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# H5U Series
# Programmable Logic Controller

## User Guide

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# Legal Information

## Copyright



## Trademarks



## Disclaimer of Liability

Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.
The contents are subject to change without notice due to product upgrade.

## Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

## Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

## Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met.

All operations must follow the guidelines provided in this documentation.

# Preface

## Introduction

The H5U is a small programmable logic controller (PLC) designed to support EtherCAT bus control. It enables technology encapsulation and reuse through the FB/FC function and multi-level network communication through RS485, CAN, Ethernet and EtherCAT interfaces.

This guide mainly covers product information, mechanical installation, communication connection specifications, characteristics, and instructions for use.

## Related Documents

| Document | Description |
|---|---|
| H5U & Easy Series Programmable Logic Controller Instruction Guide | Covers basic and complex instructions with examples in product programming applications. |
| H5U & Easy Series Programmable Logic Controller Programming Guide | Covers basic knowledge of PLC programming, quick start guidance, communication, motion control, and instructions for use of high-speed counters. |

## Revision History

| Revision time | Version | Description of change(s) |
|---|---|---|
| 2025-09 | A13 | Updated the battery code |
| 2025-05 | A12 | Corrected minor errors |
| 2025-02 | A11 | Corrected minor errors |
| 2024-08 | A10 | Updated the number of axes in Section *1.3 General Specifications* |

| Revision time | Version | Description of change(s) |
|---|---|---|
| 2023-12 | A09 | Added the following contents:<br>◆ Added the EtherCAT communication specifications in Section 1.3 General Specifications<br>◆ Added the PROFINET connection in Section 4.7Communication Connection Through Ethernet<br>Modified the following contents:<br>Updated the Ethernet specifications in Section 1.3 General Specifications |
| 2023-06 | A08 | Added the UKCA certification mark in Nameplate part and the DIN rail dimensions in Mechanical Design part. |
| 2022-10 | A07 | ◆ Added the description that electronic gear is not supported by H5U-1614MTD-A8S<br>◆ Added the surge voltage specifications |
| 2022-05 | A06 | Added the terminal wiring diagram, modified the specifications, and corrected minor errors |
| 2021-10 | A05 | Updated the barcode |
| 2021-07 | A04 | Added new model |
| 2021-04 | A03 | Added the links to all the H5U specific documents |
| 2020-11 | A02 | Corrected minor errors |
| 2020-06 | A01 | Added new model and revised information on LED fault codes |
| 2019-10 | A00 | Initial release |

## Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version by the following methods:

■ Website: Log in to the Inovance website (http://www.inovance.com), go to Service > Documentation > Download, enter the keyword, and then download the guide.

■ QR code: Scan the QR code on the product with your mobile phone.

■ My Inovance app: Scan the QR code below to install My Inovance app, where you can search for and download the guide.

Inovance provides gratis warranty service within the gratis warranty term (as specified in your order) for any fault or damage under normal use conditions.

Maintenance will be charged after the gratis warranty term.

Even within the gratis warranty term, maintenance will be charged for any damage caused by:

- Operations not following the instructions in the guide
- Fire, flood, and unusual voltage
- Using the product for unintended functions
- Using the product outside the specified scope
- Force majeure (natural disaster, earthquake, and lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

# Fundamental Safety Instructions

## ■ Safety statements

1. Read the following safety instructions before installation, use, and maintenance of the product.
2. To ensure the personal and product safety, follow all the instructions on the product and in this guide during installation, use, and maintenance of the product.
3. The "CAUTION", "WARNING", and "DANGER" signs are only supplements to the precautions, and do not reflect all safety instructions to be followed.
4. Use this product in the environment specified in this guide. Using this product in the environment not satisfying all the specifications can cause malfunction or damage to parts not covered by the gratis warranty range.
5. Inovance shall not be held responsible for any personal injury or loss of property caused by improper use.

## ■ Levels of precautions

DANGER : "DANGER" indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING : "WARNING" indicates that death or severe personal injury may result if proper precautions are not taken.

CAUTION : "CAUTION" indicates that minor personal injury or product damage can result if proper precautions are not taken.

Keep this guide properly at hand to read at any time and have it available for the end user.

| Design |
| --- |
| WARNING<br>◆ Configure safety circuits outside the product that include an emergency stop circuit, a protection circuit, an interlock circuit with contrary operations such as normal/reverse rotations, and an interlock circuit for preventing a machine from breaking beyond the upper or lower positioning limit.<br>◆ Configure a fault protection circuit outside the product to prevent unexpected mechanical movement caused by, for example, errors in a non-detectable I/O control area.<br>◆ Design a user program to ensure the user system safety in case of a fault regarding the display, control, communication, power supply of the product.<br>◆ Be sure that appropriate actions have been taken to prevent malfunction caused by a communication fault between the product and the master controller. Failure to doing so may cause personal injury or product damage.<br>◆ Protect the metal enclosure of the product in operation from touching any live parts. |

CAUTION

- Never configure switches on the touch panel that could cause personal injury or product damage. Configure separate switches for performing important operations, or an accident may result in case of an output error or a fault.
- Never configure switches on the touch panel that are used to control the safe operations of the product, such as an emergency stop switch. Configure separate hardware switches to control such operations. Failure to do so may cause severe personal injury or product damage.
- Never use the product as a warning device to give critical alarms that warn potential severe personal injury, product damage, or system down. Use a separate hardware and/or mechanical interlock to design a mechanism for giving critical alarms and the related control/triggering devices.

