



19011100 A02

1. Overview

Thank you for purchasing the GL10-4TC/8TC temperature detection expansion modules (including GL10-8TC and GL10-4TC) developed and manufactured independently by Inovance.

GL10-4TC/8TC series temperature detection expansion modules are thermocouple temperature collection modules used together with the AM600 series medium-sized PLC and the H3U series PLC main modules. The expansion modules support temperature collection of multiple types of thermocouples, and provides a resolution of up to 24 bits.

This guide describes the specifications, characteristics and using methods of the product. Read this guide carefully before using to ensure more safely usage. See the Medium-Sized PLC Programming Manual to understand the use of the user program development environment and design method of the user program of the product. You can download the latest materials from www.inovance.com.

2. Safety Information and Precautions

■ Safety Statement

- Read and comply with the safety instructions during installation, operation, and maintenance on the equipment.
- To ensure the safety of humans and the products, follow the marks on the products and all the safety instructions in this document.
- "CAUTION", "WARNING", and "DANGER" information in this guide is only supplements to the safety instructions.
- Use this equipment based on the designated environment requirements. Damages caused by improper usage are not covered by warranty.
- The company shall take no responsibility of any personal injuries or property damages caused by improper usage.

■ Safety Levels and Definitions



Indicates an improper operation, which, if not avoided, may result in severe personal injuries or even death.



Indicates an improper operation, which, if not avoided, may result in moderate personal injuries or damage to the equipment.

During control system design



- Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
- Add a fuse or circuit breaker because the module may smoke or catch fire due to long-time overcurrent caused by operation above rated current or load short-circuit.



- An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and a upper position limit and lower position limit interlocked circuit must be set in the external circuits of the PLC to prevent damage to the machine.
- To ensure safe operation, for the output signals related to critical accidents, please design external protection circuit and safety mechanism;
- Once the PLC CPU detects abnormality in the system, all outputs may be closed; however, when a fault occurs in the controller circuit, the output may not be under control. Therefore, it is necessary to design an appropriate external control circuit to ensure normal operation;
- If the PLC's output units such as relays or transistors are damaged, the output may fail to switch between ON and OFF states according to the commands;
- The PLC is designed to be used in indoor electrical environment (overvoltage category II). The power supply must have a system-level lightning protection device, assuring that overvoltage due to lightning shock can't be applied to the PLC's power supply input terminals, signal input terminals and output terminals and so forth, so as to avoid damage to the equipment.

During installation



WARNING

- Installation must be carried out by the specialists who have received the necessary electrical training and understood enough electrical knowledge.
- Disconnect all external power supplies of the system before module assembly/disassembly and wiring. Failure to do so may result in electric shock, module fault or malfunction.
- Do not use the PLC where there are dust, oil smoke, conductive dust, corrosive or combustible gases, or exposed to high temperature, condensation, wind & rain, or subject to vibration and impact. Electric shock, fire and malfunction may also result in damage or deterioration to the product.
- The PLC is open-type equipment that must be installed in a control cabinet with lock (cabinet housing protection > IP20). Only the personnel who have received the necessary electrical training and understood enough electrical knowledge can open the cabinet.



CAUTION

- Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during installation. Failure to comply may result in fire, fault and malfunction.
- Ensure there are no foreign matters on the ventilation surface. Failure to comply may result in poor ventilation, which may cause fire, fault and malfunction.
- Ensure the module is connected to the respective connector securely and hook the module firmly. Improper installation may result in malfunction, fault or fall-off.

During wiring



WARNING

- Wiring must be carried out by personnel who have received the necessary electrical training and understood enough electrical knowledge.
- Disconnect all external power supplies of the system before wiring. Failure to comply may result in electric shock, module fault or malfunction.
- Install the terminal cover attached to the product before power-on or operation after wiring is completed. Failure to comply may result in electric shock.
- Perform good insulation on terminals so that insulation distance between cables will not reduce after cables are connected to terminals. Failure to comply may result in electric shock or damage to the equipment.



