Digitized Automation for a Changing World

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

www.deltaww.com

ΔELTΔ

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. ■ 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. ■ Properly set the parameters before operating the machine, or it may cause abnormal operation or malfunction. ■ 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).

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Introduction of NC System Operation

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System Parameters

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MLC Special M Relay and Special D Register

A   CNC Alarm Information

B   Special Memory

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 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.

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1.2 NC5 series product model explanation

■ Nameplate information

Model Name - - - - →
Power Input - - - - →

Bar Code & - - - - →
Serial Number

MODLE: NC50E-FE
INPUT : DC +24V Class 2 / 800 mA

NC50EFE0W21480035

Designed by DELTA Taiwan
No.18, Xinglong Rd., Taoyuan City 33068, Taiwan   MADE IN Taiwan

DELTA ELECTRONICS, INC.
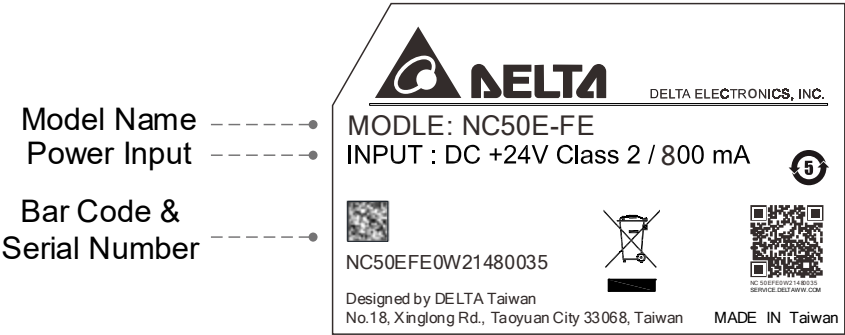
■ Model explanation

NC series controller (MOP integrated)

NC500E□-FIE-□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 1: 10.4" screen 2: 15" screen
(4)	Screen orientation	0: Horizontal 1: Vertical
(5)	Series type	E: Economic S: Standard
(6)	Interpolate axes	Blank: Below 4 axes interpolation H: 5 axes interpolate
(7)	Field type	L: Lathe F: General purpose
(8)	Model type	I: Integrated P: Integrated with MPG S: Separated
(9)	Communication field bus	E: EtherCAT field bus
(10)	Screen Type	Blank: Non-touch screen C: Capacitance type touch screen R: Resistance type touch screen
(11)	Language	T: Traditional Chinese S: Simplified Chinese E: English

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OPNCNC series controller

$$\underline{\text{NC}}\ \underline{5}\underline{0}\underline{E}\underline{\square}-\ \underline{\text{F}}\underline{\text{E}}$$
(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 S: Standard
(5)	Interpolate axes	Blank: Below 4 axes interpolation H: 5 axes interpolate
(6)	Model	F: General purpose W: Wood working
(7)	Communication field bus	E: EtherCAT field bus

1.3 Product interface of NC controller

NC500E series

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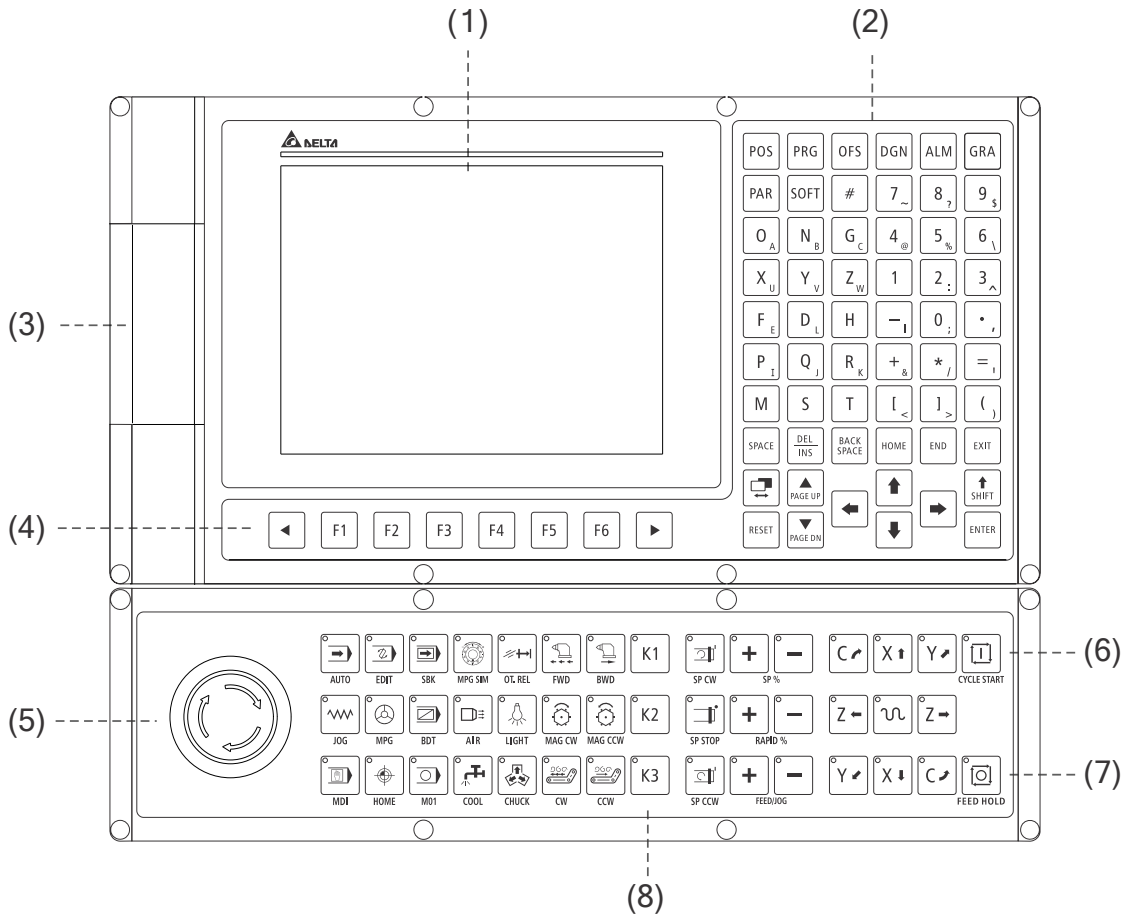
No.	Item	No.	Item
(1)	Screen	(5)	Emergency stop
(2)	1st Machine operation panel	(6)	CYCLE START
(3)	USB port	(7)	FEED HOLD
(4)	Function keys	(8)	2nd Machine operation panel

1

Rear interface
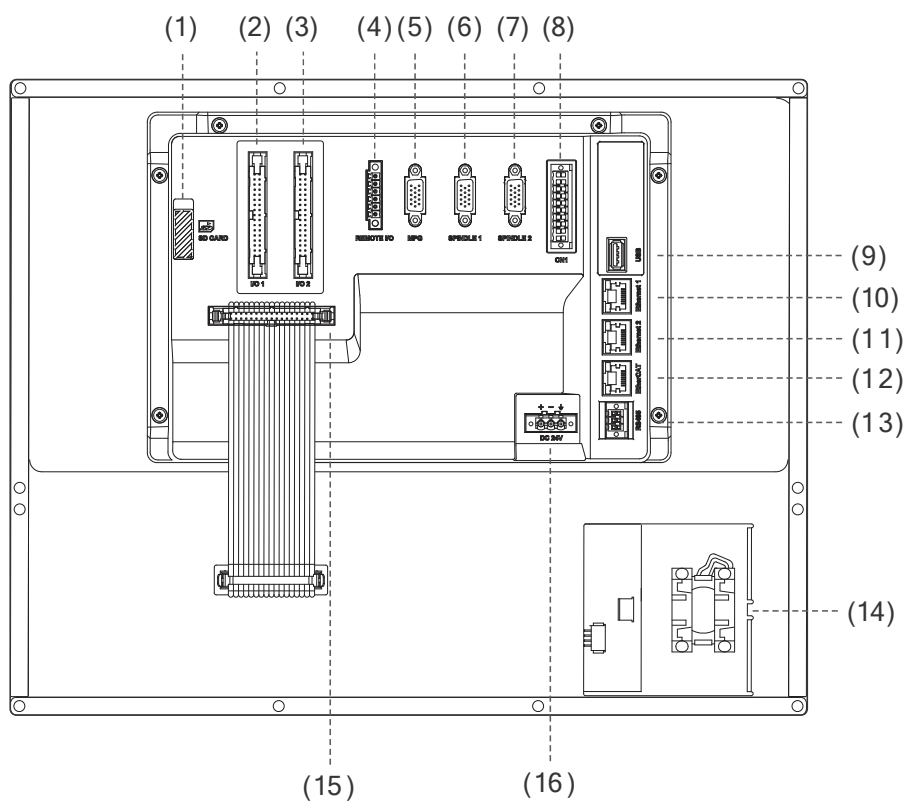
No.	Item	NC500E-LIE	NC500E-FIE
(1)	Micro SD card slot	●	●
(2)	I/O 1 connector	N/A	●
(3)	I/O 2 connector	N/A	●
(4)	MPG connector	●	●
(5)	Spindle 1	●	●
(6)	Spindle 2	N/A	●
(7)	CN1 function connector	● (Without Endat and only one analog output)	●
(8)	USB port (connect mouse, keyboard or USB drive)	●	●
(9)	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
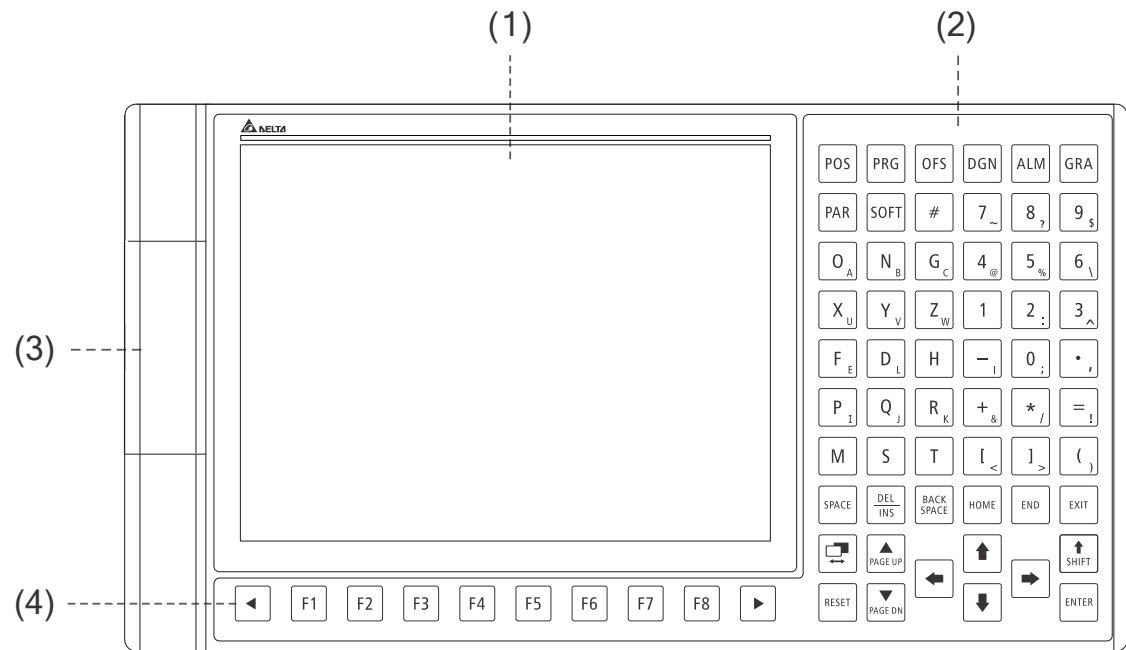
No.	Item	No.	Item
(1)	Screen	(3)	USB port (connect mouse, keyboard or USB drive)
(2)	1st Machine operation panel	(4)	Function keys

1

Rear interface
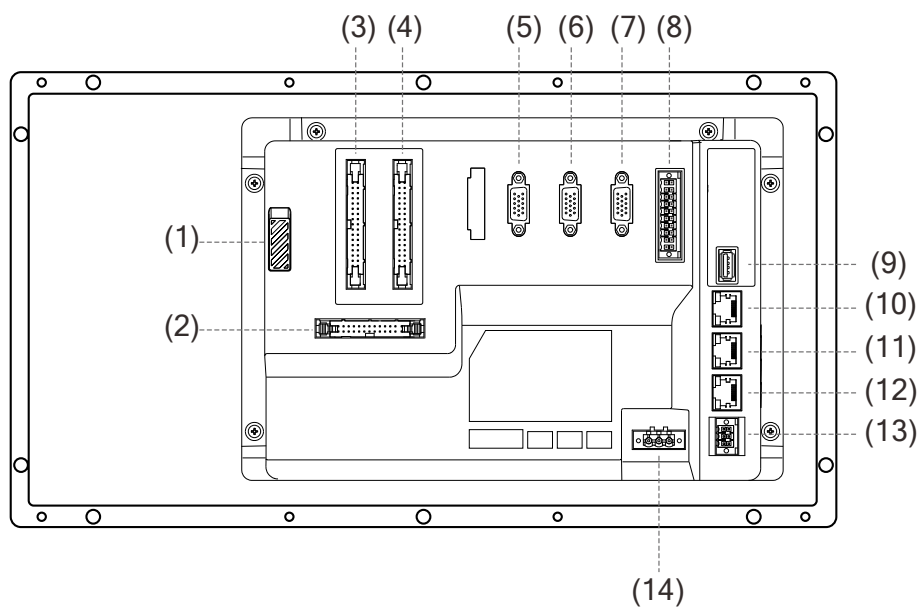
No.	Item	NC510E-CSE	NC510E-FSE	NC510EH-FSE
(1)	Micro SD card slot	●	●	●
(2)	2nd Machine operation panel cable connector	●	●	●
(3)	I/O 1 connector	●	●	●
(4)	I/O 2 connector	●	●	●
(5)	MPG connector	●	●	●
(6)	Spindle 1	N/A	●	●
(7)	Spindle 2	N/A	●	●
(8)	CN1 function connector	● (without Endat)	●	●
(9)	USB 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	●	●	●

1

NC50E series
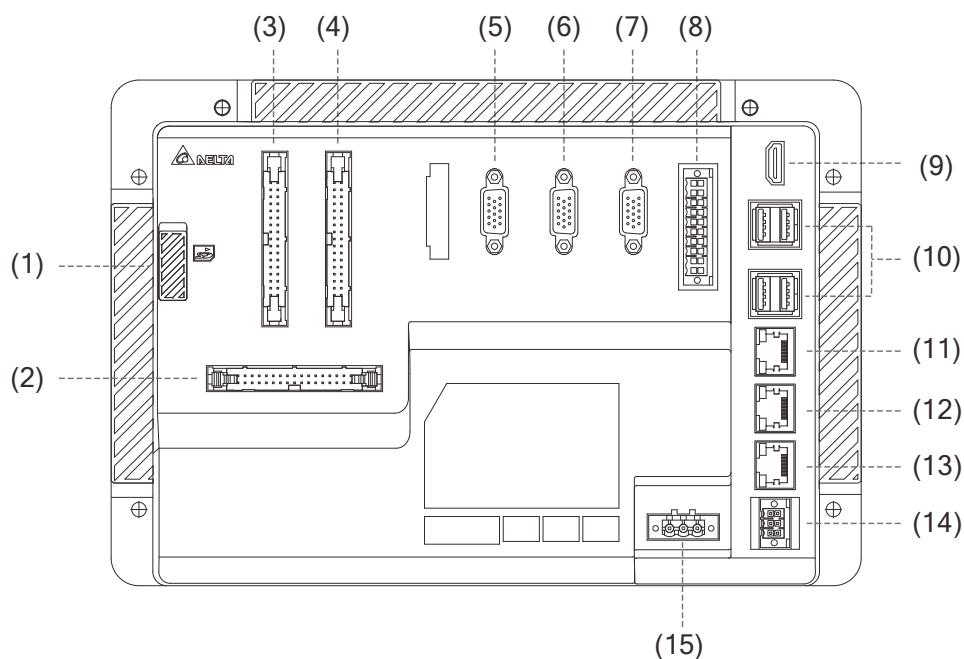
No.	Item	NC50E-WE	NC50E-FE	NC50EH-FE
(1)	Micro SD card slot	●	●	●
(2)	2nd Machine operation panel cable connector	N/A	●	●
(3)	I/O 1 connector	●	●	●
(4)	I/O 2 connector	●	●	●
(5)	MPG connector	●	●	●
(6)	Spindle 1	N/A	●	●
(7)	Spindle 2	N/A	●	●
(8)	CN1 function connector	● (Without Endat and only one analog 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

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

■ NC50E series

Item	Function	NC50E-WE	NC50E-FE	NC50EH-FE
CN1	Endat Encoder input	N/A	1	1
	HSI High speed input	8	8	8
	EMG input	1	1	1
	Analog output	1	2	2
Spindle 1	OA/OB/OZ Encoder pulse input	N/A	1	1
	A/B phase 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 Encoder pulse input	N/A	1	1
	A/B phase Pulse output		1	1
	Servo on output		1	1
	Alarm input		1	1
	5V$_{DC}$ output		1	1
MPG	A/B phase 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	2nd Machine operation panel cable connector 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

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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

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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: 500V_{AC} for 1 minute	
Power consumption	36 W (24 V; 1.5 A)	
Digital input type	24V_{DC} / 5mA; frequency 1K Hz	
Digital input activate level	Off→On: above 15 V_{DC} On→Off: below 5 V_{DC}	
Digital output type	24 V_{DC} optical coupling interface, frequency 1K Hz Load: < 100 mA / 1 point (25°C), < 50 mA / 1 point (85°C)	
Digital output response time	Off→On < 300 µs On→Off < 100 µs	
Battery	3V lithium battery (CR2032) × 1 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 Continuously vibration 5 Hz ~ 8.3 Hz 3.5 mm, 8.3 Hz ~ 150 Hz 1G	
Shock withstanding	IEC 60068-2-27 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)	400 x 320 x 121	400 x 220 x 92
Weight (kg)	4.4	3

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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: 500V_{AC} for 1 minute
Power consumption	24 W (24V ; 1 A)
Digital input type	24V_{DC} / 5mA; frequency 1K Hz
Digital input activate level	Off→On: above 15 V_{DC} On→Off: below 5 V_{DC}
Digital output type	24 V_{DC} optical coupling interface, frequency 1K Hz Load: < 100 mA / 1 point (25°C), < 50 mA / 1 point (85°C)
Digital output response time	Off→On < 300 µs On→Off < 100 µs
Battery	3V lithium battery (CR2032) × 1 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 Continuously vibration 5 Hz ~ 8.3 Hz 3.5 mm, 8.3 Hz ~ 150 Hz 1G
Shock withstanding	IEC 60068-2-27 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

2.1.5 Outline and mounting dimensions

NC500E series

■ Front side and mounting dimensions.
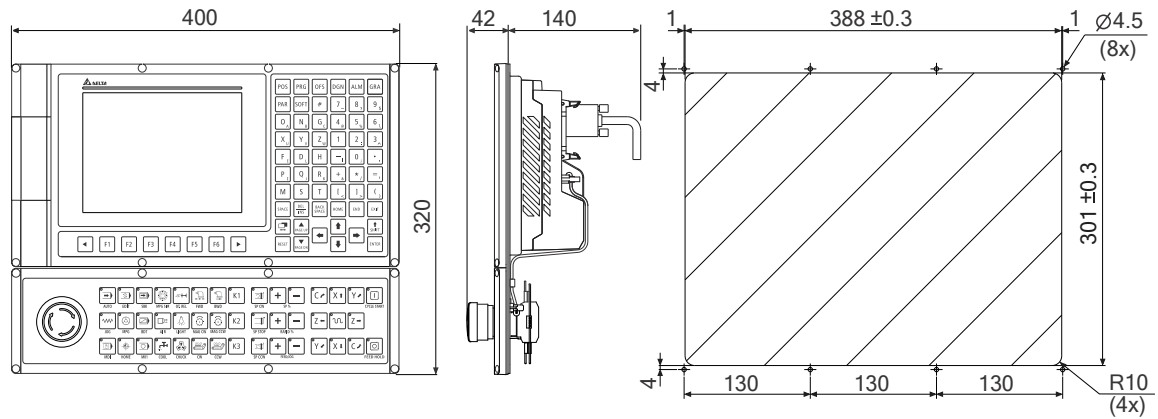
NC510E series

■ Front side and mounting dimensions.
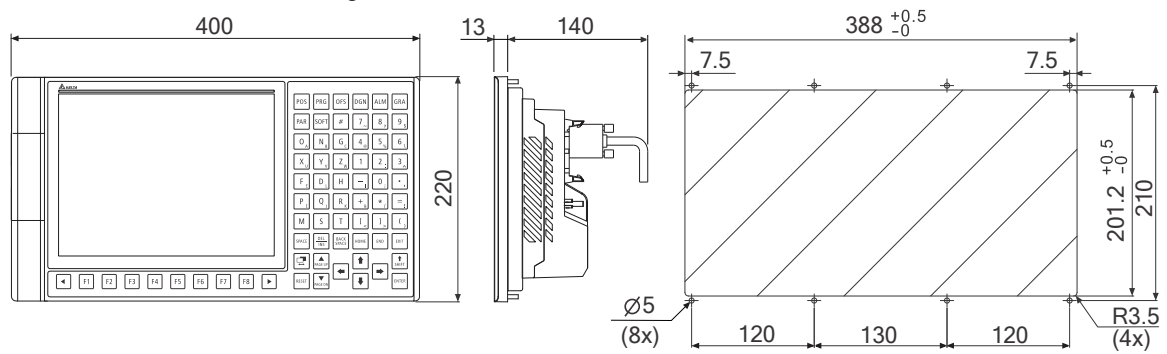
NC50E series

■ Front side and mounting dimensions.

Unit: mm (inch)
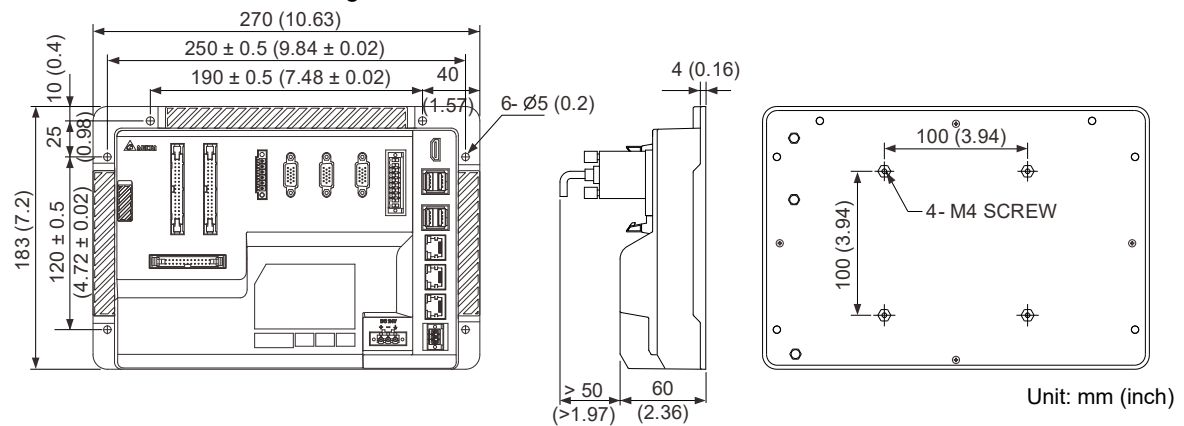
2.2 NC5 series product

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
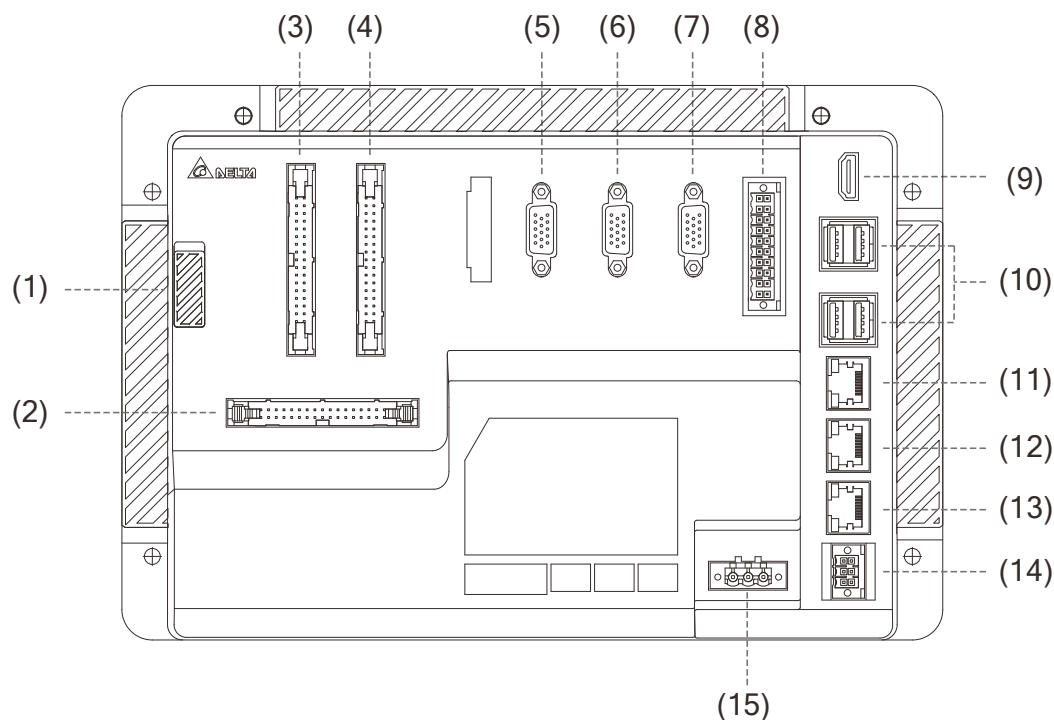
Introduction of each connector

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. 16 sets NPN 24V digital output interface.
(4)	I/O 2	16 sets NPN / PNP 24V digital input interface. 16 sets NPN 24V digital output interface.
(5)	MPG	MPG device connector. Provides 5 V_{DC} power output. 8 sets NPN / PNP digital input interface.
(6)	SPINDLE 1	The 1st spindle encoder pulse feedback input. The 1st spindle pulse control output.
(7)	SPINDLE 2	The 2nd spindle encoder pulse feedback input. The 2nd spindle pulse control output.

No.	connector	Description
(8)	CN1*	8 sets NPN / PNP 24V high speed digital input interface. 2 sets analog voltage output. 1 set ENDAT communication. 1 set Emergency stop digital input. *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. *This connector ONLY support on OpenCNC type NC5xE series products.
(10)	USB*	USB host connectors for connecting to the mouse, keyboard, and flash drive. *NC5xxE series module support 1 set connector. *NC5xE series OpenCNC module support 4 sets connectors.
(11)	Ethernet 1	1st ethernet connector. 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

2.2.2 NC5 series connectors

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

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. 1 set of differential type MPG pulse signal input.	
		Pin No.	Description
		P1	DI_COM; connects to +24 V$_{DC}$ or 0V

2

2

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 V_{DC} power
	0V	0 V_{DC} ground
	⏚	Noise signal grounding
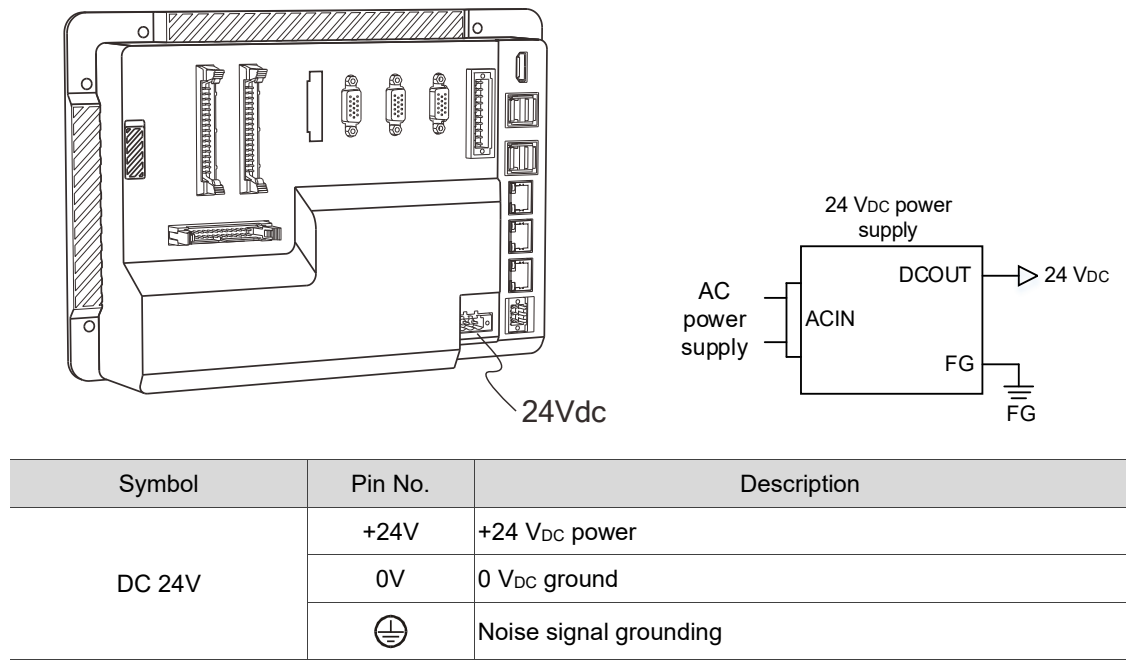
2.2.4 Wiring for spindle connector

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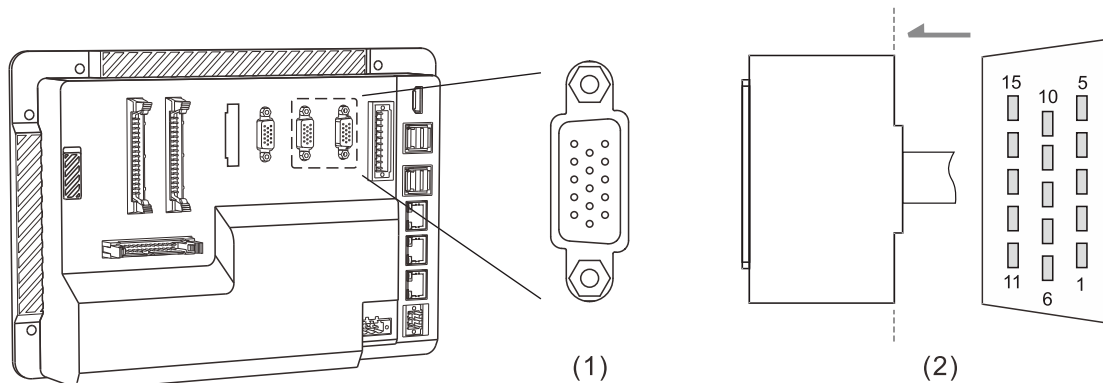
(1) Spindle connector   (2) Spindle connector pin definition

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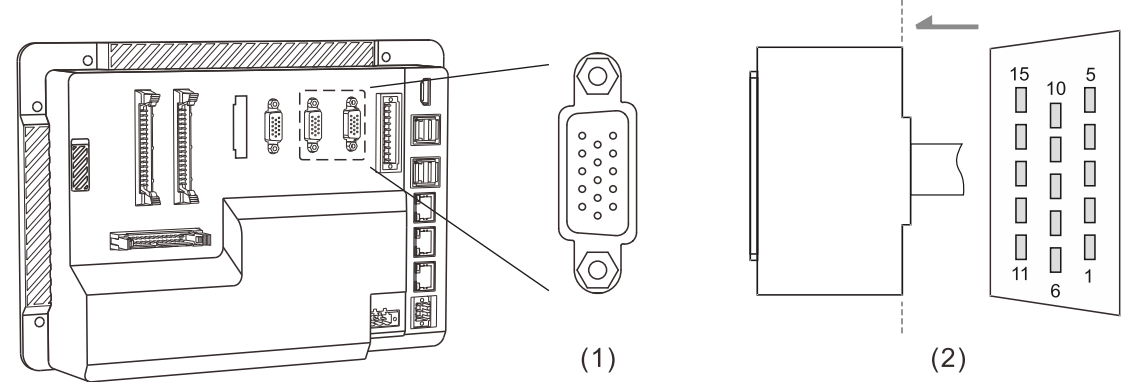
(1) Spindle connector   (2) Spindle pulse output connector pin definition

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

2.2.4.2 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.
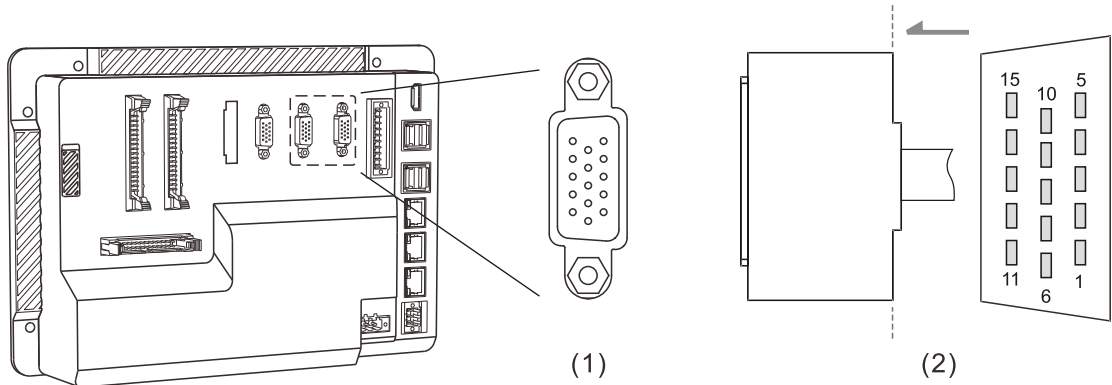
(1) Spindle connector   (2) Spindle pulse feedback connector pin definition

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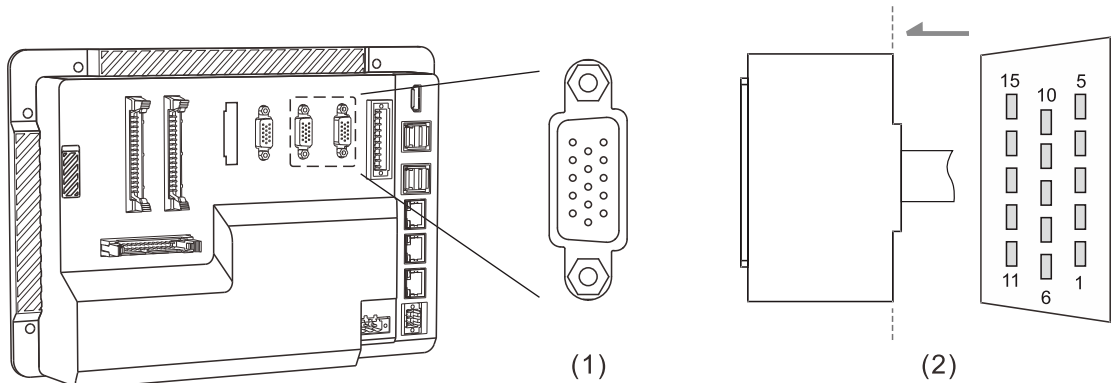
(1) Spindle connector　(2) Spindle status connector pin definition

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.
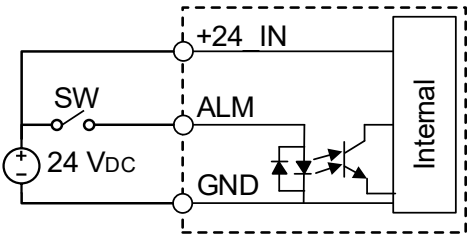
■　Spindle motor enable status output
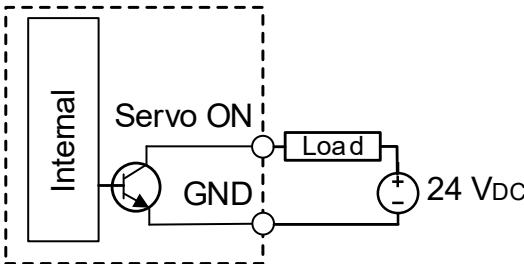
2.2.5 Wiring for CN1 connector

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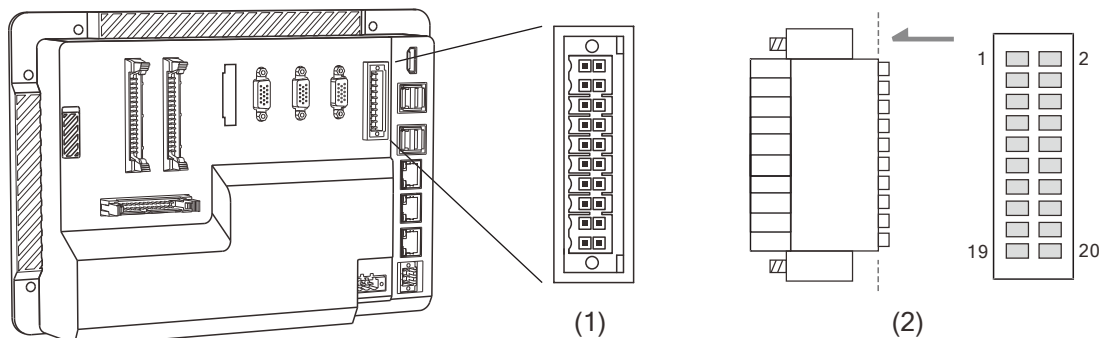
(1) CN1 connector   (2) CN1 connector pin definition

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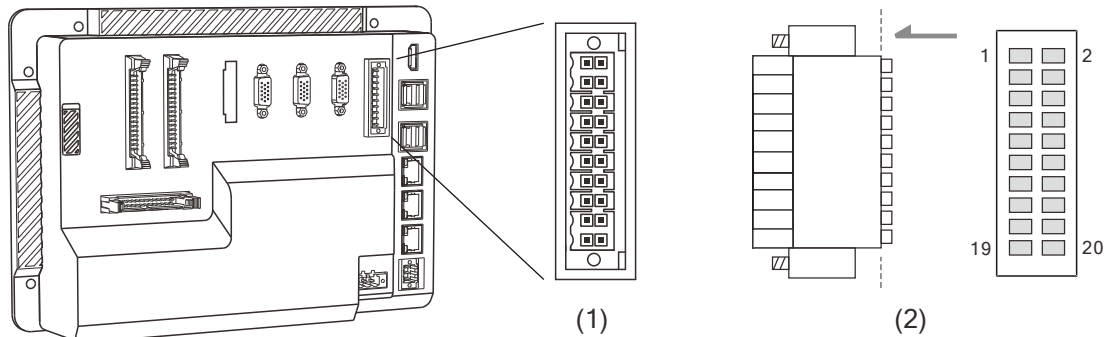
(1) CN1 connector   (2) CN1 analog output connector pin definition

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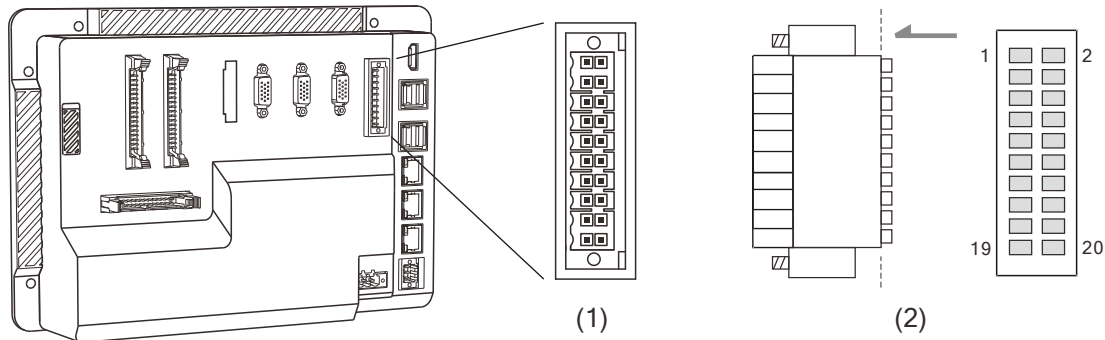
(1) CN1 connector   (2) CN1 emergency connector pin definition

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} ~ 26V_{DC}, current limitation is between 8 ~ 20 mA and peak current is below 50 mA.
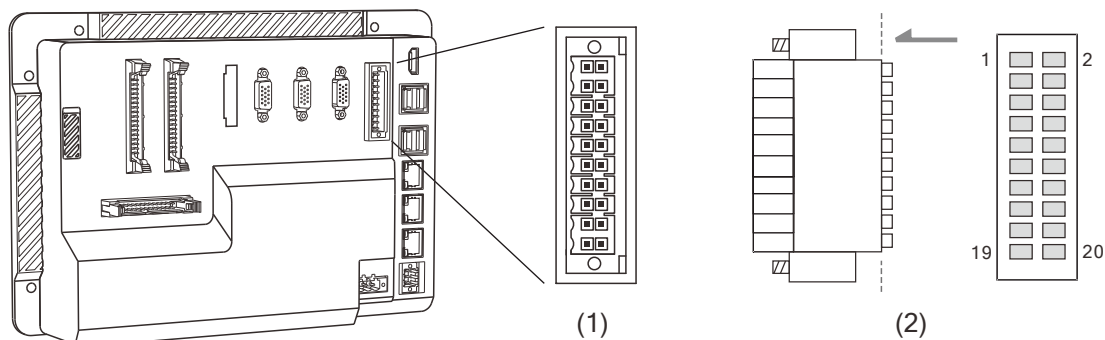
(1) CN1 connector   (2) CN1 HSI connector pin definition

Symbol	Pin No.		Description
	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
HSI	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.
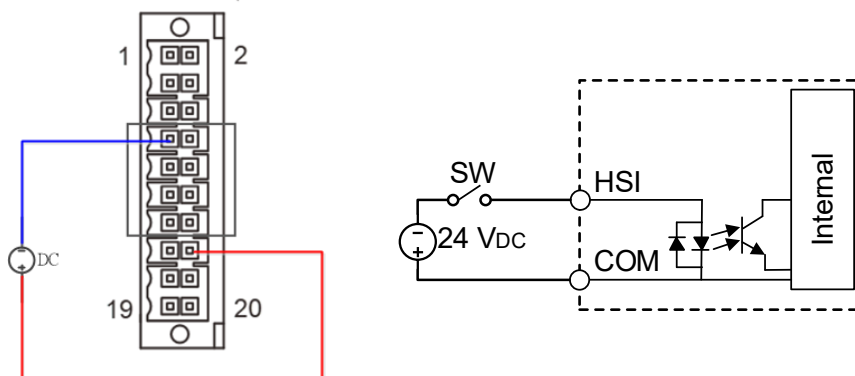
■   HSI for PNP wiring

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.
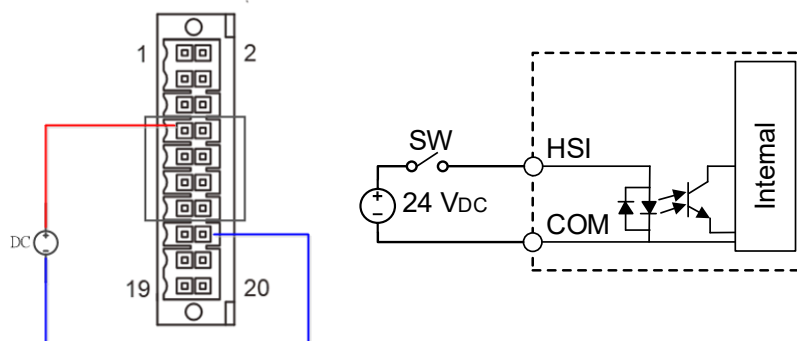
2.2.6 Wiring for MPG connector

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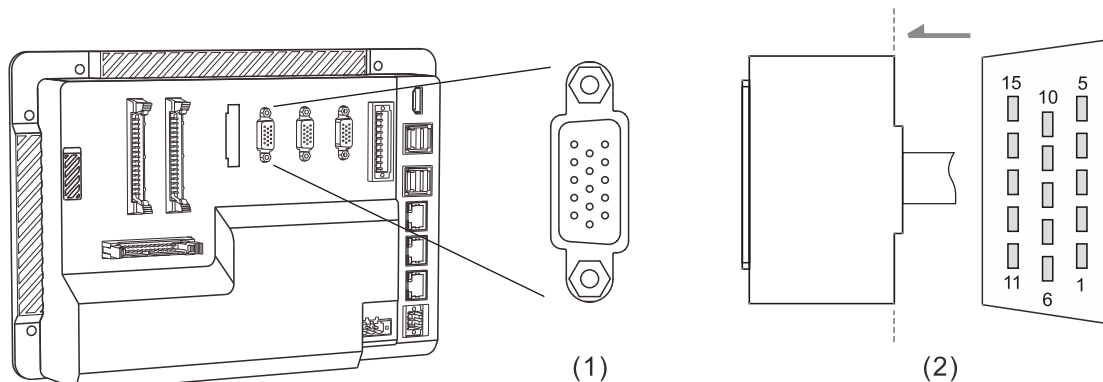
(1) MPG connector　　(2) MPG connector pin definition

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 This connector will be the 3rd MPG's XA+ when 3 set MPG enabled
	7	DI_6	X37; recommend connect to x100 ratio selection This connector will be the 3rd MPG's XB+ when 3 set MPG enabled
	8	DI_7	X38; recommend connect to A axis selection This connector will be the 2nd MPG's XA+ when 3 set MPG enabled
	9	DI_8	X39; recommend connect to B axis selection 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.

Wiring for MPG digital signal.

■   MPG connector provides 5V_{DC} output directly.
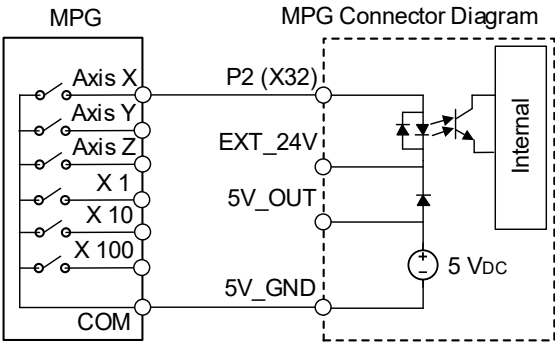
■   MPG device power source from power supply as 24V_{DC}. The EXT_24 can connect +24V as NPN type or 0V as PNP type wiring.
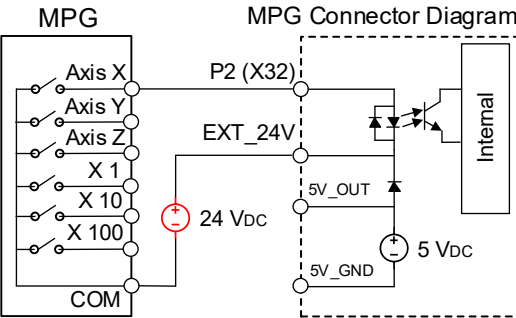
NPN wiring
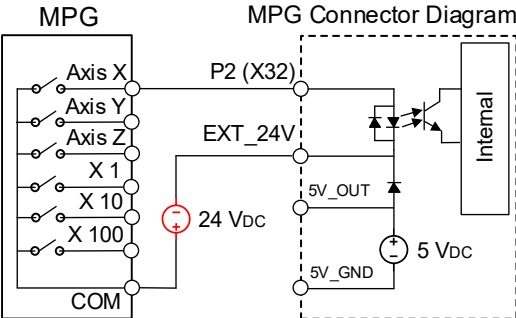
PNP wiring

2.2.7 Wiring for local I/O connector

The NC 5 series controller provides local I/Os for digital signal control.
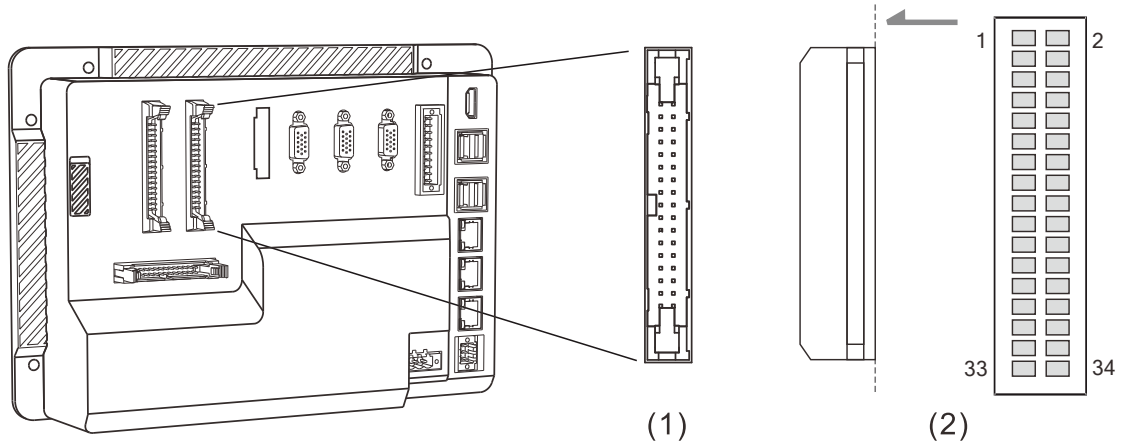
(1) Local I/O connector   (2) Local I/O connector pin definition

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

2

■ DI signal for NPN wiring: COM connector connect to +24 V_{DC} all the other digital input connects to ground 0 V_{DC}.
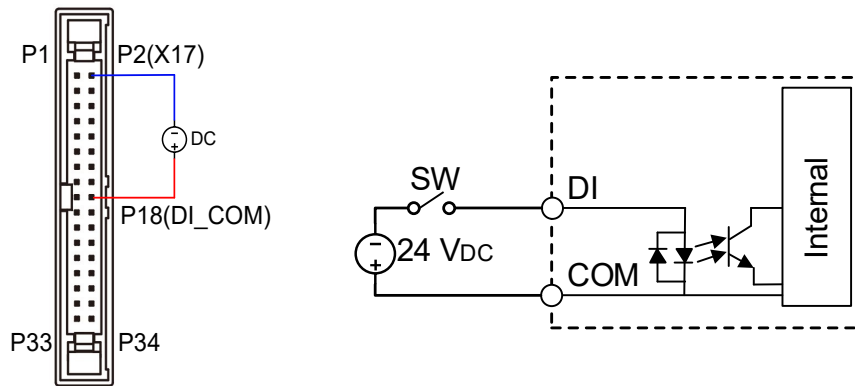
■ DI signal for PNP wiring: COM connector connect to ground 0 V_{DC} all the other digital input connects to +24 V_{DC}.
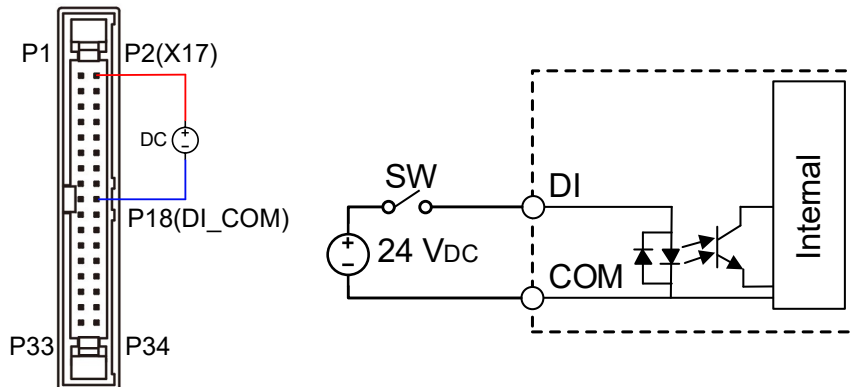
■ DO signal only support for NPN wiring: COM connector connect to ground 0 V_{DC} all the other digital output connects to +24 V_{DC}.
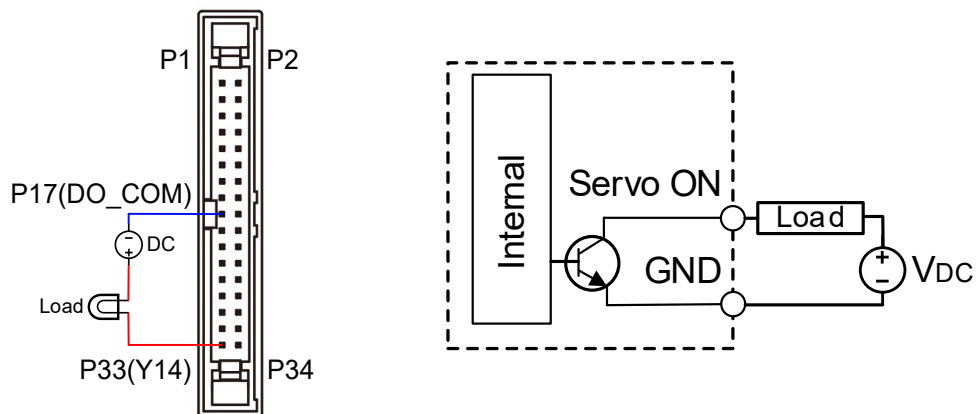
2.2.8 Wiring for RS485 connector

The NC 5 series controller provides one RS-485 series communication port for other devices communication with CNC via Modbus protocol.
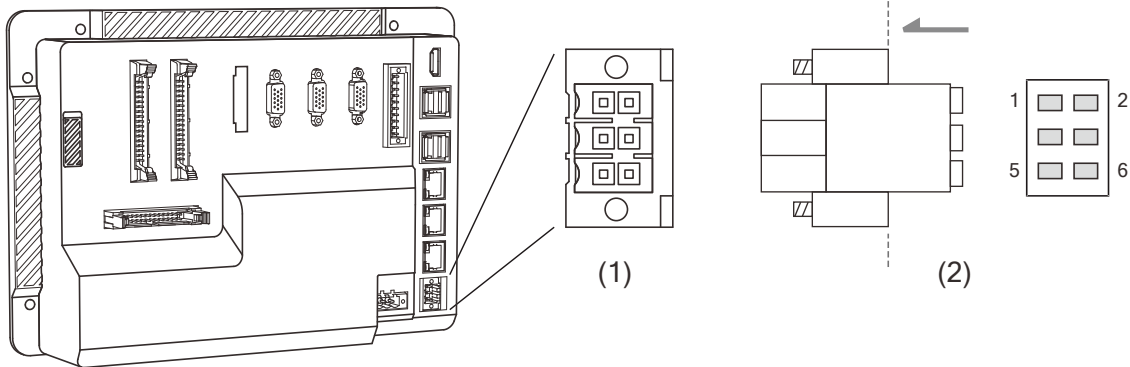
(1) RS485 connector   (2) RS-485 connector pin definition

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

2.3 EtherCAT remote module

2.3.1 Remote power module R1-EC5500

R1-EC5500 Model explanation

$$\underset{(1)(2)}{\underline{R\ 1}} - \underset{(3)}{\underline{EC}}\ \underset{(4)}{\underline{5}}\ \underset{(5)}{\underline{5}}\ \underset{(6)}{\underline{00}}$$

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
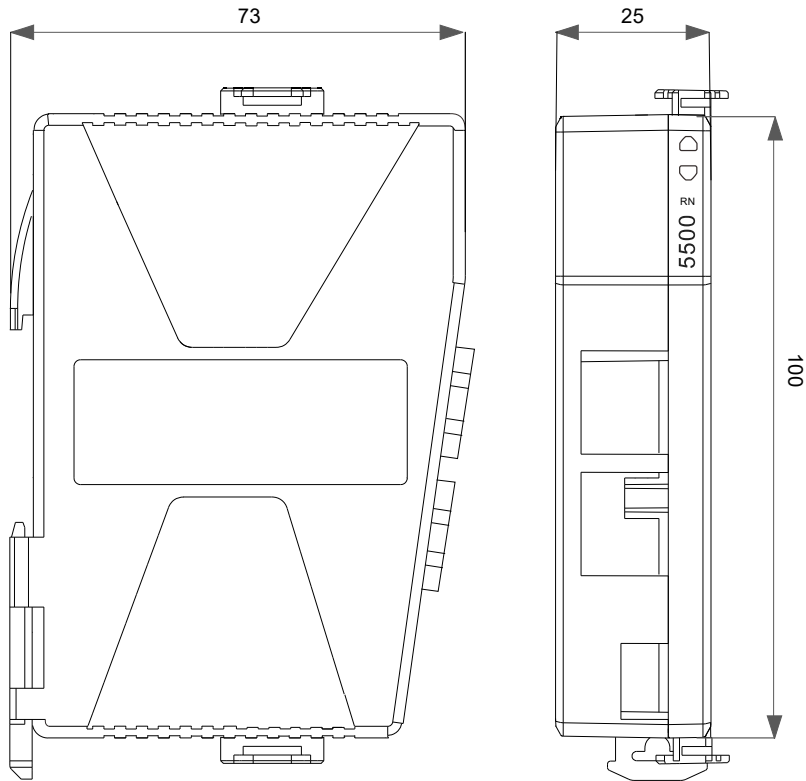
2
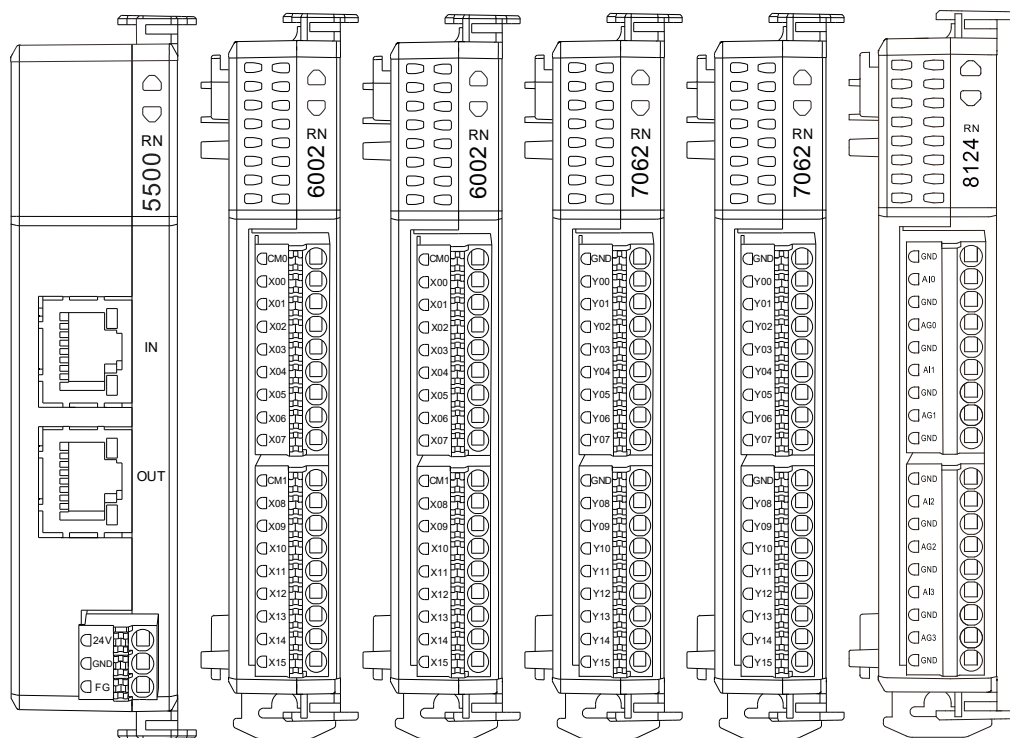
Module Type	Module Name	Power Supply	Consumption
Remote power module	R1-EC5500	2.0A (2000mA)	
Remote digital input module	R1-EC6xx2		120mA
Remote digital output module	R1-EC7062 R1-EC70A2		120mA
Remote digital output module	R1-EC70E2 R1-EC70F2		200mA
Remote analog input module	R1-EC8124		300mA

*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**
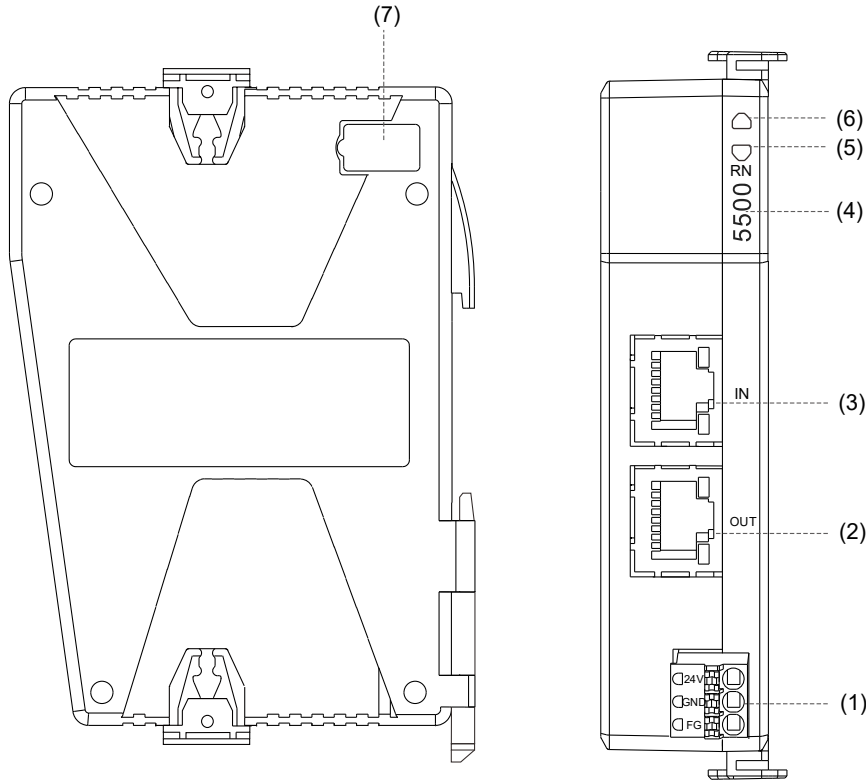
■ Product interface of R1-EC5500

