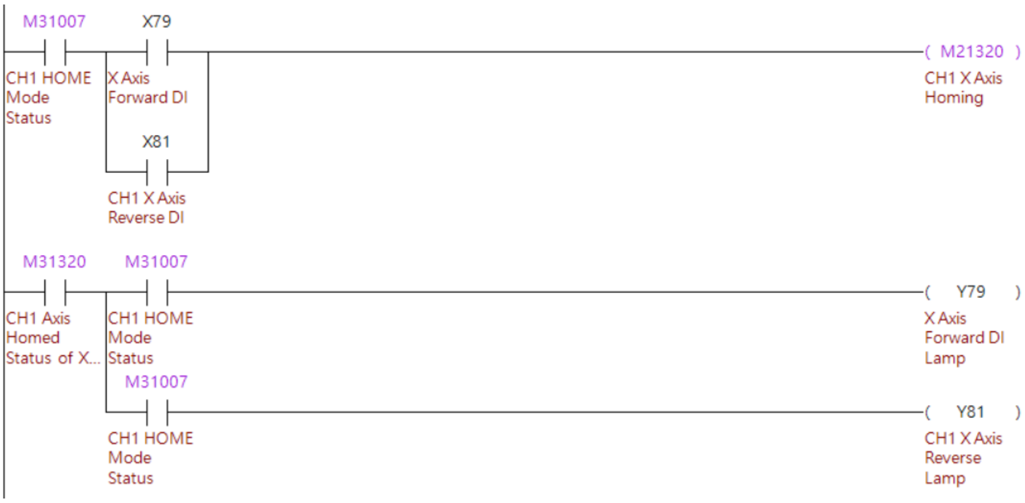
Homing procedure for home switch and Z phase defined as **N2.050 (Homing Mode)** and **N2.051 (Origin Type)**.

**Homing speed:**

Homing speed is defined as **N2.053 (1st Searching Speed)** and **N2.054 (2nd Searching Speed)**.

## ■ MLC Example

The system needs to switch to HOME mode and then use special M and D to start the procedure.




**Program execution procedure:**

1. Switch the system to HOME mode.
2. Use the key to set the special M relay for X axis homing to ON.
3. Output the homing complete signal to the button indicator.

Note: adjust the DIs and special M relays for each axis according to the applications.

## 5.8 M / S / T codes execution

Most of the time, each M, S and T code on the controller is relevant to the machine action; therefore, when the controller executes an M, S, or T code, it triggers the M, S or T code execution. This special M relay must be confirmed and reset to OFF by the MLC. The functions of M, S and T codes are as follows.

### ■ MLC special D

| | | | |
|---|---|---|---|
| M, S, and T Codes Finished | M2x016 | 1st M Code Data | D3x048 |
| M Code Execution | M3x064 | 1st S Code Data | D3x050 |
| S Code Execution | M3x065 | 1st T Code Data | D3x052 |
| T Code Execution | M3x066 | - | - |

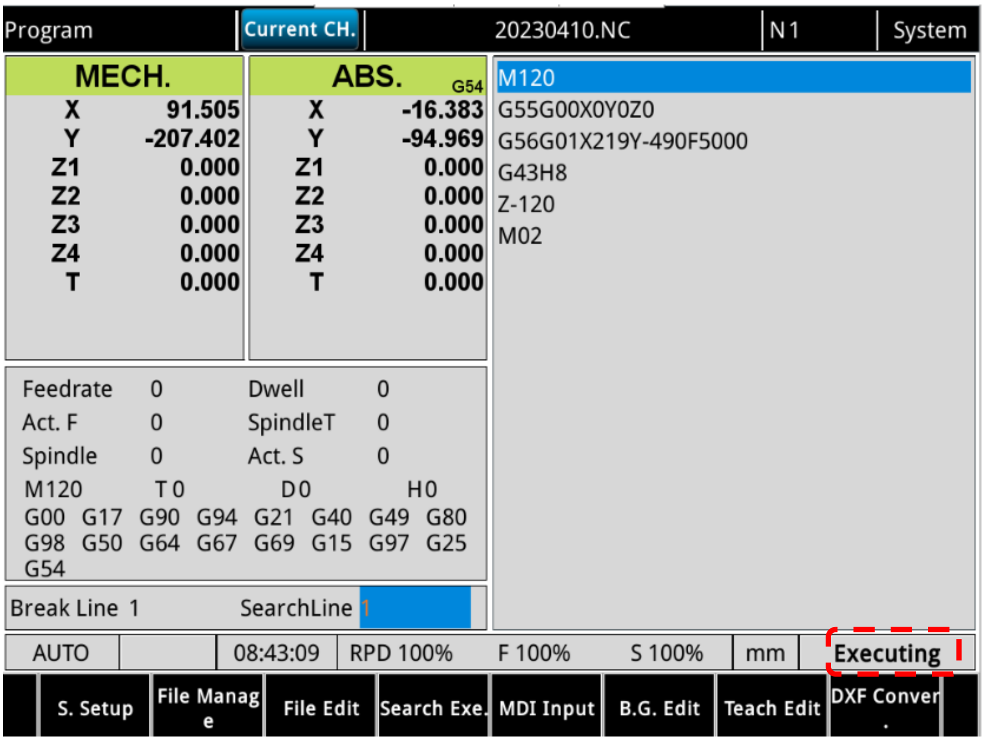



Figure 5.8.1 M, S, and T codes in execution

<u>**[M, S and T Codes Finished] M2x016**</u>

When the system is executing the program and the M, S, or T code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[M, S and T Codes Execution]** flags to ON. After the MLC program finishes these M, S and T codes' actions, the MLC will need to set **[M, S and T Codes Finished]** to ON. Once the system receives the trigger of **[M, S and T Codes Finished]**, it will reset **[M, S and T Codes Execution]** and then continue with the rest of the NC program.

<u>**[M Codes Execution] M3x064**</u>

When the system is executing the program and the M code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[M Codes Execution]** flags to ON. After the MLC program finishes these M codes' actions, the MLC will need to set **[M, S and T Codes Finished]** to ON. Once the system receives the trigger of **[M, S and T Codes Finished]**, it will reset **[M Codes Execution]** and then continue with the rest of the NC program.

**[S Codes Execution] M3x065**

When the system is executing the program and the S code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[S Codes Execution]** flags to ON. After the MLC program finishes these M codes' actions, the MLC will need to set **[M, S and T Codes Finished]** to ON. Once the system receives the trigger of **[M, S and T Codes Finished]**, it will reset **[S Codes Execution]** and then continue with the rest of the NC program.

**[T Codes Execution] M3x066**

When the system is executing the program and the T code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[T Codes Execution]** flags to ON. After the MLC program finishes these M codes' actions, the MLC will need to set **[M, S and T Codes Finished]** to ON. Once the system receives the trigger of **[M, S and T Codes Finished]**, it will reset **[T Codes Execution]** and then continue with the rest of the NC program.

**[1st M Code Data] D3x048**

When the system is executing the program and the M code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[1st M Code Data]** to the 1st M code in the command block.

- For example: When the system is executing M13, the value of **[1st M Code Data]** will be 13.
- If the 1st M code in the block is defined as macro call, this **[1st M Code Data]** will stay as the previous value.

**[1st S Code Data] D3x050**

When the system is executing the program and the S code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[1st S Code Data]** to the 1st S code in the command block.

- For example: When the system is executing S4000, the value of **[1st S Code Data]** will be 4000.

**[1st T Code Data] D3x052**

When the system is executing the program and the T code is executed, the system pauses executing the program, which keeps the state as "Executing" (as shown in Figure 5.8.1) and sets the **[1st T Code Data]** to the 1st T code in the command block.

- For example: When the system is executing T5, the value of **[1st T Code Data]** will be 5.
- The first T code command number must also be defined in the range of the tool magazine, and it will respond in the **[1st T Code Data]**. When the system executes the T code command and the **"Continue Index"** is not set to 1, the system will return an error and this T code will not respond in the **[1st T Code Data]**. If users execute the corresponding T code, which is disabled, the system will return an alarm to acknowledge.

## Relevant Parameter

**M code call macro setting:**

**N1.123 (M Code Call Macro Stater M Index):**

Setting for the first code number for M command.

**N1.124 (M Code Call Macro Stater Macro File Number):**

Setting the first Macro file name as number corresponding to the parameter N1.123.

**N1.125 (M Code Call Macro Amount):**

Setting the M code call Macro amount start from N1.123.

If the M code in the block is defined as a macro call function, this M code data will not update to the **[M Code Data]** and the **[M Codes Execution]** will not be triggered. It will be based on parameter N1.123 to N1.125 to execute the responded macro program.

- If the N1.125 is set to 0, it means the M code call macro function is disabled.
- For example, when N1.23 is set to 10, N1.124 is set to 9100 and N1.125 is set to 15, this means the system will execute Macro O9100 when M10 is executed, execute Macro O9101 when M11 is executed, etc. until M24, the system will execute Macro O9114 and for M25 it will execute normal M code procedures.
- If the macro call function's M code is programed inside the corresponded macro, this M code will progress as a normal M code procedure.

**T code call macro O9000 setting:**

**N1.010 (T Code Call Macro O9000)**

- N1.010 Bit 22 set to 0, function disabled.
- When **N1.010 Bit 22** is set to 1, the system will execute the O9000 macro directly instead of triggering the **[T Codes Execution]** or updating the T code to **[T Code Data]**, and instead will execute O9000.

  If the current program is O9000, the system will not execute O9000 again. It will instead execute using the regular method, which will trigger the **[T Codes Execution]** and update the T code to **[T Code Data]**.

Halt M code setting:

**N1.118 (Beginning M Code of Halt Function):**

The first M code of the halt function.

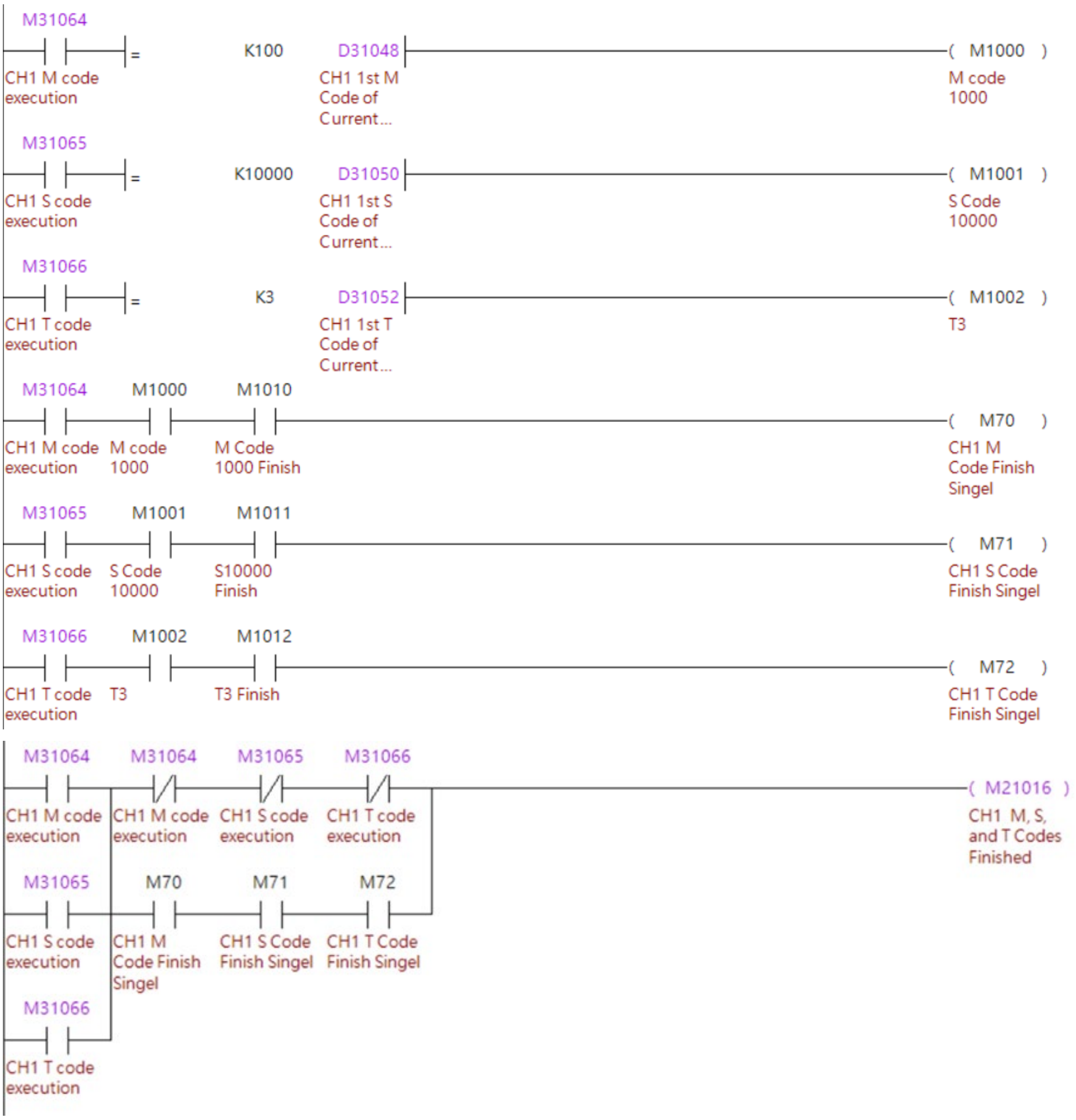
**N1.119 (Amount of Halt M Code):**

The number of halt M code function.

- When the controller is executing the program, the system automatically plans the path by looking ahead of the subsequent program, which has not been executed. When the M code is set to halt the look-ahead of the M code, once the system reads the M code, it does not look ahead of the program. After the system completes executing the M code, it continues to look ahead of the program. When N1.118 is set to 100 and N1.119 is set to 10, this means M100 to M109 has enabled the halt M code function.
- When the controller is executing the program and reads the Halt M code:
  a. The system continues to execute the program that follows and sets the state to "Executing".
  b. The system sets **[M Code Execution]** to ON and writes the executed M code value to **[M Code Data]**.
  c. Users can plan the MLC actions for the M code normally. The **[M, S and T Codes Finished]** has to be set to ON to execute this M code.

## ■ MLC Example

The following example illustrates the execution procedure of M, S, and T codes.




**Program execution procedure:**

M-code execution procedure

1. When the system is executing the program and executes M100, it sets **[M Code Execution]** to ON and writes 100 to **[1st M Code Data]**.
2. When the conditions are met, M1000 in the MLC is set to ON, so users can use M1000 to trigger the required MLC actions.
3. Once MLC has finished the planned MLC actions, set M1010 of the MLC to ON.
4. When you set M1010 to ON, M70 is set to ON because the conditions are met.
5. When M70 is ON, the **[M, S, and T Codes Finished]** flag is set to ON because the conditions are met.
6. When the system confirms that the **[M, S, and T Codes Finished]** flag is ON, it considers the M code execution to be complete and sets **[M Code Execution]** to OFF.
7. M code actions complete.

5

S-code execution procedure

1. When the system is executing the program and executes S10000, it sets **[S Code Execution]** to ON and writes 10000 to **[1st S Code Data]**.
2. When the conditions are met, M1001 in the MLC is set to ON, so users can use M1001 to trigger the required MLC actions.
3. Once MLC has finished the planned MLC actions, set M1011 of the MLC to On.
4. When you set M1011 to ON, M71 is set to ON because the conditions are met.
5. When M71 is ON, the **[M, S, and T Codes Finished]** flag is set to ON because the conditions are met.
6. When the system confirms that the **[M, S, and T Codes Finished]** flag is ON, it considers the S code execution to be complete and sets **[S Code Execution]** to OFF.
7. S code actions complete.

T-code execution procedure

1. When the system is executing the program and executes T3, it sets **[T code execution]** to ON and writes 3 to **[1st T code data]**.
2. When the conditions are met, M1002 in the MLC is set to ON, so users can use M1002 to trigger the required MLC actions.
3. Once MLC has finished the planned MLC actions, set M1012 of the MLC to On.
4. When you set M1012 to ON, M72 is set to ON because the conditions are met.
5. When M72 is ON, the **[M, S, and T Codes Finished]** flag is set to ON because the conditions are met.
6. When the system confirms that the **[M, S, and T codes execution complete]** flag is ON, it considers the T code execution to be complete and sets **[T code execution]** to OFF.
7. T code actions complete.

**Important:**

the examples in this section are only based on T code. For more details about the tool magazine and T code functions, refer to Section 6.13.

# 5.9 1st software limit / hardware limit cancellation

When the controller is moving the axis, there are software and hardware limit settings to protect the axis from exceeding the allowable range. Two sets of software and hardware limit settings are available. Users need to cancel the 1st software limit before using the 2nd software limit. When the axis reaches the hardware limit, the system immediately stops executing all axis motion commands. To resume the movement, users must cancel the hardware limit.



## ■ MLC special M relays

| Axis | Disable 1st Software Limit | Disable Hardware Limit |
|---|---|---|
| X Axis | M2x368 | M2x007 |
| Y Axis | M2x369 | |
| Z Axis | M2x370 | |
| A Axis | M2x371 | |
| B Axis | M2x372 | |
| C Axis | M2x373 | |
| U Axis | M2x374 | |
| V Axis | M2x375 | |
| W Axis | M2x376 | |
| 10th Axis | M2x377 | |
| 11th Axis | M2x378 | |
| 12th Axis | M2x379 | |
| 13th Axis | M2x380 | |
| 14th Axis | M2x381 | |
| 15th Axis | M2x382 | |
| 16th Axis | M2x383 | |

**[Disable 1st Software Limit] M2x368 ~ M2x383**

When **[Disable 1st Software Limit]** set to ON, the 1st software limit of this axis will be canceled.

**[Disable Hardware Limit] M2x007**

When **[Disable Hardware Limit]** set to ON, the hardware limits of all axes are canceled.

## ■ Relevant Parameter

**Software limit setting:**

N2.006 (1st positive software limit), N2.007 (1st negative software limit),
N2.008 (2nd positive software limit), N2.009 (2nd negative software limit): When axes reach different limit positions, the system will return the corresponding alarm. The software limit will be active after the axes' origin position is established.

- Therefore, if axes are using incremental motors and system has just started up, it will need to finish its home procedure.

**Hardware limit setting:**

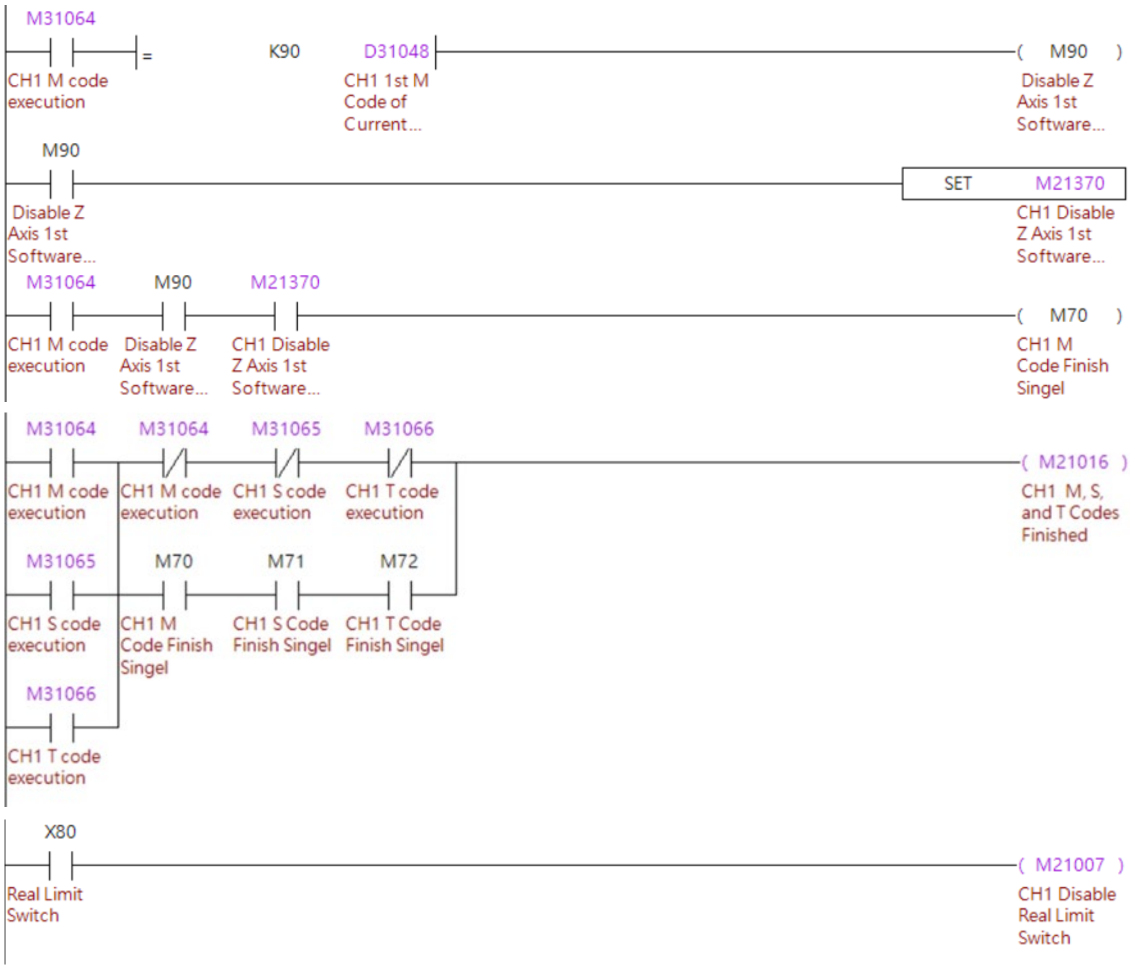
Users can set up the limit sensor type such as normal open or normal close and parameter N2.010 for position or negative limit. The system can correctly identify the hardware limit status of each axis.

5

## ■ MLC Example

The following example uses the M code to disable the 1st software limit of the Z axis and provides the descriptions for manually triggering the signal for hardware limit cancellation.

| Disable the 1st software limit of Z axis | |
|---|---|
| Axis | Z Axis |
| Environment settings | N2.006: The 1st software positive limit is set to 70.<br>N2.008: The 2nd software positive limit is set to 140. |
| Program execution | G90G54X100.<br>G0Z-50.<br>M90<br>G0Z134.<br>M30 |



**Program execution procedure:**

Software limit

1. When the system is executing the main program and executes M90, the M90 is set to ON.
2. When M90 is ON, **[Z axis 1st software limit cancellation]** is also set to ON.
3. The system does not send the alarm for reaching the 1st software limit when it continues to execute the main program and G0Z134 is executed.

Hardware limit

The hardware limit alarm occurs when the mechanism reaches the hardware limit in AUTO, MDI or any other mode of operation. Users can press the key for canceling the limit. Once the conditions are met, **[Hardware limit cancellation]** goes to ON, and the controller temporarily ignores the hardware limit signal. Users can move the mechanism to a safe position with JOG or MPG operation.

- When the hardware limit is canceled, pay attention to the axis moving direction to prevent damage to the mechanical parts.

5

## 5.10 Spindle control

On the controller, the spindle is controlled by multiple special M relays and special D registers. The descriptions for forward/reverse operation, positioning, and speed override of the spindle are as follows.

### ■ MLC special D

| Spindle | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th |
|---|---|---|---|---|---|---|---|---|
| Forward Rotation | M2x704 | M2x720 | M2x736 | M2x752 | M2x768 | M2x784 | M2x800 | M2x816 |
| Reverse Rotation | M2x705 | M2x721 | M2x737 | M2x753 | M2x769 | M2x785 | M2x801 | M2x817 |
| Positioning | M2x706 | M2x722 | M2x738 | M2x754 | M2x770 | M2x786 | M2x802 | M2x818 |
| Speed Reach | M3x704 | M3x720 | M3x736 | M3x752 | M3x768 | M3x784 | M3x800 | M3x816 |
| Zero Speed | M3x705 | M3x721 | M3x737 | M3x753 | M3x769 | M3x785 | M3x801 | M3x817 |
| Target Reach | M3x706 | M3x722 | M3x738 | M3x754 | M3x770 | M3x786 | M3x802 | M3x818 |
| Command Source | M2x710 | M2x726 | M2x742 | M2x758 | M2x774 | M2x790 | M2x806 | M2x822 |
| Speed Control | D2x024 | D2x030 | D2x320 | D2x326 | D2x332 | D2x338 | D2x344 | D2x350 |
| Speed Rate | D2x026 | D2x032 | D2x322 | D2x328 | D2x334 | D2x340 | D2x346 | D2x352 |
| Speed Command | D3x024 | D3x030 | D3x362 | D3x374 | D3x386 | D3x398 | D3x410 | D3x422 |
| Speed Feedback | D3x026 | D3x032 | D3x364 | D3x376 | D3x388 | D3x400 | D3x412 | D3x424 |
| Actual Degree | D3x028 | D3x034 | D3x366 | D3x378 | D3x390 | D3x402 | D3x414 | D3x426 |

**[Forward Rotation, Reverse Rotation] M2x704 ~ M2x705, M2x720 ~ M2x721, M2x736 ~ M2x737, M2x752 ~ M2x753, M2x768 ~ M2x769, M2x784 ~ M2x785, M2x800 ~ M2x801, M2x816 ~ M2x817**

When **[Forward Rotation]** or **[Reverse Rotation]** is ON, the spindle starts rotating forward or reversely referring to the S code data.

**[Spindle Positioning] M2x706, M2x722, M2x738, M2x754, M2x770, M2x786, M2x802, M2x818**

When **[Spindle Positioning]** is ON, the spindle uses the Z pulse as the zero degree and positions based on the setting of N0.1013 (Spindle positioning offset). When the spindle completes positioning, it stops rotating.

**[Spindle Speed Reach] M3x704, M3x720, M3x736, M3x752, M3x768, M3x784, M3x800, M3x816**

When the spindle rotates forward or reversely and reaches the target speed, the system sets **[Spindle Speed Reach]** to ON.

- When the rotation speed changes, **[Spindle Speed Reach]** is set to OFF until the spindle reaches the target speed, when **[Spindle Speed Reach]** is set to ON again.
- When the speed command is 0 and the spindle stops, **[Spindle Speed Reach]** is set to ON.
- The duration when **[Spindle Speed Reach]** is ON is influenced by N0.1018 (Spindle Target Speed Deviation).

**[Spindle Zero Speed] M3x705, M3x721, M3x737, M3x753, M3x769, M3x785, M3x801, M3x817**

When the spindle speed reaches zero or the spindle stops, the system sets **[Spindle Zero Speed]** to ON.

- When the spindle starts rotating forward or reversely, [Spindle Zero Speed] is set to OFF.
- When the rotation command becomes a non-zero value, [Spindle Zero Speed] is set to OFF.

**[Spindle Target Reach] M3x706, M3x722, M3x738, M3x754, M3x770, M3x786, M3x802, M3x818**

When **[Spindle Positioning]** is ON and the spindle completes the positioning based on **N0.1013 (Spindle Positioning Offset)**, the system sets M2258 **[Spindle Target Reach]** to ON.

- When the spindle starts rotating, [Spindle Target Reach] is set to OFF.

**[Spindle Command Source] M2x710, M2x726, M2x742, M2x758, M2x774, M2x790, M2x806, M2x822**

When **[Spindle Command Source]** is ON, the spindle speed command will refer to **[Spindle Speed]**. When **[Spindle Command Source]** is set to OFF, the spindle speed command will refer to the S code as program speed.

**[Spindle Speed] D2x024, D2x030, D2x320, D2x326, D2x332, D2x338, D2x344, D2x350**

When **[Spindle Command Source]** is set to ON, the spindle speed command will refer to **[Spindle Speed]**.

- The applicable input rage is 0 to 2,147,483,647.
- The spindle command speed is limited by parameter N0.1008 (Spindle Maximum Speed).
- When the value of [Spindle Speed] is changed, the spindle speed changes immediately.

**[Spindle Speed Rate] D2x026, D2x032, D2x322, D2x328, D2x334, D2x340, D2x346, D2x352**

When the spindle starts rotating forward or reversely, users can refer to the S code as the programed speed and **[Spindle Speed Rate]** to adjust the spindle speed with the speed override.

- The applicable input rage for **[Spindle Speed Rate]** is 0 to 120.
- The spindle command speed is limited by parameter N0.1008 (Spindle Maximum Speed).
- When the value of **[Spindle Speed Rate]** is changed, the spindle speed changes immediately.

5

**[Speed Command] D3x024, D3x030, D3x362, D3x374, D3x386, D3x398, D3x410, D3x422**

When the controller executes the S code in the program, it writes the value of this S code to **[1st S code data]** as well as **[Speed Command]**.

**[Speed Feedback] D3x026, D3x032, D3x364, D3x376, D3x388, D3x400, D3x412, D3x424**

When the spindle rotates forward or reversely, **[Speed Feedback]** displays the spindle's actual speed.

**[Actual Degree] D3x028, D3x034, D3x366, D3x378, D3x390, D3x402, D3x414, D3x426**

When the spindle rotates forward or reversely, **[Actual Degree]** displays the spindle's actual degree.

## ■ Relevant Parameter

**Spindle setting:**

According to system parameter setting "**Channel Setting**", users can determine whether to enable the spindle function and spindle ID.

**Spindle Function:**

N0.1000 (Spindle Setting):

| Spindle Function | Description |
|---|---|
| Spindle Control Type | 0: Communication Mode<br>1: Reserved<br>2: Analog Mode |
| Analog Close Loop Control | 0: Disable<br>1: Enable |
| Analog Spindle Command Source | 0: Reference from command speed<br>1: Reference from encoder |
| Analog Spindle Encoder Feedback Source | 0: Reference from spindle encoder<br>1: Reference from end motor encoder |
| Spindle Speed Reference | 0: Reference from NC program<br>1: Reference from N0.1006 (Spindle Initial Speed) |
| Spindle High Speed Command Check | 0: Disable<br>1: Enable |
| Multi-Spindle Encoder Feedback Function Switch | 0: Disable<br>1: Enable |
| Spindle Target Speed Error Unit | 0: RPM<br>1: % |

**Speed parameter setting:**

Spindle's rotary speed will be based on the below parameter setting:

N0.1006 (Spindle Initial Speed): S code initialized value.

N0.1008 (Spindle Maximum Speed): When the spindle is set to communication mode, this will limit the spindle maximum speed. When the spindle is set to analog mode, this will be the voltage ratio of the spindle speed.

N0.1009 (Spindle Acc and Dec Time): Spindle acceleration and deceleration time.

N0.1010 (Spindle S Curve Time): Spindle S curve time when acceleration and deceleration.

N0.1017 (Spindle Zero Speed Error): When the speed difference between actual speed and zero speed is lower than parameter N0.1017, the system will set **[Spindle Zero Speed]** to ON automatically.

- When the N0.1017 is 100 and the actual speed is ≤100 RPM, the system will set **[Spindle Zero Speed]** to ON automatically.

N0.1018 (Spindle Target Speed Error): When the speed difference between actual speed and command speed is lower than parameter N0.1018, the system will set [Spindle Speed Reach] to ON automatically.

- When **[Speed Command]** is 1000 and N0.1018 is 100, when the actual speed is 900 to 1100 RPM, the system will set **[Spindle Speed Reach]** to ON automatically.

**Spindle positioning setting:**

N0.1013 (Spindle Positioning Offset): When the positioning command procedure is finished, the system will be based on the position of the Z phase and then add the offset configure from parameter N1.1013.

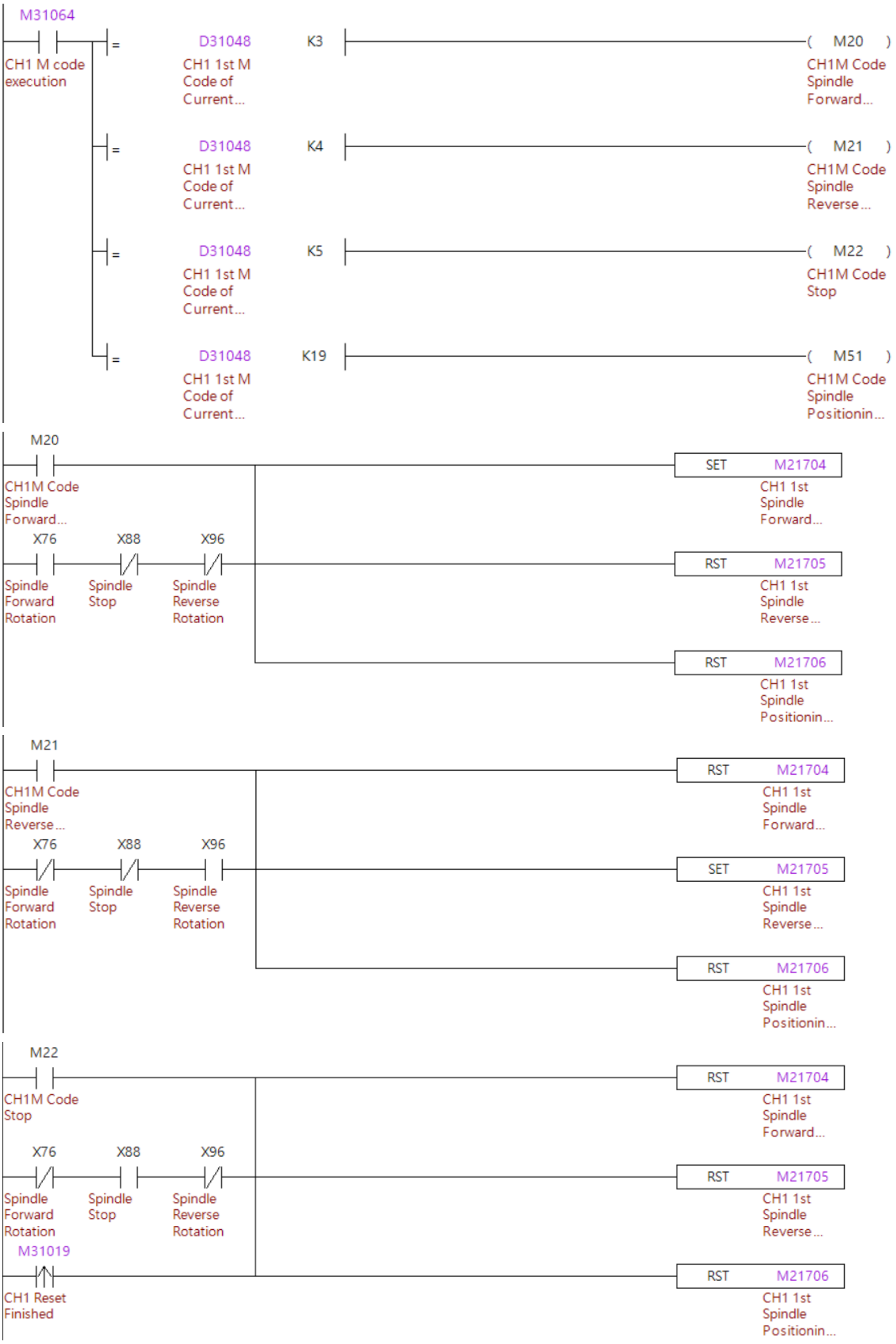
N0.1019 (Spindle Positioning Error): When the spindle is executing positioning procedures and the distance between actual position and N0.1013 (Spindle Positioning Offset) is lower than parameter N0.1019, the system will set **[Spindle Speed Reach]** to ON automatically.

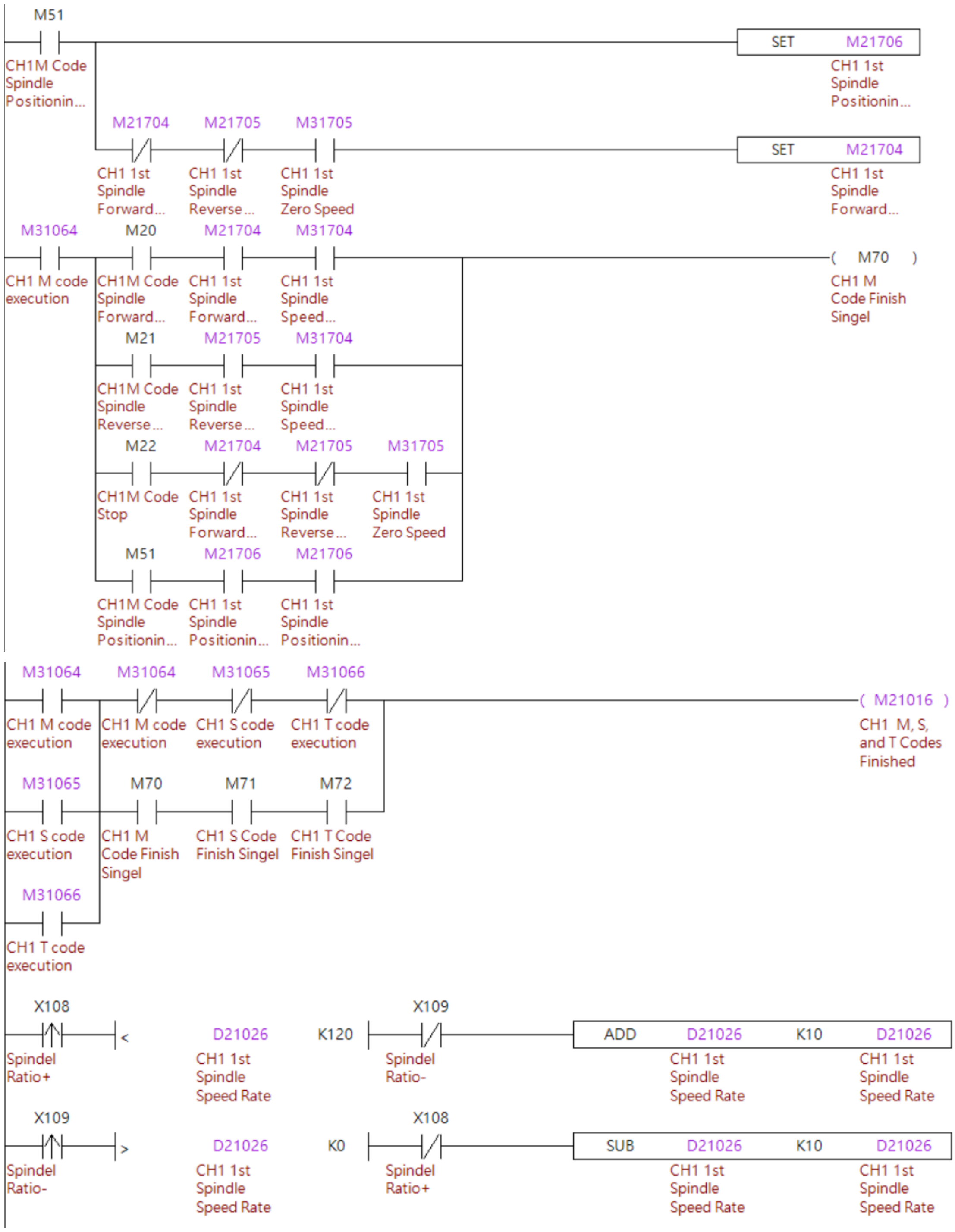
- If the parameter N0.1013 is 1000 and N0.1019 is 500 (Unit: 0.01 degrees), the **[Spindle Speed Reach]** will be ON when the spindle feedback degree is between 5 to 15.

5

## ■ MLC Example

The following illustrates the usage of spindle forward/reverse operation, stop, positioning, and speed override.




M51
CH1M Code Spindle Positionin...
SET M21706
CH1 1st Spindle Positionin...
M21704 M21705 M31705
CH1 1st Spindle Forward...
CH1 1st Spindle Reverse...
CH1 1st Spindle Zero Speed
SET M21704
CH1 1st Spindle Forward...
M31064 M20 M21704 M31704
CH1 M code execution
CH1M Code Spindle Forward...
CH1 1st Spindle Forward...
CH1 1st Spindle Speed...
M70
CH1 M Code Finish Singel
M21 M21705 M31704
CH1M Code Spindle Reverse...
CH1 1st Spindle Reverse...
CH1 1st Spindle Speed...
M22 M21704 M21705 M31705
CH1M Code Stop
CH1 1st Spindle Forward...
CH1 1st Spindle Reverse...
CH1 1st Spindle Zero Speed
M51 M21706 M21706
CH1M Code Spindle Positionin...
CH1 1st Spindle Positionin...
CH1 1st Spindle Positionin...
M31064 M31064 M31065 M31066
CH1 M code execution
CH1 M code execution
CH1 S code execution
CH1 T code execution
M21016
CH1 M, S, and T Codes Finished
M31065 M70 M71 M72
CH1 S code execution
CH1 M Code Finish Singel
CH1 S Code Finish Singel
CH1 T Code Finish Singel
M31066
CH1 T code execution
X108
Spindel Ratio+
< D21026 K120
CH1 1st Spindle Speed Rate
X109
Spindel Ratio-
ADD D21026 K10 D21026
CH1 1st Spindle Speed Rate
CH1 1st Spindle Speed Rate
X109
Spindel Ratio-
> D21026 K0
CH1 1st Spindle Speed Rate
X108
Spindel Ratio+
SUB D21026 K10 D21026
CH1 1st Spindle Speed Rate
CH1 1st Spindle Speed Rate

**Program execution procedure**

Forward / reverse operation and stop.

1. If users press the key to spindle forward operation, reverse operation, or stop operation, the corresponding **[Forward Rotation]** or **[Reverse Rotation]** is set to ON or OFF to have the spindle rotate forward, reversely, or stopped.
2. When the program runs to M3, M4, or M5, it uses the M code procedure to set **[Forward Rotation]** or **[Reverse Rotation]** to ON or OFF to have the spindle rotate forward, reversely, or stopped.
3. Confirm the spindle status with **[Speed Reach]** and **[Zero Speed]** and end the M code procedure.

Spindle positioning.

1. When M19 is executed in the program, the M code procedure sets **[Positioning]** to ON.
2. Confirm the spindle positioning is complete with **[Spindle Target Reach]** and end the M code procedure.

Spindle speed rate.

Use the key signal to increase or decrease the spindle speed rate. The maximum is 120 and the minimum is 0. Each trigger increases or decreases the ratio by 10 and writes the ratio to **[Spindle Speed Rate]**.

## 5.11 Spindle gear ratio switch

In the controller, there are four sets of spindle gear ratio parameters that need to be switched with the MLC. The description of the spindle gear ratio switch is as follows.

### ■ MLC special D register

| | | |
|---|---|---|
| 1st Spindle Gear Ratio Selection | D2x027 | 1: Take N0.1034, N0.1035 as Ratio<br>2: Take N0.1036, N0.1037 as Ratio<br>3: Take N0.1038, N0.1039 as Ratio<br>4: Take N0.1040, N0.1041 as Ratio |
| 2nd Spindle Gear Ratio Selection | D2x033 | 1: Take N0.1084, N0.1085 as Ratio<br>2: Take N0.1086, N0.1087 as Ratio<br>3: Take N0.1088, N0.1089 as Ratio<br>4: Take N0.1090, N0.1091 as Ratio |
| 3rd Spindle Gear Ratio Selection | D2x323 | 1: Take N0.1134, N0.1135 as Ratio<br>2: Take N0.1136, N0.1137 as Ratio<br>3: Take N0.1138, N0.1139 as Ratio<br>4: Take N0.1140, N0.1141 as Ratio |
| 4th Spindle Gear Ratio Selection | D2x329 | 1: Take N0.1184, N0.1185 as Ratio<br>2: Take N0.1186, N0.1187 as Ratio<br>3: Take N0.1188, N0.1189 as Ratio<br>4: Take N0.1190, N0.1191 as Ratio |
| 5th Spindle Gear Ratio Selection | D2x335 | 1: Take N0.1234, N0.1235 as Ratio<br>2: Take N0.1236, N0.1237 as Ratio<br>3: Take N0.1238, N0.1239 as Ratio<br>4: Take N0.1240, N0.1241 as Ratio |
| 6th Spindle Gear Ratio Selection | D2x341 | 1: Take N0.1284, N0.1285 as Ratio<br>2: Take N0.1286, N0.1287 as Ratio<br>3: Take N0.1288, N0.1289 as Ratio<br>4: Take N0.1290, N0.1291 as Ratio |
| 7th Spindle Gear Ratio Selection | D2x347 | 1: Take N0.1334, N0.1335 as Ratio<br>2: Take N0.1336, N0.1337 as Ratio<br>3: Take N0.1338, N0.1339 as Ratio<br>4: Take N0.1340, N0.1341 as Ratio |
| 8th Spindle Gear Ratio Selection | D2x353 | 1: Take N0.1384, N0.1385 as Ratio<br>2: Take N0.1386, N0.1387 as Ratio<br>3: Take N0.1388, N0.1389 as Ratio<br>4: Take N0.1390, N0.1391 as Ratio |

**[Spindle Gear Ratio Selection] D2x027, D2x033, D2x323, D2x329, D2x335, D2x341, D2x347, D2x353**

When users need to switch the spindle gear ratio, set **[Spindle Gear Ratio Selection]** to the group 1 to 4 as preferred. (As shown in the above table)

## Relevant Parameter

**Spindle gear ratio setting:**

N0.1034 ~ N0.1041: When users set **[1st Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1034 (Numerator of 1st Gear Ratio) and N0.1035 (Denominator of 1st Gear Ratio)
- N0.1036 (Numerator of 2nd Gear Ratio) and N0.1037 (Denominator of 2nd Gear Ratio)
- N0.1038 (Numerator of 3rd Gear Ratio) and N0.1039 (Denominator of 3rd Gear Ratio)
- N0.1040 (Numerator of 4th Gear Ratio) and N0.1041 (Denominator of 4th Gear Ratio)

N0.1084 ~ N0.1091: When users set **[2nd Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1084 (Numerator of 1st Gear Ratio) and N0.1085 (Denominator of 1st Gear Ratio)
- N0.1086 (Numerator of 2nd Gear Ratio) and N0.1087 (Denominator of 2nd Gear Ratio)
- N0.1088 (Numerator of 3rd Gear Ratio) and N0.1089 (Denominator of 3rd Gear Ratio)
- N0.1090 (Numerator of 4th Gear Ratio) and N0.1091 (Denominator of 4th Gear Ratio)

N0.1134 ~ N0.1141: When users set **[3rd Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1134 (Numerator of 1st Gear Ratio) and N0.1135 (Denominator of 1st Gear Ratio)
- N0.1136 (Numerator of 2nd Gear Ratio) and N0.1137 (Denominator of 2nd Gear Ratio)
- N0.1138 (Numerator of 3rd Gear Ratio) and N0.1139 (Denominator of 3rd Gear Ratio)
- N0.1140 (Numerator of 4th Gear Ratio) and N0.1141 (Denominator of 4th Gear Ratio)

N0.1184 ~ N0.1191: When users set **[4th Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1184 (Numerator of 1st Gear Ratio) and N0.1185 (Denominator of 1st Gear Ratio)
- N0.1186 (Numerator of 2nd Gear Ratio) and N0.1187 (Denominator of 2nd Gear Ratio)
- N0.1188 (Numerator of 3rd Gear Ratio) and N0.1189 (Denominator of 3rd Gear Ratio)
- N0.1190 (Numerator of 4th Gear Ratio) and N0.1191 (Denominator of 4th Gear Ratio)

N0.1234 ~ N0.1241: When users set **[5th Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1234 (Numerator of 1st Gear Ratio) and N0.1235 (Denominator of 1st Gear Ratio)
- N0.1236 (Numerator of 2nd Gear Ratio) and N0.1237 (Denominator of 2nd Gear Ratio)
- N0.1238 (Numerator of 3rd Gear Ratio) and N0.1239 (Denominator of 3rd Gear Ratio)
- N0.1240 (Numerator of 4th Gear Ratio) and N0.1241 (Denominator of 4th Gear Ratio)

N0.1284 ~ N0.1291: When users set **[6th Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

- N0.1284 (Numerator of 1st Gear Ratio) and N0.1285 (Denominator of 1st Gear Ratio)
- N0.1286 (Numerator of 2nd Gear Ratio) and N0.1287 (Denominator of 2nd Gear Ratio)
- N0.1288 (Numerator of 3rd Gear Ratio) and N0.1289 (Denominator of 3rd Gear Ratio)
- N0.1290 (Numerator of 4th Gear Ratio) and N0.1291 (Denominator of 4th Gear Ratio)

N0.1334 ~ N0.1341: When users set **[7th Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

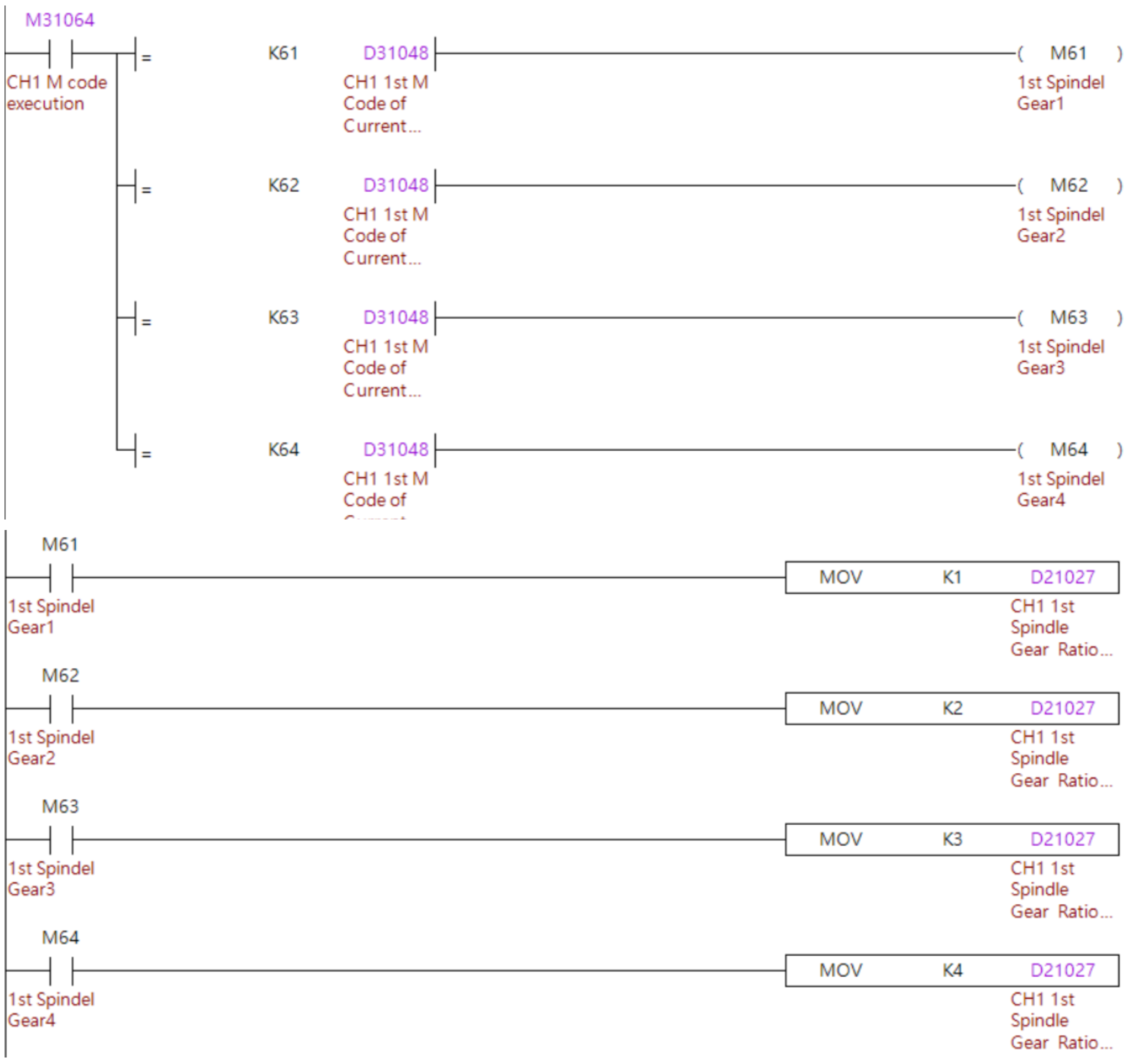
- N0.1334 (Numerator of 1st Gear Ratio) and N0.1335 (Denominator of 1st Gear Ratio)
- N0.1336 (Numerator of 2nd Gear Ratio) and N0.1337 (Denominator of 2nd Gear Ratio)
- N0.1338 (Numerator of 3rd Gear Ratio) and N0.1339 (Denominator of 3rd Gear Ratio)
- N0.1340 (Numerator of 4th Gear Ratio) and N0.1341 (Denominator of 4th Gear Ratio)

N0.1384 ~ N0.1391: When users set **[8th Spindle Gear Ratio Selection]** and the ratio can be defined as below parameters.

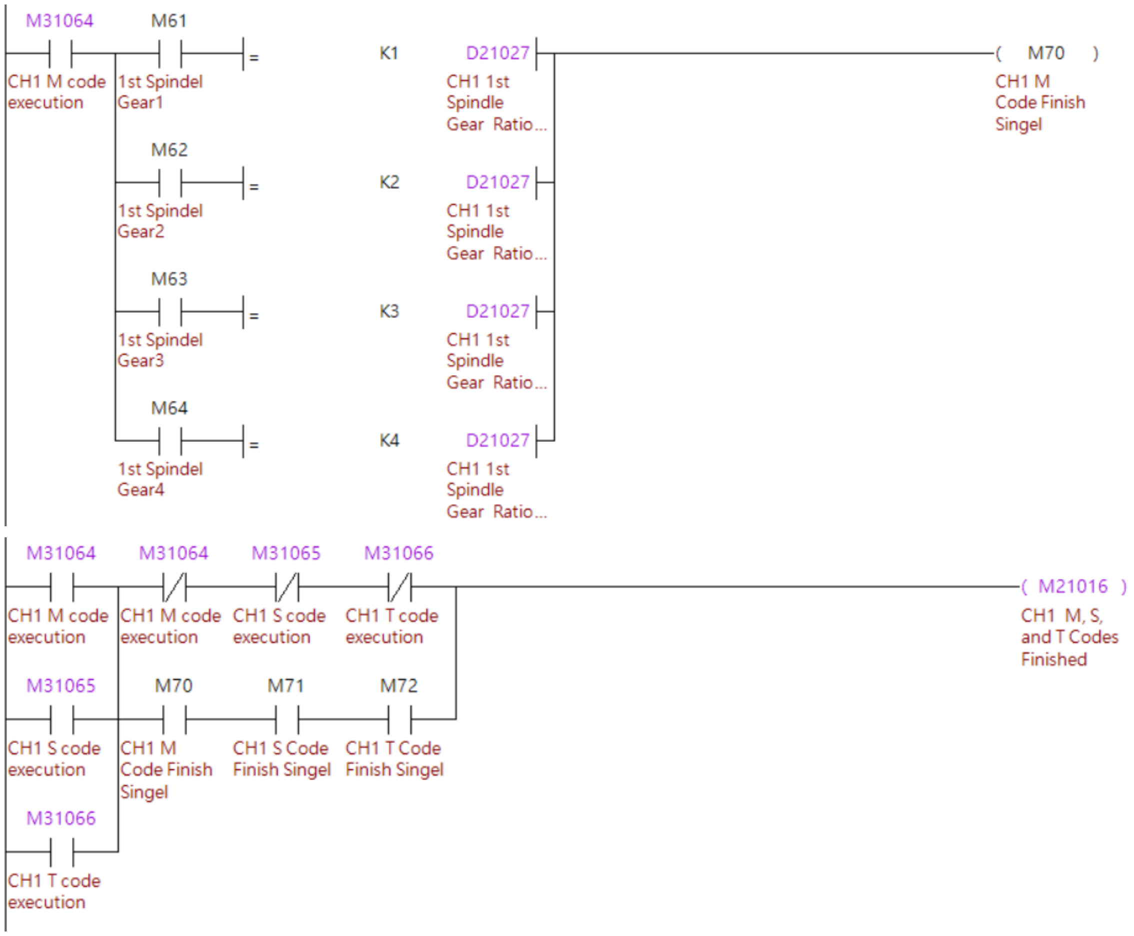
- N0.1384 (Numerator of 1st Gear Ratio) and N0.1385 (Denominator of 1st Gear Ratio)
- N0.1386 (Numerator of 2nd Gear Ratio) and N0.1387 (Denominator of 2nd Gear Ratio)
- N0.1388 (Numerator of 3rd Gear Ratio) and N0.1389 (Denominator of 3rd Gear Ratio)
- N0.1390 (Numerator of 4th Gear Ratio) and N0.1391 (Denominator of 4th Gear Ratio)

## ■ MLC Example

When switching between gear ratios during program execution, you need to use the M code to complete the switching, instead of simply setting **[Spindle Gear Ratio Selection]**. An example of using the M code to switch the gear ratio is as follows.



5




**Program execution procedure:**

1. When the NC program executes M61, the MLC will set 1 to **[1st Spindle Gear Ratio Selection].**
2. In this example the MLC uses the M61 relay to switch the ratio and check the status. After the process is finished, the MLC will acknowledge system M code finished.
3. When the NC program executes M62, MLC will set 2 to **[1st Spindle Gear Ratio Selection].** In this example the MLC uses the M62 relay to switch ratio and check status.
4. After the process is finished, the MLC will acknowledge system M code finished.
5. When the NC program executes M63, MLC will set 3 to **[1st Spindle Gear Ratio Selection].** In this example the MLC uses the M63 relay to switch ratio and check status.
6. After the process is finished, the MLC will acknowledge system M code finished.
7. When the NC program executes M64, MLC will set 4 to **[1st Spindle Gear Ratio Selection].** In this example the MLC uses the M64 relay to switch ratio and check status.
8. After the process is finished, the MLC will acknowledge system M code finished.

**Important:**

If you use the M code to switch the gear ratio with **[Spindle Gear Ratio Selection],** it only switches the spindle speed command. If there is a physical mechanical part for the gear switch, you need to compose the corresponding MLC and the output DO, so the external mechanical part can correctly change the gear ratio.

# 5.12 One-button macro call

The one-button macro call function enables you to have the system call the specific macro with the MLC by triggering the signals. The MLC determines the conditions and then switches the macros for execution.

## ■ MLC special D

| | | | |
|---|---|---|---|
| Macro Call Activation | M2x025 | Macro Call Status | M3x027 |
| 1st Macro Call Preparation | M2x032 | Macro Call Ready | M3x028 |
| 2nd Macro Call Preparation | M2x033 | Macro Call Error | M3x029 |
| 3rd Macro Call Preparation | M2x034 | 1st Macro Call Initial Finished | M3x048 |
| 4th Macro Call Preparation | M2x035 | 2nd Macro Call Initial Finished | M3x049 |
| 5th Macro Call Preparation | M2x036 | 3rd Macro Call Initial Finished | M3x050 |
| 6th Macro Call Preparation | M2x037 | 4th Macro Call Initial Finished | M3x051 |
| 7th Macro Call Preparation | M2x038 | 5th Macro Call Initial Finished | M3x052 |
| 8th Macro Call Preparation | M2x039 | 6th Macro Call Initial Finished | M3x053 |
| 9th Macro Call Preparation | M2x040 | 7th Macro Call Initial Finished | M3x054 |
| 10th Macro Call Preparation | M2x041 | 8th Macro Call Initial Finished | M3x055 |
| 11th Macro Call Preparation | M2x042 | 9th Macro Call Initial Finished | M3x056 |
| 12th Macro Call Preparation | M2x043 | 10th Macro Call Initial Finished | M3x057 |
| 13th Macro Call Preparation | M2x044 | 11th Macro Call Initial Finished | M3x058 |
| 14th Macro Call Preparation | M2x045 | 12th Macro Call Initial Finished | M3x059 |
| 15th Macro Call Preparation | M2x046 | 13th Macro Call Initial Finished | M3x060 |
| 16th Macro Call Preparation | M2x047 | 14th Macro Call Initial Finished | M3x061 |
| - | - | 15th Macro Call Initial Finished | M3x062 |
| - | - | 16th Macro Call Initial Finished | M3x063 |

| | | | |
|---|---|---|---|
| 1st Macro Call Macro Number | D2x064 | 9th Macro Call Macro Number | D2x072 |
| 2nd Macro Call Macro Number | D2x065 | 10th Macro Call Macro Number | D2x073 |
| 3rd Macro Call Macro Number | D2x066 | 11th Macro Call Macro Number | D2x074 |
| 4th Macro Call Macro Number | D2x067 | 12th Macro Call Macro Number | D2x075 |
| 5th Macro Call Macro Number | D2x068 | 13th Macro Call Macro Number | D2x076 |
| 6th Macro Call Macro Number | D2x069 | 14th Macro Call Macro Number | D2x077 |
| 7th Macro Call Macro Number | D2x070 | 15th Macro Call Macro Number | D2x078 |
| 8th Macro Call Macro Number | D2x071 | 16th Macro Call Macro Number | D2x079 |

**[Macro Call Activation] M2x025**

When the controller is in AUTO mode, first set **[Macro Call Initial Finished]** to ON and then set **[Macro Call Activation]** to ON, and the system will execute the O macro corresponding to the number of **[Macro Call Macro Number]**.

**[Macro Call Preparation] M2x032 ~ M2x047**

When users set **[Macro Call Preparation]** to ON, the system will start to load the O macro and file name as **[Macro Call Macro Number].**

- The corresponding O macro must be stored in the correct channel folder of folder **[O_MACRO]** or the corresponding macro of the location INTER.

5

**[Macro Call Status] M3x027**

When the user sets **[Macro Call Preparation]** to ON, the system will set **[Macro Call Status]** to ON right away.

**[Macro Call Ready] M3x028**

Regardless of whether the controller system is in AUTO mode, the system will set **[Macro Call Ready]** to ON after it finishes the macro initialization and then set **[Macro Call Initial Finished]** to ON. This is in order to notify users to switch the system mode to AUTO, which is able to execute the macro program.

- When the **[Macro Call Activation]** is ON, the **[Macro Call Ready]** will change to OFF.
- After the **[Macro Call Ready]** is ON, it will reset to OFF once the **[NC Reset]** has triggered.

