

Thank you for purchasing the H_{3U} Series Programmable Logic Controller (PLC), the third-generation high-performance PLC developed by Inovance Technology. Thanks to the latest industrial-strength CPU and FPGA hardware structure and embedded software with independent intellectual property rights, the product performance and capacity has been substantially improved. In addition, H_{3U} provides a wide range of functions including positioning and trajectory tracking control. What's more, Inovance has separately developed the H_{3U} pulse-type model for three-axis motion control. The model integrates the patented pulse-by-pulse modulation technology to realize frequency modulation at each pulse during acceleration and deceleration, thus substantially improving stability of motors.

Related Manuals
 This manual only provides information including specifications, environmental requirements, and installation and wiring instructions. Before use, please also read following manuals to understand definitions and scope of soft components and other functional and application instructions related to this product (please visit www.inovance.cn to download the latest versions): Programming Manual of Inovance Small-sized PLCs – the programming manual of H_{1U} and H_{2U}, document code: 19010209 Hardware Manual of AM600 Series PLC – It is used when the AM600 expansion module is used, document code: 19010322

Summary
 The following table highlights the major specifications of the H_{3U} motion control model:

Item	H3U Standard Model	H3U Motion Control Model
Program capacity	64K	64K
Basic instruction rate	100ns	100ns
High-speed input	200K (8 inputs)	200K (3 inputs) ¹⁾
High-speed output ²⁾	200K (5 inputs)	500K (3 inputs) ³⁾
Storage capacity in case of a power failure	40K	40K
Interpolation	Two-axis arc, straight line	Two-axis arc, three-axis straight line and spiral line
Electronic cam	None	Three-axis electronic cam
Communication	RS485 (1), RS422(1), USB, Ethernet and CAN ⁴⁾	RS485 (1), RS422 (1), USB, Ethernet and CAN ⁴⁾
Scalability	AM600 local expansion module, CANLink remote module of H _{3U} and CANOpen remote module of AM600	AM600 local expansion module, CANLink remote module of H _{3U} and CANOpen remote module of AM600

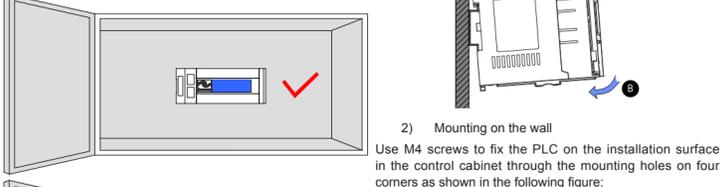
- The three channels of AB phase counters need 6 high-speed differential or single-ended inputs as handle inputs or feedback inputs.
- High-speed outputs apply for only models with transistor outputs. H_{3U} standard models use open-drain outputs. Motion models use differential outputs.
- Three-axis output is defined. Each axis includes two groups of differential outputs, which can serve as AB phase outputs in the CW/CCW output format or pulse plus direction mode.
- CAN supports Inovance CANLink or CANOpen, DS301 master and slave protocols.

Safety Precautions
 This product should be used only by professionals according to the right procedures. Please pay attention to the following safety precautions during use. Otherwise, bodily injury or property loss can be caused. Safety identifications have the following definitions:

- DANGER:** Wrong operations are very likely to cause death or serious injury;
- WARNING:** Wrong operations can cause death or serious injury;
- CAUTION:** Wrong operations can cause moderate or minor injury and equipment damage.

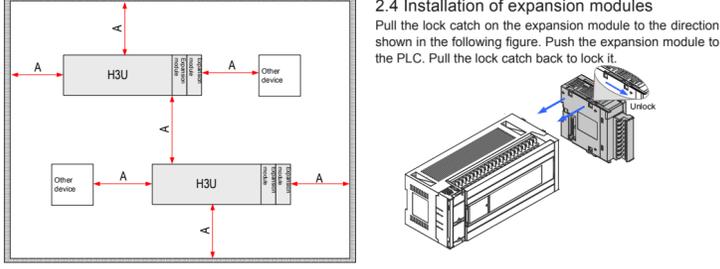
2.2 Installation position and space

The PLC should be installed in the correct position horizontally as shown in the following figure.