## Installation

WARNING

- Install the product indoors where the ambient conditions meet the requirements in "General Specifications" section below.
- Install the product in locations free from strong magnetic field, direct sunlight, high temperature, and inflammable gas/vapor/dust. Failure to do so may cause an explosion.
- Operate the product only in locations where there is no risk of severe temperature changes or high humidity. Failure to do so may cause water condensation inside the product, resulting in product damage.
- Be sure that all the cable connectors are connected to the product securely. Loose connection may result in wrong I/O signals.

CAUTION

- Install the product within the storage temperature range recommended in this guide. Failure to do so may cause display faults of the controller.

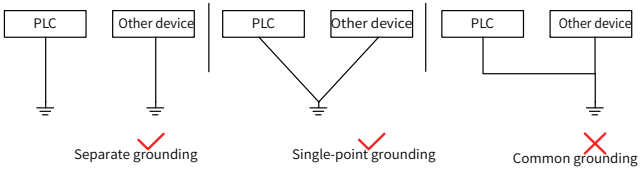
## Wiring

DANGER

- Before installing or wiring the product, be sure to turn off all the power supplies. Failure to do so may cause an electric shock or damage to the circuit.
- Connect the DC power supply to the terminals specified in this guide.
- When drilling screw holes or connecting cables, prevent metal chips and wire tailings from entering into the controller, which may cause a fault, component damage, or a fire.
- Check the cable connections carefully after wiring to ensure that the operating voltage and terminal positions are correct. Failure to do so may cause a fire or an accident.

## ☞ Grounding

Separate grounding or single-point grounding, other than common grounding, is recommended.




CAUTION

- Turn off all the power supplies before connecting the product to the power supply. Failure to do so may cause an electric shock.
- The rated input voltage of the product is 24 VDC. The input voltage outside 24 VDC ± 20% will cause severe damage to the product. Therefore, check the stability of the DC voltage from the switching power supply at a regular interval.

### Operation and maintenance

CAUTION

- Take care to protect the controller in operation. Touch the display panel of the product with your finger only. Failure to do so may cause panel damage, which is out of the gratis warranty range.
- When disposing of the product, treat it as industrial waste because lithium batteries, capacitors and other components may be harmful to personal health and the environment.

## ☞ Safety recommendations

- In positions where the operator directly touches the mechanical components, for example, where a mechanical device is loaded/unloaded, or where a machine runs automatically, manually-operated devices or other alternative means must be carefully designed so that they are independent of the controller to start or stop the automatic operation of the system.
- If you need to modify the program while the system is running, use the lock function or other protective measures to ensure that only authorized personnel can make the necessary modifications.

### Disposal

CAUTION

- When disposing of the product, treat it as industrial waste. When disposing of a used battery, trash it separately under the local relevant laws.

## Industrial Information Safety

The product has a network interface for data transmission. Provide an appropriate industrial information security mechanism in real time to protect plants, systems, machines, and networks from cyber attacks and ensure their safe operation.

Users are responsible for providing and continuously ensuring a secure connection between the product and their own or any third-party network to protect their plants, systems, machines and networks from unauthorized access. The product can be only connected to a safe network or the Internet when appropriate security measures are in place (e.g., using antivirus software, installing a firewall).

Inovance will keep developing and improving products and solutions for better safety. It is strongly recommended that you keep your product up to date and always use the latest product version.

CAUTION

Malicious software such as viruses, worms, and trojan horses may cause unsafe drive conditions, leaving the product in an unsafe operating state. This could result in death, serious injury, and loss of property. Strictly observe the following:

- Always use the latest software version. Users are at increased risk of cyber attacks if they use a product version that is no longer supported or if they fail to use the latest version of the program.
- Develop and maintain appropriate protection measures (including but not limited to deploying antivirus software, firewall, WAF, IPS/IDS, situation awareness system, authentication, data encryption) to prevent files in mobile storage devices from being corrupted by malicious software, and protect the product, networks, systems, and interfaces from unauthorized access, interference, intrusion, or data disclosure or snooping.
- Check all security-related interfaces and settings after commissioning.

