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PS00007354A07

GS20-ECT-8L

High Protection IO-Link Master Module

User Guide

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■ Disclaimer of Liability

Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.

The contents are subject to change without notice due to product upgrade.

■ Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

■ Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

■ Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

■ Introduction

GS20-ECT-8L is an IP67 IO-Link master module that transfers EtherCAT communication to IO-Link communication. The module has eight IO-Link ports and can connect up to eight IO-Link devices (Class A).

This guide describes the product information, mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.

■ Standards compliance

The following table lists the certifications, directives, and standards that 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 61010-1UL 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

■ More documents

Name	Code	Description
GR20-16EMNL Digital Input and Output Module User Guide	PS00007355	Presents the product information, mechanical installation, and electrical installation of the product.
GR20-16EMPL Digital Input and Output Module User Guide	PS00007356	Presents the product information, mechanical installation, and electrical installation of the product.
GS20-16EMNL Digital Input and Output Module User Guide	PS00009314	Presents the product information, mechanical installation, and electrical installation of the product.
GS20-16EMPL Digital Input and Output Module User Guide	PS00009714	Presents the product information, mechanical installation, and electrical installation of the product.
GS20-16EMNL-S Digital Input and Output Module User Guide	PS00018165	Presents the product information, mechanical installation, and electrical installation of the product.

Name	Code	Description
GS20-16EMPL-S Digital Input and Output Module User Guide	PS00018166	Presents the product information, mechanical installation, and electrical installation of the product.
GS20-ECT-8L High Protection IO-Link Master Module User Guide (This guide)	PS00007354	This guide describes the product information, mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.

■ Revision history

Date	Version	Revision
April 2026	A07	• Updated *"1.1 General Safety Instructions" on page 7*. • Updated *"2.4 Technical Specifications" on page 25*.
December 2025	A06	Updated *"2.4 Technical Specifications" on page 25*.
November 2025	A05	• Updated product illustrations and product codes in *"2.2 Model and Nameplate" on page 20*, *"2.3 Components" on page 21* and *"4.1 IO-Link Topology" on page 33*. • *"4.4 Terminal wiring" on page 38* Added tightening torque specifications to "Terminal Wiring".
July 2025	A04	• New content *"6.1 Solutions to Common Faults" on page 72* • Modified the plug and connector assemblies in *"4.2 Cable Selection" on page 34*. • Minor corrections.
October 2024	A03	Minor corrections.
January 2024	A02	Modified the cable model in *"4.2 Cable Selection" on page 34*.

Date	Version	Revision
September 2023	A01	• Added *" Configuring IO-Link in InoProShop" on page 40*. • Added *" Configuring IO-Link in AutoShop " on page 62*.
		Modified IO-Link pin assignment in *"4.3 Terminal Assignment" on page 37*.
April 2023	A00	First release.

■ Access to the guide

This guide is not delivered with the product. You can download the PDF version in the following ways:

- Visit **https://www.inovance.com/global**, and choose Service&Support > Support > Documentation Download.
- Scan the **QR code** on the product with your smartphone.
- Scan the QR code below to install **My Inovance** app, where you can search for and download the guide.

■ Warranty disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. Maintenance will be charged after the warranty expires.

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

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Warranty Card.

1 Fundamental Safety Instructions

1.1 General Safety Instructions

■ Safety disclaimer

1. Read and comply with the safety instructions during installation, operation, and maintenance of the product.
2. To ensure personal and equipment safety, observe all safety precautions marked on the product and described in this guide during installation, operation, and maintenance.
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



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



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



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

Unpacking

WARNING

- Do not install the product in case of any damage, rust, or signs of prior use on the product or its 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 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.
- 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.
- Do not stand or stay below the product which 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.

Storage and transportation



- Handle the equipment with care and mind your step during transportation 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.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- 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



- Design a safety circuit and add an error handling program in the software to ensure the product remains in a safe state upon external power failure or product faults.
- 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.



Design

- If an output component (such as a relay or transistor) in this product is damaged, the corresponding output may become uncontrolled and remain permanently ON or OFF.
- The product design must comply with the overvoltage category requirements specified in the environmental specifications. A system-level lightning protection device must be installed on the power supply to ensure that lightning-induced overvoltages do not reach the product’ s power input, signal input, or control output terminals, thereby preventing 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.



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



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



Installation

- 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 will 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 retrofit the equipment.
- Never loosen or turn the fixing bolts on product components, 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 the 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.

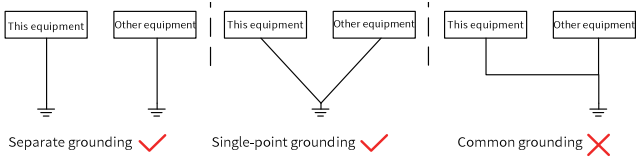


- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent the ventilation holes from being blocked, which could cause overheating due to poor heat dissipation.
- During installation, ensure the equipment is connected to the respective connector securely and hook the equipment firmly. Improper installation may result in malfunction, failure, or detachment.

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. Separate grounding or single-point grounding, other than common grounding, is recommended.



- 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

Wiring

- 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 to 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.



- 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 pair cables for the control circuit. Connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on



- 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.



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 parts, 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 equipment 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 fire or hot ovens. 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 for connector installation. 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 faulty or damaged equipment must be performed by professionals in accordance with the repair instructions, and proper repair records must be kept.
- 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 scrapped equipment as industrial waste. Dispose of the 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 product may become very hot during operation. Do not touch these hot areas, as this may cause burns!

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.



Tampering with software (such as viruses, Trojans, and Worms) can lead to unsafe drive state, which can put the device in an unsafe operation state. This may result in death, serious injury, and property damage. Observe the following strictly.

- Always use the latest software version. If the product version is no longer supported or the latest version of the program is not applied, customers are at increased risk of cyber-attacks.
- Take proper protection measures (including but not limited to deploying antivirus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the mobile storage device from being damaged by malware and protect products, networks, systems, and interfaces from unauthorized access, disturbance, intrusion, data disclosure, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product information

2.1 Product Functions

■ Basic functions

- IO-Link communication
  - IO-Link master that can communicate with the IO-Link V1.0 and V1.1 devices
  - Equipped with 8 IO-Link ports to connect up to 8 IO-Link devices (Class A type)
  - Read-write of I/O-Link slave parameters available through this module
  - Slave standard upgrade function supported
- EtherCAT communication
  - Standard EtherCAT slave function supported, with EtherCAT slave version being V5.13
  - Two EtherCAT network interfaces (M12-4pin-D type)
  - Used for process data transmission between IO-Link device and EtherCAT device
  - Equipped with EtherCAT standard diagnostic function, allowing you to view the diagnosis information of IO-Link devices
  - Compliant with ETG5001-6220 standard protocol
- Parameter settings
  - Parameter configured through EtherCAT CoE function
  - Device parameter backup: automatic parameter restoration for connected IO-Link device
  - Port parameter backup: When this function is enabled, the system automatically backs up the configuration parameters of the slave connected to the port for the first time, and the slave connected to the port will run according to this backup parameter.
- Port mode configuration
  - Standard IO-Link master mode
  - Standard digital input mode
  - Standard digital output mode
- Visualized diagnosis
  - Port connection and communication rate indicator
  - EtherCAT state and error indicator

- US/UA power supply voltage status indicator
- IO-LINK port communication status, fault, short circuit/overcurrent indicator
- Standard EtherCAT diagnostic function supported

■ Digital input and output function

- Equipped with 16 configurable DI/DOs
- Pin2 and Pin4 of each port can be configured as DI/DO mode.
- The reference potential of all inputs and outputs is Pin3 voltage.