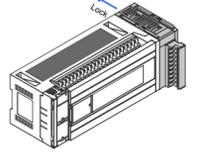
2) Mounting on the wall
 Use M4 screws to fix the PLC on the installation surface in the control cabinet through the mounting holes on four corners as shown in the following figure:

To ensure properly ventilation, the distance A between the PLC and modules should be larger than 50 mm.



2.3 Installation procedure

- The H_{3U} series PLC can be installed on DIN rails or mounted on the wall using M4 screws.
 - Installation of DIN rail (DIN46277, 35 mm wide)
 - Fix the DIN rails on the mounting surface in the control cabinet.
 - Clip the mounting slot on the PLC in the upper edge of the rail horizontally as shown in the following figure.
 - Press the PLC in the direction B shown in the following figure until you hear a click sound. Check whether the PLC is fully and vertically clipped in on the DIN rails.



2 Design Precautions

- DANGER:** Please configure the external safety circuit for the PLC to ensure that the entire system can work safely when the external power supply or PLC fails. Wrong operations or outputs can lead to accidents.
- Please configure the emergency stop circuit, protective circuit, interlocking circuit that can prevent concurrent opposite operations such as forward and reverse rotations, and interlocking circuits that can prevent mechanical damage such as top and bottom positioning limits.
- When the PLC's CPU detects a fault using its self-diagnosis functions such as watchdog timer failure, all outputs are disconnected. In addition, when the PLC's CPU cannot detect input/output control faults, output control becomes invalid. In such case, external circuits and structure should be designed to ensure that the mechanical equipment can work safely.
- The output current supplied by DC24V to the power supply can be different by the model and expansion modules. In case of overload, some outputs become OFF in addition to that the voltage declines automatically and inputs of the PLC become invalid. In such case, external circuits and structure should be designed to ensure that the mechanical equipment can work safely.
- Failures in relays, transistors and thyristors of output components can lead to consistent connection or disconnection of outputs.
- External circuits and structures should be designed for output signals that can lead to serious accidents to ensure that the mechanical equipment can work safely.
- Do not bundle control cables together with or close to the main circuit or power cables in principle, the distance between the cables should exceed 100 mm. Otherwise, noise can cause false tripping.
- Please ensure that no external force is exerted on connectors of peripheral equipment during use. Otherwise, disconnection and faults can be caused.

2 Installation Precautions

- CAUTION:** Disconnect all external power supplies before installation. Failing to do so may cause an electric shock.
- This product must be used in the environment specified in section 2.1 "General Specifications" of this manual. Do not use this product in an environment with dust, oil smoke, conductive dust, corrosive gases and inflammable gases. Do not expose the product to high-temperature, condensing, windy and rainy environments. Do not use the product under vibration and impact. Otherwise, electric shocks, fires, false tripping, product damage and aging can be caused.
- Do not touch any conductive parts of the product. Otherwise, false tripping and faults can be caused.
- While mounting the product, use DIN rail or mounting screws to fix the product. Please mount the product on a flat surface. While handling bolt holes, do not let cuttings and wire crumbs fall into the PLC through ventilation holes. Otherwise, fires, faults and false tripping may be caused.
- Please remove the dust-proof paper sheets on the ventilation holes of the PLC after the mounting process is finished. Otherwise, fires, faults and false tripping may be caused.
- Please connect the connection cables of peripheral units, input and output cables, and battery cable to the specified connectors. Poor contact may cause false tripping. Local expansion modules must be firmly locked on two sides. Otherwise, false tripping can be caused.

2 Wiring Precautions

- CAUTION:** Disconnect all external power supplies before wiring. Otherwise, electric shocks and product damage can be caused.
- The terminal cover must be installed before the PLC can be powered on after wiring. Failing to do so may cause an electric shock.
- Perform D-type grounding on the grounding terminals of the main module and expansion modules using cables of 2 mm² and above (grounding resistance: under 100 Ω). Do not ground the terminals together with strong current.
- Connect AC power cables to the terminals specified in this manual. Connect DC power cables to the terminals specified in this manual. The PLC will get burnt if the AC power supply is connected to the DC output/input terminals and DC power terminals.
- Do not connect NC terminal. Otherwise, this may damage the product.
- While handling bolt holes and connecting wires, do not let cuttings and wire crumbs fall into the PLC through ventilation holes. Otherwise, fires, faults and false tripping may be caused.
- While wiring the terminal block on expansion units or terminal module, handle cable ends according to the dimensions specified on the manual. Use the torques specified in this manual as the fastening torques. Otherwise, an electric shock, faults, short circuit, disconnection, false tripping and product damage can be caused.
- Please pay attention to the following while connecting terminals on a European-style terminal block. Otherwise, electric shocks, faults, short circuit, disconnection, false tripping and product damage can be caused.
 - Ends of twisted wires must be properly and fully twisted. Do not tin the ends of electric wires.
 - Do not connect electric wires of wrong specifications or connect more wires than the specified.
 - Do not exert a force directly on the connection part of the terminal block or electric wire.

