

GL10-4TC/8TC

Temperature Module User Guide



19011100A03

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Overview

Thank you for purchasing the GL10 series temperature detection expansion modules (including GL10-4TC and GL10-8TC) independently developed and manufactured by Inovance. It supports the temperature collection via multiple type of thermocouples, with resolution of up to 24 bits.

This guide mainly covers the specifications, features, and instructions for use of the module. Before using this module, read this guide carefully to fully understand and ensure the safe use. The latest version of the guide can be available from the Inovance website (www.inovance.com).

Safety Precautions

Safety statements

1. Read these safety precautions before installing, using, and maintaining the product.
2. Follow all the safety precautions on the product and in this guide to ensure the personal and equipment safety during installation, use, and maintenance of the product.
3. The "Caution" and "Warning" 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.

Level of precautions

- Warning** : "Warning" indicates that dangerous situations will lead to death or serious injury if the right procedures are not followed.
- Caution** : "Caution" indicates that dangerous situations will lead to light injury or the loss of property if the right procedures are not followed.

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

Design



- ◆ Provide this product with external safety circuits so that the control system still works safely even if the external power supply malfunctions or the programmable controller breaks down.
- ◆ If an overcurrent continues to flow for an extended period of time due to a rating error or short-circuited load, the module may smoke or burn. Provide an external safety circuit such as a fuse or circuit breaker.



- ◆ Configure the circuits outside the programmable controller 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.
- ◆ To ensure safe operation, provide this product with an external fail-safe circuit or mechanism for the output signals that suggest major accidents.
- ◆ If the programmable controller CPU detects any abnormality in the system itself, all of the outputs may be turned off; when partial circuit fault occurs in the controller, the output may be out of control, for which an appropriate external control circuit must be designed to ensure normal operation.
- ◆ Depending on the fault of a relay or transistor in an output module, the output may not remain ON or OFF.
- ◆ The programmable controller is designed for use in an indoor electrical environment (overvoltage category II). The system level power supply must have a lightning protection device, assuring that overvoltage due to lightning shock is not applied to the controller's terminals such as power supply input terminals, signal input terminals, and control output terminals, to prevent damage to the equipment.

Installation



- ◆ Installation must be performed by skilled maintenance personnel who have received the trainings on electrical devices and have sufficient electrical knowledge.
- ◆ Before attaching or detaching this product, be sure to turn the external power supply off for all phases. Failure to turn it off for all phases may cause an electric shock, module damage, or malfunction.
- ◆ Never use the controller in locations where there is dust, greasy smoke, conductive dust, corrosive or combustible gas; which are exposed to high temperature, condensation, wind & rain, or subject to vibration or shock. Electric shock, fire, and malfunction may also result in product damage or deterioration.
- ◆ The programmable controller is of open type and must be installed in a control cabinet with lock (IP rating of the control cabinet enclosure > IP20), which can be opened only by the personnel who have received the trainings on electrical devices and have sufficient electrical knowledge.

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- ◆ Keep the vent of the controller away from metal chips or wire tailings during installation. It may cause a fire, fault, and malfunction.
- ◆ Ensure that there are no foreign matters on ventilation surface after installation; otherwise, it may result in poor heat dissipation and then cause a fire, fault, and malfunction.
- ◆ Use the module fixing hook to fasten this module securely to appropriate connectors. Failure to mount this module correctly can allow the module to malfunction, break down, or fall.

Wiring



- ◆ Wiring must be performed by skilled maintenance personnel who have received the trainings on electrical devices and have sufficient electrical knowledge.
- ◆ Before wiring, be sure to turn the external power supply off for all phases. Failure to turn it off for all phases may cause an electric shock, product damage, or malfunction.
- ◆ After wiring, install the terminal cover packed with the product before power-on, or it may cause an electric shock.
- ◆ Insulate the cable terminals properly to ensure the insulation distance between cables will not be shortened after cables are connected to the terminal block; otherwise, it may cause an electric shock or product damage.