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

2

■ R1-EC5500 EtherCAT communication port description
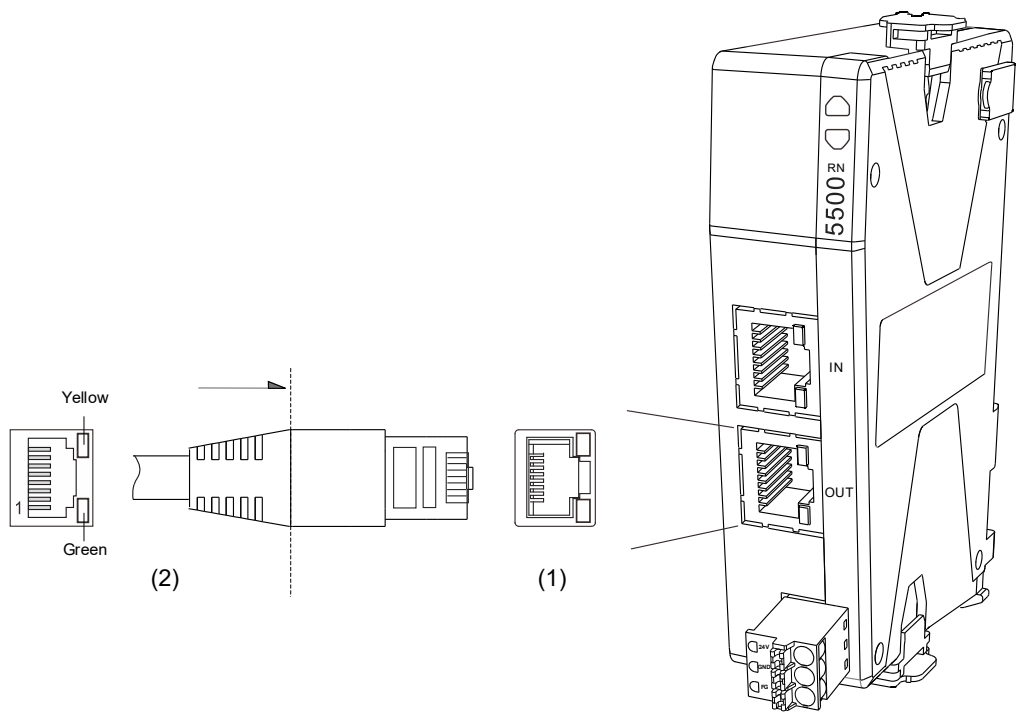
(1) EtherCAT connector ; (2) EtherCAT cable side

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

$$\underset{(1)}{\underline{R}}\,\underset{(2)}{\underline{1}} - \underset{(3)}{\underline{EC}}\,\underset{(4)}{\underline{6}}\,\underset{(5)}{\underline{X}}\,\underset{(6)}{\underline{X}}\,\underset{(7)}{\underline{2}}$$

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

2

R1-EC6xx2 device interface introduction
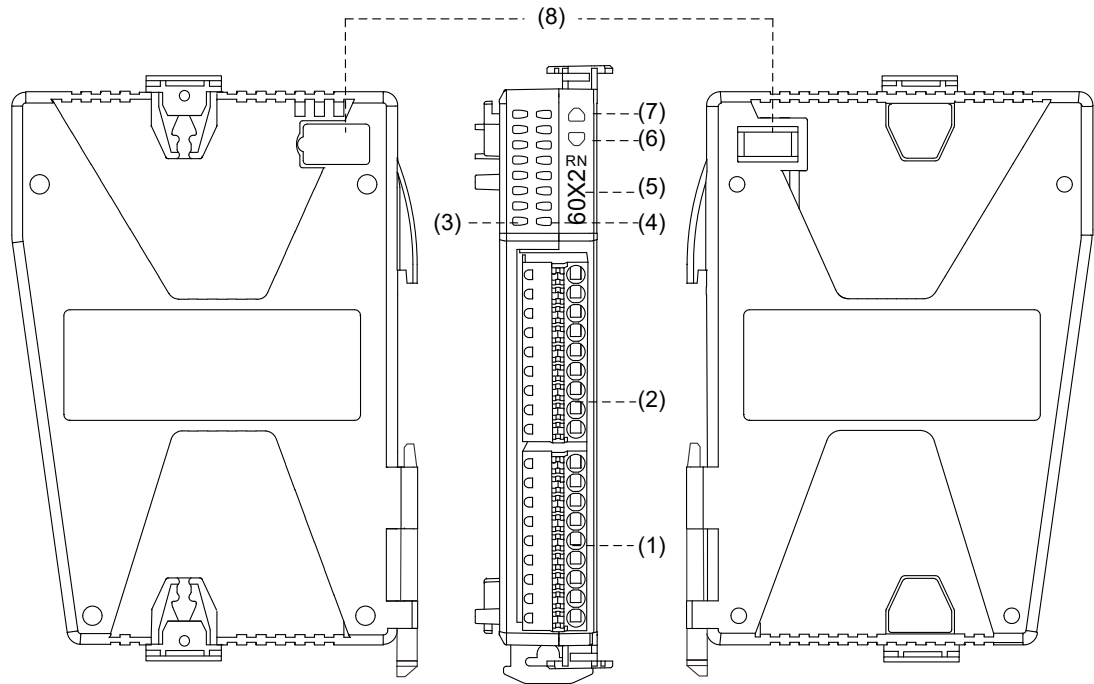
No.	Description
(1)	Port 1 IO
(2)	Port 0 IO
(3)	X00 – X07 I/O signal display for Port 0 (from top to bottom)
(4)	X08 – X15 I/O signal display for Port 1 (from top to bottom)
(5)	Product number (6002 / 6022)
(6)	Status indicator
(7)	Power indicator
(8)	E-BUS transmission port

2

R1-EC6xx2 I/O port description

■   R1-EC60X2 Port 0 pin definition

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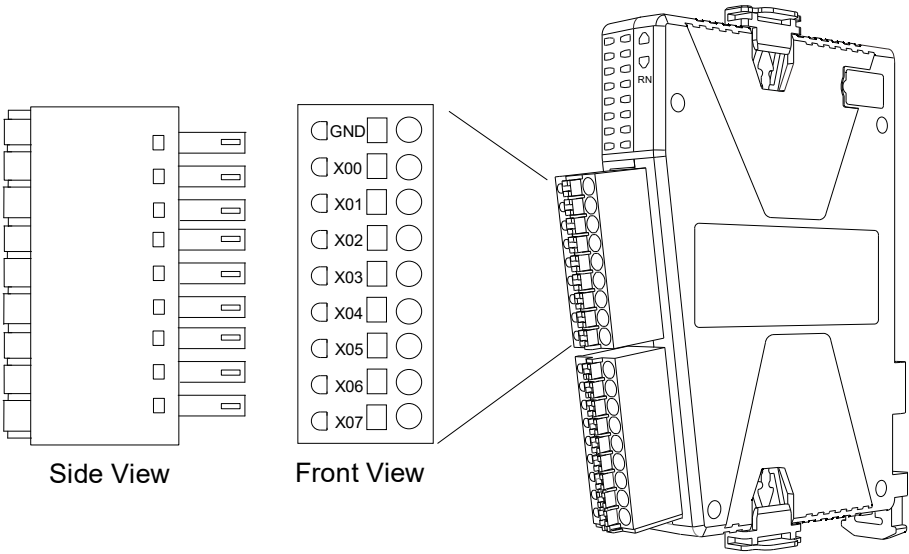
Symbol	Description
CM0	Port 0 power / grounding common point (COM) type input
X00	1st set of input of Port 0
X01	2nd set of input of Port 0
X02	3rd set of input of Port 0
X03	4th set of input of Port 0
X04	5th set of input of Port 0
X05	6th set of input of Port 0
X06	7th set of input of Port 0
X07	8th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

2

■ R1-EC60X2 Port 1 pin definition

Side View   Front View
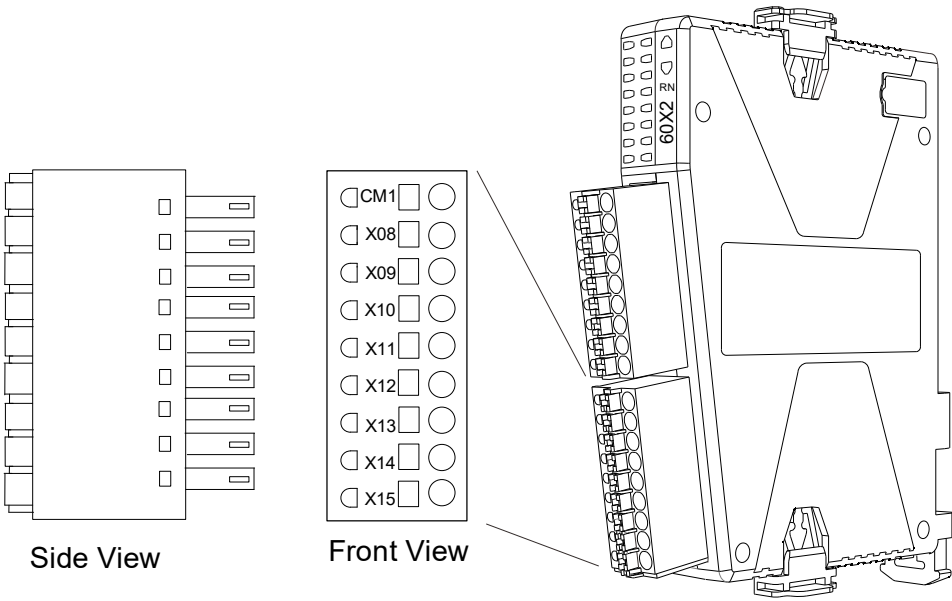
Symbol	Description
CM1	Port 1 power / grounding common point (COM) type input
X08	1st set of input of Port 1
X09	2nd set of input of Port 1
X10	3rd set of input of Port 1
X11	4th set of input of Port 1
X12	5th set of input of Port 1
X13	6th set of input of Port 1
X14	7th set of input of Port 1
X15	8th 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).
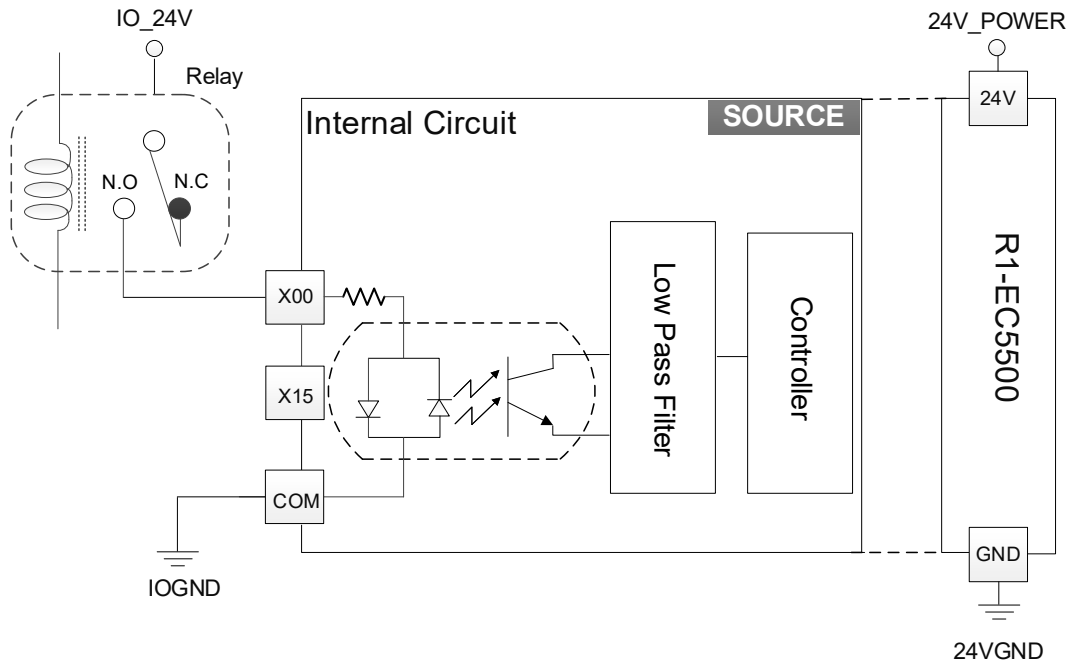
2.3.3 Remote digital output module - R1-EC7_ _2

R1-EC70x2 model name explanation

$$\underset{(1)}{R} \underset{(2)}{1} - \underset{(3)}{EC} \underset{(4)}{7} \underset{(5)}{X} \underset{(6)}{X} \underset{(7)}{2}$$

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 Output retentive when disconnect.
		A	A: PNP type / 24 V_{DC} / 0.25 A Output retentive when disconnect.
		E	E: NPN type / 24 V_{DC} / 0.25 A Configurable output retentive or not when disconnect.
		F	F: PNP type / 24 V_{DC} / 0.25 A 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
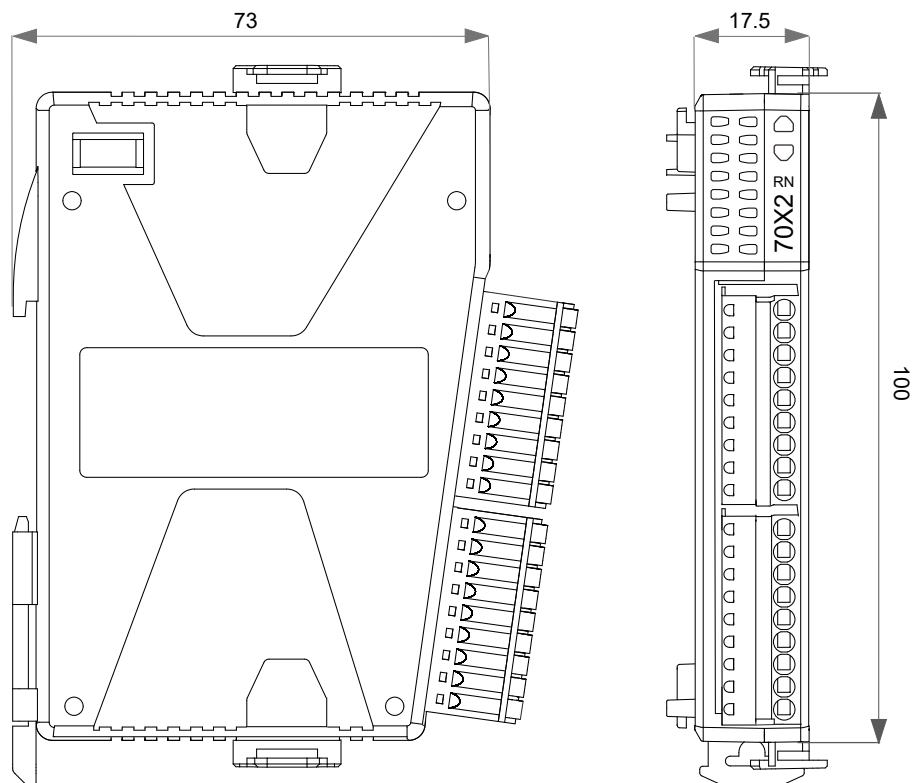
■ R1-EC70X2 electrical specifications

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) ; 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) EFT (IEC 61131-2, IEC 61000-4-4) RS (IEC 61131-2, IEC 61000-4-3)			
Protection level	IP20			
Approvals	CE UL CERTIFIED SAFETY US-CA E206327 IND. CONT. EQ.			

2

■ Product interface of R1-EC70X2
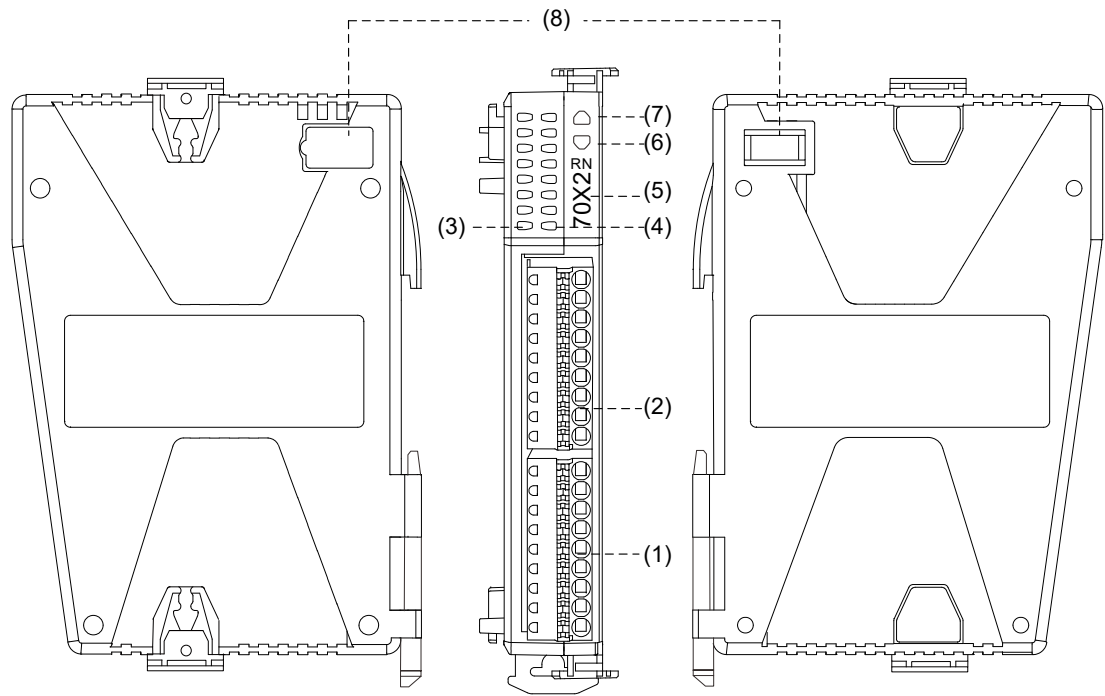
No.	Description
(1)	Port 1
(2)	Port 0
(3)	Y00 ~ Y07 I/O signal display for Port 0 (from top to bottom)
(4)	Y08 ~ Y15 I/O signal display for Port 1 (from top to bottom)
(5)	Product number (7062 / 70E2 / 70A2 / 70F2)
(6)	Status indicator
(7)	Power indicator
(8)	E-BUS transmission port

R1-EC7XX2 Port 0

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

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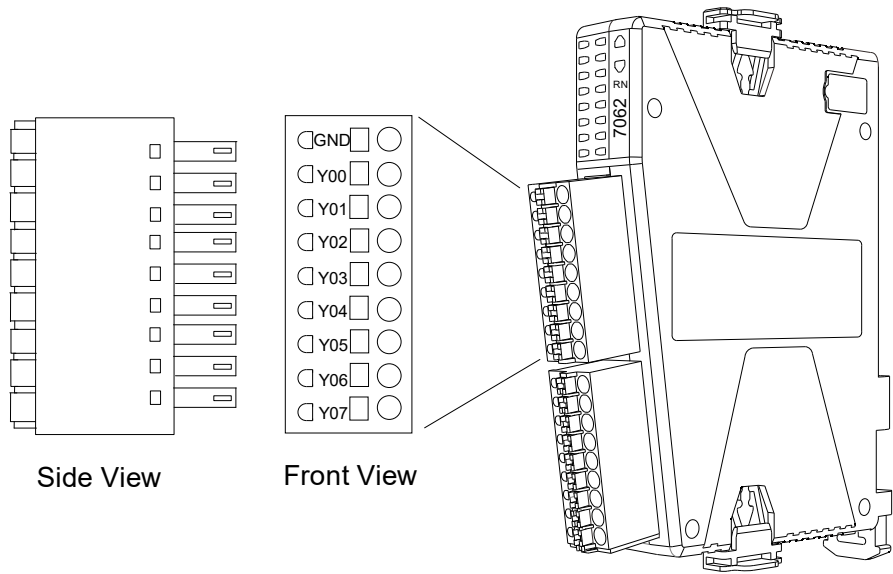
Symbol	Description
GND	Power ground of Port 0
Y00	1st set of output of Port 0
Y01	2nd set of output of Port 0
Y02	3rd set of output of Port 0
Y03	4th set of output of Port 0
Y04	5th set of output of Port 0
Y05	6th set of output of Port 0
Y06	7th set of output of Port 0
Y07	8th set of output of Port 0

2

■   R1-EC70X2 Port 1 pin definition:

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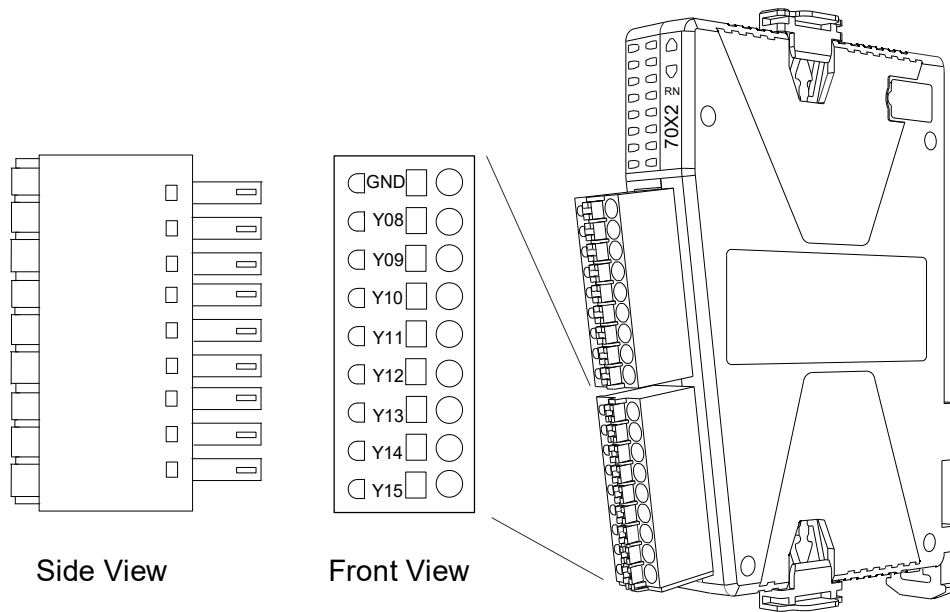
Symbol	Description
GND	Power ground of Port 1
Y08	1st set of output of Port 1
Y09	2nd set of output of Port 1
Y10	3rd set of output of Port 1
Y11	4th set of output of Port 1
Y12	5th set of output of Port 1
Y13	6th set of output of Port 1
Y14	7th set of output of Port 1
Y15	8th set of output of Port 1

R1-EC70X2 indicator definition:
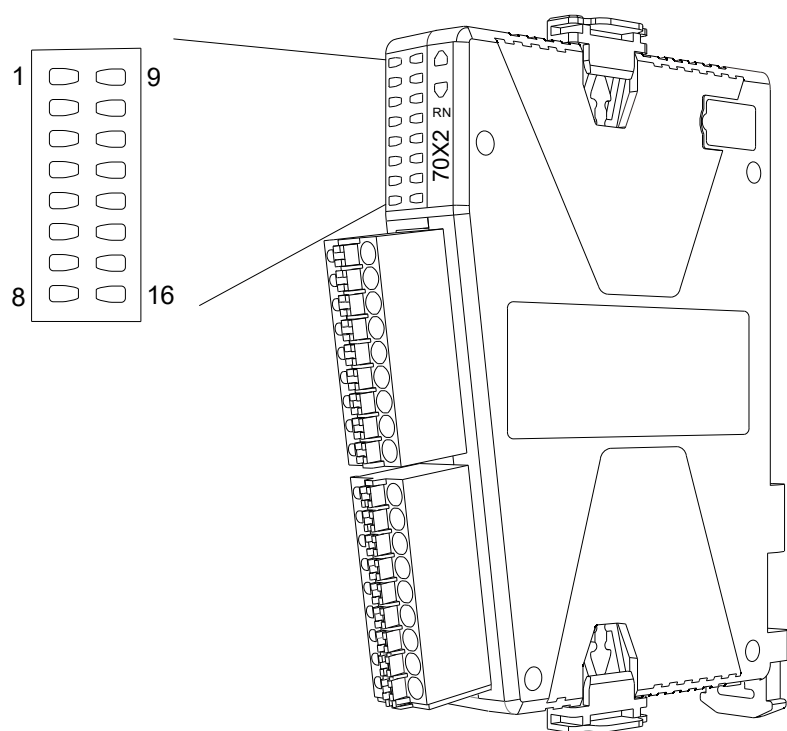
Indicator mark	Description	Indicator mark	Description
1	Y00	9	Y08
2	Y01	10	Y09
3	Y02	11	Y10
4	Y03	12	Y11
5	Y04	13	Y12
6	Y05	14	Y13
7	Y06	15	Y14
8	Y07	16	Y15

R1-EC7XX2 output port wiring example

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

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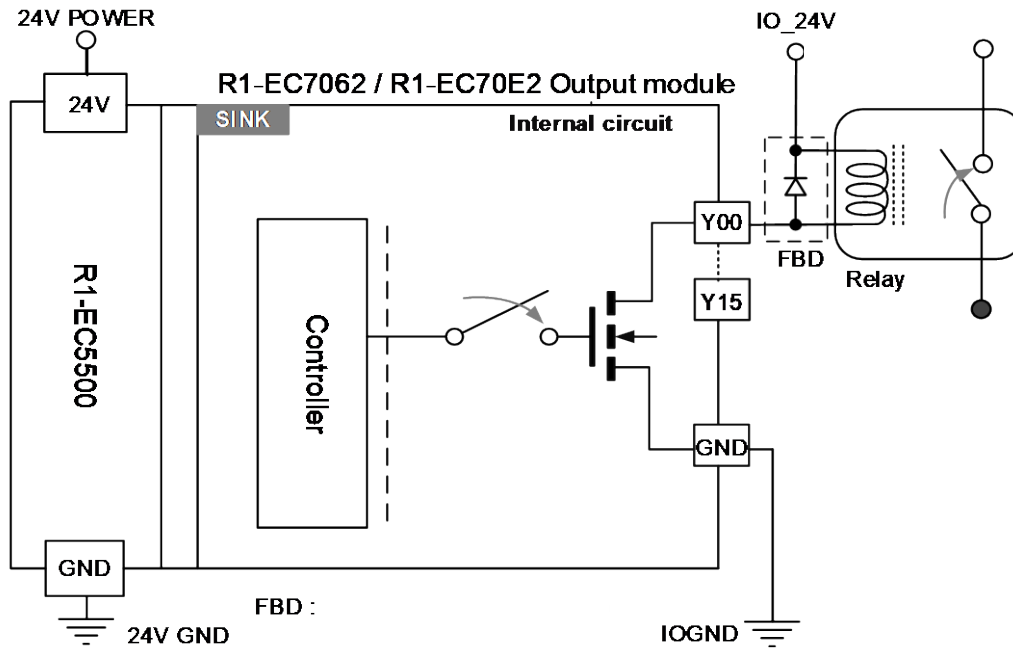
■   R1-EC70A2 / R1-EC70F2 is connected to PNP (SOURCE) type load

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.
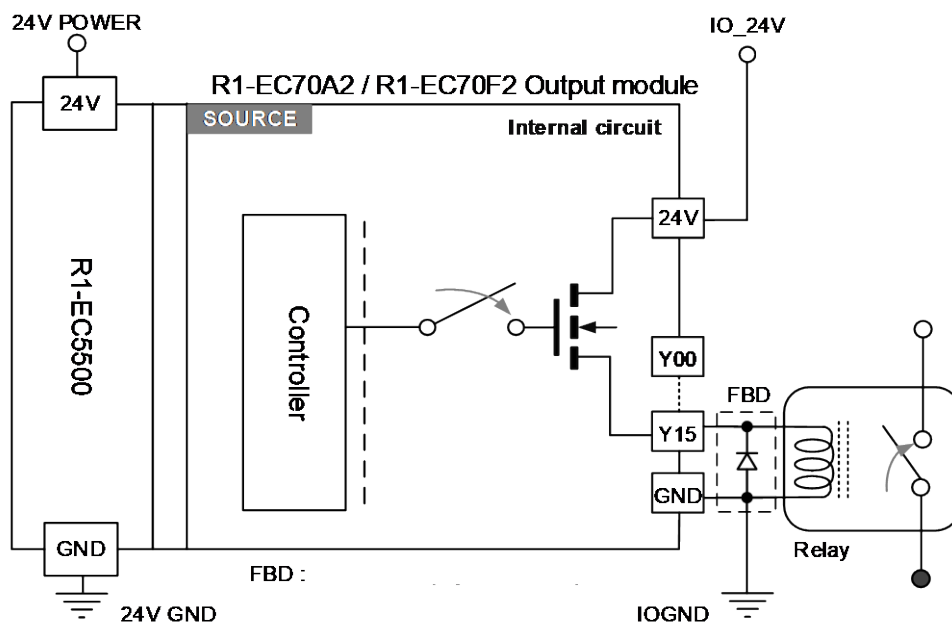
2.3.4 Remote analog input module - R1-EC8124

R1-EC8124 model name explanation

$$\underset{(1)(2)}{\underline{R\ 1}} - \underset{(3)}{\underline{EC}} - \underset{(4)}{\underline{8}}\ \underset{(5)}{\underline{1}}\ \underset{(6)}{\underline{2}}\ \underset{(7)}{\underline{4}}\ \underset{(8)}{\underline{D0}}$$

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: $\leq$ 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)
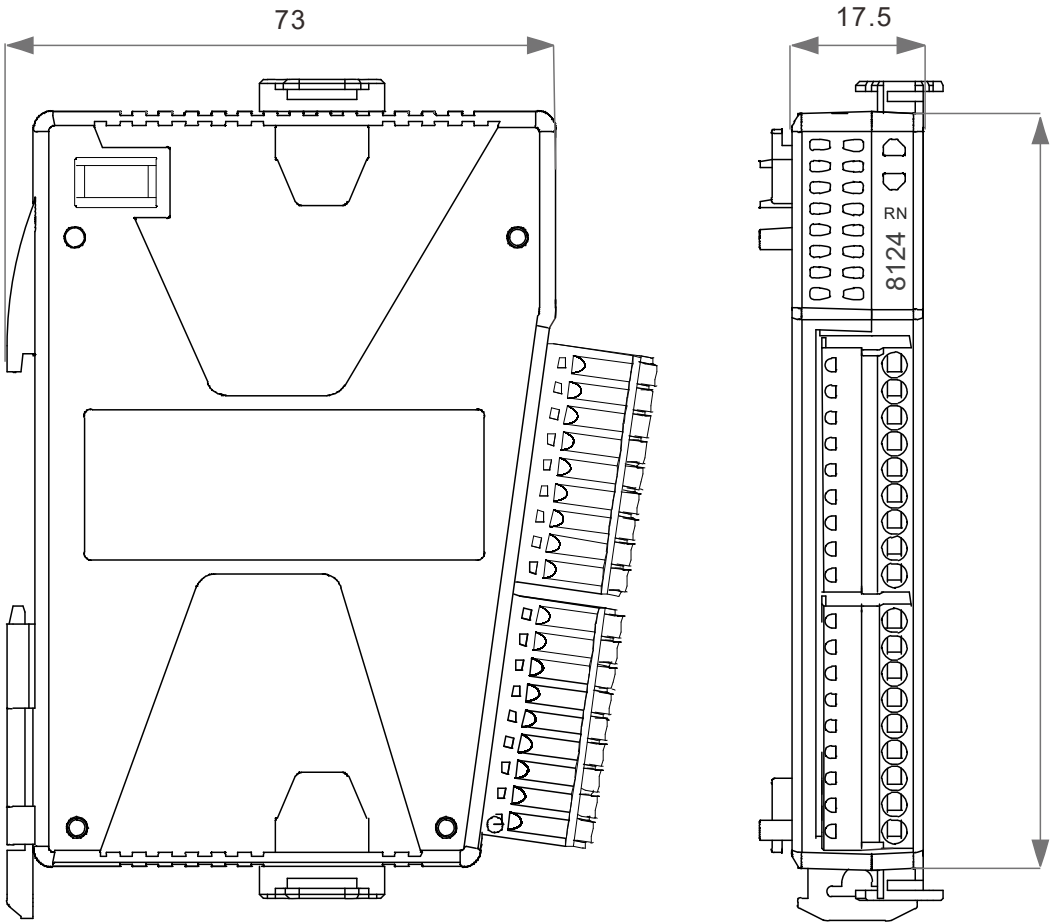
■ Product interface of R1-EC8124D0
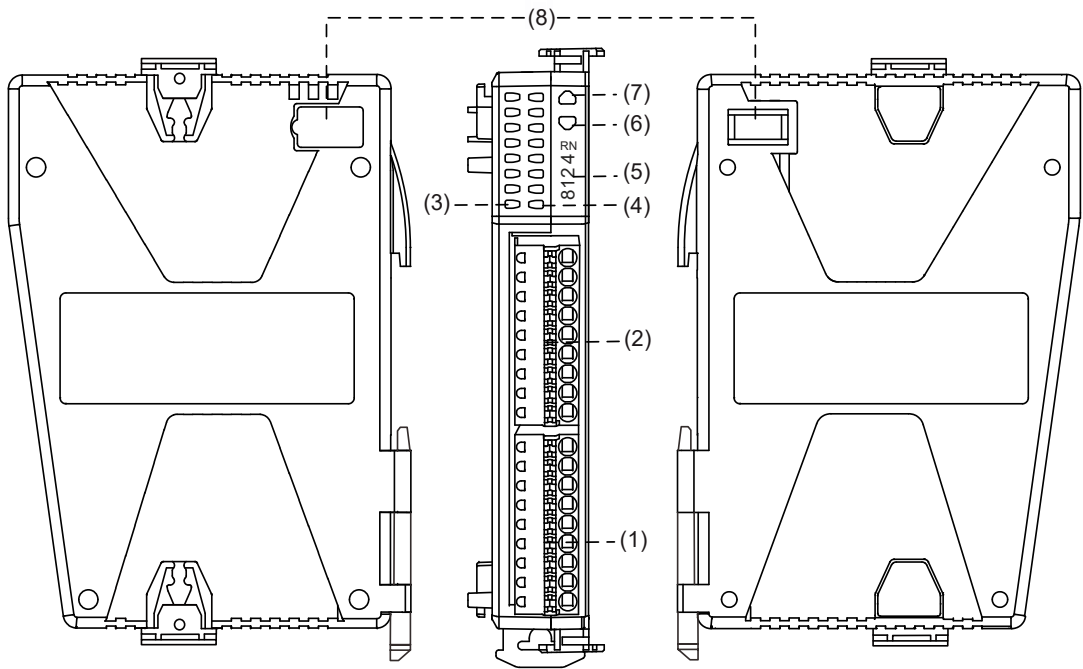
No.	Description
1	CH2 / CH3 signal port
2	CH0 / CH1 signal port
3	CH0 / CH1 signal indicator (from top to down)
4	CH2 / CH3 signal indicator (from top to down)
5	Product ID number
6	Status indicator
7	Power indicator
8	E-BUS transmission port

2

R1-EC8124D0 signal port

■   CH0 / CH1 pin definition

Side View   Front View
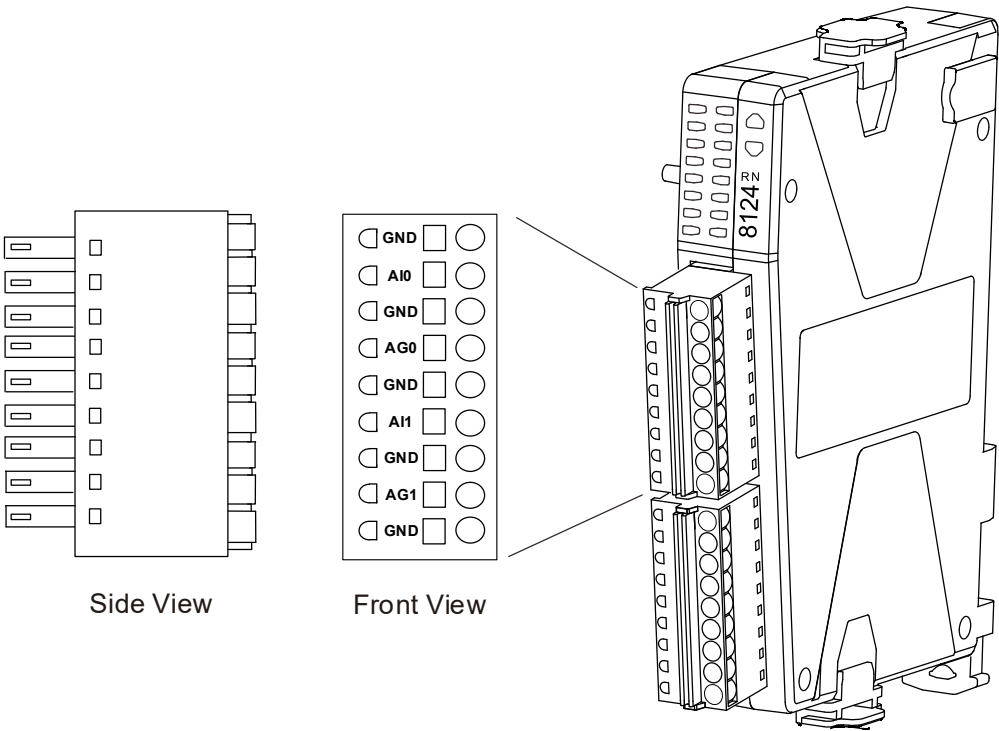
Symbol	Description
GND	Analog ground
AI0	CH0 voltage/current input
GND	Analog ground
AG0	CH0 current COM
GND	Analog ground
AI1	CH1 voltage/current input
GND	Analog ground
AG1	CH1 current COM
GND	Analog ground

2

■   CH2 / CH3 pin definition

Side View   Front View
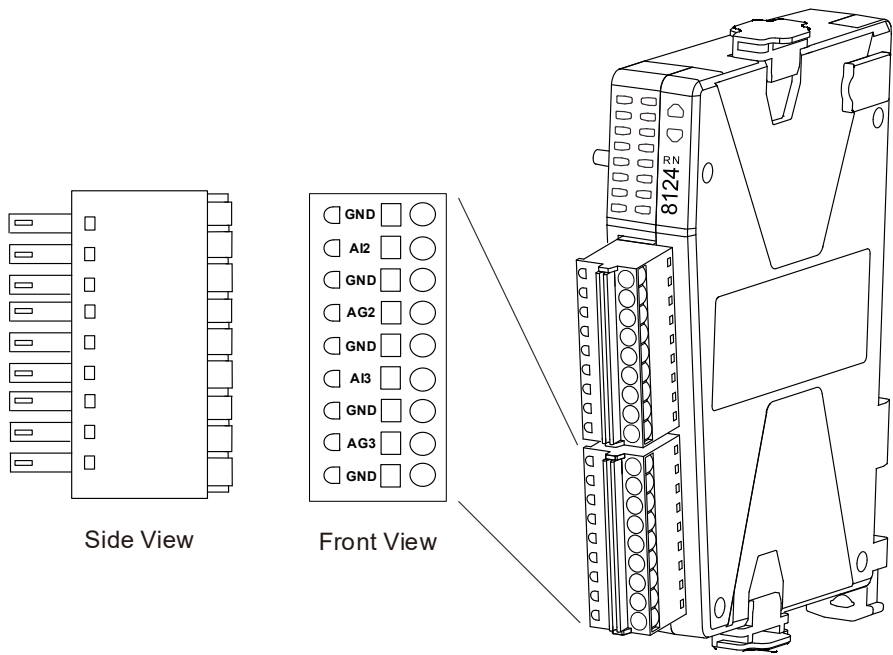
Symbol	Description
GND	Analog ground
AI2	CH2 voltage/current input
GND	Analog ground
AG2	CH2 current COM
GND	Analog ground
AI3	CH3 voltage/current input
GND	Analog ground
AG3	CH3 current COM
GND	Analog ground

2

R1-EC8124 indicator definition
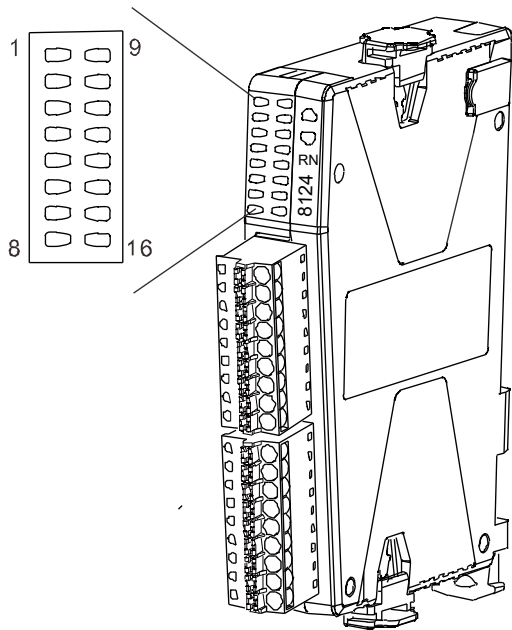
Indicator mark	Description	Indicator mark	Description
1	CH0 enable	9	CH2 enable
2	CH0 input range ±5V	10	CH2 input range ±5V
3	CH0 input range ±10V	11	CH2 input range ±10V
4	CH0 OSCT[1] 192 us select	12	CH2 OSCT 192 us select
5	CH1 enable	13	CH3 enable
6	CH1 input range ±5V	14	CH3 input range ±5V
7	CH1 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
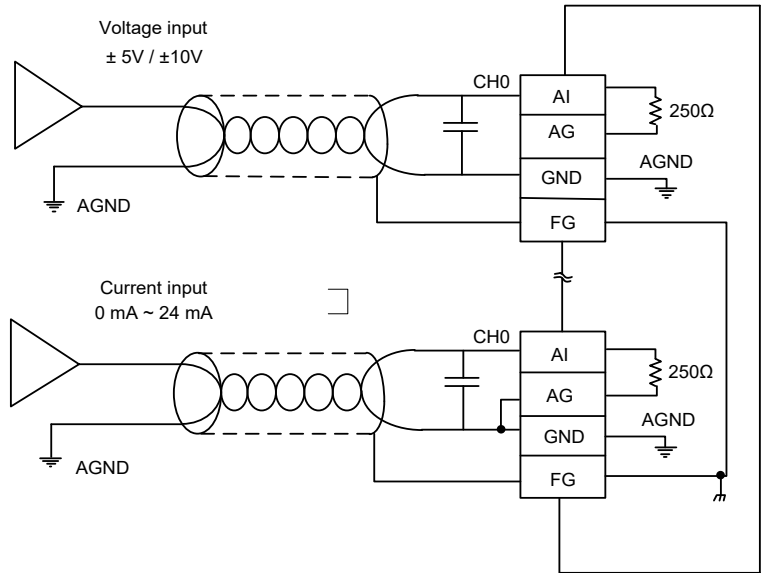
2.3.5 Remote analog output module - R1-EC9144

R1-EC9144 model name explanation

$$\underset{(1)(2)}{\underline{R\ 1}} - \underset{(3)}{\underline{EC}} - \underset{(4)(5)(6)(7)}{\underline{9\ 1\ 4\ 4}}$$

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 Voltage: ±10V / ±5V / 0 ~ 5V / 0 ~ 10V 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
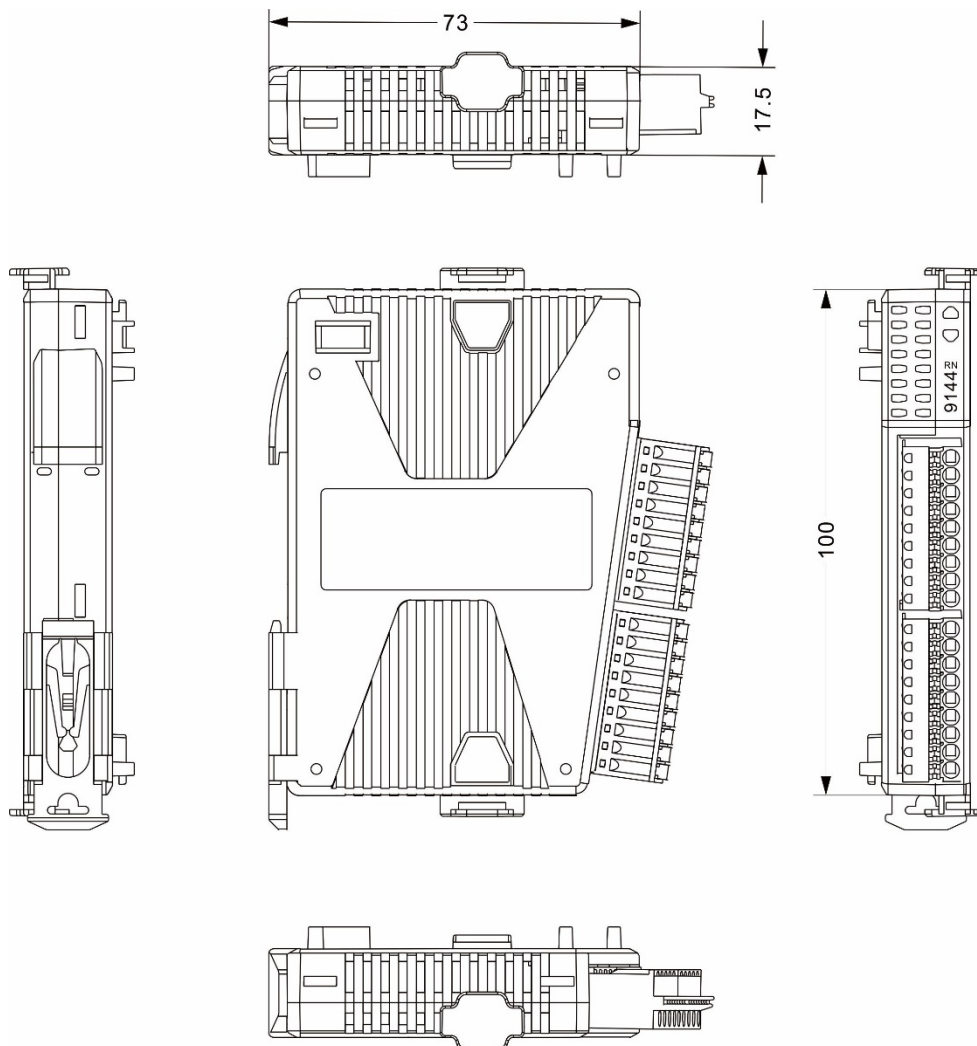
■   Product interface of R1-EC9144
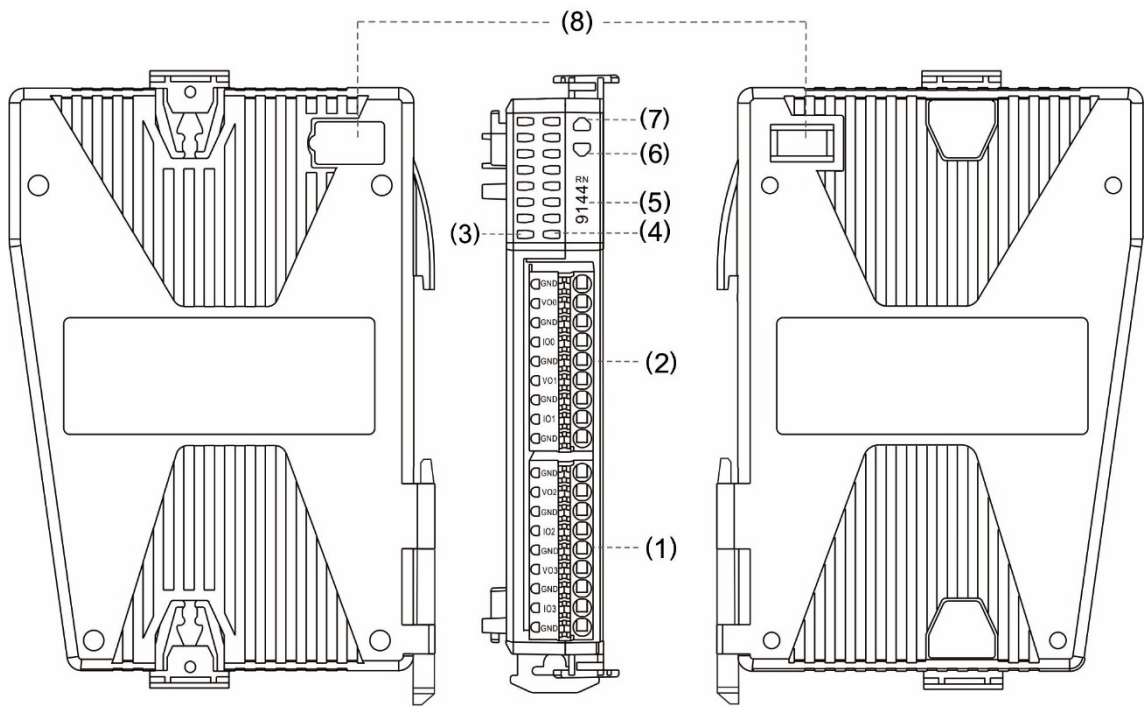
No.	Description
(1)	CH2 / CH3 signal port
(2)	CH0 / CH1 signal port
(3)	CH0 / CH1 signal indicator (from top to down)
(4)	CH2 / CH3 signal indicator (from top to down)
(5)	Product ID number
(6)	Status indicator
(7)	Power indicator
(8)	E-BUS transmission port

2

■   Port 0 / Port 1 pin definition
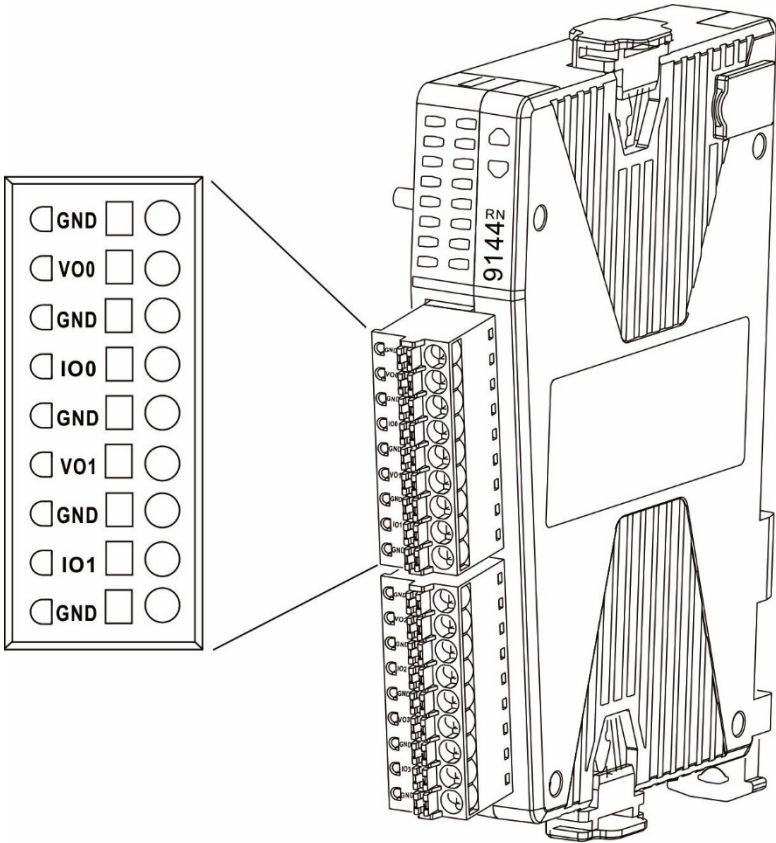
Symbol	Description
GND	Analog COM
VO0	Port 0 voltage output
GND	Analog COM
IO0	Port 0 current output
GND	Analog COM
VO1	Port 1 voltage output
GND	Analog COM
IO1	Port 1 current output
GND	Analog COM

■   Port 2 / Port 3 pin definition
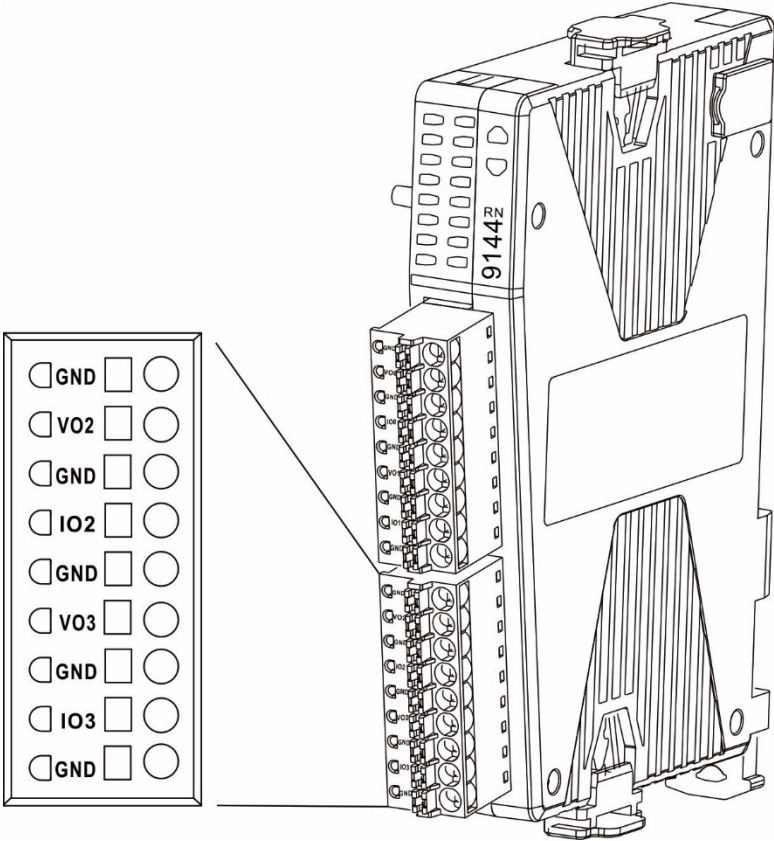
Symbol	Description
GND	Analog COM
VO2	Port 2 voltage output
GND	Analog COM
IO2	Port 2 current output
GND	Analog COM
VO3	Port 3 voltage output
GND	Analog COM
IO3	Port 3 current output
GND	Analog COM

2

R1-EC9144 indicator definition
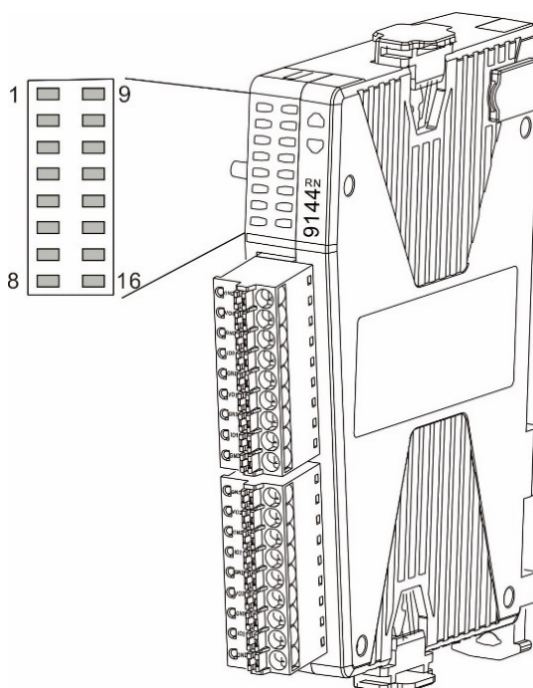
Indicator mark	Description	Indicator mark	Description
1	CH0 enable	9	CH2 enable
2	CH0 voltage selection	10	CH2 voltage selection
3	CH0 current selection	11	CH2 current selection
4	CH0 error flag	12	CH2 error flag
5	CH1 enable	13	CH3 enable
6	CH1 voltage selection	14	CH3 voltage selection
7	CH1 current 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).
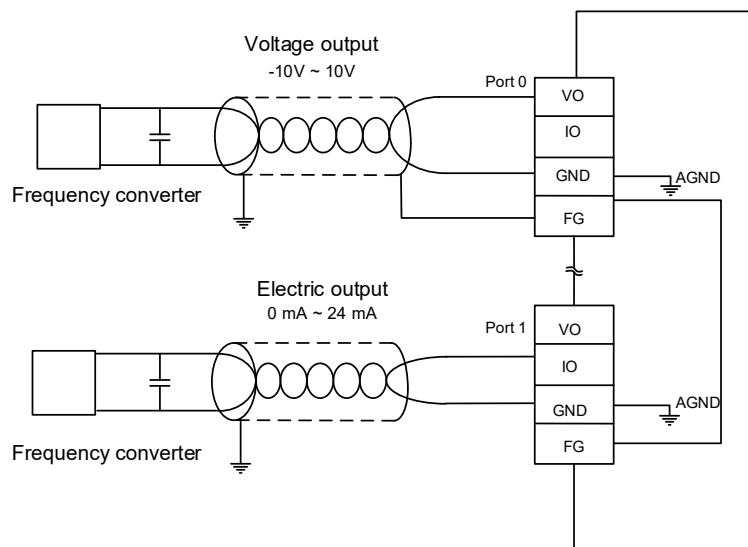
2.3.6 Remote digital input/output module - R2-EC0902

R2-EC0902 model name explanation

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

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
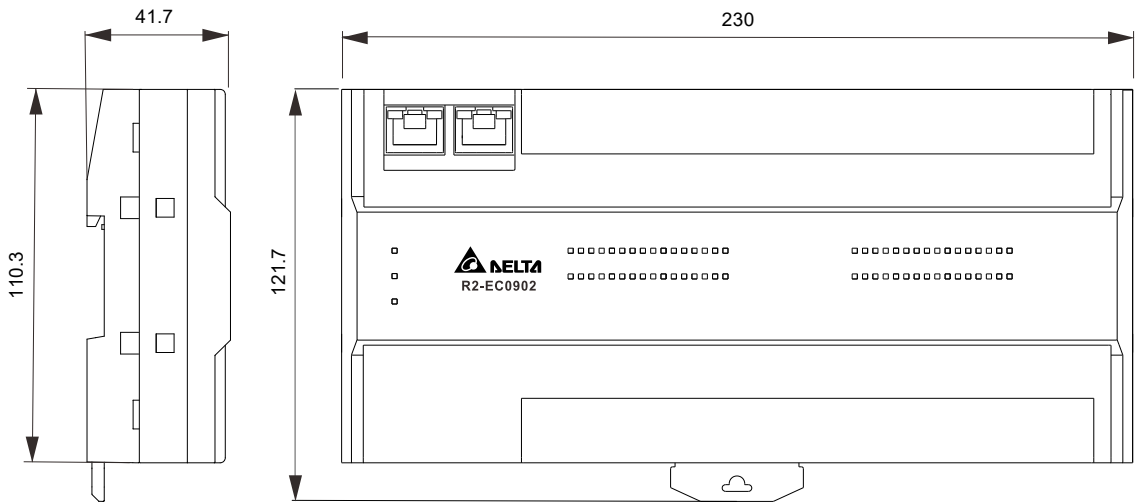
■   Product interface of R2-EC0902
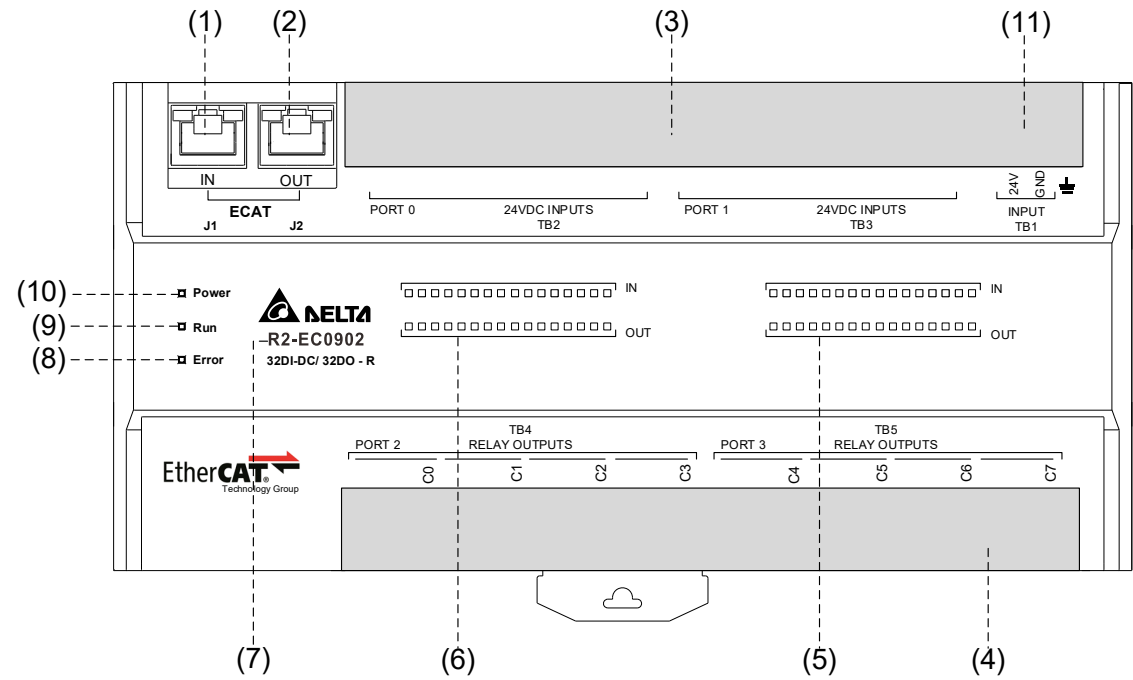
No.	Description
(1)	EtherCAT input port (connection status indicator included)
(2)	EtherCAT output port (connection status indicator included)
(3)	GPIO input ports (Port 0 and Port 1)
(4)	GPIO output ports (Port 2 and Port 3)
(5)	Status indicators for GPIO Port 1 (input) and Port 3 (output)
(6)	Status 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
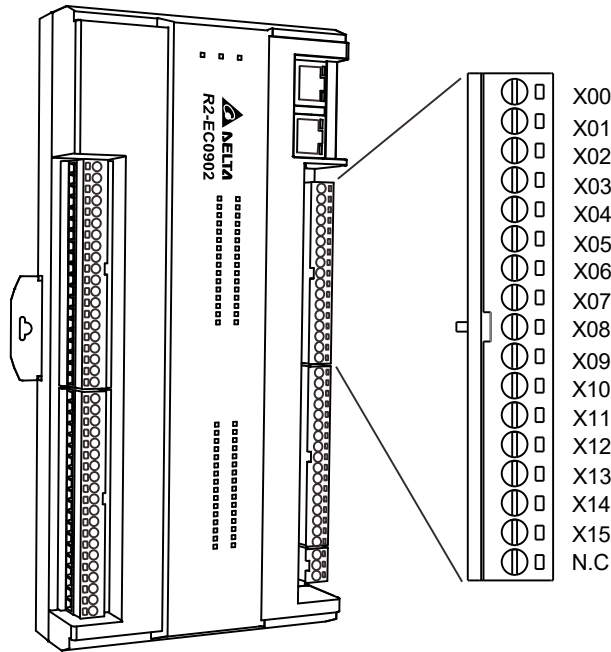
Symbol	Description	Symbol	Description
X00	1st set of input of Port 0	X09	10th set of input of Port 0
X01	2nd set of input of Port 0	X10	11th set of input of Port 0
X02	3rd set of input of Port 0	X11	12th set of input of Port 0
X03	4th set of input of Port 0	X12	13th set of input of Port 0
X04	5th set 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	-	-

2

■   I/O Port 1
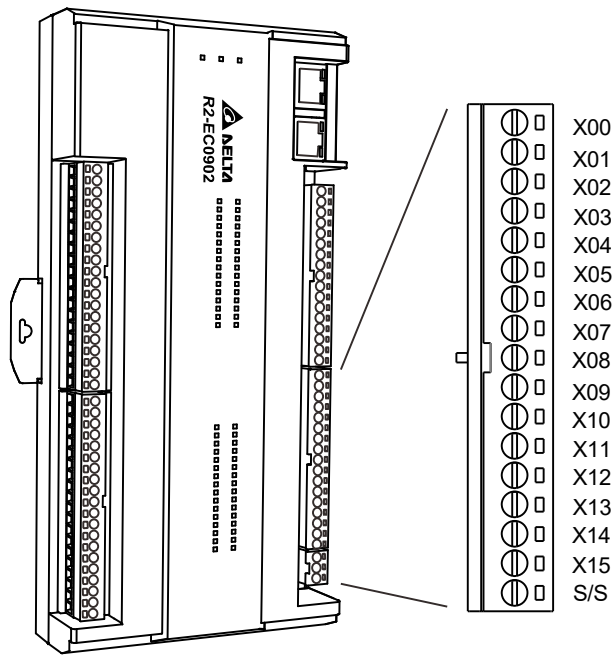
Symbol	Description	Symbol	Description
X00	1st set of input of Port 1	X09	10th set of input of Port 1
X01	2nd set of input of Port 1	X10	11th set of input of Port 1
X02	3rd set of input of Port 1	X11	12th set of input of Port 1
X03	4th set of input of Port 1	X12	13th set of input of Port 1
X04	5th set 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
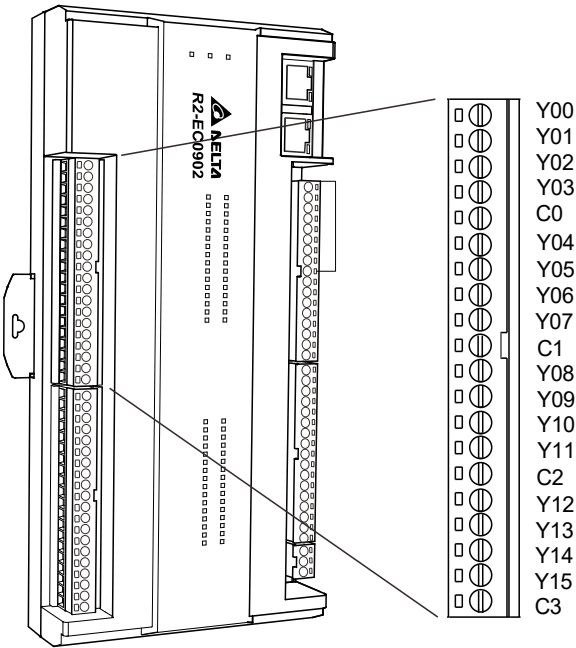
Symbol	Description	Symbol	Description	Group Symbol
Y00	1st set of output of Port 2	Y01	2nd set of output of Port 2	C0*
Y02	3rd set of output of Port 2	Y03	4th set of output of Port 2	
Y04	5th set of output of Port 2	Y05	6th set of output of Port 2	C1*
Y06	7th set of output of Port 2	Y07	8th set of output 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.

