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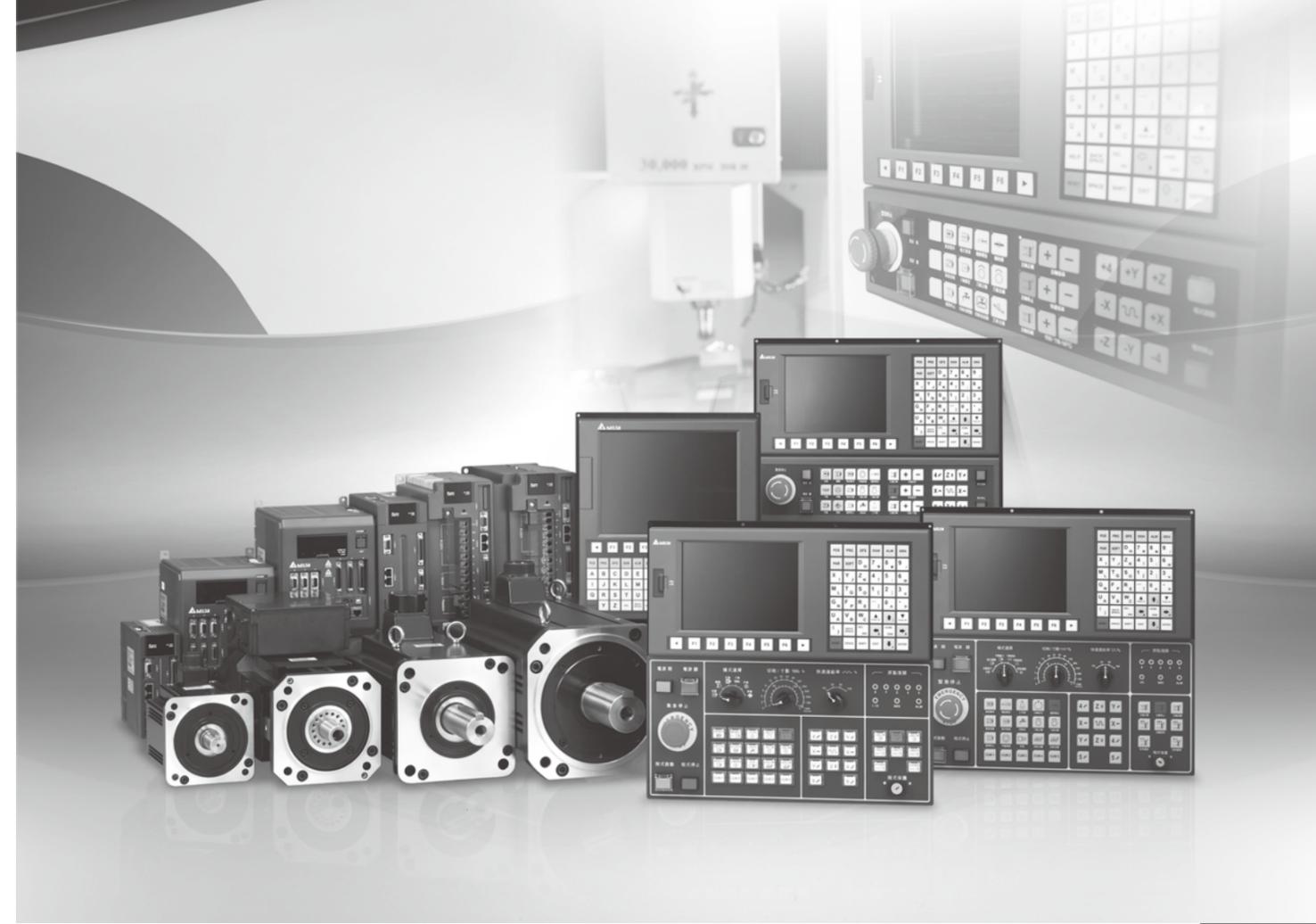
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*We reserve the right to change the
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DELTA_NC300_MM_EN_20130705

Delta CNC Solution

NC300 Series Maintenance Manual

Delta CNC Solution

NC300 Series Maintenance Manual

www.delta.com.tw/ia

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Table of Content

Chapter 1: Product Inspection and Model Numbers

1.1 Product Inspection

Please check the items listed below against what you have received to identify any

damage and or missed item(s) caused during purchasing and delivery.

Items	Description
What you have received	Please check the Model number on NC300 nameplate. See Section 1.2 for descriptions on Model numbers.
Keys and buttons	Press each buttons and keys. Normal membrane keys can be pressed smoothly. If you feel any abnormality when pressing them, they may be damaged!
Improper appearances	Visual checking for any exterior damage and/or scratch.
Loose connector(s)	Visual checking for any loose or poorly fastened connector.

Please contact the agent for any situation listed above.

Items included with the NC300 product:

(1) NC300 controller.

(2) Two 6-pin connectors for connecting to MPG and Remote I/O (Delta P/N: 3051622646

*2 PCS).

(3) One 2-pin connector for connecting to the secondary control panel IES (Delta P/N:

3051622246 *1 PCS).

(4) One 3-pin connector for connecting to DC24V power supply (Delta P/N: 3050243446

*1 PCS).

1.2 Model numbers

1.2.1 Nameplate

NC300 series controller

■ Contents of the nameplate
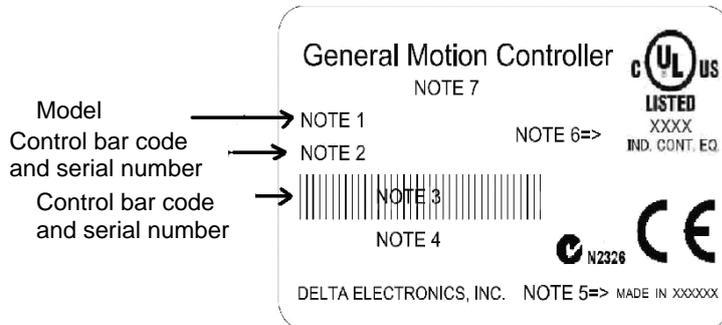
1.2.2 Structure of Model number

NC300 series controller

NC300A - MI - A

[Product name]
NC300: 3-axis series 8" controller
NC311: 3-axis series 10.4" vertical controller

[Category]
M: miller controller

[Type]
I = integrated
S = standalone

A: Version
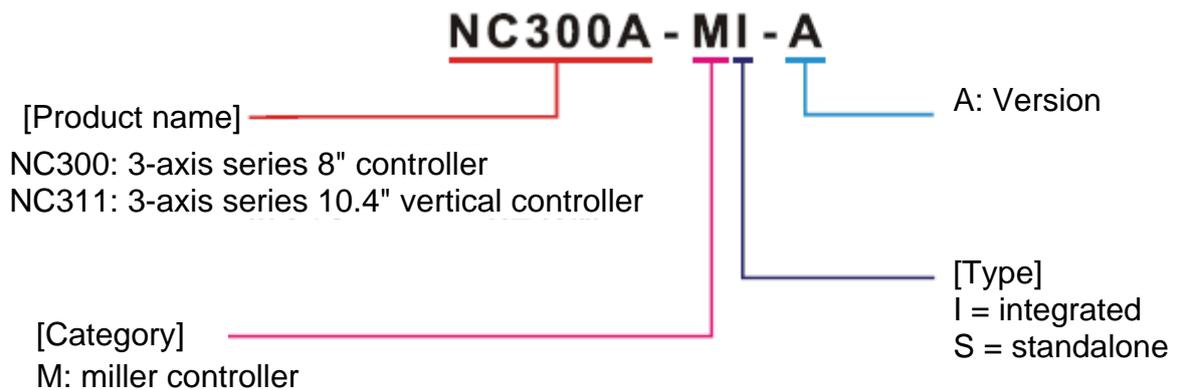
1.3 Cross References of NC300 Controller Accompanying Servo Drive and Motor Models

Servo drive		Accompanying servo motor
200W	ASD-A2-0221-F	ECMA-C10602☐S (S=14mm)
400W	ASD-A2-0421-F	ECMA-C10604☐S (S=14mm) ECMA-C10804☐7 (7=14mm) ECMA-E11305☐S (S=22mm) ECMA-G11303☐S (S=22mm)
750W	ASD-A2-0721-F	ECMA-C10807☐S (S=19mm) ECMA-G11306☐S (S=22mm)
1000W	ASD-A2-1021-F	ECMA-C11010☐S (S=22mm) ECMA-E11310☐S (S=22mm) ECMA-G11309☐S (S=22mm)
1500W	ASD-A2-1521-F	ECMA-E11315☐S (S=22mm)
2000W	ASD-A2-2023-F	ECMA-C11020☐S (S=22mm) ECMA-E11320☐S (S=22mm) ECMA-E11820☐S (S=35mm)
3000W	ASD-A2-3023-F	ECMA-E11830☐S (S=35mm) ECMA-F11830☐S (S=35mm)

Specifications of servo drives shown in the table above are designed with three times the rated current of the servo motor. Please contact distributors for custom servo drive with six times the rated current of the servo motor. See Chapter for detailed specifications on motors and drives.

1.4   NC300 Controller Overview

●MPG hand wheel connector

●Origin limit connector

●High speed serial I/O connector

●RS-485 connector

●Local I/O connector

●Spindle connector

●CF connector

●DC 24V power supply

●Network connector

●Battery holder

●DMCNET connector

●Emergency stop connector
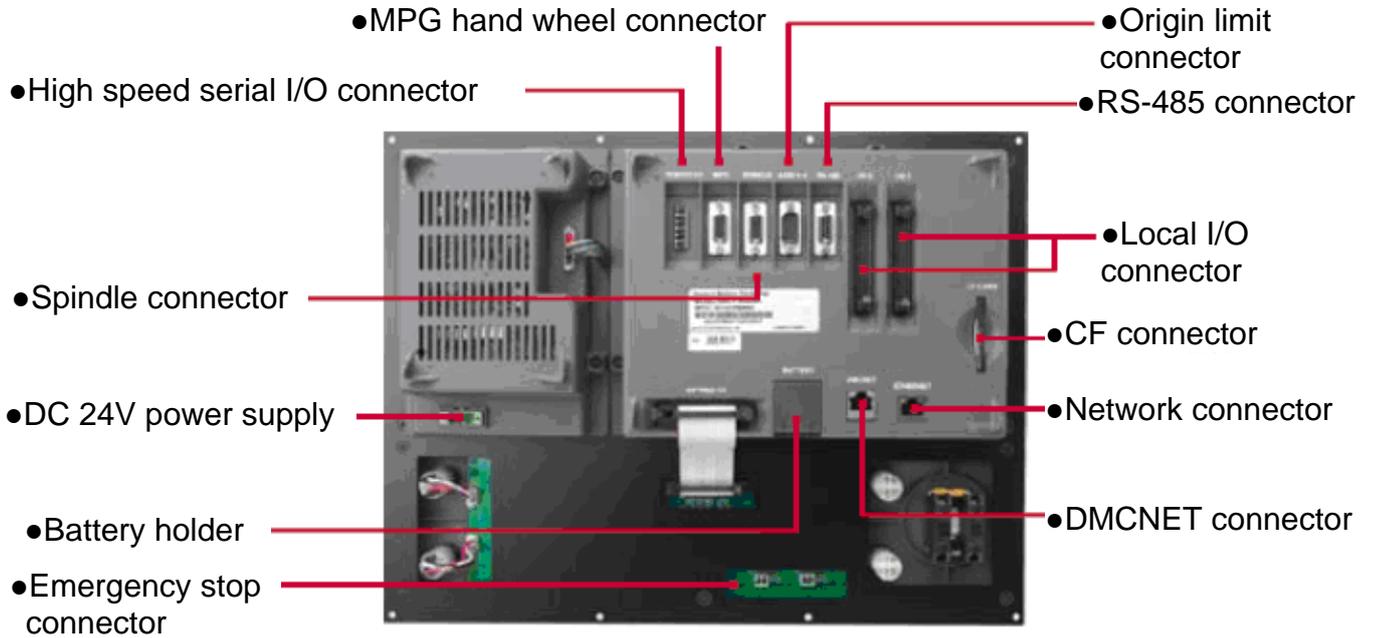
1.5 Operation Mode Overview

This controller offers multiple operation modes as described below:

Name	Description
AUTO	Users are required to set the system in AUTO mode before a program can be executed. This enables users to validate machining program, cutting conditions, and coordinates of positions before execution as well as to avoid unexpected operation by incorrectly pressing keys in non-auto mode. The AUTO mode allows running program only. Users cannot edit the program nor do manual axial offset among other operations.
EDIT	Users can edit the program only in EDIT mode. In EDIT mode, users may fully access various program editing functions available in the PROGRAM group. Please note that users cannot execute the program and do manual axial offset either as only the file editing function is available in this mode.
MDI	Users can input a single block program with screens available in PROGRAM group and run it in MDI mode. Memory capacity of the program is limited as most MDI programs are simple ones manually entered by users. MDI's PROGRAM group screens allow a single step program of up to 17 statements. General program editing and editing and manual axial operations are unavailable in MDI mode.
MPG	Users can do manual axial offset for each axis with external hand wheel in MPG mode for fast and solid axial movements. Program editing, execution, and jog operations are prohibited in MPG mode.
INC	Users can use the axial keys in the secondary control panel for manual incremental offset in INC mode. Users can move the tool by one unit of a given distance by pressing relevant axial keys once. Pressing and holding the key have the same effect as pressing it once rather than moving the tool continuously. Users cannot edit and execute the program in INC mode.
JOG	The JOG mode enables users to do axial jog offset by pressing relevant axial movement keys in the secondary control panel. The speed and distance of each jog movement is controlled by the jog adjustment key. There are two JOG types available: normal and fast. Both program execution and editing functions are banned from the JOG mode. Users can only do manual axial offset with relevant axial movement keys in the secondary control panel.

Name	Description
HOME	The HOME mode simplifies the manual origin reset operation. Users can reset each axis to its mechanical origin by pressing all axial movement keys in the secondary control panel in HOME mode. After re-starting the controller, users are required to reset each axis to its mechanical origin by running the HOME mode first. Otherwise, the controller stops the program execution function.
DNC	The DNC mode enables importing machining programs from external devices through communication connection. Select the DNC mode and then starts to import program files from external devices with the networking function of the PROGRAM group.

Chapter 2: Installation

2.1 Cautions

Please pay special attention to conditions, including voltage, current, and temperature, given in this document to prevent personal injury and/or equipment damage from occurring.

2.2 Storage Environment

Please keep this product in its original package before installation. Please ensure your product is stored in an environment as described below if it is to be not used for a while in order to meet warranty specifications and maintenance requirements:

Keep your product in a dust-free and dry place.
Keep the ambient temperature of the storage location in the range of -20°C ~ +60°C (-4°F ~ 149°F).
Keep the relative humidity of the storage location in the range of 10% ~ 95% without condensation.
Keep your product away from an environment of corrosive gases and liquids.
Keep your product in a proper package and placed on a rack or flat surface.
Hardware specifications

Model	NC300
Working environment	10% ~ 95% RH (0 ~ +55°C)
Storage environment	10% ~ 95% RH (-20~ +60°C)
Cooling	Natural cooling
Voltage	DC +24V (-10% ~ +15%) (embedded isolated circuit $^{()}$)
Insulation endurance	Between DC24 and FG terminals: AC500V, 1 minute
Power consumption	24V 0.6A 15W
Backup battery for memory	3V lithium battery CR2032 × 1
Life span of backup battery	Varies with ambient temperature and working conditions; about three years in 25°C room temperature
Dimensions (W) x (H) x (D) mm	400 x 309 x 129
Opening dimensions (W) x (H) mm	378 x 289
Weight	Around 3700g

2.3 Installation Environment

Operation temperature

NC300 series controller   :   0°C ~ 55°C (32°F ~ 131°F)

Please keep the ambient temperature below 45°C for long-term operation to ensure the reliability of the product.

Please place the product in a place with good ventilation if the ambient temperature tops 45°C. For a product installed in a distribution box, please ensure that the size and ventilation status of the box can prevent overheating of electronic devices. Keep electronic devices within the product away from the effect of vibration of the machine.

Please install the product subject to the conditions described below to ensure the validity of NC300 controller's warranty and subsequent maintenance:

Please install the product in an environment where meets the requirements described below:
- free from strong heating devices,
- free from water, steam, dust and oil,
- free from corrosive and/or flammable gas and liquid,
- free from floating dust and metal particles,
- robust and vibration-free places without electromagnetic noise interference.

Make sure the installation site of NC300 controller is of a temperature and humidity in a given range.

Store NC300 controller in a place with vibration in a specified range.

2.4 Installation Direction and Space

NC300 series controller must be installed vertically on a dry and robust as well as NEMA standards-compliant surface. For good ventilation and cooling efficiency, sufficient clearance (50mm or roughly 2 inches) must be maintained between adjacent objects and partitions (walls) surrounding your product.

Note:

For good ventilation and cooling efficiency, sufficient clearance must be maintained between adjacent objects and partitions (walls) surrounding the product. Otherwise, product failure may result.

Do not block the ventilation slot of NC300 controller or product failure may result.

2.5 Dimensions

NC300A-MI-A
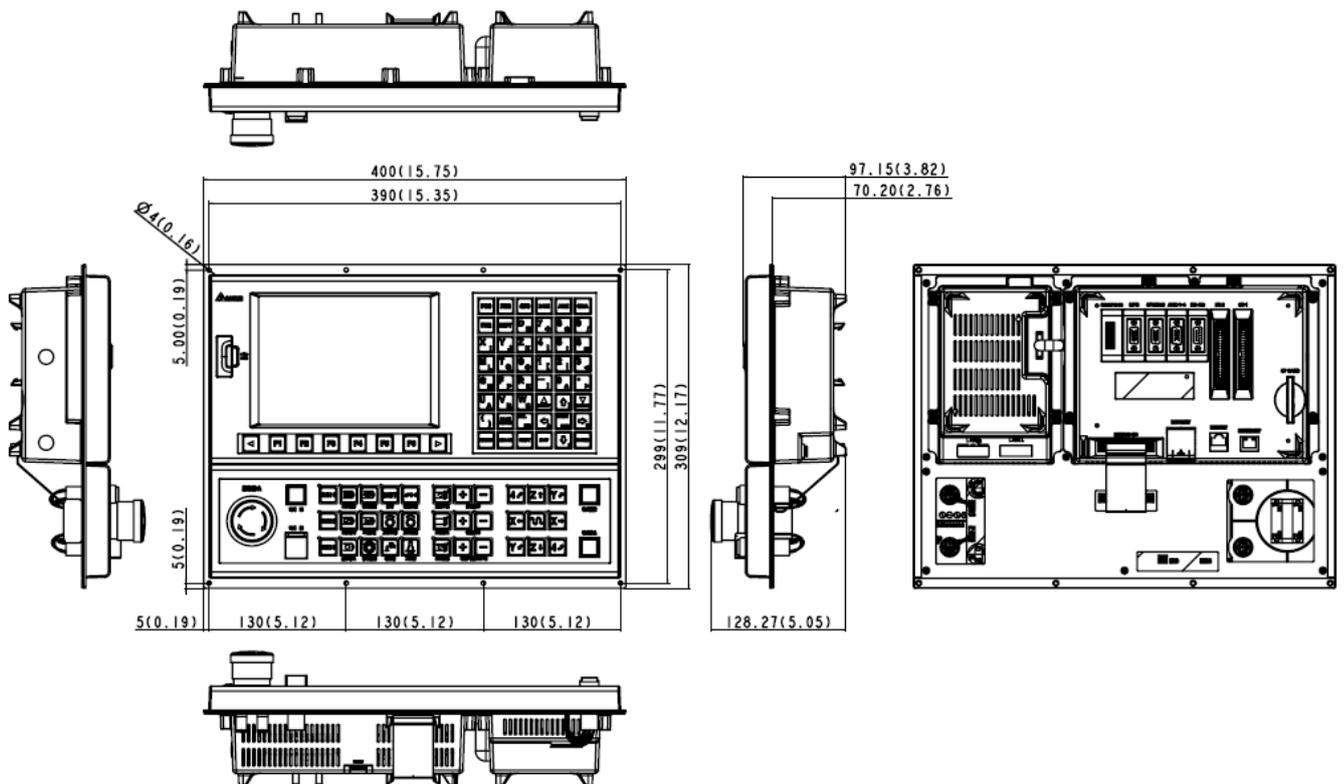
NC300A-MS-A
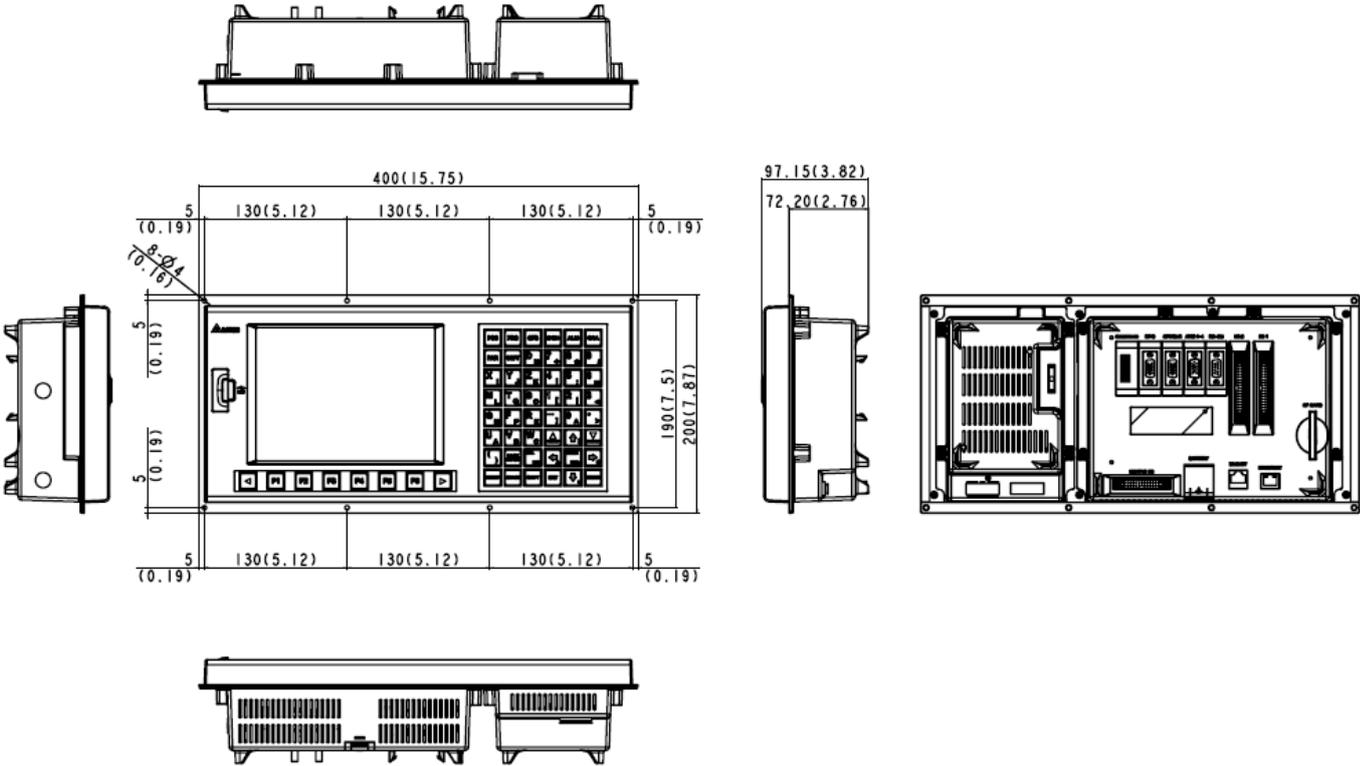
Chapter 3: Wiring

This chapter explains the wiring of the servo drive and the meaning of various signals along with the standard wiring diagrams for various modes.

3.1 Wiring of system interface and main power circuit

3.1.1 System interface wiring diagram
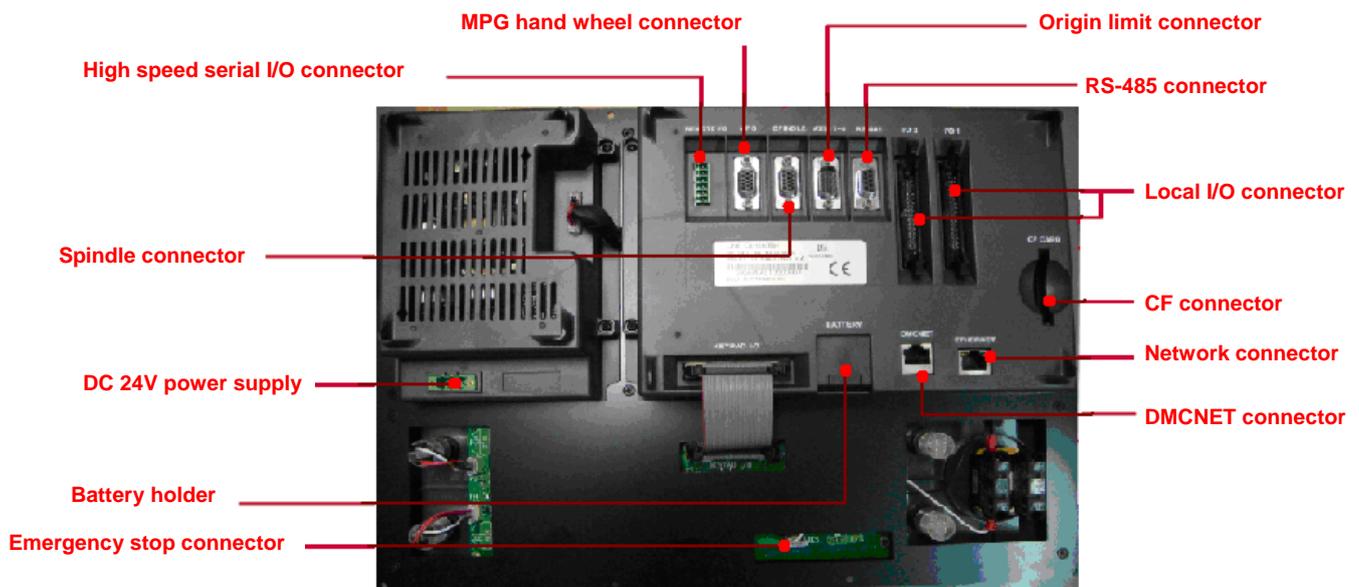
Connector	Description
High speed serial I/O	Every module features 32 pairs of inputs and outputs
	Up to 20M between stations and up to 160M (20 x 8) total length
MPG hand wheel	External hand wheel function with internal DC 5V driving power and 6 inputs
Spindle	One spindle encoder signal input
	One analog signal output
	G31 high speed input
Origin limit	4-axis limit and origin input

Connector	Description
Power socket	DC 24V power input
DMCNET	High speed communication network connector
Ethernet network	DNC control and system monitoring
CF card	G code program storage
Emergency stop	Triggers immediate system stop when opening circuit
I/O 1 and I/O 2	I/O 1 for 16 pairs of I/O
	I/O 2 for 12 pairs of I/O

NOTE   Notes on installation:

1) Ensure correct DC 24V power connection. Do not connect to AC 110V power.

2) On board and remote I/O require extra DC 24V power to drive X input and Y output.

3) Short circuit the EMG (emergency stop) switch of the product to ready the controller.

4) For abnormal or emergency stop, disconnect the servo drive power by breaking the electromagnetic contactor power with the Y output.

3.1.2 Connectors and terminals of NC300 controller

Terminal mark	Name	Description		
0V, +24V ⏚	Controller power input	Connect the DC 24V power (15W at 0.6A)		
		Terminal ID	Wire color	Description
		+24V	Red	Positive of DC 24V power
		0V	White	Negative of DC 24V power
		⏚	Green	Power grounding
I/O 1	On Board I/O 1	DI/DO range (X0~X15, Y0~Y15), see Section 3.3		
		PIN ID	Description	
		P1~ P16	Input X0~X15 terminal, up to 16 points (8~25mA)	
		P19~P34	Output Y0~Y15 terminal, up to 16 points (<120mA)	
		P18	Input COM2 port, for +24V or 24V GND	
		P17	Output OUT-COM port for VDD GND	
		DO power specifications apply: voltage: <DC 24V; current <60mA		
I/O 2	On Board I/O 2	DI/DO range: (X16~X27, Y16~Y27), see Section 3.3		
		PIN ID	Description	
		P1~ P12	Input X16~X27 terminal, up to 12 points (8~25mA)	
		P19~P30	Output Y16~Y27 terminal, up to 12 points (<120mA)	
		P18	Input COM3 port, for +24V or 24V GND	
		P17	Output OUT-COM port for VDD GND	
		DO power specifications apply: voltage: < DC 24V; current < 60mA		
AXIS 1~4	Limit to each axis and home sensor	0~3 axis, the positive/negative limits and home sensor input terminal, up to 12 points (Operating current: 8~25mA)		
		PIN ID	Description	
		P1~P3	Positive limit, negative limit, home point input for axis 0 (Special M [M2144], [M2145], [M2146])	
		P4~P6	Positive limit, negative limit, home point input for axis 1 (Special M [M2148], [M2149], [M2150])	
		P7~P9	Positive limit, negative limit, home point input for axis 2 (Special M [M2152], [M2153], [M2154])	

Terminal mark	Name	Description	
		P10~P12	Positive limit, negative limit, home point input for axis 3 (Special M [M2156], [M2157], [M2158])
		P13~P15	Input COM1 port, for +24V or 24V GND
SPINDLE	Spindle specific connector	Including spindle revolution speed feedback, analog output and 2 high speed counter inputs (the HIS_1 is for G31 disconnection)	
		PIN ID	Description
		P1	HIS_COM, for +24V or 24V GND
		P2	HIS_1 counter C78, Input [M2142]
		P3	HIS_2 counter C79, Input [M2143]
		P4	SP_OUT
		P5	SP_GND
		P6	EMG_STOP
		P7	No connection
		P8	SP_A+
		P9	SP_A-
		P10	+5V_OUT
		P11	SP_B+
		P12	SP_B+
		P13	SP_Z+
		P14	SP_Z+
		P15	+5V_GND
MPG	Hand wheel pulse input	6 DI input and along with one hand wheel input terminal, A, /A, B, /B	
		PIN ID	Description
		P1	External 24V input
		P2~P7	DI (X28~X33) < 8~20mA, connect to +5V_GND May trigger DI
		P8	+5V_GND
		P9	+5V_GND
		P10	+5V power positive end + (<300mA)
		P11	XA+
		P12	XA-
		P13	XB+
		P14	XB-
		P15	+5V_GND
REMOTE I/O	Remote I/O serial connection terminal	Remote I/O communication terminal, with ranges X256~X511, Y256~Y511 Every remote I/O is X32/Y32 and may connect up to 8 modules	
		PIN ID	Description
		P1	SHIELD

Terminal mark	Name	Description		
		P2	GND	
		P3	RX+	
		P4	RX-	
		P5	TX-	
		P6	TX+	
ETHERNET	Ethernet connector	Connect PC with RJ45 connector with normal network cable. See below for wire jumping.		
		PIN ID/color at end A		PIN ID/color at end B
		1. Orange white		1. Orange white
		2. Orange		2. Orange
		3. Green white		3. Green white
		4. Blue		4. Blue
		5. Blue white		5. Blue white
		6. Green		6. Green
		7. Brown white		7. Brown white
		8. Brown		8. Brown
DMCNET	DMCNET communication connector	Connect to Delta's servo drive ASD-A2 model N with standard RJ45 connector. Wire in standard Ethernet manner.		
EMG	Emergency stop switch	Press to open circuit		
Power On	Key	A connector key with key light indicator (with DC 24V power)		
Power Off	Key	B connector key with key light indicator (with DC 24V power)		
IES	EMG emergency stop contact	Emergency stop contact. Activate EMG when breaking circuit.		

Notes on wiring:

1) The IES connector is for EMG emergency stop switch. Activate EMG when breaking circuit.

2) Power On / Power Off, with key light indicator (with DC 24V power)

3.1.3 Wiring the power line

The NC300 series controller can be powered by direct or machine power supply. As shown in figure below, connector "**a**" is for power ON and "**b**" for power OFF. The MC is for magnetic contactor coil and self-keep power as well as the main circuit power connector.