**[Macro Call Error] M3x029**

The **[Macro Call Error]** will be set to ON when the **[Macro Call Preparation]** has triggered and the system is not in the AUTO mode or **[Macro Call Macro Number]** is 0.

**[Macro Call Initial Finished] M3x048 ~ M3x063**

When the **[Macro Call Preparation]** is ON, the system will start to prepare the macro and set **[Macro Call Initial Finished]** to ON right after the process is finished.

- After the **[Macro Call Initial Finished]** is ON, the **[Macro Call Initial Finished]** will reset to OFF once the **[NC Reset]** has triggered.

**[Macro Call Macro Number] D2x064 ~ D2x079**

When the **[Macro Call Preparation]** is ON, the system will access the O macro to refer to the value of **[Macro Call Macro Number].**

- Available range between 1 to 65535.
- When the **[Macro Call Macro Number]** is set to 10000, the system will load O10000. Or, when it is set to 12345, the system will load O12345.
- When the value is set between 1 to 9999, the system will refer to the parameter N8.022 (Macro Call File Source) as a different location.
  a. When N8.022 = 0, the system will load the macro that is stored in the INTER location's O_MACRO folder of the correct channel folder.
  b. When N8.022 = 1, the system will load the macro that is stored in the SD card location's O_MACRO folder of the correct channel folder.
- When the value is set between 10000 to 65535, the system will refer to the parameter N8.022 (Macro Call File Source) as a different root location.
  a. When N8.022 = 0, the system will load the macro that is stored in the root INTER location of the correct channel folder.
  b. When N8.022 = 1, the system will load the macro that is stored in the root SD card location of the correct channel folder.

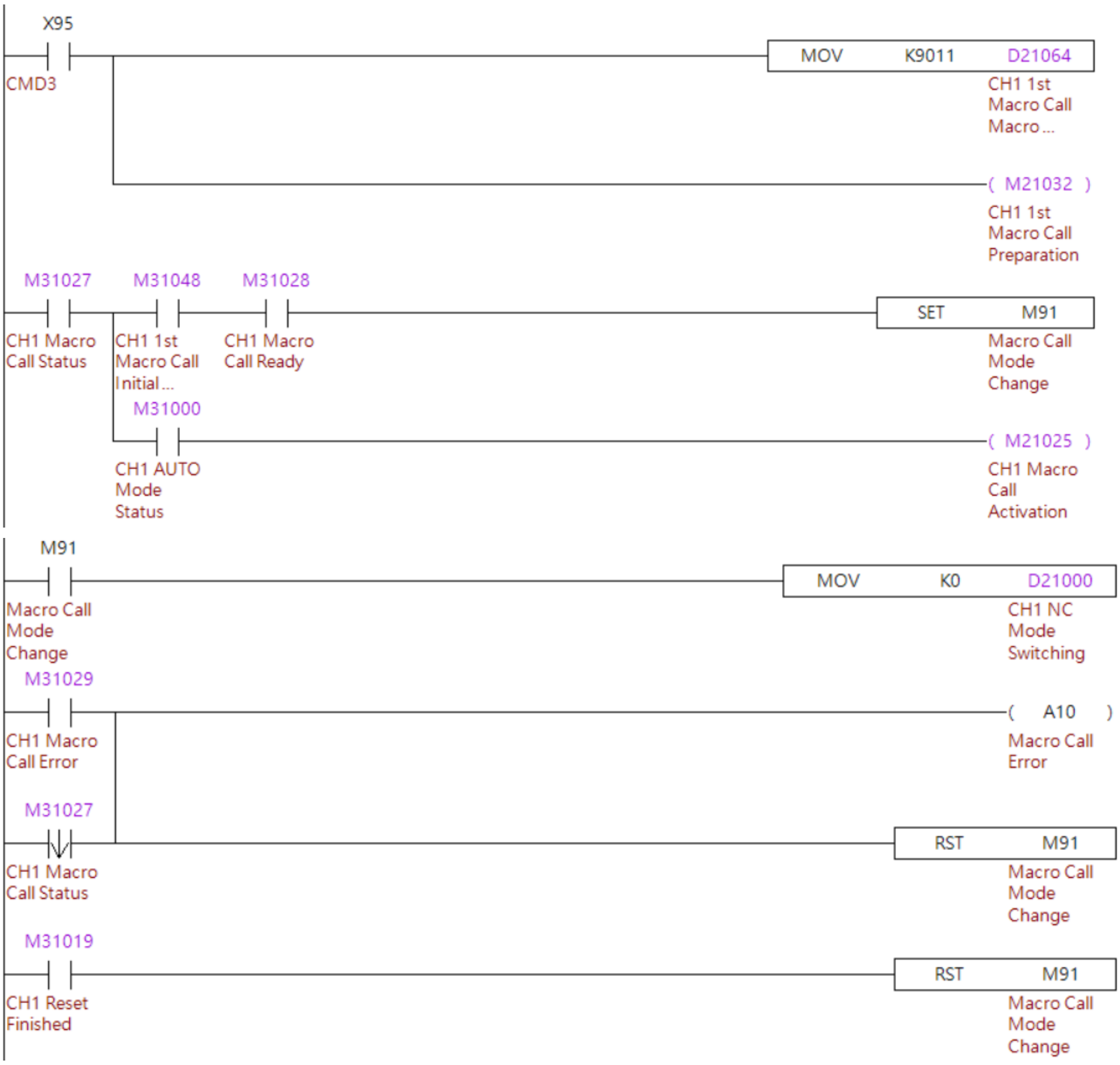
## ■ Relevant Parameter

**Setting macro call file source:**

N8.022 (Macro Call File Source): the O macro file source to call.

- **[Macro Call Macro Number]** value between 1 to 9999:
  When N8.022 = 0, the system will load the macro that is stored in the INTER location's O_MACRO folder of the correct channel folder.
  When N8.022 = 1, the system will load the macro that is stored in the SD card location's O_MACRO folder of the correct channel folder.
- **[Macro Call Macro Number]** value between 10000 to 65535:
  When N8.022 = 0, the system will load the macro that is stored in the root INTER location of the correct channel folder.
  When N8.022 = 1, the system will load the macro that is stored in the root SD card location of the correct channel folder.

## ■ MLC Example




**Program execution procedure:**

1. Call the specific macros with the X95 signals.
2. When X95 is on, the MLC will give a value to D21064 and then set **[Macro Call Preparation]** to ON. The system will set **[Macro Call Status]** to ON automatically.

3. When the system finishes the macro preparation, it will set **[Macro Call Initial Finished]** to ON and then set **[Macro Call Status]** to ON as well. Once this signal status is finished, in this example MLC will set M91 to ON and then switch the system to AUTO mode and activate the **[Macro Call Activation]**.
4. After the macro is finished, the system will set **[Macro Call Status]** to OFF and then MLC will set M91 to OFF.

**Important:**

Executing this one-button macro call function is not recommended when the system is in AUTO or MDI mode. This is because during the macro preparation, the system will be initializing some system inner status, which could affect the macro start in unexpected ways.

# 5.13 Tool magazine control with I/O

The controller changes tools with an external tool exchanger and transmits data or status with the I/O. The following describes how to control the tool magazine with the I/O.

## ■ MLC special D

| Tool Magazine 1 | | Tool Magazine 2 | |
|---|---|---|---|
| Tool Magazine 1 Move Forward | M2x064 | Tool Magazine 2 Move Forward | M2x072 |
| Tool Magazine 1 Move Backward | M2x065 | Tool Magazine 2 Move Backward | M2x073 |
| Tool 1 Exchange | M2x066 | Tool 2 Exchange | M2x074 |
| Tool Magazine 1 Reset | M2x067 | Tool Magazine 2 Reset | M2x075 |
| Current Tool Number Tool Magazine 1 | D3x036 | Current Tool Number Tool Magazine 2 | D3x042 |
| Standby Tool Number Tool Magazine 1 | D3x037 | Standby Tool Number Tool Magazine 2 | D3x043 |
| Standby Tool Pot Tool Magazine 1 | D3x038 | Standby Tool Pot Tool Magazine 2 | D3x044 |
| Tool Pot Deviation Tool Magazine 1 | D3x039 | Tool Pot Deviation Tool Magazine 2 | D3x045 |

**[Tool Magazine Move Forward] M2x064, M2x072**

When **[Tool Magazine Move Forward]** is set to ON, the standby tool pot number and standby tool number increase by 1. When both the standby tool pot number and standby tool number are the maximum numbers and set **[Tool Magazine Move Forward]** to ON again, the standby tool pot number and standby tool number will become 1.

- The operation is the same for both tool magazine 1 and tool magazine 2.

**[Tool Magazine Move Backward] M2x065, M2x073**

When **[Tool Magazine Move Backward]** is set to ON, the standby tool pot number and standby tool number decrease by 1. When both the standby tool pot number and standby tool number are 1 and set **[Tool Magazine Move Backward]** to ON again, the standby tool pot number and standby tool number will become the maximum numbers.

- The operation is the same for both tool magazine 1 and tool magazine 2.

**[Tool Exchange] M2x066, M2x074**

When **[Tool Exchange]** is set to ON, the system exchanges the spindle tool number with the standby tool number.

- The operation is the same for both tool magazine 1 and tool magazine 2.

5

**[Tool Magazine Reset] M2x067, M2x075**

To reset the tool magazine, in addition to using the tool setting function in the OFS screen, users can set **[Tool Magazine Reset]** to ON for the system to reset the tool numbers and arrange the tools in ascending order based on the tool pot sequence.

- After the **[Tool Magazine Reset]** is triggered, the spindle tool number refers to the **[Continue]** setting in the **[Tool Magazine Setting Component]**.
  When **[Continue]** is 0, the current spindle tool number will be 0 after reset. When **[Continue]** is 1, the current spindle tool number will refer to the settings of **[StartNumber]** and **[PotAmount]**, which will increase maximum tool number by 1 (where tool numbers are arranged in ascending order).
  For example, when the tool magazine 1 sets **[StartNumber]** to 3, **[PotAmount]** to 16 and **[Continue]** to 1, the current tool number will be 19, $1^{st}$ tool pot will be 3 and $2^{nd}$ tool pot will be 4.
- After reset, the system will set default standby tool pot to **[StandbyPot]** in the **[Tool Magazine Setting Component]**.
- After reset, the system will set command tool number to **[StartNumber]** in the **[Tool Magazine Setting Component]** and set standby tool number to the command tool number plus 1. Then, all the other tool pots in this tool magazine will increase by 1 in the tool number setting.
- The operation is the same for both tool magazine 1 and tool magazine 2.

**[Current Tool Number] D3x036, D3x042**

This shows the current in use tool number according to the corresponding **[Current Tool Number]** based on the channel and tool magazine.

**[Standby Tool Number] D3x037, D3x043**

When the controller is in AUTO or MDI mode, once the T code block has been executed, the system will execute the tool change procedure. At the same time, the tool number will be set to the **[Standby Tool Number]**, which is based on the setting of **[Tool Pot Amount]** in the **[Tool Magazine Setting Component]** (as shown in the relevant parameters).

- The operation is the same for both tool magazine 1 and tool magazine 2.

**[Standby Tool Pot] D3x038, D3x044**

This shows the current standby tool pot number according to the corresponding **[Standby Tool Pot]** based on the channel and tool magazine.

**[Tool Pot Deviation] D3x039, D3x045**

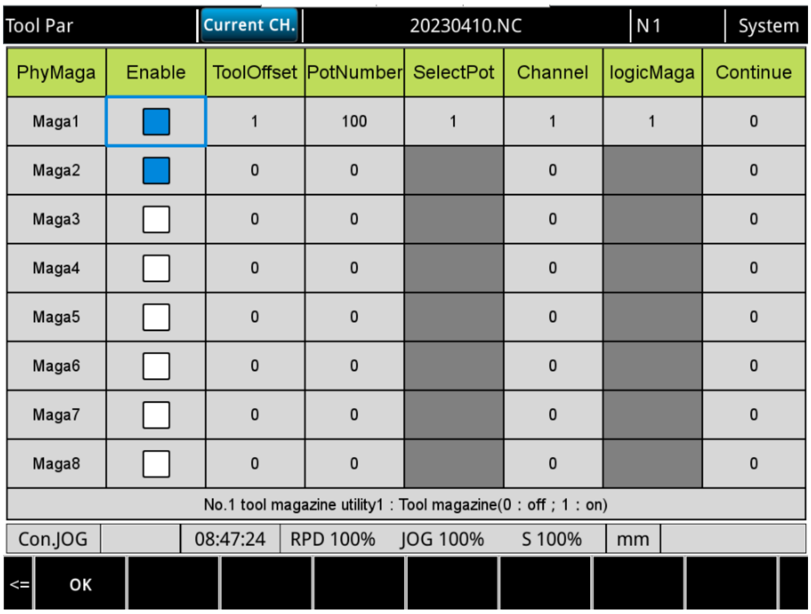
This shows the difference between the current tool number and command tool number. Users can rotate the tool magazine forward or backward through positive or negative values here. After the **[Tool Magazine Move Forward] or [Tool Magazine Move Backward]** is ON, the system will update the new difference to this **[Tool Pot Deviation].**

- The operation is the same for both tool magazine 1 and tool magazine 2.

## ■ Relevant Parameter

**Tool magazine setting component:**

Tool magazines relate parameters are in this **[Tool Magazine Setting Component]** page. Users can set the machine's requirements as described below.




| PhyMaga | Enable | ToolOffset | PotNumber | SelectPot | Channel | logicMaga | Continue |
|---|---|---|---|---|---|---|---|
| Maga1 | ■ | 1 | 100 | 1 | 1 | 1 | 0 |
| Maga2 | ■ | 0 | 0 | | 0 | | 0 |
| Maga3 | □ | 0 | 0 | | 0 | | 0 |
| Maga4 | □ | 0 | 0 | | 0 | | 0 |
| Maga5 | □ | 0 | 0 | | 0 | | 0 |
| Maga6 | □ | 0 | 0 | | 0 | | 0 |
| Maga7 | □ | 0 | 0 | | 0 | | 0 |
| Maga8 | □ | 0 | 0 | | 0 | | 0 |

**PhyMaga**: the actual physical sequence of the tool magazine.

**Enable**: to determine whether to use this tool magazine.

- If users execute a T code that is disabled, the system will return an alarm to acknowledge.

**SrartNumber**: to determine the beginning tool number after tool magazine reset.

- After reset, the system will set the command tool number to **[StartNumber]** and set the standby tool number to the command tool number plus 1. The tool magazine is based on the **[PotAmount]** and the allocated number is increased starting from the **[StartNumber]**.

**PotAmount**: Set the total tool number of the tool magazine.

**StandbyPot**: Set the standby tool pot number after tool magazine reset.

- After tool magazine reset, the standby tool pot number will be 2 if this setting is 2.

**Channel**: Set the channel of the physical tool magazine.

- When set to 1, this physical tool magazine will be allocated to channel 1.

**LogicMaga**: Set the sequence number of the physical tool magazine.

- When set to 2, this tool magazine will be the 2nd logic magazine in the channel.

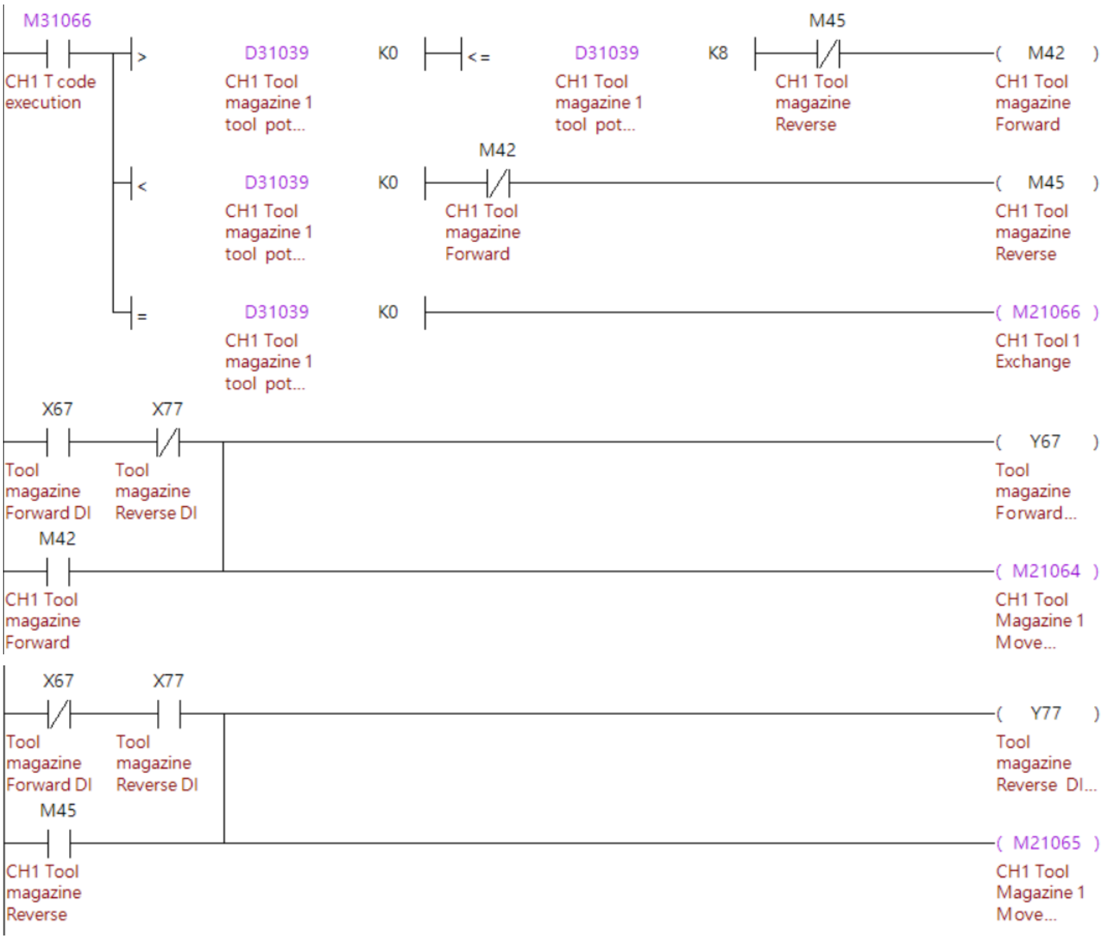
**Continue**: Set the current tool number after the tool magazine has been reset.

- When **[Continue]** is 0, the current spindle tool number will be 0 after reset. When **[Continue]** is 1, the current spindle tool number will refer to the settings of **[StartNumber]** and **[PotAmount]**, which will apply the maximum tool number increases by 1 (where tool numbers are arranged in ascending order).

5

## ■ MLC Example

The following example illustrates the program execution with tool magazine 1 set to hold 16 tools.




**Program execution procedure:**

1. When reading the T code in the program, the system sets **[T code execution]** to ON and automatically write the difference between the current standby tool pot and command tool pot to **[Tool Pot Deviation]**. Since the deviation is displayed in both positive and negative values, when there are only 16 tools in the tool magazine, the maximum deviation is ±8.
2. The system determines in which direction and how many positions the tool magazine must move by performing logic statements. Then, it sets **[Tool Magazine Move Forward]** or **[Tool Magazine Move Backward]** to ON by referring to the corresponding signals such as tool magazine moves forward and external tool counting.
3. When the value of **[Tool Pot Deviation]** is 0, the tool data is exchanged. Additionally, the tools of an external mechanical part can be changed with the MLC.

## 5.14 MLC axes control

Users can dynamically switch a specific axis to the NC axis mode or MLC axis mode with the following special M relays. In MLC axis mode, users can perform position control, speed control, and applications requiring rotations like the spindle rotation or positioning control.

5

### ■ MLC special D

| Axis | Trigger Movement | Command Type | Control Mode | Target Position | Target Velocity | Target Reached | Axis Moving |
|---|---|---|---|---|---|---|---|
| X Axis | M2x448 | M2x464 | M2x416 | D2x256 | D2x288 | M3x448 | M3x464 |
| Y Axis | M2x449 | M2x465 | M2x417 | D2x258 | D2x290 | M3x449 | M3x465 |
| Z Axis | M2x450 | M2x466 | M2x418 | D2x260 | D2x292 | M3x450 | M3x466 |
| A Axis | M2x451 | M2x467 | M2x419 | D2x262 | D2x294 | M3x451 | M3x467 |
| B Axis | M2x452 | M2x468 | M2x420 | D2x264 | D2x296 | M3x452 | M3x468 |
| C Axis | M2x453 | M2x469 | M2x421 | D2x266 | D2x298 | M3x453 | M3x469 |
| U Axis | M2x454 | M2x470 | M2x422 | D2x268 | D2x300 | M3x454 | M3x470 |
| V Axis | M2x455 | M2x471 | M2x423 | D2x270 | D2x302 | M3x455 | M3x471 |
| W Axis | M2x456 | M2x472 | M2x424 | D2x272 | D2x304 | M3x456 | M3x472 |
| 10$^{th}$ Axis | M2x457 | M2x473 | M2x425 | D2x274 | D2x306 | M3x457 | M3x473 |
| 11$^{th}$ Axis | M2x458 | M2x474 | M2x426 | D2x276 | D2x308 | M3x458 | M3x474 |
| 12$^{th}$ Axis | M2x459 | M2x475 | M2x427 | D2x278 | D2x310 | M3x459 | M3x475 |
| 13$^{th}$ Axis | M2x460 | M2x476 | M2x428 | D2x280 | D2x312 | M3x460 | M3x476 |
| 14$^{th}$ Axis | M2x461 | M2x477 | M2x429 | D2x282 | D2x314 | M3x461 | M3x477 |
| 15$^{th}$ Axis | M2x462 | M2x478 | M2x430 | D2x284 | D2x316 | M3x462 | M3x478 |
| 16$^{th}$ Axis | M2x463 | M2x479 | M2x431 | D2x286 | D2x318 | M3x463 | M3x479 |

| Axis | NC / MLC Axis Switching | Switch to MLC Axis Finished |
|---|---|---|
| X Axis | M2x432 | M3x432 |
| Y Axis | M2x433 | M3x433 |
| Z Axis | M2x434 | M3x434 |
| A Axis | M2x435 | M3x435 |
| B Axis | M2x436 | M3x436 |
| C Axis | M2x437 | M3x437 |
| U Axis | M2x438 | M3x438 |
| V Axis | M2x439 | M3x439 |
| W Axis | M2x440 | M3x440 |
| 10$^{th}$ Axis | M2x441 | M3x441 |
| 11$^{th}$ Axis | M2x442 | M3x442 |
| 12$^{th}$ Axis | M2x443 | M3x443 |
| 13$^{th}$ Axis | M2x444 | M3x444 |
| 14$^{th}$ Axis | M2x445 | M3x445 |
| 15$^{th}$ Axis | M2x446 | M3x446 |
| 16$^{th}$ Axis | M2x447 | M3x447 |

**[Trigger Movement] M2x448 ~ M2x463**

When the axis is in the MLC control mode and users trigger the **[Trigger Movement]** to ON, the specific axis will move based on the position command setting. Once the **[Trigger Movement]** is set to OFF the axis will stop actions.

- Before triggering the **[Trigger Movement]**, users must set **[Target Position]** and **[Target Velocity]** at least one MLC scan cycle earlier.
- If the **[Target Position]** is changed during the MLC axis movement, the new target position will be available until the next **[Trigger Movement]** command is triggered.
- If the **[Target Position]** changed one MLC scan cycle before the **[Trigger Movement]** command is triggered, this new target position will be activated and available.

**[MLC Command Type] M2x464 ~ M2x479**

When the axis is in the MLC position control mode, this **[MLC Command Type]** can switch the **[Target Position]** as an absolute or relative command. Once the **[MLC Command Type]** is OFF, axes will move based on the absolute command and work on the machine coordinate system.

On the other hand, when the **[MLC Command Type]** is ON, axes will move based on the relative command.

**[MLC Control Mode] M2x416 ~ M2x431**

The controller will be using position control mode when **[MLC Control Mode]** is OFF and then using **[Target Position]** and **[Target Velocity]** for the target position and speed command. On the other hand, when the **[MLC Control Mode]** is ON, the system will take **[Target Velocity]** as the target speed and then control the axis with a continuous rotary speed.

**[MLC Target Position] D2x256 ~ D2x286**

When the axis is in the MLC position control mode, the MLC axes can be commanded in absolute or relative mode.

In absolute command mode, the **[Target Position]** will be the position command based on machine coordinate system. In relative command mode, the **[Target Position]** will be the position command, which is the actual movement after motion is triggered.

- Attention: this special D uses float format; thus, it will take two sequence special D addresses.
- The **[Target Position]** will not be available when the axis is in the velocity mode.

5

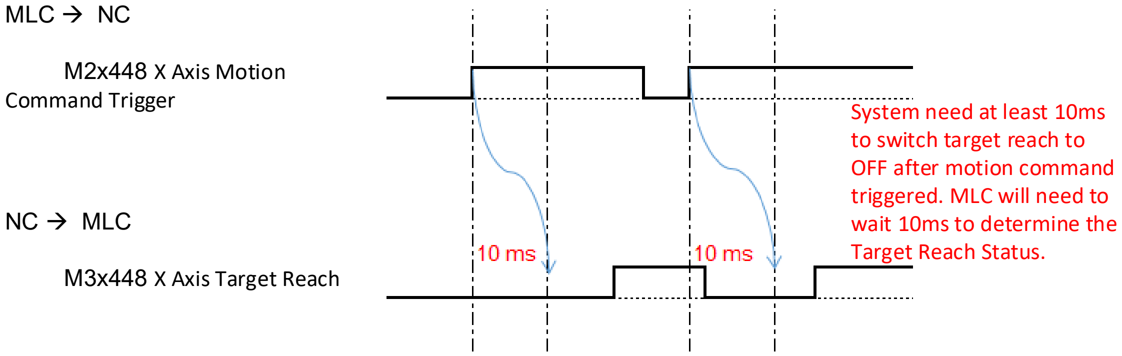
[MLC Target Velocity] D2x288 ~ D2x318

When any of the X, Y or Z axis is in the MLC velocity control mode, the axis will be defined as a linear axis and the velocity command unit will only accept mm/min. When other axes such as A, B, C, U, V, W to 16th axis are in the MLC velocity control mode, the axis can define as linear axis or rotary axis from parameter N2.001 Bit2 to 4 (Axis Command Mode). If the axis is defined as a rotary axis, the velocity command unit can be switched in the parameter N2.001 Bit11 as RPM or deg/min.

- When the MLC axis is in the position mode, the system will be using **[Target Position]** and **[Target Velocity]** for the motion command.
- When the MLC axis is in the velocity mode, the system will be using **[Target Velocity]** for the motion command.
- Attention: this special D uses float format; thus, it will take two sequence special D addresses.
- The value of **[Target Velocity]** is available to change and is active during motion once the MLC scans the new value command.

[Target Reached] M3x448 ~ M3x463

- When the axis is in the MLC position control mode, the **[Target Reached]** status reflects whether the axis has finished the command and reached the command position.
- When the axis is in the MLC velocity control mode, the **[Target Reached]** status reflects whether the axis has finished the command and reached the command speed.
- When programing these special M, users need to note the time response of these flags. After **[Trigger Movement]** is set to ON, the system will need 10ms to update the **[Target Reached]** status to ON. Therefore, users need to delay at least 10ms and then check whether the axes have reached their target command.




[Axis Moving] M3x464 ~ M3x479

When any of the axes is in motion, this **[Axis Moving]** status will be ON.

5

**[NC / MLC Axis Switching] M2x432 ~ M2x447**

The NC5 controller allows users to switch axes from NC axis to MLC axis or vice versa. Setting **[NC / MLC Axis Switching]** to ON will change the axis to MLC axis mode. Alternatively, set it to OFF to change the axis to NC axis mode.

- Users need to configure the axis to NC axis by setting **[Type]** as 1 in the **[Channel Setting]** page. (As shown in the below Relevant Parameter section)
- This function is only available when the system is in AUTO or MDI mode and is switched through the Halt M Code.
- The axis must be motionless before the switch.

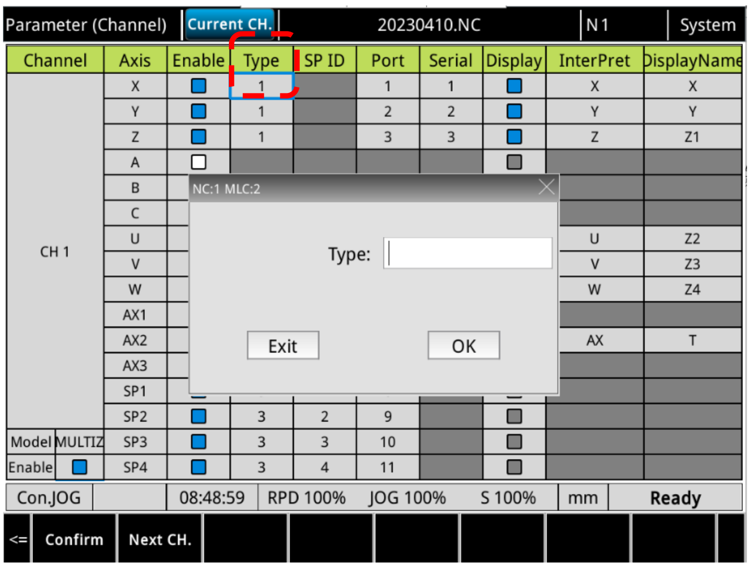
**[NC / MLC Axis Switching Finished] M3x432 ~ M3x447**

After setting the **[NC / MLC Axis Switching]** to ON to change the axis to MLC axis mode, the **[NC / MLC Axis Switching Finished]** will change to ON automatically once the switching is finished. Similarly, the **[NC / MLC Axis Switching Finished]** will change to OFF automatically if users set the **[NC / MLC Axis Switching]** to OFF.

## ■ Relevant Parameter

**Channel setting:**

When the setting in the **[Type]** is set to 1, the specific axis will be one of the NC axes and it will be allowed to switch between MLC or NC axis. When the setting in the **[Type]** is set to 2, the specific axis will be MLC axis and will not be able to switch to NC axis mode.

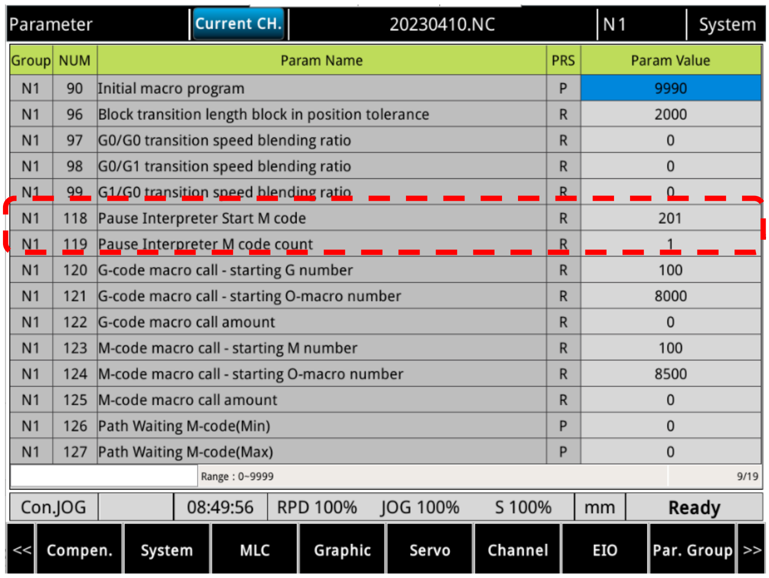



**Speed parameter setting:**

The MLC axis moving speed will refer to N2.023 (G01 Max Velocity), N2.024 (G01 Acc and Dec Time), N2.025 (G01 S Curve Time).

**Operate parameter setting:**

This function is only available when the system is in AUTO or MDI mode and uses the Halt M Code to switch. The Halt M Code is defined by N1.118 (Beginning M Code of Halt Function) and N1.119 (Amount of Halt M Code).



Parameter | Current CH. | 20230410.NC | N1 | System

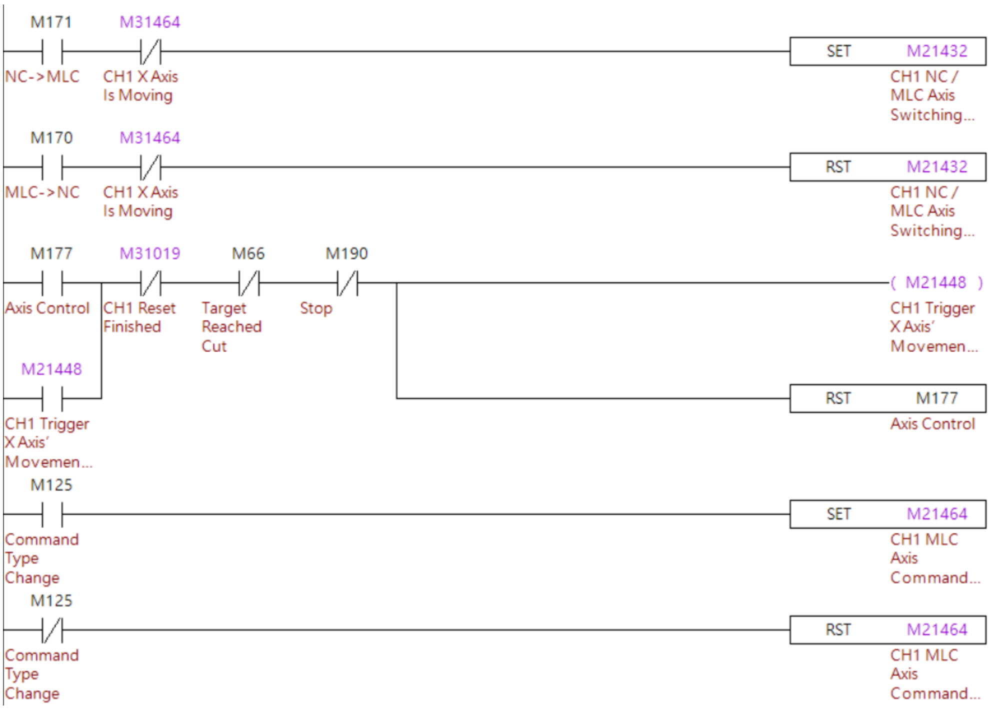
| Group | NUM | Param Name | PRS | Param Value |
|---|---|---|---|---|
| N1 | 90 | Initial macro program | P | 9990 |
| N1 | 96 | Block transition length block in position tolerance | R | 2000 |
| N1 | 97 | G0/G0 transition speed blending ratio | R | 0 |
| N1 | 98 | G0/G1 transition speed blending ratio | R | 0 |
| N1 | 99 | G1/G0 transition speed blending ratio | R | 0 |
| N1 | 118 | Pause Interpreter Start M code | R | 201 |
| N1 | 119 | Pause Interpreter M code count | R | 1 |
| N1 | 120 | G-code macro call - starting G number | R | 100 |
| N1 | 121 | G-code macro call - starting O-macro number | R | 8000 |
| N1 | 122 | G-code macro call amount | R | 0 |
| N1 | 123 | M-code macro call - starting M number | R | 100 |
| N1 | 124 | M-code macro call - starting O-macro number | R | 8500 |
| N1 | 125 | M-code macro call amount | R | 0 |
| N1 | 126 | Path Waiting M-code(Min) | P | 0 |
| N1 | 127 | Path Waiting M-code(Max) | P | 0 |

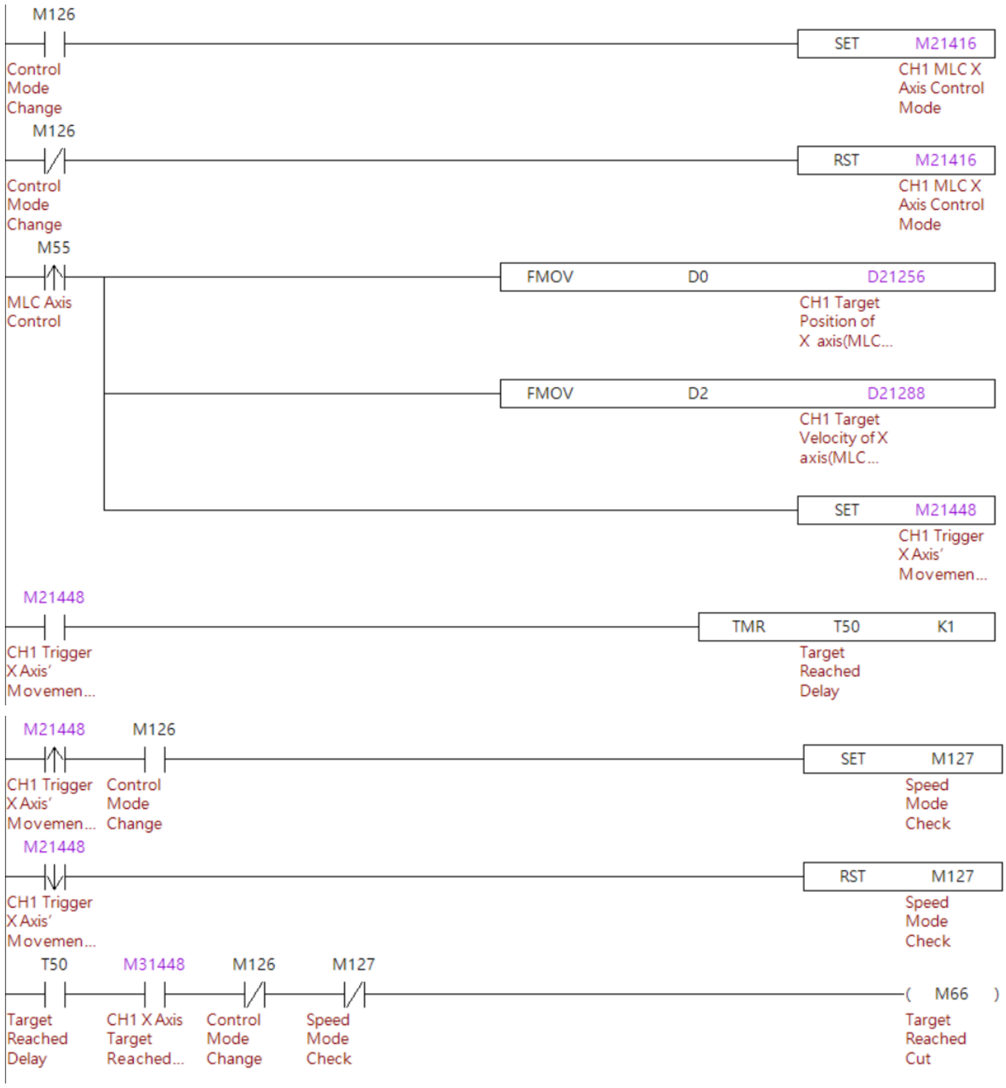
Range : 0~9999 9/19

Con.JOG | 08:49:56 | RPD 100% | JOG 100% | S 100% | mm | Ready

<< | Compen. | System | MLC | Graphic | Servo | Channel | EIO | Par. Group | >>

## ■ MLC Example






**Program execution procedure:**

Position mode:

1. M171 switches the X axis from an NC axis to MLC axis. (This action is not available when the axis is set to an MLC axis in the **channel setting** page)
2. M125 Sets the axis to absolute or incremental mode.
3. Set M126 to OFF and the axis is in position mode.
4. Set D0 for the position command value.
5. Set D2 for the speed command value.
6. Trigger M55 to update the position and speed values and activate the axis.

Speed mode:

1. M171 switches the X axis from an NC axis to MLC axis. (This action is not available when the axis is set to an MLC axis in the **channel setting** page)
2. Set M126 to ON and the axis is in speed mode.
3. Set D2 for the speed command value.
4. Trigger M55 to update the speed value and activate the axis.

**Important:**

1. The homing speed for the rotation axis refers to the settings of N2.053 (1st Searching Speed) and N2.054 (2nd Searching Speed) (unit: RPM).
2. Pay attention to the execution timing of the program. The **[M, S and T Codes Finished]** must be executed after the **[NC / MLC Axis Switching]** to ensure correct operation.
3. When a switching program is executed but the system does not perform any actions, check that the special M relays **[NC / MLC Axis Switching Finished]** are ON.
4. When a motion program is executed but the system does not perform any actions, check that the values **[Target Position]** and **[Target Velocity]** are floating-point values.
5. The corresponding halt M code parameter is required in AUTO mode when the axis is switched from MLC to NC axis mode.
6. Users need to re-trigger **[Trigger Movement]** to have the updated value take effect, except for the speed command **[Target Velocity]** which takes immediate effect after being modified.
7. The axes must stay in still when changing NC axis into MLC axis.

5

## 5.15 Synchronous control and command transfer

The system provides the functions of synchronous axis control and transferring command to another axis, which are enabled or disabled with the MLC. The command transfer function is only available when the system is in AUTO mode. The following describes the two functions.

### ■ MLC special M relays

| Axis | Synchronous Control Enable | Enable as Slave Axis of the Synchronous Control | Command Transfer Enable | Enable as Slave Axis of the Command Transfer Control |
|---|---|---|---|---|
| X Axis | M2x256 | M2x288 | M2x257 | M2x304 |
| Y Axis | | M2x289 | | M2x305 |
| Z Axis | | M2x290 | | M2x306 |
| A Axis | | M2x291 | | M2x307 |
| B Axis | | M2x292 | | M2x308 |
| C Axis | | M2x293 | | M2x309 |
| U Axis | | M2x294 | | M2x310 |
| V Axis | | M2x295 | | M2x311 |
| W Axis | | M2x296 | | M2x312 |
| $10^{th}$ Axis | | M2x297 | | M2x313 |
| $11^{th}$ Axis | | M2x298 | | M2x314 |
| $12^{th}$ Axis | | M2x299 | | M2x315 |
| $13^{th}$ Axis | | M2x300 | | M2x316 |
| $14^{th}$ Axis | | M2x301 | | M2x317 |
| $15^{th}$ Axis | | M2x302 | | M2x318 |
| $16^{th}$ Axis | | M2x303 | | M2x319 |

**[Synchronous Control Enable] M2x256**

Set the **[Synchronous Control Enable]** to ON to enable the function of axes synchronous control. Users still need to switch ON the **[Slave Axis of the Synchronous Control]** for each slave axis.

**[Slave Axis of the Synchronous Control] M2x288 ~ M2x303**

To enable the axes synchronous control, users will need to set the **[Synchronous Control Enable]** to ON and the **[Slave Axis of the Synchronous Control]** to ON for each slave axis.

**[Command Transfer Enable] M2x257**

Set the **[Command Transfer Enable]** to ON to enable the function of axes command transfer control. Users still need to switch ON the **[Slave Axis of the Command Transfer Control]** for each slave axis.

**[Slave Axis of the Command Transfer Control] M2x304 ~ M2x319**

To enable the axes command transfer control, users will need to set the **[Command Transfer Enable]** to ON and the **[Slave Axis of the Command Transfer Control]** to ON for each slave axis.

## Relevant Parameter

N1.128 (M Code to Enable Halt Function for Synchronous and Command Transfer)
N1.129 (M Code to Disable Halt Function for Synchronous and Command Transfer)



- When the controller is in AUTO or MDI mode, the synchronous and command transfer function needs to utilize the M code of halt to enable or disable the function. Controllers provide a specific halt M code for users to configure based on their preferences.
- Available range 0 to 65,535.
- When the N1.128 is set to 10, the M10 will be the halt function and specific for enable or disable synchronous or command transfer function.

N2.015 (Master Axis of Synchronous and Command Transfer):

Set for the master axis for synchronous and command transfer function.

- Value set to 1 means X axis; value set to 2 means Y axis …, etc. For example, when this parameter is set to 3, the system will use the Z axis as master axis.

N2.016 (Slave Direction of Synchronous and Command Transfer):

Set for the slave direction when the synchronous and command transfer is enabled.

- When set to 0, the slave axes will follow the same direction as the master axis.
When set to 1, the slave axes will follow the opposite direction of the master axis.

N2.051 (Homing Action of Synchronous and Command Transfer):

Set for slave axis home action mode when the synchronous and command transfer is enabled.

- When set to 0, the slave axes will follow up the master axis during the home procedure.
When set to 1, the slave axes and master axis are separated and proceed with the home procedure independently.

N8.009 (Slave Coordinate Setting of Synchronous and Command Transfer):

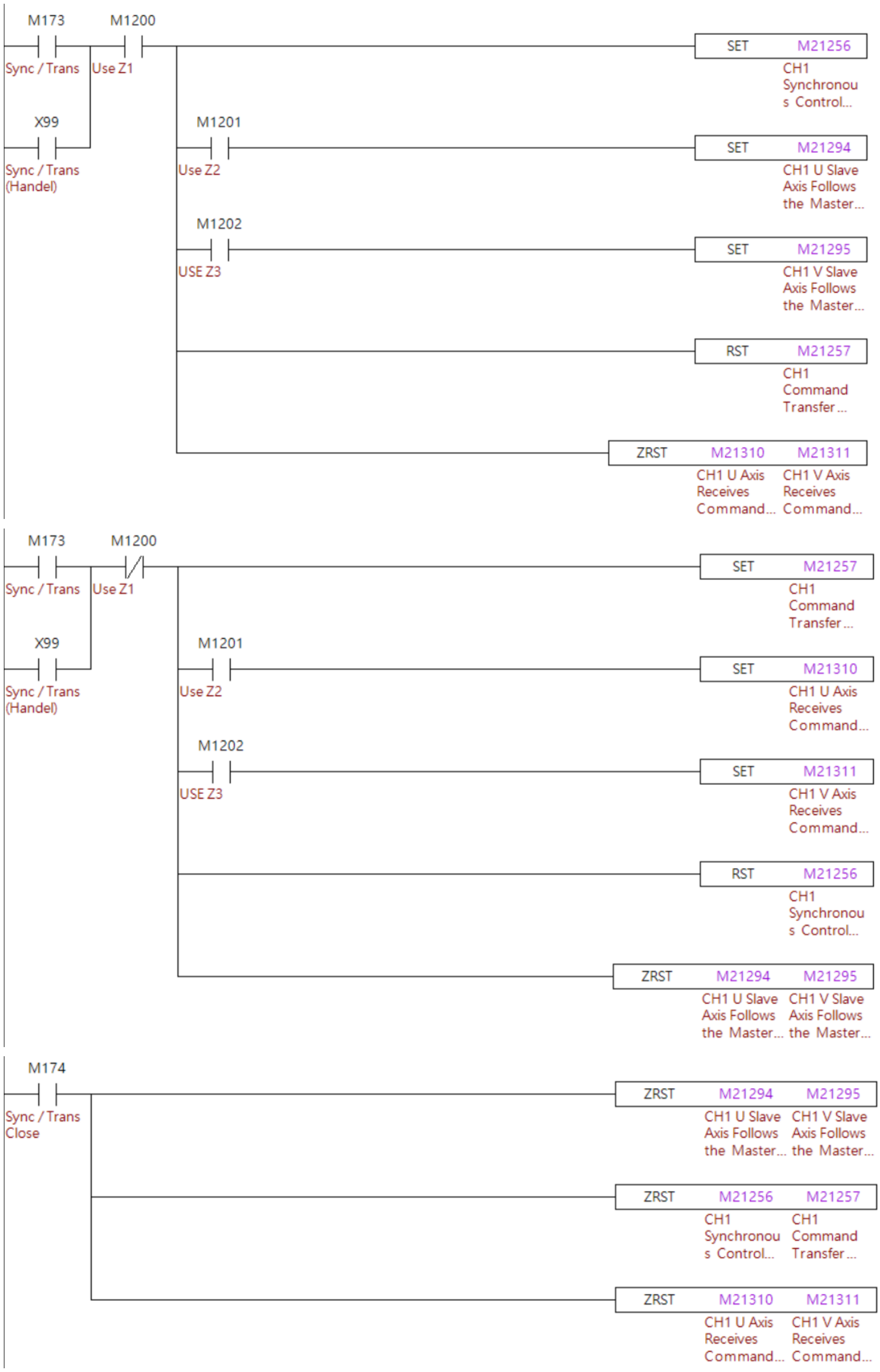
Set for whether to show slave axes' coordinates (Bit 0) and work coordinates (Bit 2).

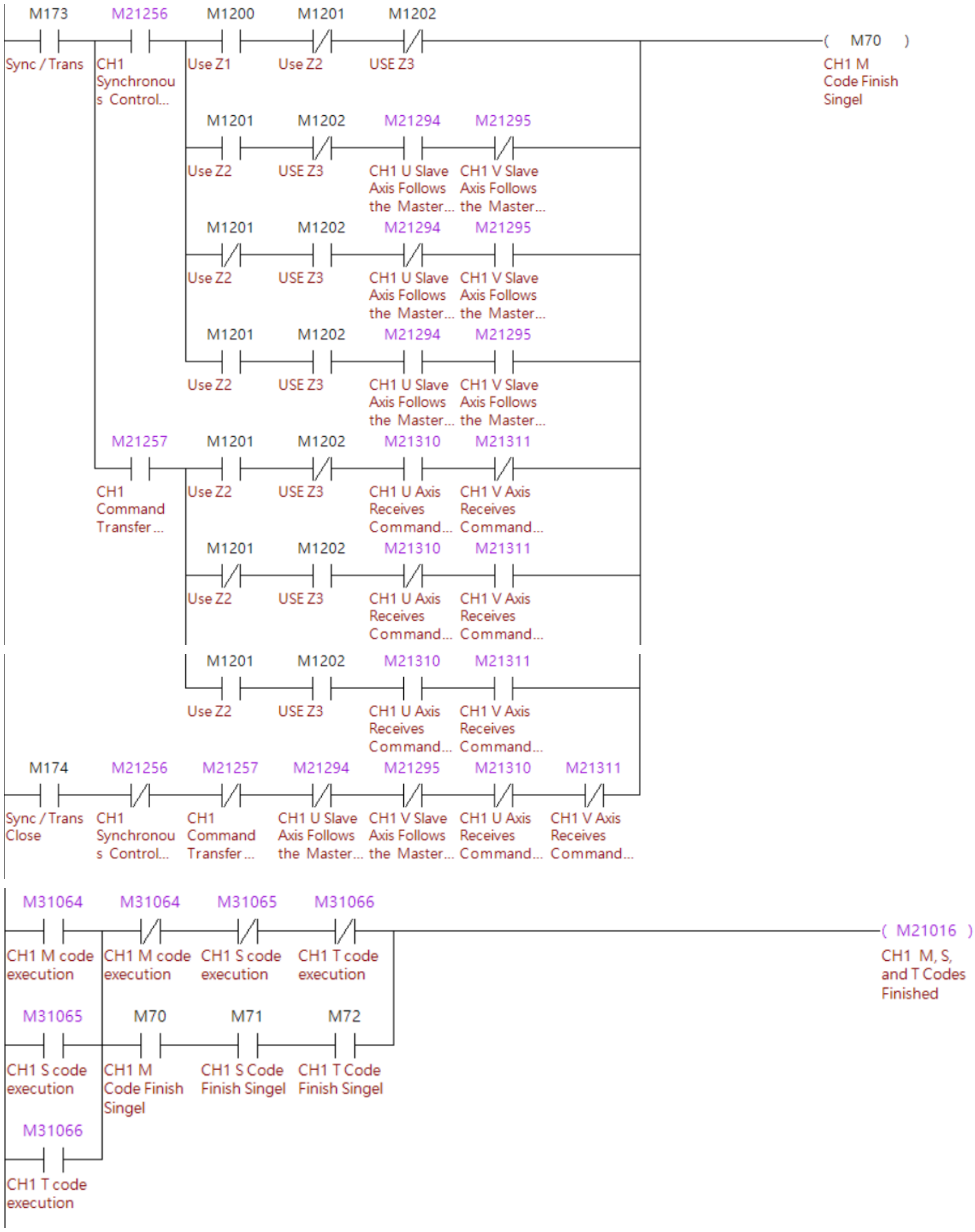
- When set to 0, not display the coordinates. When set to 1, display the coordinates.

5

## ■ MLC Example

The Z, U, and V axes are used in the following example. M1200 enables Z axis, M1201 enables U axis and M1202 enables V axis. Set the corresponding special M relay to ON to activate the axis. In addition, the following illustrates how to enable and disable the synchronous control and command transfer functions with the MLC.




M173 Sync / Trans
M21256 CH1 Synchronous Control...
M1200 Use Z1
M1201 Use Z2
M1202 USE Z3
M70 CH1 M Code Finish Singel
M21294 CH1 U Slave Axis Follows the Master...
M21295 CH1 V Slave Axis Follows the Master...
M21257 CH1 Command Transfer...
M21310 CH1 U Axis Receives Command...
M21311 CH1 V Axis Receives Command...
M174 Sync / Trans Close
M31064 CH1 M code execution
M31065 CH1 S code execution
M31066 CH1 T code execution
M71 CH1 S Code Finish Singel
M72 CH1 T Code Finish Singel
M21016 CH1 M, S, and T Codes Finished

**Program execution procedure:**

- JOG or MPG mode
  1. When X99 is ON in JOG or MPG mode, the system determines whether to execute the synchronous control or command transfer function depending on whether the Z axis is enabled.
  2. When the synchronous control function is enabled, the command transfer function must be disabled to avoid errors, and vice versa.
  3. The synchronous control or command transfer function can be disabled through RESET.
- AUTO or MDI mode
  1. When the program reads M171 in AUTO or MDI mode, the system determines whether to execute the synchronous control or command transfer function depending on whether the Z axis is enabled.
  2. When the synchronous control function is enabled, the command transfer function must be disabled to avoid errors, and vice versa.
  3. After the function is enabled, the M code procedure is complete.
  4. When the program reads M172, the synchronous control or command transfer function is disabled.

**Important:**

1. All of the M code must be defined as halt M code function in order to enable or disable the synchronous control or command transfer function in AUTO and MDI modes.
2. The system checks whether to enable the synchronous control or command transfer function at different time points in different modes, which are described as follows.
   a. AUTO, MDI: when the M code procedure is complete.
   b. JOG, MPG: at all times.
   c. HOME
      Synchronous control: After **[Slave Axis of the Synchronous Control]** and **[Slave Axis of the Synchronous Control]** are set to ON or OFF, the system will check the corresponding axis and activate the related function once the **[Axis Homing]** is triggered.
   d. EDIT: the system does not check for the enabling of the function and operates according to the mode users switch to.
3. One axis cannot be the master axis and slave axis at the same time.
4. Multiple slave axes can follow the same master axis for synchronous control or command transfer at the same time.
5. When the synchronous control or command transfer function is enabled, if the program reads the movement command for the slave axis, the slave axis will not move, and the movement command is skipped.
6. The command transfer function supports the cutting cycle command for Z axis.
7. When N2.050 (Origin Search Mode) is 0 - 5 and the synchronous control function is enabled, if N2.051 (Origin Search Mode for Sync. Motion) is 0, the slave axes and the

master axis will perform the homing procedure synchronously.

8. The settings of the machine parameters and homing modes for the synchronous axes should be consistent.
9. When the A, B, C, U, V, and W axes are the slave axes and X, Y, and Z axes are the master axes, the setting of N2.001 (Rotation Axis Feed Mode) for A, B, C, U, V, and W axes must be 5. When the A, B, C, U, V, and W axes are the master axes, the setting of N2.001 for these axes must be consistent.

5

## 5.16 Synchronous gantry control

Users can use the synchronous gantry control function with M code in AUTO or MDI modes, directly enable or disable the function in JOG and MPG modes or execute the function at startup. The following describes the synchronous gantry control function.

### ■ MLC special M relays

| Axis | Synchronous Control Enable | Enable as Slave Axis of the Synchronous Control |
|---|---|---|
| X Axis | M2x256 | M2x288 |
| Y Axis | | M2x289 |
| Z Axis | | M2x290 |
| A Axis | | M2x291 |
| B Axis | | M2x292 |
| C Axis | | M2x293 |
| U Axis | | M2x294 |
| V Axis | | M2x295 |
| W Axis | | M2x296 |
| 10th Axis | | M2x297 |
| 11th Axis | | M2x298 |
| 12th Axis | | M2x299 |
| 13th Axis | | M2x300 |
| 14th Axis | | M2x301 |
| 15th Axis | | M2x302 |
| 16th Axis | | M2x303 |

**[Synchronous Control Enable] M2x256**

Set the **[Synchronous Control Enable]** to ON to enable the function of axes synchronous control. Users still need to switch ON the **[Slave Axis of the Synchronous Control]** for each slave axis.

**[Slave Axis of the Synchronous Control] M2x288 ~ M2x303**

To enable the axes synchronous control, users will need to set the **[Synchronous Control Enable]** to ON and the **[Slave Axis of the Synchronous Control]** to ON for each slave axis.

## Relevant Parameter

N1.128 (M Code to Enable Halt Function for Synchronous and Command Transfer)

N1.129 (M Code to Disable Halt Function for Synchronous and Command Transfer)

- When the controller is in AUTO or MDI mode, the synchronous and command transfer function needs to utilize the M code of halt to enable or disable the function. Controllers provide a specific halt M code for users to configure based on their preferences.
- The parameter names “enable” and “disable” do not turning functions ON or OFF, but are only for the user to distinguish whether the two M codes are ON or OFF.
- Available range 0 to 65,535.
- When the N1.128 is set to 10, the M10 will be the halt function and specific for enable or disable synchronous or command transfer function.

N2.015 (Master Axis of Synchronous and Command Transfer):

Set for the master axis for synchronous and command transfer function.

- Value set to 1 means X axis; value set to 2 means Y axis …, etc. For example, when this parameter is set to 3, the system will use the Z axis as master axis.
- 

N2.016 (Slave Direction of Synchronous and Command Transfer):

Set for the slave direction when the synchronous and command transfer is enabled.

- When set to 0, the slave axes will follow the same direction as the master axis.
  When set to 1, the slave axes will follow the opposite direction of the master axis.

N2.051 (Homing Action of Synchronous and Command Transfer):

Set for slave axis home action mode when the synchronous and command transfer is enabled.

- When set to 0, the slave axes will follow up the master axis during the home procedure.
  When set to 1, the slave axes and master axis are separated and proceed with the home procedure independently.

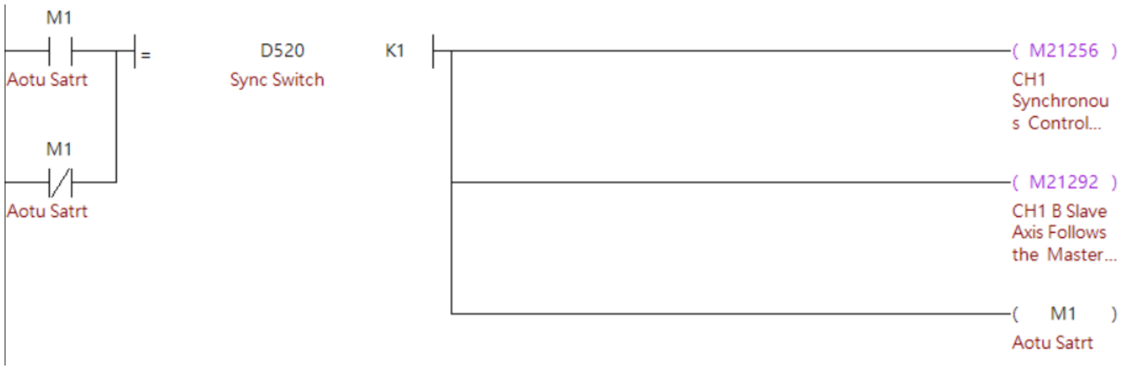
N8.009 (Slave Coordinate Setting of Synchronous and Command Transfer):

Set for whether to show slave axes’ coordinates (Bit 0) and work coordinates (Bit 2).

- When set to 0, not display the coordinates. When set to 1, display the coordinates.

5

## ■ MLC Example




**Program execution procedure:**

As soon as the system is powered on, if the switch for synchronous gantry control is 0, M1 is constantly ON, and the system sets **[Synchronous Control Enable]** and **[Slave Axis of the Synchronous Control]** to ON.

**Important:**

1. To use the synchronous gantry control function, avoid enabling or disabling the synchronous control function in AUTO or MDI mode, which might damage the machine.
2. According to the enabling rules, set the system to JOG or MPG mode when it is powered on, so the synchronous control function can be correctly enabled.
3. Multiple slave axes can follow the same master axis for synchronous control at the same time.
4. When the synchronous control function is enabled, if the program reads the movement command for the slave axis, the slave axis will not move, and the movement command is skipped.
5. When N2.050 (Origin Search Mode) is 0 - 5 and the synchronous control function is enabled, if N2.051 (Origin Search Mode for Sync. Motion) is 0, the slave axes and the master axis will perform the homing procedure synchronously.
6. The settings of the machine parameters and homing modes for the synchronous axes should be consistent.
7. When the A, B, C, U, V, and W axes are the slave axes and X, Y, and Z axes are the master axes, the setting of N2.001 (Rotation Axis Feed Mode) for A, B, C, U, V, and W axes must be 5. When the A, B, C, U, V, and W axes are the master axes, the setting of N2.001 for these axes must be consistent.

# 5.17 Devices information monitor

The system provides special D for users to monitor or compare the specific status of the controller through MLC. This specific status will be maintained and increased as a field request in the future.