2

■   I/O Port 3

The pin definitions and descriptions of Port 3 for the R2-EC0902 model are as follows.
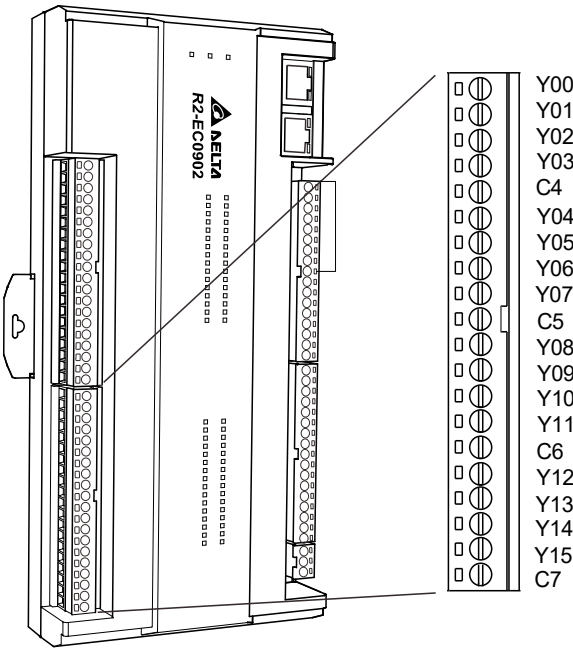
Symbol	Description	Symbol	Description	Group Symbol
Y00	1st set of output of Port 3	Y01	2nd set of output of Port 3	C4*
Y02	3rd set of output of Port 3	Y03	4th set of output of Port 3	
Y04	5th set of output of Port 3	Y05	6th set of output of Port 3	C5*
Y06	7th set of output of Port 3	Y07	8th set of output 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).
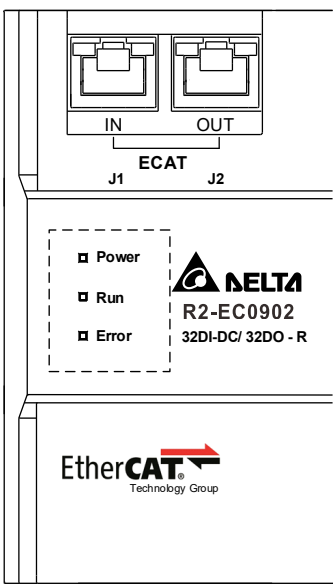
Indicator	Status	Description
Power	ON	The external voltage 24 VDC of the module is normal.
	OFF	There is no voltage input, or the voltage is abnormal.
Run	OFF	Initialization status.
	Continuous flashing*	Safe Op mode.
	Single flashing*	Pre-Op mode.
	ON	Normal operation mode.
Error	Double flashing*	The 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.
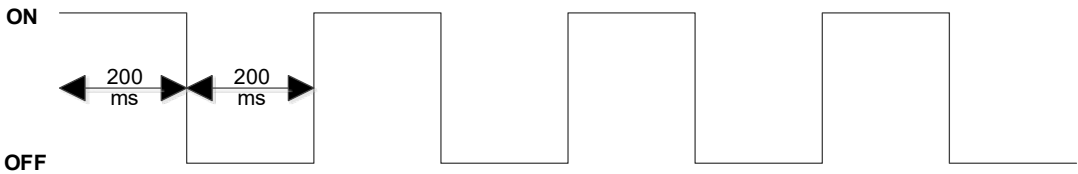
    b. Single flashing: the flashing frequency is as shown in the following figure.
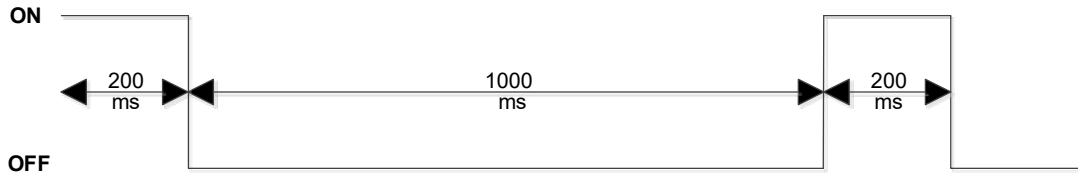
2. The Error indicator is a flashing red light.

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

2
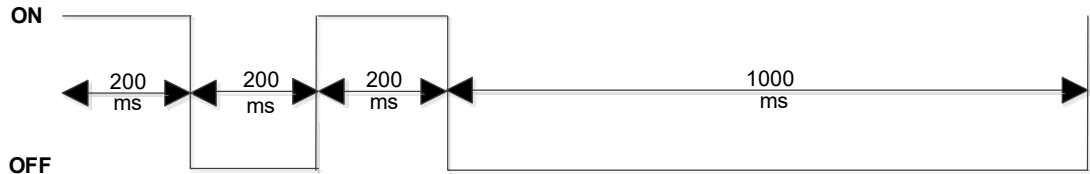
Input port wiring example

■   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.

2
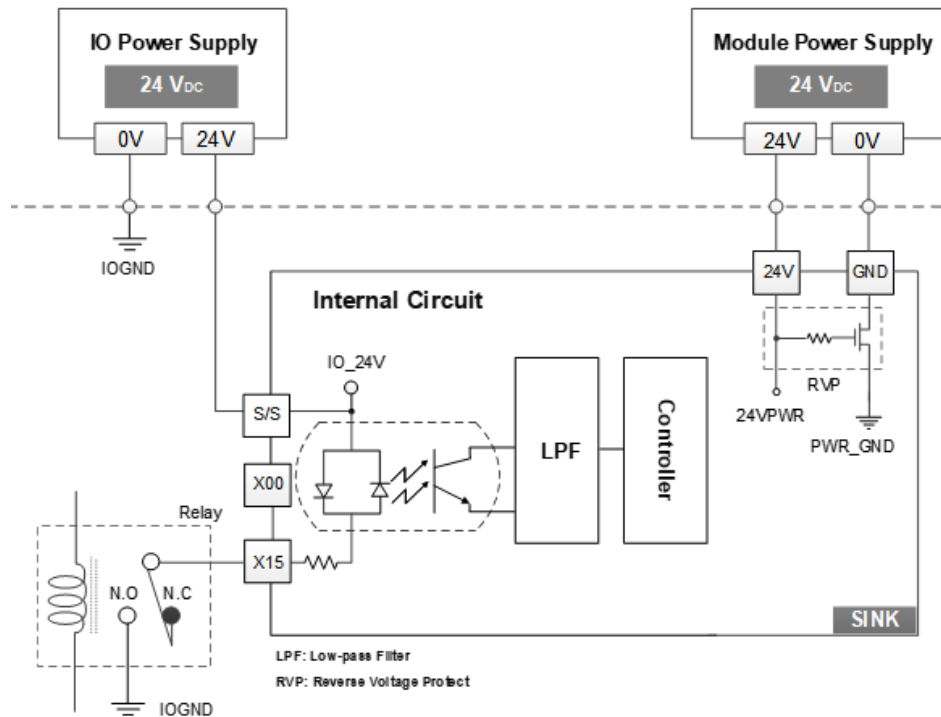
■   R2-EC0902 input port connected to PNP (SOURCE) type load

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.

LPF: Low-pass Filter
RVP: Reverse Voltage Protect

2

Output port wiring example

■   R2-EC0902 relay output port connected to the load
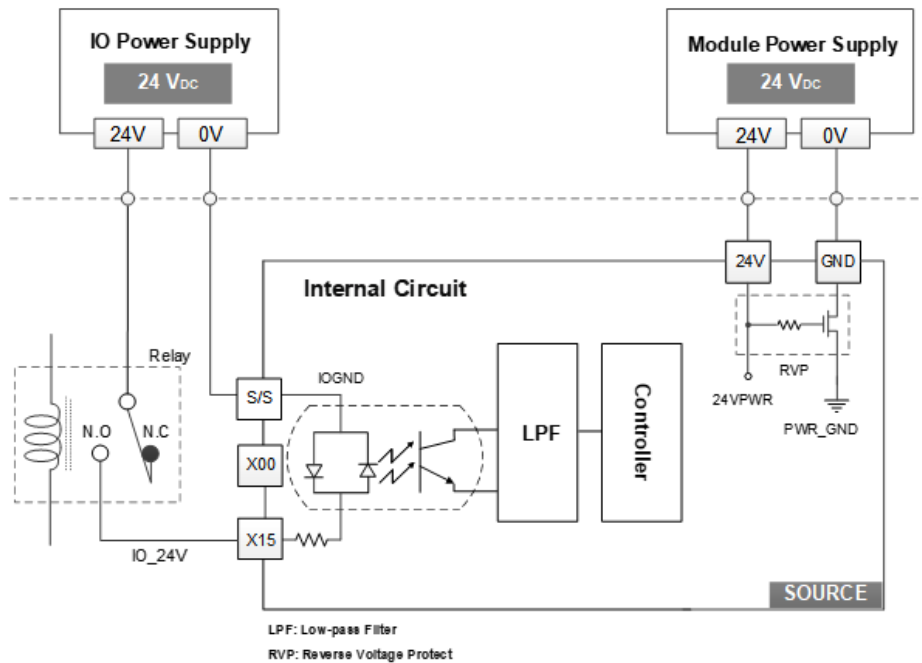
Isolate the IO power supply IO_24V / IOGND and module power supply 24V / GND circuits.
When using a relay, connect a spark quencher (SPQ) in parallel according to the load
requirements. This can prolong the life of the contacts and suppress contact sparks and surge
voltage. When using an inductive load, 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.

2
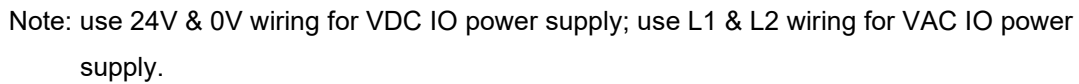
■   Precautions for using relay output:

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.
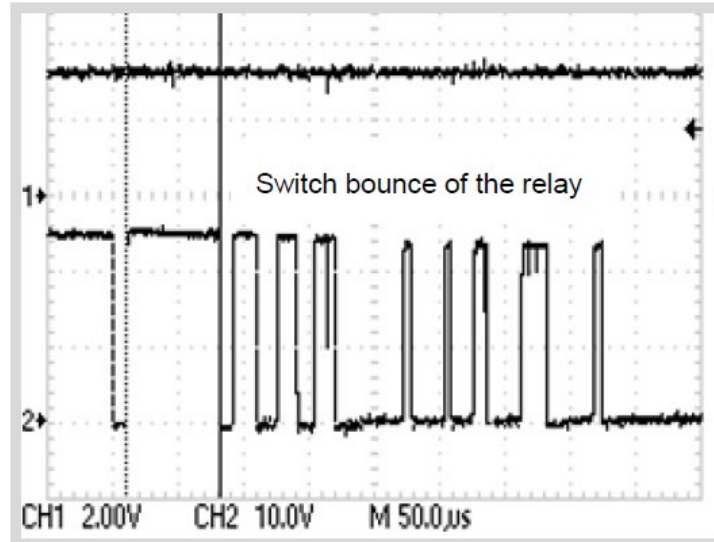
It is suggested to follow these items to avoid misoperation.

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.

2
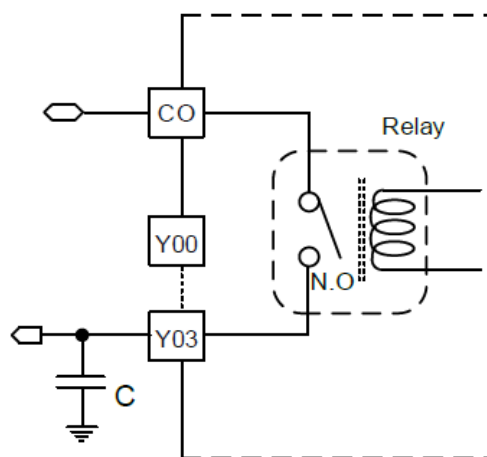
■   Use of relay spark quencher

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. (1) When in use, r should be greater than 10 ohm. (2) When applying AC voltage, the load impedance ® should be smaller than the r and C impedances of the spark quencher. r > 10 * ® r = 33 Kohm, 1/2 W
	Apply AC or DC power to the output port. (1) When r is in use, it should equal the load impedance ®. (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. (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. VR (DIODE)_Min > 2* IO_VCC (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. (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 ®. VR (DIODE)_Min > 3* IO_VCC (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.
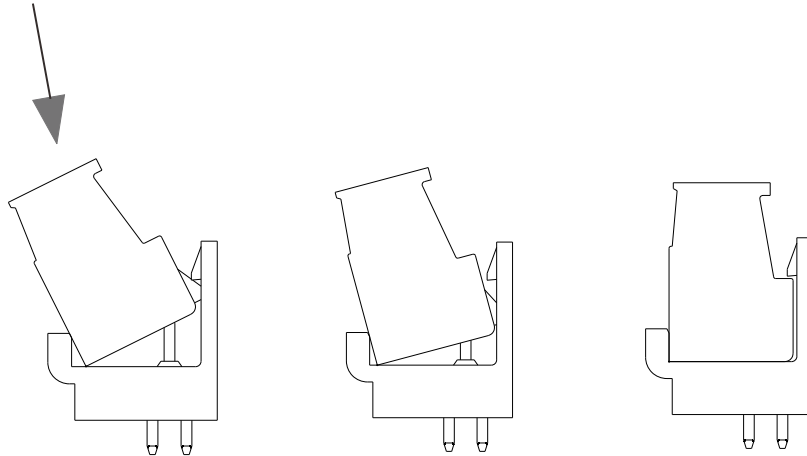
- Disassembly steps

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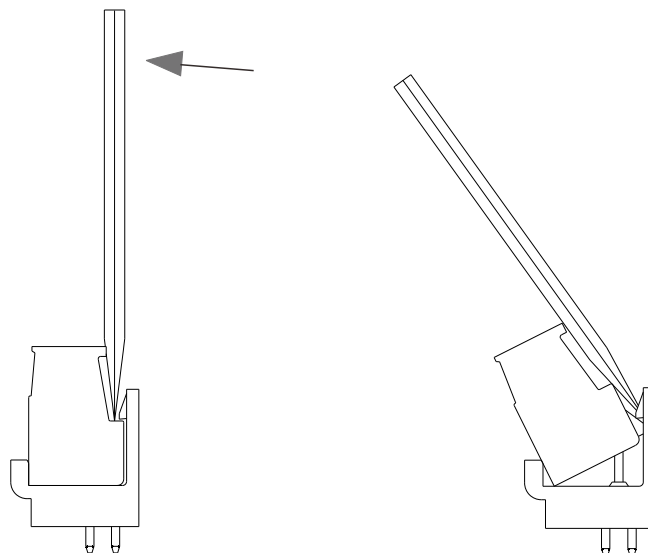
2.3.7 Remote digital input/output board module - R2-ECx004

R2-ECX004 model name explanation

$$\underset{(1)}{\underline{R}}\underset{(2)}{\underline{2}} - \underset{(3)}{\underline{E\ C}} - \underset{(4)}{\underline{x0}}\ \underset{(5)}{\underline{04}}$$

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)

2
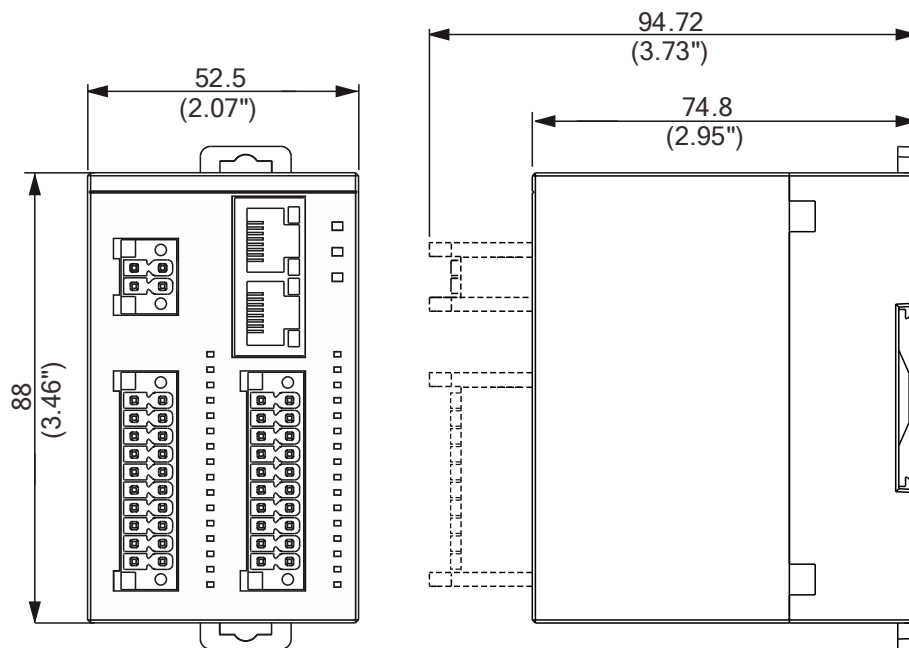
■   Electrical specifications

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) ; 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) EFT (IEC 61131-2, IEC 61000-4-4) RS (IEC 61131-2, IEC 61000-4-3)			
IP rating	IP20			
Approvals	$C\,E$			

2

■ The following describes the product interface of the R2-ECx004 series models.
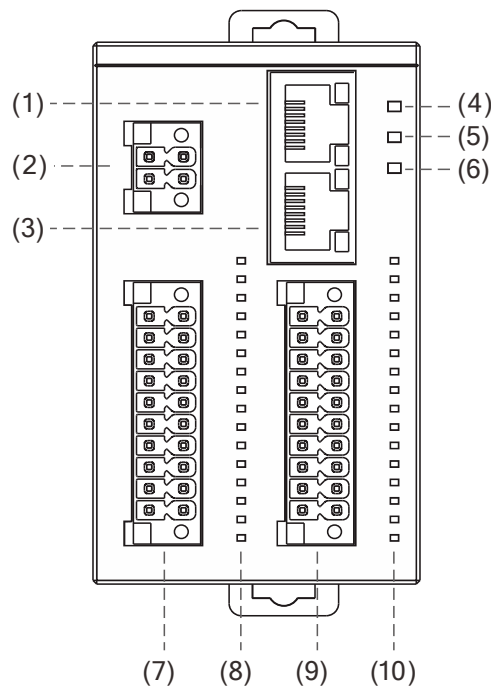
No.	Description		
(1)	EtherCAT input port (connection status indicator included)		
(2)	Module power port		
(3)	EtherCAT output port (connection status indicator included)		
(4)	Module power indicator (PWR)		
(5)	Module communication indicator (RUN)		
(6)	Module error indicator (ERR)		
(7)	Port 0	Input 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

■   Definitions of Port 1 for 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 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.

2

■ Definitions of the LED indicators for Port 0 and Port 1 of the R2-EC0004 series models are as follows.
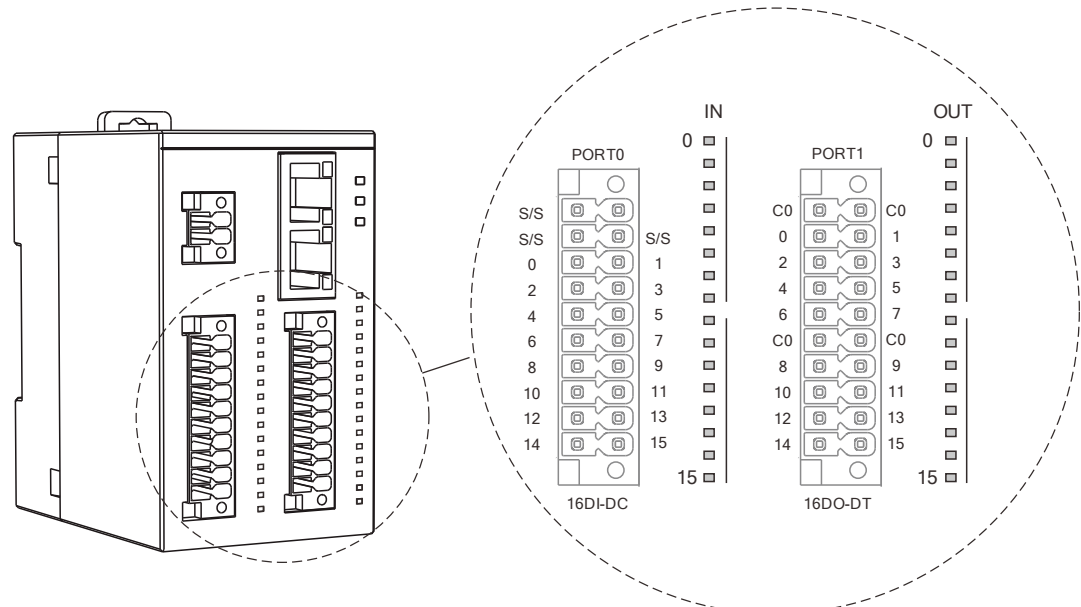
The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

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.

2

■   Definitions of the LED indicators for Port 0 and Port 1 of the R2-EC1004 series models are as follows.
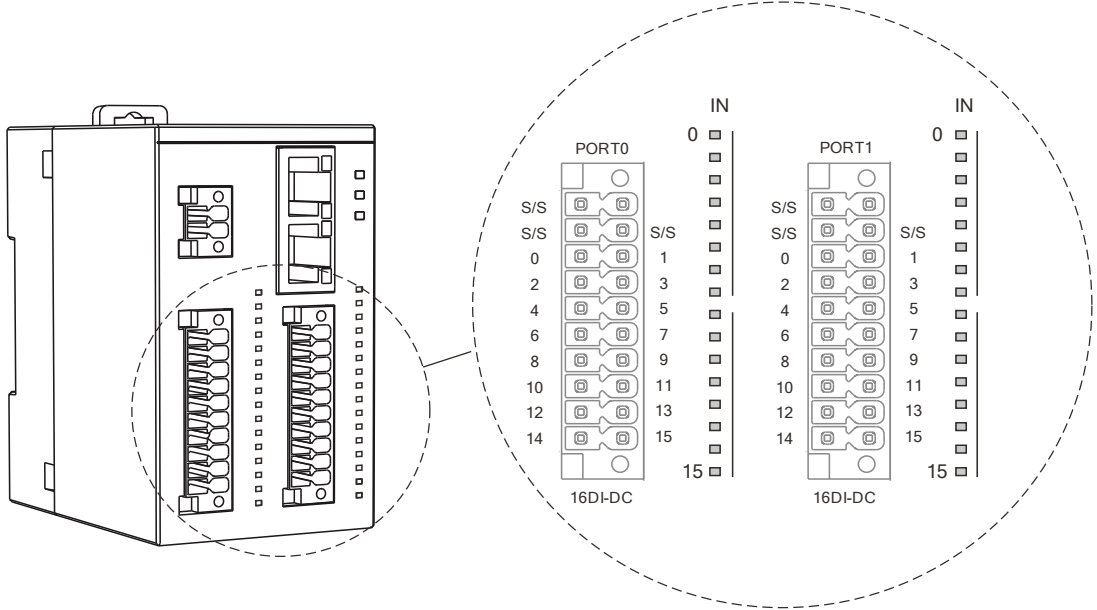
The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

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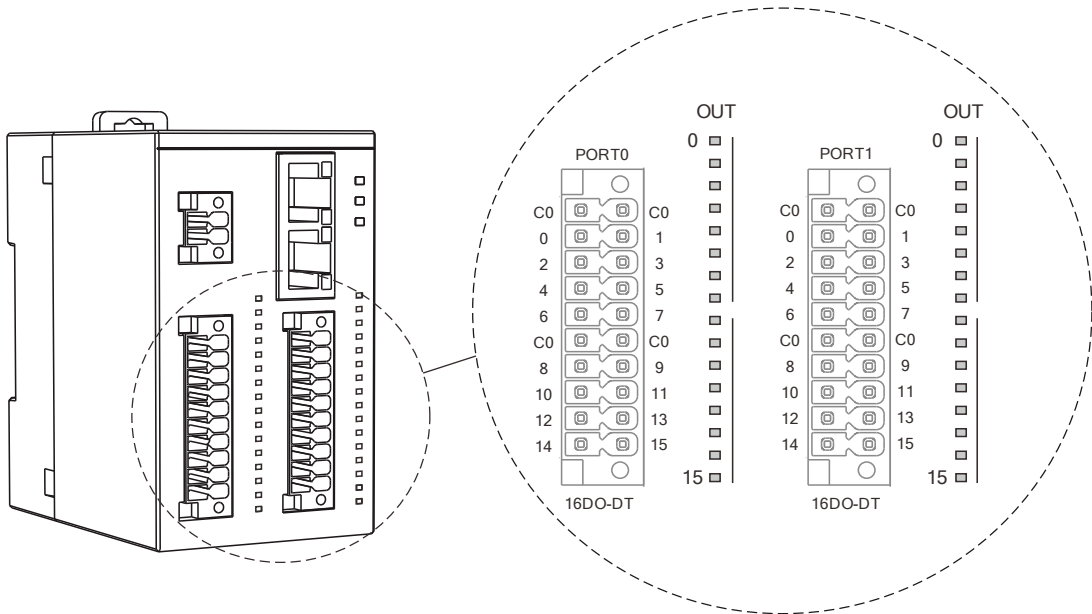
The LED indicators show the status of the GPIO signals. When the input / output signal is on, the corresponding indicator shows green (solid on).

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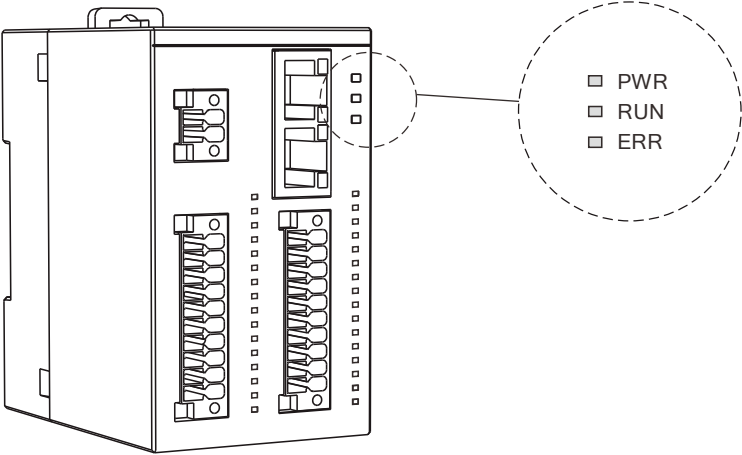
The module status indicators include module power indicator (PWR), module communication status indicator (RUN), and module error indicator (ERR).

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.

ON

|←→| 200 ms |←→| 200 ms |←→| 200 ms |←→| 1000 ms |←→|

OFF
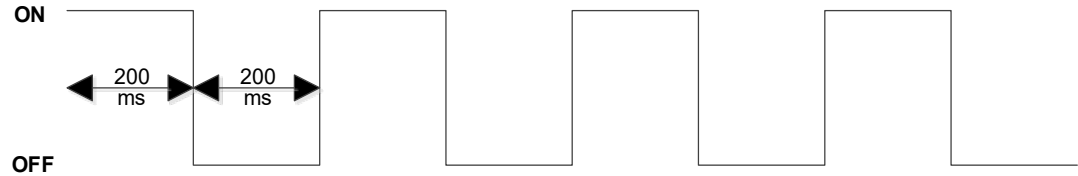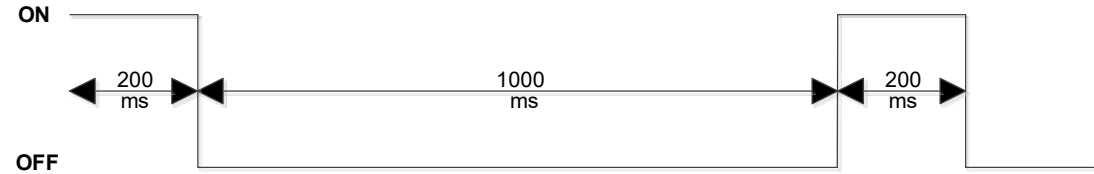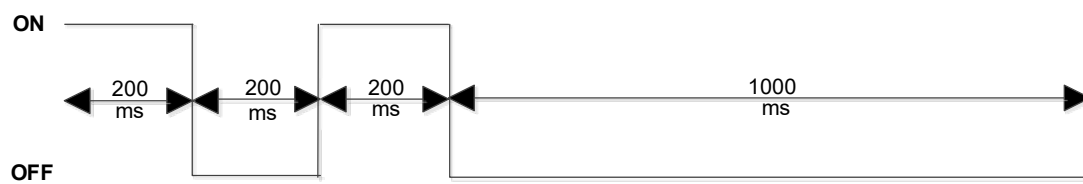
2

2.4 Operation panel I/O connector

2

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.
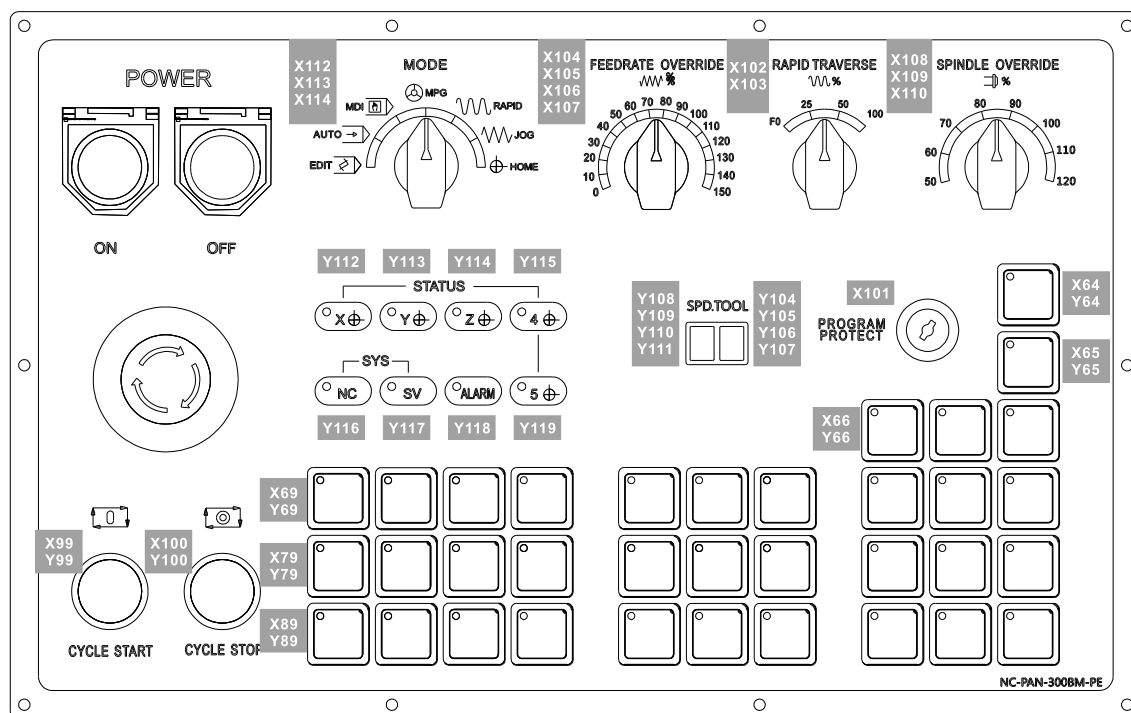
Mounting dimension of 2nd operation panel for 8" horizontal type model.
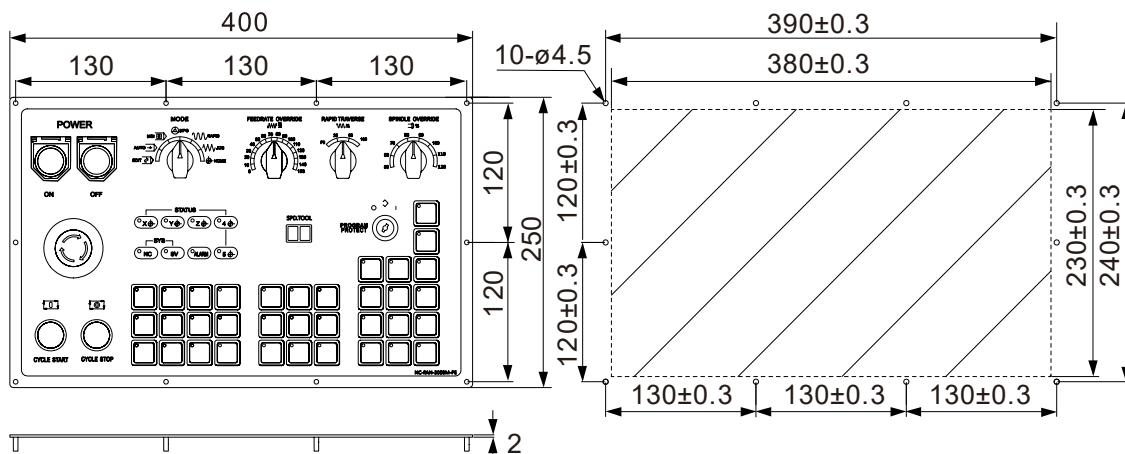
■   NC-PAN-301BM-PE: 2nd operation panel of vertical type for 8" model controller.

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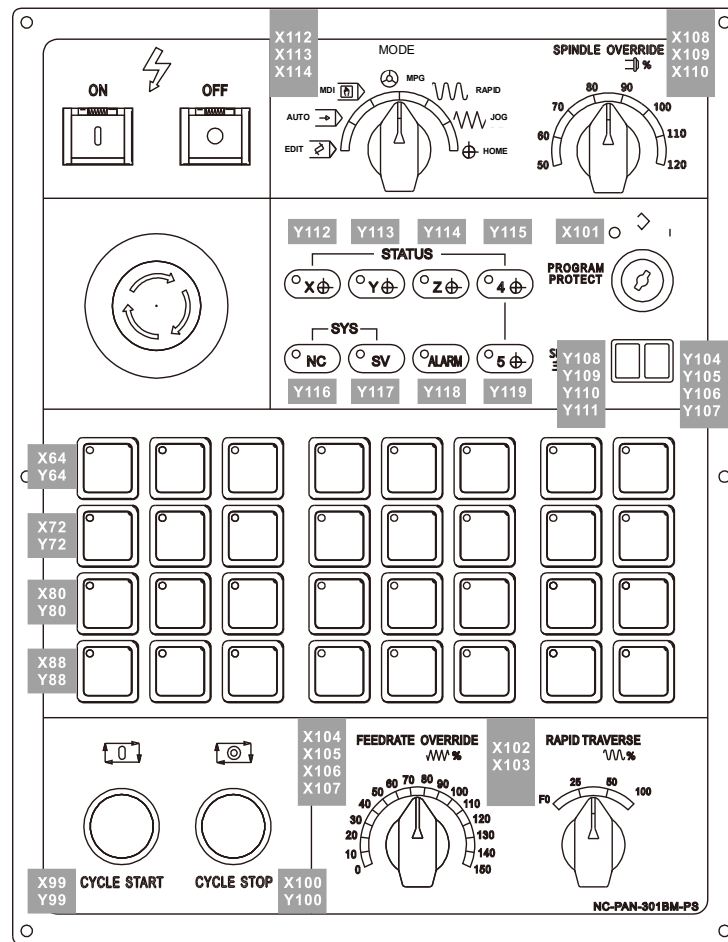
Mounting dimension of 2nd operation panel for 8" vertical type model.

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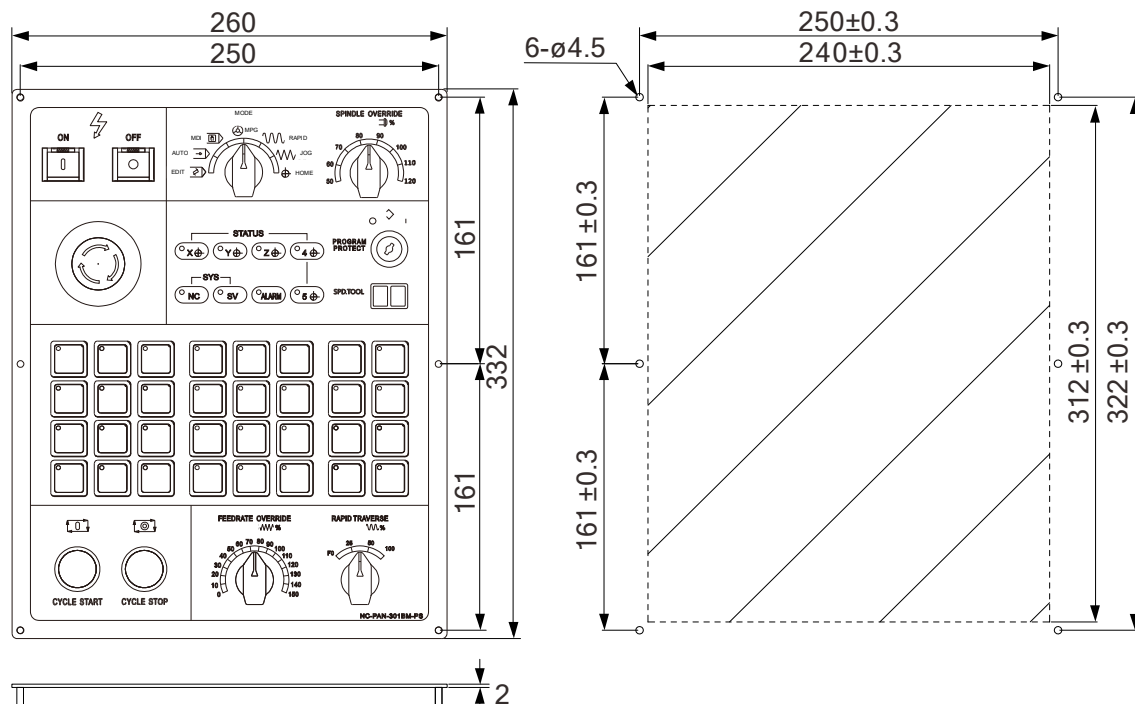
■   NC-PAN-310BM-PE: 2nd operation panel of horizontal type for 10" model controller.

2nd operation panel outline for 10" model and MLC relays of each button and status light.
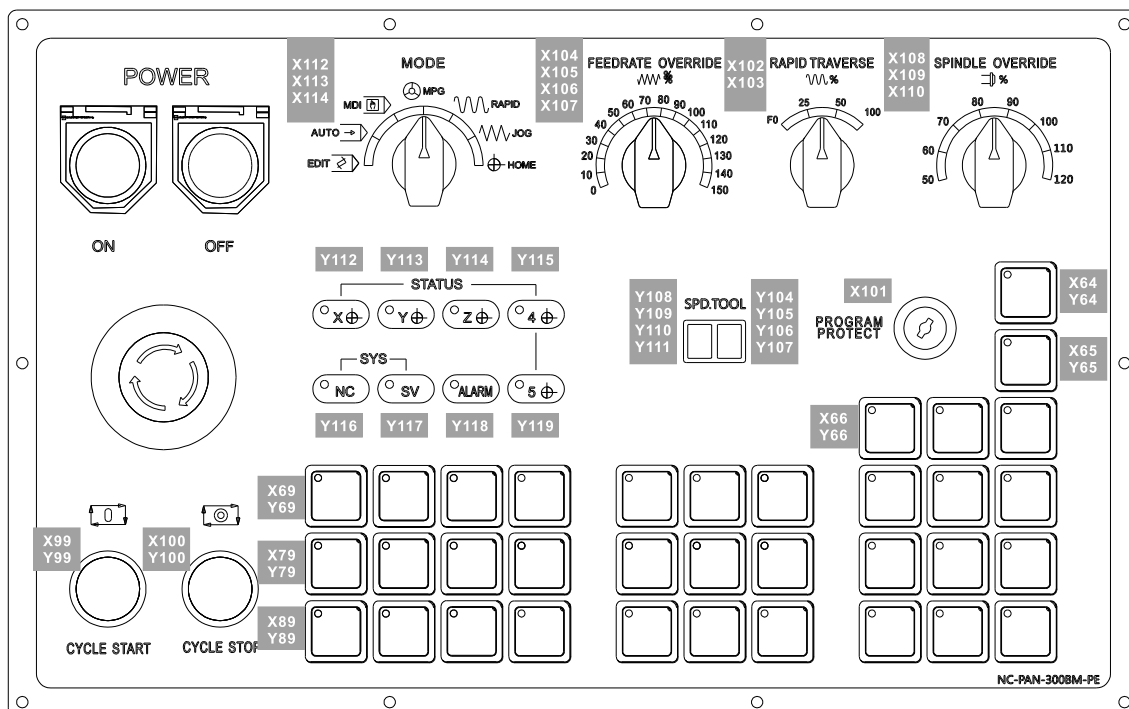
Mounting dimension of 2nd operation panel for 10" horizontal type model.

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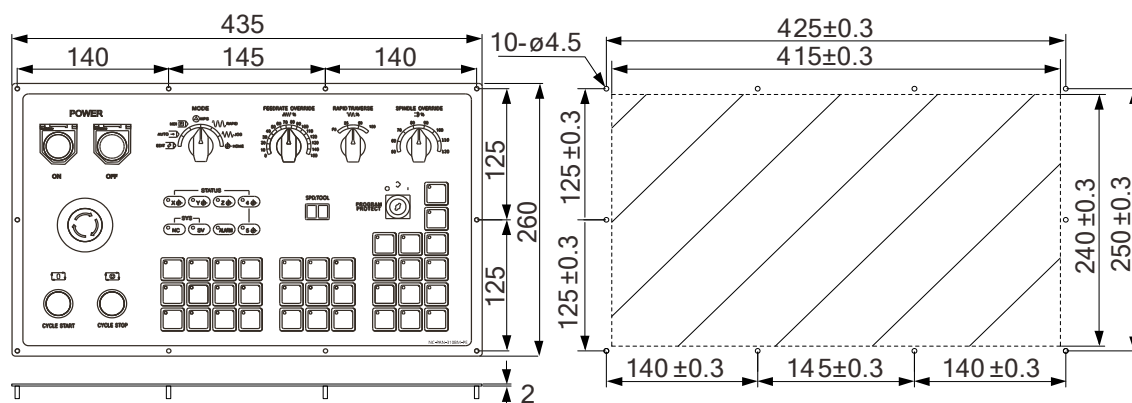
■ NC-PAN-311BM-PE: 2nd operation panel of vertical type for 10" model controller.

2nd operation panel outline for 10" model and MLC relays of each button and status light.
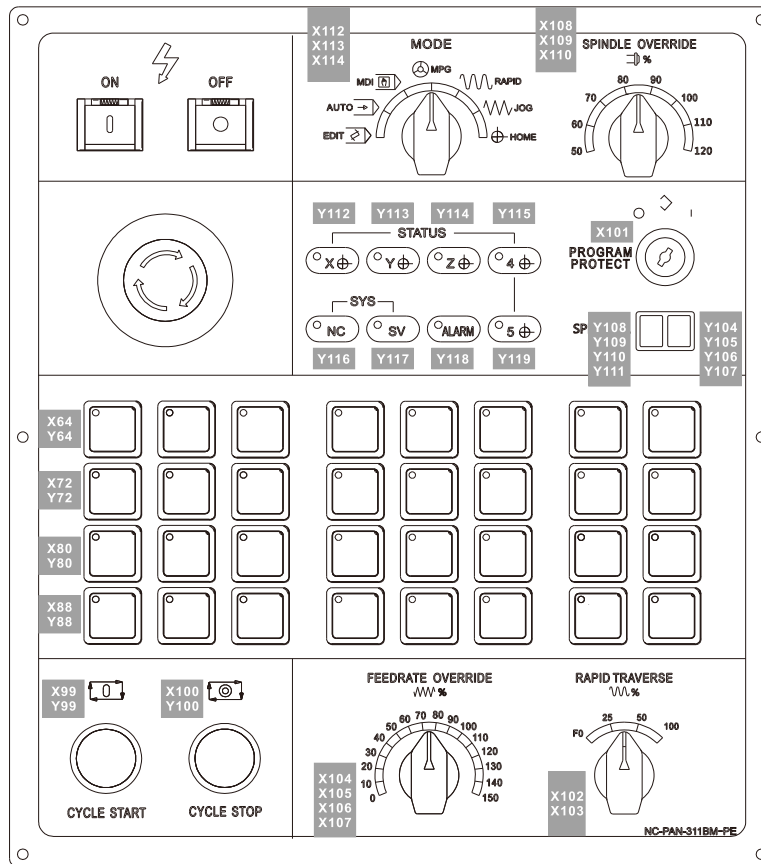
Mounting dimension of 2nd operation panel for 10" vertical type model.
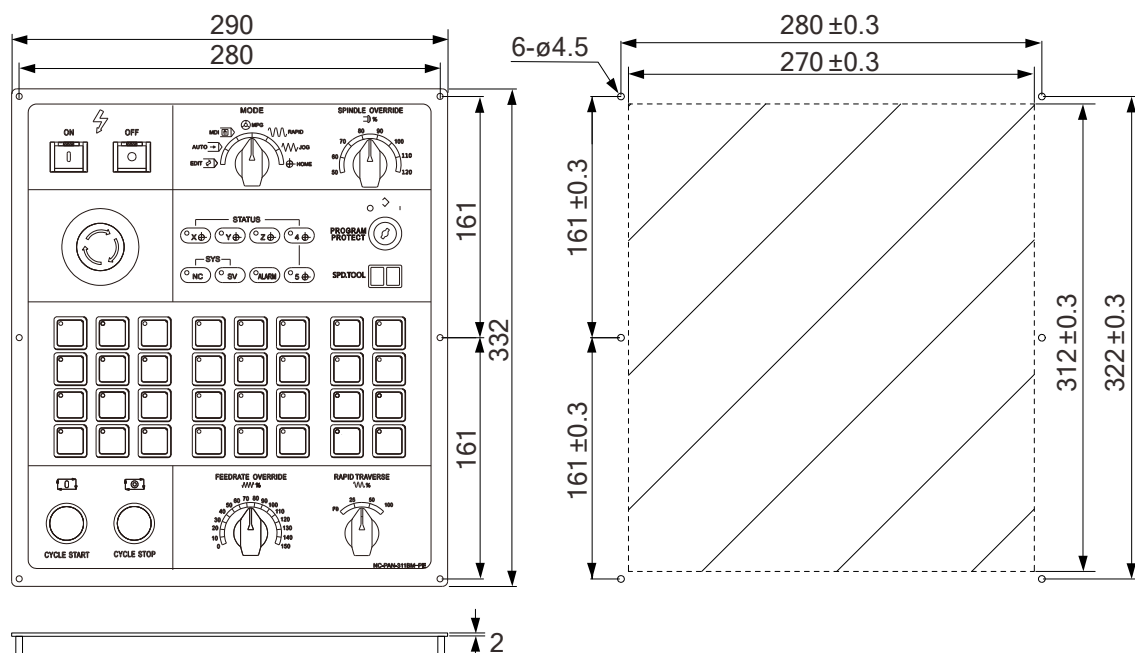
2

■ Wiring of the Power On / Power Off switches

NC-PAN-300AM-F

(1)   (2)
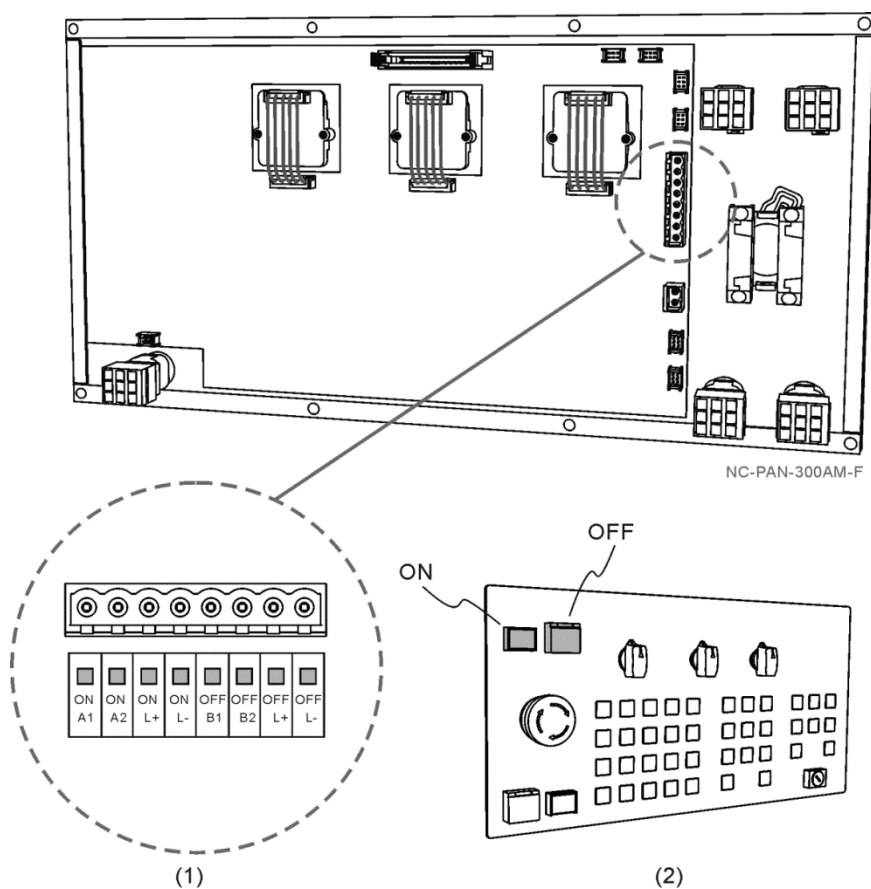
■ Description of the connector

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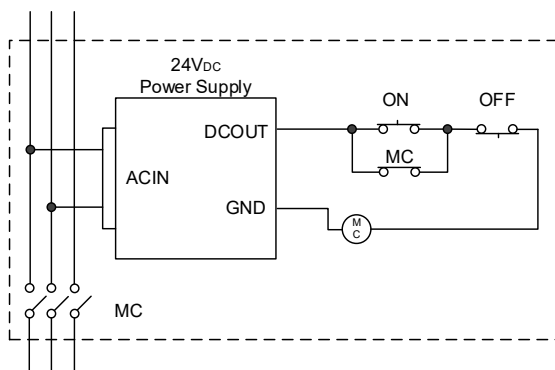
When the Power On key is pressed, the circuit between ONA1 and ONA2 is closed; when the Power Off key is pressed, the circuit between OFFB1 and OFFB2 is open.

Introduction of NC System Operation

<div style="text-align: right; font-size: 3em;">3</div>

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

3

3

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 (absolute coordinates)	-	-	-
REL (the clear function of the corresponding axis is available only when the axis connected)	-	-	-
MECH (machine coordinates)	-	-	-
REL. Clear (the clear function of the corresponding axis is available only when the axis connected)	CLR ALL	-	-
	CLR X	-	-
	CLR Y	-	-
	CLR Z	-	-
View Switch (Two channel display/ One channel display)	-	-	-

Program (PRG) function (Ctrl + F2)			
Layer 1	Layer 2	Layer 3	Layer 4
Seed Setup (Spindle speed setup)	-	-	-
File Manage	➔	-	-
	←	-	-
	Date Sort	-	-
	Select (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

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. (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

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	-	-

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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	-	-	-
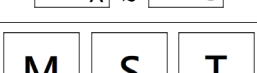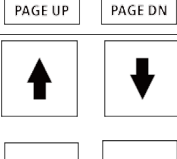
3
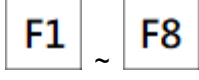
Parameter (PAR) Function (Ctrl + F7)			
Layer 1	Layer 2	Layer 3	Layer 4
Search	-	-	-
Process	-	-	-
Operation	-	-	-
Magazine	OK	-	-
Spindle	-	-	-
Machine	-	-	-
Home	-	-	-
Network	Default	-	-
Compen. (Compensation)	Pitch com. (Pitch Compensation)	OK	-
		Import Ren	-
		um	-
		um+	-
System	Default	-	-
	Color 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.
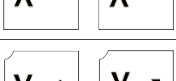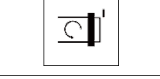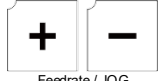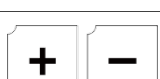
Soft Interface (SOFT) Function (Ctrl + F8)				
Panel functions	Program execution	MPG simulation	Tool magazine forward	Spindle forward
	Stop execution	Optional stop	Tool magazine backward	Spindle stop
	Single block execution	Light	Limit release	Spindle reverse
	Optional stop	Single block skip	Coolant	-
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
$\cdot_,$	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 axis direction: in JOG mode, manually operate the X axis towards positive or negative direction
	Y axis direction: in JOG mode, manually operate the Y axis towards positive or negative direction
	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 override: increment / decrement
	Rapid override: increment / decrement
	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

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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.

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■   **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.