■ Three-phase power wiring (powered by DC 24V transformed by machine AC power supply). Please note that the light indicator is in DC 24V power.
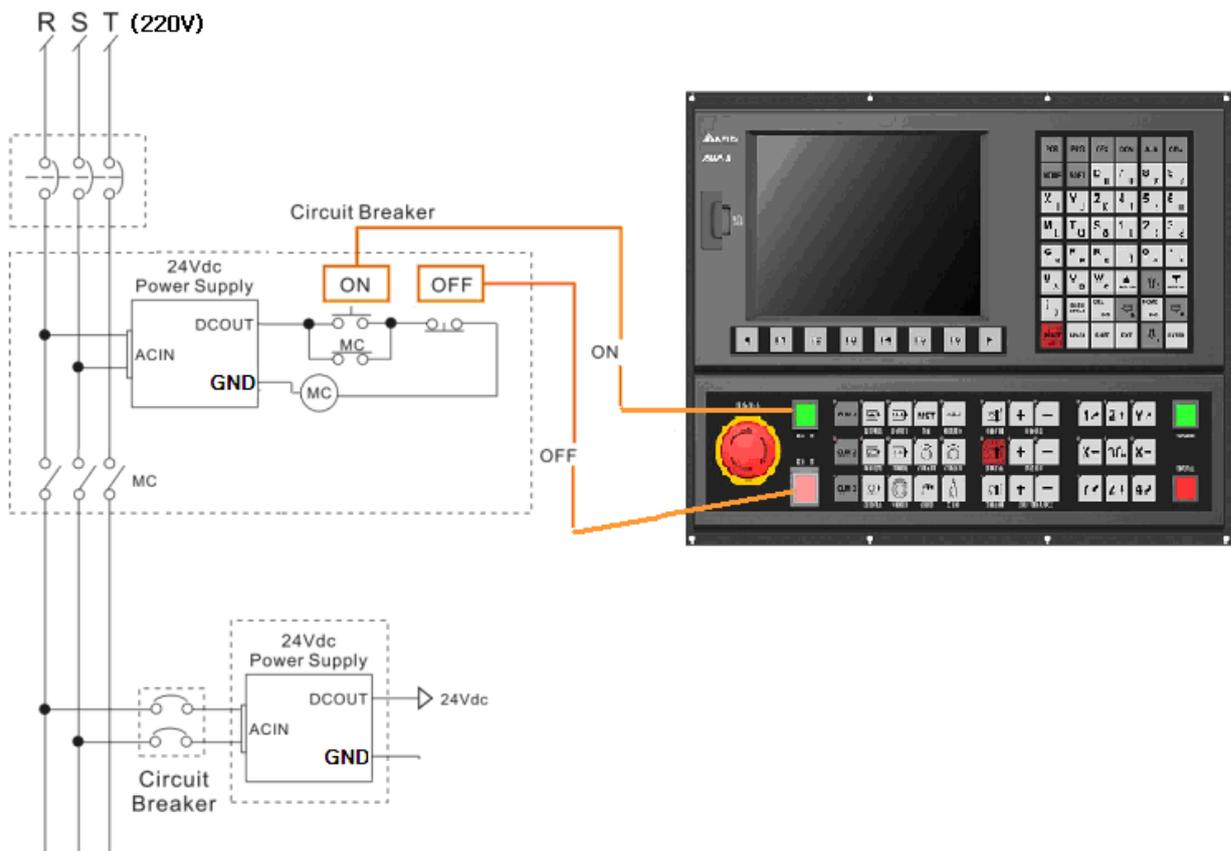
■ Wiring for direct DC power supply (to power ON the controller)
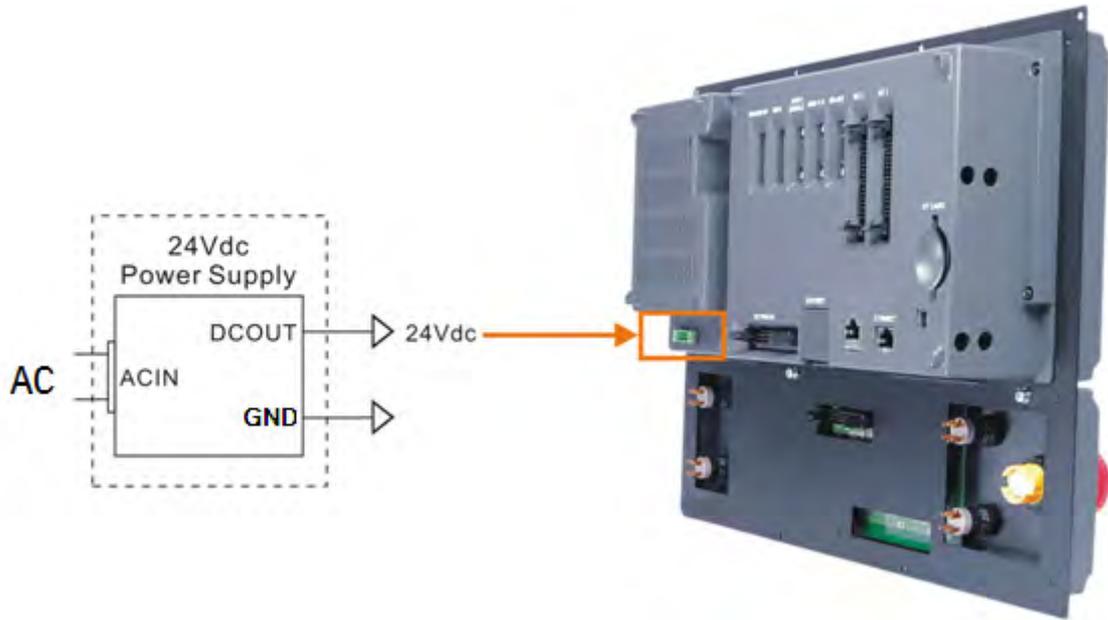
3.1.4 DMC connection setup for NC300 and ASDA-A2-N

Simple DMC Connection

ASDA-A2-N and DMC connection setup

Set P1-01 to b
Set P1-01 (CW, CCW) to 010b
Set P3-00 (station ID) to 1~12
Set P3-01 (CNC connection) to 0203
Set P3-10 (communication) to 1
Set P2-15 (limit to the right) to 1XX
Set P2-16 (limit to the left) to 1XX
Set P2-17 (EMG) to 1XX

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3.1.5 Specifications for lead connectors to each NC300 port

Terminal name and mark	Connector	PINs
DC 24V power input		3
I/O 1 and I/O 2		34
REMOTE I/O		6
DMCNET and ETHERNET (with standard RJ45 connector)		8
AXIS 1~4		15
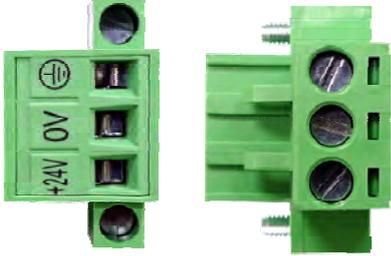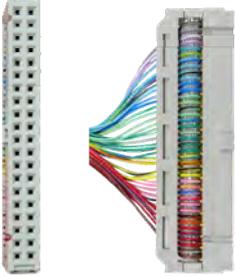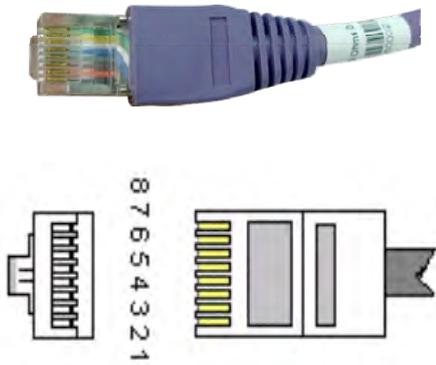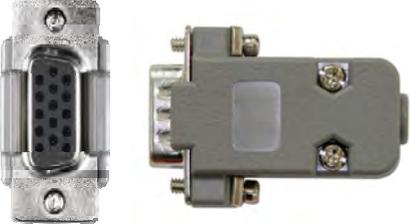
Terminal name and mark	Connector	PINs
SPINDLE and MPG		15
RS-485		9
IES		2
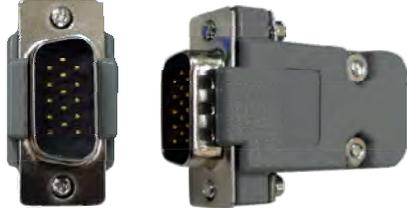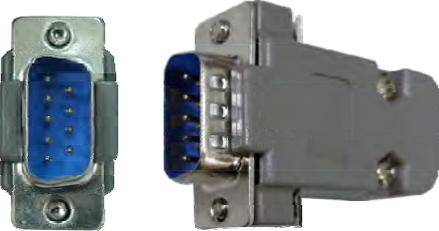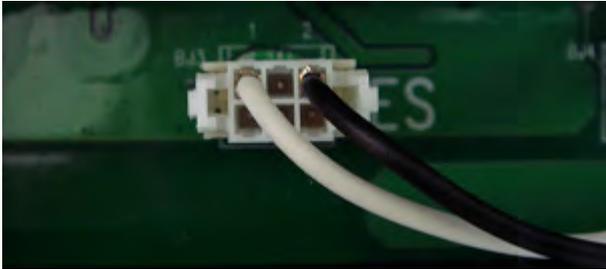
Please use AWG30, UL1007 compliant I/O wires shielded with metal mesh to prevent signal noise. The DMCNET terminal uses RJ45 connector and insulated network cable to connect with the server.

3.2 I/O Wiring

Layout of I/O 1and I/O 2 terminal blocks

For more flexible I/O configuration, the controller features On Board I/O. There are 16 pairs of inputs and outputs in I/O 1 with the outputs entered with +V. Users may set input point signal to GND or +V depending upon whether the COM2 is connected to +V or GND.

In total, there are 28 input and 28 output points. See the table below for pins of the MLC (X0~27/Y0~27):
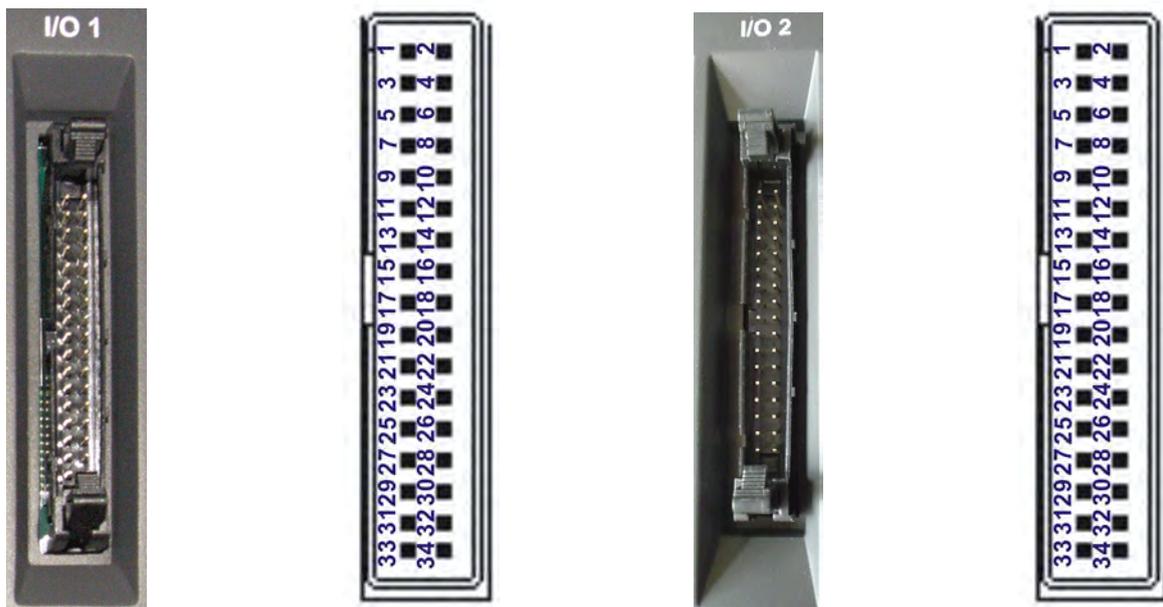
I/O 1					I/O 2			
PIN 1	X0	PIN 2	X1		PIN 1	X16	PIN 2	X17
PIN 3	X2	PIN 4	X3		PIN 3	X18	PIN 4	X19
PIN 5	X4	PIN 6	X5		PIN 5	X20	PIN 6	X21
PIN 7	X6	PIN 8	X7		PIN 7	X22	PIN 8	X23
PIN 9	X8	PIN 10	X9		PIN 9	X24	PIN 10	X25
PIN 11	X10	PIN 12	X11		PIN 11	X26	PIN 12	X27
PIN 13	X12	PIN 14	X13		PIN 13	NC	PIN 14	NC
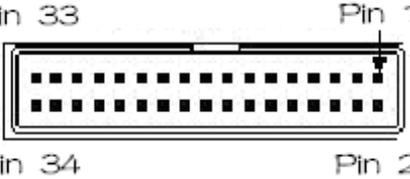
I/O 1			
PIN 15	X14	PIN 16	X15
PIN 17	OUTCOM	PIN 18	COM2
PIN 19	Y0	PIN 20	Y1
PIN 21	Y2	PIN 22	Y3
PIN 23	Y4	PIN 24	Y5
PIN 25	Y6	PIN 26	Y7
PIN 27	Y8	PIN 28	Y9
PIN 29	Y10	PIN 30	Y11
PIN 31	Y12	PIN 32	Y13
PIN 33	Y14	PIN 34	Y15
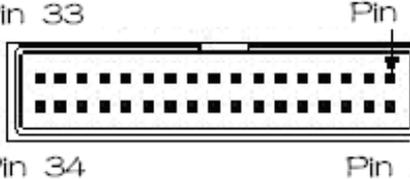
I/O 2			
PIN 15	NC	PIN 16	NC
PIN 17	OUTCOM	PIN 18	COM3
PIN 19	Y16	PIN 20	Y17
PIN 21	Y18	PIN 22	Y19
PIN 23	Y20	PIN 24	Y21
PIN 25	Y22	PIN 26	Y23
PIN 27	Y24	PIN 28	Y25
PIN 29	Y26	PIN 30	Y27
PIN 31	NC	PIN 32	NC
PIN 33	NC	PIN 34	NC

DO drive general load (with allowable current less than 140mA and surge current less than 200mA)

DO wiring: external power source and normal load

I/O 1   I/O 2
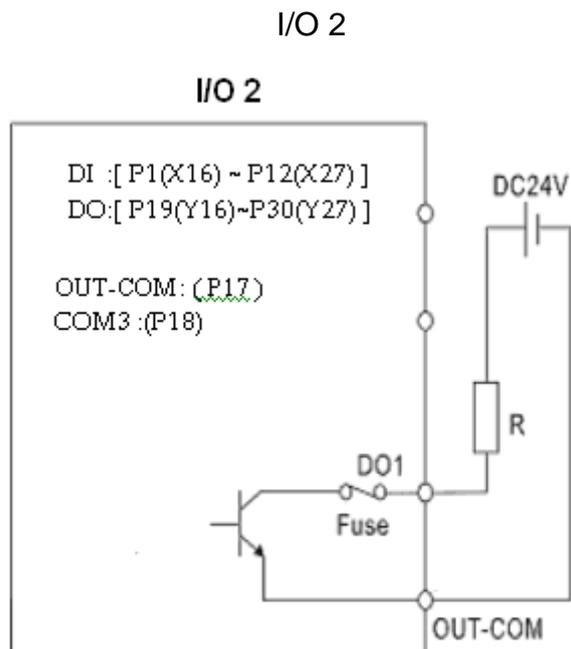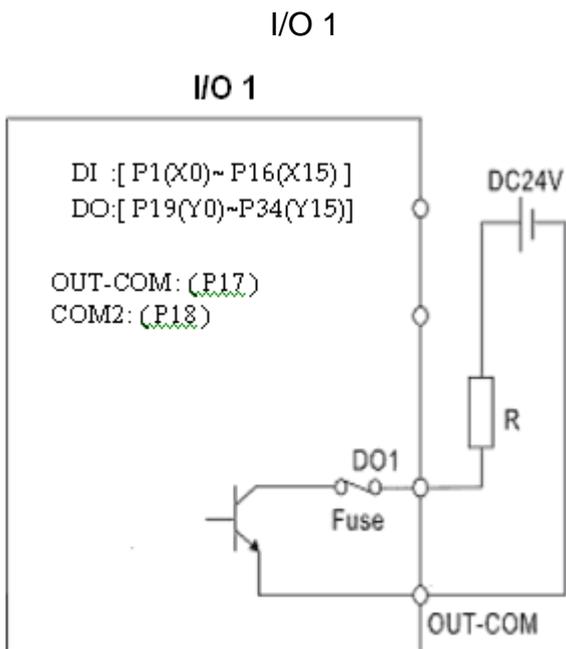
When it connects to inductive load, it is suggested to adds diode so as to protect DO contact.
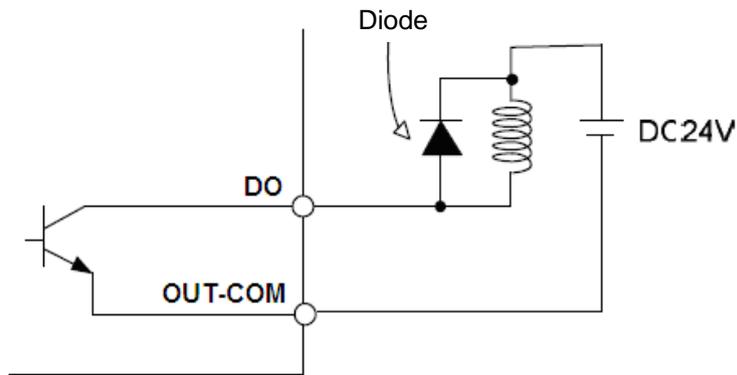
Take voltage as input signal (with allowable current between 8~25mA and surge current less than 50mA)

DI wiring: external power source
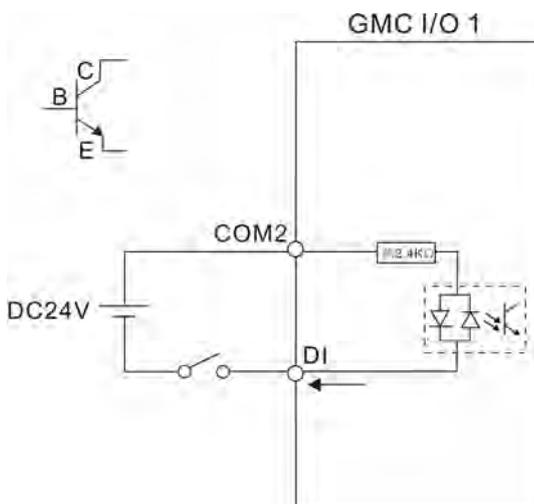
NPN transistor (SINK mode)   PNP transistor (SOURCE mode)
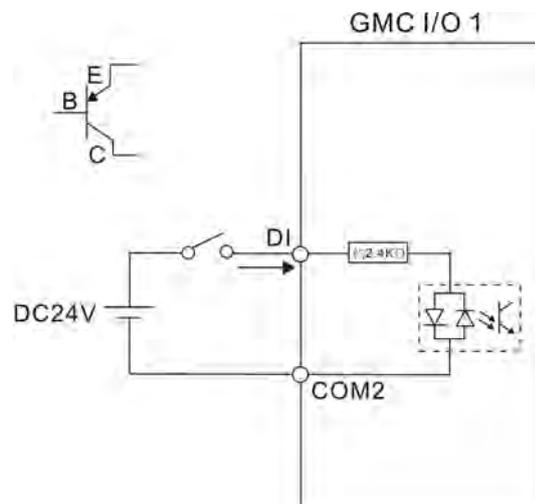
3.3 Signal Wiring for AXIS 1~4 Input Terminal

AXIS1~4 Connector terminal layout

The NC300 series controller feature hardware positive and negative limits and home point for each of its 4 axes at the AXIS 1~4 terminal blocks respectively. There are 12 input points and users may set the input point signal to GND or +V depending upon whether COM1 is connected to +V or GND.

See figure for pin wiring:

AXISI 1~4					
Pin No.	**Function**	**Pin No.**	**Function**	**Pin No.**	**Function**
PIN 1	0-axis positive limit	PIN 6	1-axis home	PIN 11	3-axis negative limit
	OT0+		DOG1		OT3-
PIN 2	0-axis negative limit	PIN 7	2-axis positive limit	PIN 12	3-axis home
	OT0-		OT2+		DOG3
PIN 3	0-axis home	PIN 8	2-axis negative limit	PIN 13	COM
	DOG0		OT2-		

PIN 4	1-axis positive limit	PIN 9	2-axis home	PIN 14	COM
	OT1+		DOG2		
PIN 5	1-axis negative limit	PIN 10	3-axis positive limit	PIN 15	COM
	OT1-		OT3+		

Special M description:

Pin P1~P3	Positive limit, negative limit, home point input of axis-0 (Special M [M2144], [M2145], [M2146])
Pin P4~P6	Positive limit, negative limit, home point input of axis-1 (Special M [M2148], [M2149], [M2150])
Pin P7~P9	Positive limit, negative limit, home point input of axis-2 (Special M [M2152], [M2153], [M2154])
Pin P10~P12	Positive limit, negative limit, home point input of axis-3 (Special M [M2156], [M2157], [M2158])

Take voltage as input signal (with allowable current between 8~25mA and surge current less than 50mA)

DI wiring: external power source
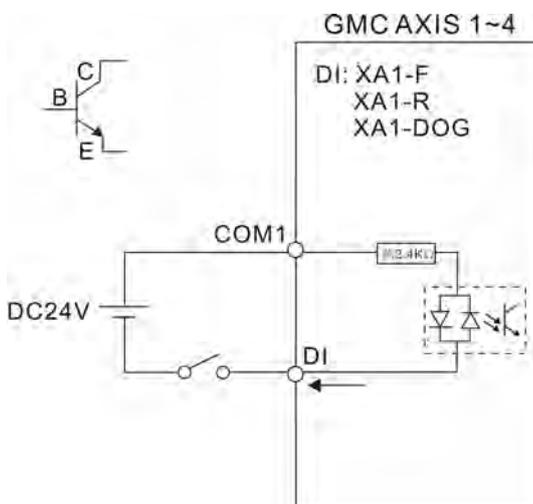
NPN transistor (SINK mode)   PNP transistor (SOURCE mode)
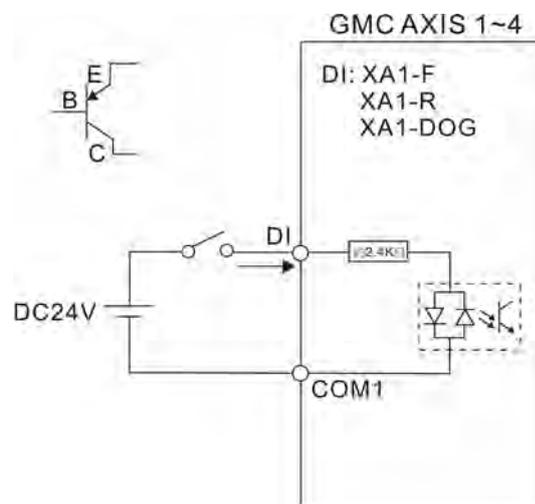
AXIS1~4 Connector Terminal NC-EXM-S01Wiring of Conversion Card
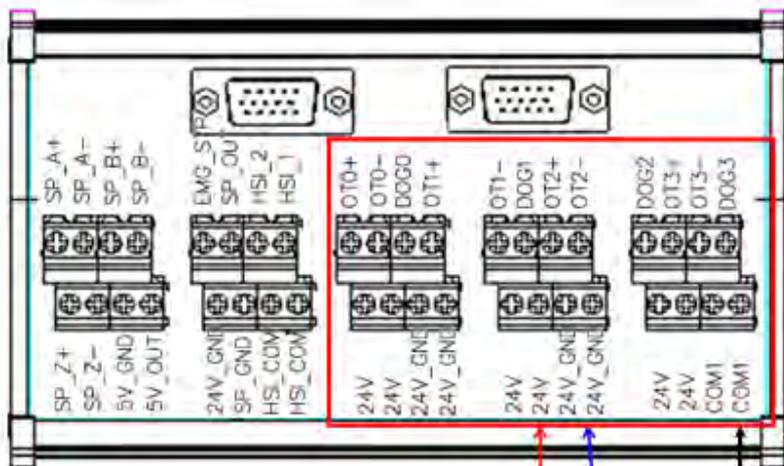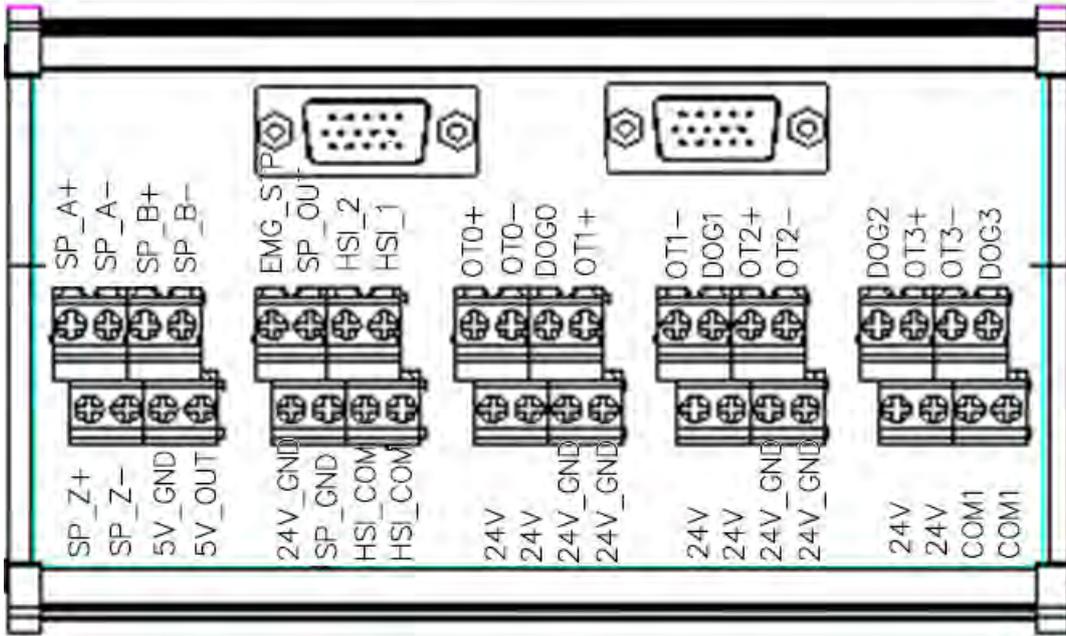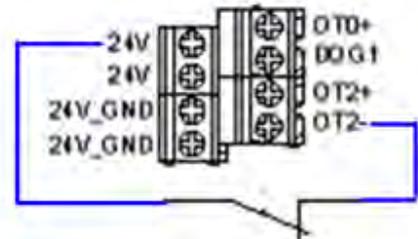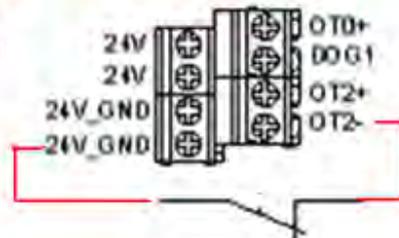
3.4 Wiring for spindle input terminal signal

SPINDLE connector terminal layout

The NC300 series controller features one spindle feedback input and two hardware high speed counter inputs.
See the figure below for its wiring:

Pin No		Function
	SPINDLE	
PIN 1	HSI_COM	High speed counter COM that may connect to +24V or 24V GND
PIN 2	HSI_1	High speed counter input 1 (**24**v 10mA)
PIN 3	HSI_2	High speed counter input 2
PIN 4	SP_OUT	Spindle analog output
PIN 5	SP_GND	Spindle analog ground
PIN 6	EMG_STOP	Emergency stop input
PIN 7	NC	No connection
PIN 8	SP_A+	Spindle encoder A phase positive input
PIN 9	SP_A-	Spindle encoder A phase negative input

PIN 10	+5V_OUT	Spindle encoder power output
PIN 11	SP_B+	Spindle encoder B phase positive input
PIN 12	SP_B-	Spindle encoder B phase negative input
PIN 13	SP_Z+	Spindle encoder Z phase positive input
PIN 14	SP_Z-	Spindle encoder Z phase negative input
PIN 15	+5V_GND	Spindle encoder power ground

The high speed counter DI wiring supports a band up to 5MHz input and is suitable for G31 interruption input, external power (with voltage tops 24V and restrict current between 8~20mA and surge current less than 50m). Set high speed counter input 1 for G31 interruption with parameter 46Bit5=1; parameter 307Bit4=1; input limit parameter 25Bit0=1 and special M=M2142.

The high speed counter input 1 wiring (input bi-directional optical coupler) HIS_1 can be set for G31 interrupt input.

High Speed Counter Inputs
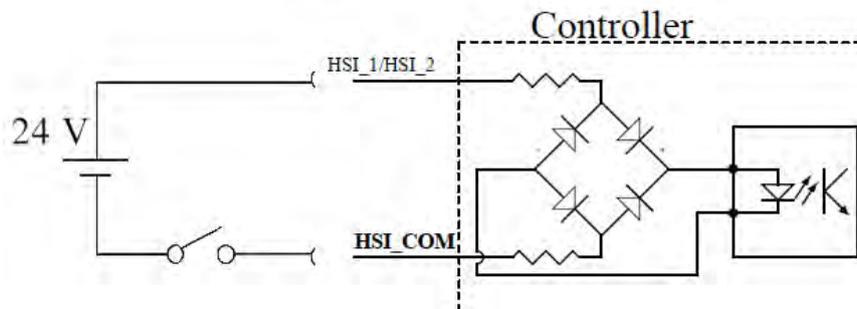
High Speed Counter Inputs
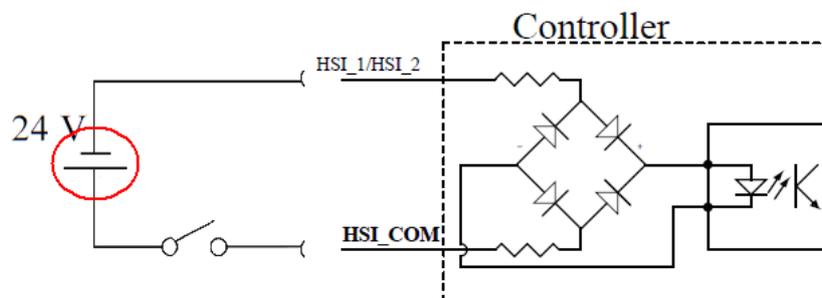
Analog spindle setup:

Parameter setup

399 Servo spindle: set to 1101
Analog spindle: set to 1020

0	Spindle function started 0: spindle OFF /1: spindle ON	0~1
1	Close loop control flag 0: close loop control OFF / 1: Close loop control ON (feedback encoder is required)	0~1
2 ~3	Spindle output mode 0: DMCNET (servo spindle) 2: EDAC (analog output)	0~2
4	Speed control mode 0: rmp / 1: PPM	0~1
5	Bit5: feedback form 0: high resolution (x1000) / 1: normal resolution (x4)	0~1

Please activate SP1 and set its port number to 10 in channel setup and match 0~10V DC to S0~S maximum turning speed (with -10V~+10V parsed to 14bit).