## ■ MLC special D register

| | | | |
|---|---|---|---|
| Information Monitoring 1 Sort 1 | D3x096<br>D3x097 | Information Monitoring 2 Sort 1 | D3x104<br>D3x105 |
| Information Monitoring 1 Sort 2 | D3x098<br>D3x099 | Information Monitoring 2 Sort 2 | D3x106<br>D3x107 |
| Information Monitoring 1 Sort 3 | D3x100<br>D3x101 | Information Monitoring 2 Sort 3 | D3x108<br>D3x109 |
| Information Monitoring 1 Sort 4 | D3x102<br>D3x103 | Information Monitoring 2 Sort 4 | D3x110<br>D3x111 |

**[Information Monitoring 1 Sort 1] D3x096, D3x097**

The system will be showing the slave devices' information based on the configured parameter N1.321 (Information Monitoring Category 1) and N1.322 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 1 Sort 2] D3x098, D3x099**

The system will be showing the slave devices' information based on the configured parameter N1.321 (Information Monitoring Category 1) and N1.323 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 1 Sort 3] D3x100, D3x101**

The system will be showing the slave devices' information based on the configured parameter N1.321 (Information Monitoring Category 1) and N1.324 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 1 Sort 4] D3x102, D3x103**

The system will be showing the slave devices' information based on the configured parameter N1.321 (Information Monitoring Category 1) and N1.325 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 2 Sort 1] D3x104, D3x105**

The system will be showing the slave devices' information based on the configured parameter N1.326 (Information Monitoring Category 2) and N1.327 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 2 Sort 2] D3x106, D3x107**

The system will be showing the slave devices' information based on the configured parameter N1.326 (Information Monitoring Category 2) and N1.328 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 2 Sort 3] D3x108, D3x109**

The system will be showing the slave devices' information based on the configured parameter N1.326 (Information Monitoring Category 2) and N1.329 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

**[Information Monitoring 2 Sort 4] D3x110, D3x111**

The system will be showing the slave devices' information based on the configured parameter N1.326 (Information Monitoring Category 2) and N1.330 (Information Monitoring Sort 1).

- This is a 32-bit special D data, which will occupy two sequence D addresses.

■ **Relevant Parameter**

N1.321 (Information Monitoring Category 1):

Users can set this to determine the data type of 1st category to read.

- The input range is 0 – 65535.
- When set to 1, the system will allocate the 1st category as the axes' machine coordinates.

N1.322 (Information Monitoring Sort 1 of Category 1):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 1).

- The input range is 0 – 65535.
- When N1.321 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinate to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.323 (Information Monitoring Sort 2 of Category 1):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 1).

- The input range is 0 – 65535.
- When N1.321 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.324 (Information Monitoring Sort 3 of Category 1):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 1).

- The input range is 0 – 65535.
- When N1.321 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.325 (Information Monitoring Sort 4 of Category 1):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 1).

- The input range is 0 – 65535.
- When N1.321 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.326 (Information Monitoring Category 2):

Users can set this to determine the data type of 2nd category to read.

- The input range is 0 – 65535.
- When set to 1, the system will allocate the 2nd category as the axes' machine coordinate.

N1.327 (Information Monitoring Sort 1 of Category 2):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 2).

- The input range is 0 – 65535.
- When N1.326 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.328 (Information Monitoring Sort 2 of Category 2):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 2).

- The input range is 0 – 65535.
- When N1.326 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

N1.329 (Information Monitoring Sort 3 of Category 2):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 2).

- The input range is 0 – 65535.
- When N1.326 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

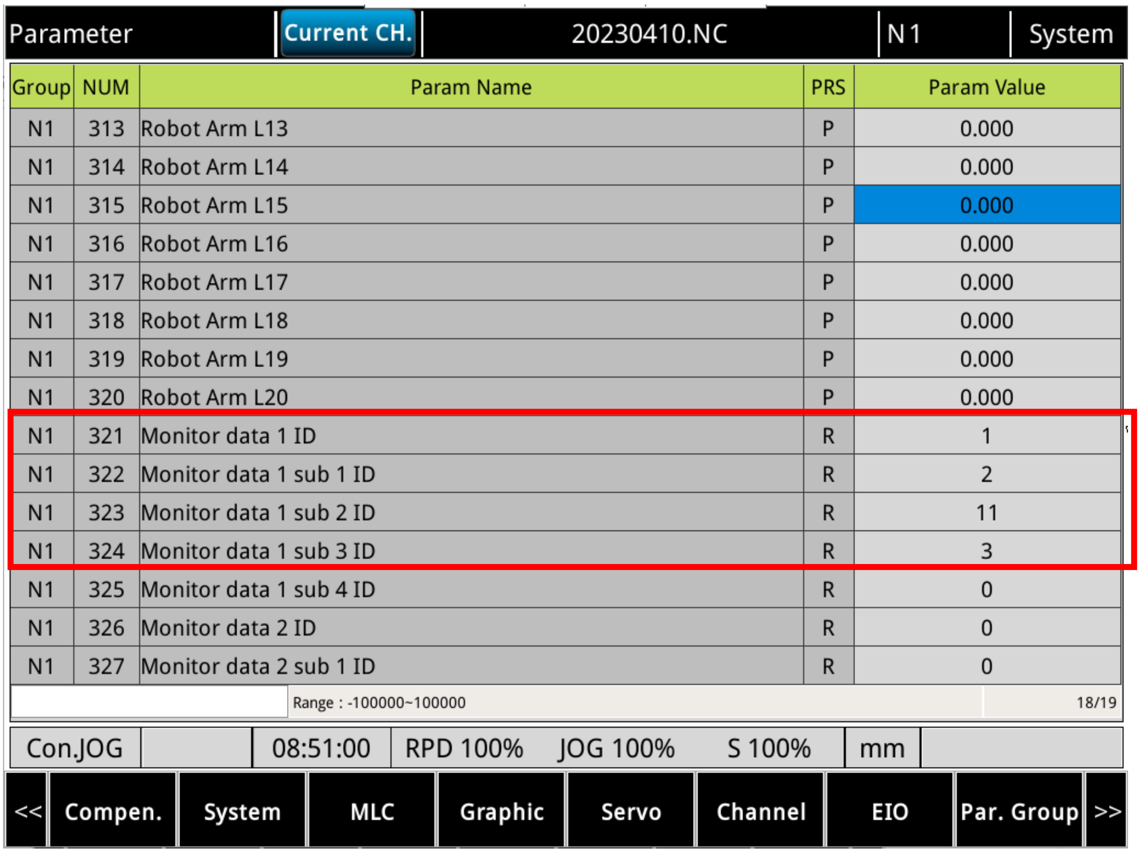
N1.330 (Information Monitoring Sort 4 of Category 2):

The special D can show specific monitored information in accordance with the setting of N1.321 (Information Monitoring Category 2).

- The input range is 0 – 65535.
- When N1.326 is set to 1 and this parameter is set to 1, the system will update the X axis's machine coordinates to the corresponding special D. If this parameter is set to 2, the system will update the Y axis's information to the corresponding special D.

## ■ MLC Example

When the parameter N1.321 (Information Monitoring Category) is set to 1 and N1.322 to N1.324 (Information Monitoring Sort 1 to 3) are set to 1, 2 and 3 respectively, users can read the machine coordinates of X, Y and Z through the special D in the MLC.



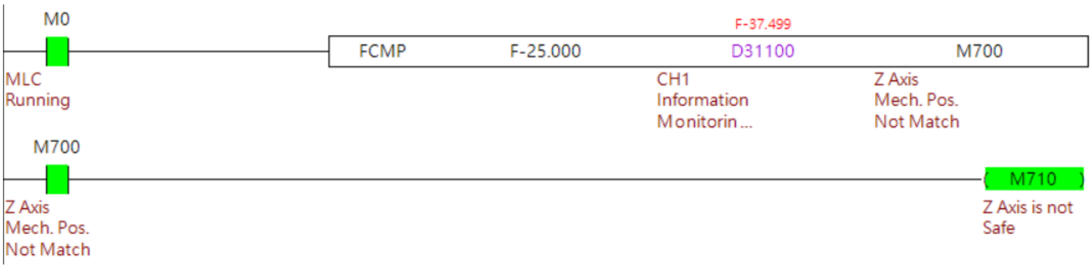
Parameter | Current CH. | 20230410.NC | N1 | System

| Group | NUM | Param Name | PRS | Param Value |
|---|---|---|---|---|
| N1 | 313 | Robot Arm L13 | P | 0.000 |
| N1 | 314 | Robot Arm L14 | P | 0.000 |
| N1 | 315 | Robot Arm L15 | P | 0.000 |
| N1 | 316 | Robot Arm L16 | P | 0.000 |
| N1 | 317 | Robot Arm L17 | P | 0.000 |
| N1 | 318 | Robot Arm L18 | P | 0.000 |
| N1 | 319 | Robot Arm L19 | P | 0.000 |
| N1 | 320 | Robot Arm L20 | P | 0.000 |
| N1 | 321 | Monitor data 1 ID | R | 1 |
| N1 | 322 | Monitor data 1 sub 1 ID | R | 2 |
| N1 | 323 | Monitor data 1 sub 2 ID | R | 11 |
| N1 | 324 | Monitor data 1 sub 3 ID | R | 3 |
| N1 | 325 | Monitor data 1 sub 4 ID | R | 0 |
| N1 | 326 | Monitor data 2 ID | R | 0 |
| N1 | 327 | Monitor data 2 sub 1 ID | R | 0 |

Range : -100000~100000 18/19

Con.JOG | 08:51:00 | RPD 100% JOG 100% S 100% | mm

<< | Compen. | System | MLC | Graphic | Servo | Channel | EIO | Par. Group | >>




**Program execution procedure:**

In this MLC example, FCMP instructions are used to compare the Z axis's machine position. In addition, the M700 will be triggered due to the Z axis's actual position being smaller than the setting position.

# 5.18 Robot arm control



The NC5 controller provides multi-axes and multi-path functions. From the different paths, users can define each path with different mechanisms, such as a Cartesian coordinate system or robot coordinate system. Furthermore, users can use the different path for regular processes or utilize the robot arm for such as load and unload procedures at the same time.

## ■ MLC special D

| | | | |
|---|---|---|---|
| Servo On / Off | M2x012 | MPG Ratio Selection | D2x009 |
| Robot Coordinate System | M2x048<br>M2x049<br>M2x050<br>M2x051 | Robot's Coordinate System Switch in Manual Mode | D2x016 |
| NC Mode Switch | D2x000 | Robot's Tool System Switch in Manual Mode | D2x017 |
| Feed Rate Override for JOG, INC and Dry Run Mode | D2x006 | Current Coordinate System | D3x016 |
| MPG Axes Selection | D2x008 | Current Robot Tool Coordinate System | D3x017 |

**[Servo ON / OFF] M2x012**

Servo ON or OFF for all connected servo drives in the corresponding channel.

- The parameter **[N1.010 Axes Manually Enable after Startup]** must be set to 1.

**[Robot Coordinate System Switching] M2x048 ~ M2x051**

Robot coordinate system can be switched as shown in the table below. CNC controllers need to be in manual mode.

| Robot Mode Control | M2x048 | M2x049 | M2x050 | M2x051 | D2x016 |
|---|---|---|---|---|---|
| PCS (Piece) | 1 | 1 | 1 | 1 | - |
| TCS (Tool) | 1 | 1 | 0 | 1 | - |
| JCS (Joint) | 0 | 0 | 0 | 0 | - |

**[NC Mode Switch] D2x000**

The NC system uses this D2x000 to switch between different NC modes. The x in D2x000 represents different NC channels.

| NC Mode Switch | Value | Mode | Mode Status |
|---|---|---|---|
| D2x000 | 0 | AUTO | M3x000 |
| | 1 | EDIT | M3x001 |
| | 2 | MDI | M3x002 |
| | 3 | MPG | M3x003 |
| | 4 | JOG | M3x004 |
| | 5 | RAPID | M3x005 |
| | 6 | INC | M3x006 |
| | 7 | HOME | M3x007 |

**[Dry Run, Feed Rate] M2x005, D2x006**

When the controller is in AUTO or MDI mode, if **[Dry Run]** is triggered, the system will load the main program or MDI program and then start the execution with the **[Feed Rate]** speed.

- When **[Dry Run]** is triggered as ON, the system will take **[Feed Rate]** as the process speed.
- When the system is executing in dry run mode and the **[Dry Run]** is reset to OFF, the system will continue running but at the NC programed speed.

**[MPG Axes Selection] D2x008**

Users can switch the MPG axis by setting this special D to the indicated axes as below.
When the channel is configured as a robot system, the system will determine whether the robot is in the PCS (Piece Coordinate) or TCS (Tool Coordinate) mode, and it will switch MPG axis control accordingly as
0 = X Axis, 1 = Y Axis, 2 = Z Axis, 3 = A Axis, 4 = B Axis or 5 = C Axis.
When the robot system is in JCS (Joint Coordinate) mode, the system will switch the MPG axis control accordingly as
0 = J1 Axis, 1 = J2 Axis, 2 = J3 Axis, 3 = J4 Axis, 4 = J5 Axis or 5 = J6 Axis.

**[MPG Ratio Selection] D2x009**

This **[MPG Ratio Selection]** can be set to 1, 10 or 100. When users rotate one unit from the wheel, the system will obtain 1 pulse from the MPG device. The system will take the parameter **N9.013 (Unit Decimal Point)** as the command unit for each pulse. In addition, the system will multiply the **[MPG Ratio Selection]** as the ratio for the final command sent to a specific axis.
For example: **[MPG Ratio Selection]** is 10 and the N9.013 (Unit Decimal Point) set to 0.001mm. The minimum movement of the MPG control will be 0.001 × 10 = 0.01 mm.

**[Robot's Coordinate System Switch in Manual Mode] D2x016**

When the robot system is in manual mode, users can use this special D to switch between different work coordinate systems.
1 ~ 6: corresponding to G54 to G59.

**[Robot's Tool System Switch in Manual Mode] D2x017**

When the robot system is in manual mode, users can use this special D to switch between different tool coordinate systems.
0: Not using tool offset.
1 ~ n: corresponding to the tool number.

**[Current Coordinate System] D3x016**

This shows the current applied working coordinate system.

- When the **[model]** in the **[Channel Setting]** page is not set to Robot, this special D will show the current coordinate system.
  1 ~ 6: corresponding to G54 to G59.
  7: corresponding to G54 P1 to G54 P256
- When the **[model]** in the **[Channel Setting]** page is set to Robot, this special D will show the current robot coordinate system.
  1 ~ 6: corresponding to G54 to G59.

**[Current Coordinate System] D3x017**

This shows the current applied tool coordinate system.

0: Not using tool offset

1 ~ n: corresponding to the tool number.

## ■ Relevant Parameter

**N1.301~N1.320 (Robot Arm Length 1~20):**

The NC5 controller provides a Robot arm control mechanism, users will need to provide corresponding hardware mechanical arm length parameters (MDH definition) for the system's algorithm.

- Unit: mm, available range: -100000 to +100000

**N1.064 MPG Path Acc and Dec Time**

The system will use this parameter as the path filter to smooth out the machining speed between each command. The smoother the machining speed, the longer the total process time. Larger value settings could cause the command deceleration to become too long, which can cause the machine to continue moving for a short distance after MPG is stopped.

**N1.065 MPG Path S Curve Time**

The system will use this parameter as the path filter to smooth out the machining speed between each command. Larger value settings could cause a loss in precision.

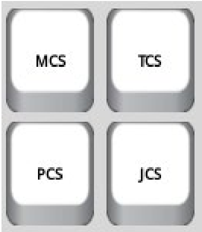
**N.915 Enable the Robot Teaching Programming**

Users can easily teach and program the robot control program directly on the controller.
After moving and confirming the robot to the teaching point using MPG or JOG control, users can click on the linear move (G01.1) or point-to-point (G00.1) buttons on the lower left corner. The system will insert the relative command to the user’s NC program. The teaching position is based on the Robot’s current coordinate mode, which is PCS, TCS or JCS. In the PCS and TCS modes, the point command is based on XYZABC coordinates. Furthermore, the XYZABC coordinates will describe the values of the machine coordinates when it is in JCS mode.

5

## Robot mode switching example

User can manage the system mode of the robot arm directly on the controller HMI.




In this example, the robot mode switch is demonstrated using the mandatory button, utilizing the corresponding *SYSVRM to ON/OFF button source with after call macro to complete the mode switch function. The following description illustrates the mode switching and macro content with *SYSVRW.

- PCS (Piece Coordinate System): *SYSVRW_0_40.2

  Macro content: Setting [**Robot Coordinate System manual switch**] to 0 to disable manual mode, and then set **[Robot Coordinate System Switching]** to PCS (Piece Coordinate) and then reset other button sources to OFF.

```
$D_0_21016 = 0
BITON M_0_21048
BITON M_0_21049
BITON M_0_21050
BITON M_0_21051
BITOFF *SYSVRW_0_40.4
BITOFF *SYSVRW_0_40.3
BITOFF *SYSVRW_0_40.1
```

- TCS (Tool Coordinate System): *SYSVRW_0_40.3

  Macro content: Setting **[Robot Coordinate System Switching]** to TCS (Tool Coordinate) and then reset other button sources to OFF.

```
BITON M_0_21048
BITON M_0_21049
BITOFF M_0_21050
BITON M_0_21051
BITOFF *SYSVRW_0_40.1
BITOFF *SYSVRW_0_40.2
BITOFF *SYSVRW_0_40.4
```

- JCS (Joint Coordinate): *SYSVRW_0_40.4

  Macro content: Setting **[Robot Coordinate System Switching]** to JCS (Joint Coordinate) and then reset other button sources to OFF.

```
BITOFF M_0_21048
BITOFF M_0_21049
BITOFF M_0_21050
BITOFF M_0_21051
BITOFF *SYSVRW_0_40.2
BITOFF *SYSVRW_0_40.3
BITOFF *SYSVRW_0_40.1
```

## ■ Instruction description

When the system is in AUTO or MDI mode, the robot is controlled by G code instructions, as shown below.

G00.1 **MovP** point-to-point moving instruction.

| | |
|---|---|
| Format | G00.1 X_Y_Z_A_B_C_ P0000 H_R_Q_F_ |
| Example | G00.1 X400. Y0. Z300. A180. B0. C0. P0000 H0 R1 Q1 F20 |

G01.1 **MovL** linear moving instruction.

| | |
|---|---|
| Format | G01.1 X_Y_Z_A_B_C_ P0000 H_R_Q_F_ |
| Example | G01.1 X400. Y0. Z300. A180. B0. C0. P0000 H0 R1 Q1 F20 |

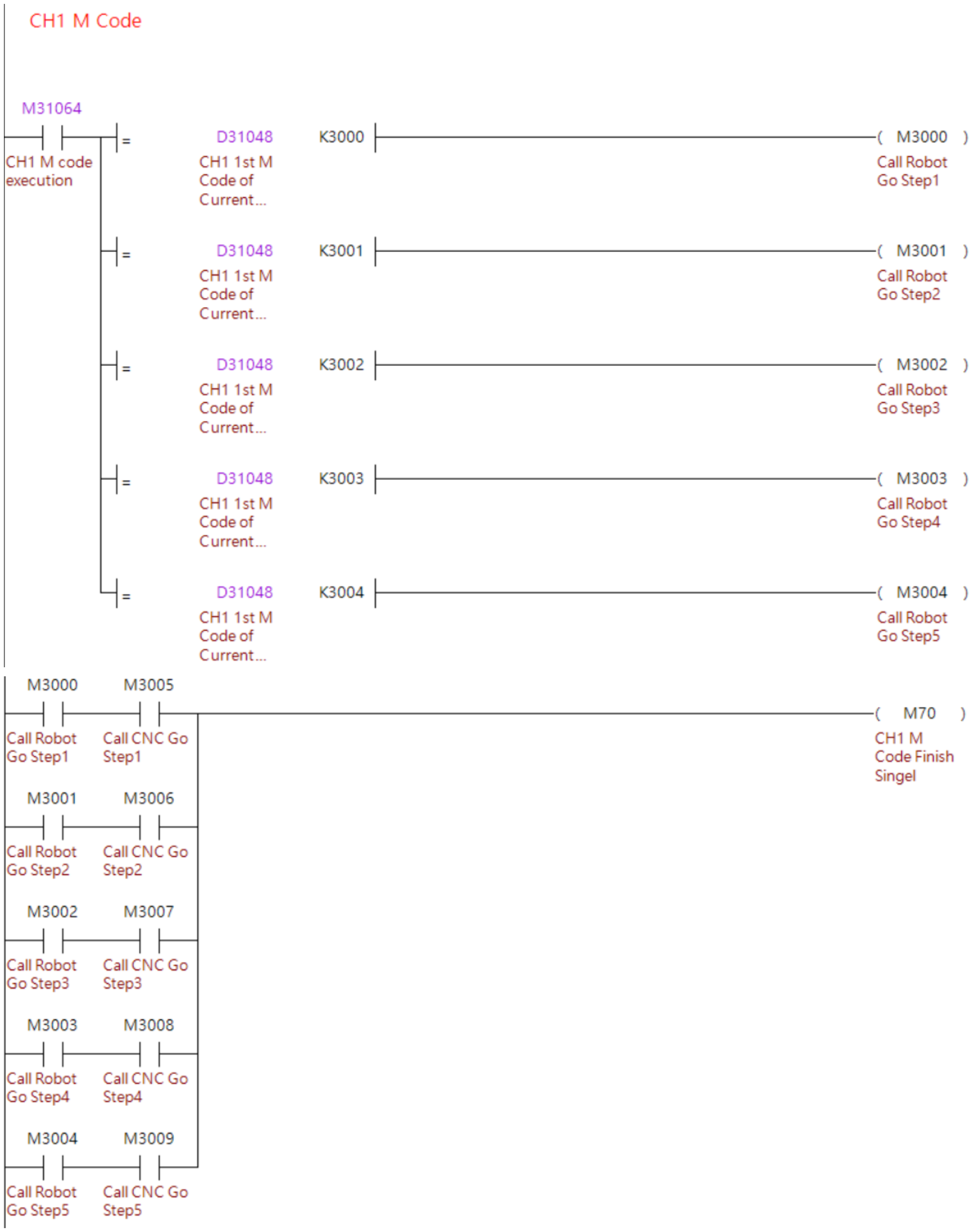
● Instruction Description

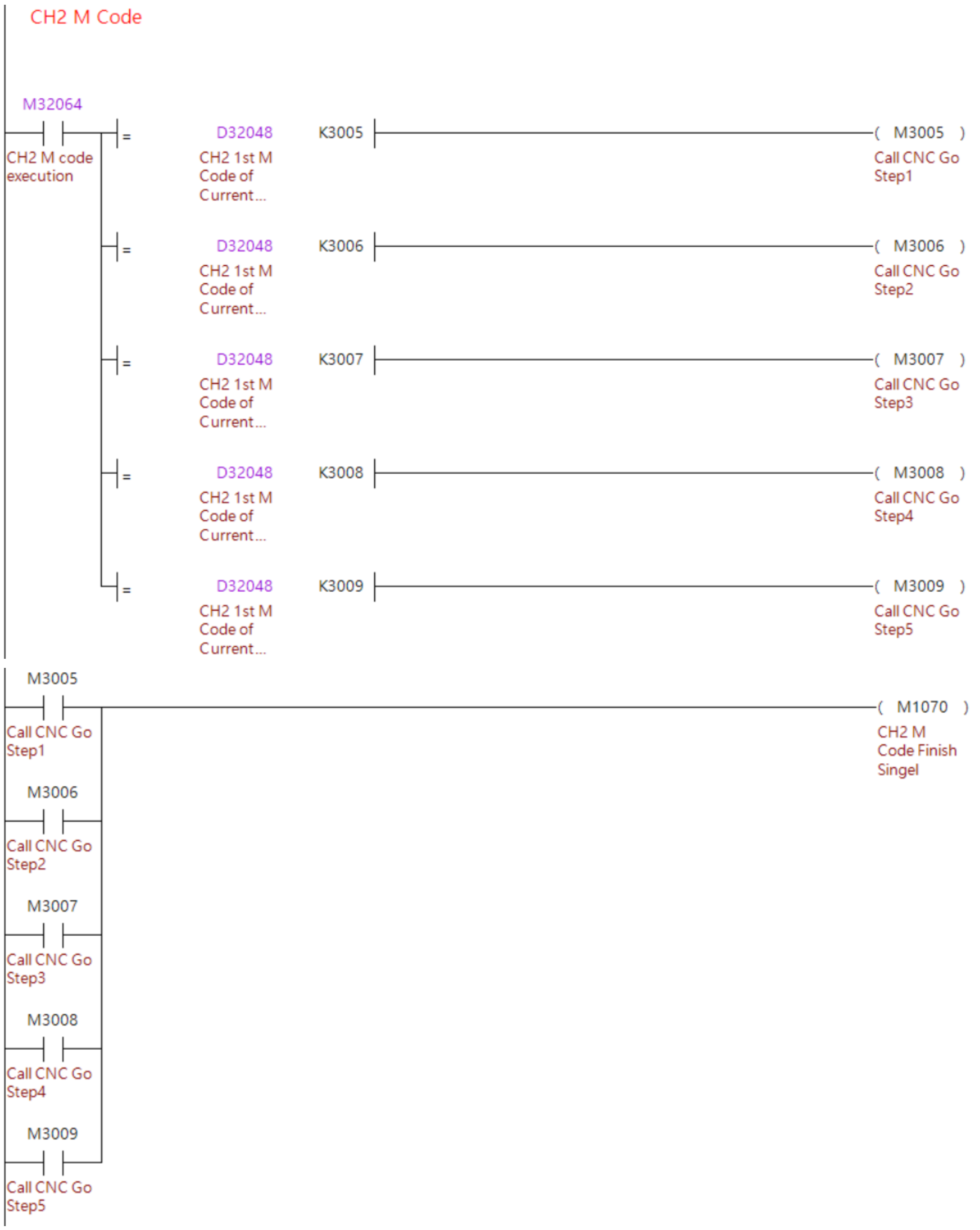
<table>
<tr><th>Instruction</th><th>Description</th></tr>
<tr><td>XYZABC</td><td>Refers to Q coordinate settings, if the coordinate system is PCS or TCS (Q = 0 to 2), the XYZABC represent space coordinates for each direction. If the coordinate system is JCS (Q = 3), the XYZABC represent joint coordinates for J1 to J6.</td></tr>
<tr><td>P0000</td><td>Posture setting of Robot arm control can be defined as below, in bits.
<table>
<tr><td>Bit</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Robot posture</td><td>PS*</td><td>Shoulder</td><td>Elbow</td><td>Flip</td></tr>
</table>
Note: represents applying the current posture and ignores any other setting.</td></tr>
<tr><td>H</td><td>Tool coordinate system<br>0: Not using tool offset<br>1 ~ n: corresponding to the tool number</td></tr>
<tr><td>R</td><td>Working coordinate<br>1 ~ 6: corresponding to G54 to G59.</td></tr>
<tr><td>Q</td><td>Coordinate system setting<br>1: PCS (Piece coordinate)<br>2: TCS (Tool coordinate)<br>3: JCS (Joint coordinate)</td></tr>
<tr><td>F</td><td>Speed percentage (%)</td></tr>
</table>

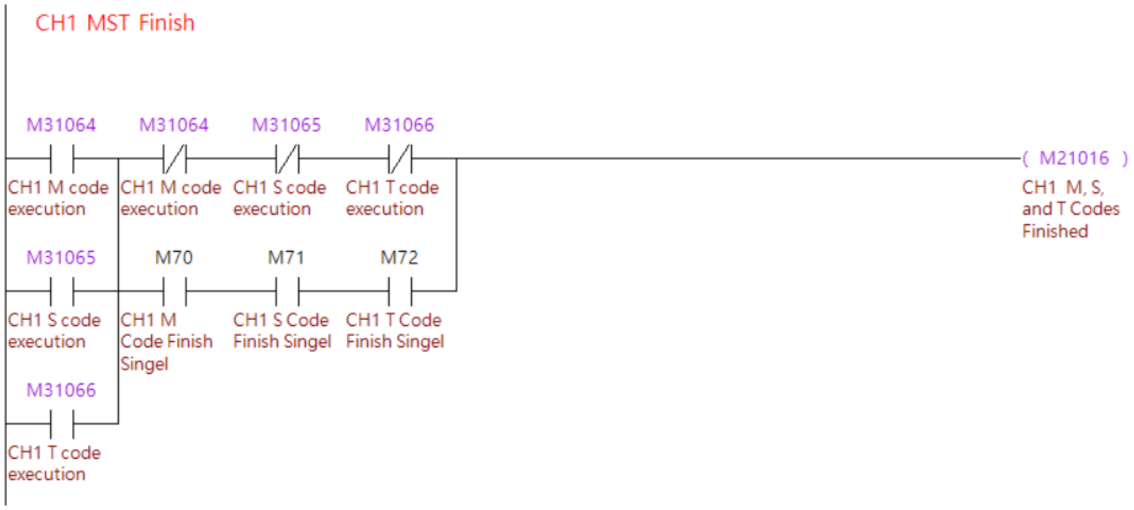
5

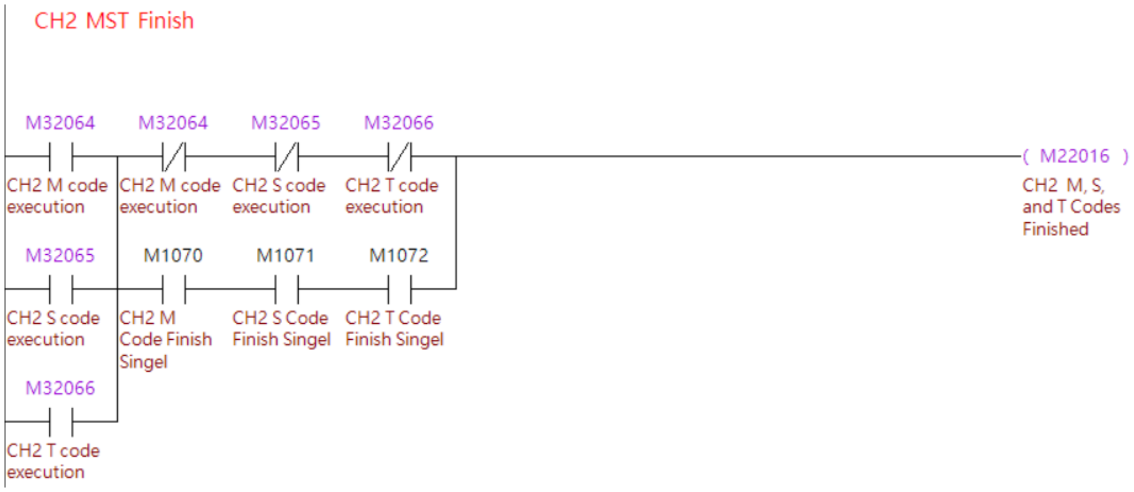
## ■ MLC Example

The following example provides a two channels application as multi-channel. Therefore, the same MLC can access two different CH1 and CH2 and exchange data or whether to execute or to hold execution based on the other channel's status.




CH2 M Code
M32064
CH2 M code execution
=
D32048
CH2 1st M Code of Current...
K3005
M3005
Call CNC Go Step1
=
D32048
CH2 1st M Code of Current...
K3006
M3006
Call CNC Go Step2
=
D32048
CH2 1st M Code of Current...
K3007
M3007
Call CNC Go Step3
=
D32048
CH2 1st M Code of Current...
K3008
M3008
Call CNC Go Step4
=
D32048
CH2 1st M Code of Current...
K3009
M3009
Call CNC Go Step5
M3005
Call CNC Go Step1
M1070
CH2 M Code Finish Singel
M3006
Call CNC Go Step2
M3007
Call CNC Go Step3
M3008
Call CNC Go Step4
M3009
Call CNC Go Step5




**Program execution procedure:**

The 1st channel (CH1) is defined as a milling machine and the 2nd channel (CH2) is defined as a robot arm. Users can use M / S / T code to exchange status or data and hold procedures based on the status of each other. For more information on the M / S / T functions, please refer to section 6.8.

The above example demonstrates that when the CH1 milling machine finishes the process it will activate M3000 to acknowledge the CH2 to start the robot action. Furthermore, after CH2 finishes the procedure with the command as G00.1, G01.1 or M code, it will acknowledge CH1 to continue work by M3005.

**Important:**

In order to enable the teaching function, users need to set up the below items.

1. Set N.915 (Enable the Robot Teaching Programming) to 1.
2. Set up two function keys as function number 9226 (Linear move) and function number 9227 (Point-to-point move).

# 5.19 Axes Oscillation Control



The NC5 controller provides axes oscillation control, which is special design for grinding solution. Controller system will add a SIN wave position directly on the configured axes. In the grinding field, this oscillation can greatly improve performance and the grinding wheel can efficiently uniform the usage.

## ■ MLC Special M & Special D

| | | | |
|---|---|---|---|
| Axes Oscillation Control Enable | M2x264 | - | - |
| Axes Oscillation Amplitude | D2x018<br>D2x019 | Axes Oscillation Cycle Time | D2x020<br>D2x021 |
| Oscillation Axes Enable | D2x022 | Axes Oscillation Wave Type | D2x023 |

**[Axes Oscillation Control Enable]: M2x264**

Set this **[Axes Oscillation Control Enable]** to ON to enable the axes oscillation function, and the system will execute axis oscillation commands based on the settings in **[Axes Oscillation Amplitude]** and **[Axes Oscillation Cycle Time]**. The **[Oscillation Axes Enable]** defines the axes number to be performed the oscillation function.

- If the axis is already performing path interpolation, the oscillation command will be added to the original position command.
- The system will enable the function when **[Axes Oscillation Control Enable]** is ON instead of raising edge. During the function is enabled, the system will continuously add oscillation command based on **[Axes Oscillation Amplitude]** and **[Axes Oscillation Cycle Time]** and return an alarm code **[0602 Over speed acceleration]** once axes speed acceleration is too fast.
- When the **[Axes Oscillation Control Enable]** is ON and function is enabled, any alarm occur will stop the oscillation function immediately. If users want to enable the function again after the system reset, they will need to set **[Axes Oscillation Control Enable]** to OFF and then turn it ON again.
- When the **[Axes Oscillation Wave Type]** set as mode 0, the system will stop adding oscillation command after axes pass the beginning position by set the **[Axes Oscillation Control Enable]** from ON to OFF to turn off the function.
- When the **[Axes Oscillation Wave Type]** set as mode 1, the system will stop adding oscillation command after axes at the beginning position by set the **[Axes Oscillation Control Enable]** from ON to OFF to turn off the function.
- When the **[Axes Oscillation Control Enable]** is ON, the current position of each axis is showing the added new position.
- Only available on modes other than HOME and EDIT.

**[Axes Oscillation Amplitude]: D2x018 ~ D2x019**

When the axes oscillation control **[Axes Oscillation Control Enable]** is enabled, the activated axes will oscillate based on the amplitude here.

- Value range -2,147,483,648 ~ +2,147,483,647
- Unit: mm
- When the **[Axes Oscillation Wave Type]** set as mode 0 and **[Axes Oscillation Amplitude]** is positive, the axes will oscillate forward first and then backward continuously. On the other hands, it will oscillate backward first and then forward continuously when the value is negative.
- When the **[Axes Oscillation Wave Type]** set as mode 1 and **[Axes Oscillation Amplitude]** is positive, the axes will oscillate forward first to the amplitude value and then backward to the beginning position continuously. On the other hands, it will oscillate backward first and then forward continuously when the value is negative.

**[Axes Oscillation Cycle Time]: D2x020 ~ D2x021**

The system will take this **[Axes Oscillation Cycle Time]** as the cycle time for each oscillation command.

- Unit: ms
- The cycle time is defined as the axes pass through one cycle distance from original position to the amplitude movement and then back to the original position.

**[Oscillation Axes Enable]: D2x022**

The oscillation axes use this 16-bit **[Oscillation Axes Enable]** as the mask to determine whether to enable the function on each specific axis.

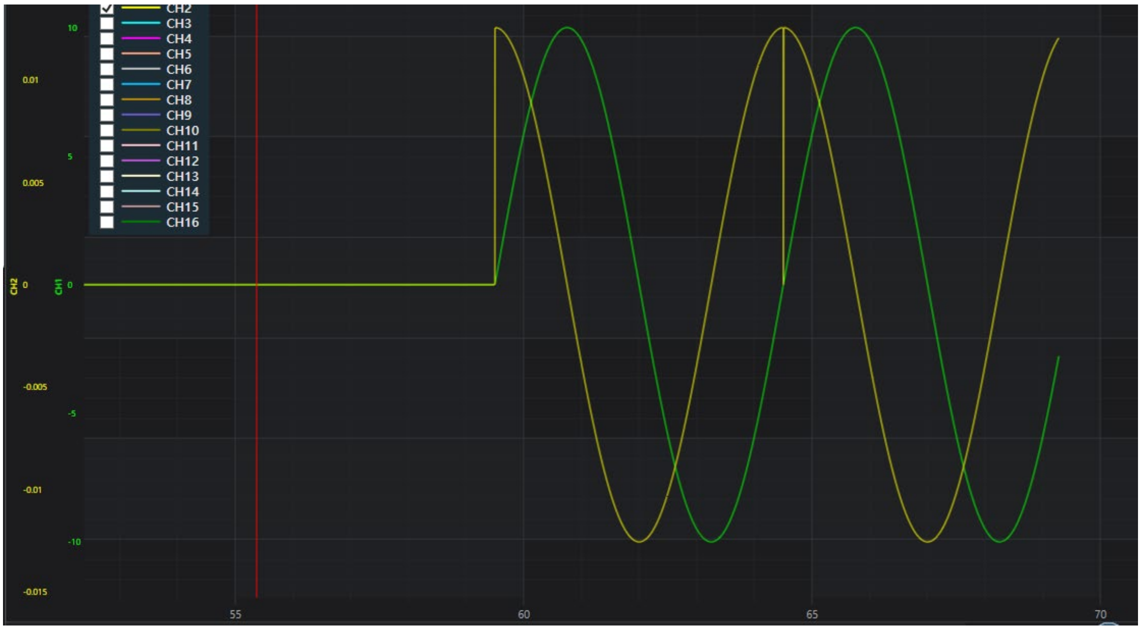
For example, if this set to 5, it means the X and Z axes will both have their oscillation function activated.

- Value range 0 ~ 65535.
- For example, if this set to 5, it means the X and Z axes will both have their oscillation function activated.

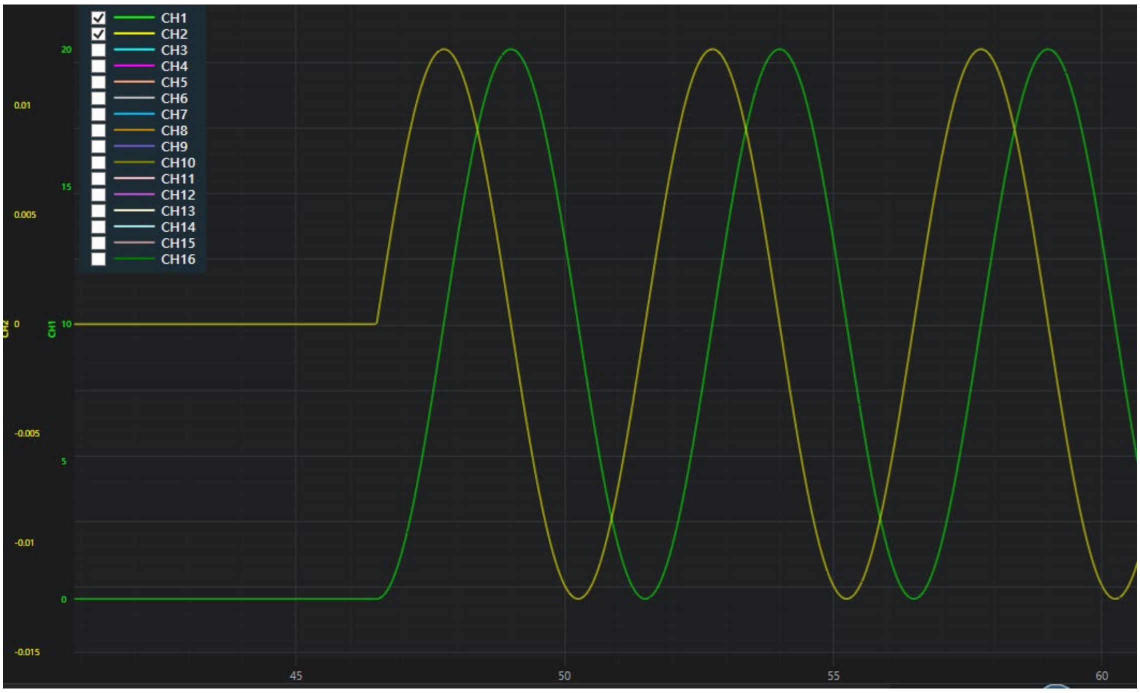
**[Axes Oscillation Wave Type]: D2x023**

Setting for axes oscillation wave type.

- Value range 0 ~ 65535.
- When set as 0, the system will apply [Asin(w)] as overlay oscillation wave. In this [Asin(W)] formula, the added command will take 0 as median incremental position and then add positive and negative additional movement continuously as shown below in green line.



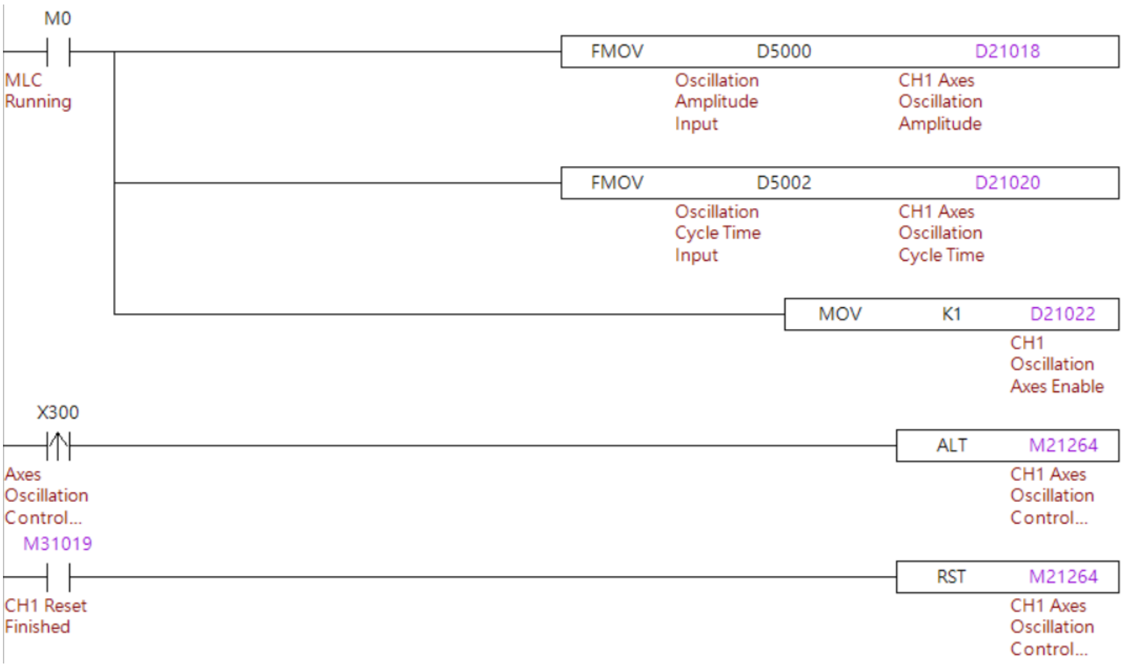

- When set as 0, the system will apply [A-cos(w) + A] as overlay oscillation wave. In this [A-cos(w) + A] formula, the added command will take 0 as based incremental position and then add positive or negative as one direction additional movement continuously as shown below in green line.



5

## ■ MLC example

The following example provides oscillation function enable through real digital input and then indicated to the X axis.




**Program execution procedure:**

1. The example MLC will continuously move user provide amplitude and cycle time into special D register.
2. When users triggered the digital input signal (X300), the MLC will enable the oscillation function on the X axis.
3. After trigger the system Reset, the MLC will disable the oscillation function on the X axis.

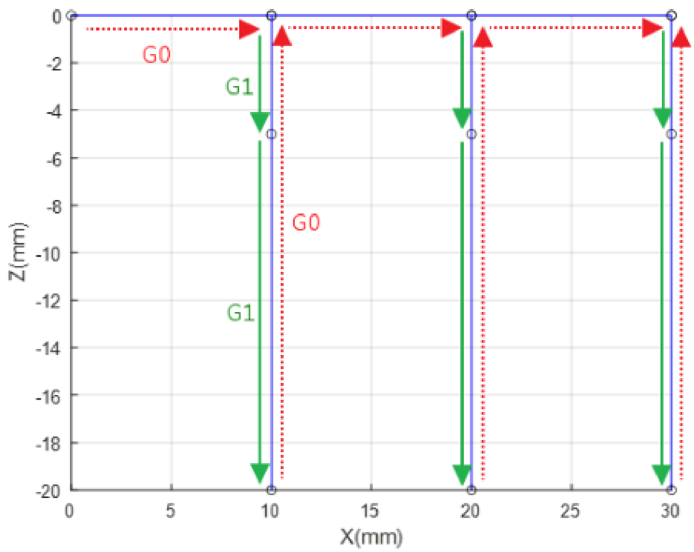
**Important:**

Only available on modes other than HOME and EDIT.

## 5.20 High speed tapping



In general tapping application, users usually apply G00 as rapid command for positioning when changing each hole position. The G00 rapid command is designed as zero speed on target position, which means this command will slow down and then stop at the exact target position. However, the tapping solution doesn't need such high positioning in the beginning of the tapping command. Thus, in order to increase the process performance, this section illustrate the high-speed tapping solution, which provide the G00 rapid speed blending function. According to this G00 speed blending function, the system will execute the next command before axes reach the target position. Relevant parameters please refer to **[N1.21]**, **[N1.96]**, **[N1.97]**, **[N1.98]**, **[N1.99]** and **[N2.27]**.




Above diagram including G00 to G00, G00 to G01 and G01 to G00 three types of command combination, and each of them can be decided the blending mode by the parameter **[N1.21 Bit0~Bit1]** and then enable them by the parameter **[N1.21 Bit2~Bit4]**.

| N1.021 | Rapid speed blending mode | | | P |
|---|---|---|---|---|
| Default | 0 | Range | - | |
| Data Type | Dword | Unit | - | |

- Bit 0-1: Speed blending mode.
- Bit 2: Enable G00 to G00 speed blending.
- Bit 3: Enable G00 to G01 speed blending.
- Bit 4: Enable G01 to G00 speed blending.
- Bit 5: Position command reference of position mode.

| N1.096 | Blending – distance before next block | | | R |
|---|---|---|---|---|
| Default | 0 | Range | 0~60000 | |
| Data Type | Dword | Unit | um | |

- This parameter defines the distance before the block command target position to start the blending function, when the **[N1.021 Rapid speed blending mode]** configurate as interpolation position mode.

5

| N1.097 | Blending – velocity percentage between rapid command | | R |
|---|---|---|---|
| Default | 0 | Range | 0~100 |
| Data Type | Dword | Unit | % |

- This parameter defines the speed blending percentage between two G00 rapid commands, when the **[N1.021 Rapid speed blending mode]** configurate as speed mode.

| N1.098 | Blending – velocity percentage between rapid and cutting command | | R |
|---|---|---|---|
| Default | 0 | Range | 0~100 |
| Data Type | Dword | Unit | % |

- This parameter defines the speed blending percentage between G00 rapid command and G01 cutting command, when the **[N1.021 Rapid speed blending mode]** configurate as speed mode.

| N1.099 | Blending – velocity percentage between cutting command | | R |
|---|---|---|---|
| Default | 0 | Range | 0~100 |
| Data Type | Dword | Unit | % |

- This parameter defines the speed blending percentage between two G01 cutting commands, when the **[N1.021 Rapid speed blending mode]** configurate as speed mode.

| N2.027 | Blending – axis target reach distance | | R |
|---|---|---|---|
| Default | 0 | Range | 0~60000 |
| Data Type | Dword | Unit | um |

- This parameter is the distance setting to trigger the speed blending function when the parameter **[N1.021 bit0~1]** set as 3 as axis speed blending position mode.

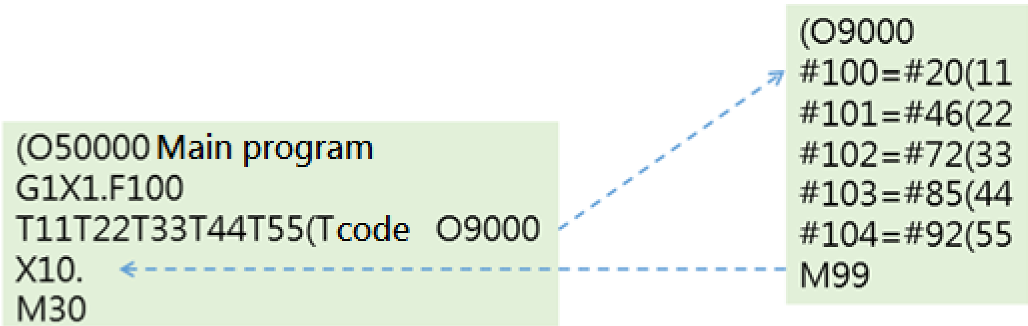
# 5.21 Multi T code

The NC5 system provides multi-T code function, which can be available to program in the same command block, in addition these T code tools can be machining together at the same process path once they are activated.

Function enable: Set the parameter **[N1.10.Bit22 T code call macro O9000]** = 1.

Limitation: Each command block allowed up to 5 T code commands.

G code example:




As above diagram, the T11 command will response to #20 and T22 will response to #46.

1st T code: #20

2nd T code: #46

3rd T code: #72

4th T code: #85

5th T code: #92

After the T code data response to the # variables, users can further to program them in the corresponding Macro program.

## 5.22 Multi M code

The NC5 system provides multi-M code function, which can be available to program in the same command block.

Limitation:

(1) Each command block allowed up to 4 M code commands. Otherwise, the system will return ALM 0x854.

(2) Cannot be program with M commands such as M00, M01, M02, M30, M98 and M99.

(3) Cannot be program with M code call macro function. Otherwise, the system will return ALM 0x585.

Relevant special M relay.

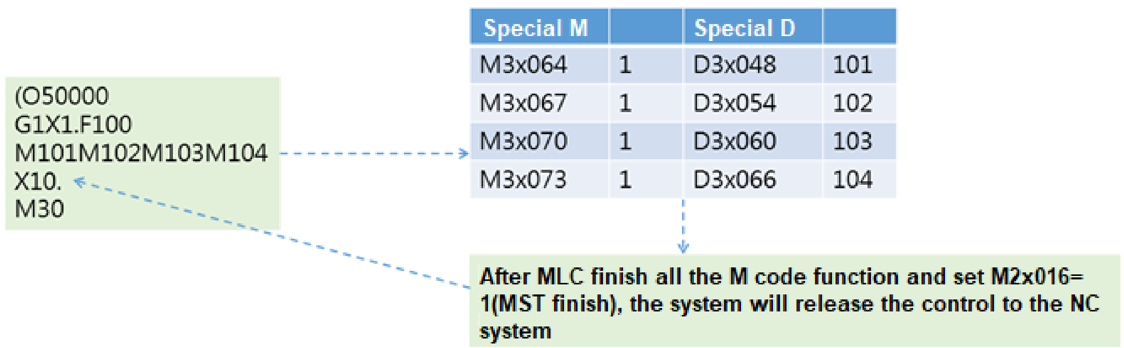
| Special M | Function | Description |
|---|---|---|
| M3x064 | 1st M code Execution | When the M code is executed in the program (not including M00, M01, M02, M30, M98, M99), this special M will be triggered. When the M, S, and T codes complete their execution and then the MLC triggers the M2x016, this special M will be set to OFF. This action does not include an M code that is used for macro calls. |
| M3x067 | 2nd M code Execution | |
| M3x070 | 3rd M code Execution | |
| M3x073 | 4th M code Execution | |

| Special M | Function | Description |
|---|---|---|
| M2x016 | M, S, and T Codes Finished | Triggering this signal informs the NC system that the procedures for M, S and T codes are complete. |

Relevant special D register.

| Special D | Function | Description |
|---|---|---|
| D3x048 | 1st M code Data | When the 1st M code is executed in the program (Not including M00, M01, M02, M30, M98, M99), the M code value will be mapped to this register. When the M code is used to call the macro, this special D will keep the previous value. |
| D3x054 | 2nd M code Data | |
| D3x060 | 3rd M code Data | |
| D3x066 | 4th M code Data | |

G code example:



# 5.23 System recovery

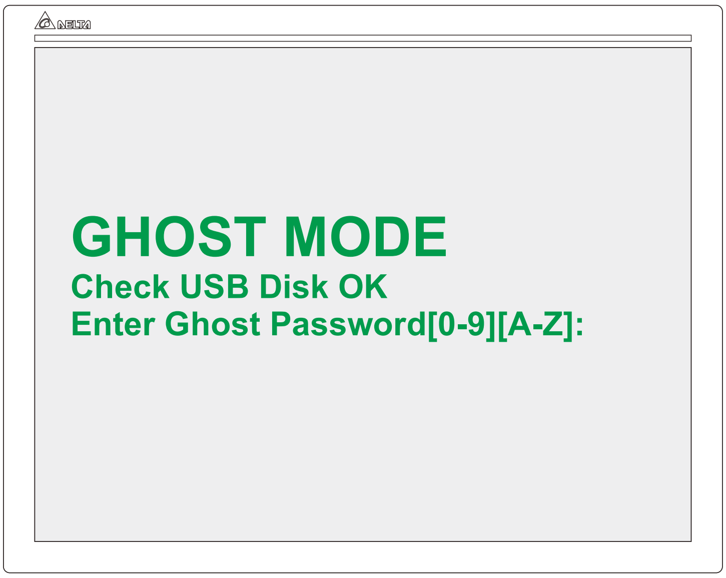
## 5.23.1 Overview

The NC5 controller system provide Ghost system just like regular computer. Users can utilize this tool to backup image file and then recover all the system backup such as program, parameters, and environment.

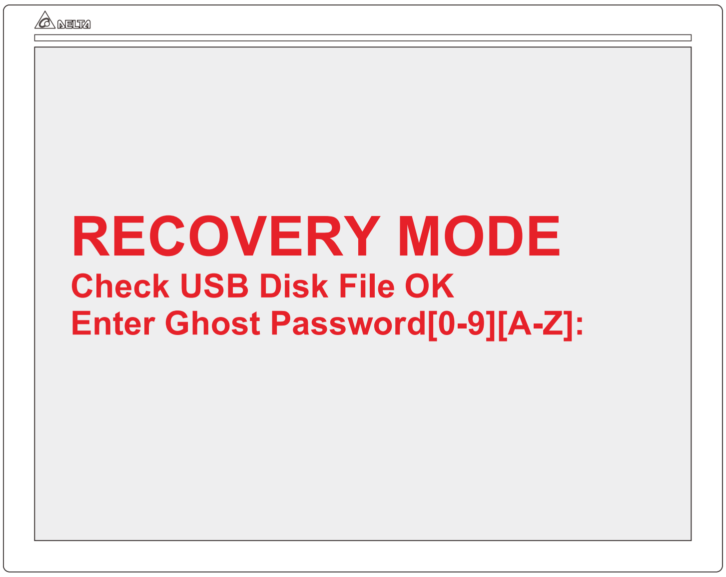
**A.** **Make recovery image:** Need to insert USB drive for system to store the image. The password is necessary and please note is down for future use.

**B.** **Recover image:** Need to insert USB drive for system to load the recovery. The password is necessary to unlock the procedure.

**Note:** please make sure the recovery image environment is as same as the target CNC machine. Otherwise, the recover procedure will fail.




Make recover image file.




Recover system by image file.

5

## 5.23.2 Recovery process

The system provides two different methods to start the recovery process. One is USB drive and the other is Embedded HMI interface.

A. USB drive:

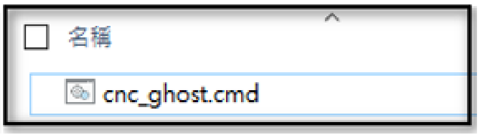
After insert a USB drive, which has specific image file, the system will automatically start the corresponding recovery or backup procedure when the controller power on.

**Image file name for backup procedure:** cnc_ghost.cmd

**Image file name for recovery procedure:** cnc_recovery.cmd

**Note:**

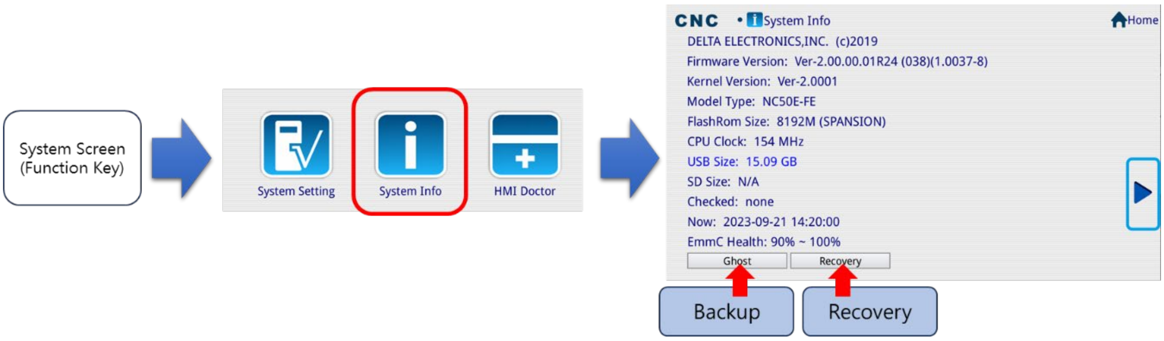
1. To avoid action conflict, above file can only select one of them to start the procedure.
2. Please remove any of above files, after finishing the recovery or backup procedure. Otherwise, the system will start the procedure again.

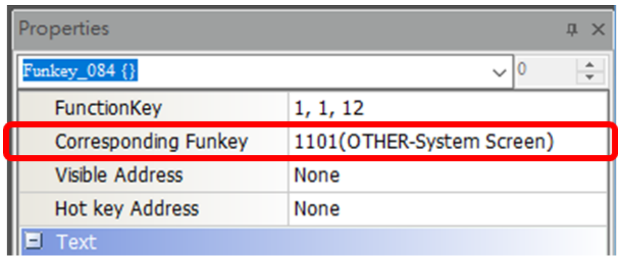




B. Embedded HMI interface:

After clicking the function key and open the [System Screen], users can be able to execute the recovery or backup procedure. The function key for the system screen function code is 1101.



## 5.23.3 Make backup file

The procedure steps for making system backup ghost file are as below:

**Step 1:** Insert a USB drive with a “cnc_ghost.cmd” inside.

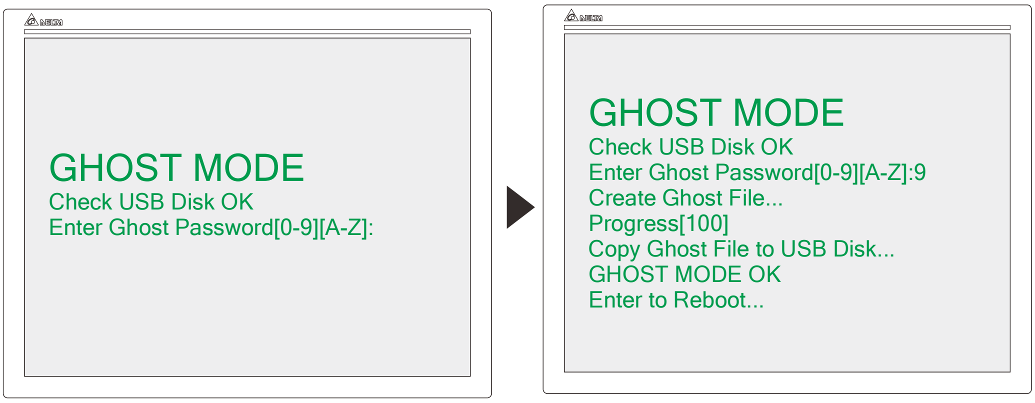
This “cnc_ghost.cmd” file can be an empty file that without any information inside.

**Step 2:** Start / restart the CNC controller.

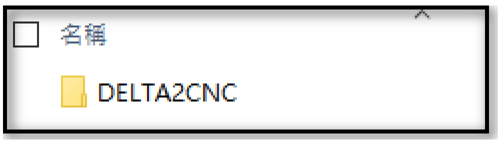
**Step 3:** Make sure the system is running the backup mode.

**Step 4:** Type in 0~9 or A~Z as combination password for future recovery purpose.

**Step 5:** After the progress shows 100, please follow the system message to finish the backup procedure.




**Step 6:** After finishing the procedure, the system will create a new folder named as $\boxed{\text{DELTE2CNC}}$, which content the backup image in the USB drive.



5

## 5.23.4 Recover system

The procedure steps for recover system with backup ghost are as below:

**Step 1:** Insert a USB drive with a “cnc_recovery.cmd” and the DELTE2CNC folder, which contain the backup image for recovery inside.

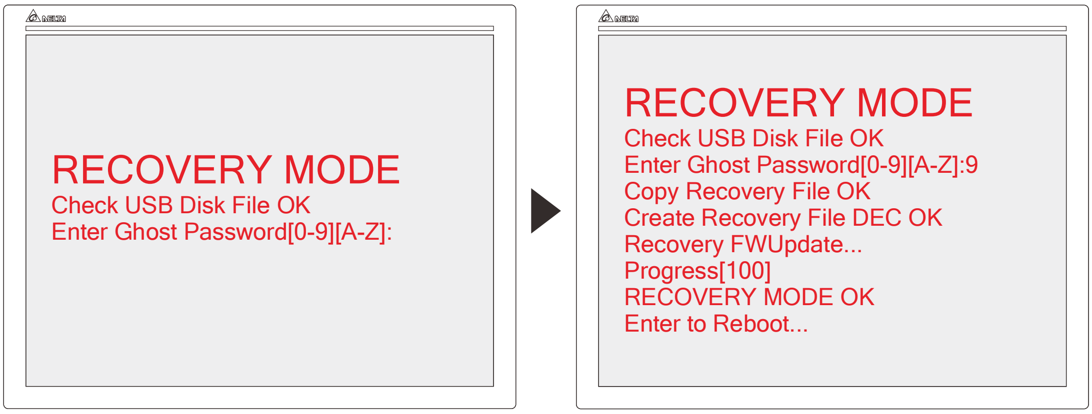
This “cnc_recovery.cmd” file can be an empty file that without any information inside.