■ IO-Link power supply function

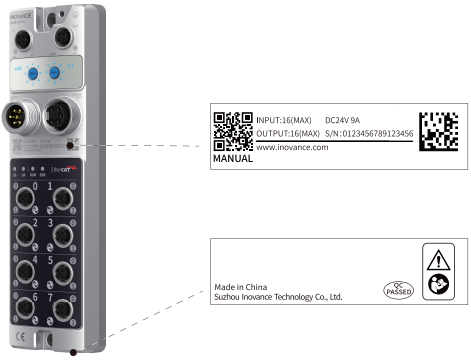
- Equipped with 8 IO-Link device power supplies
- Class-A IO-Link ports
- Short circuit detection available for the power supply of each port
- Short circuit overcurrent protection: short circuit overcurrent protection available for Pin1, Pin2 (DO mode) and Pin4 (DO mode)

2.2 Model and Nameplate

G S 20 - ECT - 8 L

① ② ③ ④ ⑤ ⑥

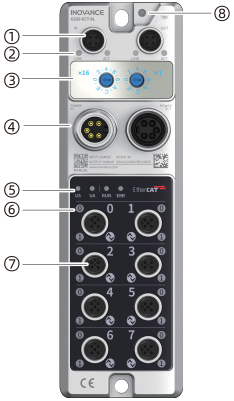
① **Product family** G: Inovance controller common module	④ **Communication protocol** ECT: EtherCAT bus communication
② **Product type** S: High protection	⑤ **Number of conversion channels** 8: Eight channels
③ **Series** 20: 20 series	⑥ **Module type** L: IO-Link



Based on the above model and nameplate information, relevant ordering information of the product is provided in the following table.

Model	Description	Product code	Applicable model
GS20-ECT-8L-INT	GS20 series high protection IO 8-channel IO-Link master EtherCAT IP67 module	01441094	Class A IO-Link slave

2.3 Components



No.	Name	Description			
①	EtherCAT communication interface	IN OUT	Used for EtherCAT communication input and output. For pin assignment, see *"4.3 Terminal Assignment" on page 37*.		
②	EtherCAT communication indicator	LINK	Network connection indicator	Green	• Solid ON: Network connection succeeded • OFF: Network connection failed
		ACT	Data transmission indicator	Green	• Flashing: Data transmission is in progress. • OFF: No data is under transmission.
③	DIP switch	Slave address setting switch (value range: 0 to 255) x16/x1: Slave address code plate switch. The code plate switch uses hexadecimal. The value of the x16 DIP switch represents the high 4 bits of the slave alias. The value corresponding to the x1 DIP switch represents the low 4 bits of the slave alias. Slave decimal address = (value corresponding to the x16 DIP switch) x 16+ (value corresponding to the x1 DIP switch) x 1 Example: Turn the x16 DIP switch to A (A = 10 in hexadecimal) and the x1 DIP switch to E (E = 14 in hexadecimal), then the slave alias is 0 x AE. The slave address in decimal is 10 x 16 + 14 = 174.			
④	Power supply interface	POWER IN POWER OUT	For power supply input/output, see the pin assignment in *"4.3 Terminal Assignment" on page 37*.		

No.	Name	Description			
⑤	Status indicator	US	System power supply indicator	Green/ Red	• Solid green: The US power supply voltage is normal (18 V < US power supply voltage < 30.2 V). • Solid red: Indicates that the US power supply voltage is > 30.2 V. • Flashing in red [2]: 11 V < US power supply voltage < 18 V • Flashing in red [1]: Indicates the US power supply voltage < 11 V. • Off: No power supply is provided.
		UA	Actuator power supply indicator	Green/ Red	• Steady green: UA power supply voltage normal (18 V < UA power supply voltage < 30.2 V) • Steady red: UA power supply voltage > 30.2 V • Flashing in red [2]: 11 V < UA power supply voltage < 18 V • OFF: VA power supply voltage < 11 V
		RUN	EtherCAT status Indicators	Green	• OFF: The EtherCAT slave is in the initialization state. • Flashing: The EtherCAT slave is in the pre-operational state. • Single flashing: The EtherCAT slave is in the safe operational state. • Solid ON: The EtherCAT slave is running. • Quick flashing: The EtherCAT slave is in the bootstrap state
					• Flashing: An EtherCAT

No.	Name	Description			
⑥	IO-link indicator	0	0 indicator	Yellow/ Red/ Green	• Steady yellow: input or output state of Pin4 being 1 • Steady red: Pin4 overcurrent • Flashing red: IO-Link error • Steady green: IO-Link communication connected • Flashing green: IO-Link communication not connected • OFF: input or output state of Pin4 being 0
		1	Indicator 1	Yellow/ Red	• Steady yellow: input or output state of Pin2 being 1 • Steady red: Pin2 overcurrent • Flashing red (LED1 and LED0 flashing simultaneously): Pin1 overcurrent • OFF: input or output state of Pin4 being 0
⑦	IO-Link port	0/1/2/3/4/ 5/6/7	For I/O-Link data transmission, see the pin assignment in *"4.3 Terminal Assignment" on page 37*.		
⑧	Grounding terminal		Use M4×8 SEMS screws for grounding. Ensure the protective grounding terminal is well grounded during installation. The grounding impedance should be less than 1 Ω.		

The indicator's quick flashing/single flashing/flashing is defined as shown in the table below.

Status	Definition
Quick flashing	50 ms ON followed by 50 ms OFF, repeating periodically
Single flashing	200 ms ON followed by 1000 ms OFF, repeating periodically
Flashing	• US/UA indicator (flashing[1]): 250 ms ON followed by 250 ms OFF, repeating periodically. • EtherCAT indicator: 200 ms ON followed by 200 ms OFF, repeating periodically • IO-Link indicator & US/UA indicator (flashing[2]): 500 ms ON followed by 500 ms OFF, repeating periodically.



 : High temperature caution for the module.

2.4 Technical Specifications

■ General specifications

Item	Specification
Dimensions (W x H x D)	69.8 mm x 224.8 mm x 20.5 mm
Weight	Approx. 550 g

■ Power supply specifications

Item	Specification
Rated voltage of US power supply	24 VDC (18 VDC to 30.2 VDC)
Maximum current of US power supply	Maximum input 9 A, maximum output 9 A (external +24 V power supply disabled for IO-Link port)
US reverse polarity protection	Supported

Item	Specification
US undervoltage detection	Undervoltage (lower than 18 V) detection supported by software
Rated voltage of UA power supply	24 VDC (18 VDC to 30.2 VDC, common ground with US)
Maximum current of UA power supply	Maximum input 9 A, maximum output 9 A (DO disabled)
UA reverse polarity protection	Supported
UA undervoltage detection	Undervoltage (lower than 18 V) and voltage-loss (lower than 11 V) detection supported by software

■ Input specifications

Item	Specification
Input type	Digital input
Input mode	PNP
Number of input channels	16
Input voltage class	24 VDC (18 VDC to 30.2 VDC) (SELV power supply)
Input current (typical)	4 mA (typical@24 V)
ON-state voltage	> 15 VDC
OFF voltage	< 5 VDC
Hardware response time (ON/OFF)	100 μs/100 μs
Input impedance	5.3 kΩ to 5.6 kΩ
Isolation	No
Input status display	When the drive state is inputted, the input indicator turns on.
Input derating	Not supported

