INOVANCE



GL10-RTU-ECTA

EtherCAT Communication Module User Guide

19011107A05

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Overview

Thank you for purchasing the GL10-RTU-ECTA EtherCAT communication module developed and manufactured independently by Inovance. It is an EtherCAT bus slave expansion module. It provides the automatic scanning function. Each GL10-RTU-ECTA module can connect up to 16 modules (DI/DO/AI/AO).
This guide describes the specifications, characteristics and using methods of this module. Read this guide carefully before using to ensure more safe usage. You can download the latest materials from 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 indicates that failure to comply with the notice will result in death or serious injury.

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

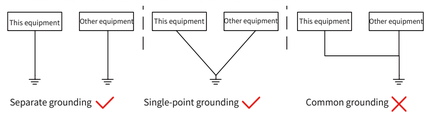
CAUTION

- 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

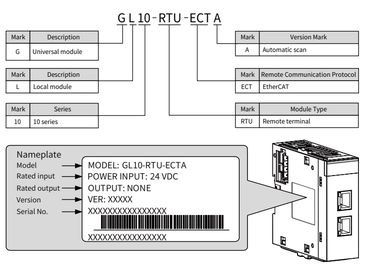


Figure 1 Description of model and nameplate

Model	Category	Description
GL10-RTU-ECTA	EtherCAT communication module	EtherCAT protocol communication interface module

■ External Interface

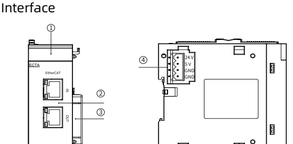


Figure 2 Diagram of EtherCAT communication module interface

No.	Interface	Function			
①	Signal indicator	POWER	Power indicator	Green	ON upon power-on
		RUN	Running status indicator	Green	ON when the module is running properly. Off when the module is in state INIT. Blinking when the module is in state PRE-OPERATIONAL. Single flash when the module is in state SAFE OPERATIONAL.
		SF	Expansion module and network error	Red	Single flash when an error occurs in the expansion module. Blinking when the module is disconnected from the network.
		BF	Communication error indicator	Red	Blinking when a communication error occurs.
②	IN	EtherCAT input port			
	OUT	EtherCAT output port, used to connect to a back-end EtherCAT slave			
③	Local expansion module back-end interface	Connected to a back-end module			
④	Input terminal of 24 V internal power supply	Connected to a power module			

■ General Specifications

Item	Specification
Power supply specifications	24 VDC (20.4 VDC to 28.8 VDC) (–15% to +20%)
Communication protocol	EtherCAT industrial real-time bus protocol
Maximum communication rate	Ethernet 100 Mbps
Network port/Network cable	Standard Ethernet port and standard Ethernet cable (Cat 5e network cable) with a cable length of not more than 100 m
Station ID range	1 to 125. The internal address is automatically arranged in the network bus connection sequence.
Expandability of subsequent I/O modules	Up to 16 I/O modules can be added. The actual number and configuration depend on each module's power consumption.

■ Environmental Parameters

Type		Operating Environment	Transportation Environment	Storage Environment
Environment class		IE33	IE22	IE12
Temperature		–5° C to +55° C	–40° C to +70° C	–25° C to +70° C
Humidity		10% to 95%, non-condensing		
Vibration	Frequency	5 Hz to 150 Hz	2M2	1M2
	Displacement	3.5 mm (direct installation) (< 9 Hz)		
	Acceleration rate	1 g (direct installation) (> 9 Hz)		
	Orientation	3 axial directions		

■ Specific Performance Indexes Reached Are Shown in the Following Table:

Item	Specification
Communication protocol	EtherCAT protocol
Application layer protocol	ETG.5001.1 S(D) V0.1.1
Service supported	CoE (PDO and SDO)
Physical layer	100BASE-TX
Baud rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex
Topology structure	Linear topology
Transmission media	Network cable (For details, see "Wiring".)
Transmission distance	Less than 100 m between two nodes
Number of slaves	Up to 125 slaves
EtherCAT frame length	44 bytes to 1,498 bytes
Process data	Maximum 1,486 bytes per Ethernet frame
Synchronization jitter of two slaves	< 1 μs
Refresh time	About 30 μs for 1,000 digital inputs and outputs, and about 100 μs for 32 servo axes

■ Module Power Consumption:

GL10-RTU-ECTA is an EtherCAT communication module with a rated power consumption of 1,500 mA, and up to 16 expansion modules can be connected.

Module	Rated Power Consumption (mA)	Specification
GL10-0016ETN	85	16-channel digital output module (NPN)

Module	Rated Power Consumption (mA)	Specification
GL10-0016ETP	65	16-channel digital output module (PNP)
GL10-0016ER	65	16-channel digital output module (relay)
GL10-0032ETN	115	32-channel digital output module (NPN)
GL10-1600END	55	16-channel digital input module (source/sink)
GL10-3200END	65	32-channel digital input module (source/sink)
GL10-4AD	85	4-channel analog input module (voltage/current)
GL10-4DA	85	4-channel analog output module (voltage/current)
GL10-4PT	85	4-channel temperature module

NOTE

The specific number of modules that can be connected depends on the total rated current.