**Step 2:** Start / restart the CNC controller.

**Step 3:** Make sure the system is running the recovery mode.

**Step 4:** Type in the combination password, which is provided when making the backup image from the step 1.

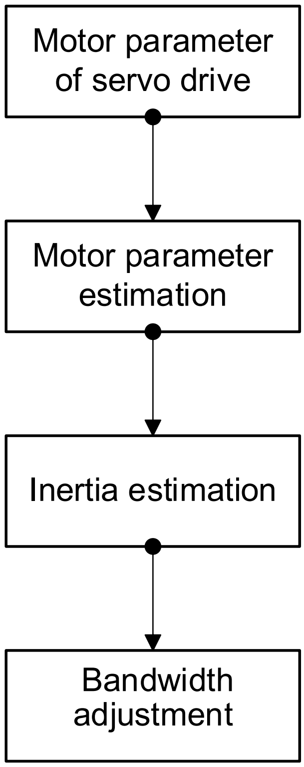
**Step 5:** After the progress shows 100, please follow the system message and press ENTER to restart the system and finish the recovery procedure.



## 5.24 Induction spindle motor

This section illustrates the induction spindle motor commissioning method by the ASDA-A3E DELTA servo drive. After finishing the wiring between servo drive and spindle motor, users still need to set the corresponding motor parameters into the servo drive to let the servo drive can perform a better spindle control. Generally, the nameplate on the motor will describe the basic motor information such as rated voltage, rate frequency and rate speed. However, these are not good enough for motor vector control, which will need more detail information such as stator resistance, rotor resistance and leakage inductance.

The DELTA servo drive ASDA-A3E provides auto tuning function to help users to calculate the suitable parameter and steps as following. In the following section will give more detail about these steps.

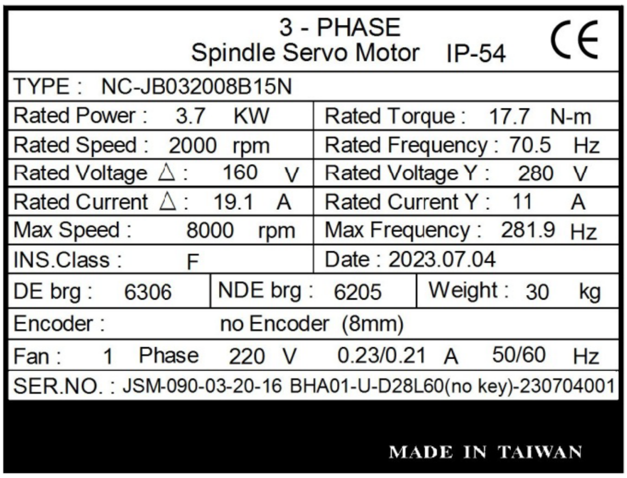


### 5.24.1 Parameter description of induction motor

DELTA servo drive ASDA-A3E can not only connect with DELTA permanent-magnet synchronous motor but also third-party induction motor. The relevant drive setting, parameter turning, and inertia estimate are as following sections.

#### 5.24.1.1 Motor parameter of servo drive

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. PM-00 Motor type: Set as 3 to use induction moto.
3. PM-03 Encoder type: Based on the encoder type.
   Bit 0: Signal type. 0: Pulse type, 1: SIN wave type. (Delta communication type set 0)
   Bit 2: Pulse filter. 0: By Pass, 1: 16M, 2: 8M, 3: 3M.
   Bit 3: Signal source. 0: From CN2; 1: From CN5.
4. PM-04 Encoder resolution: If it is pulse type encoder, this is for pulse per revolution. (pulse/rev) If it is SIN wave type encoder, this is for SIN wave number per revolution. (periods/rev)
5. PM-05 Converter card interpolate ratio: Only for SIN wave encoder.
   The interpolate resolution will be one round pulse number*2 ^ ratio. (**[PM-04]** * 2 ^ **[PM-05]**)
6. PM-64 IM control selection: Set as 0 to use vector control.
7. PM-65 ~ PM-72 Motor parameter: Refers to motor nameplate.




| Parameter | Name | Example |
|---|---|---|
| **PM-65** | IM rated voltage (V) | 220V set as 220 |
| **PM-66** | IM rated frequency (HZ) | 50Hz set as 50 |
| **PM-67** | IM rated power (0.01kw) | 3KW set as 3 |
| **PM-68** | IM motor poles (poles) | 4 poles set as 4 |
| **PM-69** | IM rated current (0.01A) | 10A set as 10 |
| **PM-70** | IM maximum current (0.01A) | 10A set as 10 |
| **PM-71** | IM rated speed (RPM) | 3000 RPM set as 3000 |
| **PM-72** | IM maximum speed (RPM) | 3000 RPM set as 3000 |

Note: The maximum current of induction motor IM usually is 1.5 ~ 2 times of rated current.
Note: The free load current of induction motor IM usually is 40% of rated current.

5

### 5.24.1.2 Motor parameter estimate

The ASDA-A3E servo drive provides three types of motor auto tuning. Users can choose any of them depends on machine need. Steps as follows.

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. P1-01 set the control mode as 4.
3. PM-01 Estimate method:
   A. **[Dynamic estimation]**: PM-01 set as 1, and the motor will rotate as rated speed when running the estimation.
   B. **[Static estimation]**: PM-01 set as 2, and the motor will not rotate but only little movements when running the estimation.
   C. **[Manually]**: PM-01 set as 3, the motor will not rotate when running the estimation.
   D. **[UVW phase detection]**: PM-01 set as 8, and the motor will not rotate but only little movements when running the estimation.
4. Estimation reference table:

| Estimation | Necessary information | Conditions |
|---|---|---|
| Dynamic | Known parameters information from PM-65 to PM-72. | Rated speed below 6000RPM. |
| Static | 1. Known parameter information from PM-65 to PM-72.<br>2. Provide PM-78 free load current.<br>3. Proceed UVW phase detection. | Rated speed more than 6000RPM |
| Manually | Known parameter information from PM-65 to PM-81. | Known all motor relevant parameters information. |
| UVW phase detection | - | 1. After [Static Estimation]<br>2. After [Manually] |

5. P2-30 set as 1, the servo drive will force motor enabled and then start estimation automatically.
6. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.

5

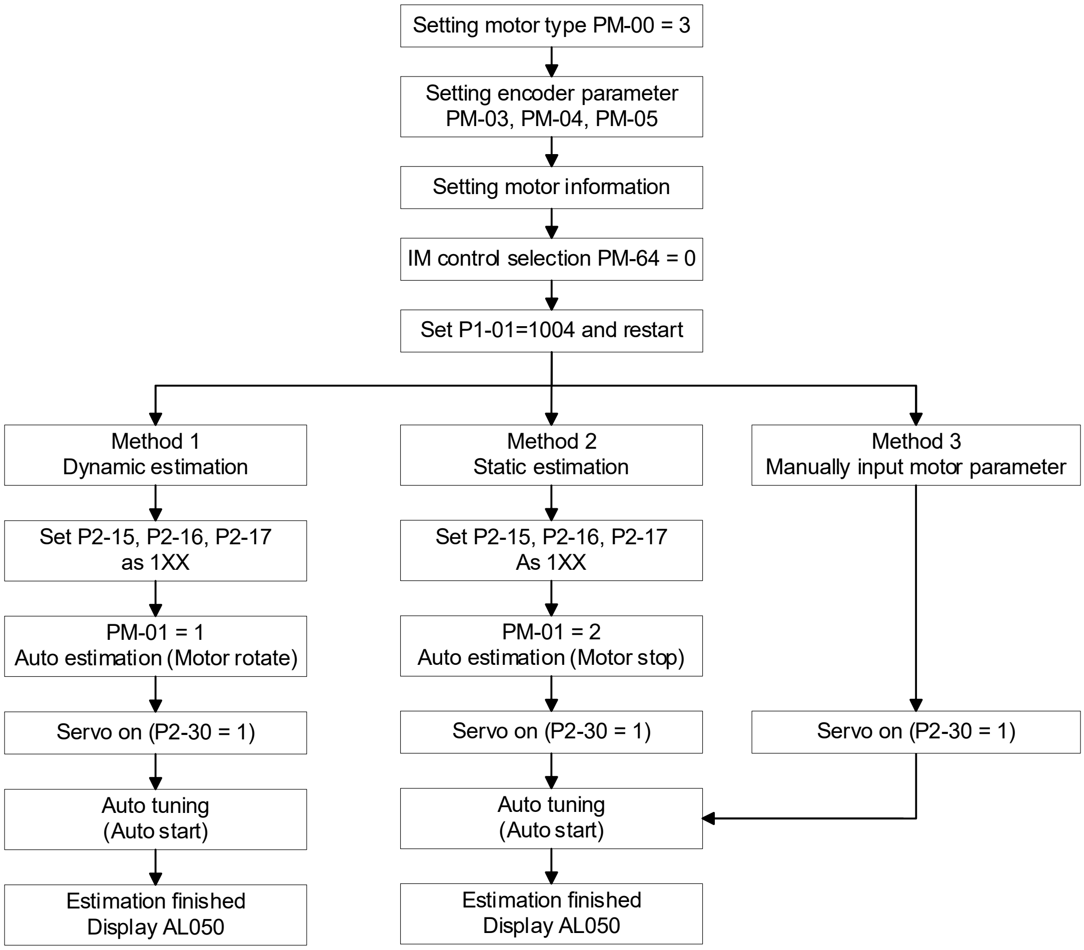



圖 5.24.1.2.1

### 5.24.1.3 Inertia estimation

The estimation steps of the inertia induction motor are same as servo motor but only the parameter PM-01 need to set to 4. Detail steps as below:

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. P1-01 set the control mode as 4.
3. PM-01 set the estimate method as 4 for inertia estimation.
4. P2-30 set as 1, the servo drive will force motor enabled and then start estimation automatically. After finishing the estimation, the inertia result will set to PM-73 and the P1-37 will reset to 0 automatically. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.

### 5.24.1.4 Bandwidth adjustment

Connect the ASDA-A3E to the CNC controller through EtherCAT control for bandwidth adjustment and test run.

1. P1-01 set the control mode as C and then restart the servo drive.
2. Set the spindle parameter as 15Hz and test run with speed 60 RPM. After then, users can observe the motor whether has vibration or different sound. If there are no issue, users can try to increase the bandwidth; otherwise, the bandwidth needs to decrease.
3. During the CNC controller is running the test, users can utilize the ASDA-Soft to observe the motor speed and whether the current percentage is fine (low speed around 30% to 60%, high speed will perform lower percentage). It is recommended to lower the spindle speed override to 20% at the beginning and observe the speed and current percentage at any time. If there are no problems, user can increase the override.

## 5.24.2 Encoder combination

DELTA ASDA-A3E is allowed to connect with 3rd party pulse type encoder or SIN wave encoder with converter card. For achieve closed-loop control, users can also apply the DELTA communication type encoder, 3rd party pulse type encoder or 3rd party SIN wave encoder on the machine side.

| Encoder combination | Spindle Running | Spindle Tapping |
|---|---|---|
| 3rd party pulse type encoder<br>(Motor side, without gear ratio) | ○ | ○ |
| Delta AM3 communication type encoder<br>(Motor side, without gear ratio) | ○ | ○ |
| Delta AM3 communication type encoder + 3rd party pulse type encoder<br>(Both sides, with gear ratio) | ○ | ○ |

### 5.24.2.1 3rd party pulse encoder

This section describes the application scenario where the spindle motor has no gear ratio, and a 3rd pulse type encoder is installed. After the feedback signal is connected to the CN5 connector of the DELTA servo drive, the closed-loop control function is performed.

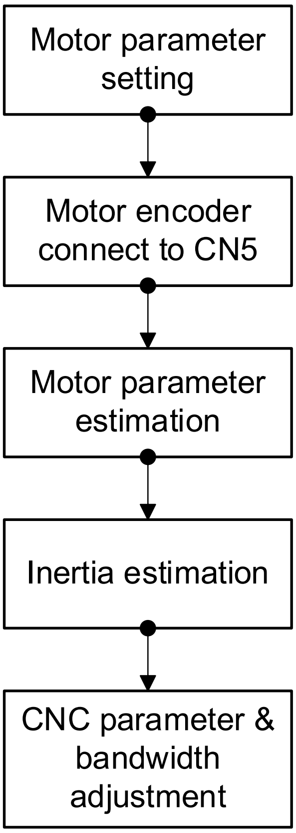
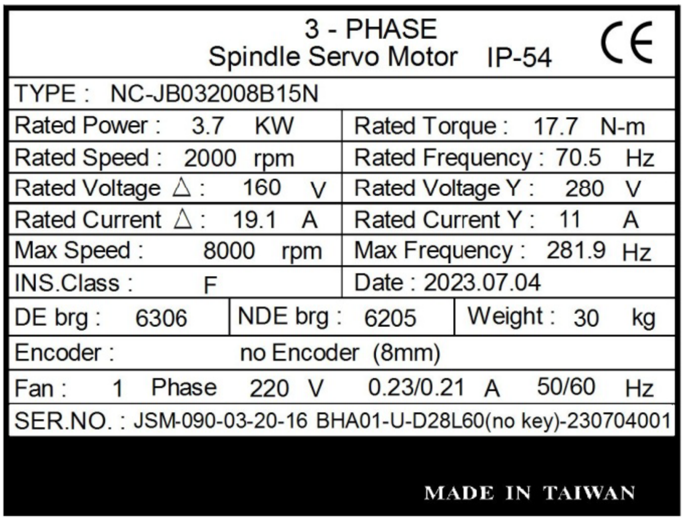



Figure 5.24.2.1.1 Estimate procedure

- **Step 1: Motor parameters set up.**

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. PM-00 set as 3 for the induction motor type.
3. PM-64 IM control selection: set as 0 for vector control.
4. PM-65 ~ PM-72 motor parameter: Please refers to the information on the motor nameplate.



| Parameter | Name | Example |
| --- | --- | --- |
| **PM-65** | IM rated voltage (V) | 220V set as 220 |
| **PM-66** | IM rated frequency (HZ) | 50Hz set as 50 |
| **PM-67** | IM rated power (0.01kw) | 3KW set as 3 |
| **PM-68** | IM motor poles (poles) | 4 poles set as 4 |
| **PM-69** | IM rated current (0.01A) | 10A set as 10 |
| **PM-70** | IM maximum current (0.01A) | 10A set as 10 |
| **PM-71** | IM rated speed (RPM) | 3000 RPM set as 3000 |
| **PM-72** | IM maximum speed (RPM) | 3000 RPM set as 3000 |

Note: The maximum current of induction motor is generally set to 1.5 to 2 times of rated current.

Note: The free load current of induction motors is generally about 40% of the rated current.

- **Step 2: Connect encoder signal to CN5.**

The motor encoder signal needs to be connected to the CN5 connector of the servo drive.

- **Step 3: Motor parameters auto tuning.**

When auto tuning the motor parameters, please first connect the motor encoder signal to the CN5 connector of the servo drive to perform motor parameter estimation.

1. P1-01: set the control mode as 4 and then restart the servo drive.
2. P2-08: set as 40 for enable the PM parameter.
3. PM-03: set as 0x1000 for encoder type.
4. PM-04: encoder resolution set as 1024. (Take resolution 1024 pulse/rev as an example)
5. PM-01: estimation method set as 1. The motor will running as rated speed when estimating the parameters.
   Note: if it is a high-speed motor, please apply static estimation. Refers to section 5.24.1.
6. P2-30: set as 1. The servo drive will enable the motor and then start the estimation automatically.
7. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.
   Note: if there are anything wrong with the setting, the servo drive will return alarm AL51.

- **Step 4: Inertia estimation.**

Below steps illustrate the procedure of inertia auto estimation.

1. P1-01: set the control mode as 4.
2. P2-08: set as 40 for enable the PM parameter.
3. PM-03: set as 0x1000 for encoder type.
4. PM-04: encoder resolution set as 1024. (Take resolution 1024 pulse/rev as an example)
5. PM-01: estimation method set as 4 for inertia auto estimation.
6. P2-30: set as 1. The servo drive will enable the motor and then start the inertia estimation automatically.
7. After finishing the estimation, the inertia result will set to PM-73 and the P1-37 will reset to 0 automatically.
8. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.

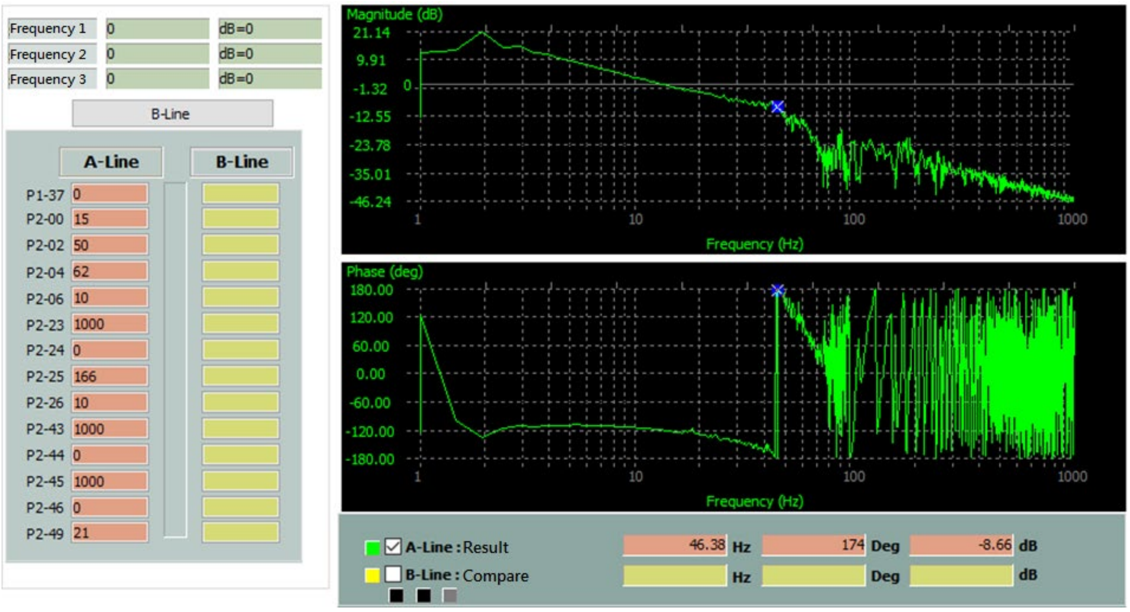
- **Step 5: CNC parameters and bandwidth adjustment.**

Connect the ASDA-A3E to the CNC controller through EtherCAT control for bandwidth adjustment and test run.

1. P1-01 set the control mode as C and then restart the servo drive.
2. CNC controller parameters.

| | |
|---|---|
| CNC parameter [N0.1000 Bit 2 Analog close loop control] | 1 |
| CNC parameter<br>[N0.1000 Bit 3 Speed command source of analog spindle] | 1 |
| CNC parameter<br>[N0.1005 Encoder resolution of 1st spindle] | 4096<br>(4 times frequency) |

3. restart the servo drive.
4. Set the spindle parameter as 15Hz and test run with speed 60 RPM. After then, users can observe the motor whether has vibration or different sound. If there are no issue, users can try to increase the bandwidth; otherwise, the bandwidth needs to decrease.
5. users can utilize the ASDA-Soft to observe whether the bandwidth is fine.



### 5.24.2.2 DELTA AM3 communication encoder

This section describes the application scenario where the spindle motor has no gear ratio, and a DELTA AM3 communication encoder is installed. After the feedback signal is connected to the CN2 connector of the DELTA servo drive, the closed-loop control function is performed.

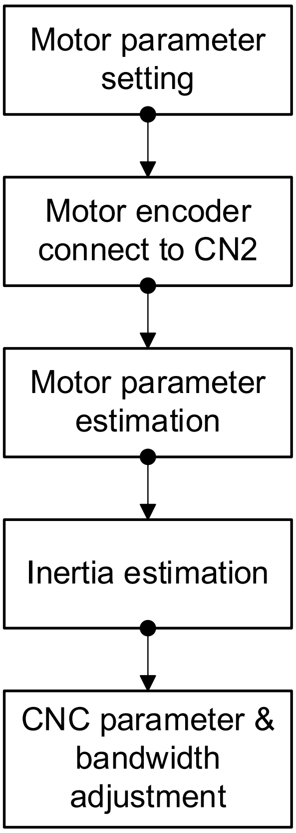
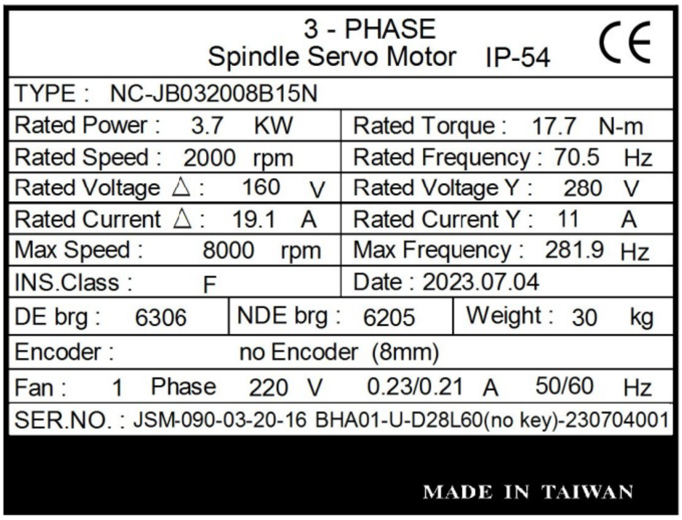



Figure 5.24.2.2.1 Estimate procedure

- **Step 1: Motor parameters set up.**

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. PM-00 set as 3 for the induction motor type.
3. PM-64 IM control selection: set as 0 for vector control.
4. PM-65 ~ PM-72 motor parameter: Please refers to the information on the motor nameplate.



| Parameter | Name | Example |
|---|---|---|
| **PM-65** | IM rated voltage (V) | 220V set as 220 |
| **PM-66** | IM rated frequency (HZ) | 50Hz set as 50 |
| **PM-67** | IM rated power (0.01kw) | 3KW set as 3 |
| **PM-68** | IM motor poles (poles) | 4 poles set as 4 |
| **PM-69** | IM rated current (0.01A) | 10A set as 10 |
| **PM-70** | IM maximum current (0.01A) | 10A set as 10 |
| **PM-71** | IM rated speed (RPM) | 3000 RPM set as 3000 |
| **PM-72** | IM maximum speed (RPM) | 3000 RPM set as 3000 |

Note: The maximum current of induction motor is generally set to 1.5 to 2 times of rated current.

Note: The free load current of induction motors is generally about 40% of the rated current.

- **Step 2: Connect encoder signal to CN2.**

The motor encoder signal needs to be connected to the CN2 connector of the servo drive.

- **Step 3: Motor parameters auto tuning.**

When auto tuning the motor parameters, please first connect the motor encoder signal to the CN2 connector of the servo drive to perform motor parameter estimation.

1. P1-01: set the control mode as 4 and then restart the servo drive.
2. P2-08: set as 40 for enable the PM parameter.
3. PM-03: set as 0x1000 for encoder type.
4. PM-04: encoder resolution set as 5,120,000.
   (Take resolution 5,120,000 pulse/rev as an example)
5. PM-01: estimation method set as 1. The motor will running as rated speed when estimating the parameters.
   Note: if it is a high-speed motor, please apply static estimation. Refers to section 5.24.1.
6. P2-30: set as 1. The servo drive will enable the motor and then start the estimation automatically.
7. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.
   Note: if there are anything wrong with the setting, the servo drive will return alarm AL51.

- **Step 4: Inertia estimation.**

Below steps illustrate the procedure of inertia auto estimation.

1. P1-01: set the control mode as 4.
2. P2-08: set as 40 for enable the PM parameter.
3. PM-03: set as 0x1000 for encoder type.
4. PM-04: encoder resolution set as 5,120,000.
   (Take resolution 5,120,000 pulse/rev as an example)
5. PM-01: estimation method set as 4 for inertia auto estimation.
6. P2-30: set as 1. The servo drive will enable the motor and then start the inertia estimation automatically.

7. After finishing the estimation, the inertia result will set to PM-73 and the P1-37 will reset to 0 automatically.
8. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.

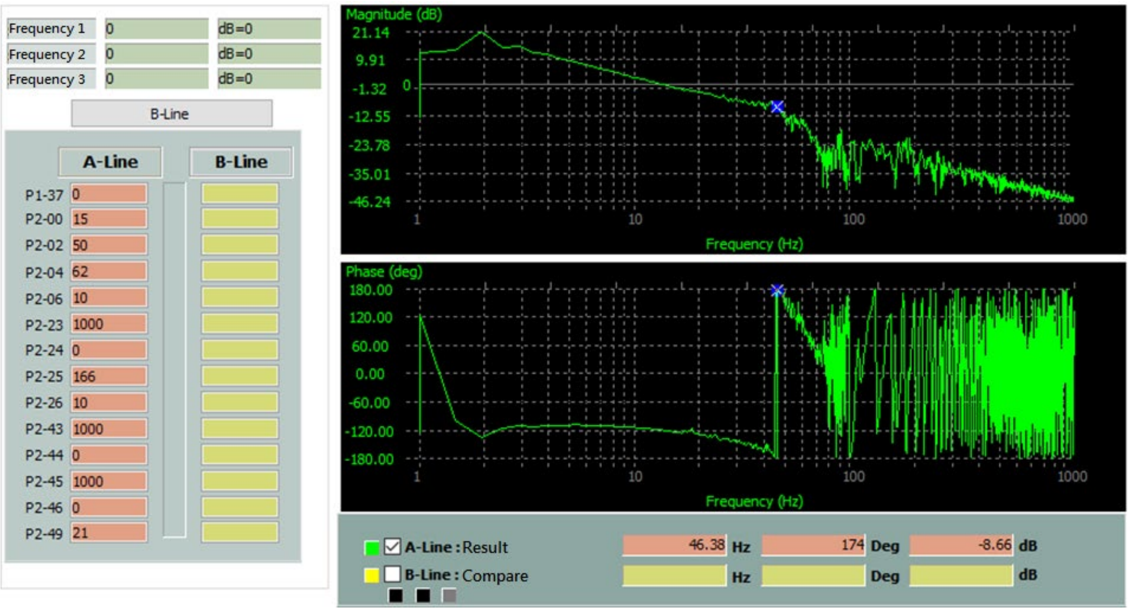
- **Step 5: CNC parameters and bandwidth adjustment.**

Connect the ASDA-A3E to the CNC controller through EtherCAT control for bandwidth adjustment and test run.

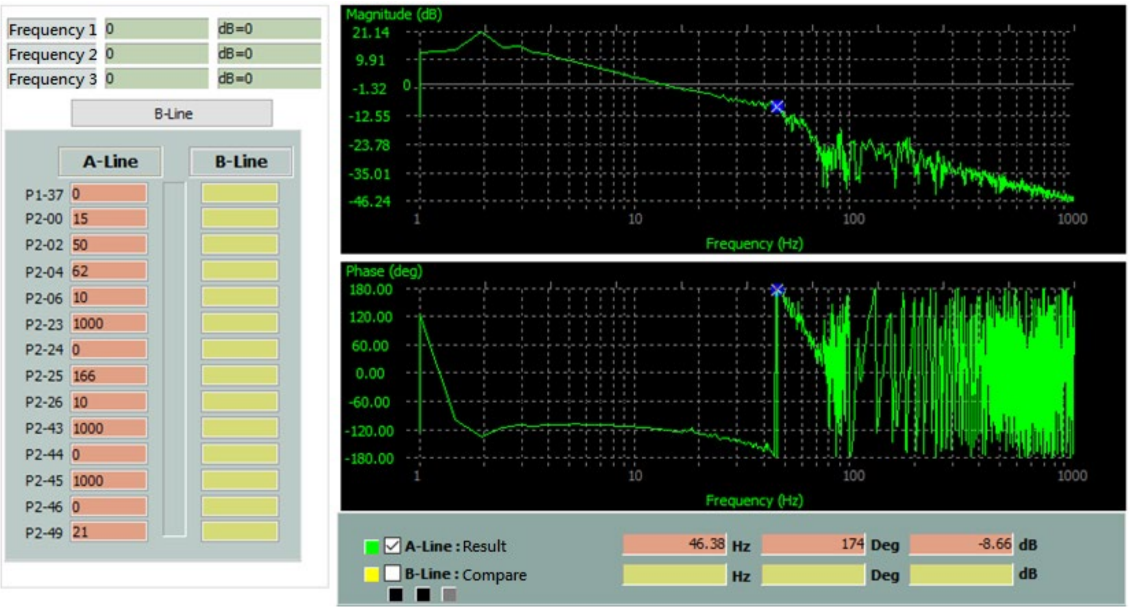
1. P1-01 set the control mode as C and then restart the servo drive.
2. CNC controller parameters.

| | |
|---|---|
| CNC parameter [N0.1000 Bit 2 Analog close loop control] | 1 |
| CNC parameter<br>[N0.1000 Bit 3 Speed command source of analog spindle] | 1 |
| CNC parameter<br>[N0.1005 Encoder resolution of 1st spindle] | 5,120,000 |

3. restart the servo drive.
4. Set the spindle parameter as 15Hz and test run with speed 60 RPM. After then, users can observe the motor whether has vibration or different sound. If there are no issue, users can try to increase the bandwidth; otherwise, the bandwidth needs to decrease.
5. users can utilize the ASDA-Soft to observe whether the bandwidth is fine.



5


Frequency 1 0 dB=0
Frequency 2 0 dB=0
Frequency 3 0 dB=0
B-Line
A-Line
B-Line
P1-37 0
P2-00 15
P2-02 50
P2-04 62
P2-06 10
P2-23 1000
P2-24 0
P2-25 166
P2-26 10
P2-43 1000
P2-44 0
P2-45 1000
P2-46 0
P2-49 21
Magnitude (dB)
21.14
9.91
-1.32
-12.55
-23.78
-35.01
-46.24
1
10
100
1000
Frequency (Hz)
Phase (deg)
180.00
120.00
60.00
0.00
-60.00
-120.00
-180.00
Frequency (Hz)
A-Line : Result
46.38 Hz
174 Deg
-8.66 dB
B-Line : Compare
Hz
Deg
dB

### 5.24.2.3 Dual encoder

This section describes the application scenario where the spindle motor has a gear ratio and uses DELTA's AM3 communication encoder to connect feedback communication to the CN2 connector at the motor side and uses a 3rd pulse encoder to feedback communication to the CN5 connector at the mechanism side. This scenario realizes the fully closed-loop function of double feedback.

| | |
|---|---|
| CN2 (Spindle motor resolution) | 5,120,000 |
| CN5 (Machine side resolution) | 4,096 (4 times frequency) |

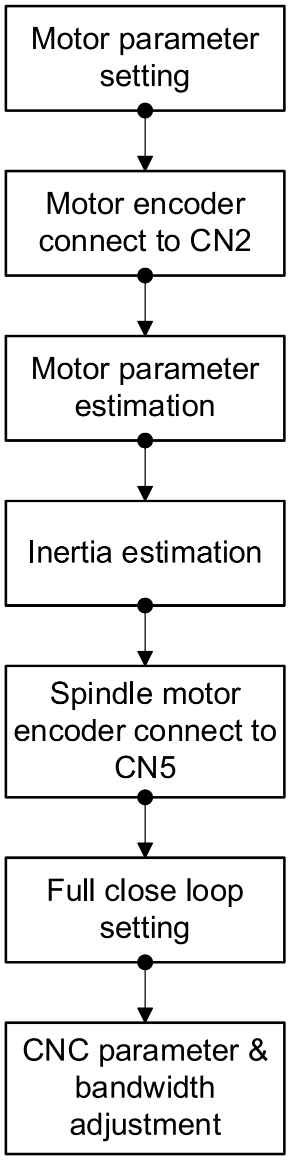
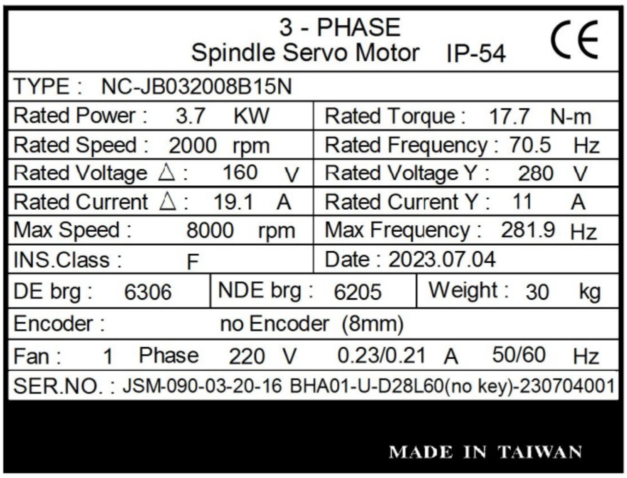



Figure 5.24.2.3.1 Estimate procedure

- **Step 1: Motor parameters set up.**

1. **Make sure the firmware version is A3E_v(21506)_sub(8692)_cpld(22).A36 above.**
2. PM-00 set as 3 for the induction motor type.
3. PM-64 IM control selection: set as 0 for vector control.
4. PM-65 ~ PM-72 motor parameter: Please refers to the information on the motor nameplate.




| Parameter | Name | Example |
|---|---|---|
| **PM-65** | IM rated voltage (V) | 220V set as 220 |
| **PM-66** | IM rated frequency (HZ) | 50Hz set as 50 |
| **PM-67** | IM rated power (0.01kw) | 3KW set as 3 |
| **PM-68** | IM motor poles (poles) | 4 poles set as 4 |
| **PM-69** | IM rated current (0.01A) | 10A set as 10 |
| **PM-70** | IM maximum current (0.01A) | 10A set as 10 |
| **PM-71** | IM rated speed (RPM) | 3000 RPM set as 3000 |
| **PM-72** | IM maximum speed (RPM) | 3000 RPM set as 3000 |

Note: The maximum current of induction motor is generally set to 1.5 to 2 times of rated current.

Note: The free load current of induction motors is generally about 40% of the rated current.

- **Step 2: Connect encoder signal to CN2.**

The motor encoder signal needs to be connected to the CN2 connector of the servo drive.

- **Step 3: Motor parameters auto tuning.**

When auto tuning the motor parameters, please first connect the motor encoder signal to the CN2 connector of the servo drive to perform motor parameter estimation.

6. P1-01: set the control mode as 4 and then restart the servo drive.
7. P2-08: set as 40 for enable the PM parameter.
8. PM-03: set as 0x1000 for encoder type.
9. PM-04: encoder resolution set as 5,120,000.
   (Take resolution 5,120,000pulse/rev as an example)
10. PM-01: estimation method set as 1. The motor will running as rated speed when estimating the parameters.
    Note: if it is a high-speed motor, please apply static estimation. Refers to section 5.24.1.

8. P2-30: set as 1. The servo drive will enable the motor and then start the estimation automatically.
9. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.
   Note: if there are anything wrong with the setting, the servo drive will return alarm AL51.

- **Step 4: Inertia estimation.**

Below steps illustrate the procedure of inertia auto estimation.

1. P1-01: set the control mode as 4.
2. P2-08: set as 40 for enable the PM parameter.
3. PM-03: set as 0x1000 for encoder type.
4. PM-04: encoder resolution set as 5,120,000.
   (Take resolution 5,120,000pulse/rev as an example)
5. PM-01: estimation method set as 4 for inertia auto estimation.
6. P2-30: set as 1. The servo drive will enable the motor and then start the inertia estimation automatically.
7. After finishing the estimation, the inertia result will set to PM-73 and the P1-37 will reset to 0 automatically.
8. After finishing the estimation procedure, the servo drive will return alarm AL50. Users need to restart the drive to activate the setting result.

- **Step 5: Connect spindle encoder signal to CN5.**

The motor encoder signal on the machine side needs to be connected to the CN5 connector of the servo drive.

- **Step 6: Full close loop function setting.**

Please check below steps and relevant servo drive parameters before enable the full close loop control.

| Step | Content | Servo drive parameter | Description |
|---|---|---|---|
| 1 | Wiring confirmation | - | Auxiliary encoder (A, B, Z format), connect to CN5 for full closed loop |
| 2 | Set external encoder direction | P1-74 | 0 or 1 on the hundreds digit |
| 3 | Resolution of full closed-loop spindle encoder | P1-71 | P1-71 is to set spindle motor resolution. |
| 4 | Feedback pulse number of full closed-loop spindle encoder | P1-72 | P1-72 is to set the pulse number (four times frequency) by the encoder at the spindle side when the motor rotates one revolution when the motor is connected to the spindle. |
| 5 | Set electronic gear ratio | P1-44<br>P1-45 | Ratio should be 1:1. |
| 6 | Position error protection of full closed-loop spindle encoder and motor encoder | P1-73 | When initially setting the full-closed loop function, do not set P1-73 too high to prevent the motor from running continuously when the external encoder is disconnected, or the direction is reversed. |
| 7 | Low-pass filter time of the full closed-loop position detector and the semi-closed-loop position detector | P1-75 | |

| | | | |
|---|---|---|---|
| 8 | the error clearing function when switching between full and semi-closed loop | P1-84 | This parameter is invalid in PR mode |
| 9 | Position error auto clean between the spindle and the motor | P1-85 | |
| 10 | DI setting:<br>Full and semi-closed loop switching DI<br>Spindle and motor encoder position error clearing DI | DI:<br>0X0B (trigger mode: level)<br>0X0E (trigger mode: positive edge) | |
| 11 | Detector output pulse number | P1-03<br>P1-46 | |
| 12 | Full closed loop function switch | P1-74 | 0 or 1 on the first digits. |
| 13 | PR full closed loop feedback setting | P3-13 | This parameter is invalid in PT mode. |
| 14 | Electronic gear ratio | P1-44<br>P1-45 | Ratio should be 1:1 when install dual encoder scenario. |
| 15 | Motor speed ratio | PM-94 | PM-94 should be 0 when install dual encoder scenario. |

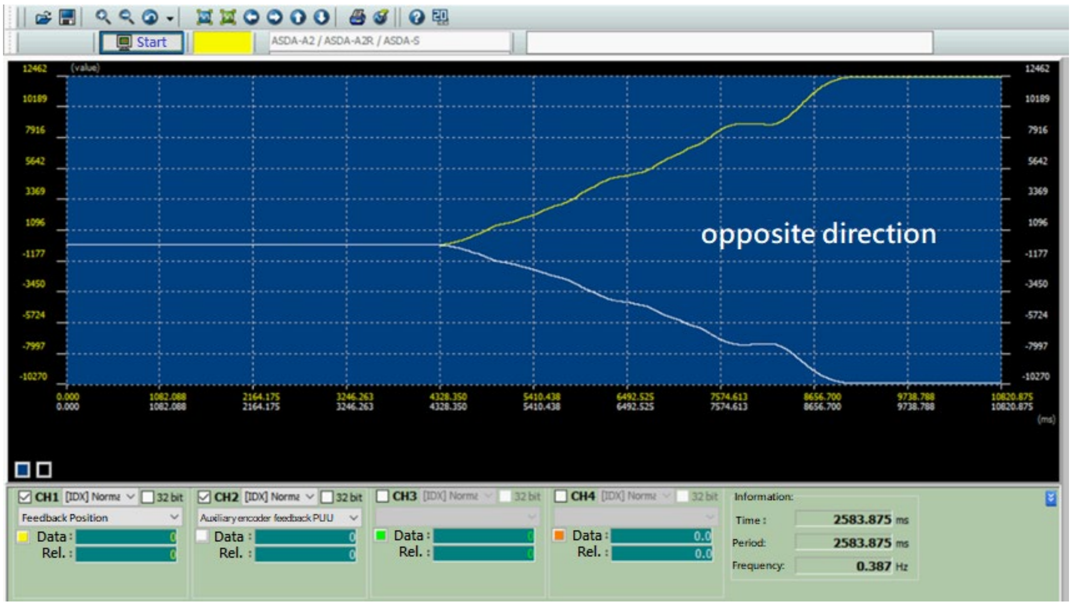
Note:

To confirm the direction of the external encoder, please refer to the following steps:

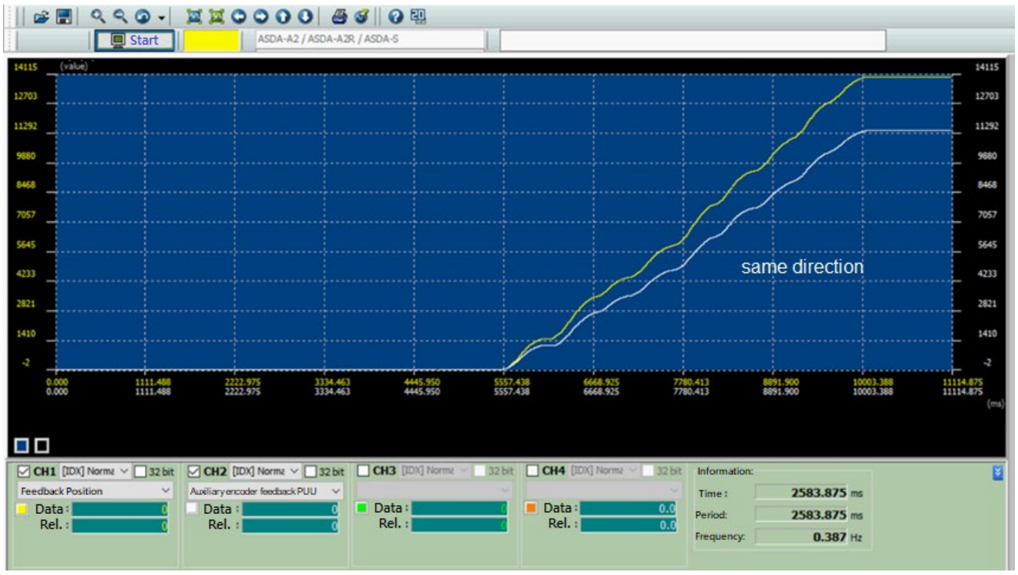
Step 1: Go to scope monitor interface.

Step 2: Check CH1 and CH2. Set as "feedback position" and "Auxiliary encoder feedback PUU"

Step 3: Under the premise of machine safety, let the motor rotate in the same direction and observe the wave pattern. If the directions of the two waves are opposite, the hundreds digit of P1-74 can be adjusted to make the directions of the two waves consistent.




Encoder direction is opposite




Encoder direction is the same

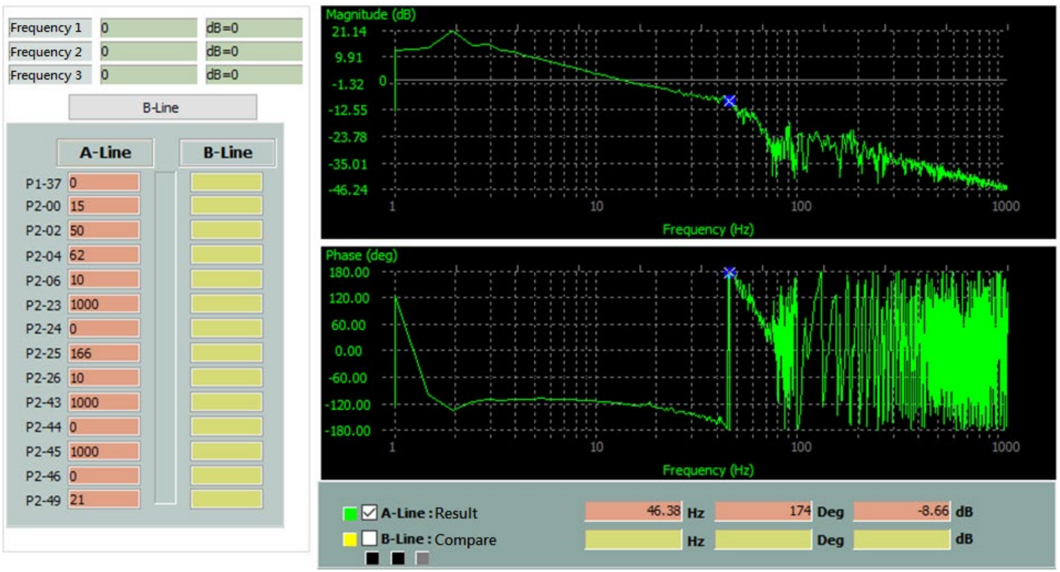
- **Step 7: CNC parameters and bandwidth adjustment.**

Connect the ASDA-A3E to the CNC controller through EtherCAT control for bandwidth adjustment and test run.

1. P1-01 set the control mode as C and then restart the servo drive.
2. CNC controller parameters.

| | |
|---|---|
| CNC parameter [N0.1000 Bit 2 Analog close loop control] | 1 |
| CNC parameter<br>[N0.1000 Bit 3 Speed command source of analog spindle] | 1 |
| CNC parameter<br>[N0.1005 Encoder resolution of 1st spindle] | 4096<br>(4 times frequency) |

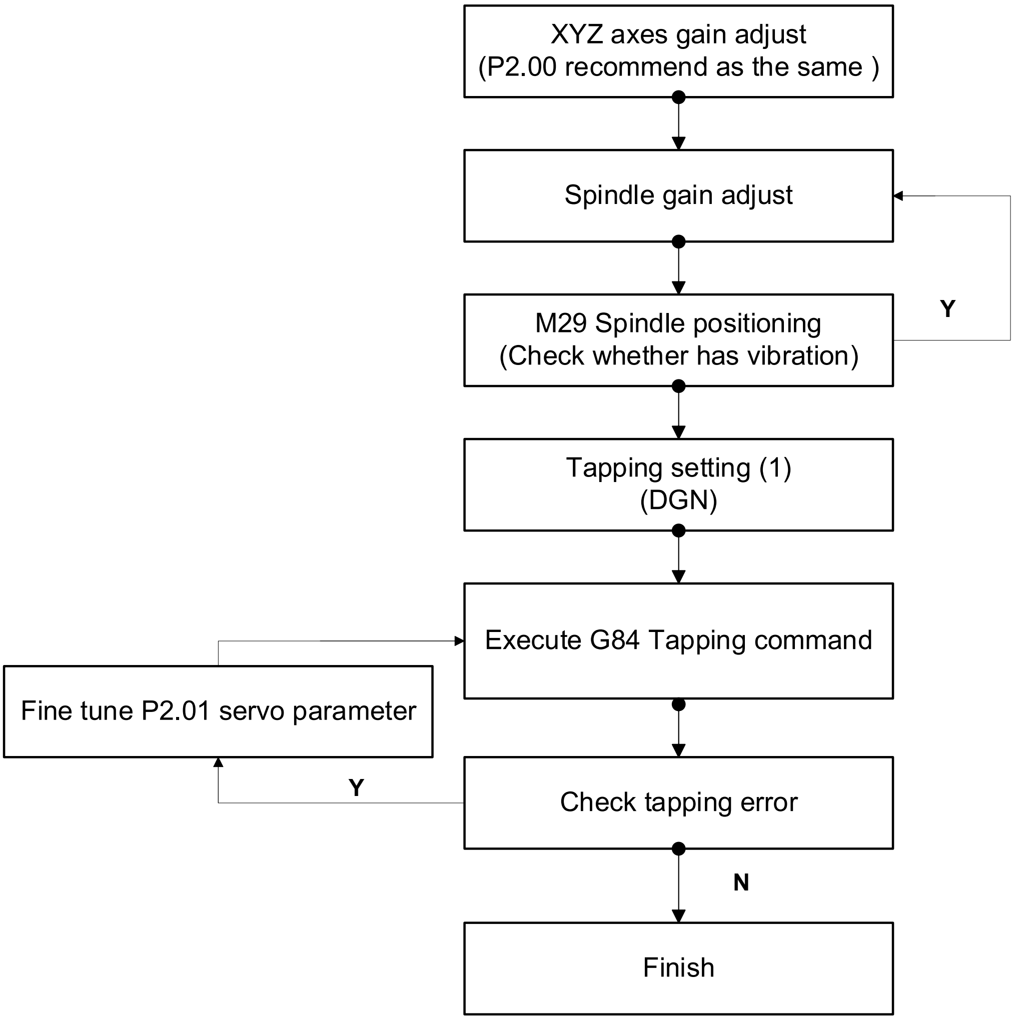
3. restart the servo drive.
4. Set the spindle parameter as 15Hz and test run with speed 60 RPM. After then, users can observe the motor whether has vibration or different sound. If there are no issue, users can try to increase the bandwidth; otherwise, the bandwidth needs to decrease.
5. users can utilize the ASDA-Soft to observe whether the bandwidth is fine.



5

### 5.24.3 Induction motor tapping

This section explains the optimal tapping adjustment of the CNC controller and ASDA-A3E servo driver. Users can follow the steps in this section to adjust. The instructions are as follows:




**Step 1**:

To adjust the NC axis gain in the CNC controller panel, it is recommended that the bandwidth of the NC axis be set to the same value. If there is a problem with machine rigidity and different bandwidths need to be set, it is also strongly recommended that all NC axis parameters P02.00 in its servo drive be set as the same.

**Step 2**:

Perform spindle (SP) gain adjustment on the CNC controller panel. Initially set the bandwidth to 15 and gradually increase it depending on the situation.

Note:

1. If the spindle inertia adopts automatic estimation, the inertia ratio in the gain adjustment panel must be set to 0.
2. The higher the bandwidth, the smaller the tapping error.

**Step 3**:

Execute M29 spindle positioning. When performing M29 positioning, if the spindle has abnormal vibration, the bandwidth can be reduced.

**Step 4**:

Execute tapping adjustment.

CNC → DGN → Gain adjustment → Tapping adjustment → Tapping setting(1)

**Step 5**:

Execute tapping command.

Example:

S3000

G84 R5. Z-2. F750 (Here is M1.2*0.25, so the value of F is 750)

**Step 6**:

Observe tapping errors.

(It is recommended that the error value is within 20um, and the parameter **[N1.13 Bit31]** can be set to 0)

Note:

1. D3x350 Tapping error of the 1st spindle.
2. Unit: Set according to parameter **[N1.13 Bit31]**, 0: mm, 1: degree.
3. If the tapping error is still not satisfactory, users can manually fine-tune the parameter P02.01 in the Z axis servo drive to match the spindle bandwidth.

# CNC Alarm Information A

This appendix provides the information about the alarms and troubleshooting methods for the NC system. Search this appendix for the methods of handling the NC system related malfunctions.

# A.1 CNC Alarm Categories

A

The CNC alarms can be divided into three categories, which are system alarms, user-defined alarms, and user-defined macro alarms. This appendix only describes the **[system alarms]** while the rest are user-defined.

| Alarm Category | Alarm Code | Alarm Description |
|---|---|---|
| System alarms | - | The system alarms caused by system error or operation error. Some system alarms include information, which has different meanings according to the different alarms. |
| User-defined alarms | A _ | The user-defined alarms which are programed in the MLC. When the A_ device is triggered, the alarm corresponding to the A_ device defined in **[DOPSoft - User-defined alarm]** will reported as well.<br>Range: A0~A511 |
| User-defined macro alarms | MR_ | The user-defined macro alarm works with NC program # variable. When the command as #20020=_, the alarm triggered and have the corresponding macro alarm defined in **[DOPSoft - Macro-defined alarm]** will displayed on the controller.<br>Range: M1~M1000 |

# A.2 CNC System Alarms

The system alarms are divided into MLC related alarms and NC related alarms by function.

| System alarm category | Alarm code range | Abnormal action | Description |
|---|---|---|---|
| NC alarms | 0x0000 ~ 0x1FFF | NC error | The alarms in this range are the error code that terminate the execution when an error occurs during the operation of the NC system, mainly divided into system abnormalities or operation error alarms. If the reason of the error cannot be identified, please report to Delta for assistance. |
| MLC alarms | 0xA000 ~ 0xAFFF | MLC error | The alarms in this range are the warning errors reported when the MLC and HMI screen inside the controller make errors during operation. If there is a related alarm, powering on the CNC again first, and if it still cannot be resolved, please contact Delta or supplier for assistance. |
| HMI alarms | 0x8000 ~ 0x8FFF | HMI error | |
| Servo related alarms | 0xF002 | - | The error code is an alarm when the errors of servo axes occur during system operation. When the error occurs, the servo alarm message will display on the screen. |

## A.2.1 NC Instruction Errors



| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x0000 | NC internal error. | An internal error occurred in the control system, please contact Delta or supplier. |
| 0x0002 | The specified line number or N line number cannot be found. | The specified file message cannot be found. |
| 0x0004 | Macro file call error. | Macro number error. |
| 0x0005 | Macro call mode error. | System mode error. |
| 0x0201 | Undefined operator. | Incorrect syntax. (Undefined symbol)<br>Wrong example:<br>G01O100.; “O” is undefined. |
| 0x0202 | Repeated operators command in one line. | Incorrect syntax. Please correct the syntax.<br>Wrong example:<br>G01 X100 G01 X50. |
| 0x0203 | Operators that must be command at the beginning of the block are not written at the beginning of the line. | Specific commands need to be used at the beginning of the line.<br>Wrong example:<br>G01 IF ➔ IF misused.<br>G01 WHILE ➔ WHILE is misused. |
| 0x0204 | Operators that are forbidden to be command at the beginning of the block are written at the beginning of the line. | Specific commands cannot be used at the beginning of the line.<br>Ex: DO, THEN |
| 0x0205 | Operators that must be command at the end of the block are not written at the end of the line. | Specific commands are not used at the end of the line.<br>Wrong example:<br>END 1 X100. ➔ END misused. |
| 0x0206 | Operators’ syntax error. | Wrong example:<br>#100=*3 ➔ character * misused. |
| 0x0207 | Command syntax error. | Wrong example:<br>X10. G1 ➔ command “X10.” misused. |
| 0x0208 | Command syntax error.<br>Statements and motion command cannot program in the same line. | Wrong example:<br>#1=2 G01 X10.<br>➔”#1=2” and “G01 X10.” cannot be on the same line. |
| 0x0209 | Command syntax error.<br>Wrong use of brackets. | “[“ and ”]” are not paired. |
| 0x020A | Command syntax error.<br>Wrong command characters. | Example error:<br>#1=BIT[2,SIN[3]]. The command content is incorrect with a comma. Only numbers or ‘#’ for arithmetic operations are allowed. |
| 0x020B | Command syntax error.<br>Cannot resolve multi-input operators. | Multi-input instructions such as ATAN can’t recognized by the system when it comes to negative numbers or the minus sign. |
| 0x020C | Command syntax error.<br>Newline character error. | Newline character incomplete. |
| 0x020D | Command syntax error. Violation of judgement operator in command syntax. | Syntax error. Correct the syntax format.<br>Invalid syntax for judgement operators such as ‘>’, ‘<’, ‘<>’, ‘=’.<br>Error example:<br>#1>G01. |
| 0x020E | Command syntax error.<br>IF command error. | Syntax error. Correct the syntax format.<br>There is no condition after the IF judgement. |
| 0x020F | Command syntax error. WHILE condition statement error. | Syntax error. Correct the syntax format.<br>There is no condition after the WHILE statement. |

A

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x0210 | Command syntax error. Divisor is 0. | Syntax error. Correct the syntax format.<br>Expression divided by zero, unable to compute. |
| 0x0211 | Command syntax error. Assignment operator used incorrectly. | Syntax error. Correct the syntax format.<br>Incorrect syntax for the '=' operator.<br>Error example:<br>#1=G01. |
| 0x0212 | The macro program is being called more times than the allowed limit. | Subprogram or macro program stack exceeds 8 levels. |
| 0x0213 | Command syntax error. WHILE loop command without END instruction. | Syntax error. Correct the syntax format.<br>The WHILE statement lacks the END instruction. |
| 0x0214 | Command syntax error. The loop count for DO is not an integer. | The character following DO can only be an integer. |
| 0x0215 | Command syntax error. The WHILE command lacks a DO instruction in its syntax. | Missing DO instruction in the syntax of the WHILE command. |
| 0x0216 | Command syntax error. The relevant instruction is missing the D parameter. | Missing usage of the D parameter in the command syntax.<br>Error example:<br>G42 X100. |
| 0x0217 | Command syntax error. The value of D exceeds the maximum limit. | The value of D parameter exceeds the maximum limit.<br>Error example:<br>G42 D1234567. |
| 0x0218 | Command syntax error. The relevant instruction is missing the H parameter. | Missing usage of the H parameter in the command syntax.<br>Error example:<br>G43 X100. |
| 0x0219 | Command syntax error. The value of H exceeds the maximum limit. | The value of H parameter exceeds the maximum limit.<br>Error example:<br>G43 H1234567. |
| 0x021A | The T value of lathe tool compensation exceeds the maximum limit. | Error example:<br>M06 T1234567. |
| 0x021B | Error in using the G53.1 command. | The G53.1 command must be used after the G68.2 command. |
| 0x021C | The T value exceeds the maximum limit. | Error example:<br>M06 T1234567. |
| 0x021D | Not supported G code instruction. | Syntax error. Correct the syntax format.<br>G code number not supported. |
| 0x021E | The coordinates instruction of robot system command is incorrect. | Syntax of [X, Y, Z] or [J1, J2, J3] command error. Correct the syntax format.<br>Correct format:<br>G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0<br>When Q is 0,1 or 2, use XYZABC.<br>G01.1 J1_ J2_ J3_ P0000 H0 R0 Q3<br>When Q is 3, use J1, J2, …, J6. |
| 0x021F | The tool number of robot system command is incorrect. | Syntax of H command error of H. Correct the syntax format.<br>Correct format:<br>G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0 |
| 0x0220 | The workpiece number of robot system command is incorrect. | Syntax of R command error. Correct the syntax format.<br>Correct format:<br>G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0 |

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x0221 | The coordinates setting of robot system command is incorrect. | Syntax of Q command error. Correct the syntax format.<br>Correct format:<br>G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0<br>Q: setting range from 0 to 3. |
| 0x0222 | Command syntax error.<br>No value specified in the instruction. | Syntax error. Correct the syntax format.<br>Error example:<br>G01 X Y100. ➔ No value specified after X. |
| 0x0223 | Command syntax error.<br>Coordinate command value exceeds the range. | Syntax error. Correct the syntax format.<br>Correct format:<br>G01 X987654.321<br>G01 X98765432.1<br>The maximum number of digits is 9. |
| 0x0224 | Command syntax error.<br>GOTO statement error. | Syntax error. Correct the syntax format.<br>Error example:<br>GOTO 2<br>N2 can’t be found in the NC program. |
| 0x0225 | Command syntax error.<br>END statement error. | Syntax error. Correct the syntax format.<br>Error example:<br>END<br>No value specified after END. |
| 0x0226 | Command syntax error.<br>DO statement error. | Syntax error. Correct the syntax format.<br>Error example:<br>WHILE DO<br>No value specified after DO. |
| 0x0229 | Operational error.<br>The specified file line number can’t be found. | Error example:<br>M98 Q10<br>Specifies line 10, but the NC program only contains 9 lines of content. |
| 0x022A | Operational error.<br>The specified N line number can’t be found. | Error example:<br>M98 H10<br>Specifies line 10, but there is no N10 line number instruction in the NC program. |
| 0x022B | Operational error.<br>The specified DO loop instruction can’t be found. | Syntax error. Correct the syntax format.<br>The END command doesn’t have a corresponding DO. |
| 0x022C | Operational error.<br>The specified END can’t be found. | The specified number of DO layers doesn’t have corresponding END layer number.<br>For example: While using WHILE DO 2, it should be ended with END 2. |
| 0x022D | Operational error.<br>Subprogram calling layers exceeds the maximum limit. | The maximum layer of subprogram call or macro stack is 8. |
| 0x022E | Operational error.<br>Missing P command in M98 subprogram calling function. | Missing P_ definition for the subprogram in M98 subprogram calling function. |
| 0x022F | Operational error.<br>Missing B command after G122. | B_ is not used with G122 command. |
| 0x0230 | Operational error.<br>G122 B command misused. | B_ misused in G122 command. |
| 0x0231 | Operational error.<br>The axis of drilling cycle is incorrect. | The axis used in the drilling cycle command doesn’t exist. |
| 0x0232 | Operational error.<br>Missing P_ or Q_ in the drilling cycle command. | The drilling cycle command doesn’t apply P or Q. |

A

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x0233 | Operational error.<br>The drilling cycle command can't find the specified Q label. | The Q label defined by the drilling cycle command can't be found in the NC program. |
| 0x0234 | Operational error.<br>Unable to find the specified N line number or file line number during breakpoint search. | While using breakpoint search, there is no corresponding N line number or file line number in the NC program. |
| 0x0235 | The # variable number exceeds the usage range. | Using an undefined # variable number or when the odd addresses are used between the # variable range #25128 ~ #25255 and #25384 ~ #25511 while using the floating-point MLC variable type with **[N1.010 Bit7=1]**, which occupies 32 bits of memory space. |
| 0x0236 | Error in the format of the extended workpiece coordinates. | The extended value for workpiece coordinates must be an integer.<br>G54 P_ ➔ The parameter of P command must be an integer. |
| 0x0237 | The extended workpiece coordinates exceed the range. | The extended workpiece coordinates exceed the maximum limit.<br>The range is G54 P1 to G54 P256. |
| 0x0238 | IF command error. | Correct the syntax of IF. |
| 0x0239 | THEN command error. | Correct the syntax of IF and THEN. |
| 0x023A | ELSEIF command error. | Correct the syntax of IF and ELSEIF. |
| 0x023B | ELSE command error. | Correct the syntax of IF and ELSE. |
| 0x023C | ENDIF command error. | Correct the syntax of IF and ENDIF. |
| 0x023D | Cannot find the specified ENDIF. | The NC program has IF statement but doesn't have the corresponding ENDIF. |
| 0x023E | The layers used of IF command exceed the maximum limit. | The maximum layers used of IF command is 5. |
| 0x0241 | The P command is not marked. | The P command is not marked with the corresponding number. |
| 0x0242 | The value of P command exceeds the maximum value. | The limit value of P command is 1 to 256. |
| 0x0243 | The P command value is incorrect. | Syntax error. Correct the syntax format. |
| 0x0244 | The setting value of the # variable exceeds the limit range. | The setting value of the special # variable exceeds the allowed range.<br>Error example:<br>#20020 = 32768<br>(The value range of #20020 is 0 to 32767). |
| 0x0245 | The command P or Q is not used in the nested loop. | Syntax error. Correct the syntax format. |
| 0x0246 | The cutting amount in the roughing cycle is invalid. | Syntax error. Correct the syntax format. |
| 0x0247 | The nested loop must be followed by 2 consecutive blocks of instructions. | Syntax error. Correct the syntax format. |
| 0x0248 | The number of M codes used in a single block instruction exceeds the limit. | The maximum number of M codes allowed in a single block instruction is 4. |
| 0x0249 | M code usage error. | Syntax error. Correct the syntax format.<br>Error example: M98 M1 M3 |
| 0x024B | Call instruction usage error. | Error example:<br>M98 G65<br>One block can only have one call command. |
| 0x024D | Multi Z axis application with tool compensation cannot specify the movement amount of the slave axis. | Syntax error. Correct the syntax format. |

