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PS00005265A05

# GL20-1600END Digital Input Module

## User Guide

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# Preface

## ■ Introduction

The GL20-1600END series digital input expansion module has 16 digital inputs and supports source and sink inputs. It is suitable for Easy series products and GL20 series communication interface modules (GL20-RTU-ECT for example).

This guide describes the product information, mechanical installation, electrical installation, programming, and commissioning of the product.

## ■ Standards compliance

The following table lists the certifications, directives, and standards that the product may comply with. For details about the certificates that the product complies with, see the certification marks on the product nameplate.

| Certification name | Directive Name | | Standards compliance |
|---|---|---|---|
| CE Certification | EMC Directive | 2014/30/EU | **24 VDC products:**<br>EN 61131-2<br>**220 VAC products:**<br>EN 61131-2<br>EN 61000-3-2<br>EN 61000-3-3 |
| | Low Voltage Directive | 2014/35/EU | EN 61010-1<br>EN 61010-2-201 |
| | RoHS Directive | 2011/65/EU amended by (EU)2015/863 | EN IEC 63000 |
| UL/cUL certification | - | | UL 61010-1<br>UL 61010-2-201<br>CAN/CSA-C22.2 No. 610101<br>CSA C22.2 NO. 610102201 |
| KCC certification | - | | - |
| EAC certification | - | | - |

| Certification name | Directive Name | | Standards compliance |
|---|---|---|---|
| UKCA | Safety regulations | Electrical Equipment (Safety) Regulations 2016 | EN 61010-1<br>EN 61010-2-201 |
| | EMC regulations | Electromagnectic Compatibility Regulations 2016 | **24 VDC products:**<br>EN 61131-2<br>**220 VAC products:**<br>EN 61131-2<br>EN 61000-3-2<br>EN 61000-3-3 |
| | RoHS regulation | Directive (RoHS) Regulations 2012 | EN IEC 63000 |

## ■ More data

| Data name | Data Code | Description |
|---|---|---|
| GL20-RTU-ECT Communication Interface Module User Guide | PS00004985 | Presents installation and wiring of the product. |
| GL20-RTU-PN Communication Interface Module User Guide | PS00007594 | Presents installation and wiring of the product. |
| GL20-RTU-ECT32 Communication Interface Module User Guide | PS00013434 | Presents product information, mechanical installation, electrical installation, programming, commissioning, and troubleshooting of the product. |
| GL20-1600END Digital Input Module User Guide | PS00005265 | Presents product information, mechanical installation, electrical installation, programming, and commissioning of the product. |

## ■ Revision History

| Date | Version | Description |
|---|---|---|
| August 2024 | A05 | Updated *"2.1 Installation Precautions" on page 15* |
| June 2024 | A04 | Made minor corrections. |
| January 2024 | A03 | **Added the following content:**<br>• Added " " *on page* .<br>• Added " *Appendix: Version Matching Information" on page 31*.<br>**Modified the following content:**<br>• Modify function definitions in *"1.2 Components" on page 11*.<br>• Modify basic specifications in *"1.3 Technical Specifications" on page 12*.<br>• Modify operating procedure in " *Program Commissioning" on page 23*. |
| February 2023 | A02 | Updated the effect diagram and structure diagram.<br>Added environmental specifications. |
| June 2022 | A01 | Made minor corrections. |
| April 2022 | A00 | First release |

## ■ Access to the Guide

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

- Do keyword search under Service and Support at *http://www.inovance.com*.
- Scan the QR code on the product.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

## ■ Warranty disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for faults or damage that occur during normal operation. Maintenance will be charged after the warranty expires.

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

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or unusual voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see Product Warranty Card.

# General Safety Precautions

## ■ Safety Disclaimer

1. Read the safety precautions before installing, operating, and maintaining this product.
2. To ensure personal and equipment safety, follow all safety precautions marked on the product and described in the user guide when installing, operating, and maintaining this product.
3. "CAUTION", "WARNING", and "DANGER" messages in the guide are only examples and do not cover all safety precautions.
4. Use this product in an environment that complies with the design specifications. Malfunctions or component damage caused by improper use is not covered by warranty.
5. Inovance shall not be liable for any physical injuries or property loss caused by improper use.

## ■ Safety Categories and Definitions


"DANGER" indicates that failure to comply with the notice will result in severe physical injuries or even death.


"WARNING" indicates that failure to comply with the notice may result in severe physical injuries or even death.


"CAUTION" indicates that failure to comply with the notice may result in minor or moderate physical injuries or equipment damage. Keep this guide properly for future reference and forward it to the end user.

### Control System Design


- Design a safety circuit to ensure that the control system can still work safely when the external power supply is cut off or the programmable controller fails.
- The product may catch fire or emit smoke in case of prolonged overcurrent due to overload or short circuit of load. Therefore, configure an external safety device such as a fuse or circuit breaker.