2 Starting and Maintenance

- CAUTION:** Do not touch terminals while the PLC is power-on. Disconnect the PLC from all external power supplies before cleaning and fastening terminals. Otherwise, an electric shock and false tripping can be caused.
- Use and connect the Lithium cell as specified in this manual. Do not recharge, dismantle, heat, short, reversely connect, weld, swallow or burn the cell. Do not cast it into fire or exert a large force (vibrate, smash or drop) on the cell. Inappropriate handling with the cell may cause bodily injury, fires or faults or false tripping of the PLC and other machines. Do not use or store the cell in high-temperature environments or under direct sunlight.
- Do not let leakage or other content in water, close to fire or touch them directly.
- Do not use it for purposes other than the specified ones.
- Please carefully read the manual and ensure safety before modifying the program, implementing pushed output, RUN, STOP and other operations. Otherwise, this may cause mechanical damage and accidents.
- Do not modify the program in the PLC from multiple peripheral devices. This may damage the program of the PLC and cause false tripping.
- Disconnect the PLC from all power supplies before dismantling the SD card. Dismounting the SD card when the PLC is power-on may damage the card and data in it.
- Do not dismantle or modify the PLC without authorization. Otherwise, fires, faults and false tripping may be caused.
- Disconnect the PLC from all power supplies before dismantling connection cables such as expansion cables. Otherwise, faults and false tripping may be caused.
- Disconnect the PLC from all power supplies before dismantling peripheral devices, expansion units/modules or cell. Otherwise, faults and false tripping may be caused.

3 Disposal and Transportation

- CAUTION:** The PLC should be disposed of as industrial waste. The lithium cells should be disposed of according to local laws.
- The PLC is a precision device. General impacts should be prevented during the transportation process. Otherwise, faults can be caused to the PLC. After the PLC is transported to the destination, check whether it can function properly.
- Follow the transportation requirements during the transportation of lithium cells.

1.1 Product information

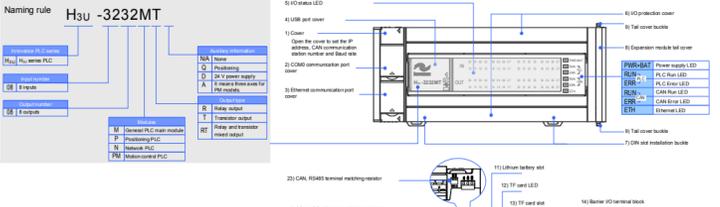


Figure 1 Outer appearance and description of H_{3U}-3232MT

1.1 Product information

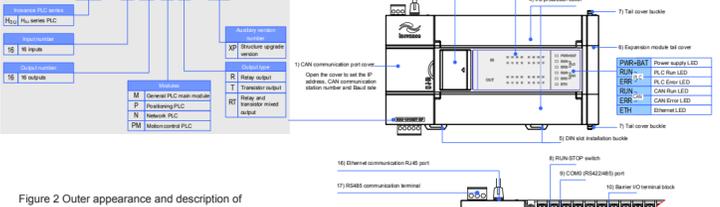
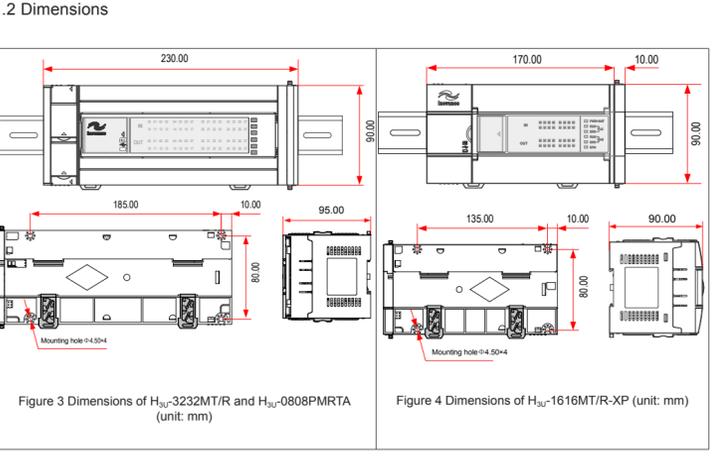


Figure 2 Outer appearance and description of H_{3U}-1616MT-XP

Note: The outer appearance of the ports of models suffixed with -XP is different from that of models without the suffix of -XP.