CAUTION

- Prevent dropping metal filings and wire ends drop into ventilation holes of the PLC at wiring. Failure to comply may result in fire, fault and malfunction.
- The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.
- To ensure safety of equipment and operator, use cables with sufficient diameter and connect the cables to ground reliably.
- Wire the module correctly after making clear of the connector type. Failure to comply may result in module and external equipment fault.
- Tighten bolts on the terminal block in the specified torque range. If the terminal is not tight, short-circuit, fire or malfunction may be caused. If the terminal is too tight, fall-off, short-circuit, fire or malfunction may be caused.
- If the connector is used to connect with external equipment, perform correct crimping or welding with the tool specified by manufacturer. If connection is in poor contact, short-circuit, fire or malfunction may be caused.
- A label on the top of the module is to prevent foreign matters entering the module. Do not remove the label during wiring. Remember to remove it before system operation, facilitating ventilation.
- Do not bundle control wires, communication wires and power cables together. They must be run with distance of more than 100 mm. Otherwise, noise may result in malfunction.
- Select shielded cable for high-frequency signal input/output in applications with serious interference so as to enhance system anti-interference ability.

During maintenance & inspection



WARNING

- Maintenance & inspection must be carried out by personnel who have the necessary electrical training and experience.
- Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
- Disconnect all external power supplies of the system before cleaning the module or re-tightening screws on the terminal block or screws of the connector. Failure to comply may result in electric shock.
- Disconnect all external power supplies of the system before removing the module or connecting/removing the communication wirings. Failure to comply may result in electric shock or malfunction.



CAUTION

- Get acquainted with the guide and ensure safety before online modification, forcible output, and RUN/STOP operation.
- Disconnect the power supply before installing/removing the extension card.

At disposal



CAUTION

- Treat scrapped module as industrial waste. Dispose the battery according to local laws and regulations.

3. Product Information

■ Model and Nameplate

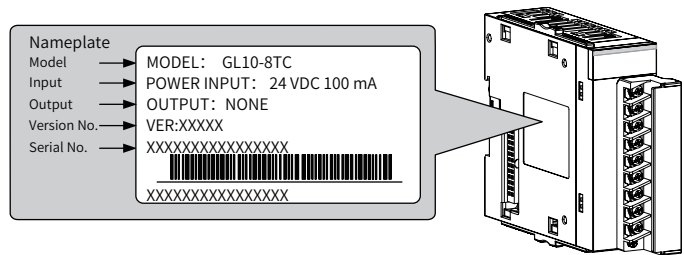
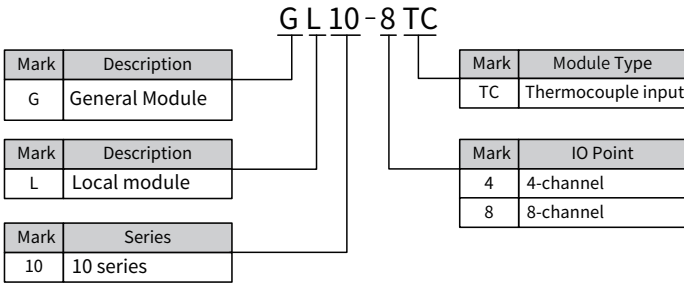


Figure 1 Description of model and nameplate

Model	Classification	Description	Applicable to
GL10-8TC	Temperature module	8-channel thermocouple temperature collection module, supporting multiple types of thermocouples.	AM600 series, H3U
GL10-4TC	Temperature module	4-channel thermocouple temperature collection module, supporting multiple types of thermocouples.	AM600 series, H3U