The analog spindle output, Pin4 and Pin5

SPINDLE ANALOG OUTPUT -10V~+10V

SP_OUT/pin 4

SP_GND/pin 5

Delta inverter
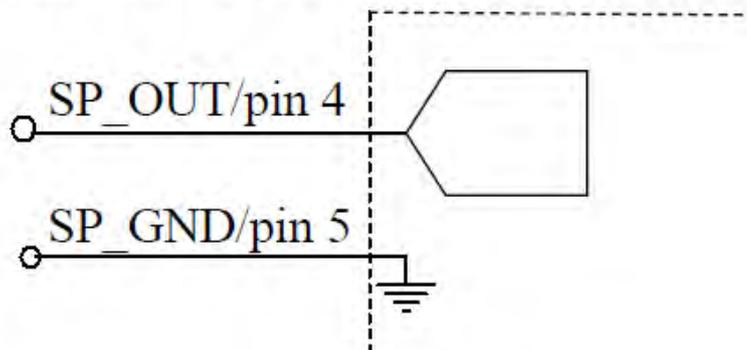
3.5 Wiring for MPG input terminal signal

MPG terminal layout

The NC300 series controller features one manual pulse input for machine's hand wheel operation. Its internal DC 5V working power can power the hand wheel device directly. See the figure below for its wiring:
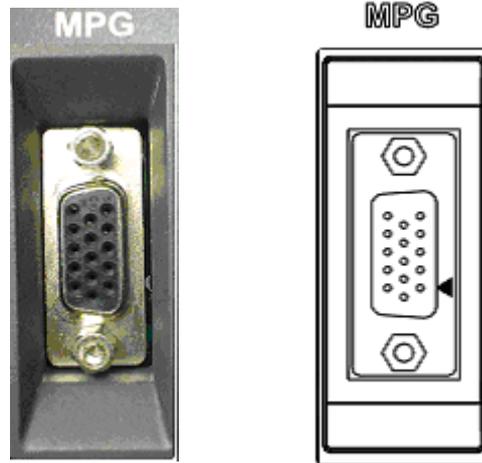
Pin No	Function
MPG	
PIN 1	External 24V input bi-directional
PIN 2	IN1 (X28) X-axis
PIN 3	IN2 (X29) Y-axis
PIN 4	IN3 (X30) Z-axis
PIN 5	IN4 (X31) 4 axis
PIN 6	IN5 (X32) magnification x10
PIN 7	IN6 (X33) magnification x100
PIN 8	+5V_GND
PIN 9	+5V_GND
PIN 10	+5V_OUT
PIN 11	XA+
PIN 12	XA-

PIN 13	XB+
PIN 14	XB-
PIN 15	+5V_GND

With servo connection in MPG mode, turning the hand wheel may lead to VS0 value updating in the information console (axis selection and magnification setup are required)

MPG pulse input wiring with internal power of 5V DC

DI pin wiring
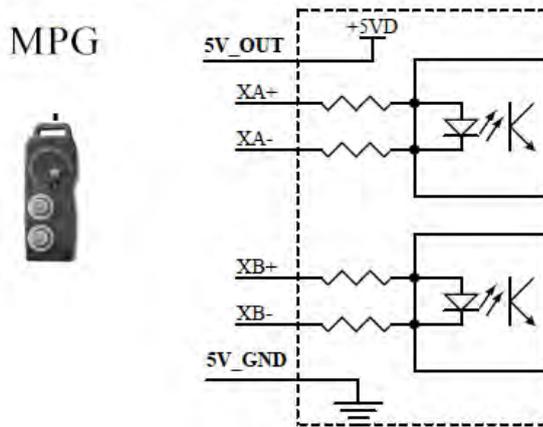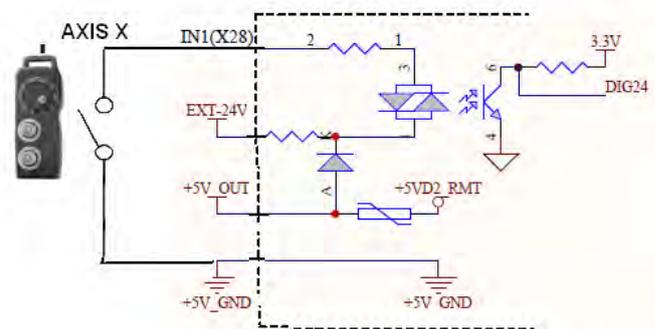
MPG Hand Wheel

For axis and triggering signal selection

Function name	Special D code	Description
MPG startup operation	D1040	Set operation code for MPG hand wheel startup with value "0" for using external hand wheel and "10" for secondary control panel incremental jogging. It triggers signal M1156 and M1157.
Select channel for MPG operation	D1041	Set to select channel for MPG hand wheel operation. It is set to "0" now.
Status of MPG 0-axial selection knob	D1043	Set the axis to be controlled by MPG0 hand wheel: 0 for X-axis; 1 for Y-axis; 2 for Z-axis.
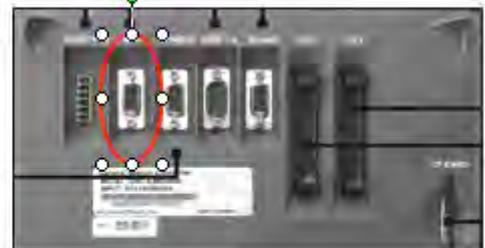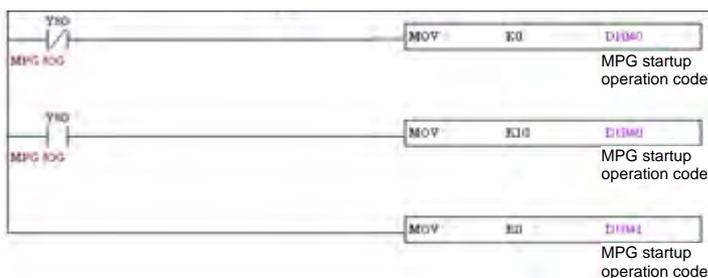
Software MPG+	M1118	Secondary control panel incremental jogging, forward triggering signal, see D1040
Software MPG-	M1119	Secondary control panel incremental jogging, backward triggering signal, see D1040

Magnification Adjustment (MPG)

For selecting MPG magnification in 3 stages, each stage is magnified 10 folds within a range of 0~100

Function name	Special D code	Description
MPG0 magnification knob status	D1042	MPG0 hand wheel pulse input magnification factors of 1, 10, and 100. These factors apply to the least movement unit 0.001mm, e.g. 1*0.001 = 0.001mm/cnt.
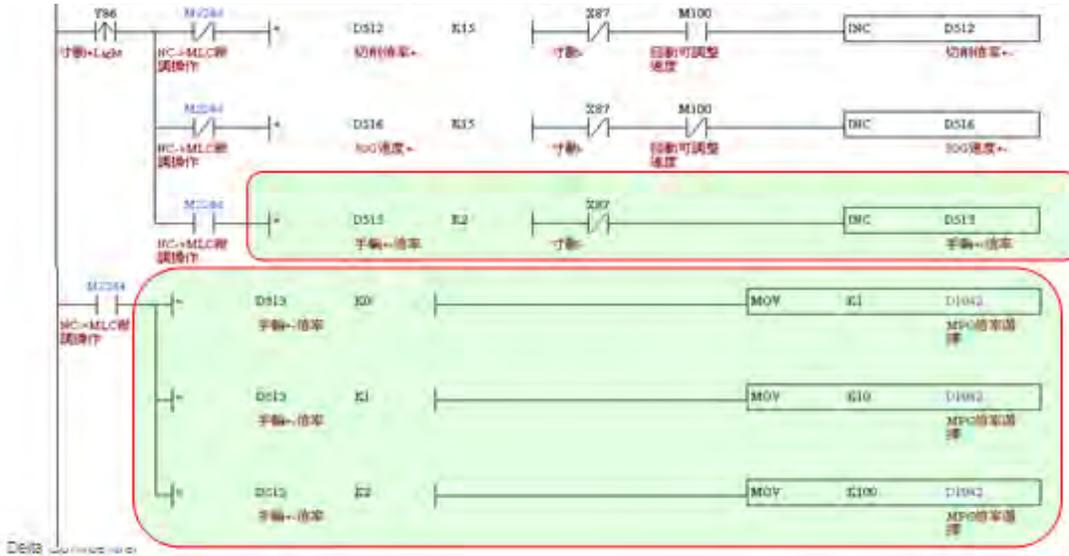
Varies with hand wheel wiring (100 PPR for every cycle): Single-ended EHDW-BA6SI and differential EHDWBE6SI.

Wiring for single-ended EHDW-BA6SI hand wheel
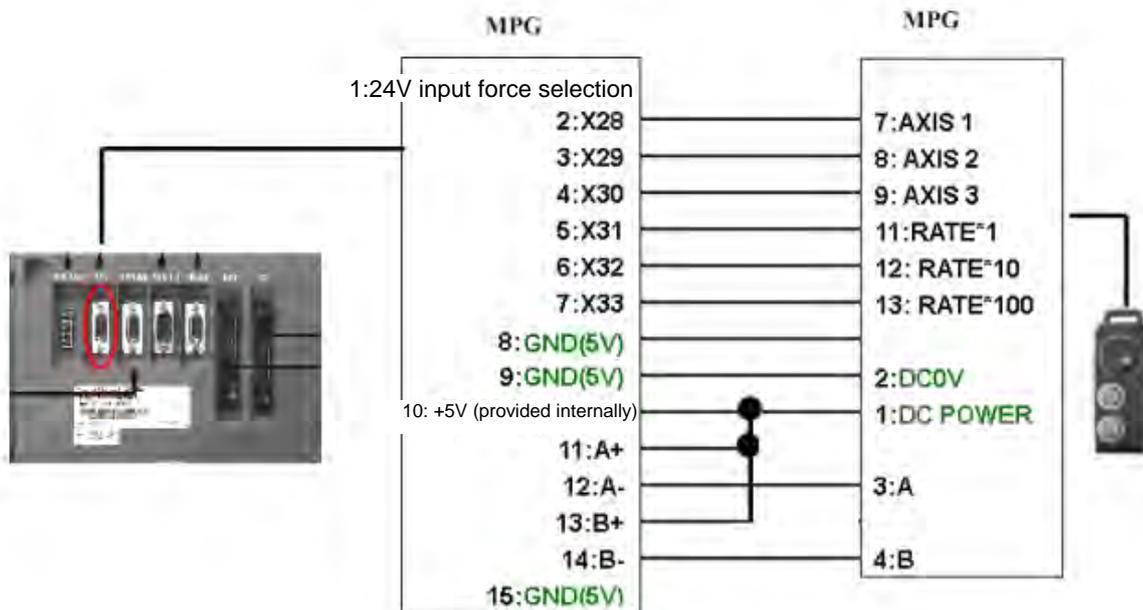
Wiring for EHDW-BE6SI hand wheel:

MPG		MPG
1:24V input force selection		
2:X28	—	7: AXIS X
3:X29	—	8: AXIS Y
4:X30	—	9: AXIS Z
5:X31		
6:X32	—	12: RATE*10
7:X33	—	13: RATE*100
8: GND(5V)		
9:GND(5V)	—	2:DC0V
10: +5V (provided internally)		1:DC POWER
11:A+	—	3:A+
12:A-	—	5:A-
13:B+	—	4:B+
14:B-	—	6:B-
15:GND(5V)		
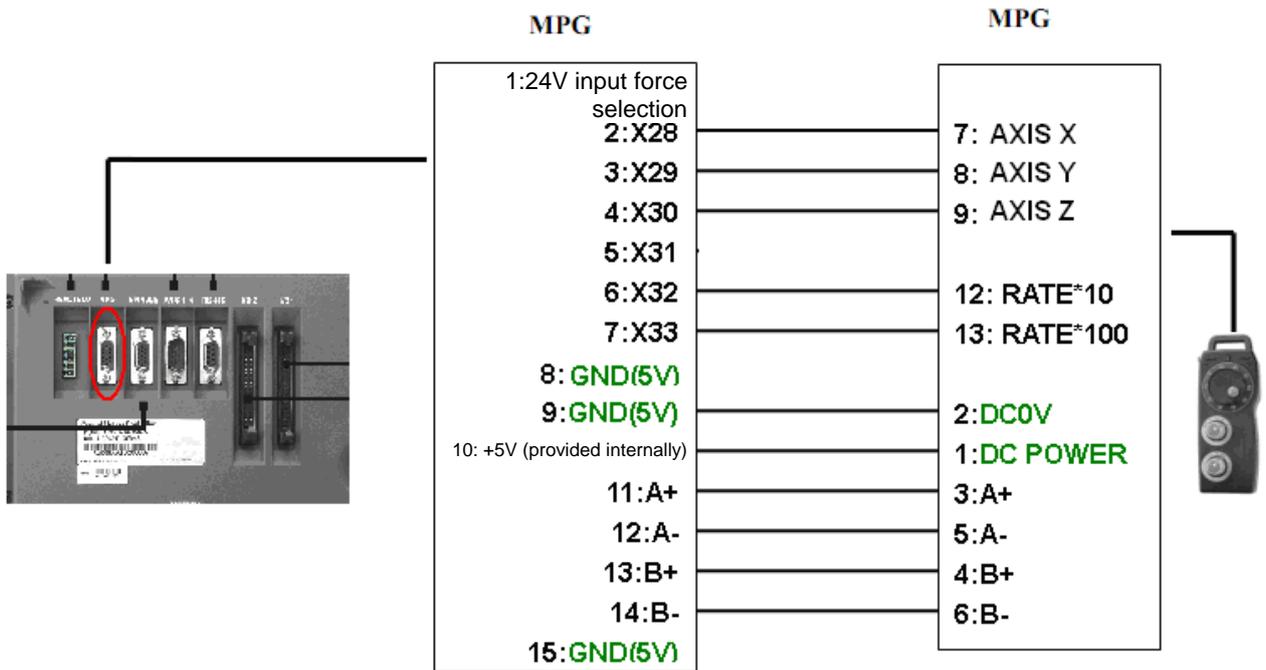
3.6 Wiring for Remote I/O Signal

Remote I/O terminal layout

The NC300 series controller features a remote I/O communication port for the remote I/O module. There are station options on board: starting with the first station of (X256, Y256), every additional station adds another 32 points. You can cascade up to 8 modules for up to 256 points. See the figure below for the communication wiring pins:
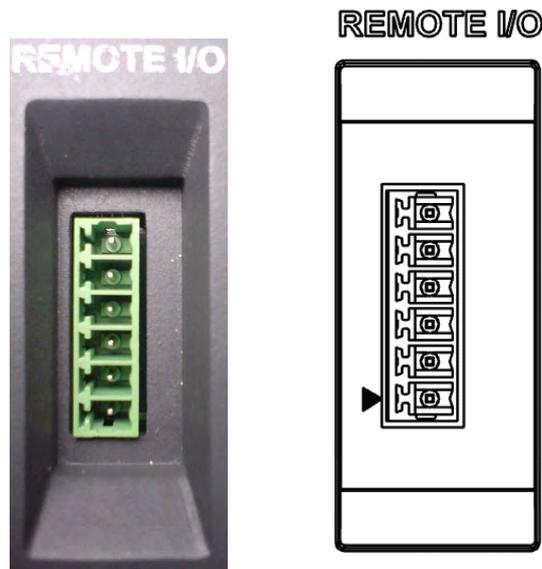
REMOTE I/O	
Pin No	Function
PIN 1	SHIELD
PIN 2	GND
PIN 3	RX+
PIN 4	RX-
PIN 5	TX-
PIN 6	TX+

Wiring description

6-pin connector at NC300 wiring end	REMOTE I/O module	Connector picture
SHIELD (1) ———— (1) SHIELD		
GND (2) ———— (2) GND		
RX+ (3) ———— (3) TX+		
RX- (4) ———— (4) TX-		
TX- (5) ———— (5) RX-		
TX+ (6) ———— (6) RX+		Top view
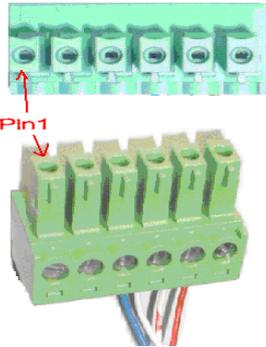
3.7 Wiring for DMCNET Communication Terminal Signal

DMCNET connector terminal layout

The NC300 series controller and servo system employ Delta's next generation high speed communication network DMCNET with instant and backup communication functionality. See the table below for its connectors:

Pin No	Signal name	Function description	Connector illustration
1,	DMCNET_1A	DMCNET Channel 1 bus line (+)	DMCNET
2,	DMCNET_1B	DMCNET Channel 1 bus line (-)	
3,	DMCNET_2A	DMCNET Channel 2 bus line (+)	
4,	-	Reserved	
5,	-	Reserved	
6,	DMCNET_2B	DMCNET Channel 2 bus line (-)	Pin8 Pin1
7,	-	Reserved	
8,	-	Reserved	

Wiring description

GMC-A wiring end 8-pin DMCNET connector (RJ45)	Motor servo wiring end	Connector end illustration
Orange white (1) ———————— (1) Orange white		
Orange (2) ———————— (2) Orange		
Green white (3) ———————— (3) Green white		8 7 6 5 4 3 2 1
Blue (4) ———————— (4) Blue		
Blue white (5) ———————— (5) Blue white		
Green (6) ———————— (6) Green		
Brown white (7) ———————— (7) Brown white		
Brown (8) ———————— (8) Brown		Top view

3.8 Wiring for Ethernet Communication Terminal Signal

Ethernet connector terminal layout

The NC300 series controller reserves Ethernet channel for communication with PC or network. See the figure below for the wiring pins:
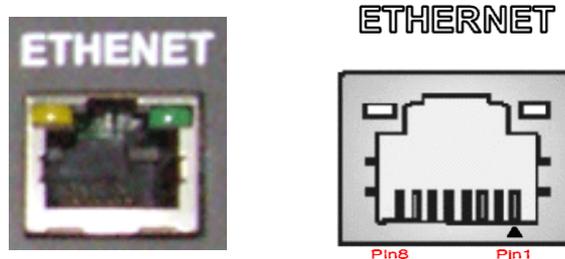
Wiring description

8-pin Ethernet connector (RJ45) at the NC300 wiring end	Wiring end for hub	Connector illustration
Orange white (1) ———————— (1) Orange white		
Orange (2) ———————— (2) Orange		
Green white (3) ———————— (3) Green white		
Blue (4) ———————— (4) Blue		
Blue white (5) ———————— (5) Blue white		
Green (6) ———————— (6) Green		
Brown white (7) ———————— (7) Brown white		
Brown (8) ———————— (8) Brown		Top view

3.9 Wiring for RS-485 Communication Terminal Signal

RS-485 terminal layout

The NC300 series controller features the RS-485 channel. See the picture below for its pins:
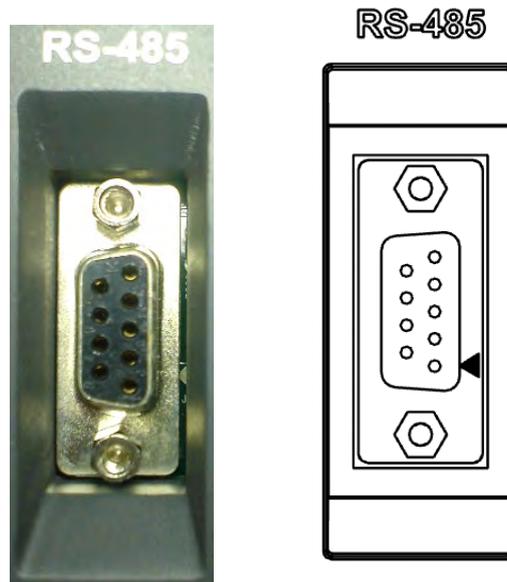
Wiring diagram

9-pin D-SUB male (RS-485) at the NC300 wiring end	Wiring end of other devices	Controller wiring end illustration
RS485_D+ (1) ———————— RS485_D+ RS485_D- (6) ———————— RS485_D-		 Top view

3.10   Optical Coupler Terminal Block Module NC-TBM-T1616

NC-TBM-T1616 terminal layout

The optical coupler terminal block module (IO: 16/16) can be used at On Board I/O module 1 (16/16 DI/DO in range of X0~X15 and Y0~Y15) and On Board I/O module 2 (12/12 DI/DO in range of X16~X27, Y16~Y27). Module 2 of this version supports 12 pairs of I/O. See below for wiring pins:
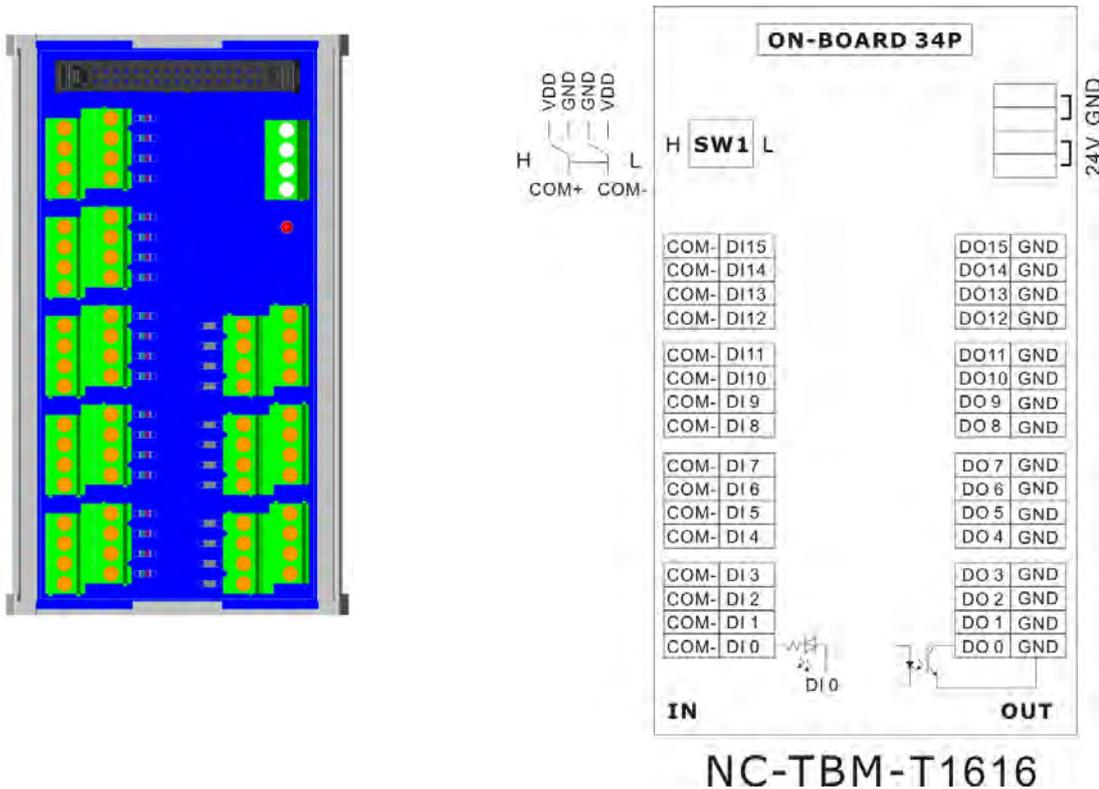
3.11   Relay Terminal Block Module NC-TBM-R1616

NC-TBM-R1616 terminal layout

The relay terminal block module (IO: 16/16) can be used at On Board I/O module 1 (16/16 DI/DO in range of X0~X15 and Y0~Y15) and On Board I/O module 2 (12/12 DI/DO in range of X16~X27, Y16~Y27). Module 2 of this version supports 12 pairs of I/O. See below for the wiring pins:

3.12 Optical Coupler Remote I/O Block Module NC-EIO-T3232

NC-EIO-T3232 terminal layout

The optical coupler remote I/O block module provides NC300 with a remote I/O connection in RS422 communication protocol. There are station options on board: starting with the first station of (X256, Y256), every additional station adds another 32 points. Users can cascade up to 8 modules for up to 256 points for each I/O. See the figure below for communication wiring pins:

NC-EIO-T3232

3.13   Relay Remote I/O Block Module NC-EIO-R3216

NC-EIO-R3216 terminal layout

The relay remote I/O block module provides NC300 with a remote I/O connection in RS422 communication protocol. There are station options on board: starting with the first station of (X256, Y256), every additional station adds another 32 points. Module of this version supports 32 points for DI, 16 points for DO. The rest of 16 points is unable to use and every additional station adds another 32 points for Y. See the figure below for their communication wiring pins:

NC-EIO-R3216

3.14 Input Description of I/O Panel

The terminal indication of COM+ and COM- in the diagram does not represent the actual direction and polarity of the current. COM- is the power output terminal, which supplies the power to the external switch. It is prohibited to connect the power of DC24V or 0V. It can select PNP or NPN as the external input signal through the switch H/L. However, both cannot be mixed with each other.

The switch description of NPN and PNP
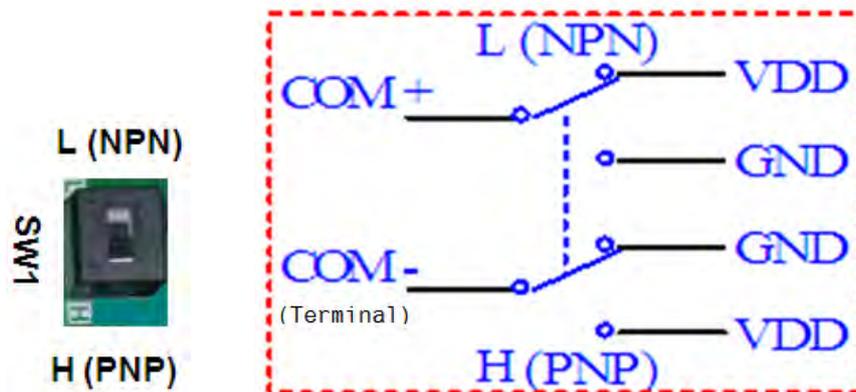
The wiring example of the bottom and mechanical switch
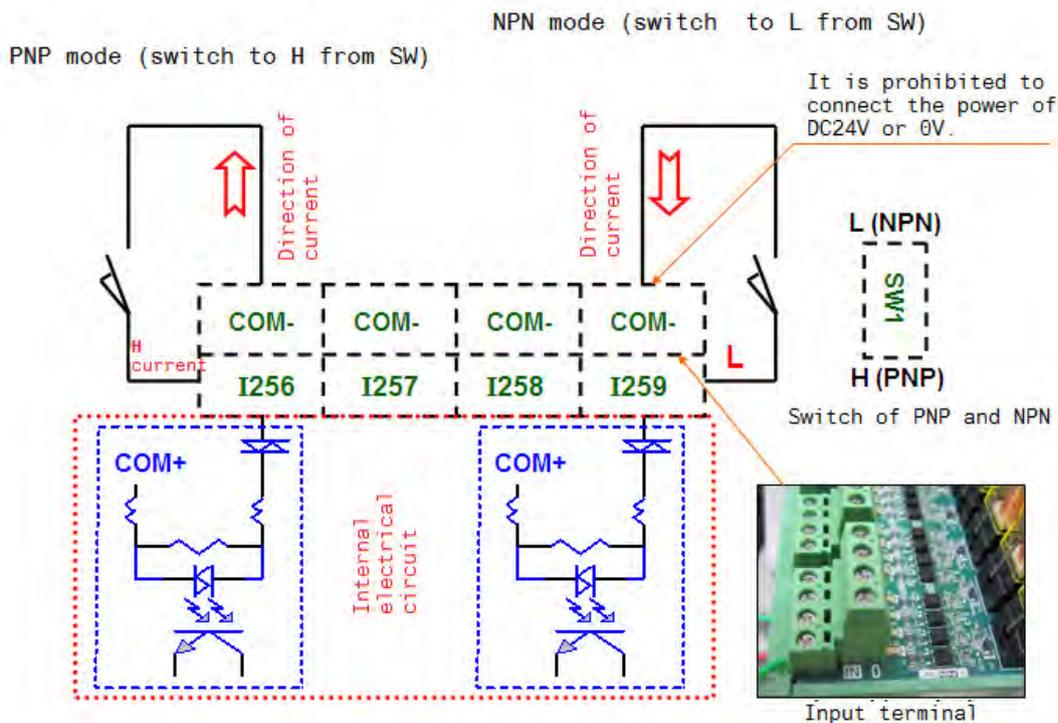
The proximity switch example of NPN 2 wire system

NPN 2 wire system
proximity switch

brown

blue

L (NPN) mode

It is prohibited to
connect the power
of DC24V or 0V.

Direction
of current

L current

COM-	COM-	COM-	COM-
I256	I257	I258	I259

Internal electrical
circuit

COM+

L (NPN)

SW1

H (PNP)

Switch of NPN and PNP

Input terminal
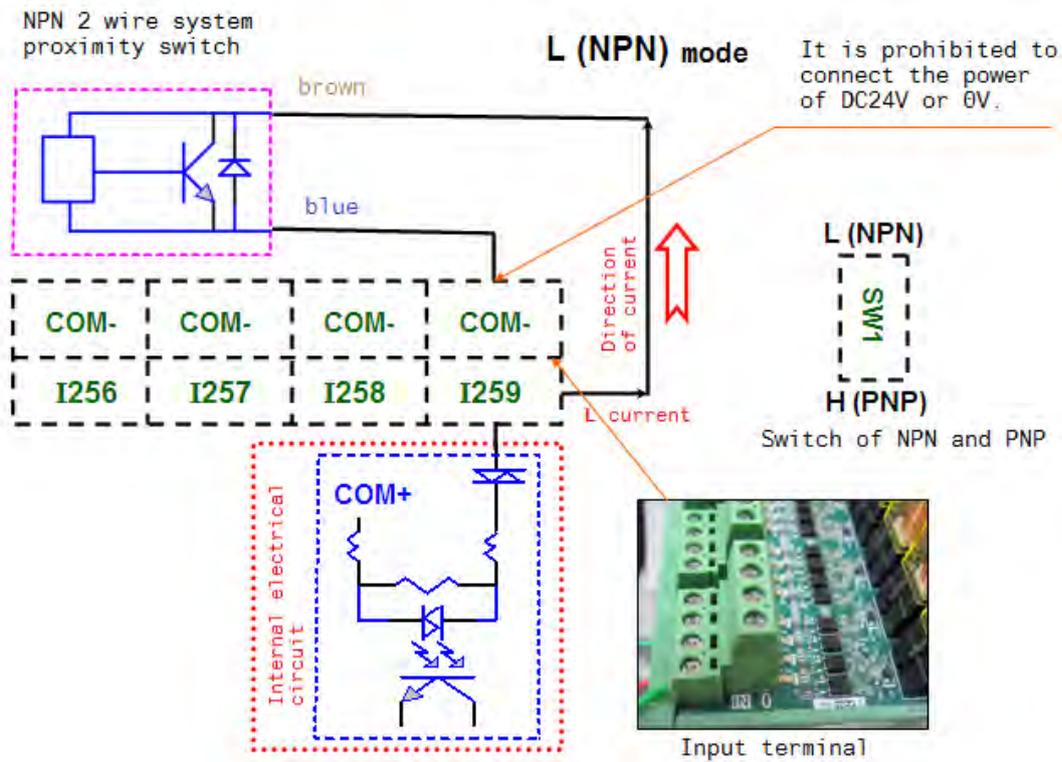
The proximity switch example of PNP 2 wire system

PNP 2 wire system
proximity switch

Blue

Brown

H (PNP) mode

It is prohibited to
connect the power of
DC24V or 0V.

Direction
of current

H current

COM-	COM-	COM-	COM-
I256	I257	I258	I259

Internal electrical
circuit

COM+

L (NPN)

SW1

H (PNP)

Switch of NPN and PNP

Input terminal
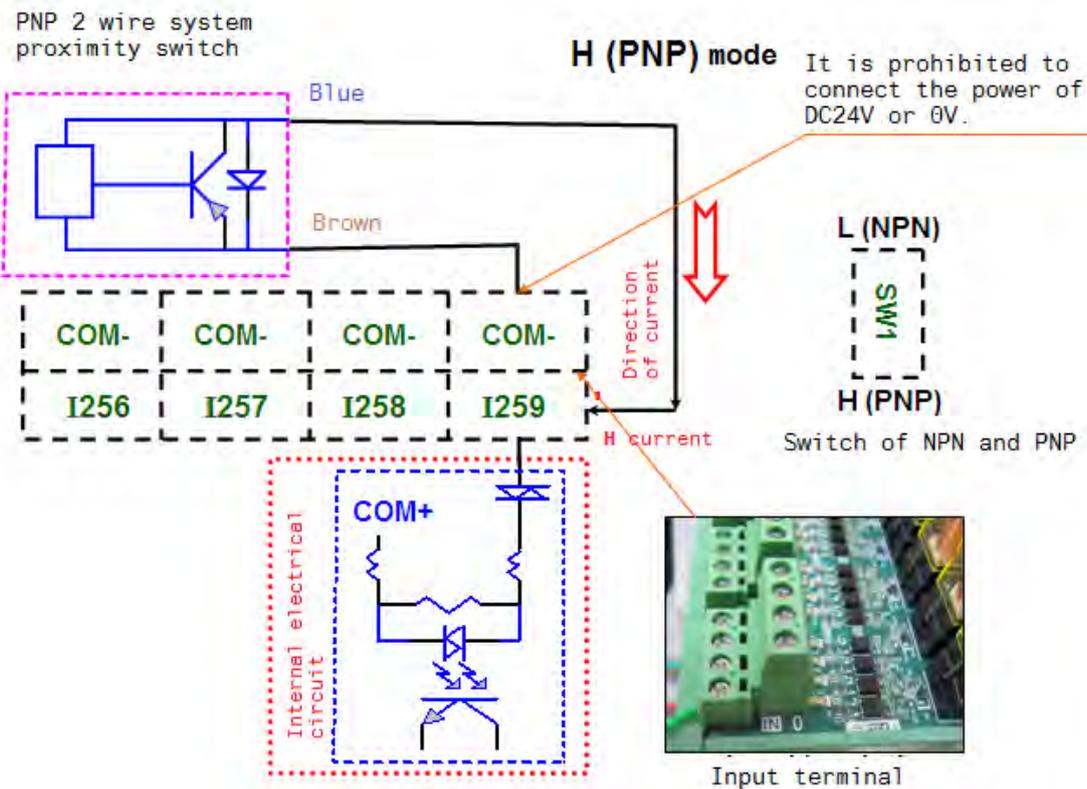
The proximity switch of NPN and PNP 3 wire system

Input terminal
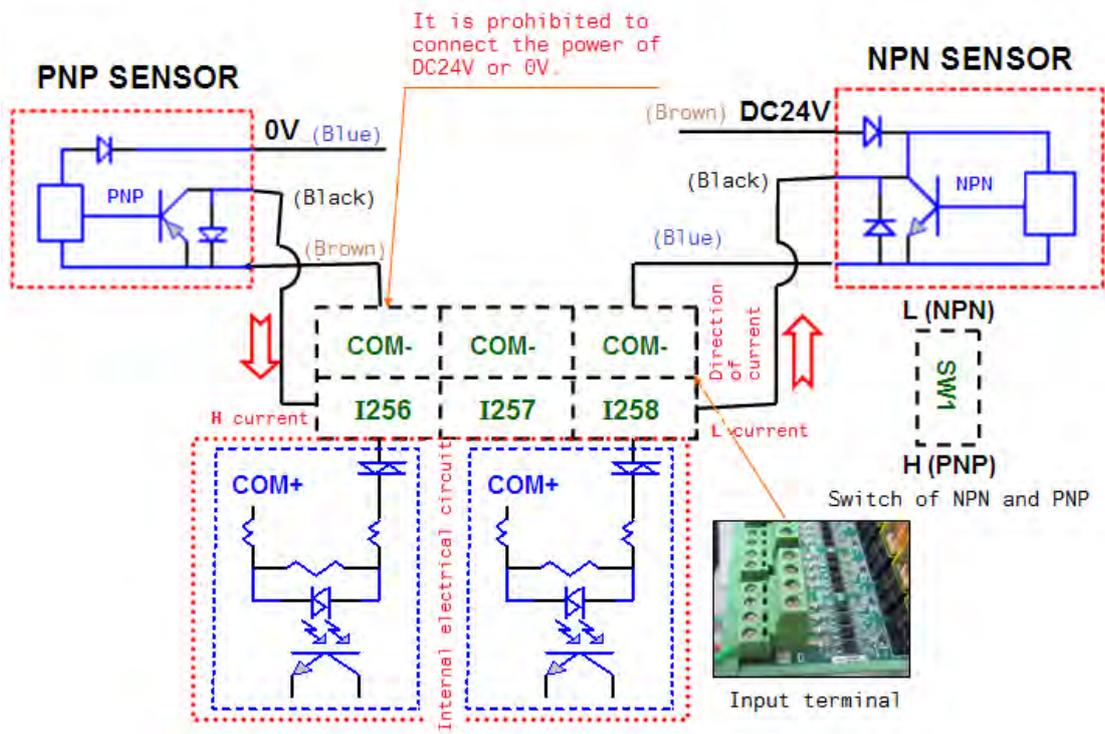
3.15 TBM-P5656 input description

In order to flexibly arrange P5656, four box headers are adopted for going with the secondary panel from other brands and our own controller. Overall, 14 sets of DI and DO (56 points in total) are offered for each box header for internal output control.