■ Output specifications

Item	Specification
Output type	Digital output; transistor output
Output mode	PNP
Output channel	16
Output voltage class	24 VDC (18 VDC to 30.2 VDC)
Output load (resistive load)	2 A/point; 9 A/module
Output load (inductive load)	24 W/point **Notes:** Stopping inductive loads generates a high-voltage back EMF, which lasts for a time shorter than the configured switch-off cycle.
Output load (lamp load)	18 W/point **Notes:** The light load generates an inrush current that is 10 to 15 times the normal current when it is switched on. This product can safely drive and withstand an inrush current load with a peak of 10 A and a duration not exceeding 300 µs.
Hardware response time (ON/OFF)	100 µs/100 µs
OFF-state leakage current	10 uA
Switching frequency	Resistive load: 100 Hz; inductive load: 0.5 Hz; lamp load: 10 Hz
Isolation	No
Output action display	The output indicator turns on when the DO circuit is in the driving state.
Output derating	Not supported
Troubleshooting	Output overcurrent
Protective functions	Overcurrent protection

■ IO-Link specifications

Item	Specification
Number of ports	8
IO-Link version	1.1.3
Transmission rate	• COM1 (4.8kBaud) • COM2 (38.4 kBaud) • COM3 (230.4 kBaud)
Size of process data	• Input per port: 32 bytes max. • Input per module: 8 x 32 bytes (8 ports) max. • Output per port: 32 bytes max. • Output per module: 8 x 32s byte (8 ports) max.
Capacity of the memory for saving device parameters	2 kbyte (applicable to each port)
Unshielded drain wire length	Max. 20 m
IO-Link port type	Class A
External +24 V supply current of IO-Link port (Pin1)	1.6 A

Note

GS20-ECT-8L-XD does not support COM3.

■ EtherCAT specifications

Item	Specification
Number of network ports	2 (M12-4pin-D type)
Communication protocol	EtherCAT protocol
Services available	FoE, CoE (PDO, SDO)
Synchronization mode	I/O adopts input and output synchronization

Item	Specification
Physical layer	100Base-TX
Baud rate	100 Mbps
Duplex mode	Full duplex
Topology	Line topology
Transmission medium	Flexible crossover cable, double-layer shielded (SFTP or SFTPP), Cat5e or above
Transmission distance	Less than 100 m between two nodes
EtherCAT frame length	44 bytes to 1,498 bytes
Process data	Up to 1486 bytes per Ethernet frame
Ring network	Supported
Automatic scanning	Supported
EtherCAT conformance certification	Certified

2.5 Environmental Specifications

Item	Operation specification	Transmission specification	Storage specification
IP rating	IP67 (with screws tightened)		
Pollution degree	2		
Overvoltage category	I		
Immunity	2 kV on power supply line (IEC61000-4-4)		
Temperature	-25°C to +70°C	-40°C to +85°C	-40°C to +85°C
Humidity	10% to 90% RH (non-condensing)		

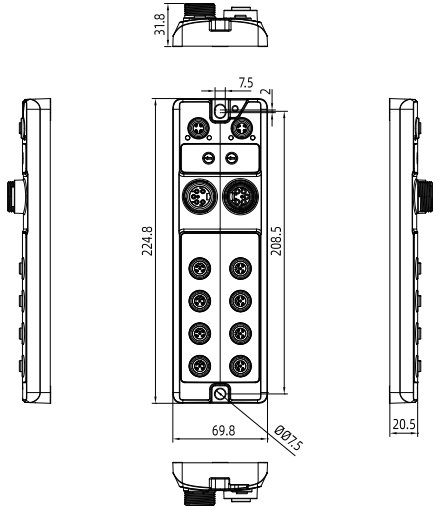
Item		Operation specification	Transmission specification	Storage specification
Vibration	Frequency	5 Hz to 500 Hz	2 M2	1 M2
	Displacement	1 mm (direct installation) (5 Hz to 61 Hz)		
	Acceleration	15 g (direct installation) (61 Hz to 500 Hz)		
	Direction	3-axial directions		
Shock resistance		Application/Transportation scenario: Tested according to IEC60068-2-27; 15 g peak acceleration, 11 ms pulse width, 18 shocks in total in X, Y and Z axes.		
Altitude		0 m to 2000 m	0 m to 3000 m	

3 Mechanical Installation

3.1 Installation Dimensions

■ Module

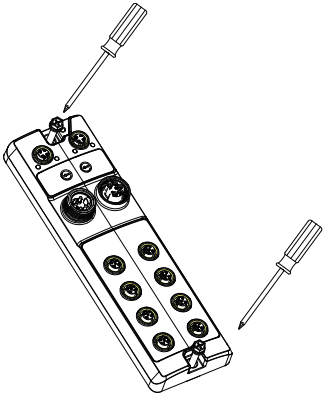
The installation dimensions (in mm) are shown in the figure below.

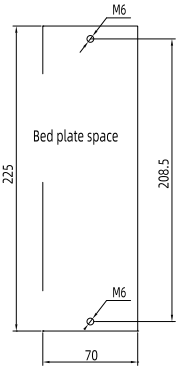


3.2 Installation Method

■ Installation

Install the module with two cross recessed hexagon SEMS screws (M6 x 25) with the washer diameter of 11 mm. The clearance between the two screws is 208.5 mm. The following figure describes the installation and clearance (in mm).





■ Disconnection

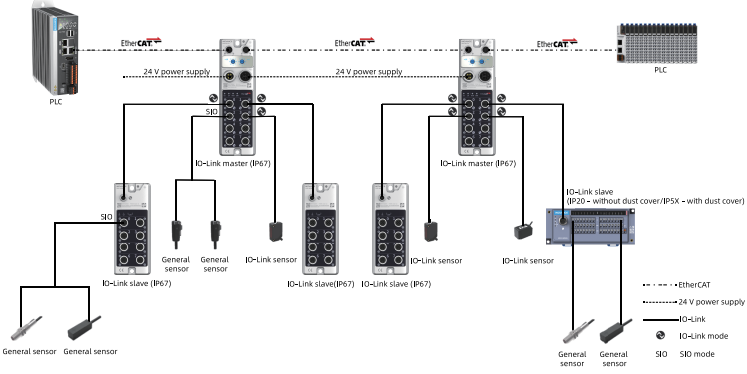
Remove the M6 screws using a Phillips screwdriver, and then detach the module.

4 Electrical Installation

4.1 IO-Link Topology

IO-Link is a serial digital communication protocol used to integrate a smart sensor and an activator into an automation system. According to IEC 61131-9, it is the first worldwide standard I/O technology for periodic data exchange between sensors/activators and PLCs. IO-Link is not a fieldbus, but an open point-to-point communication. The protocol features ease of use, stabilization, reliability, and plug and play and is used more and more widely with the development of industry 4.0.

The IO-Link topology consists of the PLC, IO-Link master (GS20-ECT-8L), and IO-Link slave (GR20-16EMNL, GR20-16EMPL, GS20-16EMNL, or GS20-16EMPL), sensor/actuator, and IO-Link cable. The IO-Link master is connected to the PLC and IO-Link master through EtherCAT communication. The IO-Link master and IO-Link slave, the IO-Link master and the sensor/actuator and the IO-Link slave and sensor/actuator are connected through IO-Link communication. The IO-Link master/slave can directly power up the sensor/actuator. The IO-Link topology is shown in the following figure.