A

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x024E | Usage error of the HSI value of multi-Z axis. | The trigger contact of G31 contains undefined contacts. |
| 0x024F | Usage error of V_ or XYZABCUVW_ in the G31 skip function of multi-Z axis. | G31 command for the slave axis was used in the NC program. |
| 0x0250 | Usage error of the input function of the multi-Z axis in the G10 programmable parameter function. | Syntax error of G10 L50. |
| 0x0251 | Error parameters of the call subprogram function. Only P_, H(Q)_, L_, can be used. | Error example:<br>M98 K5<br>K5 is not supported by M98. |
| 0x0252 | Usage error of read and write servo parameters of G10 programmable parameters function. | Syntax error of G10 L40 / G10 L41. |
| 0x0253 | Data error of the intermedia point for returning to the reference point. | Syntax error of G28. |
| 0x0254 | Attempt to assign a value to a ready-only # variable. | Error example:<br>#20005 = 10<br>#20005 is a constant value π (3.1415) and cannot be written. |
| 0x0255 | The number of interpolation axes in a single block exceeds the limit. | The maximum number of interpolation axes in a single section is 16. |
| 0x0256 | Usage error of the arithmetic command. | Syntax error of the arithmetic command.<br>Error example:<br>#100=BIT[1]<br>The BIT command requires 2 input values for calculation, but only one set of value is provided. |
| 0x0257 | Input numerical error in arithmetic command. | Syntax numerical error of the arithmetic command.<br>Error example:<br>B=ASIN[A]<br>The range of A value is not between -1 to 1. |
| 0x0258 | Decimal point is not allowed. | The value of the command does not allow decimal points.<br>Error example:<br>G04 P1.2<br>The parameter of P does not support decimal values. |
| 0x0259 | The radius of the arc command is incorrect. | The distance between the center and the end point calculated by the arc command exceeds the arc radius tolerance of **N1.040**. |
| 0x025A | The center of the arc command is incorrect. | The distance between the center and the end point calculated by the arc command exceeds the arc radius tolerance of **N1.040**. |
| 0x025B | 3-dimension arc command error. | The distance between the center and the end point calculated by the 3-dimension arc command exceeds the arc radius tolerance of **N1.040**. |
| 0x025C | Blending function data registration error | G10 L60 blending function data registration error. Please check the value of the P command. |
| 0x025D | Working plane setting error. | While enabling synchronize axis function, the plane selections such as G17, G18 and G19 have the same axis, or the plane selection is incorrect. |

A

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x025E | System obtained NULL pointers. | RBTask obtained NULL pointers. Controller malfunction, please contact Delta or supplier for assistance. |
| 0x025F | Not supported instruction for the scaling function. | When using the G68 rotation command, it is not allowed to use 3-dimension arc command, G28/G29/G30, and G54~G59 commands simultaneously. If you need to use them, you must first cancel the G68 function with G69. |
| 0x0260 | Insufficient information for circle command by three points method. | The input information used for circle command by three points is insufficient. |
| 0x0261 | Subprogram calling function missing H_ statement. | Syntax error. Correct the syntax format. |
| 0x0262 | Switching arm gesture is prohibited during arm moving. | Switching hand orientation is prohibited during motion. |
| 0x0263 | File not found. | Cannot find the specified NC program file. |
| 0x0264 | The P_Q_ command does not exist in looping command. | Make sure the NC program file includes the N line number or file line number for specified by P_Q_. |
| 0x0265 | G53 or G28/ G30 commands error | G53 and G28/G30 commands cannot be used in the same block. |

## A.2.2 NC Axis Alarms

A

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x0401 | Emergency stop signal is triggered. | Exclude the EMG signal. |
| 0x0402 | Hardware limit signal is triggered. | Exclude the hardware limit signal. |
| 0x0601 | Axes reference information error | Communication is disconnected after established.<br>Reset after reconnecting the physical cable.<br>When the alarm occurs, the origin state of the axis will be canceled if it's an incremental type of axis. |
| 0x0602 | Overspeed protection. | System overspeed protection.<br>The axis will servo off when the alarm occurs. It will be automatically servo on again after reset command and clearing the alarm. |
| 0x0A01 | The 1st segment of software limit is triggered. | The axis has reached the software limit position of 1st segment. The machine must move away from the limit position before system reset. |
| 0x0A02 | The status of 1st segment of software limit needs to be cleared. | After moving away from the 1st segment of software limit, this alarm will be displayed. Please reset the machine. |
| 0x0A03 | The 2nd segment of software limit is triggered. | The axis has reached the software limit position of 2nd segment. The machine must move away from the limit position before system reset. |
| 0x0A04 | The status of 2nd segment of software limit needs to be cleared. | After moving away from the 2nd segment of software limit, this alarm will be displayed. Please reset the machine. |
| 0x0A05 | Hardware limit triggered. | The axis has reached the hardware limit position. The machine must move away from the limit position before system reset. |
| 0x0A06 | The status of hardware limit needs to be cleared. | After moving away from the hardware limit, this alarm will be displayed. Please reset the machine. |
| 0x0A07 | Servo is not ready. | The axis is not servo ON. |
| 0x0A08 | Origin status of the axis is missing. | Please execute the homing operation. |
| 0x0C01 | Spindle positioning failed. | Verify the spindle positioning process or check if the spindle positioning time setting is incorrect.<br>**N0.1025**, Positioning check time for 1st spindle.<br>**N0.1075**, Positioning check time for 2nd spindle.<br>**N0.1125**, Positioning check time for 3rd spindle.<br>…<br>**N0.1375**, Positioning check time for 8th spindle. |
| 0x0C02 | Spindle is not rotating before cutting. | **[N1.011 bit8 the spindle enables checks before cutting]** is set to 1, and the spindle is not rotating when executing the motion command. |
| 0x0C03 | The spindle speed setting exceeds the maximum speed. | **[N0.1000 bit7 the spindle maximum speed command check]** is set to 1, and the S value in the NC instruction exceeds the maximum spindle speed setting in **N0.1008**. |
| 0x0C04 | Incorrect switching of the spindle and C-axis. | Make sure all channel parameters are set, whether the C-axis and the spindle are both configured as active axes. |
| 0x0C05 | The spindle C-axis is not set as rotational axis. | Check the C axis setting of **N2.001 bits 2 to 4** for the rotational axis feed mode. |
| 0x0C06 | The spindle is not enabled. | Please check if the spindle is enabled. |

A

| | | |
|---|---|---|
| 0x1601 | The hardware limit is triggered during execution of home mode 4.<br>The search direction does not match. | The hardware limit is triggered during homing.<br>Please check the following:<br>1. Make sure the machine is out of any limit positions before executing the homing procedure.<br>2. Verify the wiring signals for the hardware limits are functioning correctly.<br>3. Chek if the homing search direction is correct. |
| 0x1602 | The hardware limit alarm not cleared of the home mode 4. | This alarm will be triggered after clearing 0x1601 hardware limit alarm. |
| 0x1603 | Oscillation function is not allowed in the home mode. | The M2x264 oscillation function cannot be enabled in the homing mode. |
| 0x1604 | The home mode is not supported. | Please confirm the parameter settings of **N2.50** homing mode. |
| 0x1605 | The axis is set as non-rotary axis in home mode 6. | Please confirm the parameter settings of **N2.01** axis configuration. |
| 0xF002 | The alarm codes of Delta servo. | The alarm of 0xF002 needs to be interpreted in conjunction with the alarm codes of the Delta servo.<br>For example, if the Delta servo displays an alarm code 0x09 (following error), the controller will display 0xF002 and indicate the servo's alarm code as 0x09. |

A

## A.2.3 NC Motion Interpolation Alarms

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x1001 | Feed rate is not specified. | The NC program needs to specify F or set default feed rate value. |
| 0x1201 | Block command error. | Command block error. |
| 0x1202 | The repeated points of tool compensation have exceeded the maximum limit. | The repeated points exceed the maximum limit. |
| 0x1203 | Plane changing after enabling tool compensation. | Changing the plane is prohibited after enabling tool compensation. |
| 0x1204 | Unable to calculate the tool compensation path at arc-to-linear command. | Unable to calculate the tool compensation path. |
| 0x1205 | Tool compensation path interference occurred at arc-to-linear. | Tool compensation result has path interference.<br>For example:<br>The arc entry is smaller than the tool diameter. |
| 0x1206 | Changing tool diameter during arc command performing. | Tool diameter cannot be changed during arc command while tool compensation is enabled. |
| 0x1207 | Unable to calculate the tool compensation path at arc-to-arc command. | Unable to calculate the tool compensation path. |
| 0x1208 | Tool compensation path interference occurred between linear-to-arc. | Tool compensation result has path interference.<br>For example:<br>The arc entry is smaller than the tool diameter. |
| 0x1209 | Unable to calculate the tool compensation path at linear-to-arc command. | Unable to calculate the tool compensation pat. |
| 0x120A | The arc radius is less than 0 after tool compensation. | Tool compensation result has path interference. |
| 0x120B | Tool compensation path interference occurred at two linear commands. | Tool compensation result has path interference. |
| 0x120C | Calculation error at the arm path interpolation. | The endpoint position is outside the working range of the robot arm. |
| 0x120D | The P value of G05 command does not correspond to HMI recipe. | The corresponding recipe values must be filled in within the HMI interface. |
| 0x120E | Path interpolation distance exceeds the maximum travel distance. | Motion coordinate point exceeds the maximum distance.<br>Error example:<br>X[tan[90]] ➔ tan[90] is a infinity value<br>Please correct the coordinate position of the motion command. |

A

## A.2.4 NC Kernel Alarms

| Alarm code (Hex) | Name | Cause and correction |
|---|---|---|
| 0x1401 | System kernel construction failed. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1402 | System kernel RT construction failed. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1403 | System kernel RT memory error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1404 | System RT deployment configuration error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1405 | Path UTY construction failed. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1406 | Path NRT construction failed. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1407 | Path RT construction failed. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1408 | Path UTY memory error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1409 | Path NRT memory error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x140A | Path RT memory error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x140B | Retentive # variable error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x140C | Path UTY deployment parameter error. | Parameter error. |
| 0x140D | Path UTY deployment configuration error. | Parameter error. |
| 0x140E | Path NRT association error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x140F | Path NRT deployment parameter error. | Parameter error. |
| 0x1410 | Path NRT deployment configuration error. | Parameter error. |
| 0x1411 | Path RT association error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1412 | Path RT deployment parameter error. | Parameter error. |
| 0x1413 | Path RT deployment configuration error. | Parameter error. |
| 0x1414 | Path NRT registration # variable error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x1415 | Virtual axis type error. | The system axis parameters have both physical and virtual axis setting on the same axis. |
| 0x1416 | The slave address does not match. | The slave address is different from the system address setting. Please confirm the slave address or reset. |
| 0x1417 | The slave address is duplicated. | Duplicate slave addresses are being used. Please check the address setting of the slave devices and eliminate the duplicate addresses. |
| 0x1418 | The number of channels in the multi-channel is incorrect. | The NC multi-channel must be used sequentially and cannot be used with only channel one and channel three. |
| 0x1419 | NC axis number setting error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x141A | Spindle number setting error. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x141B | Coding of the tool magazine setting error. | Controller malfunction, please contact Delta or supplier for assistance. |

| | | |
|---|---|---|
| 0x141C | Setting error of the axis type. | The axis type setting, such as NC axis or PLC axis, is incorrect. Please contact Delta or supplier for assistance. |
| 0x141D | The number of Cartesian axes and joint axes in the path dose not match. | Controller malfunction, please contact Delta or supplier for assistance. |
| 0x141E | System PDO mapping mismatch. | Controller malfunction, please contact Delta or supplier for assistance.<br>The system DAT configuration does not match the connected products. |
| 0x141F | The system interrupt execution time is not supported. | The servo does not support the current interpolation time. |
| 0x1420 | EtherCAT communication establish failed. | Check if the communication cables are properly connected to the slave devices. |
| 0x1426 | The system remote module (EIO) failed. | Verify if there are any conflicts with the settings in the controller EIO interface and confirm the changes to save the modified parameter values. |
| 0x1427 | Failed to trigger the EtherCAT communication OP mode. | Check if the fieldbus is properly connected. |
| 0x1428 | Failed to switch the EtherCAT communication to OP mode. | Check if the fieldbus is properly connected. |
| 0x1429 | EtherCAT communication initialization error. | Please restart the system. |
| 0x142A | The number of axes defined in the channel exceeds the limit. | Please check the parameter definition of the channel axis. |
| 0x142B | EtherCAT slave devices not found. | Check if the cables are properly connected. |
| 0x142C | Conflicting setting between multi-Z and synchronization function. | Check for any conflicts between the multi-Z parameters and the synchronization control parameter **N2.015**. |
| 0x142D | Setting error of the multi-Z machine parameters. | Check if the setting of multi-Z parameters is correct. |
| 0x142E | The system remote module (EIO) connection device type mismatch with the settings. | Check if the EIO module type settings match the devices on the fieldbus. |
| 0x142F | The corresponding port number for the remote module (EIO) connection was not found. | Check if the port number setting for the EIO module is correct. |

# Special Memory B

This chapter introduces CNC system definition device list. It supplies users to check MLC special # variable action correct or not in CNC system.

B

B

## B.1 Definition of MLC special M relay and special D register

The motion logic control (MLC) and the NC are two independent systems. The MLC system performs button triggering control, MLC axis movements, and other logic controls, while the NC system manages functions related to the system and servo axis. The MLC's special M relays and D registers serve as the I/O interface between these two systems for data exchange and signal transmission. The output mentioned in this chapter refers to the signals sent to the NC system from the MLC special M relays and D registers. The input refers to the signals sent to the MLC special M relays and D registers from the NC system.

The M letter prefixed codes are in bit format, being 0 (OFF) and 1 (ON). The D prefixed codes are in word format, referring to numerical values such as 1000. The MLC special M and D codes are all expressed in the form of M- and D- prefixes followed by five 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)

There are each 65,535 address numbers for the M and D registers in the NC5 series controller. The range between M20000 to M24999, M30000 to M34999, D20000 to D24999 and D30000 to D34999 are the special M and D registers in the system. Therefore, all of these special M and D register will separated in different groups according to the NC5 series controller support multi-channel control, as shown in the table below.

| Channel Index | System Special M and D MLC to System (NC) | | System Special M and D System (NC) to MLC | |
|---|---|---|---|---|
| General | M20000 ~ M20999 | D20000 ~ D20999 | M30000 ~ M30999 | D30000 ~ D30999 |
| Channel 1 | M21000 ~ M21999 | D21000 ~ D21999 | M31000 ~ M31999 | D31000 ~ D31999 |
| Channel 2 | M22000 ~ M22999 | D22000 ~ D22999 | M32000 ~ M32999 | D32000 ~ D32999 |
| Channel 3 | M23000 ~ M23999 | D23000 ~ D23999 | M33000 ~ M33999 | D33000 ~ D33999 |
| Channel 4 | M24000 ~ M24999 | D24000 ~ D24999 | M34000 ~ M34999 | D34000 ~ D34999 |

B

| Channel Index | For HMI Special M and D MLC to System (HMI) | | For HMI Special M and D System (HMI) to MLC | |
|---|---|---|---|---|
| General | M49000 ~ M49099 | D49000 ~ D49099 | M59000 ~ M59099 | D59000 ~ D59099 |
| Channel 1 | M49100 ~ M49199 | D49100 ~ D49199 | M59100 ~ M59199 | D59100 ~ D59199 |
| Channel 2 | M49200 ~ M49299 | D49200 ~ D49299 | M59200 ~ M59299 | D59200 ~ D59299 |
| Channel 3 | M49300 ~ M49399 | D49300 ~ D49399 | M59300 ~ M59399 | D59300 ~ D59399 |
| Channel 4 | M49400 ~ M49499 | D49400 ~ D49499 | M59400 ~ M59499 | D59400 ~ D59499 |

For the special M and D register, when the tens of thousands digit is 2, it means the MLC is sending a value to the NC system. If the digit is 3, it means the NC system is updating its status for the MLC to read and check. If the digit is 4, it means the MLC is sending a value to the HMI system. If the digit is 5, it means the HMI system is updating its status for the MLC to read and check. When the tens of thousands digit is 2 or 3 and the thousands digit is 0, it means this register is for system general purpose use. If the digit is 1 to 4, it represents the specific NC channel respectively. The remaining three digits from 000 to 999 are for the functional index. The chapters below will give detailed function descriptions for each available special M and D.

# B.2 List of special M and special D

## B.2.1 List of special M (MLC to system)

B

### B.2.1.1 M21000 to M29999

<table>
<tr><th>Function Name</th><th>Special M</th><th>Description</th><th>Device</th></tr>
<tr><td>Spindle1 DO Control</td><td>M20018</td><td>When this function is ON, the system will output the digital signal on the Pin 9 of Spindle 1 connector.</td><td>R/W</td></tr>
<tr><td>Spindle2 DO Control</td><td>M20019</td><td>When this function is ON, the system will output the digital signal on the Pin 9 of Spindle 2 connector.</td><td>R/W</td></tr>
<tr><td>Enable 3 MPG Control</td><td>M20024</td><td>Enable 3 sets of MPG function control. The controller can process three sets of MPG pulse signals and control the three axes respectively.<br>When this special M is enabled, the 2nd and 3rd MPG will also be enabled at the same time.</td><td>R/W</td></tr>
<tr><td>Cycle Start</td><td>M2x000</td><td>Informs the NC system to execute Cycle Start and execute the NC program.</td><td>R/W</td></tr>
<tr><td>Feed Hold</td><td>M2x001</td><td>Pause the NC process in the controller system. After pausing, the system can resume the procedure with “Cycle Start” or stop all actions with “Reset”.</td><td>R/W</td></tr>
<tr><td>NC Reset</td><td>M2x004</td><td>Tells the NC system to execute the Reset procedure; all actions will be stopped.</td><td>R/W</td></tr>
<tr><td>Enable Dry Run</td><td>M2x005</td><td>Enable dry run mode. The system will execute NC programs, including regular feed and rapid command, at dry run speed. The dry run speed will refer to parameter [N1.013 Bit18 Dry run speed mode] and [N1.66 Dry run feed rate] for the speed reference.
<table>
<tr><th>Parameter</th><th>Setting</th><th>Actual Speed</th></tr>
<tr><td>N1.013 Bit18</td><td>0</td><td>N1.66 Setting</td></tr>
<tr><td>N1.013 Bit18</td><td>1</td><td>N1.66 x D2x002</td></tr>
</table></td><td>R/W</td></tr>
<tr><td>MPG Simulation</td><td>M2x006</td><td>During program execution, users can use the MPG to control the speed of movement trajectories.</td><td>R/W</td></tr>
<tr><td>Disable Hardware Limit</td><td>M2x007</td><td>The limit signal of each axis is ignored when this function is enabled.</td><td>R/W</td></tr>
<tr><td>Single Block</td><td>M2x008</td><td>In AUTO mode, the program stops after one block is executed.</td><td>R/W</td></tr>
<tr><td>Optional Stop</td><td>M2x009</td><td>Enable the optional stop key. When the program executes M01, the controller immediately stops.</td><td>R/W</td></tr>
<tr><td>Single Block Skip (‘/’)</td><td>M2x010</td><td>The program skips the block containing the symbol '/' when this function is enabled.</td><td>R/W</td></tr>
<tr><td>M, S, and T Codes Lock</td><td>M2x011</td><td>The program skips any block containing M, S, T code when this function is enabled.</td><td>R/W</td></tr>
<tr><td>Servo ON/ OFF</td><td>M2x012</td><td>Servo ON or OFF for all of connected servo drives in the corresponding channel.</td><td>R/W</td></tr>
<tr><td>Enable Emergency Stop</td><td>M2x013</td><td>When this function is ON, the NC will trigger an emergency stop.</td><td>R/W</td></tr>
<tr><td>Enable Synchronization Adjustment</td><td>M2x014</td><td>Manually trigger synchronization adjustment.</td><td>R/W</td></tr>
<tr><td>M, S, and T Codes Finished</td><td>M2x016</td><td>Triggering this signal informs the NC system that the procedures for M, S and T codes are complete.</td><td>R/W</td></tr>
<tr><td>M96 Program Interruption</td><td>M2x019</td><td>After the NC executes M96, if this function is triggered, the NC system interrupts the main program and jumps to the subprogram to execute it.</td><td>R/W</td></tr>
<tr><td>M, S, and T Codes Call Macro Lock</td><td>M2x021</td><td>When this function is ON, the NC will not execute macro program including M code process regarding M, S, and T codes in the NC program.</td><td>R/W</td></tr>
<tr><td>Macro Call Activation</td><td>M2x025</td><td>Activates macro call.<br>(Only works with the correct macro-ID in AUTO mode)</td><td>R/W</td></tr>
</table>

<table>
<tr><th>Function Name</th><th>Special M</th><th>Description</th><th>Device</th></tr>
<tr><td>M99 Call Stop</td><td>M2x026</td><td>When this function is ON, the NC system will slow down to stop and then stop all process when executing M99.</td><td>R/W</td></tr>
<tr><td>1st Macro Call Preparation</td><td>M2x032</td><td rowspan="16">Initializes macro call.<br>(A successful call will only occur when the correct macro number [D2x064~D2x079] and the corresponding macro program both exist)</td><td>R/W</td></tr>
<tr><td>2nd Macro Call Preparation</td><td>M2x033</td><td>R/W</td></tr>
<tr><td>3rd Macro Call Preparation</td><td>M2x034</td><td>R/W</td></tr>
<tr><td>4th Macro Call Preparation</td><td>M2x035</td><td>R/W</td></tr>
<tr><td>5th Macro Call Preparation</td><td>M2x036</td><td>R/W</td></tr>
<tr><td>6th Macro Call Preparation</td><td>M2x037</td><td>R/W</td></tr>
<tr><td>7th Macro Call Preparation.</td><td>M2x038</td><td>R/W</td></tr>
<tr><td>8th Macro Call Preparation</td><td>M2x039</td><td>R/W</td></tr>
<tr><td>9th Macro Call Preparation</td><td>M2x040</td><td>R/W</td></tr>
<tr><td>10th Macro Call Preparation</td><td>M2x041</td><td>R/W</td></tr>
<tr><td>11th Macro Call Preparation</td><td>M2x042</td><td>R/W</td></tr>
<tr><td>12th Macro Call Preparation</td><td>M2x043</td><td>R/W</td></tr>
<tr><td>13th Macro Call Preparation</td><td>M2x044</td><td>R/W</td></tr>
<tr><td>14th Macro Call Preparation</td><td>M2x045</td><td>R/W</td></tr>
<tr><td>15th Macro Call Preparation</td><td>M2x046</td><td>R/W</td></tr>
<tr><td>16th Macro Call Preparation</td><td>M2x047</td><td>R/W</td></tr>
<tr><td rowspan="4">Robot Coordinate System</td><td>M2x048</td><td rowspan="4">The robot coordinate system can be set as shown in the table below.<br>The CNC controller needs to be in manual mode. The D2x016 defines the coordinate system, eg.: 1 = G54, 2 = G55, …, 5 = G58 and 6 = G59.
<table>
<tr><th></th><th>PCS (Piece)</th><th>TCS (Tool)</th><th>JCS (Joint)</th></tr>
<tr><td>M2x048</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>M2x049</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>M2x050</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>M2x051</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>D2x016</td><td>1 ~ 6</td><td>1 ~ 6</td><td>1 ~ 6</td></tr>
</table></td><td rowspan="4">R/W</td></tr>
<tr><td>M2x049</td></tr>
<tr><td>M2x050</td></tr>
<tr><td>M2x051</td></tr>
<tr><td>Tool Magazine 1 Move Forward</td><td>M2x064</td><td>Moves tool magazine 1 forward. When this special M relay is triggered, the tool pot deviation [D3x039] is decreased by 1, and the standby tool pot number [D3x038] is increased by 1.</td><td>R/W</td></tr>
<tr><td>Tool Magazine 1 Move Backward</td><td>M2x065</td><td>Moves tool magazine 1 backward. When this special M relay is triggered, the tool pot deviation [D3x039] is increased by 1, and the standby tool pot number [D3x038] is decreased by 1.</td><td>R/W</td></tr>
<tr><td>Tool 1 Exchange</td><td>M2x066</td><td>Exchanges tool data in tool magazine 1.</td><td>R/W</td></tr>
<tr><td>Tool Magazine 1 Reset</td><td>M2x067</td><td>When this special M relay is triggered, the tool data in tool magazine 1 is reset.</td><td>R/W</td></tr>
</table>

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Tool Magazine 2 Move Forward | M2x072 | Moves tool magazine 1 forward. When this special M relay is triggered, the tool pot deviation **[D3x045]** is decreased by 1, and the standby tool pot number **[D3x044]** is increased by 1. | R/W |
| Tool Magazine 2 Move Backward | M2x073 | Moves tool magazine 1 backward. When this special M relay is triggered, the tool pot deviation **[D3x045]** is increased by 1, and the standby tool pot number **[D3x044]** is decreased by 1. | R/W |
| Tool 2 Exchange | M2x074 | Exchanges tool data in tool magazine 2. | R/W |
| Tool Magazine 2 Reset | M2x075 | When this special M relay is triggered, the tool data in tool magazine 2 is reset. | R/W |
| Canceling Tapping Interrupt Status | M2x080 | When the NC system is in the tapping interrupt status, users can trigger this M relay to cancel the interrupt status. | R/W |
| MLC to NC Variable 1 | M2x128 | The system will move the binary status of this special M to NC variable #25000 as 0 or 1. | R/W |
| MLC to NC Variable 2 | M2x129 | The system will move the binary status of this special M to NC variable #25001 as 0 or 1. | R/W |
| MLC to NC Variable 3 | M2x130 | The system will move the binary status of this special M to NC variable #25002 as 0 or 1. | R/W |
| MLC to NC Variable 4 | M2x131 | The system will move the binary status of this special M to NC variable #25003 as 0 or 1. | R/W |
| MLC to NC Variable 5 | M2x132 | The system will move the binary status of this special M to NC variable #25004 as 0 or 1. | R/W |
| MLC to NC Variable 6 | M2x133 | The system will move the binary status of this special M to NC variable #25005 as 0 or 1. | R/W |
| MLC to NC Variable 7 | M2x134 | The system will move the binary status of this special M to NC variable #25006 as 0 or 1. | R/W |
| MLC to NC Variable 8 | M2x135 | The system will move the binary status of this special M to NC variable #25007 as 0 or 1. | R/W |
| MLC to NC Variable 9 | M2x136 | The system will move the binary status of this special M to NC variable #25008 as 0 or 1. | R/W |
| MLC to NC Variable 10 | M2x137 | The system will move the binary status of this special M to NC variable #25009 as 0 or 1. | R/W |
| MLC to NC Variable 11 | M2x138 | The system will move the binary status of this special M to NC variable #25010 as 0 or 1. | R/W |
| MLC to NC Variable 12 | M2x139 | The system will move the binary status of this special M to NC variable #25011 as 0 or 1. | R/W |
| MLC to NC Variable 13 | M2x140 | The system will move the binary status of this special M to NC variable #25012 as 0 or 1. | R/W |
| MLC to NC Variable 14 | M2x141 | The system will move the binary status of this special M to NC variable #25013 as 0 or 1. | R/W |
| MLC to NC Variable 15 | M2x142 | The system will move the binary status of this special M to NC variable #25014 as 0 or 1. | R/W |
| MLC to NC Variable 16 | M2x143 | The system will move the binary status of this special M to NC variable #25015 as 0 or 1. | R/W |
| MLC to NC Variable 17 | M2x144 | The system will move the binary status of this special M to NC variable #25016 as 0 or 1. | R/W |
| MLC to NC Variable 18 | M2x145 | The system will move the binary status of this special M to NC variable #25017 as 0 or 1. | R/W |
| MLC to NC Variable 19 | M2x146 | The system will move the binary status of this special M to NC variable #25018 as 0 or 1. | R/W |
| MLC to NC Variable 20 | M2x147 | The system will move the binary status of this special M to NC variable #25019 as 0 or 1. | R/W |
| MLC to NC Variable 21 | M2x148 | The system will move the binary status of this special M to NC variable #25020 as 0 or 1. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC to NC Variable 22 | M2x149 | The system will move the binary status of this special M to NC variable #25021 as 0 or 1. | R/W |
| MLC to NC Variable 23 | M2x150 | The system will move the binary status of this special M to NC variable #25022 as 0 or 1. | R/W |
| MLC to NC Variable 24 | M2x151 | The system will move the binary status of this special M to NC variable #25023 as 0 or 1. | R/W |
| MLC to NC Variable 25 | M2x152 | The system will move the binary status of this special M to NC variable #25024 as 0 or 1. | R/W |
| MLC to NC Variable 26 | M2x153 | The system will move the binary status of this special M to NC variable #25025 as 0 or 1. | R/W |
| MLC to NC Variable 27 | M2x154 | The system will move the binary status of this special M to NC variable #25026 as 0 or 1. | R/W |
| MLC to NC Variable 28 | M2x155 | The system will move the binary status of this special M to NC variable #25027 as 0 or 1. | R/W |
| MLC to NC Variable 29 | M2x156 | The system will move the binary status of this special M to NC variable #25028 as 0 or 1. | R/W |
| MLC to NC Variable 30 | M2x157 | The system will move the binary status of this special M to NC variable #25029 as 0 or 1. | R/W |
| MLC to NC Variable 31 | M2x158 | The system will move the binary status of this special M to NC variable #25030 as 0 or 1. | R/W |
| MLC to NC Variable 32 | M2x159 | The system will move the binary status of this special M to NC variable #25031 as 0 or 1. | R/W |
| MLC to NC Variable 33 | M2x160 | The system will move the binary status of this special M to NC variable #25032 as 0 or 1. | R/W |
| MLC to NC Variable 34 | M2x161 | The system will move the binary status of this special M to NC variable #25033 as 0 or 1. | R/W |
| MLC to NC Variable 35 | M2x162 | The system will move the binary status of this special M to NC variable #25034 as 0 or 1. | R/W |
| MLC to NC Variable 36 | M2x163 | The system will move the binary status of this special M to NC variable #25035 as 0 or 1. | R/W |
| MLC to NC Variable 37 | M2x164 | The system will move the binary status of this special M to NC variable #25036 as 0 or 1. | R/W |
| MLC to NC Variable 38 | M2x165 | The system will move the binary status of this special M to NC variable #25037 as 0 or 1. | R/W |
| MLC to NC Variable 39 | M2x166 | The system will move the binary status of this special M to NC variable #25038 as 0 or 1. | R/W |
| MLC to NC Variable 40 | M2x167 | The system will move the binary status of this special M to NC variable #25039 as 0 or 1. | R/W |
| MLC to NC Variable 41 | M2x168 | The system will move the binary status of this special M to NC variable #25040 as 0 or 1. | R/W |
| MLC to NC Variable 42 | M2x169 | The system will move the binary status of this special M to NC variable #25041 as 0 or 1. | R/W |
| MLC to NC Variable 43 | M2x170 | The system will move the binary status of this special M to NC variable #25042 as 0 or 1. | R/W |
| MLC to NC Variable 44 | M2x171 | The system will move the binary status of this special M to NC variable #25043 as 0 or 1. | R/W |
| MLC to NC Variable 45 | M2x172 | The system will move the binary status of this special M to NC variable #25044 as 0 or 1. | R/W |
| MLC to NC Variable 46 | M2x173 | The system will move the binary status of this special M to NC variable #25045 as 0 or 1. | R/W |
| MLC to NC Variable 47 | M2x174 | The system will move the binary status of this special M to NC variable #25046 as 0 or 1. | R/W |
| MLC to NC Variable 48 | M2x175 | The system will move the binary status of this special M to NC variable #25047 as 0 or 1. | R/W |
| MLC to NC Variable 49 | M2x176 | The system will move the binary status of this special M to NC variable #25048 as 0 or 1. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC to NC Variable 50 | M2x177 | The system will move the binary status of this special M to NC variable #25049 as 0 or 1. | R/W |
| MLC to NC Variable 51 | M2x178 | The system will move the binary status of this special M to NC variable #25050 as 0 or 1. | R/W |
| MLC to NC Variable 52 | M2x179 | The system will move the binary status of this special M to NC variable #25051 as 0 or 1. | R/W |
| MLC to NC Variable 53 | M2x180 | The system will move the binary status of this special M to NC variable #25052 as 0 or 1. | R/W |
| MLC to NC Variable 54 | M2x181 | The system will move the binary status of this special M to NC variable #25053 as 0 or 1. | R/W |
| MLC to NC Variable 55 | M2x182 | The system will move the binary status of this special M to NC variable #25054 as 0 or 1. | R/W |
| MLC to NC Variable 56 | M2x183 | The system will move the binary status of this special M to NC variable #25055 as 0 or 1. | R/W |
| MLC to NC Variable 57 | M2x184 | The system will move the binary status of this special M to NC variable #25056 as 0 or 1. | R/W |
| MLC to NC Variable 58 | M2x185 | The system will move the binary status of this special M to NC variable #25057 as 0 or 1. | R/W |
| MLC to NC Variable 59 | M2x186 | The system will move the binary status of this special M to NC variable #25058 as 0 or 1. | R/W |
| MLC to NC Variable 60 | M2x187 | The system will move the binary status of this special M to NC variable #25059 as 0 or 1. | R/W |
| MLC to NC Variable 61 | M2x188 | The system will move the binary status of this special M to NC variable #25060 as 0 or 1. | R/W |
| MLC to NC Variable 62 | M2x189 | The system will move the binary status of this special M to NC variable #25061 as 0 or 1. | R/W |
| MLC to NC Variable 63 | M2x190 | The system will move the binary status of this special M to NC variable #25062 as 0 or 1. | R/W |
| MLC to NC Variable 64 | M2x191 | The system will move the binary status of this special M to NC variable #25063 as 0 or 1. | R/W |
| MLC to NC Variable 65 | M2x192 | The system will move the binary status of this special M to NC variable #25064 as 0 or 1. | R/W |
| MLC to NC Variable 66 | M2x193 | The system will move the binary status of this special M to NC variable #25065 as 0 or 1. | R/W |
| MLC to NC Variable 67 | M2x194 | The system will move the binary status of this special M to NC variable #25066 as 0 or 1. | R/W |
| MLC to NC Variable 68 | M2x195 | The system will move the binary status of this special M to NC variable #25067 as 0 or 1. | R/W |
| MLC to NC Variable 69 | M2x196 | The system will move the binary status of this special M to NC variable #25068 as 0 or 1. | R/W |
| MLC to NC Variable 70 | M2x197 | The system will move the binary status of this special M to NC variable #25069 as 0 or 1. | R/W |
| MLC to NC Variable 71 | M2x198 | The system will move the binary status of this special M to NC variable #25070 as 0 or 1. | R/W |
| MLC to NC Variable 72 | M2x199 | The system will move the binary status of this special M to NC variable #25071 as 0 or 1. | R/W |
| MLC to NC Variable 73 | M2x200 | The system will move the binary status of this special M to NC variable #25072 as 0 or 1. | R/W |
| MLC to NC Variable 74 | M2x201 | The system will move the binary status of this special M to NC variable #25073 as 0 or 1. | R/W |
| MLC to NC Variable 75 | M2x202 | The system will move the binary status of this special M to NC variable #25074 as 0 or 1. | R/W |
| MLC to NC Variable 76 | M2x203 | The system will move the binary status of this special M to NC variable #25075 as 0 or 1. | R/W |
| MLC to NC Variable 77 | M2x204 | The system will move the binary status of this special M to NC variable #25076 as 0 or 1. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC to NC Variable 78 | M2x205 | The system will move the binary status of this special M to NC variable #25077 as 0 or 1. | R/W |
| MLC to NC Variable 79 | M2x206 | The system will move the binary status of this special M to NC variable #25078 as 0 or 1. | R/W |
| MLC to NC Variable 80 | M2x207 | The system will move the binary status of this special M to NC variable #25079 as 0 or 1. | R/W |
| MLC to NC Variable 81 | M2x208 | The system will move the binary status of this special M to NC variable #25080 as 0 or 1. | R/W |
| MLC to NC Variable 82 | M2x209 | The system will move the binary status of this special M to NC variable #25081 as 0 or 1. | R/W |
| MLC to NC Variable 83 | M2x210 | The system will move the binary status of this special M to NC variable #25082 as 0 or 1. | R/W |
| MLC to NC Variable 84 | M2x211 | The system will move the binary status of this special M to NC variable #25083 as 0 or 1. | R/W |
| MLC to NC Variable 85 | M2x212 | The system will move the binary status of this special M to NC variable #25084 as 0 or 1. | R/W |
| MLC to NC Variable 86 | M2x213 | The system will move the binary status of this special M to NC variable #25085 as 0 or 1. | R/W |
| MLC to NC Variable 87 | M2x214 | The system will move the binary status of this special M to NC variable #25086 as 0 or 1. | R/W |
| MLC to NC Variable 88 | M2x215 | The system will move the binary status of this special M to NC variable #25087 as 0 or 1. | R/W |
| MLC to NC Variable 89 | M2x216 | The system will move the binary status of this special M to NC variable #25088 as 0 or 1. | R/W |
| MLC to NC Variable 90 | M2x217 | The system will move the binary status of this special M to NC variable #25089 as 0 or 1. | R/W |
| MLC to NC Variable 91 | M2x218 | The system will move the binary status of this special M to NC variable #25090 as 0 or 1. | R/W |
| MLC to NC Variable 92 | M2x219 | The system will move the binary status of this special M to NC variable #25091 as 0 or 1. | R/W |
| MLC to NC Variable 93 | M2x220 | The system will move the binary status of this special M to NC variable #25092 as 0 or 1. | R/W |
| MLC to NC Variable 94 | M2x221 | The system will move the binary status of this special M to NC variable #25093 as 0 or 1. | R/W |
| MLC to NC Variable 95 | M2x222 | The system will move the binary status of this special M to NC variable #25094 as 0 or 1. | R/W |
| MLC to NC Variable 96 | M2x223 | The system will move the binary status of this special M to NC variable #25095 as 0 or 1. | R/W |
| MLC to NC Variable 97 | M2x224 | The system will move the binary status of this special M to NC variable #25096 as 0 or 1. | R/W |
| MLC to NC Variable 98 | M2x225 | The system will move the binary status of this special M to NC variable #25097 as 0 or 1. | R/W |
| MLC to NC Variable 99 | M2x226 | The system will move the binary status of this special M to NC variable #25098 as 0 or 1. | R/W |
| MLC to NC Variable 100 | M2x227 | The system will move the binary status of this special M to NC variable #25099 as 0 or 1. | R/W |
| MLC to NC Variable 101 | M2x228 | The system will move the binary status of this special M to NC variable #25100 as 0 or 1. | R/W |
| MLC to NC Variable 102 | M2x229 | The system will move the binary status of this special M to NC variable #25101 as 0 or 1. | R/W |
| MLC to NC Variable 103 | M2x230 | The system will move the binary status of this special M to NC variable #25102 as 0 or 1. | R/W |
| MLC to NC Variable 104 | M2x231 | The system will move the binary status of this special M to NC variable #25103 as 0 or 1. | R/W |
| MLC to NC Variable 105 | M2x232 | The system will move the binary status of this special M to NC variable #25104 as 0 or 1. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC to NC Variable 106 | M2x233 | The system will move the binary status of this special M to NC variable #25105 as 0 or 1. | R/W |
| MLC to NC Variable 107 | M2x234 | The system will move the binary status of this special M to NC variable #25106 as 0 or 1. | R/W |
| MLC to NC Variable 108 | M2x235 | The system will move the binary status of this special M to NC variable #25107 as 0 or 1. | R/W |
| MLC to NC Variable 109 | M2x236 | The system will move the binary status of this special M to NC variable #25108 as 0 or 1. | R/W |
| MLC to NC Variable 110 | M2x237 | The system will move the binary status of this special M to NC variable #25109 as 0 or 1. | R/W |
| MLC to NC Variable 111 | M2x238 | The system will move the binary status of this special M to NC variable #25110 as 0 or 1. | R/W |
| MLC to NC Variable 112 | M2x239 | The system will move the binary status of this special M to NC variable #25111 as 0 or 1. | R/W |
| MLC to NC Variable 113 | M2x240 | The system will move the binary status of this special M to NC variable #25112 as 0 or 1. | R/W |
| MLC to NC Variable 114 | M2x241 | The system will move the binary status of this special M to NC variable #25113 as 0 or 1. | R/W |
| MLC to NC Variable 115 | M2x242 | The system will move the binary status of this special M to NC variable #25114 as 0 or 1. | R/W |
| MLC to NC Variable 116 | M2x243 | The system will move the binary status of this special M to NC variable #25115 as 0 or 1. | R/W |
| MLC to NC Variable 117 | M2x244 | The system will move the binary status of this special M to NC variable #25116 as 0 or 1. | R/W |
| MLC to NC Variable 118 | M2x245 | The system will move the binary status of this special M to NC variable #25117 as 0 or 1. | R/W |
| MLC to NC Variable 119 | M2x246 | The system will move the binary status of this special M to NC variable #25118 as 0 or 1. | R/W |
| MLC to NC Variable 120 | M2x247 | The system will move the binary status of this special M to NC variable #25119 as 0 or 1. | R/W |
| MLC to NC Variable 121 | M2x248 | The system will move the binary status of this special M to NC variable #25120 as 0 or 1. | R/W |
| MLC to NC Variable 122 | M2x249 | The system will move the binary status of this special M to NC variable #25121 as 0 or 1. | R/W |
| MLC to NC Variable 123 | M2x250 | The system will move the binary status of this special M to NC variable #25122 as 0 or 1. | R/W |
| MLC to NC Variable 124 | M2x251 | The system will move the binary status of this special M to NC variable #25123 as 0 or 1. | R/W |
| MLC to NC Variable 125 | M2x252 | The system will move the binary status of this special M to NC variable #25124 as 0 or 1. | R/W |
| MLC to NC Variable 126 | M2x253 | The system will move the binary status of this special M to NC variable #25125 as 0 or 1. | R/W |
| MLC to NC Variable 127 | M2x254 | The system will move the binary status of this special M to NC variable #25126 as 0 or 1. | R/W |
| MLC to NC Variable 128 | M2x255 | The system will move the binary status of this special M to NC variable #25127 as 0 or 1. | R/W |
| Synchronous Control Enable | M2x256 | This special M must be set to ON when using synchronous functions to allow the NC to enable synchronous control. | R/W |
| Command Transfer Enable | M2x257 | This special M must be set to ON when using command transfer functions to allow the NC to enable command transfer. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Axes Oscillation Control Enable | M2x264 | This special M must be set to ON when using axes oscillation functions. The system will execute axis oscillation commands based on the settings in **[D2x018 ~ D2x023]**. If the axis is already performing path interpolation, the oscillation command will be added to the original position command. Only available on modes other than HOME and EDIT. | R/W |
| X Axis Servo OFF | M2x272 | Trigger this special M to set the X axis to Servo OFF status. | R/W |
| Y Axis Servo OFF | M2x273 | Trigger this special M to set the Y axis to Servo OFF status. | R/W |
| Z Axis Servo OFF | M2x274 | Trigger this special M to set the Z axis to Servo OFF status. | R/W |
| A Axis Servo OFF | M2x275 | Trigger this special M to set the A axis to Servo OFF status. | R/W |
| B Axis Servo OFF | M2x276 | Trigger this special M to set the B axis to Servo OFF status. | R/W |
| C Axis Servo OFF | M2x277 | Trigger this special M to set the C axis to Servo OFF status. | R/W |
| U Axis Servo OFF | M2x278 | Trigger this special M to set the U axis to Servo OFF status. | R/W |
| V Axis Servo OFF | M2x279 | Trigger this special M to set the V axis to Servo OFF status. | R/W |
| W Axis Servo OFF | M2x280 | Trigger this special M to set the W axis to Servo OFF status. | R/W |
| $10^{th}$ Axis Servo OFF | M2x281 | Trigger this special M to set the $10^{th}$ axis to Servo OFF status. | R/W |
| $11^{th}$ Axis Servo OFF | M2x282 | Trigger this special M to set the $11^{th}$ axis to Servo OFF status. | R/W |
| $12^{th}$ Axis Servo OFF | M2x283 | Trigger this special M to set the $12^{th}$ axis to Servo OFF status. | R/W |
| $13^{th}$ Axis Servo OFF | M2x284 | Trigger this special M to set the $13^{th}$ axis to Servo OFF status. | R/W |
| $14^{th}$ Axis Servo OFF | M2x285 | Trigger this special M to set the $14^{th}$ axis to Servo OFF status. | R/W |
| $15^{th}$ Axis Servo OFF | M2x286 | Trigger this special M to set the $15^{th}$ axis to Servo OFF status. | R/W |
| $16^{th}$ Axis Servo OFF | M2x287 | Trigger this special M to set the $16^{th}$ axis to Servo OFF status. | R/W |
| X Slave Axis Follows the Master Axis | M2x288 | Sets the X axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| Y Slave Axis Follows the Master Axis | M2x289 | Sets the Y axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| Z Slave Axis Follows the Master Axis | M2x290 | Sets the Z axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| A Slave Axis Follows the Master Axis | M2x291 | Sets the A axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| B Slave Axis Follows the Master Axis | M2x292 | Sets the B axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| C Slave Axis Follows the Master Axis | M2x293 | Sets the C axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| U Slave Axis Follows the Master Axis | M2x294 | Sets the U axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| V Slave Axis Follows the Master Axis | M2x295 | Sets the V axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| W Slave Axis Follows the Master Axis | M2x296 | Sets the W axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 10th Slave Axis Follows the Master Axis | M2x297 | Sets the 10th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 11th Slave Axis Follows the Master Axis | M2x298 | Sets the 11th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 12th Slave Axis Follows the Master Axis | M2x299 | Sets the 12th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 13th Slave Axis Follows the Master Axis | M2x300 | Sets the 13th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 14th Slave Axis Follows the Master Axis | M2x301 | Sets the 14th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 15th Slave Axis Follows the Master Axis | M2x302 | Sets the 15th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 16th Slave Axis Follows the Master Axis | M2x303 | Sets the 16th axis as the slave axis for synchronous control. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| X Axis Receives Command from The Master Axis | M2x304 | Specifies the X axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| Y Axis Receives Command from The Master Axis | M2x305 | Specifies the Y axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| Z Axis Receives Command from The Master Axis | M2x306 | Specifies the Z axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| A Axis Receives Command from The Master Axis | M2x307 | Specifies the A axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| B Axis Receives Command from The Master Axis | M2x308 | Specifies the B axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| C Axis Receives Command from The Master Axis | M2x309 | Specifies the C axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| U Axis Receives Command from The Master Axis | M2x310 | Specifies the U axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| V Axis Receives Command from The Master Axis | M2x311 | Specifies the V axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| W Axis Receives Command from The Master Axis | M2x312 | Specifies the W axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 10th Axis Receives Command from The Master Axis | M2x313 | Specifies the 10th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 11th Axis Receives Command from The Master Axis | M2x314 | Specifies the 11th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 12th Axis Receives Command from The Master Axis | M2x315 | Specifies the 12th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 13th Axis Receives Command from The Master Axis | M2x316 | Specifies the 13th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 14th Axis Receives Command from The Master Axis | M2x317 | Specifies the 14th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 15th Axis Receives Command from The Master Axis | M2x318 | Specifies the 15th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| 16th Axis Receives Command from The Master Axis | M2x319 | Specifies the 16th axis as the slave axis to receive the transfer command from the master axis. The master axis ID must be set with **[N2.015]** in advance. | R/W |
| X Axis Homing | M2x320 | Trigger this special M for X axis homing procedure. | R/W |
| Y Axis Homing | M2x321 | Trigger this special M for Y axis homing procedure. | R/W |
| Z Axis Homing | M2x322 | Trigger this special M for Z axis homing procedure. | R/W |
| A Axis Homing | M2x323 | Trigger this special M for A axis homing procedure. | R/W |
| B Axis Homing | M2x324 | Trigger this special M for B axis homing procedure. | R/W |
| C Axis Homing | M2x325 | Trigger this special M for C axis homing procedure. | R/W |
| U Axis Homing | M2x326 | Trigger this special M for U axis homing procedure. | R/W |
| V Axis Homing | M2x327 | Trigger this special M for V axis homing procedure. | R/W |
| W Axis Homing | M2x328 | Trigger this special M for W axis homing procedure. | R/W |
| 10th Axis Homing | M2x329 | Trigger this special M for 10th axis homing procedure. | R/W |
| 11th Axis Homing | M2x330 | Trigger this special M for 11th axis homing procedure. | R/W |
| 12th Axis Homing | M2x331 | Trigger this special M for 12th axis homing procedure. | R/W |
| 13th Axis Homing | M2x332 | Trigger this special M for 13th axis homing procedure. | R/W |
| 14th Axis Homing | M2x333 | Trigger this special M for 14th axis homing procedure. | R/W |
| 15th Axis Homing | M2x334 | Trigger this special M for 15th axis homing procedure. | R/W |
| 16th Axis Homing | M2x335 | Trigger this special M for 16th axis homing procedure. | R/W |
| Lock X Axis Movement in Positive Direction | M2x336 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock Y Axis Movement in Positive Direction | M2x337 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock Z Axis Movement in Positive Direction | M2x338 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock A Axis Movement in Positive Direction | M2x339 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock B Axis Movement in Positive Direction | M2x340 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock C Axis Movement in Positive Direction | M2x341 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock U Axis Movement in Positive Direction | M2x342 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock V Axis Movement in Positive Direction | M2x343 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock W Axis Movement in Positive Direction | M2x344 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 10th Axis Movement in Positive Direction | M2x345 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 11th Axis Movement in Positive Direction | M2x346 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 12th Axis Movement in Positive Direction | M2x347 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Lock 13th Axis Movement in Positive Direction | M2x348 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 14th Axis Movement in Positive Direction | M2x349 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 15th Axis Movement in Positive Direction | M2x350 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock 16th Axis Movement in Positive Direction | M2x351 | When this special M is ON, the axis will not be able to move in the positive direction. | R/W |
| Lock X Axis Movement in Negative Direction | M2x352 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock Y Axis Movement in Negative Direction | M2x353 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock Z Axis Movement in Negative Direction | M2x354 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock A Axis Movement in Negative Direction | M2x355 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock B Axis Movement in Negative Direction | M2x356 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock C Axis Movement in Negative Direction | M2x357 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock U Axis Movement in Negative Direction | M2x358 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock V Axis Movement in Negative Direction | M2x359 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock W Axis Movement in Negative Direction | M2x360 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 10th Axis Movement in Negative Direction | M2x361 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 11th Axis Movement in Negative Direction | M2x362 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 12th Axis Movement in Negative Direction | M2x363 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 13th Axis Movement in Negative Direction | M2x364 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 14th Axis Movement in Negative Direction | M2x365 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 15th Axis Movement in Negative Direction | M2x366 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Lock 16th Axis Movement in Negative Direction | M2x367 | When this special M is ON, the axis will not be able to move in the negative direction. | R/W |
| Disable X Axis 1st Software Limit | M2x368 | Trigger this special M to disable the X axis 1st software limit. | R/W |
| Disable Y Axis 1st Software Limit | M2x369 | Trigger this special M to disable the Y axis 1st software limit. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Disable Z Axis 1st Software Limit | M2x370 | Trigger this special M to disable the Z axis 1st software limit. | R/W |
| Disable A Axis 1st Software Limit | M2x371 | Trigger this special M to disable the A axis 1st software limit. | R/W |
| Disable B Axis 1st Software Limit | M2x372 | Trigger this special M to disable the B axis 1st software limit. | R/W |
| Disable C Axis 1st Software Limit | M2x373 | Trigger this special M to disable the C axis 1st software limit. | R/W |
| Disable U Axis 1st Software Limit | M2x374 | Trigger this special M to disable the U axis 1st software limit. | R/W |
| Disable V Axis 1st Software Limit | M2x375 | Trigger this special M to disable the V axis 1st software limit. | R/W |
| Disable W Axis 1st Software Limit | M2x376 | Trigger this special M to disable the W axis 1st software limit. | R/W |
| Disable 10th Axis 1st Software Limit | M2x377 | Trigger this special M to disable the 10th axis 1st software limit. | R/W |
| Disable 11th Axis 1st Software Limit | M2x378 | Trigger this special M to disable the 11th axis 1st software limit. | R/W |
| Disable 12th Axis 1st Software Limit | M2x379 | Trigger this special M to disable the 12th axis 1st software limit. | R/W |
| Disable 13th Axis 1st Software Limit | M2x380 | Trigger this special M to disable the 13th axis 1st software limit. | R/W |
| Disable 14th Axis 1st Software Limit | M2x381 | Trigger this special M to disable the 14th axis 1st software limit. | R/W |
| Disable 15th Axis 1st Software Limit | M2x382 | Trigger this special M to disable the 15th axis 1st software limit. | R/W |
| Disable 16th Axis 1st Software Limit | M2x383 | Trigger this special M to disable the 16th axis 1st software limit. | R/W |
| X Axis JOG Forward | M2x384 | Trigger this special M for X axis forward JOG or INC operation. | R/W |
| Y Axis JOG Forward | M2x385 | Trigger this special M for Y axis forward JOG or INC operation. | R/W |
| Z Axis JOG Forward | M2x386 | Trigger this special M for Z axis forward JOG or INC operation. | R/W |
| A Axis JOG Forward | M2x387 | Trigger this special M for A axis forward JOG or INC operation. | R/W |
| B Axis JOG Forward | M2x388 | Trigger this special M for B axis forward JOG or INC operation. | R/W |
| C Axis JOG Forward | M2x389 | Trigger this special M for C axis forward JOG or INC operation. | R/W |
| U Axis JOG Forward | M2x390 | Trigger this special M for U axis forward JOG or INC operation. | R/W |
| V Axis JOG Forward | M2x391 | Trigger this special M for V axis forward JOG or INC operation. | R/W |
| W Axis JOG Forward | M2x392 | Trigger this special M for W axis forward JOG or INC operation. | R/W |
| 10th Axis JOG Forward | M2x393 | Trigger this special M for 10th axis forward JOG or INC operation. | R/W |
| 11th Axis JOG Forward | M2x394 | Trigger this special M for 11th axis forward JOG or INC operation. | R/W |
| 12th Axis JOG Forward | M2x395 | Trigger this special M for 12th axis forward JOG or INC operation. | R/W |
| 13th Axis JOG Forward | M2x396 | Trigger this special M for 13th axis forward JOG or INC operation. | R/W |
| 14th Axis JOG Forward | M2x397 | Trigger this special M for 14th axis forward JOG or INC operation. | R/W |
| 15th Axis JOG Forward | M2x398 | Trigger this special M for 15th axis forward JOG or INC operation. | R/W |
| 16th Axis JOG Forward | M2x399 | Trigger this special M for 16th axis forward JOG or INC operation. | R/W |
| X Axis JOG Reverse | M2x400 | Trigger this special M for X axis reverse JOG or INC operation. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Y Axis JOG Reverse | M2x401 | Trigger this special M for Y axis reverse JOG or INC operation. | R/W |
| Z Axis JOG Reverse | M2x402 | Trigger this special M for Z axis reverse JOG or INC operation. | R/W |
| A Axis JOG Reverse | M2x403 | Trigger this special M for A axis reverse JOG or INC operation. | R/W |
| B Axis JOG Reverse | M2x404 | Trigger this special M for B axis reverse JOG or INC operation. | R/W |
| C Axis JOG Reverse | M2x405 | Trigger this special M for C axis reverse JOG or INC operation. | R/W |
| U Axis JOG Reverse | M2x406 | Trigger this special M for U axis reverse JOG or INC operation. | R/W |
| V Axis JOG Reverse | M2x407 | Trigger this special M for V axis reverse JOG or INC operation. | R/W |
| W Axis JOG Reverse | M2x408 | Trigger this special M for W axis reverse JOG or INC operation. | R/W |
| $10^{th}$ Axis JOG Reverse | M2x409 | Trigger this special M for $10^{th}$ axis reverse JOG or INC operation. | R/W |
| $11^{th}$ Axis JOG Reverse | M2x410 | Trigger this special M for $11^{th}$ axis reverse JOG or INC operation. | R/W |
| $12^{th}$ Axis JOG Reverse | M2x411 | Trigger this special M for $12^{th}$ axis reverse JOG or INC operation. | R/W |
| $13^{th}$ Axis JOG Reverse | M2x412 | Trigger this special M for $13^{th}$ axis reverse JOG or INC operation. | R/W |
| $14^{th}$ Axis JOG Reverse | M2x413 | Trigger this special M for $14^{th}$ axis reverse JOG or INC operation. | R/W |
| $15^{th}$ Axis JOG Reverse | M2x414 | Trigger this special M for $15^{th}$ axis reverse JOG or INC operation. | R/W |
| $16^{th}$ Axis JOG Reverse | M2x415 | Trigger this special M for $16^{th}$ axis reverse JOG or INC operation. | R/W |
| MLC X Axis Control Mode | M2x416 | When this special M is ON, X axis will be in speed mode. When this special M is OFF, X axis will be in position mode. | R/W |
| MLC Y Axis Control Mode | M2x417 | When this special M is ON, Y axis will be in speed mode. When this special M is OFF, Y axis will be in position mode. | R/W |
| MLC Z Axis Control Mode | M2x418 | When this special M is ON, Z axis will be in speed mode. When this special M is OFF, Z axis will be in position mode. | R/W |
| MLC A Axis Control Mode | M2x419 | When this special M is ON, A axis will be in speed mode. When this special M is OFF, A axis will be in position mode. | R/W |
| MLC B Axis Control Mode | M2x420 | When this special M is ON, B axis will be in speed mode. When this special M is OFF, B axis will be in position mode. | R/W |
| MLC C Axis Control Mode | M2x421 | When this special M is ON, C axis will be in speed mode. When this special M is OFF, C axis will be in position mode. | R/W |
| MLC U Axis Control Mode | M2x422 | When this special M is ON, U axis will be in speed mode. When this special M is OFF, U axis will be in position mode. | R/W |
| MLC V Axis Control Mode | M2x423 | When this special M is ON, V axis will be in speed mode. When this special M is OFF, V axis will be in position mode. | R/W |
| MLC W Axis Control Mode | M2x424 | When this special M is ON, W axis will be in speed mode. When this special M is OFF, W axis will be in position mode. | R/W |
| MLC $10^{th}$ Axis Control Mode | M2x425 | When this special M is ON, $10^{th}$ axis will be in speed mode. When this special M is OFF, $10^{th}$ axis will be in position mode. | R/W |
| MLC $11^{th}$ Axis Control Mode | M2x426 | When this special M is ON, $11^{th}$ axis will be in speed mode. When this special M is OFF, $11^{th}$ axis will be in position mode. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC 12th Axis Control Mode | M2x427 | When this special M is ON, 12th axis will be in speed mode. When this special M is OFF, 12th axis will be in position mode. | R/W |
| MLC 13th Axis Control Mode | M2x428 | When this special M is ON, 13th axis will be in speed mode. When this special M is OFF, 13th axis will be in position mode. | R/W |
| MLC 14th Axis Control Mode | M2x429 | When this special M is ON, 14th axis will be in speed mode. When this special M is OFF, 14th axis will be in position mode. | R/W |
| MLC 15th Axis Control Mode | M2x430 | When this special M is ON, 15th axis will be in speed mode. When this special M is OFF, 15th axis will be in position mode. | R/W |
| MLC 16th Axis Control Mode | M2x431 | When this special M is ON, 16th axis will be in speed mode. When this special M is OFF, 16th axis will be in position mode. | R/W |
| NC / MLC Axis Switching (X Axis) | M2x432 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (Y Axis) | M2x433 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (Z Axis) | M2x434 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (A Axis) | M2x435 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (B Axis) | M2x436 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (C Axis) | M2x437 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (U Axis) | M2x438 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (V Axis) | M2x439 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (W Axis) | M2x440 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (10th Axis) | M2x441 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (11th Axis) | M2x442 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (12th Axis) | M2x443 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (13th Axis) | M2x444 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (14th Axis) | M2x445 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (15th Axis) | M2x446 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |
| NC / MLC Axis Switching (16th Axis) | M2x447 | When this special M is ON, the axis will be controlled by MLC. When this special M is OFF, the axis will be controlled from NC command. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Trigger X Axis' Movement (MLC Axis) | M2x448 | Trigger this special M for MLC X axis movement. | R/W |
| Trigger Y Axis' Movement (MLC Axis) | M2x449 | Trigger this special M for MLC Y axis movement. | R/W |
| Trigger Z Axis' Movement (MLC Axis) | M2x450 | Trigger this special M for MLC Z axis movement. | R/W |
| Trigger A Axis' Movement (MLC Axis) | M2x451 | Trigger this special M for MLC A axis movement. | R/W |
| Trigger B Axis' Movement (MLC Axis) | M2x452 | Trigger this special M for MLC B axis movement. | R/W |
| Trigger C Axis' Movement (MLC Axis) | M2x453 | Trigger this special M for MLC C axis movement. | R/W |
| Trigger U Axis' Movement (MLC Axis) | M2x454 | Trigger this special M for MLC U axis movement. | R/W |
| Trigger V Axis' Movement (MLC Axis) | M2x455 | Trigger this special M for MLC V axis movement. | R/W |
| Trigger W Axis' Movement (MLC Axis) | M2x456 | Trigger this special M for MLC W axis movement. | R/W |
| Trigger 10$^{th}$ Axis' Movement (MLC Axis) | M2x457 | Trigger this special M for MLC 10$^{th}$ axis movement. | R/W |
| Trigger 11$^{th}$ Axis' Movement (MLC Axis) | M2x458 | Trigger this special M for MLC 11$^{th}$ axis movement. | R/W |
| Trigger 12$^{th}$ Axis' Movement (MLC Axis) | M2x459 | Trigger this special M for MLC 12$^{th}$ axis movement. | R/W |
| Trigger 13$^{th}$ Axis' Movement (MLC Axis) | M2x460 | Trigger this special M for MLC 13$^{th}$ axis movement. | R/W |
| Trigger 14$^{th}$ Axis' Movement (MLC Axis) | M2x461 | Trigger this special M for MLC 14$^{th}$ axis movement. | R/W |
| Trigger 15$^{th}$ Axis' Movement (MLC Axis) | M2x462 | Trigger this special M for MLC 15$^{th}$ axis movement. | R/W |
| Trigger 16$^{th}$ Axis' Movement (MLC Axis) | M2x463 | Trigger this special M for MLC 16$^{th}$ axis movement. | R/W |
| MLC Axis Command Type of X Axis | M2x464 | When this special M is ON, the **D2x256** will be incremental movement. | R/W |
| MLC Axis Command Type of Y Axis | M2x465 | When this special M is ON, the **D2x258** will be incremental movement. | R/W |
| MLC Axis Command Type of Z Axis | M2x466 | When this special M is ON, the **D2x260** will be incremental movement. | R/W |
| MLC Axis Command Type of A Axis | M2x467 | When this special M is ON, the **D2x262** will be incremental movement. | R/W |
| MLC Axis Command Type of B Axis | M2x468 | When this special M is ON, the **D2x264** will be incremental movement. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| MLC Axis Command Type of C Axis | M2x469 | When this special M is ON, the **D2x266** will be incremental movement. | R/W |
| MLC Axis Command Type of U Axis | M2x470 | When this special M is ON, the **D2x268** will be incremental movement. | R/W |
| MLC Axis Command Type of V Axis | M2x471 | When this special M is ON, the **D2x270** will be incremental movement. | R/W |
| MLC Axis Command Type of W Axis | M2x472 | When this special M is ON, the **D2x272** will be incremental movement. | R/W |
| MLC Axis Command Type of 10$^{th}$ Axis | M2x473 | When this special M is ON, the **D2x274** will be incremental movement. | R/W |
| MLC Axis Command Type of 11$^{th}$ Axis | M2x474 | When this special M is ON, the **D2x276** will be incremental movement. | R/W |
| MLC Axis Command Type of 12$^{th}$ Axis | M2x475 | When this special M is ON, the **D2x278** will be incremental movement. | R/W |
| MLC Axis Command Type of 13$^{th}$ Axis | M2x476 | When this special M is ON, the **D2x280** will be incremental movement. | R/W |
| MLC Axis Command Type of 14$^{th}$ Axis | M2x477 | When this special M is ON, the **D2x282** will be incremental movement. | R/W |
| MLC Axis Command Type of 15$^{th}$ Axis | M2x478 | When this special M is ON, the **D2x284** will be incremental movement. | R/W |
| MLC Axis Command Type of 16$^{th}$ Axis | M2x479 | When this special M is ON, the **D2x286** will be incremental movement. | R/W |
| 1$^{st}$ Spindle Forward Rotation | M2x704 | Sets the 1$^{st}$ spindle to rotate in forward direction. | R/W |
| 1$^{st}$ Spindle Reverse Rotation | M2x705 | Sets the 1$^{st}$ spindle to rotate in reverse direction. | R/W |
| 1$^{st}$ Spindle Positioning Control | M2x706 | Positioning the 1$^{st}$ spindle. | R/W |
| 1$^{st}$ Spindle Retraction After Tapping | M2x707 | Retracts the 1$^{st}$ spindle after tapping. | R/W |
| Switching C / S Axis of 1$^{st}$ Spindle | M2x708 | Trigger to switch between C or S axes for the spindle. | R/W |
| 1$^{st}$ Spindle Command Source | M2x710 | When this special M is ON, the speed command for the 1$^{st}$ spindle will refer to **D2x024**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 1$^{st}$ Spindle Alarm | M2x711 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 1$^{st}$ spindle. | R/W |
| 2$^{nd}$ Spindle Forward Rotation | M2x720 | Sets the 2$^{nd}$ spindle to rotate in forward direction. | R/W |
| 2$^{nd}$ Spindle Reverse Rotation | M2x721 | Sets the 2$^{nd}$ spindle to rotate in reverse direction. | R/W |
| 2$^{nd}$ Spindle Positioning Control | M2x722 | Positioning the 2$^{nd}$ spindle. | R/W |
| 2$^{nd}$ Spindle Retraction After Tapping | M2x723 | Retracts the 2$^{nd}$ spindle after tapping. | R/W |
| Switching C / S Axis of 2$^{nd}$ Spindle | M2x724 | Trigger to switch between C or S axes for the spindle. | R/W |
| 2$^{nd}$ Spindle Command Source | M2x726 | When this special M is ON, the speed command for the 2$^{nd}$ spindle will refer to **D2x030**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 2$^{nd}$ Spindle Alarm | M2x727 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 2$^{nd}$ spindle. | R/W |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 3rd Spindle Forward Rotation | M2x736 | Sets the 3rd spindle to rotate in forward direction. | R/W |
| 3rd Spindle Reverse Rotation | M2x737 | Sets the 3rd spindle to rotate in reverse direction. | R/W |
| 3rd Spindle Positioning Control | M2x738 | Positioning the 3rd spindle. | R/W |
| 3rd Spindle Retraction After Tapping | M2x739 | Retracts the 3rd spindle after tapping. | R/W |
| Switching C / S Axis of 3rd Spindle | M2x740 | Trigger to switch between C or S axes for the spindle. | R/W |
| 3rd Spindle Command Source | M2x742 | When this special M is ON, the speed command for the 3rd spindle will refer to **D2x320**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 3rd Spindle Alarm | M2x743 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 3rd spindle. | R/W |
| 4th Spindle Forward Rotation | M2x752 | Sets the 4th spindle to rotate in forward direction. | R/W |
| 4th Spindle Reverse Rotation | M2x753 | Sets the 4th spindle to rotate in reverse direction. | R/W |
| 4th Spindle Positioning Control | M2x754 | Positioning the 4th spindle. | R/W |
| 4th Spindle Retraction After Tapping | M2x755 | Retracts the 4th spindle after tapping. | R/W |
| Switching C / S Axis of 4th Spindle | M2x756 | Trigger to switch between C or S axes for the spindle. | R/W |
| 4th Spindle Command Source | M2x758 | When this special M is ON, the speed command for the 4th spindle will refer to **D2x326**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 4th Spindle Alarm | M2x759 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 4th spindle. | R/W |
| 5th Spindle Forward Rotation | M2x768 | Sets the 5th spindle to rotate in forward direction. | R/W |
| 5th Spindle Reverse Rotation | M2x769 | Sets the 5th spindle to rotate in reverse direction. | R/W |
| 5th Spindle Positioning Control | M2x770 | Positioning the 5th spindle. | R/W |
| 5th Spindle Retraction After Tapping | M2x771 | Retracts the 5th spindle after tapping. | R/W |
| Switching C / S Axis of 5th Spindle | M2x772 | Trigger to switch between C or S axes for the spindle. | R/W |
| 5th Spindle Command Source | M2x774 | When this special M is ON, the speed command for the 5th spindle will refer to **D2x332**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 5th Spindle Alarm | M2x775 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 5th spindle. | R/W |
| 6th Spindle Forward Rotation | M2x784 | Sets the 6th spindle to rotate in forward direction. | R/W |
| 6th Spindle Reverse Rotation | M2x785 | Sets the 6th spindle to rotate in reverse direction. | R/W |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 6th Spindle Positioning Control | M2x786 | Positioning the 6th spindle. | R/W |
| 6th Spindle Retraction After Tapping | M2x787 | Retracts the 6th spindle after tapping. | R/W |
| Switching C / S Axis of 6th Spindle | M2x788 | Trigger to switch between C or S axes for the spindle. | R/W |
| 6th Spindle Command Source | M2x790 | When this special M is ON, the speed command for the 6th spindle will refer to **D2x338**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 6th Spindle Alarm | M2x791 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 6th spindle. | R/W |
| 7th Spindle Forward Rotation | M2x800 | Sets the 7th spindle to rotate in forward direction. | R/W |
| 7th Spindle Reverse Rotation | M2x801 | Sets the 7th spindle to rotate in reverse direction. | R/W |
| 7th Spindle Positioning Control | M2x802 | Positioning the 7th spindle. | R/W |
| 7th Spindle Retraction After Tapping | M2x803 | Retracts the 7th spindle after tapping. | R/W |
| Switching C / S Axis of 7th Spindle | M2x804 | Trigger to switch between C or S axes for the spindle. | R/W |
| 7th Spindle Command Source | M2x806 | When this special M is ON, the speed command for the 7th spindle will refer to **D2x344**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 7th Spindle Alarm | M2x807 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 7th spindle. | R/W |
| 8th Spindle Forward Rotation | M2x816 | Sets the 8th spindle to rotate in forward direction. | R/W |
| 8th Spindle Reverse Rotation | M2x817 | Sets the 8th spindle to rotate in reverse direction. | R/W |
| 8th Spindle Positioning Control | M2x818 | Positioning the 8th spindle. | R/W |
| 8th Spindle Retraction After Tapping | M2x819 | Retracts the 8th spindle after tapping. | R/W |
| Switching C / S Axis of 8th Spindle | M2x820 | Trigger to switch between C or S axes for the spindle. | R/W |
| 8th Spindle Command Source | M2x822 | When this special M is ON, the speed command for the 8th spindle will refer to **D2x350**. When this special M is OFF, the speed command will be based on the S command from the NC program. | R/W |
| 8th Spindle Alarm | M2x807 | When the MLC receive an alarm signal from digital input and then trigger this special M, the system will stop NC process and return alarm code [0x0C0A MLC activate spindle alarm] of 8th spindle. | R/W |
| Time Pulse (500 ms) | M29032 | This special M will continuously switch between ON and OFF for 500 ms each. | R |
| Time Pulse (50 ms) | M29033 | This special M will continuously switch between ON and OFF for 50 ms each. | R |
| Remaining OFF | M29034 | After the controller system is ready, this special M will always remain OFF. | R |
| Remaining ON | M29035 | After the controller system is ready, this special M will always remain ON. | R |