■ External Interfaces

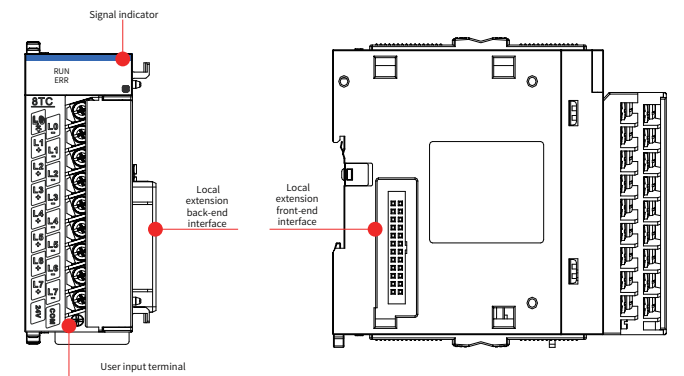


Figure 2 Diagram of the temperature module interfaces

Interface Name	Function
User input terminals	GL10-8TC: 8 channels of thermocouple inputs/GL10-4TC: 4 channels of thermocouple inputs.
Signal indicators	RUN: operation state indicator, which is turned on during normal operation and turned off when a fault occurs ERR: error state indicator, which is turned on when a fault occurs
Local expansion module back-end interface	Connect the back-end module, not supporting hot plugging
Local expansion module front-end interface	Connect the front-end module, not supporting hot plugging

General Specifications

Item	Specifications
Input channel	GL10-8TC: 8 channels/GL10-4TC: 4 channels
Supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (−15% to +20%)
Internal 5 V power consumption	85 mA (typical value)
Sensor type	Thermocouple: B, E, J, K, N, R, S, and T
Display mode:	Celsius degree (°C), and Fahrenheit degree (°F)
Thermocouple wiring method	Two wires
Thermocouple cold junction compensation manner	Internal/external cold junction compensation (GL10-4TC does not support cold junction compensation)
Resolution	24 bits
Sensitivity	0.1 °C or 0.1 °F
Sampling cycle	250 ms, 500 ms, and 1000 ms/8 channels (The sampling cycle can be set using software.)

Item	Specifications
Filter time	0s to 100s (The filter time can be set using software. The default value is 5s.)
Diagnosis and protection	Provides overrun and disconnection diagnosis functions.
Isolation method	I/O terminals isolated from power supply; Isolation between channels
System program updated via	USB interface
Accuracy (normal temperature: 25 °C)	Full scale ^[Note] (±0.1%) ± 1 °C
Accuracy (ambient temperature: 0 to 55 °F)	Full scale ^[Note] (±0.3%) ± 1 °C

[Note] Perform installation in strict accordance with the installation requirements of the product. (For detailed installation requirements, refer to Chapter 4 "Installation and Fastening" in the AM600 Series PLC Hardware Manual.) Otherwise, sampling accuracy is affected.

Thermocouple Detection Range and Accuracy

Item	Sensor	Detection Range (°C)	Detection Range (°F)	Accuracy
Thermocouple Type	B	200°C to 1800°C	392°F to 3272°F	≥±5°C@200°C<T<400°C ±5°C@400°C<T<750°C ±3°C@750°C<T<1200°C ±3.5°C@1200°C<T<1800°C
	E	-270°C to 1000°C	-454°F to 1832°F	≥±1@-270°C<T<-200°C ±1@-200°C<T<400°C ±1.5@400°C<T<1000°C
	N	-200°C to 1300°C	-328°F to 2372°F	±2@-200°C<T<-150°C ±1.5@-150°C<T<750°C ±0.2%displayed value@750°C<T<1300°C
	J	-210°C to 1200°C	-346°F to 2192°F	≥±1@-210°C<T<-100°C ±1@-100°C<T<500°C ±0.2%displayed value@500°C<T<1200°C
	K	-270°C to 1370°C	-454°F to 2498°F	≥±1.5@-270°C<T<-200°C ±1.5@-200°C<T<-100°C ±1@-100°C<T<500°C ±0.2%displayed value@500°C<T<1300°C
				≥2.6@1300°C<T<1370°C
				≥±4@-50°C<T<0°C ±4@0°C<T<250°C
	R	-50°C to 1768°C	-58°F to 3214°F	±2@250°C<T<500°C ±3.5@500°C<T<1700°C ≥±3.5@1700°C<T<1768°C
				≥±4@-50°C<T<0°C ±4@0°C<T<250°C
				±2@250°C<T<500°C ±3.5@500°C<T<1700°C ≥±3.5@1700°C<T<1768°C
	T	-270°C to 400°C	-454°F to 752°F	≥±1@-270°C<T<-200°C ±1@-200°C<T<400°C

