HNC-8 Commissioning Manual (Lathe)

V2.4 Series

Introduction

The manual may help you to quickly get familiar with the HNC-8 system, providing detailed information about commissioning, programming or application methods. Any updates or modification of the manual is not allowed without the written permission of Wuhan Huazhong Numerical Control Co., LTD (hereafter referred to as "HCNC"). Without HCNC's authorization or written permission, any units or individuals are not allowed to modify or correct the manual. HCNC will not be responsible for any losses thus incurred to customers.

In this manual we have tried as much as possible to describe all the various matters concerning of the system. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as “impossible” or “not allowed”.

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Please favor me your instruction for shortages and inadequacies of the manual.

Note

- As to notes such as "Limitations" and "Usable functions", the specification provided by the machine tool manufacturer is superior to the manual. Please conduct dryrun before actual machining and confirm machining program, tool compensation volume and workpiece offset, and so on.
- Please explain matters which are not described in the manual as "Infeasible".
- The manual is prepared on the condition that all functions are configured. Please make a confirmation according to the specification provided by the machine tool manufacturer in use.
- For relevant instructions for machine tools, please refer to the specification provided by the machine tool manufacturer.
- Usable screens and functions differ with different NC systems (or versions). Please be sure to confirm specifications before use.

Contents

Overview

Commissioning procedure for HNC-8 system:

- Preparation for commissioning and connection of controller-Correct and reasonable connection is the basis for smooth commissioning of controller.
- Parameter debugging-Set relevant parameters of drive and controller.
- PLC commissioning-Realize movement of axis and action and protection of machine tool using subprogram module.
- Common function optimization-Conduct performance improvement and optimization of common functions of machine tool [spindle and tapping].
- Data backup-Back up data for ease of maintenance after commissioning of machine tool.

1 Common Hardware Configuration List

808D system +160U traverse axis servo drive +180U spindle servo drive +HIO-1200 series I/O unit

SN	Function	Quantity
1	Turning CNC controller /HNC-808D/horizontal type/NC unit	1
2	Turning CNC controller /HNC-808D/MCP unit/ without handwheel	1
3	PLC unit/HIO-1200-M1/detached IO unit baseplate +terminal board_V1.1	1
4	Bus cable/HCB-0000-2102-005/5m	2
5	Bus cable/HCB-0000-2102-001/1m	2
6	Bus cable /HCB-0000-2102-002/2m	1
7	Servo drive/HSV-160U-030/hardware current loop	2
9	130ST-M0641530LM1DD (Z axis of lathe)	1
10	130ST-M0641530LM1DDZ (X axis of lathe with brake)	1
11	Power line/HCB-9160-1116-005-CG/5m/detachable	1
12	Encoder cable/HCB-9160-0123-005-DB/5m	1
13	Power line/HCB-9160-1116-005-CH/5m	1
14	Brake line/HCB-9160-4001-005-CD/purple/5m	1
15	Encoder cable/HCB-9160-0123-005-DB/5m	1
16	Spindle drive/HSV-180US-050(Infineon PIM)	1
17	Spindle motor/DH10-2-35-5.5/7.5-4-1500GG1B3-08	1
18	Electric reactor/ACL-5.5KW /5.5KW/15A/three-phase input/screw	1
19	Braking resistor/51Ω/1100W/RXLG/plug-in	1
20	Power line/HCB-9018-3000-005-CH/5m/detachable	1
21	Encoder cable/HCB-9180-2210-005-DB/5m	1
22	Handheld unit/HWL-1013-3/3 axes	1

Note: This table is an example of configuration and actual configuration should prevail.

2 Connection Diagram

2.1 Connection Diagram of Corresponding 808D Hardware

CNC device and bus servo drive unit are connected in series using NCUC bus, as shown in Fig. 2.1.

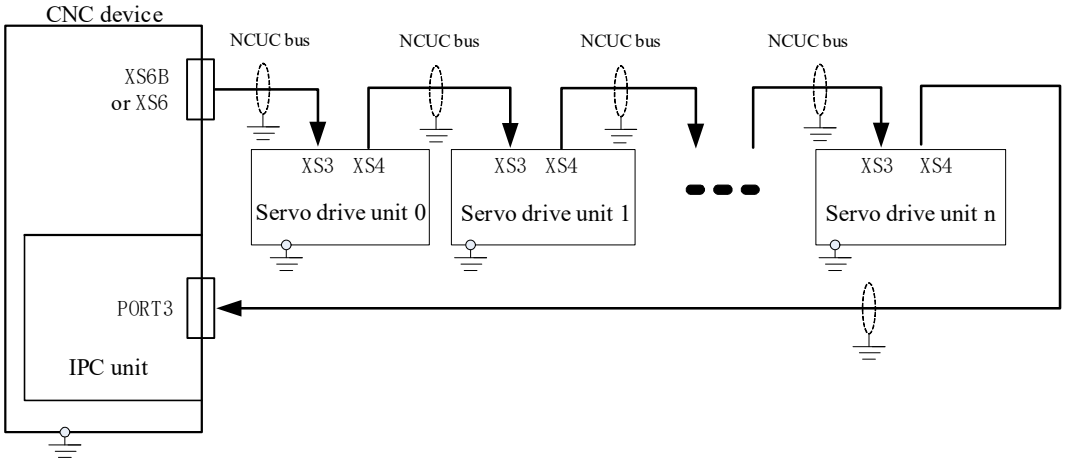


Fig. 2.1 Connection diagram of CNC controller and bus-type servo drive unit

2.2 Connection of CNC Controller and Bus I/O Unit

The connection is performed in series using NCUC bus, as shown in Fig. 2.2.

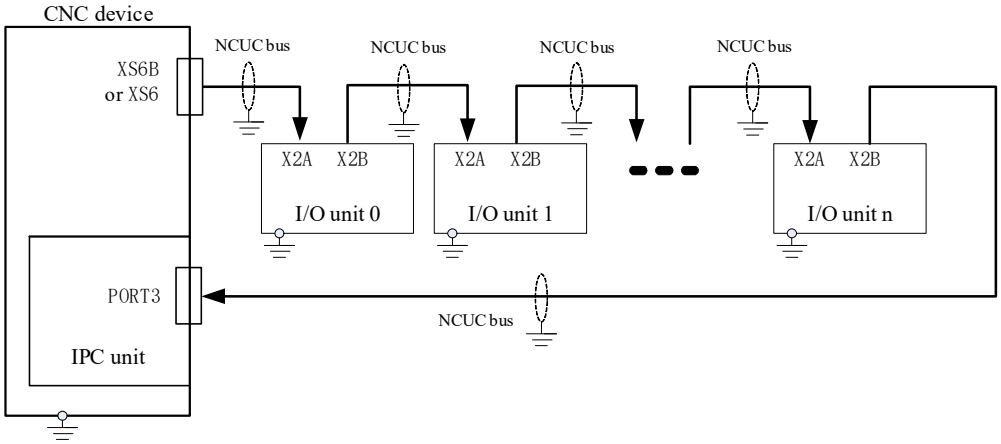


Fig. 2.2 Connection diagram of CNC controller and bus I/O unit

PLC input/output interface and non-bus axis control interface can be expanded through bus I/O unit.

2.3 Typical Connection of CNC Controller

Typical connection between HNC-8 series CNC controller and bus I/O unit and bus-type servo drive unit, as shown in Fig. 2.3.

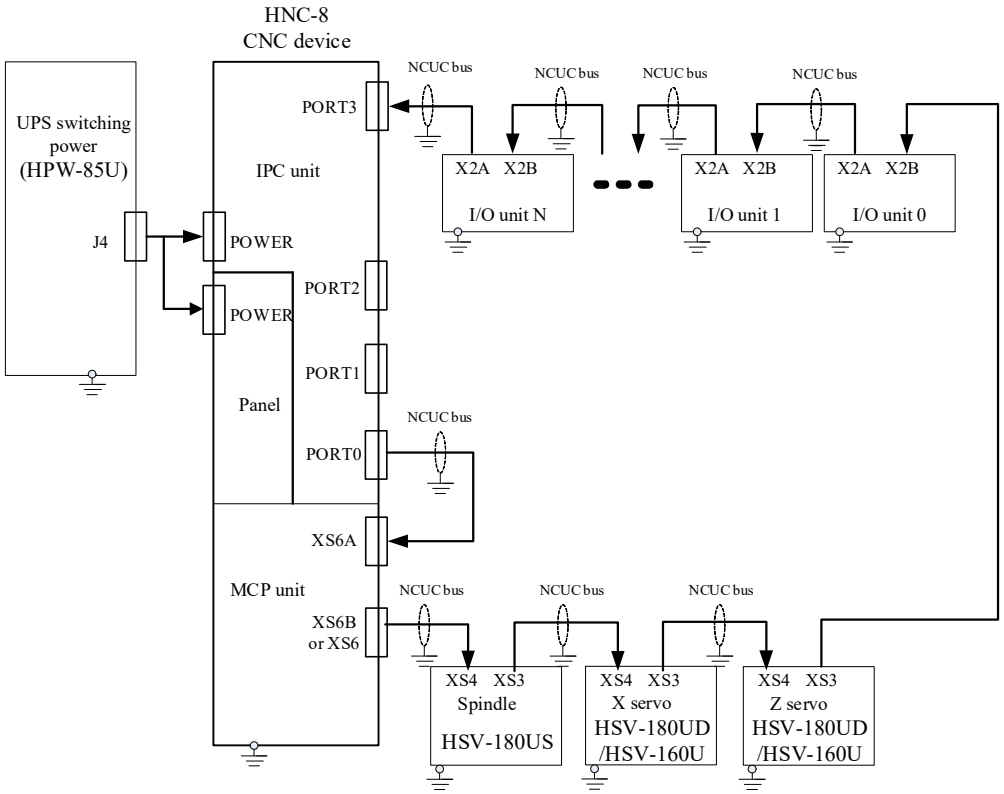
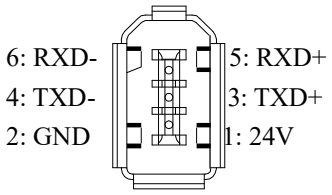


Fig. 2.3 Typical connection between HNC-8 series CNC controller and bus-type I/O unit and bus-type servo drive unit

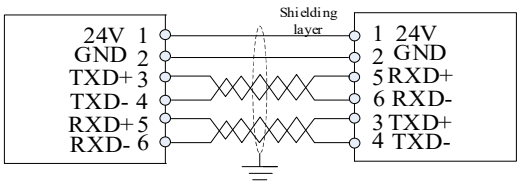
3 Interface Definition

3.1 Definition of NCUC Bus Interface

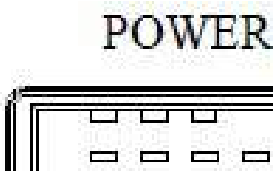


Connection diagram of NCUC bus cable

Signal	Description
24V	DC 24V voltage
GND	
TXD+	Data transmission
TXD-	
RXD+	Data receiving
RXD-	



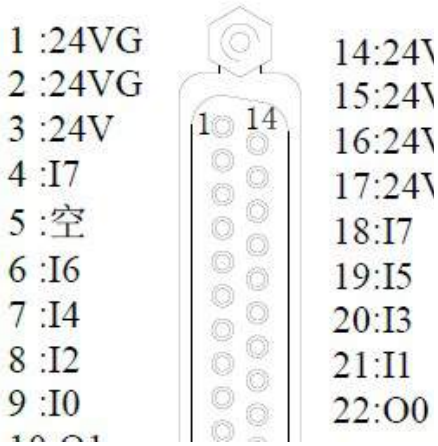
3.2 Definition of IPC24V Power Supply Interface (POWER)



1:24V UPS 2: GND 3: SGND 4: ACFail 5:PE

Signal	Description
24V UPS	DC 24V with UPS function
GND	Power ground
SGND	Signal earth
ACFail	Power failure detection signal
PE	Protection earth

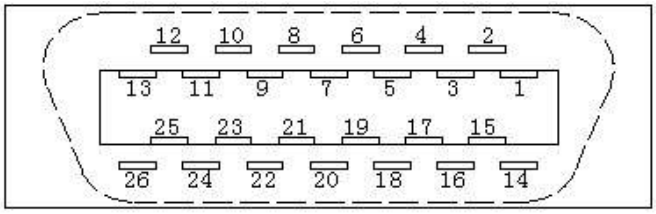
3.3 Definition of Handheld Unit Interface



Signal	Description
24V, 24VG	DC24V power supply output
I7	Handheld unit emergency stop button
I0 to I6	Handheld unit input switch value
O0 to O3	Handheld unit output switch value
HA	Handwheel A phase
HB	Handwheel B phase
+5, 5VG	Handwheel DC5V power supply output

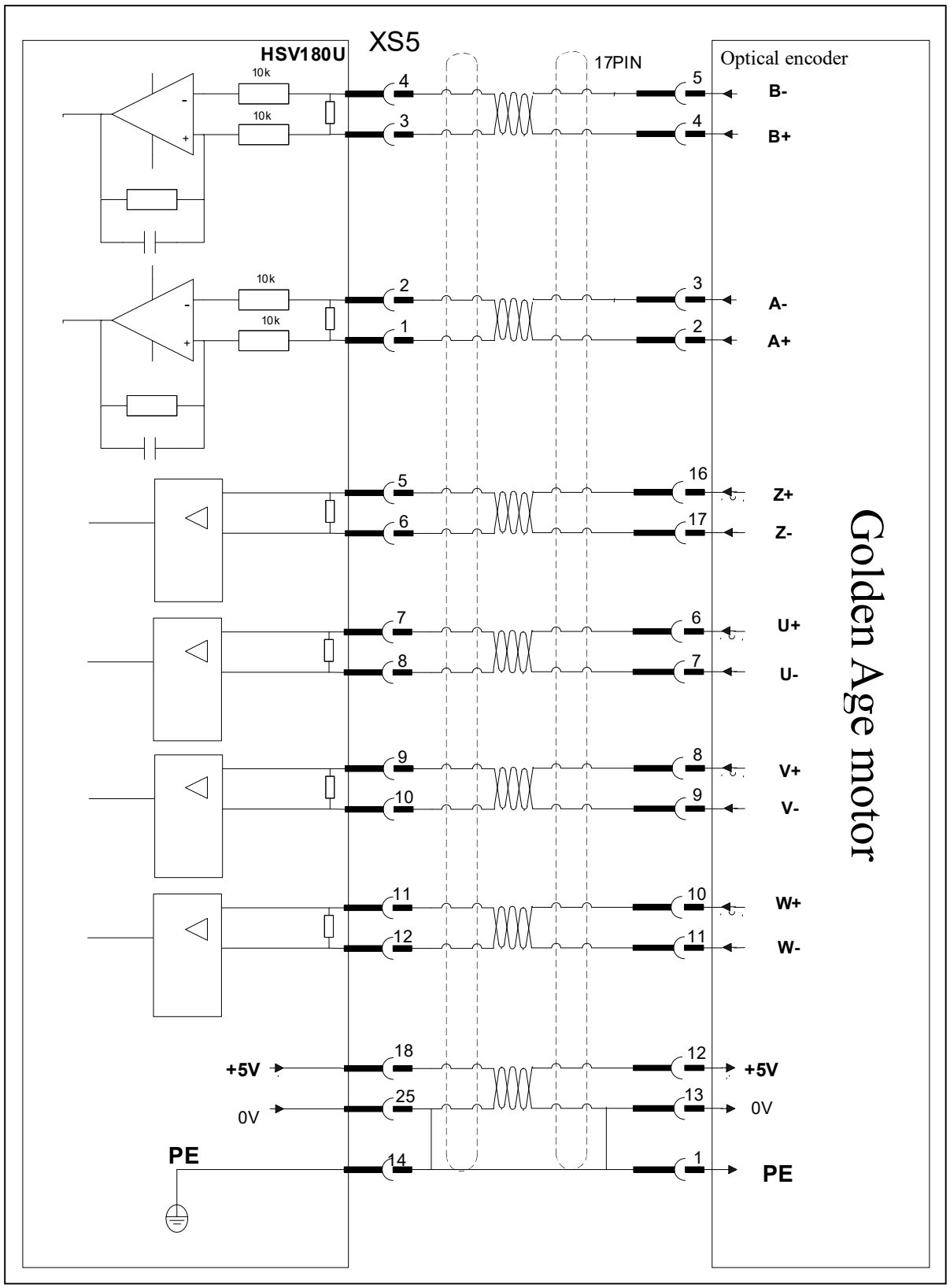
3.4 Definition of Traverse Axis Servo Drive Encoder Interface

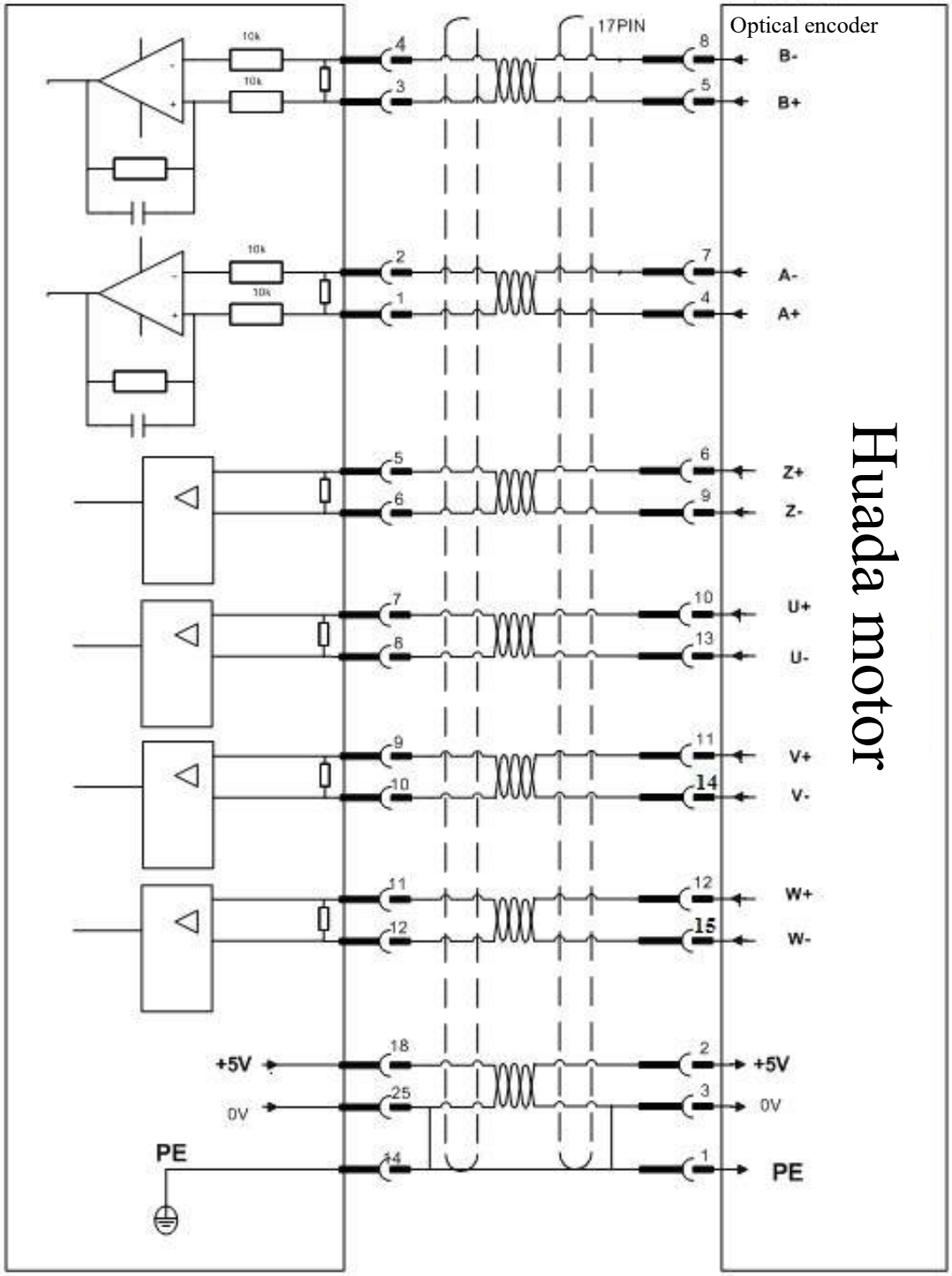
160U and 180U encoder interfaces correspond to XS1 and XS5 respectively and are defined consistently. However, HSV-160U includes HSV-160UP (full-function type) and HSV-160UD series and both support different encoder protocols.



Pin of input interface plug of servomotor encoder
(facing the plug pin)

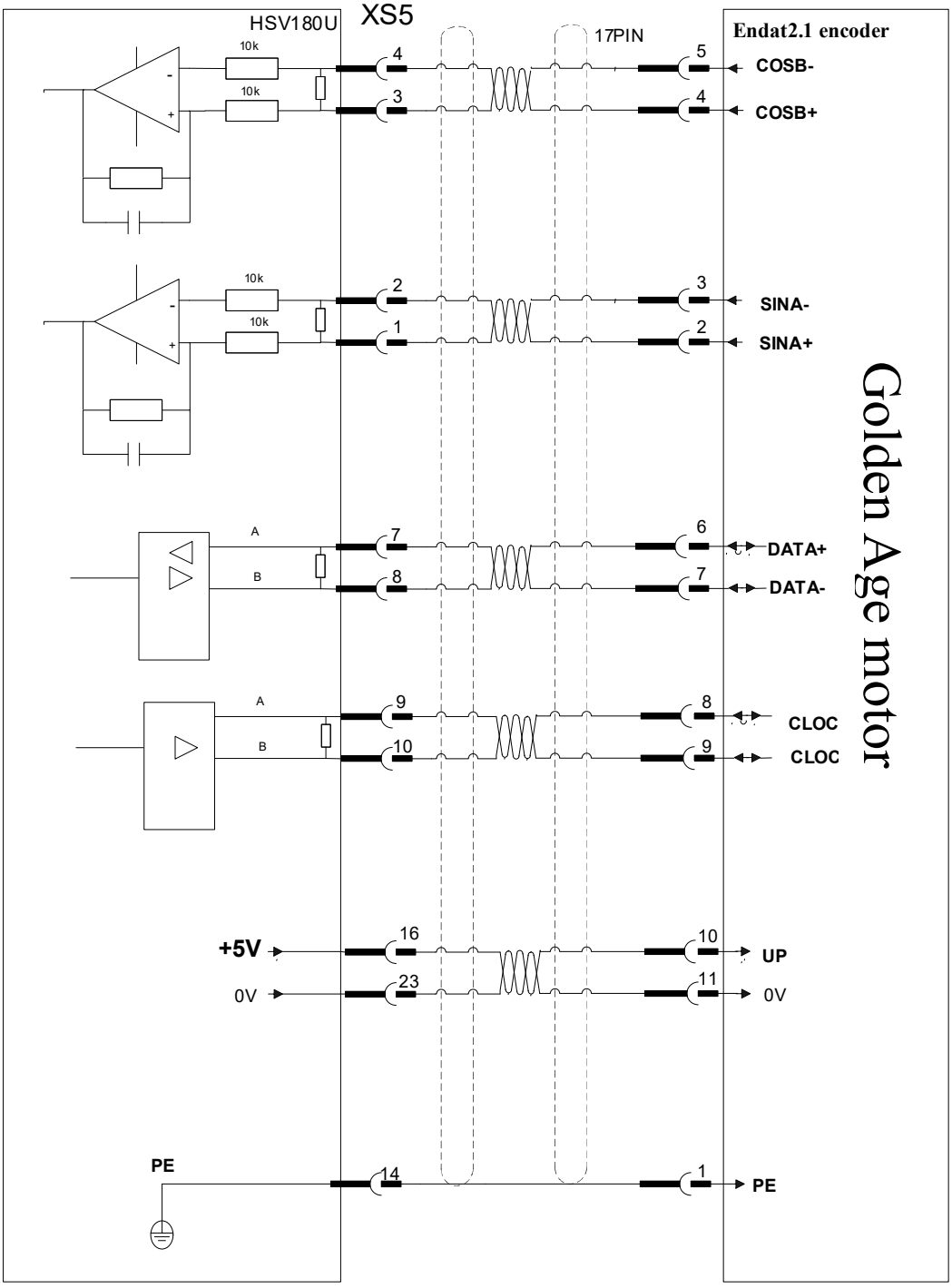
3.4.1 Servo Drive Unit Connects to Composite Optical Encoder


HSV180U
XS5
17PIN
Optical encoder
10k
10k
4
3
5
4
B-
B+
10k
10k
2
1
3
2
A-
A+
5
6
16
17
Z+
Z-
7
8
6
7
U+
U-
9
10
8
9
V+
V-
11
12
10
11
W+
W-
+5V
18
12
+5V
0V
25
13
0V
PE
14
1
PE
Golden Age motor


17PIN
Optical encoder
B-
B+
A-
A+
Z+
Z-
U+
U-
V+
V-
W+
W-
+5V
0V
PE
+5V
0V
PE
Huada motor

Terminal number	Symbol	I/O	Signal	Function
1	A+/SINA+	I	Encoder A+ input	Connect to servomotor optical encoder A+
2	A-/SINA-	I	Encoder A- input	Connect to servomotor optical encoder A-
3	B+/COSB+	I	Encoder B+ input	Connect to servomotor optical encoder B+
4	B-/COSB-	I	Encoder B- input	Connect to servomotor optical encoder B-
5	Z+	I	Encoder Z+ input	Connect to servomotor optical encoder Z+
6	Z-	I	Encoder Z- input	Connect to servomotor optical encoder Z-
7	U+/DATA+	I	Encoder U+ input	Connect to servomotor optical encoder U+
8	U-/DATA-	I	Encoder U- input	Connect to servomotor optical encoder U-
9	V+/CLOCK+	I	Encoder V+ input	Connect to servomotor optical encoder V+
10	V-/CLOCK-	I	Encoder V- input	Connect to servomotor optical encoder V-
11	W+	I	Encoder W+ input	Connect to servomotor optical encoder W+
12	W-	I	Encoder W- input	Connect to servomotor optical encoder W-
13,26	Reserved			
16,17, 18,19	+5V	O	Output +5V	1. Supply +5V power to the connected optical encoder. 2. When cable is long, multiple core wires should be connected in parallel.
23,24,25	GNDD	O	Signal earth	1. Connect to 0V signal of servomotor optical encoder. 2. When cable is long, multiple core wires should be connected in parallel.
20,22	Reserved			
21	Reserved			
14,15	PE	O	Shielded signal	Connect to PE signal of servomotor optical encoder.

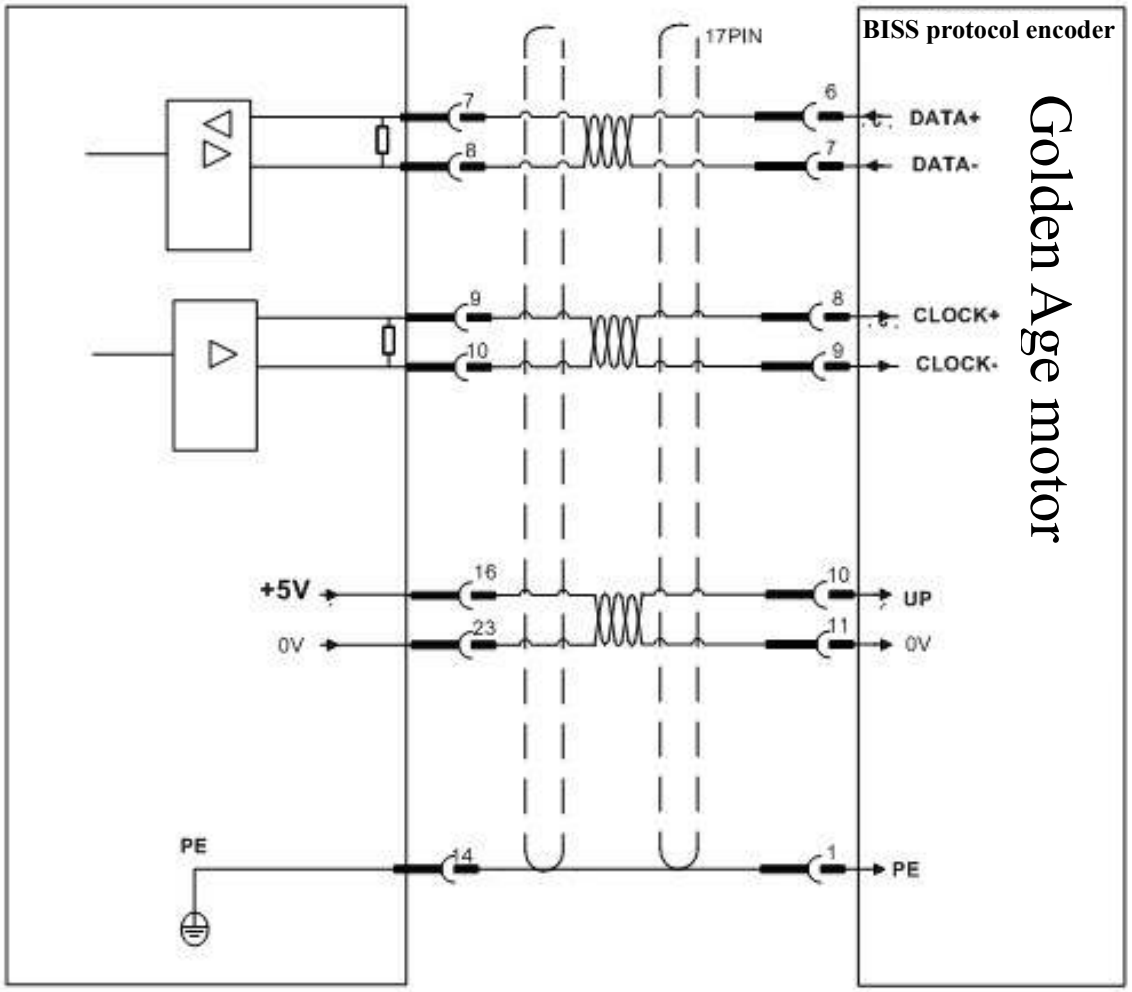
3.4.2 Servo Drive Unit Connects to Absolute Encoder of ENDAT2.1 Protocol



Note: HSV-160UP and HSV-180UD series support this encoder and HSV-160UD series do not support it.