### B.2.1.2 M49000 to M49899

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Program Lock | M49000 | When this special M is ON, the system will lock the current main program and not allow changes or edits. | R/W |

B

## B.2.2 List of special M (System status)

### B.2.2.1 M30000 to M38999

| Function Name | Special M | Description | Device |
|---|---|---|---|
| EtherCAT Communication Status | M30000 | After EtherCAT communication is initialized and without errors, this special M will be ON. Note: this special M status only corresponds to the EtherCAT communication status, it does not indicate Servo ON. | R |
| HSI 1 Status | M30016 | When the system executes the skip command G31P1, this special M will be also set to ON by the NC. | R |
| HSI 2 Status | M30017 | When the system executes the skip command G31P2, this special M will be also set to ON by the NC. | R |
| HSI 3 Status | M30018 | When the system executes the skip command G31P3, this special M will be also set to ON by the NC. | R |
| HSI 4 Status | M30019 | When the system executes the skip command G31P4, this special M will be also set to ON by the NC. | R |
| HSI 5 Status | M30020 | When the system executes the skip command G31P5, this special M will be also set to ON by the NC. | R |
| HSI 6 Status | M30021 | When the system executes the skip command G31P6, this special M will be also set to ON by the NC. | R |
| HSI 7 Status | M30022 | When the system executes the skip command G31P7, this special M will be also set to ON by the NC. | R |
| HSI 8 Status | M30023 | When the system executes the skip command G31P8, this special M will be also set to ON by the NC. | R |
| EIO 1 Connection Status | M30032 | This special M is ON when the EtherCAT remote module node ID 501 is connected. | R |
| EIO 2 Connection Status | M30033 | This special M is ON when the EtherCAT remote module node ID 502 is connected. | R |
| EIO 3 Connection Status | M30034 | This special M is ON when the EtherCAT remote module node ID 503 is connected. | R |
| EIO 4 Connection Status | M30035 | This special M is ON when the EtherCAT remote module node ID 504 is connected. | R |
| EIO 5 Connection Status | M30036 | This special M is ON when the EtherCAT remote module node ID 505 is connected. | R |
| EIO 6 Connection Status | M30037 | This special M is ON when the EtherCAT remote module node ID 506 is connected. | R |
| EIO 7 Connection Status | M30038 | This special M is ON when the EtherCAT remote module node ID 507 is connected. | R |
| EIO 8 Connection Status | M30039 | This special M is ON when the EtherCAT remote module node ID 508 is connected. | R |
| EIO 9 Connection Status | M30040 | This special M is ON when the EtherCAT remote module node ID 509 is connected. | R |
| EIO 10 Connection Status | M30041 | This special M is ON when the EtherCAT remote module node ID 510 is connected. | R |
| EIO 11 Connection Status | M30042 | This special M is ON when the EtherCAT remote module node ID 511 is connected. | R |
| EIO 12 Connection Status | M30043 | This special M is ON when the EtherCAT remote module node ID 512 is connected. | R |
| EIO 13 Connection Status | M30044 | This special M is ON when the EtherCAT remote module node ID 513 is connected. | R |
| EIO 14 Connection Status | M30045 | This special M is ON when the EtherCAT remote module node ID 514 is connected. | R |
| EIO 15 Connection Status | M30046 | This special M is ON when the EtherCAT remote module node ID 515 is connected. | R |
| EIO 16 Connection Status | M30047 | This special M is ON when the EtherCAT remote module node ID 516 is connected. | R |
| EIO 17 Connection Status | M30048 | This special M is ON when the EtherCAT remote module node ID 517 is connected. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| EIO 18 Connection Status | M30049 | This special M is ON when the EtherCAT remote module node ID 518 is connected. | R |
| EIO 19 Connection Status | M30050 | This special M is ON when the EtherCAT remote module node ID 519 is connected. | R |
| EIO 20 Connection Status | M30051 | This special M is ON when the EtherCAT remote module node ID 520 is connected. | R |
| NC Channel 1 Enable Status | M30080 | This special M is ON when the 1st NC channel is enabled. | R |
| NC Channel 2 Enable Status | M30081 | This special M is ON when the 2nd NC channel is enabled. | R |
| NC Channel 3 Enable Status | M30082 | This special M is ON when the 3rd NC channel is enabled. | R |
| NC Channel 4 Enable Status | M30083 | This special M is ON when the 4th NC channel is enabled. | R |
| Spindle 1 DI Status | M30096 | This special M is normal close type relay, means it will always stay ON until Pin 8 on the Spindle 1 connector has turn ON, and this special M will be OFF instead. | R |
| Spindle 2 DI Status | M30097 | This special M is normal close type relay, means it will always stay ON until Pin 8 on the Spindle 2 connector has turn ON, and this special M will be OFF instead. | R |
| G900 Command Control M_1 | M30200 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_2 | M30201 | | R |
| G900 Command Control M_3 | M30202 | | R |
| G900 Command Control M_4 | M30203 | | R |
| G900 Command Control M_5 | M30204 | | R |
| G900 Command Control M_6 | M30205 | | R |
| G900 Command Control M_7 | M30206 | | R |
| G900 Command Control M_8 | M30207 | | R |
| G900 Command Control M_9 | M30208 | | R |
| G900 Command Control M_10 | M30209 | | R |
| G900 Command Control M_11 | M30210 | | R |
| G900 Command Control M_12 | M30211 | | R |
| G900 Command Control M_13 | M30212 | | R |
| G900 Command Control M_14 | M30213 | | R |
| G900 Command Control M_15 | M30214 | | R |
| G900 Command Control M_16 | M30215 | | R |
| G900 Command Control M_17 | M30216 | | R |
| G900 Command Control M_18 | M30217 | | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_19 | M30218 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_20 | M30219 | | R |
| G900 Command Control M_21 | M30220 | | R |
| G900 Command Control M_22 | M30221 | | R |
| G900 Command Control M_23 | M30222 | | R |
| G900 Command Control M_24 | M30223 | | R |
| G900 Command Control M_25 | M30224 | | R |
| G900 Command Control M_26 | M30225 | | R |
| G900 Command Control M_27 | M30226 | | R |
| G900 Command Control M_28 | M30227 | | R |
| G900 Command Control M_29 | M30228 | | R |
| G900 Command Control M_30 | M30229 | | R |
| G900 Command Control M_31 | M30230 | | R |
| G900 Command Control M_32 | M30231 | | R |
| G900 Command Control M_33 | M30232 | | R |
| G900 Command Control M_34 | M30233 | | R |
| G900 Command Control M_35 | M30234 | | R |
| G900 Command Control M_36 | M30235 | | R |
| G900 Command Control M_37 | M30236 | | R |
| G900 Command Control M_38 | M30237 | | R |
| G900 Command Control M_39 | M30238 | | R |
| G900 Command Control M_40 | M30239 | | R |
| G900 Command Control M_41 | M30240 | | R |
| G900 Command Control M_42 | M30241 | | R |
| G900 Command Control M_43 | M30242 | | R |
| G900 Command Control M_44 | M30243 | | R |
| G900 Command Control M_45 | M30244 | | R |
| G900 Command Control M_46 | M30245 | | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_47 | M30246 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_48 | M30247 | | R |
| G900 Command Control M_49 | M30248 | | R |
| G900 Command Control M_50 | M30249 | | R |
| G900 Command Control M_51 | M30250 | | R |
| G900 Command Control M_52 | M30251 | | R |
| G900 Command Control M_53 | M30252 | | R |
| G900 Command Control M_54 | M30253 | | R |
| G900 Command Control M_55 | M30254 | | R |
| G900 Command Control M_56 | M30255 | | R |
| G900 Command Control M_57 | M30256 | | R |
| G900 Command Control M_58 | M30257 | | R |
| G900 Command Control M_59 | M30258 | | R |
| G900 Command Control M_60 | M30259 | | R |
| G900 Command Control M_61 | M30260 | | R |
| G900 Command Control M_62 | M30261 | | R |
| G900 Command Control M_63 | M30262 | | R |
| G900 Command Control M_64 | M30263 | | R |
| G900 Command Control M_65 | M30264 | | R |
| G900 Command Control M_66 | M30265 | | R |
| G900 Command Control M_67 | M30266 | | R |
| G900 Command Control M_68 | M30267 | | R |
| G900 Command Control M_69 | M30268 | | R |
| G900 Command Control M_70 | M30269 | | R |
| G900 Command Control M_71 | M30270 | | R |
| G900 Command Control M_72 | M30271 | | R |
| G900 Command Control M_73 | M30272 | | R |
| G900 Command Control M_74 | M30273 | | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_75 | M30274 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_76 | M30275 | | R |
| G900 Command Control M_77 | M30276 | | R |
| G900 Command Control M_78 | M30277 | | R |
| G900 Command Control M_79 | M30278 | | R |
| G900 Command Control M_80 | M30279 | | R |
| G900 Command Control M_81 | M30280 | | R |
| G900 Command Control M_82 | M30281 | | R |
| G900 Command Control M_83 | M30282 | | R |
| G900 Command Control M_84 | M30283 | | R |
| G900 Command Control M_85 | M30284 | | R |
| G900 Command Control M_86 | M30285 | | R |
| G900 Command Control M_87 | M30286 | | R |
| G900 Command Control M_88 | M30287 | | R |
| G900 Command Control M_89 | M30288 | | R |
| G900 Command Control M_90 | M30289 | | R |
| G900 Command Control M_91 | M30290 | | R |
| G900 Command Control M_92 | M30291 | | R |
| G900 Command Control M_93 | M30292 | | R |
| G900 Command Control M_94 | M30293 | | R |
| G900 Command Control M_95 | M30294 | | R |
| G900 Command Control M_96 | M30295 | | R |
| G900 Command Control M_97 | M30296 | | R |
| G900 Command Control M_98 | M30297 | | R |
| G900 Command Control M_99 | M30298 | | R |
| G900 Command Control M_100 | M30299 | | R |
| G900 Command Control M_101 | M30300 | | R |
| G900 Command Control M_102 | M30301 | | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_103 | M30302 | | R |
| G900 Command Control M_104 | M30303 | | R |
| G900 Command Control M_105 | M30304 | | R |
| G900 Command Control M_106 | M30305 | | R |
| G900 Command Control M_107 | M30306 | | R |
| G900 Command Control M_108 | M30307 | | R |
| G900 Command Control M_109 | M30308 | | R |
| G900 Command Control M_110 | M30309 | | R |
| G900 Command Control M_111 | M30310 | | R |
| G900 Command Control M_112 | M30311 | | R |
| G900 Command Control M_113 | M30312 | | R |
| G900 Command Control M_114 | M30313 | | R |
| G900 Command Control M_115 | M30314 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_116 | M30315 | | R |
| G900 Command Control M_117 | M30316 | | R |
| G900 Command Control M_118 | M30317 | | R |
| G900 Command Control M_119 | M30318 | | R |
| G900 Command Control M_120 | M30319 | | R |
| G900 Command Control M_121 | M30320 | | R |
| G900 Command Control M_122 | M30321 | | R |
| G900 Command Control M_123 | M30322 | | R |
| G900 Command Control M_124 | M30323 | | R |
| G900 Command Control M_125 | M30324 | | R |
| G900 Command Control M_126 | M30325 | | R |
| G900 Command Control M_127 | M30326 | | R |
| G900 Command Control M_128 | M30327 | | R |
| G900 Command Control M_129 | M30328 | | R |
| G900 Command Control M_130 | M30329 | | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_131 | M30330 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_132 | M30331 | | R |
| G900 Command Control M_133 | M30332 | | R |
| G900 Command Control M_134 | M30333 | | R |
| G900 Command Control M_135 | M30334 | | R |
| G900 Command Control M_136 | M30335 | | R |
| G900 Command Control M_137 | M30336 | | R |
| G900 Command Control M_138 | M30337 | | R |
| G900 Command Control M_139 | M30338 | | R |
| G900 Command Control M_140 | M30339 | | R |
| G900 Command Control M_141 | M30340 | | R |
| G900 Command Control M_142 | M30341 | | R |
| G900 Command Control M_143 | M30342 | | R |
| G900 Command Control M_144 | M30343 | | R |
| G900 Command Control M_145 | M30344 | | R |
| G900 Command Control M_146 | M30345 | | R |
| G900 Command Control M_147 | M30346 | | R |
| G900 Command Control M_148 | M30347 | | R |
| G900 Command Control M_149 | M30348 | | R |
| G900 Command Control M_150 | M30349 | | R |
| G900 Command Control M_151 | M30350 | | R |
| G900 Command Control M_152 | M30351 | | R |
| G900 Command Control M_153 | M30352 | | R |
| G900 Command Control M_154 | M30353 | | R |
| G900 Command Control M_155 | M30354 | | R |
| G900 Command Control M_156 | M30355 | | R |
| G900 Command Control M_157 | M30356 | | R |
| G900 Command Control M_158 | M30357 | | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_159 | M30358 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_160 | M30359 | | R |
| G900 Command Control M_161 | M30360 | | R |
| G900 Command Control M_162 | M30361 | | R |
| G900 Command Control M_163 | M30362 | | R |
| G900 Command Control M_164 | M30363 | | R |
| G900 Command Control M_165 | M30364 | | R |
| G900 Command Control M_166 | M30365 | | R |
| G900 Command Control M_167 | M30366 | | R |
| G900 Command Control M_168 | M30367 | | R |
| G900 Command Control M_169 | M30368 | | R |
| G900 Command Control M_170 | M30369 | | R |
| G900 Command Control M_171 | M30370 | | R |
| G900 Command Control M_172 | M30371 | | R |
| G900 Command Control M_173 | M30372 | | R |
| G900 Command Control M_174 | M30373 | | R |
| G900 Command Control M_175 | M30374 | | R |
| G900 Command Control M_176 | M30375 | | R |
| G900 Command Control M_177 | M30376 | | R |
| G900 Command Control M_178 | M30377 | | R |
| G900 Command Control M_179 | M30378 | | R |
| G900 Command Control M_180 | M30379 | | R |
| G900 Command Control M_181 | M30380 | | R |
| G900 Command Control M_182 | M30381 | | R |
| G900 Command Control M_183 | M30382 | | R |
| G900 Command Control M_184 | M30383 | | R |
| G900 Command Control M_185 | M30384 | | R |
| G900 Command Control M_186 | M30385 | | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| G900 Command Control M_187 | M30386 | These Special M relay can be controlled by the G900 P_ Q_ command. This G900 will not stop look-ahead or pause the NC process.<br>P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399. When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.<br>Q: control the M relay status by 0 as OFF and any not 0 value will set as ON. | R |
| G900 Command Control M_188 | M30387 | | R |
| G900 Command Control M_189 | M30388 | | R |
| G900 Command Control M_190 | M30389 | | R |
| G900 Command Control M_191 | M30390 | | R |
| G900 Command Control M_192 | M30391 | | R |
| G900 Command Control M_193 | M30392 | | R |
| G900 Command Control M_194 | M30393 | | R |
| G900 Command Control M_195 | M30394 | | R |
| G900 Command Control M_196 | M30395 | | R |
| G900 Command Control M_197 | M30396 | | R |
| G900 Command Control M_198 | M30397 | | R |
| G900 Command Control M_199 | M30398 | | R |
| G900 Command Control M_200 | M30399 | | R |
| AUTO | M3x000 | This special M is ON when the NC system is in AUTO mode. | R |
| EDIT | M3x001 | This special M is ON when the NC system is in EDIT mode. | R |
| MDI | M3x002 | This special M is ON when the NC system is in MDI mode. | R |
| MPG | M3x003 | This special M is ON when the NC system is in MPG mode. | R |
| JOG | M3x004 | This special M is ON when the NC system is in JOG mode. | R |
| RAPID | M3x005 | This special M is ON when the NC system is in RAPID mode. | R |
| INC | M3x006 | This special M is ON when the NC system is in INC mode. | R |
| HOME | M3x007 | This special M is ON when the NC system is in HOME mode. | R |
| Cycle Start Status | M3x016 | This special M is ON when the NC system is running NC program. | R |
| Feed Hold Status | M3x017 | This special M is ON when the NC system pause NC process. | R |
| Emergency Stop Status | M3x018 | This special M is ON when the EMG button or signal is triggered. | R |
| Reset Finished | M3x019 | This special M is ON when the NC system finishes reset procedures. | R |
| Break Point Searching | M3x020 | This special M is ON when the NC system is searching for the break point. | R |
| Program End Finished | M3x021 | This special M is ON when the NC system finishes the last block, M02 or M30. | R |
| M02 Executed | M3x022 | This special M is ON when the NC system finishes executing the M02 command and cycle stop. | R |
| M30 Cycle Stop and Index Reset | M3x023 | This special M is ON when the NC system finishes executing the M30 command, cycle stop and program line index back to first line. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Single Block Hold | M3x024 | This special M is ON when the NC system is holding on a single block. | R |
| NC Error | M3x025 | This special M is ON when the NC system encounters an error. | R |
| Macro Call Status | M3x027 | This special M is ON when the macro call is in execution. | R |
| Macro Call Ready | M3x028 | After users trigger the macro call preparation and then system finishes the preparation, this special M will be ON. When this special M is ON, users will need to switch the NC system to AUTO mode and finish the remaining actions to start the macro. | R |
| Macro Call Error | M3x029 | Indicates a macro call error. | R |
| M96 (Program Interruption) in Execution | M3x031 | This special M is ON when M96 (program interruption) is in execution. | R |
| System Mode Switching | M3x032 | When the system is switching between operation modes such as AUTO or JOG, this special M will be triggered. | R |
| Main Program Lock | M3x033 | When the system locks the current NC main program and it is not allowed to change, this special M will be triggered. | R |
| Servo Drive Error | M3x034 | When any of the connected servo drives encounter an error, this special M will be triggered. | R |
| Axes Auto Servo ON Status | M3x035 | When the system parameter **[N1.10 Axes Manual Servo ON]** is set to 0, the system will set all axes and this special M to servo ON after initialization is finished. | R |
| System Ready and Servo ON | M3x036 | When the system is successful initialized and servo drives are set to servo ON, this special M will be triggered. | R |
| M00 System Hold | M3x037 | After the system executes M00 and pauses the procedure, this special M will be triggered. | R |
| M01 Optional Stop | M3x038 | After the system executes M01 and stops the procedure, this special M will be triggered. | R |
| Block Finished on Single Block Mode | M3x039 | When the system is in single block mode and then finishes the current block, this special M will be triggered. | R |
| User Define Alarm Status | M3x040 | This special M is ON when a user defined alarm occurs. | R |
| NC Program Scanning | M3x044 | This special M is ON when the system is scanning the NC program. | R |
| NC Program Scan finished | M3x045 | This special M is ON when the system finishes the NC program scanning. | R |
| M99 Call Stop Status | M3x047 | When the **M2x026** is ON and execute the M99, the NC system will trigger this special M after slowing down the motion and stop the process.<br>This special M will be reset to OFF when the cycle start triggered again, M30 executed or system reset. | R/W |
| 1st Macro Call Initial Finished | M3x048 | This special M is ON when macro call finishes. | R |
| 2nd Macro Call Initial Finished | M3x049 | This special M is ON when macro call finishes. | R |
| 3rd Macro Call Initial Finished | M3x050 | This special M is ON when macro call finishes. | R |
| 4th Macro Call Initial Finished | M3x051 | This special M is ON when macro call finishes. | R |
| 5th Macro Call Initial Finished | M3x052 | This special M is ON when macro call finishes. | R |
| 6th Macro Call Initial Finished | M3x053 | This special M is ON when macro call finishes. | R |
| 7th Macro Call Initial Finished | M3x054 | This special M is ON when macro call finishes. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 8th Macro Call Initial Finished | M3x055 | This special M is ON when macro call finishes. | R |
| 9th Macro Call Initial Finished | M3x056 | This special M is ON when macro call finishes. | R |
| 10th Macro Call Initial Finished | M3x057 | This special M is ON when macro call finishes. | R |
| 11th Macro Call Initial Finished | M3x058 | This special M is ON when macro call finishes. | R |
| 12th Macro Call Initial Finished | M3x059 | This special M is ON when macro call finishes. | R |
| 13th Macro Call Initial Finished | M3x060 | This special M is ON when macro call finishes. | R |
| 14th Macro Call Initial Finished | M3x061 | This special M is ON when macro call finishes. | R |
| 15th Macro Call Initial Finished | M3x062 | This special M is ON when macro call finishes. | R |
| 16th Macro Call Initial Finished | M3x063 | This special M is ON when macro call finishes. | R |
| M Code Execution | M3x064 | When the M code is executed in the program (not including M00, M01, M02, M30, M98, M99), this special M will be triggered. When the M, S, and T codes complete their execution and then the MLC triggers the **M2x016**, this special M will be set to OFF. This action does not include an M code that is used for macro calls. | R |
| S Code Execution | M3x065 | When the S code is executed in the program, this special M will be triggered. When the M, S, and T codes complete their execution and then the MLC triggers the **M2x016**, this special M will be set to OFF. The NC does not trigger this special M when an S code is used for macro call. | R |
| T Code Execution | M3x066 | When the T code (Standby tool number) is executed in the program, this special M will be triggered. When the M, S, and T codes complete their execution and then the MLC triggers the **M2x016**, this special M will be set to OFF. The NC does not trigger this special M when a T code is used for macro call. This special M is related to the tool pot setting of the tool magazine, and the special M will be triggered only when the T code value is set within the specified range of tool number for the tool magazine parameter. | R |
| Connection Status of 1st Spindle | M3x096 | This special M is ON when the 1st spindle is connected. | R |
| Connection Status of 2nd Spindle | M3x097 | This special M is ON when the 2nd spindle is connected. | R |
| Connection Status of 3rd Spindle | M3x098 | This special M is ON when the 3rd spindle is connected. | R |
| Connection Status of 4th Spindle | M3x099 | This special M is ON when the 4th spindle is connected. | R |
| Connection Status of 5th Spindle | M3x100 | This special M is ON when the 5th spindle is connected. | R |
| Connection Status of 6th Spindle | M3x101 | This special M is ON when the 6th spindle is connected. | R |
| Connection Status of 7th Spindle | M3x102 | This special M is ON when the 7th spindle is connected. | R |
| Connection Status of 8th Spindle | M3x103 | This special M is ON when the 8th spindle is connected. | R |
| NC Variable to MLC 1 | M3x128 | The NC system will update the status of variable #25256 into this special M as ON or OFF. | R |
| NC Variable to MLC 2 | M3x129 | The NC system will update the status of variable #25257 into this special M as ON or OFF. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| NC Variable to MLC 3 | M3x130 | The NC system will update the status of variable #25258 into this special M as ON or OFF. | R |
| NC Variable to MLC 4 | M3x131 | The NC system will update the status of variable #25259 into this special M as ON or OFF. | R |
| NC Variable to MLC 5 | M3x132 | The NC system will update the status of variable #25260 into this special M as ON or OFF. | R |
| NC Variable to MLC 6 | M3x133 | The NC system will update the status of variable #25261 into this special M as ON or OFF. | R |
| NC Variable to MLC 7 | M3x134 | The NC system will update the status of variable #25262 into this special M as ON or OFF. | R |
| NC Variable to MLC 8 | M3x135 | The NC system will update the status of variable #25263 into this special M as ON or OFF. | R |
| NC Variable to MLC 9 | M3x136 | The NC system will update the status of variable #25264 into this special M as ON or OFF. | R |
| NC Variable to MLC 10 | M3x137 | The NC system will update the status of variable #25265 into this special M as ON or OFF. | R |
| NC Variable to MLC 11 | M3x138 | The NC system will update the status of variable #25266 into this special M as ON or OFF. | R |
| NC Variable to MLC 12 | M3x139 | The NC system will update the status of variable #25267 into this special M as ON or OFF. | R |
| NC Variable to MLC 13 | M3x140 | The NC system will update the status of variable #25268 into this special M as ON or OFF. | R |
| NC Variable to MLC 14 | M3x141 | The NC system will update the status of variable #25269 into this special M as ON or OFF. | R |
| NC Variable to MLC 15 | M3x142 | The NC system will update the status of variable #25270 into this special M as ON or OFF. | R |
| NC Variable to MLC 16 | M3x143 | The NC system will update the status of variable #25271 into this special M as ON or OFF. | R |
| NC Variable to MLC 17 | M3x144 | The NC system will update the status of variable #25272 into this special M as ON or OFF. | R |
| NC Variable to MLC 18 | M3x145 | The NC system will update the status of variable #25273 into this special M as ON or OFF. | R |
| NC Variable to MLC 19 | M3x146 | The NC system will update the status of variable #25274 into this special M as ON or OFF. | R |
| NC Variable to MLC 20 | M3x147 | The NC system will update the status of variable #25275 into this special M as ON or OFF. | R |
| NC Variable to MLC 21 | M3x148 | The NC system will update the status of variable #25276 into this special M as ON or OFF. | R |
| NC Variable to MLC 22 | M3x149 | The NC system will update the status of variable #25277 into this special M as ON or OFF. | R |
| NC Variable to MLC 23 | M3x150 | The NC system will update the status of variable #25278 into this special M as ON or OFF. | R |
| NC Variable to MLC 24 | M3x151 | The NC system will update the status of variable #25279 into this special M as ON or OFF. | R |
| NC Variable to MLC 25 | M3x152 | The NC system will update the status of variable #25280 into this special M as ON or OFF. | R |
| NC Variable to MLC 26 | M3x153 | The NC system will update the status of variable #25281 into this special M as ON or OFF. | R |
| NC Variable to MLC 27 | M3x154 | The NC system will update the status of variable #25282 into this special M as ON or OFF. | R |
| NC Variable to MLC 28 | M3x155 | The NC system will update the status of variable #25283 into this special M as ON or OFF. | R |
| NC Variable to MLC 29 | M3x156 | The NC system will update the status of variable #25284 into this special M as ON or OFF. | R |
| NC Variable to MLC 30 | M3x157 | The NC system will update the status of variable #25285 into this special M as ON or OFF. | R |
| NC Variable to MLC 31 | M3x158 | The NC system will update the status of variable #25286 into this special M as ON or OFF. | R |
| NC Variable to MLC 32 | M3x159 | The NC system will update the status of variable #25287 into this special M as ON or OFF. | R |
| NC Variable to MLC 33 | M3x160 | The NC system will update the status of variable #25288 into this special M as ON or OFF. | R |
| NC Variable to MLC 34 | M3x161 | The NC system will update the status of variable #25289 into this special M as ON or OFF. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| NC Variable to MLC 35 | M3x162 | The NC system will update the status of variable #25290 into this special M as ON or OFF. | R |
| NC Variable to MLC 36 | M3x163 | The NC system will update the status of variable #25291 into this special M as ON or OFF. | R |
| NC Variable to MLC 37 | M3x164 | The NC system will update the status of variable #25292 into this special M as ON or OFF. | R |
| NC Variable to MLC 38 | M3x165 | The NC system will update the status of variable #25293 into this special M as ON or OFF. | R |
| NC Variable to MLC 39 | M3x166 | The NC system will update the status of variable #25294 into this special M as ON or OFF. | R |
| NC Variable to MLC 40 | M3x167 | The NC system will update the status of variable #25295 into this special M as ON or OFF. | R |
| NC Variable to MLC 41 | M3x168 | The NC system will update the status of variable #25296 into this special M as ON or OFF. | R |
| NC Variable to MLC 42 | M3x169 | The NC system will update the status of variable #25297 into this special M as ON or OFF. | R |
| NC Variable to MLC 43 | M3x170 | The NC system will update the status of variable #25298 into this special M as ON or OFF. | R |
| NC Variable to MLC 44 | M3x171 | The NC system will update the status of variable #25299 into this special M as ON or OFF. | R |
| NC Variable to MLC 45 | M3x172 | The NC system will update the status of variable #25300 into this special M as ON or OFF. | R |
| NC Variable to MLC 46 | M3x173 | The NC system will update the status of variable #25301 into this special M as ON or OFF. | R |
| NC Variable to MLC 47 | M3x174 | The NC system will update the status of variable #25302 into this special M as ON or OFF. | R |
| NC Variable to MLC 48 | M3x175 | The NC system will update the status of variable #25303 into this special M as ON or OFF. | R |
| NC Variable to MLC 49 | M3x176 | The NC system will update the status of variable #25304 into this special M as ON or OFF. | R |
| NC Variable to MLC 50 | M3x177 | The NC system will update the status of variable #25305 into this special M as ON or OFF. | R |
| NC Variable to MLC 51 | M3x178 | The NC system will update the status of variable #25306 into this special M as ON or OFF. | R |
| NC Variable to MLC 52 | M3x179 | The NC system will update the status of variable #25307 into this special M as ON or OFF. | R |
| NC Variable to MLC 53 | M3x180 | The NC system will update the status of variable #25308 into this special M as ON or OFF. | R |
| NC Variable to MLC 54 | M3x181 | The NC system will update the status of variable #25309 into this special M as ON or OFF. | R |
| NC Variable to MLC 55 | M3x182 | The NC system will update the status of variable #25310 into this special M as ON or OFF. | R |
| NC Variable to MLC 56 | M3x183 | The NC system will update the status of variable #25311 into this special M as ON or OFF. | R |
| NC Variable to MLC 57 | M3x184 | The NC system will update the status of variable #25312 into this special M as ON or OFF. | R |
| NC Variable to MLC 58 | M3x185 | The NC system will update the status of variable #25313 into this special M as ON or OFF. | R |
| NC Variable to MLC 59 | M3x186 | The NC system will update the status of variable #25314 into this special M as ON or OFF. | R |
| NC Variable to MLC 60 | M3x187 | The NC system will update the status of variable #25315 into this special M as ON or OFF. | R |
| NC Variable to MLC 61 | M3x188 | The NC system will update the status of variable #25316 into this special M as ON or OFF. | R |
| NC Variable to MLC 62 | M3x189 | The NC system will update the status of variable #25317 into this special M as ON or OFF. | R |
| NC Variable to MLC 63 | M3x190 | The NC system will update the status of variable #25318 into this special M as ON or OFF. | R |
| NC Variable to MLC 64 | M3x191 | The NC system will update the status of variable #25319 into this special M as ON or OFF. | R |
| NC Variable to MLC 65 | M3x192 | The NC system will update the status of variable #25320 into this special M as ON or OFF. | R |
| NC Variable to MLC 66 | M3x193 | The NC system will update the status of variable #25321 into this special M as ON or OFF. | R |
| NC Variable to MLC 67 | M3x194 | The NC system will update the status of variable #25322 into this special M as ON or OFF. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| NC Variable to MLC 68 | M3x195 | The NC system will update the status of variable #25323 into this special M as ON or OFF. | R |
| NC Variable to MLC 69 | M3x196 | The NC system will update the status of variable #25324 into this special M as ON or OFF. | R |
| NC Variable to MLC 70 | M3x197 | The NC system will update the status of variable #25325 into this special M as ON or OFF. | R |
| NC Variable to MLC 71 | M3x198 | The NC system will update the status of variable #25326 into this special M as ON or OFF. | R |
| NC Variable to MLC 72 | M3x199 | The NC system will update the status of variable #25327 into this special M as ON or OFF. | R |
| NC Variable to MLC 73 | M3x200 | The NC system will update the status of variable #25328 into this special M as ON or OFF. | R |
| NC Variable to MLC 74 | M3x201 | The NC system will update the status of variable #25329 into this special M as ON or OFF. | R |
| NC Variable to MLC 75 | M3x202 | The NC system will update the status of variable #25330 into this special M as ON or OFF. | R |
| NC Variable to MLC 76 | M3x203 | The NC system will update the status of variable #25331 into this special M as ON or OFF. | R |
| NC Variable to MLC 77 | M3x204 | The NC system will update the status of variable #25332 into this special M as ON or OFF. | R |
| NC Variable to MLC 78 | M3x205 | The NC system will update the status of variable #25333 into this special M as ON or OFF. | R |
| NC Variable to MLC 79 | M3x206 | The NC system will update the status of variable #25334 into this special M as ON or OFF. | R |
| NC Variable to MLC 80 | M3x207 | The NC system will update the status of variable #25335 into this special M as ON or OFF. | R |
| NC Variable to MLC 81 | M3x208 | The NC system will update the status of variable #25336 into this special M as ON or OFF. | R |
| NC Variable to MLC 82 | M3x209 | The NC system will update the status of variable #25337 into this special M as ON or OFF. | R |
| NC Variable to MLC 83 | M3x210 | The NC system will update the status of variable #25338 into this special M as ON or OFF. | R |
| NC Variable to MLC 84 | M3x211 | The NC system will update the status of variable #25339 into this special M as ON or OFF. | R |
| NC Variable to MLC 85 | M3x212 | The NC system will update the status of variable #25340 into this special M as ON or OFF. | R |
| NC Variable to MLC 86 | M3x213 | The NC system will update the status of variable #25341 into this special M as ON or OFF. | R |
| NC Variable to MLC 87 | M3x214 | The NC system will update the status of variable #25342 into this special M as ON or OFF. | R |
| NC Variable to MLC 88 | M3x215 | The NC system will update the status of variable #25343 into this special M as ON or OFF. | R |
| NC Variable to MLC 89 | M3x216 | The NC system will update the status of variable #25344 into this special M as ON or OFF. | R |
| NC Variable to MLC 90 | M3x217 | The NC system will update the status of variable #25345 into this special M as ON or OFF. | R |
| NC Variable to MLC 91 | M3x218 | The NC system will update the status of variable #25346 into this special M as ON or OFF. | R |
| NC Variable to MLC 92 | M3x219 | The NC system will update the status of variable #25347 into this special M as ON or OFF. | R |
| NC Variable to MLC 93 | M3x220 | The NC system will update the status of variable #25348 into this special M as ON or OFF. | R |
| NC Variable to MLC 94 | M3x221 | The NC system will update the status of variable #25349 into this special M as ON or OFF. | R |
| NC Variable to MLC 95 | M3x222 | The NC system will update the status of variable #25350 into this special M as ON or OFF. | R |
| NC Variable to MLC 96 | M3x223 | The NC system will update the status of variable #25351 into this special M as ON or OFF. | R |
| NC Variable to MLC 97 | M3x224 | The NC system will update the status of variable #25352 into this special M as ON or OFF. | R |
| NC Variable to MLC 98 | M3x225 | The NC system will update the status of variable #25353 into this special M as ON or OFF. | R |
| NC Variable to MLC 99 | M3x226 | The NC system will update the status of variable #25354 into this special M as ON or OFF. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| NC Variable to MLC 100 | M3x227 | The NC system will update the status of variable #25355 into this special M as ON or OFF. | R |
| NC Variable to MLC 101 | M3x228 | The NC system will update the status of variable #25356 into this special M as ON or OFF. | R |
| NC Variable to MLC 102 | M3x229 | The NC system will update the status of variable #25357 into this special M as ON or OFF. | R |
| NC Variable to MLC 103 | M3x230 | The NC system will update the status of variable #25358 into this special M as ON or OFF. | R |
| NC Variable to MLC 104 | M3x231 | The NC system will update the status of variable #25359 into this special M as ON or OFF. | R |
| NC Variable to MLC 105 | M3x232 | The NC system will update the status of variable #25360 into this special M as ON or OFF. | R |
| NC Variable to MLC 106 | M3x233 | The NC system will update the status of variable #25361 into this special M as ON or OFF. | R |
| NC Variable to MLC 107 | M3x234 | The NC system will update the status of variable #25362 into this special M as ON or OFF. | R |
| NC Variable to MLC 108 | M3x235 | The NC system will update the status of variable #25363 into this special M as ON or OFF. | R |
| NC Variable to MLC 109 | M3x236 | The NC system will update the status of variable #25364 into this special M as ON or OFF. | R |
| NC Variable to MLC 110 | M3x237 | The NC system will update the status of variable #25365 into this special M as ON or OFF. | R |
| NC Variable to MLC 111 | M3x238 | The NC system will update the status of variable #25366 into this special M as ON or OFF. | R |
| NC Variable to MLC 112 | M3x239 | The NC system will update the status of variable #25367 into this special M as ON or OFF. | R |
| NC Variable to MLC 113 | M3x240 | The NC system will update the status of variable #25368 into this special M as ON or OFF. | R |
| NC Variable to MLC 114 | M3x241 | The NC system will update the status of variable #25369 into this special M as ON or OFF. | R |
| NC Variable to MLC 115 | M3x242 | The NC system will update the status of variable #25370 into this special M as ON or OFF. | R |
| NC Variable to MLC 116 | M3x243 | The NC system will update the status of variable #25371 into this special M as ON or OFF. | R |
| NC Variable to MLC 117 | M3x244 | The NC system will update the status of variable #25372 into this special M as ON or OFF. | R |
| NC Variable to MLC 118 | M3x245 | The NC system will update the status of variable #25373 into this special M as ON or OFF. | R |
| NC Variable to MLC 119 | M3x246 | The NC system will update the status of variable #25374 into this special M as ON or OFF. | R |
| NC Variable to MLC 120 | M3x247 | The NC system will update the status of variable #25375 into this special M as ON or OFF. | R |
| NC Variable to MLC 121 | M3x248 | The NC system will update the status of variable #25376 into this special M as ON or OFF. | R |
| NC Variable to MLC 122 | M3x249 | The NC system will update the status of variable #25377 into this special M as ON or OFF. | R |
| NC Variable to MLC 123 | M3x250 | The NC system will update the status of variable #25378 into this special M as ON or OFF. | R |
| NC Variable to MLC 124 | M3x251 | The NC system will update the status of variable #25379 into this special M as ON or OFF. | R |
| NC Variable to MLC 125 | M3x252 | The NC system will update the status of variable #25380 into this special M as ON or OFF. | R |
| NC Variable to MLC 126 | M3x253 | The NC system will update the status of variable #25381 into this special M as ON or OFF. | R |
| NC Variable to MLC 127 | M3x254 | The NC system will update the status of variable #25382 into this special M as ON or OFF. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| NC Variable to MLC 128 | M3x255 | The NC system will update the status of variable #25383 into this special M as ON or OFF. | R |
| Servo Connection Status of X Axis | M3x256 | This special M is ON when the servo drive of the X axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of Y Axis | M3x257 | This special M is ON when the servo drive of the Y axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of Z Axis | M3x258 | This special M is ON when the servo drive of the Z axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of A Axis | M3x259 | This special M is ON when the servo drive of the A axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of B Axis | M3x260 | This special M is ON when the servo drive of the B axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of C Axis | M3x261 | This special M is ON when the servo drive of the C axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of U Axis | M3x262 | This special M is ON when the servo drive of the U axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of V Axis | M3x263 | This special M is ON when the servo drive of the V axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of W Axis | M3x264 | This special M is ON when the servo drive of the W axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 10$^{th}$ Axis | M3x265 | This special M is ON when the servo drive of the 10$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 11$^{th}$ Axis | M3x266 | This special M is ON when the servo drive of the 11$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 12$^{th}$ Axis | M3x267 | This special M is ON when the servo drive of the 12$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 13$^{th}$ Axis | M3x268 | This special M is ON when the servo drive of the 13$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 14$^{th}$ Axis | M3x269 | This special M is ON when the servo drive of the 14$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Connection Status of 15$^{th}$ Axis | M3x270 | This special M is ON when the servo drive of the 15$^{th}$ axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Servo Connection Status of 16th Axis | M3x271 | This special M is ON when the servo drive of the 16th axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of X Axis | M3x272 | This special M is ON when the servo drive of the X axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of Y Axis | M3x273 | This special M is ON when the servo drive of the Y axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of Z Axis | M3x274 | This special M is ON when the servo drive of the Z axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of A Axis | M3x275 | This special M is ON when the servo drive of the A axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of B Axis | M3x276 | This special M is ON when the servo drive of the B axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of C Axis | M3x277 | This special M is ON when the servo drive of the C axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of U Axis | M3x278 | This special M is ON when the servo drive of the U axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of V Axis | M3x279 | This special M is ON when the servo drive of the V axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of W Axis | M3x280 | This special M is ON when the servo drive of the W axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 10th Axis | M3x281 | This special M is ON when the servo drive of the 10th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 11th Axis | M3x282 | This special M is ON when the servo drive of the 11th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 12th Axis | M3x283 | This special M is ON when the servo drive of the 12th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 13th Axis | M3x284 | This special M is ON when the servo drive of the 13th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 14th Axis | M3x285 | This special M is ON when the servo drive of the 14th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Servo Enable Status of 15th Axis | M3x286 | This special M is ON when the servo drive of the 15th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Servo Enable Status of 16th Axis | M3x287 | This special M is ON when the servo drive of the 16th axis is servo ON. This connection status can be monitored from the [Ready] status light of the [Servo Monitor Table] page. | R |
| Oscillation Control Status of 1st Axis | M3x304 | This special M is ON when the 1st axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 2nd Axis | M3x305 | This special M is ON when the 2nd axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 3rd Axis | M3x306 | This special M is ON when the 3rd axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 4th Axis | M3x307 | This special M is ON when the 4th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 5th Axis | M3x308 | This special M is ON when the 5th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 6th Axis | M3x309 | This special M is ON when the 6th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 7th Axis | M3x310 | This special M is ON when the 7th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 8th Axis | M3x311 | This special M is ON when the 8th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 9th Axis | M3x312 | This special M is ON when the 9th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 10th Axis | M3x313 | This special M is ON when the 10th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 11th Axis | M3x314 | This special M is ON when the 11th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 12th Axis | M3x315 | This special M is ON when the 12th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 13th Axis | M3x316 | This special M is ON when the 13th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 14th Axis | M3x317 | This special M is ON when the 14th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 15th Axis | M3x318 | This special M is ON when the 15th axis has enabled the oscillation function and set movement command. | R |
| Oscillation Control Status of 16th Axis | M3x319 | This special M is ON when the 16th axis has enabled the oscillation function and set movement command. | R |
| Axis Homed Status of X Axis | M3x320 | This special M is ON when the X axis is homed, and the controller’s POS page shows the origin complete symbol. | R |
| Axis Homed Status of Y Axis | M3x321 | This special M is ON when the Y axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of Z Axis | M3x322 | This special M is ON when the Z axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of A Axis | M3x323 | This special M is ON when the A axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of B Axis | M3x324 | This special M is ON when the B axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of C Axis | M3x325 | This special M is ON when the C axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of U Axis | M3x326 | This special M is ON when the U axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of V Axis | M3x327 | This special M is ON when the V axis is homed and the controller's POS page shows the origin complete symbol. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Axis Homed Status of W Axis | M3x328 | This special M is ON when the W axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 10th Axis | M3x329 | This special M is ON when the 10th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 11th Axis | M3x330 | This special M is ON when the 11th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 12th Axis | M3x331 | This special M is ON when the 12th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 13th Axis | M3x332 | This special M is ON when the 13th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 14th Axis | M3x333 | This special M is ON when the 14th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 15th Axis | M3x334 | This special M is ON when the 15th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Axis Homed Status of 16th Axis | M3x335 | This special M is ON when the 16th axis is homed, and the controller's POS page shows the origin complete symbol. | R |
| Homing Finished Status of X Axis | M3x336 | This special M is ON when the X axis has finished its homing procedure. | R |
| Homing Finished Status of Y Axis | M3x337 | This special M is ON when the Y axis has finished its homing procedure. | R |
| Homing Finished Status of Z Axis | M3x338 | This special M is ON when the Z axis has finished its homing procedure. | R |
| Homing Finished Status of A Axis | M3x339 | This special M is ON when the A axis has finished its homing procedure. | R |
| Homing Finished Status of B Axis | M3x340 | This special M is ON when the B axis has finished its homing procedure. | R |
| Homing Finished Status of C Axis | M3x341 | This special M is ON when the C axis has finished its homing procedure. | R |
| Homing Finished Status of U Axis | M3x342 | This special M is ON when the U axis has finished its homing procedure. | R |
| Homing Finished Status of V Axis | M3x343 | This special M is ON when the V axis has finished its homing procedure. | R |
| Homing Finished Status of W Axis | M3x344 | This special M is ON when the W axis has finished its homing procedure. | R |
| Homing Finished Status of 10th Axis | M3x345 | This special M is ON when the 10th axis has finished its homing procedure. | R |
| Homing Finished Status of 11th Axis | M3x346 | This special M is ON when the 11th axis has finished its homing procedure. | R |
| Homing Finished Status of 12th Axis | M3x347 | This special M is ON when the 12th axis has finished its homing procedure. | R |
| Homing Finished Status of 13th Axis | M3x348 | This special M is ON when the 13th axis has finished its homing procedure. | R |
| Homing Finished Status of 14th Axis | M3x349 | This special M is ON when the 14th axis has finished its homing procedure. | R |
| Homing Finished Status of 15th Axis | M3x350 | This special M is ON when the 15th axis has finished its homing procedure. | R |
| Homing Finished Status of 16th Axis | M3x351 | This special M is ON when the 16th axis has finished its homing procedure. | R |
| X Axis at Origin Position | M3x352 | This special M is ON when the X axis's machine position is 0. | R |
| Y Axis at Origin Position | M3x353 | This special M is ON when the Y axis's machine position is 0. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Z Axis at Origin Position | M3x354 | This special M is ON when the Z axis's machine position is 0. | R |
| A Axis at Origin Position | M3x355 | This special M is ON when the A axis's machine position is 0. | R |
| B Axis at Origin Position | M3x356 | This special M is ON when the B axis's machine position is 0. | R |
| C Axis at Origin Position | M3x357 | This special M is ON when the C axis's machine position is 0. | R |
| U Axis at Origin Position | M3x358 | This special M is ON when the U axis's machine position is 0. | R |
| V Axis at Origin Position | M3x359 | This special M is ON when the V axis's machine position is 0. | R |
| W Axis at Origin Position | M3x360 | This special M is ON when the W axis's machine position is 0. | R |
| $10^{th}$ Axis at Origin Position | M3x361 | This special M is ON when the $10^{th}$ axis's machine position is 0. | R |
| $11^{th}$ Axis at Origin Position | M3x362 | This special M is ON when the $11^{th}$ axis's machine position is 0. | R |
| $12^{th}$ Axis at Origin Position | M3x363 | This special M is ON when the $12^{th}$ axis's machine position is 0. | R |
| $13^{th}$ Axis at Origin Position | M3x364 | This special M is ON when the $13^{th}$ axis's machine position is 0. | R |
| $14^{th}$ Axis at Origin Position | M3x365 | This special M is ON when the $14^{th}$ axis's machine position is 0. | R |
| $15^{th}$ Axis at Origin Position | M3x366 | This special M is ON when the $15^{th}$ axis's machine position is 0. | R |
| $16^{th}$ Axis at Origin Position | M3x367 | This special M is ON when the $16^{th}$ axis's machine position is 0. | R |
| X Axis Switch to MLC Axis Finished | M3x432 | This special M is ON when **M2x432** is triggered, and the X axis has switched to MLC control mode. | R |
| Y Axis Switch to MLC Axis Finished | M3x433 | This special M is ON when **M2x433** is triggered, and the Y axis has switched to MLC control mode. | R |
| Z Axis Switch to MLC Axis Finished | M3x434 | This special M is ON when **M2x434** is triggered, and the Z axis has switched to MLC control mode. | R |
| A Axis Switch to MLC Axis Finished | M3x435 | This special M is ON when **M2x435** is triggered, and the A axis has switched to MLC control mode. | R |
| B Axis Switch to MLC Axis Finished | M3x436 | This special M is ON when **M2x436** is triggered, and the B axis has switched to MLC control mode. | R |
| C Axis Switch to MLC Axis Finished | M3x437 | This special M is ON when **M2x437** is triggered, and the C axis has switched to MLC control mode. | R |
| U Axis Switch to MLC Axis Finished | M3x438 | This special M is ON when **M2x438** is triggered, and the U axis has switched to MLC control mode. | R |
| V Axis Switch to MLC Axis Finished | M3x439 | This special M is ON when **M2x439** is triggered, and the V axis has switched to MLC control mode. | R |
| W Axis Switch to MLC Axis Finished | M3x440 | This special M is ON when **M2x440** is triggered, and the W axis has switched to MLC control mode. | R |
| $10^{th}$ Axis Switch to MLC Axis Finished | M3x441 | This special M is ON when **M2x441** is triggered, and the $10^{th}$ axis has switched to MLC control mode. | R |
| $11^{th}$ Axis Switch to MLC Axis Finished | M3x442 | This special M is ON when **M2x442** is triggered, and the $11^{th}$ axis has switched to MLC control mode. | R |
| $12^{th}$ Axis Switch to MLC Axis Finished | M3x443 | This special M is ON when **M2x443** is triggered, and the $12^{th}$ axis has switched to MLC control mode. | R |
| $13^{th}$ Axis Switch to MLC Axis Finished | M3x444 | This special M is ON when **M2x444** is triggered, and the $13^{th}$ axis has switched to MLC control mode. | R |
| $14^{th}$ Axis Switch to MLC Axis Finished | M3x445 | This special M is ON when **M2x445** is triggered, and the $14^{th}$ axis has switched to MLC control mode. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 15$^{th}$ Axis Switch to MLC Axis Finished | M3x446 | This special M is ON when **M2x446** is triggered, and the 15$^{th}$ axis has switched to MLC control mode. | R |
| 16$^{th}$ Axis Switch to MLC Axis Finished | M3x447 | This special M is ON when **M2x447** is triggered, and the 16$^{th}$ axis has switched to MLC control mode. | R |
| X Axis Target Reached (MLC Axis) | M3x448 | This special M is ON when the X axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x448** will be written to the special M. | R |
| Y Axis Target Reached (MLC Axis) | M3x449 | This special M is ON when the Y axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x449** will be written to the special M. | R |
| Z Axis Target Reached (MLC Axis) | M3x450 | This special M is ON when the Z axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x450** will be written to the special M. | R |
| A Axis Target Reached (MLC Axis) | M3x451 | This special M is ON when the A axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x451** will be written to the special M. | R |
| B Axis Target Reached (MLC Axis) | M3x452 | This special M is ON when the B axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x452** will be written to the special M. | R |
| C Axis Target Reached (MLC Axis) | M3x453 | This special M is ON when the C axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x453** will be written to the special M. | R |
| U Axis Target Reached (MLC Axis) | M3x454 | This special M is ON when the U axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x454** will be written to the special M. | R |
| V Axis Target Reached (MLC Axis) | M3x455 | This special M is ON when the V axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x455** will be written to the special M. | R |
| W Axis Target Reached (MLC Axis) | M3x456 | This special M is ON when the W axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x456** will be written to the special M. | R |
| 10$^{th}$ Axis Target Reached (MLC Axis) | M3x457 | This special M is ON when the 10$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x457** will be written to the special M. | R |
| 11$^{th}$ Axis Target Reached (MLC Axis) | M3x458 | This special M is ON when the 11$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x458** will be written to the special M. | R |
| 12$^{th}$ Axis Target Reached (MLC Axis) | M3x459 | This special M is ON when the 12$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x459** will be written to the special M. | R |
| 13$^{th}$ Axis Target Reached (MLC Axis) | M3x460 | This special M is ON when the 13$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x460** will be written to the special M. | R |
| 14$^{th}$ Axis Target Reached (MLC Axis) | M3x461 | This special M is ON when the 14$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x461** will be written to the special M. | R |
| 15$^{th}$ Axis Target Reached (MLC Axis) | M3x462 | This special M is ON when the 15$^{th}$ axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x462** will be written to the special M. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 16th Axis Target Reached (MLC Axis) | M3x463 | This special M is ON when the 16th axis reaches the target position. If the MLC is in speed mode, then the speed represented by **M3x463** will be written to the special M. | R |
| X Axis Is Moving | M3x464 | This special M is ON when the X axis is in motion, regardless of the type of mode. | R |
| Y Axis Is Moving | M3x465 | This special M is ON when the Y axis is in motion, regardless of the type of mode. | R |
| Z Axis Is Moving | M3x466 | This special M is ON when the Z axis is in motion, regardless of the type of mode. | R |
| A Axis Is Moving | M3x467 | This special M is ON when the A axis is in motion, regardless of the type of mode. | R |
| B Axis Is Moving | M3x468 | This special M is ON when the B axis is in motion, regardless of the type of mode. | R |
| C Axis Is Moving | M3x469 | This special M is ON when the C axis is in motion, regardless of the type of mode. | R |
| U Axis Is Moving | M3x470 | This special M is ON when the U axis is in motion, regardless of the type of mode. | R |
| V Axis Is Moving | M3x471 | This special M is ON when the V axis is in motion, regardless of the type of mode. | R |
| W Axis Is Moving | M3x472 | This special M is ON when the W axis is in motion, regardless of the type of mode. | R |
| 10th Axis Is Moving | M3x473 | This special M is ON when the 10th axis is in motion, regardless of the type of mode. | R |
| 11th Axis Is Moving | M3x474 | This special M is ON when the 11th axis is in motion, regardless of the type of mode. | R |
| 12th Axis Is Moving | M3x475 | This special M is ON when the 12th axis is in motion, regardless of the type of mode. | R |
| 13th Axis Is Moving | M3x476 | This special M is ON when the 13th axis is in motion, regardless of the type of mode. | R |
| 14th Axis Is Moving | M3x477 | This special M is ON when the 14th axis is in motion, regardless of the type of mode. | R |
| 15th Axis Is Moving | M3x478 | This special M is ON when the 15th axis is in motion, regardless of the type of mode. | R |
| 16th Axis Is Moving | M3x479 | This special M is ON when the 16th axis is in motion, regardless of the type of mode. | R |
| X Axis Moving Forward | M3x480 | This special M is ON when the X axis is moving in the positive direction. | R |
| Y Axis Moving Forward | M3x481 | This special M is ON when the Y axis is moving in the positive direction. | R |
| Z Axis Moving Forward | M3x482 | This special M is ON when the Z axis is moving in the positive direction. | R |
| A Axis Moving Forward | M3x483 | This special M is ON when the A axis is moving in the positive direction. | R |
| B Axis Moving Forward | M3x484 | This special M is ON when the B axis is moving in the positive direction. | R |
| C Axis Moving Forward | M3x485 | This special M is ON when the C axis is moving in the positive direction. | R |
| U Axis Moving Forward | M3x486 | This special M is ON when the U axis is moving in the positive direction. | R |
| V Axis Moving Forward | M3x487 | This special M is ON when the V axis is moving in the positive direction. | R |
| W Axis Moving Forward | M3x488 | This special M is ON when the W axis is moving in the positive direction. | R |
| 10th Axis Moving Forward | M3x489 | This special M is ON when the 10th axis is moving in the positive direction. | R |
| 11th Axis Moving Forward | M3x490 | This special M is ON when the 11th axis is moving in the positive direction. | R |
| 12th Axis Moving Forward | M3x491 | This special M is ON when the 12th axis is moving in the positive direction. | R |
| 13th Axis Moving Forward | M3x492 | This special M is ON when the 13th axis is moving in the positive direction. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 14th Axis Moving Forward | M3x493 | This special M is ON when the 14th axis is moving in the positive direction. | R |
| 15th Axis Moving Forward | M3x494 | This special M is ON when the 15th axis is moving in the positive direction. | R |
| 16th Axis Moving Forward | M3x495 | This special M is ON when the 16th axis is moving in the positive direction. | R |
| X Axis Moving Backward | M3x496 | This special M is ON when the X axis is moving in the negative direction. | R |
| Y Axis Moving Backward | M3x497 | This special M is ON when the Y axis is moving in the negative direction. | R |
| Z Axis Moving Backward | M3x498 | This special M is ON when the Z axis is moving in the negative direction. | R |
| A Axis Moving Backward | M3x499 | This special M is ON when the A axis is moving in the negative direction. | R |
| B Axis Moving Backward | M3x500 | This special M is ON when the B axis is moving in the negative direction. | R |
| C Axis Moving Backward | M3x501 | This special M is ON when the C axis is moving in the negative direction. | R |
| U Axis Moving Backward | M3x502 | This special M is ON when the U axis is moving in the negative direction. | R |
| V Axis Moving Backward | M3x503 | This special M is ON when the V axis is moving in the negative direction. | R |
| W Axis Moving Backward | M3x504 | This special M is ON when the W axis is moving in the negative direction. | R |
| 10th Axis Moving Backward | M3x505 | This special M is ON when the 10th axis is moving in the negative direction. | R |
| 11th Axis Moving Backward | M3x506 | This special M is ON when the 11th axis is moving in the negative direction. | R |
| 12th Axis Moving Backward | M3x507 | This special M is ON when the 12th axis is moving in the negative direction. | R |
| 13th Axis Moving Backward | M3x508 | This special M is ON when the 13th axis is moving in the negative direction. | R |
| 14th Axis Moving Backward | M3x509 | This special M is ON when the 14th axis is moving in the negative direction. | R |
| 15th Axis Moving Backward | M3x510 | This special M is ON when the 15th axis is moving in the negative direction. | R |
| 16th Axis Moving Backward | M3x511 | This special M is ON when the 16th axis is moving in the negative direction. | R |
| Diameter or Radius Mode of X Axis | M3x512 | In the lathe system, this special M is ON when the X axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of Y Axis | M3x513 | In the lathe system, this special M is ON when the Y axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of Z Axis | M3x514 | In the lathe system, this special M is ON when the Z axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of A Axis | M3x515 | In the lathe system, this special M is ON when the A axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of B Axis | M3x516 | In the lathe system, this special M is ON when the B axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of C Axis | M3x517 | In the lathe system, this special M is ON when the C axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of U Axis | M3x518 | In the lathe system, this special M is ON when the U axis is in the diameter mode or OFF when it is in the radius mode. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| Diameter or Radius Mode of V Axis | M3x519 | In the lathe system, this special M is ON when the V axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of W Axis | M3x520 | In the lathe system, this special M is ON when the W axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 10th Axis | M3x521 | In the lathe system, this special M is ON when the 10th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 11th Axis | M3x522 | In the lathe system, this special M is ON when the 11th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 12th Axis | M3x523 | In the lathe system, this special M is ON when the 12th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 13th Axis | M3x524 | In the lathe system, this special M is ON when the 13th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 14th Axis | M3x525 | In the lathe system, this special M is ON when the 14th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 15th Axis | M3x526 | In the lathe system, this special M is ON when the 15th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| Diameter or Radius Mode of 16th Axis | M3x527 | In the lathe system, this special M is ON when the 16th axis is in the diameter mode or OFF when it is in the radius mode. | R |
| 1st Spindle Speed Reach | M3x704 | This special M is ON when the 1st spindle's speed reaches the target value. | R |
| 1st Spindle Zero Speed | M3x705 | This special M is ON when the 1st spindle's speed reaches zero. | R |
| 1st Spindle Target Reach | M3x706 | This special M is ON when the 1st spindle reaches the target position. | R |
| 1st Spindle Is in The Rigid Tapping | M3x707 | This special M is ON when the 1st spindle is executing the rigid tapping. | R |
| 1st Spindle Is in Position Axis Mode | M3x709 | This special M is ON when the 1st spindle is switching from S axis to C axis. | R |
| 1st Spindle Ready | M3x710 | This special M is ON when the 1st spindle is ready to use. | R |
| 2nd Spindle Speed Reach | M3x720 | This special M is ON when the 2nd spindle's speed reaches the target value. | R |
| 2nd Spindle Zero Speed | M3x721 | This special M is ON when the 2nd spindle's speed reaches zero. | R |
| 2nd Spindle Target Reach | M3x722 | This special M is ON when the 2nd spindle reaches the target position. | R |
| 2nd Spindle Is in The Rigid Tapping | M3x723 | This special M is ON when the 2nd spindle is executing the rigid tapping. | R |
| 2nd Spindle Is in Position Axis Mode | M3x725 | This special M is ON when the 2nd spindle is switching from S axis to C axis. | R |
| 2nd Spindle Ready | M3x726 | This special M is ON when the 2nd spindle is ready to use. | R |
| 3rd Spindle Speed Reach | M3x736 | This special M is ON when the 3rd spindle's speed reaches the target value. | R |
| 3rd Spindle Zero Speed | M3x737 | This special M is ON when the 3rd spindle's speed reaches zero. | R |
| 3rd Spindle Target Reach | M3x738 | This special M is ON when the 3rd spindle reaches the target position. | R |
| 3rd Spindle Is in The Rigid Tapping | M3x739 | This special M is ON when the 3rd spindle is executing the rigid tapping. | R |
| 3rd Spindle Is in Position Axis Mode | M3x741 | This special M is ON when the 3rd spindle is switching from S axis to C axis. | R |