3.2.2 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:
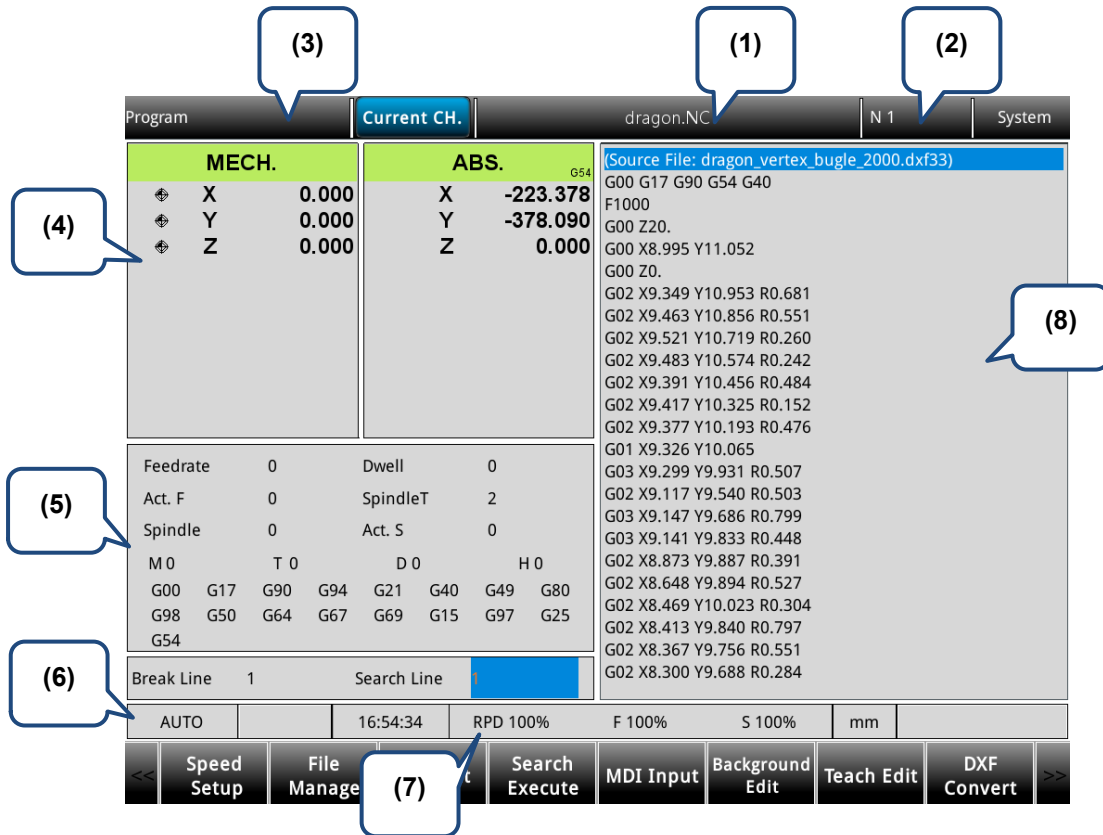
Figure 3.2.7.2

(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:
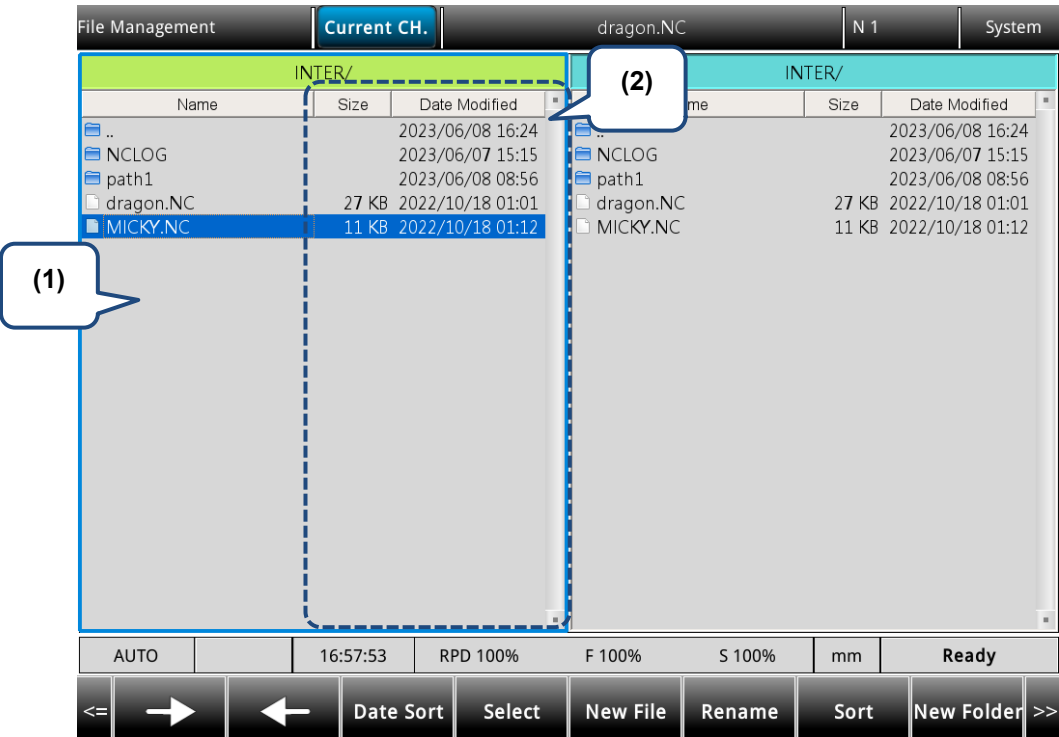
Figure 3.2.7.3

(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

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

Tool information:

Cutter Num	Length	Radius	Length Wear	Radius Wear	Life
1	0.000	0.000	0.000	0.000	0
2	0.000	0.000	0.000	0.000	0
3	0.000	0.000	0.000	0.000	0
4	0.000	0.000	0.000	0.000	
5	10.000	0.000	0.000	0.000	0
6	0.000	0.000	0.000	0.000	0
7	0.000	0.000	0.000	0.000	0
8	0.000	0.000	0.000	0.000	0
9	0.000	0.000	0.000	0.000	0
10	0.000	0.000	0.000	0.000	0
11	0.000	0.000	0.000	0.000	0
12	0.000	0.000	0.000	0.000	0
13	0.000	0.000	0.000	0.000	0
14	0.000	0.000	0.000	0.000	0
15	0.000	0.000	0.000	0.000	0

Tool Register — Current CH. — dragon.NC — N 1 — System

Mech Z : 0.000 — Channel 1

Con.JOG — 10:27:38 — RPD 100% — JOG 100% — S 100% — mm

<= | Inc. Set | Set Length | Clear | | | | | >>

(1) (2) (3) (4)

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

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■ **Diagnosis (DGN) Group**

Servo Tuning:
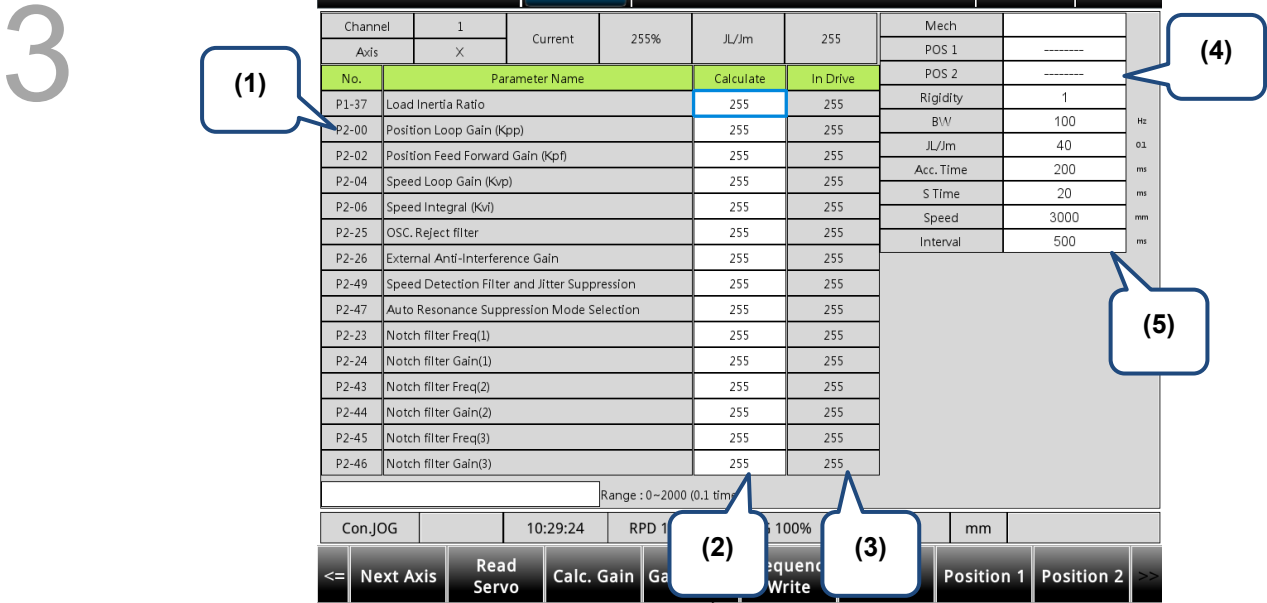
Figure 3.2.7.8

(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:
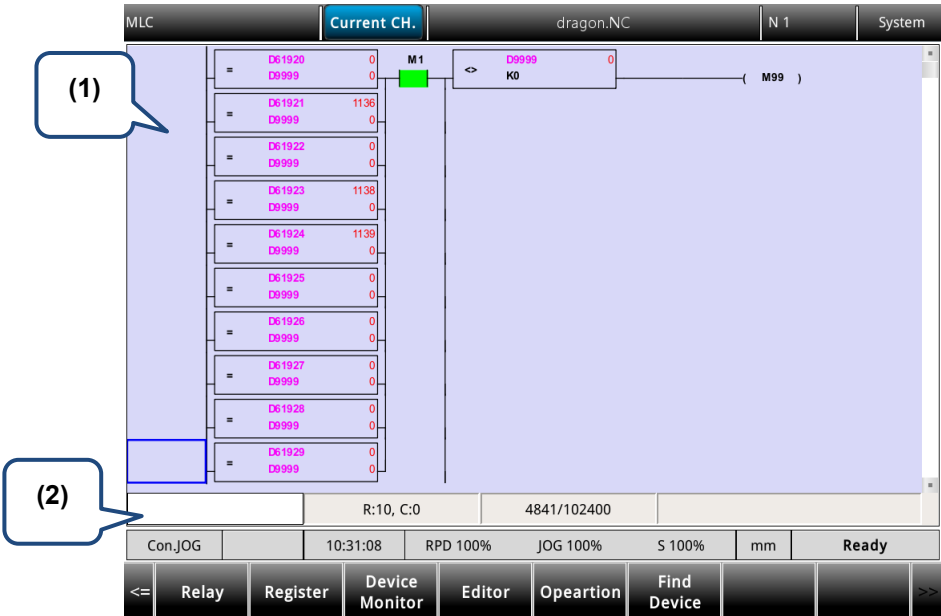
Figure 3.2.7.9

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

■ Alarm (ALM) Group

Figure 3.2.7.10

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

■ Graph (GRA) Group
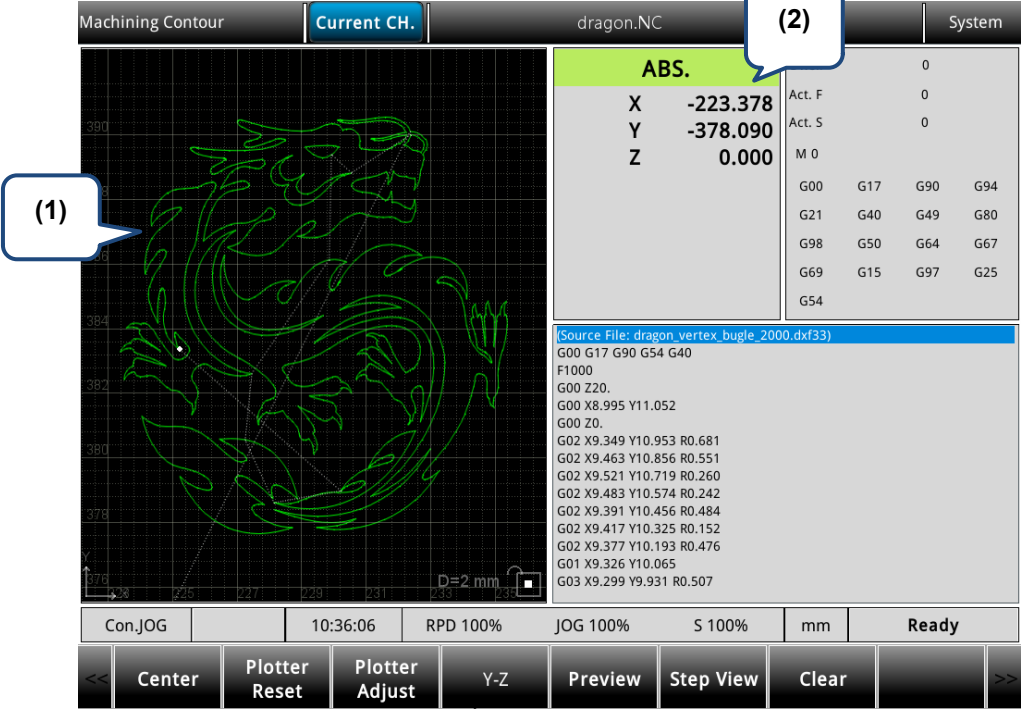
Figure 3.2.7.11

(1) Path diagram: displays the program path

(2) Coordinate information: machine / absolute coordinates

3.3 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.
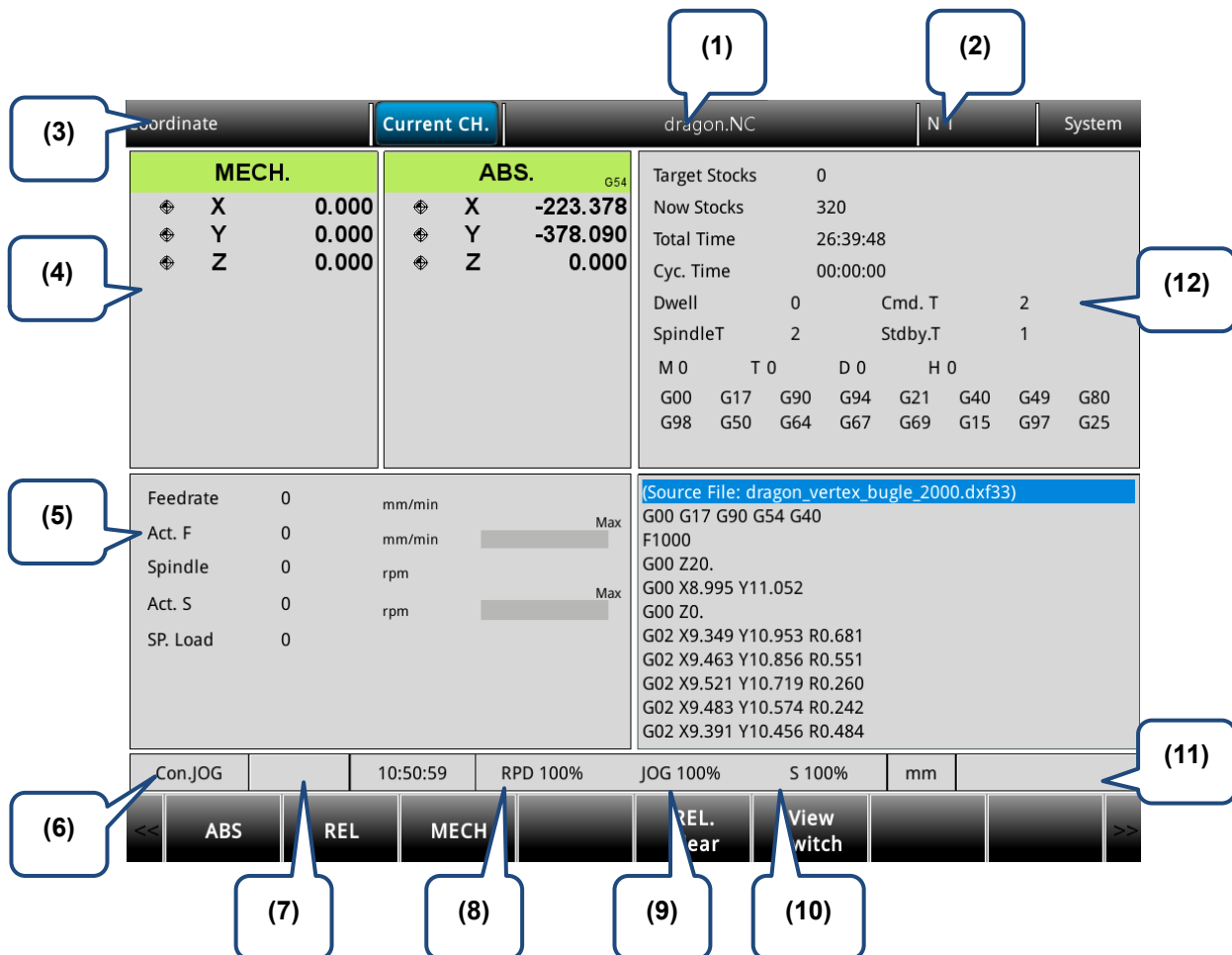
(1) Name of current program
(2) Currently executed program line
(3) Current group function
(4) Current coordinates
(5) Spindle & feed information:
    Spindle speed: command value
    Cutting feedrate: command value
    Spindle load rate: %
    Actual speed: RPM
    Actual feedrate: mm/min

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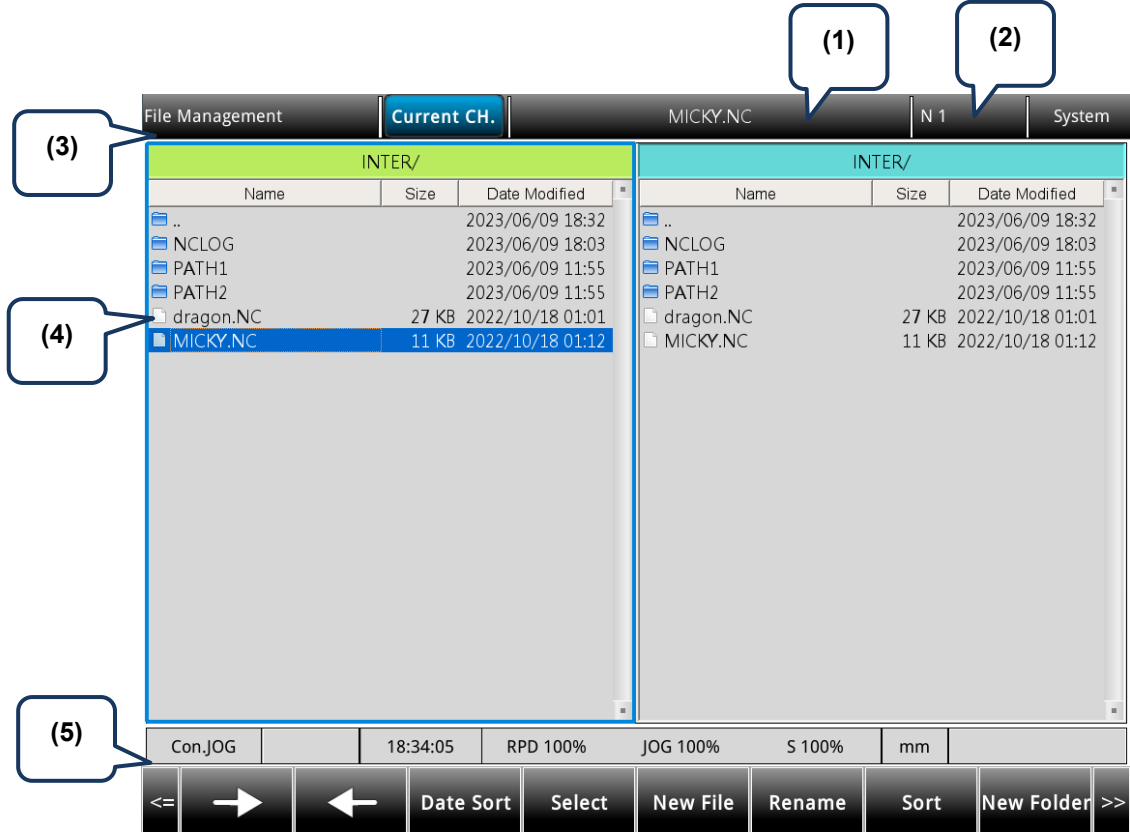
(1) Name of current program　　　(4) Disk options
(2) Currently executed program line　(5) Current system mode
(3) Current group function

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.

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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.

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

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 $\boxed{\text{PRG}}$ to switch to the PRG screen.

(3) Press $\boxed{\text{File Manage}}$ to switch to the file manage screen.

(4) In the File manage screen, press ⬆ and ⬇ or $\boxed{\text{PAGE UP}}$ and $\boxed{\text{PAGE DN}}$ to move the cursor, and press $\boxed{\text{ENTER}}$ to enter the 2nd or 3rd 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 $\boxed{\text{ENTER}}$ 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 $\boxed{\text{PRG}}$ to switch to the PRG screen.

(3) Press $\boxed{\text{File Manage}}$ 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 $\boxed{\text{PAGE UP}}$ and $\boxed{\text{PAGE DN}}$ 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**.

3
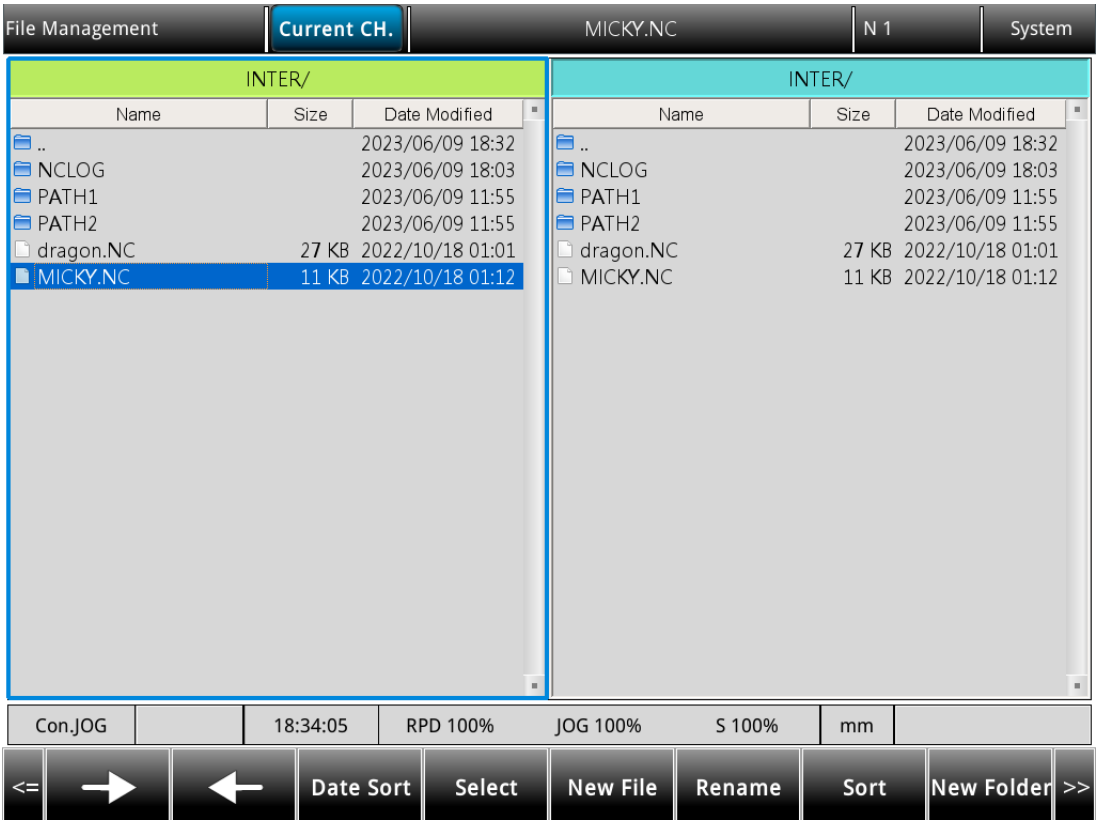
Figure 3.4.5.1

(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.
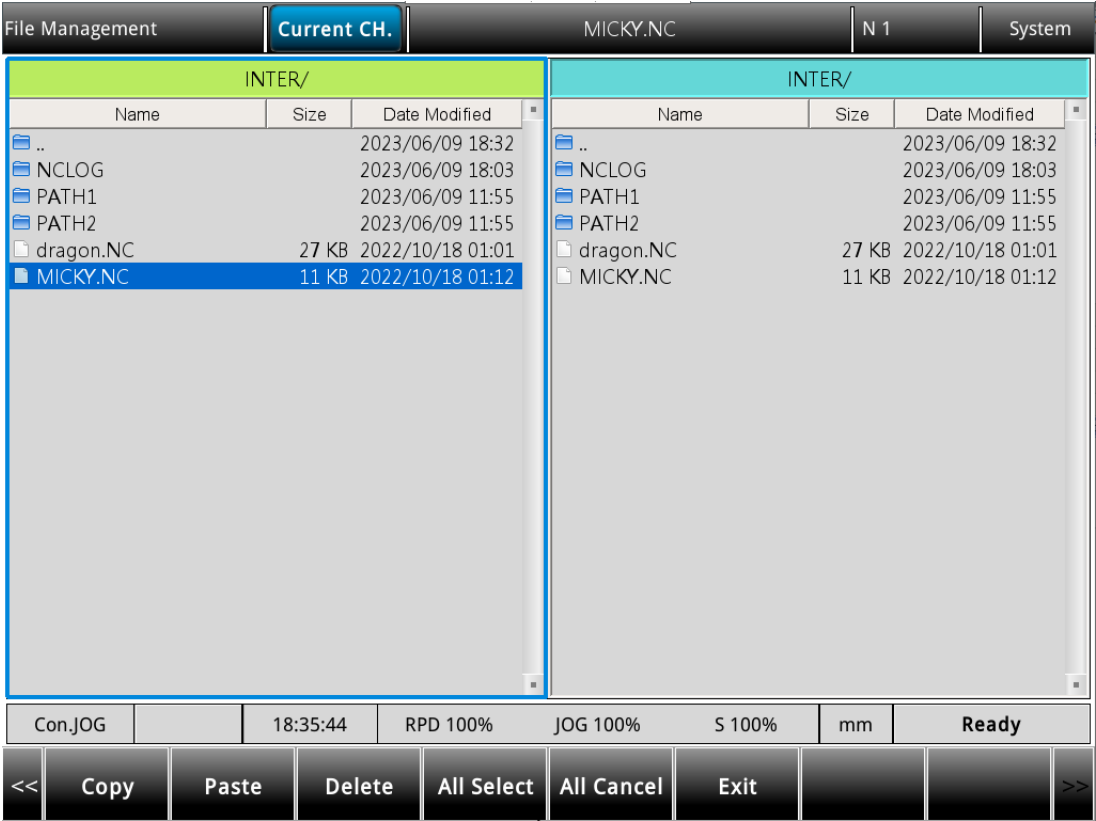
Figure 3.4.5.2

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).
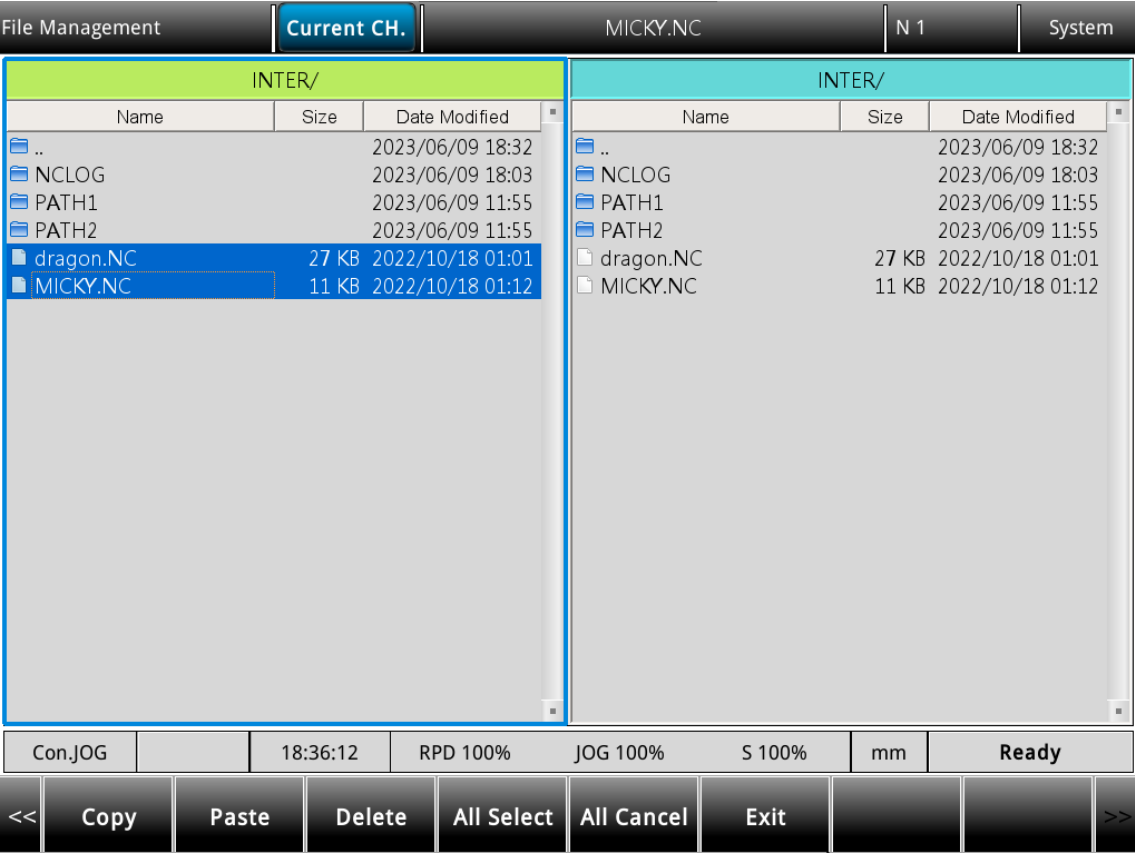
Figure 3.4.5.3

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 2nd or 3rd 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 2nd and 3rd layers of File manage but not in the 1st 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.
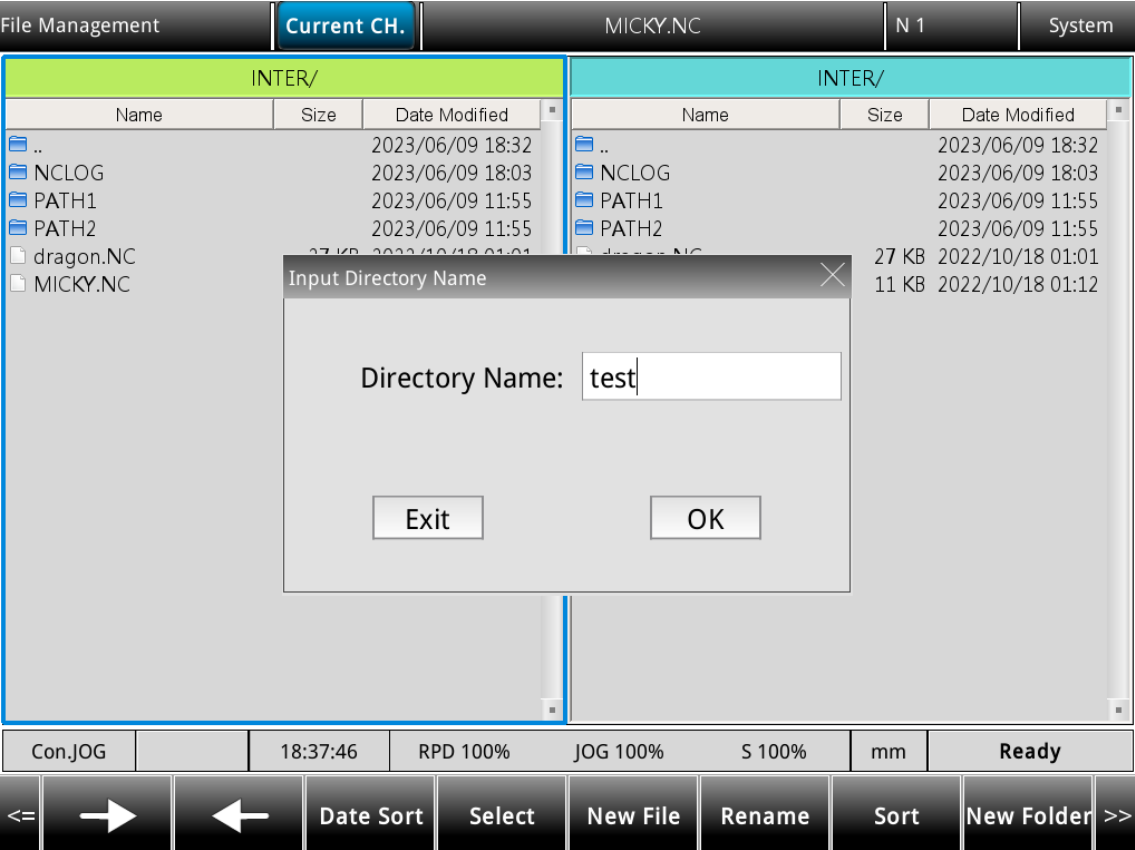
Figure 3.4.7.1

(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.

(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.

Main Program Edit	Current CH.	MICKY.NC	N 1	System

```
G01 X696.4920 Y482.7436 Z0.0000
G02 X696.9330 Y482.5399 Z0.0000 I0.1771 J-0.1958
G01 X696.9328 Y482.5399 Z0.0000
G02 X696.6036 Y481.1941 Z0.0000 I-3.3366 J0.1031
G01 X696.6037 Y481.1940 Z0.0000
G03 X696.7017 Y480.8553 Z0.0000 I0.2379 J-0.1147
G01 X696.7018 Y480.8555 Z0.0000
G01 X697.1520 Y480.5744 Z0.
G01 X697.1520 Y480.5744 Z0.
G02 X697.2735 Y480.3110 Z0.
G01 X697.2736 Y480.3110 Z0.
G02 X696.6796 Y476.7528 Z0.
G01 X696.6796 Y476.7528 Z0.
G02 X696.4623 Y476.5398 Z0.
G01 X696.4623 Y476.5396 Z0.
G03 X694.1512 Y474.9086 Z0.
G01 X694.1512 Y474.9086 Z0.
G02 X693.9301 Y474.7721 Z0.
G01 X693.9301 Y474.7722 Z0.
G03 X688.6956 Y471.7117 Z0.
G01 X688.6955 Y471.7117 Z0.0000
G03 X690.5583 Y467.7429 Z0.0000 I2.5281 J-1.2350
G01 X690.5583 Y467.7429 Z0.0000
G03 X699.5696 Y469.7022 Z0.0000 I2.5218 J10.1040
G01 X699.5695 Y469.7023 Z0.0000
```

Text Search ✕

Text: G01

Replace:

Exit   OK

Con.JOG		12:05:08	RPD 100%	JOG 100%	S 100%	mm	

<<	All Select	Line Search	Find String						>>

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.
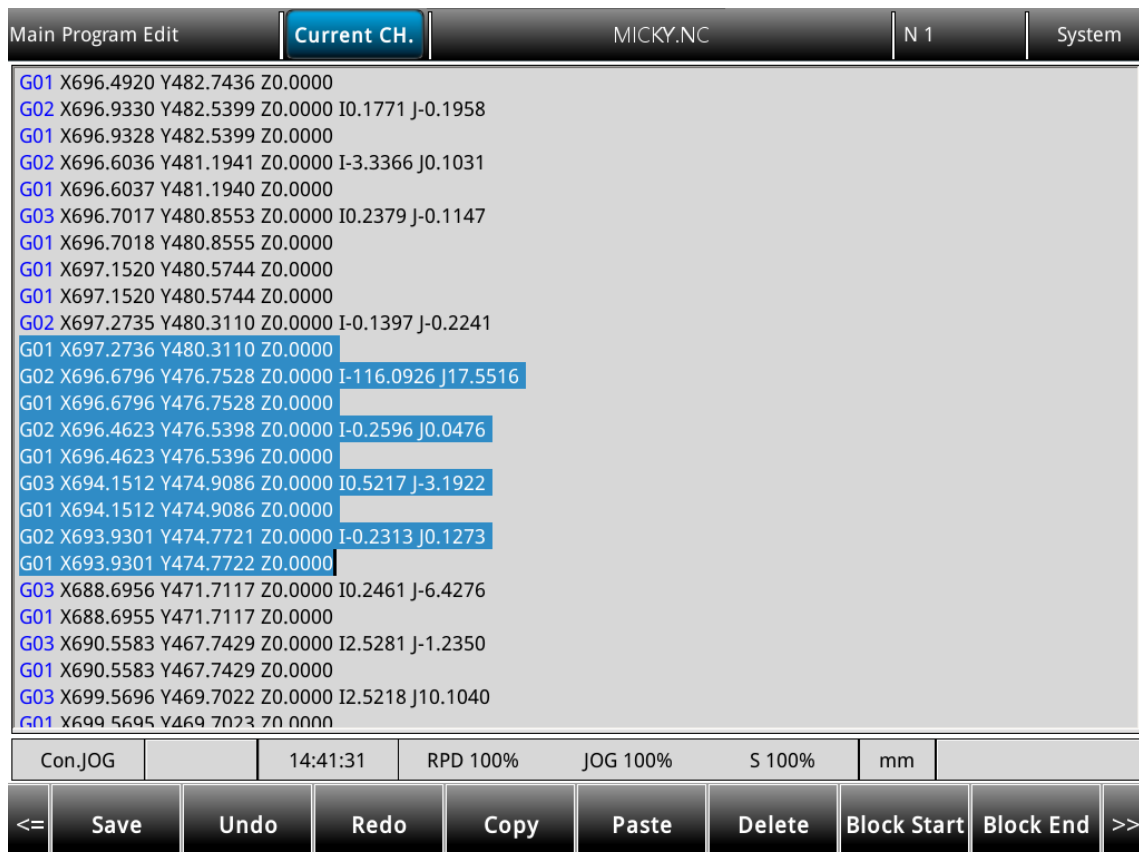
Figure 3.4.10.3.1

(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

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

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.

Program		Current CH.		MICKY.NC		N 1	System

MECH.			ABS.	G54
⊕ X	0.000	X	-223.378
⊕ Y	0.000	Y	-378.090
⊕ Z	0.000	Z	0.000

```
(99
(11111
G00G17G55G40
F3000
G04X1.
G00X0Y0Z0
G00Z20.0000
G00 X702.3118 Y485.1175
G00 Z0.0000
G01 X703.1958 Y486.1988 Z0.0000
G00 Z20.0000
G00 X697.1938 Y488.1743
G00 Z0.0000
G03 X696.5166 Y484.8526 Z0.0000 I6.8706 J-3.1306F10000
G01 X696.5168 Y484.8526 Z0.0000
G02 X696.4377 Y484.6575 Z0.0000 I-0.2640 J-0.0066
G01 X696.4378 Y484.6574 Z0.0000
G02 X690.2575 Y481.7944 Z0.0000 I-7.1041 J7.2336
G01 X690.2575 Y481.7946 Z0.0000
G03 X687.4492 Y477.4103 Z0.0000 I0.8170 J-3.6149
G01 X687.4492 Y477.4103 Z0.0000
G03 X687.9472 Y477.4309 Z0.0000 I0.2478 J0.0401
G01 X687.9475 Y477.4309 Z0.0000
G02 X692.2650 Y481.1359 Z0.0000 I4.4630 J-0.8327
```

Feedrate	0	Dwell	0
Act. F	0	SpindleT	2
Spindle	0	Act. S	0

M 0		T 0		D 0		H 0	
G00	G17	G90	G94	G21	G40	G49	G80
G98	G50	G64	G67	G69	G15	G97	G25
G54							

Break Line	1		Search Line	1

Con.JOG		14:51:31	RPD 100%	JOG 100%	S 100%	mm	Ready

<<	Speed Setup	File Manage	File Edit	Search Execute	MDI Input	Background Edit	Teach Edit	DXF Convert	>>

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.

3

(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.
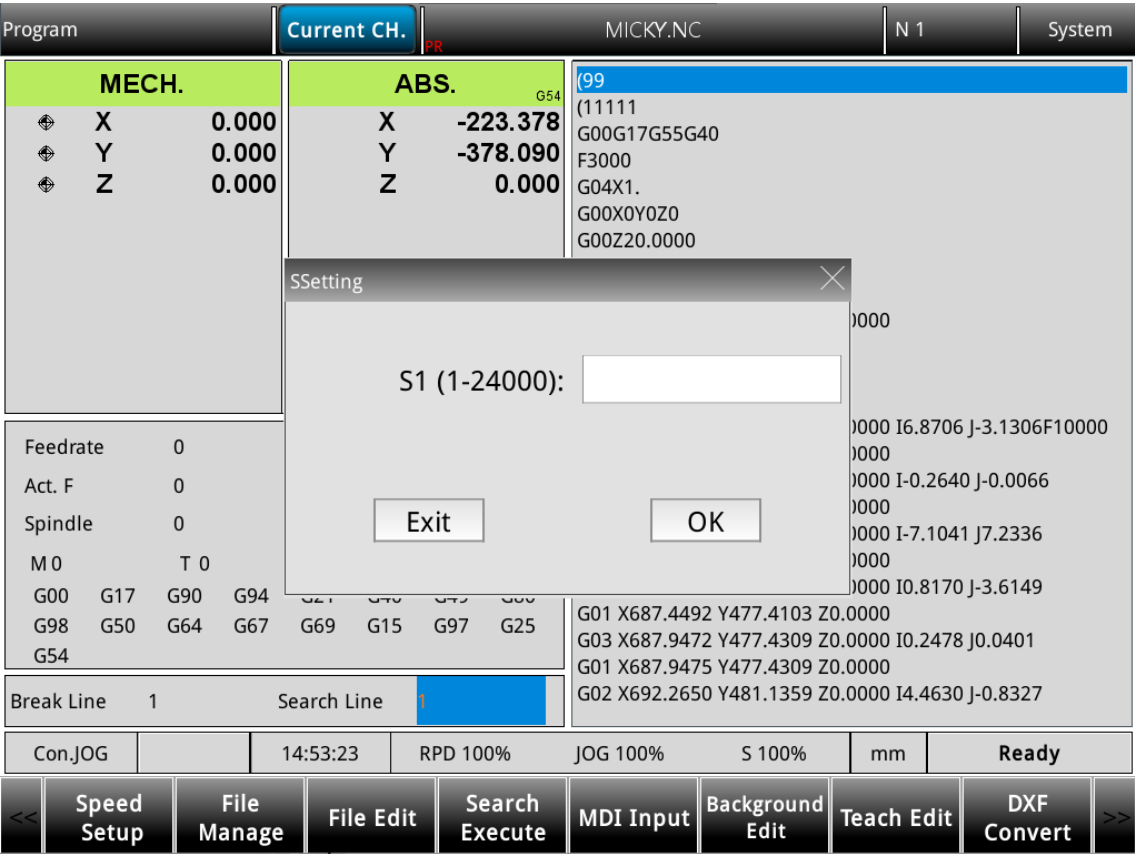
Figure 3.4.11.2

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.

3

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)

3.5 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.

3

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).
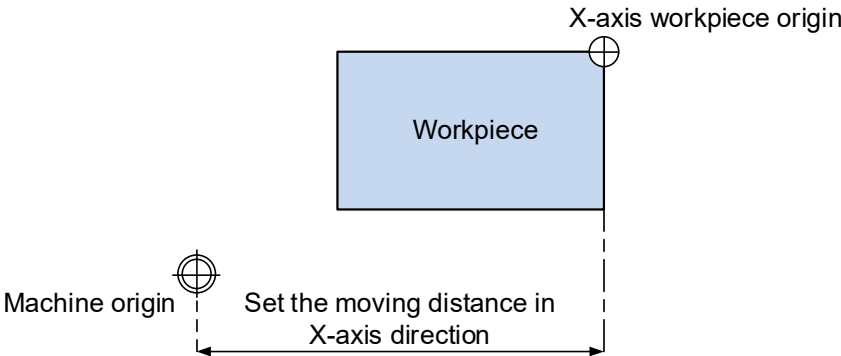
Figure 3.5.1.1.2

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).
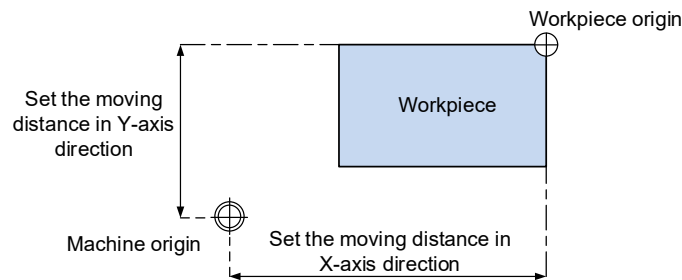
Figure 3.5.1.1.4

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.
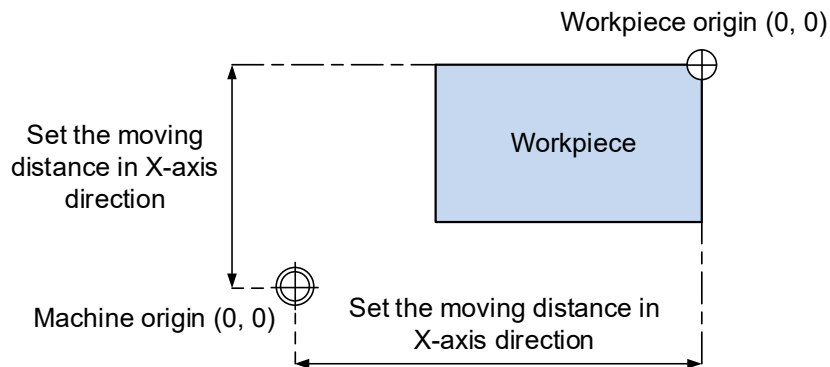
Figure 3.5.1.2.1

3

Offset		Current CH.		MICKY.NC		N 1	System

OFFSET		G54		G55		MECH.	
X	0.000	X	223.378	X	0.000	X	0.000
						Y	0.000
						Z	0.000
Y	0.000	Y	378.090	Y	0.000		
Z	0.000	Z	0.000	Z	0.000		

G56		G57		G58		ABS.	
X	0.000	X	180.033	X	0.000	X	-223.378
						Y	-378.090
						Z	0.000
Y	0.000	Y	299.600	Y	0.000		
Z	0.000	Z	0.000	Z	0.000		

Con.JOG		15:03:39				mm	

<=	Set All	Set	Inc. Set	All Clear	Center	Rectangle Center	Circle Center	MPG Offset	>>

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 ⁻₁ 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.
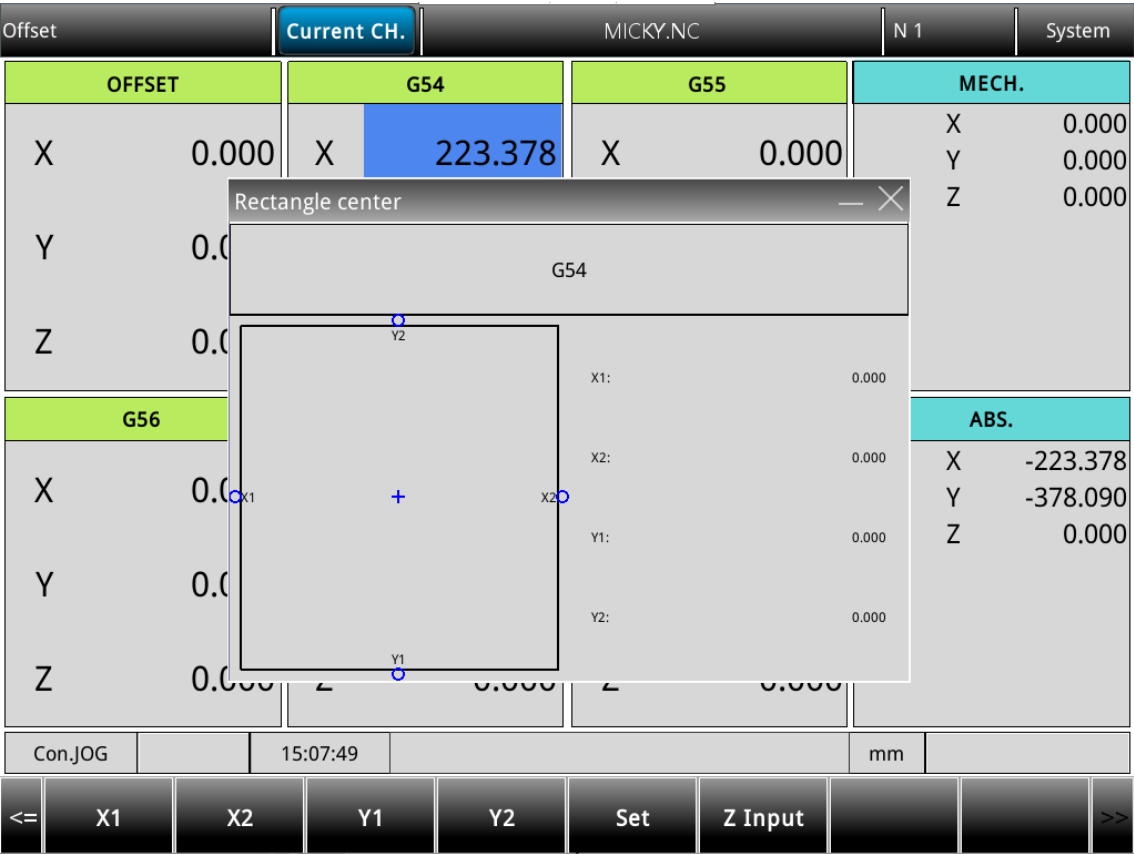
Figure 3.5.1.4.1

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.

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.
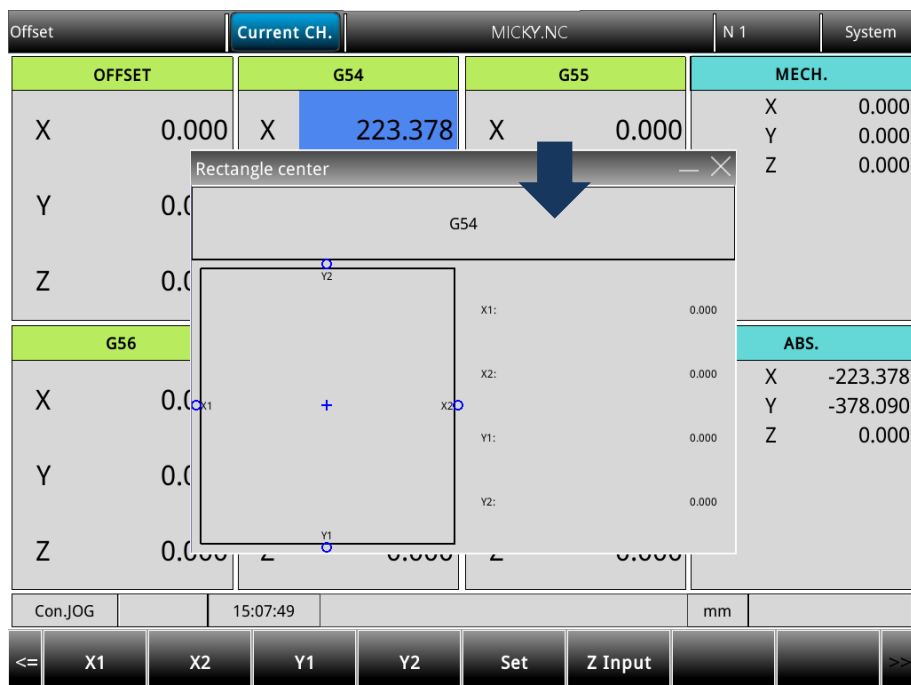
Figure 3.5.1.4.2

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.
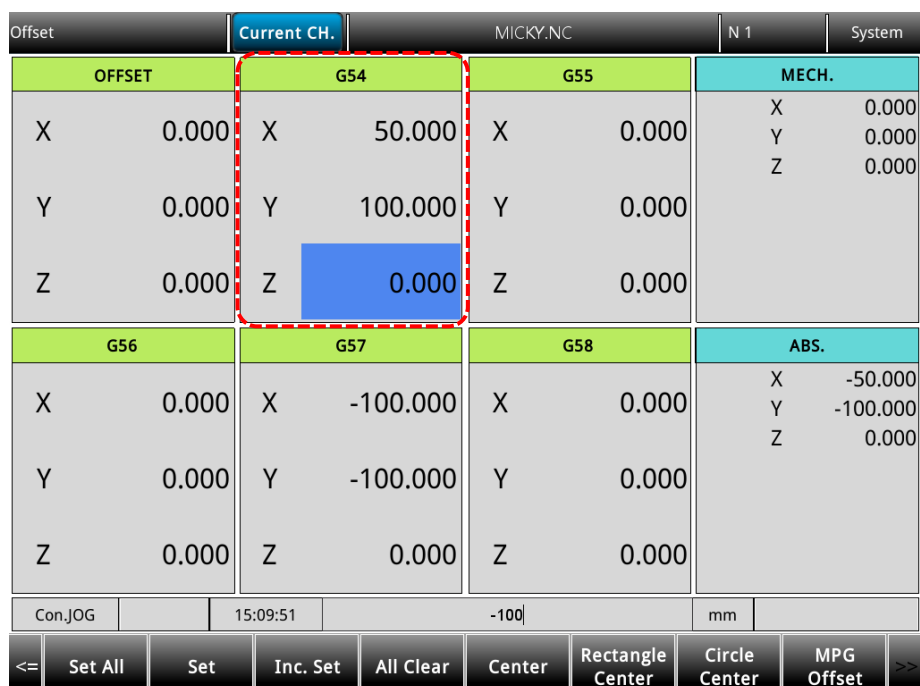
Figure 3.5.1.4.3

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.
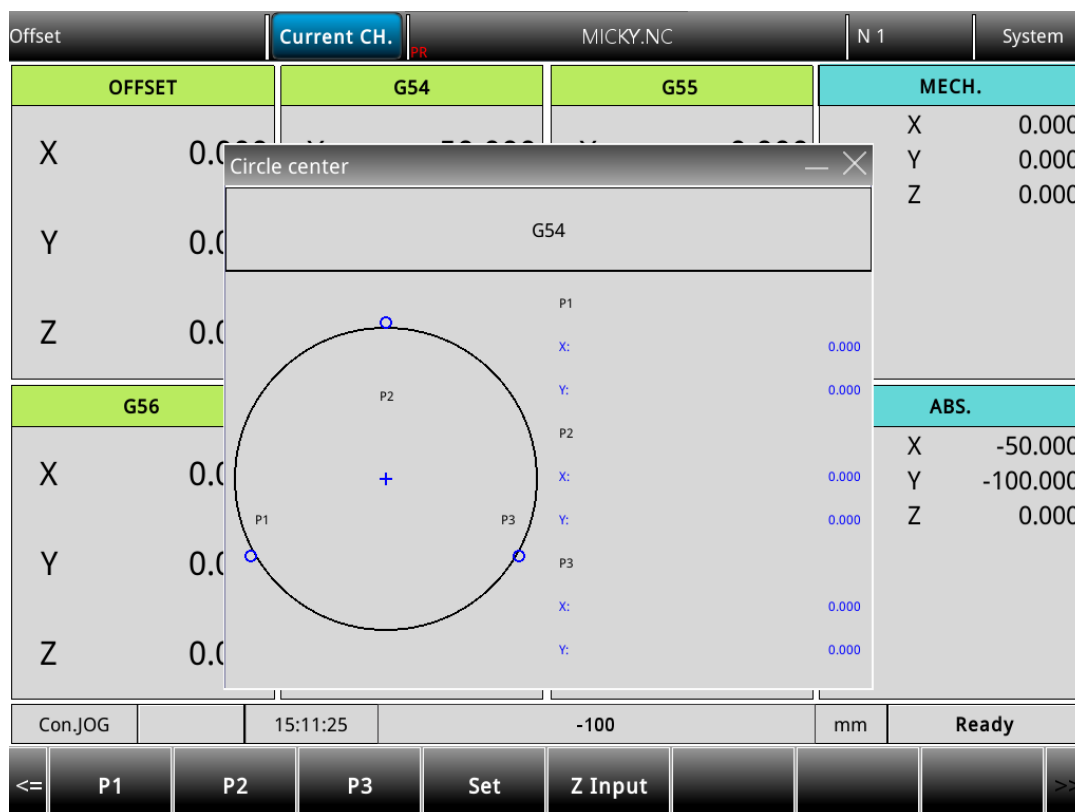
Figure 3.5.1.5.1

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.

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.
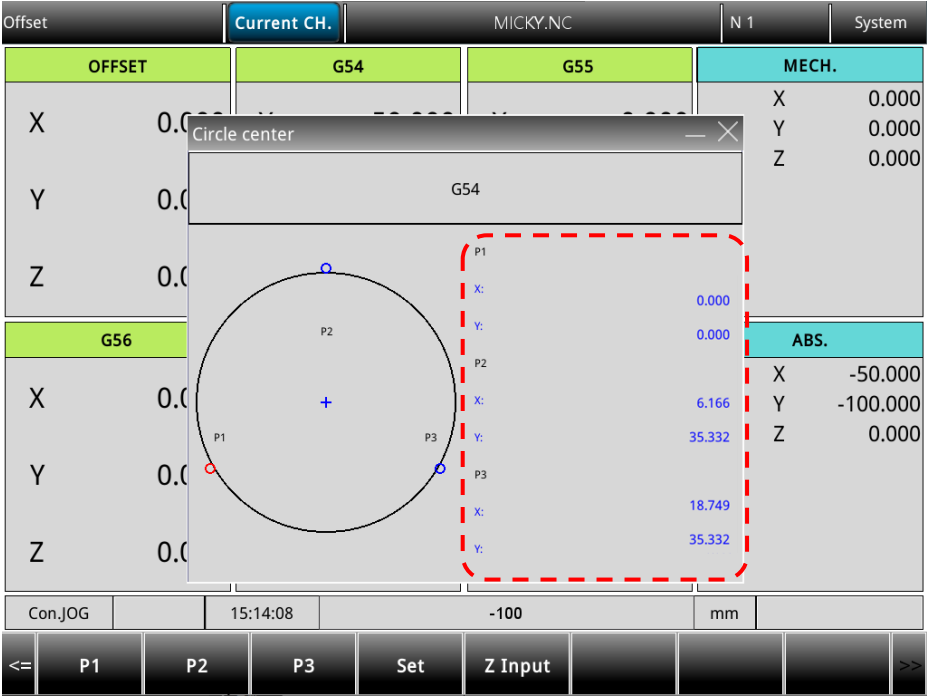
Figure 3.5.1.5.2

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

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.
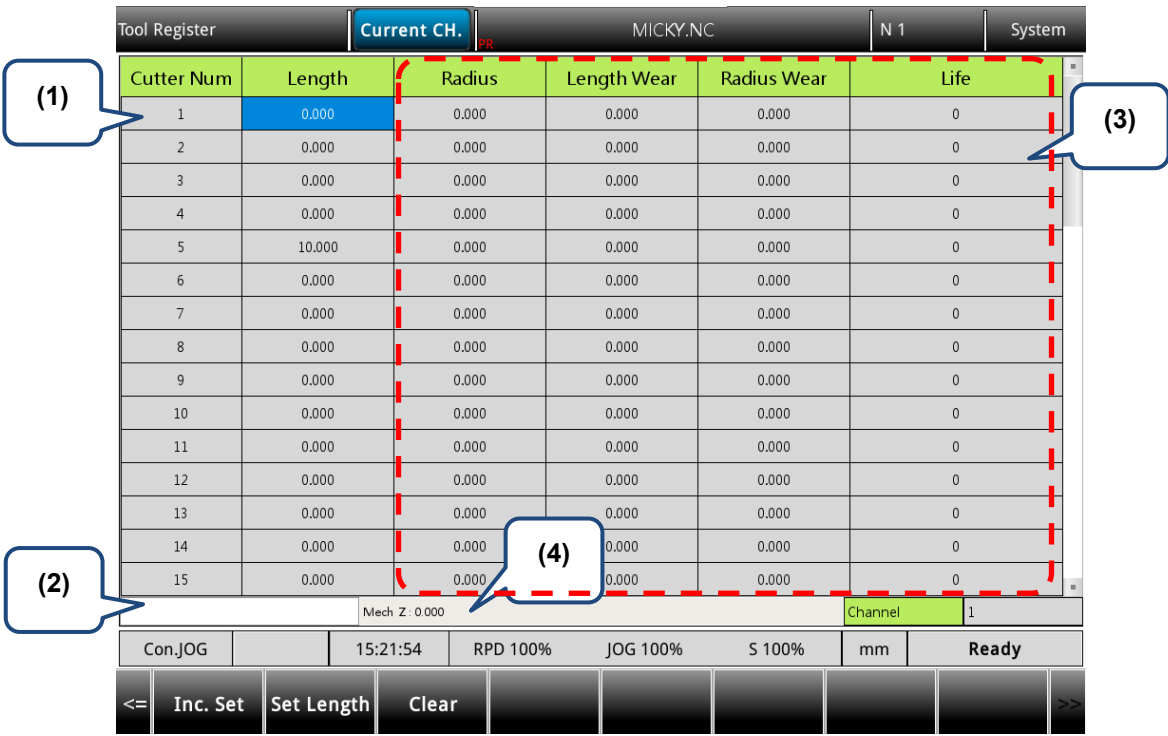
Figure 3.5.2.1.1

(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.

3

■ 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.
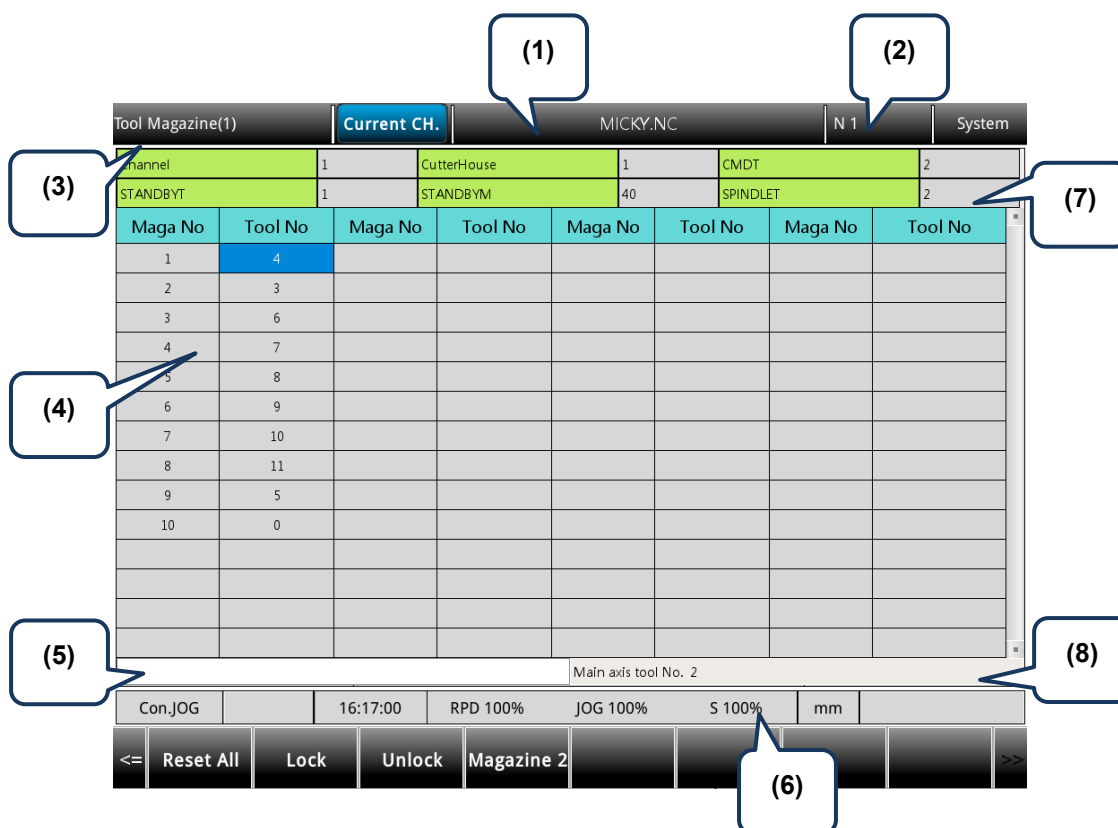
Figure 3.5.3.1

(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.

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.

Tool Magazine(1)		Current CH.		MICKY.NC		N 1		System
Channel		1	CutterHouse		1	CMDT		1
STANDBYT		2	STANDBYM		1	SPINDLET		0
Maga No	Tool No	Maga No	Tool No	Maga No	Tool No	Maga No	Tool No	
1	2							
2	1							
3	5							
4	4							
5	3							
6	6							
7	7							
8	8							
9	9							
10	10							
				Main axis tool No. 0				

Con.JOG		16:20:03	RPD 100%	JOG 100%	S 100%	mm	

<=	Reset All	Lock	Unlock	Magazine 2				>>

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.

Tool Magazine(1)		Current CH.		MICKY.NC		N 1	System
Channel	1	CutterHouse	1	CMDT	1		
STANDBYT	2	STANDBYM	1	SPINDLET	0		

Maga No	Tool No	Maga No	Tool No	Maga No	Tool No	Maga No	Tool No
1	2						
2	1						
3	5						
4	4						
5	3						
6	6						
7	7						
8	8						
9	9						
10	10						

Main axis tool No. 0

Con.JOG		16:21:00	RPD 100%	JOG 100%	S 100%	mm	

| <= | Reset All | Lock | Unlock | Magazine 2 | | | | | >> |

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

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 $\boxed{\text{Function}}$) 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.

Diagnosis		Current CH.		MICKY.NC		N 1	System

Date	2023/06/09		Target Stocks	0	
Time	16:26:49		Comp. Stocks	320	
Total Time	26:39:48				
Cycle Time	00:00:00				

Ch	Axis	Connect	Ready	Load	Peak	JL/Jm	Dist. to Z P.	Mech	Home	Abs. Reset
1	X	●	●	0 %	0 %	-	-	0.000	●	0
1	Y	●	●	0 %	0 %	-	-	0.000	●	0
1	Z	●	●	0 %	0 %	-	-	0.000	●	

Con.JOG		16:26:49	RPD 100%	JOG 100%	S 100%	mm	Ready

<<	Stock Set	User Var.	MLC	System Monitor	System Info.	Authority	Export	Import	>>

Figure 3.6.1.1

The operation steps are as follows.

(1) Press $\boxed{\text{DGN}}$ 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 $\boxed{\text{ENTER}}$ 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.

3.6.2 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).

User Variable	Current CH.	MICKY.NC	N 1	System

User	Variable name	Value	REG D
1		1	60000
2		20	60019
3		20	60020
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Con.JOG		16:28:27	RPD 100%	JOG 100%	S 100%	mm	

<=	Delete	Unsigned Decimal	Hex	Signed Decimal	Floating			>>

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.
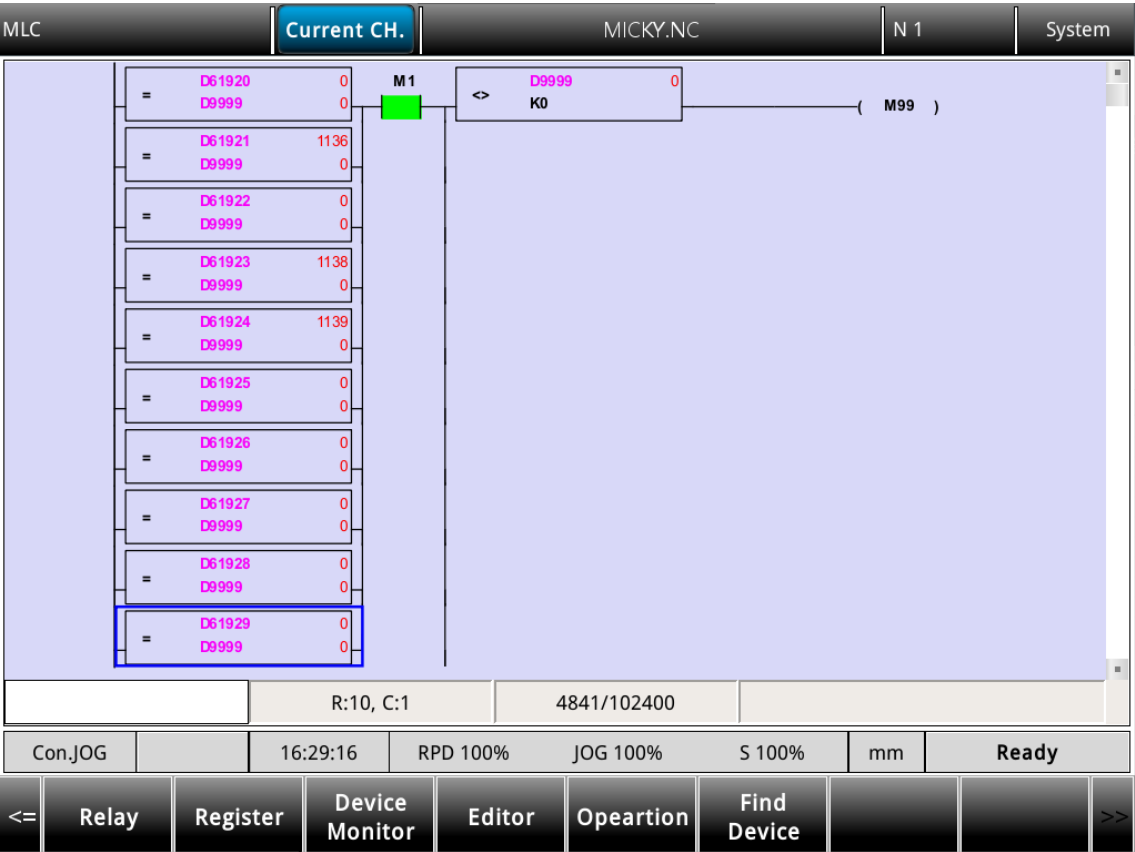
Figure 3.6.3.1

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).

	+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.

MLC Register	Current CH.	MICKY.NC	N 1	System

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

Con.JOG		16:30:37	RPD 100%	JOG 100%	S 100%	mm	

<=	[T]	[C(16)]	[C(32)]	[D]	[V]	[Z]	Unsigned Decimal	Signed Decimal	>>

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

3

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.