Terminal number	Symbol	I/O	Signal	Function
1	A+/SINA+	I	Encoder A+ input	Connect to SINA+ of servomotor ENDAT2.1 protocol encoder
2	A-/SINA-	I	Encoder A- input	Connect to SINA+ of servomotor ENDAT2.1 protocol encoder
3	B+/COSB+	I	Encoder B+ input	Connect to COSB+ of servomotor ENDAT2.1 protocol encoder
4	B-/COSB-	I	Encoder B- input	Connected to COSB- of servomotor ENDAT2.1 protocol encoder
5,6	Reserved			
7	U+/DATA+	I/O	Encoder DATA+	Connected to DATA+ of servomotor ENDAT2.1 protocol encoder
8	U-/DATA-	I/O	Encoder DATA-	Connected to DATA- of servomotor ENDAT2.1 protocol encoder
9	V+/CLOCK+	O	Encoder CLOCK+	Connected to CLOCK+ of servomotor ENDAT2.1 protocol encoder
10	V-/CLOCK-	O	Encoder CLOCK-	Connected to CLOCK- of servomotor ENDAT2.1 protocol encoder
11,12	Reserved			
13,26	Reserved			
16,17, 18,19	+5V	O	Output +5V	1. Supply +5V power to the connected ENDAT2.1 protocol encoder. 2. When cable is long, multiple core wires should be connected in parallel.
23,24,25	GNDD	O	Signal earth	1. Connect to 0V signal of servomotor ENDAT2.1 protocol encoder. 2. When cable is long, multiple core wires should be connected in parallel.
20,22	Reserved			
21	Reserved			
14,15	PE	O	Shielding layer	Connect to PE signal of servomotor ENDAT2.1 protocol encoder

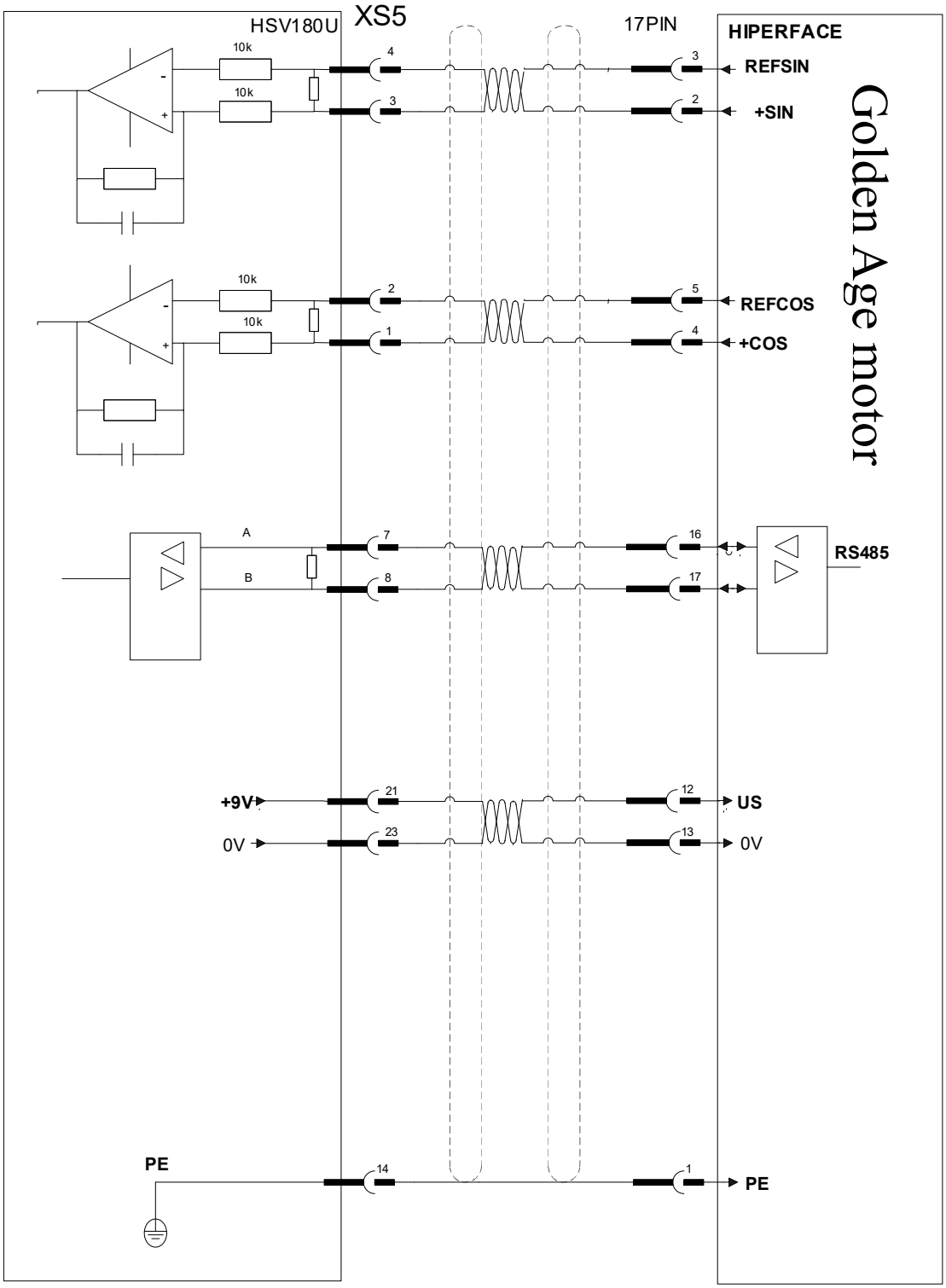
3.4.3 Servo Drive Unit Connects to BISS Protocol Absolute Encoder



Note: HSV-160UP and HSV-180UD series support this encoder and HSV-160UD series do not support it.

Terminal number	Symbol	I/O	Signal	Function
1,2	Reserved	I		
3,4	Reserved	I		
5,6	Reserved			
7	U+/DATA+	I	Encoder DATA+	Connect to DATA+ signal of servomotor BISS protocol encoder
8	U-/DATA-	I	Encoder DATA-	Connect to DATA- signal of servomotor BISS protocol encoder
9	V+/CLOCK+	O	Encoder CLOCK+	Connect to CLOCK+ signal of servomotor BISS protocol encoder
10	V-/CLOCK-	O	Encoder CLOCK-	Connected to CLOCK- signal of servomotor BISS protocol encoder
11,12	Reserved			
13,26	Reserved			
16,17, 18,19	+5V	O	Output +5V	1. Supply + 5V power to the connected BISS protocol encoder. 2. When cable is long, multiple core wires are connected in parallel.
23,24,25	GNDD	O	Signal earth	1. Connect to 0V signal of servomotor BISS protocol encoder. 2. When cable is long, multiple core wires should be connected in parallel.
20,22	Reserved			
21	Reserved			
14,15	PE	O	Shielding layer	Connect to PE signal of servomotor BISS protocol encoder.

3.4.4 Servo Drive Unit Connects to HiperFACE Protocol Absolute Encoder

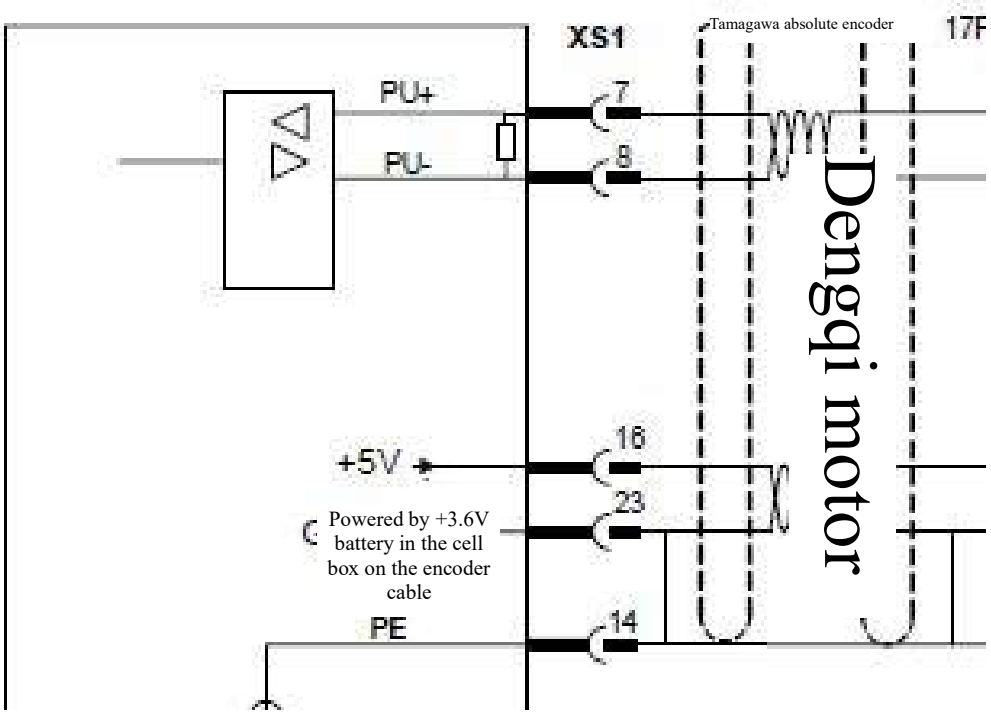


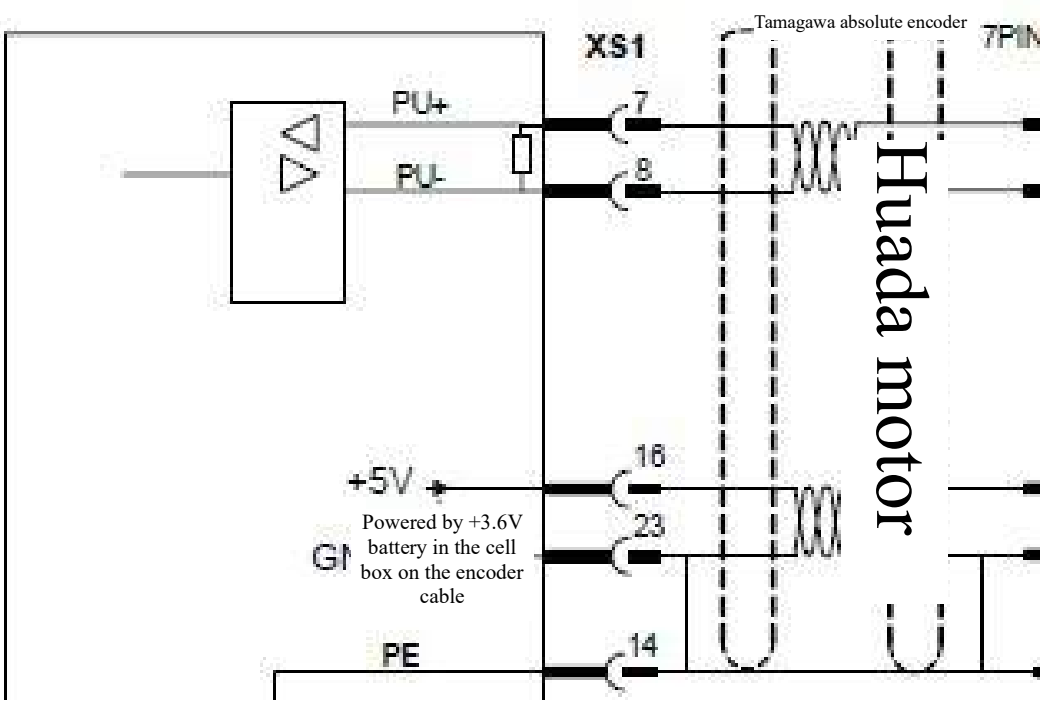
Note: HSV-160UP and HSV-180UD series support this encoder and HSV-160UD series do not support it.

Terminal number	Symbol	I/O	Signal	Function

1	A+/SINA+	I	Encoder A+ input	Connect to COS+ of servomotor HiperFACE protocol encoder
2	A-/SINA-	I	Encoder A- input	Connect to REFCOS of servomotor HiperFACE protocol encoder
3	B+/COSB+	I	Encoder B+ input	Connect to SIN+ of servomotor HiperFACE protocol encoder
4	B-/COSB-	I	Encoder B- input	Connect to REFSIN of servomotor HiperFACE protocol encoder
5,6	Reserved			
7	U+/DATA+	I/O	Encoder DATA+	Connect to DATA+ signal of servomotor HiperFACE protocol encoder
8	U-/DATA-	I/O	Encoder DATA-	Connect to DATA- signal of servomotor HiperFACE protocol encoder
9,10	Reserved			
11,12	Reserved			
13,26,	Reserved			
16,17,18,19	Reserved			
21	+9V	O	Output +9V	1. Supply +9V power to the connected HiperFACE protocol encoder. 2. When cable is long, multiple core wires are connected in parallel.
23,24,25	GNDD	O	Signal earth	1. Connect to 0V signal of servomotor HiperFACE protocol encoder. 2. When cable is long, multiple core wires are connected in parallel.
20, 22	Reserved			
14,15	PE	O	Shielding layer	Connect to PE signal of servomotor HiperFACE protocol encoder.

3.4.5 Servo Drive Unit Connects to TAMAGAWA Absolute Encoder





Note: 1. While connecting **TAMAGAWA** absolute encoder, encoder cable with cell box is recommended.
2. While configuring **TAMAGAWA** absolute encoder, users are suggested to buy encoder cable with cell box produced by our company. After the drive is powered off, the encoder is powered by the cell box.

Terminal number	Symbol	I/O	Signal	Function
1,2	Reserved	I		
3,4	Reserved	I		
5,6	Reserved	I		
7	U+/DATA+	I	Encoder DATA+	Connect to DATA+ signal of servomotor TAMAGAWA encoder
8	U-/DATA-	I	Encoder DATA-	Connect to DATA- signal of servomotor TAMAGAWA encoder
9,10	Reserved	O		
11,12	Reserved			
13,26	Reserved			
16,17, 18,19	+5V	O	Output +5V	1. Supply + 5V power to the connected TAMAGAWA encoder. 2. When cable is long, multiple core wires are connected in parallel.
23,24,25	GNDD	O	Signal earth	1. Connect to 0V signal of servomotor TAMAGAWA encoder. 2. When cable is long, multiple core wires should be connected in parallel.
20	Reserved	O		
22	Reserved	O		
21	Reserved	O		
14,15	PE	O	Shielding layer	Connect to PE signal of servomotor TAMAGAWA protocol encoder.

Note: While connecting TAMAGAWA absolute encoder, encoder cable with cell box is recommended.

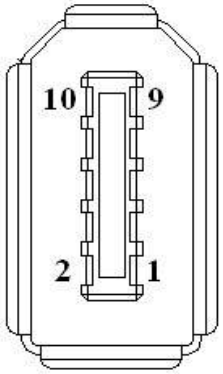
Note:

1. Pins of the same name have been short circuited on the internal circuit board.
2. Diameter of encoder cable: Shielded cable (stranded shielded cable is recommended) whose cross section is ≥0.12mm^2 (AWG24-26) should be adopted and the shielding layer must be connected to the metal shell of plug.
3. Length of encoder cable: Cable should be as short as possible and its shielding layer should be connected to GNDD signal of encoder power supply (to avoid intervention of encoder feedback signal).

4. Wiring: Keep away from power line to prevent intervention. Please install surge absorption elements for inductive elements (coil) in relevant circuits: DC coil is connected in parallel with freewheel diode reversely, and AC coil is connected to RC absorption circuit in parallel.
5. When the drive unit is connected to different encoders, compatible encoder cables are different. Please connect them upon confirmation; otherwise, burnout of encoder may occur.

3.5 Definition of the Second Encoder Interface of Traverse Axis Servo Drive

160UP and 180UD drives support full-closed loop function (the second encoder) and correspond to XS5 and XS6 interfaces respectively.



The second position feedback signal input interface socket (facing socket)

3.5.1 Connect Incremental Encoder

Terminal number	Symbol	Signal	Function
1	+5V	Output +5V	1. Provide +5V power supply to the encoder connected to XS6. 2. Connect to power supply pin of the encoder. 3. WhenWhen cable is long, multiple core wires should be connected in parallel.
2	GNDD	Signal earth	1. Connect to 0V pin of the encoder. 2. When cable is long, several core wires should be connected in parallel.
3	A+/SINA+	Encoder A+ input	Connect to A+ (or SINA+) of worktable position encoder
4	A-/SINA-	Encoder A- input	Connect to A- (or SINA-) of worktable position encoder
5	B+/COSB+	Encoder B+ input	Connect to B+ (or COSB+) of worktable position encoder
6	B-/COSB-	Encoder B- input	Connect to B- (or COSB-) of worktable position encoder
7	DATA+	Encoder DATA+	Connect to Z+ (or R+) of worktable position encoder

8	DATA-	Encoder DATA-	Connect to Z- (or R-) of worktable position encoder
9	Reserved		
10	Reserved		

3.5.2 Connect Endat2.1/2.2 Protocol Absolute Encoder

Terminal number	Symbol	Signal	Function
1	+5V	Power supply output +	1. Supply +5V power to Endat2.1/2.2 protocol encoder connected to XS5. 2. Connect to power supply pin of the encoder. 3. When cable is long, multiple core wires should be connected in parallel.
2	GNDD	Power supply output -	1. Connect to 0V pin of the encoder. 2. When cable is long, multiple core wires should be connected in parallel.
3	A+/SINA+	Encoder A+ input	Connect to SINA+ of worktable position ENDAT2.1 protocol encoder
4	A-/SINA-	Encoder A- input	Connect to SINA- of worktable position ENDAT2.1 protocol encoder
5	B+/COSB+	Encoder B+ input	Connect to COSB+ of worktable position ENDAT2.1 protocol encoder
6	B-/COSB-	Encoder B- input	Connect to COSB- of worktable position ENDAT2.1 protocol encoder
7	DATA+	Encoder DATA+	Connect to DATA+ of worktable position ENDAT2.1 protocol encoder
8	DATA-	Encoder DATA-	Connect to DATA- of worktable position ENDAT2.1 protocol encoder
9	CLOCK+	Encoder CLOCK+	Connect to CLOCK+ of worktable position ENDAT2.1 protocol encoder
10	CLOCK-	Encoder CLOCK-	Connect to CLOCK- of worktable position ENDAT2.1 protocol encoder

3.6 Definition of Spindle Servo Drive Encoder Interface

Specification and model of spindle drive unit:

HSV-180US- □□□

Spindle drive unit **Specification**

035 050 075
100 150
200 300 450

HSV-180US-035～450 spindle drive units (match incremental optical encoder and incremental sin-cos encoder)

HSV-180US- □□□**R**

Spindle drive unit **Specification**

035 050 075
100 150

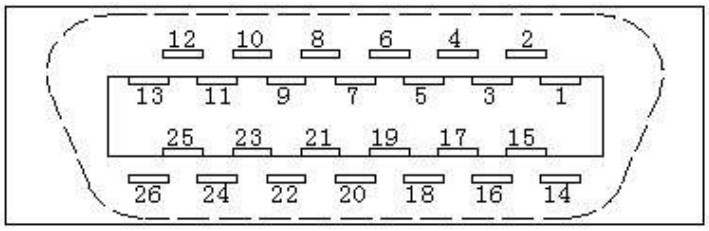
HSV-180US-035R～150R spindle drive units (match incremental optical encoder, incremental sin-cos encoder and rotary transformer encoder)

HSV-180U1S- □□□

Spindle drive unit **Specification**

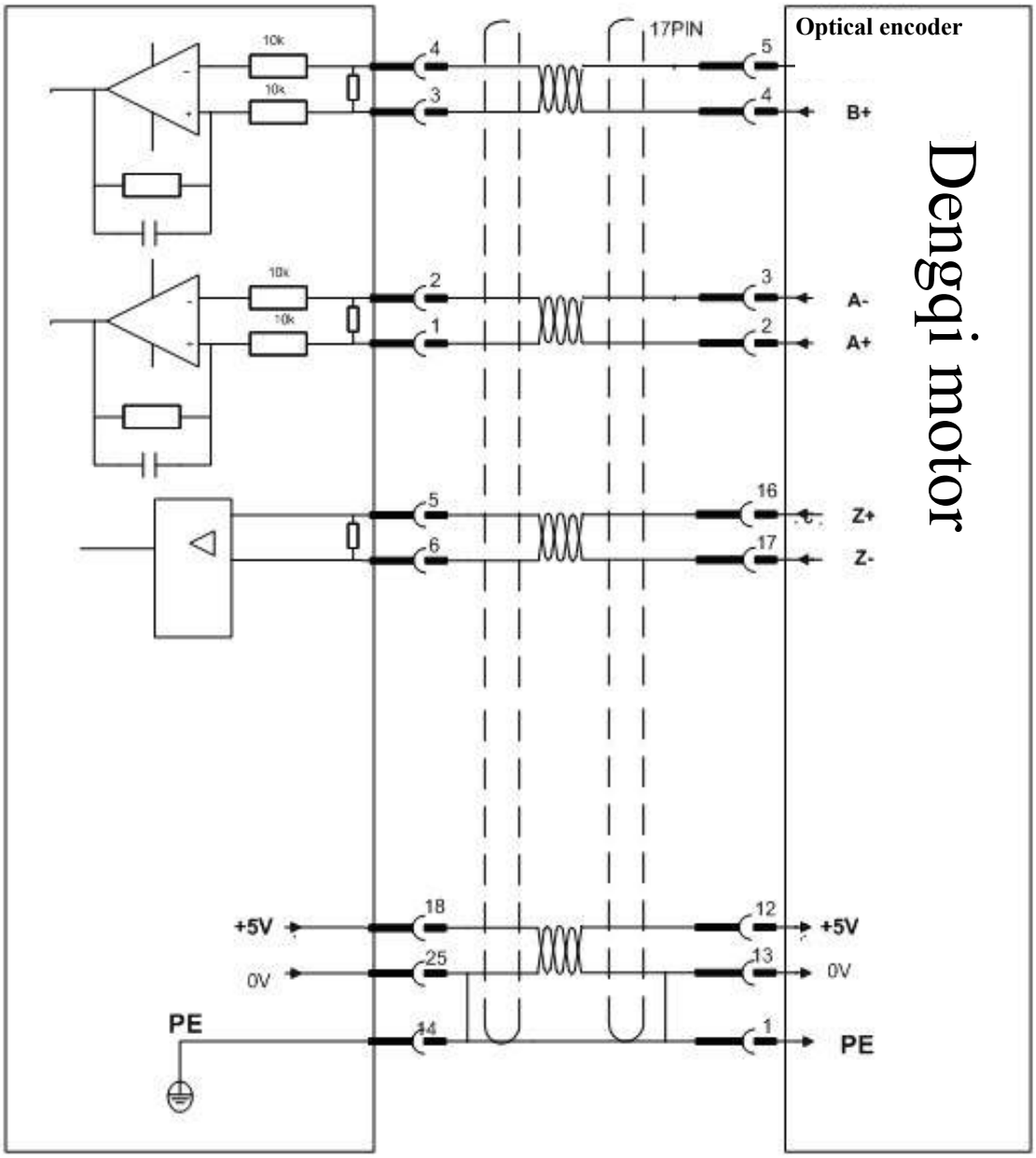
100 150
200 300

HSV-180U1S-100～300 spindle drive units (match incremental optical encoder and incremental sin-cos encoder)



Pin of XS5 spindle motor encoder input interface plug
(Facing plug pin)

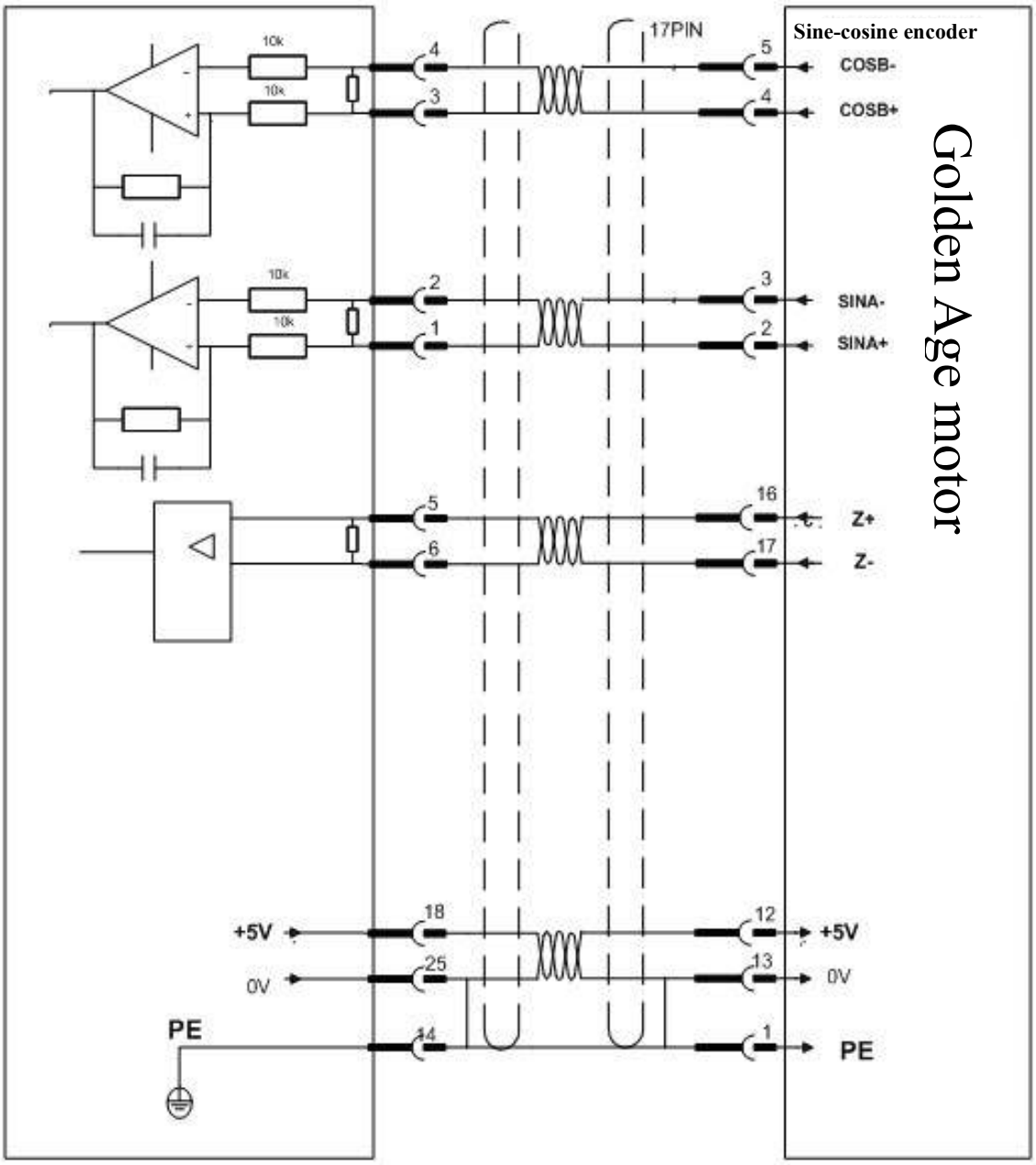
3.6.1 XS5 ENCODER1 Interface Connects to Incremental Optical Encoder



Pin	Name	Function	Signal standard
1	A+/SINA+	Motor encoder A+ phase pulse input	Line driver and receiver RS422 standard
2	A-/SINA-	Motor encoder A- phase pulse input	
3	B+/COSB+	Motor encoder B+ phase pulse input	
4	B-/COSB-	Motor encoder B- phase pulse input	
5	Z+	Motor encoder Z+ phase pulse input	
6	Z-	Motor encoder Z- phase pulse input	
7,8	Reserved		
9,10	Reserved		
11,12	Reserved		
13	Reserved		
26	Reserved		
16,17 18,19	+5V	Motor encoder power supply DC +5V 1. Supply +5V power to the motor encoder connected to XS5. 2. Connect to the power supply pin of the motor encoder. 3. When cable is long, multiple core wires should be connected in parallel.	DC +5V/150mA
23,24,25	GNDD	Motor encoder power earth 0V	
20	PTC+/ KTY84+	Detection signal input of temperature sensor	Specific input type is determined by the temperature sensor used by the motor
22	PTC-/ KTY84-		
21	Reserved		
14,15	PE	Shielded signal Connect to PE signal of the motor encoder	

Note: Pins of the same name have been short-circuited on the internal circuit board.

