INOVANCE



GL10-4AD

Analog Input Module User Guide

19011099A03

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Overview

This user guide provides information on the GL10-4AD analog input expansion module developed and manufactured independently by Inovance. It is a 4-channel analog input module that supports voltage and current input, with a resolution of up to 16 bits.

This user guide covers the specifications, functional characteristics, and operational guidelines of the product. Read the document before use to ensure safe operation. Visit Innovance's official website (www.inovance.com) to download the latest version of the guide.

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 indicates that failure to comply with the notice will result in death or severe injury.

WARNING indicates that failure to comply with the notice may result in death or severe injury.

CAUTION indicates that failure to comply with the notice may result in minor or moderate injury, or equipment damage.

Unpacking

- Provide a safety circuit outside the controller so that the control system can still work safely once external power failure or controller 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.

CAUTION

- An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and an upper position limit and lower position limit interlocked circuit must be set in the external circuits of controller to prevent damage to the machine.
- For the output signals that may cause critical accidents, use external protection circuits and safety mechanism to ensure safe operation.
- Once 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 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 an indoor electrical environment (overvoltage category II). The power supply must have a system-level surge protector, 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, to prevent damage to the equipment.

2

Storage and transpostation

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 cannot 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.

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 may 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

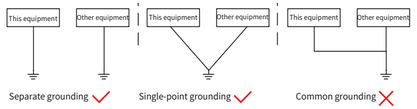
- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper for effective ventilation and cooling.
- During 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.

3

Wiring

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals cannot 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 cannot 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.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 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.

4

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 batterries to extremely high temperatures. Failure to comply may 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 Labels

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

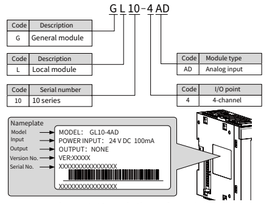


Figure 1 Description of model and nameplate

Model	Type	Description
GL10-4AD	Analog input	4-channel AD module, supporting analog voltage/current input

■ External interface

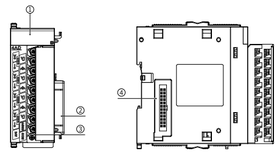


Figure 2 Module interface

No.	Interface	Definition
①	Signal indicator	RUN Status Indicator: Lights on when the local bus and module are operational; lights off when the local bus and module are stopped. ERR: error state indicator, which is turned on when a fault occurs.
②	Local expansion module downstream interface	Connect downstream module, not supporting hot plugging.
③	User input terminal	4-channel input (supporting voltage or current input)
④	Local expansion module upstream interface	Connect upstream module, not supporting hot plugging.

■ General specifications

Item	Specification
Input channel	4
Power supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15%~+20%)
Internal 5 V power consumption	85 mA (typical value)
Voltage input impedance	> 1 MΩ
Current sampling impedance	250 Ω
Voltage input range	Bipolar: ±5 V, ±10 V; Unipolar: +5 V, +10 V
Current input range	0 mA to 20 mA, 4 mA to 20 mA, ±20 mA
Resolution	16 bits
Sampling time	1 ms
Accuracy (normal temperature: 25° C)	Voltage: ±0.1%, current: ±0.1% (full ranges)
Accuracy (ambient temperature: 0°C to 55°C)	Voltage: ±0.3%, current: ±0.8%
Voltage limits	±15 V
Current limits	±30 mA (transient), ±24 mA (average)
Maximum common mode voltage between channels	30 VDC
Isolation mode	I/O terminals isolated from power supply; Non-isolation between channels.
System program upgrade method	USB interface

Note: For environmental parameter details, refer to the "Product Information > Environmental Parameters" section in the GL10-RTU-ECTA EtherCAT Communication Module User Guide.