WARNING

- Design an external emergency stop circuit, protective circuit, forward and reverse rotation interlock circuit, as well as up and down limit interlock circuit to be connected to the programmable controller.
- Design an external protective circuit and a safety mechanism for output signals that may cause major incidents.
- When the programmable controller CPU detects a system exception, it may turn off all outputs. When partial circuit of the controller malfunctions, the controller outputs may become uncontrollable. To ensure proper operation, it is necessary to design an appropriate external control circuit.
- If a programmable controller output unit such as the relay or transistor is damaged, its output cannot be controlled to turn ON or OFF.
- The programmable controller is intended for use in an indoor electrical environment with an overvoltage class of II. The power system must contain a lightning arrester to prevent lightening from causing overvoltage on the power supply input, signal input, and control output terminals of the programmable controller and damaging the equipment.

## Installation

WARNING

- Only allow trained professionals with electrical expertise to install this product.
- Cut off all external power sources before you install or remove this product. Failure to comply may result in electric shock or faults or malfunctions of this product.
- Do not use the programmable controller in places with dirt, oily fume, conductive dust, corrosive gas, flammable gas, high temperature, condensation, wind and rain, vibration, or shock. Electric shock, fire, and improper operation will lead to damage and deterioration of the product.
- The programmable controller is an open-type device to be installed in a control cabinet with a door lock (housing IP rating higher than IP20). Only allow trained operators with electrical expertise to open the cabinet.

CAUTION

- During installation, prevent metal chippings and cable ends from falling into the vent of the product. Failure to comply may result in fire, faults, or malfunctions.
- After installation, ensure that no unwanted objects exist on the ventilation surface. Failure to comply may result in poor heat dissipation, fire, faults, or malfunctions.
- During installation, tightly connect the product and its connectors and firmly lock its hooks. Improper module installation may lead to malfunctions, faults, and detachment.

## Wiring


- Only allow trained professionals with electrical expertise to conduct wiring for this product.
- Cut off all external power sources before wiring. Failure to comply may result in electric shock or equipment faults or malfunctions.
- Properly insulate the cable terminals and ensure a proper insulation distance between the cables connected to the terminal block. Failure to comply will result in electric shock or equipment damage.


- Turn off the main power supply before connecting it to the product. Failure to comply may result in electric shock.
- Select a proper power supply according to the power supply specifications of the product in the "Technical Specifications" section. If the selected power supply is beyond the required range, the product may be damaged. Regularly check whether the DC power provided by the switching-mode power supply unit is stable.

## Operation and Maintenance


- Only allow trained professionals with electrical expertise to operate and maintain this product.
- Do not touch terminals when the power is on. Failure to comply may result in electric shock or malfunctions.
- Cut off all external power sources before you clean the product. Failure to comply may result in electric shock.
- Cut off all external power sources before you install or remove the product or communication cables. Failure to comply may result in electric shock or malfunctions.

**Safety suggestions**

- In places where operators have direct contact with mechanical parts, such as loading and unloading places and areas with automatic machinery operation, carefully configure an on-site manual operating device or alternative means that works independently of the programmable controller and can start or stop the automatic operation.
- If programs need to be modified when the system is running, apply a lock or take other necessary measures to ensure that only authorized personnel can perform such modification.

## Disposal


- Dispose of this product as industrial wastes. Dispose of the battery separately in accordance with local laws and regulations.
- Recycle retired equipment in accordance with waste disposal standards of the industry to avoid environmental pollution.