# 1. Product Information

## 1.1 Model and Nameplate

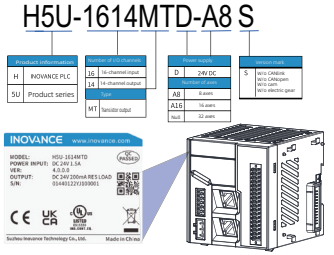
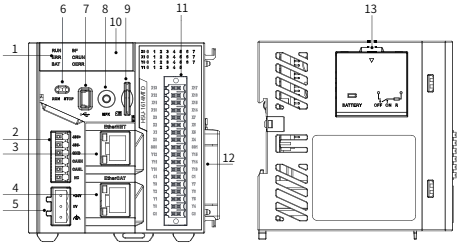



Figure 1 Description of model and nameplate

| Model | Type | Description | Code |
|---|---|---|---|
| H5U-1614MTD | PLC | H5U series PLC with 16-channel input and 14-channel output (32 axes) | 01440087 |
| H5U-1614MTD-A16 | PLC | H5U series PLC with 16-channel input and 14-channel output (16 axes) | 01440235 |
| H5U-1614MTD-A8 | PLC | H5U series PLC with 16-channel input and 14-channel output (8 axes) | 01440236 |
| H5U-1614MTD-A8S | PLC | H5U series PLC with 16-channel input and 14-channel output (8 axes, without CANopen/ CANlink and electronic cam/gear) | 01440315 |

## 1.2 External Terminals



| No. | Type | Assignment | Definition | Remarks |
|---|---|---|---|---|
| 1 | State indicator | RUN | Current operation state of the system | Steady ON when the system is running and OFF when the system is not running |
| | | ERR | PLC system fault | - |
| | | BAT | Battery error | - |
| | | BF | EtherCAT bus error | - |
| | | CRUN | CAN operation | - |
| | | CERR | CAN error | - |
| 2 | RS485/CAN interface | 485+ | 485 communication signal+ | MODBUS 485 and free communication protocols |
| | | 485- | 485 communication signal- | |
| | | GND | 485 communication ground | |
| | | CANH | CAN communication signal+ | CANopen/CANlink protocol (not supported by H5U-1614MTD-A8S) |
| | | CANL | CAN communication signal- | |
| | | CGND | CAN communication ground | |
| 3 | Ethernet interface | EtherNet | RJ45 interface for Ethernet communication | - |
| 4 | EtherCAT interface | EtherCAT | For EtherCAT communication | - |
| 5 | Power terminal | 24V | 24 VDC power supply | 24 VDC voltage input |
| | | 0V | 24 VDC power supply | |
| | | ⏚ | Functional ground | |
| 6 | DIP switch | RUN/STOP | Controls the operation/ stop of the main module | - |
| 7 | USB interface | ⇿ | Connects the USB device | - |
| 8 | Multifunction key | MFK | PLC IP address reset key | Active when PLC is in STOP state |
| 9 | SD card slot | SD | Holds the SD card | User program download |
| 10 | LED display | - | 00 - Normal<br>88 - System failure | Displays PLC operation and error states, and achieves special functions with the use of the MFK |
| 11 | I/O terminal | - | 16-channel input and 14-channel output | See terminal arrangement for detailed definition. |
| 12 | Module extension interface | - | For expansion module/ device connection | Supports up to 16 IO modules (hot plugging not supported) |

| No. | Type | Assignment | Definition | Remarks |
|---|---|---|---|---|
| 13 | Battery/DIP switch holder | Battery | Holds the standby battery and termination resistor | Installs the backup battery and termination resistor in the holder |

## 1.3 General Specifications

| Item | Specifications |
|---|---|
| Program data capacity | 200K steps<br>2 MB customized variable, of which 256 kB supports power-off memory<br>Approx. 150 KB soft elements, of which the elements numbered above 1000 supports power-off memory |
| Ethernet | Supports EtherNet/IP, PROFINET, Modbus TCP, Socket, program upload and download, and firmware upgrade |
| EtherCAT communication | Supports one EtherCAT master with up to 72 EtherCAT slaves |
| Number of axes | H5U-1614MTD: maximum 32 axes (up to 32 axes for bus axis, 4 axes for local pulse axis, and 32 axes for virtual axis)<br>H5U-1614MTD-A16: maximum 16 axes (up to 16 axes for bus axis, 4 axes for local pulse axis, and 16 axes for virtual axis)<br>H5U-1614MTD-A8: maximum 8 axes (up to 8 axes for bus axis, 4 axes for local pulse axis, and 16 axes for virtual axis)<br>H5U-1614MTD-A8S: maximum 8 axes (up to 8 axes for bus axis, 4 axes for local pulse axis, and 16 axes for virtual axis) |
| Serial communication | One-channel RS485 |
| CAN communication | Supports CANlink and CANopen (not supported by H5U-1614MTD-A8S) |
| Power supply specifications | 24 V, 1.5 A |
| High-speed input | Four-channel 200 kHz |
| High-speed output | Four-axis 200 kHz |
| Expansion module | 16 local expansion modules |
| Programming language | LD and SFC, supporting the FB/FC function (LD) |
| USB and SD card | Supports user program download/upload and firmware update (firmware upgrade not supported by USB) |
| Operating temperature | – 10℃ to +55℃ |
| IP rating | IP20 |
| Ambient conditions | Locations free of corrosive or flammable gas and conductive dust |
| Altitude | Up to 2000 m (80 kPa) |
| Pollution degree | 2 |
| Interference immunity | 2 kV on power cables (IEC 61000-4-4) |
| Overvoltage category | I |
| Electromagnetic compatibility (EMC) immunity level | Zone B, IEC61131-2 |

