INOVANCE



User Guide

GR10-0808ETNE

19011281A04

EtherCAT Slave I/O Module

Overview

Thank you for purchasing the GR10-0808ETNE EtherCAT communication slave I/O module developed and manufactured independently by Inovance.

This DC24V-powered product is used for EtherCAT communication, coming with 8-point digital NPN output and 8-point digital input.

This guide describes the specifications, characteristics and using methods of the product. Please read this guide carefully before using to ensure safe usage. Visit our website (www.inovance.com) for 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 could result in death or severe injury.

CAUTION 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 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.

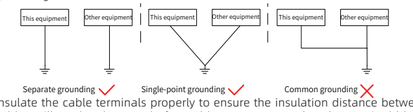
CAUTION

- 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.

Wiring

DANGER

- This equipment must be operated only by trained and qualified electrical personnel.
- 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 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 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

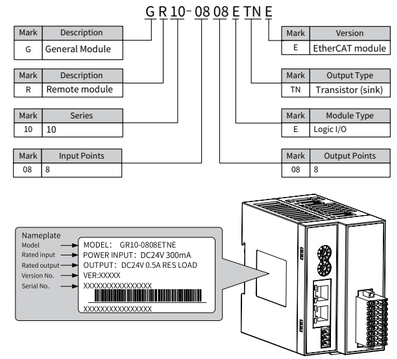


Figure 1 Description of model number and nameplate

Model	Category	Description
GR10-0808ETNE	EtherCAT communication slave module	8-Point DO, transistor output (sink); 8-point DI (source and sink)

■ External Interface

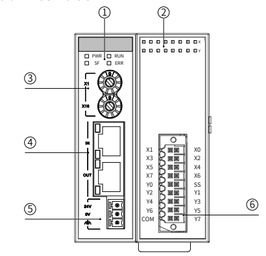


Figure 2 Diagram of module interfaces

Interface Name	Function			
① Signal indicator	PWR	Power indicator	Green	ON when power supply is switched on
	RUN	Running status indicator	Green	ON when the module is in normal operation
	SF	Fault indicator	Red	Is ON when the module is faulty
	ERR	State machine error indicator	Red	Is ON when an error occurs in the state machine
② I/O signal indicator	For input and output signals ON: signal active OFF: signal inactive			

③ Address DIP switch	Slave address setting switch: ADDR1/ADDR0: address DIP switch, address is set in hexadecimal, slave decimal address = ADDR1*16+ADDR0*1 1–255
④ EtherCAT communication interface	X1 IN: EtherCAT input
	X2 OUT: EtherCAT output for connecting back-end EtherCAT slaves
⑤ 24 V power input terminal	For module power supply input
⑥ User output terminal	See "Electrical Design Reference" for details

■ General Specifications

Item	Specifications
Power supply specifications	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Communication protocol	EtherCAT industrial real-time bus protocol
Max. communication speed	100 Mbps
Network port/ network cable	Standard network port with Cat 5e network cables below 100 meters
Station number range	1 to 255 if set by a DIP switch, or automatically allocated by a network bus

The specific performance indicators are as follows:

Item	Specifications
Communication protocol	EtherCAT protocol
Service supported	CoE (PDO, SDO), FoE
Min. synchronization period of the 6-axis cam	1250 us (TYP)
Synchronization mode	Input and output synchronization or DC-distributed clock
Physical layer	100BASE-TX
Baud rate	100 Mbit/s (100Base-TX)
Duplex mode	Full duplex
Topological structure	Linear topological structure
Transmission medium	Network cables, see the Wring section
Transmission distance	Less than 100 m between two nodes
EtherCAT frame length	44–1,498 bytes
Process data	Max. 1486 bytes per frame
Synchronization jitter of two slave stations	< 1 us
Update time	30 us for 1,000 digital inputs and outputs; 100 us for 32 servo axes

■ Output specification

Item		Specifications
Output channels		8
Output connection method		Leaf spring terminal
Output type		Transistor, low-side output
Power supply voltage		24 VDC (–15% to +20%)
Output voltage class		24 VDC (–15% to +20%)
Max. leakage current at OFF		Less than 0.5 mA
Response time when the module is turned ON		Less than 0.5 ms (for hardware)
Response time when the module is turned OFF		Less than 0.5 ms (for hardware)
Max. load	Resistive load	0.5 A/point, 2 A/common terminal[1]
	Inductive load	12 W/24 VDC (total)
	Lamp load	2 W/24 VDC (total)
Isolation mode		Optocoupler isolation
Output action display		Output indicator ON when optocoupler drive is activated
Short circuit-proof output		Yes

NOTE

[1]: The COM and 0V Power Supply terminal need to be short connected additionally when the output Current is overloaded (> 1A).

■ Input specification

Item	Specifications
Input channels	8
Input connection method	Leaf spring terminal
Input type	Digital input
Input mode	SINK/SOURCE
Input voltage class	24 VDC (max.: 30 V)
Input current (typical)	4 mA
On voltage	> 15 VDC
OFF voltage	< 5 VDC
Port hardware filter time constant	10 ms
Input resistance	4.3 K
Input signal form	DC voltage input, supporting SINK/SOURCE input
Isolation mode	Optocoupler isolation
Input action display	Input indicator ON when the input is in the driving state

Mechanical Design Reference

■ Mounting Dimensions

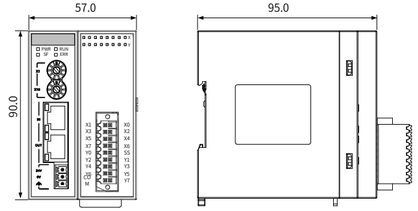
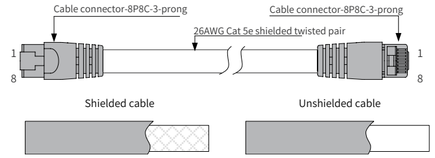


Figure 3 Mounting dimensions (in mm)

Electrical Design Reference

■ EtherCAT Cable Selection

- Cable Preparation



* Use Cat 5e shielded twisted pair (STP) cables, with injection molded and iron shelled connector.