- **Supports 56IN/56OUT**
- **Part No.**
  NC-TBM-P5656
- **Size:**
  Length 163.25mm x Width 120.8mm x Total Height 53.9mm

NC-TBM-P5656 Layout
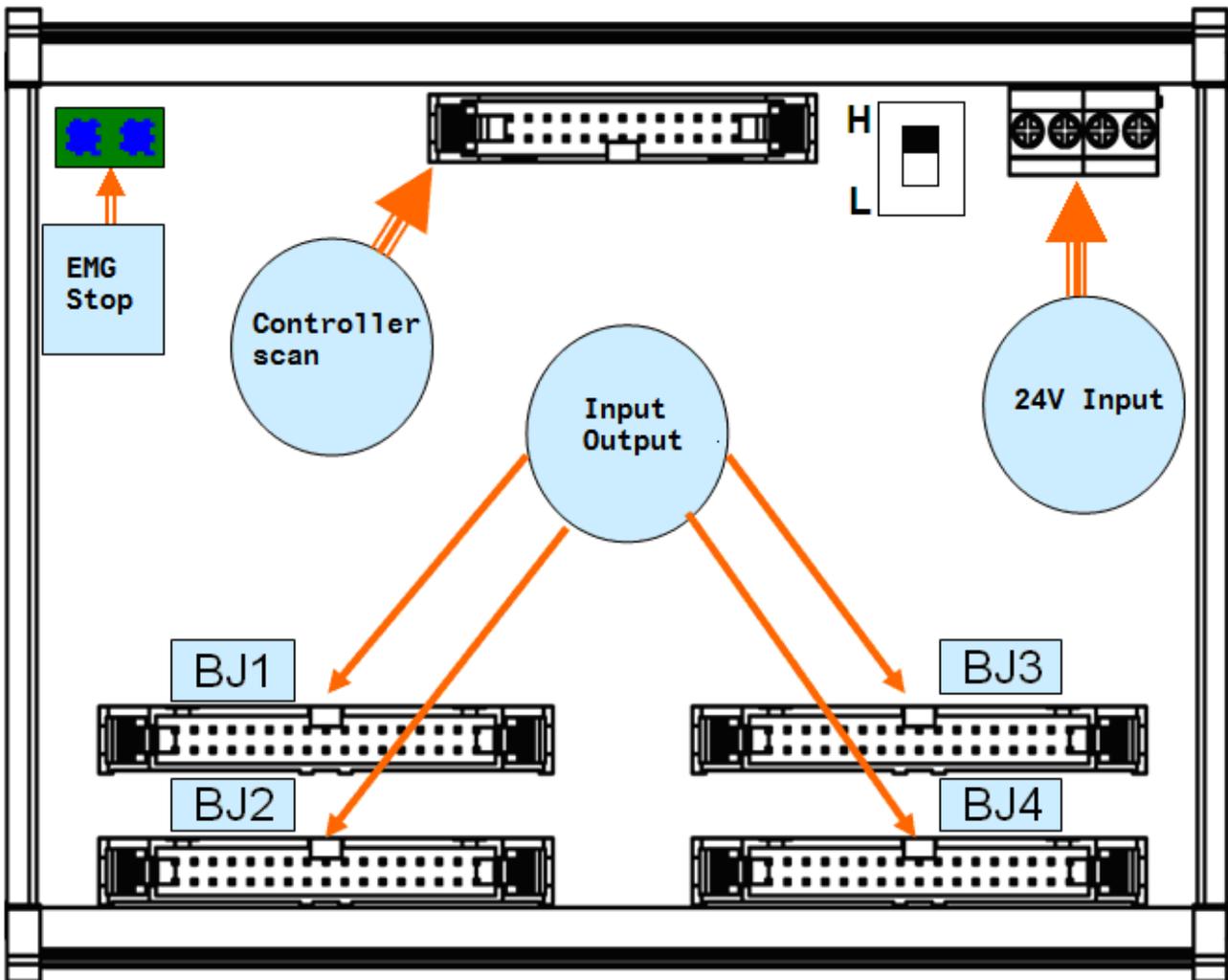
It applied to DC24V power and the controller scan is 26 pin flat cable (See product accessories). Emergency stop applies the dry contact (EMG contact will be enabled when the circuit is opened.).   And the dip switch determines the DI direction.

BJ1/BJ2/BJ3/BJ4 Terminal Block Layout

56 DI and DO corresponds to X64~X119 and Y64~Y119 respectively. Following is the pin diagram.
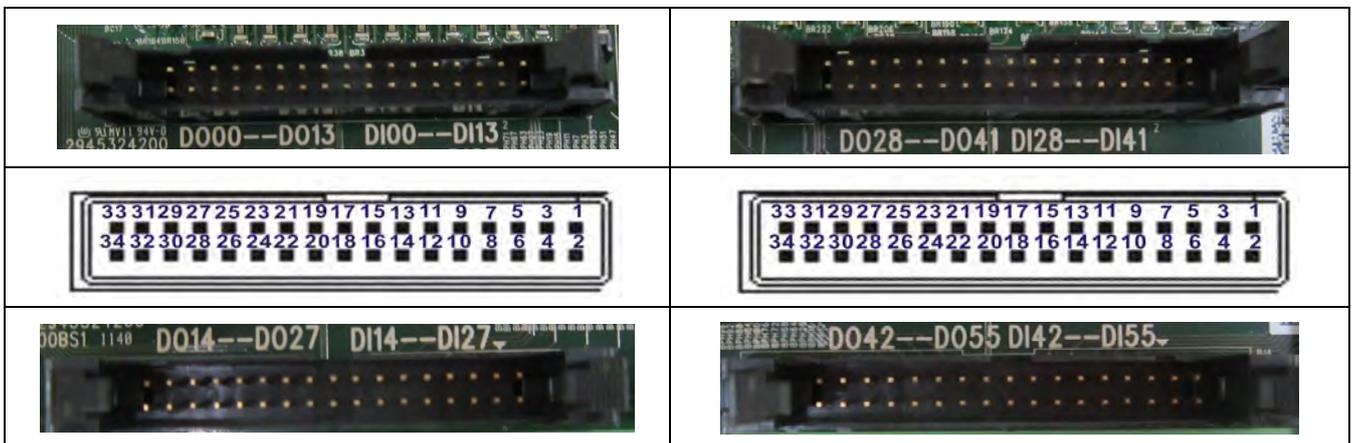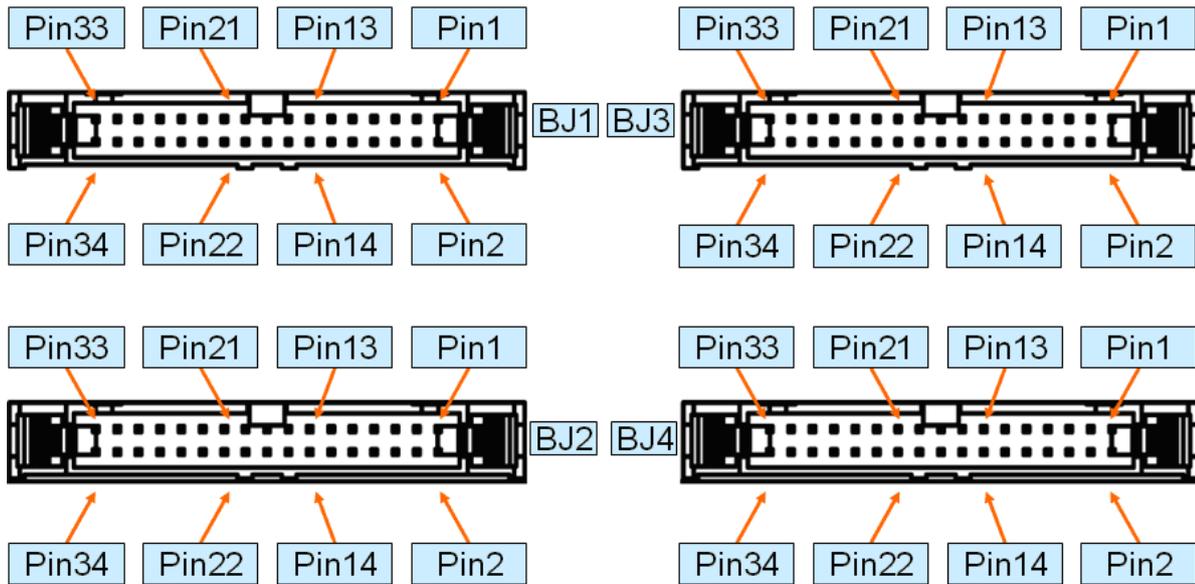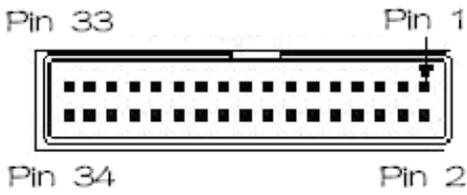
BJ 1 (X64~X77/Y64~Y77)			
PIN 1	X65	PIN 2	X65
PIN 3	X66	PIN 4	X67
PIN 5	X68	PIN 6	X69
PIN 7	X70	PIN 8	X71
PIN 9	X72	PIN 10	X73
PIN 11	X74	PIN 12	X75
PIN 13	X76	PIN 14	X77
PIN 15	+24V (Power)	PIN 16	+24V (Power)
PIN 17	NC	PIN 18	NC
PIN 19	GND	PIN 20	GND
PIN 21	Y64	PIN 22	Y65
PIN 23	Y66	PIN 24	Y67
PIN 25	Y68	PIN 26	Y69
PIN 27	Y70	PIN 28	Y71
PIN 29	Y72	PIN 30	Y73
PIN 31	Y74	PIN 32	Y75
PIN 33	Y76	PIN 34	Y77
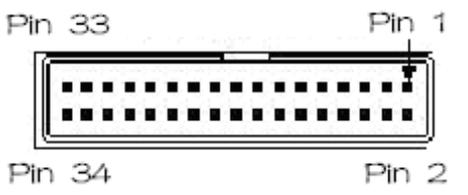
BJ 2 (X78~X91/Y78~Y91)			
PIN 1	X78	PIN 2	X79
PIN 3	X80	PIN 4	X81
PIN 5	X82	PIN 6	X83
PIN 7	X84	PIN 8	X85
PIN 9	X86	PIN 10	X87
PIN 11	X88	PIN 12	X89
PIN 13	X90	PIN 14	X91
PIN 15	+24V (Power)	PIN 16	+24V (Power)
PIN 17	NC	PIN 18	NC
PIN 19	GND	PIN 20	GND
PIN 21	Y78	PIN 22	Y79
PIN 23	Y80	PIN 24	Y81
PIN 25	Y82	PIN 26	Y83
PIN 27	Y84	PIN 28	Y85
PIN 29	Y86	PIN 30	Y87
PIN 31	Y88	PIN 32	Y89
PIN 33	Y90	PIN 34	91
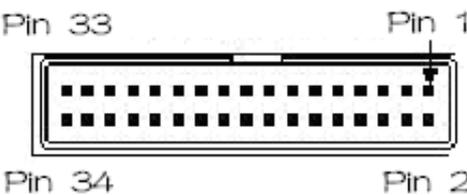
BJ 3 (X92~X105/Y92~Y105)			
PIN 1	X92	PIN 2	X93
PIN 3	X94	PIN 4	X95
PIN 5	X96	PIN 6	X97
PIN 7	X98	PIN 8	X99
PIN 9	X100	PIN 10	X101
PIN 11	X102	PIN 12	X103
PIN 13	X104	PIN 14	X105
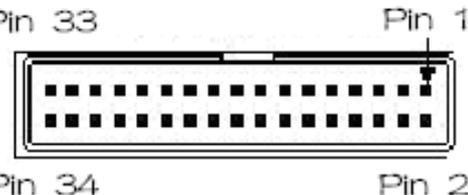
BJ 4 (X106~X77/Y64~Y77)			
PIN 1	X106	PIN 2	X107
PIN 3	X108	PIN 4	X109
PIN 5	X110	PIN 6	X111
PIN 7	X112	PIN 8	X113
PIN 9	X114	PIN 10	X115
PIN 11	X116	PIN 12	X117
PIN 13	X118	PIN 14	X119

PIN 15	+24V (Power)	PIN 16	+24V (Power)	PIN 15	+24V (Power)	PIN 16	+24V (Power)
PIN 17	NC	PIN 18	NC	PIN 17	NC	PIN 18	NC
PIN 19	GND	PIN 20	GND	PIN 19	GND	PIN 20	GND
PIN 21	Y92	PIN 22	Y93	PIN 21	Y106	PIN 22	Y107
PIN 23	Y94	PIN 24	Y95	PIN 23	Y108	PIN 24	Y109
PIN 25	Y96	PIN 26	Y97	PIN 25	Y110	PIN 26	Y111
PIN 27	Y98	PIN 28	Y99	PIN 27	Y112	PIN 28	Y113
PIN 29	Y100	PIN 30	Y101	PIN 29	Y114	PIN 30	Y115
PIN 31	Y102	PIN 32	Y103	PIN 31	Y116	PIN 32	Y117
PIN 33	Y104	PIN 34	Y105	PIN 33	Y118	PIN 34	119

DO driven load (allowable current: under 40mA; surge current: under 100mA)

DO wiring, external power and general load

DO (BJ1/BJ2/BJ3/BJ4)
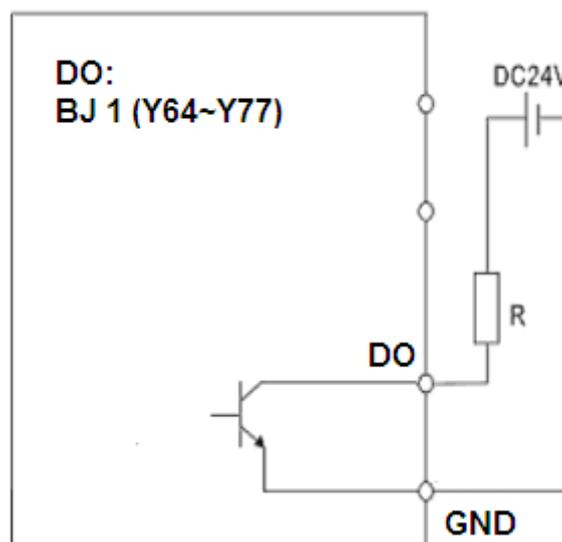
DI wiring, external power

Use voltage as the input signal (allowable current: 8~25mA; surge current: under 40mA)

NPN (SINK mode)   PNP (SOURCE mode)
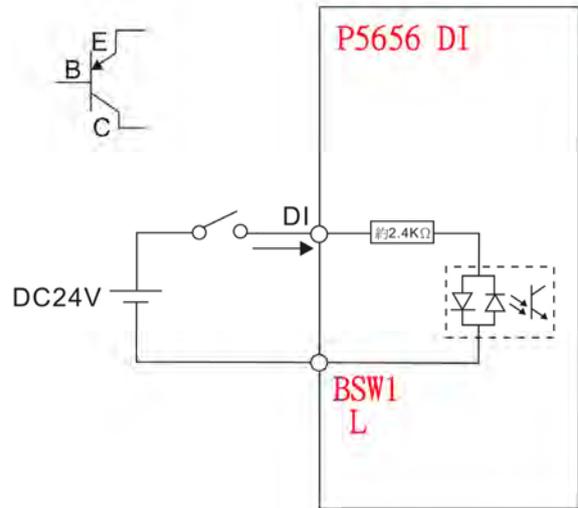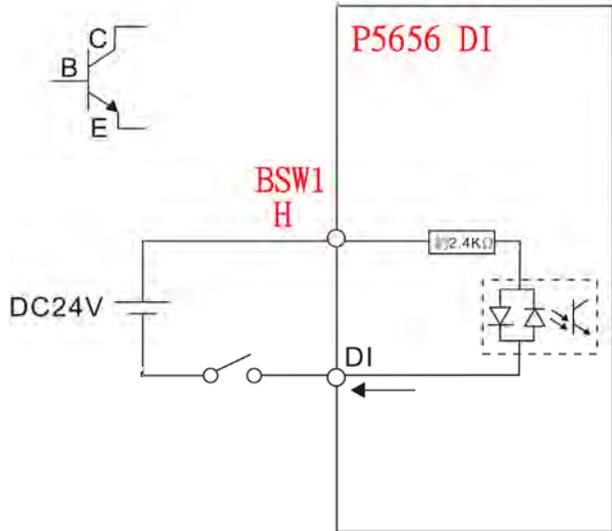
3.16   Definitions of the Secondary Control Panel I/O

NC300-MI-A (all-in-one model)
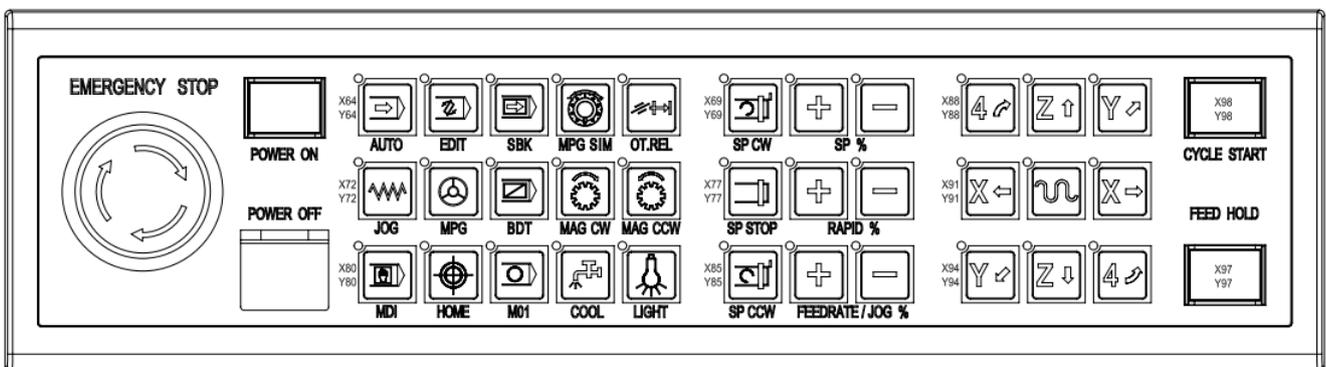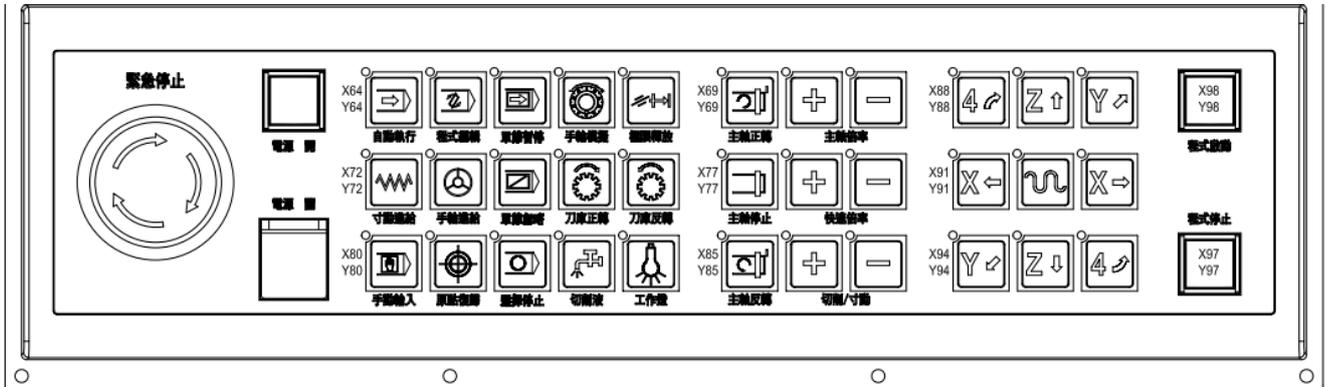
NC-PAN-300AM-F (P)

NC-PAN-300AM-F(P)E

Terminal wiring

Terminal block: The indicator is DC24V

Indicator of power ON (ONL+, ONL-) and OFF (OFFL+, OFFL-); Frequently open contact (ONA1, ONA2) and frequently close contact (OFFB1, OFFB2)
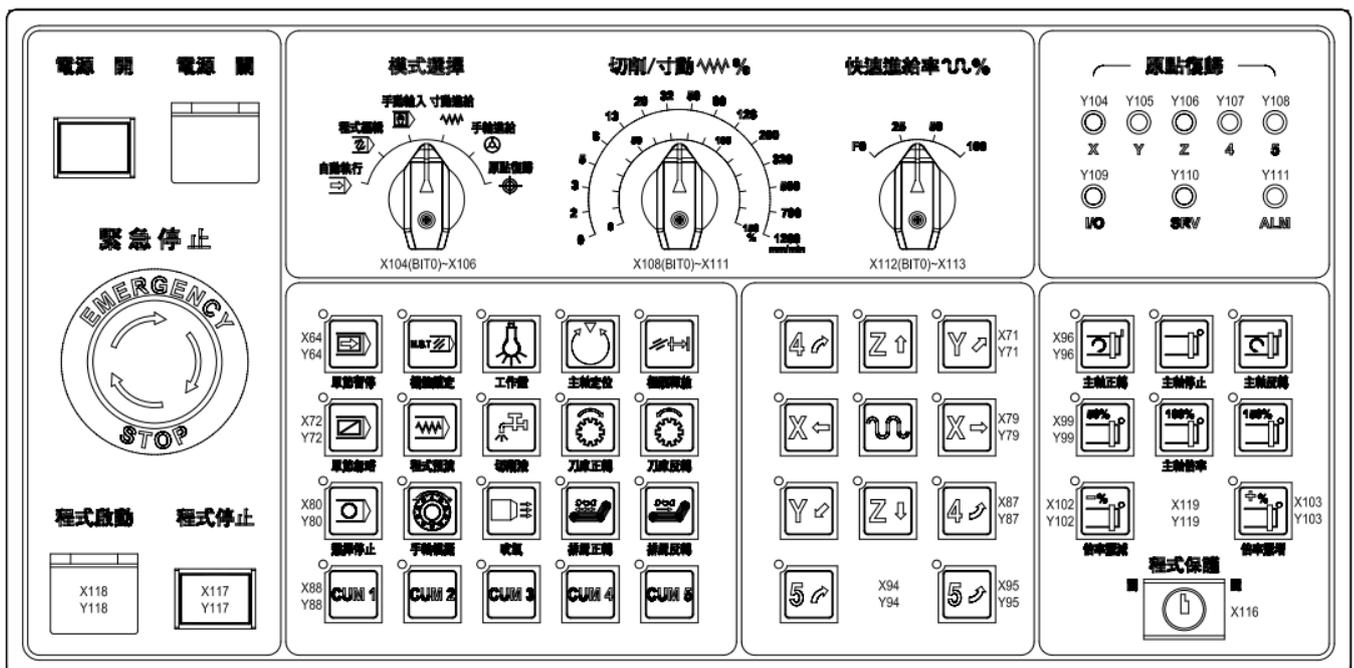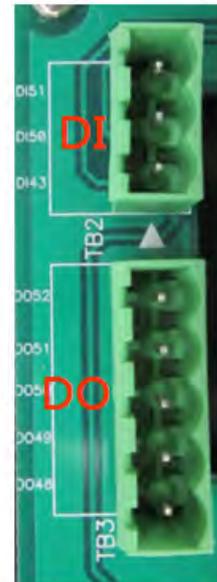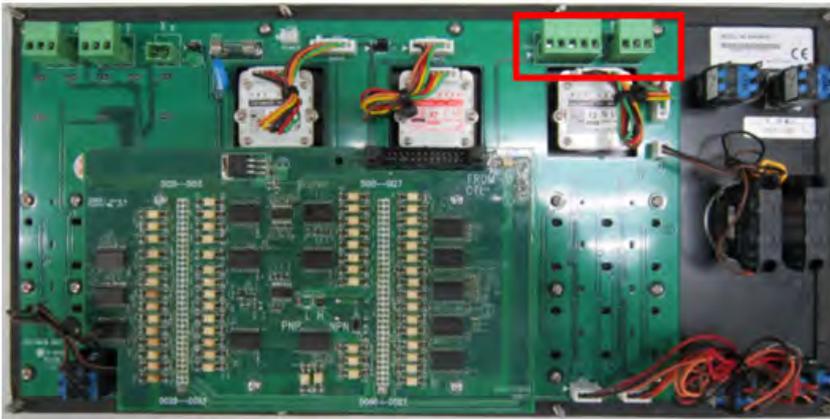
NC-PAN-300AM-P

TB2(DI) :
DI43→X107
DI50→X114
DI51→X115

TB3(DO) :
DO48→Y112
DO49→Y113
DO50→Y114
DO51→Y115
DO52→Y116

NC-PAN-300AM-P
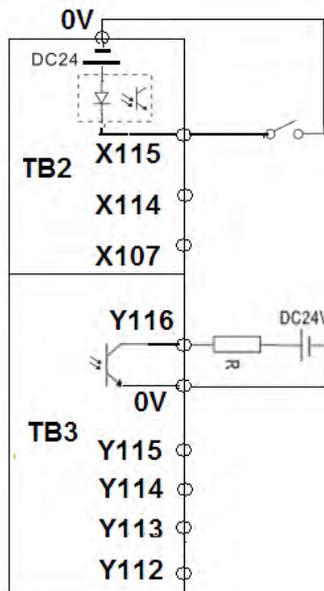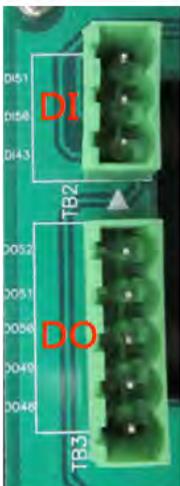
DI input signal (allowable current: 8~25mA; surge current: under 40mA)

DO driven load (allowable current: under 40mA; surge current: under 100mA)

NC-PAN-311AM-F (P)
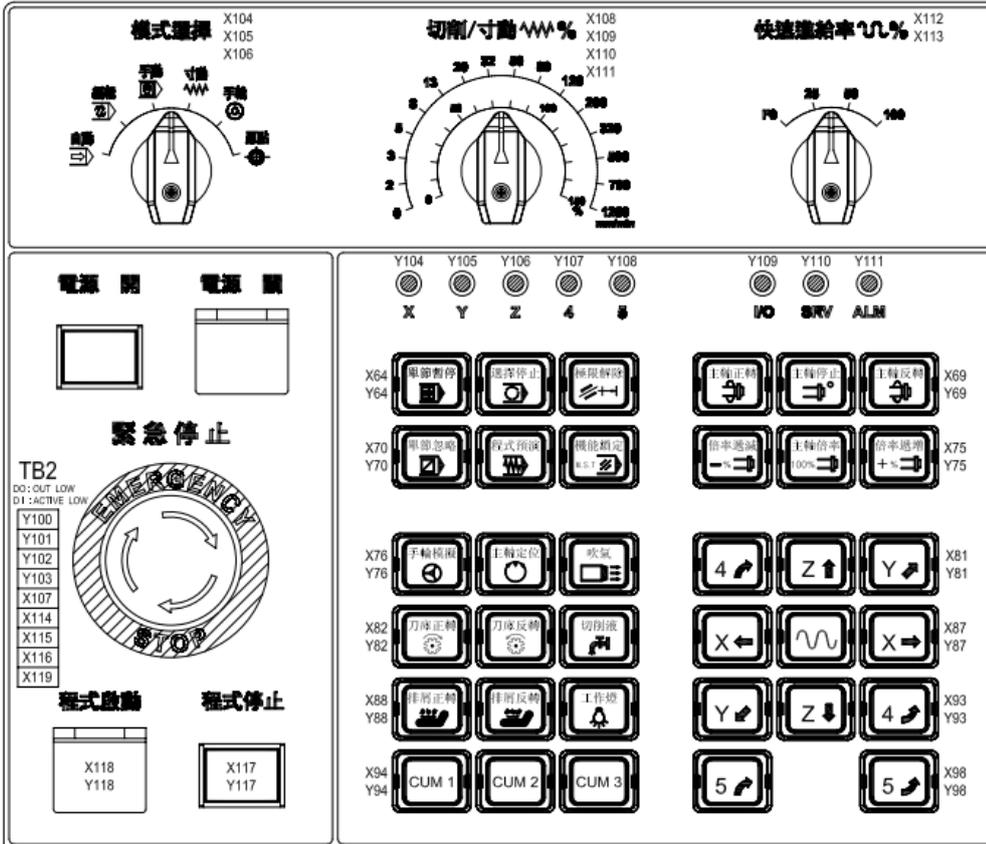
NC-PAN-311AM-F(P)E
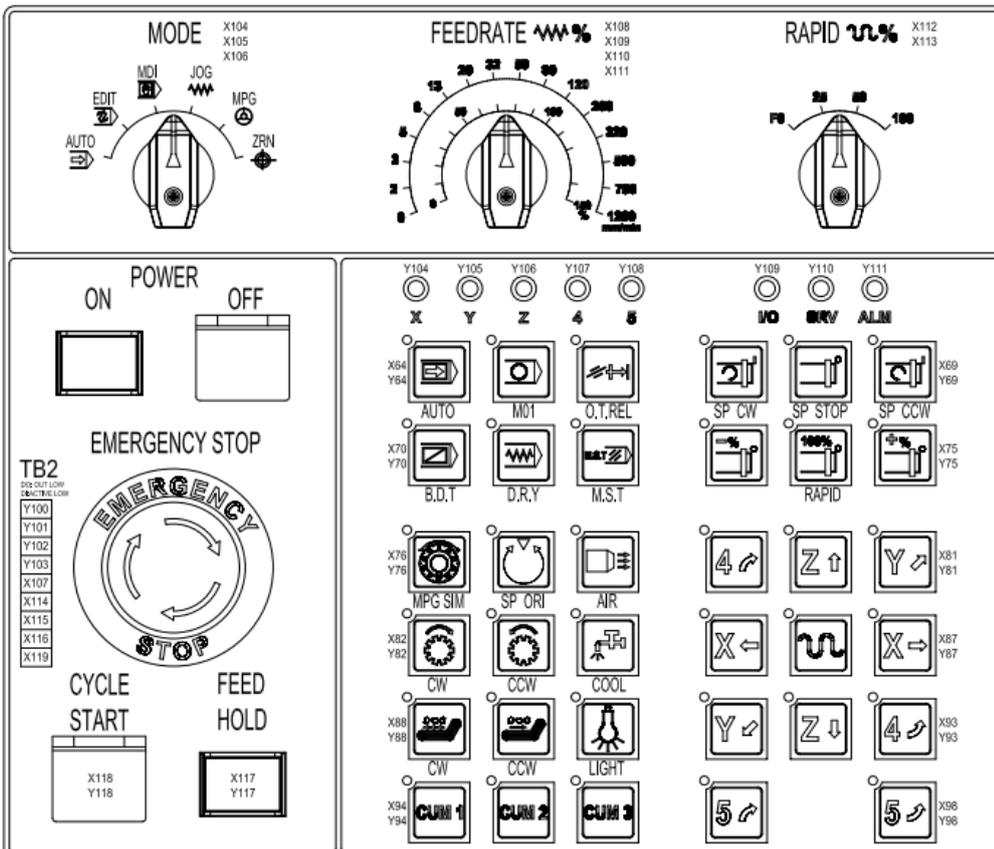
Terminal wiring
NC-PAN-311AM-P
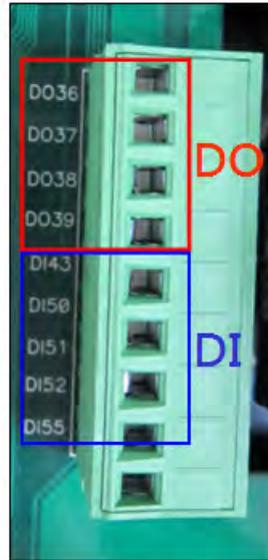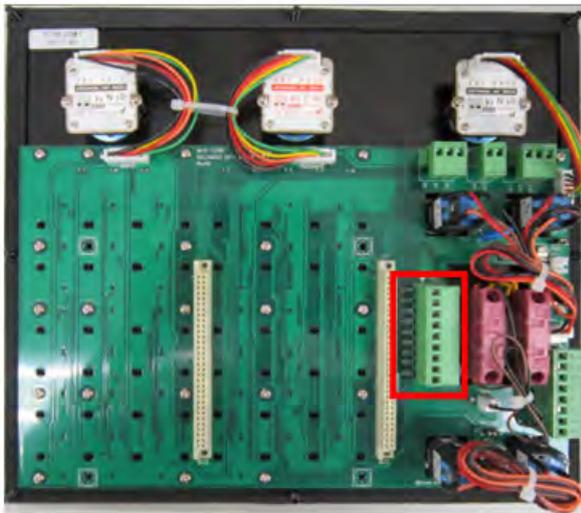
TB2 :
DO36→Y100
DO37→Y101
DO38→Y102
DO39→Y103