B

| Function Name | Special M | Description | Device |
|---|---|---|---|
| 3rd Spindle Ready | M3x742 | This special M is ON when the 3rd spindle is ready to use. | R |
| 4th Spindle Speed Reach | M3x752 | This special M is ON when the 4th spindle's speed reaches the target value. | R |
| 4th Spindle Zero Speed | M3x753 | This special M is ON when the 4th spindle's speed reaches zero. | R |
| 4th Spindle Target Reach | M3x754 | This special M is ON when the 4th spindle reaches the target position. | R |
| 4th Spindle Is in The Rigid Tapping | M3x755 | This special M is ON when the 4th spindle is executing the rigid tapping. | R |
| 4th Spindle Is in Position Axis Mode | M3x757 | This special M is ON when the 4th spindle is switching from S axis to C axis. | R |
| 4th Spindle Ready | M3x758 | This special M is ON when the 4th spindle is ready to use. | R |
| 5th Spindle Speed Reach | M3x768 | This special M is ON when the 5th spindle's speed reaches the target value. | R |
| 5th Spindle Zero Speed | M3x769 | This special M is ON when the 5th spindle's speed reaches zero. | R |
| 5th Spindle Positioning Control | M3x770 | This special M is ON when the 5th spindle reaches the target position. | R |
| 5th Spindle Is in The Rigid Tapping | M3x771 | This special M is ON when the 5th spindle is executing the rigid tapping. | R |
| Switching C / S Axis of 5th Lathe Spindle | M3x773 | This special M is ON when the 5th spindle is switching from S axis to C axis. | R |
| 5th Spindle Ready | M3x774 | This special M is ON when the 5th spindle is ready to use. | R |
| 6th Spindle Speed Reach | M3x784 | This special M is ON when the 6th spindle's speed reaches the target value. | R |
| 6th Spindle Zero Speed | M3x785 | This special M is ON when the 6th spindle's speed reaches zero. | R |
| 6th Spindle Target Reach | M3x786 | This special M is ON when the 6th spindle reaches the target position. | R |
| 6th Spindle Is in The Rigid Tapping | M3x787 | This special M is ON when the 6th spindle is executing the rigid tapping. | R |
| 6th Spindle Is in Position Axis Mode | M3x789 | This special M is ON when the 6th spindle is switching from S axis to C axis. | R |
| 6th Spindle Ready | M3x790 | This special M is ON when the 6th spindle is ready to use. | R |
| 7th Spindle Speed Reach | M3x800 | This special M is ON when the 7th spindle's speed reaches the target value. | R |
| 7th Spindle Zero Speed | M3x801 | This special M is ON when the 7th spindle's speed reaches zero. | R |
| 7th Spindle Target Reach | M3x802 | This special M is ON when the 7th spindle reaches the target position. | R |
| 7th Spindle Is in The Rigid Tapping | M3x803 | This special M is ON when the 7th spindle is executing the rigid tapping. | R |
| 7th Spindle Is in Position Axis Mode | M3x805 | This special M is ON when the 7th spindle is switching from S axis to C axis. | R |
| 7th Spindle Ready | M3x806 | This special M is ON when the 7th spindle is ready to use. | R |
| 8th Spindle Speed Reach | M3x816 | This special M is ON when the 8th spindle's speed reaches the target value. | R |
| 8th Spindle Zero Speed | M3x817 | This special M is ON when the 8th spindle's speed reaches zero. | R |
| 8th Spindle Target Reach | M3x818 | This special M is ON when the 8th spindle reaches the target position. | R |
| 8th Spindle Is in The Rigid Tapping | M3x819 | This special M is ON when the 8th spindle is executing the rigid tapping. | R |

| Function Name | Special M | Description | Device |
|---|---|---|---|
| $8^{th}$ Spindle Is in Position Axis Mode | M3x821 | This special M is ON when the $8^{th}$ spindle is switching from S axis to C axis. | R |
| $8^{th}$ Spindle Ready | M3x822 | This special M is ON when the $8^{th}$ spindle is ready to use. | R |

B

## B.2.3 List of special D (MLC to system)

### B.2.3.1 D20000 to D28999

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Channel Selection | D20000 | Setting the current NC channel for the controller and screen interface. When the value is 1, it means the system is using and showing NC channel 1; when the value is 2, it means the system is using and showing NC channel 2, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| Spindle Analog Voltage Output Port 1 | D20160 | When the spindle is in EtherCAT mode, users can use this special D register to output the analog voltage.<br>Unit: 0.01V. | R/W | Decimal | -1,000 ~ +1,000 |
| Spindle Analog Voltage Output Port 2 | D20161 | | R/W | Decimal | -1,000 ~ +1,000 |
| 1st Remote Module Output | D20200<br>D20201<br>D20202<br>D20203 | For connected modules that do not include digital input/output (DI/O), the system will set the arrangement order according to the EtherCAT module, and will set the special D module with the special D based on the connection order (such as analog modules). After the remote modules get these data, it will output the results as transferred data.<br>Taking the first module as an example, D20200 corresponds to the first set of values on the module, D20201 corresponds to the second set of values on the module, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 2nd Remote Module Output | D20204<br>D20205<br>D20206<br>D20207 | | R/W | Decimal | 0 ~ 65,535 |
| 3rd Remote Module Output | D20208<br>D20209<br>D20210<br>D20211 | | R/W | Decimal | 0 ~ 65,535 |
| 4th Remote Module Output | D20212<br>D20213<br>D20214<br>D20215 | | R/W | Decimal | 0 ~ 65,535 |
| 5th Remote Module Output | D20216<br>D20217<br>D20218<br>D20219 | | R/W | Decimal | 0 ~ 65,535 |
| 6th Remote Module Output | D20220<br>D20221<br>D20222<br>D20223 | | R/W | Decimal | 0 ~ 65,535 |
| 7th Remote Module Output | D20224<br>D20225<br>D20226<br>D20227 | | R/W | Decimal | 0 ~ 65,535 |
| 8th Remote Module Output | D20228<br>D20229<br>D20230<br>D20231 | | R/W | Decimal | 0 ~ 65,535 |
| NC Mode Switching | D2x000 | This special D is for NC channels to switch to different operation modes.<br>0: AUTO<br>1: EDIT<br>2: MDI<br>3: MPG<br>4: JOG<br>5: RAPID<br>6: INC<br>7: HOME | R/W | Decimal | 0 ~ 7 |

B

<table>
<tr><th>Function Name</th><th>Special D</th><th>Description</th><th>Device</th><th>Type</th><th>Range</th></tr>
<tr><td>Feed Rate Percentage</td><td>D2x002</td><td>Setting for feed rate percentage of NC program speed.<br>Unit: %<br>Ex: When the NC program speed is 1000 mm/min and this D2x002 is 50, this means the NC system will execute the axes interpolation speed as 1000 x 50% = 500 mm/min.</td><td>R/W</td><td>Decimal</td><td>0 ~ 150</td></tr>
<tr><td>Rapid Speed Percentage</td><td>D2x004</td><td>Setting NC rapid speed percentage for G00 command.<br>Unit: %<br>Ex: When the NC rapid speed [N1.030] is 6000 mm/min and this D2x004 is 50, this means the NC system will execute the axes rapid speed as 6000 x 50% = 3000 mm/min.</td><td>R/W</td><td>Decimal</td><td>0 ~ 65,535</td></tr>
<tr><td>Speed Override for JOG and INC</td><td>D2x006</td><td>Setting JOG and INC speed.<br>When the system is in JOG or INC mode, it will take two different mode types to determine the moving speed. If the JOG speed mode [N1.011 Bit26] is set as 0, the system will take the JOG maximum speed [N2.030] and then multiply this the value in this special D (unit: %) as the JOG moving speed.<br>If the JOG speed mode [N1.011 Bit26] is set as 1, the system will take the value of this special D as the JOG moving speed directly.<br>The unit of this special D will refer to parameter axes control type [N2.001].
<table>
<tr><th colspan="2">N2.001</th><th>Unit</th></tr>
<tr><td colspan="2">Bit 2~4 (Linear axis)</td><td>mm/min</td></tr>
<tr><td rowspan="2">Bit 2~4 (Rotary axis)</td><td>Bit 11 = 0</td><td>Deg/min</td></tr>
<tr><td>Bit 11 = 1</td><td>RPM</td></tr>
</table></td><td>R/W</td><td>Decimal</td><td>Percentage Mode 0 ~ 100<br><br>Constant Mode 0 ~ 65,535</td></tr>
<tr><td>1st MPG Axes Selection</td><td>D2x008</td><td>This special D is for the NC system to switch the 1st MPG axis in MPG mode.<br>0: X axis<br>1: Y axis<br>2: Z axis<br>3: A axis<br>…<br>15: 16th axis</td><td>R/W</td><td>Decimal</td><td>0 ~ 15</td></tr>
<tr><td>1st MPG Ratio Selection</td><td>D2x009</td><td>This special D is for the NC system to switch the 1st MPG axis moving ratio, which can be 1, 10 or 100. The system will take the unit setting [N9.013] as the smallest movement and then multiply it by this ratio to derive the final movement on each scale of the MPG hand wheel.<br>Ex: When D2x009 is 1 and the unit setting [N9.013] is 0.001, with 3 decimal places, the minimum movement of the MPG hand wheel will be 0.001 × 1 = 0.001 mm.</td><td>R/W</td><td>Decimal</td><td>0 ~ 65,535</td></tr>
</table>

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 2nd MPG Axes Selection | D2x010 | This special D is for the NC system to switch the 2nd MPG axis in MPG mode.<br>0: X axis<br>1: Y axis<br>2: Z axis<br>3: A axis<br>...<br>15: 16th axis<br>*Set M20024 **[Enable 3 MPG Control]** to ON to enable this function. | R/W | Decimal | 0 ~ 15 |
| 2nd MPG Ratio Selection | D2x011 | This special D is for the NC system to switch the 2nd MPG axis moving ratio, which can be 1, 10 or 100. The system will take the unit setting **[N9.013]** as the smallest movement and then multiply it by this ratio to derive the final movement on each scale of the MPG hand wheel.<br>Ex: When D2x009 is 1 and the unit setting **[N9.013]** is 0.001, with 3 decimal places, the minimum movement of the MPG hand wheel will be 0.001 × 1 = 0.001 mm.<br>*Set M20024 **[Enable 3 MPG Control]** to ON to enable this function. | R/W | Decimal | 0 ~ 65,535 |
| 3rd MPG Axes Selection | D2x012 | This special D is for the NC system to switch the MPG axis in the 3rd MPG mode.<br>0: X axis<br>1: Y axis<br>2: Z axis<br>3: A axis<br>...<br>15: 16th axis<br>*Set M20024 **[Enable 3 MPG Control]** to ON to enable this function. | R/W | Decimal | 0 ~ 15 |
| 3rd MPG Ratio Selection | D2x013 | This special D is for the NC system to switch the 3rd MPG axis moving ratio, which can be 1, 10 or 100. The system will take the unit setting **[N9.013]** as the smallest movement and then multiply it by this ratio to derive the final movement on each scale of the MPG hand wheel.<br>Ex: When D2x009 is 1 and the unit setting **[N9.013]** is 0.001, with 3 decimal places, the minimum movement of the MPG hand wheel will be 0.001 × 1 = 0.001 mm.<br>*Set M20024 **[Enable 3 MPG Control]** to ON to enable this function. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Axes Movement in INC Mode | D2x014 | When the NC system is in INC mode and the JOG motion trigger special M (M2x384 ~ M2x415) is enabled, the system will take this special D and then multiply the unit setting **[N9.013]** to derive the target movement.<br>Ex: When D2x014 is 1234 and unit setting [N9.013] is 0.001, with 3 decimal places, the axes will move 1.234 mm every time the special M of JOG motion trigger enabled. | R/W | Decimal | 0 ~ 4,294,967,295 |
| Robot's Coordinate System Switch in Manual Mode | D2x016 | Setting the Robot's coordinate system when the system is in manual mode.<br>0: Not using coordinate manual mode<br>1 ~ 6: corresponding to G54 ~ G59. | R/W | Decimal | 0 ~ 6 |
| Robot's Tool System Switch in Manual Mode | D2x017 | Setting the Robot's tool offset system when the system is in manual mode.<br>0: Not using tool offset<br>1 ~ N: corresponds to tool number | R/W | Decimal | 0 ~ N<br>N will be based on N0.408 ~ N0.411 |
| Axes Oscillation Amplitude | D2x018<br>D2x019 | When the axes oscillation control **[M2x264]** is enabled, the activated axes will oscillate based on the amplitude here.<br>Unit: mm | R/W | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Axes Oscillation Cycle Time | D2x020<br>D2x021 | When the axes oscillation control **[M2x264]** is enabled, the system will take this special D as the cycle time for each oscillation command.<br>Unit: ms | R/W | Float | 2,147,483,648 ~ +2,147,483,647 |
| Oscillation Axes Enable | D2x022 | The oscillation axes use this 16-bit special D as the mask to determine whether to enable the function on each specific axis.<br>For example, if this set to 5, it means the X and Z axes will both have their oscillation function activated. | R/W | Decimal | 0 ~ 65,535 |
| Axes Oscillation Wave Type | D2x023 | Setting for axes oscillation wave type.<br>0: Start position as middle position of the SIN wave.<br>1: Start position as base position (max or min) of the SIN wave. | R/W | Decimal | 0 ~ 1 |
| 1st Spindle Speed | D2x024<br>D2x025 | Write the 1st spindle's speed through the special D (in accordance with **M2x710**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 1st Spindle Speed Rate | D2x026 | Setting the spindle's speed ratio.<br>Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 1st Spindle Gear Ratio Selection | D2x027 | Select in accordance with **N0.1034 ~ N0.1041**. Ex: When this special D is set to 1, the system will set the 1st spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 2nd Spindle Speed | D2x030 D2x031 | Write the 2nd spindle's speed through the special D (in accordance with **M2x726**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 2nd Spindle Speed Rate | D2x032 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 2nd Spindle Gear Ratio Selection | D2x033 | Select in accordance with **N0.1084 ~ N0.1091**. Ex: When this special D is set to 1, the system will set the 2nd spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| Tool Number Tool Magazine 1 | D2x036 | Write the tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| Standby Tool Number Tool Magazine 1 | D2x037 | Write the standby tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| Command Tool Number Tool Magazine 1 | D2x038 | Write the command tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| Tool Number Tool Magazine 2 | D2x042 | Write the tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| Standby Tool Number Tool Magazine 2 | D2x043 | Write the standby tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| Command Tool Number Tool Magazine 2 | D2x044 | Write the command tool number through the special D (in accordance with **N1.010**). | R/W | Decimal | 0 ~ 65,535 |
| 1st Macro Call Macro Number | D2x064 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 1st macro call is triggered with special **M2x032**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 2nd Macro Call Macro Number | D2x065 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 2nd macro call is triggered with special **M2x033**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 3rd Macro Call Macro Number | D2x066 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 3rd macro call is triggered with special **M2x034**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 4th Macro Call Macro Number | D2x067 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 4th macro call is triggered with special **M2x035**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 5th Macro Call Macro Number | D2x068 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 5th macro call is triggered with special **M2x036**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 6th Macro Call Macro Number | D2x069 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 6th macro call is triggered with special **M2x037**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 7th Macro Call Macro Number | D2x070 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 7th macro call is triggered with special **M2x038**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 8th Macro Call Macro Number | D2x071 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 8th macro call is triggered with special **M2x039**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 9th Macro Call Macro Number | D2x072 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 9th macro call is triggered with special **M2x040**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 10th Macro Call Macro Number | D2x073 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 10th macro call is triggered with special **M2x041**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 11th Macro Call Macro Number | D2x074 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 11th macro call is triggered with special **M2x042**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 12th Macro Call Macro Number | D2x075 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 12th macro call is triggered with special **M2x043**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 13th Macro Call Macro Number | D2x076 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 13th macro call is triggered with special **M2x044**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 14th Macro Call Macro Number | D2x077 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 14th macro call is triggered with special **M2x045**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 15th Macro Call Macro Number | D2x078 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 15th macro call is triggered with special **M2x046**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| 16th Macro Call Macro Number | D2x079 | Specify the macro call function's O macro file number, such as O9xxx. Ex: When this special D is written to K9100 and the 16th macro call is triggered with special **M2x047**, the NC system will execute the O9100 program. | R/W | Decimal | 1 ~ 65,535 |
| MLC to NC Variable 1 | D2x128 | The system will move data from this special D to NC variable #25128. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 2 | D2x129 | The system will move data from this special D to NC variable #25129. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 3 | D2x130 | The system will move data from this special D to NC variable #25130. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 4 | D2x131 | The system will move data from this special D to NC variable #25131. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 5 | D2x132 | The system will move data from this special D to NC variable #25132. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 6 | D2x133 | The system will move data from this special D to NC variable #25133. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 7 | D2x134 | The system will move data from this special D to NC variable #25134. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 8 | D2x135 | The system will move data from this special D to NC variable #25135.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 9 | D2x136 | The system will move data from this special D to NC variable #25136. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 10 | D2x137 | The system will move data from this special D to NC variable #25137.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 11 | D2x138 | The system will move data from this special D to NC variable #25138. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 12 | D2x139 | The system will move data from this special D to NC variable #25139.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 13 | D2x140 | The system will move data from this special D to NC variable #25140. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 14 | D2x141 | The system will move data from this special D to NC variable #25141.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 15 | D2x142 | The system will move data from this special D to NC variable #25142. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 16 | D2x143 | The system will move data from this special D to NC variable #25143.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 17 | D2x144 | The system will move data from this special D to NC variable #25144. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 18 | D2x145 | The system will move data from this special D to NC variable #25145.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 19 | D2x146 | The system will move data from this special D to NC variable #25146. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 20 | D2x147 | The system will move data from this special D to NC variable #25147.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 21 | D2x148 | The system will move data from this special D to NC variable #25148. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 22 | D2x149 | The system will move data from this special D to NC variable #25149.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 23 | D2x150 | The system will move data from this special D to NC variable #25150. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 24 | D2x151 | The system will move data from this special D to NC variable #25151.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 25 | D2x152 | The system will move data from this special D to NC variable #25152. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 26 | D2x153 | The system will move data from this special D to NC variable #25153.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 27 | D2x154 | The system will move data from this special D to NC variable #25154. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 28 | D2x155 | The system will move data from this special D to NC variable #25155.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 29 | D2x156 | The system will move data from this special D to NC variable #25156. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 30 | D2x157 | The system will move data from this special D to NC variable #25157.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 31 | D2x158 | The system will move data from this special D to NC variable #25158. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 32 | D2x159 | The system will move data from this special D to NC variable #25159.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 33 | D2x160 | The system will move data from this special D to NC variable #25160. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 34 | D2x161 | The system will move data from this special D to NC variable #25161.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 35 | D2x162 | The system will move data from this special D to NC variable #25162. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 36 | D2x163 | The system will move data from this special D to NC variable #25163.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 37 | D2x164 | The system will move data from this special D to NC variable #25164. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 38 | D2x165 | The system will move data from this special D to NC variable #25165.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 39 | D2x166 | The system will move data from this special D to NC variable #25166. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 40 | D2x167 | The system will move data from this special D to NC variable #25167.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 41 | D2x168 | The system will move data from this special D to NC variable #25168. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 42 | D2x169 | The system will move data from this special D to NC variable #25169. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 43 | D2x170 | The system will move data from this special D to NC variable #25170. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 44 | D2x171 | The system will move data from this special D to NC variable #25171. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 45 | D2x172 | The system will move data from this special D to NC variable #25172. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 46 | D2x173 | The system will move data from this special D to NC variable #25173. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 47 | D2x174 | The system will move data from this special D to NC variable #25174. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 48 | D2x175 | The system will move data from this special D to NC variable #25175. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 49 | D2x176 | The system will move data from this special D to NC variable #25176. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 50 | D2x177 | The system will move data from this special D to NC variable #25177. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 51 | D2x178 | The system will move data from this special D to NC variable #25178. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 52 | D2x179 | The system will move data from this special D to NC variable #25179. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 53 | D2x180 | The system will move data from this special D to NC variable #25180. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 54 | D2x181 | The system will move data from this special D to NC variable #25181.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 55 | D2x182 | The system will move data from this special D to NC variable #25182. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 56 | D2x183 | The system will move data from this special D to NC variable #25183.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 57 | D2x184 | The system will move data from this special D to NC variable #25184. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 58 | D2x185 | The system will move data from this special D to NC variable #25185.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 59 | D2x186 | The system will move data from this special D to NC variable #25186. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 60 | D2x187 | The system will move data from this special D to NC variable #25187.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 61 | D2x188 | The system will move data from this special D to NC variable #25188. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 62 | D2x189 | The system will move data from this special D to NC variable #25189.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 63 | D2x190 | The system will move data from this special D to NC variable #25190. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 64 | D2x191 | The system will move data from this special D to NC variable #25191.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 65 | D2x192 | The system will move data from this special D to NC variable #25192. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 66 | D2x193 | The system will move data from this special D to NC variable #25193.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 67 | D2x194 | The system will move data from this special D to NC variable #25194. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 68 | D2x195 | The system will move data from this special D to NC variable #25195.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 69 | D2x196 | The system will move data from this special D to NC variable #25196. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 70 | D2x197 | The system will move data from this special D to NC variable #25197.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 71 | D2x198 | The system will move data from this special D to NC variable #25198. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 72 | D2x199 | The system will move data from this special D to NC variable #25199.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 73 | D2x200 | The system will move data from this special D to NC variable #25200. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 74 | D2x201 | The system will move data from this special D to NC variable #25201.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 75 | D2x202 | The system will move data from this special D to NC variable #25202. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 76 | D2x203 | The system will move data from this special D to NC variable #25203.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 77 | D2x204 | The system will move data from this special D to NC variable #25204. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 78 | D2x205 | The system will move data from this special D to NC variable #25205.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 79 | D2x206 | The system will move data from this special D to NC variable #25206. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 80 | D2x207 | The system will move data from this special D to NC variable #25207.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 81 | D2x208 | The system will move data from this special D to NC variable #25208. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 82 | D2x209 | The system will move data from this special D to NC variable #25209.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 83 | D2x210 | The system will move data from this special D to NC variable #25210. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 84 | D2x211 | The system will move data from this special D to NC variable #25211.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 85 | D2x212 | The system will move data from this special D to NC variable #25212. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 86 | D2x213 | The system will move data from this special D to NC variable #25213.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 87 | D2x214 | The system will move data from this special D to NC variable #25214. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 88 | D2x215 | The system will move data from this special D to NC variable #25215.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 89 | D2x216 | The system will move data from this special D to NC variable #25216. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 90 | D2x217 | The system will move data from this special D to NC variable #25217.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 91 | D2x218 | The system will move data from this special D to NC variable #25218. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 92 | D2x219 | The system will move data from this special D to NC variable #25219.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 93 | D2x220 | The system will move data from this special D to NC variable #25220. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 94 | D2x221 | The system will move data from this special D to NC variable #25221.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 95 | D2x222 | The system will move data from this special D to NC variable #25222. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 96 | D2x223 | The system will move data from this special D to NC variable #25223.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 97 | D2x224 | The system will move data from this special D to NC variable #25224. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 98 | D2x225 | The system will move data from this special D to NC variable #25225.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 99 | D2x226 | The system will move data from this special D to NC variable #25226. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 100 | D2x227 | The system will move data from this special D to NC variable #25227.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 101 | D2x228 | The system will move data from this special D to NC variable #25228. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 102 | D2x229 | The system will move data from this special D to NC variable #25229.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 103 | D2x230 | The system will move data from this special D to NC variable #25230. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 104 | D2x231 | The system will move data from this special D to NC variable #25231.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 105 | D2x232 | The system will move data from this special D to NC variable #25232. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 106 | D2x233 | The system will move data from this special D to NC variable #25233.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 107 | D2x234 | The system will move data from this special D to NC variable #25234. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 108 | D2x235 | The system will move data from this special D to NC variable #25235.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 109 | D2x236 | The system will move data from this special D to NC variable #25236. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 110 | D2x237 | The system will move data from this special D to NC variable #25237.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 111 | D2x238 | The system will move data from this special D to NC variable #25238. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 112 | D2x239 | The system will move data from this special D to NC variable #25239.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 113 | D2x240 | The system will move data from this special D to NC variable #25240. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 114 | D2x241 | The system will move data from this special D to NC variable #25241.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 115 | D2x242 | The system will move data from this special D to NC variable #25242. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 116 | D2x243 | The system will move data from this special D to NC variable #25243.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 117 | D2x244 | The system will move data from this special D to NC variable #25244. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 118 | D2x245 | The system will move data from this special D to NC variable #25245.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 119 | D2x246 | The system will move data from this special D to NC variable #25246. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 120 | D2x247 | The system will move data from this special D to NC variable #25247.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 121 | D2x248 | The system will move data from this special D to NC variable #25248. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 122 | D2x249 | The system will move data from this special D to NC variable #25249.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| MLC to NC Variable 123 | D2x250 | The system will move data from this special D to NC variable #25250. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 124 | D2x251 | The system will move data from this special D to NC variable #25251.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 125 | D2x252 | The system will move data from this special D to NC variable #25252. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 126 | D2x253 | The system will move data from this special D to NC variable #25253.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 127 | D2x254 | The system will move data from this special D to NC variable #25254. | R/W | Decimal | 0 ~ 65,535 |
| MLC to NC Variable 128 | D2x255 | The system will move data from this special D to NC variable #25255.<br>*Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R/W | Decimal | 0 ~ 65,535 |
| Target Position of X axis (MLC Axis) | D2x256 D2x257 | Specifies the target position of the X axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of Y axis (MLC Axis) | D2x258 D2x259 | Specifies the target position of the Y axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of Z axis (MLC Axis) | D2x260 D2x261 | Specifies the target position of the Z axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of A axis (MLC Axis) | D2x262 D2x263 | Specifies the target position of the A axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of B axis (MLC Axis) | D2x264 D2x265 | Specifies the target position of the B axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of C axis (MLC Axis) | D2x266 D2x267 | Specifies the target position of the C axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of U axis (MLC Axis) | D2x268 D2x269 | Specifies the target position of the U axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Target Position of V axis (MLC Axis) | D2x270 D2x271 | Specifies the target position of the V axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of W axis (MLC Axis) | D2x272 D2x273 | Specifies the target position of the W axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 10th axis (MLC Axis) | D2x274 D2x275 | Specifies the target position of the 10th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 11th axis (MLC Axis) | D2x276 D2x277 | Specifies the target position of the 11th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 12th axis (MLC Axis) | D2x278 D2x279 | Specifies the target position of the 12th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 13th axis (MLC Axis) | D2x280 D2x281 | Specifies the target position of the 13th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 14th axis (MLC Axis) | D2x282 D2x283 | Specifies the target position of the 14th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 15th axis (MLC Axis) | D2x284 D2x285 | Specifies the target position of the 15th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Position of 16th axis (MLC Axis) | D2x286 D2x287 | Specifies the target position of the 16th axis in MLC axis mode. Unit: mm or inch. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of X axis (MLC Axis) | D2x288 D2x289 | Specifies the target velocity of the X axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of Y axis (MLC Axis) | D2x290 D2x291 | Specifies the target velocity of the Y axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of Z axis (MLC Axis) | D2x292 D2x293 | Specifies the target velocity of the Z axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of A axis (MLC Axis) | D2x294 D2x295 | Specifies the target velocity of the A axis in MLC axis mode. Unit: RPM. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of B axis (MLC Axis) | D2x296 D2x297 | Specifies the target velocity of the B axis in MLC axis mode. Unit: RPM. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of C axis (MLC Axis) | D2x298 D2x299 | Specifies the target velocity of the C axis in MLC axis mode. Unit: RPM. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Target Velocity of U axis (MLC Axis) | D2x300 D2x301 | Specifies the target velocity of the U axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of V axis (MLC Axis) | D2x302 D2x303 | Specifies the target velocity of the V axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of W axis (MLC Axis) | D2x304 D2x305 | Specifies the target velocity of the W axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 10th axis (MLC Axis) | D2x306 D2x307 | Specifies the target velocity of the 10th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 11th axis (MLC Axis) | D2x308 D2x309 | Specifies the target velocity of the 11th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 12th axis (MLC Axis) | D2x310 D2x311 | Specifies the target velocity of the 12th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 13th axis (MLC Axis) | D2x312 D2x313 | Specifies the target velocity of the 13th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 14th axis (MLC Axis) | D2x314 D2x315 | Specifies the target velocity of the 14th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 15th axis (MLC Axis) | D2x316 D2x317 | Specifies the target velocity of the 15th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Velocity of 16th axis (MLC Axis) | D2x318 D2x319 | Specifies the target velocity of the 16th axis in MLC axis mode. Unit: mm/min, inch/min. | R/W | Float | -2,147,483,648 ~ +2,147,483,647 |
| 3rd Spindle Speed | D2x320 D2x321 | Write the 3rd spindle's speed through the special D (in accordance with **M2x742**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 3rd Spindle Speed Rate | D2x322 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 3rd Spindle Gear Ratio Selection | D2x323 | Select in accordance with **N0.1134 ~ N0.1141**. Ex: When this special D is set to 1, the system will set the 3rd spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 4th Spindle Speed | D2x326 D2x327 | Write the 4th spindle's speed through the special D (in accordance with **M2x758**). | R/W | Decimal | 0 ~ 4,294,967,295 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 4th Spindle Speed Rate | D2x328 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 4th Spindle Gear Ratio Selection | D2x329 | Select in accordance with **N0.1184 ~ N0.1191**. Ex: When this special D is set to 1, the system will set the 4th spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 5th Spindle Speed | D2x332 D2x333 | Write the 5th spindle's speed through the special D (in accordance with **M2x774**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 5th Spindle Speed Rate | D2x334 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 5th Spindle Gear Ratio Selection | D2x335 | Select in accordance with **N0.1234 ~ N0.1241**. Ex: When this special D is set to 1, the system will set the 5tht spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 6th Spindle Speed | D2x338 D2x339 | Write the 6th spindle's speed through the special D (in accordance with **M2x790**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 6th Spindle Speed Rate | D2x340 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 6th Spindle Gear Ratio Selection | D2x341 | Select in accordance with **N0.1284 ~ N0.1291**. Ex: When this special D is set to 1, the system will set the 6th spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 7th Spindle Speed | D2x344 D2x345 | Write the 7th spindle's speed through the special D (in accordance with **M2x806**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 7th Spindle Speed Rate | D2x346 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |
| 7th Spindle Gear Ratio Selection | D2x347 | Select in accordance with **N0.1334 ~ N0.1341**. Ex: When this special D is set to 1, the system will set the 7th spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |
| 8th Spindle Speed | D2x350 D2x351 | Write the 8th spindle's speed through the special D (in accordance with **M2x822**). | R/W | Decimal | 0 ~ 4,294,967,295 |
| 8th Spindle Speed Rate | D2x352 | Setting the spindle's speed ratio. Ex: When the program speed is S1000 and this special D is 30, then the NC system will execute the spindle speed as 1000 x 30% = 300 RPM. | R/W | Decimal | 0 ~ 65,535 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 8th Spindle Gear Ratio Selection | D2x353 | Select in accordance with **N0.1384 ~ N0.1391**. Ex: When this special D is set to 1, the system will set the 8th spindle to 1st gear, when it is set to 2, it will be in 2nd gear, and so forth. | R/W | Decimal | 0 ~ 65,535 |

B

### B.2.3.2 D49000 to D49899

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Complete Process Amount | D49x00 D49x01 | Available to set this special D from system interface or MLC. | R/W | Decimal | 0 ~ 4,294,967,295 |
| Process Target Amount | D49x02 D49x03 | Available to set this special D from system interface or MLC. | R/W | Decimal | 0 ~ 4,294,967,295 |
| Total Process Time | D49x04 D49x05 | When the system parameter **[N6.032 Process Time Record]** is 1, the system will automatically record the total process time, in units of seconds. | R/W | Decimal | 0 ~ 4,294,967,295 |
| Single Process Time | D49x06 D49x07 | When the system parameter **[N6.032 Process Time Record]** is 1, the system will automatically record the single process time, in units of seconds. | R/W | Decimal | 0 ~ 4,294,967,295 |

B

## B.2.4 List of special D (System status)

### B.2.4.1 D30000 to D38999

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Pulse Feedback of Spindle 1 | D30000 | Pulse feedback of spindle 1 connector. | R | Decimal | 0 ~ 65,535 |
| Pulse Feedback of Spindle 2 | D30001 | Pulse feedback of spindle 2 connector. | R | Decimal | 0 ~ 65,535 |
| Z Phase Pulse Feedback of Spindle 1 | D30002 | Z phase pulse feedback of spindle 1 connector. | R | Decimal | 0 ~ 65,535 |
| Z Phase Pulse Feedback of Spindle 2 | D30003 | Z phase pulse feedback of spindle 2 connector. | R | Decimal | 0 ~ 65,535 |
| MPG Pulse Feedback | D30004 | Pulse feedback of MPG connector. | R | Decimal | 0 ~ 65,535 |
| Pulse Output of Spindle 1 | D30008 | Pulse output of spindle 1 connector. | R | Decimal | 0 ~ 65,535 |
| Pulse Output of Spindle 2 | D30009 | Pulse output of spindle 2 connector. | R | Decimal | 0 ~ 65,535 |
| Spindle 1 Pulse Feedback Coordinate | D30174 D30175 | Display the pulse feedback coordinate from the Spindle 1 connector. The NC system will calculate the pulse feedback from the Spindle 1 connector as the 1st spindle's feedback coordinate, which based on parameter setting of **[N0.030 ~ N0.032]**. When the [N0.030] set as rotary axis, this special D register will display the position between 0 ~ 359.999. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Spindle 2 Pulse Feedback Coordinate | D30176 D30177 | Display the pulse feedback coordinate from the Spindle 2 connector. The NC system will calculate the pulse feedback from the Spindle 2 connector as the 2nd spindle's feedback coordinate, which based on parameter setting of **[N0.035 ~ N0.037]**. When the [N0.035] set as rotary axis, this special D register will display the position between 0 ~ 359.999. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 1st Remote Module Input | D30200 D30201 D30202 D30203 | For connected modules that do not include digital input/output (DI/O), the system will set the arrangement order according to the EtherCAT module, and will set the special D module with the special D based on the connection order (such as analog modules). Taking the first module as an example, D30200 corresponds to the first set of values on the module, D30201 corresponds to the second set of values on the module, and so forth. | R | Decimal | 0 ~ 65,535 |
| 2nd Remote Module Input | D30204 D30205 D30206 D30207 | | R | Decimal | 0 ~ 65,535 |
| 3rd Remote Module Input | D30208 D30209 D30210 D30211 | | R | Decimal | 0 ~ 65,535 |
| 4th Remote Module Input | D30212 D30213 D30214 D30215 | | R | Decimal | 0 ~ 65,535 |
| 5th Remote Module Input | D30216 D30217 D30218 D30219 | | R | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 6th Remote Module Input | D30220<br>D30221<br>D30222<br>D30223 | For connected modules that do not include digital input/output (DI/O), the system will set the arrangement order according to the EtherCAT module, and will set the special D module with the special D based on the connection order (such as analog modules).<br>Taking the first module as an example, D30200 corresponds to the first set of values on the module, D30201 corresponds to the second set of values on the module, and so forth. | R | Decimal | 0 ~ 65,535 |
| 7th Remote Module Input | D30224<br>D30225<br>D30226<br>D30227 | | R | Decimal | 0 ~ 65,535 |
| 8th Remote Module Input | D30228<br>D30229<br>D30230<br>D30231 | | R | Decimal | 0 ~ 65,535 |
| Torque Feedback of 1st Axis | D30240 | Torque feedback for the axis. The axis index is set according to the NC channel axis sequence setting.<br>PDO address 0x6077H<br>Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 2nd Axis | D30241 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 3rd Axis | D30242 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 4th Axis | D30243 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 5th Axis | D30244 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 6th Axis | D30245 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 7th Axis | D30246 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 8th Axis | D30247 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 9th Axis | D30248 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 10th Axis | D30249 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 11th Axis | D30250 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 12th Axis | D30251 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 13th Axis | D30252 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 14th Axis | D30253 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 15th Axis | D30254 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 16th Axis | D30255 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 17th Axis | D30256 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 18th Axis | D30257 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 19th Axis | D30258 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 20th Axis | D30259 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 21st Axis | D30260 | | R | Decimal | -32,768 ~ +32,767 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Torque Feedback of 22th Axis | D30261 | Torque feedback for the axis. The axis index is set according to the NC channel axis sequence setting.<br>PDO address 0x6077H<br>Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 23th axis | D30262 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 24th Axis | D30263 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 25th Axis | D30264 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 26th Axis | D30265 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 27th Axis | D30266 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 28th Axis | D30267 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 29th Axis | D30268 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 30th Axis | D30269 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 31th Axis | D30270 | | R | Decimal | -32,768 ~ +32,767 |
| Torque Feedback of 32th Axis | D30271 | | R | Decimal | -32,768 ~ +32,767 |
| Velocity Feedback of 1st Axis (mm/min) | D30272<br>D30273 | Axis speed feedback for the axis. The axis index is set according to the NC channel axis sequence setting.<br>PDO address 0x606CH<br>Unit: mm/min | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 2nd Axis (mm/min) | D30274<br>D30275 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 3rd Axis (mm/min) | D30276<br>D30277 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 4th Axis (mm/min) | D30278<br>D30279 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 5th Axis (mm/min) | D30280<br>D30281 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 6th Axis (mm/min) | D30282<br>D30283 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 7th Axis (mm/min) | D30284<br>D30285 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 8th Axis (mm/min) | D30286<br>D30287 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 9th Axis (mm/min) | D30288<br>D30289 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 10th Axis (mm/min) | D30290<br>D30291 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 11th Axis (mm/min) | D30292<br>D30293 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 12th Axis (mm/min) | D30294<br>D30295 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Velocity Feedback of 13th Axis (mm/min) | D30296 D30297 | Axis speed feedback for the axis. The axis index is set according to the NC channel axis sequence setting. PDO address 0x606CH Unit: mm/min | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 14th Axis (mm/min) | D30298 D30299 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 15th Axis (mm/min) | D30300 D30301 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 16th Axis (mm/min) | D30302 D30303 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 17th Axis (mm/min) | D30304 D30305 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 18th Axis (mm/min) | D30306 D30307 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 19th Axis (mm/min) | D30308 D30309 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 20th Axis (mm/min) | D30310 D30311 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 21th Axis (mm/min) | D30312 D30313 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 22th Axis (mm/min) | D30314 D30315 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 23th Axis (mm/min) | D30316 D30317 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 24th Axis (mm/min) | D30318 D30319 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 25th Axis (mm/min) | D30320 D30321 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 26th Axis (mm/min) | D30322 D30323 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 27th Axis (mm/min) | D30324 D30325 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 28th Axis (mm/min) | D30326 D30327 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 29th Axis (mm/min) | D30328 D30329 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 30th Axis (mm/min) | D30330 D30331 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 31th Axis (mm/min) | D30332 D30333 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 32th Axis (mm/min) | D30334 D30335 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Velocity Feedback of 1st Axis (RPM) | D30336<br>D30337 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 2nd Axis (RPM) | D30338<br>D30339 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 3rd Axis (RPM) | D30340<br>D30341 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 4th Axis (RPM) | D30342<br>D30343 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 5th Axis (RPM) | D30344<br>D30345 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 6th Axis (RPM) | D30346<br>D30347 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 7th Axis (RPM) | D30348<br>D30349 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 8th Axis (RPM) | D30350<br>D30351 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 9th Axis (RPM) | D30352<br>D30353 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 10th Axis (RPM) | D30354<br>D30355 | Axis speed feedback for the axis. The axis index is set according to the NC channel axis sequence setting.<br>PDO address 0x606CH<br>Unit: RPM | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 11th Axis (RPM) | D30356<br>D30357 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 12th Axis (RPM) | D30358<br>D30359 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 13th Axis (RPM) | D30360<br>D30361 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 14th Axis (RPM) | D30362<br>D30363 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 15th Axis (RPM) | D30364<br>D30365 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 16th Axis (RPM) | D30366<br>D30367 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 17th Axis (RPM) | D30368<br>D30369 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 18th Axis (RPM) | D30360<br>D30371 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Velocity Feedback of 19th Axis (RPM) | D30372<br>D30373 | | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Velocity Feedback of 20th Axis (RPM) | D30374 D30375 | Axis speed feedback for the axis. The axis index is set according to the NC channel axis sequence setting. PDO address 0x606CH Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 21th Axis (RPM) | D30376 D30377 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 22th Axis (RPM) | D30378 D30379 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 23th Axis (RPM) | D30380 D30381 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 24th Axis (RPM) | D30382 D30383 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 25th Axis (RPM) | D30384 D30385 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 26th Axis (RPM) | D30386 D30387 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 27th Axis (RPM) | D30388 D30389 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 28th Axis (RPM) | D30390 D30391 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 29th Axis (RPM) | D30392 D30393 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 30th Axis (RPM) | D30394 D30395 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 31th Axis (RPM) | D30396 D30397 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Velocity Feedback of 32th Axis (RPM) | D30398 D30399 | | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Torque Peak of 1st Axis | D30400 | The system will monitor and record the maximum axis torque shown in **D30240** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 2nd Axis | D30401 | The system will monitor and record the maximum axis torque shown in **D30241** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 3rd Axis | D30402 | The system will monitor and record the maximum axis torque shown in **D30242** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 4th Axis | D30403 | The system will monitor and record the maximum axis torque shown in **D30243** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Torque Peak of 5th Axis | D30404 | The system will monitor and record the maximum axis torque shown in **D30244** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 6th Axis | D30405 | The system will monitor and record the maximum axis torque shown in **D30245** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 7th Axis | D30406 | The system will monitor and record the maximum axis torque shown in **D30246** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1% | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 8th Axis | D30407 | The system will monitor and record the maximum axis torque shown in **D30247** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 9th Axis | D30408 | The system will monitor and record the maximum axis torque shown in **D30248** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 10th Axis | D30409 | The system will monitor and record the maximum axis torque shown in **D30249** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 11th Axis | D30410 | The system will monitor and record the maximum axis torque shown in **D30250** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 12th Axis | D30411 | The system will monitor and record the maximum axis torque shown in **D30251** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 13th Axis | D30412 | The system will monitor and record the maximum axis torque shown in **D30252** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 14th Axis | D30413 | The system will monitor and record the maximum axis torque shown in **D30253** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 15th Axis | D30414 | The system will monitor and record the maximum axis torque shown in **D30254** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 16th Axis | D30415 | The system will monitor and record the maximum axis torque shown in **D30255** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 17th Axis | D30416 | The system will monitor and record the maximum axis torque shown in **D30256** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Torque Peak of 18th Axis | D30417 | The system will monitor and record the maximum axis torque shown in **D30257** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 19th Axis | D30418 | The system will monitor and record the maximum axis torque shown in **D30258** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 20th Axis | D30419 | The system will monitor and record the maximum axis torque shown in **D30259** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 21th Axis | D30420 | The system will monitor and record the maximum axis torque shown in **D30260** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 22th Axis | D30421 | The system will monitor and record the maximum axis torque shown in **D30261** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 23th Axis | D30422 | The system will monitor and record the maximum axis torque shown in **D30262** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 24th Axis | D30423 | The system will monitor and record the maximum axis torque shown in **D30263** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 25th Axis | D30424 | The system will monitor and record the maximum axis torque shown in **D30264** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 26th Axis | D30425 | The system will monitor and record the maximum axis torque shown in **D30265** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 27th Axis | D30426 | The system will monitor and record the maximum axis torque shown in **D30266** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 28th Axis | D30427 | The system will monitor and record the maximum axis torque shown in **D30267** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 29th Axis | D30428 | The system will monitor and record the maximum axis torque shown in **D30268** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 30th Axis | D30429 | The system will monitor and record the maximum axis torque shown in **D30269** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Torque Peak of 31th Axis | D30430 | The system will monitor and record the maximum axis torque shown in **D30270** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| Torque Peak of 32th Axis | D30431 | The system will monitor and record the maximum axis torque shown in **D30271** during Servo ON. Once the axis enters Servo OFF, these special D will be cleared as well. Unit: 0.1%. | R | Decimal | 0 ~ 4,294,967,295 |
| 1st Spindle Torque Feedback | D30432 | Display the spindle current torque feedback according to the spindle ID setting in the channel. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 2nd Spindle Torque Feedback | D30433 | | R | Decimal | -32,768 ~ +32,767 |
| 3rd Spindle Torque Feedback | D30434 | | R | Decimal | -32,768 ~ +32,767 |
| 4th Spindle Torque Feedback | D30435 | | R | Decimal | -32,768 ~ +32,767 |
| 5th Spindle Torque Feedback | D30436 | | R | Decimal | -32,768 ~ +32,767 |
| 6th Spindle Torque Feedback | D30437 | | R | Decimal | -32,768 ~ +32,767 |
| 7th Spindle Torque Feedback | D30438 | | R | Decimal | -32,768 ~ +32,767 |
| 8th Spindle Torque Feedback | D30439 | | R | Decimal | -32,768 ~ +32,767 |
| 1st Spindle Torque Feedback Peak | D30440 | The NC system will record the maximum torque feedback which showing in the **D30432** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 2nd Spindle Torque Feedback Peak | D30441 | The NC system will record the maximum torque feedback which showing in the **D30433** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 3rd Spindle Torque Feedback Peak | D30442 | The NC system will record the maximum torque feedback which showing in the **D30434** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 4th Spindle Torque Feedback Peak | D30443 | The NC system will record the maximum torque feedback which showing in the **D30435** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 5th Spindle Torque Feedback Peak | D30444 | The NC system will record the maximum torque feedback which showing in the **D30436** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 6th Spindle Torque Feedback Peak | D30445 | The NC system will record the maximum torque feedback which showing in the **D30437** when the spindle is enabled. Value cleared when the spindle is disabled. Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 7th Spindle Torque Feedback Peak | D30446 | The NC system will record the maximum torque feedback which showing in the **D30438** when the spindle is enabled. Value cleared when the spindle is disabled.<br>Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| 8th Spindle Torque Feedback Peak | D30447 | The NC system will record the maximum torque feedback which showing in the **D30439** when the spindle is enabled. Value cleared when the spindle is disabled.<br>Unit: 0.1% | R | Decimal | -32,768 ~ +32,767 |
| Current Status of Multi-Z axis | D3x014 | This special D will show the Z axes index currently in use when the Multi-Z axis function is enabled. When the value is 12, it means Z1 and Z2 are working. When the value is 123, it means Z1, Z2, and Z3 are working. | R | Decimal | 0 ~ 4,294,967,295 |
| Current Coordinate System | D3x016 | Shows the coordinate system the system is currently using. This coordinate system can be different according to the channel machine type setting such as standard type and Robot.<br>When the channel set as standard machine type such as milling or lathe, the system will show as below working coordinate system.<br>1~6: corresponding to G54~G59.<br>7~262: corresponding to G54 P1~G54 P256.<br>When the channel set as Robot machine type, the system will show as below working coordinate system.<br>1~6: corresponding to G54~G59. | R | Decimal | Standard<br>1 ~ 262<br><br>Robot<br>1~6 |
| Current Robot Tool Coordinate System | D3x017 | Shows the robot tool coordinate system.<br>0: Not using tool offset<br>1 ~ n: corresponds to tool number | R | Decimal | 0 ~ 65,535 |
| Speed Command of 1st Spindle | D3x024 | When the 1st spindle S code is executed in a program, the command value will be sent in this special D.<br>Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 1st Spindle Speed Feedback | D3x026 | Shows the 1st spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 1st Spindle Actual Degree | D3x028 | Shows the 1st spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Speed Command of 2nd Spindle | D3x030 | When the 2nd spindle S code is executed in a program, the command value will be sent in this special D.<br>Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 2nd Spindle Speed Feedback | D3x032 | Shows the 2nd spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 2nd Spindle Actual Degree | D3x034 | Shows the 2nd spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Current Tool Number Tool Magazine 1 | D3x036 | Current tool number in the tool magazine 1. | R | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Standby Tool Number Tool Magazine 1 | D3x037 | Current standby tool number in the tool magazine 1. (The latest T code) | R | Decimal | 0 ~ 65,535 |
| Standby Tool Pot Tool Magazine 1 | D3x038 | Current standby tool pot number in the tool magazine 1. | R | Decimal | 0 ~ 65,535 |
| Tool Pot Deviation Tool Magazine 1 | D3x039 | The deviation between the positions specified for the current tool and command tool in tool magazine 1. Users can determine the rotation direction by whether this value is positive or negative. When the tool magazine rotates forward (**M2x064**) or backward (**M2x065**) during tool exchange, the tool magazine needs to rotate according to the value to compensate for the offset. | R | Decimal | 0 ~ 65,535 |
| Current Tool Number Tool Magazine 2 | D3x042 | Current tool number in the tool magazine 2. | R | Decimal | 0 ~ 65,535 |
| Standby Tool Number Tool Magazine 2 | D3x043 | Current standby tool number in the tool magazine 2. (The latest T code) | R | Decimal | 0 ~ 65,535 |
| Standby Tool Pot Tool Magazine 2 | D3x044 | Current standby tool pot number in the tool magazine 2. | R | Decimal | 0 ~ 65,535 |
| Tool Pot Deviation Tool Magazine 2 | D3x045 | The deviation between the positions specified for the current tool and command tool in tool magazine 2. Users can determine the rotation direction by whether this value is positive or negative. When the tool magazine rotates forward (**M2x072**) or backward (**M2x073**) during tool exchange, the tool magazine needs to rotate according to the value to compensate for the offset. | R | Decimal | 0 ~ 65,535 |
| 1st M Code Data | D3x048 | When the 1st M code is executed in the program (Not including M00, M01, M02, M30, M98, M99), the M code value will be mapped to this register. When the M code is used to call the macro, this special D will keep the previous value. | R | Decimal | 0 ~ 4,294,967,295 |
| 1st S Code Data | D3x050 | When the 1st spindle's 1st S code is executed in the program, the 1st spindle's S code will be mapped to this register. Unit: RPM. | R | Decimal | 0 ~ 4,294,967,295 |
| 1st T Code Data | D3x052 | When the 1st T code is executed in the program, the T code will be mapped to this register. When the 1st T code is used to call the macro, this special D will keep the previous value. This data is related to the tool pot setting of the tool magazine, and the T code will be shown only when the T code value is set within the specified range of tool number for the tool magazine parameter. | R | Decimal | 0 ~ 4,294,967,295 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Information Monitoring 1 Sort 1 | D3x096 D3x097 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.321] for information type and [N1.322] for data sort 1 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 1 Sort 2 | D3x098 D3x099 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.321] for information type and [N1.323] for data sort 2 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 1 Sort 3 | D3x100 D3x101 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.321] for information type and [N1.324] for data sort 3 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 1 Sort 4 | D3x102 D3x103 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.321] for information type and [N1.325] for data sort 4 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 2 Sort 1 | D3x104 D3x105 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.326] for information type and [N1.327] for data sort 1 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 2 Sort 2 | D3x106 D3x107 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.326] for information type and [N1.328] for data sort 2 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 2 Sort 3 | D3x108 D3x109 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.326] for information type and [N1.329] for data sort 3 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |
| Information Monitoring 2 Sort 4 | D3x110 D3x111 | This special D is for users to monitor the information of system devices according to the variable settings. In order to use this special D, users need to set up [N1.326] for information type and [N1.330] for data sort 4 in advance. *Please check section 6.17 for more details. | R | Decimal | 0 ~ 65,535 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 1 | D3x128 | The system will move data from NC variable #25384 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 2 | D3x129 | The system will move data from NC variable #25385 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 3 | D3x130 | The system will move data from NC variable #25386 to this special D. | R | | |
| NC Variable to MLC 4 | D3x131 | The system will move data from NC variable #25387 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 5 | D3x132 | The system will move data from NC variable #25388 to this special D. | R | | |
| NC Variable to MLC 6 | D3x133 | The system will move data from NC variable #25389 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 7 | D3x134 | The system will move data from NC variable #25390 to this special D. | R | | |
| NC Variable to MLC 8 | D3x135 | The system will move data from NC variable #25391 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 9 | D3x136 | The system will move data from NC variable #25392 to this special D. | R | | |
| NC Variable to MLC 10 | D3x137 | The system will move data from NC variable #25393 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 11 | D3x138 | The system will move data from NC variable #25394 to this special D. | R | | |
| NC Variable to MLC 12 | D3x139 | The system will move data from NC variable #25395 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 13 | D3x140 | The system will move data from NC variable #25396 to this special D. | R | | |
| NC Variable to MLC 14 | D3x141 | The system will move data from NC variable #25397 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 15 | D3x142 | The system will move data from NC variable #25398 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 16 | D3x143 | The system will move data from NC variable #25399 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 17 | D3x144 | The system will move data from NC variable #25400 to this special D. | R | | |
| NC Variable to MLC 18 | D3x145 | The system will move data from NC variable #25401 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 19 | D3x146 | The system will move data from NC variable #25402 to this special D. | R | | |
| NC Variable to MLC 20 | D3x147 | The system will move data from NC variable #25403 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 21 | D3x148 | The system will move data from NC variable #25404 to this special D. | R | | |
| NC Variable to MLC 22 | D3x149 | The system will move data from NC variable #25405 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 23 | D3x150 | The system will move data from NC variable #25406 to this special D. | R | | |
| NC Variable to MLC 24 | D3x151 | The system will move data from NC variable #25407 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 25 | D3x152 | The system will move data from NC variable #25408 to this special D. | R | | |
| NC Variable to MLC 26 | D3x153 | The system will move data from NC variable #25409 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 27 | D3x154 | The system will move data from NC variable #25410 to this special D. | R | | |
| NC Variable to MLC 28 | D3x155 | The system will move data from NC variable #25411 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 29 | D3x156 | The system will move data from NC variable #25412 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 30 | D3x157 | The system will move data from NC variable #25413 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 31 | D3x158 | The system will move data from NC variable #25414 to this special D. | R | | |
| NC Variable to MLC 32 | D3x159 | The system will move data from NC variable #25415 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 33 | D3x160 | The system will move data from NC variable #25416 to this special D. | R | | |
| NC Variable to MLC 34 | D3x161 | The system will move data from NC variable #25417 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 35 | D3x162 | The system will move data from NC variable #25418 to this special D. | R | | |
| NC Variable to MLC 36 | D3x163 | The system will move data from NC variable #25419 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 37 | D3x164 | The system will move data from NC variable #25420 to this special D. | R | | |
| NC Variable to MLC 38 | D3x165 | The system will move data from NC variable #25421 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 39 | D3x166 | The system will move data from NC variable #25422 to this special D. | R | | |
| NC Variable to MLC 40 | D3x167 | The system will move data from NC variable #25423 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 41 | D3x168 | The system will move data from NC variable #25424 to this special D. | R | | |
| NC Variable to MLC 42 | D3x169 | The system will move data from NC variable #25425 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 43 | D3x170 | The system will move data from NC variable #25426 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 44 | D3x171 | The system will move data from NC variable #25427 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 45 | D3x172 | The system will move data from NC variable #25428 to this special D. | R | | |
| NC Variable to MLC 46 | D3x173 | The system will move data from NC variable #25429 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 47 | D3x174 | The system will move data from NC variable #25430 to this special D. | R | | |
| NC Variable to MLC 48 | D3x175 | The system will move data from NC variable #25431 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 49 | D3x176 | The system will move data from NC variable #25432 to this special D. | R | | |
| NC Variable to MLC 50 | D3x177 | The system will move data from NC variable #25433 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 51 | D3x178 | The system will move data from NC variable #25434 to this special D. | R | | |
| NC Variable to MLC 52 | D3x179 | The system will move data from NC variable #25435 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 53 | D3x180 | The system will move data from NC variable #25436 to this special D. | R | | |
| NC Variable to MLC 54 | D3x181 | The system will move data from NC variable #25437 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 55 | D3x182 | The system will move data from NC variable #25438 to this special D. | R | | |
| NC Variable to MLC 56 | D3x183 | The system will move data from NC variable #25439 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 57 | D3x184 | The system will move data from NC variable #25440 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 58 | D3x185 | The system will move data from NC variable #25441 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 59 | D3x186 | The system will move data from NC variable #25442 to this special D. | R | | |
| NC Variable to MLC 60 | D3x187 | The system will move data from NC variable #25443 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 61 | D3x188 | The system will move data from NC variable #25444 to this special D. | R | | |
| NC Variable to MLC 62 | D3x189 | The system will move data from NC variable #25445 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 63 | D3x190 | The system will move data from NC variable #25446 to this special D. | R | | |
| NC Variable to MLC 64 | D3x191 | The system will move data from NC variable #25447 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 65 | D3x192 | The system will move data from NC variable #25448 to this special D. | R | | |
| NC Variable to MLC 66 | D3x193 | The system will move data from NC variable #25449 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 67 | D3x194 | The system will move data from NC variable #25450 to this special D. | R | | |
| NC Variable to MLC 68 | D3x195 | The system will move data from NC variable #25451 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 69 | D3x196 | The system will move data from NC variable #25452 to this special D. | R | | |
| NC Variable to MLC 70 | D3x197 | The system will move data from NC variable #25453 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 71 | D3x198 | The system will move data from NC variable #25454 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 72 | D3x199 | The system will move data from NC variable #25455 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 73 | D3x200 | The system will move data from NC variable #25456 to this special D. | R | | |
| NC Variable to MLC 74 | D3x201 | The system will move data from NC variable #25457 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 75 | D3x202 | The system will move data from NC variable #25458 to this special D. | R | | |
| NC Variable to MLC 76 | D3x203 | The system will move data from NC variable #25459 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 77 | D3x204 | The system will move data from NC variable #25460 to this special D. | R | | |
| NC Variable to MLC 78 | D3x205 | The system will move data from NC variable #25461 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 79 | D3x206 | The system will move data from NC variable #25462 to this special D. | R | | |
| NC Variable to MLC 80 | D3x207 | The system will move data from NC variable #25463 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 81 | D3x208 | The system will move data from NC variable #25464 to this special D. | R | | |
| NC Variable to MLC 82 | D3x209 | The system will move data from NC variable #25465 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 83 | D3x210 | The system will move data from NC variable #25466 to this special D. | R | | |
| NC Variable to MLC 84 | D3x211 | The system will move data from NC variable #25467 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 85 | D3x212 | The system will move data from NC variable #25468 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 86 | D3x213 | The system will move data from NC variable #25469 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 87 | D3x214 | The system will move data from NC variable #25470 to this special D. | R | | |
| NC Variable to MLC 88 | D3x215 | The system will move data from NC variable #25471 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 89 | D3x216 | The system will move data from NC variable #25472 to this special D. | R | | |
| NC Variable to MLC 90 | D3x217 | The system will move data from NC variable #25473 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 91 | D3x218 | The system will move data from NC variable #25474 to this special D. | R | | |
| NC Variable to MLC 92 | D3x219 | The system will move data from NC variable #25475 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 93 | D3x220 | The system will move data from NC variable #25476 to this special D. | R | | |
| NC Variable to MLC 94 | D3x221 | The system will move data from NC variable #25477 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 95 | D3x222 | The system will move data from NC variable #25478 to this special D. | R | | |
| NC Variable to MLC 96 | D3x223 | The system will move data from NC variable #25479 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 97 | D3x224 | The system will move data from NC variable #25480 to this special D. | R | | |
| NC Variable to MLC 98 | D3x225 | The system will move data from NC variable #25481 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 99 | D3x226 | The system will move data from NC variable #25482 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 100 | D3x227 | The system will move data from NC variable #25483 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 101 | D3x228 | The system will move data from NC variable #25484 to this special D. | R | | |
| NC Variable to MLC 102 | D3x229 | The system will move data from NC variable #25485 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 103 | D3x230 | The system will move data from NC variable #25486 to this special D. | R | | |
| NC Variable to MLC 104 | D3x231 | The system will move data from NC variable #25487 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 105 | D3x232 | The system will move data from NC variable #25488 to this special D. | R | | |
| NC Variable to MLC 106 | D3x233 | The system will move data from NC variable #25489 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 107 | D3x234 | The system will move data from NC variable #25490 to this special D. | R | | |
| NC Variable to MLC 108 | D3x235 | The system will move data from NC variable #25491 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 109 | D3x236 | The system will move data from NC variable #25492 to this special D. | R | | |
| NC Variable to MLC 110 | D3x237 | The system will move data from NC variable #25493 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 111 | D3x238 | The system will move data from NC variable #25494 to this special D. | R | | |
| NC Variable to MLC 112 | D3x239 | The system will move data from NC variable #25495 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 113 | D3x240 | The system will move data from NC variable #25496 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 114 | D3x241 | The system will move data from NC variable #25497 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 115 | D3x242 | The system will move data from NC variable #25498 to this special D. | R | | |
| NC Variable to MLC 116 | D3x243 | The system will move data from NC variable #25499 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 117 | D3x244 | The system will move data from NC variable #25500 to this special D. | R | | |
| NC Variable to MLC 118 | D3x245 | The system will move data from NC variable #25501 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 119 | D3x246 | The system will move data from NC variable #25502 to this special D. | R | | |
| NC Variable to MLC 120 | D3x247 | The system will move data from NC variable #25503 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 121 | D3x248 | The system will move data from NC variable #25504 to this special D. | R | | |
| NC Variable to MLC 122 | D3x249 | The system will move data from NC variable #25505 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 123 | D3x250 | The system will move data from NC variable #25506 to this special D. | R | | |
| NC Variable to MLC 124 | D3x251 | The system will move data from NC variable #25507 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| NC Variable to MLC 125 | D3x252 | The system will move data from NC variable #25508 to this special D. | R | | |
| NC Variable to MLC 126 | D3x253 | The system will move data from NC variable #25509 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| NC Variable to MLC 127 | D3x254 | The system will move data from NC variable #25510 to this special D. | R | Decimal / Float | (Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647 |
| NC Variable to MLC 128 | D3x255 | The system will move data from NC variable #25511 to this special D. *Both this special D and the variable # are NOT available to use when using MLC floating mode **[N1.010 Bit7=1]**. Otherwise, the system will return error 0x235. | R | | |
| Look Ahead Remaining Command | D3x320 D3x321 | When the system is executing an NC program, it will preview the current program and planning path, and the remaining number of previewed and executable blocks will be written to this special D. | R | Decimal | 0 ~ 4,294,967,295 |
| Rigid Tapping Max Error of 1st Spindle | D3x350 D3x351 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 1st spindle executes the tapping function. This special D will be reset prior to every time the tapping function is triggered. Unit: mm | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Rigid Tapping Max Error of 2nd Spindle | D3x352 D3x353 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 2nd spindle executes the tapping function. This special D will be reset prior to every time the tapping function is triggered. Unit: mm | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Feed of 1st Spindle | D3x354 D3x355 | Target feed movement of the 1st spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Feed of 2nd Spindle | D3x356 D3x357 | Target feed movement of the 2nd spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Actual Feed of 1st Spindle | D3x358 D3x359 | Actual feed movement of the 1st spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Actual Feed of 2nd Spindle | D3x360 D3x361 | Actual feed movement of the 2nd spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Speed Command of 3rd Spindle | D3x362 D3x363 | When the 3rd spindle S code is executed in a program, the command value will be sent in this special D. Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 3rd Spindle Speed Feedback | D3x364 D3x365 | Shows the 3rd spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 3rd Spindle Actual Degree | D3x366 D3x367 | Shows the 3rd spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648 ~ +2,147,483,647 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Rigid Tapping Max Error of 3rd Spindle | D3x368<br>D3x369 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 3rd spindle executes the tapping function.<br>This special D will be reset prior to every time the tapping function is triggered.<br>Unit: mm | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Target Feed of 3rd Spindle | D3x370<br>D3x371 | Target feed movement of the 3rd spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Actual Feed of 3rd Spindle | D3x372<br>D3x373 | Actual feed movement of the 3rd spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Speed Command of 4th Spindle | D3x374<br>D3x375 | When the 4th spindle S code is executed in a program, the command value will be sent in this special D.<br>Unit: RPM | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| 4th Spindle Speed Feedback | D3x376<br>D3x377 | Shows the 4th spindle’s speed. The data source is from the spindle’s command speed. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| 4th Spindle Actual Degree | D3x378<br>D3x379 | Shows the 4th spindle’s actual degree. The data source is from the spindle’s actual degree. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Rigid Tapping Max Error of 4th Spindle | D3x380<br>D3x381 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 4th spindle executes the tapping function.<br>This special D will be reset prior to every time the tapping function is triggered.<br>Unit: mm | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Target Feed of 4th Spindle | D3x382<br>D3x383 | Target feed movement of the 4th spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Actual Feed of 4th Spindle | D3x384<br>D3x385 | Actual feed movement of the 4th spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Speed Command of 5th Spindle | D3x386<br>D3x387 | When the 5th spindle S code is executed in a program, the command value will be sent in this special D.<br>Unit: RPM | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| 5th Spindle Speed Feedback | D3x388<br>D3x389 | Shows the 5th spindle’s speed. The data source is from the spindle’s command speed. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| 5th Spindle Actual Degree | D3x390<br>D3x391 | Shows the 5th spindle’s actual degree. The data source is from the spindle’s actual degree. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Rigid Tapping Max Error of 5th Spindle | D3x392<br>D3x393 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 5th spindle executes the tapping function.<br>This special D will be reset prior to every time the tapping function is triggered.<br>Unit: mm | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Target Feed of 5th Spindle | D3x394<br>D3x395 | Target feed movement of the 5th spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| Actual Feed of 5th Spindle | D3x396 D3x397 | Actual feed movement of the 5th spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Speed Command of 6th Spindle | D3x398 D3x399 | When the 6th spindle S code is executed in a program, the command value will be sent in this special D. Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 6th Spindle Speed Feedback | D3x400 D3x401 | Shows the 6th spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 6th Spindle Actual Degree | D3x402 D3x403 | Shows the 6th spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Rigid Tapping Max Error of 6th Spindle | D3x404 D3x405 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 6th spindle executes the tapping function. This special D will be reset prior to every time the tapping function is triggered. Unit: mm | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Feed of 6th Spindle | D3x406 D3x407 | Target feed movement of the 6th spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Actual Feed of 6th Spindle | D3x408 D3x409 | Actual feed movement of the 6th spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Speed Command of 7th Spindle | D3x410 D3x411 | When the 7th spindle S code is executed in a program, the command value will be sent in this special D. Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 7th Spindle Speed Feedback | D3x412 D3x413 | Shows the 7th spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 7th Spindle Actual Degree | D3x414 D3x415 | Shows the 7th spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Rigid Tapping Max Error of 7th Spindle | D3x416 D3x417 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 7th spindle executes the tapping function. This special D will be reset prior to every time the tapping function is triggered. Unit: mm | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Target Feed of 7th Spindle | D3x418 D3x419 | Target feed movement of the 7th spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Actual Feed of 7th Spindle | D3x420 D3x421 | Actual feed movement of the 7th spindle in each revolution. Unit: mm/rev. | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| Speed Command of 8th Spindle | D3x422 D3x423 | When the 8th spindle S code is executed in a program, the command value will be sent in this special D. Unit: RPM | R | Float | -2,147,483,648 ~ +2,147,483,647 |
| 8th Spindle Speed Feedback | D3x424 D3x425 | Shows the 8th spindle's speed. The data source is from the spindle's command speed. | R | Float | -2,147,483,648 ~ +2,147,483,647 |