Mechanical Design Reference

■ Mounting Dimensions

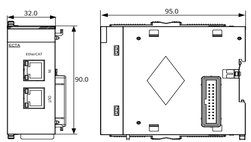


Figure 3 Mounting dimensions (in mm)

Electrical Design Reference

■ EtherCAT Communication Interface Description

The EtherCAT bus uses a standard RJ45 network port and a standard connector.

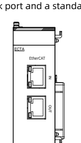


Figure 4 Terminal arrangement

■ Wiring

- Network cable preparation



Figure 5 EtherCAT cable preparation requirements

- Signal pin assignment

Pin	Signal	Direction	Description
1	TD+	Output	Data transmission+
2	TD-	Output	Data transmission-
3	RD+	Input	Data receive+
4	-	-	Reserved
5	-	-	Reserved
6	RD-	Input	Data receive-
7	-	-	Reserved
8	-	-	Reserved

- Length requirements:

FastEthernet technology demonstrates that the cable length between devices shall not exceed 100 m when the EtherCAT bus is used. Otherwise, it will cause signal attenuation, affecting normal communication.

- Technical requirements:

There is no evidence of short circuit, open circuit, displacement, or poor contact during the 100% continuity test.

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
Compliance	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Conductor size	AWG26
Conductor type	Twisted pair
Number of pairs	4

■ Communication Connection

6) Connection of RJ45 network cable

- Insert the cable connector into the RJ45 port of the communication module until you hear a click sound.

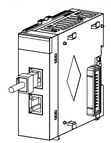


Figure 6 Diagram of network cable connection

- Removal: Press the retaining latch of the cable connector while pulling out the connector in the direction parallel to the port.

7) Ethernet cable requirements:



Figure 7 Ethernet cable requirements

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

8) Communication cable fixing requirements:

To protect the communication cable from tension and to ensure communication stability, fix the cable near the equipment before EtherCAT communication, as shown in the following figure.

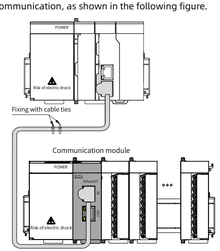


Figure 8 Fixing of the communication cable near the equipment

LED Indicator		Meaning	Solution
RUN	OFF	The EtherCAT master is not connected to the EtherCAT slave.	Check the configuration and parameter settings. Check the communication address. Check whether the specifications and length of the network cable meet the requirements.
	Blinking	The EtherCAT slave is in a non-OP state.	Check the slave configuration. Check whether any required module is missing or faulty. Check whether any module is not configured.
BF	Blinking	The EtherCAT master does not exchange data with the EtherCAT slave. A status conversion instruction that cannot be executed is received during EtherCAT communication. The ECTA module has a synchronization error. A watchdog error occurs during EtherCAT communication.	Check whether the RJ45 connector is correctly inserted. Check whether the network cable is damaged. Restart the power supply. Check whether the PDO configuration is correct.
SF	Blinking	A configuration error occurs. Indicates the module error.	Check whether the host controller configuration is consistent with the module configuration. Check whether the module suffers from interference.

Software Diagnosis

■ Fault Type

All faults of the GL10-RTU-ECTA EtherCAT communication module support object dictionary access, and fault information can be further confirmed through object dictionary.

When a fault occurs, the fault information can be viewed through the object dictionaries 0xF100 and 0xF110 and the module's diagnostic object dictionary 0xAnnn.

When the related fault flag bit of 0xF100h is valid, further details can be obtained through the object dictionary 0xF110h.

The following figure shows the fault relationship.

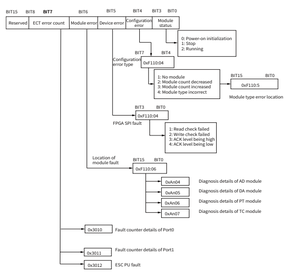


Figure 9 Fault relationship

■ Troubleshooting

The following table lists faults of the GL10-RTU-ECTA EtherCAT communication module and their solutions.

Fault Type	Cause	Solution
ETC error counter	ESC detects a communication error due to signal interference or network cable disconnection or other external causes.	◆ Check whether the system power supply is normal. ◆ Check whether the network cable is connected properly. ◆ Check whether the network cable is inserted firmly.
Module error	The expansion module is faulty.	◆ Check whether the 24 V external power supply is stable and reliable. ◆ Check whether the wiring is proper. ◆ View the 0xAnnn diagnostic object dictionary of the module to locate the cause.
Device error	A device error is mainly caused by abnormal SPI communication between the connector and the expansion module.	◆ Check whether the expansion module is connected properly and whether the snap-fit joint is fastened. ◆ Check whether the module type is matching. ◆ Check whether the power supply system is normal. ◆ Contact Inovance for technical support.
Configuration error	The connection configuration of the expansion module in the host configuration is different from that of the connected module.	◆ Delete the configuration and add the module through auto scanning. ◆ Make the expansion module configuration in the host consistent with that of the connected module. ◆ After connecting an expansion module to the connector, power off and then on the connector. ◆ View the 0XF110 object dictionary of the module to locate the cause.

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