| Item | Specifications |
|---|---|
| Vibration resistance | Operation: Pass the sinusoidal vibration test according to IEC 60068-2-6. Test conditions: 5 Hz to 8.4 Hz, 3.5 mm; 8.4 Hz to 200 Hz, 1 g; 10 cycles each in X, Y and Z directions.<br>Transport: Pass the random vibration test according to IEC 60068-2-64. Test conditions: 5 Hz to 100 Hz, 0.01 $g^2$/Hz; 200 Hz, 0.001 $g^2$/Hz, 1.14 g; 30 min each in X, Y and Z directions. |
| Shock resistance | Operation: Pass the shock test according to IEC 60068-2-27. Test conditions: 15 g peak acceleration, 11 ms pulse width, total 18 shocks in X, Y and Z directions.<br>Transport: Pass the shock test according to IEC 60068-2-27. Test conditions: 15 g peak acceleration, 11 ms pulse width, total 18 shocks in X, Y and Z directions. |
| Overcurrent protection device | 1.5 A fuse |
| Storage temperature and humidity | Storage temperature: – 20℃ to +60℃<br>Relative humidity: < 90% RH, non-condensing |
| Transportation temperature and humidity | Transportation temperature: – 40℃ to +70℃<br>Relative humidity: < 95% RH, non-condensing |

## 1.4 Input Specifications

The bipolar voltage input is supported. The signal state is defined as OFF when the absolute voltage is below 5.0 V and as ON when the absolute voltage is above 15.0 V; the signal state is undefined when the absolute voltage ranges from 5.0 V to 15.0 V.

| Item | | High-speed input (X0 – X3) | Medium-speed input (X4 – X7) | Normal input (X10 – X17) |
|---|---|---|---|---|
| Signal input mode | | Sink/Source<br>Sink input in case of shorting the SS0/SS1 terminal to 24 V<br>Source input in case of shorting the SS0/SS1 terminal to 0 V | | |
| Electrical parameters | Input voltage | 24 VDC | | |
| | Input impedance | 2 kΩ | 3.3 kΩ | 4.3 kΩ |
| | Input ON | Input current above 7.5 mA | Input current above 4.5 mA | Input current above 3.5 mA |
| | Input OFF | Input current below 2.5 mA | Input current below 1.5 mA | Input current below 1.5 mA |
| Filter | Digital filter | High-speed input (X0 – X3) and medium-speed input (X4 – X7) support digital filter setting. | | |
| | Hardware filter | Normal input (X10-X17) supports hardware RC filter with the RC time of about 15 ms. | | |
| High-speed function | | X0 – X3 support high-speed counting and interruption, with a frequency of 200 kHz. | | |
| Surge voltage | | 35 VDC for 0.5s | | |

| Item | High-speed input (X0 – X3) | Medium-speed input (X4 – X7) | Normal input (X10 – X17) |
|---|---|---|---|
| Common wiring terminal | The PLC has two common terminals of SS0 (for X0 – X3 and SS1 (for X4 – X17). | | |

NOTE

- When all inputs are ON, the voltage cannot be more than 26.4 V.
- The low-speed input filter time is the RC time ranging from 2 ms to 1000 ms.
- The high-speed input digital filter time is 2 μs to 1000 μs.
- For medium-speed input, the response time is about 4 μs for input ON and 35 μs for input OFF.

## 1.5 Output Specifications

The output is dry contact type. An active output ("ON") indicates a closed state, and an inactive output ("OFF") indicates an open state.

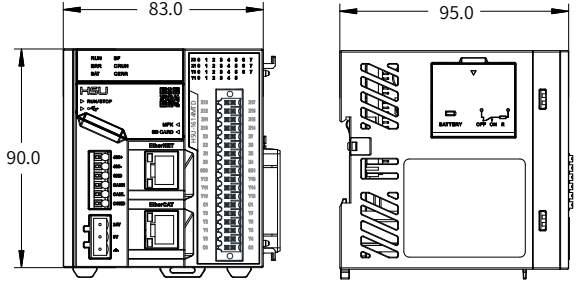
| Item | | High-speed output (Y0 – Y7) | Normal output (Y10 – Y15) |
|---|---|---|---|
| Circuit supply voltage | | 5 VDC to 24 VDC | |
| Output type | | Transistor NPN | |
| Isolation mode | | Optocoupler isolation | |
| Leakage current in open circuit | | Less than 0.1 mA/30 VDC | |
| Min. load | | 12 mA at 10 kHz and above high-speed output | 5 mA |
| Max. output current | Resistive load | 0.8 A/4 points | 0.8 A/4 points; 1.6 A/6 points |
| | Inductive load | 7.2 W/24 VDC | 12 W/24 VDC |
| | Lamp load | 0.9 W/24 VDC | 1.5 W/24 VDC |
| ON response time | | High speed output (12 mA load): 1 μs | 0.5 ms |
| OFF response time | | | |
| High-speed output frequency | | Up to 200 kHz per channel | / |
| Common terminal | | One group shares one common terminal and groups are isolated from each other. | |
| Fuse protection | | No | |

The high-speed output circuit is equipped with automatic short-circuit protection, which is deactivated when the output is OFF. The energy shock cannot be more than 100 times/second under the protection. Therefore, high-speed output cannot be connected to capacitive load greater than 10 μF.