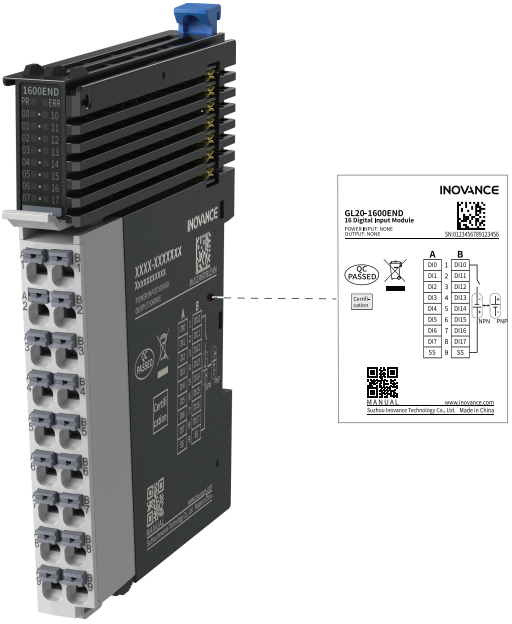
# 1 Product Information

## 1.1 Model and Nameplate

GL 20 -16 00 E N D

① ② ③ ④ ⑤ ⑥ ⑦

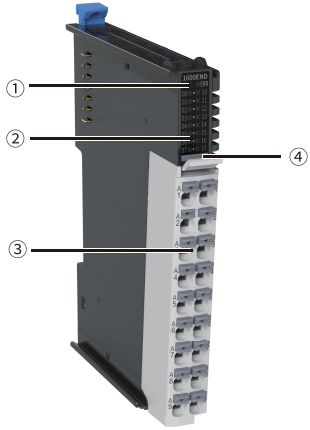
| | | | |
|---|---|---|---|
| ① **Product information**<br>GL: General local module | ③ **Number of I/Os**<br>16: 16 inputs | ⑤ **Module type**<br>E: Logic I/O expansion module | ⑦ **Voltage type**<br>D: 24 VDC |
| ② **Series number**<br>20: 20 series module | ④ **Number of I/Os**<br>00: Zero output | ⑥ **Output type**<br>N: No output | - |




The order data of the product is described in the following table.

| Model | Description | Product code | Applicable model |
|---|---|---|---|
| GL20-1600END | GL20 series GL20-1600END with 16 DIs (source/sink type) | 01440291 | It is suitable for Easy series products and GL20 series communication interface modules (GL20-RTU-ECT for example). |

## 1.2 Components




| No. | Name | Description | | | |
|---|---|---|---|---|---|
| ① | Signal indicator | PR (POWER +RUN) | Power/Operation indicator | Yellow-green | • ON: The module is in normal operation.<br>• Flashing quickly: The module is addressed successfully.<br>• Flashing slowly: The module is powered on but not addressed.<br>• OFF: The module is not powered on or is faulty. |
| | | ERR | - | - | - |
| ② | I/O signal indicator | Corresponds to various output signal:<br>ON: Active;<br>OFF: Inactive | | | |
| ③ | User terminal | For details, see *"3.2 Terminal Assignment" on page 21*. | | | |

| No. | Name | Description | |
|---|---|---|---|
| ④ | Color identification | Red: Digital output | Orange: Analog output |
| | | Gray: Digital input | Green: Analog input |
| | | White: Communication | Blue: Other module |

## 1.3 Technical Specifications

### ■ General specifications

| Item | Specification |
|---|---|
| IP rating | IP20 |
| Dimensions (W x H x D) | 12 mm x 100 mm x 75 mm |
| Weight | Approx. 60 g |

### ■ Power supply specifications

| Item | Specification |
|---|---|
| Rated bus input voltage | 5 VDC (4.75 VDC to 5.25 VDC) |
| Rated bus input current | 120 mA (typical value @ 5 VDC) |
| Rated terminal input voltage | / |
| Rated terminal input current | / |
| Rated terminal output voltage | / |
| Rated terminal output current | / |
| Hot swap | Not supported |

### ■ Input specifications

| Item | Specification |
|---|---|
| Input type | Digital input |
| Input mode | Sink/Source |
| Number of input channels | 16 |
| Input voltage class | 24 VDC±10% (21.6 VDC to 26.4 VDC) |

| Item | Specification |
| --- | --- |
| Input current (typical value) | 4 mA (typical value @ 24 V) |
| ON voltage | > 15 VDC |
| OFF voltage | < 5 VDC |
| Hardware response time ON/ OFF | 100 us/100 us |
| Software filter time | Supported |
| Input impedance | Reference value: 5.3 k to 5.6 k |
| Isolation | Yes |
| Input action display | Input indicators are turned on (through software control) when the inputs are in the driving state. |
| Input derating | Full load at 45°C, derating 75% at 55°C (namely, no more than 12 inputs ON at the same time) |

## ■ Software specifications

| Item | Specification |
| --- | --- |
| PDO data size: input | 2-byte |
| Software input filter time | No filter, 0.25 ms, 0.5 ms, 1 ms (default), 2 ms, 4 ms, 8 ms, 16 ms, and 32 ms<br>You can set two groups of filter parameters, with each group covers eight channels. One filter parameter is needed for one group. |
| Input terminal error detection and indication | / |
| Input channel logic level configuration | Not supported |
| Independent channel enable configuration | Not supported |
| Diagnosis report function configuration | Not supported |
| In the stop mode | Outputs are not refreshed, inputs can be refreshed when in state SAFE-OPERATIONAL state. |
| I/O mapping | Supports bitwise, bytewise and wordwise addressing |