4. Mechanical Design Reference

■ Mounting Dimensions

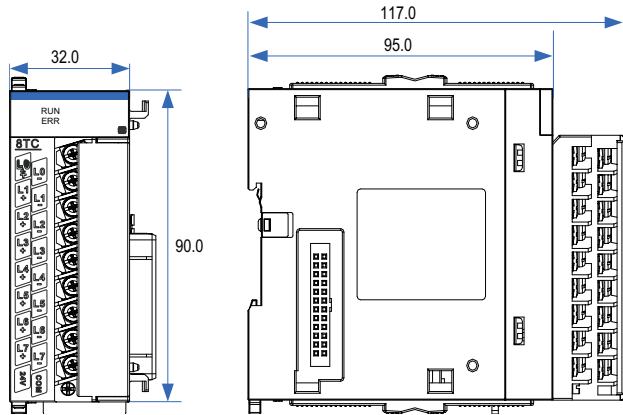


Figure 3 Mounting dimensions (in mm)

5. Electrical Design Reference

■ Cable Selection

Cable Name	Model	Applicable Cable Diameter		Manufacturer	Crimping Tool
		Chinese standard/MM ²	American standard/AWG		
Y-type cable lug	TNS 1.25-3	0.5-0.75	22-18	Suzhou Yuanli	RYO-8 YYT-8

Those cable lugs are applicable to digital and analog temperature modules, and the cable rated temperature needs to be higher than 75 °C.

■ Cable Preparing Procedures

- Strip the insulation layer of the cable by 6 mm.
- Pass the cable through the tube of proper wire size.
- Insert the exposed end into the hole of the cable lug, and then crimp it with the recommended crimping tool.
- Use a 20 mm heat-shrinkable tube (Φ3) to wrap the copper tube of the cable lug and then perform thermal shrinkage.

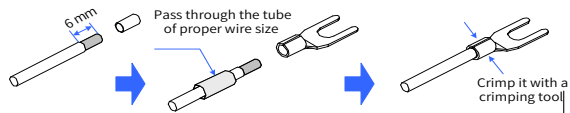


Figure 4 Diagram of cable preparation

- Put the cable lug onto the terminal and tighten the screw with a screwdriver. The tightening torque cannot be greater than 0.8 N.m.

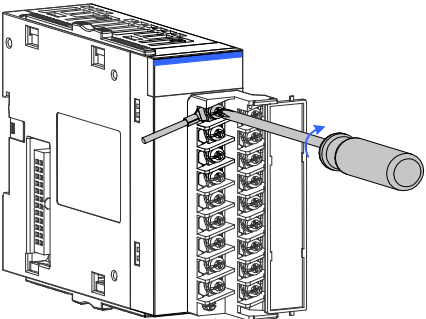


Figure 5 Connecting cable to terminal block

■ Terminal Arrangement

The figure below shows the interfaces of the GL10-8TC temperature module. Channels L4+/L4- to L7+/L7- of the GL10-4TC temperature module are reserved.

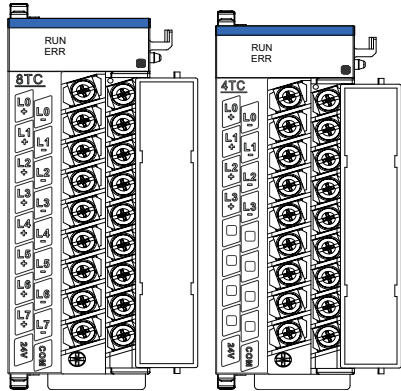


Figure 6 Temperature module terminal definition

■ Terminal Definition

SN	Network Name	Type	Function
1	L0+	Input	Thermocouple of channel 0
2	L0-	Input	Thermocouple of channel 0
3	L1+	Input	Thermocouple of channel 1
4	L1-	Input	Thermocouple of channel 1
5	L2+	Input	Thermocouple of channel 2
6	L2-	Input	Thermocouple of channel 2
7	L3+	Input	Thermocouple of channel 3
8	L3-	Input	Thermocouple of channel 3
9	L4+	Input	Thermocouple of channel 4
10	L4-	Input	Thermocouple of channel 4
11	L5+	Input	Thermocouple of channel 5

