N3E Series Controller

Instruction manual

Please read the instructions thoroughly and fully understand their contents before using this controller. Please designate a custodian to keep it safely in the designated location so that it can be read at any time.

Shanghai Lynuc CNC Technology Co., Ltd.

Summarize

About this manual

- Name N3E Series Controller Instruction Manual
- Type Electrical and structural characteristics and installation instructions for N3E series controller
- Version V1.0

Use of this instruction manual

This instruction should be used during installation.

This manual is intended to be read by

This instruction manual is oriented:

- Electrical engineer
- Product technicians
- Technical service staff
- Product users

Operational prerequisites

Readers should:

- Familiarize yourself with the relevant concepts in the installation instruction
- Trained in N3E controller installation

Reference information

Instruction manual version history

Version	Release Date	Revision description
V1.0	2020/09/17	1. Product release.

☞ Reference documents (product specifications, operation manual, technical parameter manual)

CONTENTS

1. Safe use

summarize

N3E controller for precision electronic products, for the safety of the operator and machinery and equipment, please be sure to leave the installation and testing by professional electrical engineers and adjust the parameters, the product manual is labeled with "**Danger**", "**Warning**", " **Attention**"" and other symbols of the instruction, please be sure to read carefully, if there is any doubt, you can contact the company's branch offices around the world to consult, or directly with the company related to the known technical personnel consulting, our professionals will be happy to serve you.

1.1 Basic matters of safe operation

summarize

This manual includes safety-related precautions to ensure the safety of the installer and to prevent damage to the controller, and describes them in the body of the text as "**Warning**" and "**Attention**" according to their level of importance in terms of safety, and the related supplemental descriptions are described as Additional instructions are described as "**Description**".

These **DANGERS**, **WARNING**, **ATTENTION** and **DESCRIPTION** must be read before use.

Danger

Indicates that if this hazard cannot be avoided, the result is likely to be serious injury or death.

Warning

Indicates that there is a potential risk of serious injury or death if this hazard cannot be avoided.

Attention

Indicates that violating this precaution may damage the equipment or shorten its life.

Description	Indicate additional instructions other than danger, warning and caution.

1.2 Safe work practices for installation

summarize

The following describes safe work practices for installation.

For safe use of this equipment, please read carefully and be sure to observe the following.

Warning

1. Please read the instruction manual thoroughly and understand its contents.

   The instruction manual describes how to operate the equipment for installation and commissioning. Before installing the equipment, be sure to read and fully understand the contents of the instruction manual. Do not operate the equipment using procedures or methods not described in the instructions.

2. Equipment operators must be appropriately qualified.

   The equipment operator must have received the necessary training on the installation and commissioning of the equipment, have sufficient knowledge of safe operation, and be authorized by the person responsible for safety in the user enterprise. The enterprise management should carry out safety and operation of the work of the guidance.

3. Please observe the safety precautions.

   To operate this equipment safely, be sure to observe the safety precautions recorded in the instruction manual and the safety precautions recorded in the warning labels. Failure to observe the precautions may result in a major personal accident.

Attention

- When connecting to external devices, please use the standard cables.
- If standard cables are not used, misoperation may occur due to different specifications. For details, please consult the maintenance person in charge of our company.

1.3 Prevention of personal injury

summarize

The following is a description of safe work practices in terms of personal safety precautions.

To protect the safety of the installer, please read carefully and be sure to observe the following.

Warning

1. Use the connection cable supplied with the unit.
   - For interconnection of modules, use the connection cable supplied with the unit.
   - When selecting the main grid AC power cable, use the connection cable supplied with the unit.
   - To avoid discharge and fire, do not exceed the voltage range outside the limit panel of Lynuc.
2. Make sure all ground wires are properly connected.
   - To avoid leakage, connect all module grounds to the main ground. Make sure all ground connections are correct before connecting the unit's input and output.
   - Before adding power to the unit, make sure it is grounded. And to avoid leakage, make sure all ground connections are correct.
3. Ensure a safe working environment.
   - Do not work in a damp environment. To avoid electrical leakage, work in an environment where the relative humidity is less than 90% (no

condensation) and the temperature is less than 58℃.

- To avoid danger, do not work in explosive atmosphere.

1.4 Prevention of product damage

summarize

The following describes safe work practices for preventing product damage.

To protect the integrity of the product in use, please read and be sure to observe the following.

Warning

1. Avoidance matters:
   - Keep the CNC device as far away as possible from coolant, chemicals, impact objects, and other items that may cause damage to it.
   - Please keep away from sources of electromagnetic interference as far as possible, such as:

     -Large load sharing an AC power line with the equipment.

     -Portable transmitter (wireless telephone and transmitter).

     -Near the wireless/TC transmitter.

     -Arc welding machine.

     -High voltage wire.
   - Avoid interference from the machine tool. The machine tool must be uncoupled from all interference-generating factors (relay windings, current contactors, motors, etc.).
   - Please do not disassemble the controller by yourself, otherwise it will easily cause aging or damage to the connectors.
   - Please do not remove the batteries from the controller card, so as not to lose the information of the board and cause the controller not to work normally. When replacing the batteries, please ensure that it is done

within 2 hours.

2. About the power supply:
   - Use an externally regulated 24V DC power supply for input and output.
   - The zero voltage of the external power supply must be connected to the main grounding point of the machine tool.
   - Analog input and output are recommended to be connected with shielded cables and their shields connected to the corresponding pins.