- Signal pins

Pin	Signal	Signal Direction	Signal Description	Pin	Signal	Signal Direction	Signal Description
1	TD+	Output	Data transmission+	5	--	--	Not used
2	TD-	Output	Data transmission-	6	RD-	Input	Data reception–
3	RD+	Input	Data reception+	7	--	--	Not used
4	--	--	Not used	8	--	--	Not used

- Length requirements:

According to FastEthernet technology, when an EtherCAT bus is used, the length of the cable between the devices cannot exceed 100 meters. Exceeding this length will attenuate the signal and affect communication.

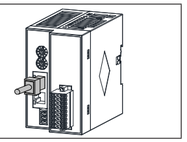
- Technical requirements:

100% continuity test, no short circuit, open circuit, misalignment and poor contact; use a shielded cable as the EtherCAT bus for network data transmission, with the following recommended specifications:

Item	Specifications
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Complied standards:	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Conductor type	Twisted pair
Pair	4

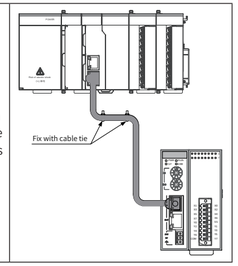
■ Communication Wiring

Insert the cable into the EtherCAT port of the communication module until you hear a click sound.



- Requirements for securing communication cable

To protect the communication cable from any tension and to ensure communication stability, fix the cable end which is near the device before EtherCAT communication, as shown on the right:



■ Fault Indication and Troubleshooting for EtherCAT Slave Station Module

LED indicator		Indication	Solution
RUN	OFF	EtherCAT master and slaves are initialized	Check configuration and parameter assignment; check communication address Check that the length and other specifications of the network cable are as specified.
	Blinking	EtherCAT slave is in a state other than OP	Check slave configuration for any missing, faulty or unconfigured module.
ERR	Blinking	Communication error between EtherCAT master and slave	Check that the master and slave parameter configurations are correct
SF	Steady ON	Output channel is faulty	Check the output channel for short circuit or overtemperature.

■ Connection of User Output Terminals

- Cable Selection

Material Name	Model	Applicable Cable Diameter		Manufacturer	Crimping Tool
		MM^2	AWG		
Tubular lug	GTVE07512	0.75	21	Suzhou Yuanli	YAC-5

Those cable lugs are applicable to this module, and the cable rated temperature is required to be above 75℃.

■ Cable Preparing Procedures

◆ Remove the insulation of the cable so that a length of 11–14 mm of the conductor is exposed, and put the cable through a cable marking sleeve.
◆ Insert the exposed end into the hole of the cable lug, and then crimp it with recommended crimping tool.

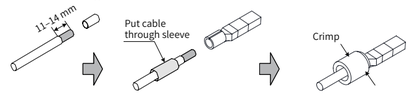


Figure 4 Diagram of cable preparing

■ Terminal Layout

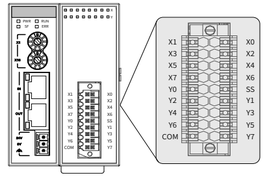
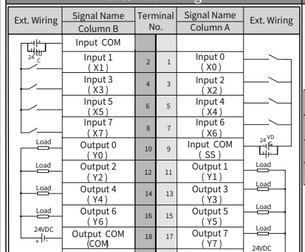


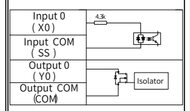
Figure 5 Terminal layout

■ External Wiring

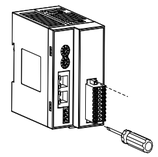
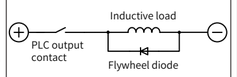
External Wiring



Internal Equivalent Circuit



■ Precautions

After the IO terminal block is mounted to CN5, fix it with a torque of 0.2–0.25 N m, as shown in the figure.	
Contact protection in the case of inductive load: when the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, you can use a parallel flywheel diode with the load to extend the lifetime of the product. The freewheel diode must satisfy: ① reverse voltage is 5 to 10 times of load voltage; ② forward current is larger than load current.	

1) Do not bundle the terminal connection cables together with power cables (high voltage, large current) which produce strong interference signals. Separate it from other cables and avoid cabling in parallel.
2) Use recommended cables and adapter boards. It is recommended to use shielded cables as terminal cables for increased anti-interference ability.

INOVANCE Warranty Agreement

The warranty period of the product is 18 months (The period is subject to the date information indicated by the barcode on the product, or the terms and conditions of the purchase contract if otherwise specified). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inovance will be responsible for free maintenance.

Within the warranty period, maintenance will be charged for the damages due to the following causes:

a) Improper use or uninstallation/repair/modification without prior permission
b) Fire, flood, abnormal voltage, other disasters, and secondary disasters
c) Hardware damage caused by dropping or transportation after procurement
d) Failure to operate the product by observing the User Guide provided by Inovance
e) Faults and damages caused by factors outside of the product (such as peripheral devices)

If there is any failure or damage to the product, correctly fill out the Product Warranty Card.

The maintenance fee is charged as the latest Maintenance Price List of Inovance.

The Product Warranty Card is not re-issued. Keep the card and present it to the maintenance personnel when seeking maintenance.

If there is any problem during the service, contact us or our agent directly.

You are assumed to agree on terms and conditions of this warranty agreement by purchase of the product. This agreement shall be interpreted by Inovance.

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