MLC Dev. (Hex.)	Current CH.		MICKY.NC	N 1	System
	Device	**Value**	**Status**	**Comment**	
1	D100	0x0000	##		
2	D6000	0x0002	##		
3	D6200	0x000A	##		
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Con.JOG		16:50:30	RPD 100%	JOG 100%	S 100%	mm	Ready

<=	Unsigned Decimal	Hex	Signed Decimal	Floating					>>

Figure 3.6.3.3.3

MLC Dev. (Floating)	Current CH.		MICKY.NC	N 1	System
	Device	**Value**	**Status**	**Comment**	
1	D100	0.000	##		
2	D6000	10.000	##		
3	D6200	4.000	##		
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Con.JOG		16:51:43	RPD 100%	JOG 100%	S 100%	mm	Ready

<=	Unsigned Decimal	Hex	Signed Decimal	Floating					>>

Figure 3.6.3.3.4

3

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.
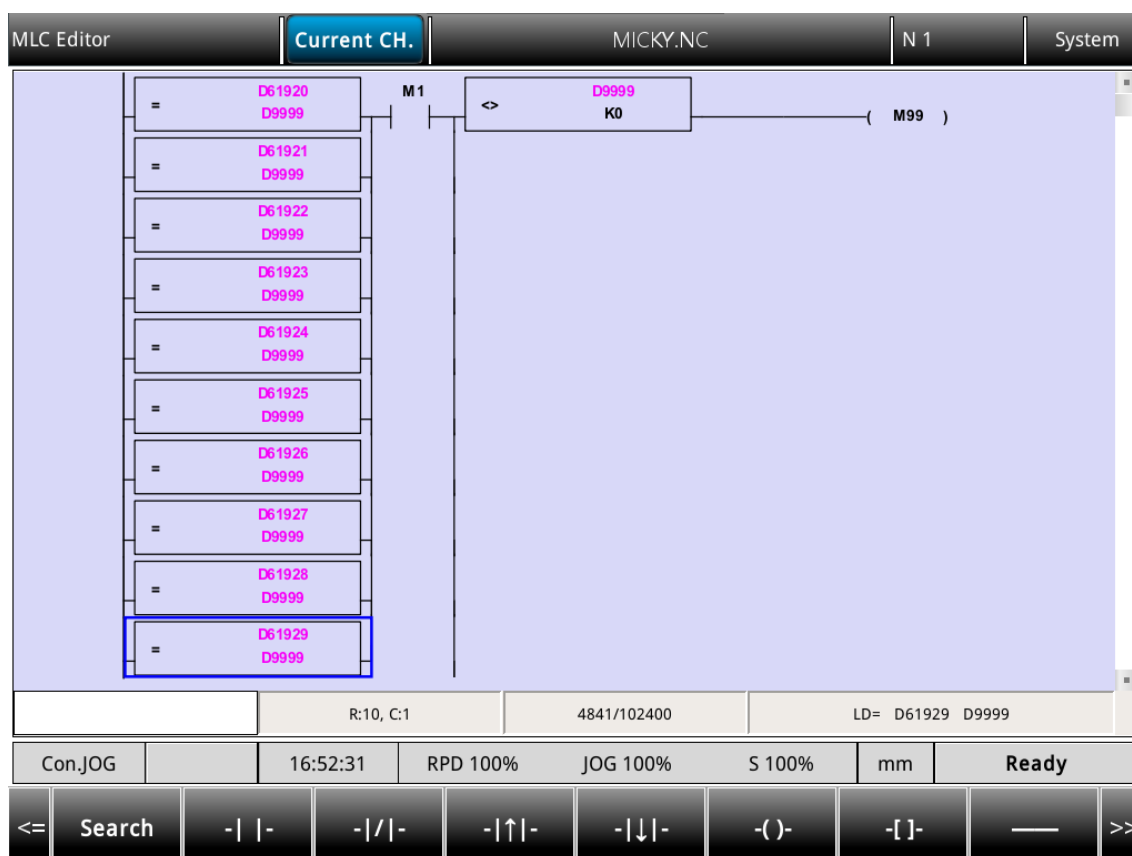
Figure 3.6.3.5.1

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.

No.	Value	No.	Value
0	1		
1	0		
2	2		
3	3		
4	5		
5	4		
6	7		
7	7		

MLC Table Edit   CH. 1   dragon-M30.NC   N1   System

R:56, C:1   5903/102400   VRT X112 K3 D100

Con.JOG   00:09:33   RPD 25% JOG 10% S 0%   mm

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.

3.6.4.1 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.

Diagnosis		Current CH.		MICKY.NC		N 1	System

Date	2023/06/09	Target Stocks	0
Time	16:26:49	Comp. Stocks	320
Total Time	26:39:48		
Cycle Time	00:00:00		

Ch	Axis	Connect	Ready	Load	Peak	JL/Jm	Dist. to Z P.	Mech	Home	Abs. Reset
1	X	●	●	0 %	0 %	-	-	0.000	●	0
1	Y	●	●	0 %	0 %	-	-	0.000	●	0
1	Z	●	●	0 %	0 %	-	-	0.000	●	

Con.JOG		16:26:49	RPD 100%	JOG 100%	S 100%	mm	Ready

<<	Stock Set	User Var.	MLC	System Monitor	System Info.	Authority	Export	Import	>>

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

3.6.4.2 Variable monitoring

■ System variables: VS0 – VS19, VS100 – VS119 and VS200 - VS219. The operation steps are as follows:

(1) Press $\boxed{\text{DGN}}$ 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 $\boxed{\text{PAGE UP}}$ and $\boxed{\text{PAGE DN}}$ to scroll to the page with the specified variable.

(6) Users can also enter the full name of a specific system variable and press $\boxed{\text{ENTER}}$ or enter the variable number and press **System Var** to search for and display the specified system variable.

Variable Monitor	Current CH.		MICKY.NC		N 1	System
ID	Value		ID	Value		
VS0	0		VS10	0		
VS1	0		VS11	0		
VS2	0		VS12	0		
VS3	3		VS13	0		
VS4	0		VS14	0		
VS5	0		VS15	0		
VS6	0		VS16	0		
VS7	0		VS17	0		
VS8	0		VS18	0		
VS9	0		VS19	0		

Con.JOG		17:49:38	RPD 100%	JOG 100%	S 100%	mm	Ready

| <= | MLC Var. | System Var. | Channel Var. | Axis Var. | HMI Var. | Signed Decimal | Unsigned Decimal | Binary | >> |

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 $\boxed{\text{DGN}}$ 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 $\boxed{\text{PAGE UP}}$ and $\boxed{\text{PAGE DN}}$ to scroll to the page with the specified variable.

3

(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.
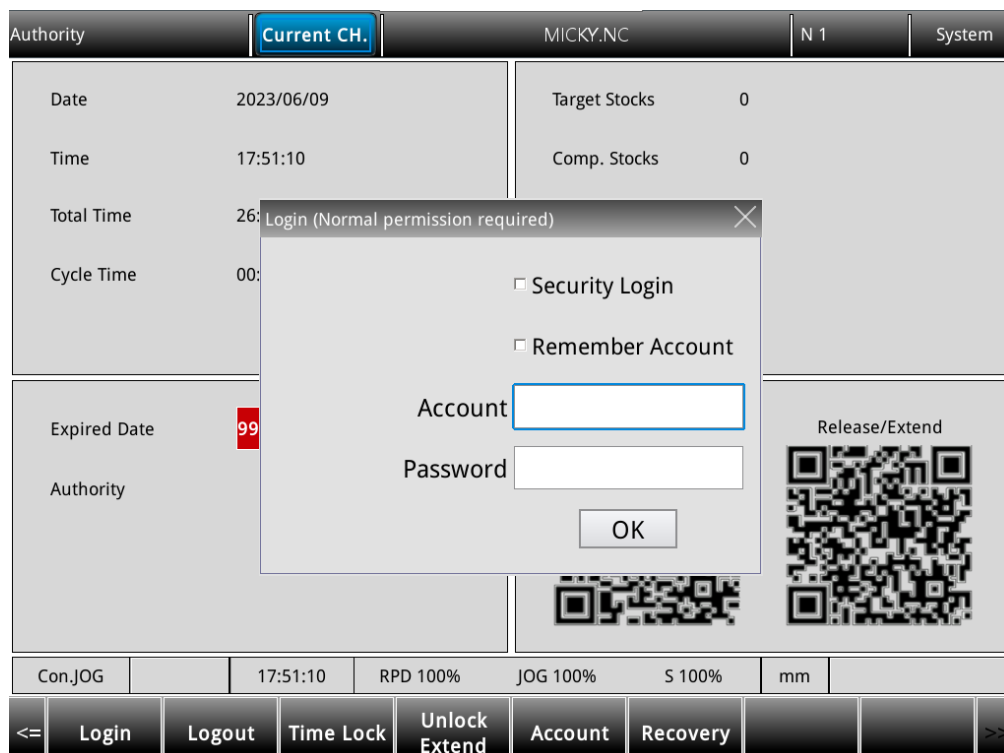
Figure 3.6.5.2.1

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.
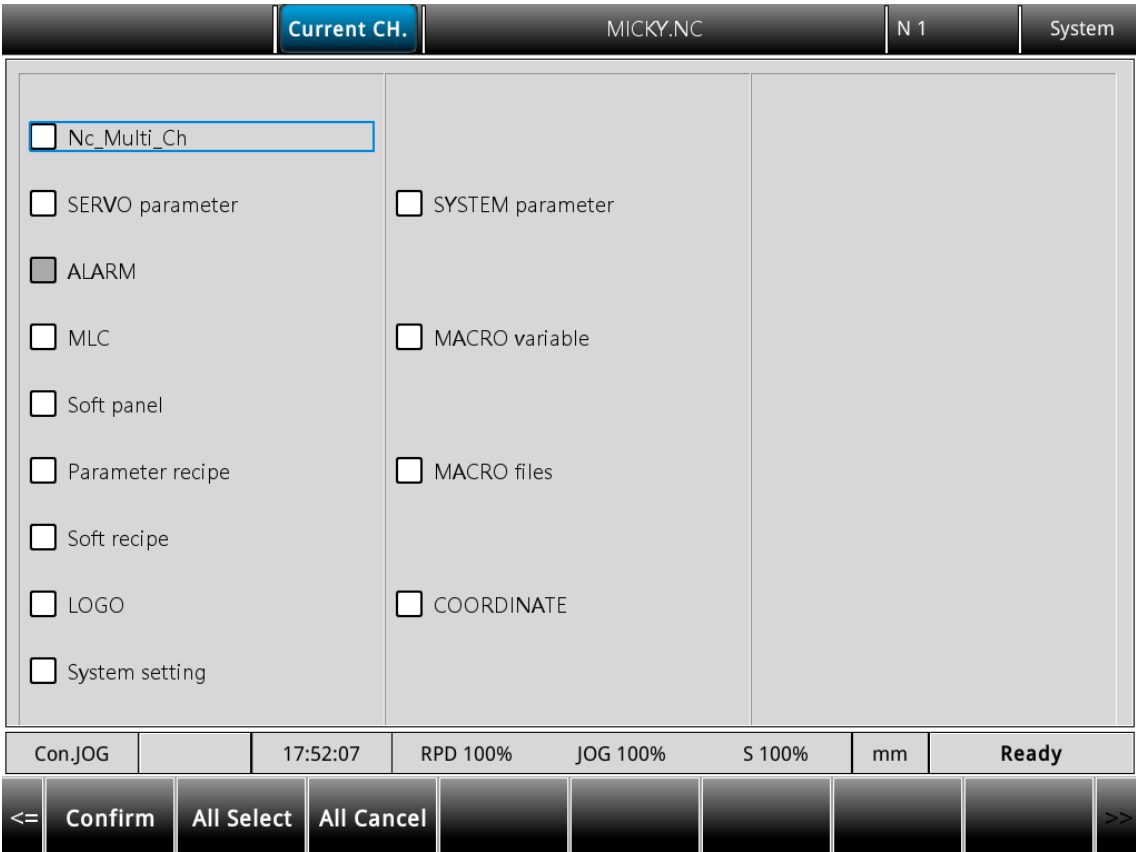
Figure 3.6.5.2.2

3.6.5.3 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.
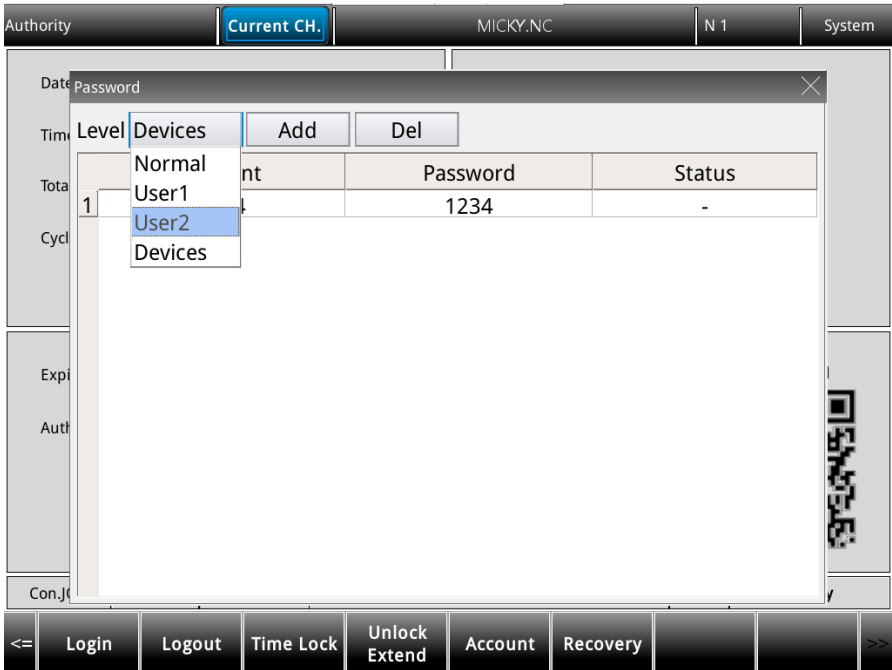
Figure 3.6.5.3.1
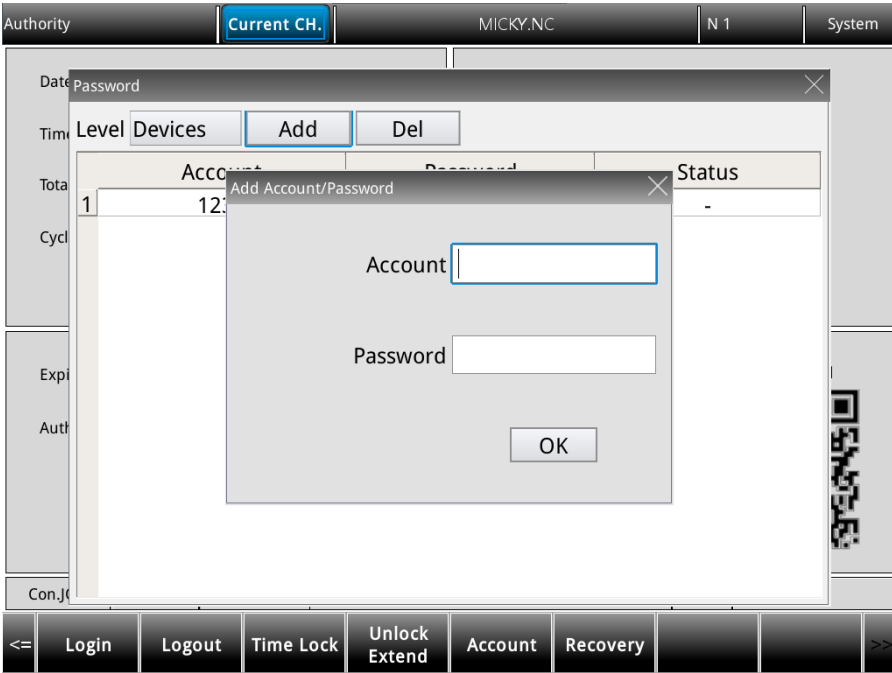
Figure 3.6.5.3.2

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 **Time limit** has set and not expired, the **expiration date** will display the deadline date, as shown in Figure 3.6.5.4.2.
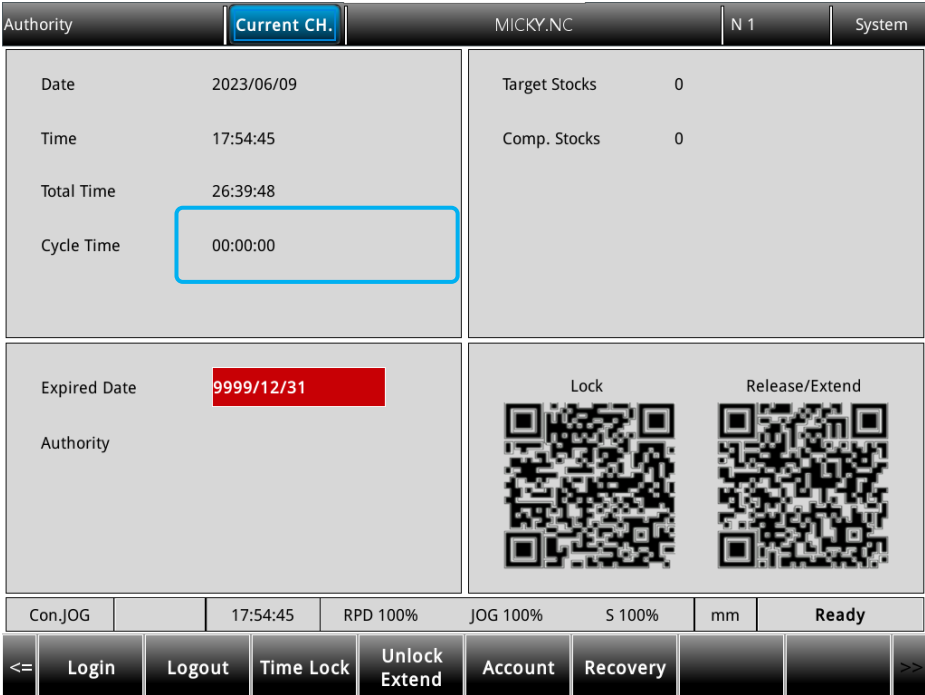
Figure 3.6.5.4.1

Figure 3.6.5.4.2

3
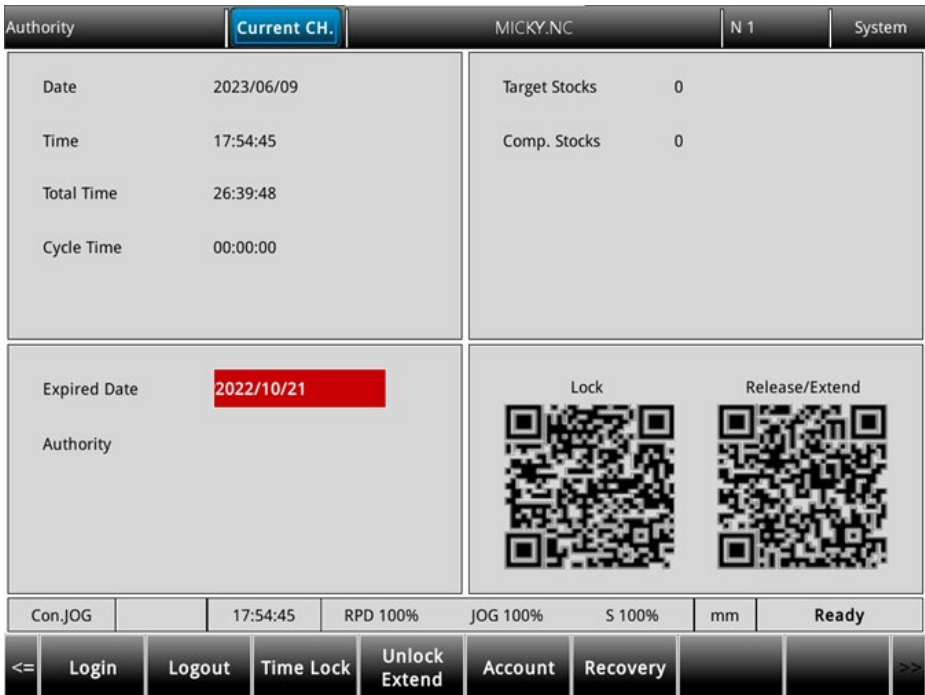
Users can see the controller's operation expiration date and time on this screen. When the duration is up, the system will be locked, meaning that any execution of G-code program (in both AUTO and MDI modes) is prohibited. The execution will not resume until the time limit setting is disabled or extended. 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.
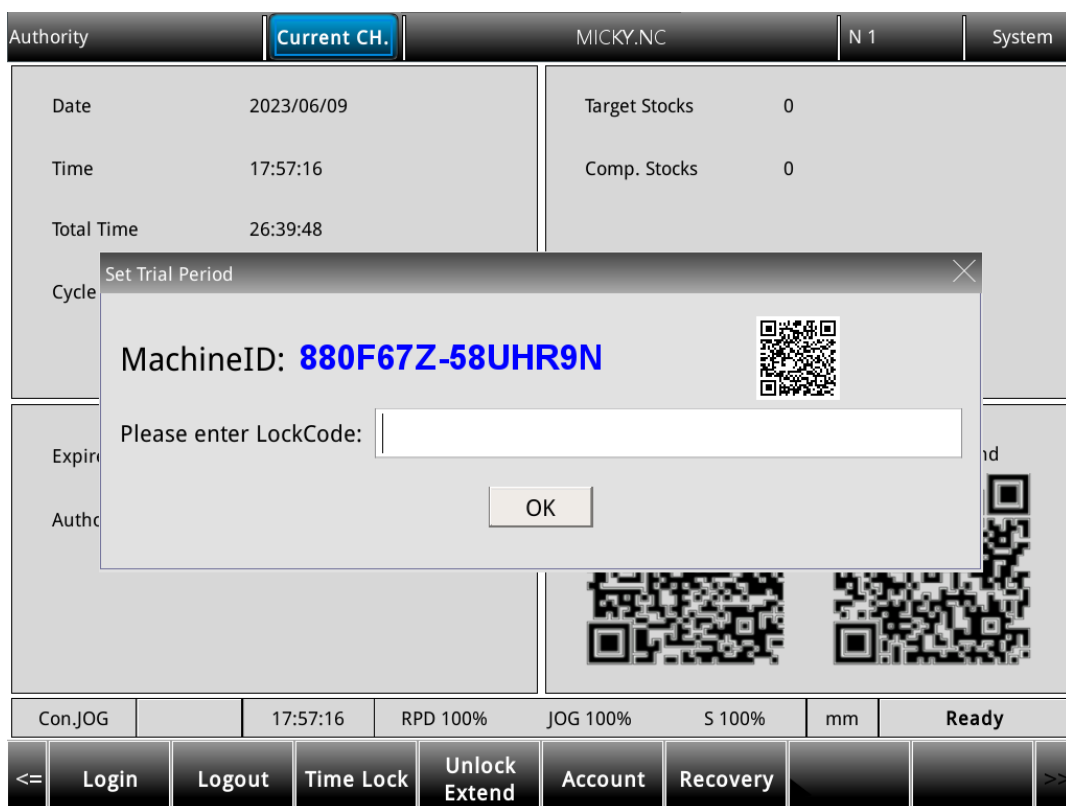
Figure 3.6.5.4.3

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
System Information	Current CH.	MICKY.NC	N 1	System
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

| Con.JOG | | 17:58:28 | RPD 100% | JOG 100% | S 100% | mm | Ready |

| <= | System Info. | Firmware Info. | | | | | | | >> |

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.
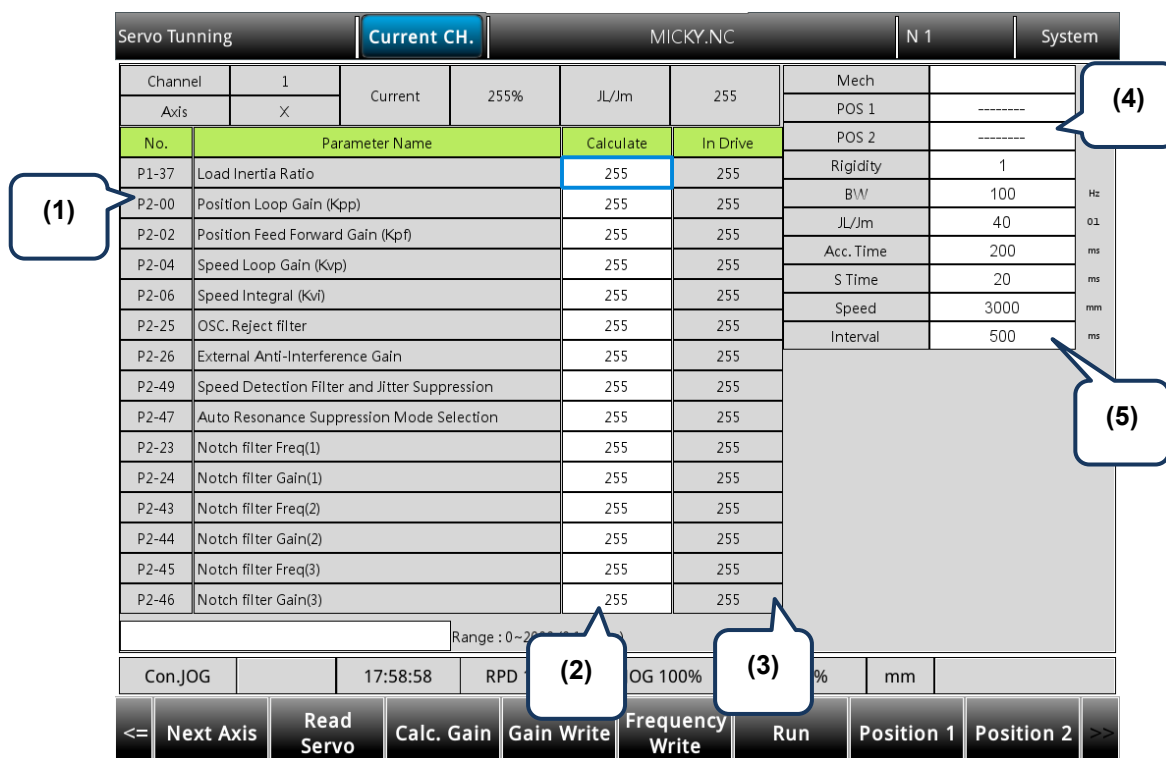
Figure 3.6.7.1

(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.

3

■ **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.
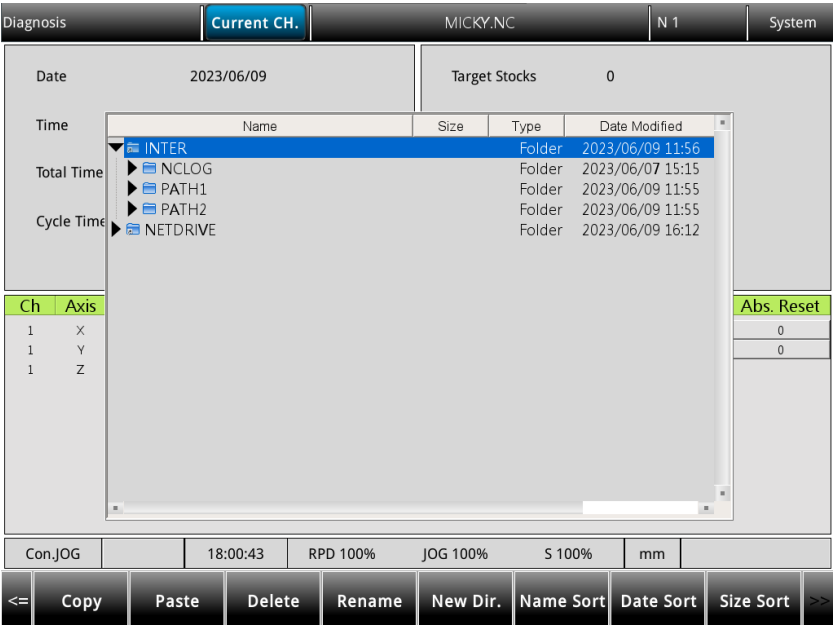
Figure 3.6.8.1

(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**.
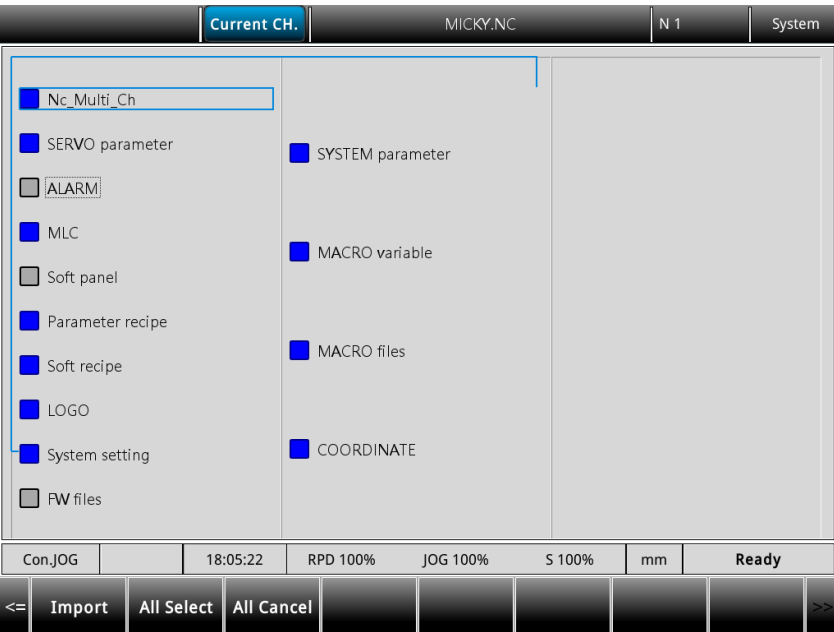
Figure 3.6.8.2

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.
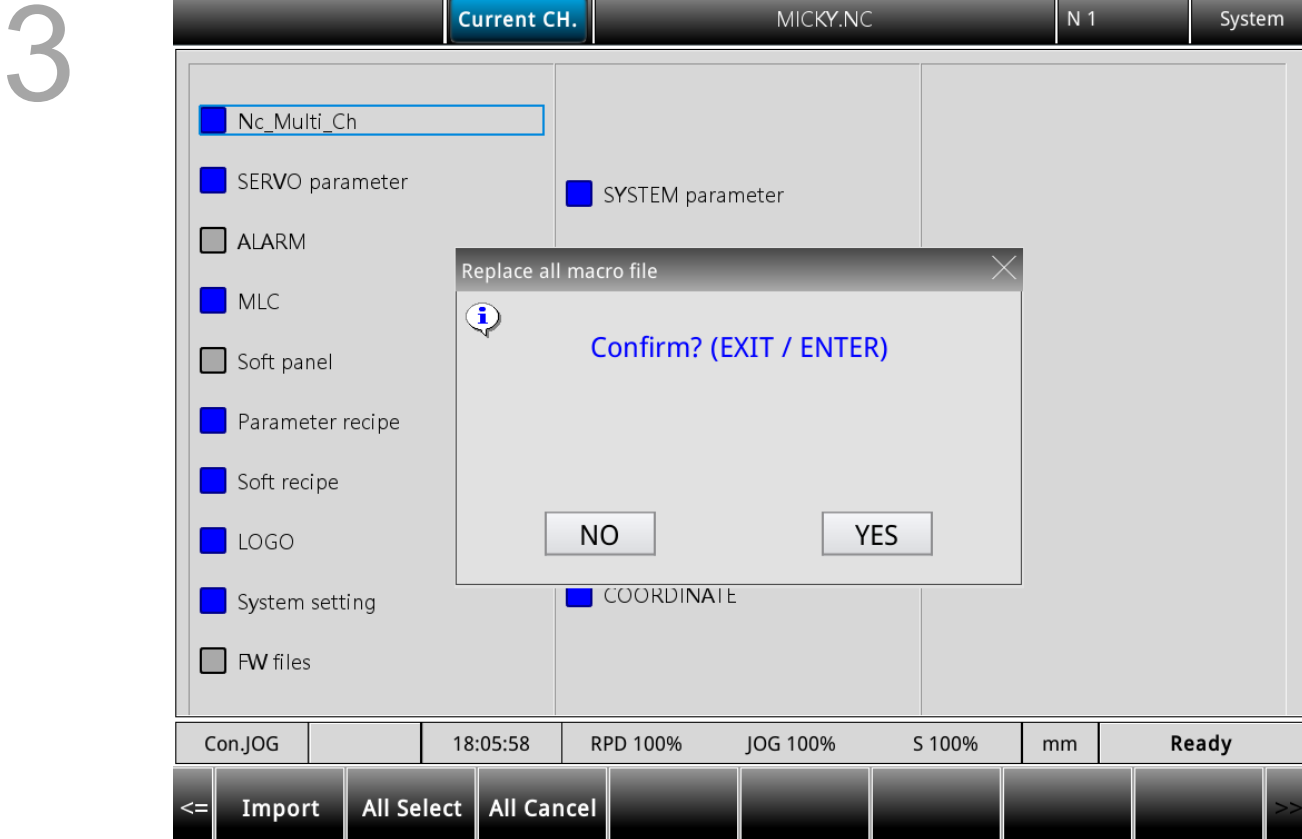
Figure 3.6.8.3

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**.
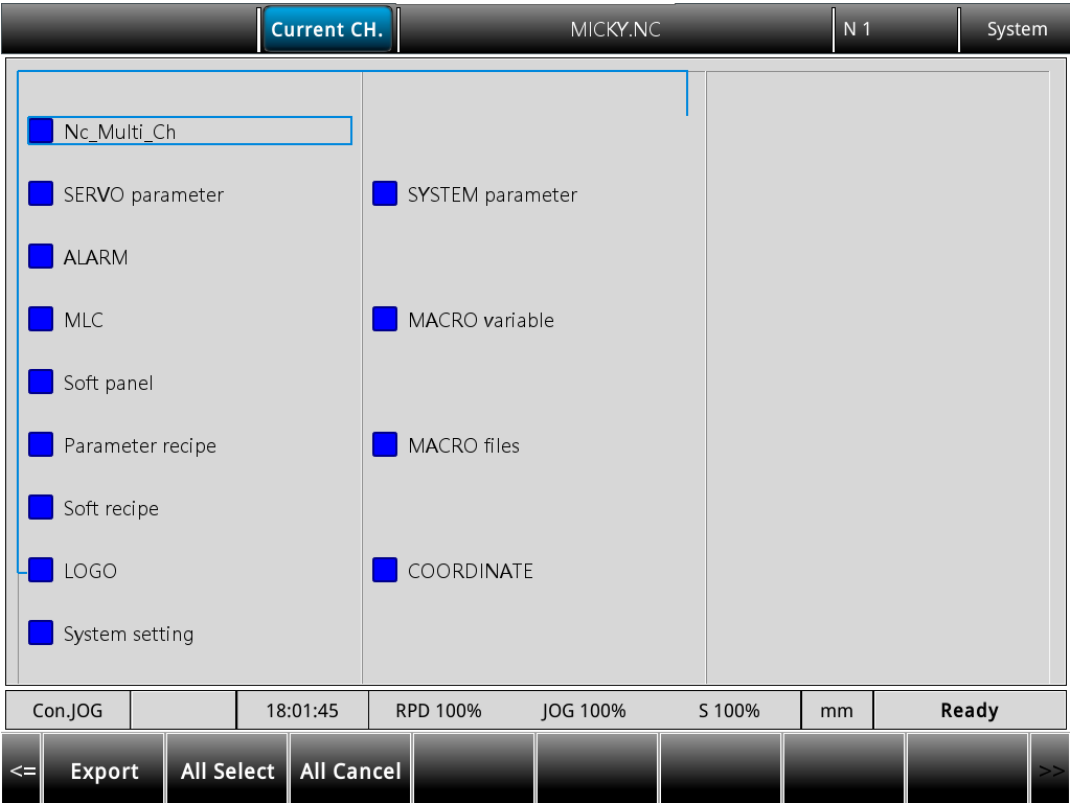
Figure 3.6.9.1

(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.
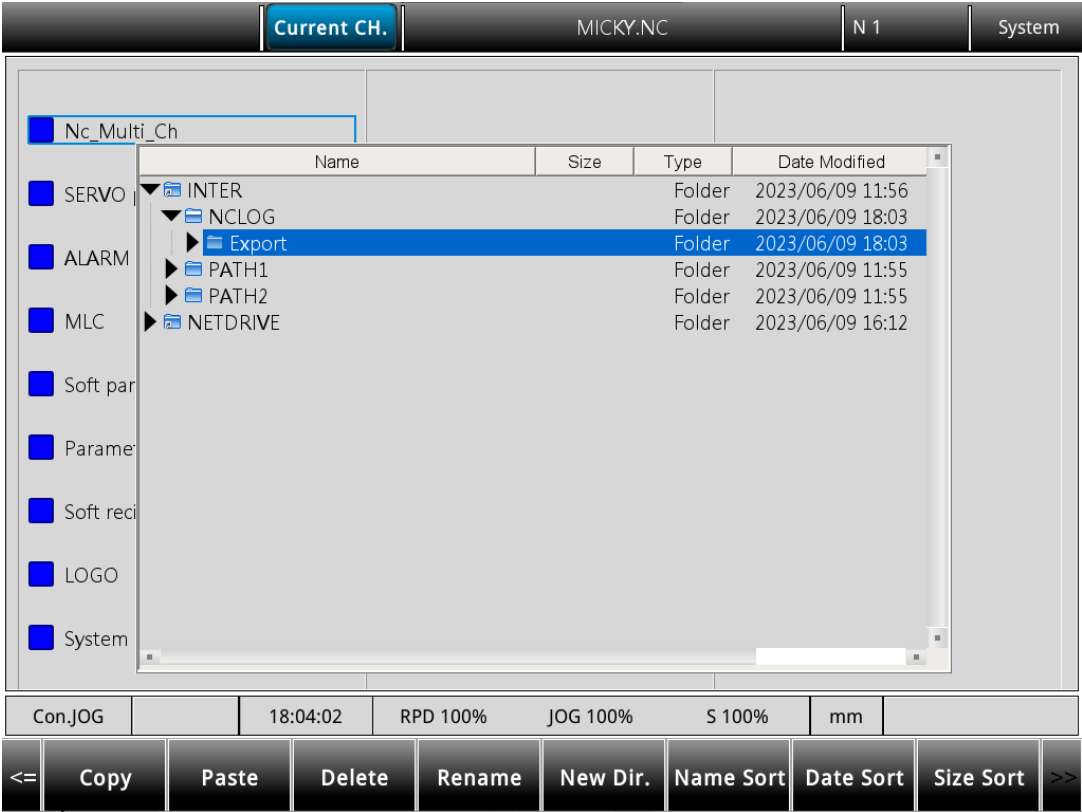
Figure 3.6.9.2

(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.
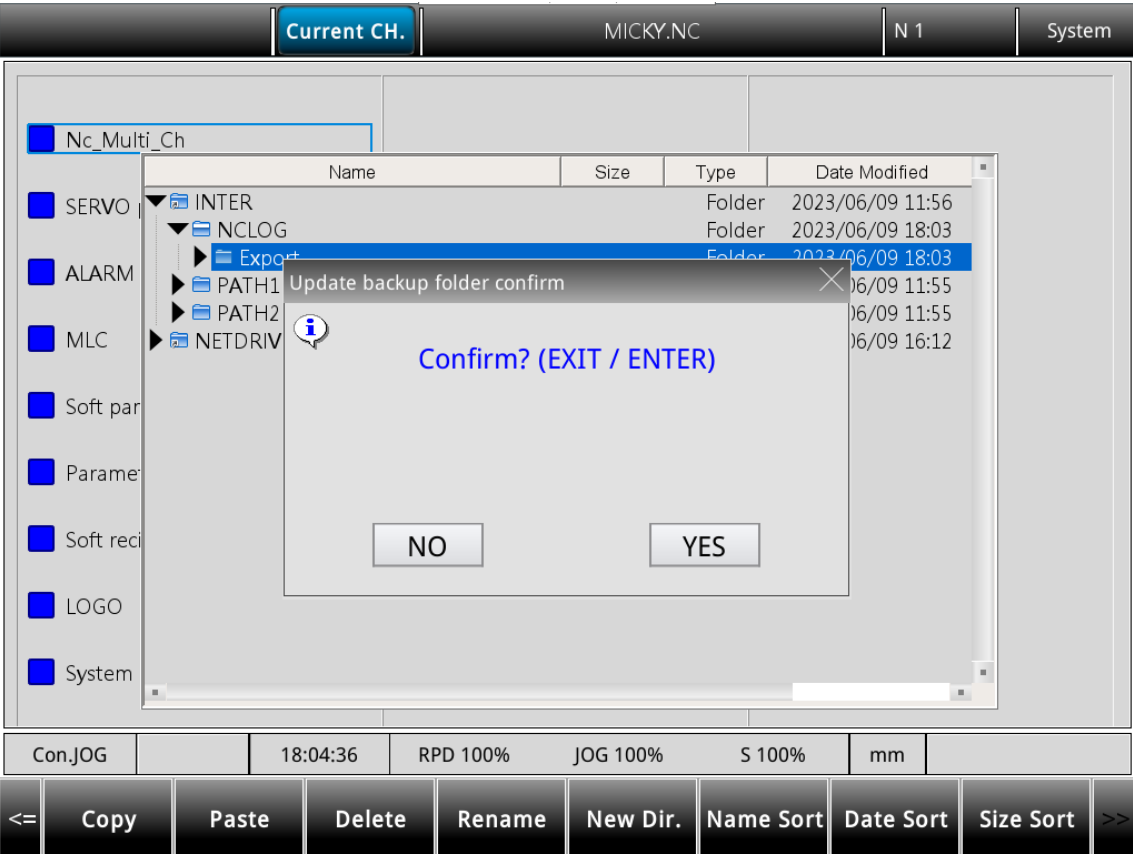
Figure 3.6.9.3

3.7 Alarm (ALM) Group

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 $\boxed{\text{Function}}$) 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 $\boxed{\text{RESET}}$ 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.
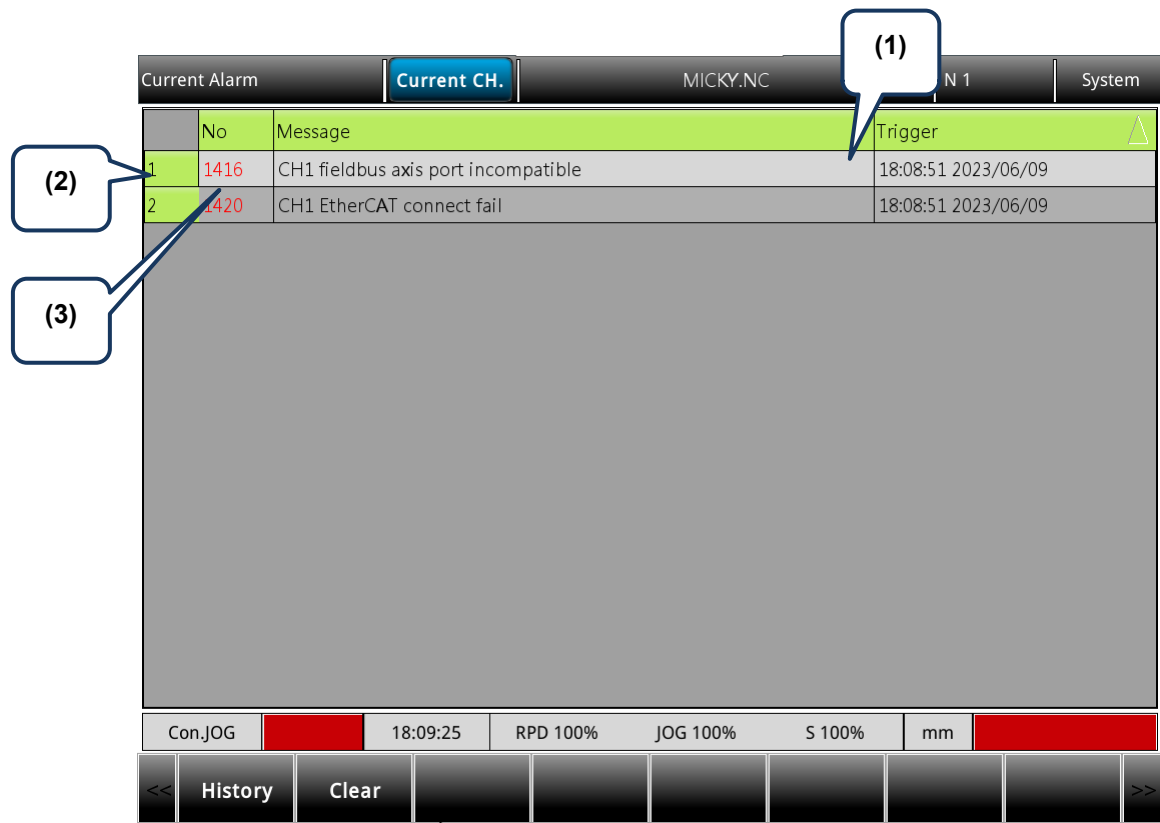
Figure 3.7.1.1

(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 $\boxed{\text{ALM}}$ 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.

3.7.2 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.

Historical Alarm	Current CH.		MICKY.NC	N 1	System
No ▽		Message		Trigger	
1	1416	CH1 fieldbus axis port incompatible		15:59:54 2023/06/09	
2	1420	CH1 EtherCAT connect fail		15:59:54 2023/06/09	
3	A0			17:02:09 2023/06/08	
4	A0			13:38:35 2023/06/08	
5	1420	CH1 EtherCAT connect fail		18:36:37 2023/06/07	
6	1420	CH1 EtherCAT connect fail		18:35:25 2023/06/07	
7	1420	CH1 EtherCAT connect fail		15:23:15 2023/06/07	
8	8000	Resolution not match		15:15:21 2023/06/07	
9	1420	CH1 EtherCAT connect fail		15:15:10 2023/06/07	
10	A0			14:59:54 2023/06/07	
11	1420	CH1 EtherCAT connect fail		14:59:37 2023/06/07	
12	1420	CH1 EtherCAT connect fail		09:40:42 2023/02/28	
13	0A01	CH1 Software limit 1 Error Z(+)		08:17:03 2023/02/28	
14	A0			08:13:41 2023/02/28	
15	A0			08:11:30 2023/02/28	

Con.JOG		18:07:00	RPD 100%	JOG 100%	S 100%	mm	Ready

<<	Alarm	Clear							>>

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
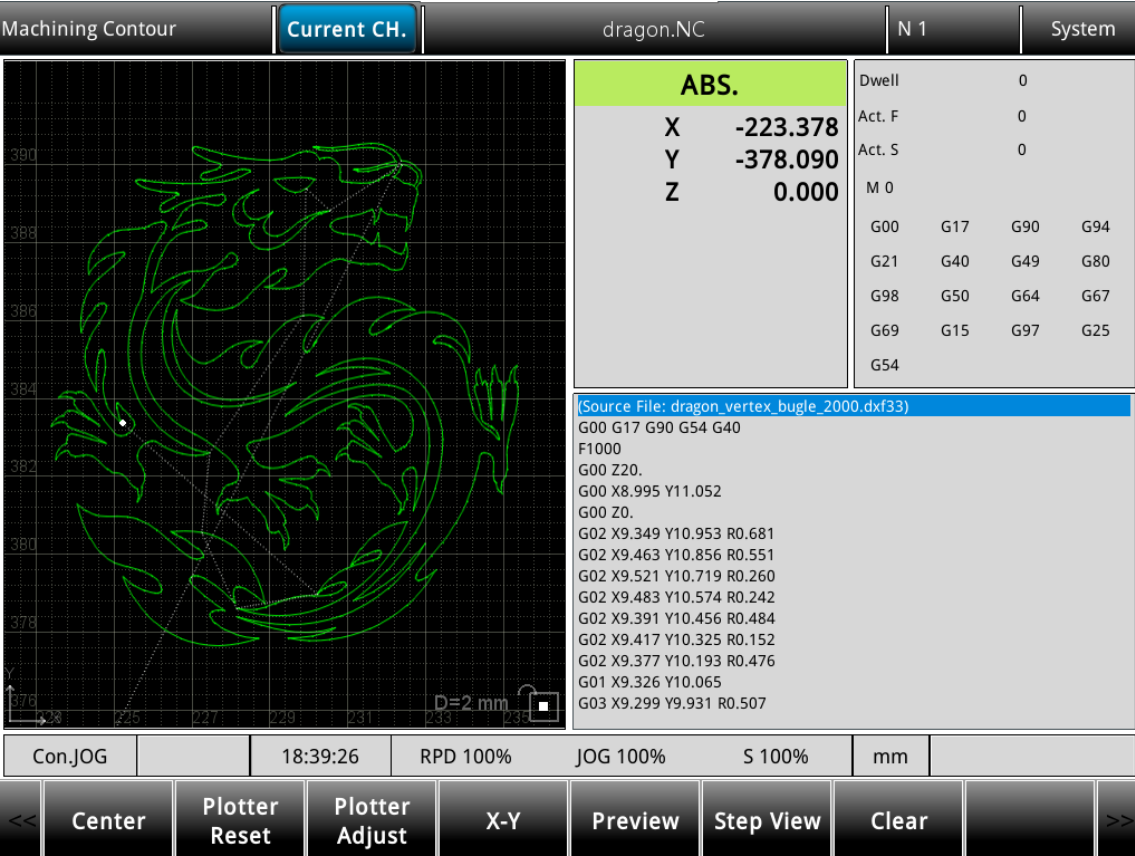
3.8.1 Trajectory display

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.

Parameter		Current CH.		MICKY.NC	N 1	System
Group	NUM	Param Name			PRS	Param Value
N8	0	System date				2023/06/09
N8	1	System time				18:29:26
N8	2	Screen brightness				80
N8	3	System language				2
N8	4	External device setting			P	
		Mouse sensitivity			P	50
		Cursor display time			P	0
		Enable TP IO(0: Off, 1: On)			P	0
		Keypad popup mode(0: Double, 1: Single)			P	0
		Enable USB second panel(0: Off, 1: On)			P	0
		Enable custom cursor			P	1
		Size of custom cursor			P	3
N8	9	Sync coordinate setting				
		Sync coordinate display(0: Off, 1: On)				0
		Sync workpiece coordinate display(0: Off, 1: On)				0
		Range : 0~2				1/5

| Con.JOG | | 18:29:28 | RPD 100% | JOG 100% | S 100% | mm | |

| << | Search | Process | Operation | Magazine | Spindle | Machine | Home | Network | >> |

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.

3.9.1 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.

Parameter		Current CH.	MICKY.NC	N 1	System

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

Range : 1~8						1/2

Con.JOG		18:29:54	RPD 100%	JOG 100%	S 100%	mm	

<=	Default								>>

Figure 3.9.1.1

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

3

Name	Setting range or format
Remote PC IP address 2	Character length: ×××. ×××. ×××. ××× Example setting: 0. 0. 0. 0
Remote PC IP address 3	Character length: ×××. ×××. ×××. ××× Example setting: 0. 0. 0. 0
Remote PC IP address 4	Character length: ×××. ×××. ×××. ××× Example setting: 0. 0. 0. 0
Remote PC IP address 5	Character length: ×××. ×××. ×××. ××× Example setting: 0. 0. 0. 0
Shared remote directory IP address	Character length: 0 ~ 5 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:
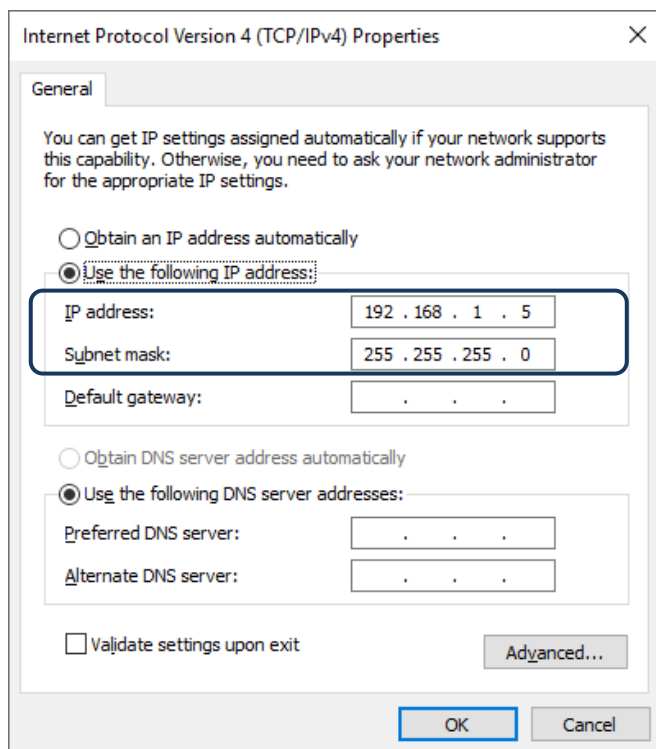
Figure 3.9.1.2

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
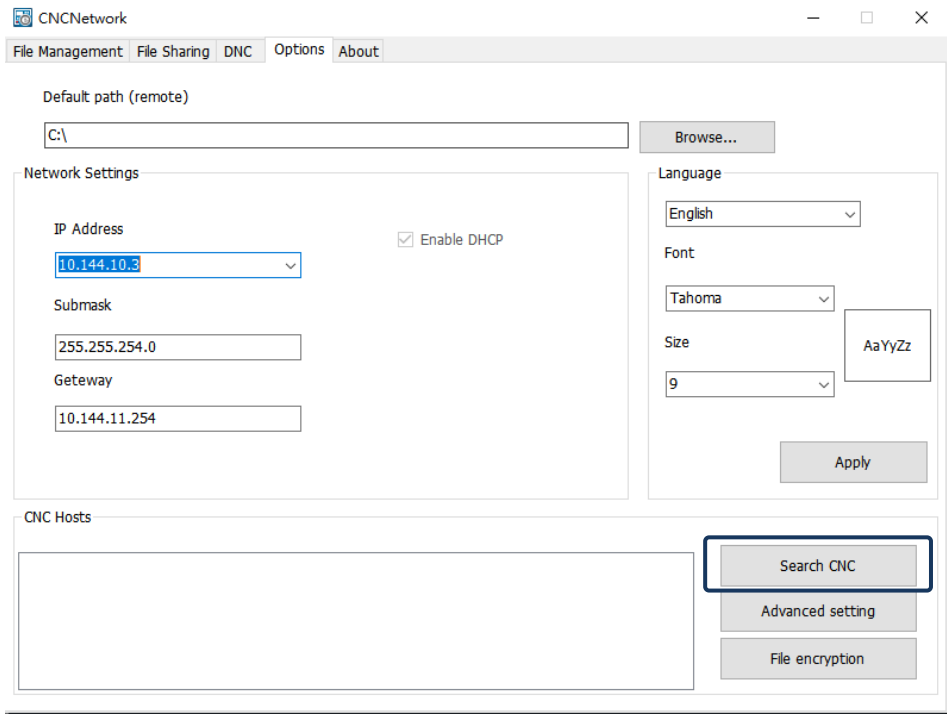
Figure 3.9.1.3

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:
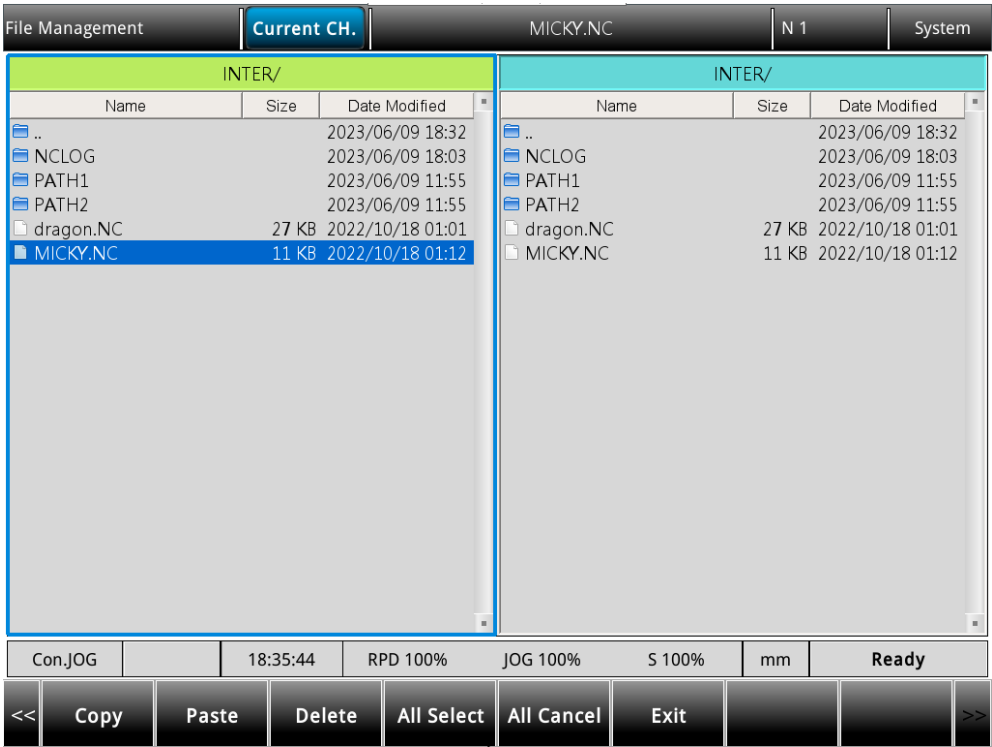
Figure 3.9.1.4

(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.
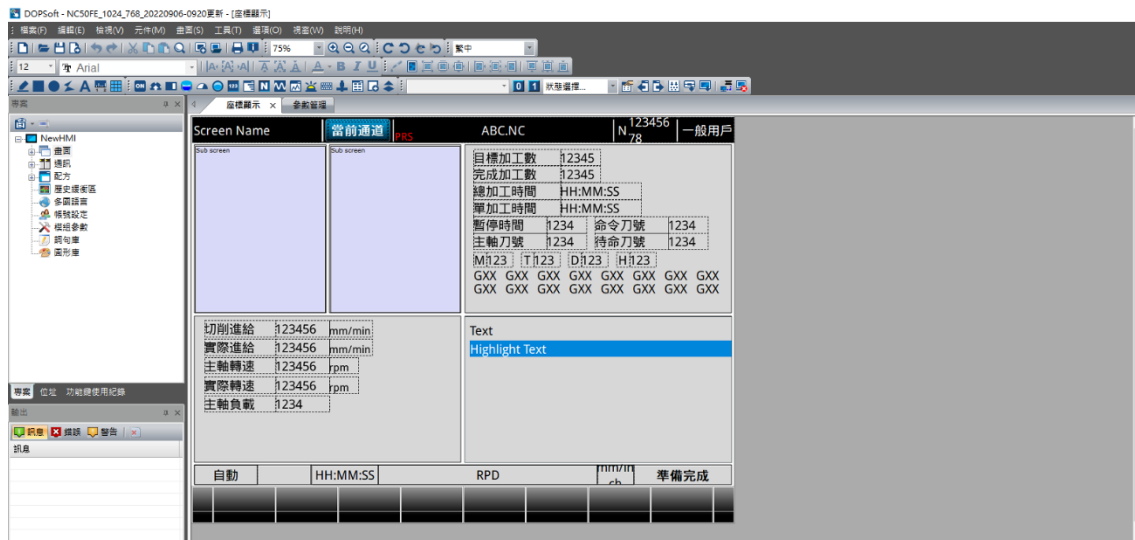
Figure 3.10.1.2

■   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.
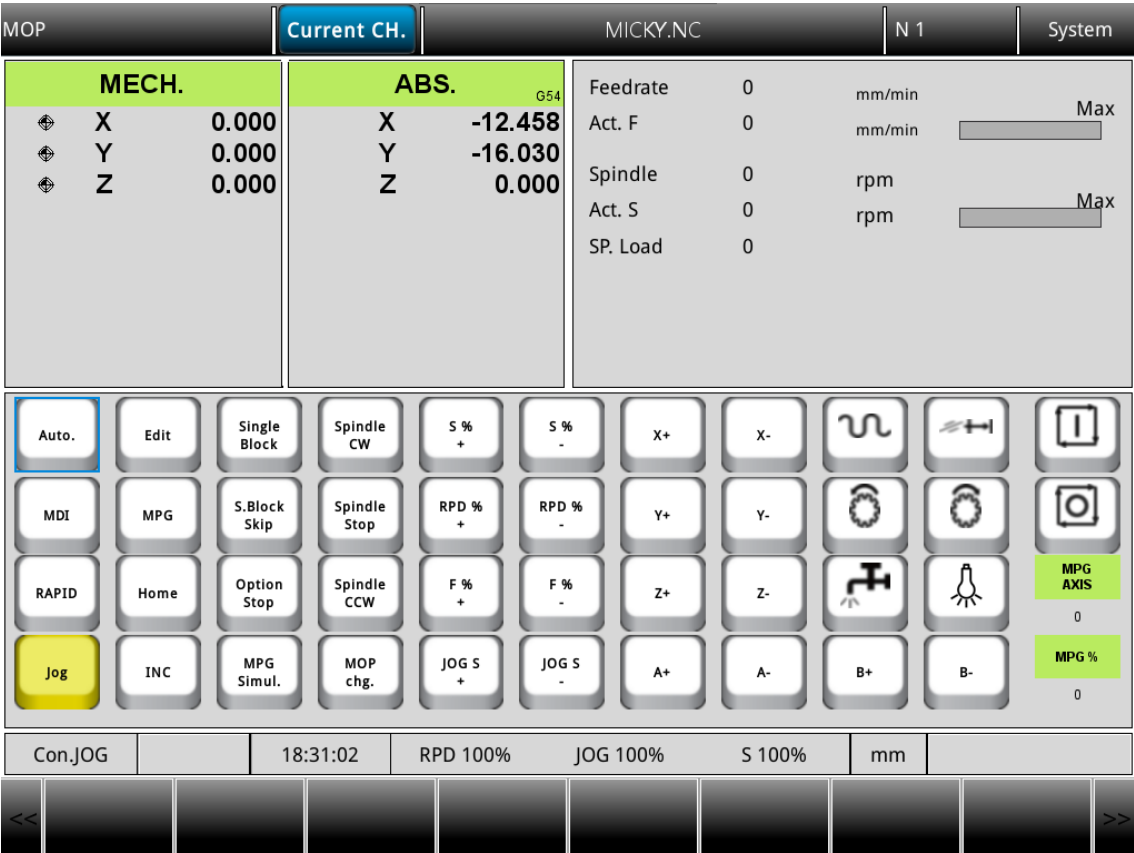
Figure 3.10.1.3

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.

4.1 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 Rotary unit: 0 ~ 359.999 degrees	F32
D30001	Spindle 2 pulse feedback	Pulse	U16
D30176	Spindle 2 coordinate position feedback	Linear unit: mm/inch 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 1st NC path		P
N0.409	Maximum tool number of 2nd NC path		
N0.410	Maximum tool number of 3rd NC path		
N0.411	Maximum tool number of 4th NC path		
N0.412	Maximum tool number of 5th NC path		
N0.413	Maximum tool number of 6th NC path		
N0.414	Maximum tool number of 7th NC path		
N0.415	Maximum tool number of 8th NC path		
Default	60	Range	0 ~ 512
Data Type	Dword	Unit	-

■ Maximum tool number in the Nth 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 1st and 2nd tool magazines.

4

N0.1000	**Configuration of 1st spindle**		
N0.1050	**Configuration of 2nd spindle**		
N0.1100	**Configuration of 3rd spindle**		
N0.1150	**Configuration of 4th spindle**		P
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		
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		P
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		
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		R
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	
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	R
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	
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	R
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		
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		R
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		
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		R
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.