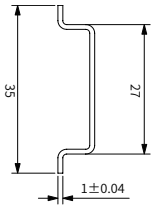
# 2 Mechanical Design

## ■ Overall dimensions

The overall dimensions (mm) of the PLC are shown in the following figure.

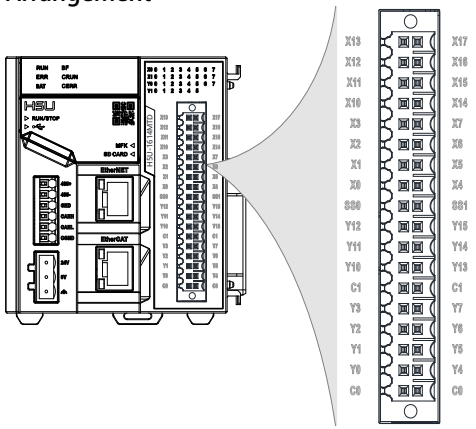



The overall dimensions (mm) of the DIN rail are shown in the following figure.



# 3 Electrical Design

## 3.1 Terminal Arrangement




| Definition | Terminal | Terminal | Definition |
|---|---|---|---|
| Normal input | X13 | X17 | Normal input |
| Normal input | X12 | X16 | Normal input |
| Normal input | X11 | X15 | Normal input |
| Normal input | X10 | X14 | Normal input |
| High-speed input | X3 | X7 | Medium-speed input |
| High-speed input | X2 | X6 | Medium-speed input |
| High-speed input | X1 | X5 | Medium-speed Input |
| High-speed input | X0 | X4 | Medium-speed Input |
| Common terminal for high-speed input | SS0 | SS1 | Common terminal for normal-/medium-speed input |
| Normal output | Y12 | Y15 | Normal output |
| Normal output | Y11 | Y14 | Normal output |
| Normal output | Y10 | Y13 | Normal output |
| Common terminal for normal output | C1 | C1 | Common terminal for normal output |
| High-speed output | Y3 | Y7 | High-speed output |
| High-speed output | Y2 | Y6 | High-speed output |
| High-speed output | Y1 | Y5 | High-speed output |
| High-speed output | Y0 | Y4 | High-speed output |
| Common terminal for high-speed output | C0 | C0 | Common terminal for high-speed output |

NOTE

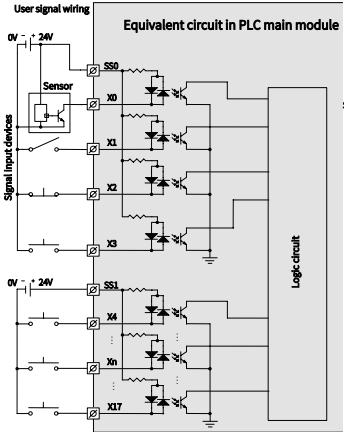
- The relationship between the screenprint and label of a terminal is as follows: CH0-X0 (label text) = X0 (screenprint); CH1-Y10 (label text) = Y10 (screenprint); COM0 (label text) = C0 (screenprint), and so forth. CH0/CH1 represents channel 0/1.
- CH0/CH1 is distinguished by COM0/COM1 and SS0/SS1 respectively. For example, CH0-Y0 corresponds to COM0 and CH0-X0 corresponds to SS0.
- SS0 is the common terminal of input terminals X0 – X3 (high-speed input) of channel 0, and SS1 is the common terminal of input terminals X4 – X17 (medium-speed and normal-speed input) of channel 1.
- C0 (COM0) is the common terminal of input terminals Y0 – Y7 of channel 0, and C1 (COM1) is the common terminal of input terminals Y10 – Y15 of channel 1.

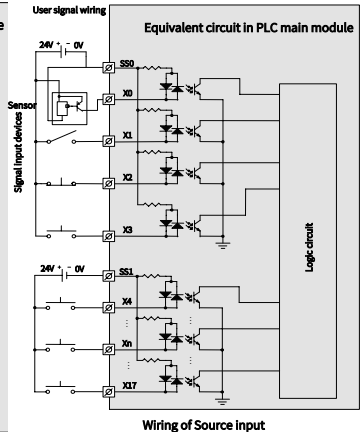
### ■ Wiring precautions

1) The length of extension cables for high-speed I/O terminals must be within 3.0 m.
2) Do not bundle the cables with power cables (high voltage, large current) and other cables that produce strong interference signals. Separate the cables from power cables or other aforementioned cables and avoid cabling in parallel.