3. About the work environment:
   - The operating environment must be between 0℃ and 58℃.
   - Storage temperature must be between -20℃ and 60℃.
   - To ensure sufficient space between the center unit and the surrounding walls, refer to the installation instruction.
   - The power switch must be easily accessible, with a clearance of between 0.7 m (27.5 in) and 1.7 m (5.5 ft) from the ground. Operate in a location free of conductive dust, corrosive metals and insulation-damaging gases or vapors.
   - Use in indoor settings.
   - If it is used in a special environment that does not meet the above conditions, the user should propose it at the time of ordering to ensure that the product can work reliably.

2. Product introduction

2.1 N3E Controller Product Overview

summarize

N3E series controller is a cost-effective, modular, multi-bus controller, with a friendly human-machine interaction interface, rich secondary development interface, mature application programs supporting the controller of Shanghai Lynuc CNC Technology Co. Its body is small and exquisite, with powerful functions, supporting CNC closed-loop control, with a minimum servo cycle of 250 μ s to ensure servo response. Its structure is safe, stable and reliable, and its machine tool panel can be customized and touch screen can be selected.

Model Description

N3E X - 0 2A

① ② ③ ④

① N3E Series Controller Products

② Bus Type

X: Support EtherCAT, RTEX, MECHATROLINK-III

R: Support EtherCAT, RTEX

M: Support EtherCAT, MECHATROLINK-III

C: EtherCAT support

③ Motherboard Model.

0: Motherboard № 0

1: Motherboard № 1

④ Version number of the control card

2.2 Product Features

The product features of the N3E controller are shown below:

Supports a wide range of bus type servo drives

- Supports EtherCAT/RTEX/ MECHATROLINK-III communication types.

Supports full closed-loop control

- Multiple encoding protocols can be received for scale position reading.

High openness

- Can be equipped with Lynuc RTCP 5-axis CNC system
- Can be equipped with different models of Lynuc panels
- Can be equipped with various functions of the Lynuc CNC system.

Communication/Network Functions

- Supports high speed and high-capacity USB interface devices
- 1000M network communication
- Supports remote diagnostics, monitoring and commissioning
- Support RS485/RS422 serial port

2.3 Product Specification

The specifications related to hardware parameters and software parameters of the N3E series controllers are shown below:

◎	☆	×
standard	optional	none

Table 2- 1 Product hardware specification parameters

Item	Specification	N3E	N3ER	N3EM	N3EC
Industrial motherboards	Intel motherboards	CPU Clock Speed 1.8G Hz	CPU Clock Speed 1.8G Hz	CPU Clock Speed 1.8G Hz	CPU Clock Speed 1.8G Hz
Memory	2GBytes	◎	◎	◎	◎
User storage	SSD card (SATA signal; PCIE interface)	8GB	8GB	8GB	8GB
Ferroelectricity	128KBytes	◎	◎	◎	◎
Network	1000Mbps EtherNet	◎	◎	◎	◎
Bus	EtherCAT	◎	◎	◎	◎
	MECHATROLINK III	◎		◎	
	RTEX	◎	◎		
Serial bus	RS485/RS422	◎	◎	◎	◎
USB port	Mobile storage interface 2-4	◎	◎	◎	◎
Pulse output	5V differential quadrature pulse output	◎	◎	◎	◎

AB phase handwheel control	AB pulse input, 9-point IO input	◎	◎	◎	◎
Number of control axes	16 servo axis servo cycles	1ms/2ms	1ms/2ms	1ms/2ms	1ms/2ms
Panel interface	YCP6S	◎	◎	◎	◎
Extended I/O	EtherCAT I/O	◎	◎	◎	◎
Display interface	VGA	◎	◎	◎	◎
	LVDS	◎	◎	◎	◎
	Touch Panel	☆	☆	☆	☆

Table 2- 2 Product software specification parameters

Item	Description
High-speed and high-precision GACC 0/1/2	High-speed contouring control function provides function packages for different machining needs of molds and parts.
RTCP tip following	5-axis RTCP machining
Program simulation	Online simulation, providing line and solid simulation modes
QUI user-defined interface	Customized screen development
PVT (G5.1)	Hermite interpolation
PlugIN development	Support customers to carry out independent secondary development, and provide encryption protection for registration code.
NCExpert	Intelligent editor
Power outage reversion	
Serial communication	
Touch Panel Support	
Bus concurrent	EtherCAT, MIII, RTEX, EtherCAT+MIII, EtherCAT+RTEX
Dual Path Support	Dual path control can be supported

3. Hardware Interface and Installation Power Distribution

3.1 Device connection

The N3E controller device connection method contains the following types:

- N3EX All-in-One RTEX+IOEM System Composition
- N3EX All-in-One MIII+IOEM System Composition
- N3EX Monoblock EtherCAT+IOEM System Composition

Attention

1. In order to avoid being affected by power interference during use, please add a magnetic ring at each power line inlet.

   Use method: Wrap the power cord around the center of the magnetic ring three or more times, and keep the magnetic ring as close to the controller as possible when connecting.

   When using IOEM / POE for expansion, you also need to use the magnetic ring, and the method of use is the same as that of the controller.

2. The N3E All-In-One Controller includes a single controller and panel, eliminating the need for a panel and VGA cable when choosing to use the N3E All-In-One Controller.