DI43→X107
DI50→X114
DI51→X115
DI52→X116
DI55→X119

NC-PAN-311AM-P
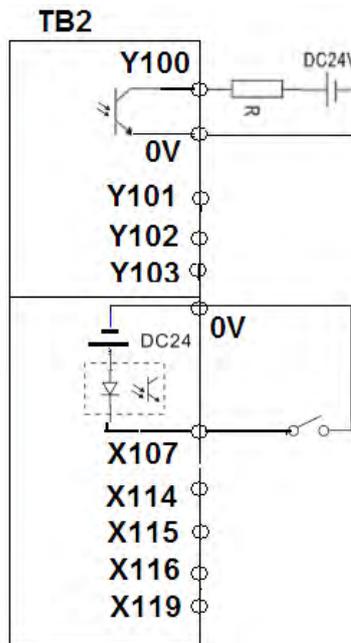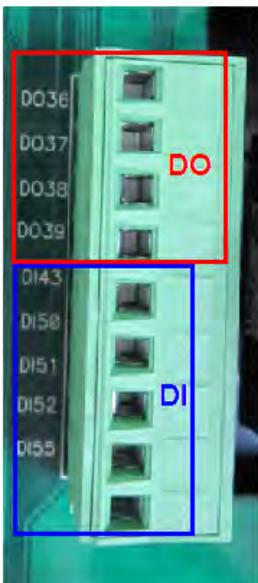
DO general load (allowable current: under 40mA; surge current: under 100mA)

DI input signal (allowable current: 8~25mA; surge current: under 40mA)

Electrical attributes:

Model	NC300A
Working environment	10% ~ 95% RH (0 ~ +55°C)
Storage environment	10% ~ 95% RH (-20~ +60°C)
Cooling	Natural cooling
Safety Certification (Panel waterproof level)	IP65／NEMA4／CE, UL [Note 4]
Working voltage [Note 5]	DC +24V (-10% ~ +15%) (embedded isolated circuit [Note 3])
Insulation endurance	Between DC24 and FG terminals: AC500V, 1 minute
Power consumption [Note 5]	24V 0.6A 15W
Backup battery for memory	3V lithium battery CR2032 × 1
Life span of backup battery	Varies with ambient temperature and working conditions; about three years in 25°C room temperature
Vibration/collision resistance	IEC61131-2 specifications: Intermittent vibration: 5Hz-9Hz 3.5mm, 9Hz-150Hz 1G Continuous vibration: 5Hz-9Hz 1.75mm, 9Hz-150Hz 0.5G 10 times in direction X, Y, and Z respectively
Dimensions (W) x (H) x (D) mm	400 x 309 x 129
Opening dimensions (W) x (H) mm	378 x 289
Weight	Around 3700g

NC accessories			TBM T16/16	TBM R1616	EIO T3232	EIO R3216
Input voltage			24V DC			
Voltage fluctuation range			DC: 21.6 ~ 26.4V			
Cooling			Natural cooling			
Digital I/O	DI	Type	16 points (photo coupler insulation) sink/source type	16 points (photo coupler insulation) sink/source type	32 points (photo coupler insulation) sink/source type	32 points (photo coupler insulation) sink/source type
		Input signal voltage	24V DC (+/-10%)	24V DC (+/-10%)	24V DC (+/-10%)	24V DC (+/-10%)
	DO	Type	16 points (photo coupler insulation)	16 points (Relay)	32 points (photo coupler insulation)	16 points (Relay)
		Working voltage	24V DC	< 250VAC, 30VDC	24V DC	< 250VAC, 30VDC
		Separation type	Photo coupler insulation	Electromagnetic insulation	Photo coupler insulation	Electromagnetic insulation
		current	< 40mA	< 16A	< 40mA	< 16A
Electrical transmission interface			CABLE		RS-422	
Environment requirements	Installation location		Indoor (away from direct sun light), without corrosive mist (free of fumes, flammable gas and dust)			
	Elevation		Below 1000M			
	Atmospheric pressure		86kPa ~ 106kPa			
	Ambient temperature		0℃ ~ 55℃ (Please add forced ventilation in case the ambient temperature exceeds given specifications)			
	Storage temperature		-20℃ ~ 65℃			
	Humidity		0 ~ 90% RH (without condensation)			

Appearance and dimensions
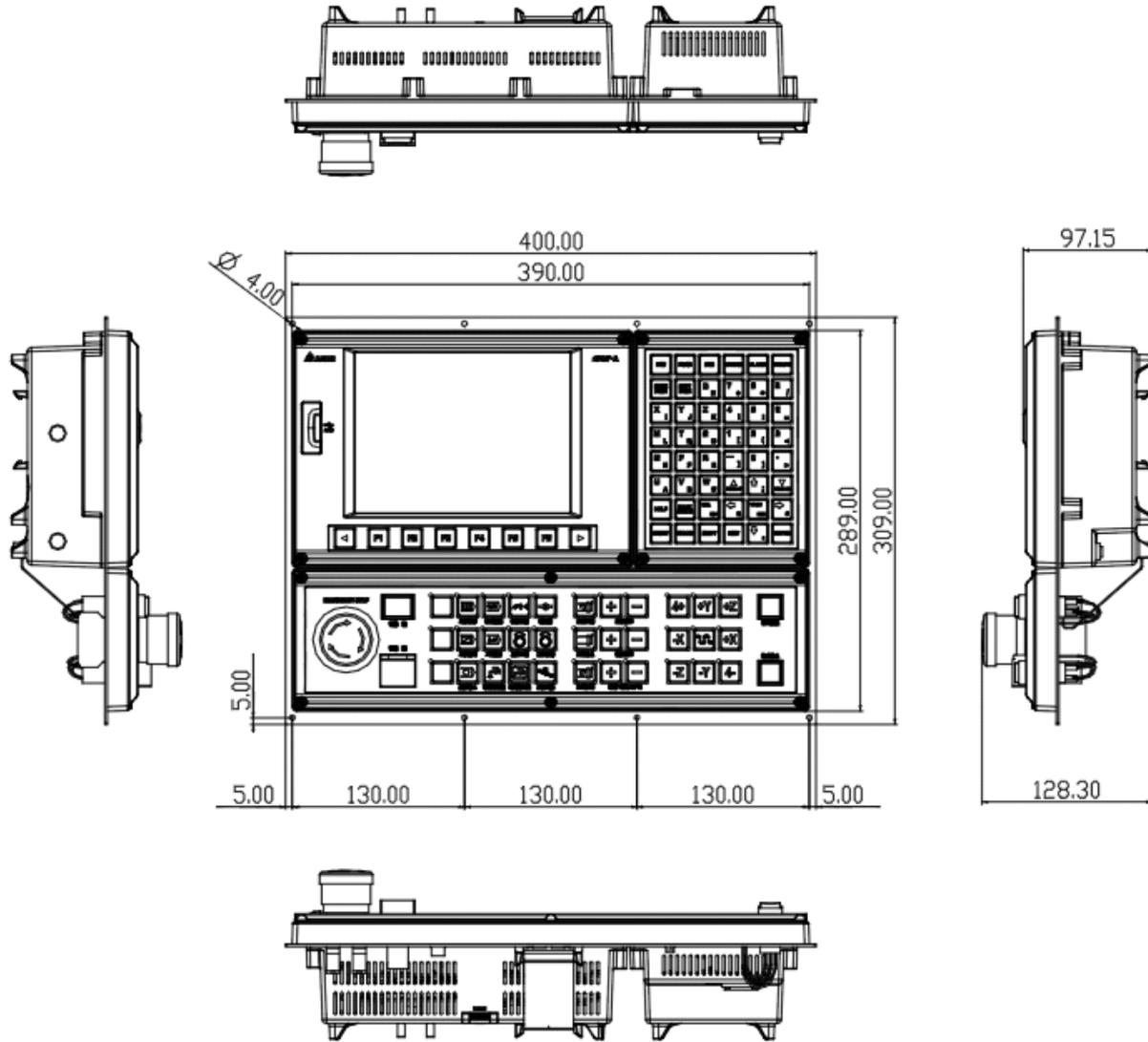
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Chapter 4: Summary of User Parameters

4.1 Overview

This document summarizes all information on parameters accessible to users including: parameter ID, Chinese and English name, description, default values, valid value range, and remarks. Later parameter pages of shall be made in accordance with this document.

(★)   Parameter values take effect only after machine is restarted
(●)   Cannot reset to default values. Changes can only be made manually
(▲)   Parameter values take effect only by pressing the Reset key

4.2 Parameter information

There are two kinds of user parameters: NC and system. The NC parameters are for CNC machining with types of operation, tool magazine, machining, spindle, mechanical, home and compensation. The system parameters are those referred by system interface or operations including: system parameters, MLC setup, and graphic parameters. See the sections below for information on each parameter category.

4.2.1 Operation Parameters

No.	Parameter Name		Value
3	GO9010	R	0
4	GO9011	R	0
5	GO9012	R	0
6	GO9013	R	0
7	GO9014	R	0
8	GO9015	R	0
9	GO9016	R	0
10	GO9017	R	0
11	GO9018	R	0
12	GO9019	R	0
13	MO9020	R	6
14	MO9021	R	0
15	MO9022	R	0
16	MO9023	R	0
17	MO9024	R	0

PARAMETER(Operation)   117.NC   N1   SFT

Range: 0 ~ 1000

JOG   Ch 0   1/6

OPERATE   MAGA   PROCESS   SPINDLE   MACHINE   HOME

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
3	GO9010 G code calls macro O9010	Set G code calling macro O9010, e.g. if GO9010 is set to 1 then statement G01 in program calls to enter O9010. 0: disable the function of calling macros		0	0~1000	1	
4	GO9011 G code calls macro O9011	Set G code calling macro O9011. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
5	GO9012 G code calls macro O9012	Set G code calling macro O9012. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
6	GO9013 G code calls macro O9013	Set G code calling macro O9013. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	

7	GO9014 G code calls macro O9014	Set G code calling macro O9014. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
8	GO9015 G code calls macro O9015	Set G code calling macro O9015. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
9	GO9016 G code calls macro O9016	Set G code calling macro O9016. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
10	GO9017 G code calls macro O9017	Set G code calling macro O9017. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
11	GO9018 G code calls macro O9018	Set G code calling macro O9018. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
12	GO9019 G code calls macro O9019	Set G code calling macro O9019. Its function is the same as GO9010. 0: disable the function of calling macros		0	0~1000	1	
13	MO9020 M code calls macro O9020	Set M code calling macro O9020, e.g. if MO9020 is set to 3 then statement M03 in program calls to enter O9020. 0: disable the function of calling macros		0	0~1000	1	
14	MO9021 M code calls macro O9021	Set M code calling macro O9021. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
15	MO9022 M code calls macro O9022	Set M code calling macro O9022. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
16	MO9023 M code calls macro O9023	Set M code calling macro O9023. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
17	MO9024 M code calls macro O9024	Set M code calling macro O9024. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
18	MO9025 M code calls macro O9025	Set M code calling macro O9025. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	

19	MO9026 M code calls macro O9026	Set M code calling macro O9026. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
20	MO9027 M code calls macro O9027	Set M code calling macro O9027. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
21	MO9028 M code calls macro O9028	Set M code calling macro O9028. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
22	MO9029 M code calls macro O9029	Set M code calling macro O9029. Its function is the same as MO9020. 0: disable the function of calling macros		0	0~1000	1	
23	TO9000 Start up T code to call macro O9000	Set T code calling macro O9000, e.g. if TO9000 is set to 1 then statement Txx in program calls to enter O9000 0: disable the function of calling macros 1: Any T code will call macro		0	0~1	1	
24	RO9030 Start up breakpoint search to call O9030	Breakpoint search: Calls entering O9030 after the desired statement is found. 0 (Off): Continue machining from statement after the breakpoint found 1 (On): Execute program O9030 after breakpoint is found and resume machining after the breakpoint		0	0~1	1	
25	System DIO signal polarity settings	Set up system HIS 0/1 DI polarity 	Bit	Name	Range
-----	------	-------
0~1	HIS 0 (G31 interrupt) and HIS 1 settings Bit0: HIS 0b input Bit1: HIS 1 input 0: b contact open->H, close->L 1: a contact open->L, close->H	0~3			0	0 ~ 65535		
46	System utility settings	Set up system utility procedures 	Bit	Name	Range
-----	------	-------
5	High speed input point (G31) 1: Open G31 input point 0: Close	0~1
10	Ignore movement	0~1		1100	0~0xFFFF	1	

		command floating point 0: Do not ignore, i.e. 1 = 1µm 1: Ignore, 1 = 1mm					
		11	(Switch function is unavailable) G00 operation mode 0: Fast path feed 1: Fast axial feed	0~1			
47	MPG hand wheel gain	MPG filter gains for hand wheel effect adjustment. The larger the value is, the faster the system reacts and the more it vibrates.		0.0001	100	1~60000	1	
48	MPG hand wheel filter	MPG filter settings: 0: None Grade 1 2 3 4 5 6 Khz 312 10 5 2.5 1.6 1.2			0	0 ~ 6	1	
49	Servo axis output settings	Servo axis output connector setup 0: the fourth axis features limit and home signal 1: Set to ABC origin signal			0	0 ~ 1	1	
50	Show macro file	Bit Name Range 0 Show macro file O 0~1 1 Show G/M macro file 0~1			0	0 ~ 3	1	
350	Halt M code 1	Halt M code 1 (0: no setting)			0	0~1000	1	(★)
351	Halt M code 2	Halt M code 2 (0: no setting)			0	0~1000	1	(★)
352	Halt M code 3	Halt M code 3 (0: no setting)			0	0~1000	1	(★)
353	Halt M code 4	Halt M code 4 (0: no setting)			0	0~1000	1	(★)
354	Halt M code 5	Halt M code 5 (0: no setting)			0	0~1000	1	(★)
355	Halt M code 6	Halt M code 6 (0: no setting)			0	0~1000	1	(★)
356	Halt M code 7	Halt M code 7 (0: no setting)			0	0~1000	1	(★)
357	Halt M code 8	Halt M code 8 (0: no setting)			0	0~1000	1	(★)
358	Halt M code 9	Halt M code 9 (0: no setting)			0	0~1000	1	(★)
359	Halt M code 10	Halt M code 10 (0: no setting)			0	0~1000	1	(★)

360	Synchronous control direction	Synchronous control direction
		Bit0~5: Synchronous control X~C
		   0: same direction
		   1: different direction
		
		Bit Name Range
		0 Synchronous direction X 0~1
					0	0~0x3F	1	(★)

		1	Synchronous direction Y	0~1			
		2	Synchronous direction Z	0~1			
		3	Synchronous direction A	0~1			
		4	Synchronous direction B	0~1			
		5	Synchronous direction C	0~1			
361	Synchronous control X	Slave axis X follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
362	Synchronous control Y	Slave axis Y follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
363	Synchronous control Z	Slave axis Z follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
364	Synchronous control A	Slave axis A follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
365	Synchronous control B	Slave axis B follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
366	Synchronous control C	Slave axis C follows the master axis 0: close 1~6:X~C			0	0 ~ 6	1	(★)
371	Transfer control X	Axis X transfers the command of master axis and the master axis does not move at the moment. 0: close 1~6:X~C			0	1~6		
372	Transfer control Y	Axis Y transfers the command of master axis. 0: close 1~6:X~C			0	1~6		
373	Transfer control Z	Axis Z transfers the command of master axis. 0: close 1~6:X~C			0	1~6		
374	Transfer control A	Axis A transfers the command of master axis. 0: close 1~6:X~C			0	1~6		
375	Transfer control B	Axis B transfers the command of master axis. 0: close 1~6:X~C			0	1~6		
376	Transfer control C	Axis C transfers the command of master axis. 0: close 1~6:X~C			0	1~6		
2010	High speed input trigger settings	Bit / Name / Range — 0 HSI 0 trigger settings 0~1 — 1 HSI 1 trigger settings 0~1 — Set up upper edge (set to 0) counting for high speed input. Set up lower edge (set to 1) counting			0	0 ~ 65535	1	(★)
621	Maximum allowable speed	Set up maximum axial moving speed in unit of mm/min or inch/min		mm/min, inch/mi	5000	0 ~ 60000	1	(★)

			n rpm				
622	ACC / DEC time constant	Set up acceleration time for manual and homing operation	0.001 sec	50	0~10000	1	
623	S curve time constant	Set up S-curve time constant for manual and homing operation	0.001 sec	5	1~2000	1	
624	EMG axial DEC time	Deceleration time constant for axial emergency stop	0.001 sec	100	1 ~ 2000	1	★
643	Allowable following error	Beeps for any movement with follow-up error greater than this setting (CU: command unit)	CU	30000	1~32767	1	(☆)

4.2.2 Tool Magazine Parameters

Item	Name	Description			UOM	Default	Range	Length (word)	Remark
304	Tool magazine parameters setup	Tool magazine selection				0x4800	0~0xFFFF	1	
			Bit	Name	Range				
			14	Enable ATC (Automatic Tool Change) function	0~1				
				0: OFF					

		Bit	Name	Range					
			1: ON						
		9	Set up ATC number 0: tool magazine 0 1: tool magazine 1	0~1					
		11	ATC type 0: switching 1: non switching	0~1					
		12~13	Set up ATC searching mode 0: shortest length path 1: CW 2: CCW	0~2					
		15	Control type 0: MLC control 1: NC control	0~1					
336	Tool magazine database control	Bit	Name	Range		0x0800	0~65535	1	(★) (●)
		11	ATC type 0: Exchanger type (switching arm) 1: Non-exchanger type (tool tray)	0~1					
337	Tool magazine database control	Bit	Name	Range		1	0~3	1	
		0	Enable ATC 1 0: Disable 1: Enable	0~1					
		1	Enable ATC 2 0: Disable 1: Enable	0~1					
338	ATC station 1	Set up number of stations of tool magazine 1 tool number				10	2 ~ 255	1	(★) (●)
339	ATC 1 init number	Set up tool number after tool magazine 1 reset				1	1 ~ 100	1	
340	ATC 1 start number	Set up starting number of tool magazine 1				1	1 ~ 100	1	
341	ATC station 2	Set up number of stations of tool magazine 2 tool number				10	2 ~ 255	1	(★) (●)
342	ATC 2 init number	Set up tool number after tool magazine 2 reset				1	1 ~ 100	1	
343	ATC 2 start number	Set up starting number of tool magazine 2				1	1 ~ 100	1	

4.2.3 Machining Parameters

Item	Name	Description				UOM	Default	Range	Length (word)	Remark
307	Channel utility setup						0xB4	0~0xFF FF	1	
			Bit	Name	Range					
			4~5	G31 input selection	0~1					
				0: input via PLC 1: HIS 0 (latch input 1) 2: HIS 1 (latch input 2) "Refer to uni_sysUtil"						
			6	Continue the execution	0~1					
				0: During the execution of one single block: offset, move remaining coordinates, recover positions in next block when running the program again; see illustration						
				1: During the execution of one single block: offset, when running the program again, recover the offset and move remaining coordinates; see illustration						
			8~9	Emergency stop mode	0~2					

			0: emergency stop then servo OFF 1: emergency stop then servo OFF after some delay 2: emergency stop without servo OFF					
		10	Enable macro O9xxx display 0: enabled and O90xx can turn on 1: disabled and O90xx cannot turn on	0~1				
309	Arc feed rate	Set up feed rate of arc with diameter 2mm			mm/min	1000	10~50000	1	
310	Minimum arc feed rate	Set up the minimum feed rate for executing G02 and G03 arcs			mm/min	500	10~50000	1	
311	Overlapped speed reduction ratio (corner speed limit)	Set the rapid speed reduction ratio to enable or disable overlap rapid traverse blocks (has no switching function yet) 			mm/min	100	0~50000	1	
315	F0 Speed	Set up speed of Rapid feed F0			mm/min, inch/min	100	10~10000	1	
316	Rapid speed (G00 feed rate)	Set up Rapid speed			mm/min, inch/min	5000	1~60000	1	
317	Rapid ACC/DEC time G00 acceleration/ deceleration time constant	Set up acceleration time of fast moving speed with the same S curve time of item 319.			0.001 sec	200	1~2000	1	
318	Maximum moving speed	Set up the maximum cut moving speed			mm/min, inch/min	5000	1~60000	1	
319	ACC/DEC time Cutting speed of acceleration/	Set up the acceleration time for cutting speed (before ACC/DEC interpolation)			0.001 sec	200	1~2000	1	
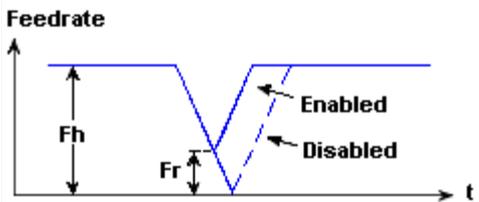
	deceleration time constant						
320	S curve time constant	Set up S curve time (before ACC/DEC interpolation)	0.001 sec	20	1~2000	1	
321	ACC/DEC time	Set up acceleration time post acceleration/deceleration (after ACC/DEC interpolation) The larger the value is the more significant the profiling error will be.	0.001 sec	50	1~500	1	
322	S curve time constant	Set up S curve time post acceleration/deceleration (after ACC/DEC interpolation)	0.001 sec	10	1~100	1	
327	EMG stop time constant	Set up the time required for a servo motor to decelerate to stop after the emergency button is pressed.	0.001 sec	50	5~500	1	(☆)
328	EMG stop delay time	Set up flag enabled (M2224) delay time after emergency stop in servo OFF mode	0.001 sec	35	0~200	1	(☆)
418	Feed forward gain ratio of master axis	Set the feed forward compensation proportion of the master axis		0	0 ~ 200	1	
635	Feed forward gain ratio	Set the feed forward compensation proportion of each axis		0	0 ~ 200	1	

4.2.4 Spindle Parameters

Item	Name	Description			UOM	Default	Range	Length (word)	Remark
399	Spindle mode					0	0~0xFFFF	1	(●)
		Bit	Name	Range					
		0	Spindle function on/off 0: Spindle OFF 1: Spindle ON	0~1					
		1	Close loop control flag 0: Close loop control OFF 1: Close loop control ON (requires feedback encoder)	0~1					
		2~3	Spindle output mode 0: DMCNET (servo spindle) 2: EDAC (analog output)	0~2					
		4	Speed control mode	0~1					

			(has no switching function yet) 0: rmp 1: PPM					
		5	Spindle encoder type selection 0: high resolution (x1000) 1: normal resolution (x4)					
401	Spindle input port number		Set up feedback channel for spindle port encoder (has no switching function yet)		8	0~8	1	(★) (●)
402	Pulse number of spindle encoder		Set up the pulse number of encoder	pulse/rev	1280	2~10000	1	(★) (●)
403	Spindle gains		Set up speed regulator gains (the smaller the value is the faster the response will be).	0.001	50	1~5000	1	
404	Spindle positioning speed		Set up positioning speed	rpm	100	1~20000	1	
405	Spindle positioning offset		Set up servo spindle positioning offset	0.01 degree	0	0~36000	1	
406	Spindle target speed error		Set up tolerance between spindle's nominal and actual speeds	rpm	10	0~100	1	
407	Spindle positioning error		Set up spindle positioning error	0.01 degree	100	0~36000	1	
408	Range of spindle zero speed		Turn on spindle zero speed signal when its speed is in given range **(NC-> MLC M2257).**	rpm	5	0~1000	1	
409	Spindle maximum speed		Set up spindle maximum speed	rpm	20000	0~50000	1	
411	Spindle acceleration/deceleration time constant		Set up spindle acceleration/deceleration time	0.001 sec	20	1~2000	1	
412	Spindle S curve time constant		Set up spindle S curve time	0.001 sec	10	1~2000	1	
416	Tapping		Set up spindle	0.001	2000	1~20000	1	(☆)

	acceleration/deceleration time constant	acceleration/deceleration time for tapping	sec				
417	Tapping S curve time constant	Set up spindle S curve time for tapping	0.001 sec	100	1~2000	1	(☆)
420	1st Spindle positioning low speed	Low speed positioning of the master axis [Unit: rpm]	rpm	100	1~ 20000	1	
421	1st spindle retrieve ratio	The 1st spindle retrieve ratio. The setting speed is the maximum, e.g. tapping speed is S1000, if the parameter is set to 20, retrieve speed will be S2000. (Uint: 0.1)	0.1	10	10~50000	1	
422	Gear ratio numerator 1	Set the numerator of the spindle gear ratio (speed at first gear)		1	0~60000	1	★
423	Gear ratio denominator 1	Set the denominator of the spindle gear ratio (speed at first gear)		1	0~60000	1	★
424	Gear ratio numerator 2	Set the numerator of the spindle gear ratio (speed at second gear)		1	0~60000	1	★
425	Gear ratio denominator 2	Set the denominator of the spindle gear ratio (speed at second gear)		1	0~60000	1	★
426	Gear ratio numerator 3	Set the numerator of the spindle gear ratio (speed at third gear)		1	0~60000	1	★
427	Gear ratio denominator 3	Set the denominator of the spindle gear ratio (speed at third gear)		1	0~60000	1	★
428	Gear ratio numerator 4	Set the numerator of the spindle gear ratio (speed at fourth gear)		1	0~60000	1	★
429	Gear ratio denominator 4	Set the denominator of the spindle gear ratio (speed at fourth gear)		1	0~60000	1	★

4.2.5 Mechanical Parameters

PARAMETER(Machine)		117.NC	N1	SFT
No.	Parameter Name	X	Y	Z
602	1st Upper soft limit ᴿ	100000.000	100000.000	100000.000
603	1st Lower soft limit ᴿ	-100000.000	-100000.000	-100000.000
604	2ed Upper soft limit ᴿ	100000.000	100000.000	100000.000
605	2ed Lower soft limit ᴿ	-100000.000	-100000.000	-100000.000
628	Port polarity ᴾ	3	3	3
	• CWL polarity	1	1	1
	• CCWL polarity	1	1	1
	• Home dog polarity	0	0	0
630	Encoder pulse count ᴾ	1280	1280	1280
631	Shaft gear number ᴾ	1	1	1
632	Motor gear number ᴾ	1	1	1
633	Lead screw pitch ᴾ	10	10	10
634	Control utility ᴾ	1	1	1
	• Rotation mode	0	0	0

Range: -100000 ~ 100000 (mm)

JOG		Ch 0	1/1	Ready

◁ | OPERATE | MAGA | PROCESS | SPINDLE | MACHINE | HOME | ▶

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
602	First positive soft limit	Set up positive software limit. 0 = OFF 1. Over travel leads to positive software limit alarm 2. Can be controlled by special M (set M1250 to NO to relieve first software limit)	mm	10^5	-10^5 ~ $+10^5$	2	
603	First negative soft limit	Set up negative software limit. 0 = OFF 1. Over travel leads to negative software limit alarm 2. Can be controlled by special M	mm	-10^5	-10^5 ~ $+10^5$	2	
604	Second positive soft limit	Set up positive software limit. 0 = OFF 1. Over travel leads to positive software limit alarm 2. Can be controlled by special M	mm	10^5	-10^5 ~ $+10^5$	2	

605	Second negative soft limit	Set up negative software limit. 0 = OFF 1. Over travel leads to negative software limit alarm 2. Can be controlled by special M	mm	-10^5	-10^5 ~ +10^5	2		
628	Polarity of hard limit setting	Set up forward/backward hardware limit and home input polarity. Value 0 = input by Hi activity and on/off at A connector 0 = input by Lo activity and on/off at B connector <table><tr><td>Bit</td><td>Name</td><td>Range</td></tr><tr><td>0</td><td>positive limit</td><td>0~1</td></tr><tr><td>1</td><td>negative limit</td><td>0~1</td></tr><tr><td>2</td><td>home</td><td>0~1</td></tr></table>		0	0~3F	1	
630	Encoder pulse number	The pulse number in each revolution of the motor when ASD-A2 is employed (default)	1000	1280	10~ 50000	1	(★) (●)
631	Number of teeth of spindle	Set up teeth number at the transmission shaft end		1	1~ 65535	1	(★) (●)
632	Number of teeth of motor	Set up teeth number at the motor end		1	1~ 65535	1	(★) (●)
633	Lead screw pitch	Set up lead screw pitch of the drive shaft	mm	10	2~100	1	(★) (●)
634	Axis control variables	<table><tr><td>Bit</td><td>Name</td><td>Range</td></tr><tr><td>1~2</td><td>Rotation mode Feed mode of the rotation axis is only suitable in axis A, B and C. Axis X, Y and Z is not applicable. 0: the rotation axis is not the shortest path 1: the rotation axis is the shortest path 2: straight line axis 3~4: reserved 5: linear axis</td><td>0~5</td></tr></table>		5	0 ~ 65535	1	★

4.2.6 Home Point Parameters

PARAMETER(Home)		117.NC	N1	SFT
No.	**Parameter Name**	**X**	**Y**	**Z**
606	Home absolute coordinate P	0.000	0.000	0.000
607	2nd ref. position P	0.000	0.000	0.000
608	3rd ref. position P	0.000	0.000	0.000
609	4th ref. position P	0.000	0.000	0.000
610	2nd ref. position range P	0.000	0.000	0.000
616	Homing mode P	3	5	3
617	Homing criteria P	0	1	1
	● Homing search direction	0	1	1
618	Rapid home speed R	2000	2000	2000
619	Creep speed R	200	200	200
620	Reference moving speed R	10	10	10

Range: -100000000 ~ 100000000

JOG		Ch 0		1/1	
◁	OPERATE	MAGA	PROCESS	SPINDLE	MACHINE	HOME ▶

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
606	Mechanical origin coordinates	Set up offset to mechanical origin coordinates. During the first system power on, the system back to the origin, get Z pulse, add the offset value, and set current point as the mechanical origin. Changed parameter value takes effect only after the system is power off and then returns to the origin again. Mechanical origin coordinates	CU	0	-10^8 ~10^8	2	
607	Second reference coordinates	Second reference point coordinates (G30 position setup)	CU	0	-10^8 ~10^8	2	
608	Third reference coordinates	Third reference point coordinates	CU	0	-10^8 ~10^8	2	
609	Fourth reference coordinates	Fourth reference point coordinates	CU	0	-10^8 ~10^8	2	
610	Second reference position	Second reference position error settings, e.g. value 0.2 indicates that the +-0.2mm section's second origin arrived and M2288		0	-10^8 ~10^8	2	(★)

	error settings	will be ON			1	0~4	1
616	Homing mode	0: Back to origin is OFF 1: mode 1 　Leave in reverse direction after the block is touched, search the first Z phase point, set it to origin 2: mode 2 　Leave in the same direction after the block is touched, search the first Z phase point, set it to origin 3: mode 3 　Move to Z phase point in slow speed 4: OT mode Set the hardware limit as the home sensor. 　Set the hardware limit as the home sensor in origin mode and the limit block in other modes. 5: Absolute motor mode			1	0~4	1
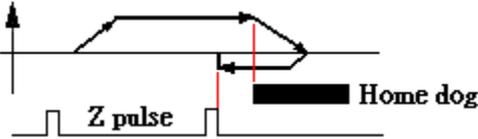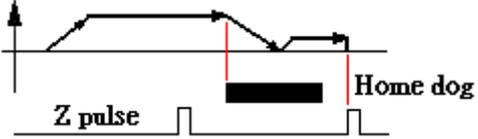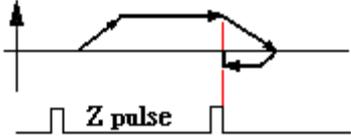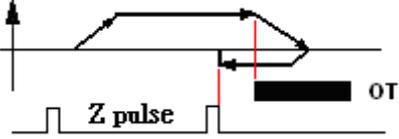
		Bit	Name	Range				
617	Searching the origin	0	Direction searching mode for returning back to the origin 0: clockwise (forward) 1: counterclockwise (backward)	0~1		1	0~7h	1

618	First stage speed of homing	Set up starting speed for origin sensor searching	mm/min	2000	0~10000	1	
619	Second	Set up speed for Z phase point searching	mm/mi	200	0~2000	1	

	stage speed of homing		n				
620	Reference point movement speed	Set up feed rate from first reference point to the origin	rpm	10	0~20000	1	

4.2.7 Compensation Parameters

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
1000	Rear gap compensation value	Set up the backlash amount that is fixed in most screws of the mechanical system. There is no difference in G00 and G01 modes. Set positive value for forward backlash and negative for backward one. Compensation is turned off for zero parameter value. Arc contouring example	mm, inch	0	0~10.0	2	
1001	Backlash compensation time	The movement direction of backlash compensation amount. The time constant for compensation ratio takes effect only when non-zero rear backlash compensation value is given.	0.0001 sec	0	0~10000	1	
1002	Backlash compensation delay time	Set up time delay for startup compensation.	0.0001 sec	0	0~10000	1	
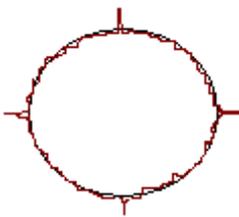
1003	Friction compensation amount	Friction compensation amount	mm	0	0 ~ 1 (float)	2	
1004	Friction compensation time	Friction compensation time	0.0001 sec	0	0~10000	1	
1005	Friction compensation delay time	Friction compensation delay time	0.0001 sec	0	0~10000	1	
1006	Pitch compensation application setup	(see bit table below)		0	0~0xFFFF	1	
1007	Measuring points	Set up screw compensation table correction value. If the value is set to zero, compensation is turned off.		0	0~128	1	
1008	Measuring intervals	Set up interval for screw compensation	mm	0	1~300	2	