SN	Network Name	Type	Function
12	L5-	Input	Thermocouple of channel 5
13	L6+	Input	Thermocouple of channel 6
14	L6-	Input	Thermocouple of channel 6
15	L7+	Input	Thermocouple of channel 7/External cold junction compensation (The high accuracy mode is used in cold junction compensation.)
16	L7-	Input	Thermocouple of channel 7/External cold junction compensation (The high accuracy mode is used in cold junction compensation.)
17	+24 V	Power supply	+24 V power supply
18	COM	Power	24 V power ground

Note 1: For GL10-4TC, terminals L4+/L4- to L7+/L7- are reserved.

Note 2: For GL10-8TC, the sampling channel L7 is for compatible use, and is used for both normal thermocouple sampling and External cold junction compensation. When the cold endpoint of the thermocouple is relatively far away from the module, and there is a relatively large temperature difference, if there is a relatively high requirement on temperature accuracy, the channel may be used in External cold junction compensation, and is connected to the Pt100 thermal resistor for compensation. In this case, the module is used by CH0-CH6 for TC sampling.

■ Detection Mode Specifications

Item	Sensor	Temperature Range (°C)	Temperature Range (°F)
Thermocouple type	B	200.0 °C to 1800.0 °C	392.0 °F to 3272.0 °F
	E	-270.0 °C to 1000.0 °C	-454.0 °F to 1832.0 °F
	N	-200.0 °C to 1300.0 °C	-328.0 °F to 2372.0 °F
	J	-210.0 °C to 1200.0 °C	-346.0 °F to 2192.0 °F
	K	-270.0 °C to 1370.0 °C	-454.0 °F to 2498.0 °F
	R	-50.0 °C to 1765.0 °C	-58.0 °F to 3209.0 °F
	S	-50.0 °C to 1765.0 °C	-58.0 °F to 3209.0 °F
	T	-270.0 °C to 400.0 °C	-454.0 °F to 752.0 °F

■ External Wiring

Channels L4+/L4- to L7+/L7- of the GL10-4TC temperature module are reserved, and wiring of other channels are consistent with that of GL10-8TC.

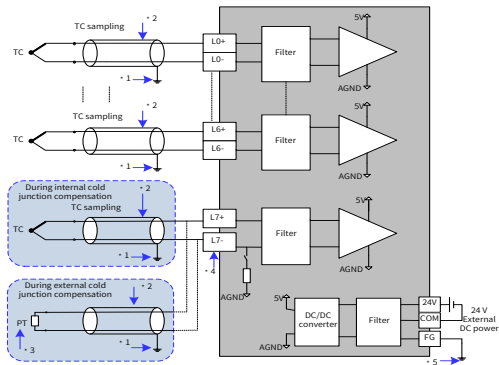


Figure 7 GL10-8TC module wiring diagram

- The cables must be shielded compensating lead wires.
- When the cold junction compensation and the thermocouple terminal are spaced, if no compensating lead wire is used, the measured temperature may be abnormal.
- The channel L7 may use a thermal resistor for cold junction compensation. In this case, the thermal resistor needs to use Pt100, and the channel needs to be enabled using software.
- When the module uses internal cold junction compensation, the channel L7 may be used for normal thermocouple sample, and the wiring is the same as that of channels L0 to L6 in the figure above. When the module uses external cold junction compensation, a Pt100 thermal resistor needs to be inserted into channel L7, and the wiring is the same as that of channel L7 in the figure above.
- The module should be mounted on a well-grounded metal bracket, and the metal shrapnel at the bottom of the module must be in good contact with the bracket.