3.6.2 XS5 ENCODER1 Interface Connects to Incremental Sin-cos Encoder



Pin	Name	Function	Signal standard
1	A+/SINA+	SINA+ phase input of motor encoder	Analog input voltage 1Vp-p
2	A-/SINA-	SINA- phase input of motor encoder	
3	B+/COSB+	COSB+ phase input of motor encoder	
4	B-/COSB-	B- phase pulse input of motor encoder	
5	Z+/R+	Z+ (or R+) phase input of motor encoder	
6	Z-/R-	Z- (or R-) phase input of motor encoder	
7,8	Reserved		
9,10	Reserved		
11,12	Reserved		
13	Reserved		
26	Reserved		
16,17 18,19	+5V	Motor encoder power supply DC +5V 1. Supply +5V power to the motor encoder connected to XS5. 2. Connect to the power supply pin of the motor encoder. 3. When cable is long, multiple core wires should be connected in parallel.	DC +5V/150mA
23,24,25	GNDD	Motor encoder power earth 0V	
20	KT+	Signal input of motor temperature sensor	
22	Kt-		
21	Reserved		
14,15	PE	Shielded signal Connect to PE signal of the motor encoder	

Note: Pins of the same name have been short-circuited on the internal circuit board.

3.6.3 XS5 ENCODER1 Interface Connects to Rotary Transformer Encoder

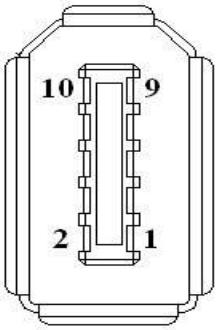
Pin	Name	Function	Signal standard
1、2	Reserved		
3、4	Reserved		
5、6	Reserved		
7	SIN+	SIN+ phase pulse input of motor encoder	Analog input voltage: 2.4V-3.0Vp-p@10 kHz
8	SIN-	SIN- phase pulse input of motor encoder	
9	COS+-	COS+ phase pulse input of motor encoder	
10	COS-	COS- phase pulse input of motor encoder	
11	EXC1	EXC1 phase pulse output of motor encoder	Analog output voltage: 4.8V-6.0Vp-p@10 kHz
112	/EXC1	EXC1 phase pulse output of motor encoder	
13	Reserved		
26	Reserved		
16,17 18,19	Reserved		
23,24,25	GNDD	XS5 ENCODER1 interface Internal power earth 0V	
20	KT+	Signal input of motor temperature sensor	
22	Kt-		
21	Reserved		
14,15	PE	Shielded signal Connect to PE signal of the motor encoder	

Note: 1. Only HSV-180US-035R～150R spindle drive units can match this type of encoders.

2. Pins of the same name have been short-circuited on the internal circuit board.

3. Resolution of rotary transformer is 14-bit, namely 16384 pulses/revolution.

3.7 Definition of the Second Encoder Interface of Spindle Servo Drive



XS6 ENCODER2 spindle encoder input interface diagram

3.7.1 XS6 ENCODER2 Interface Connects to Incremental Optical Encoder

Pin	Name	Function	Signal standard
1	+5V	Spindle encoder power supply DC +5V 1. Supply +5V power to the spindle encoder connected to XS6. 2. Connect to the power supply pin of the spindle encoder. 3. When cable is long, multiple core wires should be connected in parallel.	DC +5V/150mA
2	GNDD	1. Connect to 0V pin of the spindle encoder. 2. When cable is long, multiple core wires should be connected in parallel.	
3	A+/SINA+	Connect to A+ of the spindle encoder	Line driver and receiver RS422 standard
4	A-/SINA-	Connect to A- of the spindle encoder	
5	B+/COSB+	Connect to B+ of the spindle encoder	
6	B-/COSB-	Connect to B- of the spindle encoder	
7	DATA+	Connect to Z+ of the spindle encoder	
8	DATA-	Connect to Z- of the spindle encoder	
9	Reserved		
10	Reserved		

3.7.2 XS6 ENCODER2 Interface Connects to Incremental Sin-cos Encoder

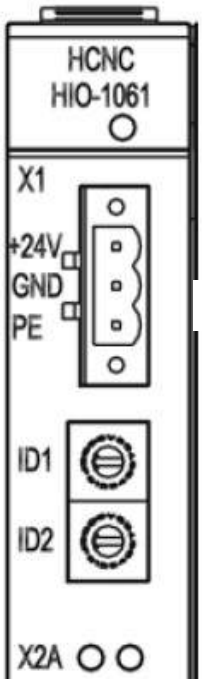
Pin	Name	Function	Signal standard
1	+5V	Power supply of motor encoder DC +5V 1. Supply +5V power to the motor encoder connected to XS5. 2. Connect to the power supply pin of the motor encoder. 3. When cable is too long, multipole core wires should be connected in parallel.	DC +5V/150mA
2	GNDD	1. Connect to 0V pin of spindle encoder. 2. When cable is long, multiple core wires should be connected in parallel.	
3	A+/SINA+	Connect to spindle encoder SINA+	Analog input voltage: 1Vp-p
4	A-/SINA-	Connect to spindle encoder SINA-	
5	B+/COSB+	Connect to spindle encoder COSB+	
6	B-/COSB-	Connect to spindle encoder COSB-	
7	DATA+	Connect to spindle encoder Z+ (or R+)	Analog input voltage: 0.5Vp-p
8	DATA-	Connect to spindle encoder Z- (or R-)	
9	Reserved		
10	Reserved		

3.8 Bus-type I/O Unit

3.8.1 HIO-1000 Series

Installation diagram of HIO-1000B bus-type I/O unit

1） Definition of industrial Ethernet communication module (HIO-1061)

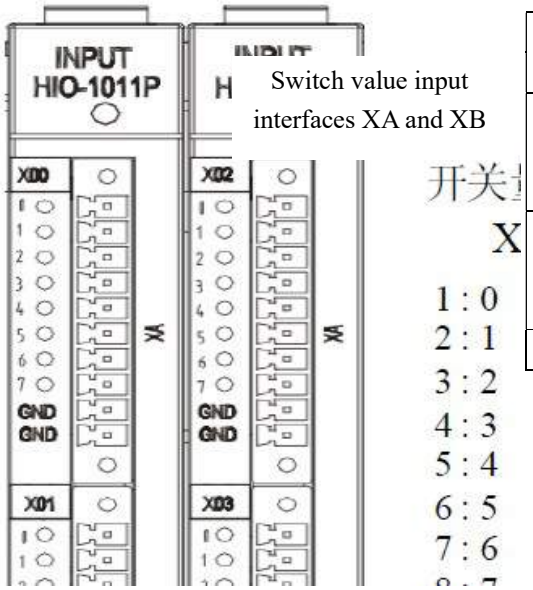


NCUC bus interface

Signal	Description
24V	DC 24V power supply
24VG	DC 24V power earth
PE	Connect to ground

Signal	Description
NC	The first pin and the second pin of X2A and X2B are connected and have no electrical definition
NC	
TXD+	Data transmission
TXD-	
RXD+	Data reception
RXD-	

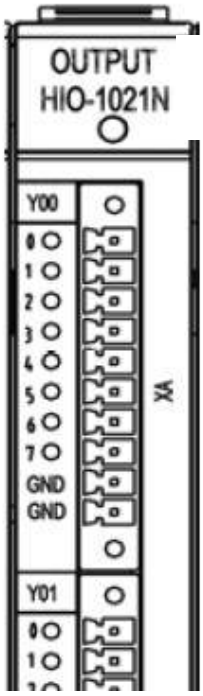
2） Definition of switch value input/output module interface



Switch value input interfaces XA and XB

Signal	Description	
	HIO-1011N XA, XB	HIO-1011P XA, XB
0-7	NPN input N0-N7 Low level is valid	-
0-7	-	NPN input N0-N7 High level is valid
GND	DC24V ground	

Definition of input module (HIO-1011N, HIO-1011P) interface



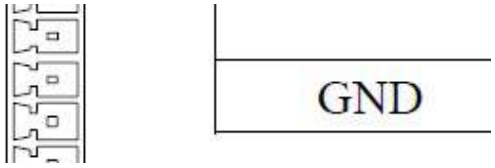
Switch value output interfaces XA and XB

输出接口

XA

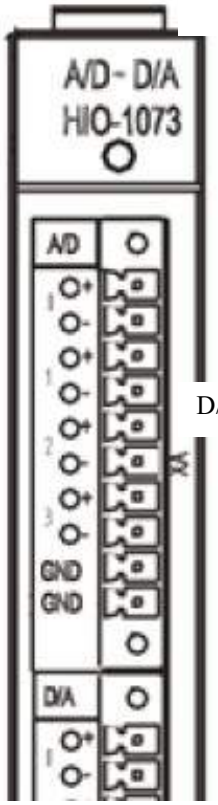
Signal	Description
0-7	NPN input O0-O7 Low level is valid
GND	DC24V ground

1 : 0
2 : 1
3 : 2
4 : 3
5 : 4
6 : 5
7 : 6
8 : 7
9 :GND



Definition of output module (HIO-1021N) interface

3） Definition of analog input/output module interface



A/D input interface XA

SN	Signal	Description
1-2	0+, 0-	4-channel A/D input AD0-AD3 (Input range: -10V to + 10V)
3-4	1+, 1-	
5-6	2+, 2-	
7-8	3+, 3-	
9-10	GND	Ground

1: 0+
2: 0-
3: 1+
4: 1-
5: 2+
6: 2-
7: 3+

7~8	3+、3-
9~10	GND

D/A output interface XB

SN	Signal	Description
1-2	0+, 0-	4 channels D/A input AD0-AD3 (Output range: -10V to + 10V)
3-4	1+, 1-	
5-6	2+, 2-	
7-8	3+, 3-	
9-10	GND	Ground

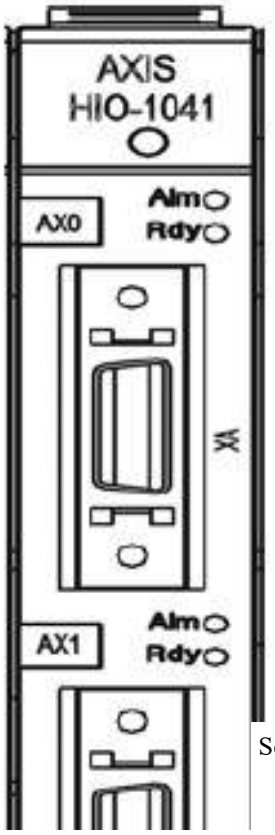
9: GND
10:GND

D/A

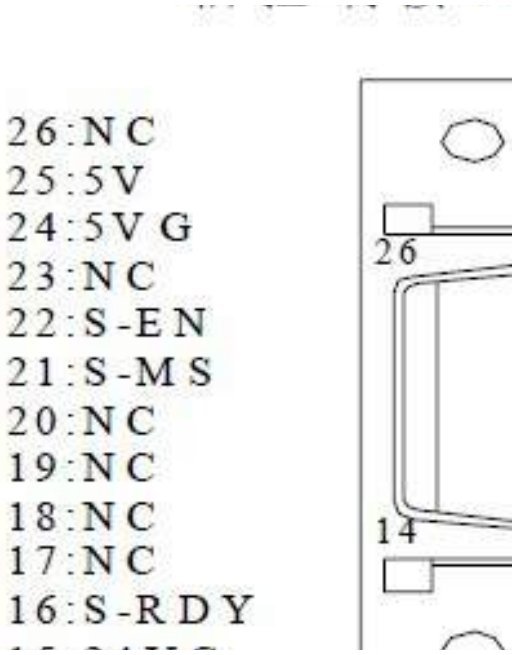
1: 0+
2: 0-

1~2	0+、0-
3~4	1-、1

4） Definition of axis control module interface



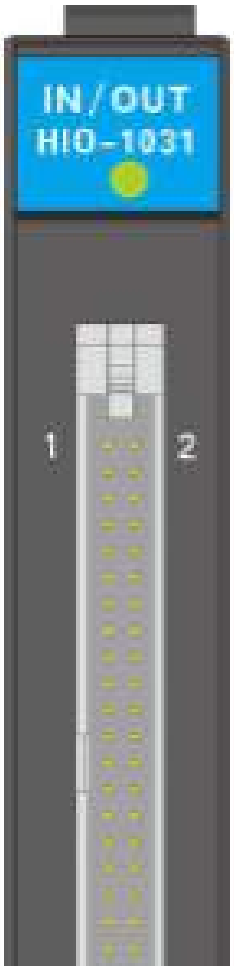
Axis control interfaces XA, XB



Sequence of plug pins (facing soldering terminal of plug)

Signal	Description
Vcmd1+ Vcmd1-	Analog output (-10V to +10V)
PA+, PA-	Encoder A phase feedback signal
PB+, PB-	Encoder B phase feedback signal
PZ+, PZ-	Encoder Z phase feedback signal
24V, 24VG	DC24V
CP+, CP-	Command pulse output (A phase)
DIR+, DIR-	Command direction output (B phase)
24VB	DC24V
S-RDY	Ready
S-MS	Mode switching
S-EN	Enable
5V, 5VG	DC5V power supply
NC	Empty

5） Definition of HIO-1031 module interface

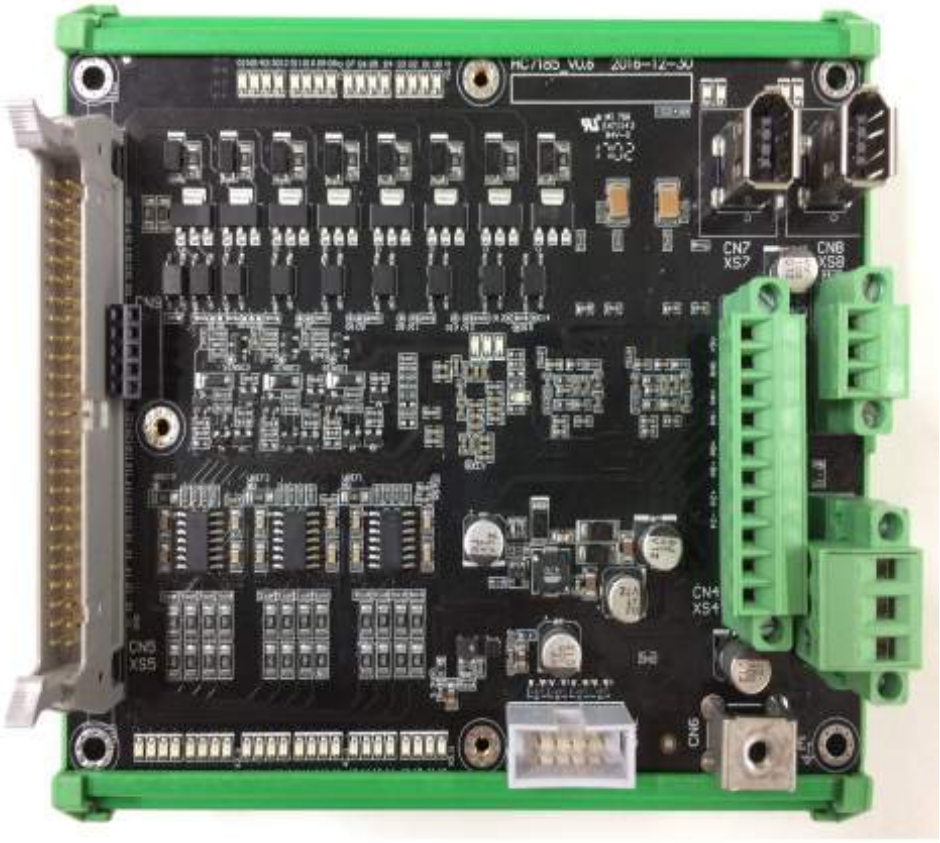


HIO-1031 port	Function	HIO-1031 port	Function
端口		+24V output	
1	GND		
3	Xm+0.0		
5	Xm+0.2		
7	Xm+0.4		
9	Xm+0.6		
11	Xm+1.0		
13	Xm+1.2		
15	Xm+1.4		
17	Xm+1.6		
19	Xm+2.0		
21	Xm+2.2		
23	Xm+2.4		
25	Xm+2.6		
27	COM0		
29	COM2		
31	Yn+0.0		

Note:

1. Three groups of input of this module occupy four groups of input points of the system, 8 bytes for each group, and the last group is reserved by default. Two groups of output occupy two groups of output points.
2. If the input configuration ports COM0 to COM2 are empty, PNP type is defaulted.
3. If COM0 port is connected to GND, Xm+0.0 ~ Xm+0.7 can be configured as PNP type input. If COM0 port is connected to 24V, Xm+0.0 ~ Xm+0.7 can be configured as NPN type input. Likewise, Xm+1.0 ~ Xm+1.7 and Xm+2.0 ~ Xm+2.7 corresponding to COM1 and COM2 can be configured as PNP type input or NPN type input. Please configure COMx port under power off and restart to validate it.
4. It is valid when the current flowing through the input port is greater than 6mA.

3.8.2 HIO-1200 Series



Picture of HIO-1200

Picture of HIO-1200-M1

Picture of HIO-1200-M2

1) Power supply interface XS1:

XS1: Power supply interface, pin is defined as below:

Pin	Signal	Port function
1	+24V1	DC24V power supply input
2	GND	GND
3	PE	PE

2) Bus interfaces XS7 and XS8:

XS7-XS8, NCUC bus interface is defined as below:

Pin	Signal	Port function
1	24V	DC24V power transmission
2	GND	
3	TXD+	Data transmission
4	TXD-	
5	RXD+	Data receiving
6	RXD-	

3) Analog spindle interface XS3:

Pin	Signal	Port function
1	DA+	Analog output +
2	DA-	Analog output -
3	AG1	Analog PE

4) Encoder input interface XS4:

Pin	Signal	Port function
1	+5V	5V output
2	GND	GND
3	PA1+	PA1+
4	PA1-	PA1-
5	PB1+	PB1+
6	PB1-	PB1-
7	PZ1+	PZ1+
8	PZ1-	PZ1-
9	NC	Empty
10	NC	Empty

5) Digital input/output interface XS5:

Pin	Signal	Port function	Pin	Signal	Port function

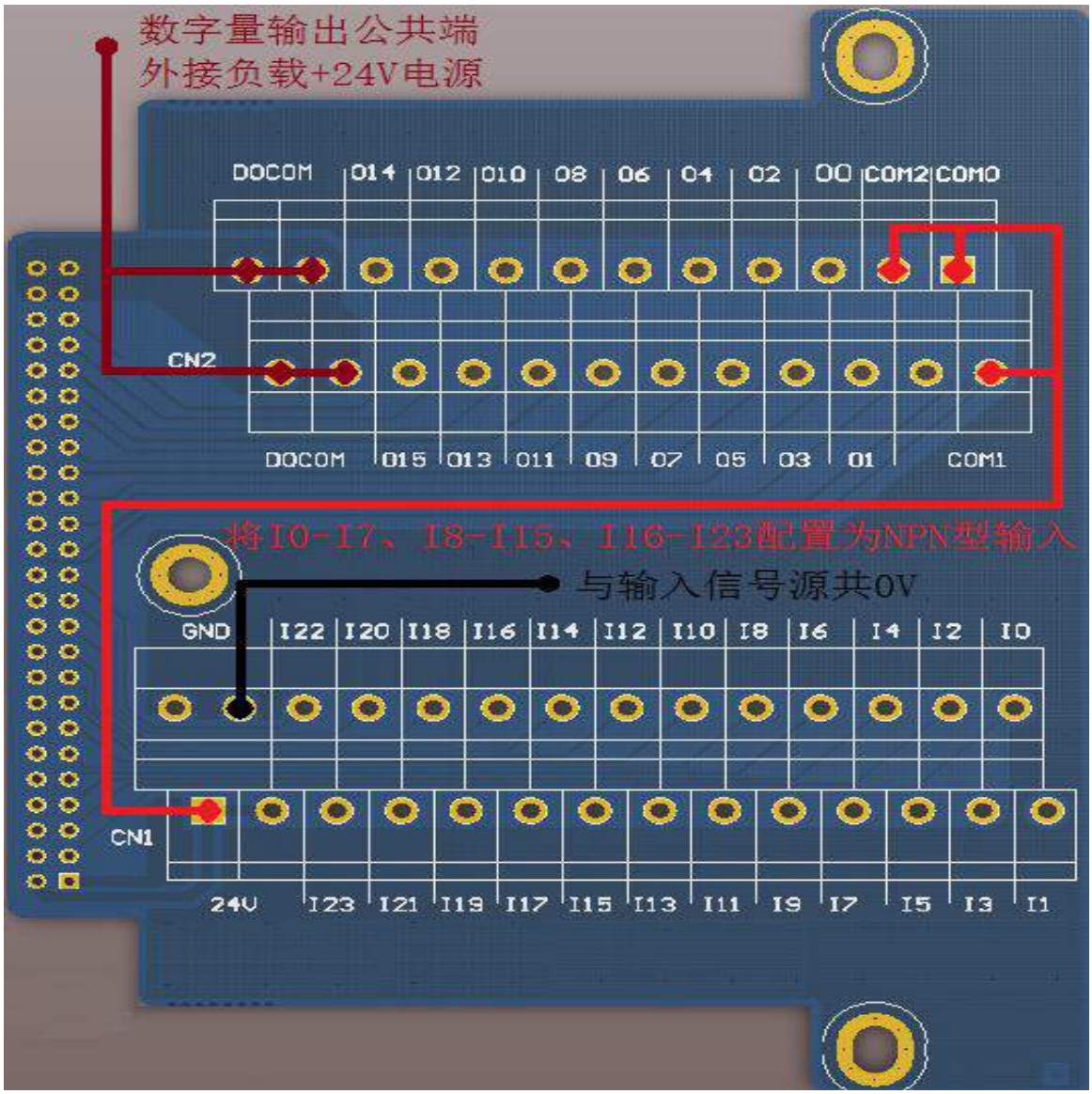
1	GND	GND	2	+24V	24V output
3	I0	X0.0	4	I1	X0.1
5	I2	X0.2	6	I3	X0.3
7	I4	X0.4	8	I5	X0.5
9	I6	X0.6	10	I7	X0.7
11	I8	X1.0	12	I9	X1.1
13	I10	X1.2	14	I11	X1.3
15	I12	X1.4	16	I13	X1.5
17	I14	X1.6	18	I15	X1.7
19	I16	X2.0	20	I17	X2.1
21	I18	X2.2	22	I19	X2.3
23	I20	X2.4	24	I21	X2.5
25	I22	X2.6	26	I23	X2.7
27	COM0	COM port of X0	28	COM1	COM port of X1
29	COM2	COM port of X2	30	NC	Null
31	O0	Y0.0	32	O1	Y0.1
33	O2	Y0.2	34	O3	Y0.3
35	O4	Y0.4	36	O5	Y0.5
37	O6	Y0.6	38	O7	Y0.7
39	O8	Y1.0	40	O9	Y1.1
41	O10	Y1.2	42	O11	Y1.3
43	O12	Y1.4	44	O13	Y1.5
45	O14	Y1.6	46	O15	Y1.7
47	DOCOM	24V input	48	DOCOM	24V input
49	DOCOM	24V input	50	DOCOM	24V input

1. Please share 0V with pin 1 (GND) of I/O interface CN5 and input signal source. Pin 2 (+24V) of CN5 is 24V output inside the board and is used for input type configuration only. If pin 27 (COM0) of CN5 is empty or grounded, pins I0-I7 can be configured as PNP type input. If COM0 is connected to 24V, pins 10-17 can be configured as NPN type input. Likewise, COM1 can be configured for I8-I15 pin input types and COM2 can be configured for I16-I23 pin input types. Please configure COMx port under power-off state and restart to validate it. Pins I0-I7 correspond to X0, pins I8-I15 correspond to X1 and pins I16-I23 correspond to X2. Definition and usage of I/O extension board interface is similar to baseboard. The PNP type input is valid when greater than 19V and NPN type input is valid when less than 4V.

2. Pins 47-50 (DOCOM) of I/O interfaces are digital output common ports and are connected to load +24V power supply externally. The rated current of PNP digital output is 100mA, If it is ≧140mA, output port will undergo overcurrent protection. Restart to recover it after fault removal. Capacity of load +24V power supply is determined according to total quantity of I/O and load power and must not be connected to the one-way load greater than 120mA for a long time to avoid irreversible damage.

Additional Description:

Picture of HIO-1200-K terminal board where I0-I7, I8-I15 and I16-I23 are set as NPN type input:



4 Preparation for Commissioning

4.1 Verification and Record

Please check whether objects are consistent with purchase order and packing list. If not, please contact HCNC company immediately.

4.2 View System Information

Steps for viewing HNC-8 software version information: Press "Maintain" on the NC panel→press F8 "System information". The system information page displays system information, system software information, servo software information and user version information.

4.3 Software Upgrade and Parameters, PLC Backup/Loading

8 type software upgrade includes application program upgrade, parameter upgrade, PLC upgrade and BTF full-package upgrade. For parameter, PLC or BTF full-package upgrade, back up PLC and parameters first. Otherwise, PLC and parameters in the original system will be covered by standard parameters and PLC after upgrade is completed.

