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19011256A02

GR10-EC-6SW Series

6-Channel EtherCAT Branch Module

User Guide

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Preface

Introduction

Thank you for purchasing the GR10-EC-6SW 6-channel EtherCAT branch module developed and manufactured independently by Inovance. This product provides one EtherCAT input channel and five EtherCAT output channels. It is suitable for star network topology applications in multi-axis complex equipment and production line networking.

This guide describes the specifications, features, and usage of the product. Read this guide carefully before use to ensure safety. You can obtain the latest version on our website www.inovance.com.

Target Audience

This guide is intended for users who use or understand Inovance PLC products, including: electrical engineers, software engineers, and system engineers.

Precautions for New Users

Read through this user guide carefully before use for the first time. In case of any question about functions or performance, contact the technical support of Inovance to ensure correct use.

Standards Compliance

The following table lists the certifications, directives, and standards of the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Directive		Standard
CE Certification	EMC Directive	2014/30/EU	24 VDC products: EN 61131-2 220 VAC products: EN 61131-2 EN 61000-3-2 EN 61000-3-3
	LVD Directive	2014/35/EU	EN 61010-1 EN 61010-2-201
	RoHS Directive	2011/65/EU amended by (EU)2015/863	EN IEC 63000
UL/cUL Certification	-		UL 61010-1 UL 61010-2-201 CAN/CSA-C22.2 No. 61010-1 CSA C22.2 NO. 61010-2-201
KCC Certification	-		-

Certification	Directive		Standard
EAC Certification	-		-
UKCA Certification	Safety Regulations	Electrical Equipment (Safety) Regulations 2016	EN 61010-1 EN 61010-2-201
	EMC Regulations	Electromagnetic Compatibility Regulations 2016	24 VDC products: EN 61131-2 220 VAC products: EN 61131-2 EN 61000-3-2 EN 61000-3-3
	RoHS Regulations	Directive (RoHS) Regulations 2012	EN IEC 63000

Revision History

Date	Version	Revision
January 2025	A06	◆ Added "Standard Compliance". ◆ Added "Installation Method". ◆ Made minor corrections.
August 2024	A05	Made minor corrections.
February 2024	A04	Made minor corrections.
January 2024	A03	Made minor corrections.
November 2020	A02	Made minor corrections.
September 2020	A01	Added descriptions on configuration and use in "Communication Connection".
November 2019	A00	Initial release.

Safety Precautions

■ Safety disclaimer

1. Before installation, operation, and maintenance, read through and comply with the safety instructions.

2. To ensure personal and equipment safety, follow all the safety instructions marked on the product and described in this guide.

3. The "CAUTION", "WARNING", and "DANGER" signs in this guide do not indicate all safety

instructions; instead, they are only supplements to the safety instructions.

4. Use this product in an environment that meets the design specifications. Malfunctions or damage caused by failure to follow relevant specifications is not covered by warranty.

5. Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

■ Safety levels and definitions

WARNING : "WARNING" indicates that failure to comply with the notice may result in death or severe personal injuries.

CAUTION : "CAUTION" indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Keep this user guide properly for future use and deliver it to the end user.

Control System Design

WARNING

- Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
- Add an external fuse or circuit breaker to prevent the module from smoking or catching fire due to long-time overcurrent caused by operation above rated current or load short-circuit.

CAUTION

- Set an emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and an upper/lower position limit interlocked circuit in the external circuits of PLC to prevent damage to the module.
- To ensure safe operation, use external protection circuits and safety mechanism for the output signals that may cause critical accidents.
- The CPU of the PLC may shut down all outputs upon detecting system abnormalities. When partial circuit faults occur in the PLC, outputs may become uncontrollable. Therefore, it is necessary to design an appropriate external control circuit to ensure normal operation.
- When the output units of the PLC (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 compliant with overvoltage category II. The power supply must have a system-level surge protector to ensure that overvoltage caused by lightning shock cannot be applied to power supply input terminals, signal input terminals, and control output terminals of the PLC, therefore preventing damage to the product.

Installation

WARNING

- Installation must be carried out by skilled personal who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Disconnect all external power supplies of the system before installing/removing the module. Failure to do so may result in electric shock, module fault, or malfunction.
- Do not use the PLC in environments with dust, greasy smoke, conductive dust, corrosive or combustible gases, exposed to high temperature, condensation, wind & rain, or subject to vibration and shock. Electric shock, fire, and malfunction may also damage the product.
- The PLC is open-type equipment that must be installed in a control cabinet with lock (IP rating of the control cabinet enclosure > IP20). Only qualified professionals who have undergone specialized electrical training and possess comprehensive electrical expertise can open the cabinet.