■ Wiring Precautions

Do not bundle the cable together with AC cable, main lines, high voltage cable and so forth; otherwise, it may result in an increased noise, surge and induction.

Apply single-point grounding for the shielding of the shielded cable and solder sealed cable.

Tubed and solderless crimp terminals cannot be used with a terminal block. It is recommended that a marking sleeve or insulation sleeve be used to cover the cable connector part of the crimp terminals.

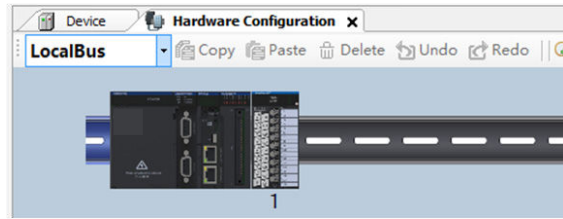
6. Programming Examples

Descriptions are given by using the GL10-8TC module as an example.

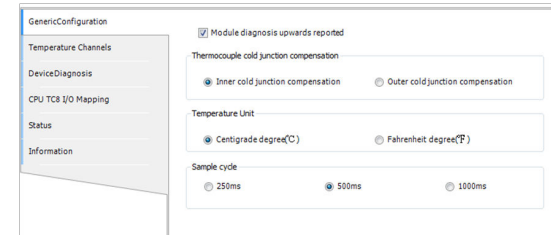
■ Programming Examples for Temperature Modules (AM600+GL10-8TC)

Descriptions are given by using an example in which channel 0 samples a K-type thermocouple, sampled values are assigned to corresponding variables, and AM600 is used as the main control module.

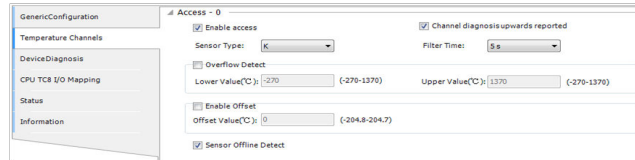
- Create a project and configure hardware as follows:



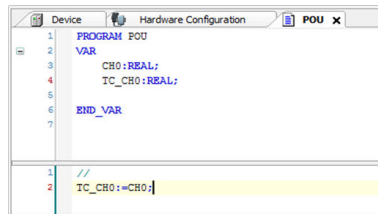
- Double-click the GL10-8TC module. On the GenericConfiguration interface, select Inner cold junction compensation or Outer cold junction compensation. The inner cold junction compensation function is used by default, and in this case, channel 7 is used for normal thermocouple sampling. When the outer cold junction compensation function is used, channel 7 needs to be externally connected to Pt100 for external cold junction compensation. Channel 7 can also be used for normal thermocouple sampling. Set parameters such as Module diagnosis upwards reported based on actual requirement on the GenericConfiguration interface.



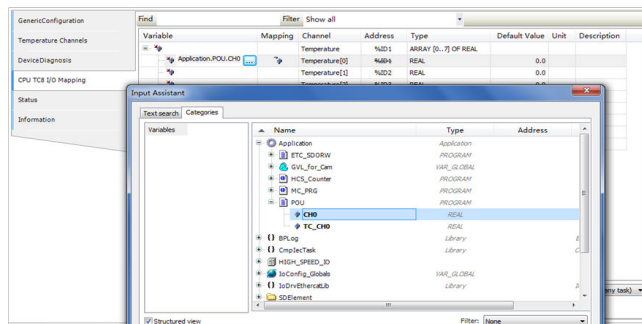
- Select Enable access on the Temperature Channels interface, set Sensor Type to K, and set other parameters as required.



- Use the ST programming language for programming, as shown in the figure below. Define variables CH0 and TC_CH0, and assign the sampled value of CH0 of channel 0 to TC_CH0.