Note

The IO-Link port supports two operating modes: IO-Link mode and SIO mode (Standard I/O mode), which can be separately configured on any port.

4.2 Cable Selection

■ EtherCAT communication cables

The data for ordering EtherCAT communication cables are as follows.

Model	Description	Length	Code
CAB-M12DMS4-M12DMS4-3	Cable assembly - EtherCAT cable - Male straight head - 22AWG - Green - Male straight head - 80°C (cables for cascading multiple IO-Link masters (EtherCAT cascaded))	3 m	15310153
CAB-M12DMS4-M12DMS4-5		5 m	15310178
CAB-M12DMS4-M12DMS4-8		8 m	15310221
CAB-M12DMS4-M12DMS4-10		10 m	15310177
CAB-M12DMS4-M12DMS4-15		15 m	15310176
CAB-RJ45-M12DMS4-3	Cable assembly - EtherCAT cable - Male straight head - 26AWG - Black - RJ45 - 80°C (PLC network port connected to EtherCAT communication cable of the master)	3 m	15310154
CAB-RJ45-M12DMS4-5		5 m	15310187
CAB-RJ45-M12DMS4-8		8 m	15310215
CAB-RJ45-M12DMS4-10		10 m	15310186
CAB-RJ45-M12DMS4-15		15 m	15310185

■ Power supply input cables

The data for ordering the power supply input cables are as follows.

Model	Description	Length	Code
CAB-7/8FL5-3	Cable assembly - 7/8 power supply cable - Female (angled) - 16 AWG - Black - NA - 80°C (used for powering IO-Link masters)	3 m	15310155
CAB-7/8FL5-5		5 m	15310175
CAB-7/8FL5-8		8 m	15310216
CAB-7/8FL5-10		10 m	15310174
CAB-7/8FL5-15		15 m	15310173

See the following table for meaning of the power supply cable colors.

ID	Color	Description
1	Black	0 V
2	Blue	0 V
PE	Green/Yellow	Grounding

ID	Color	Description
4	Brown	Sensor and power supply system (US)
5	White	Power supply of the actuator (UA)

■ Power supply output cables

The data for ordering power supply output cables are as follows.

Model	Description	Length	Code
CAB-7/8FL5-7/8ML5-3	Cable assembly - 7/8 power supply cable - Female (angled) - 16 AWG - Black - Female (angled) - 80°C (used for cascading multiple IO-Link master power supplies)	3 m	15310156
CAB-7/8FL5-7/8ML5-5		5 m	15310181
CAB-7/8FL5-7/8ML5-8		8 m	15310219
CAB-7/8FL5-7/8ML5-10		10 m	15310180
CAB-7/8FL5-7/8ML5-15		15 m	15310179

■ IO-Link communication cables

The data for ordering IO-Link communication cables are as follows.

Model	Description	Length	Code
CAB-M12AMS4-M12AFL4-3	Cable assembly - IO-Link cable - Male (straight) - 22AWG - Black - Female (angled) - 85°C (used for connecting the IO-Link master to IO-Link slaves)	3 m	15310142
CAB-M12AMS4-M12AFL4-5		5 m	15310184
CAB-M12AMS4-M12AFL4-8		8 m	15310230
CAB-M12AMS4-M12AFL4-10		10 m	15310183
CAB-M12AMS4-M12AFL4-15		15 m	15310182
CAB-M12AMS4-M12AFL4-3-T-taiyo	Cable assembly - IO-Link cable - Male (straight) - 22AWG - Black - Female (angled) - 85°C - Highly flexible cables fit for drag chains, surviving 3 to 5 million continuous tests (used for connecting the IO-Link master to IO-Link slaves)	3 m	15310232
CAB-M12AMS4-M12AFL4-5-T-taiyo		5 m	15310231
CAB-M12AMS4-M12AFL4-8-T-taiyo		8 m	15310229
CAB-M12AMS4-M12AFL4-10-T-taiyo		10 m	15310228
CAB-M12AMS4-M12AFL4-15-T-taiyo		15 m	15310227

■ Plug and connector assembly

The data for ordering connectors are as follows.

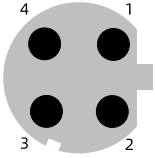
Model	Description	Code
CON-M12AFS4	4-core female straight connector, which can be connected directly	15051155
CON-M12AFL4	4-core female elbow connector, which can be connected directly	15051157
CON-M12AMS5	5-core male straight connector, which can be connected directly	15051156
CON-M12AML5	5-core male elbow connector, which can be connected directly	15051158
CON-M12AMS5-YF5	Y splitter that converts one 5-pin male M12 connector to two 5-pin female M12 DIO connectors	15051159
CON-M12AFL4-L	4-pin female (angled) field-wirable plug (applicable to GR20-16EMNL/GR20-16EMPL)	15051269
CON-M12AMS4-YM8F3	Y splitter that converts one M12 5-pin A-code male straight connector to two M8 3-pin female connectors	15051420
CON-M12AMS4-YM8F4	Y splitter used for converting one M12 5-pin A-code male straight connector to two M8 4-pin female connectors	15051419
CON-M8AMS3	M8 3-pin assembled connector	15051445
CON-M8AMS4	M8 4-pin assembled connector	15051448
CON-M12AFS5-YM5	Y splitter that converts one 5-pin female connector to two 5-pin male straight connectors. It can be used to connect the class A master to class B valve terminal slave.	15051334
IPT210-A-CAB-M12AMS5-M12AFS5-1.5	Connector that converts 5-pin male straight connector to 5-pin female straight connector. It can be used to connect the IO-Link master to valve terminal.	72235829
IPT210-A-CAB-M12AFS5-1.5	Connector that converts 5-pin female straight connector to discrete cable. It can be used to power the valve terminal.	72235870

Note

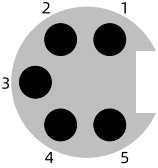
If you have additional requirements for cable selection, contact Inovance for customization.

4.3 Terminal Assignment

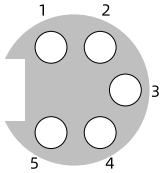
■ Assignment of EtherCAT pins

Diagram	Pin	Description
	1	TD+
	2	RD+
	3	TD—
	4	RD—

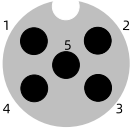
■ Assignment of power supply input pins

Diagram	Pin	Description
	1	0 V
	2	0 V
	3	Functional grounding (PE)
	4	Sensor and system power supply (US)
	5	Power supply of the actuator (UA)

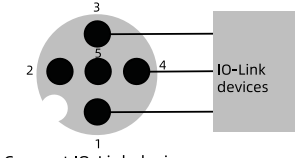
■ Assignment of power supply output pins

Diagram	Pin	Description
	1	0 V
	2	0 V
	3	Functional grounding (PE)
	4	Sensor and bus power supply (US)
	5	Power supply of the actuator (UA)

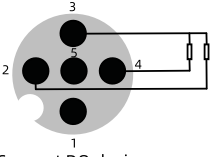
■ IO-Link port pins

Diagram	Pin	Func-tion	Description	Color definition
	1	L+	+24 V power supply (US+)	Brown
	2	I/Q	• Not connected (Class A) • DI: Digital input (Class A) • DO: Digital output (Class A)	White
		2L +	+24 V power supply (UA+)	
	3	L-	+24 V power supply (US-)	Blue
	4	C/Q	• SIO: Standard input/output mode • IO-Link communication mode	Black
	5	NC	Not connected (Class A)	Not assigned
		2L -	+24 V power supply (UA-)	