CAUTION

- Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during installation. Failure to comply may result in fire, fault and malfunction.
- Ensure there are no unwanted matters on ventilation surface. Failure to comply may result in poor ventilation, which may cause fire, fault, or malfunction.
- Ensure the module is connected to the respective connector securely and hook the module firmly. Improper installation may result in malfunction, fault, or fall-off.

Wiring

WARNING

- Wiring must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Disconnect all external power supplies of the system before wiring. Failure to comply may result in electric shock, module fault or malfunction.

- After wiring, install the terminal cover attached to the product before power-on or operation. Failure to comply may result in electric shock.
- Insulate the cable terminals properly to ensure the insulation distance between cables will not be shortened after cables are connected to the terminal block. Failure to comply may result in electric shock or damage to the product.

CAUTION

- Prevent dropping metal filings and wire ends drop into ventilation holes of the PLC at wiring. Failure to comply may result in fire, fault and malfunction.
- The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.
- To ensure safety of equipment and operator, use cables with sufficient diameter and connect the cables to ground reliably.
- Ensure that all cables are connected to the correct interface. Failure to comply may result in module and external equipment fault.
- Tighten bolts on the terminal block in the specified torque range. If the terminal is not tight, short-circuit, fire, or malfunction may occur. If the terminal is too tight, damage to the terminal and module, fall-off, short-circuit, fire, or malfunction may occur.
- If a connector is used to connect the product with an external equipment, use tools specified by the manufacturer for press-fitting and crimping, or wield properly. Improper connection may result in short-circuit, fire, or malfunction.
- A label on the top of the module is to prevent foreign matters entering the module. Do not remove the label during wiring. Remove the label before system operation for ventilation.
- Route control cables, communication cables, main circuit cables, and power cables through different routes with a clearance of at least 100 mm among different types of cables. Failure to comply may result in malfunction caused by noise.
- For scenarios with severe interference, select shielded cable for high-frequency signal input or output to enhance system anti-interference ability.

Operation and Maintenance

WARNING

- Operation and maintenance must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
- Disconnect all external power supplies of the system before cleaning the module or re-tightening screws on the terminal block or the connector. Failure to comply may result in electric shock.
- Disconnect all external power supplies of the system before installing/removing the module or connecting/disconnecting the communication cables. Failure to comply may result in electric shock or malfunction.

CAUTION

- Read through the user guide before operations such as online modification, forced output, RUN, and STOP commands to ensure safety.
- Disconnect the power supply before installing/removing the expansion card.

Disposal

CAUTION

- Dispose of the product as industrial waste.

Contents

1 Product Information

1.1 Model and Nameplate

GR 10 - EC - 6 SW

① ② ③ ④ ⑤

①	Product Type GR: General module	③	Communication Protocol EC: EtherCAT bus communication	⑤	Module Type SW: Branch device
②	Series Number 10: 10 series	④	Number of channels 6: Six channels		

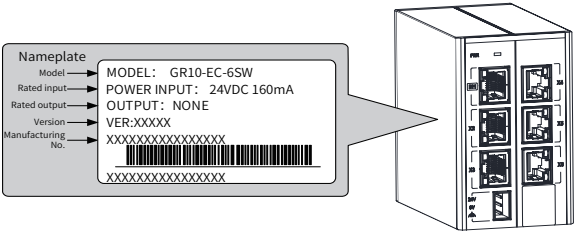


Figure 1 Model and nameplate

Model	Type	Description	Applicable Model
GR10-EC-6SW	Remote EtherCAT branch module	Remote EtherCAT branch module with one EtherCAT input and five EtherCAT outputs	Refer to the PLC functions

1.2 External Interfaces

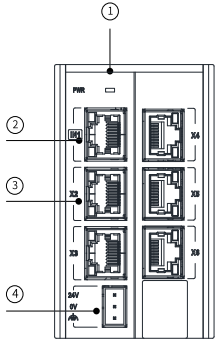


Figure 2 External interfaces of the GR10-EC-6SW module

No.	Interface	Description		
①	Power supply indicator	PWR	Green	ON when power supply is switched on.
②	EtherCAT input interface	IN	Port1 for EtherCAT input, connecting to front-end EtherCAT master	
③	EtherCAT output interfaces [Note]	X2	Port2 for EtherCAT output, connecting to back-end EtherCAT slaves	
		X3	Port3 for EtherCAT output, connecting to back-end EtherCAT slaves	
		X4	Port4 for EtherCAT output, connecting to back-end EtherCAT slaves	
		X5	Port5 for EtherCAT output, connecting to back-end EtherCAT slaves	
		X6	Port6 for EtherCAT output, connecting to back-end EtherCAT slaves	
④	24 V power input terminal	For power supply input		

Note: For details about application, see "Communication Connection".