3.1.1 N3EX All-in-One RTEX+IOEM System Composition

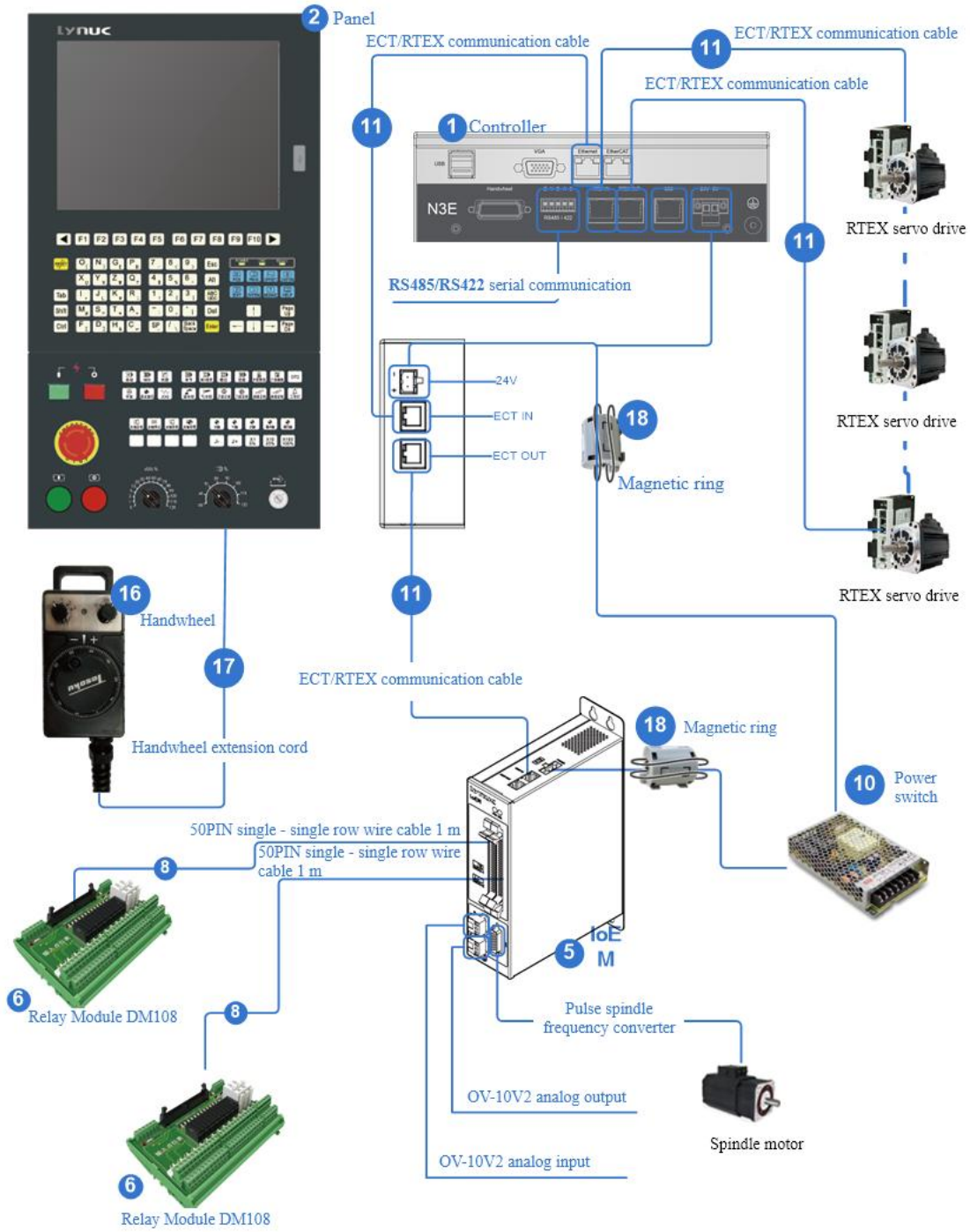


Figure 3- 1 N3EX all-in-one RTEX+IOEM system composition

3.1.2 N3EX All-in-One MIII+IOEM System Composition

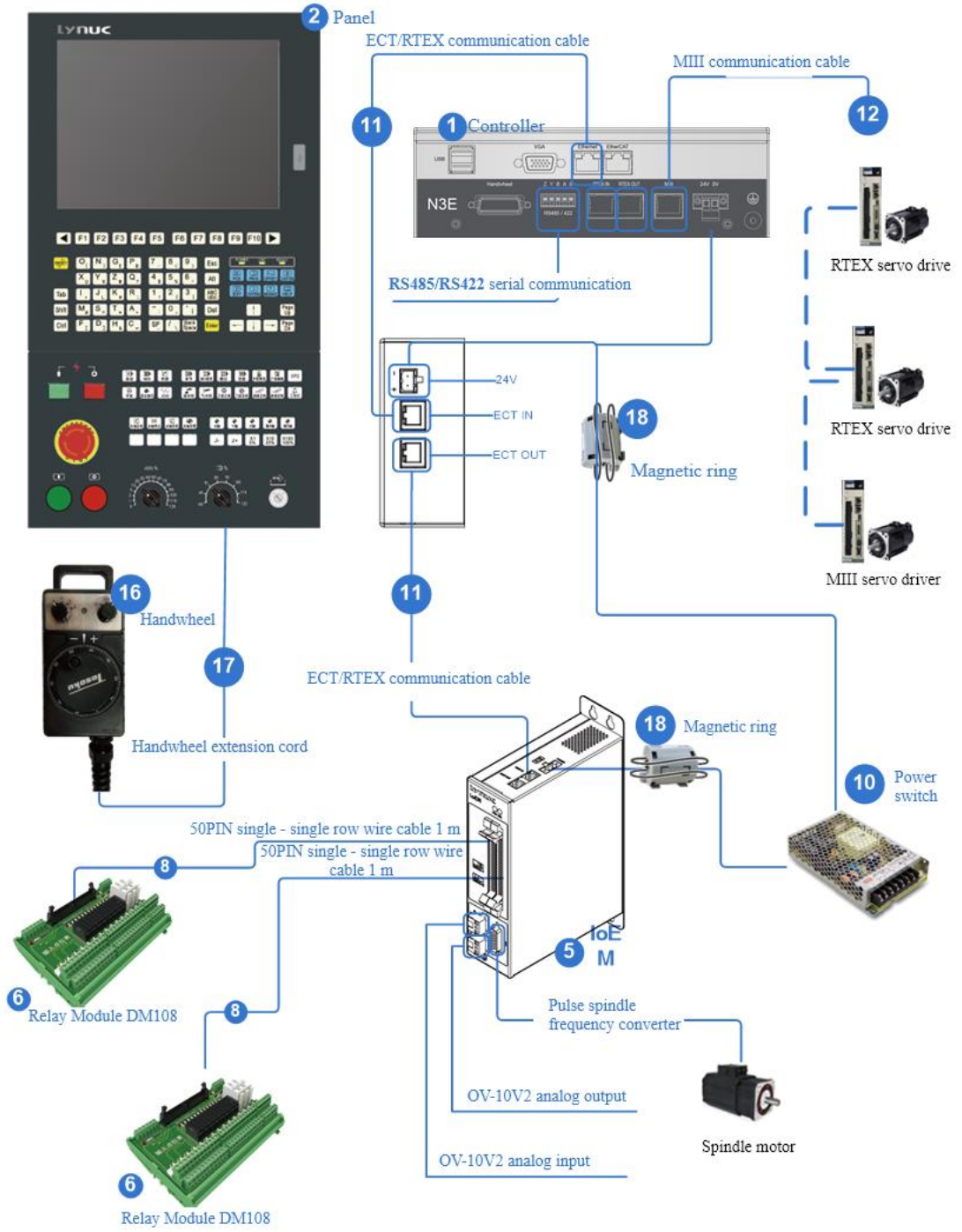


Figure 3- 2 N3EX all-in-one MIII+IOEM system composition

3.1.3 N3EX Monoblock EtherCAT+IOEM System Composition

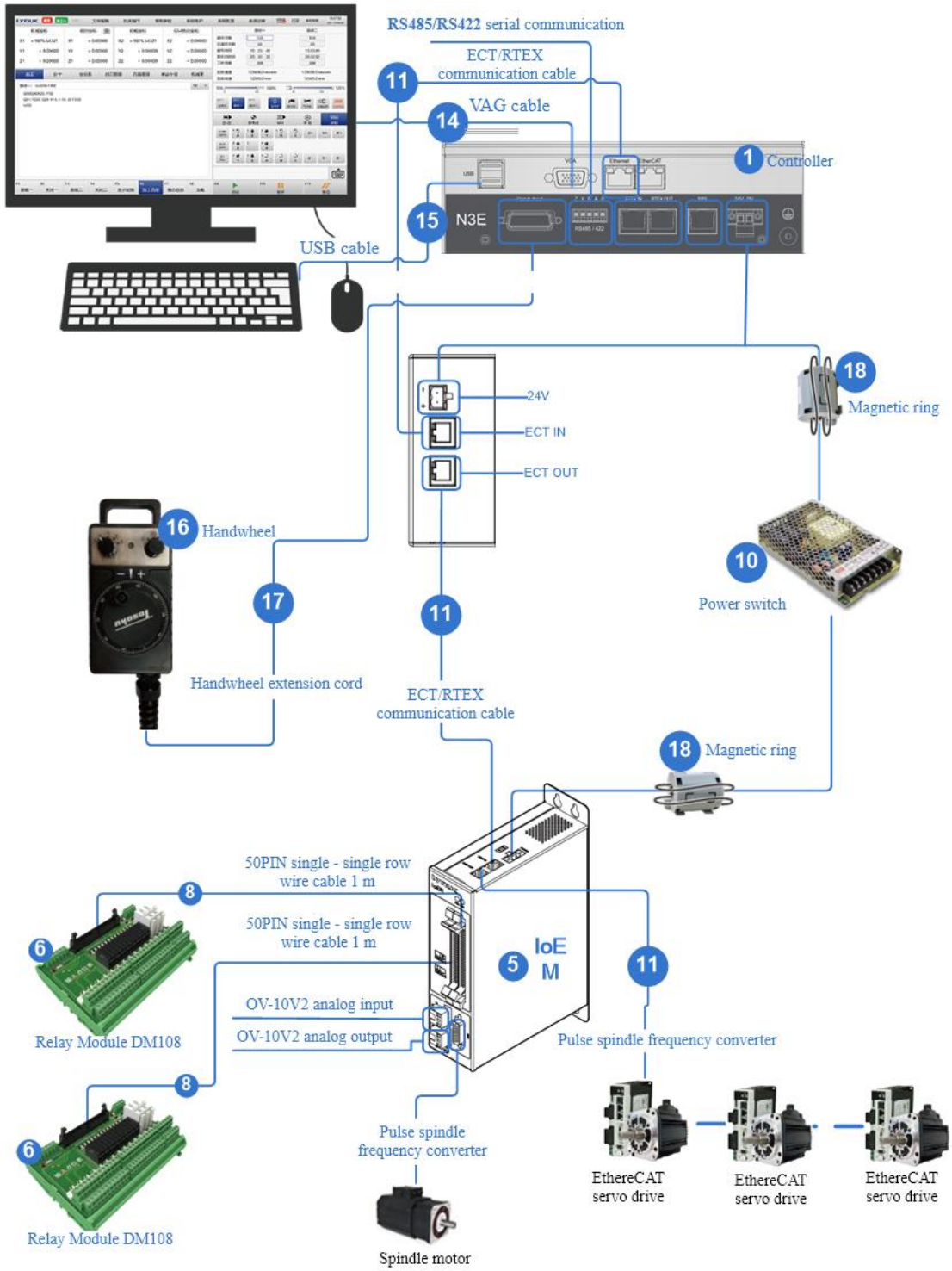


Figure 3- 3 N3EX Monoblock EtherCAT+IOEM System Composition

3.2 Hardware interface

summarize

The schematic distribution of the front interface is shown below:

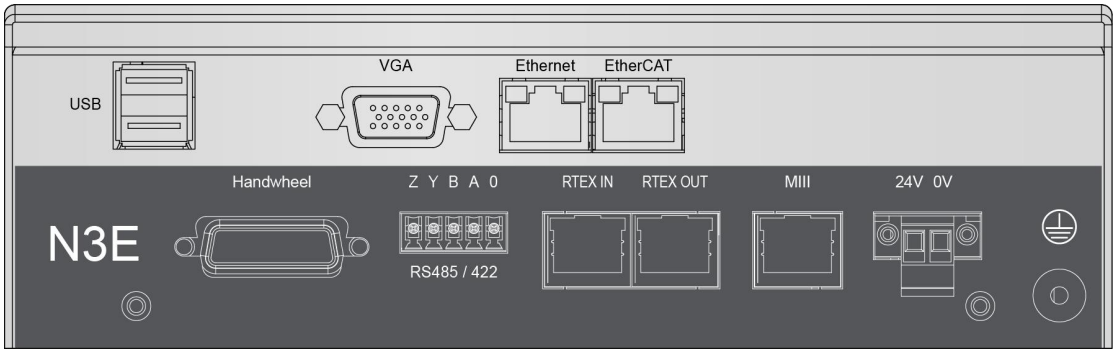


Figure 3- 4 N3E hardware interface

The interface is described in detail in the following table.

Table 3- 1 N3E Hardware Interface Details-1