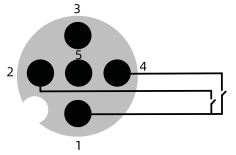
4.4 Terminal wiring



Connect IO-Link devices



Connect DO devices



Connect DI devices

Note

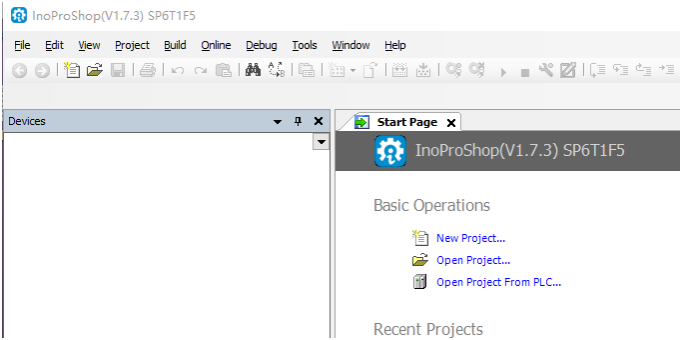
- This product adopts M12 A-coded connectors for EtherCAT communication ports and IO-Link ports. The recommended tightening torque for the connector cable is 0.5 N · m, with a maximum of 0.8 N · m. Exceeding 1.0 N · m may pose a risk of damaging the circuit board.
- This product adopts 7/8 inch terminals for power ports. The recommended tightening torque for terminal cables is 1.5 N · m, with a maximum of 1.8 N · m. Torque exceeding 2.0 N · m may damage the circuit board.

5 Program Commissioning

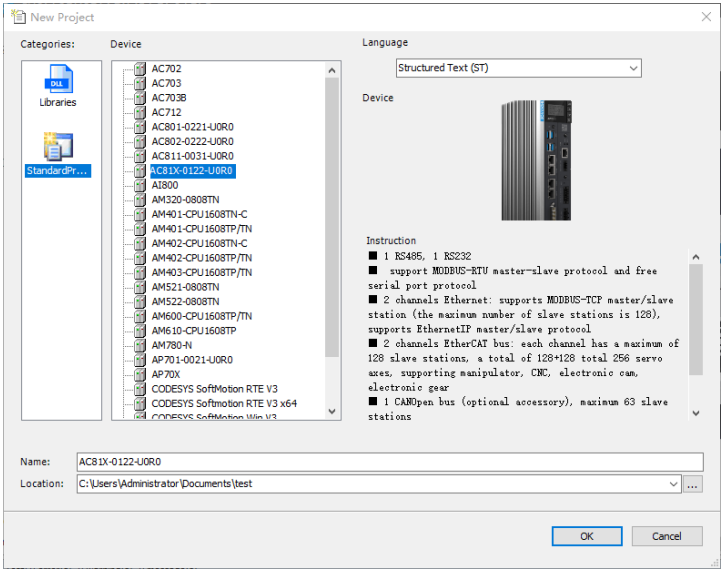
5.1 Configuring IO-Link in InoProShop

5.1.1 Creating a Project

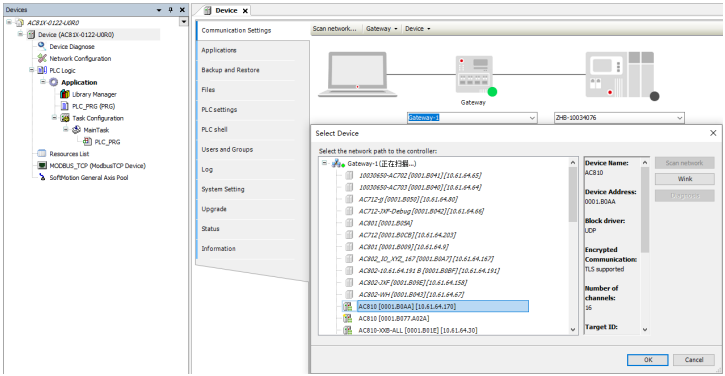
1. Double-click the InoProShop desktop shortcut (version V1.7.3 or later) to start the InoProShop programming software.
2. Select "File > New Project" from the menu bar, click the button on the toolbar, or click "New Project" in the workspace to open the "New Project" dialog box.



3. Select "Standard Project" in the "Categories" column, select the PLC device in the "Device" column (take AC81X-0122-U0R0 as an example), and select the programming language in the Language column (take "Structured Text (ST)" as an example). Customize the project name and path for storage and click "OK".



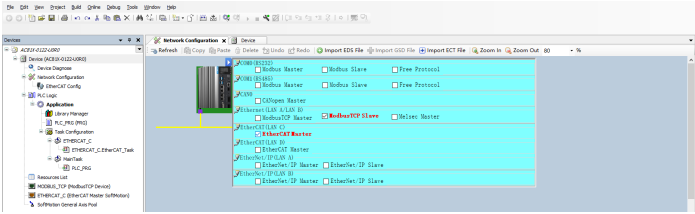
4. Double-click "Device", click "Scan Network", select the device name, and click "Flash". Check whether the PLC indicator flashes. If yes, the communication between the PC and PLC has been established successfully. Click "OK" to complete the project creation.



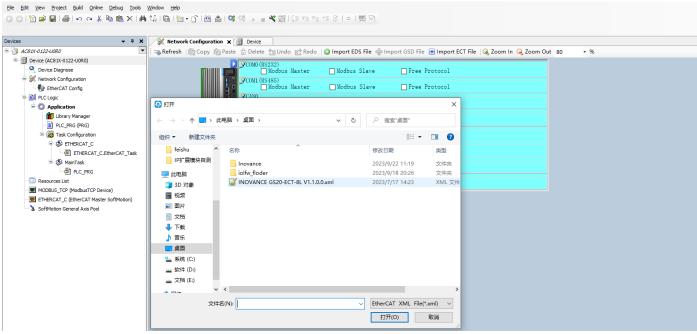
5.1.2 Loading the Master

1. Set PLC as EtherCAT master.

   a. Double-click "Network Configuration" in the navigation tree of "Device", click the middle device icon, and select "EtherCAT master" for the corresponding network port on the configuration interface to configure the PLC as the EtherCAT master.

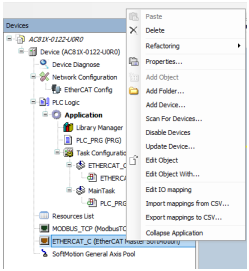


   b. (This step is skipped for published products.) Click "Import ECT File" and select the xml file of GS20-ECT-8L in the corresponding file folder. Click "Open" to add the xml file of GS20-ECT-8L.

