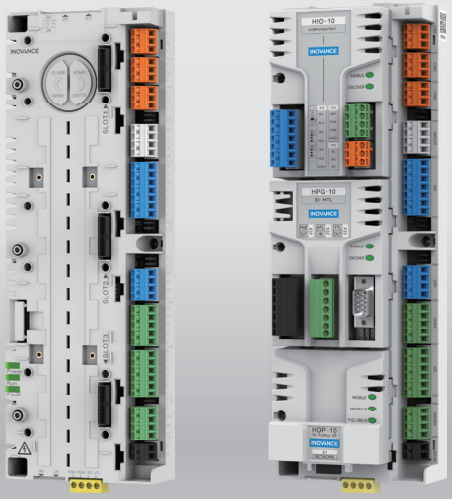
INOVANCE

FORWARD, ALWAYS PROGRESSING



HCU Control Unit

Hardware Guide

Industrial Automation

Intelligent Elevator

New Energy Vehicle

Industrial Robot

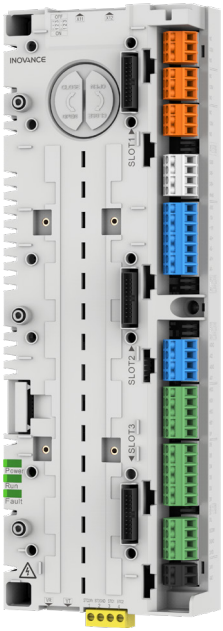
Rail Transit

Data code 19012515A00

Preface

The HCU control unit is the main controller of Inovance's new-generation variable frequency speed regulating system. It supports MD880 series products and is used to control basic rectifier, active rectifier, and inverter power units. It features powerful function, compact structure, strong extendability, high reliability, flexible networking, and excellent control algorithms. It supports V/f control, sensorless vector control (SVC), and feedback vector control (FVC).

This user guide describes the product information, installation, wiring, and application of each function.



Precautions
◆ Drawings in the user guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
◆ Drawings in the user guide are shown for description only and may not match the product you purchased.
◆ This user guide is subject to change without notice due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the user guide.
◆ Contact our agents or customer service center if you have problems during use.

Revision History

Date	Version	Description
August 2024	A00	◆ First release

Contents

Preface 1
Revision History 2
1 Fundamental Safety Instructions 6
1.1 General Safety Instructions 6
1.2 Unpacking Inspection 6
1.3 Precautions at Storage and Handling 6
1.4 Installation Precautions 6
1.5 Wiring Precautions 7
1.6 Maintenance Precautions 8
1.6.1 Normal Use Conditions 9
1.6.2 Disposal Precautions 9
2 Product Information 10
2.1 Nameplate and Model 10
2.2 Dimension Drawing 12
2.3 Components of the HCU Control Unit 13
2.3.1 Standard Terminals 14
2.3.2 Function Modules and Units 15
2.3.3 LED Indicators 17
2.3.4 SD Memory Card 17
2.4 General Specifications 18
2.5 System Connection Example 18
2.5.1 Example 1 18
2.5.2 Example 2 19
2.5.3 Example 3 20
2.5.4 Example 4 22
3 Installation 23
3.1 Installation Precautions 23
3.1.1 Installation Environment 23
3.1.2 Installation Tools and Tightening Torque 23
3.1.3 Installation Precautions 24
3.1.4 Installation Clearance and Requirements 24
3.2 Installation Method 25
3.2.1 Installing the HCU 25
3.2.2 Installing/Disassembling the Function Module 27
3.2.3 Replacing the Battery 31

3.2.4 Removing/Installing the SD Card 32
4 Wiring 34
4.1 Routing Requirements and Preparation 34
4.1.1 Routing Requirements 34
4.1.2 Wiring Requirements for InoLink Communication Network 38
4.1.3 Cable Selection 40
4.1.4 Preparations 41
4.1.5 Installing Optical Fibers and Cables 41
4.2 Overview of HCU Interfaces 46
4.3 Connecting Power Supply Cables 47
4.3.1 Terminal Assignment and Specifications 47
4.3.2 Wiring Requirements on Power Supply Cables 47
4.4 Connection of DI Signals 48
4.4.1 Terminal Assignment and Specifications 48
4.4.2 DI Interfaces 49
4.4.3 DI Wiring Requirements 52
4.4.4 Precautions for DI Wiring 53
4.5 High-speed DI/DO Signal Connection 53
4.5.1 HDI Terminal Assignment and Specifications 53
4.5.2 HDI Interfaces 54
4.5.3 HDI Wiring Requirements 56
4.5.4 HDI Wiring Precautions 57
4.5.5 HDO Terminal Assignment and Specifications 58
4.5.6 HDO Interfaces 58
4.5.7 HDO Wiring Requirements 59
4.5.8 Precautions for HDO Wiring 60
4.6 AO Signal Connection 61
4.6.1 Terminal Assignment and Specification 61
4.6.2 AO Interfaces 62
4.6.3 AO Wiring Requirements 62
4.6.4 AO Wiring Precautions 63
4.7 AI Signal Connection 63
4.7.1 Terminal Assignment and Specification 63
4.7.2 AI Interfaces 64
4.7.3 AI Wiring Requirements 65
4.7.4 AI Wiring Precautions 66
4.8 InoLink Communication Network Connection 66

4.8.1 Terminal Assignment and Specification 66
4.8.2 InoLink Communication Network Interface 67
4.8.3 Termination Resistor 68
4.8.4 Wiring Requirements for InoLink Communication Cables 68
4.8.5 InoLink Wiring Precautions 68
4.9 Relay Output Signal Selection 68
4.9.1 Terminal Assignment and Specification 68
4.9.2 Relay Output Interface 69
4.9.3 Wiring Requirements 69
4.10 Wiring of STO 70
4.10.1 Position Definition and Specification 70
4.10.2 Safe Torque Off (STO) Principle 70
4.10.3 STO Wiring Requirements 71
4.11 RS485 Connection of the Control Panel 71
4.11.1 Terminal Assignment and Specification 71
4.11.2 Control Panel RS485 Interface 72
4.11.3 Wiring Requirements 73
5 Functions and Applications 74
5.1 Slot Application 74
5.1.1 Slot Applicable Module 74
5.1.2 Expansion of Synchronous Voltage Detection Unit 77
5.1.3 Function Module Expansion Unit 77
5.2 Temperature Measurement with AI and AO 79
5.3 InoLink Communication Network Function Application 79
5.4 Control Panel Communication Application 80
5.4.1 Connecting To the SOP-20-880 80
5.5 Application of Single Mode and Parallel Mode 81
5.5.1 Single Mode Application 81
5.5.2 Parallel Mode Application 81
5.6 Safe Torque Off (STO) 82
5.6.1 STO Requirements 82
5.6.2 Application Example of STO Function 83

1 Fundamental Safety Instructions

The following signs are used for safety information in this user guide. The description of the safety signs is important and must be followed.

DANGER: Operations violating regulations can result in serious injury or even death.

CAUTION: Operations violating regulations can result in moderate or minor injury and equipment damage.

1.1 General Safety Instructions

This section describes precautions that must be observed during acceptance, storage, handling, installation, wiring, operation, inspection, and disposal.

1.2 Unpacking Inspection

Item	Description
Check whether the product delivered is consistent with your order.	The box contains the product and user guide. Confirm the product model according to the nameplate.
Check whether the product is intact.	Check whether the product delivered is in good condition. If there is any omission or damage, contact Inovance or your supplier immediately.

1.3 Precautions at Storage and Handling

Caution
◆ Keep the equipment in a place meeting the following conditions: 1. Away from direct sunlight. 2. Ambient temperature does not exceed the limit. 3. Relative humidity does not exceed the limit. 4. Without dramatic temperature change or water condensation. 5. Away from corrosive, flammable gases, dust, salty elements, and metal dust. 6. Away from locations with water, oil or medicinal drips. 7. Away from equipment that may generate vibration or shock. ◆ Do not lay many pieces of equipment one above another. Failure to comply may result in personal injury or equipment damage.

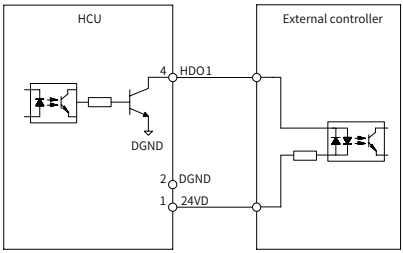
1.4 Installation Precautions

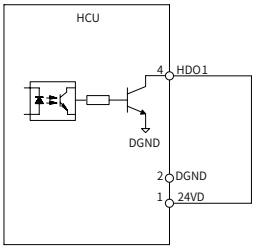
⚠ Caution
◆ Do not install the equipment in environment with water or corrosive gas. ◆ Do not subject the product to combustibles. Failure to comply may result in electric shock or a fire. ◆ Do not sit on the product or lay heavy objects on it. Failure to comply may result in personal injury. ◆ Install the product inside a cabinet with fire-proof and electrical protection. Failure to comply may result in a fire. ◆ Make sure that the air inlet and outlet are unblocked and prevent entry of foreign objects. Otherwise, internal components may be aged, causing faults and fires. ◆ Install the product in the required direction. Failure to comply may result in faults. ◆ Ensure that the specified clearance is reserved among the HCU control unit, interior surface inside the electric cabinet, and other robots. Failure to comply can result in fire or equipment fault. ◆ Do not exert strong impact on the equipment. Failure to comply may result in faults.

1.5 Wiring Precautions

Caution

- The HCU needs to be powered by a 24 VDC 2 A power supply. Failure to comply can result in improper operation of the system.
- The HCU can share the same power supply with the HPCU unit, HESD unit, and HSVM unit. Do not share with the power module interface board.
- HDO is an open collector output. Do not connect the power supply directly to the HDO port. Failure to comply can damage the control unit.





- The output triode emitter of the HDO has been connected to DGND. When using an external power supply, short the external power supply GND with DGND. Failure to comply can result in improper operation.
- DICOM is the common terminal of all DIs, configure J16 properly.
- Do not route the power cable and the signal cable through the same duct or bundle them together. Keep the power cable at least 30 cm away from the signal cable.
- Use shielded twisted pair cables for AI, AO, HDI, and HDO signals, RS485 communication cables, and encoder cables. Ground the shield according to section 4.1.
- Take proper shielding measures in the following scenarios to prevent equipment damage:
  - ① Interference caused by static electricity
  - ② Locations with strong electric field or magnetic field
  - ③ Locations with radioactive rays
- To ensure correct optical fiber assembly, install the gray optical fiber head to the gray transmission base, and install the black optical fiber head to the black reception base.

1.6 Maintenance Precautions

Caution

- The ON/OFF operations of the power supply can only be performed by professionals.
- Do not use the gasoline, diluent, alcohol, acidic or alkaline detergent during cleaning to prevent enclosure discoloration or damage.
- Do not change wiring with power on. Failure to comply may result in electric shock or personal injury.

1.6.1 Normal Use Conditions

The standard environmental conditions are as follows:
Average ambient temperature: 30° C
Average load rate: Below 80%
Daily operating time: Below 20 hours

Perform routine and regular inspections according to the following table.

Type	Period	Item
Routine inspection	Routine	Check the ambient temperature, humidity, dust, and foreign objects.
		Check whether unusual vibration and noise are generated.
		Check whether the power supply voltage is normal.
		Check whether unusual odor is generated.
		Check whether the air vent is stuck with fiber threads.
Regular inspection	One year	Check whether the fastening parts get loosened.
		Check whether the equipment overheats.
		Check whether the terminal is damaged.
		Check whether the fastening parts of the terminal become loose.
		Check whether the function module is installed properly.
		Check whether the SD card is installed properly.
Regular replacement	3 years	Replace with the backup lithium battery.

1.6.2 Disposal Precautions

⚠ Caution
◆ When disposing of the products, observe any applicable regulations or laws on recycling and reuse of electronic products.

2 Product Information

The HCU control module is the MD880 series AC drive control module. It sends control message to the power module through optical fiber or RS422 communication, and receives the operating parameters uploaded by the power module, the module faults, and operating state. It supports multiple external control modes: User I/O, SOP-20-880 operating panel, fieldbus module, and industrial Ethernet module. It serves as a transfer station for internal information collection, control, and monitoring, as well as external information exchange and control.

The standard terminals of HCU control module contains: DI, HDI, HDO, AI, AO, InoLink communication network (master/slave communication), SOP-20-880 operating panel communication, and safe torque off. At the same time, the SD card is also available as standard to save data to the memory card in real time.

For function expansion, modular design is used. It is equipped with three general slots and one dedicated slot for flexible, quick, and easy expansion of function modules. Function modules supported by the general slot include the fieldbus function module, analog or digital I/O modules, encoder detection modules, and optical fiber expansion modules. The dedicated slot is designed for functional safety function modules.

The HCU control module must be supplied with an external 24 VDC power supply. Multiple isolated power supplies inside the module are available, which provide isolated digital power supply, RS485 master-slave isolation power supply and SOP-20-880 power supply.

2.1 Nameplate and Model

HCU-XX
① ②

Figure 2-1 Model description

①	Product series HCU: MD880 control module	②	Product type 20: Basic rectifier control module 30: Regenerative rectifier control module 40: Active rectifier control module 41: Active rectifier control module (electrical interface) 50S: 2nd generation of inverter control module 51S: 2nd generation of inverter control module (electrical interface) 60: Brake control module 70: Shore power supply control module 80: DC-DC power supply control module 81: DC-DC power supply control module (electrical interface)

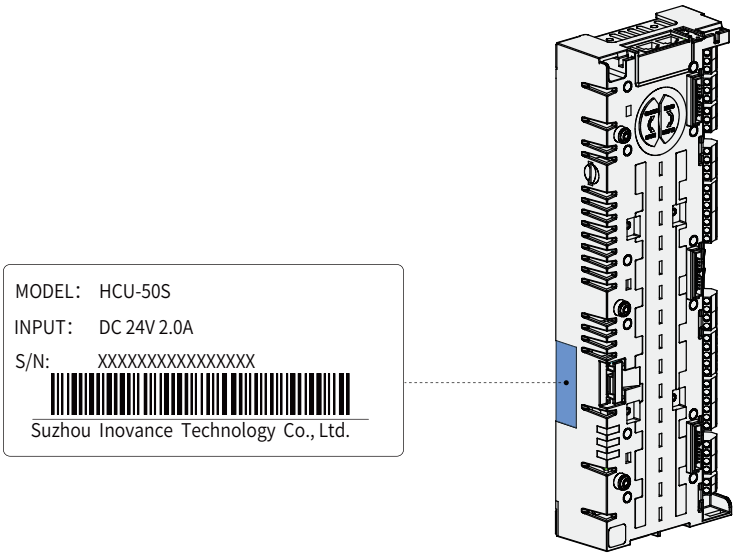


Figure 2-2 Nameplate description

The HCU control module can be divided into the following 12 type based on the interface power module category.

Table 2-1 HCU control unit type

No.	Model	Interface unit	Function
1	HCU-20	Basic rectifier control module	Main contactor/Main circuit breaker, pre-charge contactor control and status inspection, power-on logic control, and basic rectifier module control
2	HCU-30	Regenerative rectifier control module	Main contactor/Main circuit breaker, pre-charge contactor control and status inspection, power-on logic control, regenerative rectifier module control, and energy feedback grid control
3	HCU-40	Active rectifier control module	Main contactor/Main circuit breaker, pre-charge contactor control and status inspection, power-on logic control, active rectifier module output DC bus voltage regulation, and energy feedback grid control
4	HCU-41	Active rectifier control module (electrical interface)	
5	HCU-40+PCS	Active rectifier PCS function control module	
6	HCU-50S	2nd generation of inverter control module	Used to control the inverter power module (H8 model) and 690 V single-drive output to provide a matching voltage and variable frequency for the motor connected. Control and monitoring through user I/O, fieldbus, or industrial Ethernet

No.	Model	Interface unit	Function
7	HCU-51S	2nd generation of inverter control module (electrical interface)	Used to control the output of the inverter power module (H7 model and below) to provide a matching voltage and variable frequency for the motor connected. Control and monitoring through user I/O, fieldbus, or industrial Ethernet
8	HCU-50S-CS	CS model control module	Used to control the output of the CS module and 400 V single-drive module (T10 to T12 models).
9	HCU-51S-CS	CS model control module (electrical interface)	Used to control the output of the CS module and 400 V single-drive module (T9 and below).
10	HCU-60	Three-phase braking control module	Used to control the output of the three-phase braking module and adjust the DC bus voltage to the set value.
11	HCU-70	Shore power supply control module	Used to control the output of the shore power inverter module.
12	HCU-80	DC-DC power supply control module	Used to control the output of the DC/DC power supply module.
13	HCU-81	DC-DC power supply control module (electrical interface)	Used to control the output of DC-DC power supply module (H3 to H7 models).

2.2 Dimension Drawing

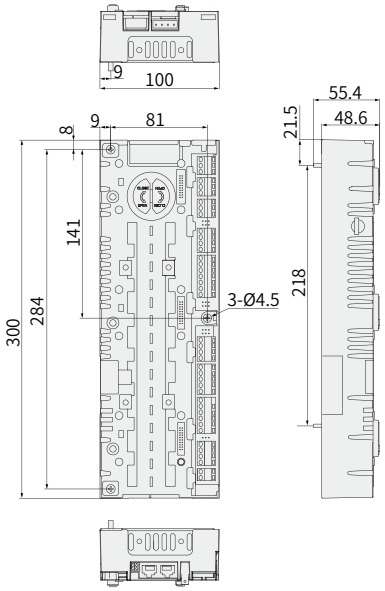


Figure 2-3 Dimensions of the HCU control unit (mm)

2.3 Components of the HCU Control Unit

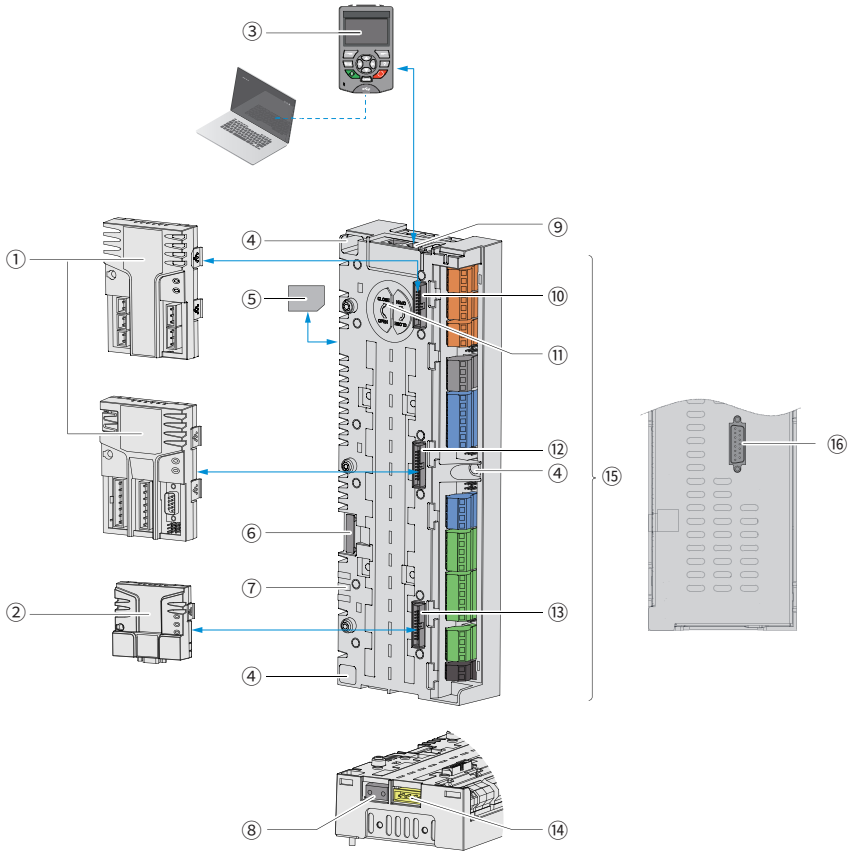


Figure 2-4 Components of HCU control unit

Table 2-2 Components of HCU control unit

Mark	Name	Function
①	Function module in size 1	105 mm x 73 mm x 24 mm function module
②	Function module in size 2	75 mm x 73 mm x 24 mm function module
③	Smart operating panel	SOP-20-880
④	Fixing hole	Three holes for fixing the HCU
⑤	SD card	Standard pluggable micro memory card for the HCU with the capacity of 8 GB
⑥	Functional safety slot	For connection of functional safety modules

Mark	Name	Function
⑦	Indicator	Power supply, operation, and fault indicators
⑧	Optical fiber communication	Optical fiber communication interface between the HCU and the power unit
⑨	Smart operating panel	Used to connect HCU to SOP-20-880. The two terminals are both RJ45 ports, which are identical and easy to be cascaded.
⑩	SLOT1	Function module interface: SLOT1_1, SLOT1_2 and SLOT1_3
⑪	Battery replacement cover	Spare RTC battery cover. The RTC battery is non-rechargeable lithium battery which must be replaced regularly.
⑫	SLOT2	Function module interface: SLOT2_1, SLOT2_2, SLOT2_3
⑬	SLOT3	Function module interface: SLOT3_1
⑭	STO terminal	STO input terminal (determined based on the actual model)
⑮	User terminal	HCU standard user I/O terminal
⑯	DB15 terminal	Communication terminal between HCU-51S and power module



NOTE

- Note 1: For detailed user terminals, see section 2.3.1. For wiring of each terminal, see Chapter 4.
- Note 2: For use of the slot, see section 2.3.2.
- Note 3: For use of LED indicators, see section 2.3.3.