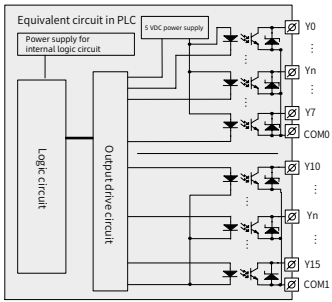
## 3.2 Equivalent Circuit for Normal-/High-Speed Input

### ■ Wiring of Sink/Source input

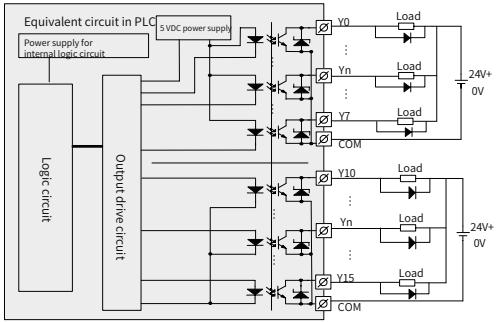



## 3.3 Transistor Equivalent Circuit for Normal-/High-Speed Output




■ Wiring of output circuit




NOTE

- External freewheel diodes are required for connection with inductive load. Diodes can be 1N4001 or similar.

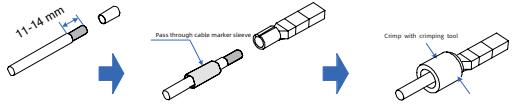
# 4 Communication Connection

## 4.1 Cable Selection and Preparation

| Applicable signal | Supporting material | Applicable cable cross-sectional area | |
|---|---|---|---|
| | | $MM^2$ | AWG |
| Power cable | Tubular lug | 0.5 – 1.5 | 24 – 16 |
| Signal cable | Tubular lug | 0.5 – 1.5 | 24 – 16 |
| Grounding cable | Tubular lug | ⩾ 2 | 14 – 1.5 |

Preparing a cable with a tubular lug:

1) Strip the cable insulation layer to expose 11 – 14 mm of copper, and then pass the cable through the cable marker sleeve.
2) Insert the exposed conductor into the hole of the cable lug, and then crimp it with the crimping tool recommended by the cable lug manufacturer.
3) Put the cable lug onto the terminal block and use a screwdriver to tighten the cable with a tightening torque of up to 0.45 N • m.

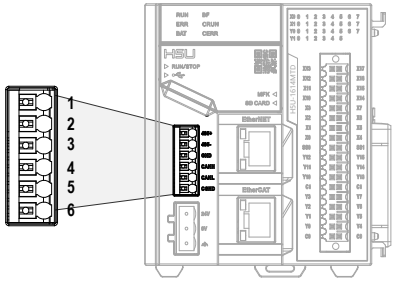



When tubular lugs are used for power cables, grounding cables, CAN and RS485 communication cables, the exposed copper portion must be 6 mm to 10 mm. For other signal cables, the exposed copper portion must be 11 mm to 14 mm.

## 4.2 Connecting PLC Cables

1) Connecting the communication terminals

The PLC communication terminals consist of CAN and RS485 communication terminals and are assigned as shown in the following figure.




Pin assignment:

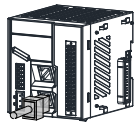
| Pin | Assignment | Description |
|---|---|---|
| 1 | 485+ | RS485 differential pair signal+ of COM0 |
| 2 | 485- | RS485 differential pair signal- of COM0 |
| 3 | GND | Power supply ground of COM0 |
| 4 | CANH | CAN communication data receipt terminal |
| 5 | CANL | CAN communication data sending terminal |
| 6 | CGND | CAN communication grounding terminal |

Wiring

Select a proper cable with a tubular lug and connect the cable to the communication terminal according to the communication settings.

2) Connecting the Ethernet/EtherCAT network cable

Insert a RJ45 connector into the RJ45 interface of the communication module until you hear a clicking sound, as shown in the following figure.



Removal: Press the tail of the RJ45 connector to pull the connector horizontally out of the module.

3) Requirements for fixing the communication cable

Fix the cable near the product before EtherCAT or CANopen communication to prevent the communication cable from being affected by other tensions and ensure the communication stability.

## 4.3 Connecting the EtherCAT Bus

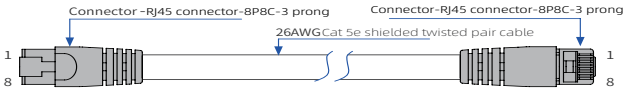
1) EtherCAT specifications

| Item | Specification |
|---|---|
| Communication protocol | EtherCAT protocol |
| Service supported | CoE (PDO, SDO) |
| Synchronization mode | Servo: distributed clock (DC); IO: synchronized input and output |
| Physical layer | 100BASE-TX |
| Baud rate | 100 Mbps (100Base-TX) |
| Duplex mode | Full duplex |
| Topology | Linear |
| Transmission medium | Network cables; see the Wiring section |
| Transmission distance | Less than 100 m between two nodes |
| Number of slaves | Up to 72 |
| EtherCAT frame length | 44 bytes to 1498 bytes |
| Process data | Max. 1486 bytes per Ethernet frame |

2) Wiring

The PLC provides a CN4 terminal for EtherCAT bus communication. The communication cable must meet the following requirements:

- Requirements on the ECT communication cable:




- Signal pin assignment

| Pin | Signal | Direction | Description |
|---|---|---|---|
| 1 | TD+ | Output | Data transmission+ |
| 2 | TD- | Output | Data transmission- |
| 3 | RD+ | Input | Data reception+ |
| 4 | - | - | Not used |
| 5 | - | - | Not used |
| 6 | RD- | Input | Data reception- |
| 7 | - | - | Not used |
| 8 | - | - | Not used |

- Length requirements:

According to FastEthernet technology, the length of an EtherCAT bus (if used) between devices cannot exceed 100 m; otherwise, it may result in signal attenuation and thus affect normal communication.