4.3.1 Parameter and PLC Backup

Operating steps:

1） Press "Maintain" on the NC panel→ press F9 "Permission management "→press F4 "Logout "→select user level (the backup is allowed only for workshop manager or above) →press F2 "Login "→input permission password→ press "Enter" on the NC panel to confirm (if the permission password is correct, parameter of this level can be modified; otherwise, the system will give a prompt message "Incorrect password".) ;

Default permission password:

Operator: Need not to enter a password

Workshop manager: GOD

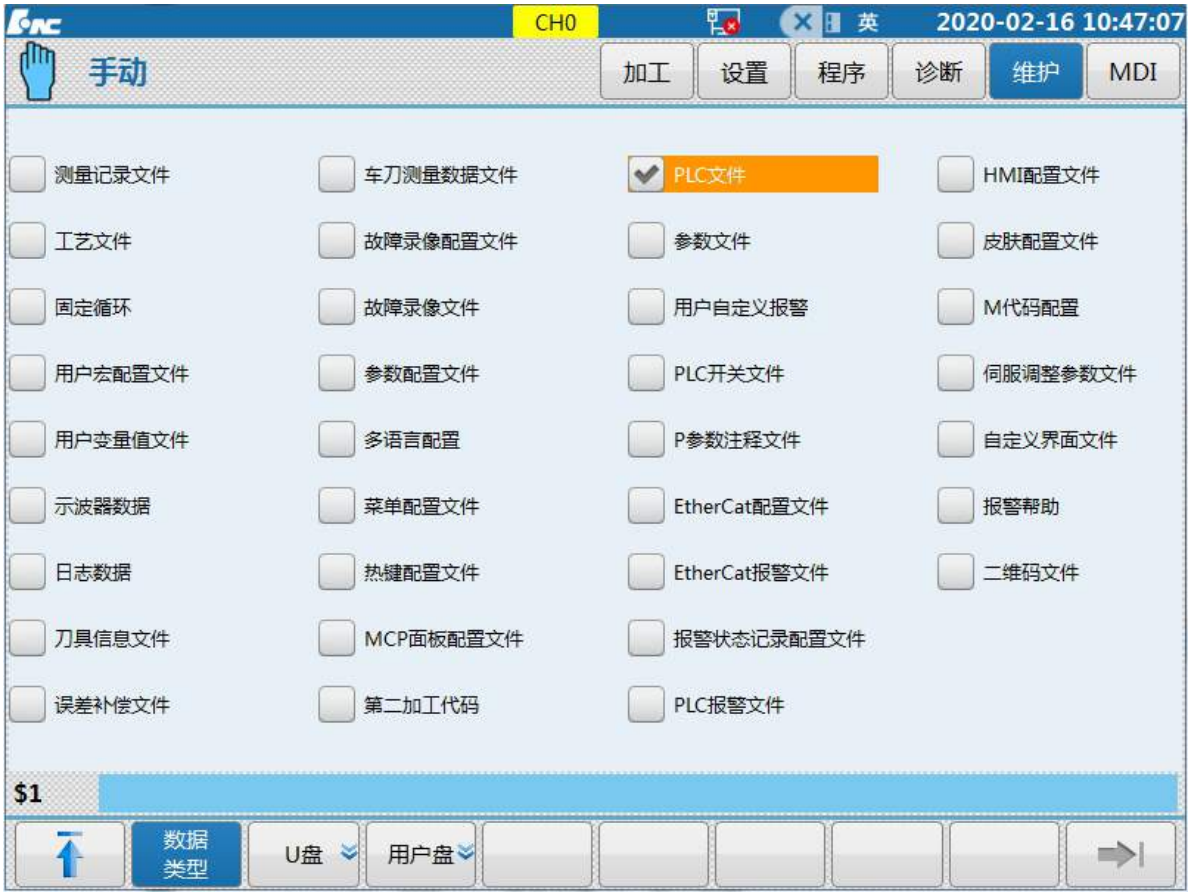
Machine manufacturer: HOG

CNC manufacturer: HIG

System administrator: HNC8

2) Press F1 “↑” to return→ press F7 "Data management";

3) Select type of data to be backed up by “↑”, “↓”, “←” and “→” on the NC panel. e.g.: To back up parameter file, select "Parameter file". To back up PLC file, select "PLC file". Then, press "Enter" on the NC panel to confirm and “√” is displayed in front of the corresponding option;



4) Select the backup path by "USB flash disk" and "User disk". For backup in USB flash disk, insert USB flash disk into USB interface of the system. When  in the upper part of the screen turns to  , it means that USB flash disk has been loaded;

5) Press F9 "Window switch" and the window returns to "System disk";

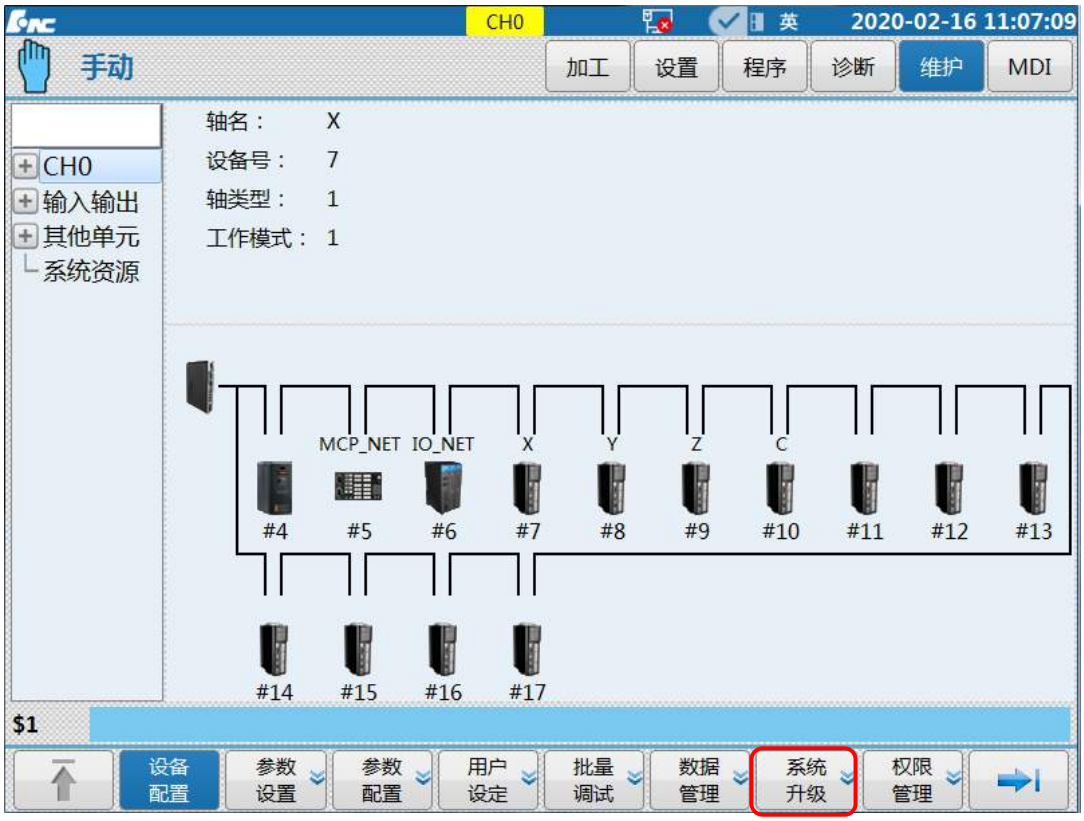
6) Press F3 "Backup" and the system gives a prompt message "Whether to back up the selected file? (Y/N)", "Y": Yes and "N": No, which correspond to "Y" and "N" on the NC panel. Select Y and the system gives a prompt message that backup succeeds and generates corresponding file name suffixed with date and time.

4.3.2 Software Upgrade

Note: For the sake of safety, it is better to disconnect the bus behind the controller after PLC or parameter upgrade; otherwise, standard PLC or parameter may differ from current machine tool and consequently the machine tool works abnormally.

1） Enter permission as per the operating step 1) in 4.3.1;

2） Press "Maintain" on the NC panel→ Press F8 "System upgrade";



3） Press "Window switch" to switch to upgrade option and select "Type of upgrade option" and "Backup or not" by “↑”, “↓”, “←” and “→” on the NC panel: Application program, parameter, PLC and BTF. Generally, BTF upgrade is selected and then press "Enter" on the NC panel to confirm. Backup or not: Select based on the actual situation. After selection, “√” is displayed in front of the corresponding option.

4） Select USB flash disk, switch to USB flash disk directory by "Window switch" and select corresponding upgrade patch by “↑” and “↓” on the NC panel. After selection, press "Enter" on the NC panel to confirm. If backup is selected, the system will start backup automatically and corresponding file to be backed up will be stored in the path of CF card. After backup is completed, the system will start the automatic verification of upgrade patch and will start automatic upgrade after passing the verification. When the upgrade is completed, the system will give a prompt message "Upgrade succeeds, please power off and restart". After the system is powered off and restarted, the loaded file is validated.

Select corresponding upgrade patch file in the USB flash disk

The system will give a prompt message "Upgrade completed"

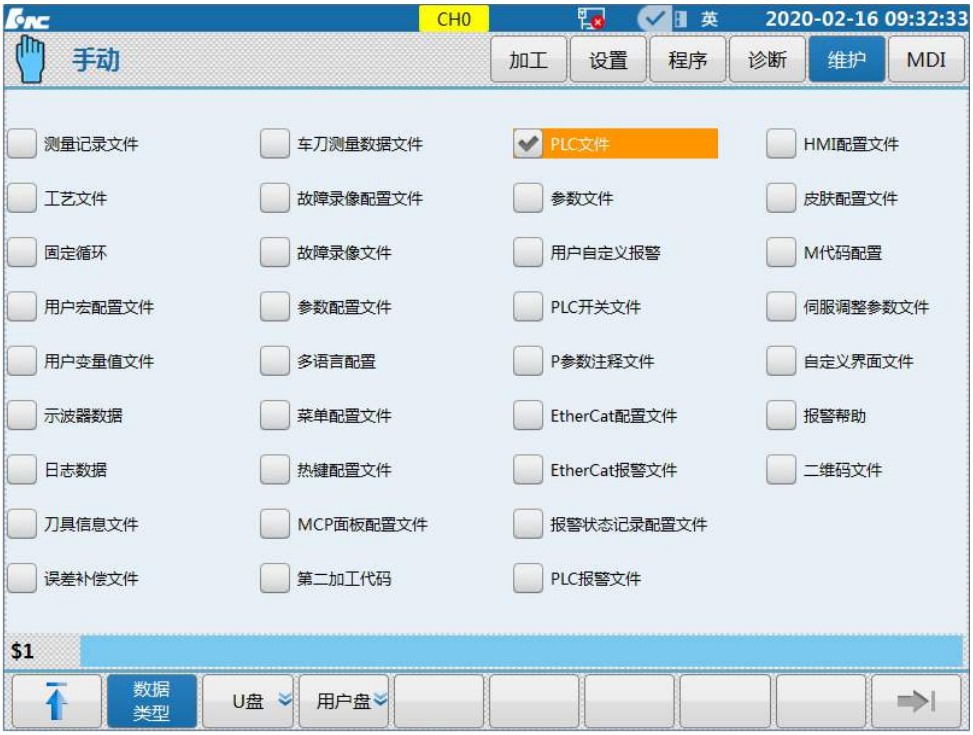
4.3.3 Parameters and PLC Loading

Operating steps:

1) Enter permission as per the operating step 1) in 4.3.1;

2) Press F1 “↑” to return→ press F7 "Data management";

3) Select the type of data to be loaded by “↑”, “↓”, “←” and “→” on the NC panel. e.g.: To load parameter file, select "Parameter file". To load PLC file, select "PLC file". Then, press "Enter" on the NC panel and "√" will be displayed in front of the corresponding option;



4) Select load path by "USB flash disk" and "User disk". For loading from USB flash disk, insert USB flash disk into USB interface of the system. When  in the upper part of the screen turns to  , it means that USB flash disk has been loaded. Press "USB flash disk";

5） Select the file to be loaded by “↑” and “↓” on the NC panel, press "Load" and the system gives a prompt

message "Whether to load the selected file? (Y/N)", "Y": Yes, "N": No, which correspond to the "Y" and "N" on the NC panel. Select Y and if there is a file of the same name in the system, the system will give a prompt message "Whether to cover the file? (Y/N)", select Y and the system will start to load the file. After the file is loaded, the system will give a prompt message "Loading succeeds and restart to take effect!". After the system is powered off and restarted, the loaded file is validated.

A prompt message whether to load the selected file will be given

A prompt message whether to cover the original file will be given

A prompt message loading succeeds and restart the system will be given

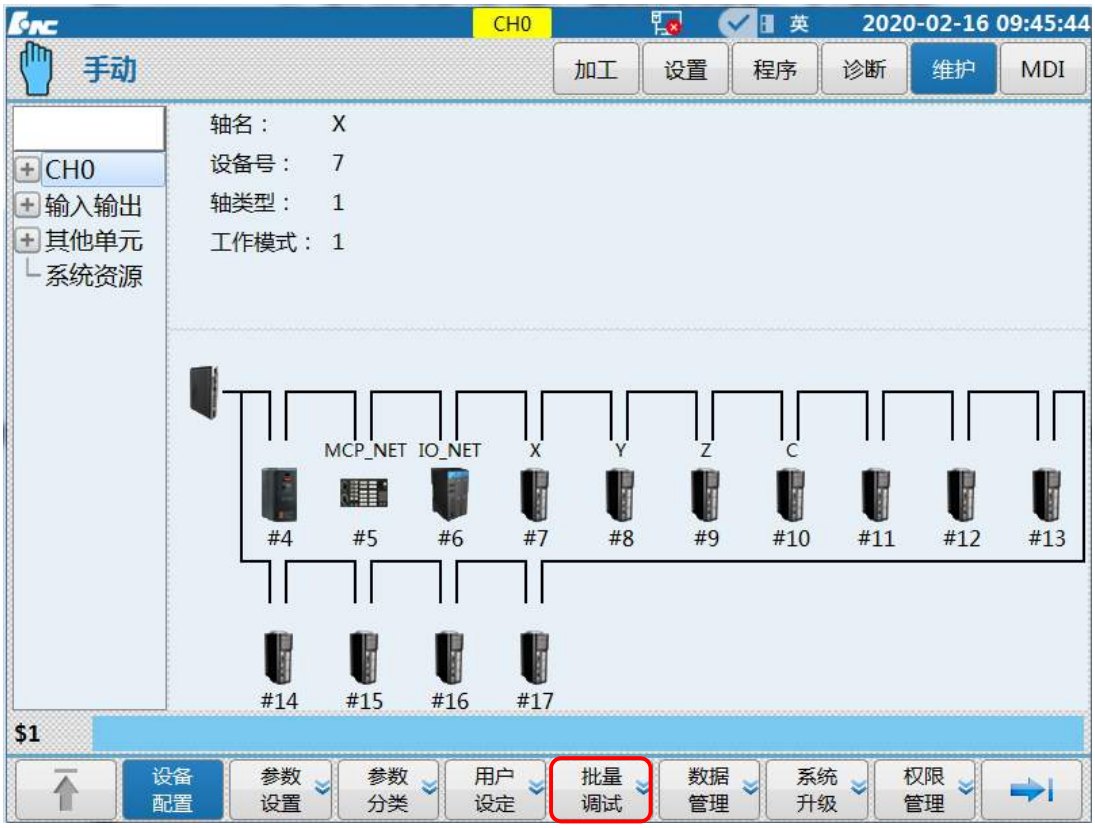
4.3.4 Batch Commissioning

Batch commissioning procedures for HNC-8 series will be described in this chapter.

Operating steps:

1） Enter permission as per the operating step 1) in 4.3.1;

2） Press F1 “↑” to return→ press F6 “Batch”;



3） Select all or a single parameter type or several parameter types by "Enter" on the MDI panel;

Select path of load and backup by F2 “USB flash disk” and F3 “User disk”;

Select corresponding operation by F4 "Load" and F5 "Backup".

4） This function is mainly used for commissioning of multiple machine tools. When a machine tool reaches the correct condition, back up all parameters in a USB flask disk according to the above steps. Then, insert the USB flask disk into a machine tool system to be commissioned and load parameters in the USB flask disk into the system according to the above steps. At this time, the optimization and commissioning of the machine tool have been completed. The machine tool manufacturer can start inspection of the machine tool.

Note:

1. For this function, users must ensure consistency of models of CNC controllers, models of drive motors, points of electrical devices and models of machine tools to be commissioned.
2. For this function, users must ensure consistency of the system version number.

4.4 Offline Commissioning

In order to prevent an accident, drive and motor should undergo offline commissioning before connected to actuator.

This step is extremely important while commissioning large machine tools. Specific steps are as follows:

1) Place drive and motor in a flat and safe position (such as the ground);

2) Connect drive and motor only, set the drive as internal enable (for details, refer to *User Manual of HSV-180UD AC Servo Drive Unit*) and test the operating condition;

Note: If the absolute motor rotates automatically after powered on, it means that zero calibration is needed. (For specific steps for zero setup, please refer to *User Manual of HSV-180UD AC Servo Drive Unit*)

3) Connect the controller to the drive, and the drive to the motor (for details, please refer to *Hardware Connection Specification*), as shown in Fig. 1.3. Recover the drive parameter to external enable and determine whether communication is normal through observing drive lights or viewing device interfaces, (to view device interface parameters, refer to 3.1). If parameters of some devices cannot be displayed, connect them and eliminate faults one by one.

Fig. 1.3 Offline commissioning

Other key points of commissioning:

- Check whether phase sequences U, V and W of power line are correct. For Dengqi absolute motor, phase sequence should be U, W and V. For Huada absolute motor, phase sequence needs not to be exchanged.
- Check whether the CNC controller can control action of drive and motor correctly and whether drive and motor are stable and reach design power;

4) Commission PLC and check emergency stop point;

4.5 Step-by-step Power-on Principle

In order to ensure safety of commissioning personnel and intactness of machine tool and for ease of fault diagnosis, comply with "Step-by-step power-on" principle in the earlier commissioning period:

1) Power on the CNC controller and power off other devices. Check parameters and PLC, and ensure correctness of power-on part of PLC, especially when the gravity axis brakes.

2) Power on the feed drive and check whether device cables are connected correctly and whether the drive and the controller are connected normally;

3) Power on the power device (motor) and check whether the motor is controlled normally, whether the machine tool runs normally and whether all limits are valid;

4) Power on the spindle module and check whether the spindle speed is normal;

5) Power on the magazine module and check whether the tool change is correct;

4.6 Boot Failure of HNC8 Controller and Causes

The system returns to linux backstage

1. Return to the backstage and there is a printed information: Step 1/11: KernelInitErr
   Cause: System core applying for memory fails.
   Solution: System memory failure.

2. Return to the backstage and there is a printed information: Step 2/11: ReadCfgErr
   Cause: Error occurs while reading system configuration file LNC32.CFG file.

Solution: Load normal LNC32.CFG file.

3. Return to the backstage and there is a printed information: Step 3/11: NcguiErr
   Cuase: System memory is insufficient and interface startup fails
   Solution: System memory failure.

4. Return to the backstage and there is a printed information: Step 3/11: BmpLoadErr
   Cause: System memory is insufficient and BMP picture module initialization is abnormal
   Solution: System memory failure.

5. Return to the backstage and there is a printed information: Step 3/11: FontErr
   Cause: Loading word stock fails and word stock file may be missing or damaged
   Solution: Load a correct word stock file

6. Return to the backstage and there is a printed information: Step 4/11: ParmXmlLoadErr
   Cause: Loading parameter configuration file PARM-CN.XML fails
   Solution: Re-copy a normal PARM-CN.XML file to the system

Note

For the above warnings, after returning to linux backstage, characters still can be entered by keyboard normally. Due to Bug of linux system, the characters printed are invisible after returning to linux background for the first time. When power is not turned off, start manually the CNC system software, then the system will return to linux backstage again and the printed incorrect characters can be seen.
How to manually start the software of the CNC system:
Enter "cd /h/lnc8" in the # interface and press the Enter key.
Enter "./n" in the # interface and press the Enter key.

If the start interface is normal, and red color on the interface displays abnormal start

1. 3---Interface initialization fails [2] is shown in red
   Cause: There is a damaged file or missing file in BMP files
   Solution: Replace BMP files again.

2. 4---Parameter initialization fails [-2] is shown in red
   Cause: Parameter "Original file and backup file are damaged (file verification fails) or "there is inconsistent data in the two files".
   Solution: The alarm is eliminated after the system restarts. If the alarm is still not eliminated after the system restart, enter "Data management" menu, delete backup file and restart the system. If the alarm still cannot be eliminated, re-import a normal parameter file into the system.

3. 5---Program manager initialization fails [-1] is shown in red
   Cause: System memory is insufficient
   Solution: System memory failure.

4. 6---PLC initialization fails [-1] is displayed in red

Cause: Loading DIT ladder diagram to the system fails
Solution: Ladder diagram file is damaged

5. 7---Alarm module initialization fails [-2] is shown in red
   Cause: Opening grammatical alarm text SYTAX.ERR fails
   Solution: The system imports a normal SYTAX.ERR file

6. 7---Alarm module initialization fails [-3] is shown in red
   Cause: Opening system alarm text SYS.ERR fails
   Solution: The system imports a normal SYS.ERR file

7. 8---Saving previous power-off data fails, please inspect UPS power [0x0010] is displayed in red
   Cause: Power-off data is not stored normally after system power-off
   Solution: UPS is not fully charged or UPS is abnormal

8. 8---Data file import module initialization fails [0x0001] is shown in red
   Cause: Workpiece coordinate system CRD.DAT file, "Original file and backup file are damaged (file verification fails)" or "There is inconsistent data in two files".
   Solution: The alarm is eliminated after system restart. If the alarm is still not eliminated after system restart, reset the workpiece coordinate system and restart the system.

9. 8---Data file import module initialization fails [0x0002] is shown in red
   Cause: Loading tool file TDATA.DAT file fails
   Solution: The alarm is eliminated after system restart. If the alarm is still not eliminated after system restart, reset tool data and restart the system.

10. Data file import module initialization fails [0x0004] is shown in red
    Cause: Loading B register file REG.DAT fails
    Solution: restart the system to eliminate the alarm.

Note 1: Different values in the brackets after 7, 8, 9 and 10 have different meanings and can be combined.

Note 2: Processing of 3 types of files in 8, 9 and 10 is the same as processing of parameter files. For specific methods, refer to parameter processing in 2.

11. 9---"Gear ratio" and "Encoder offset" are not set [0X0003] is shown in red
    Cause: “Gear ratio" and "Encoder offset" of key parameters of axis are not set and values in the square brackets represent the mask of the faulted axis number
    Solution: Set parameters such as "Gear ratio" and "Encoder offset" of the alarm axis
12. 10---Loss of motor position [0X0003] is shown in red
    Cause: Motor position recorded during previous power-off exceeds the error compared with that during startup and values in the square brackets represent the mask of the faulted axis number
    Solution: Enter "Help" menu under "Diagnosis" for solution.
13. 11---GUI module initialization fails [3] is shown in red
    Cause: System memory is insufficient and initialization of GUI related modules fails
    Solution: System memory failure.

5 Parameter Debugging

5.1 Parameter List

5.1.1 Distribution of Parameter Number

Parameter number (ID) of HNC-8 CNC system is distributed as shown below:

Parameter type	ID distribution	Description
NC parameter	000000 to 009999	Occupy 10000 ID numbers
Machine user parameter	010000 to 019999	Occupy 10000 ID numbers
Channel parameter	040000 to 049999	Every channel occupies 1000 ID numbers
Coordinate axis parameter	100000 to 199999	Every axis occupies 1000 ID numbers
Error compensation parameter	300000 to 399999	Every axis occupies 1000 ID numbers
Device interface parameter	500000 to 599999	Every device occupies 1000 ID numbers
Data table parameters	700000 to 799999	Occupy 100000 ID numbers

- NC parameters are basic parameters of the CNC system used to set interpolation period, operational resolution and other parameters.
- Machine user parameters are used to set machine tool structure, number of channels and other parameters, such as lathe or milling machine and used channels.
- Path of interpolation motion in channel. Different interpolation motions can be executed in different channels, and they do not affect each other. Dual channel means that two types of interpolation motions can be executed simultaneously. Channel parameters are used to set relevant parameters of different channels.
- Coordinate axis parameters are used to set relevant parameters of logical axes used in the channels.
- Error compensation parameters are used to set backlash, pitch error and other error compensation parameters.
- Device interface parameters are used to set relevant parameters of axis, I/O and other physical devices.
- Data table parameters are used to set error compensation, temperature and other data tables.

5.1.2 Data Type of Parameter

Data type of parameters of HNC-8 CNC system includes:

- INT4: Parameter value can only be an integer.
- BOOL: Parameter value can only be 0 or 1.
- REAL: Parameter value can be an integer or a decimal.
- STRING: Parameter value is a string containing 1-7 characters.
- HEX4: Parameters are inputted and displayed in hexadecimal.
- ARRAY: Parameters are inputted and displayed in the form of array, the data is separated by "," or ".", and the value range of array element is 0-127.

5.1.3 Parameter Access Level and Modification Permission

- Parameters of different levels must be modified and saved after corresponding password is entered for login.
- Low-level parameters can be modified after login of high-level permission.
- Curing parameters (access level 5) cannot be modified manually and are configured by the CNC system automatically (cured upon delivery).
- Parameter access level is shown below:

Parameter access level	Object-oriented	English sign
1	Normal user	ACCESS_USER
2	Machine tool manufacturer	ACCESS_MAC
3	CNC manufacturer	ACCESS_NC
4	Administrator	ACCESS_RD
5	Curing	ACCESS_VENDER

5.1.4 Parameter Validation

Validation mode of parameters of HNC-8 CNC system includes:

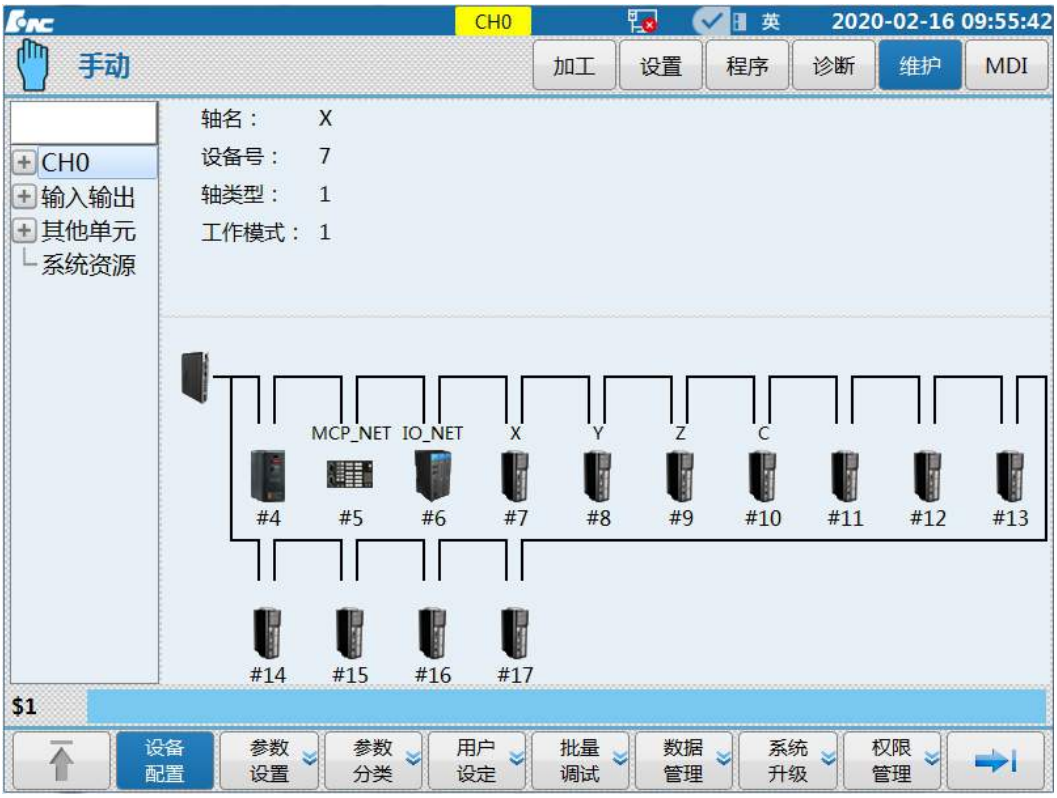
- Save: Press Save to validate the modified parameters
- Immediate: Validate the modified parameters immediately (mainly used for adjustment of servo parameters)
- Reset: Press Reset to validate the modified parameters
- Restart: Restart the CNC system to validate the modified and saved parameters

5.2 Verification of Device Parameters

5.2.1 Device Parameter

When the system is powered on for the first time after hardware connection, verify parameters first. If corresponding devices of displayed parameters are not identified, re-check the hardware connection.

Steps: Maintain=>F2 device configuration



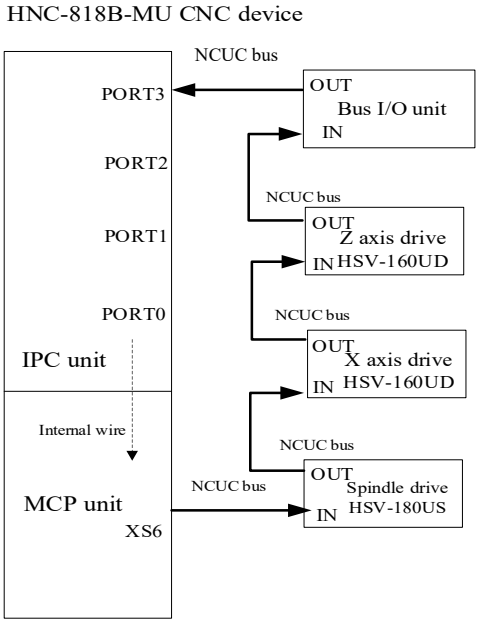
5.2.2 Axis Number Refers to Logical Axis Number in System

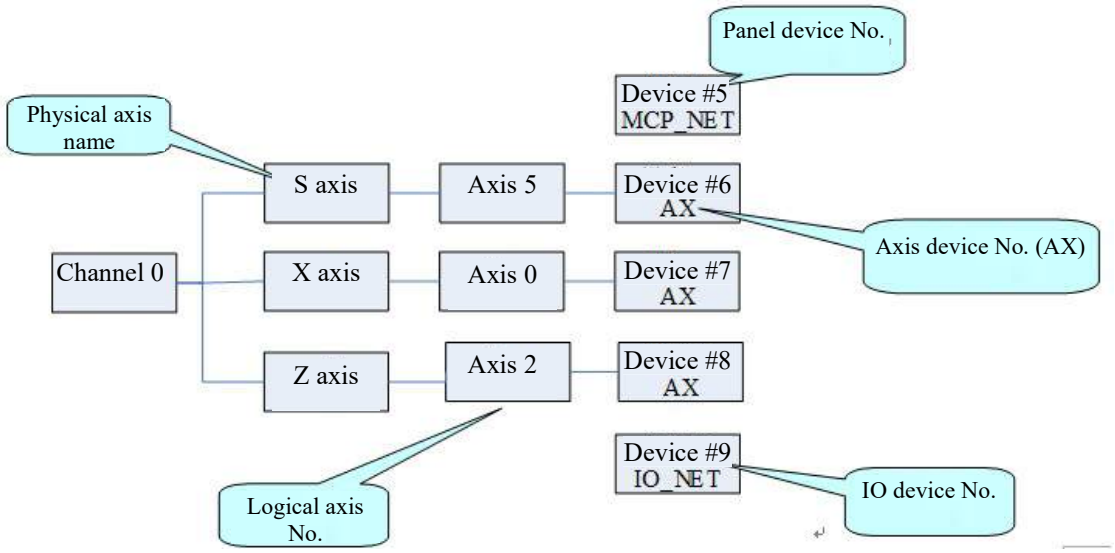
Device number refers to serial number of physical devices on the bus. Different connection of the bus correspond to different device sequences.