4

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	1st gain proportion of 1st spindle		R
N0.1070	1st gain proportion of 2nd spindle		
N0.1120	1st gain proportion of 3rd spindle		
N0.1170	1st gain proportion of 4th spindle		
N0.1220	1st gain proportion of 5th spindle		
N0.1270	1st gain proportion of 6th spindle		
N0.1320	1st gain proportion of 7th spindle		
N0.1370	1st gain proportion of 8th 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	2nd gain proportion of 1st spindle		R
N0.1071	2nd gain proportion of 2nd spindle		
N0.1121	2nd gain proportion of 3rd spindle		
N0.1171	2nd gain proportion of 4th spindle		
N0.1221	2nd gain proportion of 5th spindle		
N0.1271	2nd gain proportion of 6th spindle		
N0.1321	2nd gain proportion of 7th spindle		
N0.1371	2nd gain proportion of 8th 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 1st spindle		R
N0.1072	Integral gain of 2nd spindle		
N0.1122	Integral gain of 3rd spindle		
N0.1172	Integral gain of 4th spindle		
N0.1222	Integral gain of 5th spindle		
N0.1272	Integral gain of 6th spindle		
N0.1322	Integral gain of 7th spindle		
N0.1372	Integral gain of 8th 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.

4

N0.1025	**Positioning check time of 1st spindle**		
N0.1075	**Positioning check time of 2nd spindle**		
N0.1125	**Positioning check time of 3rd spindle**		
N0.1175	**Positioning check time of 4th spindle**		R
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**		
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**		R
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**		
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**		R
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**		
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**		**R**
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**		
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**		**R**
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**		
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**		**R**
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.

4

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

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

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

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

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

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

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.

4

■ 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.

4

■ 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.

■ 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

4

■ 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.

4

■ 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.

4

■ 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.
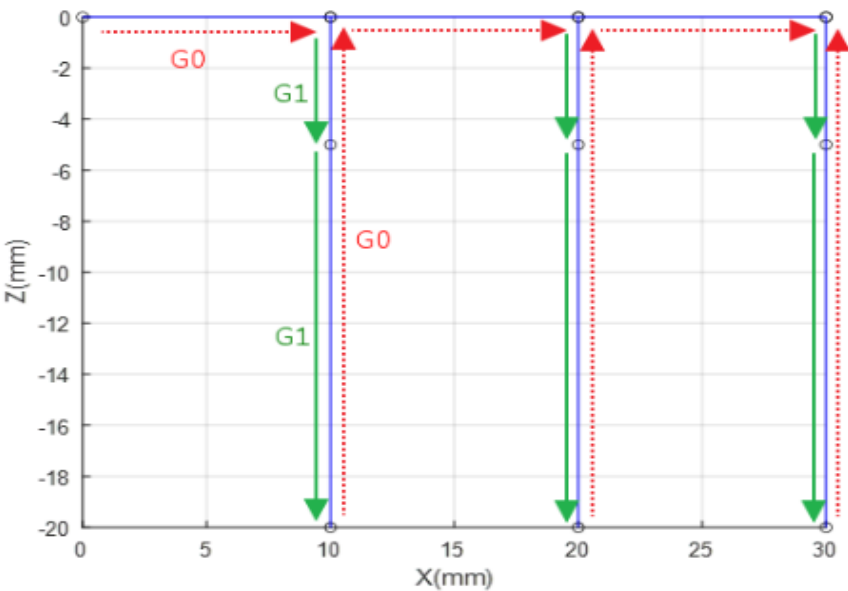
■ Bit 0-1: Speed blending mode.

0: Disable

1: Speed mode

2: Interpolation position mode

3: Axes position mode

4

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.
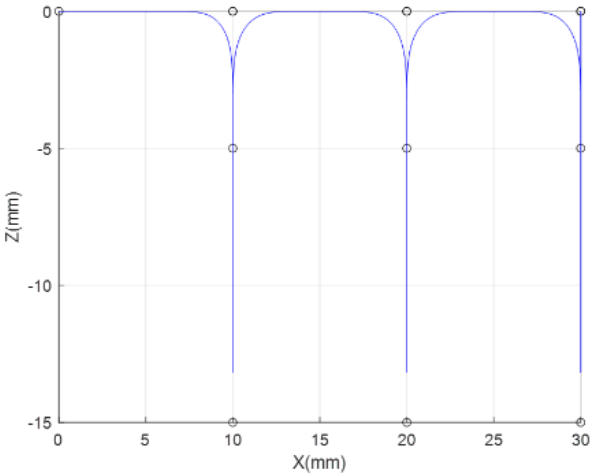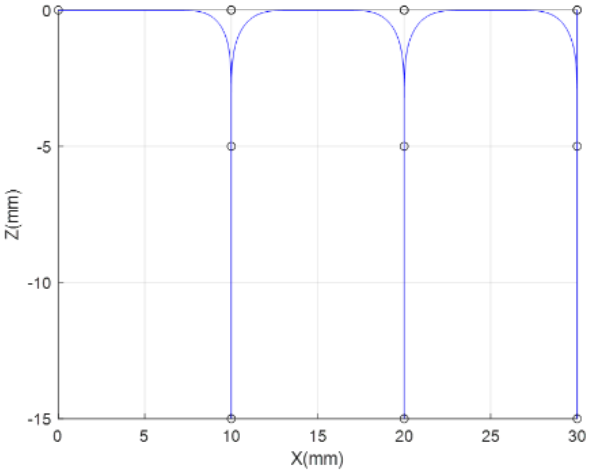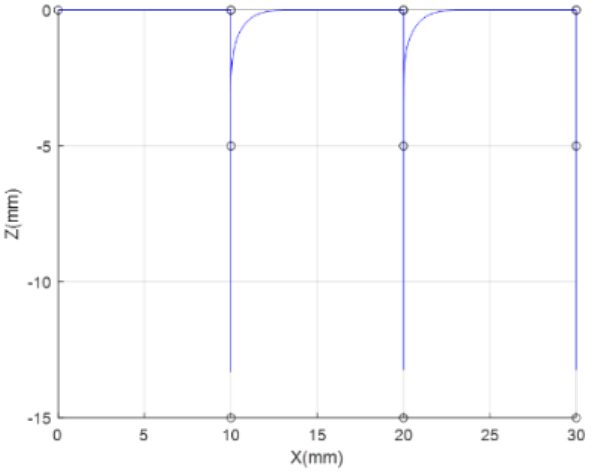
N1.021 (Bit 2~4)	Result diagram
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. **Enable** G01 to G00 speed blending.	
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. Disable G01 to G00 speed blending.	
Enable G00 to G00 speed blending. Disable G00 to G01 speed blending. **Enable** G01 to G00 speed blending.	
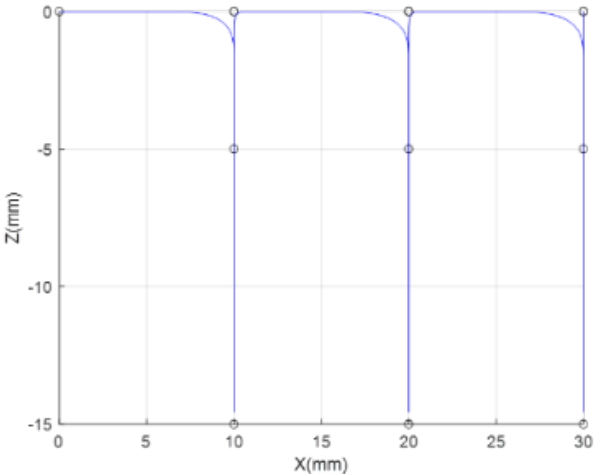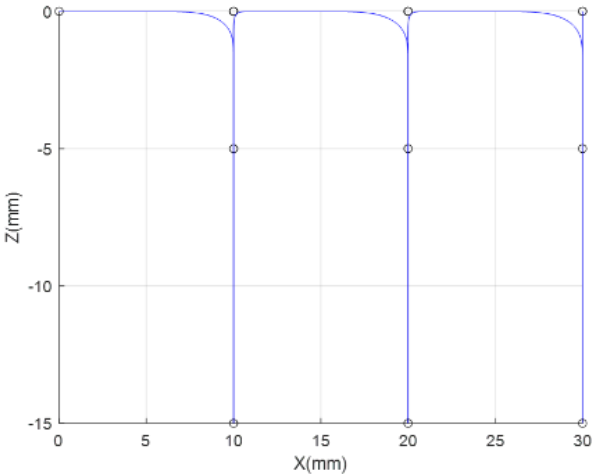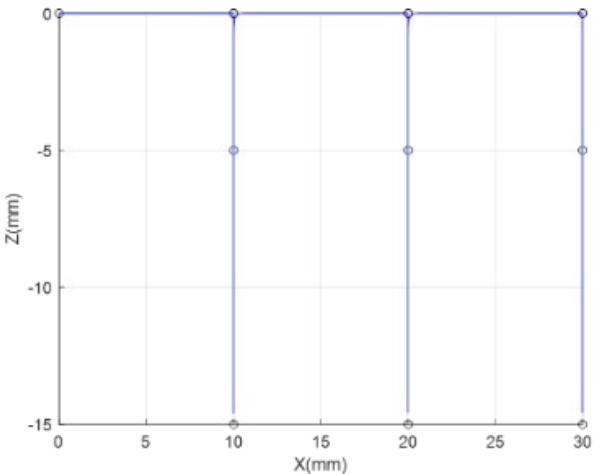
●   Mode 2 (Bit 0~1 as 1), speed mode.

N1.021 (Bit 2~4)	Result diagram
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. **Enable** G01 to G00 speed blending.	
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. Disable G01 to G00 speed blending.	
Enable G00 to G00 speed blending. Disable G00 to G01 speed blending. **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. **Enable** G00 to G01 speed blending. **Enable** G01 to G00 speed blending.	
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. Disable G01 to G00 speed blending.	
Enable G00 to G00 speed blending. Disable G00 to G01 speed blending. **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. **Enable** G00 to G01 speed blending. **Enable** G01 to G00 speed blending.	
Enable G00 to G00 speed blending. **Enable** G00 to G01 speed blending. Disable G01 to G00 speed blending.	
Enable G00 to G00 speed blending. Disable G00 to G01 speed blending. **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.

4

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.

4

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.

4
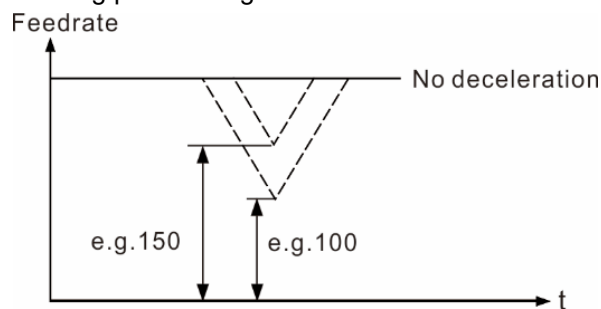
N1.042	**Default cutting feed**			**R**
Default	100	Range	0 ~ 600,000	
Data Type	Dword	Unit	mm/min or 0.1 inch/min	

■ 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.
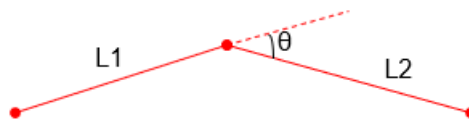
N1.052	**Minimum command length of turning**			**R**
Default	100	Range	0 ~ 10,000	
Data Type	Dword	Unit	0.1 μm / 0.00001 inch	

■ 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.

: Original Path

: After smoothing

: Adjust distance $\leqq$ N1.53
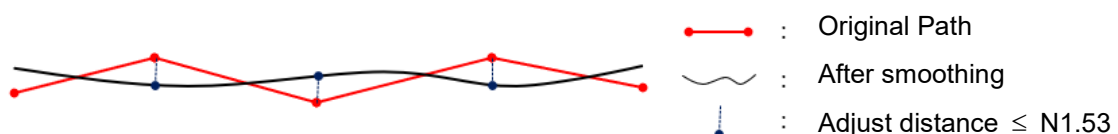
N1.054	**Path smoothing command error**			**R**
Default	100	Range	0 ~ 50,000	
Data Type	Dword	Unit	0.1 µm / 0.00001 inch	

■ 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 $\leqq$ N1.54
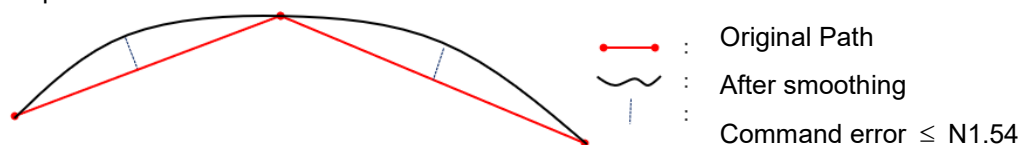
■ A larger value will result in a smoother path command, but the curve fitting result will decrease the precision. This parameter can be set to the same as the CAM tool, so the precision will stay the same without affecting smoothness.

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.

4

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.

4

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_
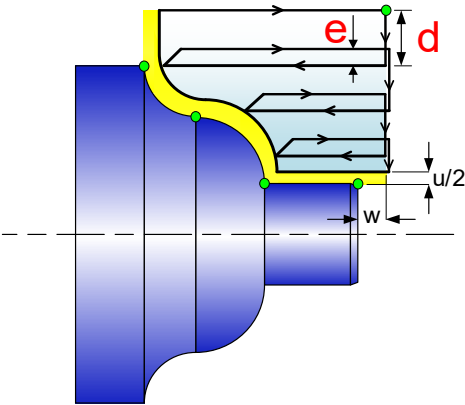
N1.171	Withdraw amount in G71 / G72 turning cycle			R
Default	1,000	Range	0 ~ 50,000	
Data Type	Dword	Unit	um / 0.0001 inch	

■ 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_
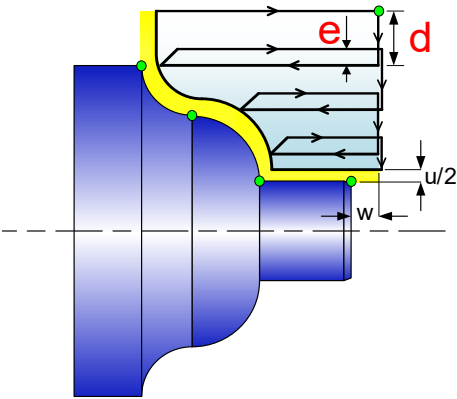
N1.172	**Thread look-ahead time**			**R**
Default	1,000	Range	0 ~ 50,000	
Data Type	Dword	Unit	0.001 sec	

■ 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)
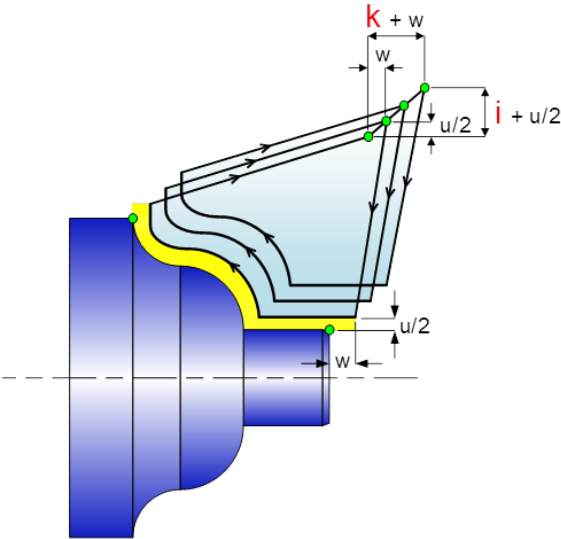
G73 P_ Q_ U(u) W(w) F_ S_ T_

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)
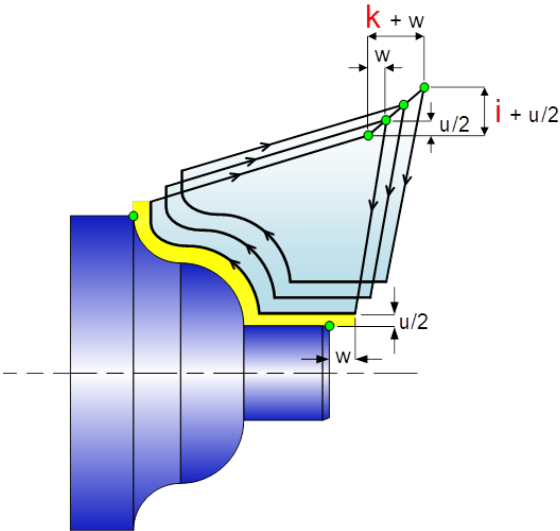
G73 P_ Q_ U(u) W(w) F_ S_ T_

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_
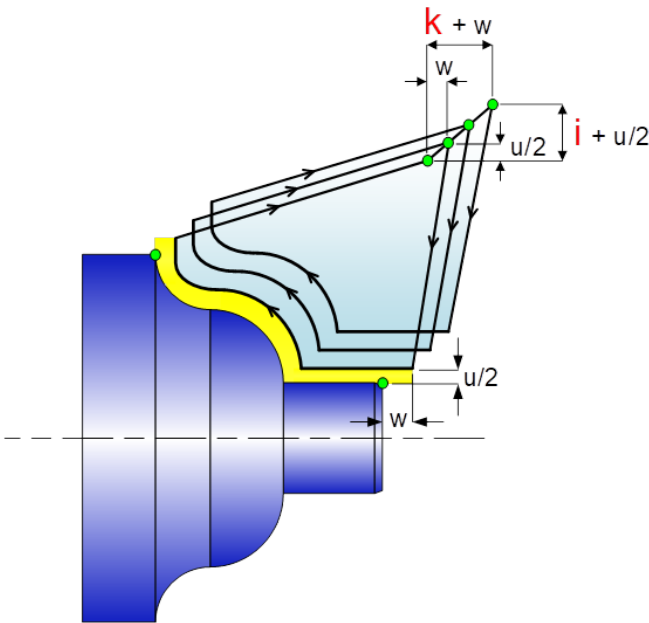
N1.176	Withdraw amount in G74 / G75 turning cycle		R
Default	1,000	Range	0 ~ 50,000
Data Type	Dword	Unit	um / 0.0001 inch

■ 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_
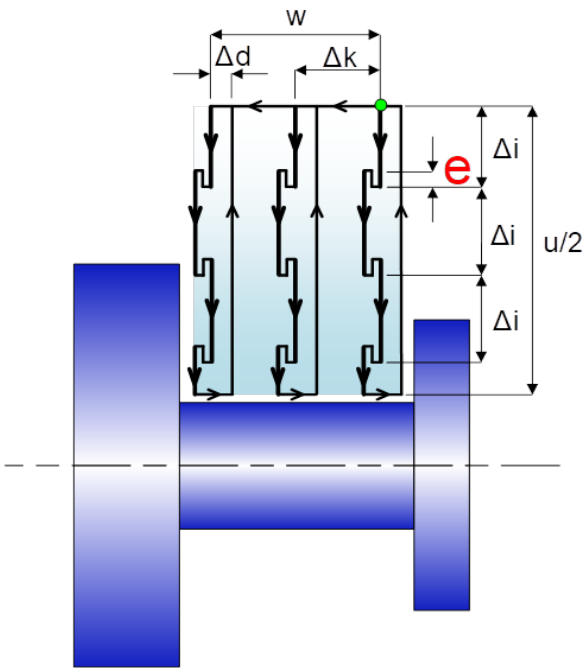
N1.177	Chamfer angle in G76 / G92 threading		R
Default	45	Range	1 ~ 89
Data Type	Dword	Unit	degree

■ 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_
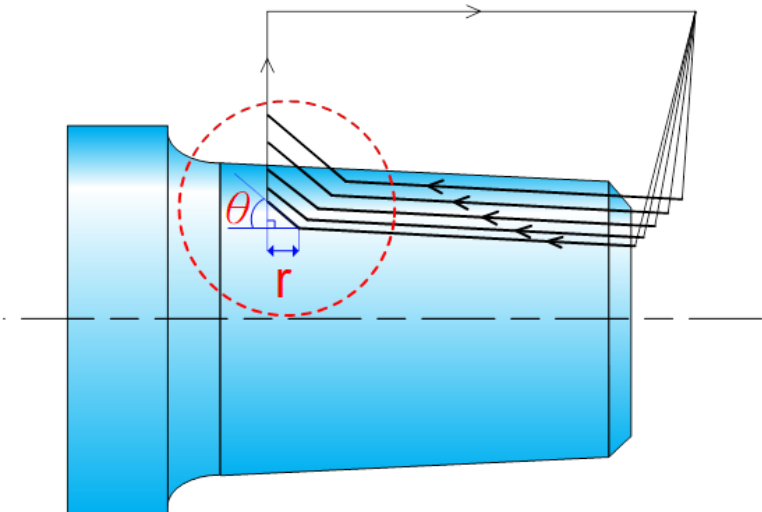
N1.178	Chamfer length in G76 / G92 threading		R
Default	3	Range	0 ~ 127
Data Type	Dword	Unit	0.1 pitch

■ 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)
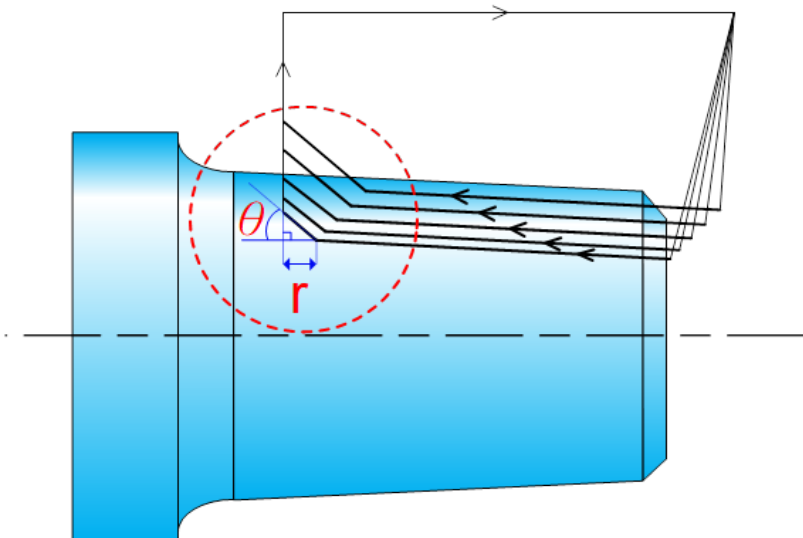
G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_

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)
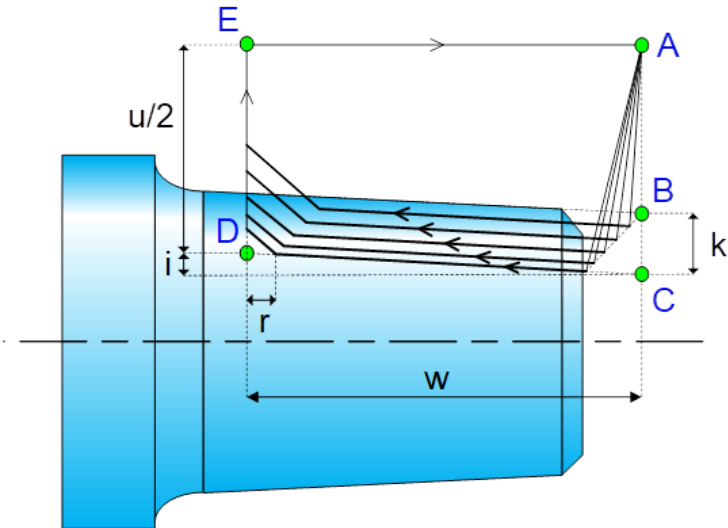
G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_

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)
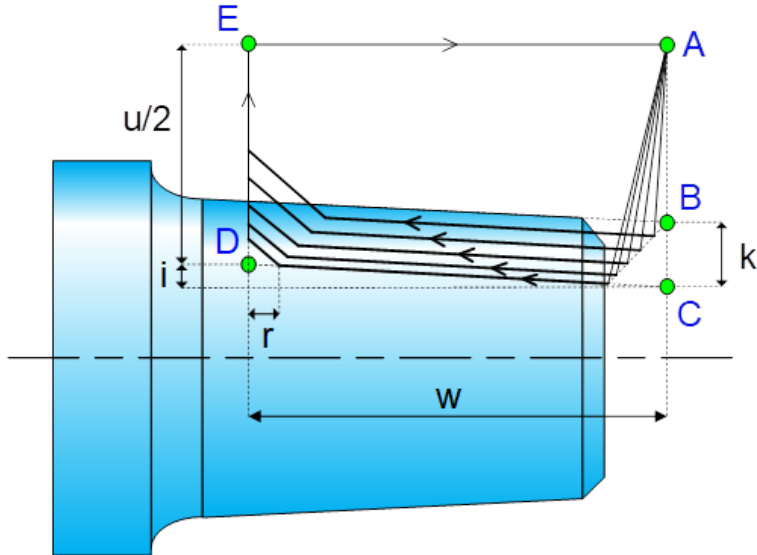
G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_

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)
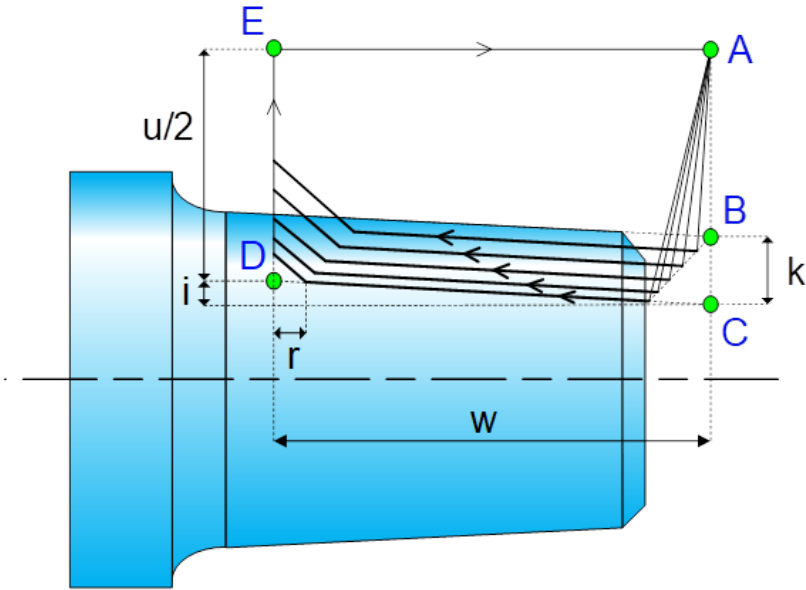
G76 X/U_ Z/W_ R(i) P(k) Q(△d) F_ L_

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_
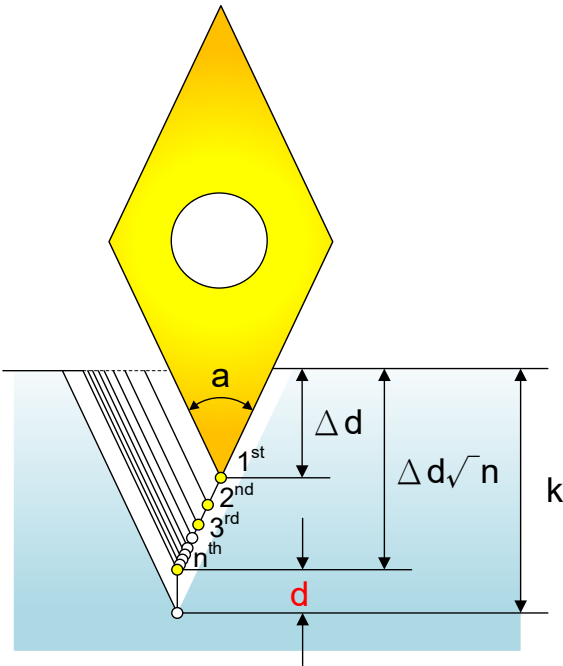
N1.183	**Tool life advance alarm percentage**			**P**
Default	0	Range	0 ~ 100	
Data Type	Dword	Unit	%	

■ 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 **~** **N1.249**	**G code number for calling macro O9100** **~** **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 **~** **N1.299**	**M code number for calling macro O9150** **~** **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			
N1.326	Monitoring data 2 – main category			R
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			
N1.323	Monitoring data 1 – sub-category 2			R
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

4

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		
N1.328	Monitoring data 2 – sub-category 2		R
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		
N1.333	Monitoring data 3 – sub-category 2		R
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.
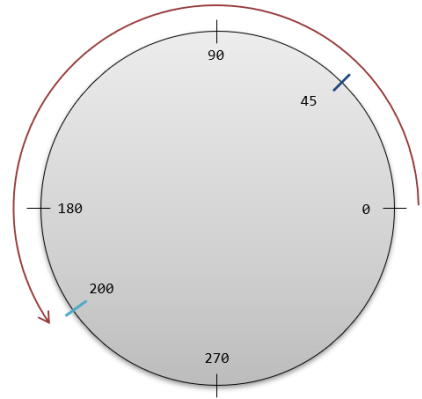
NC Gcode
G01 A0
G01 A560.
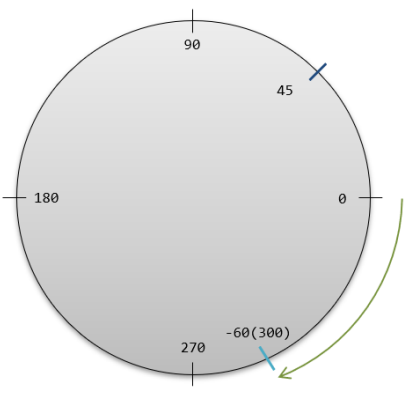
NC Gcode
G01 A0
G01 A-60.

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.

4

N2.015	Synchronize/ transfer control - master axis number			P
Default	0	Range	0 ~ 9	
Data Type	Dword	Unit	-	

■ 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	

■ 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.
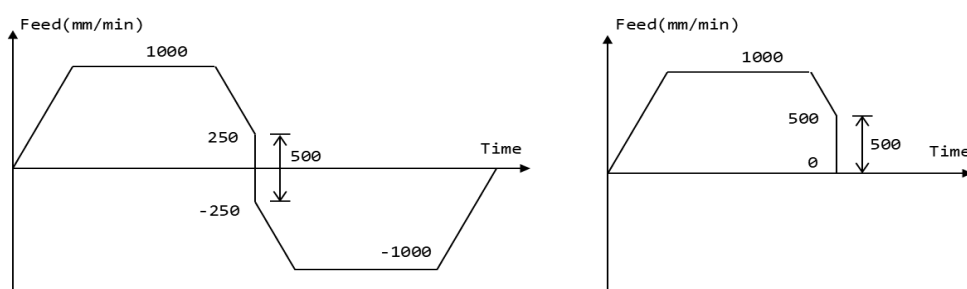
N2.027	Blending – axis target reach distance			R
Default	0	Range	0 ~ 60,000	
Data Type	Dword	Unit	um / 0.0001 inch	

■ 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	

■ 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.

N2.36=10	N2.36=50	N2.36=90
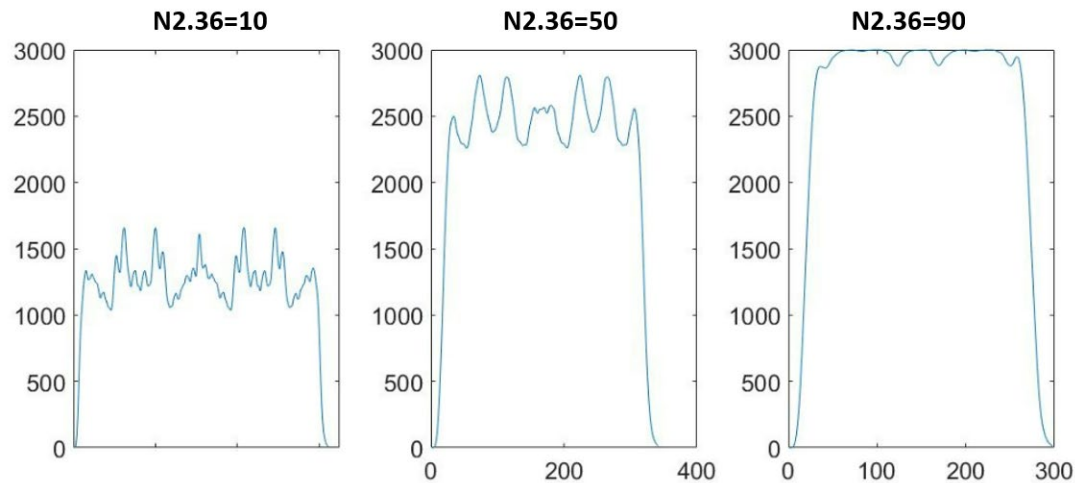
N2.037	Axis centripetal acc. ratio in cutting command		R
Default	50	Range	10 ~ 90
Data Type	Dword	Unit	%

■ 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.
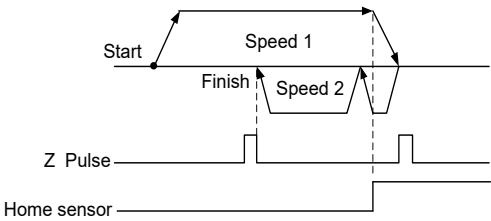
Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

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.
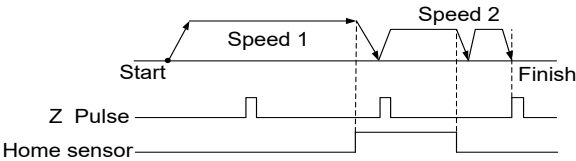
Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

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.
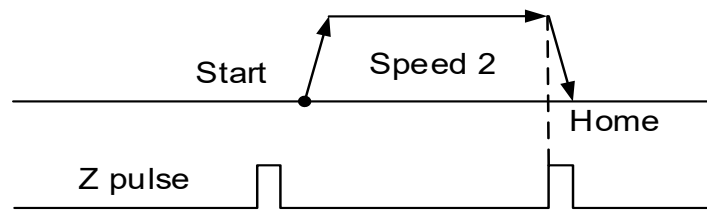
Different motor types with different **[N2.49]** and **[N2.51]** axes can have several

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. (Origin not retentive) (The axis will stop on the Z phase position)	Press the [Abs.Reset] button in the DGN page. The axis will search the Z phase position based on the direction parameter setting in **[N2.51 bit0]** and then establish the origin position. (The axis will stop on the Z phase position) (Origin is retentive)
Origin has been established, and N2.051 bit1 = 0	**Linear axis:** Return to origin position with 1st homing speed. **Rotary axis:** a. **[N2.051 bit2 = 1]** Closest origin 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. b. **[N2.051 bit2 = 0]** Machine origin Return to origin position with 1st homing speed.	**Linear axis:** Return to origin position with 1st homing speed. **Rotary axis:** a. **[N2.051 bit2 = 1]** Closest origin 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. b. **[N2.051 bit2 = 0]** Machine origin 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. (Origin not retentive) (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. (Origin is retentive) (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: 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.
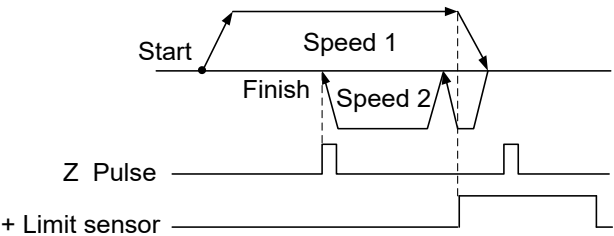
Different motor types with different **[N2.49]** and **[N2.51]** axes can have several combinations of actions when homing procedures are triggered.

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. 1. Please go to the DGN page and then press the **[Abs.Reset]** button. 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. (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. (The axis will stop on the Z phase position)
Origin has been established, and N2.051 bit1 = 0	**Rotary axis:** Move to closest zero position and then establish origin position.	**Rotary axis:** Move to closest zero position and then establish origin position.
Origin has been established, and N2.051 bit1 = 1	**Rotary axis:** Move to closest zero position and then establish origin position.	**Rotary axis:** Move to closest zero position and then establish origin position.
Diagnose page. **[Abs.Reset]** button	-	**Origin not set:** Move the axis to the Z phase position with the shortest distance and then establish the origin position. **Origin has established:** **Rotary axis:** 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. 1. Search the Z phase position in the negative direction and then set it as the origin position. 2. Axis will stop on the Z phase position. (Origin not retentive)	The axis will not move when the system is in **HOME** mode. 1. Please go to the DGN page and then press the **[Abs.Reset]** button. 2. Search the Z phase position in the negative direction and then set it as the origin position. 3. Axis will stop on the Z phase 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	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. 1. Search the Z phase position in the positive direction and then set it as the origin position. 2. Axis will stop on the Z phase position. (Origin not retentive)	The axis will not move when the system is in **HOME** mode. 1. Please go to the DGN page and then press the **[Abs.Reset]** button. 2. Search the Z phase position in the positive direction and then set it as the origin position. 3. Axis will stop on the Z phase 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	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. 1. Please go to the DGN page and then press the **[Abs.Reset]** button. 2. Execute servo homing mode 35. (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	-

■ 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(%)]**.

4

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
```

4.5 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.
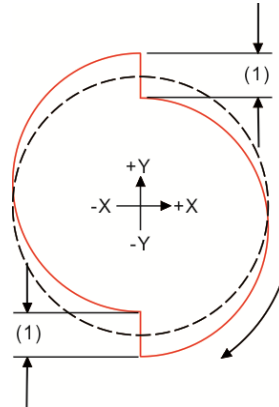
Parameter		Actual compensation	
N3.3 bit1 (Measurement direction)	N3.3 bit6 (Compensation mode)	Axis moves in negative direction	Axis moves in positive direction
0 (Positive)	0	-1 x **N3.00** / 2	**N3.00** / 2
1 (Negative)	(Average)	-1 x **N3.00** / 2	**N3.00** / 2
0 (Positive)	1	-1 x **N3.00**	0
1 (Negative)	(One way)	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.

Pitch Compensation		Current CH.		Handle_CADCAM.nc		N 1		System
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

| Con.JOG | *Alarm* | 16:45:09 | RPD 100% | JOG 100% | S 100% | mm | Servo not Ready |

| <= | OK | Import Ren. | um | um+ | | | | >> |

■ 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: 16th 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: 11th digital input on the I/O 2.

■ Bit 11: 12th 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

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■ 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

4

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.

4

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.
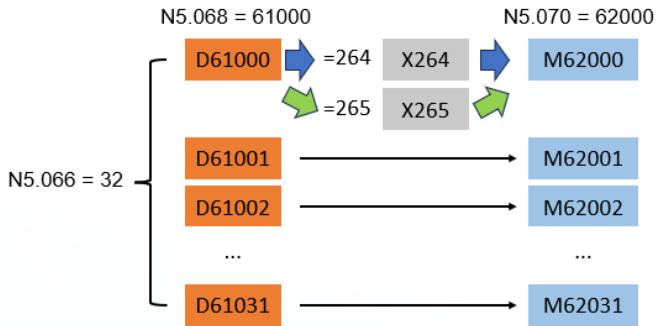
N5.067	DO - Y register virtual address amount		P
Default	0	Range	0 ~ 300
Data Type	word	Unit	-

■ 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.
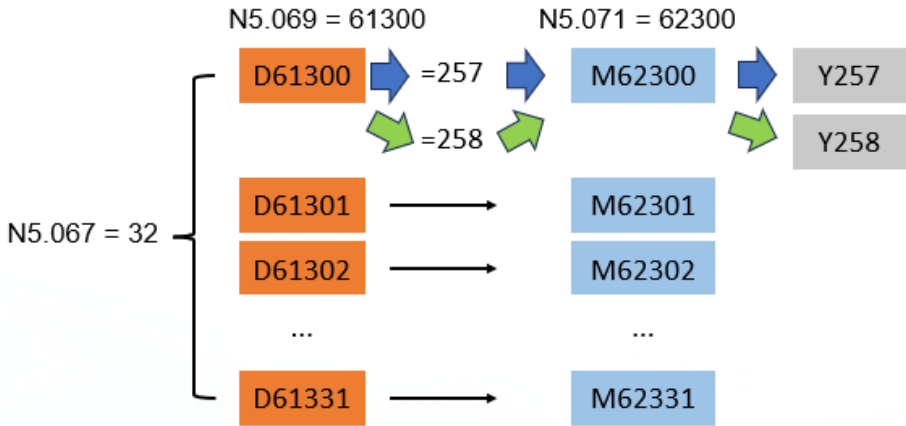
N5.068	First D register for virtual address define of X register		P
Default	60,000	Range	60,000 ~ 61,999
Data Type	word	Unit	-

■ 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	-	

4

■ 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]**.

4.7 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.

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[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.

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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 2nd 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.
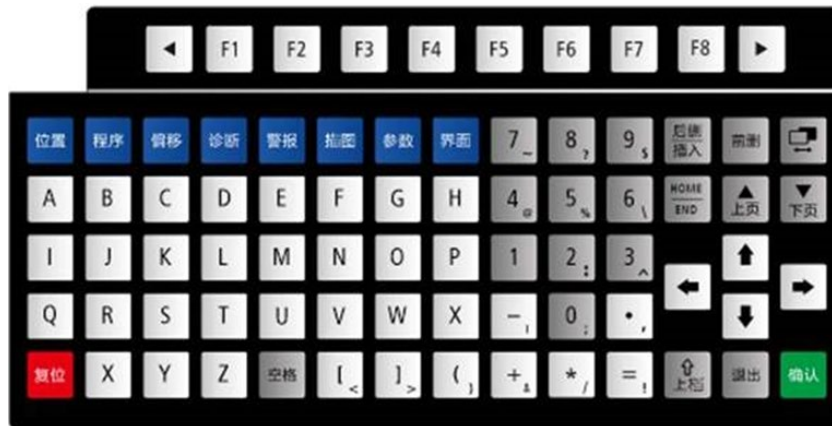
Users defined external keypad type 1

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]**.

■ 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
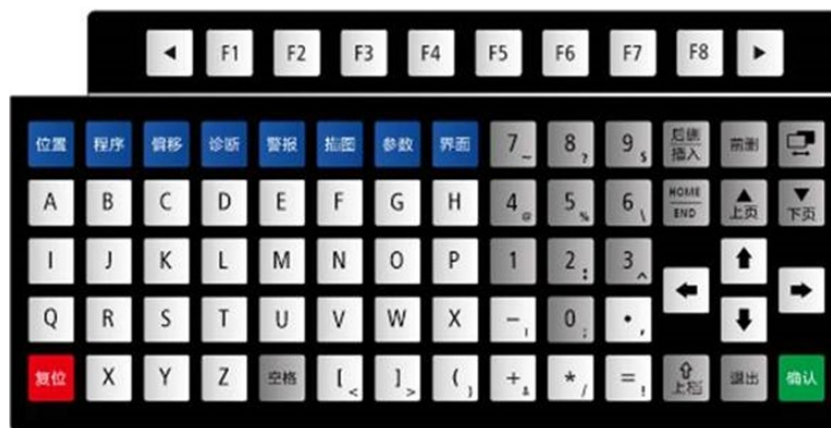
Users define external keypad type 1

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 Macro call program file direction	M98 call sub-program. M96 call macro. G65 call macro. G66 call macro.	G, M, T code macro. The macro after break & search. Cycle starts initial macro. One button call macro.
0	(1) Same root as main program (2) (DISK)/PATH_□ (3) (DISK)/PATH_□/O_MACRO (4) (DISK)/GLOBAL (5) (DISK)/GLOBAL/O_MACRO	(1) (DISK)/PATH_□ (2) (DISK)/PATH_□/O_MACRO (3) (DISK)/GLOBAL (4) (DISK)/GLOBAL/O_MACRO (5) Same root as main program
1	(1) USB root path (2) (DISK)/PATH_□ (3) (DISK)/PATH_□/O_MACRO (4) (DISK)/GLOBAL (5) (DISK)/GLOBAL/O_MACRO	(1) USB root path (2) (DISK)/PATH_□ (3) (DISK)/PATH_□/O_MACRO (4) (DISK)/GLOBAL (5) (DISK)/GLOBAL/O_MACRO

■ Bit 6: Whether to display the sub-program name when the main program is calling.

0: Disable, 1: Enable

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■ 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			
N8.033	Scope monitor setup 2			
N8.034	Scope monitor setup 3			P
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.

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.

4

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

N9.013	Unit Setting		P
Default	3 decimal digits	Range	Decimal digits (Range: 3~6) 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.

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■ 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	WORK 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	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_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	ORK 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	ORK 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]**.

4

N9.121	Graphic utility setting			P
Default	0	Range	-	
Data Type	Dword	Unit	-	

[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

EIO Setting	Current CH.	DEFAULT_MDI.NC	N1	System

No.	Type	Port	Mode	Start Address	Polarity	Disc
1	0x70e2(16 DO)	501		260		☐
2	0x8124(ADC)	502	0			
3	0x7062(16 DO)	503		280		☐
4	0x7062(16 DO)	504		300		☐
5	0x6022(16 DI)	505		320	0x0	☐
6	0x6002(16 DI)	506		340	0x0	☐
7	0x70f2(16 DO)	507		360		☐
8	0x6002(16 DI)	508		380	0x0	☐

Auto		15:03:52	RPD 100%	F 100%	S 100%		mm	Ready

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.
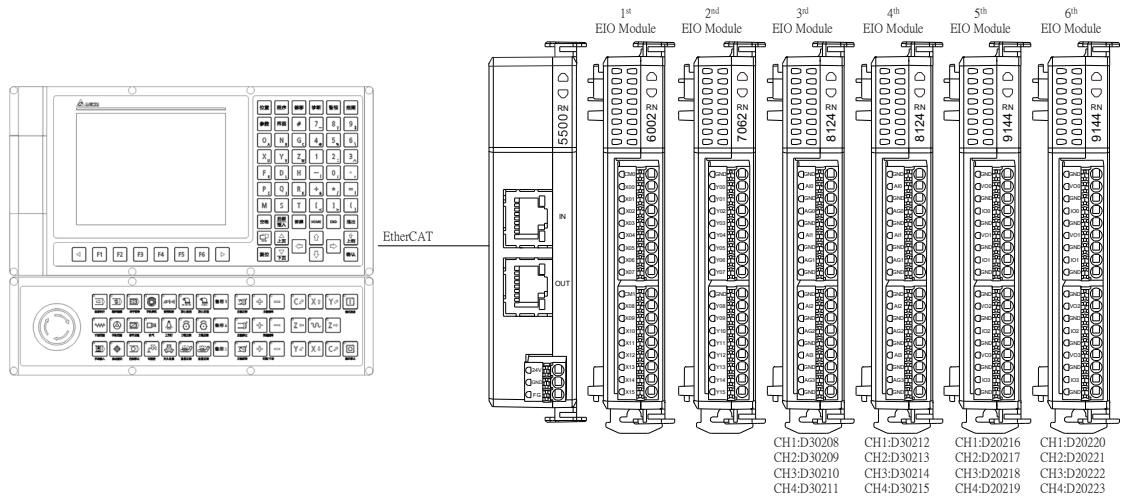
4.10.4 Compensation parameter

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

Parameter | Current CH. | Handle_CADCAM.nc | N 1 | System

Range : -2~2 (mm)   1/1

Con.JOG   14:27:46   RPD 100%   JOG 100%   S 100%   mm

<=   Pitch Comp.

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.]**.

Pitch Compensation | Current CH. | Handle_CADCAM.nc | N 1 | System

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

Con.JOG   *Alarm*   16:45:09   RPD 100%   JOG 100%   S 100%   mm   Servo not Ready

<=   OK   Import Ren.   um   um+   >>

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.

Pitch Compensation REN	Current CH.	Handle_CADCAM.nc	N 1	System
LSC Point No.	0	LSC Space	0	
Measure Direction	Forward	Reference Point	0	
Data Type	Pos-Dir Average	Start Position	0	
Compensation Mode	Absolute	End Position	0	
Compensation Type	Error Value	Unit	0	
Axis	X	File Name	0	
Amount	0			

No.	Positive	Negative
1	0.000	0.000
2	1.000	1.000
3	2.000	2.000
4	3.000	3.000
5	4.000	4.000
6	5.000	5.000
7	6.000	6.000
8	7.000	7.000
9	8.000	8.000
10	9.000	9.000

Con.JOG	*Alarm*	14:28:28	RPD 100%	JOG 100%	S 100%	mm	Servo not Ready

<=	Load Ren.	Next Axis	Import	Import +					>>

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.

5.1 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
	0	AUTO	M3x000
	1	EDIT	M3x001
	2	MDI	M3x002
D2x000	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.
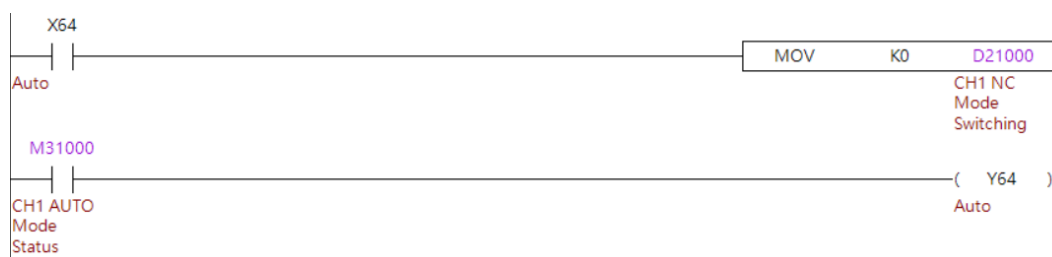
Figure 5.1.1 Mode switch by DI button

5

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.
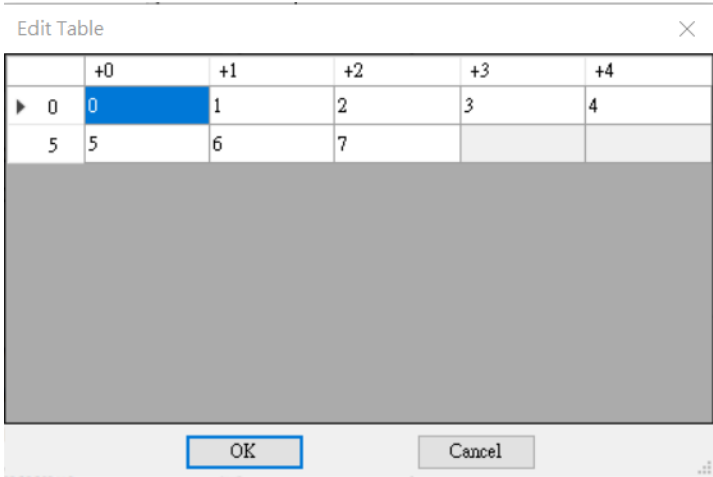
Figure 5.1.2 VRT table

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.

5

[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.

5

[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]**.

5
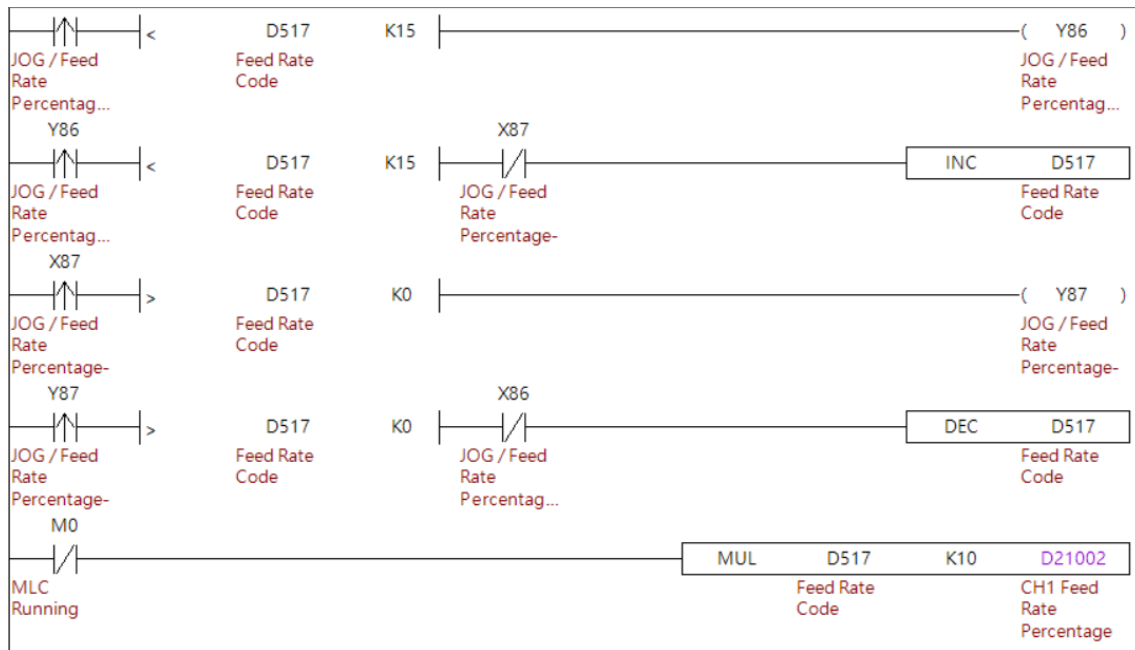
1.   Use the key signal to set the cutting feed rate override, with the maximum as 15 and the minimum as 0 and write this feed rate override ratio to the register.

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 16th 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
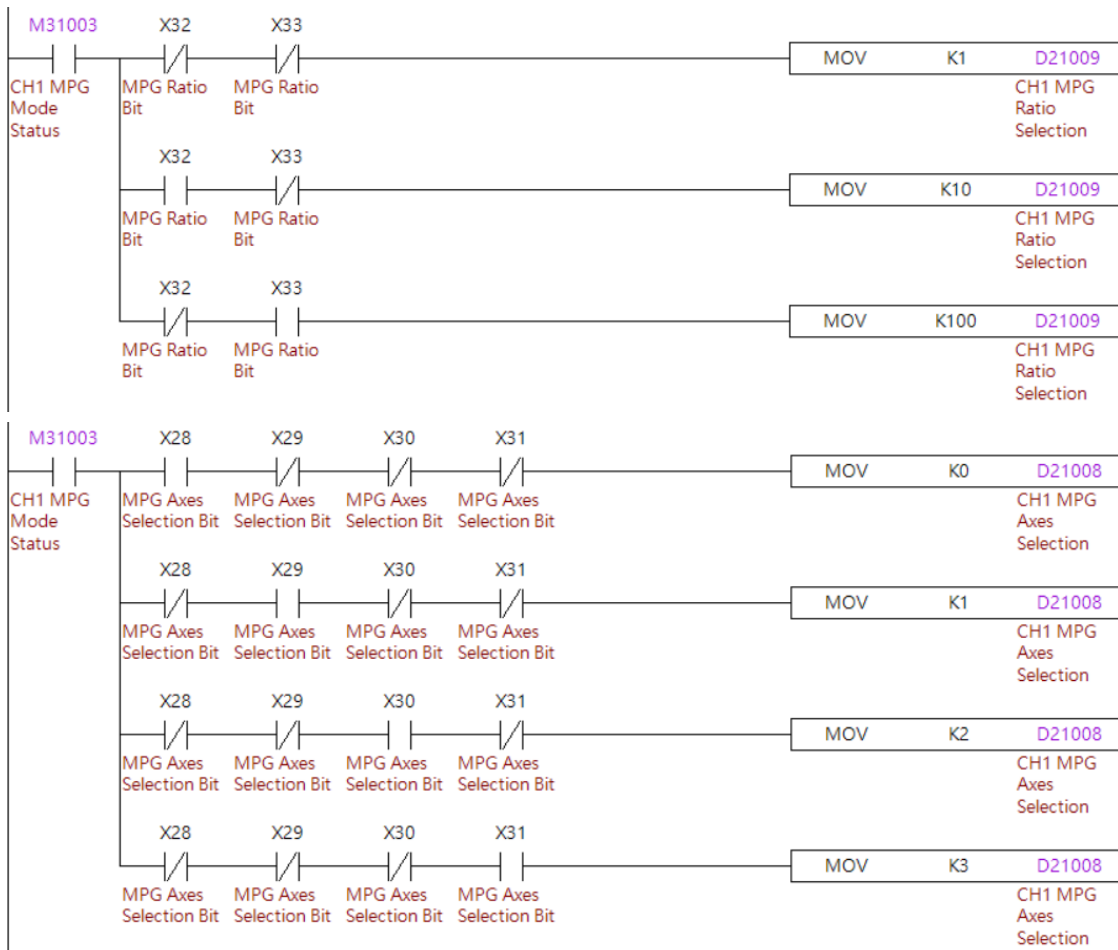
Program execution procedure

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

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	
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	D2x006
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 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.

5

```
   M0
   |/|                                              MOV    D516    K1M30
  MLC                                               JOG     JOG
  Running                                           Percentage  Percentage
                                                    Code    Bit0

   M30
   | |                                              VRT    D21006
  JOG
  Percentage                                        CH1 Feed Rate
  Bit0                                              Override for JOG,
   M31                                              INC and Dry Run
   | |                                              Mode
  JOG
  Percentage
  Bit1
   M32
   | |
  JOG
  Percentage
  Bit2
   M33
   | |
  JOG
  Percentage
  Bit3

   X79      M31004
   | |       | |                                           ( M21384 )
  X Axis    CH1 JOG                                        CH1 X Axis
  Forward DI Mode                                          JOG
            Status                                         Forward

                                                           (  Y79  )
                                                           X Axis
                                                           Forward DI
                                                           Lamp

   X81      M31004
   | |       | |                                           ( M21400 )
  CH1 X Axis CH1 JOG                                       CH1 X Axis
  Reverse DI Mode                                          JOG Reverse
            Status

