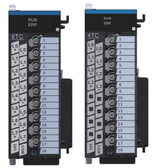
INOVANCE



GL10-4TC/8TC

Temperature Module User Guide

19011100A04

1

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).

Fundamental Safety Instructions

■ Safety disclaimer

1) Read and comply with the safety instructions during installation, operation, and maintenance of the product.
2) To ensure the safety of humans and the products, follow the marks on the products and all the safety instructions in this document.
3) The "CAUTION", "WARNING", and "DANGER" are only supplements to the safety instructions.
4) Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
5) Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

■ Safety levels and definitions

DANGER The "DANGER" sign indicates that failure to comply with the notice will result in death or serious injury.

WARNING The "WARNING" sign indicates that failure to comply with the notice could result in death or serious injury.

CAUTION The "CAUTION" sign indicates that failure to comply with the notice could result in minor or moderate injury, or equipment damage.

Unpacking

WARNING

- Do not install the product in case of any damage, rust, or signs of use on the product or accessories upon unpacking.
- Do not install the product in case of water seepage into the product or missing or damaged components upon unpacking.
- Do not install the product in the case of any discrepancy between the product you received and the product name on the packing list.

CAUTION

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.Once the CPU of the PLC detects an exception in the system, all outputs may be closed. When a fault occurs in the controller circuit, the output may not be under control. Therefore, it is necessary to set up an external control circuit to ensure normal operation.
- Check for damage, rust, or dents on the surfaces of the product and accessories upon unpacking.
- After unpacking, check the contents against the packing list to ensure that the equipment and accessories are in the correct quantities, and that all documentation is complete.

Storage and transportation

WARNING

- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injury or equipment damage.
- Never stand or stay under the equipment while it is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply could result in personal injury or equipment damage.

CAUTION

- Handle the equipment with care during transportation and mind your step to prevent personal injury or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply could result in personal injury.
- Do not store or transport the equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Never transport the equipment with other devices or items that could impact or cause harm to the equipment.

Design

DANGER

- Provide a safety circuit and include an error handling program in the software to ensure that the product remains in a safe state in case of an external power failure or an internal fault.
- If a sustained overcurrent occurs due to overload or load short circuit, the product may smoke or catch fire. An external safety device (such as a fuse or circuit breaker) must be installed.

WARNING

- Any damaged output components such as relays or transistors in this product may result in uncontrolled output that stays in a constant ON or OFF state.
- The product design must comply with the overvoltage category requirements specified in the Environmental Specifications. 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 product.
- Ensure that appropriate actions have been taken to prevent product malfunction caused by a communication fault between the product and related devices. Failure to comply could cause personal injury or equipment damage.

CAUTION

- Switches that could cause personal injury or equipment damage must not be configured on the touch screen. Use independent switches for performing critical operations. Failure to comply could result in accidents caused by wrong outputs or faults.

Installation

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Nonprofessionals must not operate this equipment.

WARNING

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic field.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may result in mechanical hazards.
- Before installation, ensure that the installation site meets the required environmental conditions. Failure to comply could result in equipment damage.
- Do not wear loose clothes or accessories during installation. Failure to comply could result in electric shock.
- When installing the equipment in an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so could result in equipment overheating or fire.
- Do not modify this equipment.
- Never loosen the fixing bolts on components and modules, or any bolts marked in red.
- This equipment must be installed inside an indoor cabinet or terminal equipment. The cabinet or terminal equipment itself must be provided with the necessary protective enclosures, such as a fireproof enclosure, an electrical protective enclosure, and a mechanical protective enclosure. The IP rating of these enclosures must comply with the relevant IEC standards, and applicable local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for this equipment to prevent malfunction.
- Install the equipment onto a non-combustible object such as metal. Keep the equipment away from combustible objects. Failure to comply could result in fire.
- For products not supporting hot swapping, disconnect all external power supplies of the system before installing/removing the product. Failure to comply could result in electric shock, product failure, or malfunction.