2.3.1 Standard Terminals

Table 2-3 Description of standard HCU terminals

Name	Terminal	Description
Input power supply	XPWR: 24 VI	HCU power supply
Digital output power supply	XDPWR: 24 VD	Digital output power supply that isolated from XPWR
Digital Input	XDI: DI1–DI6, DIL	Input type: relay contact, NPN or PNP
High-speed digital input	XHDIO: HDI1, HDI2	Input type: NPN or PNP
High-speed digital output	XHDIO: HDO1, HDO2	Output type: open collector
Analog output	XAO: AO1, AO2	Output type: current or voltage, selected by jumper
Analog input	XAI: AI1, AI2	Input type: current or voltage, selected by jumper

Name	Terminal	Description
Relay output	XRO1, XRO2, XRO3	Relay output: NO, NC and COM No NC contact for CS model or single-drive XRO3
InoLink communication	XCOMM	High-speed RS485, with termination resistor selected by jumper
RJ45 terminal	X11, X12	RJ45 terminal to cascade multiple HCU modules Cable < 3 m
Safe Torque Off (STO)	XSTO	Provides 24 V power supply for the functional safety contact, with two functional safety contact inputs Products that support STO: (multi-drive: CS model; single-drive: 690 V air-cooled; water-cooled inverter products)
Inodrive communication	Optical fiber or DB15	Optical interface: Optical fiber; electrical interface: DB15
SD card	SD	Self-eject card holder, SD card capacity: 8 G
RTC battery	BAT	Replace the non-rechargeable lithium battery regularly.

2.3.2 Function Modules and Units

HCU can be used with other function modules to expand its functions. See the following for details.

Table 2-4 Function modules used with HCU

No.	Name	Module model	Function	Connection with HCU	Dimension (mm)
1	Encoder detection module	HPG-10	HTL incremental differential, single-ended, OC or OE encoder detection, frequency-division output	Slot	105 x 73 x 24
		HPG-40	Resolver encoder signal detection module	Slot	105 x 73 x 24
		HPG-50	TTL incremental OC or differential encoder detection, frequency-division output	Slot	105 x 73 x 24
2	I/O module	HIO-10	Two AIs Two AOs Two DIOs One relay output	Slot	105 x 73 x 24
3	PROFIBUS-DP module	HDP-10	PROFIBUS-DP bus adapter	Slot	75 x 73 x 24

No.	Name	Module model	Function	Connection with HCU	Dimension (mm)
4	CAN bus module	HCAN-10	CANopen bus adapter	Slot	75 x 73 x 24
		HCAN-30	CAN2.0 fieldbus adapter	Slot	75 x 73 x 24
5	Optical fiber expansion module	HOFM-10	One pair of 50 M optical fibers	Slot	75 x 73 x 24
		HOFM-30	Three pairs of 50 M optical fibers	Slot	75 x 73 x 24
6	Modbus-RTU module	HMBA-10	Modbus RTU bus adapter	Slot	75 x 73 x 24
7	EtherCAT Module	HETC-10	EtherCAT bus adapter	Slot	75 x 73 x 24
8	Ethernet module	HETN-10	Ethernet commissioning module	Slot	75 x 73 x 24
9	PROFINET I/O module	HPFN-10	PROFINET I/O industrial Ethernet adapter	Slot	75 x 73 x 24
		HPFN-20	PROFINET IRT industrial Ethernet adapter	Slot	75 x 73 x 24
10	Modbus TCP Module	HMBT-10	Modbus TCP industrial Ethernet adapter	Slot	75 x 73 x 24
11	Parallel control module	HPCU-40	Two to four paralleled modules supported	Optical fiber	232 x 86 x 40
		HPCU-60	Two to six paralleled modules supported	Optical fiber	232 x 86 x 40
		HPCU-A0	2 to 10 paralleled modules supported	Optical fiber	232 x 86 x 40
12	Function expansion module	HESD-10	Expansion of one slot	Optical fiber	105 x 75 x 70
13	Synchronous voltage detection module	HSVM-10	Three-phase AC input voltage detection	Optical fiber	150 x 100 x 30
		HSVM-20	DC voltage detection module (supports one voltage channel and two current channels)	Optical fiber	150 x 100 x 30
14	Digital gateway commissioning monitoring module	HGW-10	Centralized commissioning and operation data collection supported	Network cable	180 x 100 x 50
15	Smart operating panel	SOP-20-880	HMI operating panel	Network cable	73 x 125 x 25
16	Optical fiber routing control module	HOFR-50	Supports data exchange among two to five HCU control modules	Optical fiber	232 x 86 x 40

2.3.3 LED Indicators

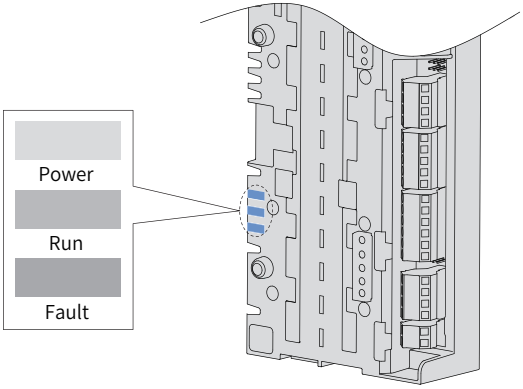


Figure 2-5 Location and definition of the LED indicator

Table 2-5 Descriptions of the LED indicator

No.	Name	Status	Function
1	Power	Solid ON	The HCU power supply is normal.
		OFF	The HCU is not energized or the power supply is faulty.
2	Run	Solid ON	Power module running
		OFF	Power module stopped
3	Fault	Solid red	System fault
		Solid yellow	System alarm
		OFF	System OK
		Flashing in red	HCU auxiliary power supply fault (Check whether the 24 V power supply is short-circuited or overloaded.)
4	Fault, Run	Flashing in yellow (FAULT) and green (RUN) simultaneously	This HCU is selected by the PC or SOP-20-880, which ends after 10s.
		Flashing alternately in red (FAULT) and green (RUN)	The FPGA of the HCU is abnormal or the external expansion RAM is abnormal.

2.3.4 SD Memory Card

The HCU is internally equipped with a SD card for the black box data and parameters, which helps facilitate monitoring and analysis on power modules. The data is saved on a microSD memory card to be analyzed by a qualified service technician.

2.4 General Specifications

Table 2-6 General specifications of HCU control unit

Item	Description
Ambient temperature	-10°C to +55°C
Storage temperature	-40°C to +70°C
Relative humidity	5% to 95% (no condensation)
Operating environment	Free from corrosive gases
Installation altitude	⩽ 2000 m
Mounting mode	Backplate mounting
Vibration	< 20 Hz: 9.8 m/s^2 (1 g) 20 Hz to 50 Hz: 5.9 m/s^2 (0.6 g)
IP rating	IP10 IEC/EN 60529
	Overvoltage category II IEC 60664-1
	IP rating: I IEC/EN 61800-5-1
Applicable standards	EN 61800-5-1:2007 EN 61800-3:2004 IEC/EN 62109-1:2010 UL508C:2002

2.5 System Connection Example

The HCU control unit, power unit, and function module can be used to form multiple control systems. The following describes several typical application cases.

2.5.1 Example 1

System components: two basic paralleled rectifiers + two paralleled inverters
The block diagram for control systems comprised of HCU-20 and HCU-50 is shown below.

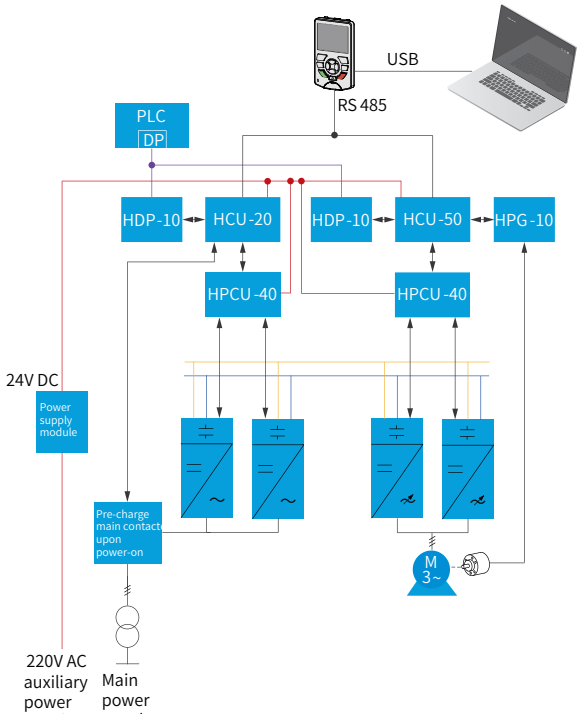


Figure 2-6 HCU system block diagram example 1

2.5.2 Example 2

System components: two paralleled active rectifiers + two paralleled inverters + one inverter

The block diagram for control systems comprised of HCU-40 and HCU-50 is shown below.

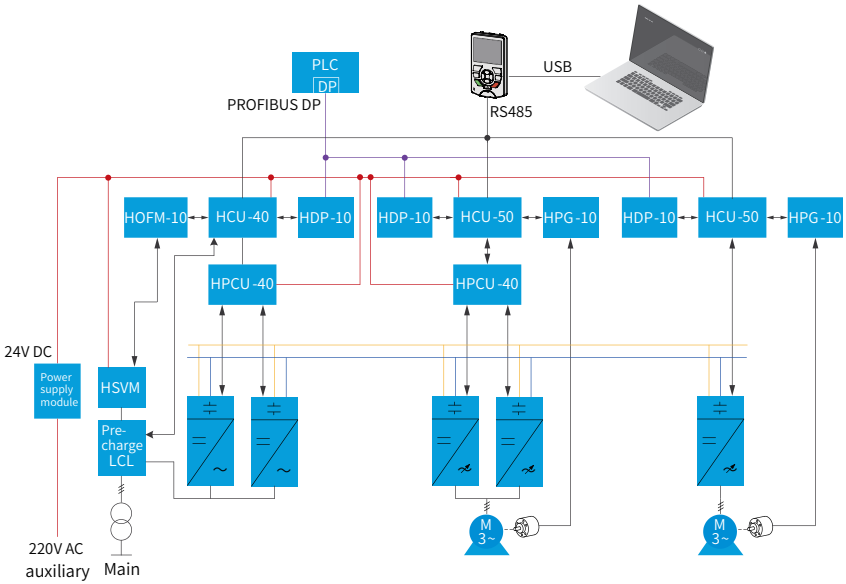


Figure 2-7 HCU system block diagram example 2

2.5.3 Example 3

System components: two active rectifiers (phase-shifting transformers provide power to two active rectifiers) + two paralleled inverters + one inverter

The block diagram for control systems comprised of HCU-40 and HCU-50 is shown below.

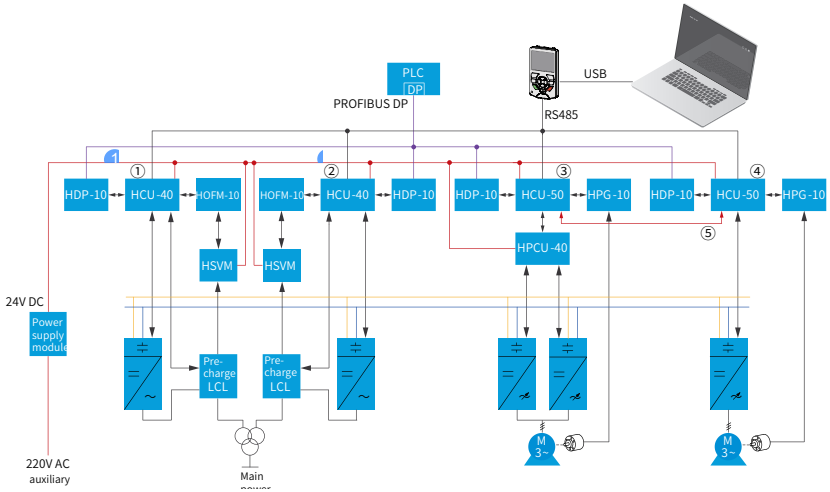


Figure 2-8 HCU system block diagram example 3

- HPCU: Power expansion unit that used in systems requiring power units to be used in parallel
  It communicates with the HCU through optical fiber. Up to 10 pairs of optical fibers can be connected to the power unit.
- HPG-10: HTL encoder signal detection module that used to detect the encoder signals
  It is installed directly in the slot of the HCU control unit and is powered by the HCU.
- SOP-20- 880: Smart operating panel that used in local control on the HC
  The operating panel is connected to the PC through RS485 bus and HCU interface. It is powered up by the HCU and can be used to set parameters, save/download data, and manage programs. For details, see section 5.6.
- HOFM: Optical fiber expansion module that installed directly in the slot of the HCU control unit
  It is powered up by the HCU and can be extended to three pairs of optical fiber to enable HCU master and slave communication, and function module expansion.
- HSVM: Input voltage detection unit that powered up by an external 24 V power supply
  It is used in energy feedback systems to detect three-phase input AC voltage. It communicates with the HCU through optical fiber. For details, see section 5.1.2.
- HDP-10: PROFIBUS-DP bus adapter module that used to communicate with the PLC module of the master
  It is installed directly in the slot of the HCU control unit and powered by the HCU.
- PLC: PLC module that used as PROFIBUS-DP master



NOTE

- Note 1: One HCU can be configured with one SOP-20-880. One SOP-20to 880 can be shared by multiple HCUs. One SOP-20-880can carry multiple HCU topologies, with the SOP-20-880as the master and HCU as the slave.
- Note 2: When two HCUs need master-slave communication, such as ⑤ in example 3, you can use the InoLink communication network circuit of the HCU and RS485 terminal of XCOMM master-slave communication (For wiring details, see section 4.8. For master-slave communication applications, see section 5.3 or use optical fibers. In one-to-multiple communication mode, one HCU must be set as the master and the others as the slaves.
- Note 3: The HCU control unit is equipped with three slots as standard. When the system needs to expand more than three function modules, This can be done through the HESD function module (for details, see section 5.1.3.).
- Note 4: In the example, the PROFIBUS-DP bus is used for networking. You can also select various networking modes such as PROFINET and EtherCAT.
- Note 5: The HTL encoder detection module is used as an example. Depending on the system, you can select the resolver signal detection module, sine/cosine encoder detection module, or TTL encoder detection module.

2.5.4 Example 4

The HGW-10 digital gateway module enables centralized drive commissioning and data collection. The basic data path is: AC drive -> Digital gateway -> User PC -> Commissioning software (InoDriveStudio). Remote local area network can be set up using Inovance IOT430DE module or third-party IoT module to enable remote commissioning and maintenance. For details, see the HGW-10 Digital Gateway Commissioning and Monitoring Module User Guide. The following figure shows the typical application topology.

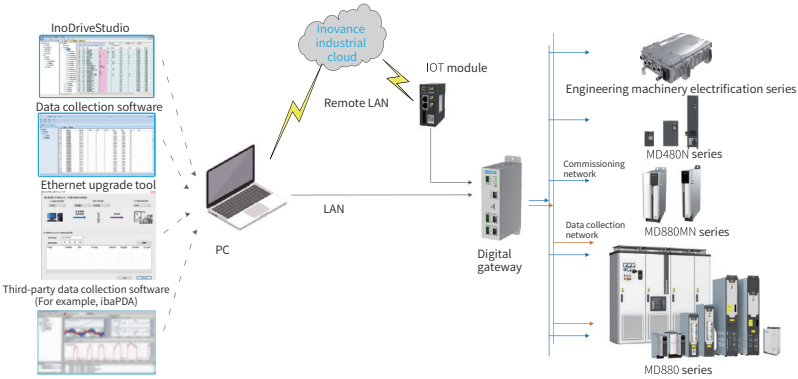


Figure 2-9 HCU system block diagram example 4

3 Installation

3.1 Installation Precautions

3.1.1 Installation Environment

- Ambient temperature: The service life of the HCU control unit is closely related to the ambient temperature. The operating temperature of the control unit ranges from –10° C to +55° C.
- Install the HCU control unit to a flame-retardant surface, with sufficient clearance reserved for heat dissipation. HCU control unit generates heat during operation.
- Install the HCU control unit in a place with minimum vibration (vibration level ⩽ 0.6 g) and meets the following requirement.
  1. Away from equipment which may generate strong vibration, such as punch presses.
  2. Free from direct sunlight, high humidity and condensation.
  3. Free from corrosive, inflammable, or explosive gases.
  4.Free from greasy dirt or dust.
- The HCU control unit must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.

3.1.2 Installation Tools and Tightening Torque

1) Tools needed

The following tools are required for installation.

- #1 or #2 cross head screwdriver
- #1 or #2 straight screwdriver

2) Tightening torque for screws and screw fasteners

The screws and screw fasteners mentioned in this user guide must be installed according to the tightening torque listed below.

Table 3-1 Tightening torque for grounding screws, protective grounding screws, and mounting screws of the control cabinet

Thread	Grounding terminals, protective grounding terminals and steel-made terminals (able to conduct fault current)	Plastic case current busbar (able to conduct operating current)
M2.5	0.8 N·m	0.6 N·m
M3	1.25 N·m	0.8 N·m
M4	2.9 N·m	1.8 N·m
M5	5.5 N·m	2.5 N·m

Thread	Grounding terminals, protective grounding terminals and steel-made terminals (able to conduct fault current)	Plastic case current busbar (able to conduct operating current)
M6	9.5 N · m	5.5 N · m
M8	20 N · m	10.5 N · m
M10	45 N · m	20 N · m
M12	80 N · m	45 N · m



NOTE

◆ The screws on the transparent protective cover made from polycarbonate matrix composite can only be tightened with 1.2 N · m.