- ◆ Be careful not to let metal chips and wire tailings enter into the vent of the controller, which may cause a fire, fault, or malfunction.
- ◆ The external wiring specifications and installation method must comply with local wiring regulations. See the wiring section in this guide for details.
- ◆ To ensure the safety of equipment and operators, use the cables with sufficient diameter for secure grounding. See the wiring section in the hardware guide for details.
- ◆ Wire each product to the module correctly after checking the terminal types to be connected. Connecting an improper terminal or miswiring may cause damage to the module or external devices.
- ◆ Tighten the bolts on the terminal block within the specified tightening torque range. Tightening a terminal bolt loosely may result in a short circuit, fire, or malfunction. Tightening a terminal bolt excessively can break the bolt or the module, also resulting in a fall, short circuit, fire, or malfunction.
- ◆ The connectors for external connection must be crimped, welded with pressure, or soldered correctly with the tools specified by the manufacturer. Improper connection can cause a short circuit, fire, or malfunction.
- ◆ A label is attached to the top of the module to prevent foreign matters, such as wire chips, from entering the module during wiring. Do not remove the label during wiring. Remove it for heat dissipation before system operation.
- ◆ Any control cable or communication cable must not be bundled with the main circuit or power cable. The control cable and communication cable must be at least 100 mm away from the main circuit or power cable.
- ◆ Select shielded cable for high-frequency signal input/output in applications with serious interference so as to enhance system anti-interference ability.

Operation and maintenance



- ◆ Operation and maintenance must be performed by skilled maintenance personnel who have received the trainings on electrical devices and have sufficient electrical knowledge.
- ◆ Never touch any terminal with the module powered, or it may cause an electric shock or malfunction.
- ◆ Before cleaning this module or tightening up the bolts on the terminal block or the bolts for connector installation, be sure to turn the external power supply off for all phases. Failure to turn it off for all phases may result in an electric shock.
- ◆ Before attaching/detaching the module or connecting/disconnecting the communication cables, be sure to turn the external power supply off for all phases. Failure to turn it off for all phases may result in an electric shock or malfunction.



- ◆ Read through this guide and check the entire system sufficiently for safety before performing relevant operations (for example, online program change, forced output, and operation status change to RUN/STOP).
- ◆ Be sure to turn the power supply off before installing/removing the expansion card.

Disposal



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

Product Information

Model and nameplate

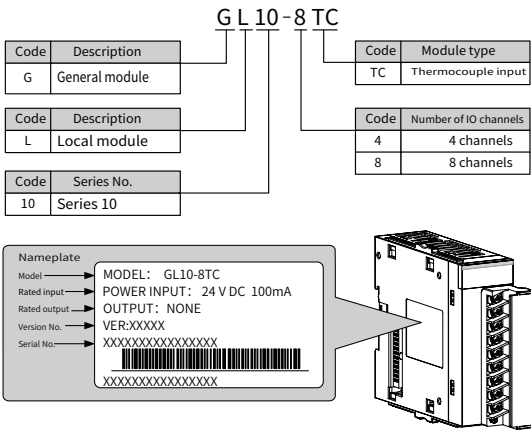


Figure 1 Description of model and nameplate

Model	Type	Description
GL10-4TC	Temperature module	Temperature collection via the 4-channel thermocouple; multiple types of thermocouples supported
GL10-8TC	Temperature module	Temperature collection via the 8-channel thermocouple; multiple types of thermocouples supported

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External terminals

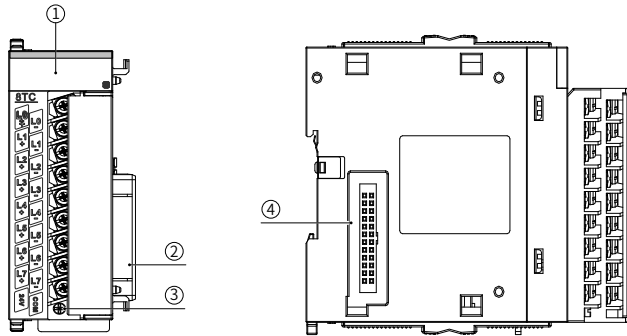


Figure 2 Diagram of module terminals

No.	Terminal	Function definition
①	Signal indicator	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
②	Back-end terminal for the local expansion module	Connect the back-end module, not supporting hot plugging
③	User input terminal	GL10-8TC: 8-channel thermocouple input/ GL10-4TC: 4-channel thermocouple input
④	Front-end terminal for the local expansion module	Connect the front-end module, not supporting hot plugging