№	interface	pin	function	interface description
1	24V		DC24V Positive Input	24V±20% 2A (DC) power input
	0V		DC24V Negative Output	
2	MIII		Mechatrolink-III channel	Mechatrolink-III master interface to standard Mechatrolink-III slave devices
3	RTEXIN		RTEX input interface	RTEX is a Panasonic high-performance bus for real-time communication with drives. The interface supports all RTEX-compliant slave devices.
4	RTEXOUT		RTEX output interface	
5	RS485 RS422	Z	RXD-	When used as a 485 interface, only the T/R+ T/R- needs to be accessed.
		Y	RXD+	
		B	T/R-	

		A	T/R+	
		O	Reference level	
6	Handwheel		Handwheel interface	For AB-phase handwheel pulse and shaft selectable multiplier signal access
7	Ethernet		Network interface	Standard Ethernet interface for Ethernet access and debugging, also for Modbus TCP communication
8	EtherCAT		EtherCAT bus interface	EtherCAT master interface to standard EtherCAT slave devices, including EtherCAT drives, I/O cards, and pulse converter card units with confirmed support from Lynuc.
9	VGA		Display interface	For connecting a VGA monitor
10	USB		USB port	Two standard USB ports for standard USB slave devices only

3.2.1 Handwheel interface

summarize

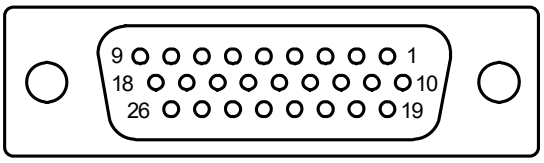
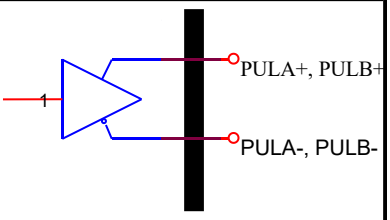


Figure 3- 5 Schematic diagram of Handwheel interface

- Used for AB-phase pulse input and shaft selection/multiplier IO input of handwheel;
- Can be used in pulse-controlled spindle variable-frequency drive with both command and feedback in the same interface;