3.1.3 Installation Precautions

- Before installation, ensure that the controller has been powered off.
- To avoid damage to the module, do not drop or strike on the module enclosure, terminal block, or connector.
- Do not disassemble the module. Otherwise the machine may be damaged.
- Do not fasten with excessive torque to avoid damage to the terminal.

3.1.4 Installation Clearance and Requirements

To facilitate the installation of the HCU module, keep the following clearance among the building, components, and upper/lower parts of the HCU module.

The HCU module must be installed to a conductive metal surface, with the entire conductive bottom of the HCU in good contact with the mounting surface.

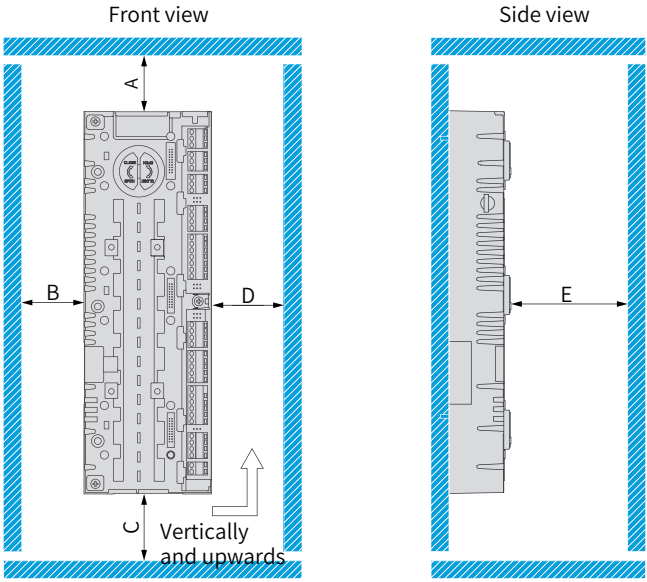


Figure 3-1 Requirements on the mounting clearance

Table 3-2 Installation clearance (unit: mm)

A	B	C	D	E
⩾ 100	⩾ 30	⩾ 100	⩾ 50	⩾ 100

3.2 Installation Method

3.2.1 Installing the HCU

1) Preparation

- Observe the "Five Safety Rules".
- Switch off the power supply of the cabinet (including the external power supply) and wait for more than 15 min.
- Check that the HCU module is installed without hindrance.

2) Unpacking and delivery inspection

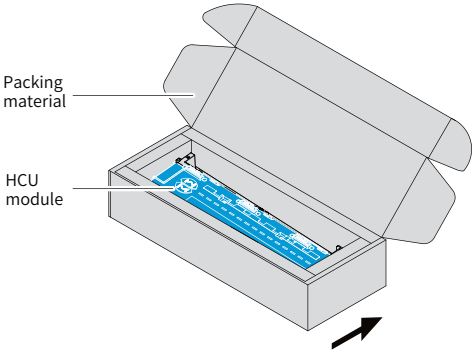


Figure 3-2 Layout of module package

Unpack the module in the following steps:

- Step 1: Unpack the HCU carton box.
- Step 2: Check whether all items are present without signs of damage.
- Step 3: Read the HCU control unit nameplate to check whether the model is correct.

1) Installation

- Step 1: Align the HCU vertically with the two positioning holes on the metal mounting plate.
- Step 2: Tighten the HCU mounting screws (three M4 screws) with a #2 Phillips screwdriver as shown below.

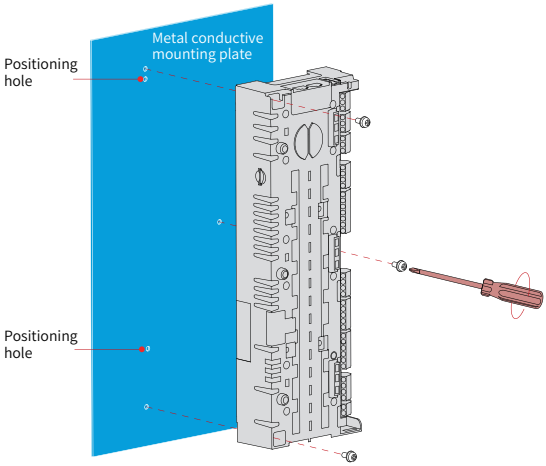


Figure 3-3 Installing the HCU

2) Grounding inside the cabinet

The mounting plate of the HCU must be a bare metal plate and reliably grounded.

The HCU enclosure is grounded to the cabinet enclosure through the screws on the mounting surface.

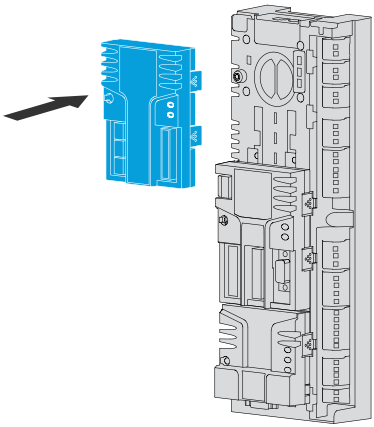
3.2.2 Installing/Disassembling the Function Module

1) Preparation

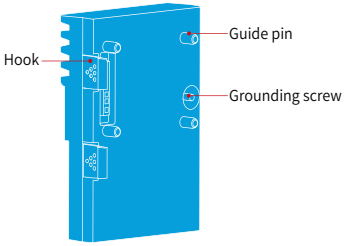
- Observe the "Five Safety Rules".
- Switch off the power supply of the cabinets (including external power supply) and wait for more than 15 min.
- Check that the function module is installed without hindrance.

2) Installing the function module in size 1

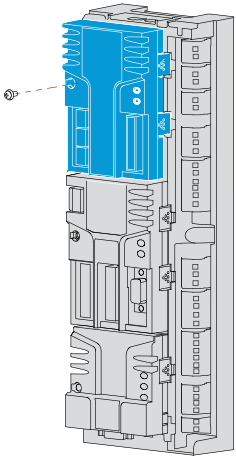
Step 1: Place the function module to the corresponding position of slot 1 of the control unit.



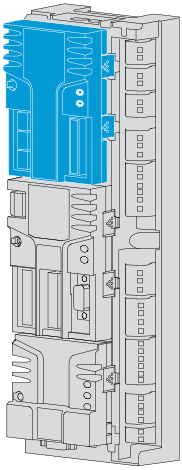
Step 2: Push the function module into the slot through the four guide pins and the two snap-fit joints that need to be pushed inwards.



Step 3: Tighten the grounding screw of the function module with a #1 Phillips screwdriver.



Step 4: The installation is done.



NOTE

- Note 1: To meet EMC requirements and guarantee reliable operation of the module, tighten the screws to ensure reliable grounding.
- Note 2: The HCU and the function module are electrically connected through the slot. Ensure that they are installed in place and electrically connected effectively.
- Note 3: Do not install or remove the function module with power ON. Failure to comply may damage the HCU or the function module.

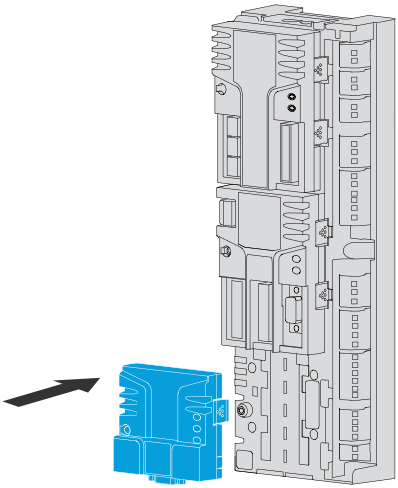
3) Removing the function module in size 1

Observe the preceding procedure, but in the reverse order.

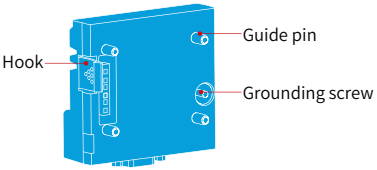
- Step 1: Remove the grounding screw of HPFN-10 module with a #1 Phillips screwdriver.
- Step 2: Press the fixing hook on the right side of function module inwards and pull it out.
- Step 3: Keep the function module removed in a proper place.

4) Installing the function module in size 2

Step 1: Place the function module in the corresponding position of slot 3 of the control unit.



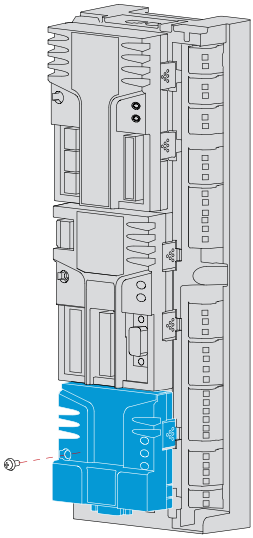
Place the function module into the slot with the aid of four guide posts, as shown below.



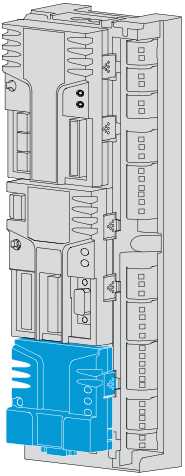
NOTE

◆ The HDP-10 function module can only be installed in the SLOT3 slot.

Step 3: Tighten the grounding screw of the function module with a #1 Phillips screwdriver.



Step 4: The installation is done.



NOTE

- Note 1: To meet EMC requirements and guarantee reliable operation of the module, tighten the screws to ensure reliable grounding.
- Note 2: The HCU and the function module are electrically connected through the slot. Ensure that they are installed in place and electrically connected effectively.

5) Removing the function module in size 2

Observe the preceding procedure, but in the reverse order.

Step 1: Remove the grounding screw of the function module with a #1 Phillips screwdriver.

Step 2: Press the fixing hook on the right side of function module inwards and pull it out.

Step 3: Keep the function module removed in a proper place.

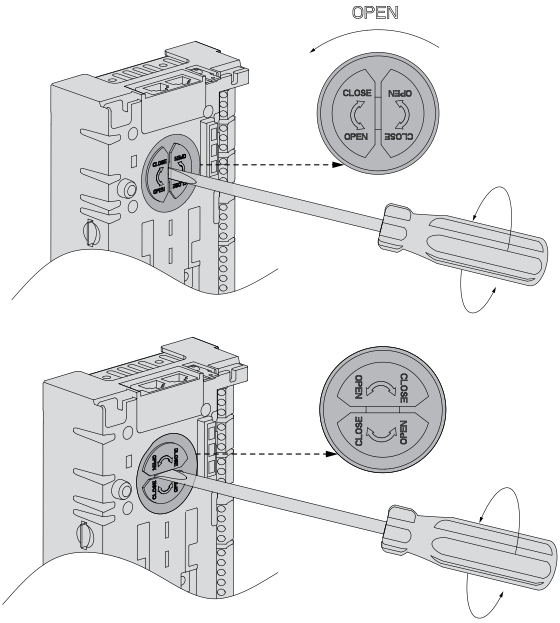
3.2.3 Replacing the Battery

1) Preparation

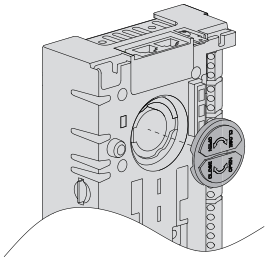
- Observe the "Five Safety Rules".
- Switch off the power supply of the cabinets (including external power supply).
- Check that the HCU control unit battery is replaced without hindrance.

2) Installation and Disassembly

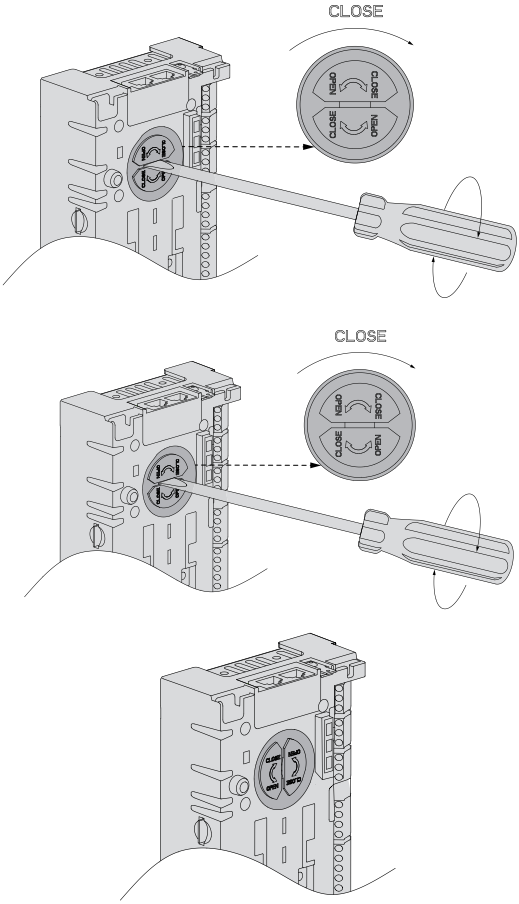
Step 1: Turn the battery cover 90° counterclockwise with a #2 straight screwdriver until the cover is released.



Step 2: Remove the cover and replace the battery.



Step 3: Put the cover back and turn it 90° clockwise to secure it.



Step 4: Dispose of retired batteries in accordance with local rules or applicable laws.

3.2.4 Removing/Installing the SD Card

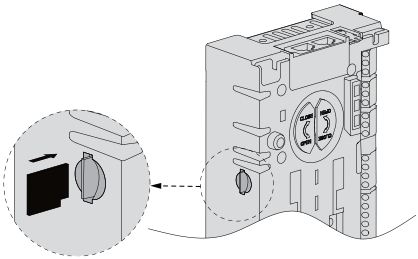
1) Preparation

- Observe the "Five Safety Rules".
- Switch off the power supply of the cabinets (including external power supply).
- Check that the SD memory card is installed without hindrance.

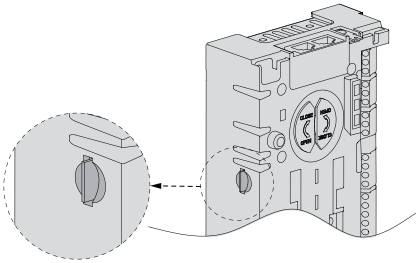
DANGER	
	◆ Ensure that the HCU control unit is voltage-free when the memory card is being inserted. Failure to comply may result in data loss or even equipment malfunction. ◆ Ensure that you insert the SD card according to the following procedure. ◆ The SD card is an electrostatic sensitive component. Therefore, ensure that the ESD protection rules are observed when you insert/ pull out the SD card.

2) Installation

Step 1: Push the SD memory card into the card slot in the direction shown below.



Step 2: Ensure that the SD memory card is pushed in place. Otherwise, an exception will occur due to poor contact.



3) Disassembly

Press the SD memory card once to eject it and pull it straight out.

4 Wiring

Precautions
◆ All covers removed while the cables are routed must be re-installed before the cabinet module is commissioned. ◆ When routing cables, do not change the internal cabinet wiring. ◆ Fix the shield of the shielded cable to the shield plate and connect the PE cable to the PE bus. ◆ Only professionals are allowed to perform operations and they must read and comply with the safety information provided in this user guide. ◆ When carrying out any kind of work on electrical devices, the following "five safety rules" must always be observed: ① Power off the device. ② Make sure that power supply will not be connected again. ③ Make sure that the equipment is de-energized, without any residual voltage. ④ Make sure that the equipment is reliably grounded. ⑤ Cover or isolate the adjacent components that are still live.

4.1 Routing Requirements and Preparation

4.1.1 Routing Requirements

1) Routing clearance

Low-voltage cables (< 1 kV) are generally divided into four types. Only cables of the same type can be bundled together. Cables of different types must be separated without cross-connection or overlap. If cross-connection cannot be avoided, make them cross-connected at 90 degrees.

Keep a proper clearance between different types of cables. For cables shorter than 30 m, the minimum clearance allowed is shown in the figure below. If two cables run parallel for an extended length, increase the clearance accordingly. You can also install spliced shield plates between different types of cables. To reduce mutual interference, route all cables as closely as possible to the grounded structure components of the cabinet. For example, the mounting plate or rack components of the cabinet.

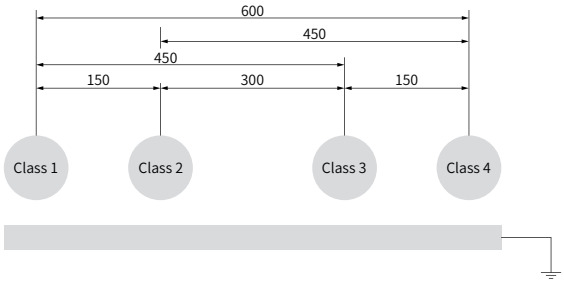


Figure 4-1 Required clearance between different types of cables (mm)

NOTE

- Type 1: Ethernet
- Type 2: Low-speed digital communication signals (RS232, RS485, and CAN) and DI/DO signals
- Type 3: Low-voltage AC power distribution cables (such as PLC 220 V AC power supply cables) or DC power supply cables (such as 24 VDC power supply cable with switched-mode power supply)
- Type 4: Input and output cables, welding machine cables, and power converter power cables

2) Requirements on routing of disturbed signal cables

Route high-current cables (power supply input, inverter output, and braking resistor cables) at least 50 cm away from analog signal cables, high-speed communication cables, critical signal feedback cables, and signal cables that may be easily disturbed. Comply with the preceding wiring requirements even in the control cabinet.

Use shielded twisted pair cables for disturbed signal cables. When stripping the sheath of the cable, keep the stripped part as short as possible (5 mm to 7 mm), and wrap the stripped shield with the insulating tape to prevent the shielded cable from contacting other devices which causes interference.

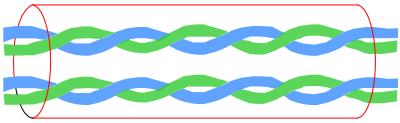


Figure 4-2 Shielded twisted pair cable

3) Cable routing position

Route cables that used to transmit different types of signals through different routes. Separate disturbing cables from disturbed cables with a minimum clearance of 30 cm wherever possible. When these two types of cables must be cross-connected, they must be cross-connected at 90 degrees to avoid interference.

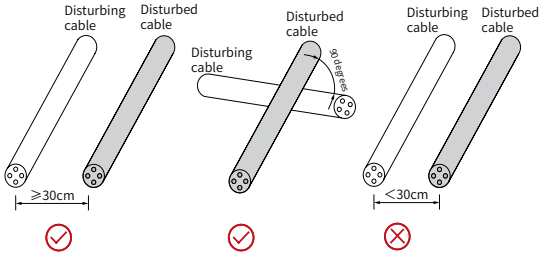


Figure 4-3 Routing of disturbing cables and disturbed cables

4) Signal circuit area requirements

For cables that transmit low-level sensor signals and relay signals that have shared cables, lay them as close to each other as possible to avoid large loop area. Use twisted pair cables for analog signals. Lay digital signal cables as close to each other as possible.

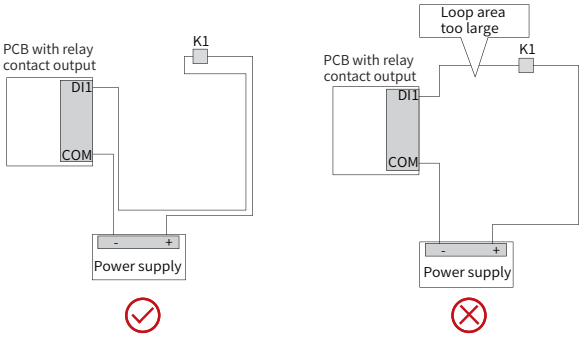


Figure 4-4 Close routing diagram

5) Requirements on handing of shielded cables

Keep the length of the unshielded cable part as short as possible, and fix the shield to the fixing point that is nearest to the HCU wiring terminal. An excessively long stripped part can make the cable susceptible to interference. This is especially true for encoder signals.