Device types supported by HNC-8 CNC system are shown below.

Device type	Device name	Device type	Connection mode	Graphic sign
Reserved	RESERVED	1000	----	
Analog spindle	SP	1001	Local	
Local IO module	IO_LOC	1007	Local	
Local control panel	MCP_LOC	1008	Local	
Handwheel	MPG	1009	Local	
CNC keyboard	NCKB	1010	Local	
Servo axis	AX	2002	Bus network	
Bus IO module	IO_NET	2007	Bus network	
Bus control panel	MCP_NET	2008	Bus network	
Position control panel	PIDC	2012	Bus network	
Encoder interface board	ENC	2013	Bus network	

As shown in the figure (bus connection of 818B lathe system) below: MCP keyboard unit corresponds to device number 5, spindle corresponds to device number 6, X axis corresponds to device number 7, Z axis corresponds to device number 8, and I/O unit corresponds to device number 9.





Relationship between axis number and device number

5.3 Parameter Setup Method

Parameter setup steps:

1） Press "Maintain" on the NC panel→ press F9 "Permission management"→ press F4 "Logout"→select user level (only workshop manager or above can be backed up)→ press F2 “Login”→Enter the password→ press "Enter" on the MDI panel to confirm (if a correct password is entered, parameter of permission level or password can be modified; otherwise, the system will give a prompt message "Incorrect password".) ;

Default permission password:

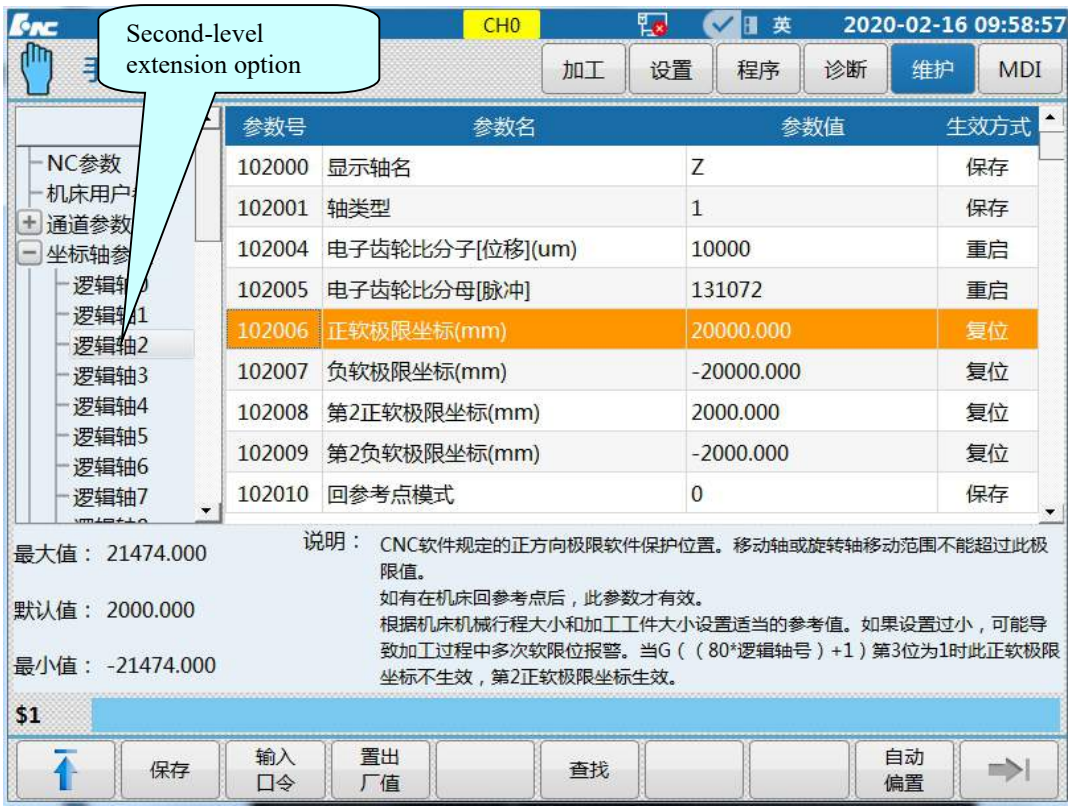
Operator: Need not to enter a password

Workshop manager: GOD
Machine tool manufacturer: HOG
CNC manufacturer: HIG
System administrator: HNC8

2） Press F1 “↑” to return→ press F2 "Parameter setup";

3） Select parameter type by “↑” and “↓” on the NCI panel and press "Enter" on the NC panel to enter the suboption;

4） Press → to switch to parameter option window and modify parameter value;


Second-level extension option
CH0
英
2020-02-16 09:58:57
加工
设置
程序
诊断
维护
MDI
NC参数
机床用户
通道参数
坐标轴参
逻辑轴2
逻辑轴3
逻辑轴4
逻辑轴5
逻辑轴6
逻辑轴7
参数号
参数名
参数值
生效方式
102000 显示轴名 Z 保存
102001 轴类型 1 保存
102004 电子齿轮比分子[位移](um) 10000 重启
102005 电子齿轮比分母[脉冲] 131072 重启
102006 正软极限坐标(mm) 20000.000 复位
102007 负软极限坐标(mm) -20000.000 复位
102008 第2正软极限坐标(mm) 2000.000 复位
102009 第2负软极限坐标(mm) -2000.000 复位
102010 回参考点模式 0 保存
最大值： 21474.000
默认值： 2000.000
最小值： -21474.000
说明： CNC软件规定的正方向极限软件保护位置。移动轴或旋转轴移动范围不能超过此极限值。
如有在机床回参考点后，此参数才有效。
根据机床机械行程大小和加工工件大小设置适当的参考值。如果设置过小，可能导致加工过程中多次软限位报警。当G（（80*逻辑轴号）+1）第3位为1时此正软极限坐标不生效，第2正软极限坐标生效。
$1
保存
输入口令
置出厂值
查找
自动偏置

5.4 Parameter Setup of HNC-8 Lathe System

5.4.1 NC Parameter Setup

1） PARM000013, "G00 interpolation enable", the parameter is used to determine whether to enable G00 interpolation motion just like G01 interpolation motion.

- 0: G00 does not execute interpolation motion.
- 1: G00 executes interpolation motion

2） PARM000018, "System time display enable", the parameter is used to set whether the HMI of the CNC system displays current system time.

- 0: System time is not displayed
- 1: System time is displayed

3） PARM000020, "Automatic display enable of alarm window", the parameter is used to set whether the CNC system displays the alarm message window automatically.

- 0: Alarm message window is not displayed automatically.
- 1: If the system gives a new alarm message, the alarm message window will be displayed automatically.

4） PARM000024, "G code line number display mode", the parameter is used to set display mode of G code line number in the HMI of the system.

- 0: G code line number is not displayed
- 1: G code line number is displayed only in the editing interface
- 2: G code line number is displayed only in the program running interface
- 3: G code line number is displayed in the editing interface and the program running interface

5） PARM000025, "Selection of size metric/imperial display".

- 0: Imperial display, the HMI of the CNC system displays according to imperial system.

- 1: Metric display, the HMI of the CNC system displays according to metric system.

6） PARM000026, "Decimal places of positional value", the parameter is used to set the decimal places displayed of positional value in the HMI of the CNC system, including machine tool coordinates, workpiece coordinates and remaining feed, etc.

7） PARM000027, "Decimal places of speed value", the parameter is used to set the decimal places displayed of speed value in the HMI of the CNC system, including F feed speed, etc.

8） PARM000028, "Decimal places of rotation speed", the parameter is used to set the decimal places displayed of rotation speed in the HMI of the CNC system, including spindle speed S, etc.

9） PARM000030, "Screen protection waiting time (min)", it is set how long NC panel is not operated, the system enters screen protection state. When it is set as 0, screen protection function is not used.

10） **PARM000034,** "Operation prompt enable", it is set in binary system, and indicate whether a confirmation prompt is given for corresponding operation.

- Bit 0: Rerun.
- Bit 1: 【Tool compensation】->【Relative actual】
- Bit 2: 【Tool compensation】->【Current position】.

When the bit values are 0, it means that there is no confirmation prompt. When the bit values are 1, it means that there is confirmation prompt.

Example:

When bit 0 is set as 0, press system function key [Rerun] and the interface will directly refresh the cursor to the position of program head;

When bit 0 is set as 1, press system function key [Rerun] and the interface will give a prompt message whether to execute rerun.

11） **PARM000060,** "Number of tool data saved by system", the parameter is used to set number of tools whose data (tool offset, wear, radius, tool nose orientation and length) is saved in the tool table, which should be greater than or equal to the total number of tools in all channels.

- Maximum value is 1000 (which can be modified through configuration file)

12） **PARM000061,** "Digits of T command tool offset and tool compensation numbers", the parameter is used to set the effective digits of tool number and tool offset number in T commands.

- It is set as 2 by default and means that effective digits of tool offset number and tool compensation number is 2. e.g.: T0203, 02 is the tool number and 03 is the tool offset number.

13） **PARM000064,** "Tool wear accumulation enable", it is to set whether the tool wear value is the input value or the input value plus original value.

- 0: Input value
- 1: Input value plus original value

14） **PARM000065,** "Tool diameter display enable", the parameter is used to set whether the coordinate value in X axis direction in the tool table displays in diameter or radius.

- 0: Disable diameter display of X axis coordinate value
- 1: Enable diameter display of X axis coordinate value
- 2: Enable diameter display of Y axis coordinate value
- 3: Enable diameter display of X and Y axes coordinate values

15） **PARM000072,** "Whether machining time display is enabled", the parameter is used to disable the machining time display function.

- 0: Machining time is displayed
- 1: Machining time is not displayed

16） PARM000090, “Data upload switch”.

- 0: Data is not uploaded
- 1: Data is uploaded to HCNC cloud

17) PARM000102, “Display coordinate selection”. This parameter is used to set the coordinate type of display column in the machining interface.

- 0: Machine actual
- 1: Machine command
- 2: Workpiece actual
- 3: Workpiece command
- 4: Remaining feed
- 5: Relative actual

18） PARM000349, "Trigonometric function selection, 0: radian; 1: angle".

- 0: Trigonometric function is calculated in radian
- 1: Trigonometric function is calculated in angle

19） **PARM000358,** "Clear MDI program while exiting MDI".

- 0: MDI program is not cleared while exiting MDI
- 1: MDI program is cleared while exiting MDI

20） PARM000359, “Default permission”.

- 0: The default permission is workshop manager permission
- 1: The default permission is operator permission

21） **PARM000370,** "Intelligent function switch", set by bit

- Bit 0: Triathlon health security function
- Bit 1: Single sensor thermal error compensation function
- Bit 2: Fault data recorder function
- Bit 3: None
- Bit 4: Feed axis load diagram function
- Bit 5: Process parameter evaluation function
- Bit 6: Broken tool detection function
- Bit 7: One-click restore function
- Bit 8: Power-on consistency detection function
- Bit 9: Enable servo self-diagnosis function
- Bit 15: Current/power switching function

22） PARM000371, "MDI mode switching".

- 0: MCP-MDI
- 1: NC-MDI

23） **PARM000373,** " M Code of servo adjustment sampling start".

- Used to configure the M command for starting the servo adjustment sampling

24） PARM000374, " M Code of servo adjustment sampling end".

- Used to configure the M command for ending the servo adjustment sampling

5.4.2 Machine User Parameter Setup

1） **PARM010000,** "Maximum number of channels", the parameter is used to set the maximum number of channels allowed. It is set as 1 by default and 2 when there are two channels.

2） **PARM010001,** "Cutting type of channel 0", the parameter is used to designate the type of the station.

- 0: Milling system
- 1: Lathe system
- 2: Turn-mill combo system

3） **PARM010009,** "Channel 0 selection sign".

Description

Multiple spindles and drive feed axes can work on a workpiece clamping position, that is, a workpiece clamping position corresponds more than one channel.

This set of parameters are effective after reset. Bits 0-7 represent selection signs of channels 0-7 respectively. While configuring the channel for a station, the designated bit of channel selection sign should be set as 1 for this station.

4） **PARM010017,** "Channel 0 display axis sign [1]"

Description

The HMI of the CNC system can display axes in every station selectively based on actual need.

This set of parameters are effective after reset. Bits 0-31 of "Station display axis sign【1】" represent selections signs of axes 0-31 respectively. When the system supports no more than 64 axes, bits 0-31 of the extension parameter "Station display axis sign【2】" represent selections signs of axes 32-63 respectively. While configuring the display axis for a station, the designated bit of display axis sign should be set as 1 for this station.

Note

This set of parameters should be inputted and displayed in hexadecimal.

Example

If station 0 includes two channels, there are 10 axes including coordinate axes 0, 2, 4, 5, 6, 7, 8, 10, 13 and 17, but the HMI of the CNC system just needs to display the first 5 axes and the Parm010017 "Station 0 axis display sign 【1】" should be set as 0x75 (hexadecimal input, bits 0, 2, 4, 5 and 6 should be set as 1).

5) PARM010033, "Customization of load current display axis in channel 0".

Description

The HMI of the CNC system can determine which axis load current is displayed in each station based on actual needs.

This set of parameters is array type parameters used to set axis number of load current display axis in the station and the inputted axis number is separated by "." or ",".

Note

Array parameters support up to 8 data to be input simultaneously and the value ranges from 0 to 127.

Example

Station 1 includes 5 axes including coordinate axes 0, 1, 2, 8 and 9. Axes 0, 1 and 2 are feed axes and axes 8 and 9 are spindles.

If the HMI of the CNC system needs to display load current of feed axes in station 1, Parm010033 "Customization of load current display axis in station 1" should be set as "0, 1, 2".

If the HMI of the CNC system needs to display load current of spindles in station 1, Parm010033 "Customization of load current display axis in station 1" should be set as "8, 9".

If the HMI of the CNC system needs to display load current of all axes in station 1, Parm010033 "Customization of load current display axis in station 1" should be set as "0, 1, 2, 8, 9".

6) PARM010041, "Whether coordinate axis is displayed dynamically"

The parameter is used to set that the spindle coordinates are not displayed in speed mode and displayed in position mode.

- 0: This axis is displayed regardless of whether the spindle is in position mode or speed mode;
- 1: The spindle coordinates are not displayed in speed mode and displayed in position mode.

Note

The parameter must be validated when there is logical axis number of the spindle in PARM010017/010018 "Station display axis sign".

7) PARM010049, "Maximum allowable number of axes of machine tool"

The parameter is used to set maximum allowable number of logical axes for machine tool. If the parameter is set as 10, the machine tool is allowed to use axes 0-9, 10 logical axes in total. If other logical axes (logical axes whose axis number is greater than 9) are configured in the channels, these axes will have no control command output.

8) PARM010091, "#500~#999 user macro-variable enable"

The parameter is used to set whether #500 to #999 macro-variables are used as user-defined macro-variables.

- 0: #500 to #999 are not used as user macro-variables.
- 1: #500 to #999 are used as user macro-variables and consistent with Mitsubishi and FANUC.

9) PARM010098, "Whether G02/G03 converts to G01 when lack of parameters"

The parameter is used to set the processing mode when center or radius is not designated during G02/G03 programming.

- 0: Alarm prompt
- 1: Convert to G01

10) PARM010103, "New function modification of turning center"

- 0X0001: Modify FS value in the interface
- 0X0002: Enable coordinate system superposition
- 0X0004: Explain G97 command in advance
- 0X0008: Determine G71 finishing direction
- 0X0010: Whether spindle speed is maintained while switching to other states under G96 mode.
- 0X0010: Enable M99 counting function
- 0X0040: Enable canned cycle single mode
- 0X0080: Enable T command gang tool mode

11) PARM010104, "New function commissioning parameters"

- 0X0001: Enable G68 space rotation function.
- 0X0002: When program is executed automatically, press one-click calling subprogram on the NC panel and call corresponding subprogram after breakpoint is saved automatically, such as "One-key tool lifting"
- 0X0004: Enable program run commissioning, run the line in blue to the canned cycle. When in the single block mode, the canned cycle is executed in single bock.
- 0X0008: Superpose workpiece zero under G91G52
- 0X0010: Multiaxis M commands ON: Spindle 0 (M3/4/5) spindle 1 (M13/14/15), spindle 2 (M23/24/25), spindle (M33/34/35).
- 0X0020: Output interpolation file under WIN simulation version
- 0X0040: Stop interpolation when an interpolation point is produced under WIN simulation version until data is taken away.
- 0X0080: M99 does not produce the exact stop.
- 0X0100: Synchronize user-defined variable type
- 0X0200: Continuously waiting for a response when there is no response in the synchronous M code
- 0X0400: When it is set as 1, any line returns to G00 speed for execution; otherwise G01+040030 speed is returned
- 0X0800: Set the default modal of the first group of G codes (set OX0800 initial modal as G00 and OX00×× initial modal as G01)

12) PARM010160, " F speed display in feed per revolution"

The parameter is used to set the display mode of F. It is set as 0 when feed per minute is used, and F displayed in the system status bar is in feed per minute (mm/min). The parameter is set as 1 when feed per revolution is used and the unit is changed to mm/r.

- 0: Minute feed speed display mm/min
- 1: Revolution feed speed display mm/r

13) PARM010164, "FANUC command support"

This parameter is used to distinguish whether the currently executing G code is in FANUC mode or HCNC mode.

- 0X2: The G command is in FANUC mode

14) PARM010165, "Delay time of reference point return "

This parameter is used to set the delay time from finding the Z pulse to the completion of reference return in the process of machine tool feed axis returning to the reference point.

15) PARM010166, "Maximum time of exact stop check"

The parameter is used to set maximum time of detecting positional tolerance of coordinate axis after rapid traverse positioning (G00) to a point. The parameter is validated only when coordinate axis parameter PARM10X060 "Positional tolerance" is not 0.

This parameter is used to set the maximum time for detecting the tolerance of the coordinate axis positioning after a certain point is reached in rapid traverse positioning (G00). This parameter only takes effect when the axis parameter Parm 100060 "positioning tolerance" is not 0.

5.4.3 "Channel Parameter" Setup

1) **PARM040001,** "X coordinate axis number"

The parameter is used to configure X axis number in current channel, realizing mapping between feed axis and logical axis in channel.

- 0-127: Designate feed axis number in current channel
- -1: The feed axis in the current channel not mapped to a logical axis is an invalid axis.
- -2: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the rotary axis in position mode.
- -3: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the linear axis in position mode.

2) **PARM040003,** "Z coordinate axis number"

The parameter is used to configure Z axis number in current channel, realizing mapping between feed axis and logical axis of channel.

- 0-127: Designate feed axis number in current channel
- -1: The feed axis in the current channel not mapped to a logical axis is an invalid axis.
- -2: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the rotary axis in position mode.
- -3: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the linear axis in position mode.

3) **PARM040006,** “C coordinate axis number”

The parameter is used to configure C axis number in current channel, realizing mapping between feed axis and logical axis in channel.

- 0-127: Designate feed axis number in current channel
- -1: The feed axis in the current channel not mapped to a logical axis is an invalid axis.
- -2: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the rotary axis in position mode.
- -3: Feed axis in current channel is reserved for C/S axis switching. After switching, the axis type is the linear axis in position mode.

4) PARM040010, "Axis number of spindle 0"

The parameter is used to set the axis number of spindle 0 in current channel, realizing mapping between spindle and logical axis in channel.

- 0-127: Designate the axis number of spindle in current channel.
- -1: The spindle in the current channel not mapped to a logical axis is an invalid axis.

5) RARM040014, "Programming name of X coordinate"

If CNC is configured with multiple channels, in order to distinguish from axes in each channel during programming, the system supports user-defined programming name of coordinate axis. This group of parameter is used to set programming name of X axis in current channel. The default value is the nine coordinate axis names based on Cartesian coordinate system in each channel (X/Y/Z/A/B/C/U/V/W).

- 0-127: Designate spindle number in current channel.
- -1: The spindle in the current channel not mapped to a logical axis is an invalid axis.

6) PARM040016, " Programming name of Z coordinate "

If CNC is configured with multiple channels, in order to distinguish from axes in each channel during programming, the system supports user-defined programming name of coordinate axis. The parameter is used to set programming name of Z axis in current channel. The default value is the nine coordinate axis names based on Cartesian coordinate system in each channel (X/Y/Z/A/B/C/U/V/W).

- 0-127: Designate spindle number in current channel.
- -1: The spindle in the current channel not mapped to a logical axis is an invalid axis.

7) PARM040023, "Programming name of spindle 0"

Each channel of HNC-8 CNC system supports no more than 4 spindles. In order to distinguish from spindles during programming, the system allows user-defined spindle name in different channels.

8) PARM040032, "Diameter programming enable"

The parameter is used to select the diameter/radius programming for power-on initialization mode in current channel.

- 0: Radius programming
- 1: Enable X axis diameter programming mode
- 2: Enable Y axis diameter programming mode
- 3: Enable X and Y axes diameter programming mode

9) PARM040127, "Initial tool number"

The parameter is used to set the initial tool number of magazine in current channel in the tool compensation table and should be used cooperatively with the channel parameter "Number of tools". The parameter is 1 by default and the minimum value is 1. The initial tool number in the tool compensation table is 1.

10) PARM040128, "Number of tools"

The parameter is used to set number of tools in current channel and consistent with number of tool positions of magazine in current channel (or plus one position). If the initial tool number in channel 0 is 1,

the number of tools is set as 5, the initial tool number in channel 1 is set as 6, the number of tools is set as 10, then the data of tools 1-5 saved in the tool table (tool offset table is included for lathe system) belongs to the magazine of channel 0 and data of tools 6-15 belongs to magazine of channel 1.

11) **PARM040130,** "Tool life management"

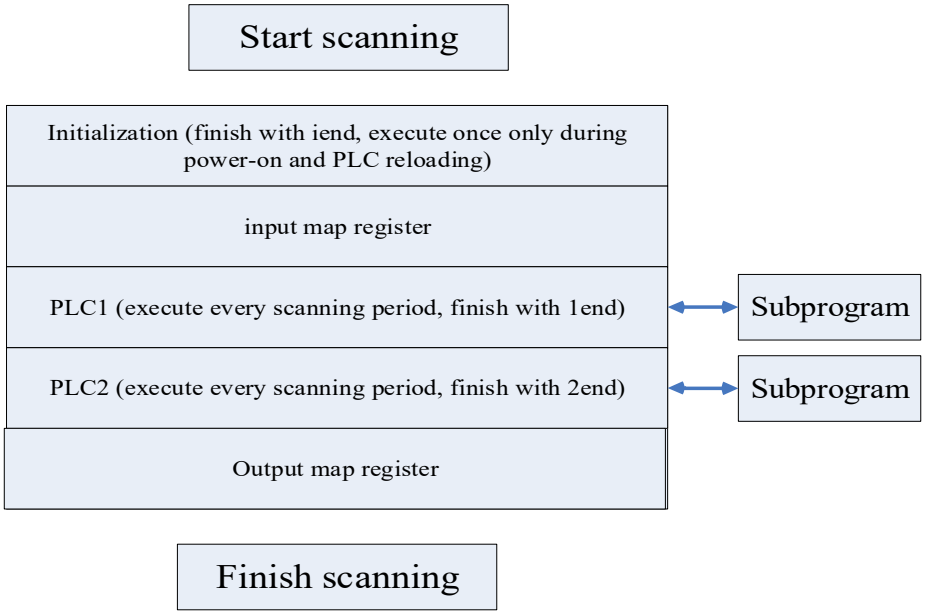
The parameter is used to set tool life management mode.

- 0: Disable tool life function
- 1: Enable tool life function, and tool grouping is not supported.
- 2: Enable tool life function, tool grouping is supported, and T command is used to specify tool group number.
- 3: Enable tool life function, tool grouping is supported, and T command is used to specify tool number.

6 System and User PLC Operation

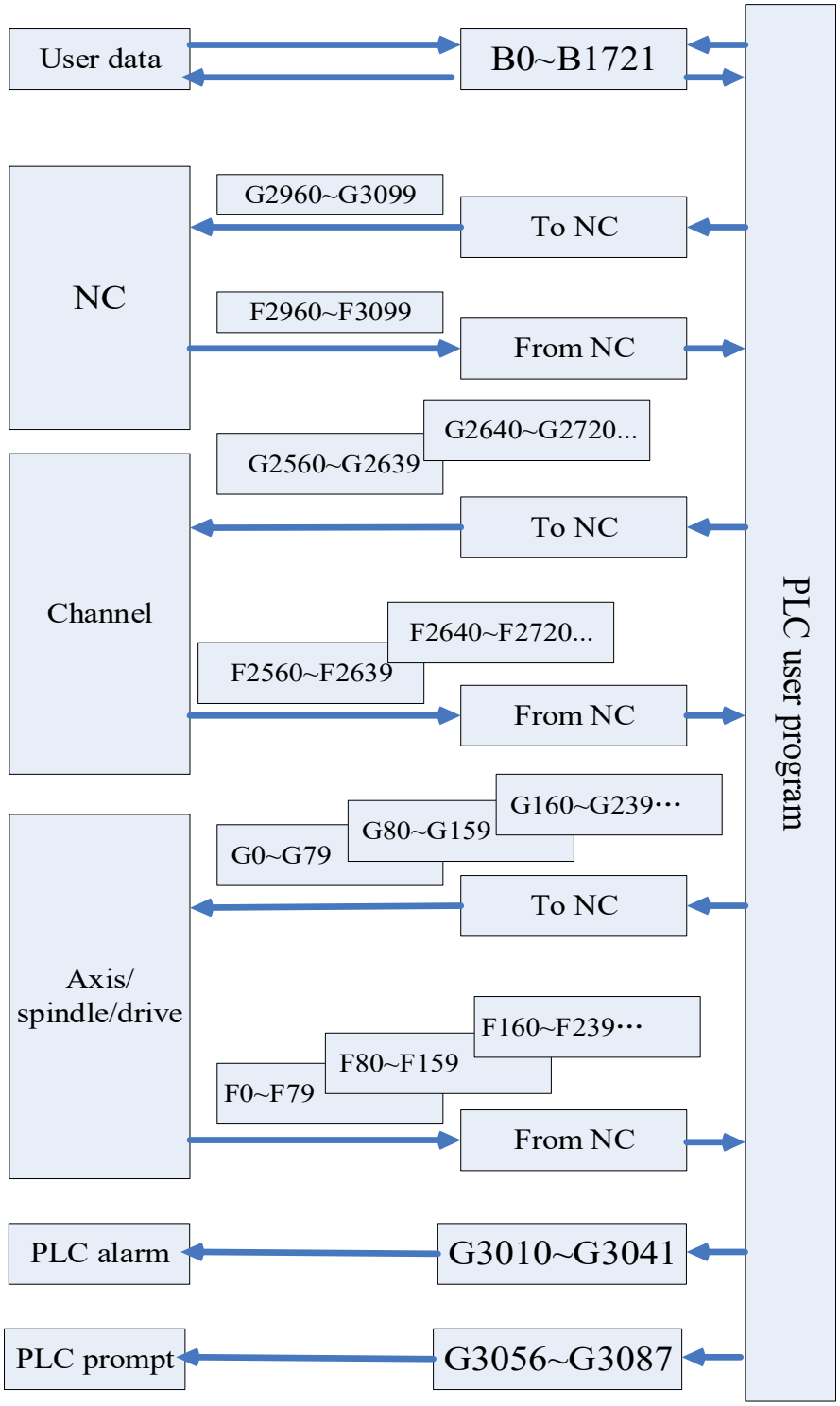
6.1 HNC-8 PLC Structure

HNC-8 ladder diagram PLC adopts loop scanning mode. In the beginning of program execution, PLC will run an initialization when it is powered on or reloaded for the first time. After that, all input states are sent to the input image register, and then the user programs PLC1 and PLC2 are called sequentially. When a scan cycle is completed, all the results are transferred to the output image register to control the actual output of the PLC, and so on.



6.2 Working Principle of PLC Interface Signal

PLC interface signal is responsible for information exchange between PLC and NC.