## 1.4 Environmental Specifications

| Item | Specification |
|---|---|
| Installation/Ambient environment | Free from conductive dust, conductive fibers, explosive dust, flammable gases, water mist/greasy dirt, corrosive dusts/gases, strong vibration, and repetitive shock |
| Max. altitude | ⩽ 2000 m |
| Pollution degree | 2 |
| Immunity | 2 kV on power supply line (compliant with IEC 61000-4-4) |
| Overvoltage category | I |
| EMC immunity level | Zone B, IEC61131-2 |
| Anti-static class | Contact discharge +/-6 kV and air discharge +/-8 kV |
| Vibration resistance | • Application scenario: Tested according to IEC60068-2-6, 3.5 mm amplitude at 5 Hz to 8.4 Hz; 1 g acceleration at 8.4 Hz to 200 Hz; in ten cycles/axes<br>• Transportation scenario: Tested according to IEC60068-2-64, 0.01 $g^2$/Hz power spectral density at 5 Hz to 100 Hz; 0.001 $g^2$/Hz power spectral density at 200Hz; 1.14 g Grms |
| Shock resistance | Application/Transportation scenario: Tested according to IEC60068-2-27; 15 g peak acceleration, 11 ms pulse width, 18 times in X/Y/Z-axis directions |
| Ambient temperature/ humidity | • Temperature: -20°C to +55°C<br>• Humidity: < 95% RH (30°C), without condensation |
| Storage temperature/ humidity | • Temperature: -20°C to +60°C<br>• Humidity: < 95% RH (30°C), without condensation |
| Transportation temperature/humidity | • Temperature: -40°C to +70°C<br>• Humidity: < 95% RH (40°C), without condensation |

# 2 Mechanical Installation

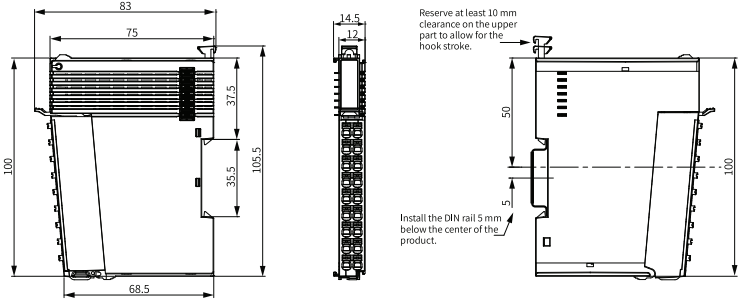
## 2.1 Installation Precautions

- Before installing or removing the module, ensure that the module is powered off.
- Do not hot swap the modules. Otherwise, the modules may be damaged by overcurrent or overvoltage, and the communication interface module or PLC may be subject to restart, user data loss or corruption.
- Prevent the enclosure or terminals of the module from dropping or suffering from impact or shock.

## 2.2 Mounting Dimensions

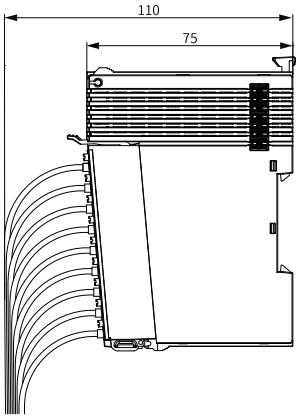
### ■ Module

The mounting dimensions (in mm) are shown in the figure below.



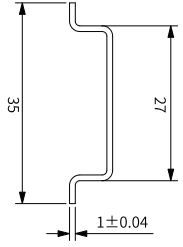

### ■ Cable connection

Cable dimensions (in mm) are shown in the figure below.




## 2.3 Mounting Method

The module is mounted onto a DIN rail in conformity with IEC 60715 (width: 35 mm, thickness: 1 mm). The dimensions (unit: mm) are shown below.

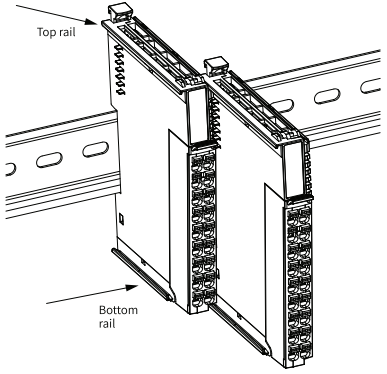



**Caution**

When installed on a DIN rail other than the recommended one (especially the one whose thickness is not 1.0 mm), the product will not fit in place as the mounting hook does not work.

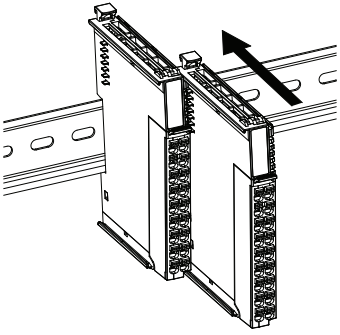
## ■ Side-by-side installation of modules

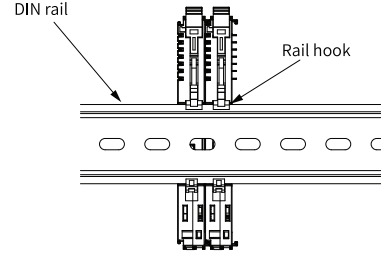
You can install multiple I/O modules to each other with the help of top and bottom guide rails on the modules, as shown below.