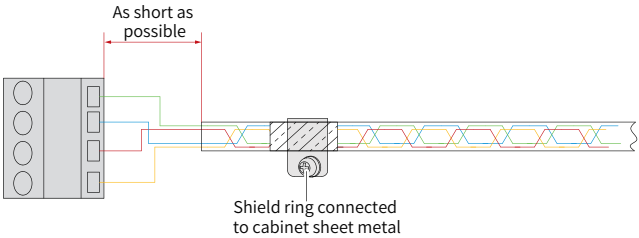


Figure 4-5 Connection of shielded cables

a. Requirements for fixing the shield of the shielded cable

The shield of the shielded cable that connected to HCU must be in large-area contact with the shield plate in the cabinet to achieve good EMC effect. The following figure shows the mounting mode.

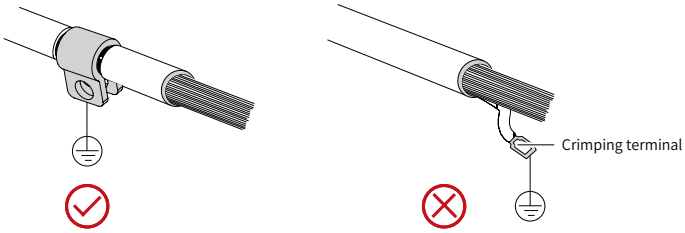


Figure 4-6 Connection requirements on shielded cables

b. Grounding requirements on shielded cables

Ground the shielded cable as close to the HCU module as possible so that the cable is not disturbed by electromagnetic induction. For a stripped shielded cable, the exposed shield must be in large-area contact with the conductive backplate ensure good contact.

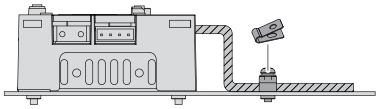


Figure 4-7 Grounding the shielded cable

The analog signal is grounded at one end only near the module side.

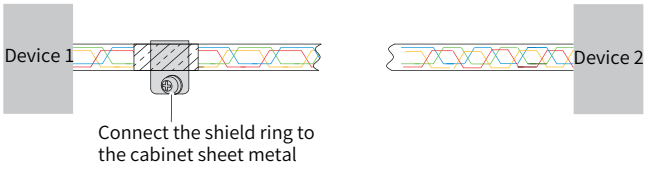


Figure 4-8 Single-end grounding

The shielded cables for high-speed I/O, fieldbus, and communication signal must be grounded at both ends.

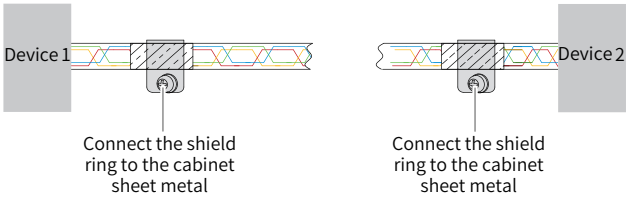


Figure 4-9 Double-end grounding

6) Grounding the module

Install the HCU module on a conductive backplate according to the following figure. Apply proper contact protection on the screws that used to secure the backplate.

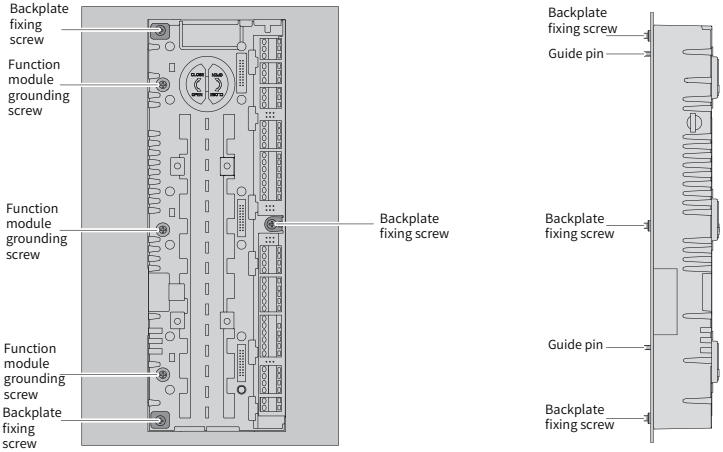


Figure 4-10 Mounting the conductive backplate of the HCU module

4.1.2 Wiring Requirements for InoLink Communication Network

1) Wiring requirements for the InoLink communication network

It is recommended to use a shielded twisted pair cable for the InoLink communication network. Used twisted pairs for C485+ and C485-. Connect a 120 Ω termination resistor to both ends of the bus to prevent signal reflection. Connect the RS485 signal reference grounds of all nodes together. Up to 16 nodes can be connected and the distance between branches must be shorter than 3 m.

2) Multi-node connection mode

It is recommended to use the hand-in-hand connection mode for the InoLink communication network with excessive number of nodes. If branches needs to be connected, keep the branch line as short as possible (not exceeding 3 m). The star connection is forbidden.

a. Recommended: Hand-in-and connection structure

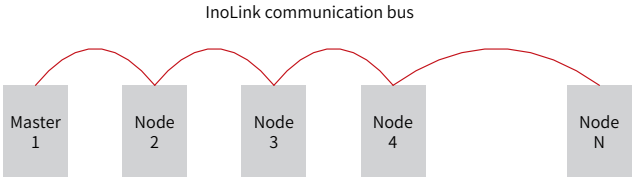


Figure 4-11 Hand-in-hand connection mode

b. Accepted: Branch connection structure

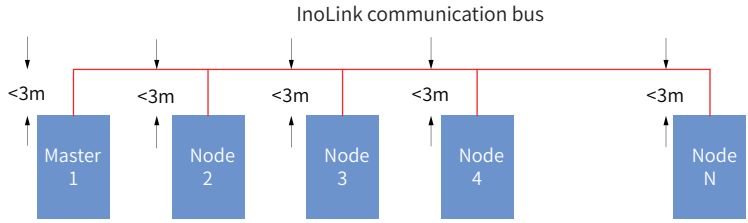


Figure 4-12 Branch line connection

c. Incorrect: Star connection structure

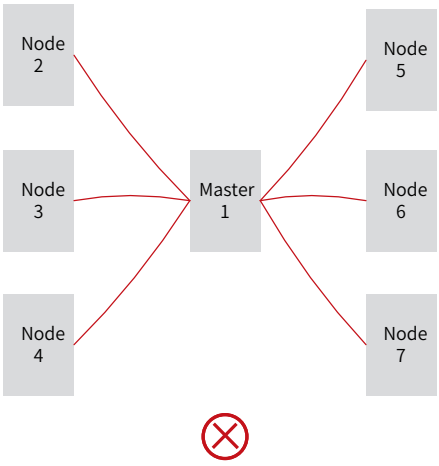


Figure 4-13 Star connection mode

3) Cable processing requirements

Due to cable attenuation, use AGW26 or thicker cables if the connection length is longer than 3 m. Always use twisted pair cables to connect 485+ and 485–.

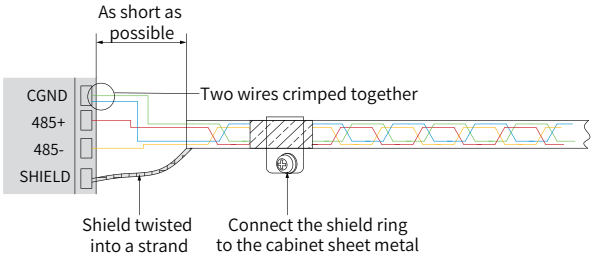


Figure 4-14 Cable processing requirements:

4) Routing distance of InoLink communication network cables

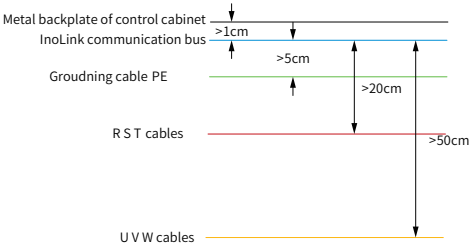


Figure 4-15 Routing requirements

NOTE

- Note 1: The distance between the InoLink communication network cable and high-current cable must be at least 20 cm.
- Note 2: The distance between the InoLink communication network cable and U, V, W motor cables must be at least 50 cm.
- Note 3: The distance between the InoLink communication network cable and grounding cable must be at least 5 cm.
- Note 4: The distance between the InoLink communication network cable and the backplate of the metal cabinet must be at least 1 cm.

4.1.3 Cable Selection

Cable manufacturers can adjust the cable according to their needs, but the following technical requirements must be met.

- The maximum allowable operating temperature of the conductor is above 75°C .
- The low temperature tolerance cannot be lower than -20°C .
- The rated operating voltage at mains frequency is above 300 V.
- The minimum cross-sectional area cannot be lower than 0.5 mm^2. The maximum allowable cross-sectional area of HCU terminals cannot exceed 2.5 mm^2.
- Multi-conductor (copper) cables
- The flame retardant performance of the cable meets the requirements of Class A, Class B, and Class C in GB/T19666-2005.

1) Shield

Use shielded cables for high-speed I/O, analog I/O, fieldbus, and communication signals.

2) Signals in separate cables

Route the analog signals and digital signals through different routes. Use separate shielded cables for different analog signals and digital signals, Do not use the same common return line. Do not use the same cable for 24 VDC and 115/230 VAC.

3) Control panel cable length and type

The length of the cable connecting the control panel to the HCU cannot exceed 3 m. The length of the cable between the two cascaded HCUs cannot exceed 3 m.

Cable type: Shielded CAT 5e or better Ethernet connection cable with RJ45 port

4.1.4 Preparations

Before wiring or connecting HCU cables, make sure that the following safety measures have been taken.

- Power off the cabinet equipment for more than 15 minutes, including the auxiliary power supply.
- Obey the "Five Safety Rules".

Preparation of tools and materials:

- #1 straight screwdriver
- Wire stripper
- Crimping tool
- Wire cutter
- Recommended cables and crimping terminals

4.1.5 Installing Optical Fibers and Cables

1) Requirements and installation of optical fiber components

a. Specifications and model selection

Optical fiber specifications are as follows:

- Optical fiber material: POF and PCS®
- Storage temperature: -55° C to +85° C
- Installation temperature: -20° C to +70° C
- Maximum short-term tension: 50 N
- Minimum short-term bending radius: 25 mm
- Minimum long-term bending radius: 35 mm
- Maximum long-term tension load: 1 N
- Deflection times: 1000 max.

Plastic optical fiber (POF) can be used for 10 MBd optical fiber components. Hard Clad Silica (PCS®) can also be used for 10 MBd components, which allows for longer

connection distances due to lower attenuation.

The maximum length of POF and PCS® fiber optic links is 45 m and 200 m respectively at 10 MBd communication speed.

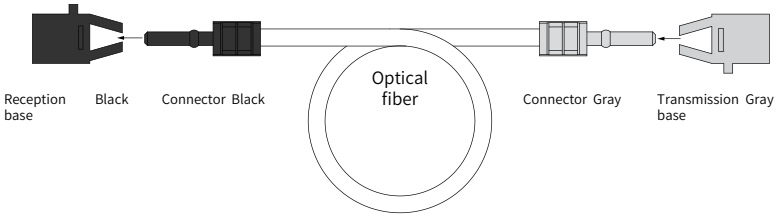


Figure 4-16 Appearance of the optical fiber

2) Cable pin specifications

The terminals of the control unit must meet the protection requirements of the ultra-low voltage (PELV). Therefore, the voltage connected to the relay output cannot exceed 48 V. The specifications of the cable pins used are as follows.

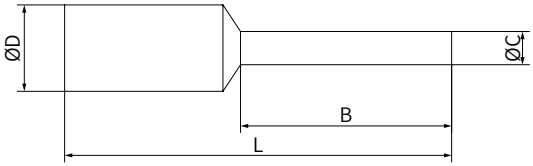


Figure 4-17 Dimensions of the cable pins

b. Optical fiber transceiver

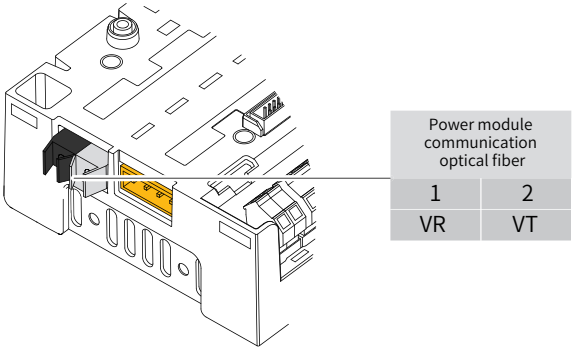


Figure 4-18 Position of optical fiber terminal and pin assignment

Table 4-1 Power module communication optical fiber

Terminal	Name	Function	Color	Technical data
1	VR	Reception	Black	Communication speed: 10 Mbps Communication protocol: Inodrive
2	VT	Transmission	Gray	

Inovance MD880 and HE200/300 products generally use the Versatile Link series 50 MBd (MBd) optical fiber components from Avago Technologies.

The optical fiber component model is not related to the actual communication speed. The actual communication rate of the 50 MBd optical fiber component is 10 MBd.

c. Installing the optical fiber

Take enough care when handling with optical fibers. When removing the optical fiber cable, pull the connector, not the cable itself. Since the optical fiber cable is extremely sensitive to dirt, do not touch the end of the cable with bare hands.

To ensure correct optical fiber assembly, install the gray optical fiber head to the gray transmission base, and install the black optical fiber head to the black reception base.

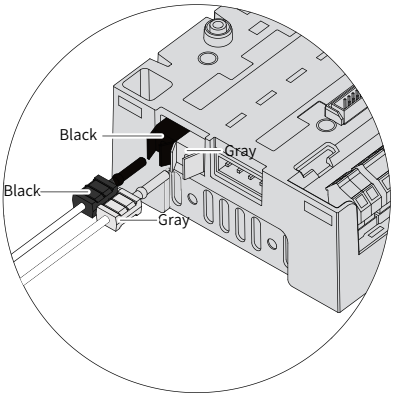


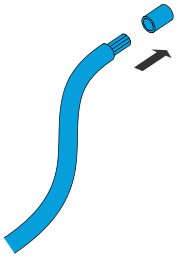
Figure 4-19 Installing the optical fiber

Table 4-2 Cable pin specifications

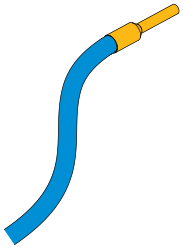
Applicable cable specifications	L±1.0	B±0.5	ϕC	ϕD
0.5 mm^2	12 mm	6 mm	1.0 mm	2.6 mm
1.0 mm^2	14 mm	8 mm	1.8 mm	3.0 mm
1.5 mm^2	14 mm	8 mm	1.7 mm	3.5 mm
2.5 mm^2	16 mm	10 mm	2.2 mm	4.2 mm

4) Procedure for installing cables

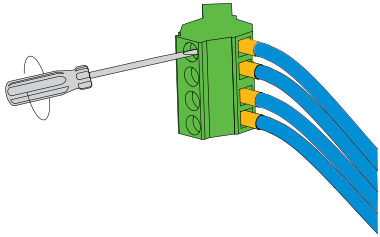
Step 1: Strip the insulation of the cable.



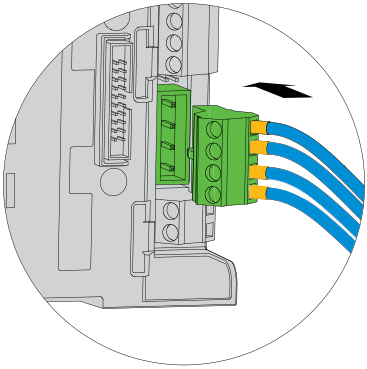
Step 2: Install the cable pin to the cable with the insulation removed.



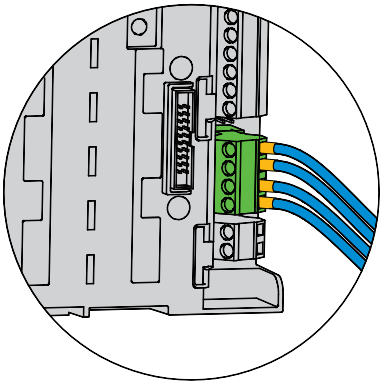
Step 3: Connect the cable with pins to the terminal block.



Step 4: Insert the wired terminal block to the HCU terminal socket.



Step 5: Complete the wiring.



4.2 Overview of HCU Interfaces

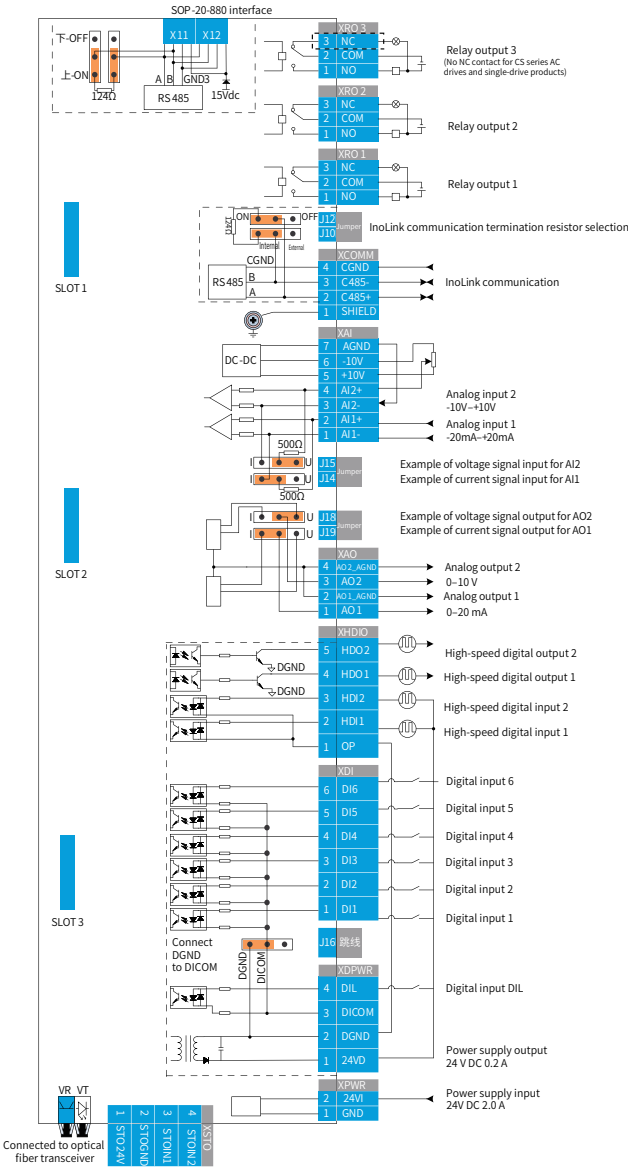


Figure 4-20 Overview of HCU interface circuits

4.3 Connecting Power Supply Cables

4.3.1 Terminal Assignment and Specifications

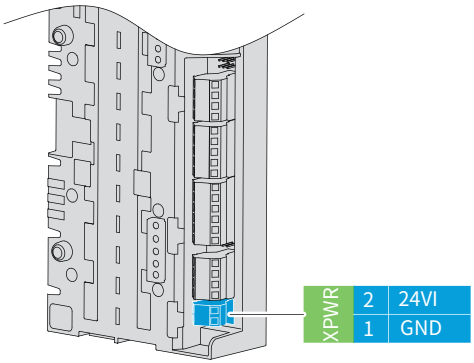


Figure 4-21 Input power supply terminal position and pin assignment

Precautions
◆ Ensure that the external power supply is turned off during installation and wiring to prevent module damage. ◆ Use a 24 VDC power supply. Do not use 220 VAC power supply. Otherwise, the HCU can be damaged.