- F register is a state flag register used to input CNC input signal to PLC control module from CNC.
- G register is a control flag register used to output CNC output signal to CNC from PLC control module and the signals are processed by CNC.
- B register is a data register (saving data after power off), and the value of the register still remains at the state before power-off after power-off. The data register can also be used as PLC parameter and users can define usage of each parameter.

6.3 PLC Specification

Specification	HNC8
Programming language	Ladder, STL
The first-level program execution cycle	1ms
Program capacity Ladder diagram Statement list Symbol name	 5000 lines 10000 lines 1000 Pcs.
Command Basic command, function command	
Single-byte internal relay (R) Dual-byte internal register (W) Four-byte internal register (D) Timer (T) Counter (C) Subprogram (S) Mark number(L) User-defined parameter (P) Single-byte internal register (I) Single-byte internal register (Q) Holding-type storage area Four-byte register (B) Holding relay (K)	2048 bytes (R0-R2047) 512 bytes (W0-W255) 1024 bytes (D0-D255) 512 (T0-T511) 512 (C0-C511) 253 (S0-S252) 10000(L0-L9999) 700(P0-P699) 128 bytes (I0-I127) 128 bytes (Q0-Q127) 6888 bytes (B0-B1721) 128 bytes (K0-K15)
I/O module (X) (Y)	X0-X511 Y0-Y511

6.4 Operation of Ladder Diagram of CNC System

To realize functions of ladder diagram on the CNC system, permission of machine tool manufacturer or above should be inputted.

Press "Ladder diagram" in the diagnosis operation interface to enter the ladder diagram operation interface.

6.4.1 Ladder Diagram Monitoring

Select the function key "Ladder monitoring" to enter the ladder diagram monitoring interface. The ladder diagram monitoring interface includes 7 function keys: program list, find, disallow, allow, recover, lock list and cross reference.

1） Program list

Function: Display PLC program block.

2） Find

Search according to type:

1. Address: Search according to address
2. Command: Search according to function command
3. Output: Search according to output result
4. Line number: Search according to line number of PLC

Find more:

1. Find previous: Continue searching downwards
2. Find next: Continue searching upwards

Find range:

1. Search mode: Fuzzy search mode, accurate search mode
2. Search range: Local search, global search

3) Disallow

Function key "disallow". Move the cursor to an element and press this key to shield the element. As shown below, move the cursor to an element, press this key and the element turns red. It means that the element is shielded and the output is disabled.

Note: The disallowed conditions are valid for the current line only. As shown above, after R2.0 normally closed is disallowed, it is invalid for this line only.

4) Allow

Function key "Allow", move the cursor to an element and press Allow to activate the element. As shown below,

move the cursor to an element, press Allow and the element turns green. It means that the element is activated. As shown in the figure, X3.0 is normally open. Move the cursor to X3.0, press "Allow", changing from open to closed.

Note: The allowed conditions are valid for the current line only. As shown above, after X3.0 normally open is allowed, it is valid for this line only.

5） Recovery

Function key "Recover", move the cursor to an element, press Recover to cancel the above operation of shielding or activating element. The red display of the element disappears. It means that the element functions is restored, as shown below.

6） Lock list

Lock list (register lock list) is mainly used to write designated data of register and lock register value. Presently, only writing, lock and unlock of X/Y register are supported.

索引	寄存器	格式	设定值	当前值
1	X0	0	11111111B	1111111
2	X1	1	255D	255D
3	X2	2	FFH	FFH
4	Y0.0	0	1	1

1. Add: Add index
2. Delete: Delete index (current index item is at unlock state)
3. Write: "Write register" is used for one-time writing of register (bit). If other logics in PLC also modify the current register (bit) where data is written, the written value may be eliminated by other bits.
4. Lock: Assign the set value to register forcibly. While adding register (bit) in the lock list interface, the system sets mutual exclusion rules for registers. That is, only register value or register bit can be inputted when index number of registers of the same type is the same. e.g.: After X0 is inputted, subsequent data such as register bit information (X0.0, X0.7) cannot be inputted, because they are exclusive of the

previously inputted X0. Likewise, after Y0.0 register bit is inputted, the newly increased data must be register bit data within Y0.1-Y0.7 and Y0 register value cannot be inputted.

5. Unlock: Release lock state.
6. Format:
   0: Binary
   1: Decimal
   2: Hexadecimal

e.g.:

Initial state of system input and output:

X	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0

Y	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0

Lock and assign X0, X1, X2 groups and Y0.0:

索引	寄存器	格式	设定值	当前
1	X0	0	11111111B	111111
2	X1	1	255D	255
3	X2	2	FFH	FFH
4	Y0.0	0	1	1

The locked input and output state is shown below:

X	7	6	5	4	3	2	1	0
0	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0

Y	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0

7) Cross reference

Cross reference is mainly used to search reference relationship of register (bit) information in a global range. Usage method: Move the cursor to the register to be searched, press the cross-reference button, and the system will automatically pop up the cross-reference block diagram.

6.4.2 Ladder Diagram Editing

Select "Ladder edit" to enter the ladder diagram edit interface. The ladder edit interface includes 16 function keys: program list, straight line, normally open, normally closed, logical output, inverse output, vertical line,

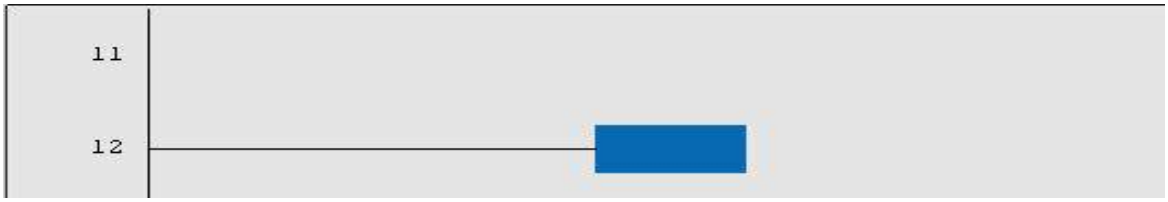
delete vertical line, find, delete element, function module, edit network, list edit, double coil, update modification and abandon modification.

1) Program list

Function: Display PLC program block. Consistent with program list function in ladder diagram monitoring.

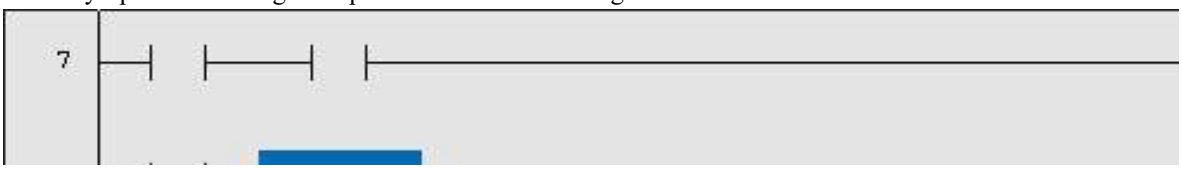
2) Straight line

Press "Straight line" to insert a straight line in the ladder diagram.



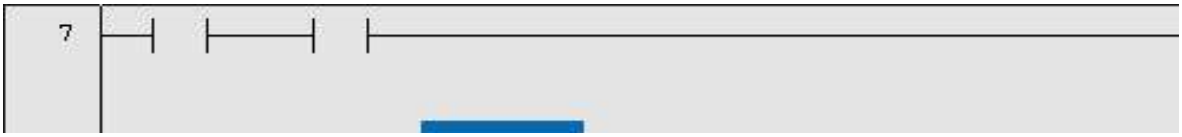
3) Normally open

Move the cursor to the position where normally-open needs to be inserted and press this key to insert normally-open in the designated position in the ladder diagram.



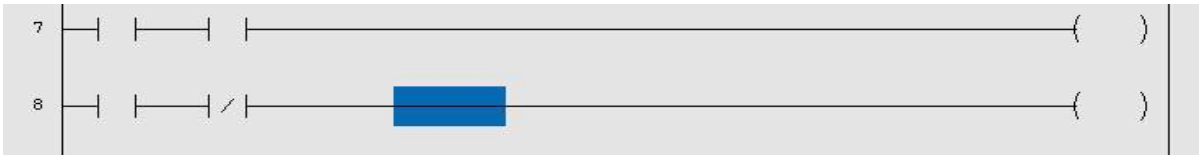
4) Normally closed

Move the cursor to the position where normally-closed needs to be inserted and press this key to insert normally-closed in the designated position in the ladder diagram.



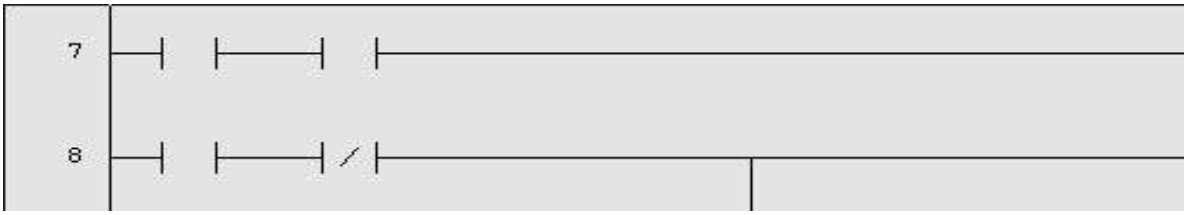
5) Logic output

Move the cursor to the position where logic output needs to be inserted and press this key to insert logical output in the designated position of the ladder diagram.



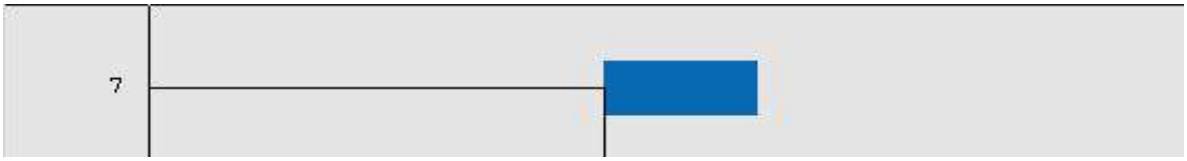
6) Inverse output

Move the cursor to the position where inverse output needs to be inserted and press this key to insert the inverse output in the designated position in the ladder diagram.



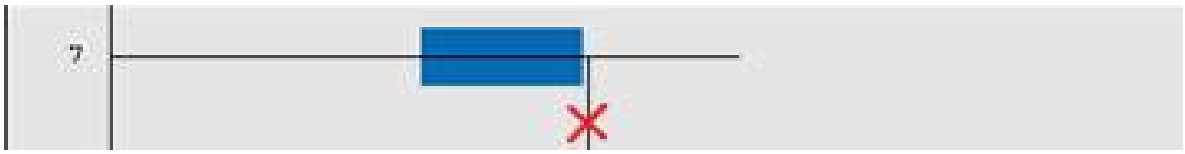
7) Vertical line

Press "Vertical line" to insert a vertical line after the cursor.



8) Delete vertical line

Press Delete vertical line to delete the vertical line after the cursor.



9) Find

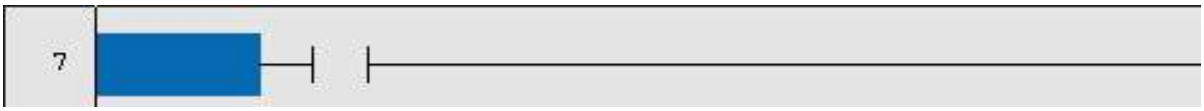
Consistent with the find function in ladder diagram monitoring.

10) Delete element

Move the cursor to the element to be deleted and press Delete element key to delete the element in the ladder diagram.

Before deletion:

After deletion:



11) Function module

Function module includes all function command lists and corresponding help files of the CNC system.

e.g.:

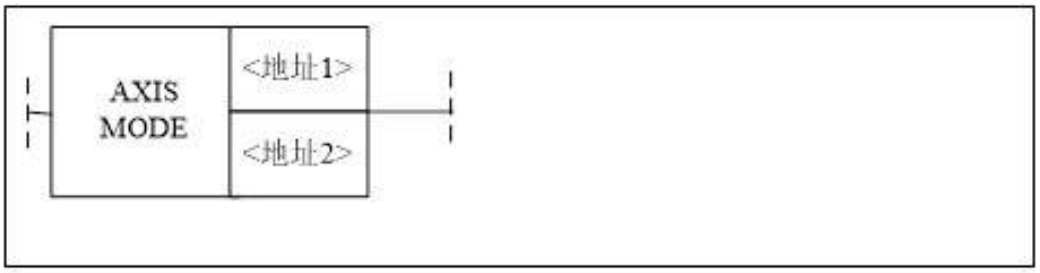
When the cursor moves to the position of axis working mode, press Help and the system will display help instructions of corresponding function module.

LDC	LDNC	SET	RST
TMRB	STMR	CTR	CTRC
1END	2END	JMP	LBL
SPE	RETN	LOOP	NEXT
ADD	ALARM	ALT	ASSEM
AXISHOM2	AXISLMF2	AXISLOCK	AXISMODE
AXISNLMT	AXISRDY	AXISPLMT	BMOV
COD	COIN	CYCL	CYCLED
DESYN	DISAS	DIV	DRYRUN
EVENT	FEEDOVRD	FILT	FMOV
HOLDLED	HOMELED	HOMERUN	HOMERUN1
JOGSW	JOGVEL	LT	MACK

LadCellHelp.html

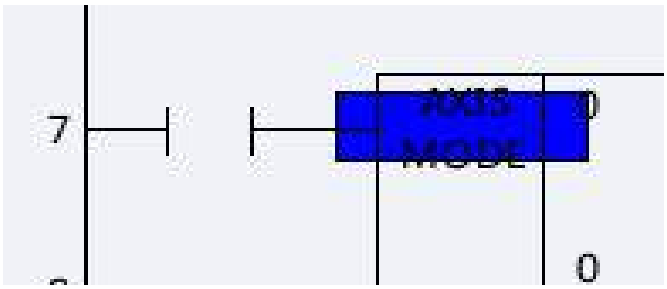
AXISMODE

格式



参数	参数格式	数据类型	存储区域	说明	属性
<地址1>	□□□□	INT	常数		前置○

If it is unnecessary to view the help file, Press Enter on the function module of corresponding cursor in the function command list and the system will insert the function module into the current PLC.



12) Edit network

Edit network includes insert line, delete line, insert column, select network, copy network, cut network, paste network and delete network.

a. Insert line

Move the cursor to the next line of the line to be inserted and press Insert line to insert a line, as shown below. It should be noted that the inserted line is often above the line where the cursor is.

Before inserting line:

After inserting line:

b. Delete line

Move the cursor to the position where the line needs to be deleted and press this key.

Before deletion:

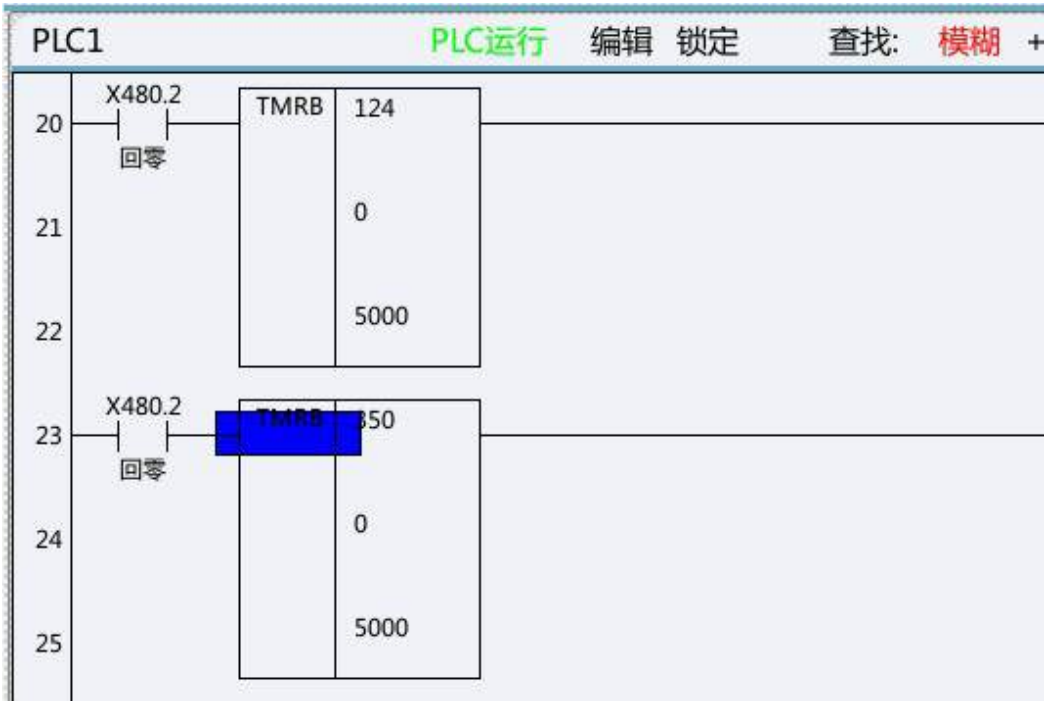
After deletion:


PLC1
PLC运行
编辑
锁定
查找:
模糊
+
27
Y9
28
X496
29
R355
30
R356
31
MOV
X496
32
R355

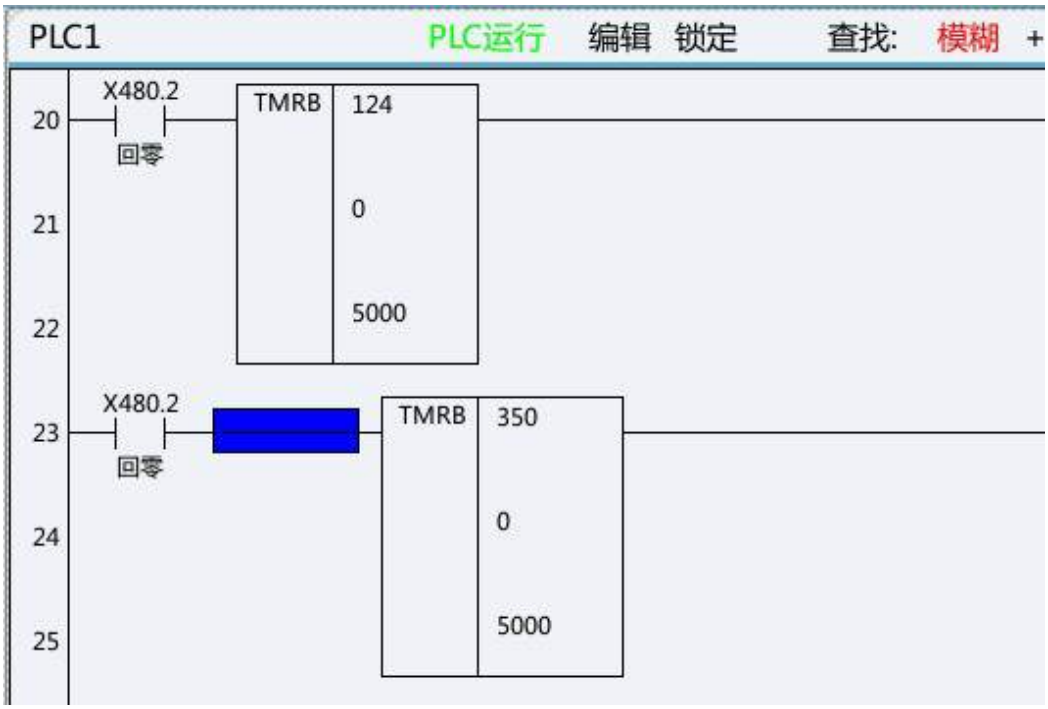
c. Insert column

Move the cursor to the next position of the column to be inserted and press this key.

Before inserting column:



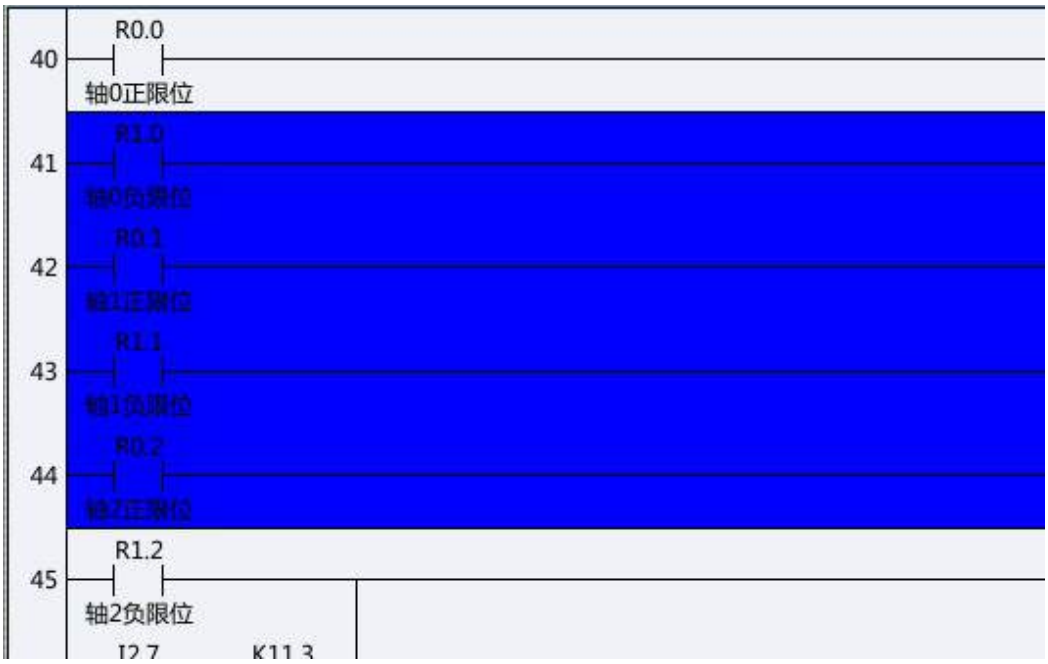
After inserting column:



d. Select network

Move the cursor to the selected line, press this key, and the selected line turns blue. Press this key again to select the next line of current line. Select the network for subsequent operations such as copy network, cut network

and delete network.



e. Copy network

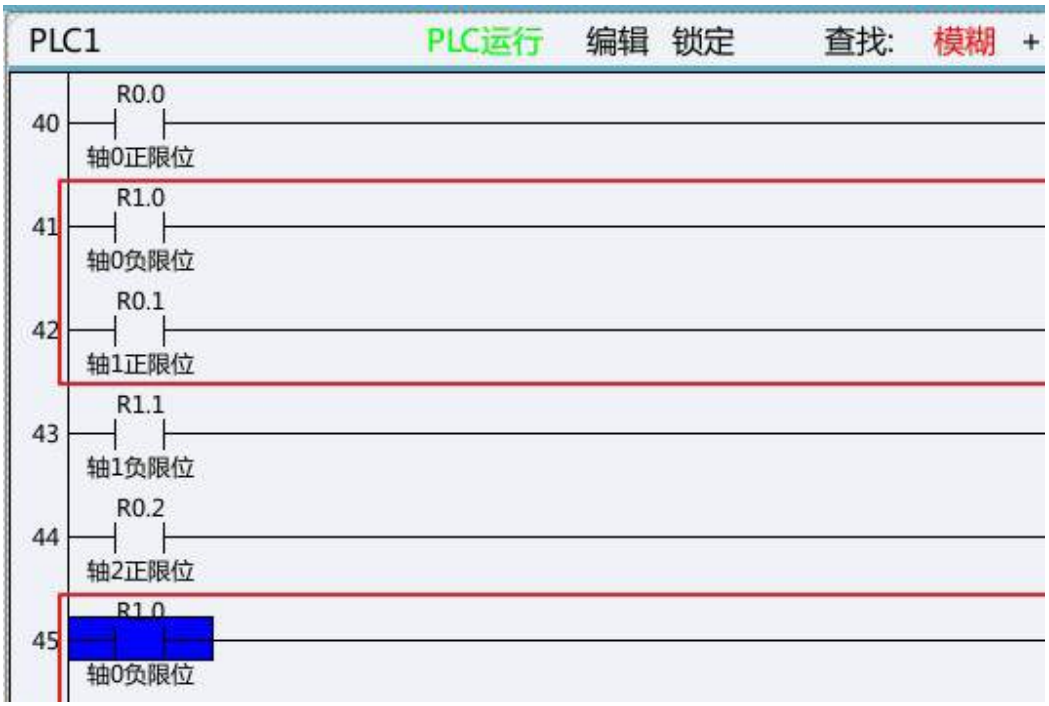
After a network is selected, press this key to copy the network.

f. Cut network

After a network is selected, Press this key to realize movement of network.

g. Paste network

After a network is copied or cut, move to the target position and press this key to paste the network.



h. Delete network

After a network is selected, press this key to delete the network.

13) List edit

List edit includes modify list, modify comment, add module, delete module, update modification and abandon modification.

a. Modify list

Tis function can realize modification of program name.

索引	子程序名	编译者	版本	标号	行数
6	报警输出		0000	S2	69
7	报警清除		0000	S3	74
8	刀盘正反转		0000	S4	21
9	斗笠式刀库		0000	S5	159
10	圆盘刀库ATC		0000	S6	173
11	圆盘刀库选刀		0000	S7	158
12	MCP面板		0000	S8	91
13	I/O报警		0000	S9	60

程序注释(I/O报警):

b. Modify comment

This function can realize detailed comments of current subprogram.

索引	子程序名	编译者	版本	标号	行数
6	报警输出		0000	S2	69
7	报警清除		0000	S3	74
8	刀盘正反转		0000	S4	21
9	斗笠式刀库		0000	S5	159
10	圆盘刀库ATC		0000	S6	173
11	圆盘刀库选刀		0000	S7	158
12	MCP面板		0000	S8	91
13	I/O报警		0000	S9	60

程序注释(I/O报警):

c. Add module

This function can add subprogram to current PLC.

索引	子程序名	编译者	版本	标号	行数
8	刀盘正反转		0000	S4	21
9	斗笠式刀库		0000	S5	159
10	圆盘刀库ATC		0000	S6	173
11	圆盘刀库选刀		0000	S7	158
12	MCP面板		0000	S8	91
13	I/O报警		0000	S9	60
14	S15		0000	S15	3
15	外部I/O		0000	S10	97

程序注释(S15):

d. Delete module

This function can delete current subprogram.

索引	子程序名	编译者	版本	标号	行数
8	刀盘正反转		0000	S4	21
9	斗笠式刀库		0000	S5	159
10	圆盘刀库ATC		0000	S6	173
11	圆盘刀库选刀		0000	S7	158
12	MCP面板		0000	S8	91
13	I/O报警		0000	S9	60
14	S15		0000	S15	3
15	外部I/O		0000	S10	97

程序注释(S15):

e. Update modification

This function can update and save the modified PLC file.

f. Abandon modification

This function can abandon saving the current modified file.

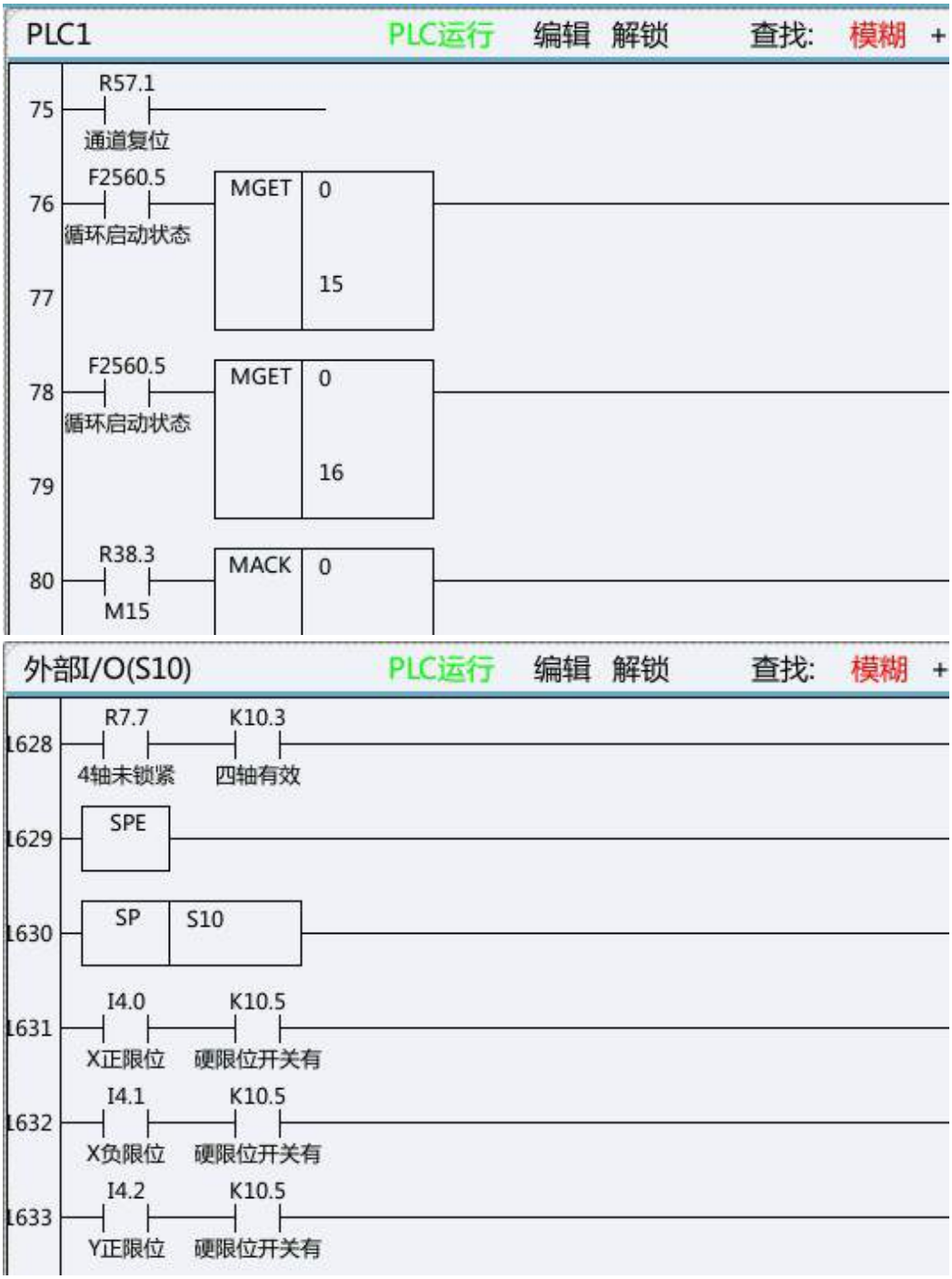
14） Double coil

This function is used to check problems of double coil output in PLC.