Interface Description

Table 3- 2 Handwheel protocol interface description

pinout	abbreviation	functional description	circuit principle description
10	EA-	Encoder or handwheel AB phase differential signal input	Bidirectional differential signals
1	EA+		
11	EB-		
2	EB+		
12	EZ-	Differential signal input for encoder zero (Index)	
3	EZ+		
14	PULA-	Pulse command output	
5	PULA+		
26	PULB-		
23	PULB+		Maximum output frequency is 10 MHZ
6	X	Handwheel axle selection	
7	Y		
8	Z		
15	4TH		
16	5TH		
17	6TH		
19	X1	Handwheel magnification	
20	X10		
21	X100		
22	Input10		
9	INCOM		
24	24V	LED+	
25	VSS	LED-	
13	VSS	Encoder 0V	

4	5V	Encoder 5V	

3.2.2 VGA interface

Typically used to connect the panel's display:

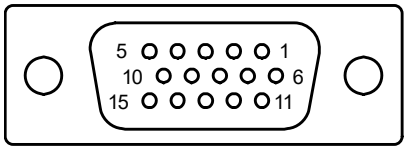


Figure 3- 6 Schematic diagram of VGA interface

Interface Description

Table 3- 3 VGA Protocol Interface Description

pinout	abbreviation	functional description
1	RED	Red primary signal
2	GREEN	Green primary signal
3	BLUE	Blue primary signal
5	GND	Ground Signal
6		
7		
8		
9	KEY	Empty, No Pin
12	ID1	Display identification bit 1, address code, I2C interface, interface used by the host to view information such as the display ID and model number
13	HSYNC	Horizontal Synchronization
14	VSYNC	Vertical Synchronization
15	ID3	Display identification bit 3, address code, I2C interface, interface used by host computer to view information such as display ID and model number

3.2.3 MIII interface

summarize

The network basic protocol of the Mechatrolink-III system has functions equivalent to layers 1, 2, and 7 of the OSI basic model, and is capable of data connection services, exchange of data units, error notification (communication alarms), and latency determination.

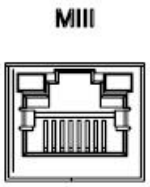


Figure 3- 7 MIII interface

Description

- The recommended RJ-45 plug in Mechatrolink-III is a locking plug, so please effectively plug the cable into place until it makes a locking sound.
- When the MIII is star-connected, a Mechatrolink-III-specific HUB must be used.

3.2.4 RTEX interface

summarize

- RTEX is a high-speed real-time network communication protocol.
- 16-axis network communication can be realized in 1ms time.
- RTEX has one exit and one entrance.
- RTEX forms a ring topology.

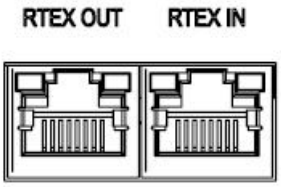


Figure 3- 8 RTEX Interface

Table 3- 4 RTEX Interface Status Indicator Description

interface	indicator light	status	description
RTEX IN	green	Flashing	Fan speed is normal

	light	Always on	Abnormal fan speed
	yellow light	Always on	RTEX master chip works normally
		off	RTEX master chip working abnormally
RTEX OUT	green light	Flashing	RTEX bus initialization successful, RTEX data frame normal
		Always on	RTEX bus initialization successful, no RTEX data frame
		off	RTEX bus not initialized
	yellow light	Always on	Communication is normal
		off	Communication is abnormal

Attention

The entire ring of RTEX must be kept connected for it to work properly, and the network is paralyzed in the event of an error or disconnection of one of the nodes.

3.2.5 EtherCAT interface

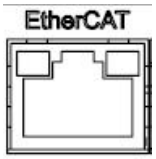


Figure 3- 9 EtherCAT bus interface

Table 3- 5 Functional description of the EtherCAT bus interface

interface	functional description	interface description
EtherCAT	Standard Ethernet interface	EtherCAT for N3E is an Ethernet-based fieldbus system with an open architecture. It has the characteristics of real-time nature of the system and the flexibility of the topology. It has the characteristics of high-precision equipment synchronization, optional cable redundancy and functional security protocol.

3.2.6 EtherNet interface

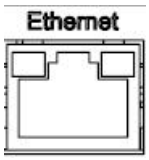


Figure 3- 10 EtherNET network interface

Table 3- 6 Network Interface Description

interface	functional description	interface description
EtherNet	Standard Ethernet interface	The N3E's Ethernet (standard Ethernet) speeds are 1000Mbps.

3.2.7 Power Input Interface

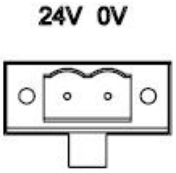


Figure 3- 11 Power Input Interface

The power input interface specifications are as follows:

Table 3- 7 Power Input Interface Specifications

name	functional description	specification
Power Input	24V Power positive input	DC 24V±10%/2A
	0V Power negative input	

Description:

In order to prevent and reduce the interference of power supply from peripheral grid to the controller, the 24V power supply of N3E needs to be equipped with a separate switching power supply, and the recommended model is: Meanwell RS-150-24.

4. Controller Installation Instructions

4.1 Preparation before installation

Required tools for installation:

- Slotted screwdriver (M2)
- Phillips screwdriver (M5)
- Hex wrench
- Socket spanner
- Multimeter, etc.

4.2 Fixed installation

Attention

- Please leave enough space on the right side and lower end of the controller for wiring; try to keep the controller away from servo amplifiers, inverters and other high-power or heat-generating electrical units.
- To improve the heat dissipation performance of the controller, make sure that the air on both sides is unobstructed; and that the heat dissipation airflow reaches the exhaust fan quickly.
- Because of the large size and heavy weight of the controller, side mounting is generally not recommended. If side mounting must be done, a mounting bracket needs to be added, and the controller is fixed to the mounting bracket by means of flush mounting, and then the mounting bracket is mounted sideways.