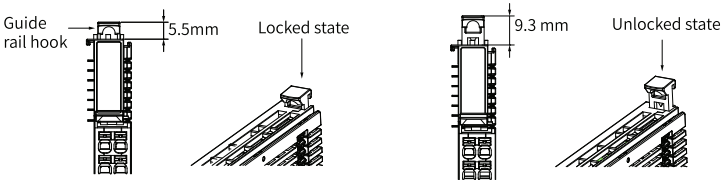

## ■ Installing the module onto DIN rail

1. Align the module with the DIN rail and push the module in the direction indicated by the arrow until you hear a clicking sound, as shown below.






2. Make sure the DIN rail mounting hook of the module is locked. The locked and unlocked states of the mounting hook are shown below.




- If the mounting hook is pressed down, it is locked.
- If the mounting hook is lifted up, it is unlocked.

Press down the mounting hook to lock the module to the DIN rail.

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**Caution**

When the module is not installed on the DIN rail, keep the rail hook in locked state. A hook that kept in unlocked state for a long period of time may fail to function properly.

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3. Mount an end plate on either side of the PLC or the module, as shown below.

   To mount the end plate, hook the bottom of it to the bottom of the DIN rail, rotate the end plate to hook the top of it to the top of the DIN rail, and then tighten the screw to lock the end plate in place.

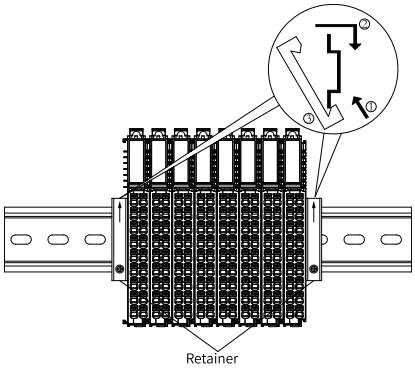
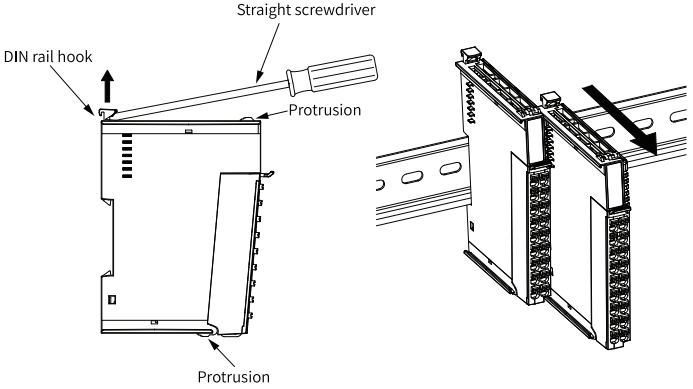



Figure 2-1 Installing end plate

## ■ Removing the module

Pry the DIN rail mounting hook upwards with a tool such as slotted screwdriver, hold the protrusions and pull the module out straight forward, and then press down the top of the DIN rail mounting hook.



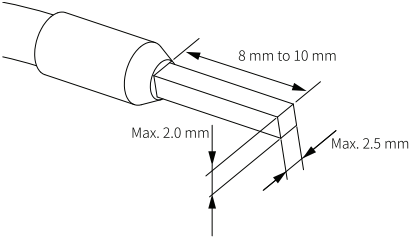
# 3 Electrical Installation

## 3.1 Cable Selection

The cable lug and cross sectional area shown in the following table are only for reference.

| Material Name | Applicable Cross Sectional Area of the Cable | | KST | | Suzhou Yuanli | |
|---|---|---|---|---|---|---|
| | $mm^2$ | AWG | Model | Crimping pliers | Model | Crimping pliers |
| Tubular lug | 0.3 | 22 | E0308 | KST2000L | 0308 | YAC-5 |
| | 0.5 | 20 | E0508 | | 0508 | |
| | 0.75 | 18 | E7508 | | 7508 | |
| | 1.0 | 18 | E1008 | | 1008 | |
| | 1.5 | 16 | E1508 | | 1508 | |

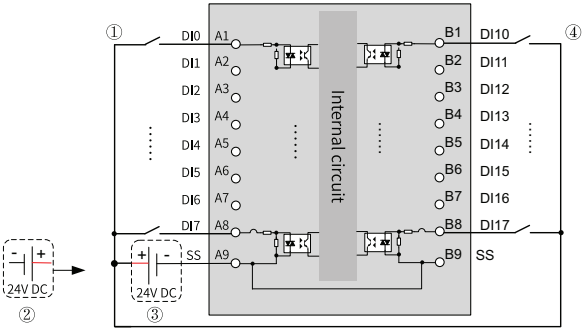
If you use other types of tubular lug, crimp the lug to the cables according to the shape and dimension requirements shown in the figure below.