1.3 General Specifications

Item	Specification
IP rating	IP20
Rated operating voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)
Internally consumed current	About 160 mA
Anti-reverse connection of power supply	Supported
Communication protocol	EtherCAT industrial real-time bus protocol
Number of EtherCAT channels	One input and five outputs
Maximum communication speed	100 Mbps
Network port/network cable	Standard network port with Cat 5e network cables below 100 m
Operating temperature	-10° C to +55° C
Storage temperature	-25° C to +70° C
Humidity	10% RH to 95% RH, without condensation
Altitude	2000 m (with 80 kPa)

1.4 EtherCAT Communication Specifications

Item	Specification
Communication protocol	EtherCAT industrial real-time bus protocol
Synchronization mode	DC/SM
Duplex mode	Full duplex
Maximum communication speed	100 Mbps (100Base-TX)
Topology	Star
Branch module cascading	Supported
Cable detection	Auto MDI/MDIX

2 Mechanical Design

2.1 Installation Dimensions

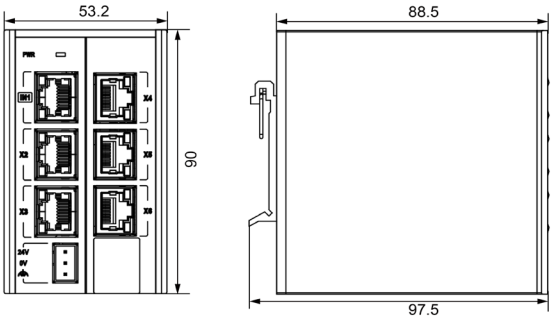
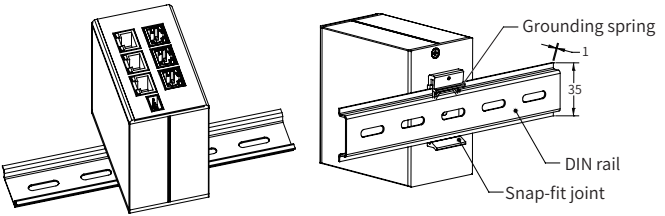


Figure 3 Installation dimensions (in mm)

2.2 Installation Method

1. Install the module onto a DIN rail and fix it using a snap-fit joint. The internal grounding spring of the module is electrically connected to the rail, as shown below (in mm).



2. Check whether the module is fixed securely to the rail.

3 Electrical Design

3.1 Network Cable Preparation

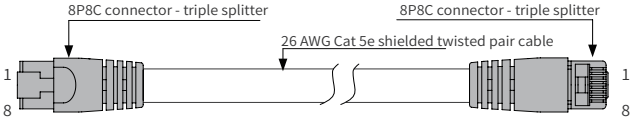
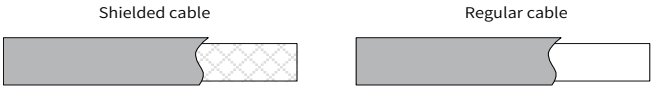


Figure 4 EtherCAT cable preparation



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

■ Signal pin assignment

Pin	Signal	Type	Description
1	TD+	Output	Data transmission +
2	TD-	Output	Data transmission -
3	RD+	Input	Data reception +
4	--	--	Not used
5	--	--	Not used
6	RD-	Input	Data reception -
7	--	--	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 must not exceed 100 m. Exceeding this length will attenuate the signal and affect communication.

■ Technical requirements:

The product is required to pass the 100% continuity test and show no sign of short circuit, open circuit, misalignment, or poor contact.

Use a shielded cable as the EtherCAT bus for network data transmission, with

the following recommended specifications:

Item	Specification
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Standard	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Cross sectional area	AWG26
Conductor type	Twisted pair
Number of pairs	4

3.2 Communication Connection

■ EtherCAT connection and removal

Connection: Insert the cable connector into the EtherCAT port of the branch module until you hear a click.