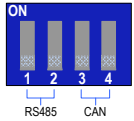
- Technical requirements:

100% continuity test must be performed to eliminate the risks of short circuit, open circuit, miswiring, and improper contact. The cable meeting the following specifications is recommended.

| Item | Specifications |
|---|---|
| Cable type | Flexible crossover cable, S-FTP, Cat 5e |
| Reference standards | EIA/TIA568A, EN50173, ISO/IEC11801<br>EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36 |
| Cross-sectional area | AWG26 |
| Conductor type | Twisted pair |
| Number of pairs | 4 |

## 4.4 DIP Switch for Termination Resistor

The DIP switch is located in the battery holder. As shown in the following figure, ON indicates that the termination resistor is connected (OFF by default); pins 1 and 2 are used for RS485 communication, while pins 3 and 4 are used for CAN communication.




## 4.5 Connecting the CANopen/CANlink Bus

In a CAN network, three cables of each device must be connected correspondingly one by one. A 120 Ω termination resistor must be installed to each end of the CAN bus. The H5U has a built-in resistor, which can be connected through a DIP switch. The CAN bus connection topology is as follows:

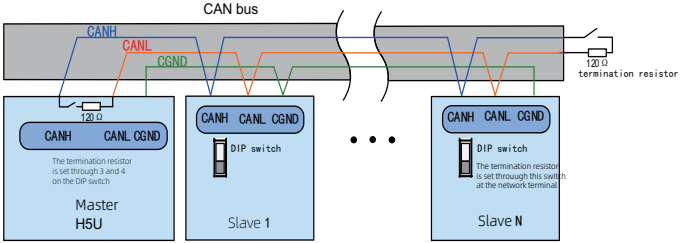



Figure 9 CANopen/CANlink communication connection

The relationship between CANopen transmission rate and transmission

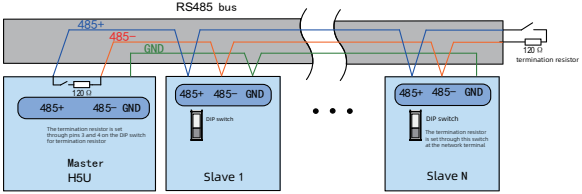
distance is as follows:

| Baud rate (bps) | Maximum bus length (m) |
|---|---|
| 1M | 20 |
| 500k | 90 |
| 250k | 150 |
| 125k | 300 |
| 50k | 1000 |

Do not bundle the cable with AC power cables and high voltage cables. Dosing so may produce interference to communication signals.

## 4.6 Serial Communication Connection Through RS485

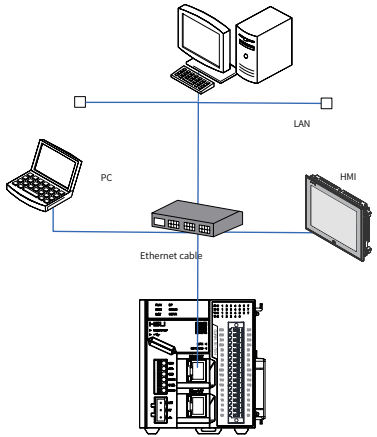
The RS485 bus connection topology is shown in the following figure. The shielded twisted pair cable is recommended to be used as the RS485 bus. Use twisted pair cables to connect 485+ and 485-. Connect a 120 Ω termination resistor to each end of the bus to prevent signal reflection. Connect the reference grounds of 485 signals for all nodes together. A maximum of 31 nodes can be connected and the distance between two nodes must be less than 3 m.



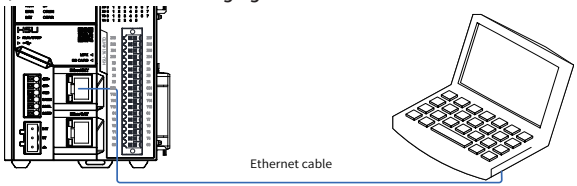

## 4.7 Communication Connection Through Ethernet

1) Networking

The PLC can be connected to other network devices through a hub or switch, as shown in the following figure.




The PLC can be also connected to a computer or HMI through an Ethernet cable, as shown in the following figure.




2) EtherNet/IP and PROFINET protocol connection
The PLC can be connected to network devices that support EtherNet/IP or PROFINET communication through a hub or switch or through an Ethernet cable.