1.2 Dimensions

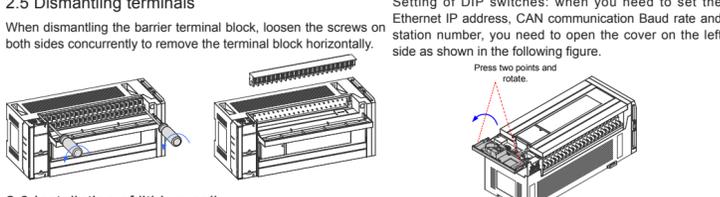


2 Installation Instructions

2.1 Installation environment

Item	Specifications			
Ambient Temperature	Running: -5~55°C, storage: -25~75°C			
Relative Humidity	Running: 5~95% RH (non-condensing)			
Vibration	When a DIN rail is installed	Frequency (Hz)	Acceleration (m/s ²)	One-way amplitude (mm)
		10~57	—	0.035
Vibration	When a PLC is directly installed	10~57	4.9	—
		57~150	9.8	0.075
Working environment	Do not use the PLC in environments with strong erosive and flammable gases or conductive dust.			
Elevation	Below 2,000 m			

2.5 Dismantling terminals



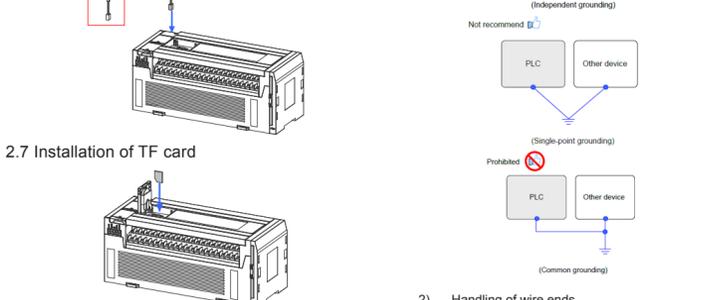
2.6 Installation of lithium cell

Follow the procedure to install a new lithium cell when necessary.



3 Wiring and Specifications

3.1 Wiring requirements



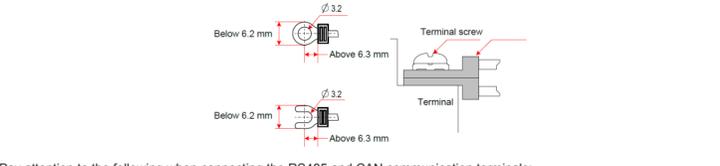
2.7 Installation of TF card



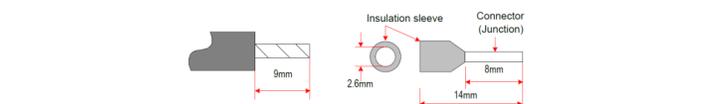
2.8 When Ethernet cable is installed via the COM0 port



3.2 Specifications requirements



- Pay attention to the following when connecting the RS485 and CAN communication terminals:
- The end of twisted wire must be properly and fully twisted;
 - Do not tin the end of the wire. Use the rod terminal.



3.2 Specifications requirements

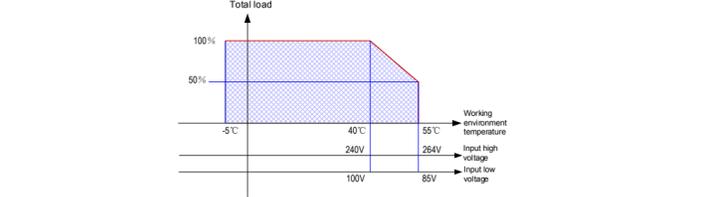
Item	Specifications	
Impact resistance	147m/s ² for 11 ms, three times in each of the X, Y and Z directions under the half-sine pulse.	
Noise resistance	Use the noise simulator with a noise voltage of 1,000 Vp-p, noise width of 1 μs, rising edge of 1 ns and frequency of 30-100 Hz.	
Withstand voltage	AC 500 V for 1 minute AC 1.5 kV for 1 minute	Between terminals and the ground
Grounding 1	D grounding (grounding resistance: below 100 Ω) < do not ground it together with a strong current system (please see section 3.1 "Grounding Requirements")	