Note: The parameter is used to check all coils or coils of current line according to the double coil checking mode in ladder diagram option function. While checking coils of current line, the cursor should move to the line where it is necessary to check whether there is double coil output. While checking all coils, the cursor can be in any position.

e.g.:

Line 76 and line 1631 in the original PLC output R0.0 simultaneously.



Move the cursor to line 76 or line 1631, press Double coil, and the system will display R0.0 register as double coil output automatically.

15） Update modification

Update modification function can update and save the modified PLC file.

16） Abandon modification

Abandon modification function can abandon saving the current modified file.

6.4.3 Ladder Diagram Information

Ladder diagram information function includes ladder diagram title, symbol table, IO comparison table, K parameter, timer, counter, alarm setup, operation stop and online debugging.

1） Ladder diagram title

Ladder diagram title stores some descriptive information of current PLC file, including project version, project name, writer, comment, machine manufacturer information, manufacturer information and PLC running status, and so on.

2） Symbol table

Symbol table is mainly used to store symbol names and comments of register (bit) information.

3） IO comparison table

IO comparison table is an added function of the new version of HNC-8 ladder diagram which is mainly used to standardize ladder diagram PLC writing. That is, in the standard ladder diagram, input and output of standard functions that we offer to users are replaced by I and Q, in which I maps to X and Q maps to Y. Users can correspond X and Y points to I and Q based on the electrical schematic diagram of machine tool. In this case, it is unnecessary to modify element parameters of ladder diagram PLC and only update data of corresponding IO comparison table to ensure correct operation of PLC. As a result, developer and commissioning personnel's work is greatly simplified and work efficiency improves.

The range of IQ register is defined using ladder diagram software based on usage scenario. The number of IQ comparison tables (users) is 80 and ranges from indexes 0 to 79. The number of IO comparison tables (system panels) is 48 and ranges from indexes 80 to 127.

IQ register is edited in two interfaces using ladder diagram software: user IO comparison table and panel IO comparison table. Different index values of IO register can be edited in different interfaces.

索引	寄存器(I/Q)	IO点(X/Y)	电平	周期	符号
1	I0.0	X2.1	0	1	紧刀
2	I0.1	X2.0	0	1	松刀
3	I0.2	X3.5	0	1	扣
4	I0.3		0	1	刀臂
5	I0.4	X2.2	0	1	刀臂
6	I0.5		0	0	
7	I0.6	X0.5	0	0	刀库
8	I0.7	X0.4	0	1	刀库
9	I1.0	X2.6	0	0	前进
10	I1.1	X2.5	0	0	后退
11	I1.2		0	0	

索引	寄存器(I/Q)	IO点(X/Y)	电平	周期	符号
1	I80.0	X481.0	0	1	自
2	I80.1	X481.1	0	1	单
3	I100.2	X480.0	0	1	手
4	I100.3	X480.1	0	1	手
5	I100.4	X480.2	0	1	回参
6	I100.5	X483.4	0	1	刀具
7	I100.6		0	1	
8	I100.7	X480.6	0	1	空运
9	I101.0	X480.7	0	1	程序
10	I101.1	X481.6	0	1	选择
11	I101.2		0	1	

4） K parameter

To set K parameter value.

地址	注释	7	6	5	4
K0	面板类型	0	0	0	0
K1	刀库类型	0	0	0	0
K2	刀库调试1	0	0	0	0
K3	刀库调试2	0	0	0	0
K4	主轴功能	0	0	0	0
K5	回零方式	0	0	0	0
K6	进给轴	0	0	0	0
K7	排屑吹气	0	0	0	0
K8	润滑功能	0	0	0	0
圆盘刀库类型(K1.0)					
00000001:圆盘刀库;00000010:斗笠式刀库					

5） Timer

To view state of timer used in the system.

6） Counter

To view state of counter used in the system.

7） Alarm setup

To view and set alarm and prompt messages of system PLC.

8） Stop operation

To stop running of current PLC.

Note: After running is stopped, press this key again to rerun PLC.

9） Online commissioning

Online commissioning function enables users to monitor running status of NC remotely and to commission specific points and program state. Communication with HNCLadder software can be realized.

6.4.4 Signal Tracking

Signal tracking is mainly used to display data of real-time sequence chart of points of registers X, Y, F, G, R, I, Q and K.

8 sets of data can be acquired simultaneously, with the default sampling period is 1ms and the maximum sampling time is 60s.

6.4.5 Ladder Diagram Option

1) Double coil checking method

- Unchecked: Check all
- Checked: Check current line of coils

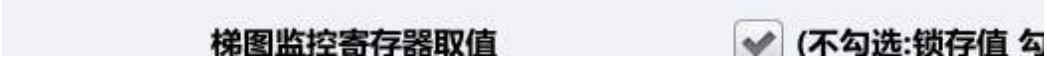
Note: This function should be used cooperatively with double coil function in the ladder diagram edit function.

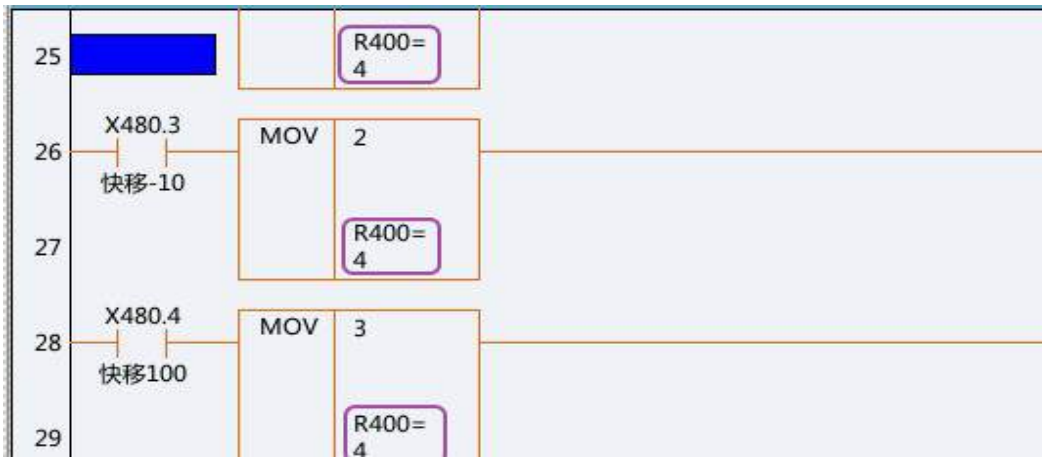
2) Value of ladder diagram monitoring register

- Unchecked: Latched value
- Checked: Current value

This function is mainly used for eliminate conflicts incurred during inspection of values in PLC assignment statement.

Current value is ticked by default and values of registers displayed in the ladder diagram monitoring screen are consistent.

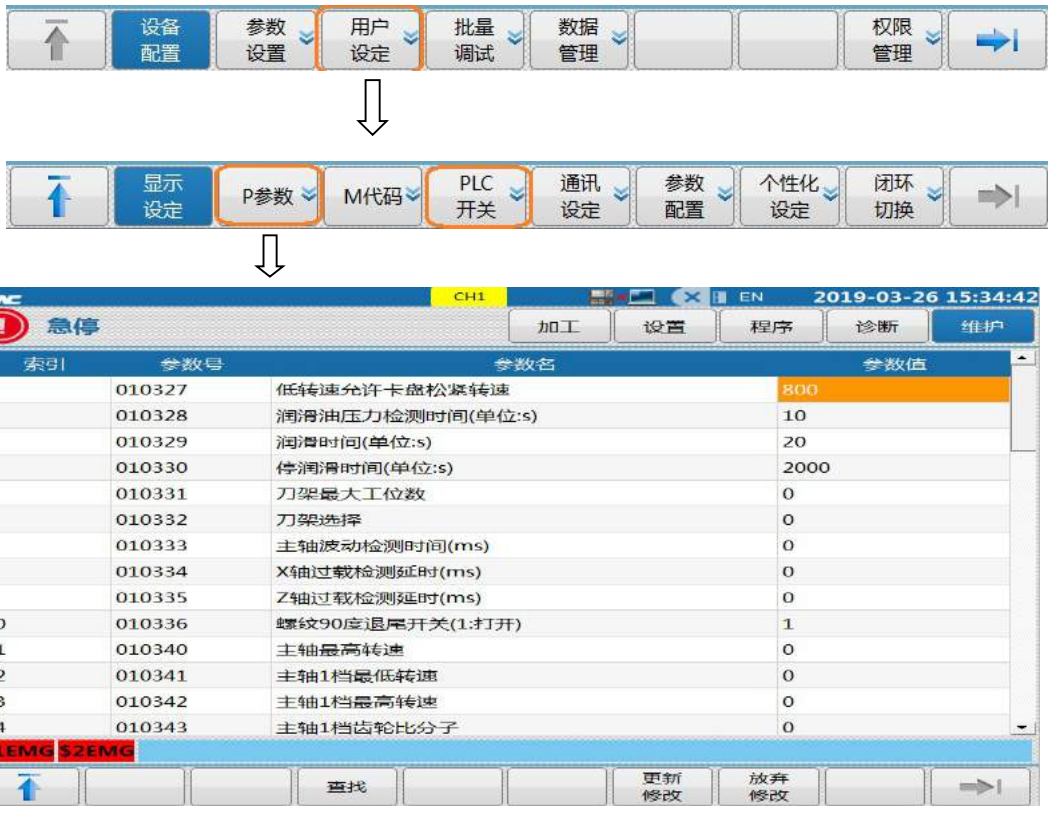




When latched value is displayed, values of registers displayed in the ladder diagram monitoring screen are displayed independently for every module.

6.4.6 PLC User Setup

In the user setup page of the maintenance interface, display P parameters used in PLC separately so that users directly selects functions and sets the value of P parameters.



P parameter page

P parameters listed in the interface are used to set various values in PLC. Press "Update modification" to save setups. The displayed parameter number is consistent with user parameter in "Machine user parameters".

索引	参数号	参数名	参数值
1	010327	低转速允许卡盘松紧转速	800
2	010328	润滑油压力检测时间(单位:s)	10
3	010329	润滑时间(单位:s)	20
4	010330	停润滑时间(单位:s)	2000

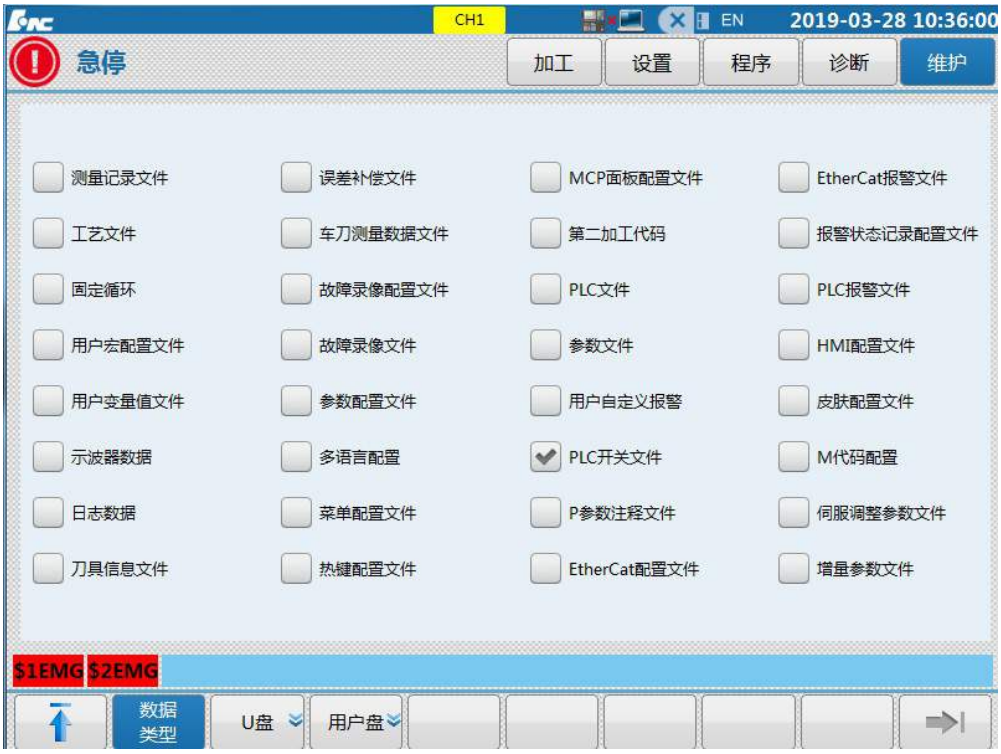
Corresponding to parameters in "Machine user parameters"

Corresponding to P parameter used in PLC

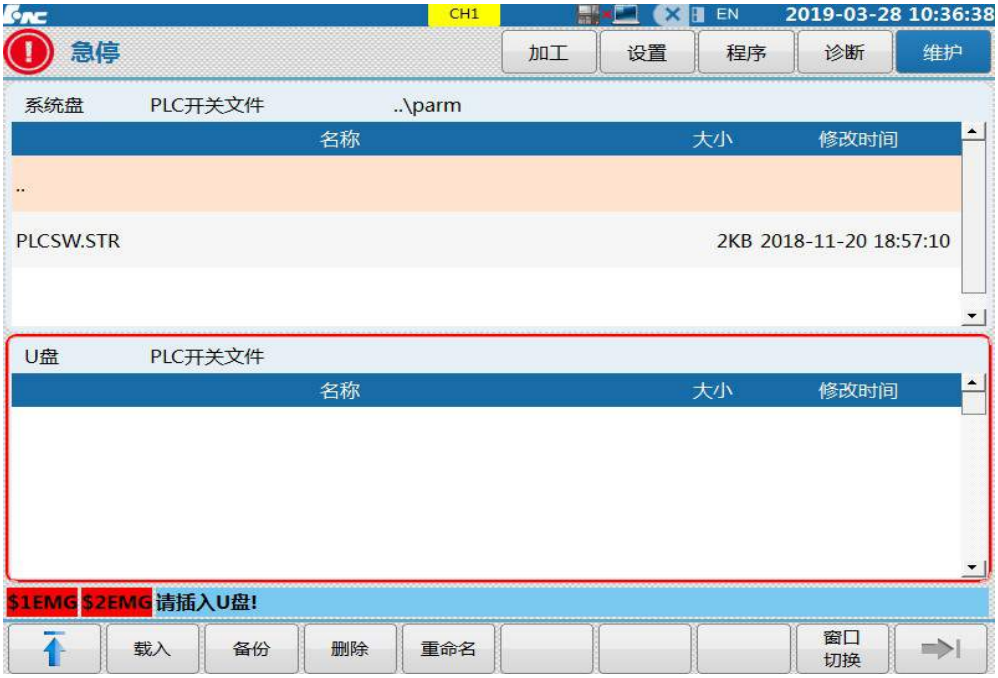
PLC switch page

P parameter displayed in the interface is used as the switch option in PLC. To select a function, press "Effective setup" to select the required function in the interface and validate it immediately.

Users can configure "P parameter" and "PLC switch" and the configuration file can be imported into/exported out by "Diagnosis"-"Data management" in the interface for modification.



Data management interface



"PLC switch" configuration file entry

"PLC parameter comment" configuration file entry

Copy PLCSW.STR and USERP.STR to PC and open it using text editing tools to edit contents to be added as required.

6.4.7 Lathe Tool Post Control Selection

Tool post control program is completed by corresponding PLC subprogram and users set "User parameter" value in "Machine user parameters" or sets "Tool post selection" value in the “Maintain”-“User setup”-“P parameter” interface to select tool post control subprogram added to PLC program:

5	010331	刀架最大工位数	0
6	010332	刀架选择	0

Select tool rest in the "P parameter" interface

Tool post type table corresponding to No. 32 P parameter (010332)

User parameter (010332)	Tool post type	Subprogram number
1	4-station electric tool post	S12、S21、S22、S23
2	8-station electric tool post	S13、S24、S25、S26
3	HCNC PMC axis electric tool post	S20、S54、S55、S56
5	Universal servo tool post (AK36215 tool post, MR-J3-100A-RJ070 servo amplifier)	S16、S33、S34、S35
6	Universal AK31 electric tool post	S17、S37、S38、S39
7	Changzhou Yaxing hydraulic tool post (HTL125-8/12T)	S18、S40、S41、S42

8	Taixin electric tool post (TX-120/160)	S19、S43、S44、S45

Setups of signal state of tool posts and rotation delay

7 Common Function and Operation

7.1 Analog Spindle (PWM Spindle) Configuration

Analog spindle is a field application program that the CNC system outputs 0-10V or -10-+10V analog voltage signals through axis control card (HIO-1041) and connects them to the third-party frequency converter or drive to realize spindle speed and position mode.

Specific to such configuration, 808D system integrates analog spindle control parameters and user PLC, and users just need to set parameters and select spindle control mode. Details are as follows:

7.1.1 Transmission Ratio Between Spindle and Motor is 1:1

1) Turn on analog spindle configuration switch in the “Maintain”-“User setup”-“PLC switch” interface:

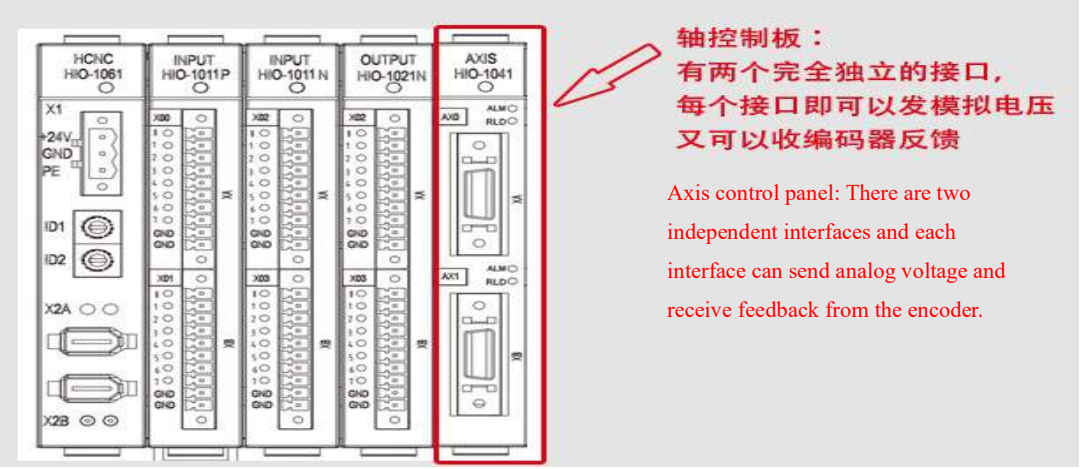
If the frequency converter or the drive does not give feedback of speed arrival signal and zero speed signal to the system to open options 8 and 9, the system will not determine such two signals of the spindle.

2) Set relevant parameters of the spindle in the “Maintain”-“User setup”-“P parameter” interface:

11	010340	主轴最高转速	0
12	010341	主轴1档最低转速	0
13	010342	主轴1档最高转速	0
14	010343	主轴1档齿轮比分子	0
15	010344	主轴1档齿轮比分母	0
16	010345	主轴2档最低转速	0
17	010346	主轴2档最高转速	0
18	010347	主轴2档齿轮比分子	0
19	010348	主轴2档齿轮比分母	0

Note: Set “010340” as maximum motor speed and “010341”, “010342”, “010345” and “010346” as minimum spindle speed and maximum spindle speed. The numerators of the gear ratio at gear 1 and gear 2 are the acceleration and deceleration coefficient on the motor side, and the denominators are the acceleration and deceleration coefficient on the spindle side.

3) Set parameters of axis control panel (HIO-1041)



If only HIO-1041 control panel is connected, parameters are configured as below:

2 IO devices will be found in device interface parameters, the first is spindle control panel and the second is bus IO module. The following parameters should be filled in the first IO device. Group number of input and output points should be 10 and initial group number of input and output points can be 0, 10 or 20, as long as they are not the same as group number of input and output points of other devices. For encoder A type, set incremental encoder as 0 or 1 and absolute encoder as 3. Pulse count per revolution of encoder A should be set as pulse count per revolution of encoder A. If B interface is connected, fill out type and pulse count per revolution of encoder B. The upper interface of HIO-1041 control panel is interface A and the lower interface is interface B.

参数列表	参数号	参数名
设备2	512000	设备名称
设备3	512002	设备类型
设备4	512003	同组设备序号
设备5	512012	输入点起始组号
设备6	512013	输入点组数
设备7	512014	输出点起始组号
设备8	512015	输出点组数

The following parameters should be filled in the second IO device: Group number of input and output points

should be 10, initial group number of input and output points can be 10, 0 or 20, which cannot be the same as those in the first IO device.

The following parameters should be filled in device 4: Working mode should be set as 3 and logical axis number should be set as 5. When spindle DA output type is set as 0, output 0V-10V voltage and not sensitive to the spindle rotation direction. When it is set as 1, output -10V to 10V voltage and sensitive to the spindle rotation direction. Pulse count of feedback position cycle is set as the pulses per revolution of spindle. Spindle encoder feedback device number should be the device number corresponding to the first IO and spindle DA output device number should be the device number corresponding to IO module (namely device number corresponding to the second IO). Spindle encoder feedback interface number should be 0 (interface A) or 1 (interface B).

For spindle DA output port number, if pins 1 and 2 of interface A are connected to the feedback, fill out 1, it is the first group, and the output IO module is group 0. If pins 1 and 2 of interface B are connected to the feedback, fill out 2, it is the second group, and the interface A is group 1.

7.1.2 Transmission Ratio Between Spindle and Motor is Not 1:1

If the transmission ratio between the spindle and the motor is not 1:1, the setting method is approximately the same as that of 1:1 transmission, except that the motor speed and transmission ratio parameters are set in the "P parameter". These parameters should be set in axis parameters, because the feedback transmission ratio is added to axis parameters, which can handle the problem of non-1:1 ratio between the feedback and the reality resulting in the non-correspondence between the rotation speed and the actual speed.

Parameter	Parameter name	Set value	Description
105156	Spindle output analog	1	0: NCUC bus spindle 1: PWM DA spindle
105157	Maximum speed of spindle motor	***	Set maximum speed of spindle motor
105158	Number of spindle gear stages	1	Set 1 when the spindle has 1 gear stage only
105159	Minimum speed of spindle gear 1	***	Set minimum and maximum speed of gear 1 on the spindle side
105160	Maximum speed of spindle gear 1	***	
105161	Numerator of transmission ratio of spindle gear 1 (motor speed)	**	Set transmission ratio between the motor and the spindle
105162	Denominator of transmission ratio of spindle gear 1 (motor speed)	**	
105163	Numerator of feedback electronic gear ratio of spindle gear 1	**	Set feedback transmission ratio between the motor and the spindle
105164	Denominator of feedback electronic gear ratio of spindle gear 1	**	

Note: Whereas the instruction sent by the system end and transmission ratio needed for feedback processing are processed separately, a group of feedback electronic gear ratio is added here. In actual application, if the spindle end is not configured with feedback, the setup of gear 1 transmission ratio and feedback electronic gear ratio is consistent. If the spindle end connects to the feedback, The gear 1 feedback electronic gear ratio is set to 1:1.
If the spindle has multiple gear stages, please set parameters according to relevant commissioning manuals.

7.2 Rigid Tapping

In the rigid tapping cycle, rotation of spindle keeps pace with feed of feed axis. That is, rotation of spindle should realize not only speed control but also position control during rigid tapping. The linear interpolation must be realized for spindle rotation and tapping axis feed. Thus, the spindle works in position mode.

The commend includes axial rigid tapping cycle (G84) and radial rigid tapping cycle (G88). The spindle reverses while the hole bottom is reached in the cycle.

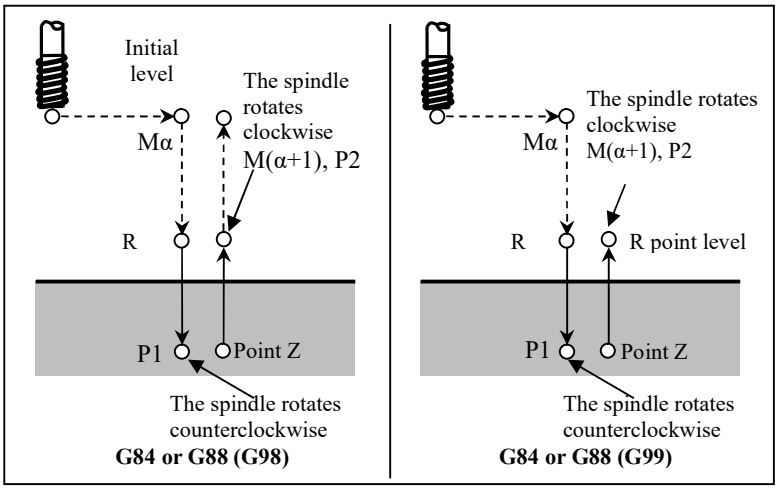
G84 format: G84 Z(W) _R_P_Q_E_J_K_F_C_I_O_H_

Parameter	Meaning
Z	Hole bottom coordinates
R	The distance from the initial level to R level
P	Dwell time at hole bottom
F	Screw lead
Q	Feed amount
K	Retract amount
C	C axis incremental movement angle
I1	M40/M41 automatic clamping/release function is invalid (I=1 by default)
I2	M40/M41 automatic clamping/release function is valid
O	Drilling times
E1	Tapping
E2	Reverse tapping
J1	Tapping on C axis of the first spindle
J2	Tapping on A axis of the second spindle
J3	Tapping on B axis of the third spindle
H1	Return by the specified return distance K
H2	Return to R point
H3	Reach to hole bottom

G88 format: G88X(U) _R_E_Q_K_H_P_F_ C_I_O_ (tapping on A axis of the second spindle only)

Parameter	Meaning
E1	Tapping
E2	Reverse tapping
Q	Feed amount
K	Retract amount
C	C axis incremental movement angle
I1	M40/M41 automatic clamping/release function is invalid (I=1 by default)
I2	M40/M41 automatic clamping/release function is valid
O	Drilling times
H1	Return by the specified return distance K
H2	Return to R point
H3	Reach to hole bottom

Action:



7.21 Spindle Position Mode (for Spindle Drive HSV-180US Series):

1) First, set mode control parameters:

8	STA-8	Whether mode switching function is allowed	0: Not allowed
			1: Allowed

When the parameter is set as 1, speed mode and position mode of the spindle are allowed to be switched by the

command.

2) Then, set function parameters:

SN	Name	Range	Default value	Unit
PA--0	Position control proportional gain	10 to 2000	200	0.1Hz

Function and setup:

① Set proportional gain of position loop regulator under C axis mode.

② The larger the set value is, the larger gain is, the larger rigidity is, and the smaller position hysteresis is under the same frequency command pulses. If the value is too large, vibration or overtravel may be caused.

③ Parameter value is determined by type of specific spindle drive unit and load.