3) Wiring

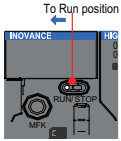
To improve the communication reliability of the product, use Cat 5 shielded twisted pair cable as the Ethernet cable with iron-shelled molded connector. Wiring must be performed as described in the EtherCAT wiring requirements.

# 5 Operation and Maintenance

## 5.1 Start and Stop

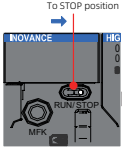
After the PLC is programmed, start and stop it as follows.

To run the PLC:




1. Toggle the RUN/STOP switch to RUN position.


2. Check that the RUN indicator in green is steady ON.




3. To stop the PLC, toggle the RUN/STOP switch to "STOP" position, or stop it through the host controller.

## 5.2 Maintenance of Backup Battery

The backup battery of the PLC is used for real-time clock (RTC) timing.

1) If the battery is not installed or is discharging, the timing will stop.
2) The maximum service life of a battery is 5 years, depending on the environment in which it is used. When a battery runs out, replace a new one promptly.
3) The battery provided is 3 V CR2032 button battery. You can purchase our battery with leads (code 71010001) as the replacement battery.

- Replacing the battery

1) Set the DIP switch to STOP position to turn off the power supply of the PLC module.
2) Open the cover of the battery/DIP switch holder, and take out the battery with a tweezer or suitable tool.
3) Push the new battery into the holder and close the cover.

NOTE

The battery is preferably replaced with power on. If the PLC is powered off, replace a new battery within 30s after removing the old one to ensure normal operation of the RTC.

## 5.3 PLC Indicators

| Name | Description | Name | Description |
|---|---|---|---|
| RUN indicator | Indicates the current system status (running or not running). Steady ON when the system is running and OFF when the system is not running | BF indicator | EtherCAT bus error |
| ERR indicator | System fault | CRUN indicator | CAN operation |
| BAT indicator | Battery error | CERR indicator | CAN error |

## 5.4 MFK Key

The MFK key is used with the LED for multi-function menu operation. When you press and hold the MFK key, the function menus are switched on the LED screen every 2s, as shown in the following figure. If you want to select a function menu, release the MFK key when the desired menu is displayed, and then press the MFK key breiefly. Note: pressing for a brief period means pressing for less than 2s.


If the desired function cannot be performed, the LED screen will display an error.

| Display code | Description | Display code | Description |
|---|---|---|---|
| E1 | The PLC is in an unsafe state (running or downloading) and thus any operation is prohibited. | E3 | Multiple programming files are detected in the SD card. |
| E2 | No SD card or programming file is detected. | E4 | There is abnormal data in a programming file or incompatible device model. |
| E5 | Password verification error. | - | - |

## 5.5 Restoring the Default IP Address

The default IP address of the CPU module is 192.168.1.88. If you have modified the address and forget the new address, use the "IP" menu to reset the address to the default.


Select the "IP" menu, and the LED screen displays a countdown from 10 to 0.


After the countdown, the IP address is reset. During the countdown, you can press the MFK key to cancel the reset operation.

## 5.6 Loading User Programs to SD Card

Save the programming file compiled in Autoshop into the "PLCProgram" directory of the SD card, and then insert the SD card into the PLC main module. Select the "Sd" menu to load the user programs in the SD card into the PLC. The LED screen displays the progress (00 – 99) during loading and "PP" after loading is done.


## 5.7 LED Display of CPU Module

When a system fault occurs, the LED screen of the CPU alternatively displays "ER" and the fault code. For example, if the fault code is 1501, the LED screen will display as follows.


For details about fault code information and solutions, see H5U & Easy Series Programmable Logic Controller Programming and Application Guide.

# Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

# INOVANCE Warranty Agreement

Inovance provides an 18-month gratis warranty term from the date of manufacturing (subject to information indicated by the barcode on the product, or the purchase contract terms if otherwise specified) for any failure or damage under normal use conditions given in the user guide.

Even within the gratis warranty term, maintenance will be charged for the following damage:

1) Damage caused by improper use and unauthorized disassembly, repair, or retrofit
2) Damage caused by fire, flood, abnormal voltage, other disasters, and secondary disasters
3) Hardware damage caused by equipment fall-off or caused during transportation
4) Damage caused by failure to operate the product according to the user guide from Inovance
5) Faults and damage caused by the factors other than the equipment itself (for example, external device factors)

If there is any failure or damage to the product, properly fill out the Product Warranty Card.

Maintenance will be charged according to the latest Maintenance Price List of Inovance.

This card is not re-issued. Keep the card properly and present it to the maintenance personnel for future maintenance needs.

Contact Inovance or Inovance agents for any issues arising during the service.

The customers who purchase the product are assumed to agree on this agreement. The interpretation of this agreement shall be at the sole discretion of Inovance.

# INOVANCE Warranty Card

<table>
<tr><td rowspan="3">Customer Information</td><td colspan="2">Company address:</td></tr>
<tr><td rowspan="2">Company name:<br>Postcode:</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 Information</td><td colspan="2">(Maintenance date and description):<br><br>Maintained by:</td></tr>
</table>