1) Power supply specifications

Item	Unit	Min	Typical value	Max	Remarks
Working voltage	Vac	100	220	240	Built-in 2 A fuse
Extreme working voltage	Vac	85	/	264	Vac85-100, the PLC needs to be de-rated when the voltage is between Vac240-Vac264.
Input current	A	/	/	1	85 Vac input, full-load output
Input power	W/VA	/	/	24W/30VA	
Output voltage	5V/GND	V	4.75	5	5.25
	24VDD/GND	V	21.6	24	26.4
	24VCC/COM	V	21.6	24	26.4
Output current	5V/GND	mA	/	/	800
	24VDD/GND	mA	/	/	350
	24VCC/COM	mA	/	/	400

If the external power supply exceeds the scope, it may cause damage to the PLC, failure in responding to input and output signals or false tripping. Please de-rate the PLC in a high-temperature environment to ensure safety. Please see the following curve for de-rating in high-temperature, high-voltage and under-voltage scenarios.

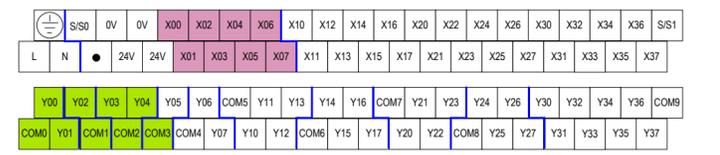
3.3 I/O terminals



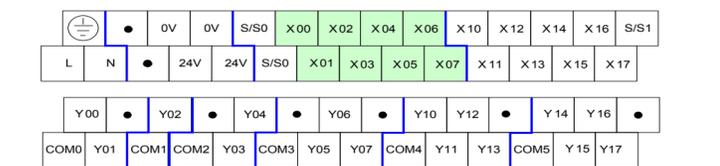
- When an expansion module is used, the module needs a current of 5 V/GND. Normally, a digital module needs 50 mA, while an analog module needs 100 mA. The main PLC module needs 200 mA. Therefore, when expansion modules are being connected:
- The total number of expansion modules must not exceed eight.
 - The total current of 5V/GND consumed by expansion modules must not exceed 600 mA.

3.3.1 Layout of terminals

Terminals of H_{3U}-3232MT/R



Terminals of H_{3U}-1616MT/R-XP



Terminals of H_{3U}-0808PMRTA

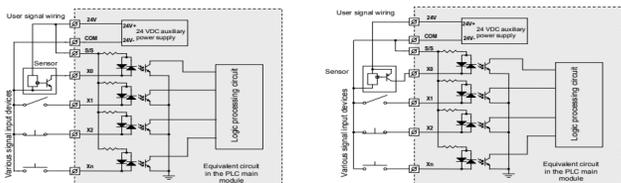


3.3.2 Functions of terminals

Table with 3 columns: Function, Terminals of standard models, Terminals of motion control models. Rows include Power input, Power output, Normal transistor NPN output, High-speed transistor NPN output, Relay output, High-speed differential output, Normal transistor zero-clearing NPN output, Normal input, High-speed input, High-speed differential input.

3.4 Input wiring

3.4.1 Normal input wiring

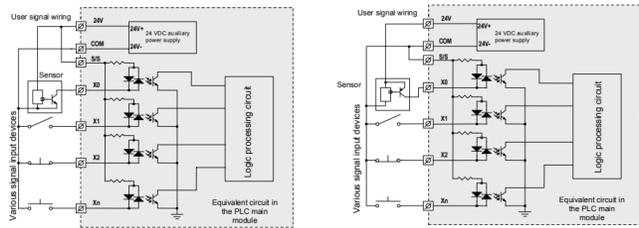


Leaking type input wiring Source type input wiring

Table with 2 columns: Item, Description. Details signal input mode, electric parameters (detection voltage, input resistance, current), filter function, and common wiring terminal.