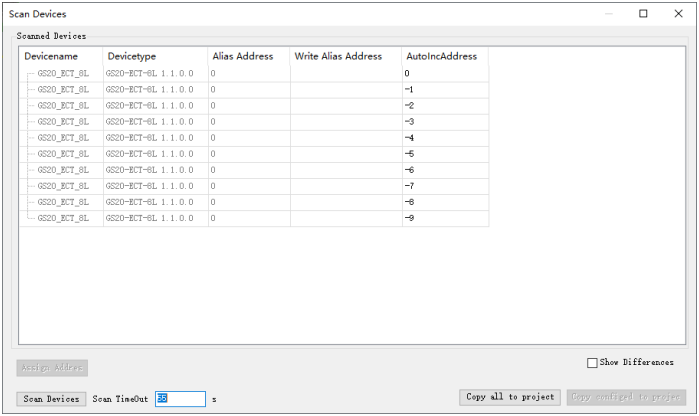


2. Setting IO-Link master

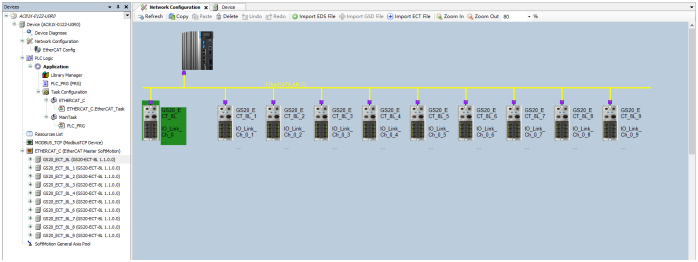
a. Right-click "ETHERCAT_C" in the navigation tree of "Device" and select "Scan for Devices" to open this interface.



b. On the "Scan for Device" interface, click "Scan Devices", and then click "Copy all to project" to finish loading the master.



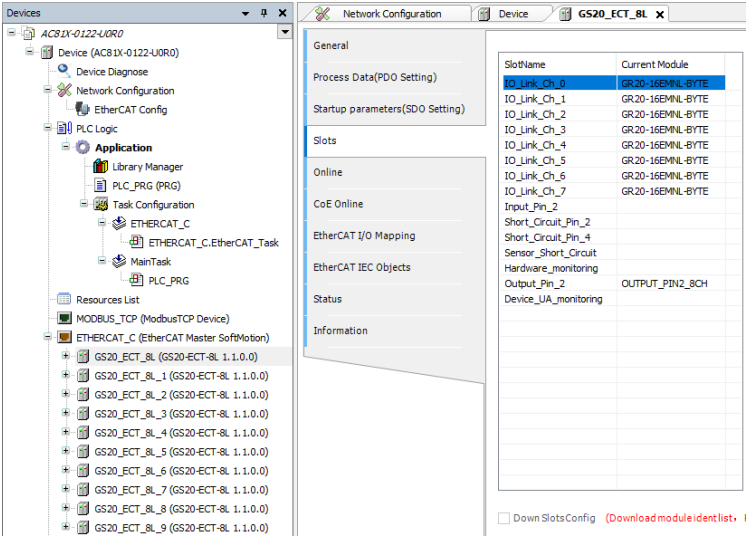
c. The corresponding master number is displayed in "ETHERCAT_C" or "Network Configuration" in the navigation tree of "Device".



5.1.3 Configuring the Master

■ Introduction to slots

There are 14 slots in GS20-ECT-8L. Double-click the master name in ETHERCAT_C in the navigation tree of "Device" (take GS20_ECT_8L as an example), and click Slot Configuration in the pop-up page to view the "Slot Name" and "Current Mode/ Module". The meaning of each slot is shown in the following table.



Slot name	Definition
IO_Link_Ch_0 to IO_Link_Ch_7	Port mode, optional Pin4 modes include: • Configured as Inovance IO-Link slave module: For example, GS20-16EMNL/GS20-16EMPL, where "N" is active low and "P" is active high. • Configured as standard input: STD_IN_1bit • Configured as standard output: STD_OUT_1 bit • Configured as I/O_Link input: For example, IOL_I_1byte represents the I/O_Link input configured with one byte. • Configured as IO_Link output: For example, IOL_O_1byte represents IO_Link output configured with one byte. • Configured as I/O_Link input/output: For example, I/O_1/_1byte represents I/O_Link input/output configured with one byte.
Input_Pin_2	Pin2 input

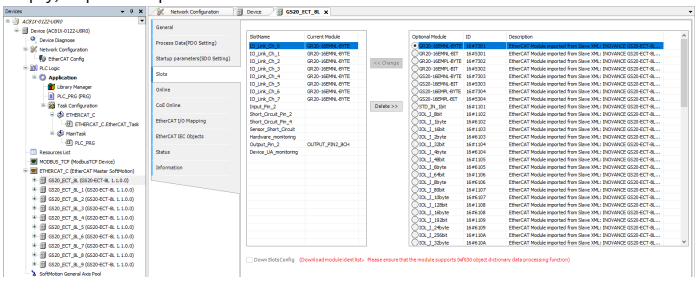
Slot name	Definition
Short_Circuit_Pin_2	Pin2 short circuit monitoring
Short_Circuit_Pin_4	Pin4 short circuit monitoring
Sensor_Short_Circuit	Pin1 short circuit monitoring
Hardware_monitoring	Hardware state monitoring (including US and UA power supply voltage and module temperature)
Output_Pin_2	Pin2 output
Device_UA_monitoring	Slave UA power supply voltage fault monitoring function (when the slave reports UA voltage overvoltage or undervoltage fault, the corresponding process data bit will be set to TRUE)

■ Slot configuration

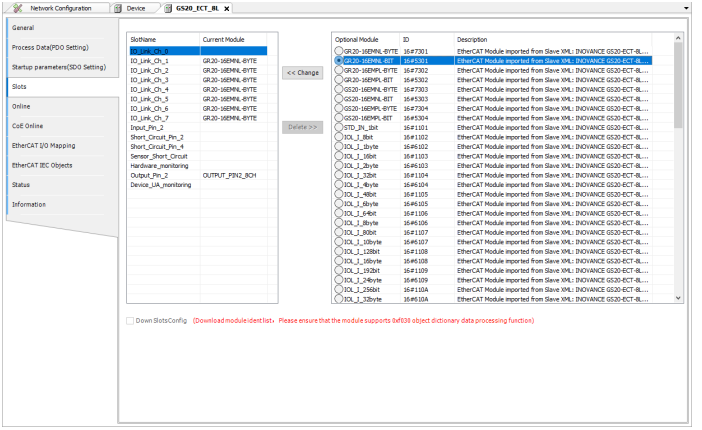
There are two ways to configure the master slot.

- Method 1: Internal overload curve download

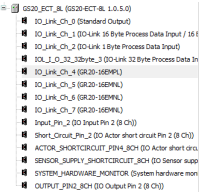
1. Double-click the master name in ETHERCAT_C in the navigation tree of "Device", and click "Slot Configuration" in the pop-up page to select the corresponding slot.
2. (Optional) Click "Slot Name" to select the corresponding slot. Click "Delete" to delete the original slot configuration. If the "Optional Mode/Module" column for the slot is empty, skip this step.



3. When the "Current Module" corresponding to the selected "Slot Name" is empty, check the desired mode/module in the "Optional Module" column on the right, then click "Change" to complete the slot configuration.

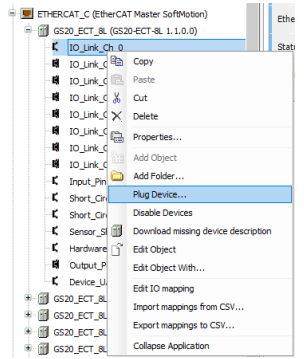


4. After the slot configuration has been completed, click ⊞ to expand the master module configured (take GS20_ECT_8L as an example) in the navigation tree of "Device" on the left to view the configuration results.