                                                           (  Y81  )
                                                           CH1 X Axis
                                                           Reverse
                                                           Lamp
```

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

5.5 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		
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	D2x006	D2x014
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.

5

[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.
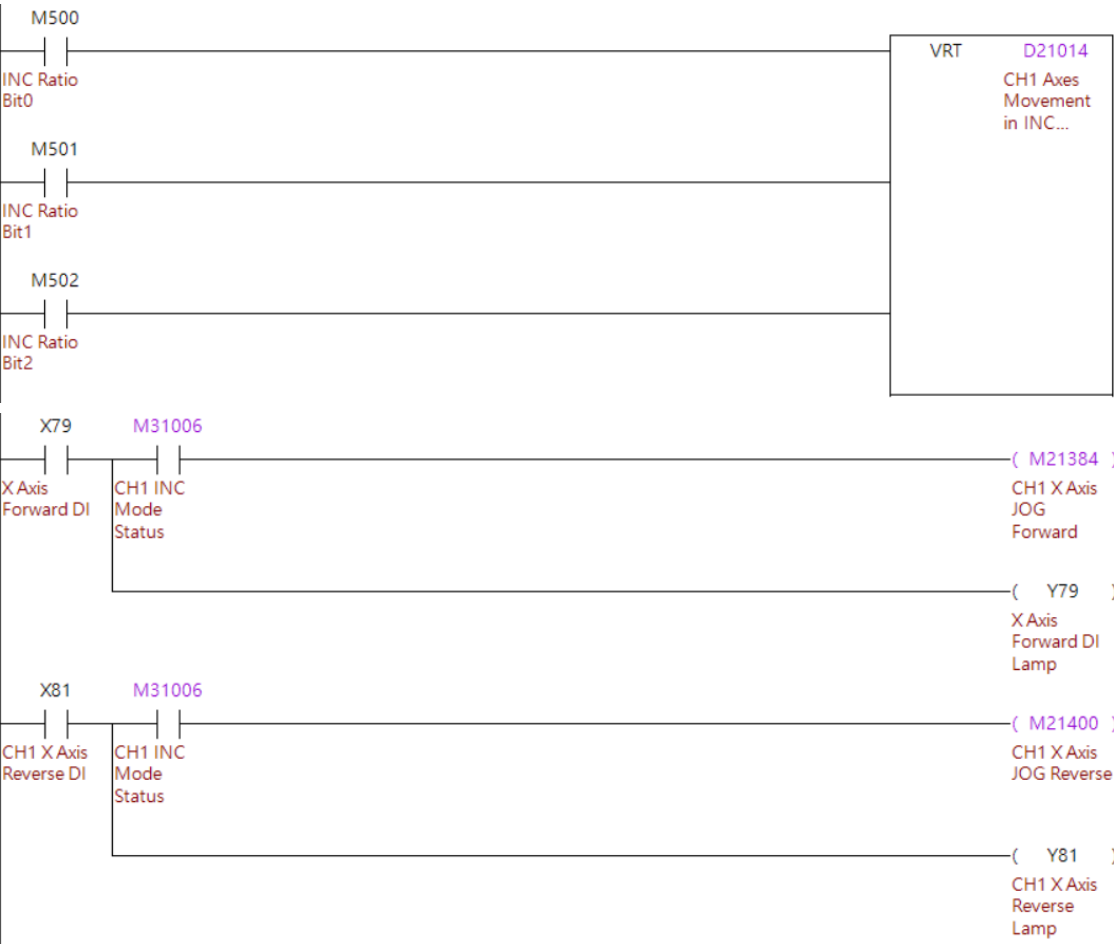
Program execution procedure

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

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.
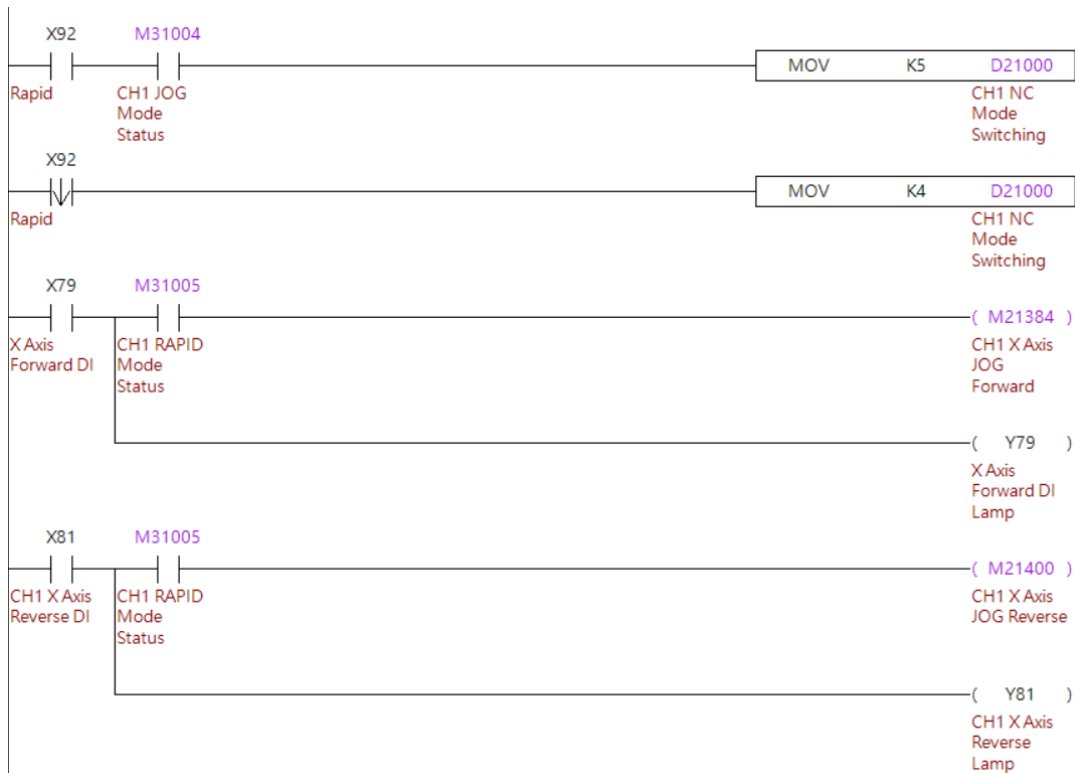
Program execution procedure

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
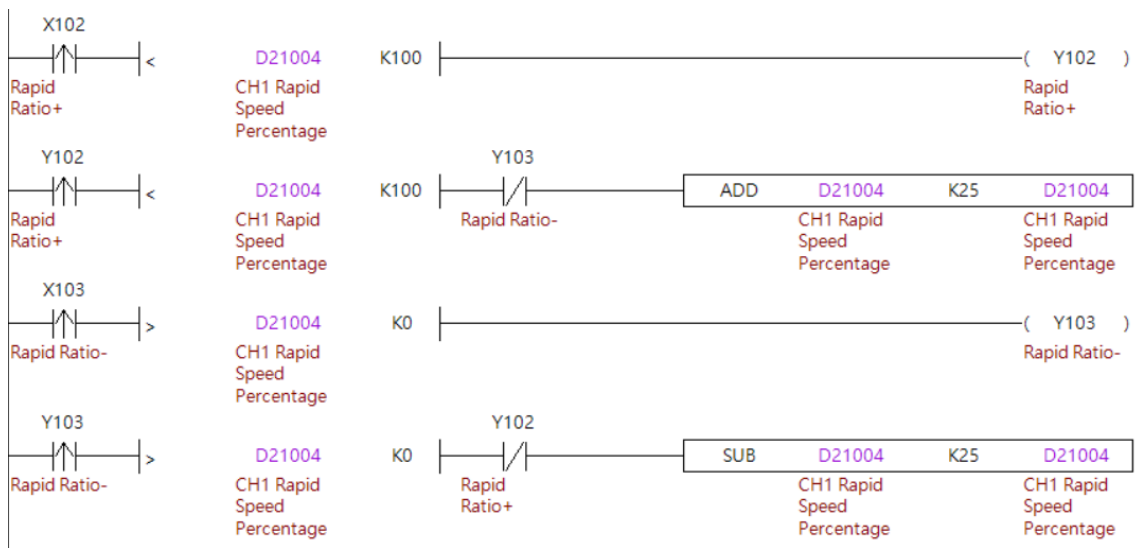
Program execution procedure

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]**.

5.7 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
10th Axis	M2x329	M3x345	M3x329
11th Axis	M2x330	M3x346	M3x330
12th Axis	M2x331	M3x347	M3x331
13th Axis	M2x332	M3x348	M3x332
14th Axis	M2x333	M3x349	M3x333
15th Axis	M2x334	M3x350	M3x334
16th 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.

5

■　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.
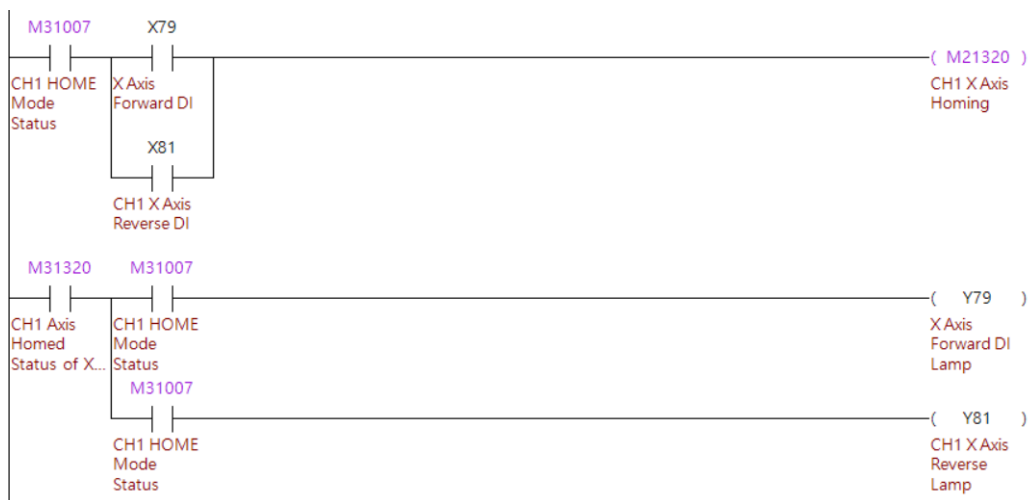
Program execution procedure:

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

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

[M, S and T Codes Finished] M2x016

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.

[M Codes Execution] M3x064

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.

5

■ **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.
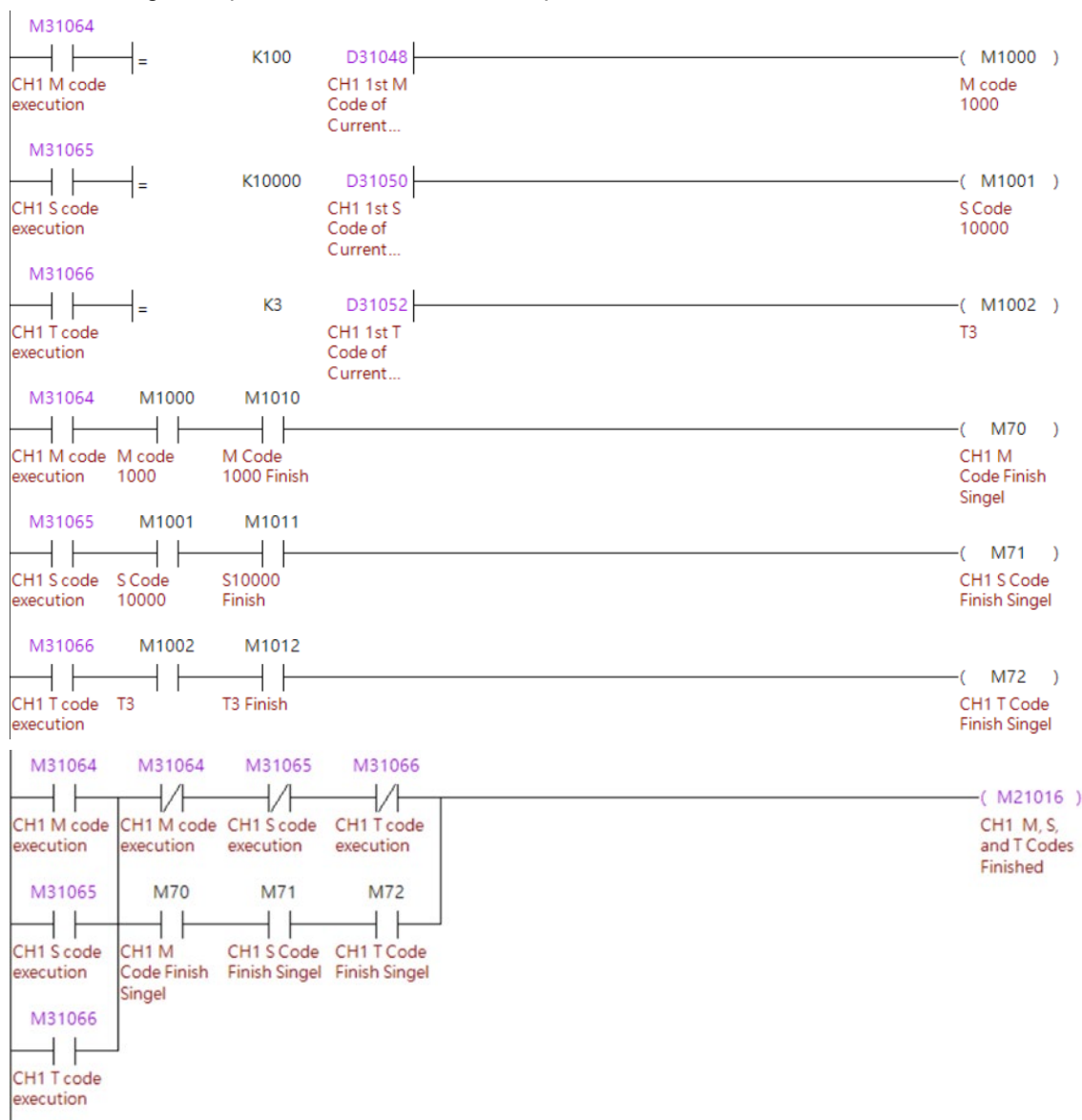
Program execution procedure:

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.

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■ 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. N2.008: The 2nd software positive limit is set to 140.
Program execution	G90G54X100. G0Z-50. M90 G0Z134. M30

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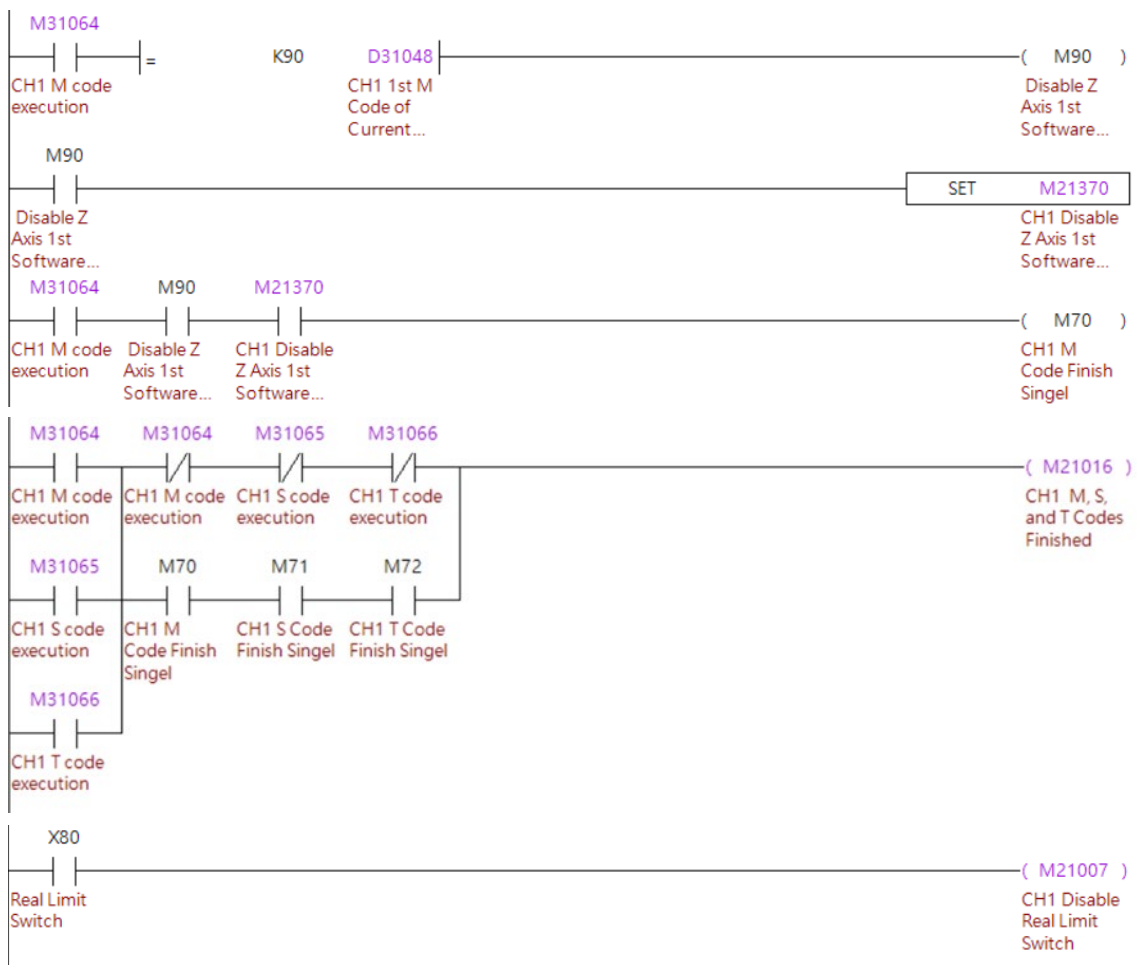
Program execution procedure:

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.

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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.

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[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 1: Reserved 2: Analog Mode
Analog Close Loop Control	0: Disable 1: Enable
Analog Spindle Command Source	0: Reference from command speed 1: Reference from encoder
Analog Spindle Encoder Feedback Source	0: Reference from spindle encoder 1: Reference from end motor encoder
Spindle Speed Reference	0: Reference from NC program 1: Reference from N0.1006 (Spindle Initial Speed)
Spindle High Speed Command Check	0: Disable 1: Enable
Multi-Spindle Encoder Feedback Function Switch	0: Disable 1: Enable
Spindle Target Speed Error Unit	0: RPM 1: %

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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.

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◼ MLC Example

The following illustrates the usage of spindle forward/reverse operation, stop, positioning, and speed override.

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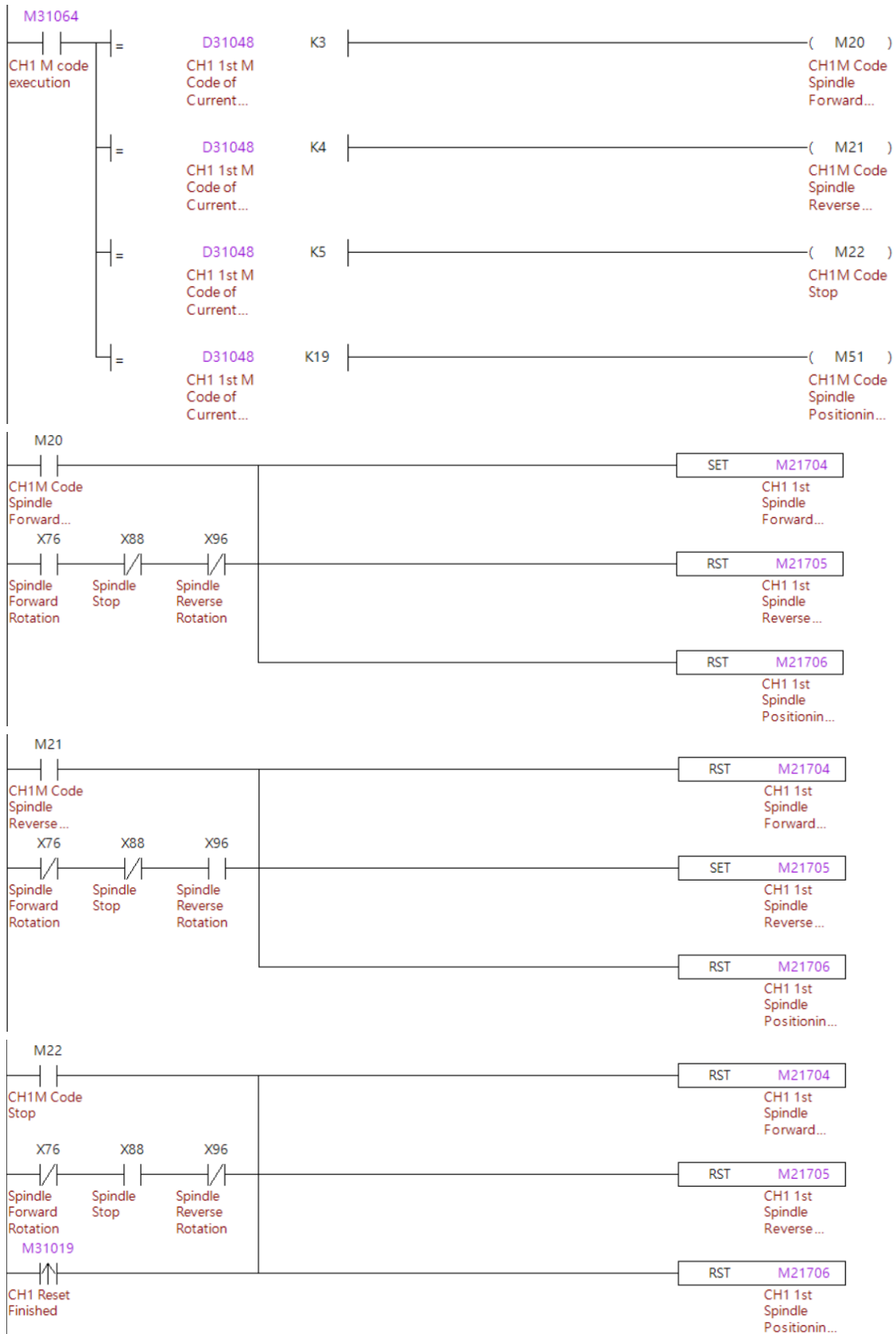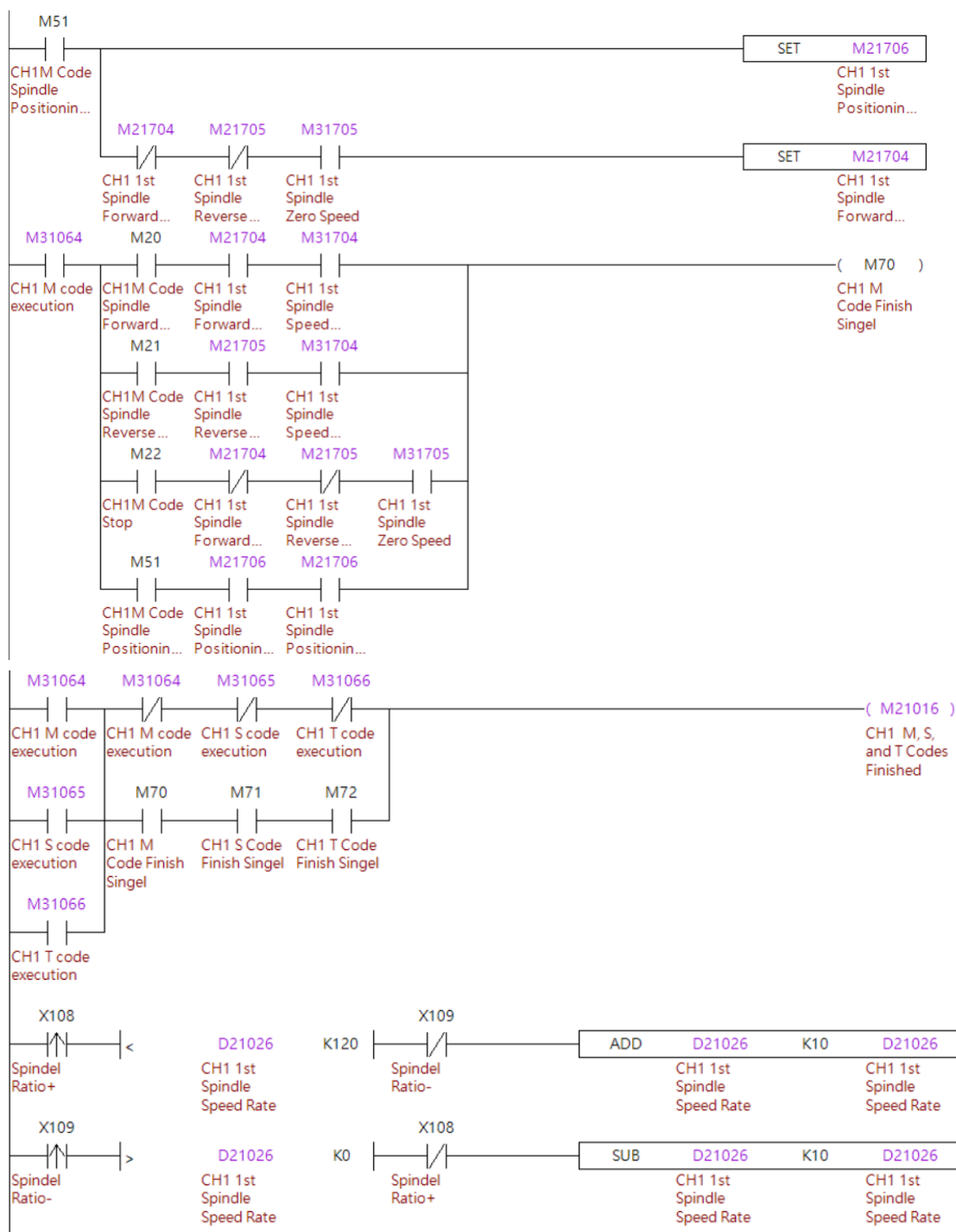
Program execution procedure

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

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 2: Take N0.1036, N0.1037 as Ratio 3: Take N0.1038, N0.1039 as Ratio 4: Take N0.1040, N0.1041 as Ratio
2nd Spindle Gear Ratio Selection	D2x033	1: Take N0.1084, N0.1085 as Ratio 2: Take N0.1086, N0.1087 as Ratio 3: Take N0.1088, N0.1089 as Ratio 4: Take N0.1090, N0.1091 as Ratio
3rd Spindle Gear Ratio Selection	D2x323	1: Take N0.1134, N0.1135 as Ratio 2: Take N0.1136, N0.1137 as Ratio 3: Take N0.1138, N0.1139 as Ratio 4: Take N0.1140, N0.1141 as Ratio
4th Spindle Gear Ratio Selection	D2x329	1: Take N0.1184, N0.1185 as Ratio 2: Take N0.1186, N0.1187 as Ratio 3: Take N0.1188, N0.1189 as Ratio 4: Take N0.1190, N0.1191 as Ratio
5th Spindle Gear Ratio Selection	D2x335	1: Take N0.1234, N0.1235 as Ratio 2: Take N0.1236, N0.1237 as Ratio 3: Take N0.1238, N0.1239 as Ratio 4: Take N0.1240, N0.1241 as Ratio
6th Spindle Gear Ratio Selection	D2x341	1: Take N0.1284, N0.1285 as Ratio 2: Take N0.1286, N0.1287 as Ratio 3: Take N0.1288, N0.1289 as Ratio 4: Take N0.1290, N0.1291 as Ratio
7th Spindle Gear Ratio Selection	D2x347	1: Take N0.1334, N0.1335 as Ratio 2: Take N0.1336, N0.1337 as Ratio 3: Take N0.1338, N0.1339 as Ratio 4: Take N0.1340, N0.1341 as Ratio
8th Spindle Gear Ratio Selection	D2x353	1: Take N0.1384, N0.1385 as Ratio 2: Take N0.1386, N0.1387 as Ratio 3: Take N0.1388, N0.1389 as Ratio 4: Take N0.1390, N0.1391 as Ratio

[Spindle Gear Ratio Selection] <u>D2x027, D2x033, D2x323, D2x329, D2x335, D2x341, D2x347, D2x353</u>

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)

5

■ 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.

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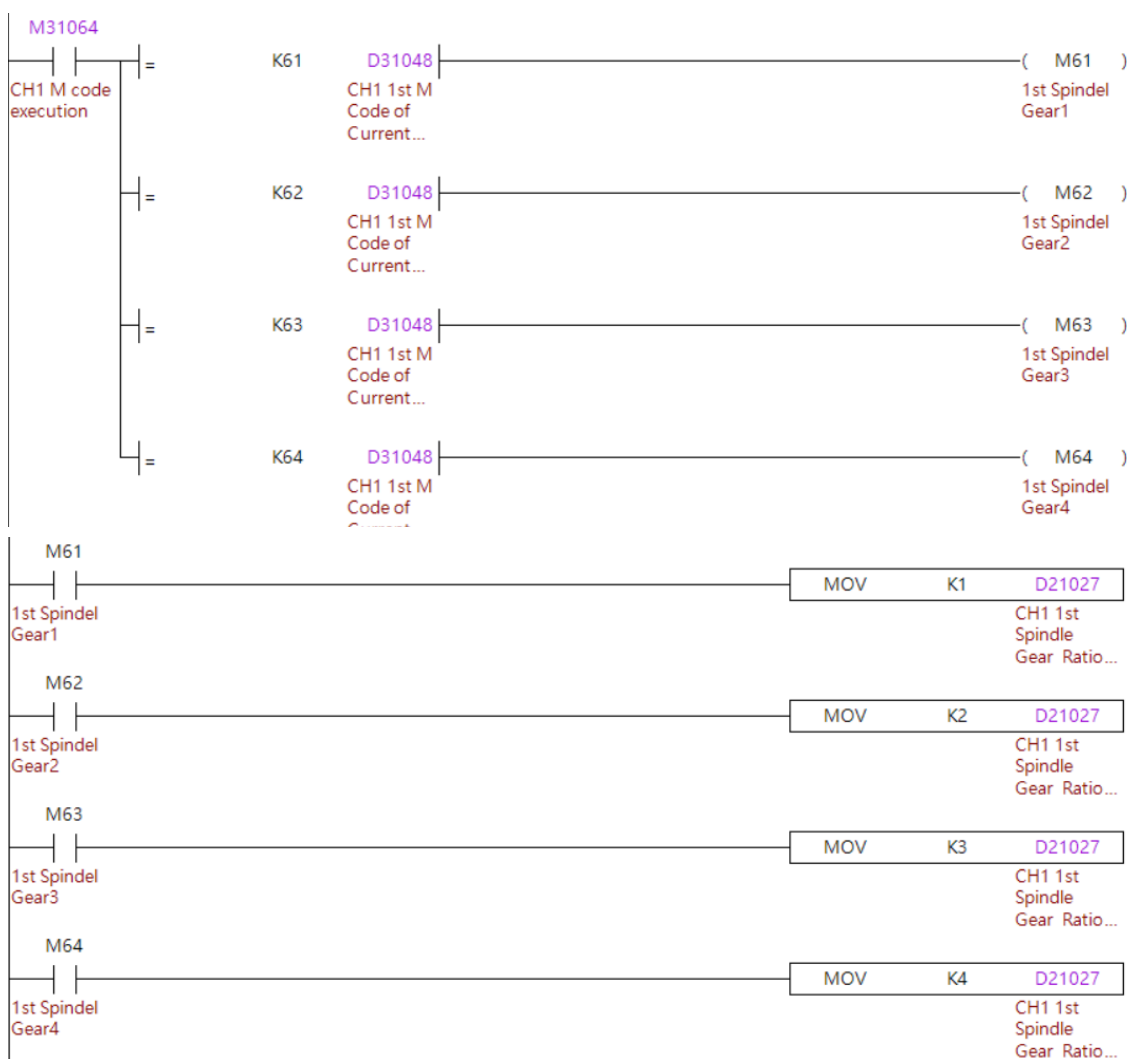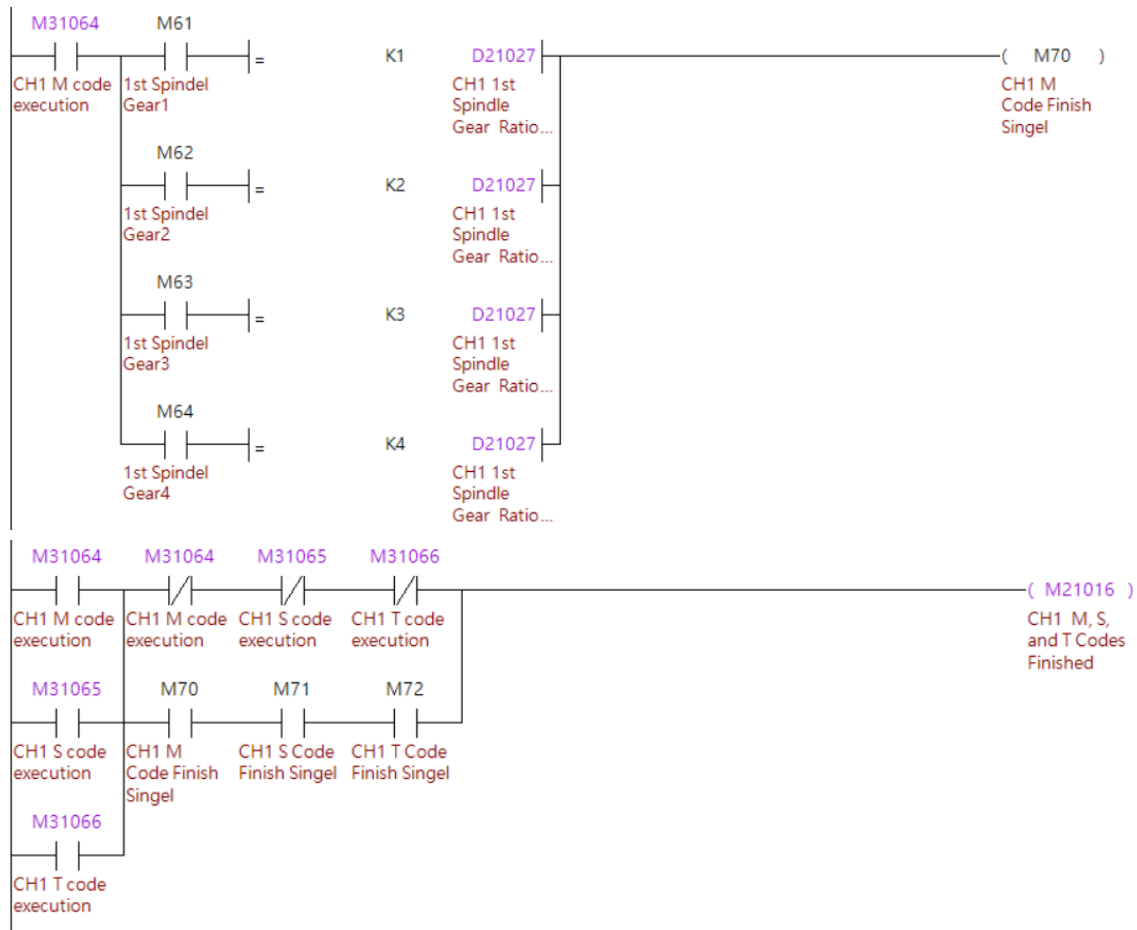
Program execution procedure:

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.

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[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**
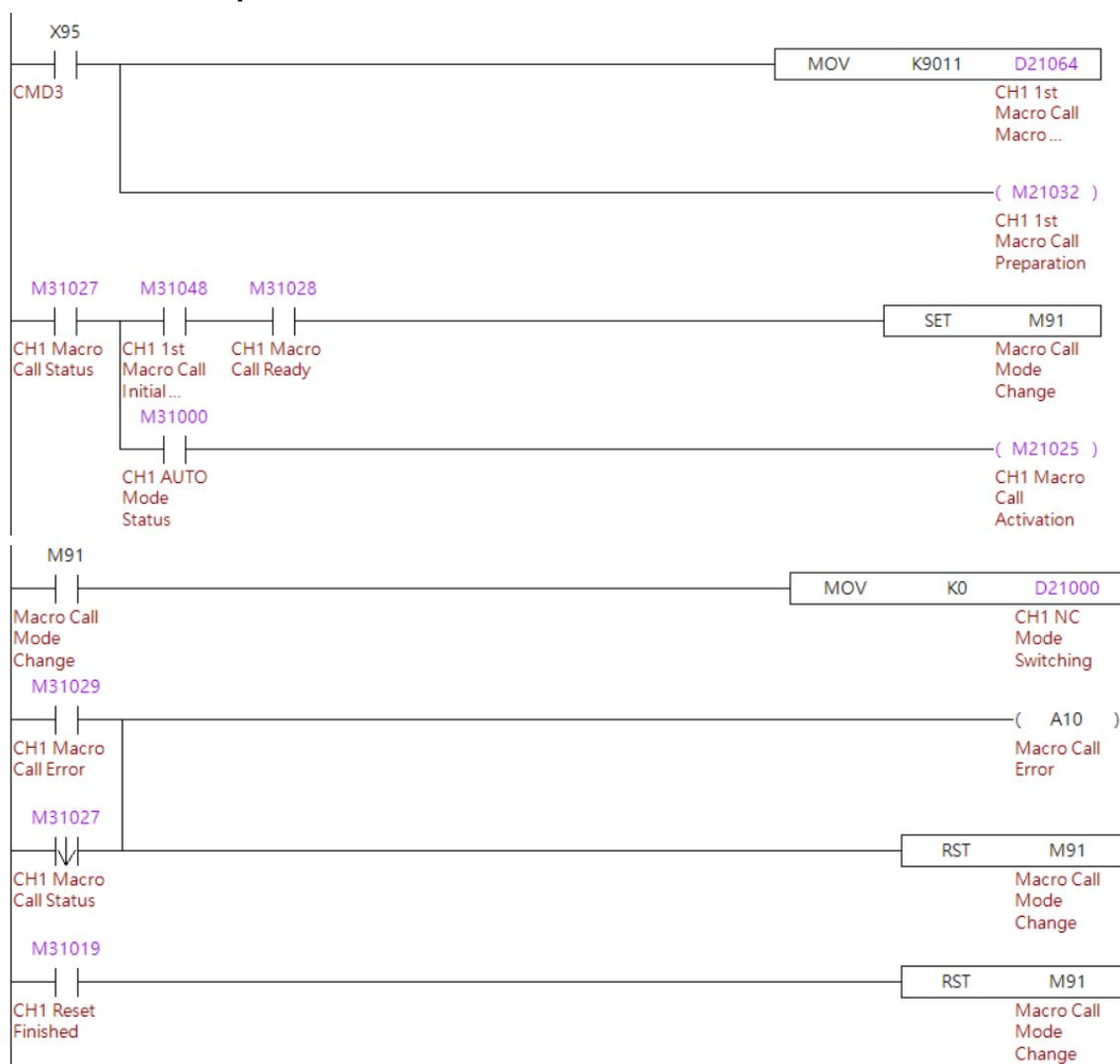
Program execution procedure:

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.

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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.

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[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, 1st tool pot will be 3 and 2nd 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.

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■ **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.

Tool Par		Current CH.		20230410.NC		N 1	System
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
No.1 tool magazine utility1 : Tool magazine(0 : off ; 1 : on)							
Con.JOG		08:47:24	RPD 100%	JOG 100%	S 100%	mm	
<=	OK						

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).

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■ MLC Example

The following example illustrates the program execution with tool magazine 1 set to hold 16 tools.
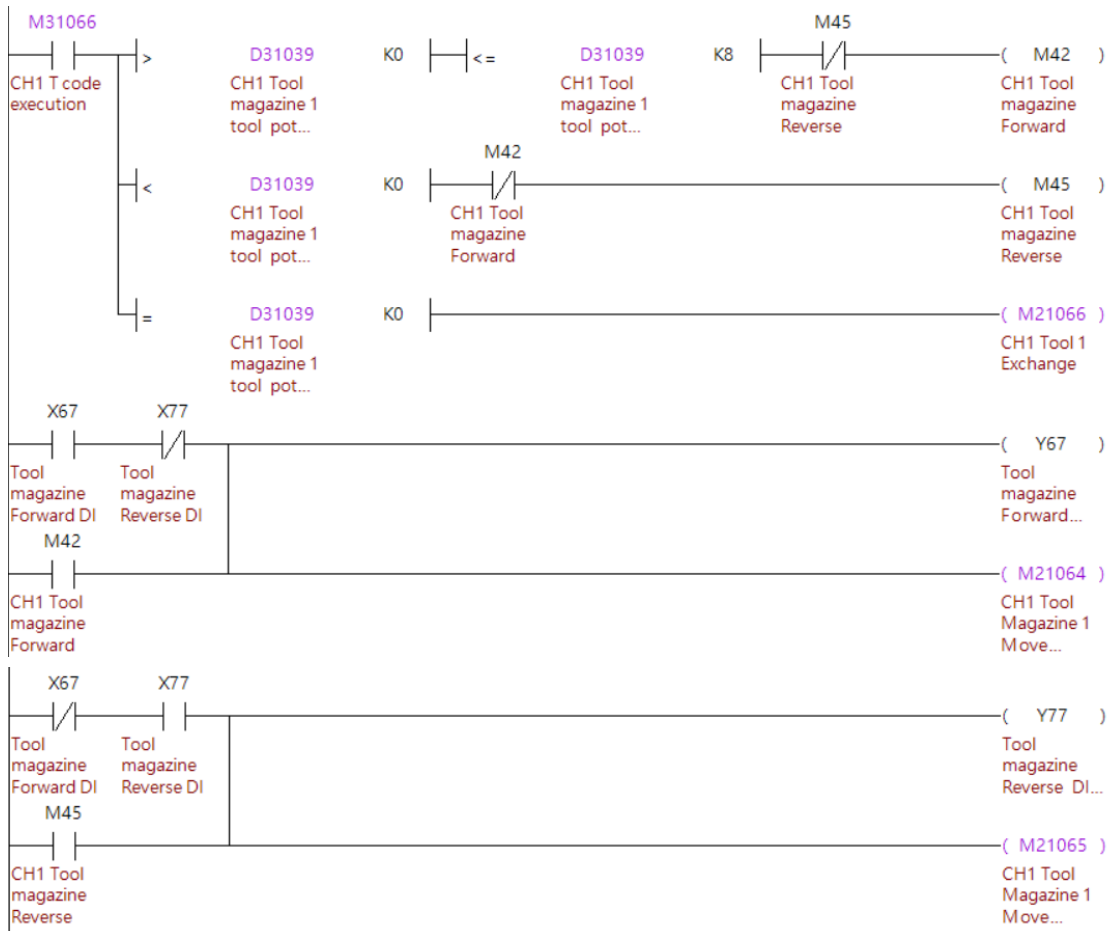
Program execution procedure:

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.

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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.

■ **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
10th Axis	M2x457	M2x473	M2x425	D2x274	D2x306	M3x457	M3x473
11th Axis	M2x458	M2x474	M2x426	D2x276	D2x308	M3x458	M3x474
12th Axis	M2x459	M2x475	M2x427	D2x278	D2x310	M3x459	M3x475
13th Axis	M2x460	M2x476	M2x428	D2x280	D2x312	M3x460	M3x476
14th Axis	M2x461	M2x477	M2x429	D2x282	D2x314	M3x461	M3x477
15th Axis	M2x462	M2x478	M2x430	D2x284	D2x316	M3x462	M3x478
16th 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
10th Axis	M2x441	M3x441
11th Axis	M2x442	M3x442
12th Axis	M2x443	M3x443
13th Axis	M2x444	M3x444
14th Axis	M2x445	M3x445
15th Axis	M2x446	M3x446
16th Axis	M2x447	M3x447

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[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.

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[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.
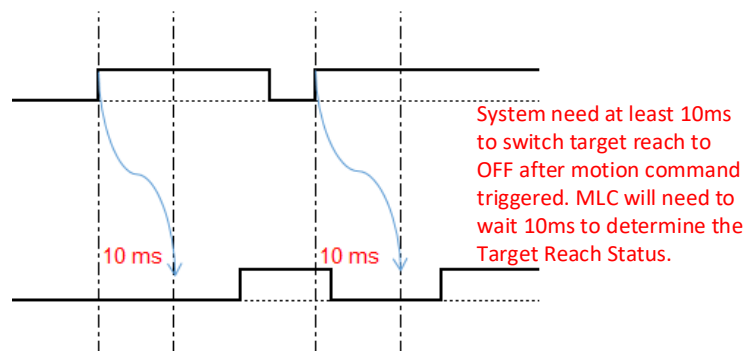
[Axis Moving] M3x464 ~ M3x479

When any of the axes is in motion, this **[Axis Moving]** status will be ON.

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[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).

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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).

■ **MLC Example**

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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.

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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		M2x288		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	M2x256	M2x296	M2x257	M2x312
10th Axis		M2x297		M2x313
11th Axis		M2x298		M2x314
12th Axis		M2x299		M2x315
13th Axis		M2x300		M2x316
14th Axis		M2x301		M2x317
15th Axis		M2x302		M2x318
16th 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.

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■ **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.

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■ 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        M1200
  ─┤├─────────┤├──────────────────────────────────────┤ SET    M21256 ├
Sync / Trans  Use Z1                                      CH1
                                                          Synchronou
                                                          s Control...

  X99                    M1201
  ─┤├─                   ─┤├────────────────────────────┤ SET    M21294 ├
Sync / Trans             Use Z2                           CH1 U Slave
(Handel)                                                  Axis Follows
                                                          the Master...

                         M1202
                         ─┤├────────────────────────────┤ SET    M21295 ├
                         USE Z3                           CH1 V Slave
                                                          Axis Follows
                                                          the Master...

                                                        ─┤ RST    M21257 ├
                                                          CH1
                                                          Command
                                                          Transfer...

                                            ─┤ ZRST   M21310    M21311 ├
                                              CH1 U Axis  CH1 V Axis
                                              Receives    Receives
                                              Command...  Command...


  M173        M1200
  ─┤├─────────┤/├──────────────────────────────────────┤ SET    M21257 ├
Sync / Trans  Use Z1                                      CH1
                                                          Command
                                                          Transfer...

  X99                    M1201
  ─┤├─                   ─┤├────────────────────────────┤ SET    M21310 ├
Sync / Trans             Use Z2                           CH1 U Axis
(Handel)                                                  Receives
                                                          Command...

                         M1202
                         ─┤├────────────────────────────┤ SET    M21311 ├
                         USE Z3                           CH1 V Axis
                                                          Receives
                                                          Command...

                                                        ─┤ RST    M21256 ├
                                                          CH1
                                                          Synchronou
                                                          s Control...

                                            ─┤ ZRST   M21294    M21295 ├
                                              CH1 U Slave  CH1 V Slave
                                              Axis Follows Axis Follows
                                              the Master... the Master...


  M174
  ─┤├───────────────────────────────────────┤ ZRST   M21294    M21295 ├
Sync / Trans                                   CH1 U Slave  CH1 V Slave
Close                                          Axis Follows Axis Follows
                                               the Master... the Master...

                                             ─┤ ZRST   M21256    M21257 ├
                                               CH1          CH1
                                               Synchronou   Command
                                               s Control... Transfer...

                                             ─┤ ZRST   M21310    M21311 ├
                                               CH1 U Axis  CH1 V Axis
                                               Receives    Receives
                                               Command...  Command...
```

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M173	M21256	M1200	M1201	M1202		(M70)
Sync / Trans	CH1 Synchronous Control...	Use Z1	Use Z2	USE Z3		CH1 M Code Finish Singel

		M1201	M1202	M21294	M21295
		Use Z2	USE Z3	CH1 U Slave Axis Follows the Master...	CH1 V Slave Axis Follows the Master...

		M1201	M1202	M21294	M21295
		Use Z2	USE Z3	CH1 U Slave Axis Follows the Master...	CH1 V Slave Axis Follows the Master...

		M1201	M1202	M21294	M21295
		Use Z2	USE Z3	CH1 U Slave Axis Follows the Master...	CH1 V Slave Axis Follows the Master...

	M21257	M1201	M1202	M21310	M21311
	CH1 Command Transfer...	Use Z2	USE Z3	CH1 U Axis Receives Command...	CH1 V Axis Receives Command...

		M1201	M1202	M21310	M21311
		Use Z2	USE Z3	CH1 U Axis Receives Command...	CH1 V Axis Receives Command...

		M1201	M1202	M21310	M21311
		Use Z2	USE Z3	CH1 U Axis Receives Command...	CH1 V Axis Receives Command...

M174	M21256	M21257	M21294	M21295	M21310	M21311
Sync / Trans Close	CH1 Synchronous Control...	CH1 Command Transfer...	CH1 U Slave Axis Follows the Master...	CH1 V Slave Axis Follows the Master...	CH1 U Axis Receives Command...	CH1 V Axis Receives Command...

M31064	M31064	M31065	M31066	(M21016)
CH1 M code execution	CH1 M code execution	CH1 S code execution	CH1 T code execution	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

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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.

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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.

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■ 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.

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■ **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 D3x097	Information Monitoring 2 Sort 1	D3x104 D3x105
Information Monitoring 1 Sort 2	D3x098 D3x099	Information Monitoring 2 Sort 2	D3x106 D3x107
Information Monitoring 1 Sort 3	D3x100 D3x101	Information Monitoring 2 Sort 3	D3x108 D3x109
Information Monitoring 1 Sort 4	D3x102 D3x103	Information Monitoring 2 Sort 4	D3x110 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.

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[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.

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■ 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	>>
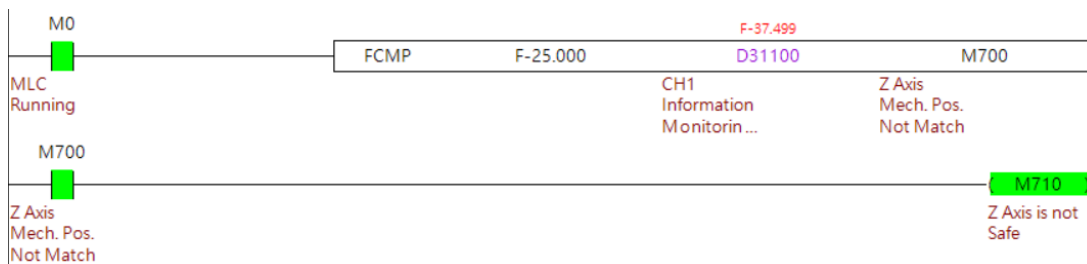
Program execution procedure:

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 M2x049 M2x050 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

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[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.

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[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

5

■ 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

Instruction	Description
XYZABC	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.
P0000	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.
H	Tool coordinate system 0: Not using tool offset 1 ~ n: corresponding to the tool number
R	Working coordinate 1 ~ 6: corresponding to G54 to G59.
Q	Coordinate system setting 1: PCS (Piece coordinate) 2: TCS (Tool coordinate) 3: JCS (Joint coordinate)
F	Speed percentage (%)

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.

CH1 M Code

```
M31064
──┤ ├──┬──┤=├── D31048    K3000 ──────────────────────────────( M3000 )
CH1 M code │      CH1 1st M              Call Robot
execution  │      Code of                Go Step1
           │      Current...
           │
           ├──┤=├── D31048    K3001 ──────────────────────────────( M3001 )
           │      CH1 1st M              Call Robot
           │      Code of                Go Step2
           │      Current...
           │
           ├──┤=├── D31048    K3002 ──────────────────────────────( M3002 )
           │      CH1 1st M              Call Robot
           │      Code of                Go Step3
           │      Current...
           │
           ├──┤=├── D31048    K3003 ──────────────────────────────( M3003 )
           │      CH1 1st M              Call Robot
           │      Code of                Go Step4
           │      Current...
           │
           └──┤=├── D31048    K3004 ──────────────────────────────( M3004 )
                  CH1 1st M              Call Robot
                  Code of                Go Step5
                  Current...

  M3000      M3005
──┤ ├───────┤ ├──┬──────────────────────────────────────────────( M70 )
Call Robot  Call CNC Go │                                          CH1 M
Go Step1    Step1       │                                          Code Finish
                        │                                          Singel
  M3001      M3006      │
──┤ ├───────┤ ├─────────┤
Call Robot  Call CNC Go │
Go Step2    Step2       │
                        │
  M3002      M3007      │
──┤ ├───────┤ ├─────────┤
Call Robot  Call CNC Go │
Go Step3    Step3       │
                        │
  M3003      M3008      │
──┤ ├───────┤ ├─────────┤
Call Robot  Call CNC Go │
Go Step4    Step4       │
                        │
  M3004      M3009      │
──┤ ├───────┤ ├─────────┘
Call Robot  Call CNC Go
Go Step5    Step5
```

CH2 M Code

M32064

─┤ ├─ ═	D32048	K3005 ─────────────────────── (M3005)
CH2 M code execution	CH2 1st M Code of Current...	Call CNC Go Step1

═	D32048	K3006 ─────────────────────── (M3006)
	CH2 1st M Code of Current...	Call CNC Go Step2

═	D32048	K3007 ─────────────────────── (M3007)
	CH2 1st M Code of Current...	Call CNC Go Step3

═	D32048	K3008 ─────────────────────── (M3008)
	CH2 1st M Code of Current...	Call CNC Go Step4

═	D32048	K3009 ─────────────────────── (M3009)
	CH2 1st M Code of Current...	Call CNC Go Step5

M3005
─┤ ├─ ──────────────────────────────────── (M1070)
Call CNC Go
Step1   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

5

CH1 MST Finish

M31064	M31064	M31065	M31066	(M21016)
CH1 M code execution	CH1 M code execution	CH1 S code execution	CH1 T code execution	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				

CH2 MST Finish

M32064	M32064	M32065	M32066	(M22016)
CH2 M code execution	CH2 M code execution	CH2 S code execution	CH2 T code execution	CH2 M, S, and T Codes Finished
M32065	M1070	M1071	M1072	
CH2 S code execution	CH2 M Code Finish Singel	CH2 S Code Finish Singel	CH2 T Code Finish Singel	
M32066				
CH2 T code execution				

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 D2x019	Axes Oscillation Cycle Time	D2x020 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.

5

[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.
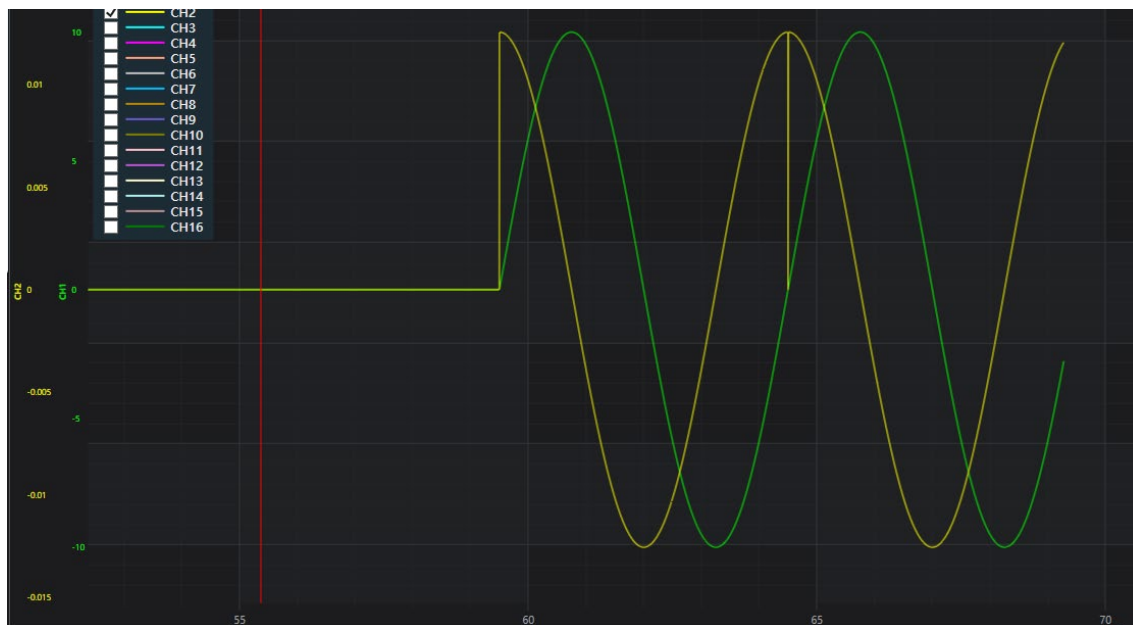
- When set as 0, the system will apply [A-cos(w) + A] as overlay oscillation wave. In this [A-cos(w) + A] formula, the added command will take 0 as based incremental position and then add positive or negative as one direction additional movement continuously as shown below in green line.

5
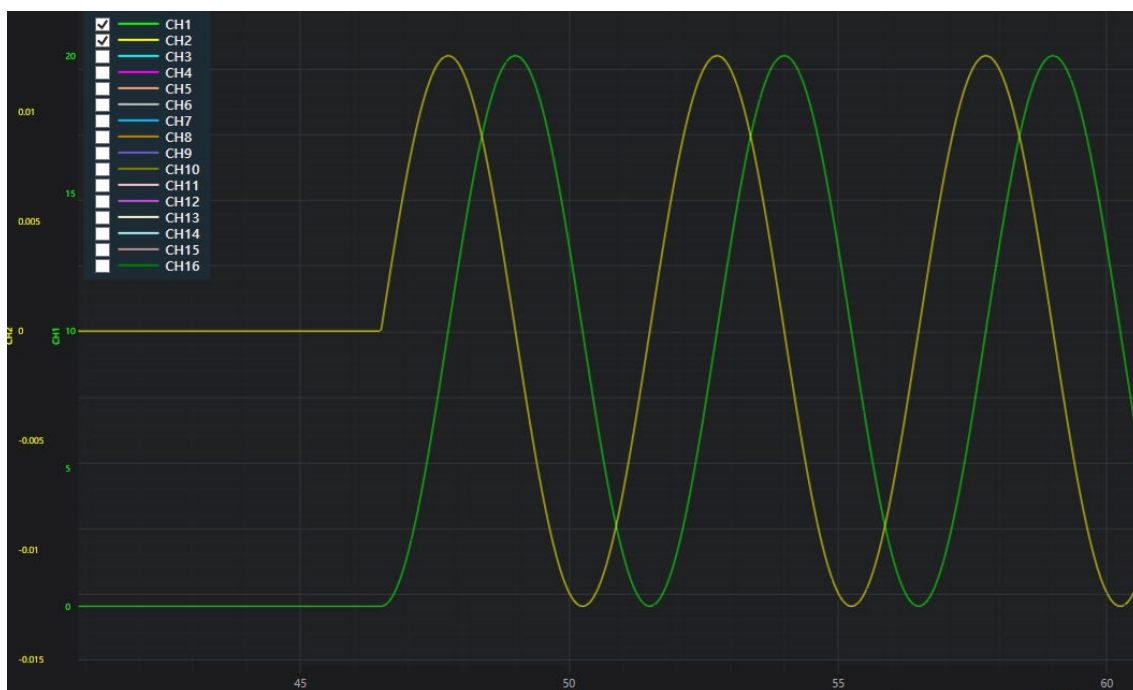
■ MLC example

The following example provides oscillation function enable through real digital input and then indicated to the X axis.
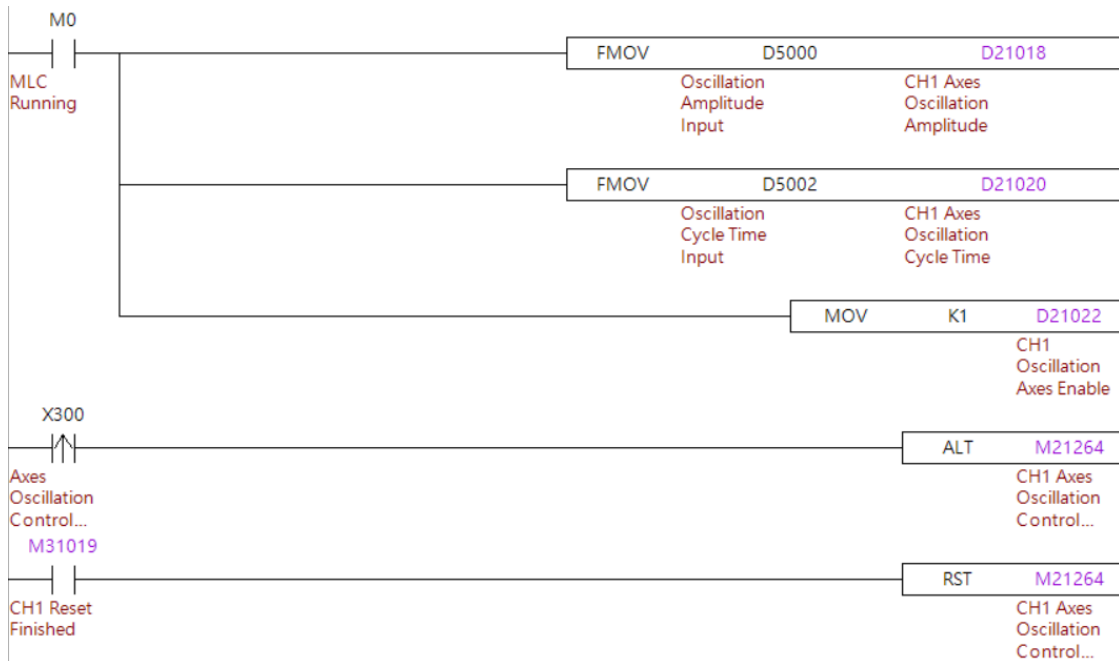
Program execution procedure:

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]**.
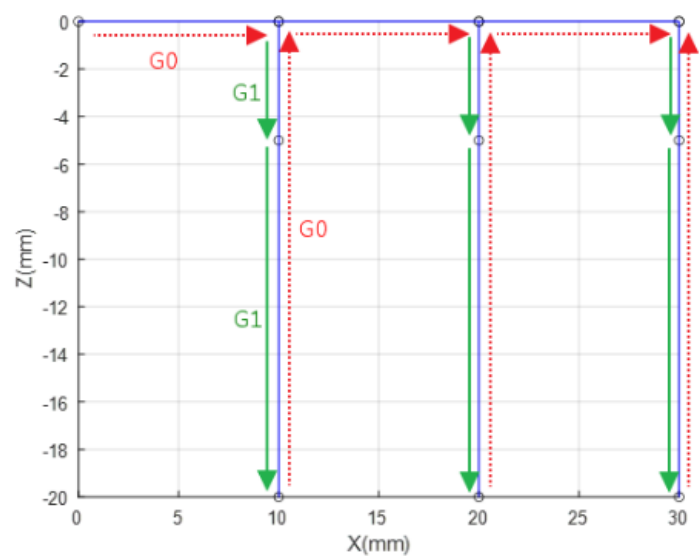
Above diagram including G00 to G00, G00 to G01 and G01 to G00 three types of command combination, and each of them can be decided the blending mode by the parameter **[N1.21 Bit0~Bit1]** and then enable them by the parameter **[N1.21 Bit2~Bit4]**.

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:

```
(O50000 Main program
G1X1.F100
T11T22T33T44T55(Tcode   O9000
X10.
M30
```

```
(O9000
#100=#20(11
#101=#46(22
#102=#72(33
#103=#85(44
#104=#92(55
M99
```
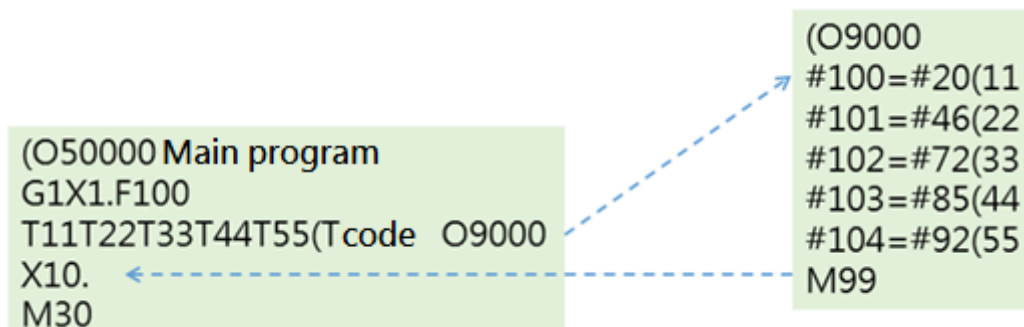
As above diagram, the T11 command will response to #20 and T22 will response to #46.

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

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:

Special M		Special D	
M3x064	1	D3x048	101
M3x067	1	D3x054	102
M3x070	1	D3x060	103
M3x073	1	D3x066	104

(O50000
G1X1.F100
M101M102M103M104
X10.
M30

After MLC finish all the M code function and set M2x016=1(MST finish), the system will release the control to the NC system
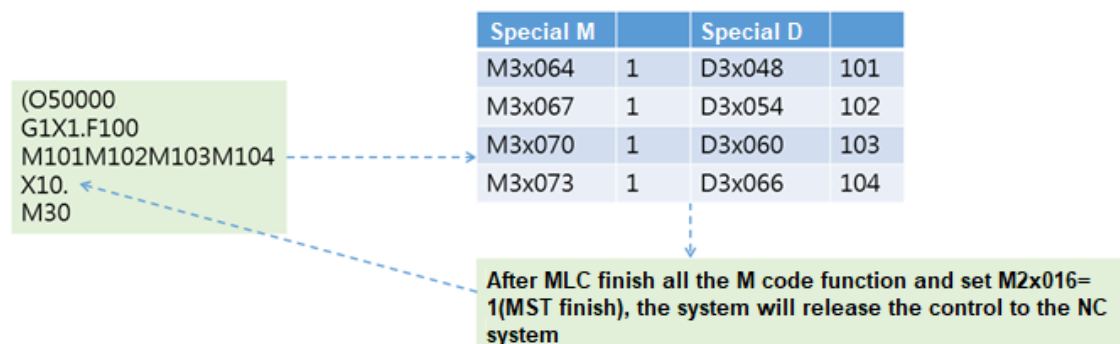
5.23 System recovery

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.
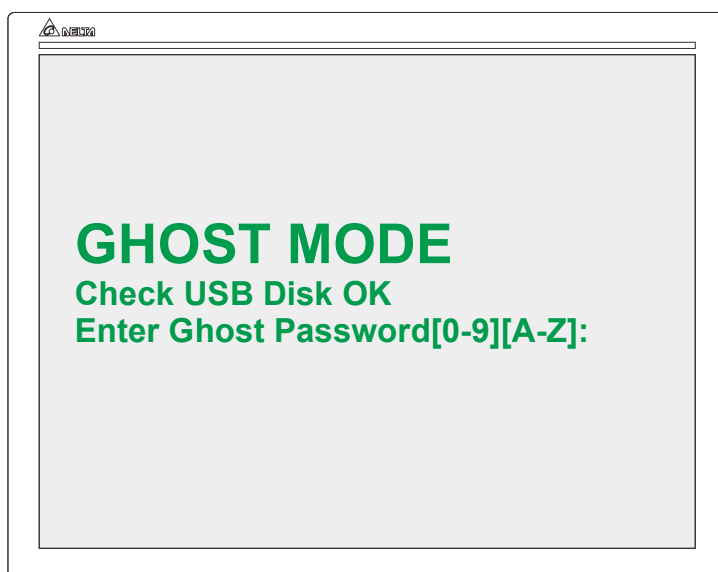
Make recover image file.
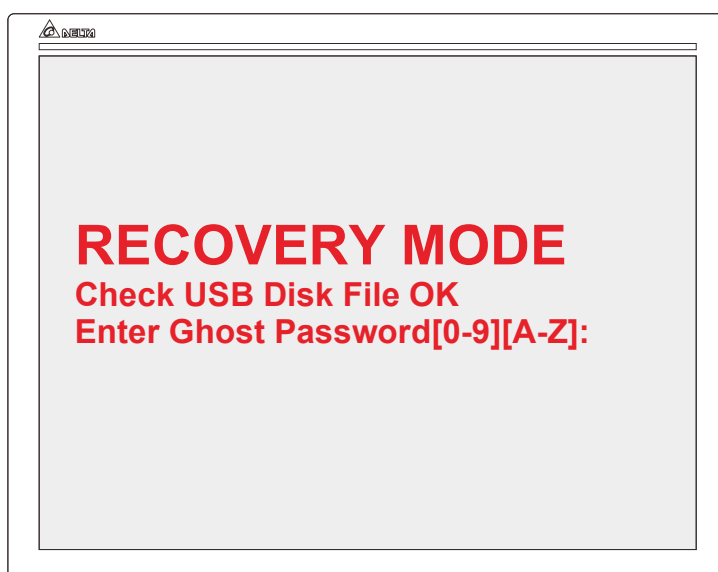
Recover system by image file.