[1]: Note 1: 15 V-24 V is ON. Voltage smaller than 5 V is OFF. The maximum value is 30V. When all inputs are ON, the input voltage should not exceed 26.4 V.

3.4.2 High-speed input wiring



Leaking type input wiring Source type input wiring

Table with 2 columns: Item, Description. Details signal input mode, electric parameters, filter function, and common wiring terminal.

[1]: When the signal is 15 V-24 V, the input is ON. When the signal is smaller than 5 V, the input is OFF. The maximum value is 30 V. When all inputs are ON, the input voltage should not exceed 26.4 V. [2]: The smallest pulse width includes the positive pulse and negative pulse. If the terminal serves as the AB phase counter, the AB phase time difference of two high-speed inputs must be larger than 250 ns, or the duty ratio under the input of 200 KHz is between 40% and 60%.

3.4.3 Differential input wiring

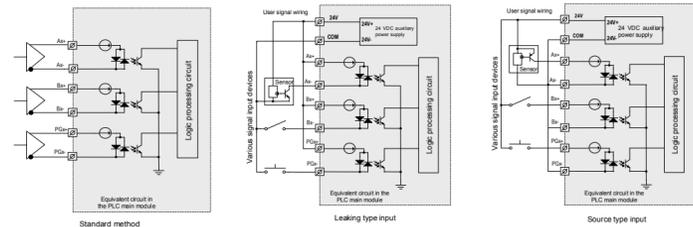


Table with 2 columns: Item, Description. Item: Input mode, Description: Differential input, leakage/source type.

Table with 2 columns: Item, Description. Details detection voltage, input ON/OFF conditions, maximum input frequency, and smallest identifiable pulse width.

[1]: The smallest pulse width includes the positive pulse and negative pulse. If the terminal serves as the AB phase counter, the AB phase time difference of two high-speed inputs must be larger than 200 ns, or the duty ratio under the input of 200K is between 40% and 60%.

3.5 Output wiring

3.5.1 Normal/high-speed transistor output wiring

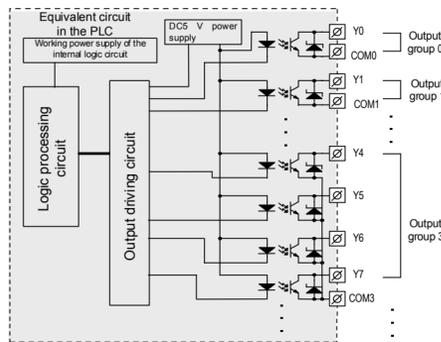
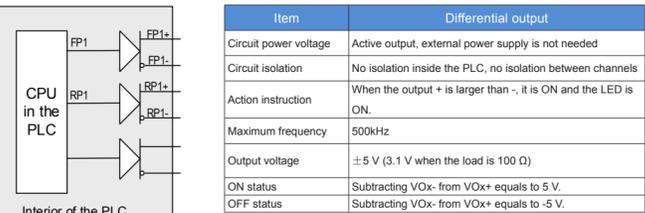


Table with 3 columns: Item, High-speed transistor NPN output, Normal transistor NPN output. Details circuit power voltage, insulation, action instruction, leak current, load capacity, and response times.

[1]: The conductive load will generate a large reverse electromotive force between contacts when it stops, thus leading to the arc discharge phenomenon. Under the same current consumption, the smaller the power is, the larger the arc power is. Therefore, an arc-control device should be used. [2]: The lamp load will generate surge current when it closes. Generally, the surge current is 10-15 times stronger than the normal current. The surge current must not exceed the current equivalent to the maximum load specifications of the resistance load.

3.5.3 Wiring of High-speed differential outputs



3.5.4 CLR outputs of H3U-0808PMRTA

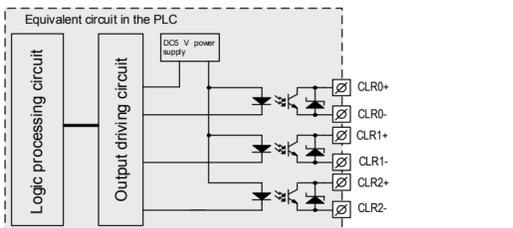


Table with 3 columns: Item, Normal transistor NPN output, Description. Details circuit power voltage, insulation, action instruction, leak current, load capacity, and response times.