XPWR: Input power supply terminal

Table 4-3 Technical data of signals

Terminal	Name	Technical data
1	GND	24.0 V±10%, 2.0 A
2	24VI	

4.3.2 Wiring Requirements on Power Supply Cables

Table 4-4 Cable requirements

Terminal	Name	Wiring requirements	Terminal specification	Cable specification
1	GND	Twisted pair	2-pin pluggable black terminal with 5.0 mm clearance	Dual-conductor twisted pair cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	24VI			

4.4 Connection of DI Signals

4.4.1 Terminal Assignment and Specifications

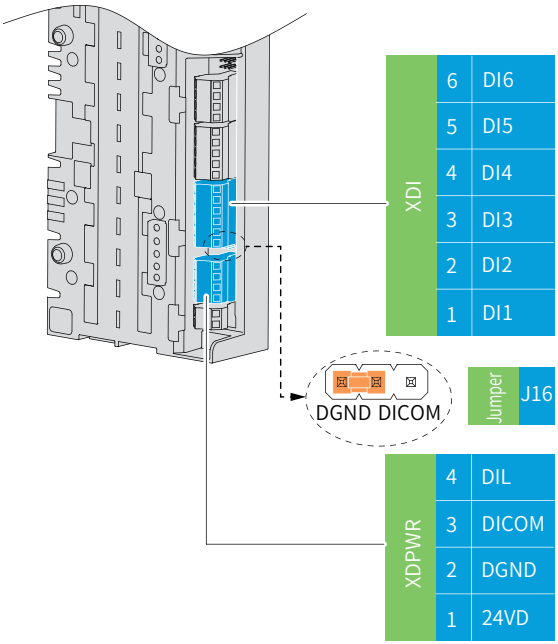


Figure 4-22 Terminal position and pin assignment

1) XDPWR: DIL terminal

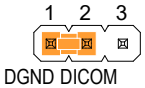
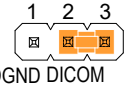
Table 4-5 Technical data of DIL terminal signals

Terminal	Name	Technical data
1	24 VD	Providing power supply for DI, HDI, and HDO 24.0 V±10%, 0.2 A
2	DGND	24VD ground
3	DICOM	DI common output, which can be connected to DGND through jumper J16
4	DIL	Digital interlock or common DI with identical technical data as common DIs

2) Jumper J16

You can use the internal 24 VDC of the HCU to power up the DI or use an external power supply to power up the DI. Pay attention to the use of jumper J16 when selecting the power supply.

Table 4-6 Instruction for use of J11

Jumper switch	Description	Position
J16	Use the internal power supply of HCU.	 DGND shorted to DICOM
	Use an external power supply.	 DGND disconnected from DICOM

3) XDI: DI terminal

Table 4-7 Technical data of DI terminal signals

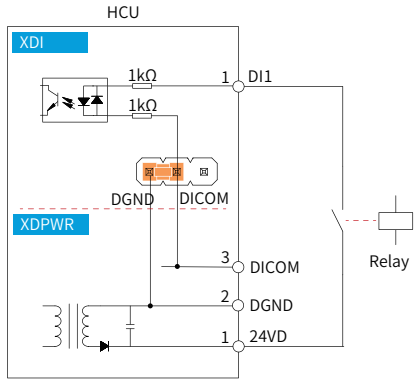
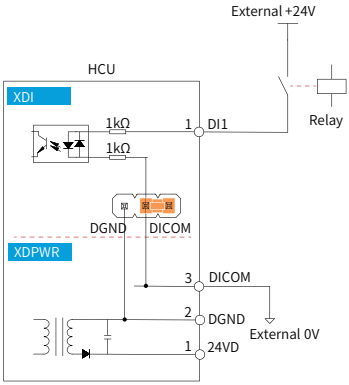
Terminal	Name	Technical data
1	DI1	24 V logic level: "0" < 5 V; "1" > 15 V; Rin: 2.0 kΩ Input type: NPN/PNP, relay contact Hardware filter: 0.04 ms Imax: 15 mA
2	DI2	
3	DI3	
4	DI4	
5	DI5	
6	DI6	

4.4.2 DI Interfaces

The circuits for DI1...DI6 and DIL are the same. The following takes the DI1 circuit as an example.

1) Relay passive contact interface mode

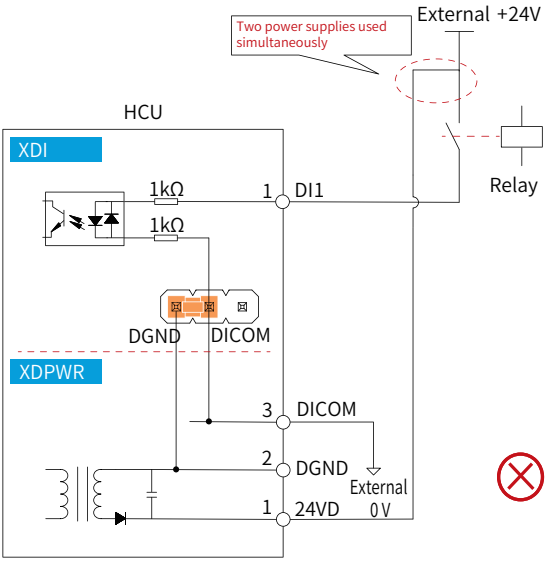
Table 4-8 DI relay passive contact interface principle

Use the internal 24 VD power supply of the HCU.	Use an external power supply.
	

NOTE

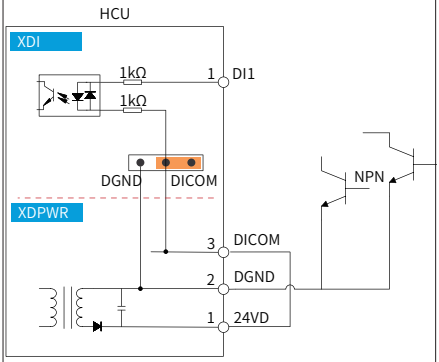
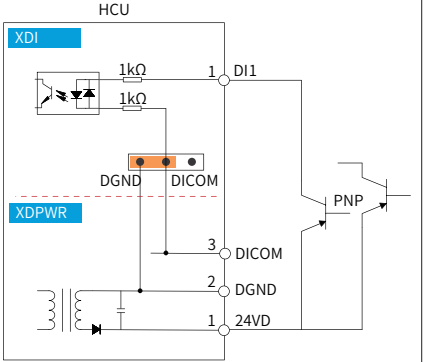
◆ Note 1: When the external power supply is used, adjust the J16 jumper to the position shown in the preceding figure to disconnect DGND from the DICOM.

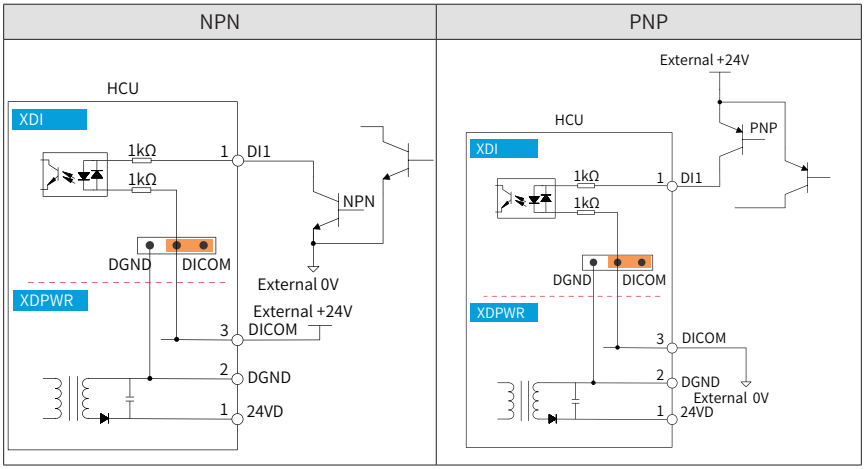
The DI supports internal power supply or external power supply interface, but does not support hybrid use of internal and external power supplies.



2) Co-emitter interface mode

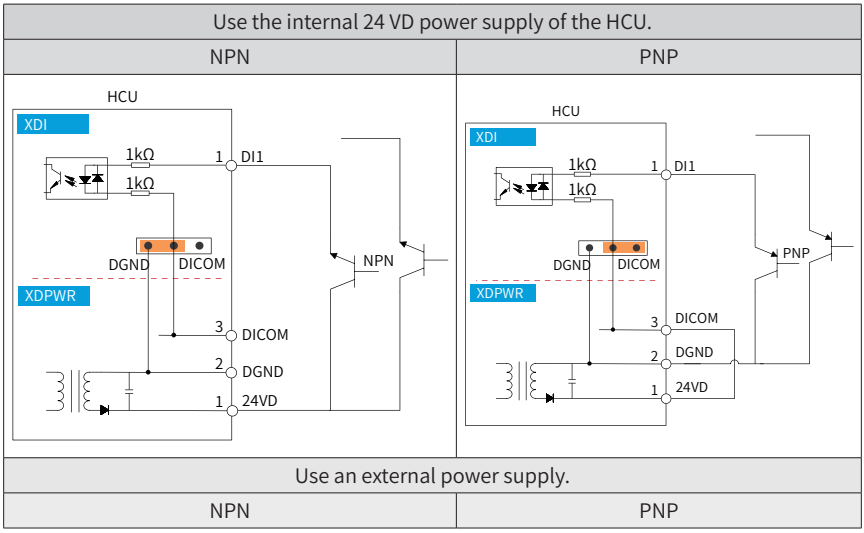
Table 4-9 DI co-emitter interface principle

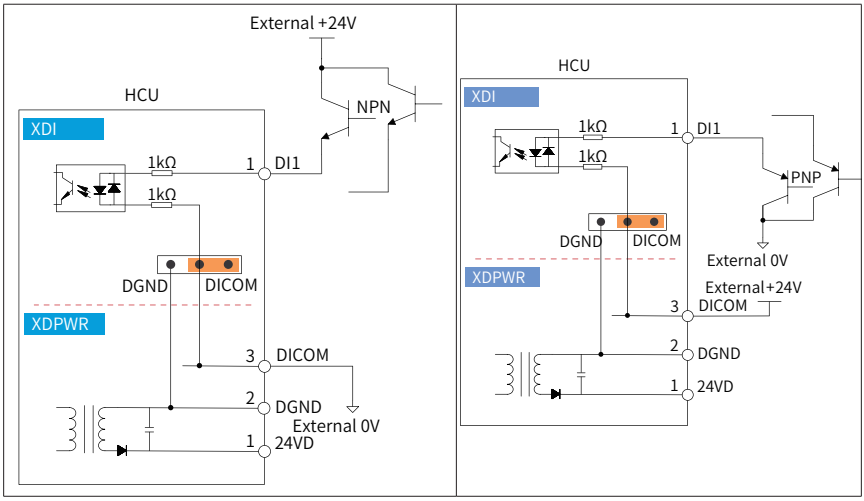
Use the internal 24 VD power supply of HCU.	
NPN	PNP
	
Use an external power supply.	



3) Common open-collector interface mode

Table 4-10 DI common open-collector interface principle





4.4.3 DI Wiring Requirements

1) XDPWR: Connecting terminal

Table 4-11 XDPWR terminal cable requirements

Terminal	Name	Wiring requirement	Terminal specification	Cable specification
1	24 VD	Twisted pair cable, single-conductor cable	4-pin green pluggable terminal with 5.0 mm clearance	2-pin twisted pair cable, single-conductor cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	DGND			
3	DICOM	Single-conductor cable		
4	DIL	Single-conductor cable		

2) XDI: DI terminal

Table 4-12 XDI terminal cable requirements

Terminal	Name	Wiring requirement	Terminal specification	Cable specification

1	DI1	Single-conductor cable	6-pin green pluggable terminal with 5.0 mm clearance	Single-conductor cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	DI2	Single-conductor cable		
3	DI3	Single-conductor cable		
4	DI4	Single-conductor cable		
5	DI5	Single-conductor cable		
6	DI6	Single-conductor cable		

4.4.4 Precautions for DI Wiring

- DI supports multiple interface modes, but DI1 to DI6 and DIL must select the same interface mode.
- Single-core cables are recommended for the DI cables mentioned above. However, if the cable is larger than 3 m, it is recommended to use a cable with a shield and shield must be grounded close to the HCU side.
- DICOM is the common terminal of DI1 to DI6 and DIL. See section 4.4.2 for wiring.

4.5 High-speed DI/DO Signal Connection

4.5.1 HDI Terminal Assignment and Specifications

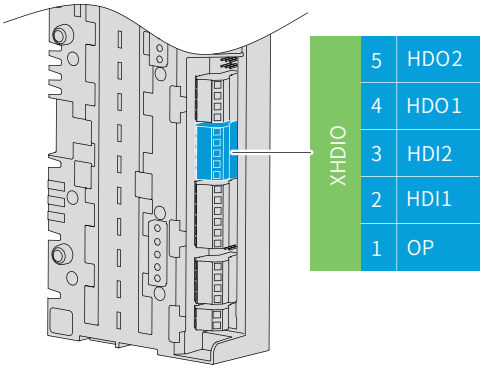


Figure 4-23 Terminal position and pin assignment

XHDIO: HDIO input terminal

Table 4-13 Technical data of HDI terminal signals

Terminal	Name	Technical data
1	OP	HDI common terminal

2	HDI1	Input type: NPN, PNP 24 V logic level: “0” < 5 V; “1” > 15 V; Rin: 2.0 kΩ Input voltage range: 0 VDC to 30 VDC Input frequency range: 0 kHz to 100 kHz HDI maximum load: Imax: 15 mA
3	HDI2	

NOTE

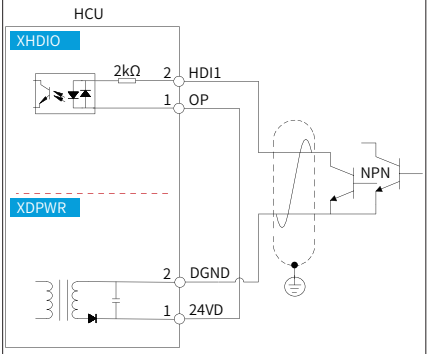
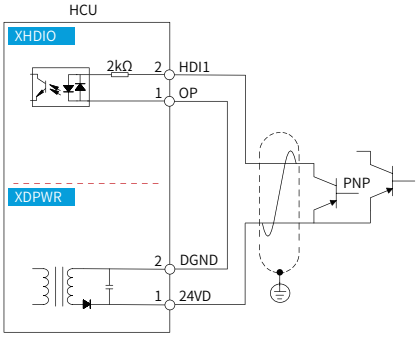
◆ Note 1: High-speed digital input HDI can also be used as a common DI.

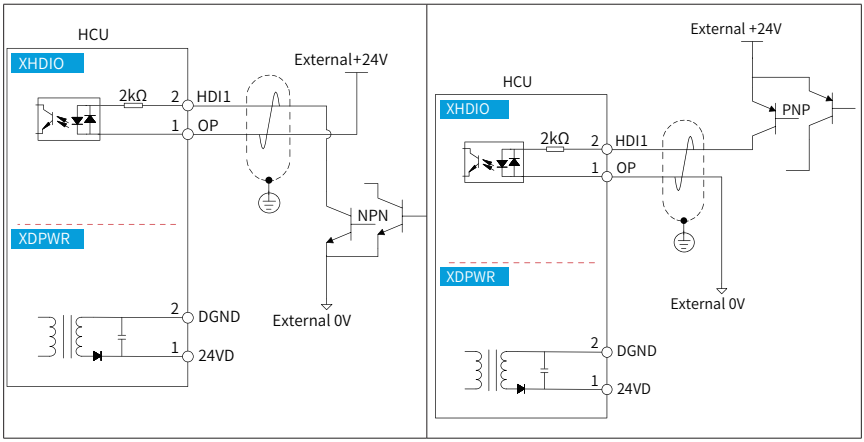
4.5.2 HDI Interfaces

The following takes HDI1 as an example. The HDI2 interface circuit is the same as HDI1. HDI wiring requires shielded twisted pair cables. For details, see section 4.5.3.

1) Co-emitter interface mode

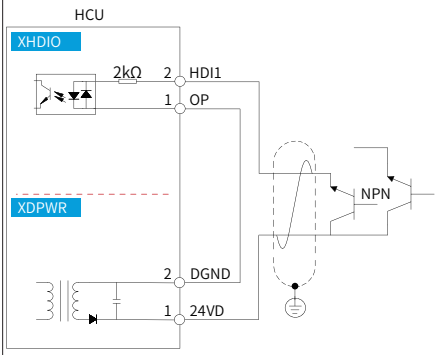
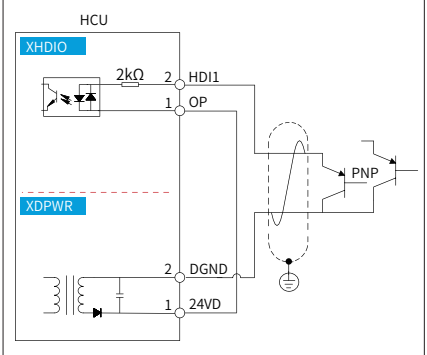
Table 4-14 HDI co-emitter interface principle

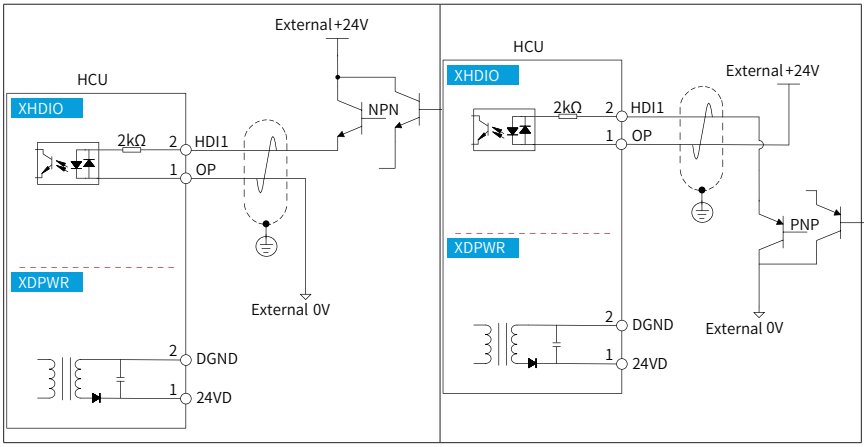
Use the internal 24 VD power supply of the HCU.	
NPN	PNP
	
Use an external power supply.	
NPN	PNP



2) Common open-collector interface mode

Table 4-15 HDI common open-collector interface principle

Use the internal 24 VD power supply of the HCU.	
NPN	PNP
	
Use an external power supply.	
NPN	PNP



4.5.3 HDI Wiring Requirements

XHDIO: High-speed communication HDI/O terminal

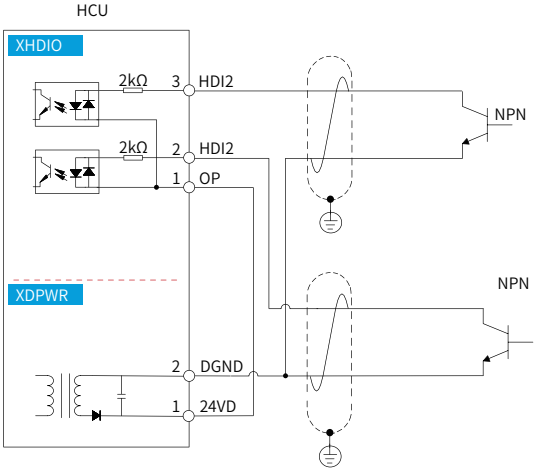
Table 4-16 Cable requirements for HDI external power supply

Terminal	Name	Wiring requirement	Terminal specification	Cable specification
1	OP	For details, see section 4.5.2.	5-pin green pluggable terminal with 5.0 mm clearance	Cross-sectional area: 0.5 mm^2 to 2.5 mm^2 Use two dual-conductor shielded twisted pair cables when using two HDIs.
2	HDI1			
3	HDI2			

NOTE

◆ Note 1: When the number of DGND or DICOM cannot meet the requirements, the terminal block can be used for expansion.