General specifications

Item	Specification
Number of input channels	GL10-4TC: 4 channels/ GL10-8TC: 8 channels
Power supply voltage	24 V DC (20.4 V DC to 28.8 V DC) (−15% to +20%)
Internal 5 V power consumption	85 mA (typical value)
Sensor type	Thermocouple: B, E, J, K, N, R, S, T
Display mode	Celsius (° C), Fahrenheit (° F)
Wiring method of the thermocouple	Two-wire
Cold junction compensation method of the thermocouple	Internal/external cold junction compensation (external cold junction compensation not supported for GL10-4TC)
Resolution	24 bits
Sensitivity	0.1°C , 0.1 °F
Sampling cycle	250 ms, 500 ms, 1000 ms/8 channels (configured via software)
Filter time	0–100s (configured via software, default 5s)
Diagnosis and protection	Over-limit and disconnection diagnosis
Isolation mode	I/O terminals isolated from power supply; Channels isolated with each other.
System program upgrade method	USB interface upgrade
Accuracy (normal temperature: 25° C)	Full scale [Note] (± 0.1%) ± 1° C
Accuracy (ambient temperature: 0°C to 55°C)	Full scale [Note] (± 0.3%) ± 1° C

[Note] Installation must be performed in strict accordance with the installation requirements for this product; otherwise, the sampling accuracy will be affected.

Specifications such as environmental and vibration parameters can be found in the GL10-RTU-ECTA EtherCAT Communication Module User Guide.

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
	N	−200° C to +1300° C	−328° F to +2372° F	± 1.5@400° C < T < 1000° C
				± 2@−200° C < T < −150° C
	J	−210° C to +1200° C	−346 °F to +2192 °F	± 1.5@−150° C < T < +750° C
				± 0.2% display value @750° C < T < 1300° C
Thermocouple type	K	−270° C to +1370° C	−454 °F to +2498 °F	≥ ± 1@−210° C < T < −100° C
				± 1@−100° C < T < +500° C
				± 0.2% display value @500° C < T < 1300° C
				≥ 2.6@1300° C < T < 1370° C
	R	−50° C to +1768° C	−58 °F to +3214 °F	≥ ± 1.5@−270° C < T < −200° C
				± 1.5@−200° C < T < −100° C
				± 1@−100° C < T < +500° C
				± 0.2% display value @500° C < T < 1300° C
				≥ ± 4@−50° C < T < 0° C
				± 4@0° C < T < 250° C
Thermocouple type	R	−50° C to +1768° C	−58 °F to +3214 °F	± 2@250° C < T < 500° C
				± 3.5@500° C < T < 1700° C
	R	−50° C to +1768° C	−58 °F to +3214 °F	≥ ± 3.5@1700° C < T < 1768° C

Item	Sensor	Detection Range (°C)	Detection Range (°F)	Accuracy
Thermocouple type	S	-50° C to +1768° C	-58 °F to +3214 °F	$\geq \pm 4@-50^{\circ}\text{C} < T < 0^{\circ}\text{C}$
				$\pm 4@0^{\circ}\text{C} < T < 250^{\circ}\text{C}$
				$\pm 2@250^{\circ}\text{C} < T < 500^{\circ}\text{C}$
				$\pm 3.5@500^{\circ}\text{C} < T < 1700^{\circ}\text{C}$
				$\geq \pm 3.5@1700^{\circ}\text{C} < T < 1768^{\circ}\text{C}$
	T	-270° C to +400° C	-454 °F to +752 °F	$\geq \pm 1@-270^{\circ}\text{C} < T < -200^{\circ}\text{C}$
				$\pm 1@-200^{\circ}\text{C} < T < +400^{\circ}\text{C}$

[Note] If the internal cold junction is used, the terminal temperature value obtained by shorting the channels will not be used as reference;

To ensure stability of measurement with internal cold junction, perform measurement 60 min after power-on or 15 min after sensor replacement.