## 3.2 Terminal Assignment


| Left indicator | Left signal | Left terminal | Right terminal | Right signal | Right indicator |
|---|---|---|---|---|---|
| 00 | DI0 | A1 | B1 | DI10 | 10 |
| 01 | DI1 | A2 | B2 | DI11 | 11 |
| 02 | DI2 | A3 | B3 | DI12 | 12 |
| 03 | DI3 | A4 | B4 | DI13 | 13 |
| 04 | DI4 | A5 | B5 | DI14 | 14 |
| 05 | DI5 | A6 | B6 | DI15 | 15 |
| 06 | DI6 | A7 | B7 | DI16 | 16 |
| 07 | DI7 | A8 | B8 | DI17 | 17 |
| / | SS | A9 | B9 | SS | / |

## 3.3 Wiring of Terminals




①: Input terminal wiring diagram (A1-48)
②: Sink type signal input mode
③: Source type signal input mode
④: Input terminal wiring diagram (B1-B8)

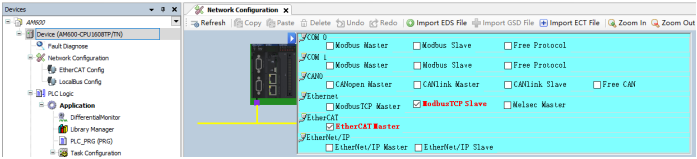
Note: Common SS for the circuit;
(A1-A8) and (B1-B8) support source or sink input.

# 4 Program Commissioning

The following takes the input channel of the GL20-1600END module as an example, in which the AM600 is used as the main control module.

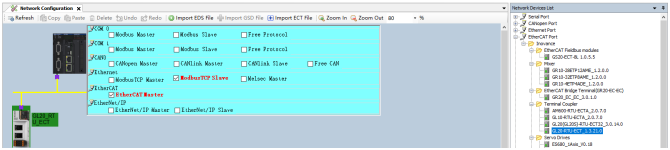
1. Enable AM600 as EtherCAT master and add the GL20-RTU-ECT module.

   a. In the **Devices** pane, double-click on **Network Configuration**, then check **EtherCAT Master** check box to enable the AM600 as an EtherCAT master.

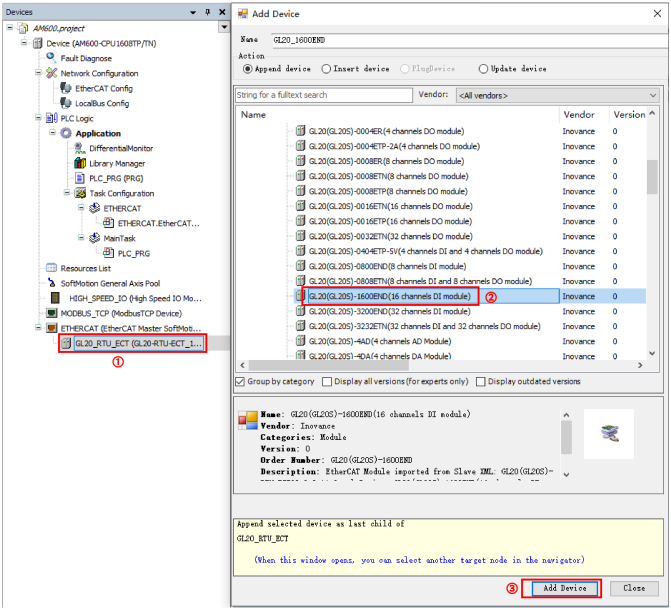



   b. Add the GL20-RTU-ECT communication interface module.

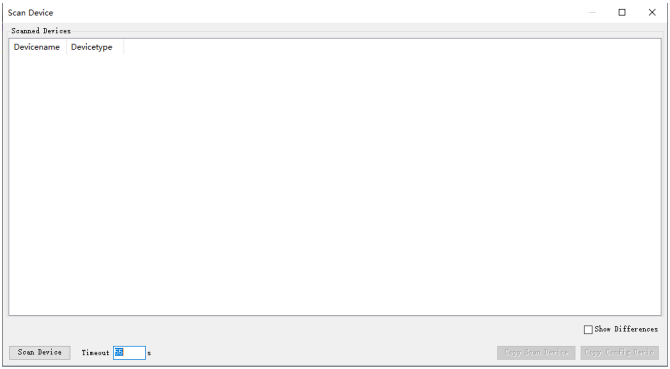
   - Method 1: In the right **Network Devices List**, double-click on GL20-RTU-ECT.




   - Method 2: In the left navigation pane, right-click on **ETHERCAT(EtherCAT Master SoftMotion)** and select **Add Device**, then select GL20_RTU_ECT *_x.x.x.x* in the popup dialog box and click **Add Device**.