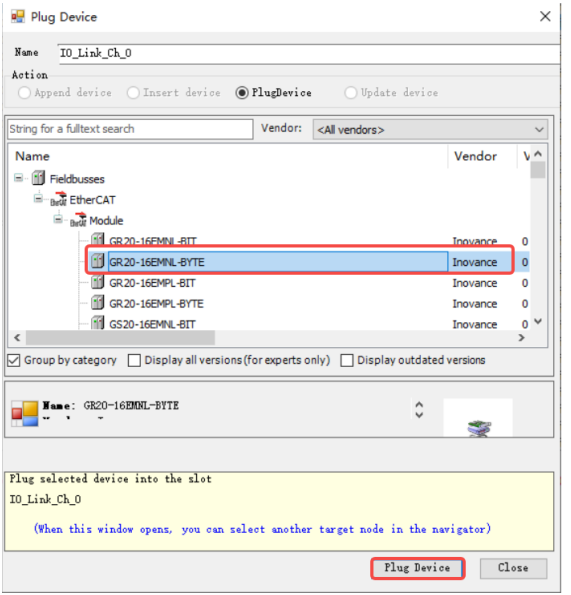


- Method 2: Overload curve download

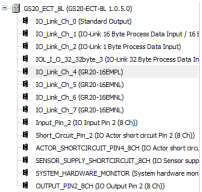
1. In the navigation tree on the left, click ⊞ to expand ETHERCAT_C->GS20_ECT_8L, right-click the corresponding slot, and click "Insert Device".



2. On the "Insert Device" page, select the corresponding slot configuration and click "Insert Device" to complete the slot configuration.

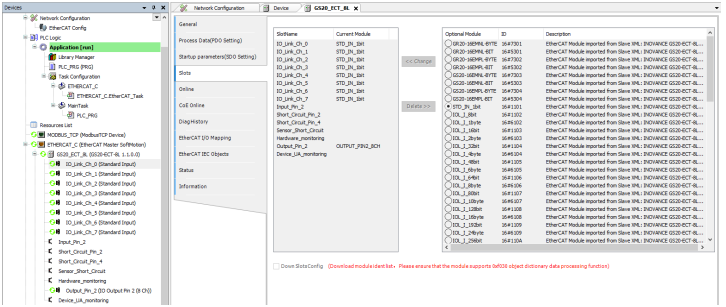


3. After the slot configuration has been completed, click ⊞ to expand the master module configured (take GS20_ECT_8L as an example) in the navigation tree of "Device" on the left to view the configuration results.

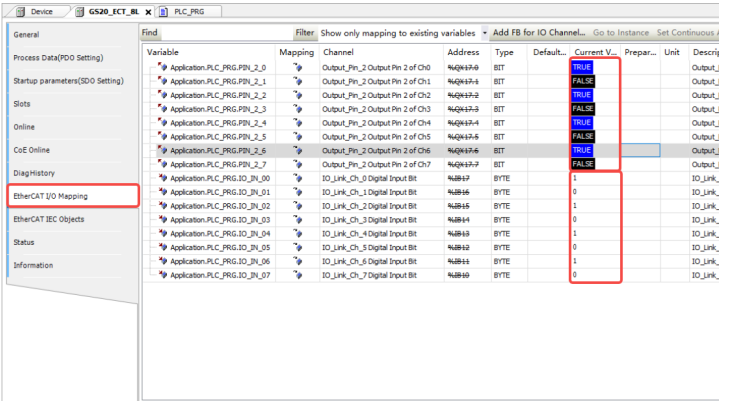


■ I/O terminal configuration of GS20-ECT-8L master

1. In the navigation tree of "Device" on the left, click ⊞ to expand ETHERCAT_C. Double-click "GS20-ECT-8L" master and click "Slot Configuration" in the pop-up window. Configure "Current Module" of any port or multiple ports in IO_Link_Ch_0 to IO_Link_Ch_7 as the input mode as shown in *"5.1.3 Configuring the Master" on page 44*.



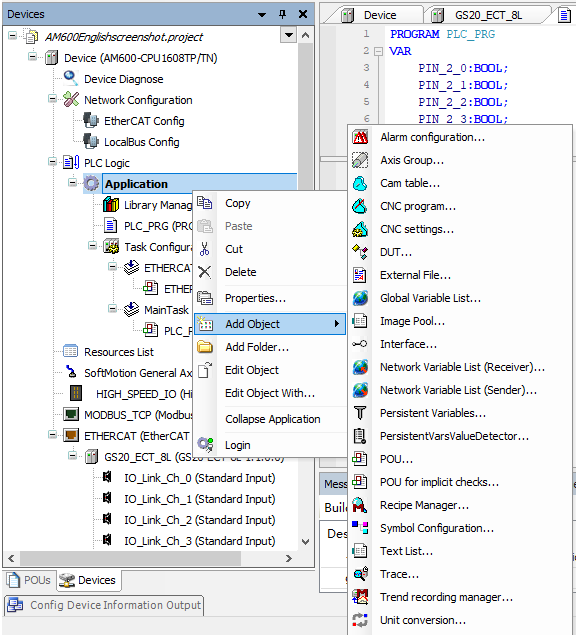
2. Log in to the PLC device, open the master configuration interface, and click "EtherCAT I/O Mapping" to enable Pin2 of the eight master ports (that is, the corresponding value in the "Current Value" column is TRUE, as shown in the blue status indicator in the following figure, which indicates Pin2 output enable), and check whether the corresponding data of Pin4 is consistent with the output of Pin2 (TRUE corresponds to 1, FALSE corresponds to 0), as shown in the following figure.



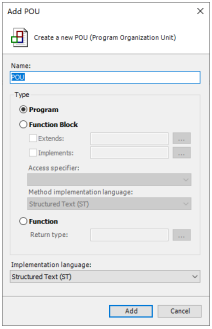
5.1.4 Writing a Program

Write a PLC program to control operation of the device through codes.

1. In the navigation tree of "Device" on the left, right-click "Application", and select "Add Object > POU…".



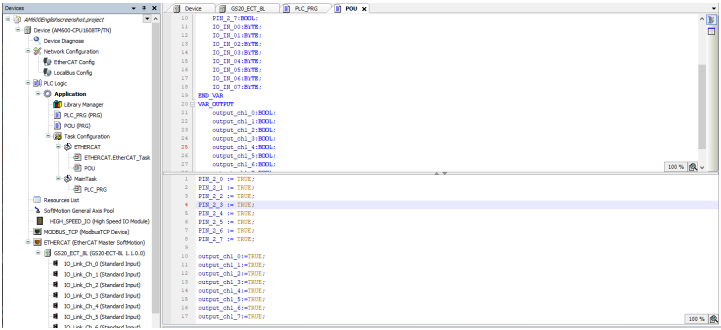
2. Set the name of the program, select "Program" for "Type" and "Structured Text (ST)" for "Implementation language", and then click "Add" to add the program.



3. In the navigation tree of "Device" on the left, you can view the organizational unit added, define variables, and write user programs. After you finish writing, drag the program files to "EtherCAT_C" or "MainTask" under "Task Configuration".