When HDI1 and HDI2 are used together, the interface circuit is as follows:



4.5.4 HDI Wiring Precautions

- It is recommended to use shielded twisted pair cables for HDI1 and HDI2. However, if the cable is shorter than 3 m without strong electromagnetic interference, you can also select a regular shielded cable.
- 24 VD and DGND only have 1-pin terminals. External terminals are needed in the case of multiple drain wires.
- HDI supports multiple interface modes. For details, see section 4.5.2. However, HDI1 and HDI2 must be wired in the same way.
- When using the internal 24 VD power supply, pay attention to its maximum load carrying capacity.
- The HDI signal and HDO signal share the same 5-pin terminal.

4.5.5 HDO Terminal Assignment and Specifications

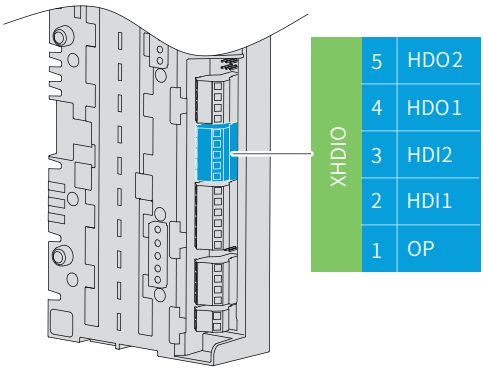


Figure 4-24 Terminal position and pin assignment

XHDIO: HDIO input terminal

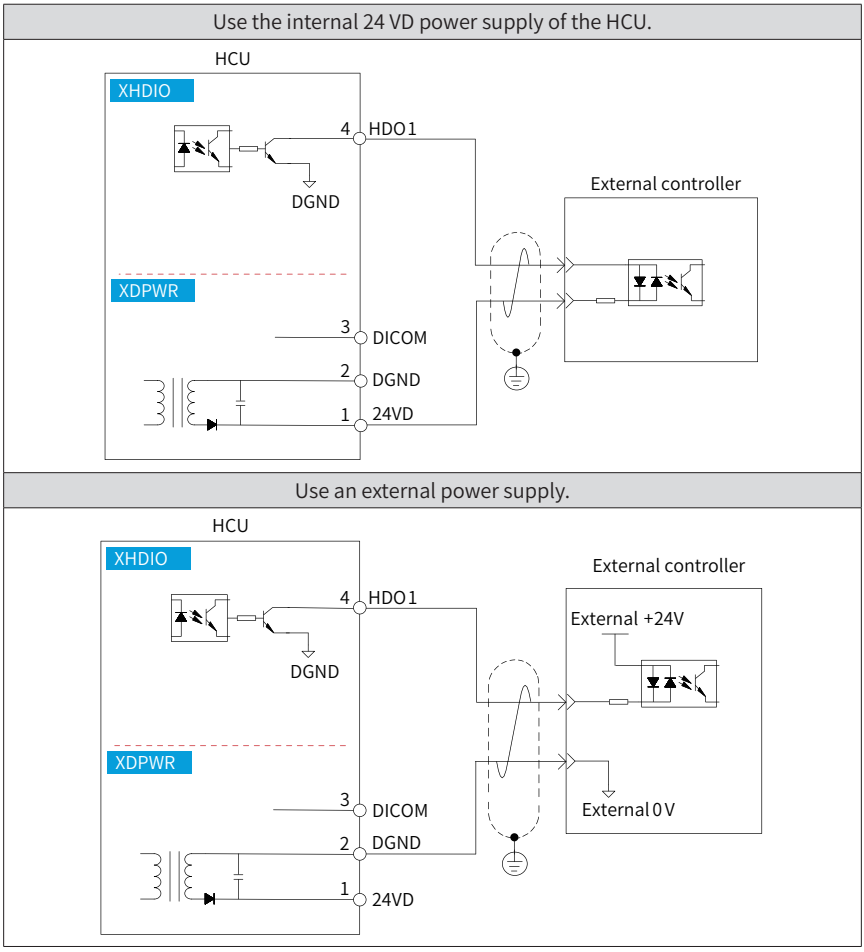
Table 4-17 Technical data of HDO terminal signals

Terminal	Name	Technical data
4	HDO1	Output type: OC Output frequency range: 0 kHz to 100 kHz HDO maximum load: Imax: 20 mA Output voltage range: 0 VDC to 26.4 VDC
5	HDO2	

4.5.6 HDO Interfaces

HDO is used to transmit high-speed pulse signals. It is generally used to transmit HDI signals to other devices. The output type is triode open collector and its emitter has been connected to DGND. You can use 24 VD to power up the HDI of the external controller. If you use an external power supply, the external power ground must be connected to DGND.

Table 4-18 HDO interface principle



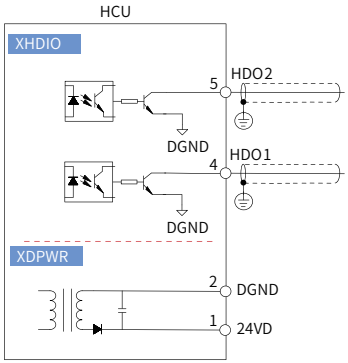
4.5.7 HDO Wiring Requirements

Table 4-19 HDO cable requirements

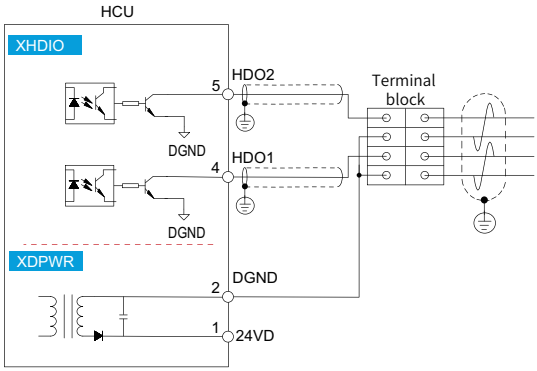
No.	Name	Wiring requirement	Terminal specification	Cable specification
4	HDO1	For details, see section 4.5.6.	5-pin green pluggable terminal with 5.0 mm clearance	Cross-sectional area: 0.5 mm^2 to 2.5 mm^2 Use two dual-conductor shielded twisted pair cables when using two HDOs.
5	HDO2			

Table 4-20 HDO wiring method and cable length requirements

Cable length shorter than 3 m



Cable length longer than 3 m



4.5.8 Precautions for HDO Wiring

- It is recommended to use shielded twisted pair cables for HDI1 and HDI2. However, if the cable is shorter than 3 m without strong electromagnetic interference, you can also select a regular shielded cable.
- HDO generates triode open-collector output. The triode emitter has been connected to DGND. If external power supply is used, short the external power supply ground to DGND.
- When using the internal 24 VD power supply, pay attention to its maximum load carrying capacity.
- The HDI signal and HDO signal share the same 5-pin terminal.

4.6 AO Signal Connection

4.6.1 Terminal Assignment and Specification

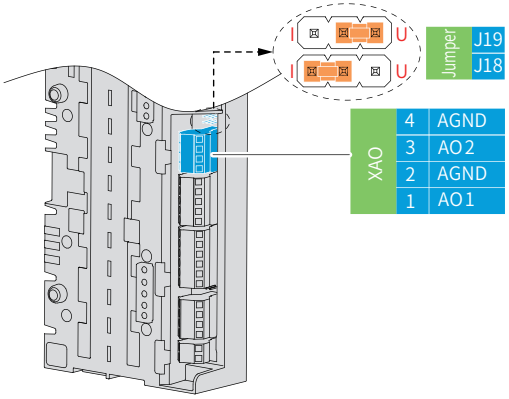


Figure 4-25 Terminal position and pin assignment

1) XAO: AO

Table 4-21 Technical data of AO terminal signals

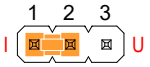
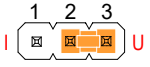
Terminal	Name	Technical data
1	AO1	AO1 output range: 0–20 mA, Rload ⩽ 500 Ω 0 V to 10 V; Rload: ⩾ 10 kΩ AO2 output range: 0–20 mA, Rload ⩽ 500 Ω 0 V to 10 V; Rload: ⩾ 10 kΩ Resolution: 11 bit + sign bit Accuracy: 2% of the full range
2	AGND	
3	AO2	
4	AGND	

2) Jumper J18/J19

Both AOs support current or voltage signal output. The output signal mode is selected by jumper J18 or J19.

Table 4-22 Instructions for use of J18 and J19

Jumper switch	Description	Position
J19	AO1 current or voltage signal output selection	1 2 3 I U Current signal output applied when 1 and 2 shorted
		1 2 3 I U Voltage signal output applied when 2 and 3 shorted

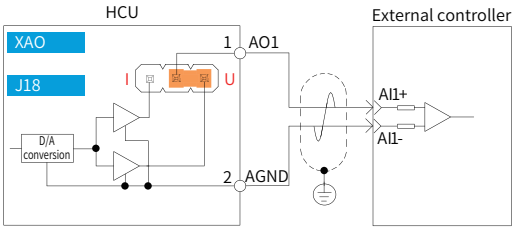
Jumper switch	Description	Position
J18	AO2 current or voltage signal output selection	 Current signal output applied when 1 and 2 shorted
		 Voltage signal output applied when 2 and 3 shorted

4.6.2 AO Interfaces

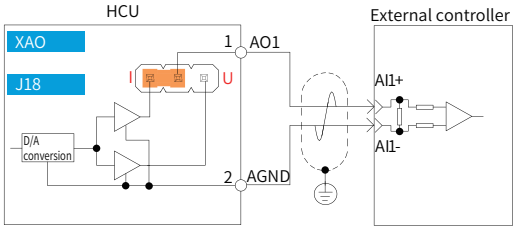
For analog output signals, you can choose current signal or voltage signal through the jumper.

Table 4-23 AO wiring method and cable length requirements

Voltage signal output



Current signal output



4.6.3 AO Wiring Requirements

XAO: Analog signal output terminal

Table 4-24 AO terminal cable requirements

Terminal	Name	Wiring requirement	Terminal specification	Cable specification
1	AO1	Twisted pair	4-pin blue pluggable terminal with 5.0 mm clearance	Cross-sectional area: 0.5 mm^2 to 2.5 mm^2 Use two dual-conductor shielded twisted pairs when using two AOs.
2	AGND			
3	AO2	Twisted pair		
4	AGND			

4.6.4 AO Wiring Precautions

- Ensure that the shield is grounded at the nearest single end on the HCU side.
- Note that the jumper cap selects the output voltage or current signal.
- Note that the color of the terminal head and terminal block is the same.

4.7 AI Signal Connection

4.7.1 Terminal Assignment and Specification

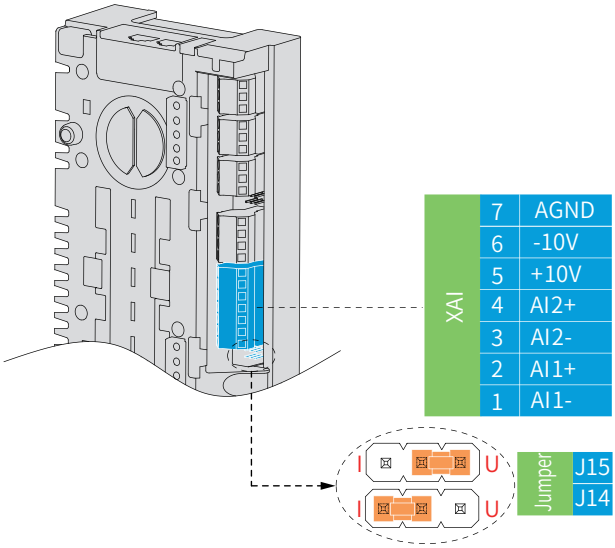


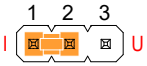
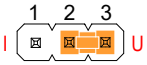
Figure 4-26 Terminal position and pin assignment

1) Jumper J14/J15

Both AIs support current or voltage signal input. The input signal mode is selected by jumper J14 or J15.

Table 4-25 Instructions for use of J14 and J15

Jumper switch	Description	Position	
J14	AI1 input mode selection (current input or voltage input)	1 2 3 I U 1 and 2 shorted	Current signal input applied when
		1 2 3 I U 2 and 3 shorted	Voltage signal input applied when

Jumper switch	Description	Position	
J15	AI2 input mode selection (current input or voltage input)	 1 and 2 shorted	Current signal input applied when
		 2 and 3 shorted	Voltage signal input applied when

2) XAI: AI

Table 4-26 Technical data of AI terminal signals

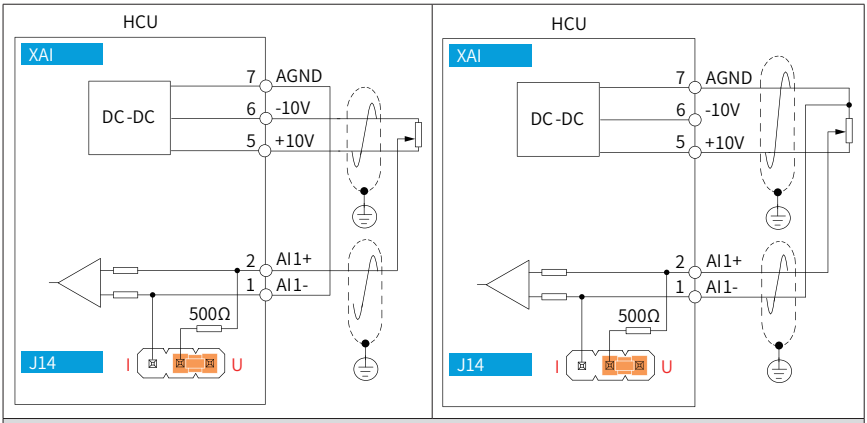
Terminal	Name	Technical data
1	AI1-	Current input: -20 mA to +20mA, Rin: 500 Ω Voltage input: -10 V to +10 V; Rin: 200 kΩ Differential input, input range: ±30 V Sampling interval per channel: 0.25 ms Hardware filter: 0.25 ms Resolution: 11 bit + sign bit Error: 1% of full range
2	AI1+	
3	AI2-	
4	AI2+	
5	+10 V	+10V: +10 V±1% -10V: -10 V±1% Rload: 1 kΩ to 10 kΩ
6	-10 V	
7	AGND	

4.7.2 AI Interfaces

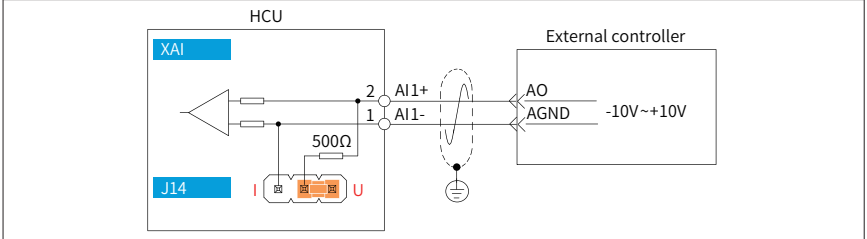
AI interfaces are used to receive external analog input signals. Both AIs can be used to select current or voltage signal input through jumpers. The reference voltage of ±10 V provided by the HCU can be used.

Table 4-27 AI interface principle

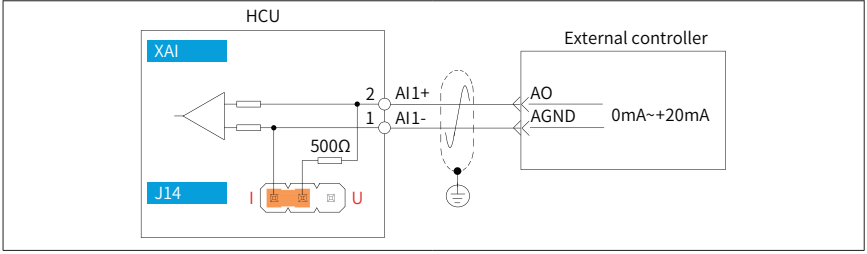
The HCU provides a reference voltage.	
-10 V to +10 V input	0 V to 10 V input



External voltage signal input



External current signal input



NOTE

◆ Note 1: The AI supports voltage and current input. The input mode must be selected correctly. For details, see section 4.7.3.

4.7.3 AI Wiring Requirements

XAI: Analog signal input terminal

Table 4-28 AI terminal cable requirements

Terminal	Name	Wiring requirement	Terminal specification	Cable specification

1	AI1-	For details, see section 4.7.2.	7-pin blue pluggable terminal with 5.0 mm clearance	Cross-sectional area: 0.5 mm^2 to 2.5 mm^2 Use two dual-conductor shielded twisted pairs when using two AIs. Use one quad-conductor shielded twisted pair cable for one AI when HCU power supply is used.
2	AI1+			
3	AI2-			
4	AI2+			
5	+10 V			
6	-10 V			
7	AGND			

4.7.4 AI Wiring Precautions

- Select the AI input mode through the jumper cap.
- The reference voltage provided by the HCU can be used. The voltage input range of the AI is -10 V to +10 V.
- Use an external reference signal, but do not exceed the input range. The voltage range is -10 V to +10 V, and the current range is -20 mA to +20 mA.
- Note that the color of the terminal head and terminal block are consistent.

4.8 InoLink Communication Network Connection

4.8.1 Terminal Assignment and Specification

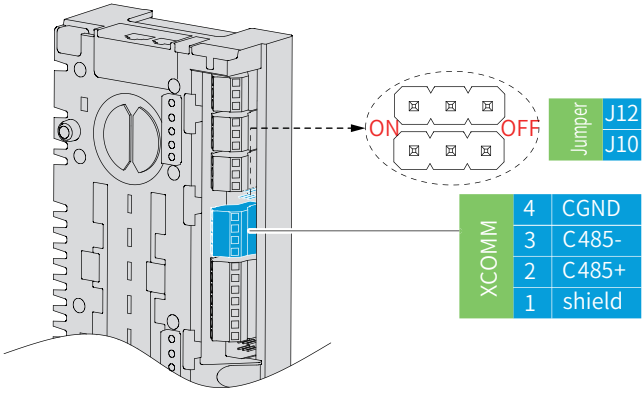


Figure 4-27 Terminal position and pin assignment

1) XCOMM: InoLink communication network terminal

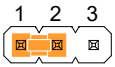
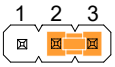
Table 4-29 Technical data of InoLink network terminal signals

Terminal	Name (Default)	Technical data
1	Shield	RS485 bus, 5 V standard level Termination resistor of the bus: 124 Ω Maximum communication rate: 5 Mbps Maximum number of nodes: 16 (without repeater) Maximum transmission distance: 40 m
2	C485+	
3	C485-	
4	CGND	

2) Jumper J10/J12

Select a 124 Ω termination resistor for the InoLink communication network through J10 and J12.

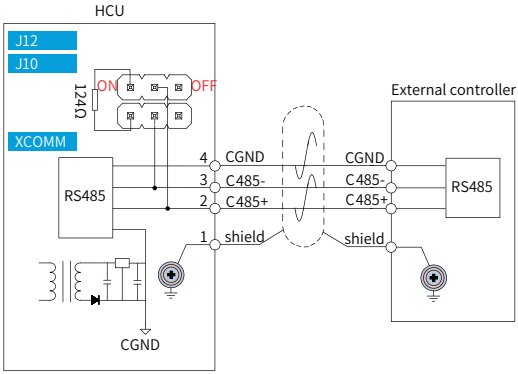
Table 4-30 Instructions for use of J10 and J12

Jumper switch	Description	Position
J10, J12	RS485 termination resistor	 If 1 and 2 are shorted, the termination resistor is connected.
		 If 2 and 3 are shorted, the termination resistor is disconnected.