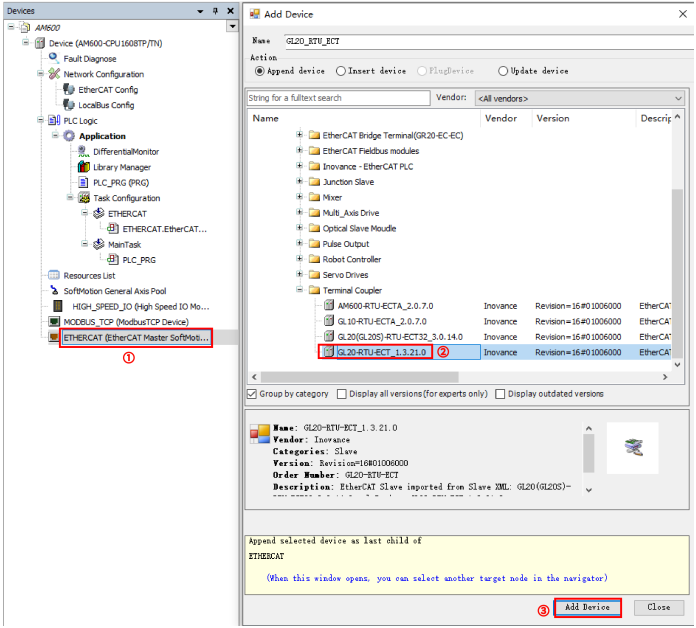

- Method 3: In the left navigation pane, right-click on **ETHERCAT(EtherCAT Master SoftMotion)** and select **Scan For Devices**, then click **Scan Devices** and select the scanned GL20-RTU-ECT module, and finally click **Copy all to project**.




2. Add GL20-1600END module.

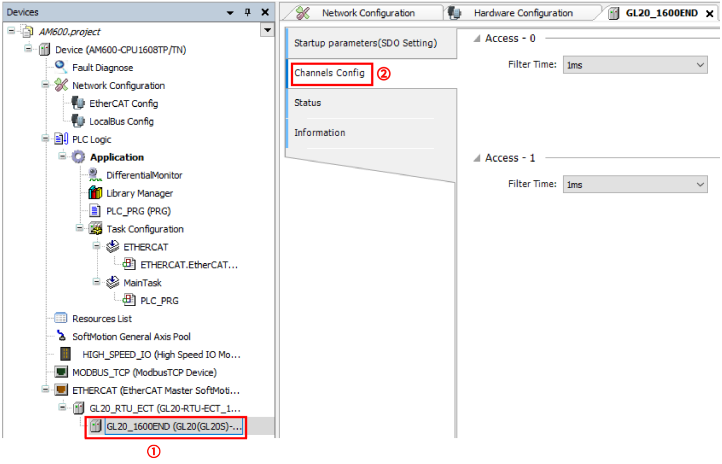
- Method 1: In the left navigation pane, double-click on **EtherCAT Config**, or in the **Network Configuration** pane, double-click on the GL20-RTU-ECT icon to open the **Hardware Configuration** pane, then in the right **In\Output Module List**, double-click on GL20-1600END or drag the GL20-1600END module and place it after the GL20-RTU-ECT module.

- Method 2: In the left navigation pane, right-click on GL20_RTU_ECT and select **Add Device**, then select GL20-1600END in the popup dialog box and click **Add Device**.




- Method 3: In the left navigation pane, right-click on **ETHERCAT(EtherCAT Master SoftMotion)** and select **Scan For Devices**, then click **Scan Devices** and select the scanned GL20-1600END module, and finally click **Copy all to project**.

3. Double-click the module to set **Channel config**.

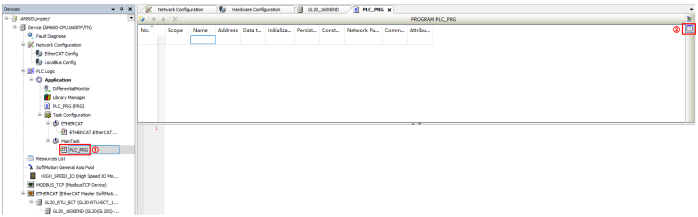



Parameters are shown in the following table.

| Name | Description | Setting |
|---|---|---|
| Filter time | Software filter parameters of the digital input channel | The following parameter values are supported.<br>• No filter<br>• 0.25 ms<br>• 0.5 ms<br>• 1 ms<br>• 2 ms<br>• 4 ms<br>• 8 ms<br>• 16 ms<br>• 32 ms<br>Default: 1 ms |

4. Create input variables.

a. Double-click **PLC_PRG** in the left device tree, and then right-click  to switch to table mode.