4.2.1 N3E Monoblock Controller Mounting Hole Dimensions

The outer dimensions and mounting holes are shown below:

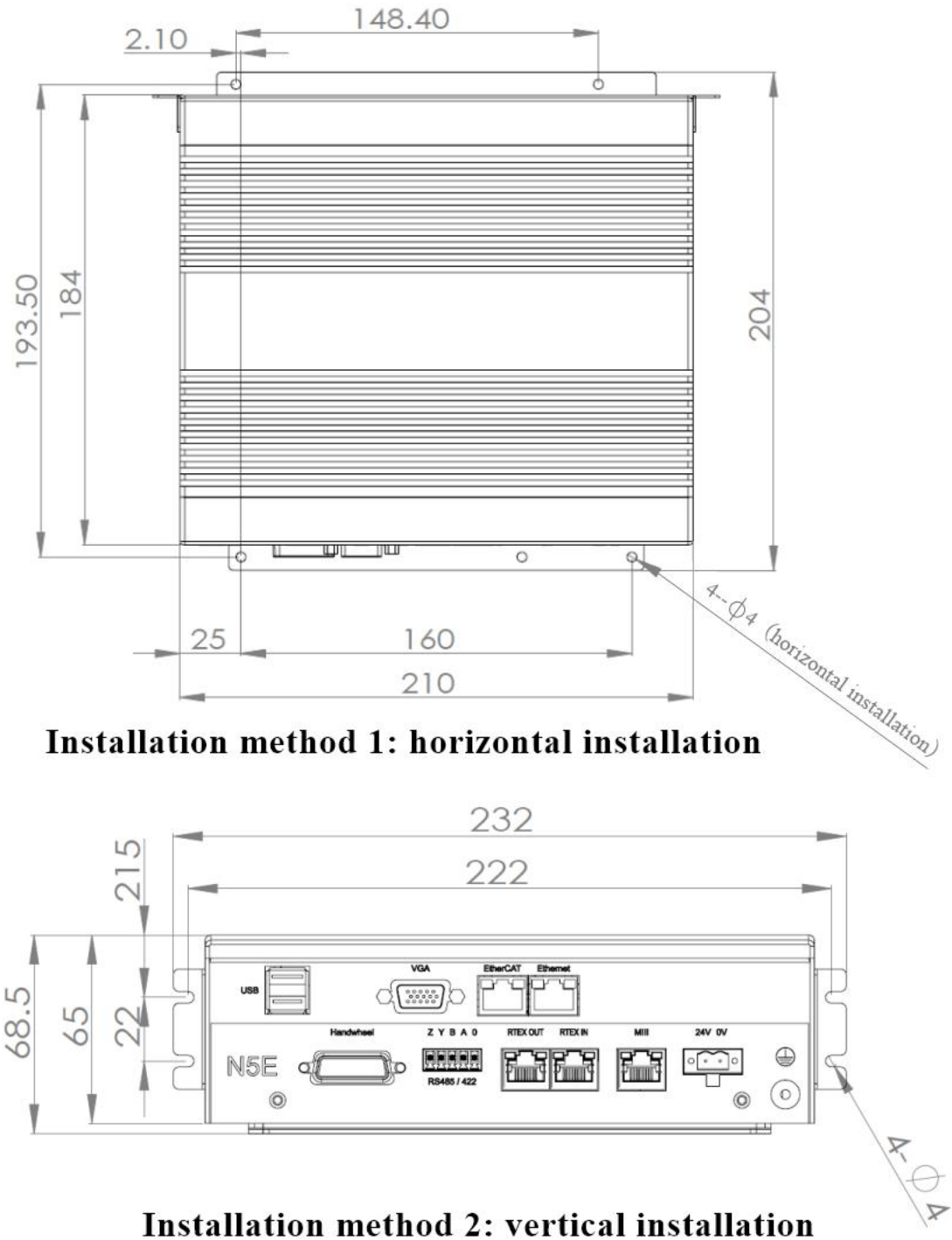


Figure 4- 1 N3E Monoblock Controller Mounting Hole Dimensions

4.2.2 N3E All-in-One Controller Mounting Hole Dimensions

For all-in-one system installation, refer to the LYNUC “Panel Instruction Manual”.

4.2.3 N3E Controller Accessory Installation

Please refer to the relevant instructions for installation details:

Table 4- 1 Accessory Installation Reference Table

Installation projects	References
Panel installation	☞ “Panel Instruction Manual”
IOEM Installation	☞ “IOEM Input-Output Modules - Instruction Manuals”

4.3 Earth wire connection method

summarize

Once the modules are secured, connect their ground terminals to the machine safety ground.

4.4 Test before power-on

summarize

In the maintenance of CNC machine tools, in order to ensure the safe and reliable operation of the machine tool, regardless of whether the failure is related to the following checks, usually should be the first to do the routine inspection and testing of the CNC system.

Testing items

- Component appearance inspection
- Installation check
- Connecting the power supply
- Confirmation of power supply voltage

4.4.1 Component Appearance Check

A visual inspection of the CNC and servo drive should include the following:

- Check the appearance of the components of the MDI/CRT unit, machine operation panel, and other units for damage;
- Check that the control unit, servo driver, power supply unit, I/O and other units are firmly mounted and that the modules are not loose or detached;
- Check each connecting cable for breakage, insulation damage, or poor plugging.