SN	Name	Range	Default value	Unit
PA--12	Position tolerance detection range	1 to 32767	30	0.1 revolution

Function and setup:

① Set the alarm range for out-of-tolerance detection of C axis.

② Under C axis position control mode, when the value of position deviation counter exceeds the parameter value, the spindle drive unit gives an alarm against position out-of-tolerance.

③ e.g.: When spindle motor encoder is 1024ppr, pulses per revolution of motor is 4096. If the parameter is set as 30 and position out-of-tolerance exceeds 30 * 0.1 * 4096 = 12288 under C axis control mode, the drive unit will give an alarm (A12).

SN	Name	Range	Default value	Unit
PA--16	Feedforward control gain of C axis	0 to 100	0	

Function and setup:

① Set feedforward gain of position loop under C axis mode.

② When it is set as 100%, it means that the position hysteresis is 0 under command pulse of any frequency.

③ When feedforward gain of position loop increases, the high-speed response characteristic of control system improves, but position control of system is instable and vibration will be easily caused.

④ The parameter is often set as 0 when very high response characteristic is not needed.

SN	Name	Range	Default value	Unit
PA--42	Position control mode Speed proportional gain	25 to 5000	450	

Function and setup:

① Set proportional gain of speed regulator under C axis mode.

② The larger the set value is, the higher gain is, the larger rigidity is. Parameter value is determined by type of spindle drive and load. Generally, the larger load inertia, the larger the set value is.

③ Try to set a large value when the system does not gnerate vibration.

SN	Name	Range	Default value	Unit
PA--43	Position control mode Speed integral time constant	5 to 32767	20	1ms

Function and setup:

① Set integral time constant of speed regulator under C axis mode.

② The smaller the set value is, the larger the integral speed is. Parameter value is determined by type of specific spindle drive unit and load. Generally, the larger load inertia, the larger the set value is.

③ Try to set a small value when the system does not generate vibration.

SN	Name	Range	Default value	Unit
PA--46	Position control mode flux current	30 to 150	110	0 to 100%

Function and setup:

① Set flux current value of motor under C axis mode. Percentage of rated exciting current of asynchronous motor used under C axis mode.

(3) If the second encoder is installed on the spindle to form full-closed loop feedback, some mode control parameters should be modified:

SN	Parameter	Parameter description	Set value
11	STA-11	Position feedback pulse of spindle encoder Inverse	0: Normal
			1: Inverse feedback pulse
13	STA-13	Full-closed loop C axis control feedback selection	0: Select feedback of motor encoder
			1: Select feedback of spindle encoder (setup)
15	STA-15	Spindle orientation encoder selection	0: Motor encoder orientation
			1: Spindle encoder orientation (setup)

Note: STA-11 parameter is used to set spindle feedback direction and the signal direction of the second encoder (encoder at the spindle end) should be consistent with the first encoder (encoder at the motor side) during commissioning; otherwise, the spindle will rotate abnormally.

7.22 Tapping Parameter Setting on System End

User-defined variables to be set before the system is used are listed by “Machining”-“User macro” , in which the followings should be set for rigid tapping:

Variable address	Name	Value	Description
54014	G84 tapping spindle selection, 1: C axis; 2:A axis;3: B axis	1	Select C axis as the tapping spindle while configuring a single spindle
54015	G84G88 return mode, 0 refers to the retraction to the specified distance; 1 refers to retracting to R point	*	When selecting pecking tapping, it is necessary to set the retract position of the tool, that is, the R level or the retract amount K
54016	G84, G88 retract amount (mm)	*	When selecting pecking tapping, it is necessary to set the feed amount Q
54017	Select G88 tapping spindle, 1: A axis, 2: B axis	*	In radial tapping, it is necessary to determine whether the tapping spindle is A-axis or B-axis, and choose according to the site configuration

Note: Parameters in G84 and G88 instructions are placed in "User macro interface" to simplify programming. Add relevant parameters in G84/G88 command while modifying parameters through command.

7.23 Debug Rigid Tapping Using System Integration Servo Adjustment Function

While executing G84/G88 command, system servo adjustment function is used to monitor the actual position of spindle and Z axis in real time, calculate synchronous error of interpolation of two axes and display them in the interface in the form of curve in order to improve the rigid tapping commissioning quality. The system interface is shown below:

1) Set G84/G88 command in the "Configuration interface":

Note: Whereas the system sampling direction is not consistent with the spindle direction, thread pitch should be set as a negative value. Axis parameters are set according to logical axis number distributed to spindle and Z axis in channel parameters and other parameters are set according to field machining.

2) View machining procedure in the "Code preview" interface:

Note: M115 and M166 commands before and after the G84 command line in the program are M commands of sampling start and end. The parameter is user-defined in 000373 and 000374 of "NC parameters" and

acquisition and response are added to PLC.

3) After the generated program passes the inspection, switch to the main interface of servo adjustment, press "Sampling start"- "Cycle start" to run the program to the complete sampling and produce synchronous error curve:

The red box indicates the synchronous error automatically calculated by the system. Z axis or spindle servo gain is adjusted according to the synchronous error so that the value is approximate to the minimum value, then the best condition of interpolation of two axes is reached. The yellow box indicates tapping axis servo gain and acceleration/deceleration adjustment window.

After reaching the best condition, press "Application"- "Save" to save the adjusted servo and system parameters to complete debugging.

7.3 Following Tapping

Following spindle rigid tapping is mainly used for machine tools with analog spindle in order to realize tapping machining economically. Specific setup steps are as follows:

7.3.1 User PLC Setting

Relevant registers are as follows:

F[spindle number*80+73].8: The spindle rotates CW

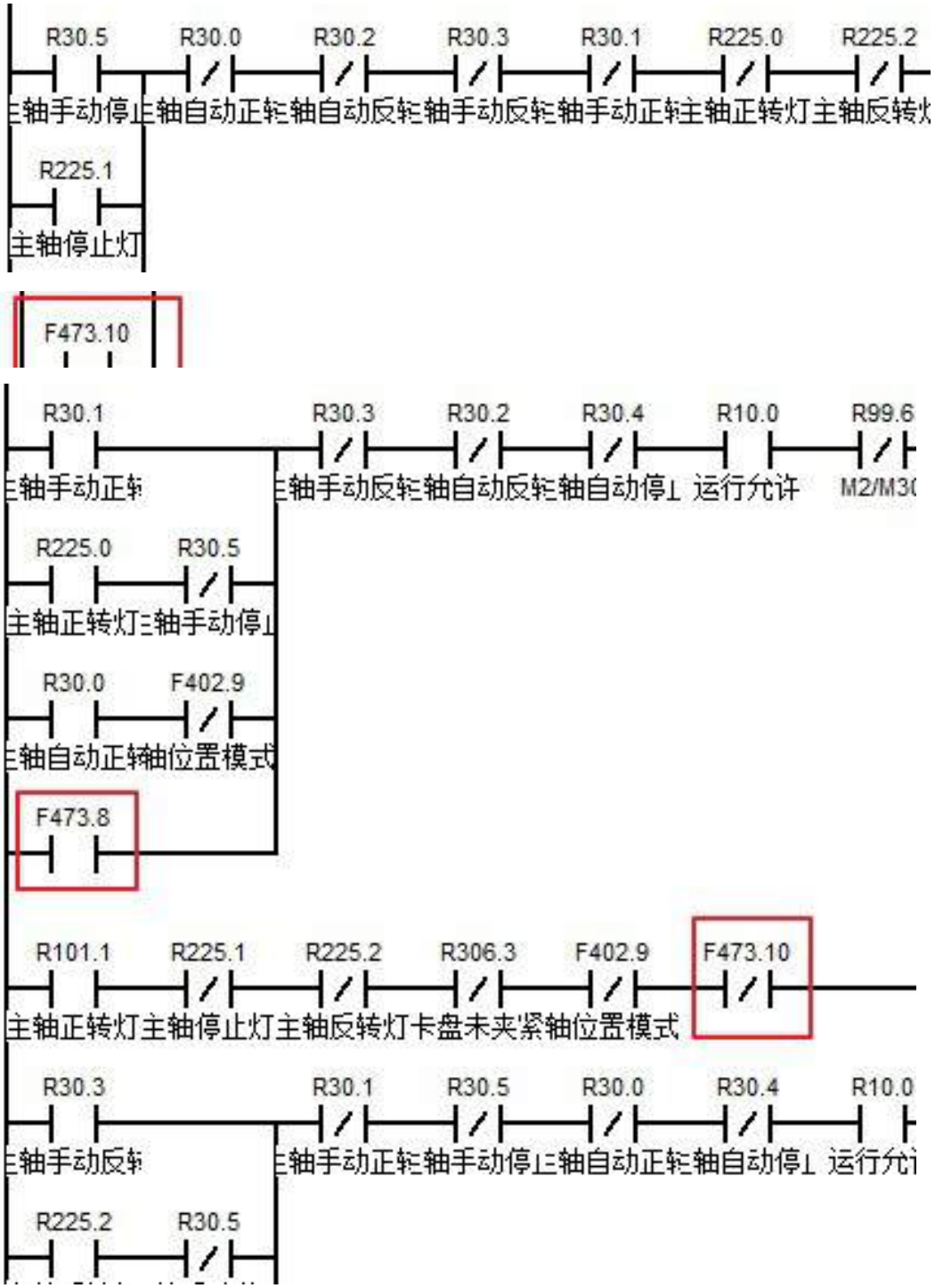
F[spindle number*80+73].9: The spindle rotates CCW

F[spindle number*80+73].10: The spindle stops

F[spindle number*80+76].1: The spindle is in rigid tapping

When the PWM spindle is commissioned normally, modify PLC as follows:

With logical axis 5 of spindle number as an example, add contents in the red box:



Note: This part has been updated before delivery. If following tapping is abnormal, check the aforesaid part and determine the problems.

7.3.2 Canned Cycle Setting

Canned cycle is called through P101 parameter in P parameters. When P101 parameter is set as 1, call directly the canned cycle of PWM spindle tapping. When it is set as 0, call canned cycle of servo spindle tapping. Press "Maintain" - "P parameters" to enter the setup interface and find parameters shown below:

37	010401	Following tapping (0: disable, 1: enable)	0

7.3.3 Debugging Application

After PLC and canned cycle are set, enter the servo adjustment interface for debugging.

1） Spindle acceleration/deceleration sampling

Enter the interface of spindle acceleration/deceleration, click on "Configure" and the following interface will appear:

Spindle number: Logical axis number of PWM spindle;

Spindle speed: Spindle speed required for tapping of PWM spindle;

Dwell time: It is the approximate time needed for the spindle to accelerate from 0 to the specified speed or decelerate from the specified speed to 0 and it is often 2 to 3s;

Sampling period is set as 2.

After setup is completed, start sampling according to cycle start. The below interface will be generated automatically after sampling:

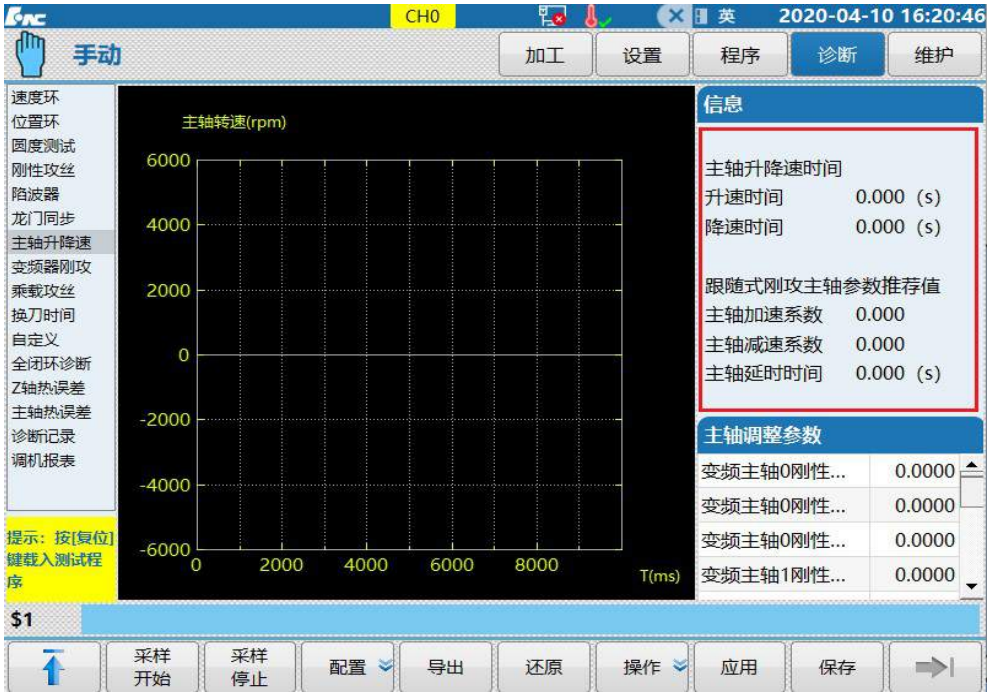


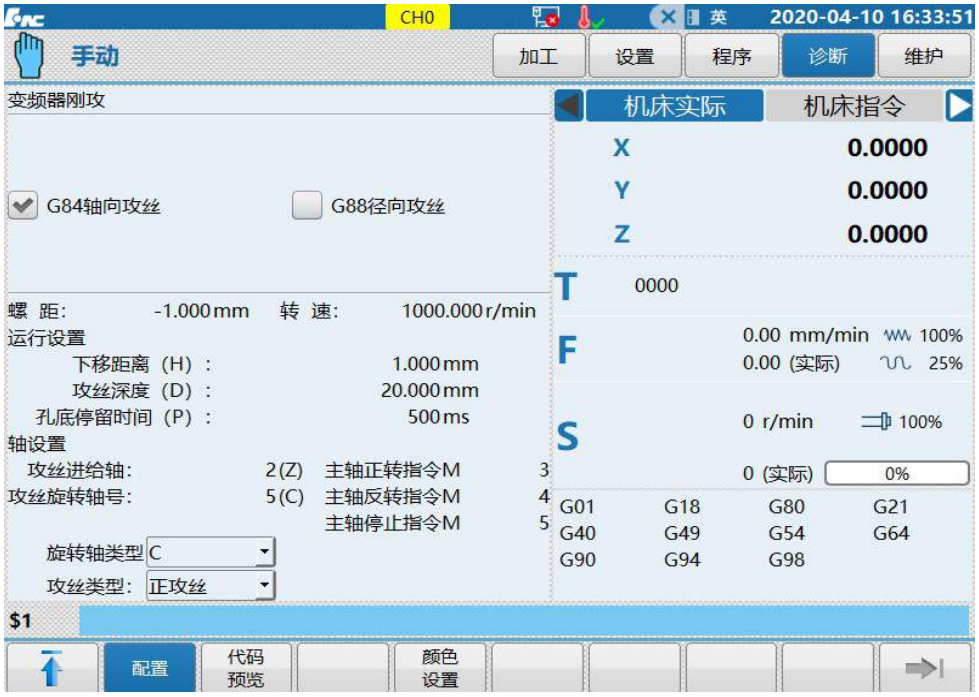
Fig. 2

The red box in the figure above is the automatically generated parameter value and it needs not modified. If "Acceleration time" automatically generated after sampling has a value and "Deceleration time" is 0, it means that "Dwell time" is too small and it is necessary to increase "Dwell time" and resample until "Deceleration time" is not 0.

After sampling is completed, click on "Apply", "Enter", "Save" and "Enter" successively.

2) Rigid tapping sampling of frequency converter

After spindle acceleration/deceleration sampling is completed, enter the rigid tapping interface of the frequency converter. Click on "Configure" and the below interface appears:



Description:

G84 axis tapping and G88 radial tapping should be selected according to actual situation and G84 is often selected.

Thread pitch: Thread pitch required by tapping, negative value;

Rotation speed: The same as spindle speed set during spindle acceleration/deceleration sampling;

MoveDown distance: Fill out according to actual situation;

Tapping depth: Fill out according to actual situation;

Dwell time at hole bottom: No less than the dwell time set during speed acceleration/deceleration sampling;

Tapping axis: Logical axis number of tapping axis;

Rotary axis: Logical axis number of spindle;

Rotary axis type: Generally it is the C axis tapping. If there is a power head, it can be A axis or B axis tapping;

Tapping type: Select tapping or reverse tapping.

After setting is completed, press Cycle start to start sampling. Conduct commissioning according to error adjustment diagram.

In the below figure: Set Z axis position proportional gain as 1200 and acceleration compensation value as 0,

Fig. 4

Keep Z axis position proportional gain unchanged, set acceleration compensation value as 2 and the sampling acquisition diagram appears as shown below:

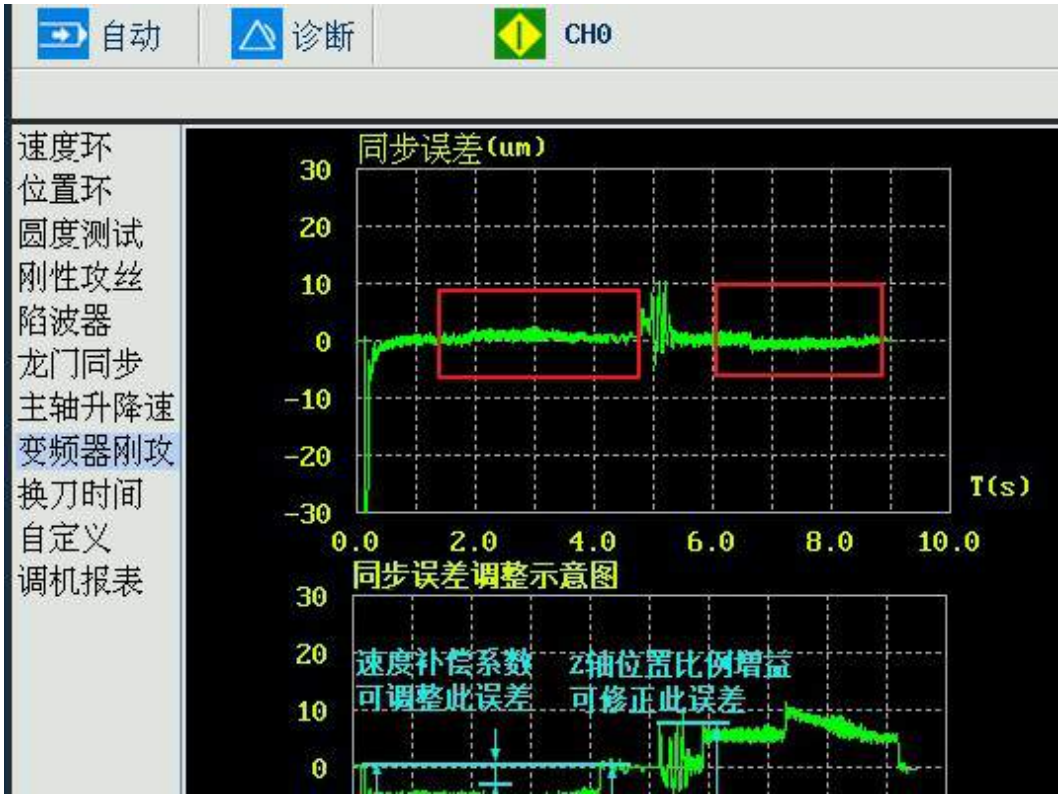


Fig. 5

The obvious steps shown in Fig.4 disappear in Fig. 5. Acceleration compensation value is used to eliminate the steps in Fig. 4. Adjust the parameter so that the graphic approaches 0 as far as possible.

Speed compensation coefficient is calculated according to Z axis position proportional gain. After Z axis position proportional gain is confirmed, set the speed compensation coefficient as the recommended value. This parameter just needs to be set as the recommended value or slightly adjusted around the recommended value.

Increase Z axis position proportional gain to decrease the fluctuation value in the middle of the curve in Fig. 5.

Z axis position proportional gain in Fig.6 is set as 800 and that in Fig. 7 is set as 900, and other parameters are set in the same way. It can be seen that synchronous error Max value in Fig. 6 is 18.550mm and that in Fig. 7 is 15.040mm. The Min value of synchronous error is not used as a reference, because the synchronous error does not affect the tapping effect before drilling.

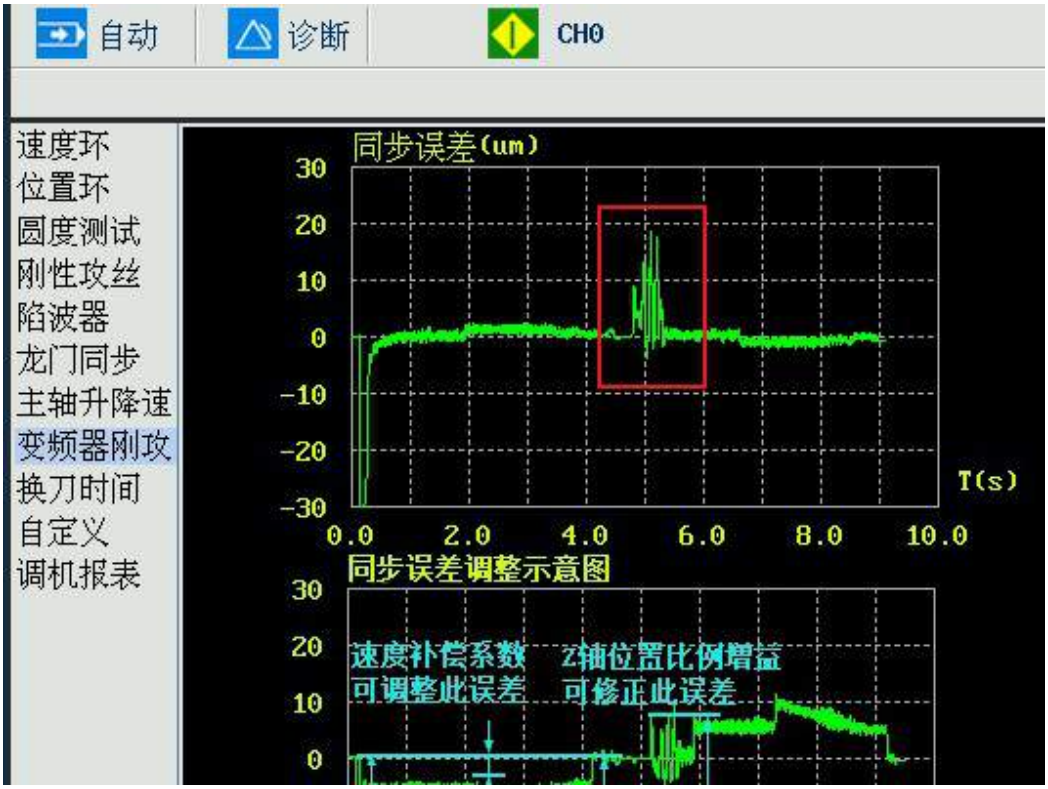


Fig. 6

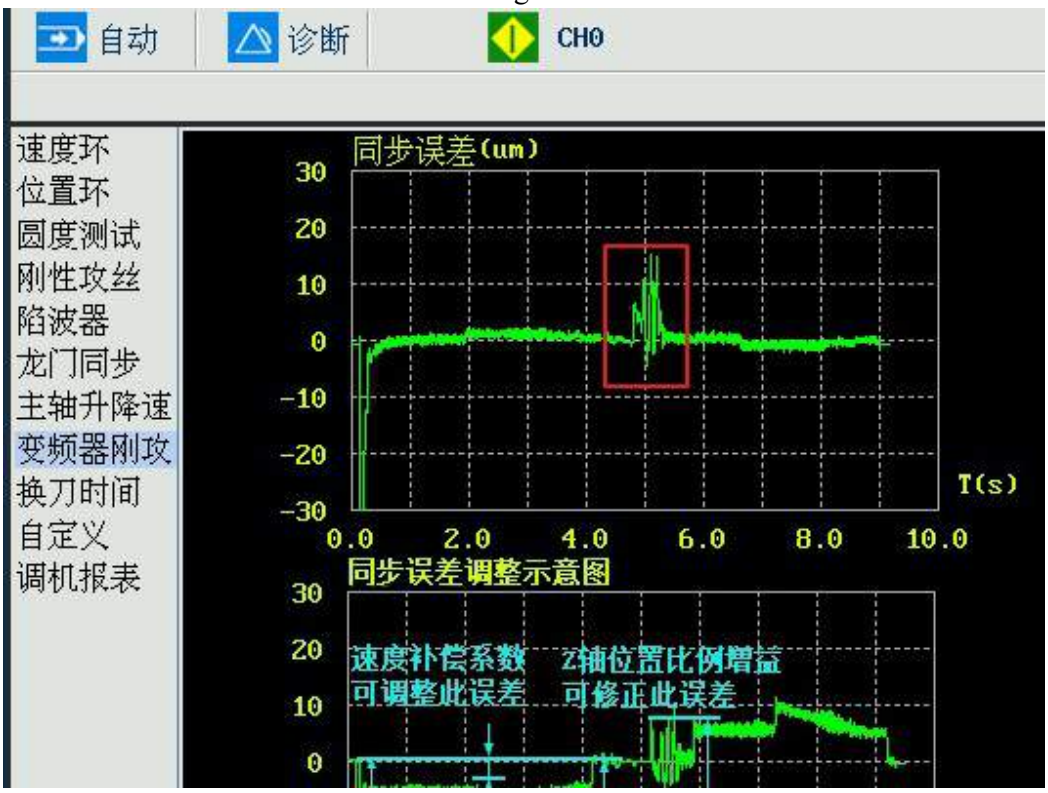


Fig. 7

The purpose of debugging is to make the graphics at both ends as close to 0 as possible and as close to a straight line as possible. The fluctuation value between the graphs is less than 10um (that is, the synchronization error Max value is less than 10um).

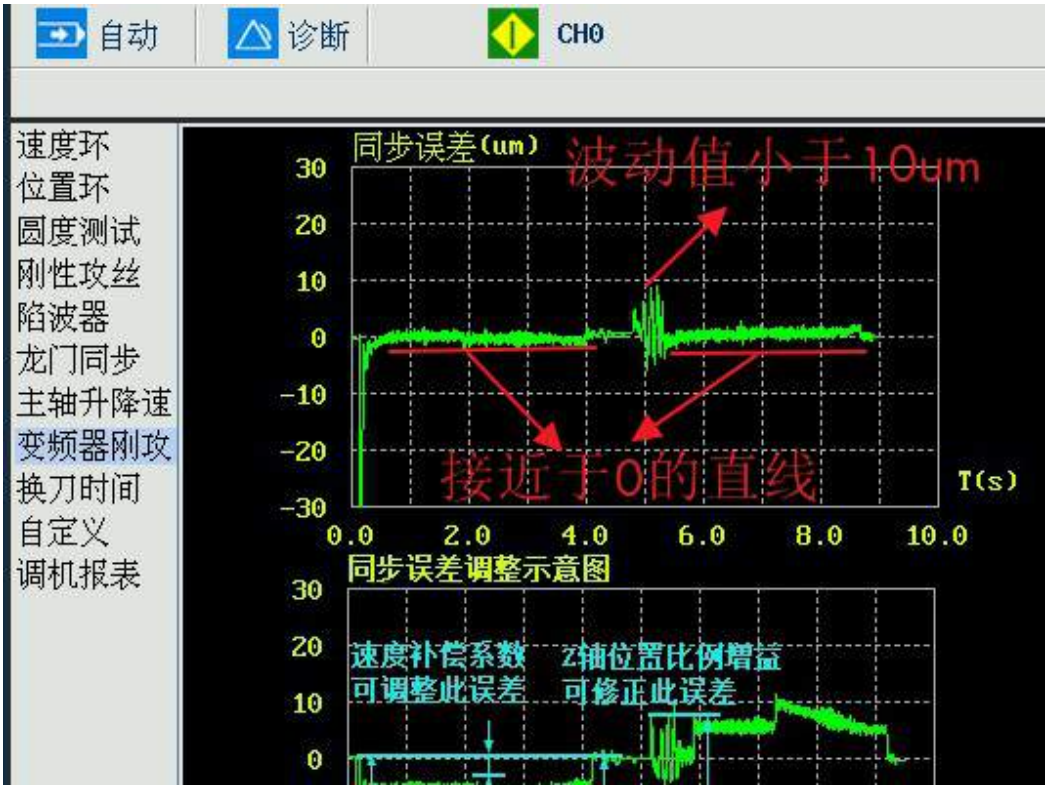

自动
诊断
CH0
速度环
位置环
圆度测试
刚性攻丝
陷波器
龙门同步
主轴升降速
变频器刚攻
换刀时间
自定义
调机报表
同步误差(um)
波动值小于10um
30
20
10
0
-10
-20
-30
接近于0的直线
T(s)
0.0
2.0
4.0
6.0
8.0
10.0
同步误差调整示意图
30
20
10
0
速度补偿系数
可调整此误差
Z轴位置比例增益
可修正此误差

Fig. 8