Bit table for 1006 (Pitch compensation application setup):

Bit	Name	Range
0	Absolute or incremental input 0: Absolute: difference against the first measuring point 1: Difference between current and the last measuring points	0~1
2	Friction positive direction	0~1
3	Friction negative direction	0~1
15	Measuring direction from starting point Mechanical coordinates direction 0: measuring toward forward direction 1: measuring toward backward direction	0~1

1009	Measuring offsets	Set measurement initial point at starting point Comply with direction of Bit 15		0	-1000~1000	2	
1010 ~113 7	Data 1 ~ data 128	1st ~128th screw compensation value, the first point is set to the origin	mm/deg	0	-20~20	2	

4.2.8 System Parameters

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
10000	System date	Set up system date Format: yyyy/mm/dd				0	
10001	System time	Set up system time Format: hh:mm:ss				0	
10002	System language	System multi-language 0: English 1: Chinese		1	0~SysTotalLang	1	
10003	Screen brightness	Set up screen brightness		50	1~60	1	
10004	User defined language	User defined system language		0	0~UserTotalLang	1	
10009	Synchronous coordinate display	Method of showing the synchronous coordinate		0	0~2	1	
10010	Screen saver ON	Activate screen save function 0: ON 1: OFF		1	0~1	1	

10011	Time of first stage screen saver	When screen saver is ON, set up the time of first stage screen saver	min	10	1~60	1	
10012	Brightness of first stage screen saver	When screen saver is ON, set up the brightness of first stage screen saver		30	0~60	1	
10013	Time of second stage screen saver	When screen saver is ON, set up the time of second stage screen saver	min	30	1~60	1	
10014	Brightness of second stage screen saver	When screen saver is ON, set up the brightness of second stage screen saver		10	0~60	1	
10015	Reserved	Reserved		0	0~0	1	
10016	System related setting	Auto generate a reset signal after releasing emergency stop 0: OFF 1: ON <table><tr><td>Bit</td><td>Name</td><td>Range</td></tr><tr><td>0</td><td>Reset system at EMG releasing Automatically generate a Reset signal after releasing EMG 0: OFF 1: ON</td><td>0~1</td></tr><tr><td>1</td><td>Displaying software panel at startup default 0: OFF 1: Display the software panel at startup</td><td>0~1</td></tr><tr><td>2</td><td>Pop up the alarm screen 0: Not pop up 1: Pop up the alarm screen when an alarm occurs</td><td>0~1</td></tr><tr><td>3</td><td>Lock the group key at software panel 0: Unlock 1: Lock (When the function of Displaying software panel at startup default is set to 1, this function will be locked.)</td><td>0~1</td></tr></table>		0	0~1	1	
10017	Open G code editor	G code editing 0: OFF 1: ON <table><tr><td>Bit</td><td>Name</td><td>Range</td></tr><tr><td>0</td><td>Enable G code editing Enable G code editing</td><td>0~1</td></tr></table>		1	0~1	1	

		0: OFF 1: ON					
		1	Call MACRO source file 0: CF card 1: INTER memory	0~1			
10018	Background color	Background color			LIGHTGRAY	0~65535	1
10019	Title bar text color	Title bar text color			BLACK	0~65535	1
10020	Mode bar text color	Mode bar text color			DARKBLUE	0~65535	1
10021	Function bar text color	Function bar text color			BLACK	0~65535	1
10022	Label text font color	Label text font color			BLACK	0~65535	1
10023	Numeric text color	Numeric text color			BLUE	0~65535	1
10024	Grid line color	Grid line color			BLACK	0~65535	1
10025	System cursor color	System cursor color			COLOR_S07	0~65535	1
10026	System highlight text color	System highlight text color			WHITE	0~65535	1
10027	Software panel cursor color	Software panel cursor color			YELLOW	0~65535	1
10028	System alarm color	System alarm color			RED	0~65535	1
10029	User alarm color	User alarm color			BLUE	0~65535	1

4.2.9 MLC Setup

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
12000	Program title	Program title				0	
12001	Company name	Company name				0	
12002	Designer's name	Name of designer				0	
12003	Display remarks	Display remarks 0: OFF 1: ON		0	0~1	1	
12004	Display symbols	Display symbols 0: OFF 1: ON		0	0~1	1	
12005	Ladder diagram color	Ladder diagram color		BLACK	0~655 35	1	
12006	Ladder diagram text color	Ladder diagram text color		BLACK	0~655 35	1	
12007	Ladder diagram symbol color	Ladder diagram symbol color		BLACK	0~655 35	1	
12008	Ladder diagram	Ladder diagram cursor color		LIGHT BLUE	0~655 35	1	

	cursor color						
12009	Ladder diagram monitoring color	Ladder diagram monitoring color		LIGHTGR EEN	0~655 35	1	
12010	Ladder diagram device remark color	Ladder diagram device remark color		BROWN	0~655 35	1	
12011	Ladder diagram section remark color	Ladder diagram section remark color		BROWN	0~655 35	1	
12012	Ladder diagram row remark color	Ladder diagram row remark color		BROWN	0~655 35	1	
12013	Ladder diagram monitoring value color	Ladder diagram monitoring value color		LIGHTRE D	0~655 35	1	
12014	Color of special NC devices	Color of special NC devices		COLOR_ S2B	0~655 35	1	
12015	Color of special MLC devices	Color of special MLC devices		MAGENT A	0~655 35	1	
12016	Enable MLC editing protection	MLC editing protection 0: protection OFF 1: protection ON		1	0~1	1	

4.2.10 Diagram Parameters

PARAMETER(Graphic)		117.NC	N1	
No.	Parameter Name	Value	
14000	Graphic line color	0	▉
14001	Graphic background color	1183	▉
14002	Graphic line width	1	
14003	Graphic stock width	500	
14004	Graphic stock height	500	
14005	Graphic stock length	500	
14006	Graphic stock X offset	0	
14007	Graphic stock Y offset	0	
14008	Graphic stock Z offset	0	

Range: 0 ~ 65535

| JOG | | Ch 0 | | 1/1 | Ready |

🏠 DEFAULT COLOR ▷

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
14000	Line color	Diagram line color *Diagram for machining program movement		BLACK	0~65535	1	
14001	Background color	Diagram background color		SEA	0~65535	1	
14002	Line width	Diagram line width		1	0~4	1	
14003	Workpiece width	Diagram workpiece width	mm	200	0~10000	1	
14004	Workpiece height	Diagram workpiece height	mm	200	0~10000	1	
14005	Workpiece length	Diagram workpiece length	mm	200	0~10000	1	
14006	Workpiece X offset	Diagram workpiece X offset	mm	100	-10000~ 10000	1	
14007	Workpiece Y offset	Diagram workpiece Y offset	mm	100	-10000~ 10000	1	
14008	Workpiece Z offset	Diagram workpiece Z offset	mm	200	-10000~ 10000	1	

4.2.11 Internet Setting

Item	Name	Description	UOM	Default	Range	Length (word)	Remark
10030	Host name	Host name		CNC000	1~8	4	
10031	IP Address	System IP address		0.0.0.0	0~255	2	
10032	Subnet mask	System subnet mask		0.0.0.0	0~255	2	
10033	Default gateway	System default gateway		0.0.0.0	0~255	2	
10034	Enable Ethernet function	Enable system network function 0: OFF 1: ON		0	0~1	1	
10035	Enable DHCP function	Enable DHCP function 0: OFF 1: ON		0	0~1	1	
10036	Remote PC IP Address 1	IP address 1		0	0~255	2	
10037	Remote PC IP Address 2	IP address 2		0	0~255	2	
10038	Remote PC	IP address 3		0	0~255	2	

	IP Address 3						
10039	Remote PC IP Address 4	IP address 4		0	0~255	2	
10040	Remote PC IP Address 5	IP address 5		0	0~255	2	
10041	IP address 1 for remote directory sharing	Edit IP address of computer defined by Network in directory 0: OFF		0	0~5	1	

4.2.12 Servo Parameters

PARAMETER(Servo)				117.NC	N2	P
Group	No.	Parameter Name	X	Y	Z	
P0	0	Firmware Version	1744	1744	1744	
P1	1	Control Mode and Output Dirt	B	B	B	
P1	8	Smooth Constant of Position	0	0	0	
P1	36	Accel /Decel S-curve	0	0	0	
P1	44	Gear Ratio(Numerator N1)	1	1	1	
P1	45	Gear Ratio(Denominator M1)	1	1	1	
P1	55	Maximum Speed Limit	3000	3000	3000	
P1	62	Friction Compensation(%)	0	0	0	
P1	63	Friction Compensation(ms)	1	1	1	
P1	68	Position Command Moving Filter	4	4	4	
P2	0	Position Loop Gain(Kpp)	78	78	78	
P2	1	Kpp Gain Switching Rate	100	100	100	
P2	2	Position Feed Forward Gain(Kpf)	0	0	0	
P2	3	Smooth Constant of Kpf Gain	5	5	5	
P2	4	Speed Loop Gain(Kvp)	314	314	314	

Range: 0 ~ 0

JOG		Ch 0		1/3	STOP
🏠 READ					▷

Group	Item	Name	Description	UOM	Default	Range	Length (word)	Remark
P1	1	Set up control mode and control command input source	Control settings for various modes		b	0x00 ~ 0x110F (HEX)	1	
P1	8	Position command smoothing constant	Position command smoothing constant	10 msec	0	0 ~ 1000	1	
P1	36	Acceleration/deceleration smoothing constant for S curve	Acceleration/deceleration smoothing constant for S curve	msec	0	0~65500	1	
P1	44	Electronic gear ratio numerator (N1)	Multi step electronic gear ratio numerator settings	pulse	1	$1 \sim (2^{29}-1)$	2	
P1	45	Electronic gear ratio denominator (M1)	Electronic gear ratio denominator (M1)	pulse	1	$1 \sim (2^{31}-1)$	2	
P1	62	Friction compensation (%)	Friction compensation level	%	0	0 ~ 100	1	
P1	63	Friction compensation (ms)	Friction compensation smoothing constant	ms	0	0 ~ 1000	1	
P1	68	Position command moving filter	Position command Moving Filter	ms	4	0 ~ 100	1	
P2	0	Proportional gain to position control (Kpp)	Proportional gain to position control	rad/s	35	0 ~ 2047	1	
P2	1	Gain change rate to	Gain change rate to	%	100	10 ~ 500	1	

		position control	position control					
P2	**2**	Feed forward gain to position control (Kpf)	Feed forward gain to position control	%	50	0 ~ 100	1	
P2	**3**	Feed forward gain smoothing constant to position control	Feed forward gain smoothing constant to position control	msec	5	2 ~ 100	1	
P2	**4**	Speed control gain (Kvp)	Speed control gain	rad/s	500	0 ~ 8191	1	
P2	**5**	Gain change rate to speed control	Gain change rate to speed control	%	100	10 ~ 500	1	
P2	**6**	Speed integral compensation (Kvi)	Speed integral compensation	rad/s	100	0 ~ 1023	1	
P2	**7**	Speed feed forward gain (Kvf)	Speed feed forward gain	%	0	0 ~ 100	1	
P2	**9**	DI response filter time	DI response filter time	2msec	2	0 ~ 20	1	
P2	**23**	Resonance suppression filter frequency (Notch filter) (1)	Mechanical resonance frequency settings 1	Hz	1000	50 ~ 1000	1	
P2	**24**	Resonance suppression decay rate (1)	Resonance suppression decay rate settings 1. Set it to 0 to disable the function of Notch filter	dB	0	0 ~ 32	1	
P2	**25**	Resonance suppression low-pass filter	Set up resonance suppression low-pass filter time constant. Set it to 0 to disable low-pass filter	0.1msec	2	0 ~ 1000	1	
P2	**26**	Anti-interference gain	Anti-interference gain	0.001	0	0 ~ 1023	1	
P2	**27**	Gain switching conditions and method selection	Gain switching conditions and method selection		0	0 ~ 4 (HEX)	1	
P2	**28**	Gain switching time constant	Gain switching time constant	10msec	10	0 ~ 1000	1	
P2	**43**	Resonance suppression filter frequency (Notch Filter)(2)	Mechanical resonance frequency settings 2	Hz	1000	50 ~ 2000	1	
P2	**44**	Resonance suppression decay rate (2)	Resonance suppression decay rate settings 2. Set it to 0 to disable the function of Notch filter.	dB	0	0 ~ 32	1	
P2	**45**	Resonance suppression filter frequency (Notch filter) (3)	Mechanical resonance frequency settings 3	Hz	1000	50 ~ 2000	1	
P2	**46**	Resonance suppression decay rate (3)	Resonance suppression decay rate settings 3. Set it to 0 to disable the function of Notch filter.	dB	0	0 ~ 32	1	

P2	**47**	Auto resonance suppression mode	0: fixed
			1: auto fix after
			    suppression
			2: continuous auto
			    suppression
					1	0 ~ 2	1	

P2	**49**	Speed detection filter and jitter suppression	Set up speed testing filter	sec	0	0 ~ 1F	1	
P4	**0**	Fault record (N)	Latest abnormality record		0		2	
P4	**1**	Fault record (N-1)	The last second fault record		0		2	
P4	**2**	Fault record (N-2)	The last third fault record		0		2	
P4	**3**	Fault record (N-3)	The last fourth fault record		0		2	
P4	**4**	Fault record (N-4)	The last fifth fault record		0		2	
P5	**00**	Firmware sub-version	Firmware sub-version in the servo drive					

4.2.13 Channel Setting

| PARAMETER(Ch/Axis Setting) | 117.NC | N1 | P | SFT |

Channel	Axis	Enable	NC	MLC	Port	Used port		
CH 0	X	v	v		1	1	v	CH0 X
	Y	v	v		2	2	v	CH0 Y
	Z	v	v		3	3	v	CH0 Z
	A					4		
	B					5		
	C					6		
	U					7		
	V					8		
	W					9		
	SP1	v			10			

| JOG | | RPD 100% | JOG 3000 | S 100% | STOP |

| OK |

Check the used axis the used port in order to correspond to the DMENT. Then, press OK to activate the setting.

4.2.14 RIO Setting

RIO Setting: Press OK after the setting is completed.

RIO Status	Enable	RIO type	Port polarity	Disc.
1 ON	V	3	00000000	
Use the RIO station number to show the connection status, M2832 is station number 0.	Check the station number. Set RIO type to 3 as DIO and the setting of the others is as the following. AD/DA(set 0) DA (set 1) AD (set 2)		The setting of DI port polarity, which only can be set as station number 0 and can set DI0~DI31 (32 points in total).	Check this for disconnection. It means, when disconnection, DO is remained in origin status.

Origin limit setting: Press OK after the setting is completed.

Home Limit **CH0** X ☑ Y ☑ Z ☐ A ☑ B ☑ C ☐ U ☐ V ☐ W ☐ **Filter level** 2	Set the positive DI, negative DI and origin DI via the DI of RIO. RIO station number 0 only
	Axis selection. If none of them is checked, it means the positive, negative and origin DI is input by AXIS1~4 of the controller. According to the checked axis number and name, starting from X256, each axis occupies three DI, positive, negative and origin respectively. For example, if check axis Y and Z, then, The positive DI (X256), negative DI (X257) and origin (X258) of axis Y; The positive DI (X259), negative DI (X260) and origin (X261) of axis Z Special M remains <table><tr><td>X positive limit M2144</td><td>X negative limit M2145</td><td>X origin signal M2146</td></tr><tr><td>Y positive limit M2148</td><td>Y negative limit M2149</td><td>Y origin signal M2150</td></tr><tr><td>Z positive limit M2152</td><td>Z negative limit M2153</td><td>Z origin signal M2154</td></tr></table>
	Set the DI filter level of RIO, each level is 40micro second(10^-6 sec) There are 5 levels in total. All DI in RIO is applicable.

4.3   Note

4.3.1 Setting Method of Absolute Motor

How to set up the absolute motor

1: For CNC controller accompanied with absolute encoder, the parameter 616 (homing mode) of the corresponding connection axis must be set to 5 as shown in the figure below. (Incremental and absolute encoders can be used together. After the first absolute motor installation, please re-start the servo and controller.)

No.	Parameter Name		X	Y	Z
PARAMETER(Home)		117.NC	N1		SFT
606	Home absolute coordinate	P	0.000	0.000	0.000
607	2nd ref. position	P	0.000	0.000	0.000
608	3rd ref. position	P	0.000	0.000	0.000
609	4th ref. position	P	0.000	0.000	0.000
610	2nd ref. position range	P	0.000	0.000	0.000
616	Homing mode	P	3	5	3
617	Homing criteria	P	0	1	1
	• Homing search direction		0	1	1
618	Rapid home speed	R	2000	2000	2000
619	Creep speed	R	200	200	200
620	Reference moving speed	R	10	10	10

Range: -100000000 ~ 100000000

JOG   Ch 0   1/1

OPERATE   MAGA   PROCESS   SPINDLE   MACHINE   HOME

2: After parameter setup, conduct absolute reset to the absolute encoder by following pages of *DGN ->
System Monitoring -> Servo Monitoring* as shown in the figure below.

DIAGNOSE(Servo Monitor)			117.NC	N1		P	SFT
Port	Channel	Axis	Servo Status	LOAD	Peak	MECH	Home	ABS RST

Port	Channel	Axis	Servo Status	LOAD	Peak	MECH	Home	ABS RST
1	0	X	ON	0 %	2 %	-147.695	OK	
2	0	Y	ON	1 %	4 %	-115.941	OK	1
3	0	Z	ON	0 %	9 %	49.046	OK	

	JOG			RPD 100%	JOG 3000	S 100%		STOP
🏠	VAR MONI	I/O MONI	SRV MONI					▷

3: A system can run absolute reset only in **JOG** or **MPG** mode. Move the mechanical position of the
axis with JOG or MPG operation to the proper location, press key [**1**] then press the **Enter** key to
finish the absolute reset. The origin status indicator lights up, the mechanical coordinates reset to 0,
and the axis returns to the origin.

    Note: When setting in MPG mode, only when selecting axis MPG will be effective. If select axis X of
        MPG, enter [1] and press [Enter], the absolute reset is completed.

If the alarm occurs after the absolute reset, reset the absolute reset flag. See below for reset alarms:

AL 060: the position of homing is not set, so conduct absolute reset.
AL 061: low battery voltage, please replace battery.
AL 069: Invalid accompanying encoder. Please ensure an absolute encoded is connected.

4.3.2 Setting Method of Synchronous Function

For example: Axis A (slave axis) has to follow axis Z (master axis) in the same direction. Assume M13 enables the synchronization and M14 disables it.

Set parameter 350 to 13
Set parameter 351 to 14
Set parameter 364 (synchronous control A) to 3

When issuing command M13, MLC triggers M1088 (Synchronous control to trigger flag) and M1092 (Slave axis A follows the master axis)
In program, when axis Z is moving, axis A will follow up. If G01A10. appears, the alarm will occur.
Issue command M14 at the end to disconnect special **M**.
It is not only effective in auto mode or when MDI is executing the program, but also in JOG, MPG and HOME mode. The effectiveness remains until M14 disconnects special **M**. (except when tapping, axis A follows axis Z, but axis A does not synchronize with axis Z.)

Rules:
A.   After the master axis is set, the axis cannot be set as the slave axis.
B.   After the slave axis is set, the axis cannot be set as the master axis.
C.   More than one slave axis can follow one master axis at the same time.
D.   If returns to the origin when synchronization, it should mainly follow the master axis.
E.   Press Reset will not cancel the function of synchronization.

Program:
G54X0Y0Z0A0
G90G54G0X10.Y10.Z10.
Z50.
A0
M13
Z0.
Z111.
G4X2.
Z150.
M14
A100.
A51.
M30

350	Halt M code 1	Halt M code 1 (0: no setting)	0	1~1000
351	Halt M code 2	Halt M code 2	0	1~1000
352	Halt M code 3	Halt M code 3	0	1~1000
353	Halt M code 4	Halt M code 4	0	1~1000
354	Halt M code 5	Halt M code 5	0	1~1000
355	Halt M code 6	Halt M code 6	0	1~1000
356	Halt M code 7	Halt M code 7	0	1~1000
357	Halt M code 8	Halt M code 8	0	1~1000
358	Halt M code 9	Halt M code 9	0	1~1000
359	Halt M code 10	Halt M code 10	0	1~1000
360	Synchronous control direction	Synchronous control direction : Bit0~5: Synchronous control X~C 0: same direction 1: different direction	0x00	0~0x3F
361	Synchronous control X	Slave axis X follows the master axis 0:close 1~6:X~C cn : c:chanal n:axis (set 1~6) (1~6 ,11~16, 21~26, 31~36)	0	1~6
362	Synchronous control Y	Slave axis Y follows the master axis 0: close 1~6:X~C	0	1~6
363	Synchronous control Z	Slave axis Z follows the master axis 0: close 1~6:X~C	0	1~6
364	Synchronous control A	Slave axis A follows the master axis 0: close 1~6:X~C	0	1~6
365	Synchronous control B	Slave axis B follows the master axis 0: close 1~6:X~C	0	1~6
366	Synchronous control C	Slave axis C follows the master axis 0: close 1~6:X~C	0	1~6

MLC   NC

0	Syn_ctrl	Synchronous control to trigger the flag	M1088
1	Syn_X	Slave axis X follows the master axis	M1089
2	Syn_Y	Slave axis Y follows the master axis	M1090
3	Syn_Z	Slave axis Z follows the master axis	M1091
4	Syn_A	Slave axis A follows the master axis	M1092
5	Syn_B	Slave axis B follows the master axis	M1093
6	Syn_C	Slave axis C follows the master axis	M1094

4.3.3 Setting Method of Command Transfer

For example: The command of axis Z (G01Z10.) has to transfer to axis a (transfer axis). Assume M20 enables the transfer function and M21 disables it.

Set parameter 350 to 20

Set parameter 351 to 21

Set parameter 374(Transfer control A) to 3

When issuing command M20, MLC triggers M1098 (command transfer control triggers the flag) and M1102 (Axis A receives the command from master axis).

If axis Z moves in program, axis A is the one that actually moves (axis Z stands still). If command G01A10. appears, the alarm will occur. At the end, M21 disconnect special M. This is function only can be enabled (M20) and disabled (M21) in auto and MDI mode. Please disable the function (M21) when the program is finished. It is unable to use in JOG, MPG and HOME mode.

Rules:

A.   After the transfer axis is set, the axis cannot be set as the master axis.

B.   After the master axis is set, the axis cannot be set as the transfer axis.

C.   It can have more than one transfer axis and follow one master axis.

D.   It is not applicable in homing mode.

Press Reset to cancel the function of command transfer

Program:

G54X0Y0Z0A0

G90G54G0X10.Y10.Z10.

Z50.

A0

M20 (The program reads M20 in advance and enable the function of command transfer control)

Z0.   (It shows that axis Z moves in this area, but actually axis A is the one is moving.)

Z111.

G4X2.

Z150.

M21 (The program reads M21 in advance and disable the function of command transfer control)

A100.

A51.

M30

350	Halt M code 1	Halt M code 1 (0: no setting)	0	1~1000
351	Halt M code 2	Halt M code 2	0	1~1000
352	Halt M code 3	Halt M code 3	0	1~1000
353	Halt M code 4	Halt M code 4	0	1~1000
354	Halt M code 5	Halt M code 5	0	1~1000
355	Halt M code 6	Halt M code 6	0	1~1000
356	Halt M code 7	Halt M code 7	0	1~1000
357	Halt M code 8	Halt M code 8	0	1~1000
358	Halt M code 9	Halt M code 9	0	1~1000
359	Halt M code 10	Halt M code 10	0	1~1000

371	Transfer control X	Axis X transfers the command of master axis. The master axis does not move at the moment. 0: close 1~6:X~C	0	1~6
372	Transfer control Y	Axis Y transfers the command of master axis. 0: close 1~6:X~C	0	1~6
373	Transfer control Z	Axis Z transfers the command of master axis. 0: close 1~6:X~C Axis A transfers the command of master axis.	0	1~6
374	Transfer control A	0: close 1~6:X~C	0	1~6
375	Transfer control B	Axis B transfers the command of master axis. 0: close 1~6:X~C	0	1~6
376	Transfer control C	Axis C transfers the command of master axis. 0: close 1~6:X~C	0	1~6

MLC   NC

10	Tran_ctrl	Transfer command control triggers the flag	M1098
11	Tran_X	Axis X receives the command of master axis	M1099
12	Tran_Y	Axis Y receives the command of master axis	M1100
13	Tran_Z	Axis Z receives the command of master axis	M1101
14	Tran_A	Axis A receives the command of master axis	M1102
15	Tran_B	Axis B receives the command of master axis	M1103
16	Tran_C	Axis C receives the command of master axis	M1104

NC   MLC

20	Trans enabled	Executing transfer function	M2228

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Chapter 5: MLC Special M&D Command

5.1   Definition to MLC special M & D command

The MLC (Motion Logic Control) and NC systems are two independent systems. The MLC system performs knobs and buttons controls, mechanical operations, and other electric on/off logic controls while the NC system manages system and servo axis related functions. The MLC special M&D acts as the I/O interface between these two systems for data exchanges and message transmissions. Signals sent to the NC system by the MLC special M&D are called output while signals send to MLC special M&D by the NC system are called input. Data exchanges are divided into four groups. The M letter prefixed commands are "bit" based with signal 0 (OFF) or 1 (ON) while the D prefixed ones are "word" based with values like 1000.

MLC special M&D codes are all expressed in the form of M- and D- suffixed with four digits.

Definitions of MLC special M&D:

1: MLC bit output from MLC to NC special M means Bit output
2: MLC bit input from NC to MLC special M means Bit input
3: MLC word output from MLC to NC special D means Word output
4: MLC word input from NC to MLC special D means Word input

5.2 MLC bit output from MLC to NC where M indicates bit output

5.2.1 System common: special M output description

Users can use variable #1801~#1832 in the machining program to read the signal status in MLC's interface output points M1024~M1055. Variable #1801 pairs with output point M1024 and #1802 with M1025 and so forth for all the remaining pairs up to #1832 and M1055. For example, for an output ON by M1024 in an MLC program, the value of the variable number #1801 will be 1 and will be 0 for an output OFF by M1024.

Global Bit (MLC->NC)

Function code	Special M code	Variable ID	Function code	Special M code	Variable ID
Interface output 1	M1024	#1801	Interface output 17	M1040	#1817
Interface output 2	M1025	#1802	Interface output 18	M1041	#1818
Interface output 3	M1026	#1803	Interface output 19	M1042	#1819
Interface output 4	M1027	#1804	Interface output 20	M1043	#1820
Interface output 5	M1028	#1805	Interface output 21	M1044	#1821
Interface output 6	M1029	#1806	Interface output 22	M1045	#1822
Interface output 7	M1030	#1807	Interface output 23	M1046	#1823
Interface output 8	M1031	#1808	Interface output 24	M1047	#1824
Interface output 9	M1032	#1809	Interface output 25	M1048	#1825
Interface output 10	M1033	#1810	Interface output 26	M1049	#1826
Interface output 11	M1034	#1811	Interface output 27	M1050	#1827
Interface output 12	M1035	#1812	Interface output 28	M1051	#1828
Interface output 13	M1036	#1813	Interface output 29	M1052	#1829
Interface output 14	M1037	#1814	Interface output 30	M1053	#1830
Interface output 15	M1038	#1815	Interface output 31	M1054	#1831
Interface output 16	M1039	#1816	Interface output 32	M1055	#1832

5.2.2 NC system function: special M output

Send signal from MLC to NC system. The MLC program outputs M signal to NC system with mechanical keys or knobs to change NC modes or enable and disable NC functions. For example, users can output an ON signal by M1060 in MLC program to have NC system running a single block function.

Function name	Special M code	Description
Select machining mode:	M1056	Users can select machining modes with command M1056~M1059.
	M1057	
0. AUTO	M1058	Use Bit 0~ 3 of digits 0~7 in binary format to
1. EDIT	M1059	represent each system mode.
2. Manual input (MDI)		For example, to select Fine tune (MPG)

3. Fine tune (MPG) 4. JOG 5. Fast feed (RAPID) 6. Homing (HOME) 7. DNC		(represented by decimal number 3 and binary number 0011) M1056= BIT0 ON M1057= BIT1 ON M1058= BIT2 OFF M1059= BIT3 OFF
Single block execution	M1060	In auto execution mode, stops the program after one block is executed
Auto loop execution	M1061	Auto execution signal
NC pause	M1062	NC controller pauses after the signal is triggered
System emergency stop	M1063 (reserved)	Triggers emergency stop and the system halts immediately
System reset	M1064	Press **Reset** key to trigger the rising edge in an interval of 4 seconds (NC->MLC)
Dummy execution	M1065	In auto execution mode, the movement speed F of G01 will be given by D1062 register after the signal is triggered.
M01 pause	M1066	Select stop key. The control pauses when M01 is encountered in the program.
Single statement delete '/'	M1067	Skip statement with symbol '/' after this function is ON.
Mechanical lock each axis	M1068	Lock X, Y, and Z axes from movement.
Z-axis lock	M1069	Lock Z-axis from movement
Relieve limit detection function	M1070	Ignore limit signal of each axis when this function is active.
M, S, and T code lock	M1071	Lock M, S, and T codes (i.e. they are ignored in the program)
Servo ON	M1072	The servo is ON during DMC connection
Macro call initial preparation	M1074	Macro call initial input (auto mode, macro number)
Macro call activation	M1075	Macro call activation
System reset	M1076	When the signal is triggered, it will reset the system (MLC → NC)
Hand wheel simulation	M1080	Control hand wheel speed
MST Code executed flag	M1152	Trigger this signal to indicate to the NC system that M, S, and T codes have been

		executed.
Tool plate 1 move forward	M1168	Tool plate 1 move forward
Tool plate 1 move backward	M1169	Tool plate 1 move backward
Tool 1 exchange	M1170	Exchange data of tool 1
Tool magazine 1 reset	M1171	Trigger resetting tool magazine 1 (auto operation when working together with M code)
Tool plate 2 move forward	M1172	Tool plate 2 move forward
Tool plate 2 move backward	M1173	Tool plate 2 move backward
Tool 2 exchange	M1174	Exchange data of tool 2
Tool magazine 2 reset	M1175	Trigger resetting tool magazine 2 (auto operation when working together with M code)
Software MPG+	M1118	Incremental jog by the secondary control panel, forward triggering signal, see D1040.
Software MPG-	M1119	Incremental jog by the secondary control panel, backward triggering signal, see D1040.
Lock program from being edited	M2935	Prevent program in controller from being edited.

5.2.3 NC axis related special M output description

After special M triggering, instructs NC to move. Set M1216 to ON to jog the axis forward.

Function name	Special M code	Function name	Special M code
Trigger the flag by synchronous control	M1088	X-axis homing control	M1236
The slave axis, X follows the master axis	M1089	Y-axis homing control	M1237
The slave axis, Y follows the master axis	M1090	Z-axis homing control	M1238
The slave axis, Z follows the master axis	M1091	A-axis homing control	M1239
The slave axis, A follows	M1092	B-axis homing control	M1240

the master axis			
The slave axis, B follows the master axis	M1093	C-axis homing control	M1241
The slave axis, C follows the master axis	M1094		
		X-axis 1st software limit relieve	M1248
Transfer command controls the flag trigger	M1098	Y-axis 1st software limit relieve	M1249
X-axis receives command from master axis	M1099	Z-axis 1st software limit relieve	M1250
Y-axis receives command from master axis	M1100	A-axis 1st software limit relieve	M1251
Z-axis receives command from master axis	M1101	B-axis 1st software limit relieve	M1252
A-axis receives command from master axis	M1102	C-axis 1st software limit relieve	M1253
B-axis receives command from master axis	M1103		
C-axis receives command from master axis	M1104	X-axis lock	M1257
		Y-axis lock	M1258
X-axis forward jog control	M1216	Z-axis lock	M1259
Y-axis forward jog control	M1217	A-axis lock	M1260
Z-axis forward jog control	M1218	B-axis lock	M1261
A-axis forward jog control	M1219	C-axis lock	M1262
B-axis forward jog control	M1220	U-axis lock	M1263
C-axis forward jog control	M1221	V-axis lock	M1264

		W-axis lock	M1265
X-axis backward jog control	M1226		
Y-axis backward jog control	M1227	X-axis cancels servo enabled	M1266
Z-axis backward jog control	M1228	Y-axis cancels servo enabled	M1267
A-axis backward jog control	M1229	Z-axis cancels servo enabled	M1268
B-axis backward jog control	M1230	A-axis cancels servo enabled	M1269
C-axis backward jog control	M1231	B-axis cancels servo enabled	M1270
		C-axis cancels servo enabled	M1271

5.2.4 Spindle and MLC axis relevant special M output description

Spindle relevant outputs

Function name	Special M code	Function name	Special M code
Spindle forward turning	M1120	Spindle as the MLC control axis	M1193
Spindle backward turning	M1121	X-axis as the MLC control axis	M1184
Select spindle gear ratio Bit 0	M1122	Y-axis as the MLC control axis	M1185
Select spindle gear ratio Bit 1	M1123	Z-axis as the MLC control axis	M1186
Spindle positioning control	M1124	A-axis as the MLC control axis	M1187
Spindle returns after tapping	M1125		

5.3 MLC bit input NC -> MLC special M Bit input description
5.3.1 System common - special M input description

Users can use variable #1864~#1895 in the machining program to write in the signal status in MLC's interface input points M2080~M2111. Variable #1864 pairs with input point M2080 and #1865 with M2081 and so forth for all the remaining pairs up to #1895 and M2111. For example, for an output ON by M2080 in an MLC program, the value of the variable number #1864 will be 1 and will be 0 for an output OFF by M2028.