Mechanical Design Reference

Installation dimensions

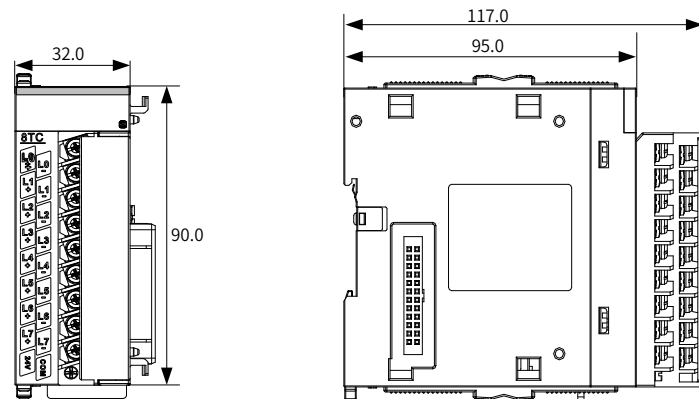


Figure 3 Installation dimensions (in mm)

Electrical Design Reference

Cable selection

Supporting material	Model	Cable diameter		Manufacturer	Crimping tool
		mm ²	AWG		
Y-type cable lug	TNS1.25-3	0.5-0.75	22-18	Suzhou Yuanli	RYO-8 YYT-8

Those cable lugs are applicable to the digital/analog module, and the rated temperature must be above 75°C.

Cable preparation

Cable preparation procedures:

- ◆ Strip the cable insulation layer to expose 6 mm of copper.
- ◆ Pass the cable through the cable marker sleeve.
- ◆ 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.
- ◆ Use a 20 mm long heat-shrinkable tube (Φ3) to wrap the copper tube of a cable lug and then perform thermal shrinkage.

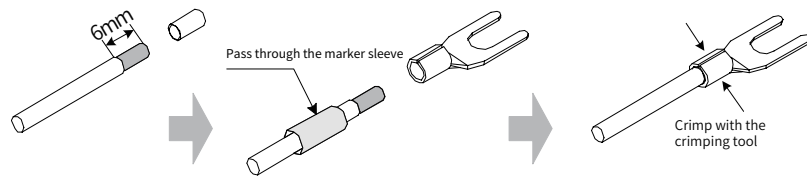


Figure 4 Diagram of cable preparation

- ◆ Put the cable lug onto the terminal block and use a screwdriver to tighten the cable lug with a tightening torque of up to 0.8 N·m.

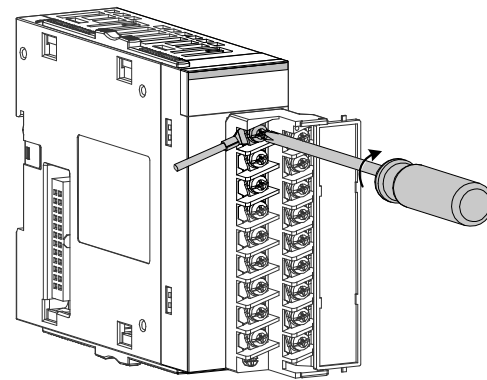


Figure 5 Connecting cable to terminal block

Terminal Arrangement

The GL10-8TC temperature module terminals are illustrated as follows (L4+/L4- to L7+/L7- reserved for GL10-4TC temperature module).