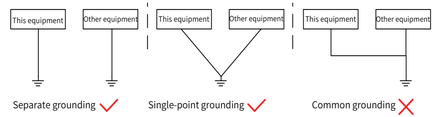
CAUTION

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper for effective ventilation and cooling.
- During installation, ensure the equipment is connected to the respective connector securely and hook the equipment firmly. Improper installation may cause the equipment malfunction, failure, or loosening.

Wiring

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.
- Before wiring, disconnect all the power supplies of the equipment. Wait for at least the time designated on the warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply could result in electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply could result in electric shock.
- Ensure that the equipment is grounded properly. Failure to comply could result in electric shock. Ground the equipment separately or to a single point. Common grounding must not be used.



- Insulate the cable terminals properly to ensure the insulation distance between cables will not be shortened after cables are connected to the terminal block. Failure to comply could result in electric shock or equipment damage.
- Install the terminal cover attached to the equipment before power-on or operation after wiring is completed. Failure to comply could result in electric shock.

WARNING

- Never connect the power cable to output terminals of the equipment. Failure to comply could cause equipment damage or even fire.
- Cables used for wiring must comply with the requirements for the cross-sectional area and shielding. The shielding layer of the shielded cable must be reliably grounded at one end.
- Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage of the joint, which could result in fire.
- After wiring is done, ensure that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply could result in electric shock or equipment damage.

CAUTION

- Follow the proper electrostatic discharge (ESD) procedure, and wear an anti-static wrist strap to perform wiring. Failure to comply could damage the equipment or its internal circuits.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.
- Before power-on, ensure that the equipment is installed and wired properly.
- Ensure that the power supply meets equipment requirements before power-on to prevent equipment damage or fire accident.
- Do not open the cabinet door or protective cover of the product, touch any wiring terminal of the product, or remove any components or parts while the product is powered on. Failure to comply could result in personal injury or even death.

WARNING

- Perform a trial run after wiring to ensure the equipment operates safely. Failure to comply could result in personal injury or equipment damage.

Operation

DANGER

- The equipment must be operated only by professionals. Failure to comply can result in injury or death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply could result in electric shock.

WARNING

- Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply could result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply could result in fire or equipment damage.
- During operation, do not bring live parts into contact with the metal enclosure of the product. Failure to comply could result in fire or product damage.

CAUTION

- Operate the equipment within the specified environmental conditions. Failure to comply could result in equipment failure or damage.
- Touch the HMI panel with hands only. Failure to comply could cause panel damage, which is out of the warranty range.

Safety recommendations

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

Battery usage

WARNING

- Do not use batteries that do not meet the product requirements. Failure to comply could result in death, personal injury, explosion, or fire.
- Do not throw batteries into a fire or heat oven. Do not crush or cut the battery. Failure to comply could result in death, personal injury, explosion, or fire.
- Do not expose the battery to extremely high temperatures. Failure to comply could result in death, personal injury, explosion, or fire.
- Do not swallow batteries. Failure to comply could result in chemical burns.
- Seek for medical treatment immediately if a button battery is swallowed by accident, because this may cause severe internal burns within two hours and even death.

CAUTION

- Keep batteries out of reach of children.
- If the battery compartment is not securely closed, stop using the product immediately and keep it out of reach of children.

Maintenance

DANGER

- Maintenance must be performed only by trained and qualified electrical personnel.
- Do not maintain the equipment with power ON. Failure to comply could result in electric shock.
- Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
- Disconnect all external power supplies of the system before cleaning the equipment or re-tightening screws on the terminal block or screws of the connectors. Failure to comply could result in electric shock.
- Disconnect all external power supplies of the system before removing or installing the product, or connecting or disconnecting cables. Failure to comply could result in electric shock or malfunction

WARNING

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

DANGER

- Repair must be performed only by trained and qualified electrical personnel.
- Do not repair the equipment with power ON. Failure to comply could result in electric shock.
- Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.