NOTE

◆ The shorting state of J10 and J12 jumpers must be consistent, that is, ON or OFF must be selected simultaneously.

4.8.2 InoLink Communication Network Interface



Communication between the drives is a hand-in-hand InoLink communication transmission line that supports the one-to-multiple communication mode. For details, see section 5.3.

4.8.3 Termination Resistor

To ensure the reliability of InoLink communication, you need to select the termination resistor on the HCU. The termination resistor is selected according to the following principle: Enable the bus terminal for the HCU at both ends of the communication. For those in the middle, do not use the bus terminal. For details, see section 4.8.1.

4.8.4 Wiring Requirements for InoLink Communication Cables

XCOMM: InoLink communication terminal

Table 4-31 InoLink communication terminal cable requirements

No.	Name	Wiring requirement	Terminal specification	Cable specification
1	SHIELD	Connected to the shield	4-pin white pluggable terminal with 5.0 mm clearance	Quad-conductor shielded twisted pair cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	C485+	Twisted pair		
3	C485-			
4	CGND	Twisted pair		

The communication cable is wired with shielded twisted pairs (about 100 Ω impedance). It is recommended to use high-quality cables to achieve the best immunity.

Avoid unnecessary winding during wiring. Do not route cables near power cables (for example, motor cables). Grounding the motor shield.

4.8.5 InoLink Wiring Precautions

For details, see section 4.1.2.

4.9 Relay Output Signal Selection

4.9.1 Terminal Assignment and Specification

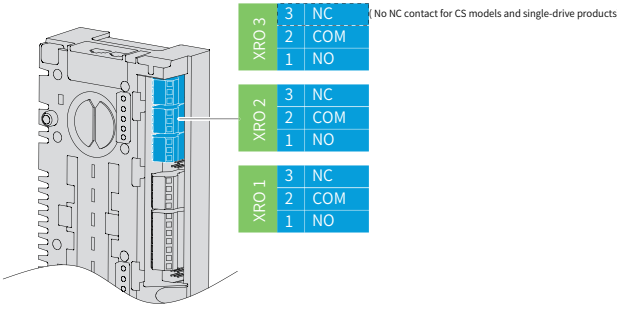


Figure 4-28 Terminal position and pin assignment

1) XRO1: Output terminal of relay 1

Table 4-32 Technical data of relay 1 output terminal signals

Terminal	Name	Technical data
1	RO1_NO	Output type: passive NO and NC contacts Contact specifications: 250 VAC/30 VDC, 2 A
2	RO1_COM	
3	RO1_NC	

2) XRO2: output terminal of relay 2

Table 4-33 Technical data of relay 2 output terminal signals

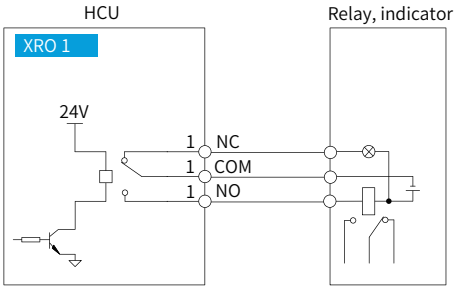
Terminal	Name	Technical data
1	RO2_NO	Output type: passive NO and NC contacts Contact specifications: 250 VAC/30 VDC, 2 A
2	RO2_COM	
3	RO2_NC	

3) XRO3: output terminal of relay 3

Table 4-34 Technical data of relay 3 output terminal signals

Terminal	Name	Technical data
1	RO3_NO	Output type: passive NO and NC contacts Contact specifications: 250 VAC/30 VDC, 2 A No NC contact for CS models or single drive
2	RO3_COM	
3	RO3_NC	

4.9.2 Relay Output Interface



4.9.3 Wiring Requirements

Table 4-35 Description of relay terminal cable requirements

Terminal	Name	Wiring requirement	Terminal specification	Technical data
1	RO1_NO	Single-conductor cable	3-pin orange pluggable terminal with 5.0 mm clearance	Single-conductor cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	RO1_COM	Single-conductor cable		
3	RO1_NC	Single-conductor cable		

4.10 Wiring of STO

4.10.1 Position Definition and Specification

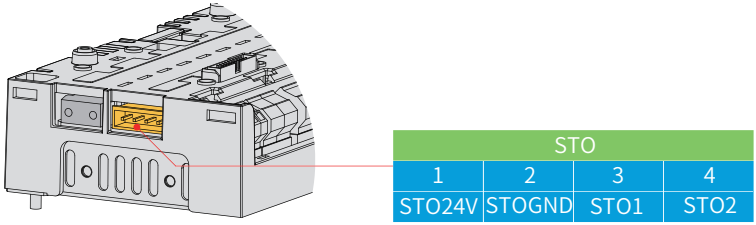


Figure 4-29 Terminal position and pin assignment

XSTO: STO interface

Table 4-36 Technical data of STO terminal signals

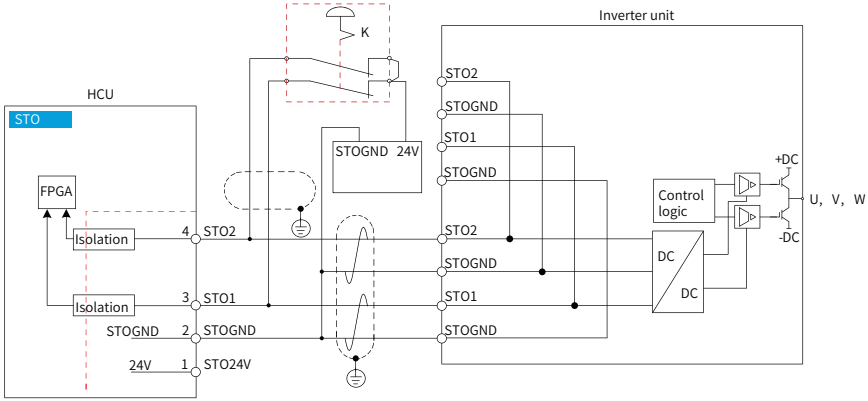
Terminal	Name (Default)	Technical data
1	STO24V	24V_EXT: 24 V±15% STO1_24V, STO2_24V: 24V±15%
2	STOGND	
3	STO1	
4	STO2	

4.10.2 Safe Torque Off (STO) Principle

The STO function can stop the inverter in emergencies or prevent inadvertent startup during, for example, short-term maintenance without disconnecting the inverter power supply.

The STO function of the HCU control unit can provide 24 V power supply for STO and detect the trigger signals of two STOs.

The following figure shows the schematic diagram of STO function.



4.10.3 STO Wiring Requirements

XSTO: Safety torque off terminal

Table 4-37 STO terminal cable requirements

Terminal	Name	Wiring description	Terminal specification	Cable specification
1	STO24V	-	4-pin yellow pluggable terminal with 5.0 mm clearance	Quad-conductor shielded twisted pair cable Cross-sectional area: 0.5 mm^2 to 2.5 mm^2
2	STOGND			
3	STO1			
4	STO2			
Connect the shield to ground.				

4.11 RS485 Connection of the Control Panel

4.11.1 Terminal Assignment and Specification

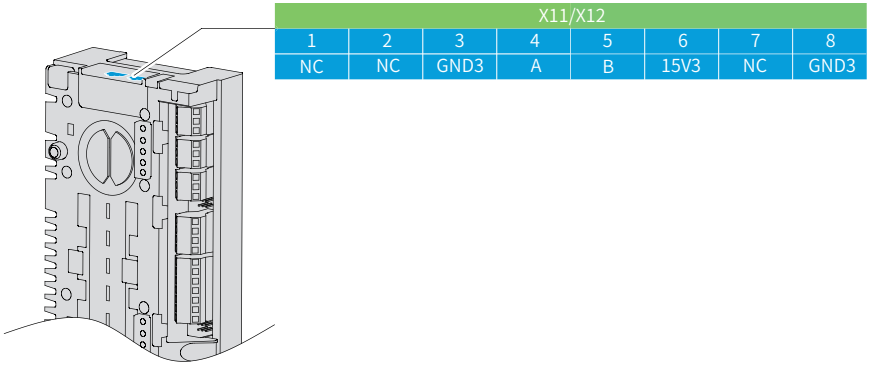


Figure 4-30 Terminal position and pin assignment

1) X11, X12: RS485 communication terminal for SOP-20-880

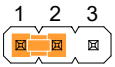
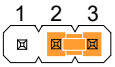
Table 4-38 Technical data of SOP-20-880RS485 terminal signals

Terminal	Name (Default)	Technical data
1	NC	RS485 bus, 5 V standard level Termination resistor of the bus: 124 Ω Maximum communication rate: 4 Mbps Maximum number of nodes: 32 (without repeater) Maximum transmission distance: 100 m
2	NC	
3	GND3	
4	A	
5	B	
6	15V3	15V3: 15 V±15%
7	NC	-
8	GND3	
Bus termination resistor selection		DIP switches 1 and 2 ON: Termination resistor applied DIP switches 1 and 2 OFF: Termination resistor canceled

2) Instructions for use of J12 and J15

Select 124 Ω termination resistor through J12/J15 for RS485 communication with SOP-20-880.

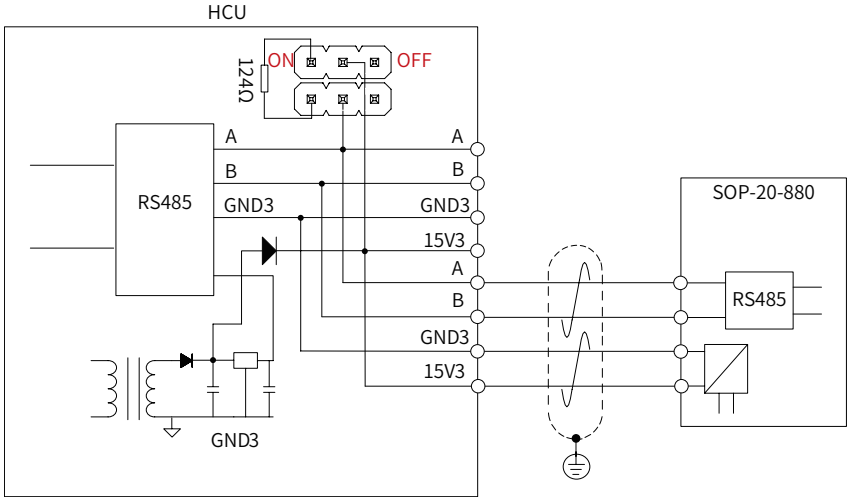
Table 4-39 Instructions for use of J12 and J15

Jumper switch	Description	Position
J12, J15	Bus termination resistor selection	 If 1 and 2 are shorted, the termination resistor is connected.
		 If 2 and 3 are shorted, the termination resistor is canceled.

NOTE

◆ The shorting state of J12 and J15 jumpers must be consistent, that is, ON or OFF must be selected simultaneously.

4.11.2 Control Panel RS485 Interface



4.11.3 Wiring Requirements

X11, X12: RS485 communication terminal for SOP-20-880

Table 4-40 RS485 communication terminal cable requirements

Terminal	Name	Wiring requirements	Terminal requirements	Cable requirements
1, 2, 7	NC	-	RJ45	Standard network cable
4	A	Twisted pair		
5	B			
6	15V3	Pins 6 and 8 twisted pair		
3, 8	GND3			

5 Functions and Applications

5.1 Slot Application

5.1.1 Slot Applicable Module

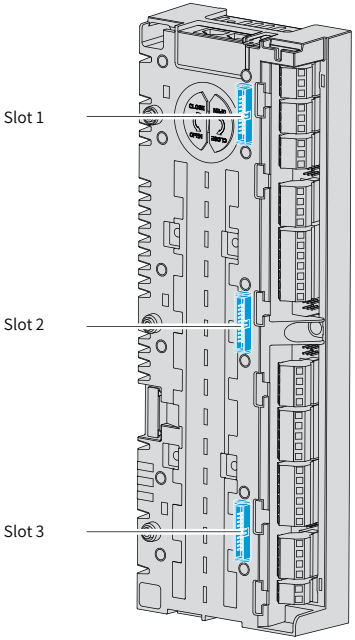


Figure 5-1 Slot position

The three slots support all function modules in theory. However, as the dimensions of the function modules and interface terminals are different, the assembly may be restricted, as shown below.

Figure 5-1 Description of the function modules that can be installed to the slot

Model	SLOT1	SLOT2	SLOT3	Type	Module dimensions
HPG-10	✓	✓	✓	Function module in size 1	105 x 73 x 24
HPG-40	✓	✓	✓		105 x 73 x 24
HPG-50	✓	✓	✓		105 x 73 x 24
HIO-10	✓	✓	✓		105 x 73 x 24

Model	SLOT1	SLOT2	SLOT3	Type	Module dimensions
HDP-10	×	×	✓	Function module in size 2	75 x 73 x 24
HCAN-10	✓	✓	✓		75 x 73 x 24
HCAN-30	✓	✓	✓		75 x 73 x 24
HOFM-10	✓	✓	×		75 x 73 x 24
HOFM-30	✓	✓	✓		75 x 73 x 24
HMBA-10	✓	✓	✓		75 x 73 x 24
HETC-10	✓	✓	✓		75 x 73 x 24
HETN-10	✓	✓	✓	Function module in size 2	75 x 73 x 24
HPFN-10	✓	✓	✓		75 x 73 x 24
HPFN-20	✓	✓	✓		75 x 73 x 24
HMBT-10	✓	✓	✓		75 x 73 x 24

NOTE

- Note 1: “√” in the table indicates that the slot can be used to install the corresponding function module.

  The "x" in the table indicates that the slot cannot be used to install the corresponding function module.

- Note 2: Function modules are divided based on their dimensions. The dimensions of size 1 and size 2 are 105 x 73 x 24 and 75 x 73 x 24 respectively (W x D x H) (unit: mm).
- Note 3: If the function module in size 1 is installed to slot 3, the lower edge of the HCU will be exceeded.

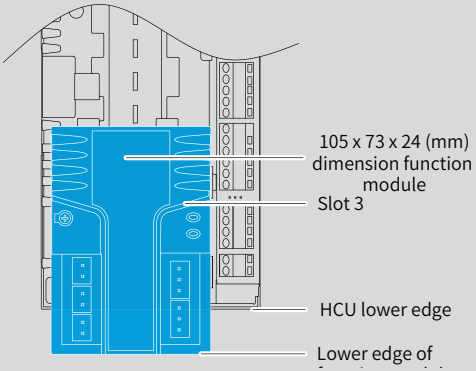


Figure 5 1 Example of a function module exceeding the lower edge of the HCU

- Note 4: The HDP-10 module can be installed in any slot in theory. However, due to the size of the PROFIBUS bus terminals, when it is installed to slot 1, it will occupy some space in slot 2, affecting installation of other function modules that intended to be installed to slot 2. It is recommended to install HDP-10 to slot 3.

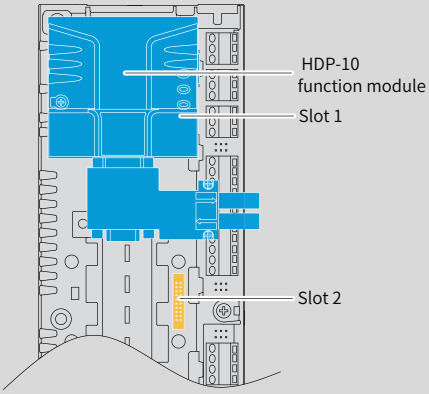


Figure 5 2 Example of HDP function module installed in slot 1

5.1.2 Expansion of Synchronous Voltage Detection Unit

The synchronous voltage detection unit HSVM-10 is used to detect the three-phase input AC voltage in the active rectifier power supply system for use in closed-loop control.

The HSVM-10 has 50 MBd optical fiber, which uploads the detected data to the HCU.

The HCU needs to be expanded with the HOFM module.

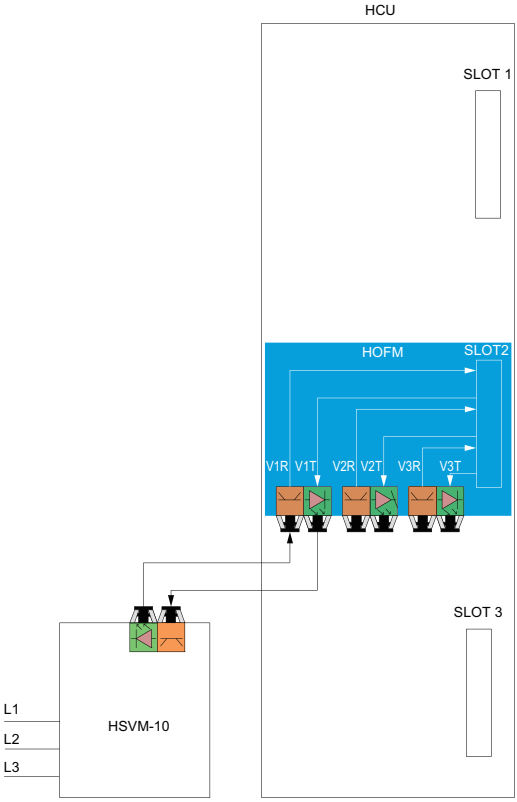


Figure 5-2 Example of HSVM optical fiber wiring

5.1.3 Function Module Expansion Unit

The HCU only has three slots. When more function modules are needed, install HESD-10 function module expansion unit. Each slot can be expanded with three function modules (slot 3 excluded), which needs to be used together with HOFM module.

Both the slot 1 and slot 2 of the HCU can be installed with the optical fiber expansion module HOFM. Up to six pairs of optical fibers can be expanded. An individual HCU can be expanded with up to six function modules together with HOFM and HESD. The

expansion principle is shown in the following figure.

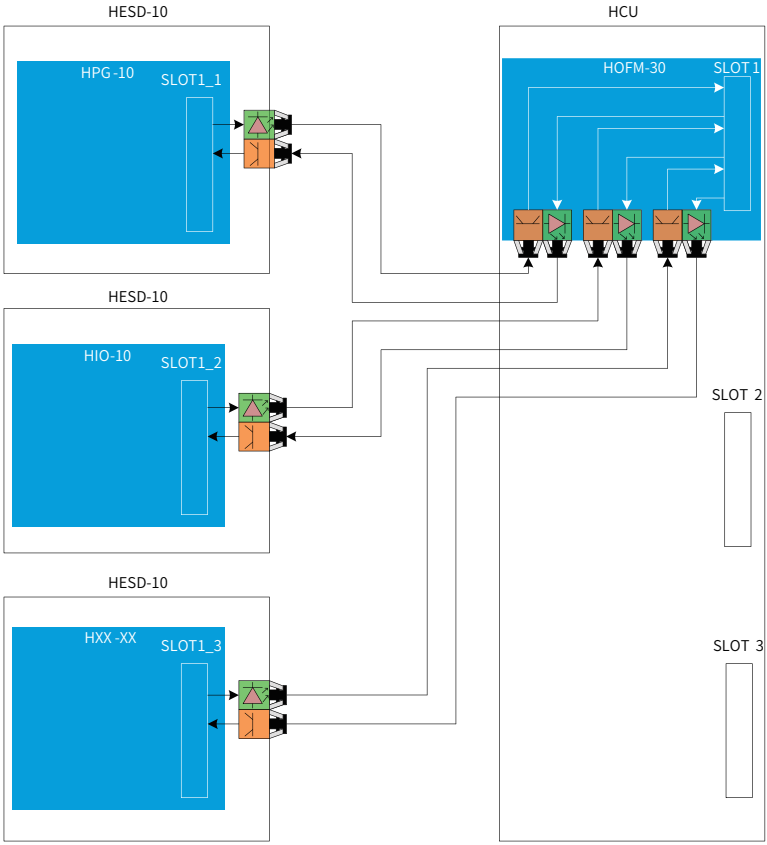


Figure 5-3 HESD wiring example

When installing function modules to the three slots, observe the following principles.