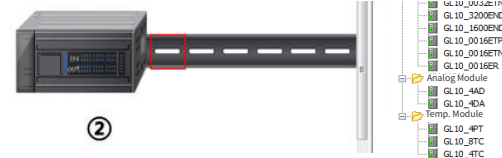
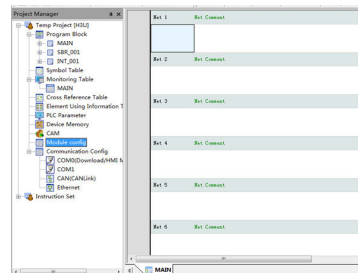
- Map the variable CH0 defined during programming to channel 0 of the configured GL10-8TC module to complete variable mapping.



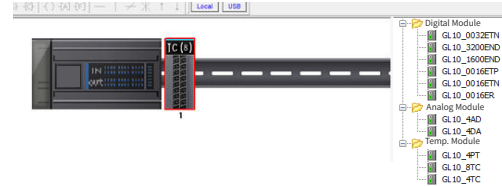
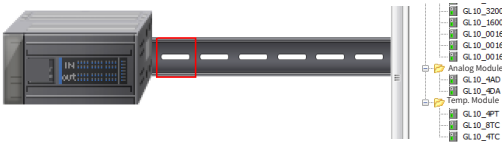
- After the project is successfully compiled, log in to download the project and run it.

■ Programming Examples for Temperature Modules (H3U+GL10-8TC)

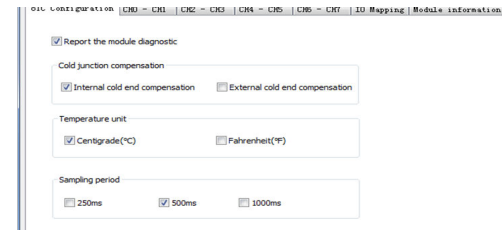
- Create a project, and select "H3U". Then the system enters the main page. ① Double-click "Module Config"; ② The simulation graphics of the rack to be configured is displayed.



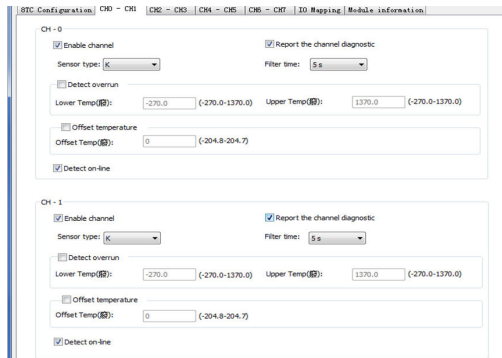
- Select the module GL10-8TC to be added from the module list. Double-click the module to automatically add it to the expansion rack, or hold the left button to drag the module to the expansion rack.



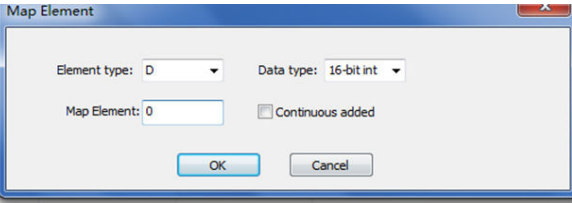
- Double-click the GL10-8TC module on the rack, and the configuration interface is displayed (as below). On the 8TC Configuration tab page, select Internal cold end compensation in the Cold junction compensation area, Centigrade (°C) in the Temperature unit area, and 500ms in the Sampling period area. Select External cold end compensation if external cold junction compensation needs to be used. When external cold junction compensation is used, channel 7 of the 8TC module cannot use a thermocouple for temperature measurement, but is used as the input channel of the external cold junction compensation sensor (Pt100).



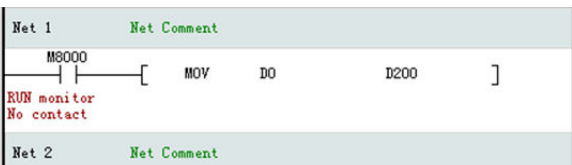
- On the CH0 - CH1 tab page, select Enable channel and set Sensor type to K in the CH0 area.



- On the IO Mapping tab page, map CH0 of the 8TC module to D0 of element D.



- Use the ladder graphic programming language to program 8TC sampling. Move the sampled temperature of channel 0 from D0 to D200.



- After the project is successfully compiled, download the project and run it.