WARNING

- Submit a request for repair based on the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply could result in equipment damage, personal injury, or death.
- Troubleshooting and repair of a faulty or damaged equipment must be performed by professionals based on the repair instructions, with the repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply could result in death, personal injury, or severe equipment damage.
- Recheck the wiring and reset the parameters after equipment replacement.

Disposal

WARNING

- Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply could result in property damage, personal injury, or death.
- Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.
- Treat the retired equipment as industrial waste. Dispose of used batteries according to local laws and regulations.

■ Safety label

To ensure safe operation, comply with safety labels on the equipment and do not damage or remove the labels. The following table describes the meanings of the safety labels.

Safety label	Description
	◆ Before using the equipment, read the guide and safety precautions carefully. Failure to comply could result in personal injury, death, or equipment damage. ◆ Do not touch the terminals or remove the cover with power-on or within 10 min after power-off. Failure to comply could result in electric shock. ◆ The surface of the running equipment may become very hot. Do not touch these hot areas. Failure to comply may cause burns.

Product Information

■ Model and nameplate

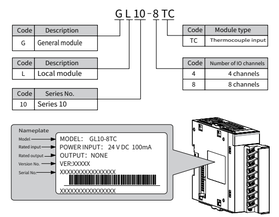


Figure 1 Description of model and nameplate

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

■ External terminals

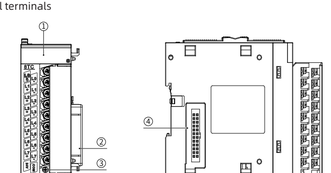


Figure 2 Diagram of module terminals

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

Item	Specification
Sensitivity	0.1℃ , 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℃ to 55℃)	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
				± 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% display 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% display 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% 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	≥ ± 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
Thermocouple type	S	-50° C to +1768° C	-58 °F to +3214 °F	≥ ± 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

[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

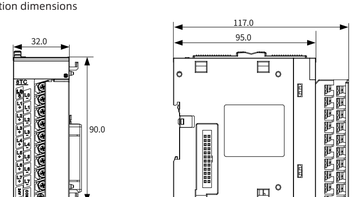


Figure 3 Installation dimensions (in mm)

Electrical Design Reference

■ Cable selection

Supporting material	Model	Cable diameter		Manufacturer	Crimping tool
		mm²	AWG		
Y-type cable lug	TNS1.25-3	0.5-0.75	22-18	Suzhou Yuanli	RYD-8 YYT-8

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

■ 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.

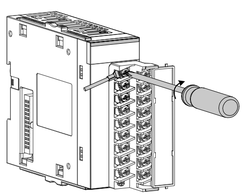


Figure 5 Connecting cable to terminal block

■ Terminal arrangement

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

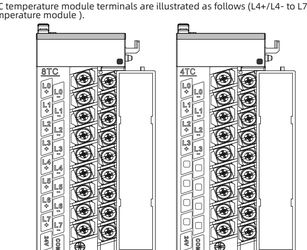


Figure 6 Module terminal arrangement

■ Terminal assignment

No.	Assignment	Type	Function
1	L0+	Input	Channel 0 thermocouple
2	L0-	Input	Channel 0 thermocouple

No.	Assignment	Type	Function
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 (℃)	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℃ to +1200.0℃	-346.0 °F to +2192.0 °F
	K	-270.0℃ to +1370.0℃	-454.0 °F to +2498.0 °F
	R	-50.0℃ to +1765.0℃	-58.0 °F to +3209.0 °F
	S	-50.0℃ to +1765.0℃	-58.0 °F to +3209.0 °F
	T	-270.0℃ to +400.0℃	-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).

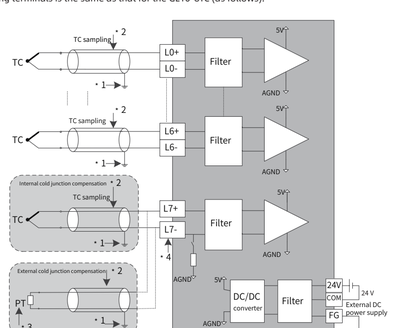


Figure 7 GL10-8TC module wiring diagram

Note:
*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.

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