4.4.2 Installation check

Inspection items

- Check that the control unit, servo driver, power supply unit, I/O unit, and other units are securely mounted, and that the modules are not loose or detached;
- Check that the operating components on the panel and on the machine are securely mounted;
- Check that the connecting cable wires are arranged and fixed as required and that the cable plugs have been reliably stabilized;
- Check the wiring of each I/O connection terminal for looseness, firm installation, etc.

4.4.3 Connection check

Inspection items

- Check that the power connections to the system and drive are correct;
- Check that the grounding wires of the CNC, Servo Driver, and I/O Unit are connected correctly, that the wire diameter is large enough, that the connection location is reasonable, and that the protective earth is a single point ground;
- Check that the signals and cables have been reliable;
- Make sure that the cable wiring from the N3E controller to the YCP panel and the cable wiring from the YCP panel to the IOEM is correct;
- Make sure the controller to drive wiring is correct;

- Make sure that the servo motor is properly wired to the servo motor driver;
- Make sure that all IOs are wired correctly and that the polarity of the IO levels is correct;
- Make sure all grounded signal wires are properly and adequately grounded.

4.4.4 Confirmation of power supply voltage

Inspection items

- Please measure the resistance of the 24V input to confirm that there is no short circuit;
- Make sure that there is a normal input of DC24V power.

4.5 Installation Precautions

summarize

1) Control board card power supply power cord: 24V must be twisted.

2) All differential form signal cables must be twisted pair per group and the cables must be reliably shielded.

3) The high-voltage line of machine tool should avoid signal line and weak power line as much as possible, and it is forbidden to run the line at close distance between signal line, weak power supply and high-voltage.

5. Controller common faults and handling

5.1 Mainframe Fault diagnosis

summarize

The host of the CNC machine tool usually refers to the mechanical, lubrication, cooling, chip removal, hydraulic, pneumatic and protection parts of the composition of the CNC machine tool, the host of common faults are mainly:

① Mechanical transmission fault caused by improper installation, commissioning, operation and use of mechanical parts.

② Faults caused by interference of moving parts such as guideway spindles, excessive friction, etc.

③ Malfunctions caused by damage to mechanical parts, poor connections, etc., etc.

The main manifestation of the faults:

Transmission noise, poor machining accuracy, high operating resistance, non-operation of mechanical parts movements, damage to mechanical parts, etc.

Common causes of faults:

Poor lubrication, clogged management of hydraulic and pneumatic systems and poor sealing are common causes of mainframe faults.

Mainframe faults handling:

Regular maintenance of CNC machine tools, maintenance, control and eradication of "three leaks" phenomenon is to reduce the host part of the failure of important measures.

5.2 Fault of the electrical control system

summarize

Electrical control system failures are usually categorized into two main groups in terms of the type of components used and according to common usage.

- "Weak power" fault
- "Strong power" fault

Description

① The "weak power" part refers to the control part of the control system which is mainly composed of electronic components and integrated circuits. The weak electric part of the CNC machine tool includes CNC, PLC, MDI/CRT and servo drive unit, input and output unit and so on. "Weak power" fault can be divided into hardware fault and software fault.

② The "strong power" part of the control system refers to the main circuit or high-pressure, high-power circuit of relays, contactors, switches, fuses, power transformers, motors, solenoids, travel switches and other electrical components and their control circuits. Although this part of the fault maintenance, diagnosis is more convenient, but because it is in high pressure, high current working condition, the chance of fault is higher than the "weak power" part. Must cause maintenance personnel enough attention.

5.2.1 Hardware faults

summarize

Hardware faults are faults of integrated circuit chips, discrete electronic components, connectors, and external connection assemblies for each of the above components (CNC, PLC, MDI/CRT, and servo drive units, input/output units).

Table 5- 1 Common Hardware faults and Handling

fault diagnosis	**fault classification/cause**	**Fault handling**
monitor black screen	Controller not activated	The 24V power supply of the controller may not be supplied, the voltage may be low, and it may be reversed.
		Power supply power is low, not using the recommended type of switching power supply, please ensure that the power of 150W
Automatic reboot occurs during operation		24V switching power supply power is not enough, may use the power, model is not correct
		The same switching power supply that powers devices other than the controller causes unstable power supply.
		Terminals are not locked, wires or terminals have poor contact, or even fall off

5.2.2 Software faults

summarize

Software faults refers to the action of germanium, data loss and other faults that occur under normal circumstances in the hardware, common processing program errors, changes or loss of system programs and parameters, computer arithmetic errors.

Table 5- 2 Common Software Faults and Handling

fault diagnosis	fault classification/cause	Fault handling
System crash occurs	a) No screen saver, display screen appears but display does not refresh	Check that the controller's fan is functioning properly.
	b) Enter the screensaver, the interface stays black and unresponsive	Check whether there is a buzzer sound when the controller is powered on, if not, then the controller is faulty, otherwise, please find the problem of the display part of the problem
The panel is inoperable	Unresponsive	First of all, please make sure that the CNC light on the panel goes out, or never lights up, indicating that the connection cable to CN24 of the controller is disconnected.
		If the cable is not abnormal, then check whether the LED behind the panel is blinking, if it does not blink, the YCP board where the LED is located may be damaged and need to be repaired.

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