Function name	Special M code	Variable ID	Function name	Special M code	Variable ID
Interface input point 1	M2080	#1864	Interface input point 17	M2096	#1880
Interface input point 2	M2081	#1865	Interface input point 18	M2097	#1881
Interface input point 3	M2082	#1866	Interface input point 19	M2098	#1882
Interface input point 4	M2083	#1867	Interface input point 20	M2099	#1883
Interface input point 5	M2084	#1868	Interface input point 21	M2100	#1884
Interface input point 6	M2085	#1869	Interface input point 22	M2101	#1885
Interface input point 7	M2086	#1870	Interface input point 23	M2102	#1886
Interface input point 8	M2087	#1871	Interface input point 24	M2103	#1887
Interface input point 9	M2088	#1872	Interface input point 25	M2104	#1888
Interface input point 10	M2089	#1873	Interface input point 26	M2105	#1889
Interface input point 11	M2090	#1874	Interface input point 27	M2106	#1890
Interface input point 12	M2091	#1875	Interface input point 28	M2107	#1891
Interface input point 13	M2092	#1876	Interface input point 29	M2108	#1892
Interface input point 14	M2093	#1877	Interface input point 30	M2109	#1893
Interface input point 15	M2094	#1878	Interface input point 31	M2110	#1894

Interface input point 16	M2095	#1879	Interface input point 32	M2111	#1895

5.3.2 NC system function special M input description

Signals are sent from NC system to MLC special M to pass NC system actual status to MLC.

Function name	Special M code	Description
System started and is ready	M2112	NC system is in ready status
System alarm	M2113	NC system encounters abnormalities
System emergency stop	M2114	System stops immediately after **EMG** key is pressed
Servo enabled	M2115	Servo ON message
HSI1	M2142	Status of high speed input point 1 (G31 input)
HSI2	M2143	Status of high speed input point 2
Macro call initial completed	M2224	Macro call initial function completed (auto mode, macro)
Macro call flag execution	M2225	Macro call flag execution
Macro call error flag	M2226	Macro call error flag
Transfer function is executing	M2228	When enabling the transfer function, this signal is ON
Channel alarm message	M2240	NC channel abnormality encountered
Auto execution (AUTO)	M2241	NC system sends this signal when in AUTO mode
Edit (EDIT)	M2242	NC system sends this signal when in EDIT mode
Manual input (MDI)	M2243	NC system sends this signal when in MDI mode
Fine tuning (MPG)	M2244	NC system sends this signal when in MPG mode
Jog (JOG)	M2245	NC system sends this signal when in JOG mode
Rapid feed (RAPID)	M2246	NC system sends this signal when in RAPID mode
Homing (HOME)	M2247	NC system sends this signal when in HOME mode

DNC	M2248	NC system sends this signal when in DNC mode
Single block stops	M2249	NC system sends this signal when single block stops
Loop enabled	M2250	NC system sends this signal when loop operation started
Pause	M2251	NC system sends this signal when the system is paused
M00 program stops	M2252	NC system sends this signal when code M00 is read
M01 optional pause	M2253	NC system sends this signal when code M01 is read
M02 program ends	M2254	NC system sends this signal when code M02 is read
M30 program ends and returns	M2255	NC system sends this signal when code M30 is read
Start program machining	M2270	Set this to ON when program machining starts
End program machining	M2271	Set this to ON when program machining ends

5.3.3 M, S and T code special M input description

When M, S, and T codes are encountered in a program, the NC system outputs relevant special M to MLC. For example, an M03 in the MLC program sets M2208 to ON.

Function name	Special M code	Description
M Code execution flag	M2208	A **M** code in the program sets this signal to ON and back to OFF only when another **M**, **S**, or **T** code triggers flag M1152. The following **M** codes are excluded: M00, M01, M02, M30, M98 and M99 or an M code macro.
S Code execution flag	M2209	A **S** code in the program sets this signal to ON and back to OFF only when another **M**, **S**, or **T** code triggers a flag. When a **S** code macro is used, the trigger does not work.
T Code execution flag	M2210	A **T** code (code of tool standby) in the program sets this signal to ON and back to OFF only when another **M**, **S**, or **T** code triggers a flag. When a **T** code macro is used, the trigger does not work. This flag varies with tool magazine station number setup. The flag is triggered only when the **T** code is within the tool ranges given by the station

		parameter.
B Code execution flag	M2211	A **B** code in the program sets this signal to ON and back to OFF only when another **M**, **S**, or **T** code triggers a flag. When a **B** code macro is used, the trigger does not work.

5.3.4 NC axis relevant special M input description

The port (port 1~9) specified by X-, Y-, and Z-axes corresponds to forward/backward and homing DI, the special M is triggered when input the hardward signal which is at the back of GMC-A controller. After each axis is home positioned, it changes to ON.

Function name	Special M code	Function name	Special M code
Port 1 positive hardware limit	M2144	X-axis home positioned	M2272
Port 1 axis negative hardware limit	M2145	Y-axis home positioned	M2273
Port 1 axis home signal	M2146	Z-axis home positioned	M2274
Port 2 axis positive hardware limit	M2148	A-axis home positioned	M2275
Port 2 axis negative hardware limit	M2149	B-axis home positioned	M2276
Port 2 axis home signal	M2150	C-axis home positioned	M2277
Port 3 axis positive hardware limit	M2152		
Port 3 axis negative hardware limit	M2153	X-axis secondary home positioned	M2286
Port 3 axis home signal	M2154	Y-axis secondary home	M2287

		positioned	
Port 4 axis positive hardware limit	M2156	Z-axis secondary home positioned	M2288
Port 4 axis negative hardware limit	M2157	A-axis secondary home positioned	M2289
Port 4 axis home signal	M2158	B-axis secondary home positioned	M2290
Port 5 positive hardware limit	M2160	C-axis secondary home positioned	M2291
Port 5 axis negative hardware limit	M2161		
Port 5 axis home signal	M2162	X-axis is moving	M2320
Port 6 positive hardware limit	M2164	Y-axis is moving	M2321
Port 6 axis negative hardware limit	M2165	Z-axis is moving	M2322
Port 6 axis home signal	M2166	A-axis is moving	M2323
		B-axis is moving	M2324
		C-axis is moving	M2325

5.3.5 Spindle and tool magazine MLC axis relevant special M input description

Spindle and MLC axis relevant

Function name	Special M code	Function name	Special M code
Speed of axis 1 reaches target speed	M2256	PLC X-axis positioned	M2304
Speed of axis 1 reaches zero speed	M2257	PLC Y-axis positioned	M2305
Primary-axis 1 positioned signal	M2258	PLC Z-axis positioned	M2306
Primary-axis is in rigid tapping mode	M2259		
Rigid tapping interruption	M2260		
Primary-axis home positioned	M2281		
Primary-axis is moving			
Tool magazine 1 reset	M2212		
Tool magazine 2 reset	M2213		

5.4　MLC register output (MLC -> NC) The description of special D Word output

5.4.1 System common - Description of special D output

Users can use variables #1833~#1848 in the machining program to read the signal status in MLC's interface output registers D1024~D1039. Variable #1833 pairs with output point D1024 and #1834 with D1025 and so forth for all the remaining pairs up to #1848 and D1039. For example, for an output value 100 by D1024 in an MLC program, the value of the variable number #1833 will be 100. That is, variable #1833 varies with register D1024.

Function name	Special D code	Variable ID	Function name	Special D code	Variable ID
Interface output register 1	D1024	#1833	Interface output register 9	D1032	#1841
Interface output register 2	D1025	#1834	Interface output register 10	D1033	#1842
Interface output register 3	D1026	#1835	Interface output register 11	D1034	#1843
Interface output register 4	D1027	#1836	Interface output register 12	D1035	#1844
Interface output register 5	D1028	#1837	Interface output register 13	D1036	#1845
Interface output register 6	D1029	#1838	Interface output register 14	D1037	#1846
Interface output register 7	D1030	#1839	Interface output register 15	D1038	#1847
Interface output register 8	D1031	#1840	Interface output register 16	D1039	#1848

5.4.2 NC system function - special D output description

Signals are sent by MLC to NC system. With mechanical keys and knobs, MLC program sends special D value to NC system to select MPG hand wheels and change its speed.

Function name	Special D code	Description
Number of completed machining	D1022	Set up in machining data or input from MLC
Number of target machining	D1023	Set up in machining data or input from MLC
MPG startup operation ID	D1040	Set up MPG hand wheel startup operation ID. Set to 0 to use external hand wheel and to 10 so that the secondary control panel incremental jogs with trigger signal M1118 and M1119 respectively.
Select channel during MPG operation	D1041	For MPG hand wheel operation channel selection, default at 0
MPG0 factor knob	D1042	MPG0 hand wheel factor settings (1, 10, 100

status		times of the least movement unit 0.001mm) e.g. 1*0.001 = 0.001mm/cnt
MPG0 spindle direction selection knob status	D1043	Select control axis set up by MPG0 hand wheel: X-axis = 0, Y-axis = 1 and Z-axis = 2.
MPG1 factor knob status	D1044	MPG1 hand wheel factor settings (1, 10, 100, 1000 times of the least movement unit 0.001mm)
MPG1 spindle direction selection knob status	D1045	Select control axis set up by MPG0 hand wheel: X-axis = 0, Y-axis = 1 and Z-axis = 2.
MPG2 factor knob status	D1046	MPG2 hand wheel factor settings (1, 10, 100 times of the least movement unit 0.001mm)
MPG2 spindle direction selection knob status	D1047	Select control axis set up by MPG0 hand wheel: X-axis = 0, Y-axis = 1 and Z-axis = 2.
Call macro file name	D1111	Specify to call macro file name O9xxx

5.4.3 NC axis relevant special D output description

Signals are sent by MLC to NC system. With mechanical keys and knobs, MLC program sends special D value to NC system to change the speed of various NC modes.

Function name	Special D code	Description
Feed rate adjustment	D1056	This is the percentage of F value set in the program. For example, for F1000 given in the program and a D value of 50, an F500 mm/min will be derived (500 = 1000 x 50%)
Fast movement speed adjustment rate	D1058	Set up a percentage against the maximum fast movement parameter G00. For example, for maximum fast movement 6000 and a D value of 50, the G00 and rapid jog speed would be 3000 mm/min (3000 = 6000 x 50%)
Spindle speed adjustment rate	D1060	Set up percentage against the S value. For example, for S1000 given in the program and a D value of 30, then a S300 r/min will be derived (300 = 1000 x 30%)
Speed set for JOG and Dry run	D1062	Set up movement speed F for dry run in JOG or AUTO mode. For example, Special D set at 50 represents F50 mm/min with a range of 0~65535mm/min.

5.4.4 Spindle and MLC axis relevant special D input description

Spindle and MLC axis relevant

Function name	Special D code/command unit	Function name	Special D code/command unit
MLC X-axis positioning command	D1064 (mm/inch)	PLC X-axis command of feed rate	D1082 (mm, inch/min)
PLC Y-axis positioning command	D1066 (mm/inch)	PLC Y-axis command of feed rate	D1084 (mm, inch/min)
PLC Z-axis positioning command	D1068 (mm/inch)	PLC Z-axis command of feed rate	D1086 (mm, inch/min)
PLC A-axis positioning command	D1070 (mm/inch)	PLC A-axis command of feed rate	D1088 (rpm)
PLC B-axis positioning command	D1072 (mm/inch)	PLC B-axis command of feed rate	D1090 (rpm)
PLC C-axis positioning command	D1074 (mm/inch)	PLC C-axis command of feed rate	D1092 (rpm)
PLC U-axis positioning command	D1076 (mm/inch)	PLC U-axis command of feed rate	D1094 (mm, inch/min)
PLC V-axis positioning command	D1078 (mm/inch)	PLC V-axis command of feed rate	D1096 (mm, inch/min)
PLC W-axis positioning command	D1080 (mm/inch)	PLC W-axis command of feed rate	D1098 (mm, inch/min)
PLC spindle positioning/speed command	D1100		

5.5   MLC register input (NC -> MLC) The description of special D word input

5.5.1 System common – Description of special D input

Users can use variables #1896~#1911 in the machining program to read the signal status in MLC's interface input registers D1336~D1351. Variable #1896 pairs with output point D1336 and #1897 with D1337 and so forth for all the remaining pairs up to #1911 and D135. For example, for an output value 101 by D1336 in MLC program, the value of the variable number #1896 will be 101. That is, variable #1896 varies with register D1336.

Function name	Special D code	Variable ID	Function name	Special D code	Variable ID
Interface input register 1	D1336	#1896	Interface input register 9	D1344	#1904
Interface input register 2	D1337	#1897	Interface input register 10	D1345	#1905
Interface input register 3	D1338	#1898	Interface input register 11	D1346	#1906
Interface input register 4	D1339	#1899	Interface input register 12	D1347	#1907
Interface input register 5	D1340	#1900	Interface input register 13	D1348	#1908
Interface input register 6	D1341	#1901	Interface input register 14	D1349	#1909
Interface input register 7	D1342	#1902	Interface input register 15	D1350	#1910
Interface input register 8	D1343	#1903	Interface input register 16	D1351	#1911

5.5.2 NC axis relevant special D input description

MPG position signal

Function name	Special D code	Description
MPG 0 current position value	D1352	Incremental pulse value when MPG0 hand wheel is used
MPG 1 current position value	D1353	Reserved
MPG 2 current position value	D1354	Reserved
ADC analog value	D1355	Reserved (channel 1)
ADC analog value	D1356	Reserved (channel 2)
DAC analog value	D1357	Reserved (channel 1)

DAC analog value	D1358	Reserved (channel 2)

5.5.3 M, S and T code special D input description

When M, S, and T codes are encountered in a program, NC system outputs relevant special **D** to MLC. For example, M03 in program sets D1368 to 3.

Function name	Special D code	Description
M code data	D1368	The program sets M code data to special D register. The following **M** codes are excluded: M00, M01, M02, M30, M98 and M99 and M code macro.
S code data	D1369	The program sets S code data to special D register. When a **S** code macro is used, the trigger does not work (unit: RPM).
T code data (command)	D1370	**T** code data in use is set to this special **D** register. When a **T** code macro is used, the trigger does not work. This flag varies with tool magazine station number setup. The flag triggers only when the **T** code is within the tool ranges given by the station parameter.
T code data (standby) tool magazine 1	D1371	Last **T** code data kept in the tool magazine 1 system is set to this special **D** register.
T code data (incremental movement station ID) tool magazine 1	D1372	The tool magazine 1 system determines the difference between tool plate forward and backward move for tool replacement code selection and setting to this special **D** register.
Tool pot (standby) tool magazine 1	D1373	Set current standby tool pot ID in the tool magazine 1 system and set to this special **D** register.
Spindle ID (in use) tool magazine 1	D1374	SpindleID (in use) Tool magazine 1 (MLC)
T code data (standby) tool magazine 2	D1375	Last **T** code data kept in the tool magazine 2 system is set to this special **D** register.
T code data (incremental movement station ID) tool magazine 2	D1376	The tool magazine 2 system determines the difference between tool plate forward and backward move for tool replacement code selection and setting to this special **D** register.

Tool pot (standby) tool magazine 2	D1377	Set current standby tool pot ID in the tool magazine 2 system and set to this special **D** register.
Spindle ID (in use) tool magazine 1	D1378	Spindle ID (in use) Tool magazine 2 (MLC)
Feed rate	D1379	Read the feed rate from the system when cutting
Spindle speed	D1380	Read the spindle speed from the system

5.5.4 NC axis relevant special D input description

Signals are sent from the NC to the MLC system and written to the mechanical system from the MLC.

Function name	Special D code	Description
X-axis mechanical coordinates	D1384	X-axis mechanical coordinates (float Low word)
X-axis mechanical coordinates	D1385	X-axis mechanical coordinates (float High word)
Y-axis mechanical coordinates	D1386	Y-axis mechanical coordinates (float Low word)
Y-axis mechanical coordinates	D1387	Y-axis mechanical coordinates (float High word)
Z-axis mechanical coordinates	D1388	Z-axis mechanical coordinates (float Low word)
Z-axis mechanical coordinates	D1389	Z-axis mechanical coordinates (float High word)
A-axis mechanical coordinates	D1390	A-axis mechanical coordinates (float Low word)
A-axis mechanical coordinates	D1391	A-axis mechanical coordinates (float High word)
B-axis	D1392	B-axis mechanical coordinates (float Low word)

mechanical coordinates		
B-axis mechanical coordinates	D1393	B-axis mechanical coordinates (float High word)
C-axis mechanical coordinates	D1394	C-axis mechanical coordinates (float Low word)
C-axis mechanical coordinates	D1395	C-axis mechanical coordinates (float High word)

5.6 Summary of settings of devices in MLC

Device name	General					Power outage maintain	Function	Total number of points
X-axis mechanical input (Bit)	On Board	MPG	N/A	Secondary control panel	Remote		Corresponds to external input point	296
	X0~X27	X28~X33	X34~X63	X64~X255	X256~X511	None		
Y-axis mechanical input (Bit)	Y0~Y27		Y28~Y63	Y64~Y255	Y256~Y511	None	Corresponds to external output point	296
M auxiliary relay (Bit)	General		Special M for system		MLC special M	M512~M1023	[General function]	3072
	M0~M3071						Contact point can turn on/off within program	
	M0~M511	MLC->NC		NC->MLC	MLC		[Special M function]	
		M1024~M1215		M1696~M1983	M2816~M3071`		For communication between system and MLC	
A Alarm (Bit)	A0~A511					None	User-customized MLC alarm with NC screen display format: A0 + alarm description	512
T — Timer (Bit)	T0~T199 (100ms unit)		T200~T255 (10ms unit)			None	The timer set by TMR command. When time is up the T contact with the same code turns ON	256
T — Timing (Word)	T0~T255 (16 bit, range 0~65535)							
C counter (Bit)	C0~C79					None	The counter set by CNT (DCNT) command. When time is up the C contact with the same code turns ON (C78 and C79 hardware counting)	80
C counter — Word or DWord		16 bit (upper)	32 bit (upper and lower)		32 bit high speed (upper and lower)	None		
	Range	0~65,536	-2,147,483,648~+2,147,483,647		-2,147,483,648~+2,147,483,647		Enabled when special M paired with the lower 32 bit is opened, e.g. the lower bit of C64 pairs to M1200 and C65 pairs to M1201.	
		C0~C63	C64~C77		C78 C79			
		None	Open the lower number after M2832~M2845		Open the lower number with parameter MLC (#312)			
D data register Word	General	Special D for system		MLC special D		D512~D1023	The memory zone for data storage. C and T can be used as register too.	1536
	D0~D511 (-32768~+32767)	MLC-->NC		NC-->MLC	For MLC		[Special D function]	
		D1024~D1118		D1336~D1384	D1456~D1535		For communication between system and MLC.	
V register Word	V0~V7 (-32768~+32768)					None	V and Z can be used for special indirect designation.	8
Z register Word	Z0~Z7 (-32768~+32768)					None		8
Indicators	Function		Range				[Function]	
N (circuit indicator)	For main circuit		N0~N7			None	Main circuit control point	8
P (jumping indicator)	For CJ, CALL		P0~P255			None	Position flag of CJ, CALL	256
I (interruption indicator)	interruptio — On Board hardware		IX00~IX07			None	The main board has 8 external hardware interruptions	34
	interruptio — Hardware counting		IC00~IC01				The 2 mainboard high speed counting interruptions	

		Remote computing	IR00~IR23		Each remote card has 3 external hardware interruptions	
K constant	Decimal	K-32,768~K+32,767 (16 bit computing)		None		
		K-2,147,483,648~ K+2,147,483,647 (32 bit computing)		None		
F floating point	Up to one thousandth	**-3.4+10^38 ~ 3.4+10^38**		None		

5.7 Function Setup

5.7.1 Analog spindle gear switch setup description

MLC accompanied gear switch

Assumptions

M Code expression	Output point	Input point	M1122=Bit0 M1123=Bit1	Gear switch parameter for the corresponding spindle (shift gear ratio)
M69 neutral point	Y256= neutral point	X256= neutral point		
M70: switch to the 1st gear	Y257: switch to the 1st gear	X257: switch to the 1st gear	00	Gear 1 [422 numerator/423 denominator]
M71: switch to the 2nd gear	Y258: switch to the 2nd gear	X258: switch to the 2nd gear	01	Gear 2 [424 numerator/425 denominator]
M72: switch to the 3rd gear	Y259: switch to the 3rd gear	X259: switch to the 3rd gear	10	Gear 3 [426 numerator/427 denominator]
M73: switch to the 4th gear	Y260: switch to the 4th gear	X260: switch to the 4th gear	11	Gear 4 [428 numerator/429 denominator]

For example, when the program gives statement M3S1000, spindle at the 2nd gear (parameter 424/425) and gear ratio at 1/2, then the analog voltage will double, motor speed will be at S2000 rpm, and the spindle end speed will be at S1000 rpm after mechanical deceleration.

Spindle and MLC axis relevant special M output description

Spindle relevant output

Function name	Special M code
Spindle forward	M1120
Spindle backward	M1121
Spindle gear ratio selection Bit0	M1122
Spindle gear ratio selection Bit1	M1123
Spindle positioning control	M1124

Switch gear with M Code calls, e.g. M70 to gear one

⊣=├	D1368	K69	─(M69) Spindle neutral point
⊣=├	D1368	K70	─(M70) Spindle gear 1
⊣=├	D1368	K71	─(M71) Spindle gear 2
⊣=├	D1368	K72	─(M72) Spindle gear 3
⊣=├	D1368	K73	─(M73) Spindle gear 4
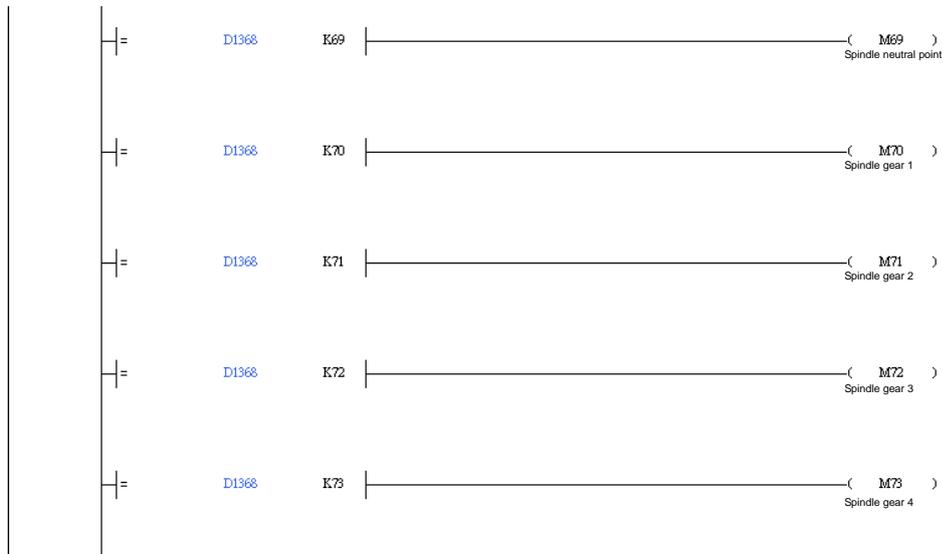
Relay DI and switch gear ratio after gear set, switch with M1122 and M1123

```
  X257      X258      X259      X260
 ──┤├──────┤/├──────┤/├──────┤/├────────────────────────────[ MOV      K0      K1M1122 ]
Switch to gear 1  Switch to gear 2  Switch to gear 3  Switch to gear 4                           Spindle gear ratio bit0

  X257      X258      X259      X260
 ──┤/├──────┤├──────┤/├──────┤/├────────────────────────────[ MOV      K1      K1M1122 ]
Switch to gear 1  Switch to gear 2  Switch to gear 3  Switch to gear 4                           Spindle gear ratio bit0

  X257      X258      X259      X260
 ──┤/├──────┤/├──────┤├──────┤/├────────────────────────────[ MOV      K2      K1M1122 ]
Switch to gear 1  Switch to gear 2  Switch to gear 3  Switch to gear 4                           Spindle gear ratio bit0

  X257      X258      X259      X260
 ──┤/├──────┤/├──────┤/├──────┤├────────────────────────────[ MOV      K3      K1M1122 ]
Switch to gear 1  Switch to gear 2  Switch to gear 3  Switch to gear 4                           Spindle gear ratio bit0

  M69
 ──┤├─────────────────────────────────────────────────────────────────( Y256 )
Spindle neutral point                                                         Neutral point

  M70
 ──┤├─────────────────────────────────────────────────────────────────( Y257 )
Spindle gear 1                                                                Gear 1

  M71
 ──┤├─────────────────────────────────────────────────────────────────( Y258 )
Spindle gear 2                                                                Gear 2

  M72
 ──┤├─────────────────────────────────────────────────────────────────( Y259 )
Spindle gear 3                                                                Gear 3

  M73
 ──┤├─────────────────────────────────────────────────────────────────( Y260 )
Spindle gear 4                                                                Gear 4
```

End M code after gear switched
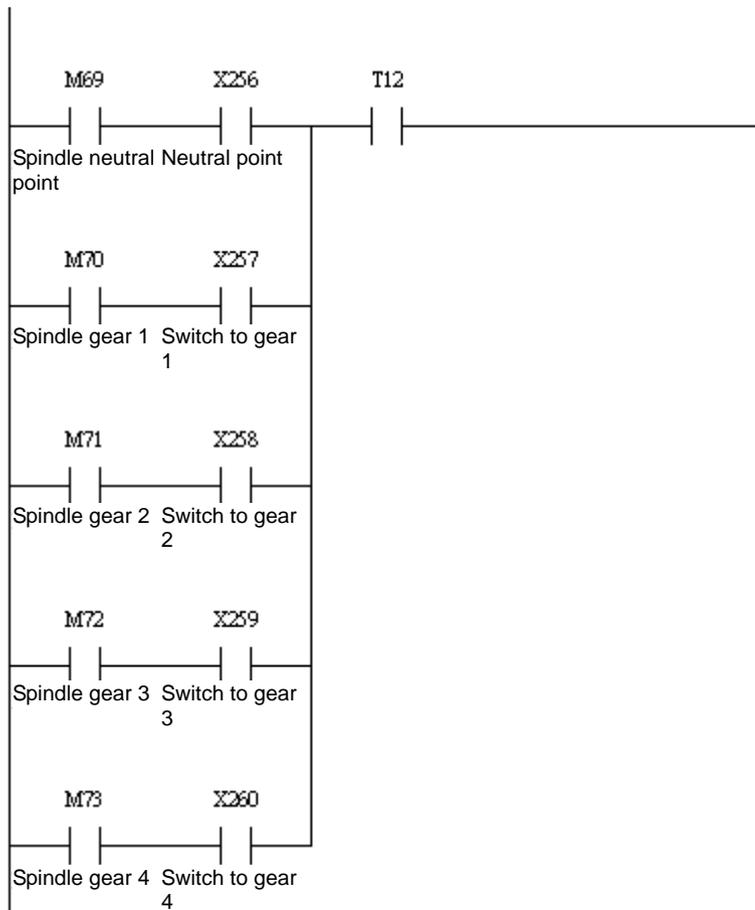
Sample macro for spindle gear switch

#1 = 500   (define gear range)

#2 = 4000

#3 = 8000

#4 = 12000

#6 = 100   (define speed after gear switch)

IF [#19<#1] GOTO 10

IF [#19<#2] GOTO11

IF [#19<#3] GOTO12

IF [#19<#4] GOTO13

GOTO 1000

(1st stage)

N10

#10=70
GOTO 20

(2nd stage)
N11
#10=71
GOTO 20

(3rd stage)
N12
#10=72
GOTO 20

(4th stage)
N13
#10=73

N20
#11=#10-69
IF [#1833==#11] GOTO1000   (compare MLC gear against target gear of the command)
S#6   (enter the gear speed and wait until the given speed is reached)
M69   (neutral point)
M#10   (MLC is informed to trigger gear switch)
G4X2.
M99

N1000
S#19
M99

5.7.2 Return from tapping interruption

A tapping interruption flag (M2260) is triggered by pressing the **RESET** key or **EMG** during tapping. A return after tapping (M1125) triggered in auto mode will return point R automatically. This tapping interruption is relieved and ignored in the following situations:

1. Spindle positioning cancelled

2. Program restarted

3. Any axial movement

4. System power on again

5. Set the emergency stop mode of parameter 307 to 0.

Note:

1. Users cannot switch modes during tapping.

2. Users cannot return from tapping when M1125 is ON during tapping.

3. Users must remove tapping interruption (execute program again and any axial movement) together with positioning (set M1120 and M1124 to 0).

4. When tapping interruption flag (M2260) is ON, the spindle and Z-axis halt at the current position. The spindle is not positioned (the spindle positioned signal is indicated by M2258 = 0).