- Functional modules can be directly installed in slot 1, slot 2, and slot 3, with addresses being SLOT1_1, SLOT2_ 1, SLOT3_1.
- The slot 1 and slot 2 can achieve expansion of three slots together with HOFM-30 module, with addresses being SLOT1_1, SLOT1_2, SLOT1_3, and SLOT2_1, SLOT2_2, SLOT2_3.
- Slot 3 does not support slot expansion.
- In this case, the HESD module is not allowed to install another HOFM optical fiber expansion module.

5.2 Temperature Measurement with AI and AO

AI and AO can be used together to detect the temperature sensor signal. They are generally used for motor temperature detection from either one PT100 sensor or two and three PT100 sensors connected in series.

In this case, select constant current output for the AO and voltage signal input for the AI. Temperature sensors PT100, PT1000, and KTY84 are supported.

Do not directly ground both ends of the cable shield. Ground one end and keep the other end unconnected, or ground one end directly and ground the other end through a capacitor in series.

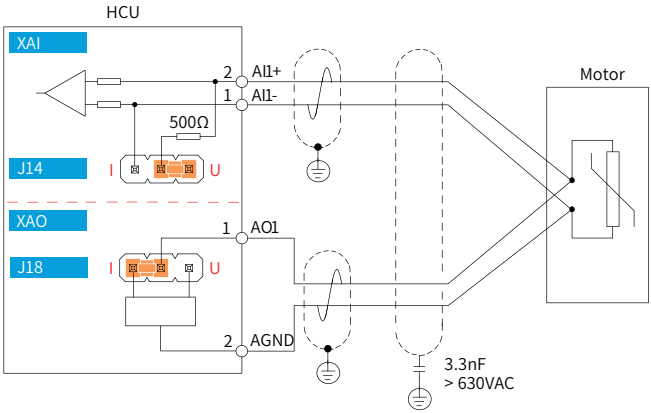


Figure 5-4 Temperature detection with the AI and AO

5.3 InoLink Communication Network Function Application

When information exchange is required between several inverter modules in the system, use InoLink network to exchange data between inverter modules.

The parameters of the InoLink network are as follows:

Communication baud rate: 5 Mbps

Maximum number of nodes: 16

Shielded twisted pair cables must be used for wiring. To achieve the best communication quality and prevent electromagnetic interference, it is recommended to use high quality cables, such as PROFIBUS cables. The cable should be as short as possible, and the link length cannot exceed 40 m. Keep the cables from entangling and away from power cables.

If a HCU is at the end of the InoLink link, it must be equipped with a termination resistor, and the J10 and J12 jumpers must be set to the ON position.

The RS485 link topology of the InoLink bus is as follows.

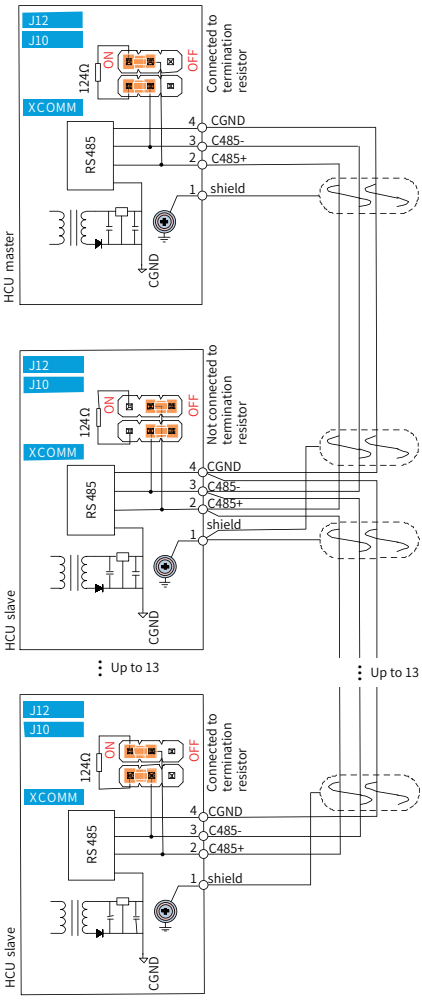


Figure 5-5 Example of connection application

5.4 Control Panel Communication Application

The RS485 communication between the HCU control module and SOP-20-880 is achieved through X11 and X12, with one SOP-20-880 as the master, and multiple HCUs as slaves. X11 and X12 are RJ45 terminals with identical pin assignment for cascading.

RS485 communication requires termination resistors at both ends. When connected to SOP-20-880, the SOP-20-880 is equipped with a 124 Ω resistor as standard. This end does not need to be connected repeatedly.

5.4.1 Connecting To the SOP-20-880

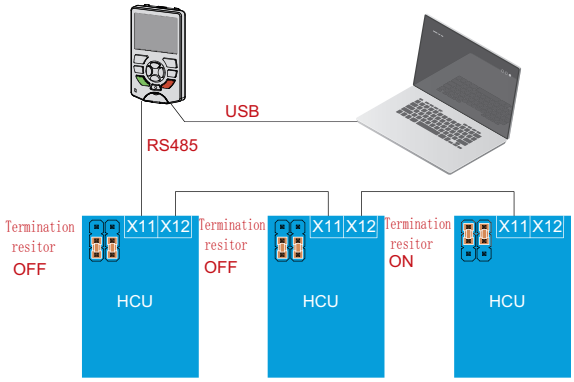


Figure 5-6 Connection with the SOP-20-880

NOTE

◆ For how to set the termination resistor, see section 4.11.1..

5.5 Application of Single Mode and Parallel Mode

The HCU control unit communicates with the basic rectifier unit, regenerative rectifier unit, active rectifier unit, and inverter unit through the optical fiber. The communication protocol is Inodrive. There are two types of applications: single mode and parallel mode based on the system.

5.5.1 Single Mode Application

The HCU control unit is directly connected to the optical fiber interface on the basic rectifier unit, regenerative rectifier unit, active rectifier unit, and inverter unit.

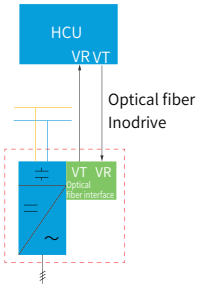


Figure 5-7 Block diagram of single model application

5.5.2 Parallel Mode Application

When the power exceeds the maximum power of a single unit, a parallel system is required. In this case, use the power expansion unit (HPCU). Up to10 pairs of optical fibers can be expanded through HPCU, allowing 10 power units to be paralled.

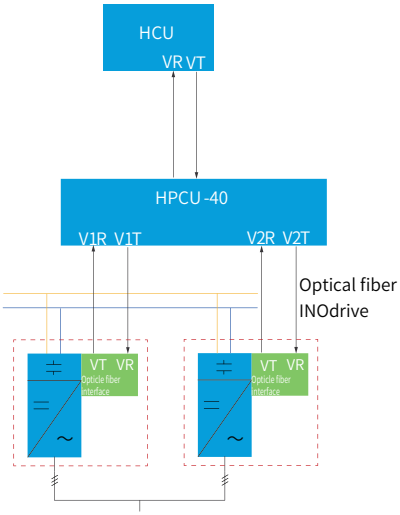


Figure 5-8 Parallel application block diagram

5.6 Safe Torque Off (STO)

The STO is used to implement the following:

- Stop the inverter effectively in dangerous situations, such as emergency stop.
- Prevent inadvertent startup during, for example, short-term maintenance without disconnecting the inverter power supply.

5.6.1 STO Requirements

1) STO activation switch requirements

The STO activation switch can be an emergency stop button switch, a manual operation switch, a safety relay, or a safety PLC contact. The switch or contact is normally open.

- The switch or relay contact used as the STO activation switch must be able to open or close within 200 ms.
- When the manual operation switch is used as the STO activation switch, the switch must have a lock function and be able to lock it in the OFF position.

2) Cable type and length requirements

It is recommended to use twisted pair (STP) cables to connect the STO activation switch. Cable length requirements:

- The length of the cable between the activation switch and the HCU is not longer than 30 m.
- The cable length between the inverters is not longer than 60 m.

- The length of the cable between the external power supply and the first inverter unit is not longer than 60 m.
- For systems with multiple paralleled H8 inverter units, the length of the cable between the HCU control unit and the last inverter unit is not longer than 30 m.

NOTE

- The voltage of each STO signal reaching the HCU control unit or H8 inverter unit terminal must be greater than 17 VDC. The HCU control unit or H8 inverter unit can detect that the STO signal is normal.

3) Grounding of the protective shield

- For the cable between the HCU control unit and the STO activation switch, ground the shield on the HCU side.
- For the cable between the HCU control units, ground the cable shield on one of the HCU sides only.
- For systems with multiple paralleled H8 inverter units, there is no need to ground the shield of the cable between the HCU and H8 inverter unit or between H8 inverter units.

5.6.2 Application Example of STO Function

The following schemes are available for wiring of the STO function in different systems.

1) Single inverter application

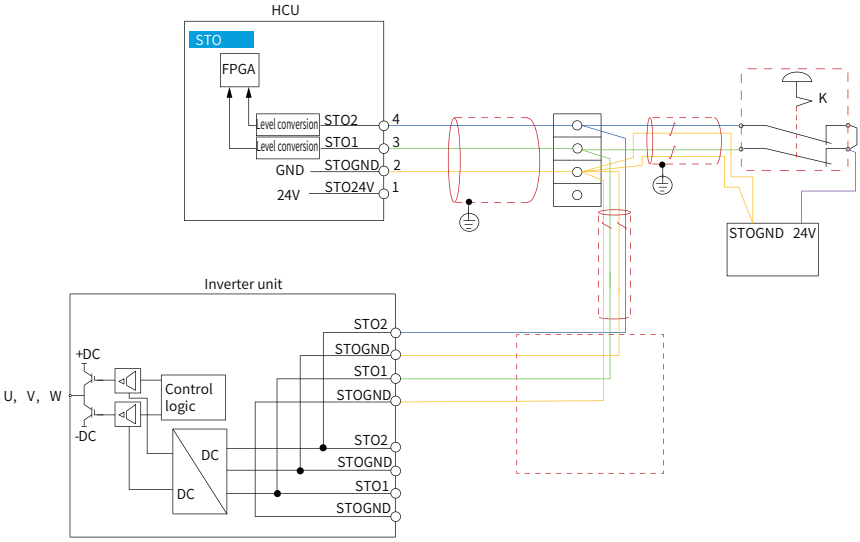


Figure 5-9 Single inverter application

2) Multiple inverters sharing the same STO trigger switch

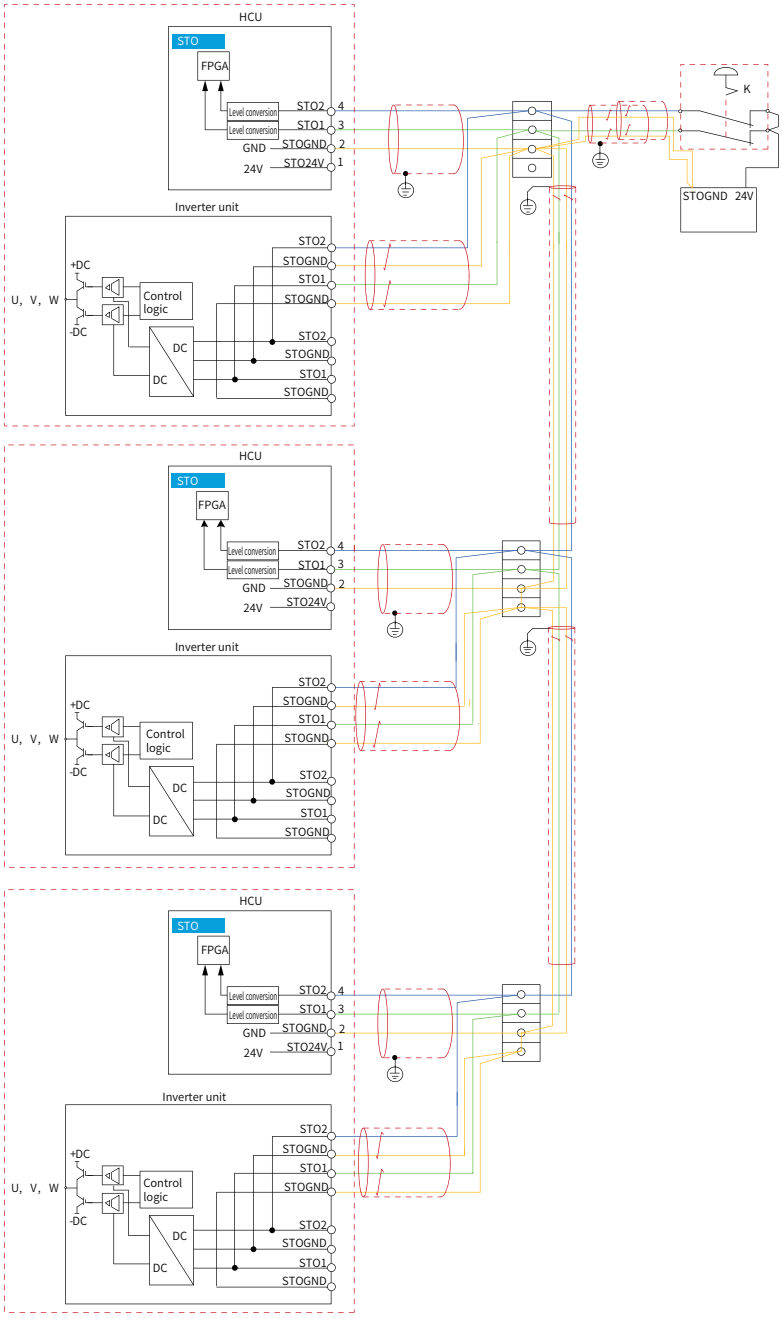


Figure 5-10 Multiple inverters sharing the same STO trigger switch

3) Parallel application of N x H8 inverter units

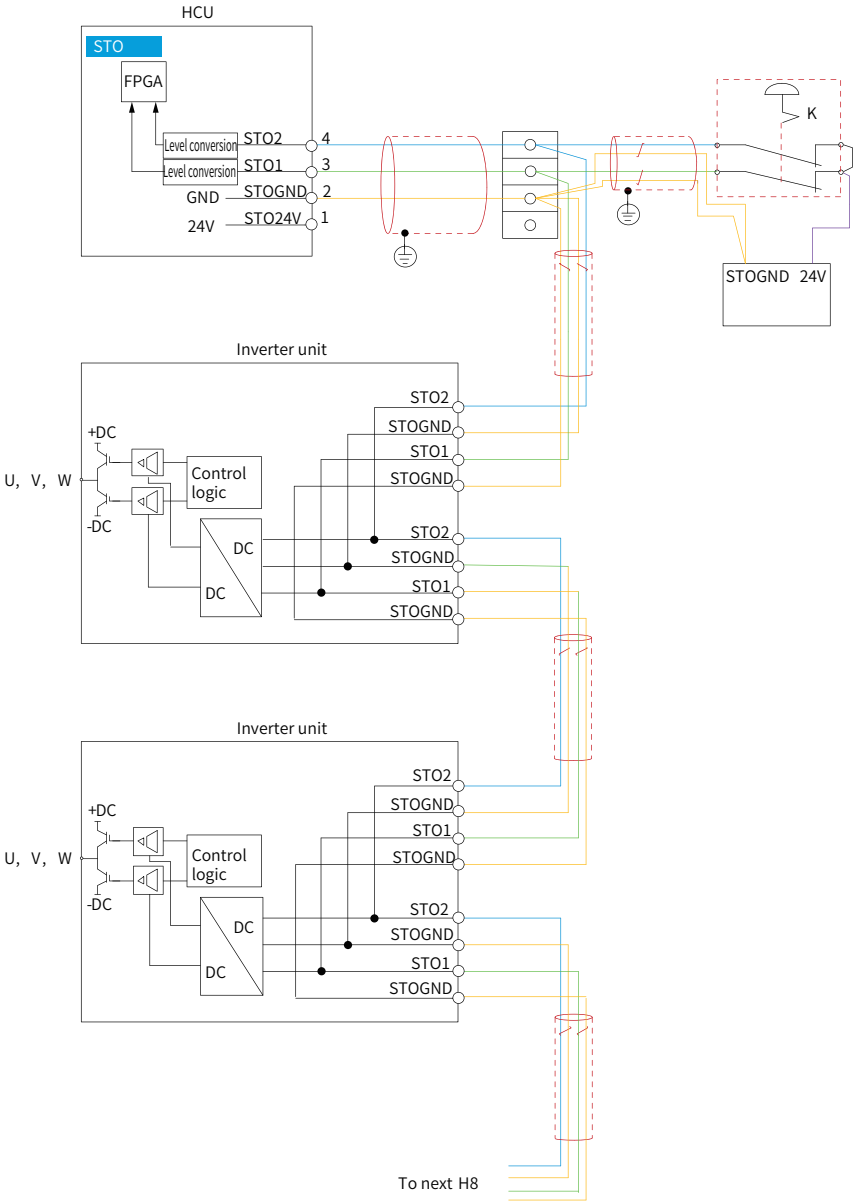


Figure 5-11 Parallel application of N x H8 inverter units

INOVANCE Warranty Agreement

1) Inovance provides an 18-month free warranty (subject to information indicated by the barcode on the equipment) to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.

2) Within the warranty period, maintenance will be charged for the following damage:

   A. Equipment damage caused by improper use or unauthorized repair or retrofit

   B. Equipment damage caused by fire, flood, abnormal voltage, other disasters and secondary disasters

   C. Hardware damage caused by falling or transportation

   D. Equipment damage caused by operations not following the user guide

   E. Faults and damage caused by external factors other than the equipment itself

3) If the equipment is faulty or damaged, fill in the Warranty Card correctly.

4) Maintenance is charged according to the latest Maintenance Price List of Inovance.

5) The Product Warranty Card is not re-issued. Keep the card and present it to the maintenance personnel during maintenance.

6) For any question during service, contact Inovance agent or Inovance.

7) This agreement shall be interpreted by Inovance.

Suzhou Inovance Technology Co., Ltd.

Technical service centers

Add.: No. 52 Tian E dang Road, Yuexi Town, Wuzhong District, Suzhou, P.R. China

P.C.: 215100

Website: www.inovance.com

INOVANCE Product Warranty Card

<table>
<tr><td rowspan="3">Customer Information</td><td colspan="2">Company address:</td></tr>
<tr><td rowspan="2">Company name:

P.C.:</td><td>Contact:</td></tr>
<tr><td>Tel.:</td></tr>
<tr><td rowspan="3">Product Information</td><td colspan="2">Product model:</td></tr>
<tr><td colspan="2">Product barcode (attached here):</td></tr>
<tr><td colspan="2">Agent name:</td></tr>
<tr><td>Fault description</td><td colspan="2">Fault details

Serviced by:</td></tr>
</table>

Copyright © Shenzhen Inovance Technology Co., Ltd.

19012515A00

Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China
Tel: (0755) 2979 9595 Fax: (0755) 2961 9897

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: No.52, Tian E Dang Road, Wuzhong District,
Suzhou 215104, P.R. China
Tel: (0512) 6637 6666 Fax: (0512) 6285 6720