5.23.2 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.
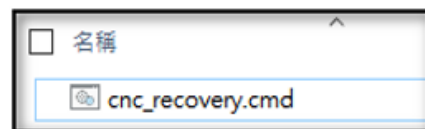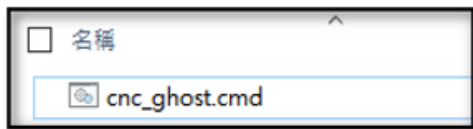
B.   Embedded HMI interface:

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.
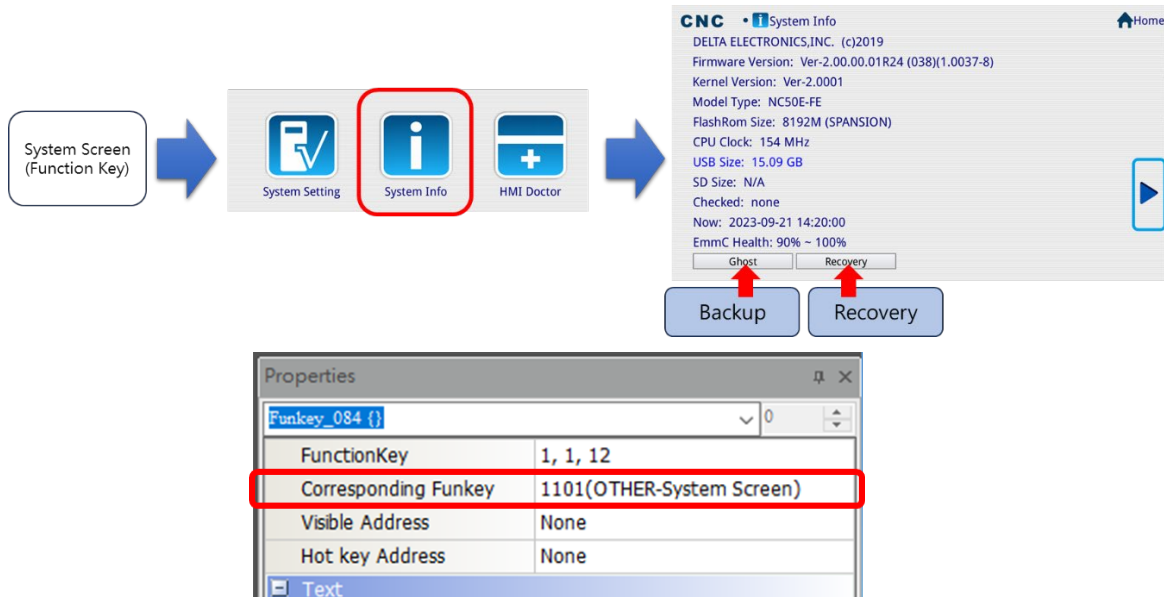
5.23.3 Make backup file

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.
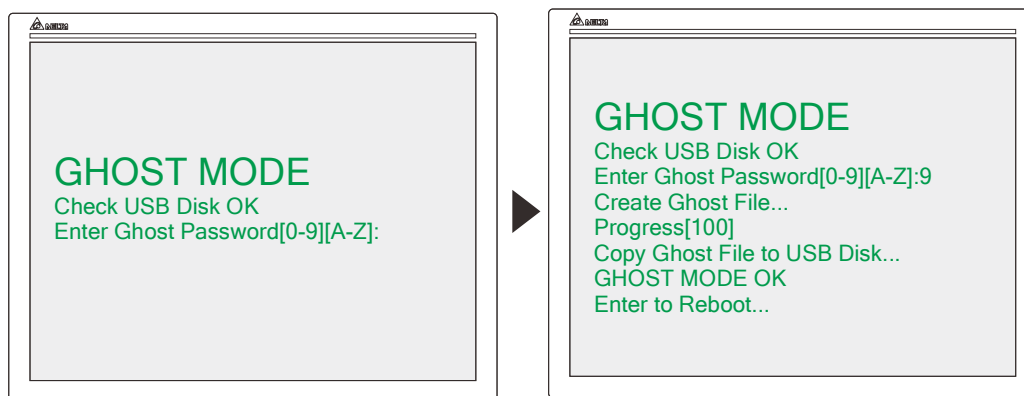
Step 6: After finishing the procedure, the system will create a new folder named as DELTE2CNC, which content the backup image in the USB drive.

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.
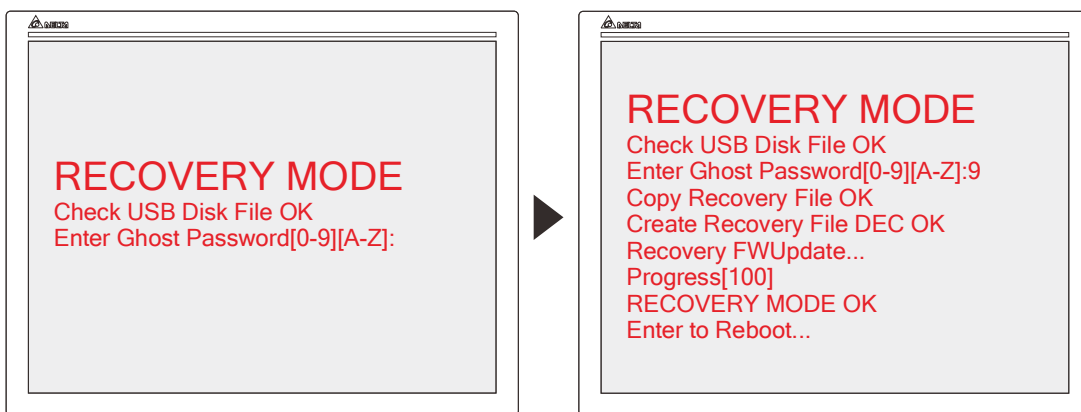
5.24 Induction spindle motor

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.

```
┌─────────────────────┐
│  Motor parameter    │
│  of servo drive     │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Motor parameter    │
│  estimation         │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Inertia estimation │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Bandwidth          │
│  adjustment         │
└─────────────────────┘
```
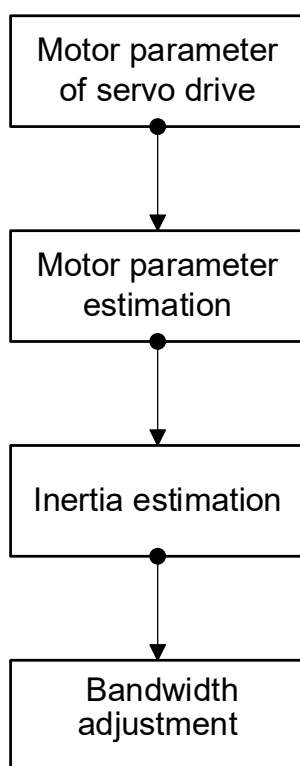
5.24.1 Parameter description of induction motor

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 <u>one round pulse number*2 ^ ratio</u>. (**[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.

	3 - PHASE Spindle Servo Motor IP-54 CE
TYPE : NC-JB032008B15N	
Rated Power : 3.7 KW	Rated Torque : 17.7 N-m
Rated Speed : 2000 rpm	Rated Frequency : 70.5 Hz
Rated Voltage △ : 160 V	Rated Voltage Y : 280 V
Rated Current △ : 19.1 A	Rated Current Y : 11 A
Max Speed : 8000 rpm	Max Frequency : 281.9 Hz
INS.Class : F	Date : 2023.07.04
DE brg : 6306	NDE brg : 6205 Weight : 30 kg
Encoder : no Encoder (8mm)	
Fan : 1 Phase 220 V 0.23/0.21 A 50/60 Hz	
SER.NO. : JSM-090-03-20-16 BHA01-U-D28L60(no key)-230704001	
	MADE IN TAIWAN

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.

5.24.1.2 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. 2. Provide PM-78 free load current. 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] 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
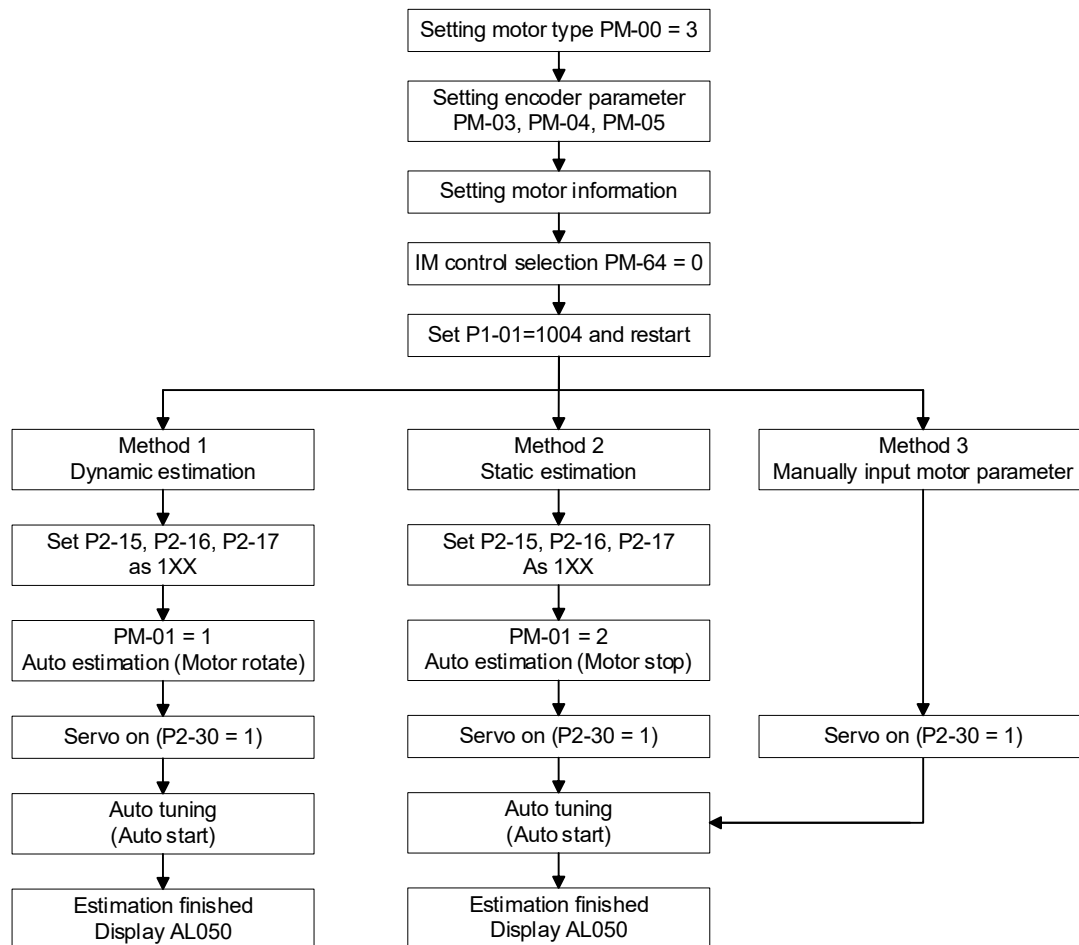
圖 5.24.1.2.1

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 (Motor side, without gear ratio)	○	○
Delta AM3 communication type encoder (Motor side, without gear ratio)	○	○
Delta AM3 communication type encoder + 3rd party pulse type encoder (Both sides, with gear ratio)	○	○

5

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.

```
┌─────────────────┐
│ Motor parameter │
│     setting     │
└────────●────────┘
         │
┌────────▼────────┐
│  Motor encoder  │
│  connect to CN5 │
└────────●────────┘
         │
┌────────▼────────┐
│ Motor parameter │
│   estimation    │
└────────●────────┘
         │
┌────────▼────────┐
│ Inertia estimation │
└────────●────────┘
         │
┌────────▼────────┐
│ CNC parameter & │
│    bandwidth    │
│   adjustment    │
└─────────────────┘
```
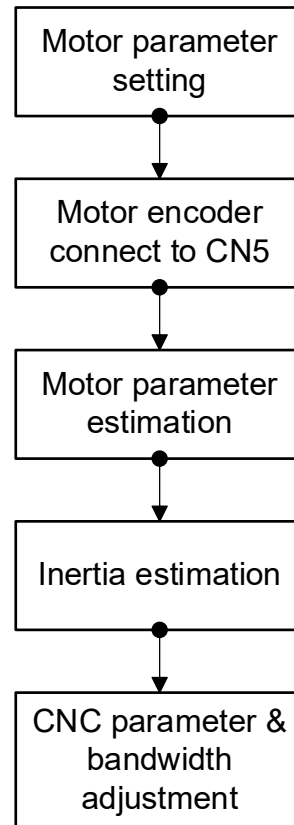
Figure 5.24.2.1.1 Estimate procedure

● **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.

3 - PHASE			CE
Spindle Servo Motor IP-54			
TYPE : NC-JB032008B15N			
Rated Power : 3.7 KW		Rated Torque : 17.7 N-m	
Rated Speed : 2000 rpm		Rated Frequency : 70.5 Hz	
Rated Voltage △ : 160 V		Rated Voltage Y : 280 V	
Rated Current △ : 19.1 A		Rated Current Y : 11 A	
Max Speed : 8000 rpm		Max Frequency : 281.9 Hz	
INS.Class : F		Date : 2023.07.04	
DE brg : 6306	NDE brg : 6205	Weight : 30 kg	
Encoder : no Encoder (8mm)			
Fan : 1 Phase 220 V 0.23/0.21 A 50/60 Hz			
SER.NO. : JSM-090-03-20-16 BHA01-U-D28L60(no key)-230704001			
		MADE IN TAIWAN	

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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 [N0.1000 Bit 3 Speed command source of analog spindle]	1
CNC parameter [N0.1005 Encoder resolution of 1st spindle]	4096 (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.

```
┌─────────────────────┐
│   Motor parameter    │
│      setting         │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│   Motor encoder      │
│   connect to CN2     │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│   Motor parameter    │
│     estimation       │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│   Inertia estimation │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│   CNC parameter &    │
│     bandwidth        │
│    adjustment        │
└─────────────────────┘
```
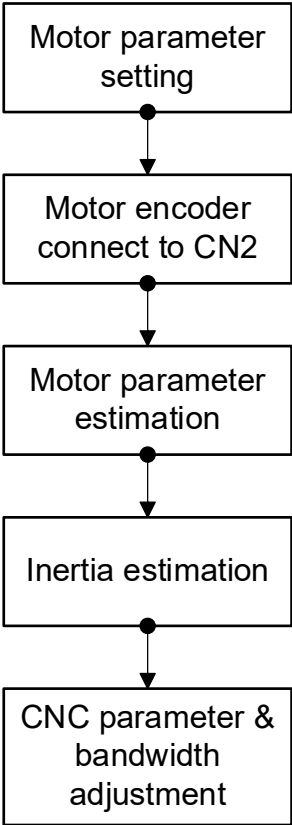
Figure 5.24.2.2.1 Estimate procedure

● **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.

3 - PHASE Spindle Servo Motor IP-54 CE	
TYPE : NC-JB032008B15N	
Rated Power : 3.7 KW	Rated Torque : 17.7 N-m
Rated Speed : 2000 rpm	Rated Frequency : 70.5 Hz
Rated Voltage △ : 160 V	Rated Voltage Y : 280 V
Rated Current △ : 19.1 A	Rated Current Y : 11 A
Max Speed : 8000 rpm	Max Frequency : 281.9 Hz
INS.Class : F	Date : 2023.07.04
DE brg : 6306	NDE brg : 6205 Weight : 30 kg
Encoder : no Encoder (8mm)	
Fan : 1 Phase 220 V 0.23/0.21 A 50/60 Hz	
SER.NO. : JSM-090-03-20-16 BHA01-U-D28L60(no key)-230704001	
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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 [N0.1000 Bit 3 Speed command source of analog spindle]	1
CNC parameter [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)

Phase (deg)

| ☑ A-Line : Result | 46.38 Hz | 174 Deg | -8.66 dB |
| ☐ B-Line : Compare | Hz | Deg | dB |
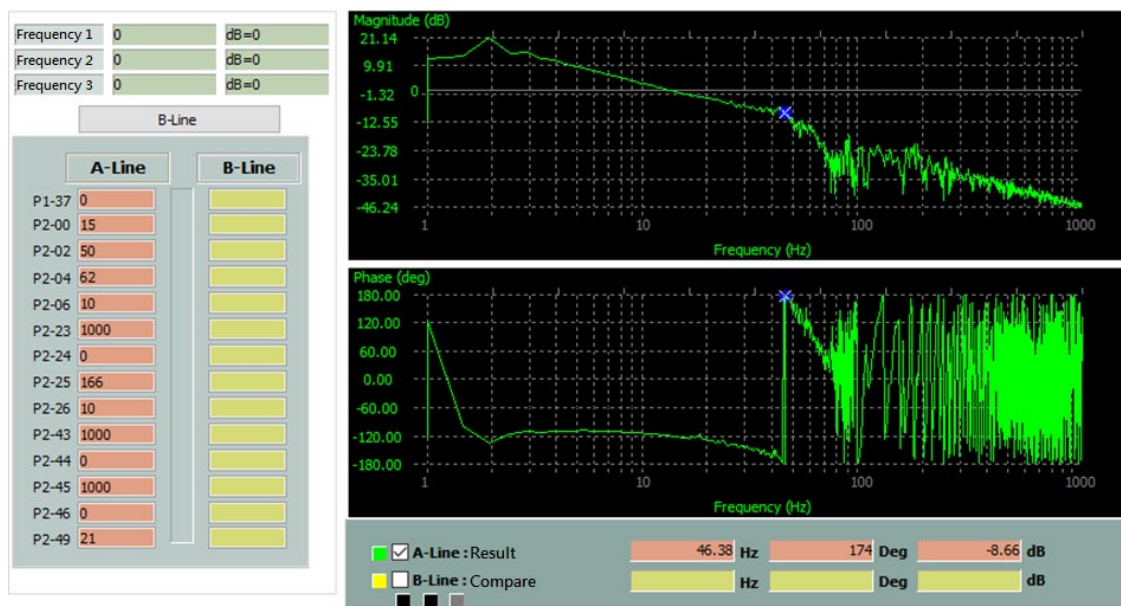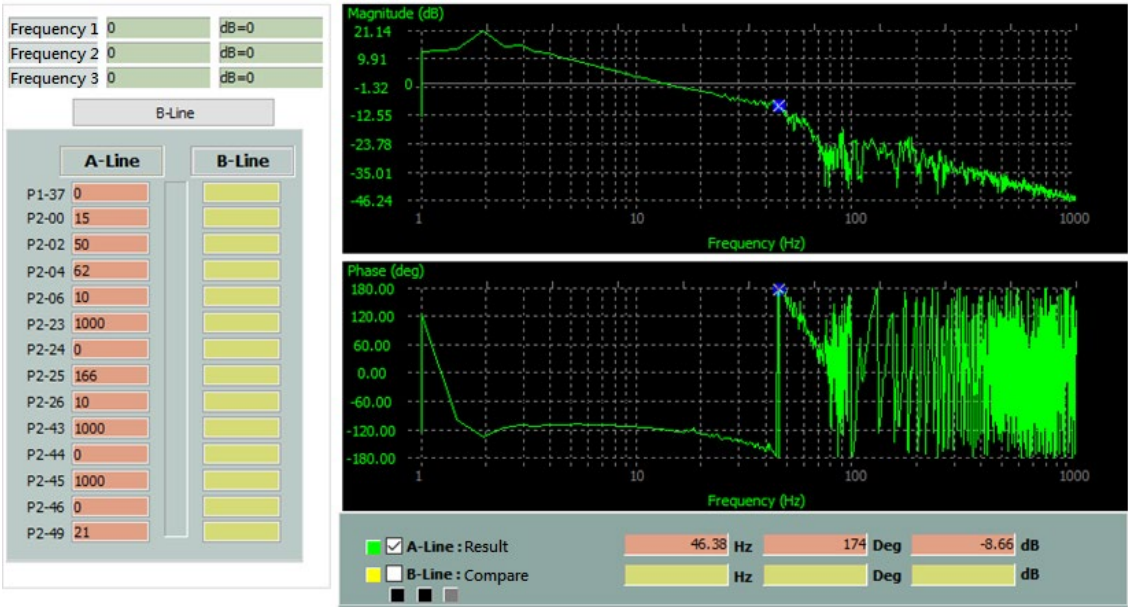
5.24.2.3 Dual encoder

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)

```
┌─────────────────────┐
│ Motor parameter     │
│ setting             │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Motor encoder       │
│ connect to CN2      │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Motor parameter     │
│ estimation          │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Inertia estimation  │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Spindle motor       │
│ encoder connect to  │
│ CN5                 │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Full close loop     │
│ setting             │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ CNC parameter &     │
│ bandwidth           │
│ adjustment          │
└─────────────────────┘
```
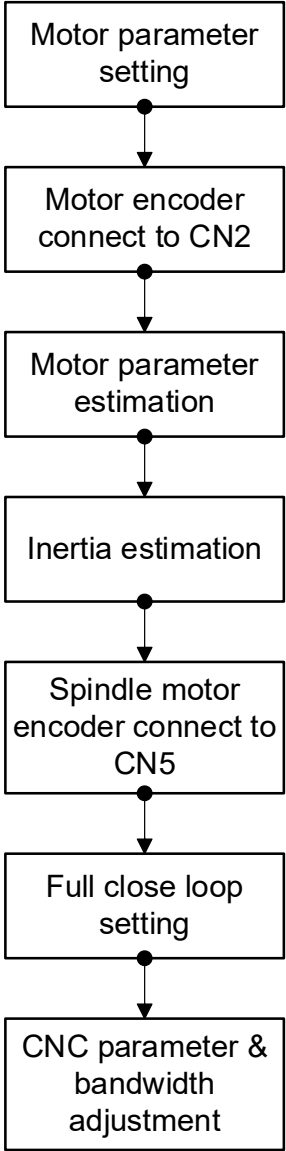
Figure 5.24.2.3.1 Estimate procedure

5

● **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.

```
                3 - PHASE                      CE
          Spindle Servo Motor    IP-54
TYPE :   NC-JB032008B15N
Rated Power :   3.7   KW      Rated Torque :   17.7   N-m
Rated Speed :   2000  rpm     Rated Frequency : 70.5   Hz
Rated Voltage △ :   160   V   Rated Voltage Y :   280   V
Rated Current △ :   19.1   A  Rated Current Y :   11    A
Max Speed :        8000  rpm  Max Frequency :  281.9  Hz
INS.Class :        F          Date : 2023.07.04
DE brg :   6306    NDE brg :  6205   Weight :  30   kg
Encoder :          no Encoder  (8mm)
Fan :   1   Phase   220  V   0.23/0.21  A   50/60  Hz
SER.NO. : JSM-090-03-20-16 BHA01-U-D28L60(no key)-230704001

                               MADE IN TAIWAN
```

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.

5

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 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: Full and semi-closed loop switching DI Spindle and motor encoder position error clearing DI	DI: 0X0B (trigger mode: level) 0X0E (trigger mode: positive edge)	
11	Detector output pulse number	P1-03 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 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.
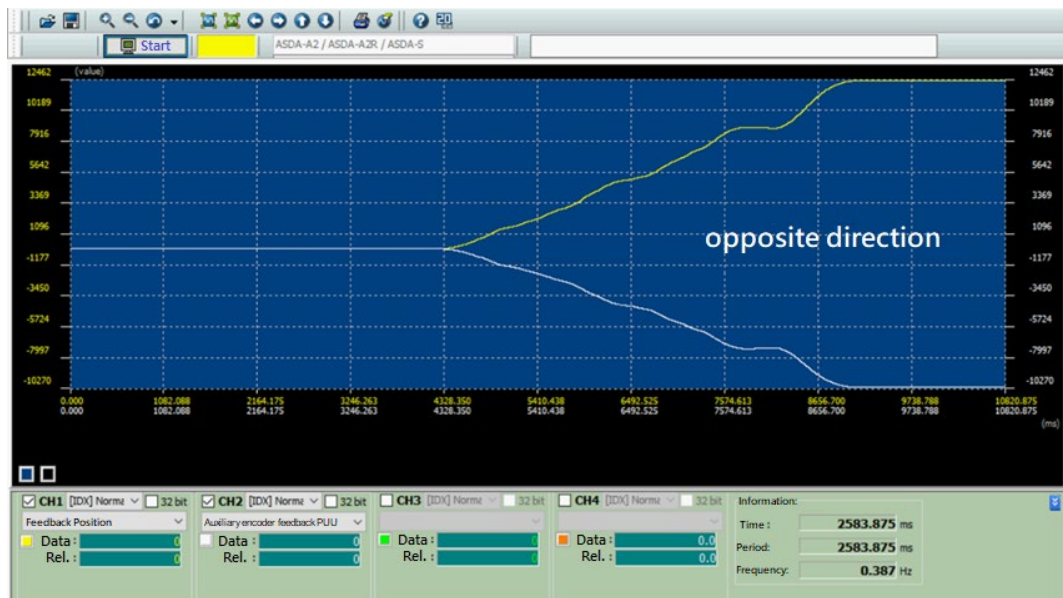
Encoder direction is opposite

5

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 [N0.1000 Bit 3 Speed command source of analog spindle]	1
CNC parameter [N0.1005 Encoder resolution of 1st spindle]	4096 (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.

5.24.3 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:

```
┌─────────────────────────────┐
│   XYZ axes gain adjust      │
│ (P2.00 recommend as the same)│
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐  ◄──┐
│     Spindle gain adjust     │     │
└─────────────────────────────┘     │
              │                      │
              ▼                      │ Y
┌─────────────────────────────┐     │
│   M29 Spindle positioning   │ ────┘
│ (Check whether has vibration)│
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      Tapping setting (1)    │
│            (DGN)            │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐ ◄──────────────┐
│  Execute G84 Tapping command│                 │
└─────────────────────────────┘                 │
              │                    ┌─────────────────────────────┐
              ▼                    │ Fine tune P2.01 servo parameter│
┌─────────────────────────────┐   └─────────────────────────────┘
│     Check tapping error     │ ──── Y ──────────┘
└─────────────────────────────┘
              │ N
              ▼
┌─────────────────────────────┐
│           Finish            │
└─────────────────────────────┘
```
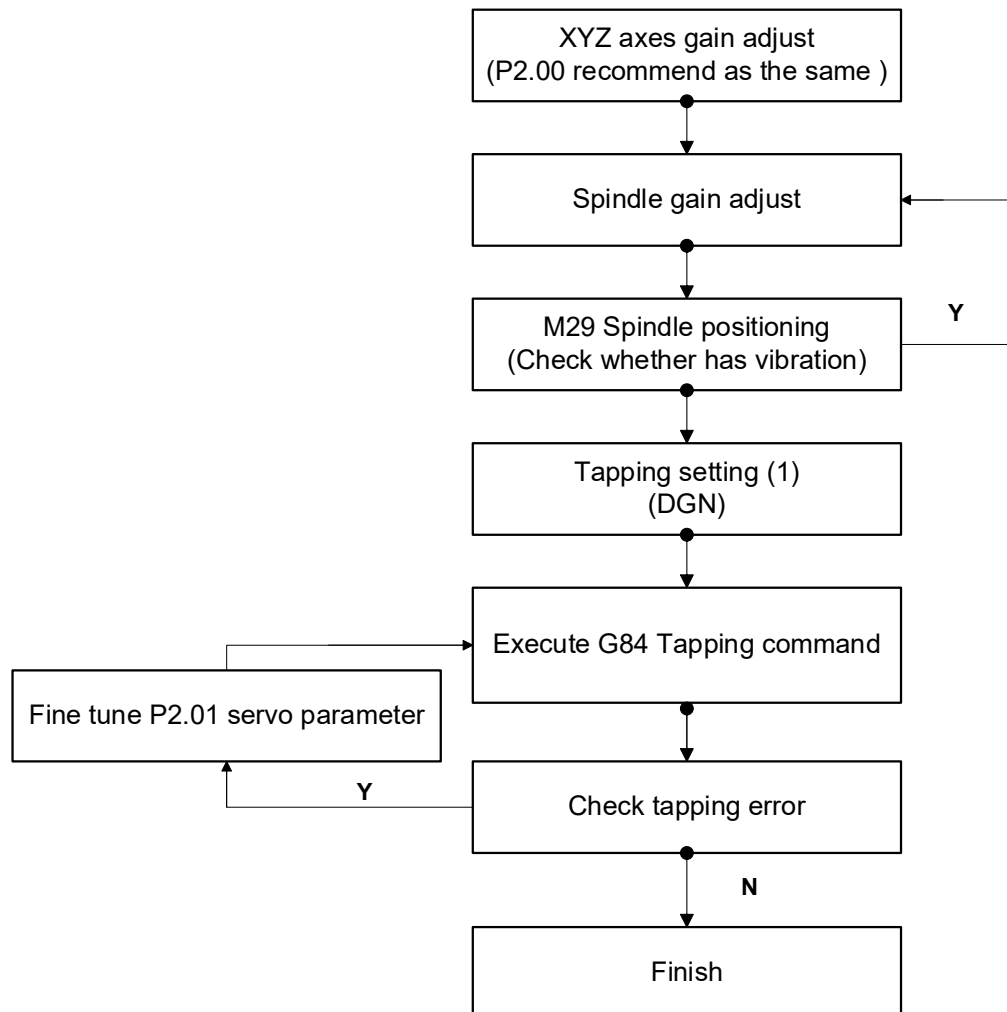
Step 1:

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.

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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

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. 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. 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) Wrong example: G01O100.; "O" is undefined.
0x0202	Repeated operators command in one line.	Incorrect syntax. Please correct the syntax. Wrong example: 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. Wrong example: G01 IF ➔ IF misused. 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. 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. Wrong example: END 1 X100. ➔ END misused.
0x0206	Operators' syntax error.	Wrong example: #100=*3 ➔ character * misused.
0x0207	Command syntax error.	Wrong example: X10. G1 ➔ command "X10." misused.
0x0208	Command syntax error. Statements and motion command cannot program in the same line.	Wrong example: #1=2 G01 X10. ➔"#1=2" and "G01 X10." cannot be on the same line.
0x0209	Command syntax error. Wrong use of brackets.	"[" and "]" are not paired.
0x020A	Command syntax error. Wrong command characters.	Example error: #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. 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. Newline character error.	Newline character incomplete.
0x020D	Command syntax error. Violation of judgement operator in command syntax.	Syntax error. Correct the syntax format. Invalid syntax for judgement operators such as '>', '<', '<>', '='. Error example: #1>G01.
0x020E	Command syntax error. IF command error.	Syntax error. Correct the syntax format. There is no condition after the IF judgement.
0x020F	Command syntax error. WHILE condition statement error.	Syntax error. Correct the syntax format. There is no condition after the WHILE statement.

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Alarm code (Hex)	Name	Cause and correction
0x0210	Command syntax error. Divisor is 0.	Syntax error. Correct the syntax format. Expression divided by zero, unable to compute.
0x0211	Command syntax error. Assignment operator used incorrectly.	Syntax error. Correct the syntax format. Incorrect syntax for the '=' operator. Error example: #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. 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. Error example: G42 X100.
0x0217	Command syntax error. The value of D exceeds the maximum limit.	The value of D parameter exceeds the maximum limit. Error example: G42 D1234567.
0x0218	Command syntax error. The relevant instruction is missing the H parameter.	Missing usage of the H parameter in the command syntax. Error example: G43 X100.
0x0219	Command syntax error. The value of H exceeds the maximum limit.	The value of H parameter exceeds the maximum limit. Error example: G43 H1234567.
0x021A	The T value of lathe tool compensation exceeds the maximum limit.	Error example: 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: M06 T1234567.
0x021D	Not supported G code instruction.	Syntax error. Correct the syntax format. 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. Correct format: G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0 When Q is 0,1 or 2, use XYZABC. G01.1 J1_ J2_ J3_ P0000 H0 R0 Q3 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. Correct format: 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. Correct format: 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. Correct format: G01.1 X_Y_Z_A_B_C_ P0000 H0 R0 Q0 Q: setting range from 0 to 3.
0x0222	Command syntax error. No value specified in the instruction.	Syntax error. Correct the syntax format. Error example: G01 X Y100. ➔ No value specified after X.
0x0223	Command syntax error. Coordinate command value exceeds the range.	Syntax error. Correct the syntax format. Correct format: G01 X987654.321 G01 X98765432.1 The maximum number of digits is 9.
0x0224	Command syntax error. GOTO statement error.	Syntax error. Correct the syntax format. Error example: GOTO 2 N2 can't be found in the NC program.
0x0225	Command syntax error. END statement error.	Syntax error. Correct the syntax format. Error example: END No value specified after END.
0x0226	Command syntax error. DO statement error.	Syntax error. Correct the syntax format. Error example: WHILE DO No value specified after DO.
0x0229	Operational error. The specified file line number can't be found.	Error example: M98 Q10 Specifies line 10, but the NC program only contains 9 lines of content.
0x022A	Operational error. The specified N line number can't be found.	Error example: M98 H10 Specifies line 10, but there is no N10 line number instruction in the NC program.
0x022B	Operational error. The specified DO loop instruction can't be found.	Syntax error. Correct the syntax format. The END command doesn't have a corresponding DO.
0x022C	Operational error. The specified END can't be found.	The specified number of DO layers doesn't have corresponding END layer number. For example: While using WHILE DO 2, it should be ended with END 2.
0x022D	Operational error. Subprogram calling layers exceeds the maximum limit.	The maximum layer of subprogram call or macro stack is 8.
0x022E	Operational error. Missing P command in M98 subprogram calling function.	Missing P_ definition for the subprogram in M98 subprogram calling function.
0x022F	Operational error. Missing B command after G122.	B_ is not used with G122 command.
0x0230	Operational error. G122 B command misused.	B_ misused in G122 command.
0x0231	Operational error. The axis of drilling cycle is incorrect.	The axis used in the drilling cycle command doesn't exist.
0x0232	Operational error. Missing P_ or Q_ in the drilling cycle command.	The drilling cycle command doesn't apply P or Q.

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Alarm code (Hex)	Name	Cause and correction
0x0233	Operational error. 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. 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. 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. 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. Error example: #20020 = 32768 (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. Error example: M98 M1 M3
0x024B	Call instruction usage error.	Error example: M98 G65 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.

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: M98 K5 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: #20005 = 10 #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. Error example: #100=BIT[1] 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. Error example: B=ASIN[A] 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. Error example: G04 P1.2 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.

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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

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. Reset after reconnecting the physical cable. 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. 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. **N0.1025**, Positioning check time for 1st spindle. **N0.1075**, Positioning check time for 2nd spindle. **N0.1125**, Positioning check time for 3rd spindle. … **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.

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0x1601	The hardware limit is triggered during execution of home mode 4. The search direction does not match.	The hardware limit is triggered during homing. Please check the following: 1. Make sure the machine is out of any limit positions before executing the homing procedure. 2. Verify the wiring signals for the hardware limits are functioning correctly. 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. 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.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. For example: 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. For example: 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. Error example: X[tan[90]] ➔ tan[90] is a infinity value Please correct the coordinate position of the motion command.

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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. 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.

A

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.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.2.1.1 M21000 to M29999

Function Name	Special M	Description	Device
Spindle1 DO Control	M20018	When this function is ON, the system will output the digital signal on the Pin 9 of Spindle 1 connector.	R/W
Spindle2 DO Control	M20019	When this function is ON, the system will output the digital signal on the Pin 9 of Spindle 2 connector.	R/W
Enable 3 MPG Control	M20024	Enable 3 sets of MPG function control. The controller can process three sets of MPG pulse signals and control the three axes respectively. When this special M is enabled, the 2nd and 3rd MPG will also be enabled at the same time.	R/W
Cycle Start	M2x000	Informs the NC system to execute Cycle Start and execute the NC program.	R/W
Feed Hold	M2x001	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".	R/W
NC Reset	M2x004	Tells the NC system to execute the Reset procedure; all actions will be stopped.	R/W
Enable Dry Run	M2x005	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>	R/W
MPG Simulation	M2x006	During program execution, users can use the MPG to control the speed of movement trajectories.	R/W
Disable Hardware Limit	M2x007	The limit signal of each axis is ignored when this function is enabled.	R/W
Single Block	M2x008	In AUTO mode, the program stops after one block is executed.	R/W
Optional Stop	M2x009	Enable the optional stop key. When the program executes M01, the controller immediately stops.	R/W
Single Block Skip ('/')	M2x010	The program skips the block containing the symbol '/' when this function is enabled.	R/W
M, S, and T Codes Lock	M2x011	The program skips any block containing M, S, T code when this function is enabled.	R/W
Servo ON/ OFF	M2x012	Servo ON or OFF for all of connected servo drives in the corresponding channel.	R/W
Enable Emergency Stop	M2x013	When this function is ON, the NC will trigger an emergency stop.	R/W
Enable Synchronization Adjustment	M2x014	Manually trigger synchronization adjustment.	R/W
M, S, and T Codes Finished	M2x016	Triggering this signal informs the NC system that the procedures for M, S and T codes are complete.	R/W
M96 Program Interruption	M2x019	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.	R/W
M, S, and T Codes Call Macro Lock	M2x021	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.	R/W
Macro Call Activation	M2x025	Activates macro call. (Only works with the correct macro-ID in AUTO mode)	R/W

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Function Name	Special M	Description	Device
M99 Call Stop	M2x026	When this function is ON, the NC system will slow down to stop and then stop all process when executing M99.	R/W
1st Macro Call Preparation	M2x032		R/W
2nd Macro Call Preparation	M2x033		R/W
3rd Macro Call Preparation	M2x034		R/W
4th Macro Call Preparation	M2x035		R/W
5th Macro Call Preparation	M2x036		R/W
6th Macro Call Preparation	M2x037		R/W
7th Macro Call Preparation.	M2x038		R/W
8th Macro Call Preparation	M2x039	Initializes macro call. (A successful call will only occur when the correct macro number **[D2x064~D2x079]** and the corresponding macro program both exist)	R/W
9th Macro Call Preparation	M2x040		R/W
10th Macro Call Preparation	M2x041		R/W
11th Macro Call Preparation	M2x042		R/W
12th Macro Call Preparation	M2x043		R/W
13th Macro Call Preparation	M2x044		R/W
14th Macro Call Preparation	M2x045		R/W
15th Macro Call Preparation	M2x046		R/W
16th Macro Call Preparation	M2x047		R/W
Robot Coordinate System	M2x048 M2x049 M2x050 M2x051	The robot coordinate system can be set as shown in the table below. 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.	R/W
Tool Magazine 1 Move Forward	M2x064	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.	R/W
Tool Magazine 1 Move Backward	M2x065	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.	R/W
Tool 1 Exchange	M2x066	Exchanges tool data in tool magazine 1.	R/W
Tool Magazine 1 Reset	M2x067	When this special M relay is triggered, the tool data in tool magazine 1 is reset.	R/W

Robot Coordinate System embedded table:

	PCS (Piece)	TCS (Tool)	JCS (Joint)
M2x048	1	1	0
M2x049	1	1	0
M2x050	1	0	0
M2x051	1	1	0
D2x016	1 ~ 6	1 ~ 6	1 ~ 6

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

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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

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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

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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
10th Axis Servo OFF	M2x281	Trigger this special M to set the 10th axis to Servo OFF status.	R/W
11th Axis Servo OFF	M2x282	Trigger this special M to set the 11th axis to Servo OFF status.	R/W
12th Axis Servo OFF	M2x283	Trigger this special M to set the 12th axis to Servo OFF status.	R/W
13th Axis Servo OFF	M2x284	Trigger this special M to set the 13th axis to Servo OFF status.	R/W
14th Axis Servo OFF	M2x285	Trigger this special M to set the 14th axis to Servo OFF status.	R/W
15th Axis Servo OFF	M2x286	Trigger this special M to set the 15th axis to Servo OFF status.	R/W
16th Axis Servo OFF	M2x287	Trigger this special M to set the 16th 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

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

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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
10th Axis JOG Reverse	M2x409	Trigger this special M for 10th axis reverse JOG or INC operation.	R/W
11th Axis JOG Reverse	M2x410	Trigger this special M for 11th axis reverse JOG or INC operation.	R/W
12th Axis JOG Reverse	M2x411	Trigger this special M for 12th axis reverse JOG or INC operation.	R/W
13th Axis JOG Reverse	M2x412	Trigger this special M for 13th axis reverse JOG or INC operation.	R/W
14th Axis JOG Reverse	M2x413	Trigger this special M for 14th axis reverse JOG or INC operation.	R/W
15th Axis JOG Reverse	M2x414	Trigger this special M for 15th axis reverse JOG or INC operation.	R/W
16th Axis JOG Reverse	M2x415	Trigger this special M for 16th 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 10th Axis Control Mode	M2x425	When this special M is ON, 10th axis will be in speed mode. When this special M is OFF, 10th axis will be in position mode.	R/W
MLC 11th Axis Control Mode	M2x426	When this special M is ON, 11th axis will be in speed mode. When this special M is OFF, 11th axis will be in position mode.	R/W

B

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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 10th Axis' Movement (MLC Axis)	M2x457	Trigger this special M for MLC 10th axis movement.	R/W
Trigger 11th Axis' Movement (MLC Axis)	M2x458	Trigger this special M for MLC 11th axis movement.	R/W
Trigger 12th Axis' Movement (MLC Axis)	M2x459	Trigger this special M for MLC 12th axis movement.	R/W
Trigger 13th Axis' Movement (MLC Axis)	M2x460	Trigger this special M for MLC 13th axis movement.	R/W
Trigger 14th Axis' Movement (MLC Axis)	M2x461	Trigger this special M for MLC 14th axis movement.	R/W
Trigger 15th Axis' Movement (MLC Axis)	M2x462	Trigger this special M for MLC 15th axis movement.	R/W
Trigger 16th Axis' Movement (MLC Axis)	M2x463	Trigger this special M for MLC 16th 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

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 10th Axis	M2x473	When this special M is ON, the **D2x274** will be incremental movement.	R/W
MLC Axis Command Type of 11th Axis	M2x474	When this special M is ON, the **D2x276** will be incremental movement.	R/W
MLC Axis Command Type of 12th Axis	M2x475	When this special M is ON, the **D2x278** will be incremental movement.	R/W
MLC Axis Command Type of 13th Axis	M2x476	When this special M is ON, the **D2x280** will be incremental movement.	R/W
MLC Axis Command Type of 14th Axis	M2x477	When this special M is ON, the **D2x282** will be incremental movement.	R/W
MLC Axis Command Type of 15th Axis	M2x478	When this special M is ON, the **D2x284** will be incremental movement.	R/W
MLC Axis Command Type of 16th Axis	M2x479	When this special M is ON, the **D2x286** will be incremental movement.	R/W
1st Spindle Forward Rotation	M2x704	Sets the 1st spindle to rotate in forward direction.	R/W
1st Spindle Reverse Rotation	M2x705	Sets the 1st spindle to rotate in reverse direction.	R/W
1st Spindle Positioning Control	M2x706	Positioning the 1st spindle.	R/W
1st Spindle Retraction After Tapping	M2x707	Retracts the 1st spindle after tapping.	R/W
Switching C / S Axis of 1st Spindle	M2x708	Trigger to switch between C or S axes for the spindle.	R/W
1st Spindle Command Source	M2x710	When this special M is ON, the speed command for the 1st 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
1st 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 1st spindle.	R/W
2nd Spindle Forward Rotation	M2x720	Sets the 2nd spindle to rotate in forward direction.	R/W
2nd Spindle Reverse Rotation	M2x721	Sets the 2nd spindle to rotate in reverse direction.	R/W
2nd Spindle Positioning Control	M2x722	Positioning the 2nd spindle.	R/W
2nd Spindle Retraction After Tapping	M2x723	Retracts the 2nd spindle after tapping.	R/W
Switching C / S Axis of 2nd Spindle	M2x724	Trigger to switch between C or S axes for the spindle.	R/W
2nd Spindle Command Source	M2x726	When this special M is ON, the speed command for the 2nd 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
2nd 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 2nd 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

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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

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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		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	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.	R
G900 Command Control M_9	M30208	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	R
G900 Command Control M_10	M30209	not return an error, but not the other special M will be triggered as well.	R
G900 Command Control M_11	M30210	Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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Function Name	Special M	Description	Device
G900 Command Control M_19	M30218		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	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.	R
G900 Command Control M_32	M30231	P: command value indicates the M address directly.	R
G900 Command Control M_33	M30232	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.	R
G900 Command Control M_34	M30233	Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

Function Name	Special M	Description	Device
G900 Command Control M_47	M30246		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	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.	R
G900 Command Control M_60	M30259	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.	R
G900 Command Control M_61	M30260		R
G900 Command Control M_62	M30261	Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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Function Name	Special M	Description	Device
G900 Command Control M_75	M30274		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	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.	R
G900 Command Control M_88	M30287	P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399.	R
G900 Command Control M_89	M30288	When the value exceeds this range, the system will not return an error, but not the other special M will	R
G900 Command Control M_90	M30289	be triggered as well. Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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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.	R
G900 Command Control M_116	M30315	P: command value indicates the M address directly. From 30200 as M30200 to 30399 as M30399.	R
G900 Command Control M_117	M30316	When the value exceeds this range, the system will not return an error, but not the other special M will be triggered as well.	R
G900 Command Control M_118	M30317	Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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Function Name	Special M	Description	Device
G900 Command Control M_131	M30330		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	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.	R
G900 Command Control M_144	M30343	P: command value indicates the M address directly.	R
G900 Command Control M_145	M30344	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	R
G900 Command Control M_146	M30345	be triggered as well.	R
G900 Command Control M_147	M30346	Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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Function Name	Special M	Description	Device
G900 Command Control M_159	M30358		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	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. 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. Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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

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Function Name	Special M	Description	Device
G900 Command Control M_187	M30386		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	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. 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. Q: control the M relay status by 0 as OFF and any not 0 value will set as ON.	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. 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

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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

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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

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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 10th Axis	M3x265	This special M is ON when the servo drive of the 10th 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 11th Axis	M3x266	This special M is ON when the servo drive of the 11th 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 12th Axis	M3x267	This special M is ON when the servo drive of the 12th 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 13th Axis	M3x268	This special M is ON when the servo drive of the 13th 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 14th Axis	M3x269	This special M is ON when the servo drive of the 14th 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 15th Axis	M3x270	This special M is ON when the servo drive of the 15th axis is connected. This connection status can be monitored from the [Connect] status light of the [Servo Monitor Table] page.	R

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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

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

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

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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
10th Axis at Origin Position	M3x361	This special M is ON when the 10th axis's machine position is 0.	R
11th Axis at Origin Position	M3x362	This special M is ON when the 11th axis's machine position is 0.	R
12th Axis at Origin Position	M3x363	This special M is ON when the 12th axis's machine position is 0.	R
13th Axis at Origin Position	M3x364	This special M is ON when the 13th axis's machine position is 0.	R
14th Axis at Origin Position	M3x365	This special M is ON when the 14th axis's machine position is 0.	R
15th Axis at Origin Position	M3x366	This special M is ON when the 15th axis's machine position is 0.	R
16th Axis at Origin Position	M3x367	This special M is ON when the 16th 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
10th Axis Switch to MLC Axis Finished	M3x441	This special M is ON when **M2x441** is triggered, and the 10th axis has switched to MLC control mode.	R
11th Axis Switch to MLC Axis Finished	M3x442	This special M is ON when **M2x442** is triggered, and the 11th axis has switched to MLC control mode.	R
12th Axis Switch to MLC Axis Finished	M3x443	This special M is ON when **M2x443** is triggered, and the 12th axis has switched to MLC control mode.	R
13th Axis Switch to MLC Axis Finished	M3x444	This special M is ON when **M2x444** is triggered, and the 13th axis has switched to MLC control mode.	R
14th Axis Switch to MLC Axis Finished	M3x445	This special M is ON when **M2x445** is triggered, and the 14th axis has switched to MLC control mode.	R

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Function Name	Special M	Description	Device
15th Axis Switch to MLC Axis Finished	M3x446	This special M is ON when **M2x446** is triggered, and the 15th axis has switched to MLC control mode.	R
16th Axis Switch to MLC Axis Finished	M3x447	This special M is ON when **M2x447** is triggered, and the 16th 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
10th Axis Target Reached (MLC Axis)	M3x457	This special M is ON when the 10th 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
11th Axis Target Reached (MLC Axis)	M3x458	This special M is ON when the 11th 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
12th Axis Target Reached (MLC Axis)	M3x459	This special M is ON when the 12th 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
13th Axis Target Reached (MLC Axis)	M3x460	This special M is ON when the 13th 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
14th Axis Target Reached (MLC Axis)	M3x461	This special M is ON when the 14th 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
15th Axis Target Reached (MLC Axis)	M3x462	This special M is ON when the 15th 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

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

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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

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

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
8th Spindle Is in Position Axis Mode	M3x821	This special M is ON when the 8th spindle is switching from S axis to C axis.	R
8th Spindle Ready	M3x822	This special M is ON when the 8th 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. 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 D20201 D20202 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. 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 D20205 D20206 D20207		R/W	Decimal	0 ~ 65,535
3rd Remote Module Output	D20208 D20209 D20210 D20211		R/W	Decimal	0 ~ 65,535
4th Remote Module Output	D20212 D20213 D20214 D20215		R/W	Decimal	0 ~ 65,535
5th Remote Module Output	D20216 D20217 D20218 D20219		R/W	Decimal	0 ~ 65,535
6th Remote Module Output	D20220 D20221 D20222 D20223		R/W	Decimal	0 ~ 65,535
7th Remote Module Output	D20224 D20225 D20226 D20227		R/W	Decimal	0 ~ 65,535
8th Remote Module Output	D20228 D20229 D20230 D20231		R/W	Decimal	0 ~ 65,535
NC Mode Switching	D2x000	This special D is for NC channels to switch to different operation modes. 0: AUTO 1: EDIT 2: MDI 3: MPG 4: JOG 5: RAPID 6: INC 7: HOME	R/W	Decimal	0 ~ 7

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Function Name	Special D	Description	Device	Type	Range
Feed Rate Percentage	D2x002	Setting for feed rate percentage of NC program speed. Unit: % 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.	R/W	Decimal	0 ~ 150
Rapid Speed Percentage	D2x004	Setting NC rapid speed percentage for G00 command. Unit: % 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.	R/W	Decimal	0 ~ 65,535
Speed Override for JOG and INC	D2x006	Setting JOG and INC speed. 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. 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. The unit of this special D will refer to parameter axes control type **[N2.001]**.	R/W	Decimal	Percentage Mode 0 ~ 100 Constant Mode 0 ~ 65,535
1st MPG Axes Selection	D2x008	This special D is for the NC system to switch the 1st MPG axis in MPG mode. 0: X axis 1: Y axis 2: Z axis 3: A axis … 15: 16th axis	R/W	Decimal	0 ~ 15
1st MPG Ratio Selection	D2x009	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. 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.	R/W	Decimal	0 ~ 65,535

Sub-table within D2x006:

N2.001		Unit
Bit 2~4 (Linear axis)		mm/min
Bit 2~4 (Rotary axis)	Bit 11 = 0	Deg/min
	Bit 11 = 1	RPM

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. 0: X axis 1: Y axis 2: Z axis 3: A axis ... 15: 16th axis *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. 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. *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. 0: X axis 1: Y axis 2: Z axis 3: A axis ... 15: 16th axis *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. 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. *Set M20024 **[Enable 3 MPG Control]** to ON to enable this function.	R/W	Decimal	0 ~ 65,535

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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. 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. 0: Not using coordinate manual mode 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. 0: Not using tool offset 1 ~ N: corresponds to tool number	R/W	Decimal	0 ~ N N will be based on N0.408 ~ N0.411
Axes Oscillation Amplitude	D2x018 D2x019	When the axes oscillation control **[M2x264]** is enabled, the activated axes will oscillate based on the amplitude here. Unit: mm	R/W	Float	-2,147,483,648 ~ +2,147,483,647
Axes Oscillation Cycle Time	D2x020 D2x021	When the axes oscillation control **[M2x264]** is enabled, the system will take this special D as the cycle time for each oscillation command. 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. 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. 0: Start position as middle position of the SIN wave. 1: Start position as base position (max or min) of the SIN wave.	R/W	Decimal	0 ~ 1
1st Spindle Speed	D2x024 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. 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

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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

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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. *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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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. *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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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. *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. *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. *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. *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. *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. *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. *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

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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. *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. *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. *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. *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. *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. *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. *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. *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. *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

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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

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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

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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.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

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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

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Function Name	Special D	Description	Device	Type	Range
6th Remote Module Input	D30220 D30221 D30222 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).	R	Decimal	0 ~ 65,535
7th Remote Module Input	D30224 D30225 D30226 D30227		R	Decimal	0 ~ 65,535
8th Remote Module Input	D30228 D30229 D30230 D30231	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
Torque Feedback of 1st Axis	D30240		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	Torque feedback for the axis. The axis index is set according to the NC channel axis sequence setting. PDO address 0x6077H Unit: 0.1%	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 21th Axis	D30260		R	Decimal	-32,768 ~ +32,767

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Function Name	Special D	Description	Device	Type	Range
Torque Feedback of 22th Axis	D30261		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	Torque feedback for the axis. The axis index is set according to the NC channel axis sequence setting. PDO address 0x6077H Unit: 0.1%	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 D30273		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 2nd Axis (mm/min)	D30274 D30275		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 3rd Axis (mm/min)	D30276 D30277		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 4th Axis (mm/min)	D30278 D30279		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 5th Axis (mm/min)	D30280 D30281		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 6th Axis (mm/min)	D30282 D30283	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 7th Axis (mm/min)	D30284 D30285		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 8th Axis (mm/min)	D30286 D30287		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 9th Axis (mm/min)	D30288 D30289		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 10th Axis (mm/min)	D30290 D30291		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 11th Axis (mm/min)	D30292 D30293		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 12th Axis (mm/min)	D30294 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		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	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 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

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Function Name	Special D	Description	Device	Type	Range
Velocity Feedback of 1st Axis (RPM)	D30336 D30337		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 2nd Axis (RPM)	D30338 D30339		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 3rd Axis (RPM)	D30340 D30341		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 4th Axis (RPM)	D30342 D30343		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 5th Axis (RPM)	D30344 D30345		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 6th Axis (RPM)	D30346 D30347		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 7th Axis (RPM)	D30348 D30349		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 8th Axis (RPM)	D30350 D30351		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 9th Axis (RPM)	D30352 D30353	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 10th Axis (RPM)	D30354 D30355		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 11th Axis (RPM)	D30356 D30357		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 12th Axis (RPM)	D30358 D30359		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 13th Axis (RPM)	D30360 D30361		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 14th Axis (RPM)	D30362 D30363		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 15th Axis (RPM)	D30364 D30365		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 16th Axis (RPM)	D30366 D30367		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 17th Axis (RPM)	D30368 D30369		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 18th Axis (RPM)	D30360 D30371		R	Float	-2,147,483,648 ~ +2,147,483,647
Velocity Feedback of 19th Axis (RPM)	D30372 D30373		R	Float	-2,147,483,648 ~ +2,147,483,647

Function Name	Special D	Description	Device	Type	Range
Velocity Feedback of 20th Axis (RPM)	D30374 D30375		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	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 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

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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

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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. 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. 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. When the channel set as standard machine type such as milling or lathe, the system will show as below working coordinate system. 1~6: corresponding to G54~G59. 7~262: corresponding to G54 P1~G54 P256. When the channel set as Robot machine type, the system will show as below working coordinate system. 1~6: corresponding to G54~G59.	R	Decimal	Standard 1 ~ 262 Robot 1~6
Current Robot Tool Coordinate System	D3x017	Shows the robot tool coordinate system. 0: Not using tool offset 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. 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. 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

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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

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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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		

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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		
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		(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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	Decimal / Float	
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		

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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		

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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		

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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		

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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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		

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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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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		

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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		
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	Decimal / Float	(Default) -32,768 ~ +32,767 / (N1.010 Bit7=1) -2,147,483,648 ~ +2,147,483,647
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

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Function Name	Special D	Description	Device	Type	Range
Rigid Tapping Max Error of 3rd Spindle	D3x368 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. 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 3rd Spindle	D3x370 D3x371	Target feed movement of the 3rd spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +2,147,483,647
Actual Feed of 3rd Spindle	D3x372 D3x373	Actual feed movement of the 3rd spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +2,147,483,647
Speed Command of 4th Spindle	D3x374 D3x375	When the 4th 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
4th Spindle Speed Feedback	D3x376 D3x377	Shows the 4th spindle's speed. The data source is from the spindle's command speed.	R	Float	-2,147,483,648 ~ +2,147,483,647
4th Spindle Actual Degree	D3x378 D3x379	Shows the 4th 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 4th Spindle	D3x380 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. 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 4th Spindle	D3x382 D3x383	Target feed movement of the 4th spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +2,147,483,647
Actual Feed of 4th Spindle	D3x384 D3x385	Actual feed movement of the 4th spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +2,147,483,647
Speed Command of 5th Spindle	D3x386 D3x387	When the 5th 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
5th Spindle Speed Feedback	D3x388 D3x389	Shows the 5th spindle's speed. The data source is from the spindle's command speed.	R	Float	-2,147,483,648 ~ +2,147,483,647
5th Spindle Actual Degree	D3x390 D3x391	Shows the 5th 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 5th Spindle	D3x392 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. 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 5th Spindle	D3x394 D3x395	Target feed movement of the 5th spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +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

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Function Name	Special D	Description	Device	Type	Range
8th Spindle Actual Degree	D3x426 D3x427	Shows the 8th 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 8th Spindle	D3x428 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. 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 8th Spindle	D3x430 D3x431	Target feed movement of the 8th spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +2,147,483,647
Actual Feed of 8th Spindle	D3x432 D3x433	Actual feed movement of the 8th spindle in each revolution. Unit: mm/rev.	R	Float	-2,147,483,648 ~ +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)

Variable	Description	Type
#0	A null and read only variable (Null). Users can move #0 value into specified variable, and then set this specified variable as null. (The value will display as NULL). Null (NULL) and 0 is different in usage, the following table describes the differences when the #100 is given in NULL or 0: 	Judgement	Value of #100 NULL	Value of #100 0
---	---	---
#100 == #0	True	False
#100 != #0	False	True
#100 >= #0	True	True
#100 <= #0	True	True
#100 > 0	False	False
#100 < 0	False	False
#100 != 0	True	False
G90X99Y#100	G90 X99	G90 X99 Y0		R/-/-

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) When non-zero value is written into this variable, the system will display Macro defined alarm on the controller screen. Value range: from 0 to 32767. If the value is not in the range, the system will return alarm 0x0244. The error message from MR1 to MR1000 are configured in the **[CNCSoft]** – **[DOPSoft]**. 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. *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. This value is associated with D3X014.	R/-/●

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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. Servo parameters reading instruction includes G10 L40, L41, L45 and L46. For example: After executing G10 L40 I3 P4 D5, this variable will store the value of P4-5 from the servo drive of address number 3. 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. For example: After executing G10 L40 I3 P4 D5, this variable will store the execution result (error code). 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 For example: controller system time is 2023/04/17, the value of #20025 is 230417	R/-/●
#20026	System time: hhmmss 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 …#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. 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 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 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 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 … #20411	System reserved. 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

B.3.4.6 G54-G59 Workpiece Coordinate (#22000~#23183)

	Offset Position	G54	G55	G56	G57	G58	G59	Type
1st axis (X)	#22000	#22002	#22003	#22004	#22005	#22006	#22007	R/W/•
2nd axis (Y)	#22078	#22080	#22081	#22082	#22083	#22084	#22085	R/W/•
3rd axis (Z)	#22156	#22158	#22159	#22160	#22161	#22162	#22163	R/W/•
4th axis (A)	#22234	#22236	#22237	#22238	#22239	#22240	#22241	R/W/•
5th axis (B)	#22312	#22314	#22315	#22316	#22317	#22318	#22319	R/W/•
6th axis (C)	#22390	#22392	#22393	#22394	#22395	#22396	#22397	R/W/•
7th axis (U)	#22468	#22470	#22471	#22472	#22473	#22474	#22475	R/W/•
8th axis (V)	#22546	#22548	#22549	#22550	#22551	#22552	#22553	R/W/•
9th axis(W)	#22624	#22626	#22627	#22628	#22629	#22630	#22631	R/W/•
10th axis	#22702	#22704	#22705	#22706	#22707	#22708	#22709	R/W/•
11th axis	#22780	#22782	#22783	#22784	#22785	#22786	#22787	R/W/•
12th axis	#22858	#22860	#22861	#22862	#22863	#22864	#22865	R/W/•
13th axis	#22936	#22938	#22939	#22940	#22941	#22942	#22943	R/W/•
14th axis	#23014	#23016	#23017	#23018	#23019	#23020	#23021	R/W/•
15th axis	#23092	#23094	#23095	#23096	#23097	#23098	#23099	R/W/•
16th 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
1st axis (X)	#22008	#22009	#22010	#22011	#22012	#22013	R/W/•
2nd axis (Y)	#22086	#22087	#22088	#22089	#22090	#22091	R/W/•
3rd axis (Z)	#22164	#22165	#22166	#22167	#22168	#22169	R/W/•
4th axis (A)	#22242	#22243	#22244	#22245	#22246	#22247	R/W/•
5th axis (B)	#22320	#22321	#22322	#22323	#22324	#22325	R/W/•
6th axis (C)	#22398	#22399	#22400	#22401	#22402	#22403	R/W/•
7th axis (U)	#22476	#22477	#22478	#22479	#22480	#22481	R/W/•
8th axis (V)	#22554	#22555	#22556	#22557	#22558	#22559	R/W/•
9th axis(W)	#22632	#22633	#22634	#22635	#22636	#22637	R/W/•
10th axis	#22710	#22711	#22712	#22713	#22714	#22715	R/W/•
11th axis	#22788	#22789	#22790	#22791	#22792	#22793	R/W/•
12th axis	#22866	#22867	#22868	#22869	#22870	#22871	R/W/•
13th axis	#22944	#22945	#22946	#22947	#22948	#22949	R/W/•
14th axis	#23022	#23023	#23024	#23025	#23026	#23027	R/W/•
15th axis	#23100	#23101	#23102	#23103	#23104	#23105	R/W/•
16th 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 1st tool magazine.	R/-/●
#24002	Activated tool number from the 2nd tool magazine.	R/-/●
#24003	Tool exchange number of the 1st tool magazine. In the 1st 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. 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 2nd tool magazine. In the 2nd 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. 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 … #24076	Last M code record before breakpoint. When using breakpoint search function, those used M code before breakpoint line number or breakpoint label will record in #24042 to #24076 variables. * 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. * 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. When using breakpoint search function, the last S code before breakpoint line number or breakpoint label will record in #24077 variable. *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. When using breakpoint search function, those used T code before breakpoint line number or breakpoint label will record in #24078 to #24079 variables. * If there are more than 2 T codes are used before the breakpoint line number,	R/-/-
#24079	the system retains only the last 2 sets of T codes based on the first-in-first-out principle. * If less than 2 T codes are used before the breakpoint line number, the corresponding variable will be NULL.	R/-/-

Variable		Function description	Type
#24080	1st axis (X)	Target position of each axis record before breakpoint line. 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. *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. When using breakpoint searching function, the T code command before breakpoint line or breakpoint label will be store in #24100 to #24103 variables. Maximum 4 sets of T code will be recorded. *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.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

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.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.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/-

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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.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/●

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