4 Communication Instructions

4.1 Functions of communication terminals

The COM1 and CAN communication ports of H3U need to be connected. The terminals are pluggable terminals. The definitions of the terminals are described in the following:

Table with 3 columns: Name, Description, Diagram. Details +24V, CGND, CANL, CANH, 485+, 485-, and GND terminals.

4.2 Others

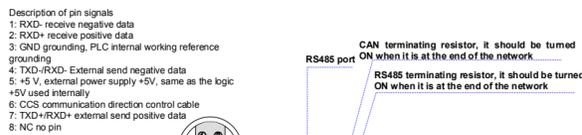


Figure 5 Communication configuration of H3U-3232MT/R and H3U-0808PMRTA

[1] The transistor NPN output circuit has a built-in voltage-regulator tube to prevent reverse electromotive force when the conductive load is broken. However, if the load capacity exceeds the specifications, an external fly-wheel diode needs to be added. [2] Normal transistor NPN output has considerable over-current capability, but it does not have the short-circuit protection function. [3] The high-speed NPN transistor output has distributed capacitance. When it works under the frequency of 200 KHz, the breakover current must be larger than 12 mA.

3.5.2 Wiring of relay outputs

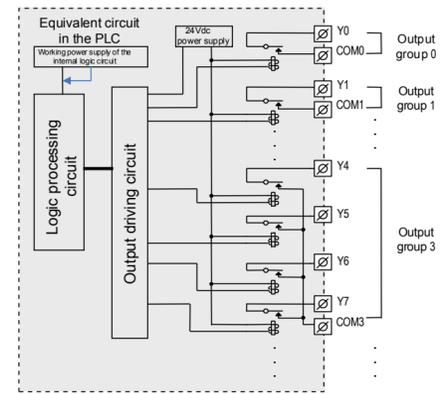


Table with 2 columns: Item, Relay output. Details circuit power voltage, insulation, action instruction, leak current, load capacity, and response times.

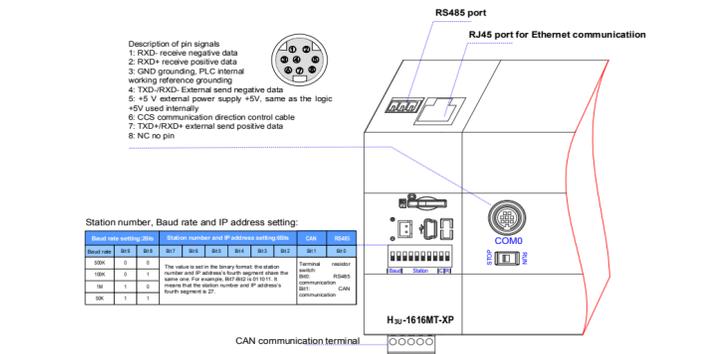


Figure 6 Communication configuration of H3U-1616MT-R-XP

5.1 Programming

The H3U series PLC adopts AutoShop V2.53 and above programming software to program and commission the user program. You can download the user program via the USB and LAN ports. Please read the H3U Series PLC Instruction and Programming Manual for details.

5.2 Selection of communication cables

Table with 4 columns: Type, Model, Order code, Remarks. Lists RS232/RS422 Mini DIN8 communication cable, USB communication cable, and their specifications.

5.3 Models

Table with 3 columns: Model, Type, Order code. Lists various PLC models and their specifications.

Warranty Agreement

- The warranty period of the product is 18 months (refer to the barcode on the equipment unless it is otherwise agreed on the purchasing contract). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inovance will be responsible for free maintenance. Within the warranty period, maintenance will be charged for the damage caused by the following reasons: a) Improper use or repair/modification without prior permission; b) Fire, flood, abnormal voltage, other disasters and secondary disasters; c) Hardware damage caused by dropping or transportation after purchasing; d) Product damage caused by improper operations; e) Trouble out of the equipment (for example, external devices). If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail. The maintenance fee is charged according to the latest Maintenance Price List of Inovance. The Product Warranty Card is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance. If there is any problem during the service, contact Inovance's agent or Inovance directly. This agreement shall be interpreted by Inovance.

Warranty Card

Table for Warranty Card with columns for Customer, Product, and Fault. Fields include Customer's address, name, contact info, Product model, bar code, distributor name, and Service engineer.

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