B

| Function Name | Special D | Description | Device | Type | Range |
|---|---|---|---|---|---|
| 8th Spindle Actual Degree | D3x426<br>D3x427 | Shows the 8th spindle's actual degree. The data source is from the spindle's actual degree. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Rigid Tapping Max Error of 8th Spindle | D3x428<br>D3x429 | The system will record the maximum absolute difference distance between the feed axis feedback and spindle feedback when the 8th spindle executes the tapping function.<br>This special D will be reset prior to every time the tapping function is triggered.<br>Unit: mm | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Target Feed of 8th Spindle | D3x430<br>D3x431 | Target feed movement of the 8th spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |
| Actual Feed of 8th Spindle | D3x432<br>D3x433 | Actual feed movement of the 8th spindle in each revolution.<br>Unit: mm/rev. | R | Float | -2,147,483,648<br>~<br>+2,147,483,647 |

# B.3 CNC Special # Variable

This appendix provides functional mapping tables of # variables in the NC 5 controller system. Variables are independently working in each channel of NC, mainly used in operation, read and system setting of NC program.

System # variable corresponding table define as following:

| Variable | 2 Description | Type |
|---|---|---|
| #0 1 | system variable of value is null (NULL) | 3 R/-/- |

1. # variable name, beginning as # and number from 0 to 223999. Number after 20000 are system variables or reserved variables.
2. # variable function description.
3. # variable operation attribute and its attribute description:

   R: # variable read only.

   W: # variable writable.

   ●: When NC system execute this # variable, it will stop look-ahead and block preview which ensure the system can obtain the current state of the NC system.

## B.3.1 Constant Variable

### B.3.1.1 Null Variable (#0)

<table>
<tr><th>Variable</th><th>Description</th><th>Type</th></tr>
<tr><td>#0</td><td>A null and read only variable (Null).<br>Users can move #0 value into specified variable, and then set this specified variable as null. (The value will display as NULL).<br>Null (NULL) and 0 is different in usage, the following table describes the differences when the #100 is given in NULL or 0:
<table>
<tr><th rowspan="2">Judgement</th><th colspan="2">Value of #100</th></tr>
<tr><th>NULL</th><th>0</th></tr>
<tr><td>#100 == #0</td><td>True</td><td>False</td></tr>
<tr><td>#100 != #0</td><td>False</td><td>True</td></tr>
<tr><td>#100 >= #0</td><td>True</td><td>True</td></tr>
<tr><td>#100 <= #0</td><td>True</td><td>True</td></tr>
<tr><td>#100 > 0</td><td>False</td><td>False</td></tr>
<tr><td>#100 < 0</td><td>False</td><td>False</td></tr>
<tr><td>#100 != 0</td><td>True</td><td>False</td></tr>
<tr><td>G90X99Y#100</td><td>G90 X99</td><td>G90 X99 Y0</td></tr>
</table></td><td>R/-/-</td></tr>
</table>

### B.3.1.2 Constant Variable (#20000~#20012)

| Variable | Description | Type |
|---|---|---|
| #20000 | $e \cong 2.718281828$ | R/-/- |
| #20001 | $\log_2 e \cong 1.442695041$ | R/-/- |
| #20002 | $\log_{10} e \cong 0.434294482$ | R/-/- |
| #20003 | $\ln 2 \cong 0.693147181$ | R/-/- |
| #20004 | $\ln 10 \cong 2.302585093$ | R/-/- |
| #20005 | $\pi \cong 3.141592654$ | R/-/- |
| #20006 | $\frac{\pi}{2} \cong 1.570796327$ | R/-/- |
| #20007 | $\frac{\pi}{4} \cong 0.785398163$ | R/-/- |
| #20008 | $\frac{1}{\pi} \cong 0.318309886$ | R/-/- |
| #20009 | $\frac{2}{\pi} \cong 0.636619772$ | R/-/- |
| #20010 | $\frac{2}{\sqrt{\pi}} \cong 1.128379167$ | R/-/- |
| #20011 | $\sqrt{2} \cong 1.414213562$ | R/-/- |
| #20012 | $\frac{1}{\sqrt{\pi}} \cong 0.707106781$ | R/-/- |

## B.3.2 Alarm Variable

### B.3.2.1 Macro Defined Alarm (#20020)

| Variable | Description | Type |
|---|---|---|
| #20020 | Macro defined alarm (MR)<br>When non-zero value is written into this variable, the system will display Macro defined alarm on the controller screen.<br>Value range: from 0 to 32767. If the value is not in the range, the system will return alarm 0x0244.<br>The error message from MR1 to MR1000 are configured in the **[CNCSoft]** – **[DOPSoft]**.<br>For example: #20020 = 100; the system displays MR100. | R/W/● |

## B.3.3 Field Special Variables

### B.3.3.1 User-Defined Coordinate (#20021)

| Variable | Description | Type |
|---|---|---|
| #20021 | Special for woodworking machine, used for displaying the working coordinate of the multi-channel.<br>*Need to be used with file sequence function | R/-/● |

### B.3.3.2 Multi-Z Axis Synchronize (#20022)

| Variable | Description | Type |
|---|---|---|
| #20022 | Slave axes number shielding of multi-Z axis.<br>This value is associated with D3X014. | R/-/● |

B

## B.3.4 NC System Status

### B.3.4.1 Servo Parameter Read and Write (#20023, #20024)

| Variable | Description | Type |
|---|---|---|
| #20023 | This variable store the servo parameter which return from the slave parameters reading instruction.<br>Servo parameters reading instruction includes G10 L40, L41, L45 and L46.<br>For example:<br>After executing G10 L40 I3 P4 D5, this variable will store the value of P4-5 from the servo drive of address number 3.<br>After executing G10 L45 I3 P4 D5, this variable will store the value of [OD-code 4] [Sub OD code 5] from the slave device of address number 3. | R/-/● |
| #20024 | This variable store the execution result (error code) after executing the slave parameters reading instruction. Servo parameters reading instruction includes G10 L40, L41, L45 and L46.<br>For example:<br>After executing G10 L40 I3 P4 D5, this variable will store the execution result (error code).<br>When executing G10 L45 I3 P4 D5, this variable will store the execution result (error code). | R/-/● |

### B.3.4.2 System Time (#20025, #20026)

| Variable | Description | Type |
|---|---|---|
| #20025 | System time: YYMMDD<br>For example: controller system time is 2023/04/17, the value of #20025 is 230417 | R/-/● |
| #20026 | System time: hhmmss<br>For example: controller system time is 17:30:01, the value of #20026 is 173001 | R/-/● |

### B.3.4.3 NC System Mode (#20300~#20330)

| Variable | Function description (Milling machine type G code) | Type |
|---|---|---|
| #20300 | G code group [0] mode: Temporary G command information | R/-/- |
| #20301 | G code group [1] mode: Interpolation mode (G00~G03) | R/-/- |
| #20302 | G code group [2] mode: Plane selection (G17~G19) | R/-/- |
| #20303 | G code group [3] mode: Absolute/ incremental instruction (G90, G91). | R/-/- |
| #20304 | G code group [4] mode: Procedure check (G22, G23). | R/-/- |
| #20305 | G code group [5] mode: Feeding mode G94, G95. | R/-/- |
| #20306 | G code group [6] mode: Metric/ inch mode (G20, G21). | R/-/- |
| #20307 | G code group [7] mode: Tool radius compensation (G40, G41, G42). | R/-/- |
| #20308 | G code group [8] mode: Tool length compensation (G43, G44, G49). | R/-/- |
| #20309 | G code group [9] mode: Circulation instruction (G80). | R/-/- |
| #20310 | G code group [10] mode: Drilling return mode (G98, G99). | R/-/- |
| #20311 | G code group [11] mode: Ratio mode (G50, G51). | R/-/- |
| #20312 | G code group [12] mode: Workpiece coordinate (G54~G59). | R/-/- |
| #20313 | G code group [13] mode: Cutting mode (G61, G64). | R/-/- |
| #20314 | G code group [14] mode: Macro call (G66, G67). | R/-/- |
| #20315 | G code group [15] mode: Coordinate rotation (G68, G69). | R/-/- |
| #20316 | G code group [16] mode: Polar coordinate instruction (G15, G16). | R/-/- |
| #20317 | G code group [17] mode: Cut speed (G96, G97). | R/-/- |
| #20318 | G code group [18] mode: Mirror function (G24, G25). | R/-/- |
| #20319<br>…#20330 | System reserved. Do not use this sector variable. | -/-/- |
| #20331 | G code group [31] mode: Extend work coordinate (G54 P1-P64). | R/-/- |

### B.3.4.4 NC Command Status (#20400~#20411)

| Variable NO. | Function description | Type |
|---|---|---|
| #20400 | Current execution feed rate F.<br>This variable records the last F command before the specified search break block when executing breakpoint search function. | R/-/- |
| #20401 | Current tool compensation H value<br>This variable records the last H command before the specified search break block when executing breakpoint search function. | R/-/- |
| #20402 | Current tool compensation D value<br>This variable records the last D command before the specified search break block when executing breakpoint search function. | R/-/- |
| #20403 | Current tool number T value<br>This variable records the last T command before the specified search break block when executing breakpoint search function. | R/-/- |
| #20404 | 1st spindle current program speed S. | R/-/● |
| #20405 | 2nd spindle current program speed S. | R/-/● |
| #20406 | 3rd spindle current program speed S. | R/-/● |
| #20407 | 4th spindle current program speed S. | R/-/● |
| #20408<br>…<br>#20411 | System reserved.<br>Do not use variables in this range. | R/-/● |

### B.3.4.5 Coordinate Information (#21000~#21079)

| | Machine Coordinate | Absolute Coordinate | Target Position | G31 Machine | G31 Absolute | Axis Compensate Feedback | Type |
|---|---|---|---|---|---|---|---|
| 1st axis (X) | #21000 | #21016 | #21032 | #21048 | #21064 | #21080 | R/-/● |
| 2nd axis (Y) | #21001 | #21017 | #21033 | #21049 | #21065 | #21081 | R/-/● |
| 3rd axis (Z) | #21002 | #21018 | #21034 | #21050 | #21066 | #21082 | R/-/● |
| 4th axis (A) | #21003 | #21019 | #21035 | #21051 | #21067 | #21083 | R/-/● |
| 5th axis (B) | #21004 | #21020 | #21036 | #21052 | #21068 | #21084 | R/-/● |
| 6th axis (C) | #21005 | #21021 | #21037 | #21053 | #21069 | #21085 | R/-/● |
| 7th axis (U) | #21006 | #21022 | #21038 | #21054 | #21070 | #21086 | R/-/● |
| 8th axis (V) | #21007 | #21023 | #21039 | #21055 | #21071 | #21087 | R/-/● |
| 9th axis (W) | #21008 | #21024 | #21040 | #21056 | #21072 | #21088 | R/-/● |
| 10th axis | #21009 | #21025 | #21041 | #21057 | #21073 | #21089 | R/-/● |
| 11th axis | #21010 | #21026 | #21042 | #21058 | #21074 | #21090 | R/-/● |
| 12th axis | #21011 | #21027 | #21043 | #21059 | #21075 | #21091 | R/-/● |
| 13th axis | #21012 | #21028 | #21044 | #21060 | #21076 | #21092 | R/-/● |
| 14th axis | #21013 | #21029 | #21045 | #21061 | #21077 | #21093 | R/-/● |
| 15th axis | #21014 | #21030 | #21046 | #21062 | #21078 | #21094 | R/-/● |
| 16th axis | #21015 | #21031 | #21047 | #21063 | #21079 | #21095 | R/-/● |

### B.3.4.6 G54-G59 Workpiece Coordinate (#22000~#23183)

| | Offset Position | G54 | G55 | G56 | G57 | G58 | G59 | Type |
|---|---|---|---|---|---|---|---|---|
| $1^{st}$ axis (X) | #22000 | #22002 | #22003 | #22004 | #22005 | #22006 | #22007 | R/W/● |
| $2^{nd}$ axis (Y) | #22078 | #22080 | #22081 | #22082 | #22083 | #22084 | #22085 | R/W/● |
| $3^{rd}$ axis (Z) | #22156 | #22158 | #22159 | #22160 | #22161 | #22162 | #22163 | R/W/● |
| $4^{th}$ axis (A) | #22234 | #22236 | #22237 | #22238 | #22239 | #22240 | #22241 | R/W/● |
| $5^{th}$ axis (B) | #22312 | #22314 | #22315 | #22316 | #22317 | #22318 | #22319 | R/W/● |
| $6^{th}$ axis (C) | #22390 | #22392 | #22393 | #22394 | #22395 | #22396 | #22397 | R/W/● |
| $7^{th}$ axis (U) | #22468 | #22470 | #22471 | #22472 | #22473 | #22474 | #22475 | R/W/● |
| $8^{th}$ axis (V) | #22546 | #22548 | #22549 | #22550 | #22551 | #22552 | #22553 | R/W/● |
| $9^{th}$ axis(W) | #22624 | #22626 | #22627 | #22628 | #22629 | #22630 | #22631 | R/W/● |
| $10^{th}$ axis | #22702 | #22704 | #22705 | #22706 | #22707 | #22708 | #22709 | R/W/● |
| $11^{th}$ axis | #22780 | #22782 | #22783 | #22784 | #22785 | #22786 | #22787 | R/W/● |
| $12^{th}$ axis | #22858 | #22860 | #22861 | #22862 | #22863 | #22864 | #22865 | R/W/● |
| $13^{th}$ axis | #22936 | #22938 | #22939 | #22940 | #22941 | #22942 | #22943 | R/W/● |
| $14^{th}$ axis | #23014 | #23016 | #23017 | #23018 | #23019 | #23020 | #23021 | R/W/● |
| $15^{th}$ axis | #23092 | #23094 | #23095 | #23096 | #23097 | #23098 | #23099 | R/W/● |
| $16^{th}$ axis | #23170 | #23172 | #23173 | #23174 | #23175 | #23176 | #23177 | R/W/● |

| | G54 Offset Position | G55 Offset Position | G56 Offset Position | G57 Offset Position | G58 Offset Position | G59 Offset Position | Type |
|---|---|---|---|---|---|---|---|
| $1^{st}$ axis (X) | #22008 | #22009 | #22010 | #22011 | #22012 | #22013 | R/W/● |
| $2^{nd}$ axis (Y) | #22086 | #22087 | #22088 | #22089 | #22090 | #22091 | R/W/● |
| $3^{rd}$ axis (Z) | #22164 | #22165 | #22166 | #22167 | #22168 | #22169 | R/W/● |
| $4^{th}$ axis (A) | #22242 | #22243 | #22244 | #22245 | #22246 | #22247 | R/W/● |
| $5^{th}$ axis (B) | #22320 | #22321 | #22322 | #22323 | #22324 | #22325 | R/W/● |
| $6^{th}$ axis (C) | #22398 | #22399 | #22400 | #22401 | #22402 | #22403 | R/W/● |
| $7^{th}$ axis (U) | #22476 | #22477 | #22478 | #22479 | #22480 | #22481 | R/W/● |
| $8^{th}$ axis (V) | #22554 | #22555 | #22556 | #22557 | #22558 | #22559 | R/W/● |
| $9^{th}$ axis(W) | #22632 | #22633 | #22634 | #22635 | #22636 | #22637 | R/W/● |
| $10^{th}$ axis | #22710 | #22711 | #22712 | #22713 | #22714 | #22715 | R/W/● |
| $11^{th}$ axis | #22788 | #22789 | #22790 | #22791 | #22792 | #22793 | R/W/● |
| $12^{th}$ axis | #22866 | #22867 | #22868 | #22869 | #22870 | #22871 | R/W/● |
| $13^{th}$ axis | #22944 | #22945 | #22946 | #22947 | #22948 | #22949 | R/W/● |
| $14^{th}$ axis | #23022 | #23023 | #23024 | #23025 | #23026 | #23027 | R/W/● |
| $15^{th}$ axis | #23100 | #23101 | #23102 | #23103 | #23104 | #23105 | R/W/● |
| $16^{th}$ axis | #23178 | #23179 | #23180 | #23181 | #23182 | #23183 | R/W/● |

# B.3.5 Tool Management and Breakpoints

## B.3.5.1 Tool Magazine (#24001~#24004)

| Variable | Function description | Type |
|---|---|---|
| #24001 | Activated tool number from the $1^{st}$ tool magazine. | R/-/● |
| #24002 | Activated tool number from the $2^{nd}$ tool magazine. | R/-/● |
| #24003 | Tool exchange number of the $1^{st}$ tool magazine.<br>In the $1^{st}$ tool magazine, after search the [#24003 specified number] and get the current tool slot, user can exchange the [#24001 activated tool number] and the [#24003 Tool exchange number] and then the tool number in the tool slot will be changed automatically.<br>if #24003 specified tool number is not in the tool magazine, the system will not exchange the tool number. | R/W/● |
| #24004 | Tool exchange number of the $2^{nd}$ tool magazine.<br>In the $2^{nd}$ tool magazine, after search the [#24004 specified number] and get the current tool slot, user can exchange the [#24002 activated tool number] and the [#24004 Tool exchange number] and then the tool number in the tool slot will be changed automatically.<br>if #240044 specified tool number is not in the tool magazine, the system will not exchange the tool number. | R/W/● |

## B.3.5.2 Breakpoint Search (#24039~#24095)

After executing the breakpoint row-searching or label execution, the NC system will directed current line number to the specified breakpoint, and the status information of M, S, T, F and axis coordinates are saved as following table:

| Variable | Function Description | Type |
|---|---|---|
| #24042<br>…<br>#24076 | Last M code record before breakpoint.<br>When using breakpoint search function, those used M code before breakpoint line number or breakpoint label will record in #24042 to #24076 variables.<br>* If there are more than 35 M codes are used before the breakpoint line number, the system retains only the last 35 sets of M codes based on the first-in-first-out principle.<br>* If less than 35 M codes are used before the breakpoint line number, the corresponding variable will be NULL. | R/-/- |
| #24077 | Last S code record before breakpoint.<br>When using breakpoint search function, the last S code before breakpoint line number or breakpoint label will record in #24077 variable.<br>*If there are no S code has been used before the breakpoint line number, this variable will be null (NULL). | R/-/- |
| #24078 | Last T code record before breakpoint.<br>When using breakpoint search function, those used T code before breakpoint line number or breakpoint label will record in #24078 to #24079 variables.<br>* If there are more than 2 T codes are used before the breakpoint line number, the system retains only the last 2 sets of T codes based on the first-in-first-out principle.<br>* If less than 2 T codes are used before the breakpoint line number, the corresponding variable will be NULL. | R/-/- |
| #24079 | | R/-/- |

B

| Variable | Function description | | Type |
|---|---|---|---|
| #24080 | 1st axis (X) | Target position of each axis record before breakpoint line.<br>When using breakpoint searching function, the target position before breakpoint line or breakpoint label of each axis will be store in #24080 to #24095 variables.<br>*If the axis is not used before the breakpoint line number, the corresponding variable will be null (NULL). | R/-/- |
| #24081 | 2nd axis (Y) | | R/-/- |
| #24082 | 3rd axis (Z) | | R/-/- |
| #24083 | 4th axis (A) | | R/-/- |
| #24084 | 5th axis (B) | | R/-/- |
| #24085 | 6th axis (C) | | R/-/- |
| #24086 | 7th axis (U) | | R/-/- |
| #24087 | 8th axis (V) | | R/-/- |
| #24088 | 9th axis (W) | | R/-/- |
| #24089 | 10th axis | | R/-/- |
| #24090 | 11th axis | | R/-/- |
| #24091 | 12th axis | | R/-/- |
| #24092 | 13th axis | | R/-/- |
| #24093 | 14th axis | | R/-/- |
| #24094 | 15th axis | | R/-/- |
| #24095 | 16th axis | | R/-/- |
| #24100 | Multiple T code record before breakpoint line.<br>When using breakpoint searching function, the T code command before breakpoint line or breakpoint label will be store in #24100 to #24103 variables.<br>Maximum 4 sets of T code will be recorded.<br>*If the multiple T code is not used before the breakpoint line number, the corresponding variable will be null (NULL). | | R/-/- |
| #24101 | | | R/-/- |
| #24102 | | | R/-/- |
| #24103 | | | R/-/- |

B

# B.3.6 MLC Exchange Variable

## B.3.6.1 MLC M Relay Write to # Variable (#25000~#25127)

| | +0 | +1 | +2 | +3 | +4 | Type |
|---|---|---|---|---|---|---|
| #25000 | M2X128 | M2X129 | M2X130 | M2X131 | M2X132 | R/-/- |
| #25005 | M2X133 | M2X134 | M2X135 | M2X136 | M2X137 | R/-/- |
| #25010 | M2X138 | M2X139 | M2X140 | M2X141 | M2X142 | R/-/- |
| #25015 | M2X143 | M2X144 | M2X145 | M2X146 | M2X147 | R/-/- |
| #25020 | M2X148 | M2X149 | M2X150 | M2X151 | M2X152 | R/-/- |
| #25025 | M2X153 | M2X154 | M2X155 | M2X156 | M2X157 | R/-/- |
| #25030 | M2X158 | M2X159 | M2X160 | M2X161 | M2X162 | R/-/- |
| #25035 | M2X163 | M2X164 | M2X165 | M2X166 | M2X167 | R/-/- |
| #25040 | M2X168 | M2X169 | M2X170 | M2X171 | M2X172 | R/-/- |
| #25045 | M2X173 | M2X174 | M2X175 | M2X176 | M2X177 | R/-/- |
| #25050 | M2X178 | M2X179 | M2X180 | M2X181 | M2X182 | R/-/- |
| #25055 | M2X183 | M2X184 | M2X185 | M2X186 | M2X187 | R/-/- |
| #25060 | M2X188 | M2X189 | M2X190 | M2X191 | M2X192 | R/-/- |
| #25065 | M2X193 | M2X194 | M2X195 | M2X196 | M2X197 | R/-/- |
| #25070 | M2X198 | M2X199 | M2X200 | M2X201 | M2X202 | R/-/- |
| #25075 | M2X203 | M2X204 | M2X205 | M2X206 | M2X207 | R/-/- |
| #25080 | M2X208 | M2X209 | M2X210 | M2X211 | M2X212 | R/-/- |
| #25085 | M2X213 | M2X214 | M2X215 | M2X216 | M2X217 | R/-/- |
| #25090 | M2X218 | M2X219 | M2X220 | M2X221 | M2X222 | R/-/- |
| #25095 | M2X223 | M2X224 | M2X225 | M2X226 | M2X227 | R/-/- |
| #25100 | M2X228 | M2X229 | M2X230 | M2X231 | M2X232 | R/-/- |
| #25105 | M2X233 | M2X234 | M2X235 | M2X236 | M2X237 | R/-/- |
| #25110 | M2X238 | M2X239 | M2X240 | M2X241 | M2X242 | R/-/- |
| #25115 | M2X243 | M2X244 | M2X245 | M2X246 | M2X247 | R/-/- |
| #25120 | M2X248 | M2X249 | M2X250 | M2X251 | M2X252 | R/-/- |
| #25125 | M2X253 | M2X254 | M2X255 | - | - | R/-/- |

### B.3.6.2 MLC Word D Register Write to # Variable (#25128~#25255)

This function effected by the parameter **[N1.010 Bit7 MLC variable status]**. When the parameter set as 0 single word type, the D register uses 16-bit signed integer is converted into the # variable, for example: D2X128 as -19, the #25128 will read out of -19.000; if set parameter as 1 floating-point type, D register uses 32-bit floating-point format conversion passed in the # variable and odd-numbered of # variables are forbidden to operate, for example: set the value of D2X128, D2X129 as 19.999, read #25128 out of 19.999 and the #25129 is not available to operate.

| | +0 | +1 | +2 | +3 | +4 | Type |
|---|---|---|---|---|---|---|
| D2X128 | #25128 | #25129[note] | #25130 | #25131[note] | #25132 | R/-/- |
| D2X133 | #25133[note] | #25134 | #25135[note] | #25136 | #25137[note] | R/-/- |
| D2X138 | #25138 | #25139[note] | #25140 | #25141[note] | #25142 | R/-/- |
| D2X143 | #25143[note] | #25144 | #25145[note] | #25146 | #25147[note] | R/-/- |
| D2X148 | #25148 | #25149[note] | #25150 | #25151[note] | #25152 | R/-/- |
| D2X153 | #25153[note] | #25154 | #25155[note] | #25156 | #25157[note] | R/-/- |
| D2X158 | #25158 | #25159[note] | #25160 | #25161[note] | #25162 | R/-/- |
| D2X163 | #25163[note] | #25164 | #25165[note] | #25166 | #25167[note] | R/-/- |
| D2X168 | #25168 | #25169[note] | #25170 | #25171[note] | #25172 | R/-/- |
| D2X173 | #25173[note] | #25174 | #25175[note] | #25176 | #25177[note] | R/-/- |
| D2X178 | #25178 | #25179[note] | #25180 | #25181[note] | #25182 | R/-/- |
| D2X183 | #25183[note] | #25184 | #25185[note] | #25186 | #25187[note] | R/-/- |
| D2X188 | #25188 | #25189[note] | #25190 | #25191[note] | #25192 | R/-/- |
| D2X193 | #25193[note] | #25194 | #25195[note] | #25196 | #25197[note] | R/-/- |
| D2X198 | #25198 | #25199[note] | #25200 | #25201[note] | #25202 | R/-/- |
| D2X203 | #25203[note] | #25204 | #25205[note] | #25206 | #25207[note] | R/-/- |
| D2X208 | #25208 | #25209[note] | #25210 | #25211[note] | #25212 | R/-/- |
| D2X213 | #25213[note] | #25214 | #25215[note] | #25216 | #25217[note] | R/-/- |
| D2X218 | #25218 | #25219[note] | #25220 | #25221[note] | #25222 | R/-/- |
| D2X223 | #25223[note] | #25224 | #25225[note] | #25226 | #25227[note] | R/-/- |
| D2X228 | #25228 | #25229[note] | #25230 | #25231[note] | #25232 | R/-/- |
| D2X233 | #25233[note] | #25234 | #25235[note] | #25236 | #25237[note] | R/-/- |
| D2X238 | #25238 | #25239[note] | #25240 | #25241[note] | #25242 | R/-/- |
| D2X243 | #25243[note] | #25244 | #25245[note] | #25246 | #25247[note] | R/-/- |
| D2X248 | #25248 | #25249[note] | #25250 | #25251[note] | #25252 | R/-/- |
| D2X253 | #25253 | #25254 | #25255 | - | - | R/-/- |

Note: parameter **[N1.010 Bit7 MLC variable status]** set as 1 floating-point type, the odd # variable number are prohibited.

B

### B.3.6.3 # Variable Write to MLC M Relay (#25256~#25383)

| | +0 | +1 | +2 | +3 | +4 | Type |
|---|---|---|---|---|---|---|
| #25256 | M2X256 | M2X257 | M2X258 | M2X259 | M2X260 | R/W/- |
| #25261 | M2X261 | M2X262 | M2X263 | M2X264 | M2X265 | R/W/- |
| #25266 | M2X266 | M2X267 | M2X268 | M2X269 | M2X270 | R/W/- |
| #25271 | M2X271 | M2X272 | M2X273 | M2X274 | M2X275 | R/W/- |
| #25276 | M2X276 | M2X277 | M2X278 | M2X279 | M2X280 | R/W/- |
| #25281 | M2X281 | M2X282 | M2X283 | M2X284 | M2X285 | R/W/- |
| #25286 | M2X286 | M2X287 | M2X288 | M2X289 | M2X290 | R/W/- |
| #25291 | M2X291 | M2X292 | M2X293 | M2X294 | M2X295 | R/W/- |
| #25296 | M2X296 | M2X297 | M2X298 | M2X299 | M2X300 | R/W/- |
| #25301 | M2X301 | M2X302 | M2X303 | M2X304 | M2X305 | R/W/- |
| #25306 | M2X306 | M2X307 | M2X308 | M2X309 | M2X310 | R/W/- |
| #25311 | M2X311 | M2X312 | M2X313 | M2X314 | M2X315 | R/W/- |
| #25316 | M2X316 | M2X317 | M2X318 | M2X319 | M2X320 | R/W/- |
| #25321 | M2X321 | M2X322 | M2X323 | M2X324 | M2X325 | R/W/- |
| #25326 | M2X326 | M2X327 | M2X328 | M2X329 | M2X330 | R/W/- |
| #25331 | M2X331 | M2X332 | M2X333 | M2X334 | M2X335 | R/W/- |
| #25336 | M2X336 | M2X337 | M2X338 | M2X339 | M2X340 | R/W/- |
| #25341 | M2X341 | M2X342 | M2X343 | M2X344 | M2X345 | R/W/- |
| #25346 | M2X346 | M2X347 | M2X348 | M2X349 | M2X350 | R/W/- |
| #25351 | M2X351 | M2X352 | M2X353 | M2X354 | M2X355 | R/W/- |
| #25356 | M2X356 | M2X357 | M2X358 | M2X359 | M2X360 | R/W/- |
| #25361 | M2X361 | M2X362 | M2X363 | M2X364 | M2X365 | R/W/- |
| #25366 | M2X366 | M2X367 | M2X368 | M2X369 | M2X370 | R/W/- |
| #25371 | M2X371 | M2X372 | M2X373 | M2X374 | M2X375 | R/W/- |
| #25376 | M2X376 | M2X377 | M2X378 | M2X379 | M2X380 | R/W/- |
| #25381 | M2X381 | M2X382 | M2X383 | - | - | R/W/- |

B

## B.3.6.4 # Variable Write to MLC D Register (#25384~#25511)

This function effected by the parameter **[N1.010 Bit7 MLC variable status]**, when set parameter as 0 single word type, the # variable uses 16-bit signed integer conversion is passed to the D register, for example: set #25384 as -19.999, read D3X128 out of -19; if set parameter as 1 floating-point type, # variable uses 32-bit floating-point format in D register and odd-numbered of # variables are forbidden to operate, for example: set the value of #25328 as 19.999, read D3X128 and D3X129 out of 19.999 and the #25329 is not available to operate.

| | +0 | +1 | +2 | +3 | +4 | Type |
|---|---|---|---|---|---|---|
| D3X128 | #25384 | #25385 note | #25386 | #25387 note | #25388 | R/W/- |
| D3X133 | #25389 note | #25390 | #25391 note | #25392 | #25393 note | R/W/- |
| D3X138 | #25394 | #25395 note | #25396 | #25397 note | #25398 | R/W/- |
| D3X143 | #25399 note | #25400 | #25401 note | #25402 | #25403 note | R/W/- |
| D3X148 | #25404 | #25405 note | #25406 | #25407 note | #25408 | R/W/- |
| D3X153 | #25409 note | #25410 | #25411 note | #25412 | #25413 note | R/W/- |
| D3X158 | #25414 | #25415 note | #25416 | #25417 note | #25418 | R/W/- |
| D3X163 | #25419 note | #25420 | #25421 note | #25422 | #25423 note | R/W/- |
| D3X168 | #25424 | #25425 note | #25426 | #25427 note | #25428 | R/W/- |
| D3X173 | #25429 note | #25430 | #25431 note | #25432 | #25433 note | R/W/- |
| D3X178 | #25434 | #25435 note | #25436 | #25437 note | #25438 | R/W/- |
| D3X183 | #25439 note | #25440 | #25441 note | #25442 | #25443 note | R/W/- |
| D3X188 | #25444 | #25445 note | #25446 | #25447 note | #25448 | R/W/- |
| D3X193 | #25449 note | #25450 | #25451 note | #25452 | #25453 note | R/W/- |
| D3X198 | #25454 | #25455 note | #25456 | #25457 note | #25458 | R/W/- |
| D3X203 | #25459 note | #25460 | #25461 note | #25462 | #25463 note | R/W/- |
| D3X208 | #25464 | #25465 note | #25466 | #25467 note | #25468 | R/W/- |
| D3X213 | #25469 note | #25470 | #25471 note | #25472 | #25473 note | R/W/- |
| D3X218 | #25474 | #25475 note | #25476 | #25477 note | #25478 | R/W/- |
| D3X223 | #25479 note | #25480 | #25481 note | #25482 | #25483 note | R/W/- |
| D3X228 | #25484 | #25485 note | #25486 | #25487 note | #25488 | R/W/- |
| D3X233 | #25489 note | #25490 | #25491 note | #25492 | #25493 note | R/W/- |
| D3X238 | #25494 | #25495 note | #25496 | #25497 note | #25498 | R/W/- |
| D3X243 | #25499 note | #25500 | #25501 note | #25502 | #25503 note | R/W/- |
| D3X248 | #25504 | #25505 note | #25506 | #25507 note | #25508 | R/W/- |
| D3X253 | #25509 note | #25510 | #25511 note | - | - | R/W/- |

Note: parameter **[N1.010 Bit7 MLC variable status]** set as 1 floating-point type, the odd # variable number are prohibited.

B

## B.3.7 Tool Management

### B.3.7.1 Tool Length (#26000~#41999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Axis 1 | #26000 | #26001 | #26002 | #26003 | ~ | #26999 | R/W/- |
| Axis 2 | #27000 | #27001 | #27002 | #27003 | ~ | #27999 | R/W/- |
| Axis 3 | #28000 | #28001 | #28002 | #28003 | ~ | #28999 | R/W/- |
| Axis 4 | #29000 | #29001 | #29002 | #29003 | ~ | #29999 | R/W/- |
| Axis 5 | #30000 | #30001 | #30002 | #30003 | ~ | #30999 | R/W/- |
| Axis 6 | #31000 | #31001 | #31002 | #31003 | ~ | #31999 | R/W/- |
| Axis 7 | #32000 | #32001 | #32002 | #32003 | ~ | #32999 | R/W/- |
| Axis 8 | #33000 | #33001 | #33002 | #33003 | ~ | #33999 | R/W/- |
| Axis 9 | #34000 | #34001 | #34002 | #34003 | ~ | #34999 | R/W/- |
| Axis 10 | #35000 | #35001 | #35002 | #35003 | ~ | #35999 | R/W/- |
| Axis 11 | #36000 | #36001 | #36002 | #36003 | ~ | #36999 | R/W/- |
| Axis 12 | #37000 | #37001 | #37002 | #37003 | ~ | #37999 | R/W/- |
| Axis 13 | #38000 | #38001 | #38002 | #38003 | ~ | #38999 | R/W/- |
| Axis 14 | #39000 | #39001 | #39002 | #39003 | ~ | #39999 | R/W/- |
| Axis 15 | #40000 | #40001 | #40002 | #40003 | ~ | #40999 | R/W/- |
| Axis 16 | #41000 | #41001 | #41002 | #41003 | ~ | #41999 | R/W/- |

### B.3.7.2 Tool Wear (#42000~#57999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Axis 1 | #42000 | #42001 | #42002 | #42003 | ~ | #42999 | R/W/- |
| Axis 2 | #43000 | #43001 | #43002 | #43003 | ~ | #43999 | R/W/- |
| Axis 3 | #44000 | #44001 | #44002 | #44003 | ~ | #44999 | R/W/- |
| Axis 4 | #45000 | #45001 | #45002 | #45003 | ~ | #45999 | R/W/- |
| Axis 5 | #46000 | #46001 | #46002 | #46003 | ~ | #46999 | R/W/- |
| Axis 6 | #47000 | #47001 | #47002 | #47003 | ~ | #47999 | R/W/- |
| Axis 7 | #48000 | #48001 | #48002 | #48003 | ~ | #48999 | R/W/- |
| Axis 8 | #49000 | #49001 | #49002 | #49003 | ~ | #49999 | R/W/- |
| Axis 9 | #50000 | #50001 | #50002 | #50003 | ~ | #50999 | R/W/- |
| Axis 10 | #51000 | #51001 | #51002 | #51003 | ~ | #51999 | R/W/- |
| Axis 11 | #52000 | #52001 | #52002 | #52003 | ~ | #52999 | R/W/- |
| Axis 12 | #53000 | #53001 | #53002 | #53003 | ~ | #53999 | R/W/- |
| Axis 13 | #54000 | #54001 | #54002 | #54003 | ~ | #54999 | R/W/- |
| Axis 14 | #55000 | #55001 | #55002 | #55003 | ~ | #55999 | R/W/- |
| Axis 15 | #56000 | #56001 | #56002 | #56003 | ~ | #56999 | R/W/- |
| Axis 16 | #57000 | #57001 | #57002 | #57003 | ~ | #57999 | R/W/- |

### B.3.7.3 Tool Radius/ Status (#42000~#57999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Tool radius | #58000 | #58001 | #58002 | #58003 | ~ | #58999 | R/W/- |
| Radius wear | #59000 | #59001 | #59002 | #59003 | ~ | #59999 | R/W/- |
| Tool status | #60000 | #60001 | #60002 | #60003 | ~ | #60999 | R/W/- |



### B.3.7.4 Tool Tolerance (#61000~#76999)

Tool tolerance # variable can be defined in the DOPSoft's tool table and then can be applied to tool wear, end tool detection by macro program.

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Axis 1 | #61000 | #61001 | #61002 | #61003 | ~ | #61999 | R/W/- |
| Axis 2 | #62000 | #62001 | #62002 | #62003 | ~ | #62999 | R/W/- |
| Axis 3 | #63000 | #63001 | #63002 | #63003 | ~ | #63999 | R/W/- |
| Axis 4 | #64000 | #64001 | #64002 | #64003 | ~ | #64999 | R/W/- |
| Axis 5 | #65000 | #65001 | #65002 | #65003 | ~ | #65999 | R/W/- |
| Axis 6 | #66000 | #66001 | #66002 | #66003 | ~ | #66999 | R/W/- |
| Axis 7 | #67000 | #67001 | #67002 | #67003 | ~ | #67999 | R/W/- |
| Axis 8 | #68000 | #68001 | #68002 | #68003 | ~ | #68999 | R/W/- |
| Axis 9 | #69000 | #69001 | #69002 | #69003 | ~ | #69999 | R/W/- |
| Axis 10 | #70000 | #70001 | #70002 | #70003 | ~ | #70999 | R/W/- |
| Axis 11 | #71000 | #71001 | #71002 | #71003 | ~ | #71999 | R/W/- |
| Axis 12 | #72000 | #72001 | #72002 | #72003 | ~ | #72999 | R/W/- |
| Axis 13 | #73000 | #73001 | #73002 | #73003 | ~ | #73999 | R/W/- |
| Axis 14 | #74000 | #74001 | #74002 | #74003 | ~ | #74999 | R/W/- |
| Axis 15 | #75000 | #75001 | #75002 | #75003 | ~ | #75999 | R/W/- |
| Axis 16 | #76000 | #76001 | #76002 | #76003 | ~ | #76999 | R/W/- |

B

## B.3.7.5 Tool Lifetime Target (#77000~92999)

These variables are tool lifetime setting for multi head machine.

Lathe and milling machine, please refer to tool lifetime description (#192000~#195999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Axis 1 | #77000 | #77001 | #77002 | #77003 | ~ | #77999 | R/W/- |
| Axis 2 | #78000 | #78001 | #78002 | #78003 | ~ | #78999 | R/W/- |
| Axis 3 | #79000 | #79001 | #79002 | #79003 | ~ | #79999 | R/W/- |
| Axis 4 | #80000 | #80001 | #80002 | #80003 | ~ | #80999 | R/W/- |
| Axis 5 | #81000 | #81001 | #81002 | #81003 | ~ | #81999 | R/W/- |
| Axis 6 | #82000 | #82001 | #82002 | #82003 | ~ | #82999 | R/W/- |
| Axis 7 | #83000 | #83001 | #83002 | #83003 | ~ | #83999 | R/W/- |
| Axis 8 | #84000 | #84001 | #84002 | #84003 | ~ | #84999 | R/W/- |
| Axis 9 | #85000 | #85001 | #85002 | #85003 | ~ | #85999 | R/W/- |
| Axis 10 | #86000 | #86001 | #86002 | #86003 | ~ | #86999 | R/W/- |
| Axis 11 | #87000 | #87001 | #87002 | #87003 | ~ | #87999 | R/W/- |
| Axis 12 | #88000 | #88001 | #88002 | #88003 | ~ | #88999 | R/W/- |
| Axis 13 | #89000 | #89001 | #89002 | #89003 | ~ | #89999 | R/W/- |
| Axis 14 | #90000 | #90001 | #90002 | #90003 | ~ | #90999 | R/W/- |
| Axis 15 | #91000 | #91001 | #91002 | #91003 | ~ | #91999 | R/W/- |
| Axis 16 | #92000 | #92001 | #92002 | #92003 | ~ | #92999 | R/W/- |

B

### B.3.7.6 Tool Lifetime Accumulation (#93000~108999)

These variables are tool actual lifetime setting for multi head machine.

Lathe and milling machine, please refer to tool lifetime description (#192000~#195999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Axis 1 | #93000 | #93001 | #93002 | #93003 | ~ | #93999 | R/W/- |
| Axis 2 | #94000 | #94001 | #94002 | #94003 | ~ | #94999 | R/W/- |
| Axis 3 | #95000 | #95001 | #95002 | #95003 | ~ | #95999 | R/W/- |
| Axis 4 | #96000 | #96001 | #96002 | #96003 | ~ | #96999 | R/W/- |
| Axis 5 | #97000 | #97001 | #97002 | #97003 | ~ | #97999 | R/W/- |
| Axis 6 | #98000 | #98001 | #98002 | #98003 | ~ | #98999 | R/W/- |
| Axis 7 | #99000 | #99001 | #99002 | #99003 | ~ | #99999 | R/W/- |
| Axis 8 | #100000 | #100001 | #100002 | #100003 | ~ | #100999 | R/W/- |
| Axis 9 | #101000 | #101001 | #101002 | #101003 | ~ | #101999 | R/W/- |
| Axis 10 | #102000 | #102001 | #102002 | #102003 | ~ | #102999 | R/W/- |
| Axis 11 | #103000 | #103001 | #103002 | #103003 | ~ | #103999 | R/W/- |
| Axis 12 | #104000 | #104001 | #104002 | #104003 | ~ | #104999 | R/W/- |
| Axis 13 | #105000 | #105001 | #105002 | #105003 | ~ | #105999 | R/W/- |
| Axis 14 | #106000 | #106001 | #106002 | #106003 | ~ | #106999 | R/W/- |
| Axis 15 | #107000 | #107001 | #107002 | #107003 | ~ | #107999 | R/W/- |
| Axis 16 | #108000 | #108001 | #108002 | #108003 | ~ | #108999 | R/W/- |

### B.3.7.7 Tool Lifetime (#192000~195999)

| | T1 | T2 | T3 | T4 | ~ | T1000 | Type |
|---|---|---|---|---|---|---|---|
| Tool target lifetime | #192000 | #192001 | #192002 | #192003 | ~ | #192999 | R/W/- |
| Tool actual use time | #193000 | #193001 | #193002 | #193003 | ~ | #193999 | R/W/- |
| Tool target lifetime count | #194000 | #194001 | #194002 | #194003 | ~ | #194999 | R/W/- |
| Tool actual used count | #195000 | #195001 | #195002 | #195003 | ~ | #195999 | R/W/● |

# Revision History

| Release Date | Version | Chapter | Revision contents |
|---|---|---|---|
| Jan, 2024 | | CH1.3 | Revise rear side interface layout of NC500E series. |
| Dec, 2023 | V1.0 | | |

Smarter. Greener. Together.

## Industrial Automation Headquarters

**Taiwan:** Delta Electronics, Inc.
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan District,
Taoyuan City 33068, Taiwan
TEL: +886-3-362-6301 / FAX: +886-3-371-6301

## Asia

**China:** Delta Electronics (Shanghai) Co., Ltd.
No.182 Minyu Rd., Pudong Shanghai, P.R.C.
Post code : 201209
TEL: +86-21-6872-3988 / FAX: +86-21-6872-3996
Customer Service: 400-820-9595

**Japan:** Delta Electronics (Japan), Inc.
Industrial Automation Sales Department
2-1-14 Shibadaimon, Minato-ku
Tokyo, Japan 105-0012
TEL: +81-3-5733-1155 / FAX: +81-3-5733-1255

**Korea:** Delta Electronics (Korea), Inc.
1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,
Seoul, 08501 South Korea
TEL: +82-2-515-5305 / FAX: +82-2-515-5302

**Singapore:** Delta Energy Systems (Singapore) Pte Ltd.
4 Kaki Bukit Avenue 1, #05-04, Singapore 417939
TEL: +65-6747-5155 / FAX: +65-6744-9228

**India:** Delta Electronics (India) Pvt. Ltd.
Plot No.43, Sector 35, HSIIDC Gurgaon,
PIN 122001, Haryana, India
TEL: +91-124-4874900 / FAX: +91-124-4874945

**Thailand:** Delta Electronics (Thailand) PCL.
909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),
Pattana 1 Rd., T.Phraksa, A.Muang,
Samutprakarn 10280, Thailand
TEL: +66-2709-2800 / FAX: +66-2709-2827

**Australia:** Delta Electronics (Australia) Pty Ltd.
Unit 2, Building A, 18-24 Ricketts Road,
Mount Waverley, Victoria 3149 Australia
Mail: IA.au@deltaww.com
TEL: +61-1300-335-823 / +61-3-9543-3720

## Americas

**USA:** Delta Electronics (Americas) Ltd.
5101 Davis Drive, Research Triangle Park, NC 27709, U.S.A.
TEL: +1-919-767-3813 / FAX: +1-919-767-3969

**Brazil:** Delta Electronics Brazil Ltd.
Estrada Velha Rio-São Paulo, 5300 Eugênio de
Melo - São José dos Campos CEP: 12247-004 - SP - Brazil
TEL: +55-12-3932-2300 / FAX: +55-12-3932-237

**Mexico:** Delta Electronics International Mexico S.A. de C.V.
Gustavo Baz No. 309 Edificio E PB 103
Colonia La Loma, CP 54060
Tlalnepantla, Estado de México
TEL: +52-55-3603-9200

## EMEA

**EMEA Headquarters:** Delta Electronics (Netherlands) B.V.
Sales: Sales.IA.EMEA@deltaww.com
Marketing: Marketing.IA.EMEA@deltaww.com
Technical Support: iatechnicalsupport@deltaww.com
Customer Support: Customer-Support@deltaww.com
Service: Service.IA.emea@deltaww.com
TEL: +31(0)40 800 3900

**BENELUX:** Delta Electronics (Netherlands) B.V.
Automotive Campus 260, 5708 JZ Helmond, The Netherlands
Mail: Sales.IA.Benelux@deltaww.com
TEL: +31(0)40 800 3900

**DACH:** Delta Electronics (Netherlands) B.V.
Coesterweg 45, D-59494 Soest, Germany
Mail: Sales.IA.DACH@deltaww.com
TEL: +49 2921 987 238

**France:** Delta Electronics (France) S.A.
ZI du bois Challand 2, 15 rue des Pyrénées,
Lisses, 91090 Evry Cedex, France
Mail: Sales.IA.FR@deltaww.com
TEL: +33(0)1 69 77 82 60

**Iberia:** Delta Electronics Solutions (Spain) S.L.U
Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.
Hormigueras – P.I. de Vallecas 28031 Madrid
TEL: +34(0)91 223 74 20

Carrer Llacuna 166, 08018 Barcelona, Spain
Mail: Sales.IA.Iberia@deltaww.com

**Italy:** Delta Electronics (Italy) S.r.l.
Via Meda 2–22060 Novedrate(CO)
Piazza Grazioli 18 00186 Roma Italy
Mail: Sales.IA.Italy@deltaww.com
TEL: +39 039 8900365

**Turkey:** Delta Greentech Elektronik San. Ltd. Sti. (Turkey)
Şerifali Mah. Hendem Cad. Kule Sok. No:16-A
34775 Ümraniye – İstanbul
Mail: Sales.IA.Turkey@deltaww.com
TEL: + 90 216 499 9910

**MEA:** Eltek Dubai (Eltek MEA DMCC)
OFFICE 2504, 25th Floor, Saba Tower 1,
Jumeirah Lakes Towers, Dubai, UAE
Mail: Sales.IA.MEA@deltaww.com
TEL: +971(0)4 2690148

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