5. After the tapping interruption flag M2260 is ON, users cannot run MPG and homing.

NC->MLC
During tapping M2259

NC->MLC
Tapping interruption M2260

MLC->NC
Return from tapping M1125
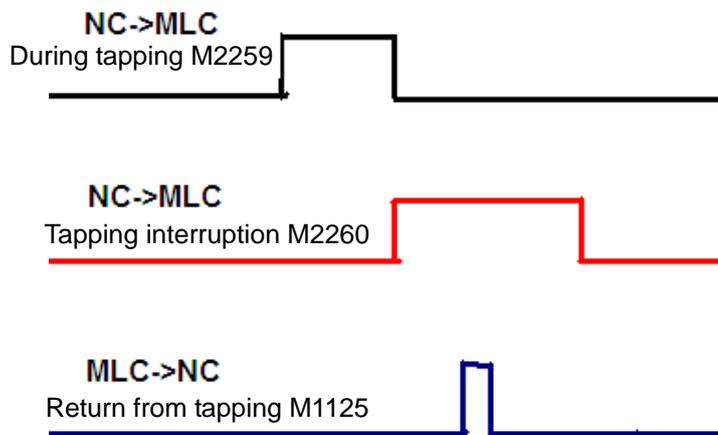
Cancel tapping interruption

NC->MLC
During tapping M2259

NC->MLC
During tapping M2259

NC->MLC
Tapping interruption M2260

NC->MLC
Tapping interruption M2260

MLC->NC
Spindle positioning cancelled
(Either M1120 or M1124 OFF)

MLC->NC
Auto loop execution M1061

NC->MLC
During tapping M2259

NC->MLC
Tapping interruption M2260

MLC->NC
Axial movement (M1216~M1219)
(M1226~M1229)
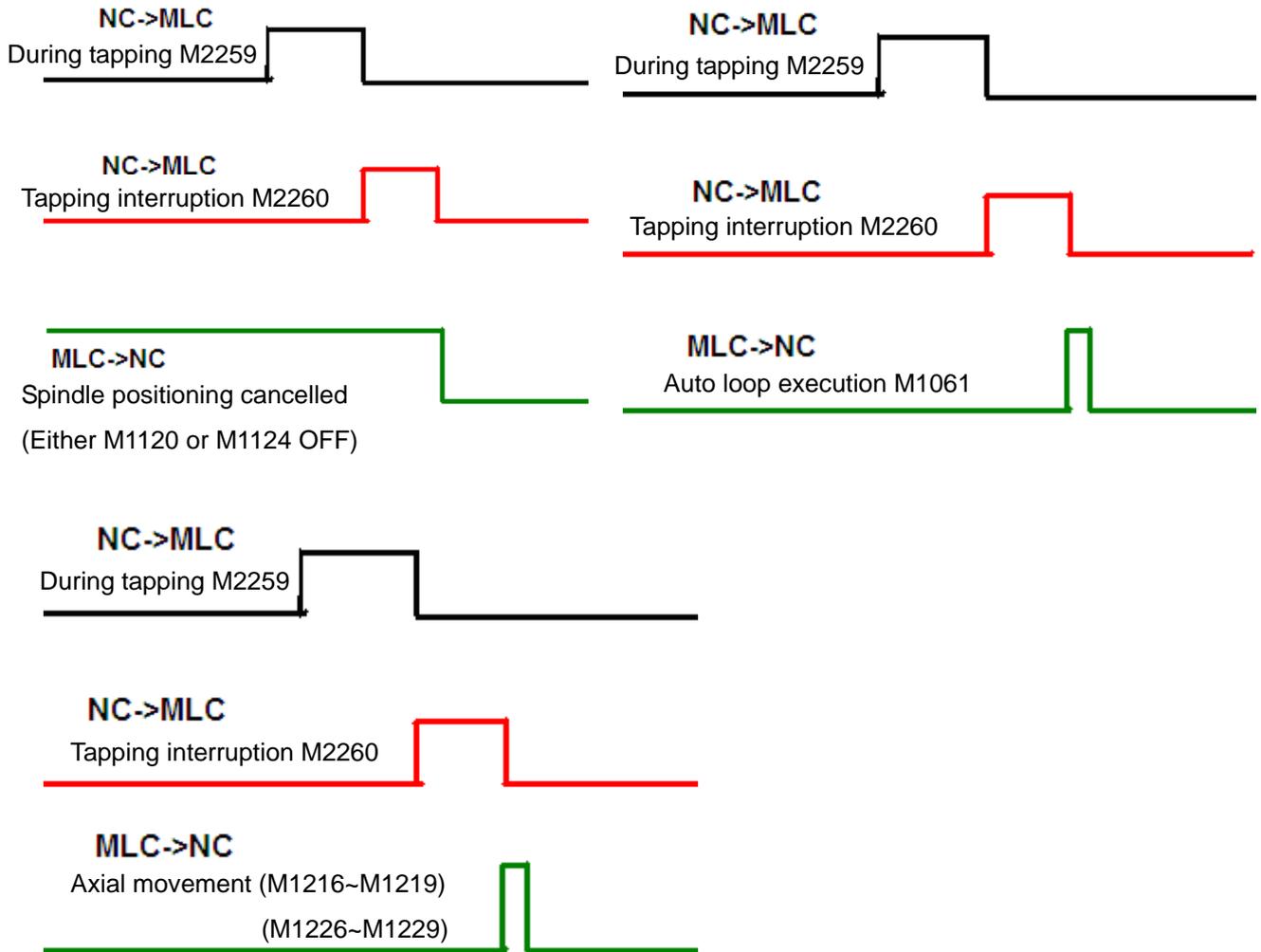
5.7.3 Call Macro function by one key

MLC->NC	Macro requested	Macro call initial input (auto mode, macro number)	M1074
	Macro execution	Macro call activation	M1075

NC->MLC	Macro confirmed	Macro call initial completed	M2224
	Macro execution	Macro call flag execution	M2225
	Macro error	Macro call error flag	M2226

MLC->NC	Macro file Nr	Call macro file number O9xxx	D1111

This example uses X92 (accesskey) as the trigger point

```
M2241                                                    (  Y64   )
 | |                                                      AUTO Light
AUTO MODE


M2244      X92      M2226                                 (  M0    )
 | |       | |       |/|                                  Call Macro
NC->MLC   Rapid    Call Macro
MPG                 Err


 M0       M2244                              MOV   K9000   D1111
 | |       |/|
Call Macro NC->MLC
          MPG


                   Y64
                   | |                                    (  M1074 )
                  AUTO Light                              Call Marco
                                                          Input


M2244                                                    (  M1075 )
 | |                                                      Call Marco
NC->MLC                                                   Star
MPG
```
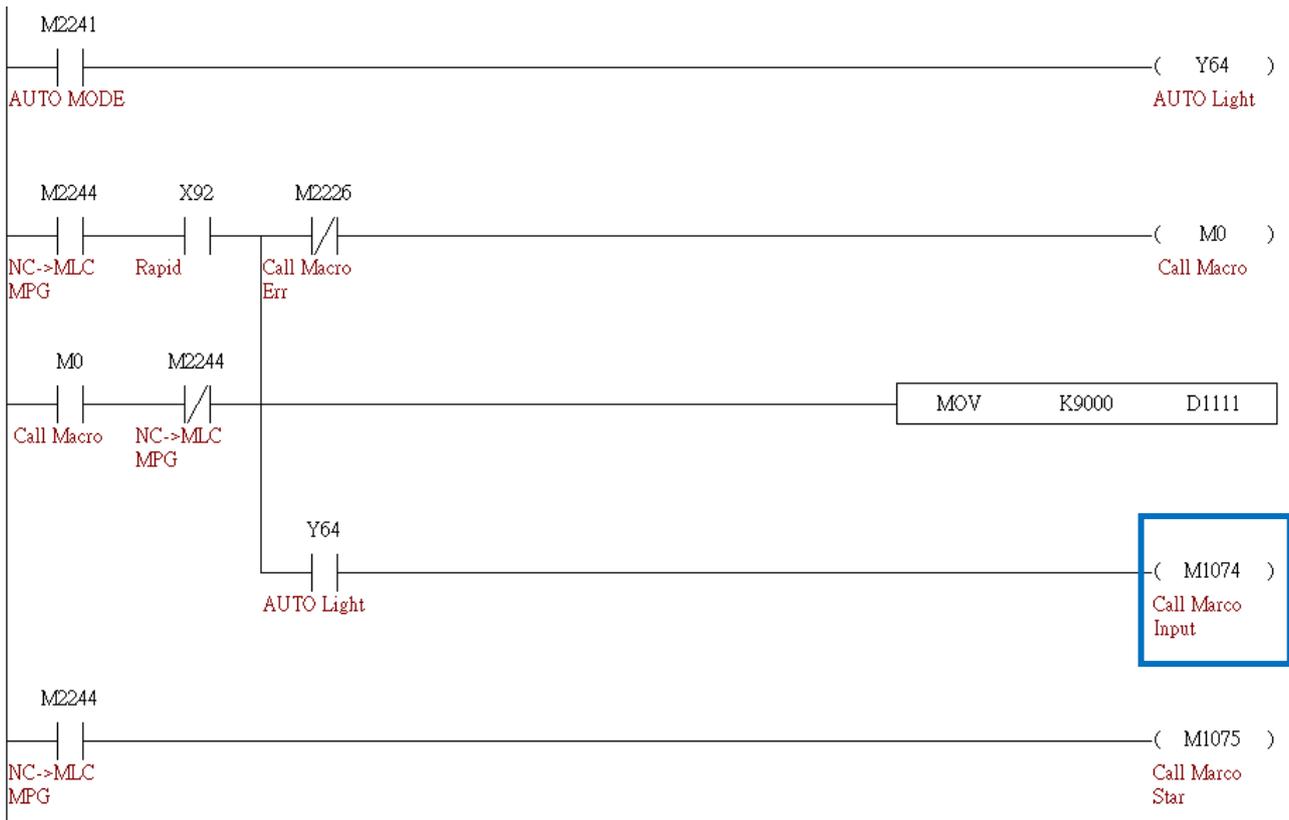
5.7.4 Function of spindle positioning and spindle forward used in MLC

Spindle and relevant special **M**

| Function name	Special M code
Spindle forward	M1120
Spindle backward	M1121
Spindle gear ratio selection Bit0	M1122
Spindle gear ratio selection Bit1	M1123
Spindle positioning control	M1124
Spindle tapping retrieval	M1125

When applying the function of spindle positioning, it needs to trigger two special **M**, M1120, M1124.
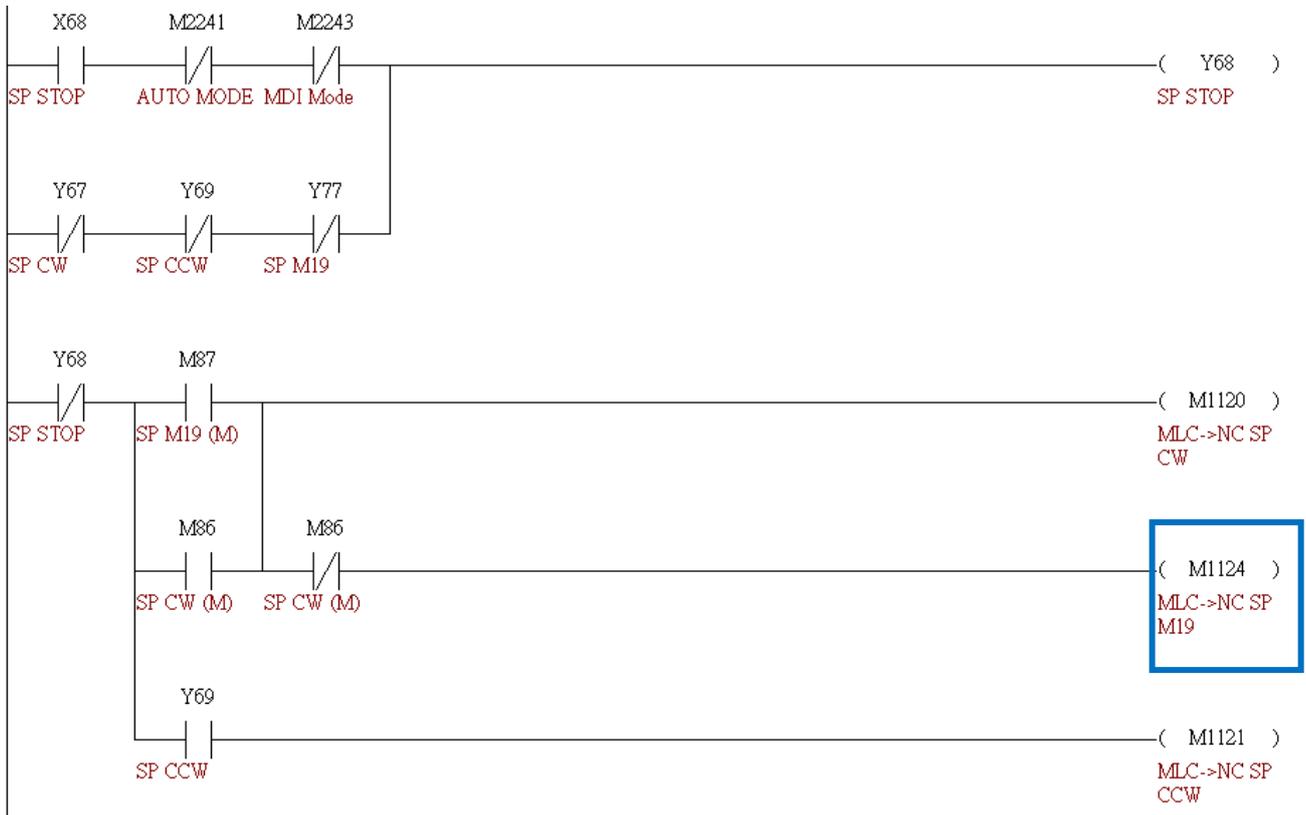
5.7.5 Function of Z-axis drop prevention and Servo RST power cut-off used in MLC

Relevant Parameter

Number	Name	Description	Unit	Default	Range
328	EMG stop delay time	It is the delay time setting of flag enable (M2115) when it is in EMG stop and Servo off mode.	0.001 sec	35	0~200
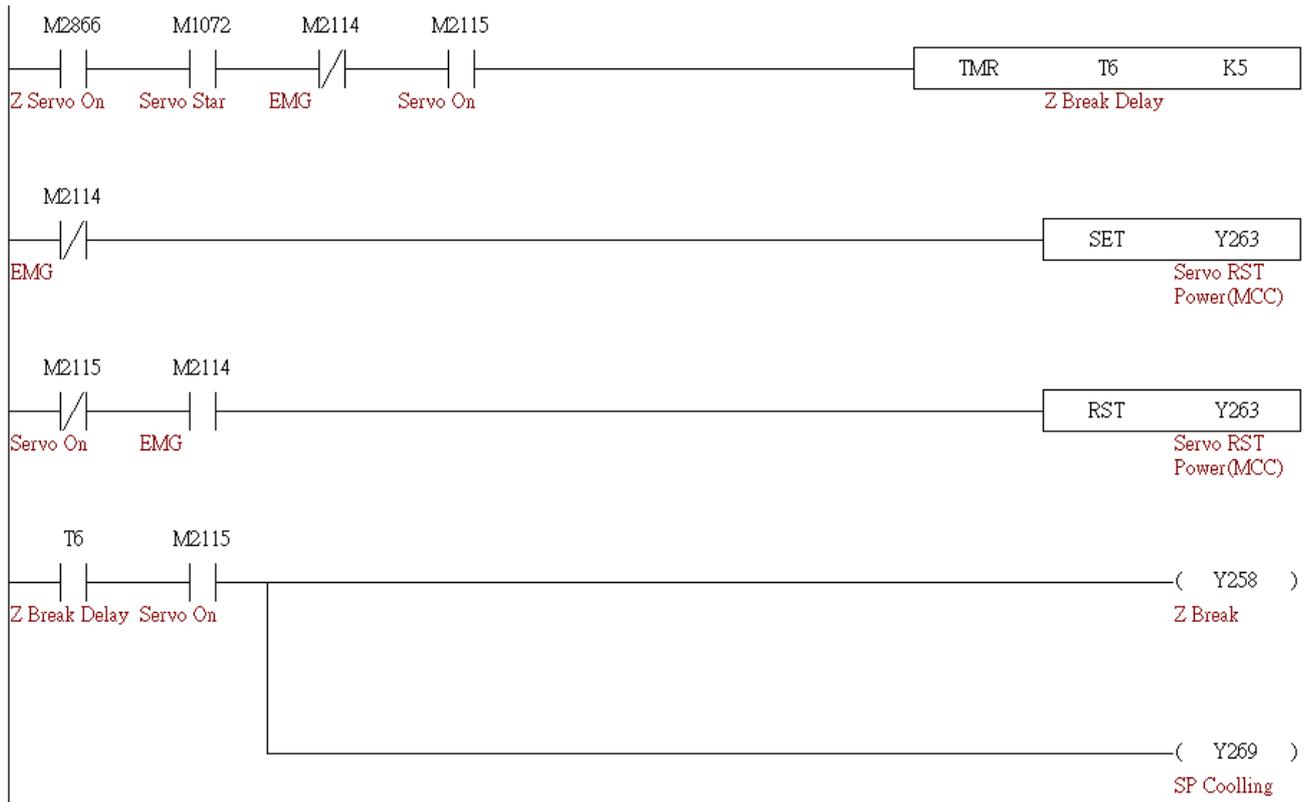
5.7.6 Reset the system before calling Macro function by one key

Use special **M**

System reset (NC->MLC)	M1064	Press the Reset Key to trigger rising edge. Its interval is 4 seconds (NC->MLC).
System reset (MLC->NC)	M1076	Triggering the signal will reset the system (MLC->NC).

Reset the system first, then execute the calling procedure

```
   X95          M88                                           ( M1076 )
   ─┤\├─        ─┤/├─                                         Sys Reset-
 Call Macro    Realy                                          >NC
 Key

   M1076
   ─┤ ├─
 Sys Reset-
 >NC

   M1064                                                      ( M88 )
   ─┤\├─                                                      Realy
 RST->MLC


   M206        M1076        M305                              ( M215 )
   ─┤ ├─       ─┤\├─        ─┤ ├─                             1 TOUH_M1
 MAN_MOD     Sys Reset-   1 TOUH_CD
             >NC

   M215        M2224                              SET        M306
   ─┤ ├─       ─┤/├─                                         1 TOUH_HD
 1 TOUH_M1   Call Marco
             Finish

                                           MOV    K9040      D1111
                                                             MARCO_NO


   M2241       M215                                          ( M1074 )
   ─┤ ├─       ─┤ ├─                                         Call Marco
 AUTO MODE  1 TOUH_M1                                        Input

   M2224                                                     ( M1075 )
   ─┤ ├─                                                     Call Marco
 Call Marco                                                  Star
 Finish
```
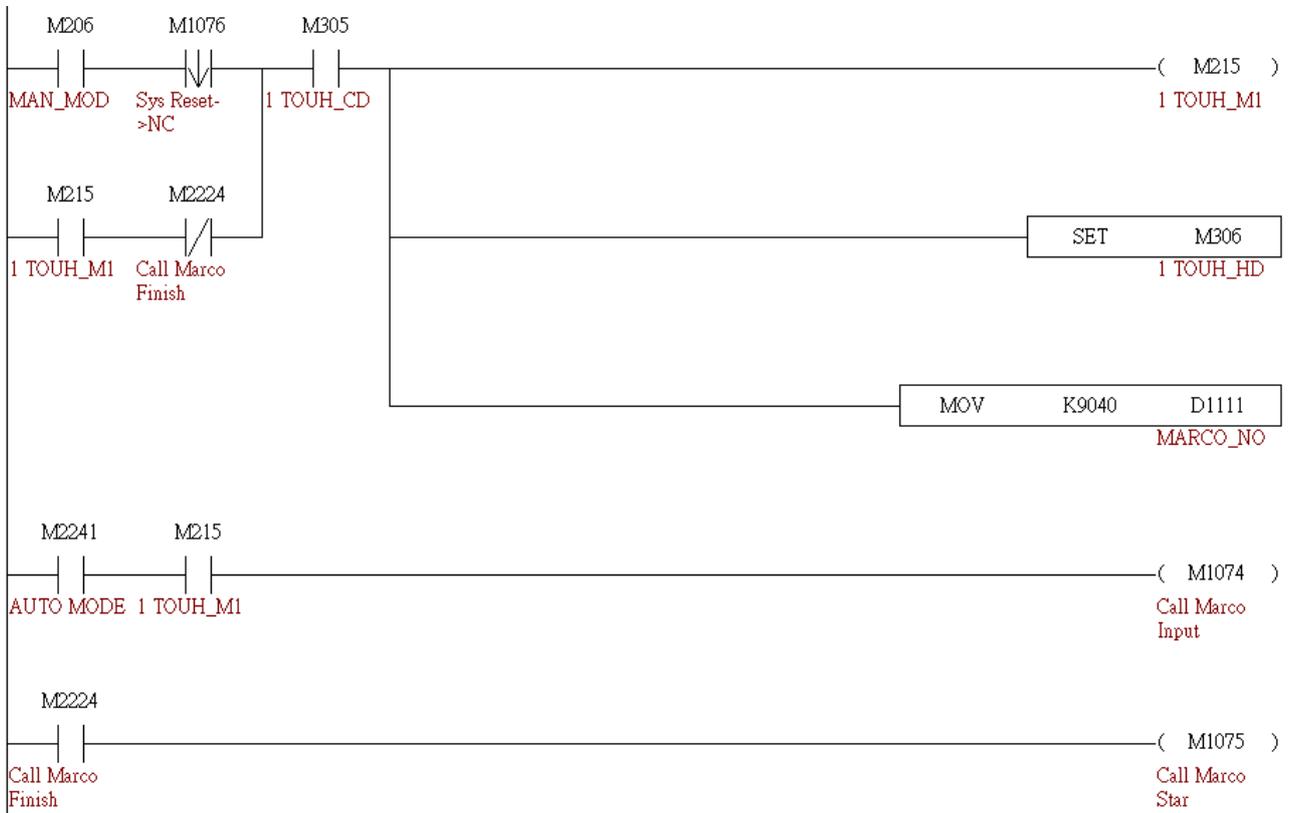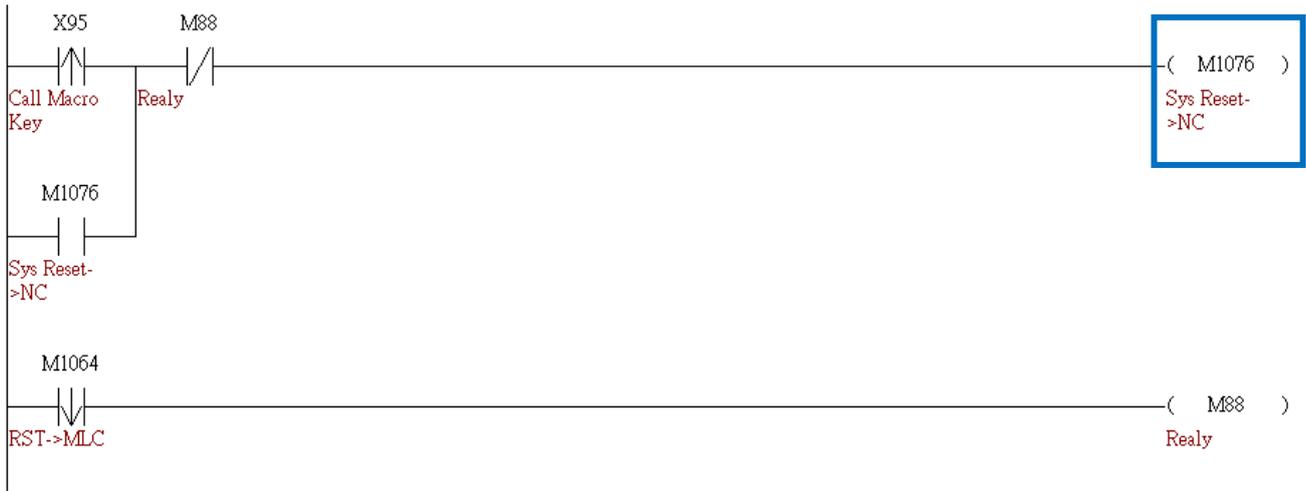
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Chapter 6: Troubleshooting

6.1   List of alarms of NC300 controller
6.1.1 PLC system alarms: (code range: 0x1200~0x1300)

Code	Name	Description and troubleshooting
0x1200	Memory access error	1. Error occurs when accessing NC memory by MLC. 2. Re-start the system or send the system back for servicing.
0x1201	System is not ready	1. The NC startup procedure is not completed successfully. 2. Re-start the system or send the system back for servicing.
0x1202	Buffer memory error	1. NC buffer memory error or not ready. 2. Re-start the system or send the system back for servicing.
0x1203	Output port is not found	1. NC output port is not found. 2. Verify axis parameter settings.
0x1204	MLC code clearance error	1. MLC program code clearance failed. 2. Send the system back for servicing.
0x1205	MLC flash memory error	1. MLC program code writing failed. 2. Re-start the system or send the system back for servicing.
0x1206	SRAM error	1. SRAM writing error. 2. Send the system back for servicing.
0x1207	Host I/O channel error	1. Host I/O access error. 2. Re-start the system or send the system back for servicing.
0x1208	Remote I/O channel error	1. Remote I/O access error. 2. Re-start the system or send the system back for servicing.
0x1209	Remote I/O channel error	1. Remote I/O access error. 2. Re-start the system or send the system back for servicing.
0x120A	NC parameter error	1. NC parameter is not set up or initialized. 2. Re-initialize parameters
0x120B	Compensation parameter error	1. Compensation parameter write-in error. 2. Re-write compensation parameters.

Code	Name	Description and troubleshooting
0x120C	Compensation parameter clearance error	1. Compensation parameter memory clearance error. 2. Re-write compensation parameters.
0x120D	Compensation parameter write-in error	1. Compensation parameter memory write-in error. 2. Re-write compensation parameters.
0x120E	Parameter initialization error	1. Parameter initialization error. 2. Re-initialized parameters.
0x120F	Memory clearance error	1. Memory clearance error. 2. Re-start the system or send the system back for servicing.
0x1210	Memory write-in error	1. Memory clearance error or initialization error. 2. Re-start the system or send the system back for servicing.
0x1211	Servo axis is not found	1. Parameter setup error. 2. Verify parameter settings.
0x1212	Servo axis parameter format error	1. Parameter setup error. 2. Verify parameter settings.
0x1213	DMCNET initialization error	1. DMCNET initialization error. 2. Ensure the DMCNET is securely connected.
0x1214	Power-outage retaining memory error	1. Power-outage retaining memory error. 2. Re-start the system or send the system back for servicing.
0x1300	Network communication error	1. Verify network wiring. 2. Re-start the system or send the system back for servicing.
0x1E00	Servo error	1. Servo error. 2. Verify servo status or replace servo.
0x1F00	Remote I/O error	1. Remote I/O error. 2. Verify remote I/O connection or replace remote I/O board.
0x4200	Homing	1. Homing

6.1.2 NC alarm code (range: 0x4200 ~0x4300)

Code	Name	Description and troubleshooting
0x4200	Homing not ready	1. Do homing operation. 2. Verify wiring or parameter settings.
0x4300	MLC is not ready	1. MLC is not ready or memory access error. 2. Re-start the system or send the system back for servicing.
0x4301	MLC is not ready	1. MLC is not ready. 2. Re-start the system or send the system back for servicing.
0x4302	I/O module program clearance failed	1. I/O module program clearance failed. 2. Re-install the program.
0x4303	I/O module program write-in failure	1. I/O module program write-in failed. 2. Re-install the program.
0x4304	NC system program clearance failure	1. NC system program clearance failed 2. Re-install the program.
0x4305	NC system program installation failure	1. NC system program installation failed. 2. Re-install the program.
0x4306	Macro clearance failure	1. Macro program clearance failed. 2. Re-install the program.
0x4307	Macro installation failure	1. Macro program installation failed. 2. Re-install the program.
0x4308	G code loading error	1. G code loading error. 2. Verify the machining program.
0x4309	ILLEGAL_PROGRAM_ADDR Illegal program address	
0x430A	EXCEED_MAX_RDCMD_RANGE Over the upper limit of the reading memory area	
0x430B	EXCEED_MAX_WRCMD_RANGE Over the upper limit of the write-in memory area	
0x4310	I/O module program is not initialized	1. I/O module program is not initialized. 2. Re-install I/O module program.
0x4311	I/O module memory error	1. I/O module memory error. 2. Re-start the system or send the system back for servicing.
0x4312	I/O module memory error	1. I/O module memory error. 2. Re-start the system or send the system back for servicing.

Code	Name	Description and troubleshooting
0x4313	I/O module status error	1. I/O module status error. 2. Ensure the I/O board is inserted securely.
0x4314	I/O module program planning error	1. I/O module program planning error. 2. Ensure the I/O board is inserted securely.
0x4315	I/O board hardware interface error	1. I/O board hardware interface error. 2. Ensure the I/O board is inserted securely.
0x4316	I/O board hardware interface error	1. I/O board hardware interface reading error. 2. Send the system back for servicing.
0x4317	NC system command error	1. NC system command error. 2. Send the system back for servicing.
0x4318	NC parameter error	1. NC parameter error or MLC not ready. 2. Re-start the system or send the system back for servicing.
0x4319	NC parameter error	1. NC parameter error or MLC not ready. 2. Re-start the system or send the system back for servicing.
0x431A	Tool magazine axis error	1. Tool magazine axis is not defined or defined repeatedly. 2. Verify parameter settings.

6.1.3 Channel alarm code: (range: 0xA000~0xD000)
Description of illegal G code line number and error messages

Code	Name	Description and troubleshooting
0xA000	Illegal G code line number	1. Illegal G code line number. 2. Verify the machining program.
0xA001	Illegal G code length	1. Illegal G code length. 2. Verify the machining program.
0xA002	G code file is not found	1. G code file is not found. 2. Verify file contents.
0xA003	Invalid name of the loaded file	1. Invalid name of the loaded file. 2. Load the program file again.
0xA004	Workpiece coordinates computing error	1. Workpiece coordinates computing error。 2. Reset workpiece coordinates.
0xA005	Workpiece coordinates computing error	1. Workpiece coordinates computing error。 2. Reset workpiece coordinates.
0xA006	Workpiece coordinates computing error	1. Workpiece coordinates computing error。 2. Reset workpiece coordinates.
0xA007	Conflicting servo port settings	1. Conflicting servo port settings. 2. Verify parameter settings.
0xA009	G code buffer zone error	1. G code buffer zone error. 2. Load machining program again.
0xA00A	Invalid interpolator command index	
0xA00B	Interpolator command buffer zone access error	
0xA00C	Feed rate is not defined	1. G code error. 2. Check G code and revise program.
0xA00D	Invalid arc diameter	1. G code error. 2. Check G code and revise program.
0xA00E	Invalid tool ID selection	1. G code error. 2. Check G code and revise program.
0xA00F	Number of servo axis does not match with parameter settings	1. Verify settings.

Code	Name	Description and troubleshooting
0xA010	Break point sub-routine is not found	1. G code error. 2. Check G code and revise program.
0xA011	SYSTEM_RESET System reset	
0xA012	INVALID_COMP_PLANE Invalid tool length compensation	1. G code error. 2. Check G code and revise program.
0xA013	INVALID_COMMAND Illegal commands	1. G code error. 2. Check G code and revise program.
0xA014	R_COMP_CONFLICT Invalid cutter compensation	1. G code error. 2. Check G code and revise program.
0xA015	EMG_STOP_MSG Emergency stop	1. Release EMG.
0xA100	Cutter interference	1. G code error. 2. Check G code and revise program.
0xA101	Cancel diameter compensation in arc	1. G code error. 2. Check G code and revise program.
0xA102	Enable diameter compensation in arc	1. G code error. 2. Check G code and revise program.
0xA103	ARC_INTERF Incorrect cutter radius	1. G code error. 2. Check G code and revise program.
0xA104	SHORT_COMP_LEN The amount of tool compensation is too small	1. G code error. 2. Check G code and revise program.
0xA600	Invalid G code ID	1. G code error. 2. Check G code and revise program.
0xA601	Too many subroutine nests	1. The subroutine calls too many programs. 2. Revise program to reduce nesting layers.
0xA603	Invalid variable symbol	1. Invalid variable symbol. 2. Check G code and revise program.
0xA604	Illegal G code symbol	1. Illegal G code symbol. 2. Check G code and revise program.
0xA605	No G code symbol	1. No G code symbol. 2. Check G code and revise program.
0xA606	Subroutine calling error	1. Subroutine calling error. 2. Revise program.

Code	Name	Description and troubleshooting
0xA607	Subroutine file name error	1. Subroutine file name error. 2. Revise program.
0xA608	Subroutine nesting error	1. Subroutine nesting error. 2. Revise program.
0xA609	G code executed before homing	1. G code executed before homing. 2. Do homing for each axis.
0xA60A	Syntax error of G04	1. Syntax error of G04. 2. Check G code and revise program.
0xA60B	Invalid workpiece offset amount	1. Workpiece offset amount calculation error. 2. Re-start the system or send the system back for servicing.
0xA60D	Invalid intermediate point for homing	1. Invalid intermediate point for homing. 2. Revise program.

6.1.4 Description of macro form configuration error message

Code	Name	Description and troubleshooting
0x0610	Invalid macro variable form	1. Invalid macro variable form. 2. Check macro and revise program.
0x0611	Macro command is not found	1. Macro command is not found. 2. Check macro and revise program.
0x0612	Invalid macro command line number	1. The target line N of GO TO command is not found. 2. Revise program.
0x0613	Bit setup error in macro	1. Bit setup error in macro. 2. Check macro and revise program.
0x0614	Divided by zero error in macro	1. Divided by zero error in macro. 2. Check macro and revise program.
0x0615	Macro command is too long	1. Macro command is too long. 2. Check macro and revise program.
0x0616	Macro command operation is not found	1. Macro command operation is not found. 2. Check macro and revise program.
0x0617	Macro command error	1. Macro command error. 2. Check macro and revise program.
0x0619	Macro operand syntax error	1. Macro operand syntax error. 2. Check macro and revise program.
0x061A	Illegal macro command	1. Illegal macro command. 2. Check macro and revise program.
0xA61B	Goto tag is not found	1. Revise program.
0xA61C	Line number given by Goto tag is not found	1. Revise program.
0x0620		
0x0621		
0x0622		
0x0623		

Code	Name	Description and troubleshooting
0x0630	FOLLOW_ERR_ALRM Excessive deviation of position	1. Verify servo connection.
0x0631	HW_LIMIT_ERR Hardware limit error	1. Revise program.
0x0632	SW_LIMIT_ERR Software limit error	1. Revise program.
0x0633	SW_LIMIT_CLR First software limit clearance	1. Revise program.
0x0634	SW_LIMIT_EXT_ERR Second software limit error	1. Revise program.
0xA635	SW_LIMIT_EXT_CLR Second software limit clearance	1. Revise program.

6.1.5 HMI system alarm: (range: 0x3010~0x3FFF)
Description of HMI interface open error messages

Code	Name	Description and troubleshooting
0x3010	HMI communication interface creation error	1. HMI communication interface creation error. 2. Re-start the system or send the system back for servicing.
0x3011	HMI communication memory zone creation error	1. HMI communication memory zone creation error. 2. Re-start the system or send the system back for servicing.
0x3012	HMI interface command zone creation error	1. HMI interface command zone creation error. 2. Re-start the system or send the system back for servicing.
0x3013	HMI interface memory zone error	1. HMI interface memory zone error. 2. Re-start the system or send the system back for servicing.
0x3014	HMI interface communication port error	1. HMI interface communication port error. 2. Re-start the system or send the system back for servicing.
0x3015	MLC interface memory zone error	1. MLC interface memory zone error. 2. Re-start the system or send the system back for servicing.
0x3016	HMI file transmission error	1. HMI file transmission error. 2. Re-start the system or send the system back for servicing.
0x3017	HMI data transmission error	1. HMI data transmission error. 2. Re-start the system or send the system back for servicing.
0x3100	Illegal file name	1. Illegal file name. 2. Revise file name.
0x3101	Too many subroutine nests	1. Reduce number of subroutine calling nests.
0x3102	Non-G code character error	1. Non-G code character error. 2. Check G code and revise program.
0x3103	MEM_CHECKSUM_ERR Memory error	1. HMI interface error. 2. Re-start the system or send the system back for servicing.
0x3200	PAR_CRC_ERR Internal parameter error	Invalid system internal parameter memory zone. Please fix it by running the system recovery function or send the system back for servicing.
0x3201	MLC_CRC_ERR MLC program error	Invalid system MLC program memory zone. Please import the MLC program again or send the system back for servicing.

Code	Name	Description and troubleshooting
0x3202	CF_READ_ERR CF card reading failure	No CF card inserted or invalid CF card is inserted.
0x3203	PAR_BK_FILE_ERR Parameter backup failure	Ensure CF card is inserted properly and has adequate free space.
0x3204	MLC_BK_FILE_ERR MLC backup failure	Ensure CF card is inserted properly and has adequate free space.
0x3205	MACHINE_LOCK Machine locked	Confirm that the validity of the machine has expired. Please call the supplier to remove or extend the machine validity.

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