■ Analog-to-digital signal correspondence

	Rated input range	Corresponding digital value	Input limit range	Limit digital value
Analog voltage input	-10 V to +10 V	+20000 to +20,000	-11 V to +11 V	-22000 to +22000
	0 V to 10 V	0 to 20000	-0.5 V to +10.5 V	-1000 to +21000
	-5 V to +5 V	-20000 to +20000	-5.5 V to +5.5 V	-22000 to +22000
	0 V to 5 V	0 to 20000	-0.25 V to +5.25 V	-1000 to +21000
	1 V to 5 V	0 to 20000	0.8 V to 5.2 V	-1000 to +21000
Analog current input	-20 mA to +20 mA	+20000 to +20,000	-22 mA to +22 mA	-22000 to +22000
	0 mA to 20 mA	0 to 20000	-1 mA to +21 mA	-1000 to +21000
	4 mA to 20 mA	0 to 20000	3.2 mA to 20.8 mA	-1000 to +21000

Mechanical Design

■ Mounting dimensions

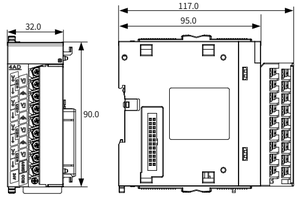


Figure 3 Mounting dimensions (in mm)

Electrical Design

■ Cable selection

Material name	Model	Applicable cross sectional area of the cable		Manufacturer	Crimping pliers
		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 digital/analog modules, and the cable rated temperature is required to be above 75 °C.

■ Cable preparation

Cable preparation:

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

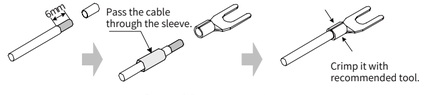


Figure 4 Cable preparation

- Put the cable lug onto the terminal and tighten the screw with a screwdriver. The maximum tightening torque is 0.8 N·m.

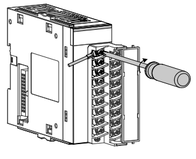


Figure 5 Connecting cable to terminal block

■ Terminal arrangement

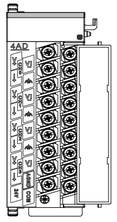


Figure 6 Terminal arrangement of the module

■ Terminal assignment

No.	Network name	Type	Function	Description
1	V+	Input	V+ of channel 0	Voltage input
2	VI-	Input	V-/I- of channel 0	Voltage/current input
3	I+	Input	I+ of channel 0	Current input
4	⏚ [1]	-	Shield ground	Internally connected to housing ground.
5	V+	Input	V+ of channel 1	Voltage input
6	VI-	Input	V-/I- of channel 1	Voltage/current input
7	I+	Input	I+ of channel 1	Current input
8	⏚ [1]	-	Shield ground	Internally connected to housing ground.
9	V+	Input	V+ of channel 2	Voltage input
10	VI-	Input	V-/I- of channel 2	Voltage/current input
11	I+	Input	I+ of channel 2	Current input
12	⏚ [1]	-	Shield ground	Internally connected to housing ground.
13	V+	Input	V+ of channel 3	Voltage input
14	VI-	Input	V-/I- of channel 3	Voltage/current input
15	I+	Input	I+ of channel 3	Current input
16	$AGND_{[2]}$	Analog ground	Analog ground	-
17	24V	Power supply	24 V power supply	-
18	COM	Power supply GND	Power supply GND	-

NOTE

- [1]: Shield ground terminals 4, 8, and 12 are internally connected.
- [2]: Terminal 16 (AGND) is internally connected to the AGND terminals of other channels.

■ External wiring

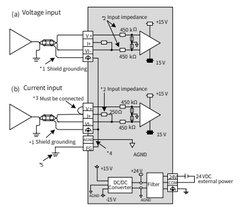


Figure 7 Module output wiring

*1 Use 2- core twisted pair shielded cable for analog signal.

*2 Indicates input impedance of 4AD.

*3 For current input, terminal (V+) must be connected to terminal (I+).

*4 When the input signal is a differential signal, "AGND" can be connected to analog ground of compatible devices to eliminate the difference of common mode voltage between devices and ensure the accuracy of module sampling.

*5 Mount the module on a grounded metal bracket, ensuring the bottom metal spring maintains firm contact.

■ Wiring precautions

1) Do not bundle the cable together with AC cable, main lines, or high voltage cables, otherwise it may increase noise, power surges and inductive interference.
2) Implement single-point grounding for shielded cables and the shielding layers of soldered connections.

Non-welded crimp terminals with sleeves are prohibited for terminal blocks. Use marking sleeve or insulation sleeve to cover the crimped terminal ends of cables.