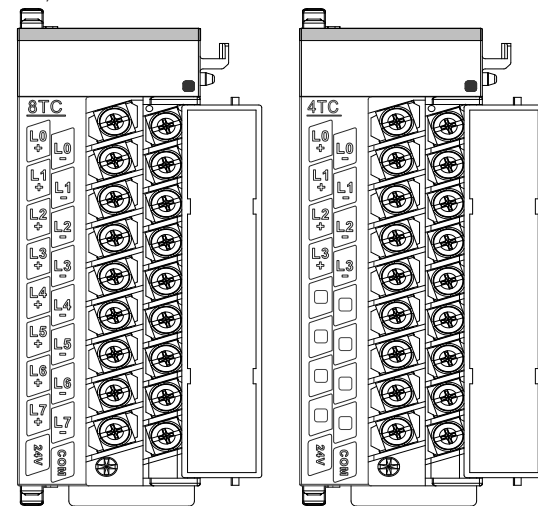


Figure 6 Module terminal arrangement

Terminal assignment

No.	Assignment	Type	Function
1	L0+	Input	Channel 0 thermocouple
2	L0-	Input	Channel 0 thermocouple
3	L1+	Input	Channel 1 thermocouple
4	L1-	Input	Channel 1 thermocouple
5	L2+	Input	Channel 2 thermocouple
6	L2-	Input	Channel 2 thermocouple
7	L3+	Input	Channel 3 thermocouple
8	L3-	Input	Channel 3 thermocouple
9	L4+	Input	Channel 4 thermocouple
10	L4-	Input	Channel 4 thermocouple
11	L5+	Input	Channel 5 thermocouple
12	L5-	Input	Channel 5 thermocouple
13	L6+	Input	Channel 6 thermocouple
14	L6-	Input	Channel 6 thermocouple
15	L7+	Input	Channel 7 thermocouple/external cold junction compensation (high accuracy mode for external cold junction compensation)
16	L7-	Input	Channel 7 thermocouple/external cold junction compensation (high accuracy mode for external cold junction compensation)
17	+24V	Power supply	+24 V power supply
18	COM	Power supply	24 V power supply ground

Note 1: L4+/L4- to L7+/L7- reserved for GL10-4TC.

Note 2: For GL10-8TC, the L7 sampling terminal is used for normal thermocouple sampling and external cold junction compensation. If the cold junction of the thermocouple is distant from the module, resulting in a large temperature difference, and high temperature accuracy is required, the terminal can be connected to PT100 resistor for external cold junction compensation. In this case, only CH0-CH6 of the module are used 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

L4+/L4- to L7+/L7- terminals are reserved for the GL10-4TC temperature module, and the wiring for the remaining terminals is the same as that for the GL10-8TC (as follows).

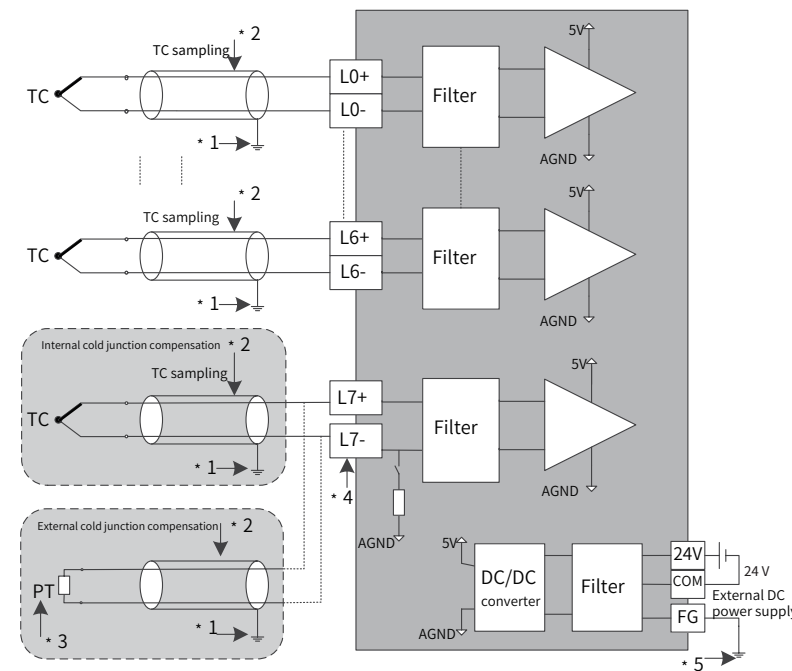


Figure 7 GL10-8TC module wiring diagram

*1 The cable must be comprised of the shielded compensation conductor.

*2 If there is a gap between the cold junction and the end of the thermocouple, the measured temperature value will be abnormal in the absence of the compensation conductor.

*3 A thermal resistor can be used for cold junction compensation at the L7 terminal. In this case, the PT100 resistor must be used, and this terminal must be enabled by the software.

*4 If the internal cold junction compensation is used, the L7 terminal can be used for normal thermocouple sampling, and the wiring is the same as L0-L6 terminals in the preceding figure. If the external cold junction compensation is used, the L7 terminal must be connected to a PT100 resistor, and the wiring is the same as the L7 terminal in the preceding figure.

*5 The module must 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

- 1) Do not bundle the cable with AC cables, main circuit cables, and high voltage cables; otherwise, it may result in an increased noise, surge and electromagnetic induction.
- 2) Apply single-point grounding for the shield of shielded cables and solder sealed cables.
- 3) The sleeved and solderless crimp terminals are not allowed for use with terminal blocks. It is recommended to use the marker sleeve or insulation sleeve to cover the cable joints of the crimp terminals.