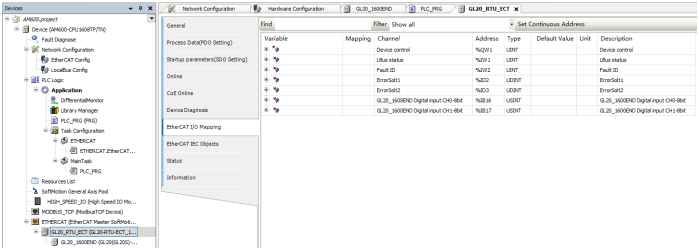


b. Add custom input variables **CHI0**, **CHI1**, and select type **VARs** and data type **USINT**, as shown below.

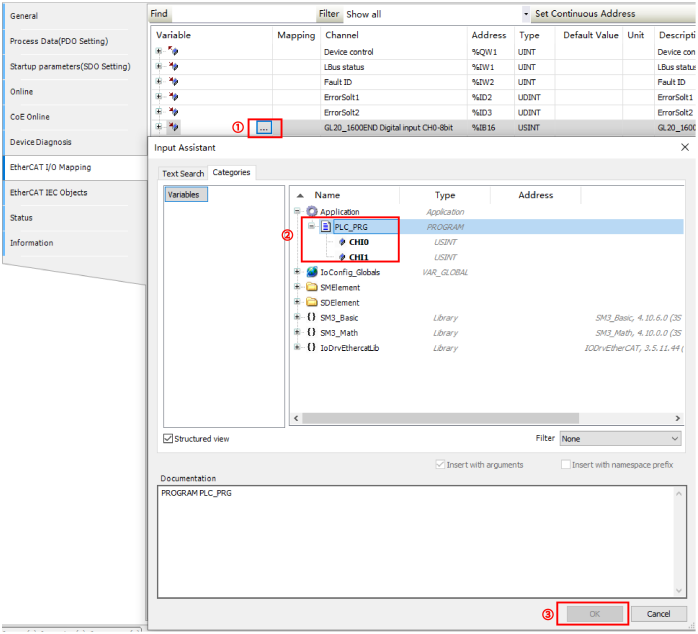
| Scope | Name | Address | Data t... | Initializa... | Persist... | Const... | Network Pu... | Comm... | Attribu... |
|---|---|---|---|---|---|---|---|---|---|
| VAR | **CHI0** | | USINT | | ☐ | ☐ | Default | | |
| VAR | **CHI1** | | USINT | | ☐ | ☐ | Default | | |

5. Map input variables to the corresponding input channel.

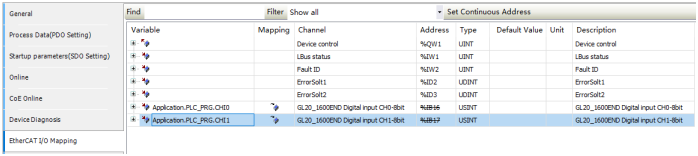
a. Double-click **GL20_RTU_ECT** in the left device tree, and then click the **EtherCAT I/O Mapping** tab on the right.



b. On the **EtherCAT I/O Mapping** tab, double-click the variable entry. Then click ... . In the **Input Assistant** dialog box, select **Application**>**PLC_PRG**>**Variables** and click **OK**.




Map the input variables **CHI0** and **CHI1** to the input channel of the configuration module, as shown in the following figure.




6. Double-click **PLC_PRG** in the left device tree and complete the programming on the **PLC_PRG** page.
7. Check, compile, log in, download, and run the program.

a. Click  on the toolbar at the top of the interface to check whether the program is correct.

b. After the program check is correct, click  on the toolbar at the top of the interface to compile all the code into PLC executable code.

c. After the compilation is correct, click  on the toolbar at the top of the interface, and follow the interface prompts to log in to the PLC and download the program.

d. After the program download is complete, click  on the toolbar at the top of the interface to execute the program.

# 5 Appendix: Version Matching Information

You can get the firmware of GL20-1600END module and the firmware of communication interface module from Inovance technical support, and get XML file and AutoShop/InoProShop from https://www.inovance.com. The following table describes the version matching information.

| GL20-1600END module firmware version | Communication interface module firmware version | XML/GSD file version | AutoShop/InoProShop version |
|---|---|---|---|
| Logic software: 0.1.2.0 and later | • GL20-RTU-ECT: board software 2.4.3.0 and later<br>• GL20-RTU-ECT32: Board software 2.5.9.0 and later<br>• GL20-RTU-PN: Board software 2.0.0.5 and later | • GL20-RTU-ECT: 1.2.7.0 and later<br>• GL20-RTU-ECT32: 3.0.2.0 and later<br>• GL20-RTU-PN: 20220930 and later | • AutoShop (ECT): V4.8.2.4 and later<br>• InoProShop (ECT): V1.7.3 and later<br>• InoProShop (ECT32): V1.7.3 SP6 and later |