Removal: Press the tail of the registered jacket to pull out the connector.

■ Communication system wiring

The EtherCAT branch module can connect multiple EtherCAT slave devices. The system wiring diagram is shown below:

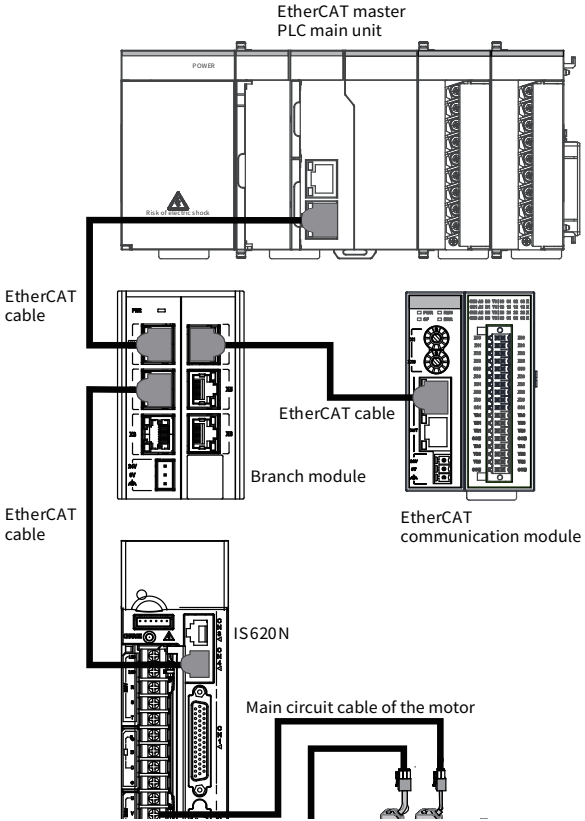


Figure 5 Communication system wiring

NOTE

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.

■ Configuration and use

1) When using this branch module, operate all EtherCAT slaves (including the two stations of this branch module) with an alias, so that an abnormality in one branch will not affect the others.

2) The data flow priority of the 6-channel branch module is X2 > X3 > X4 > X5 > X6, that is, any slave on the X2 branch has priority over all slaves on the X3 branch.

3) The branch module is configured as an EtherCAT slave in DC mode by default.

4) The branch module supports 3-level cascading. The number of cascaded units is independent of the module functions.

5) Each branch module occupies two EtherCAT slave station numbers.

3.3 Fault Indication and Solutions

When the module encounters a fault, users can check the signal status through the LED indicator and take corresponding measures:

LED Indicator		Description	Cause	Solution
PWR	Link/ Act			
OFF	OFF	Power failure	1. Power supply not connected 2. Internal circuit fault	1. Check the power supply connection. 2. Replace the branch module.
ON	OFF	Connection not established	1. Communication cable disconnected or short-circuited 2. Hardware fault of the branch module 3. EtherCAT master station disabled	1. Check the communication cable connection. Replace the communication cable in case of cable breakage or short circuit. 2. Replace the branch module. 3. Check the status of the master.

INOVANCE Warranty Agreement

Inovance provides an 18-month free warranty (subject to information indicated by the barcode on the product or the contract terms) to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.

Within the warranty period, maintenance will be charged for the following damage:

1) Damage caused by improper use or unauthorized disassembly, repair, or retrofit;
2) Damage caused by fire, flood, abnormal voltage, other disasters, or secondary disasters;
3) Hardware damage caused by equipment fall-off or that caused during transportation;
4) Damage caused by failure to operate the product according to the user guide provided by Inovance;
5) Faults and damage caused by external factors, such as peripheral devices;

If the equipment is faulty or damaged, fill in the Product Warranty Card correctly.

The maintenance fee is charged based on 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 during maintenance.

If there is any problem during the service, contact Inovance or Inovance agents.

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

INOVANCE Product Warranty Card

<table>
<tr><td rowspan="3">Customer Information</td><td colspan="2">Company address:</td></tr>
<tr><td rowspan="2">Company name:
Post code:</td><td>Contact person:</td></tr>
<tr><td>Tel.:</td></tr>
<tr><td rowspan="3">Product Information</td><td colspan="2">Product model:</td></tr>
<tr><td colspan="2">Product barcode (attached here):</td></tr>
<tr><td colspan="2">Agent name:</td></tr>
<tr><td>Fault Information</td><td colspan="2">(Service date and description):

Serviced by:</td></tr>
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