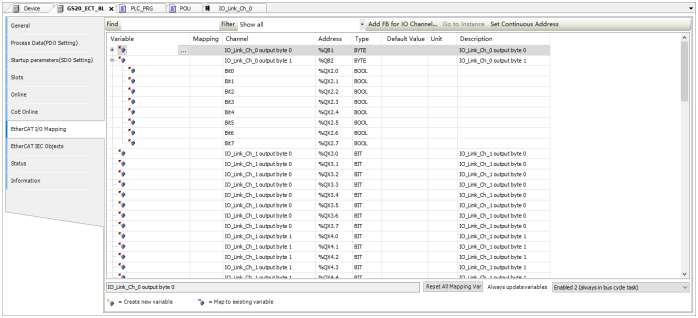
Note

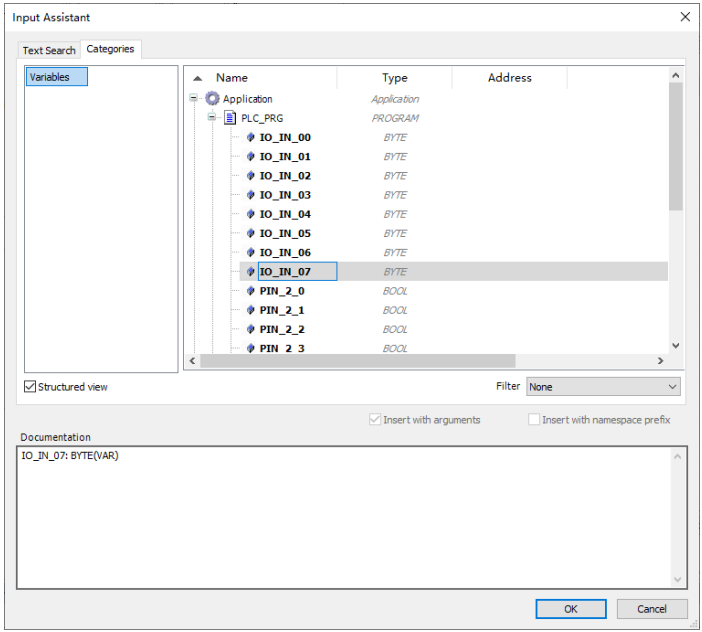
After compiling, when the program file is dragged into EtherCAT_C group under “Task configuration”, it must be dragged to ETHERCAT_C.EtherCAT_Task.



4. Configure the EtherCAT I/O mapping relation.

a. In the navigation tree of "Device" on the left, click ⊞ to expand "ETHERCAT_C". Double-click the "GS20-ECT-8L" master, click "EtherCAT I/O Mapping" in the pop-up window, and then double-click the port to be configured in the "Variables" column. Click ... (when the mapped variable type is BOOL, you need to click ⊞ in the "Variable" column to expand and complete the mapping) to display the "Input Assistant" interface.

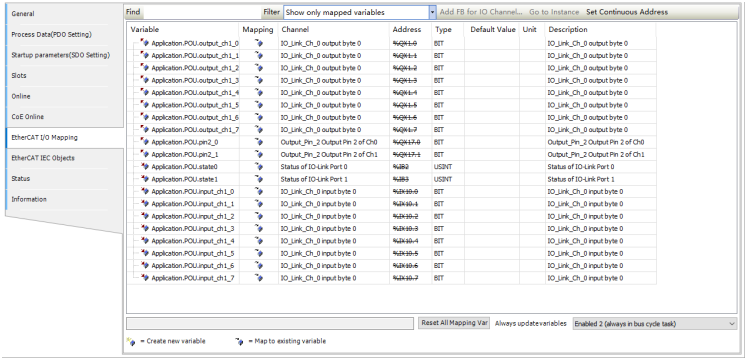




b. In the "Input Assistant" interface, click "Category", select "Variables", and then click ⊞ to expand "Application > POU". Select the corresponding variable, and click "OK" or directly double-click the corresponding variable to complete the EtherCAT I/O mapping.

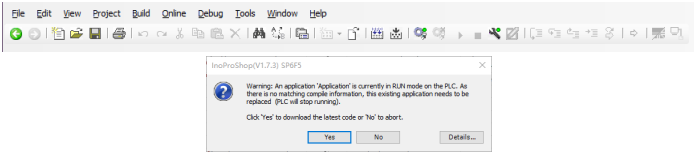
Note

Take the operation where channel 0 is configured as GR20_16EMPL and channel 1 is configured as GR20_16EMPL as an example to map the corresponding input/output variables. If the slave is configured with output, set the output_pin2_chn of the corresponding port.



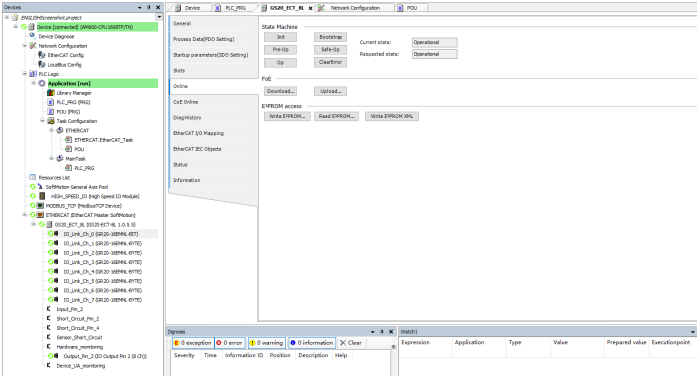
5. Compile and download the program.

a. Click  and  icons in the toolbar. Click "Yes" in the dialog box displayed to download the program to the PLC.



b. Log in to the PLC and the ERR indicator of the IO-Link master connected to the PLC flashes in red. After the program is downloaded, click ▶ to run the program.

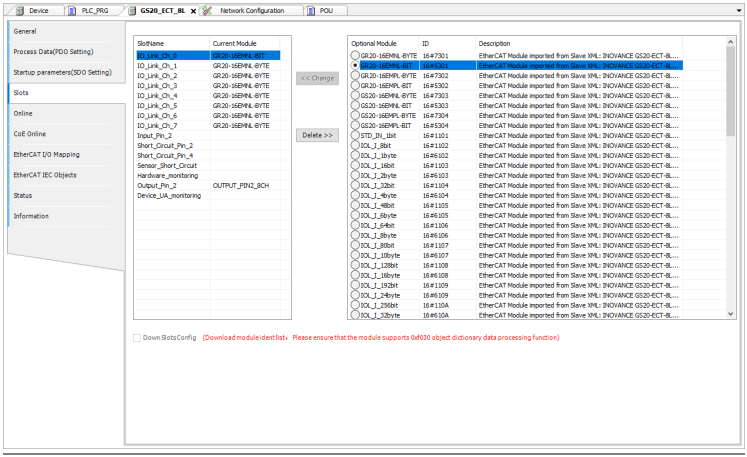
c. In the navigation tree of "Device" on the left, double-click "GS20-ECT-8L". In the pop-up window, click "Online" to view the "State Machine" configuration box with "Init" (initialization), "Pre-Op" (pre-operational), "Safe-Op" (safe operational) and "Op" (operational) states. Meanwhile, the "RUN" state can also be seen in the navigation tree of "Device" on the left.



d. The RUN indicator of the IO-Link master flashes from green to steady green, and the port "0" indicator configured as the "IO-Link" mode flashes in green.

Note

The "IO-Link" mode indicates that ports 0 to 7 are configured as non-SDT_OUT_1bit or STD_IN_1bit. Others are all configured as “IO-Link” mode, as shown below.



e. Connect the I/O-Link slave with model GR20-16EMPL at port 0.

Note

- The "0" indicator on port 0 turns steady green. The "1" indicator on port 0 are steady yellow, for example, Output_pin2_chn. At the slave, the US indicator is steady green and the COM indicator flashes green, indicating a normal IO-Link communication.
- To reduce configuration costs, the module configuration file sets the default slot mode to IO-Link general mode (2-byte input/2-byte output of process data). If no IO-Link device is connected to the corresponding port, the port indicator on the master will flash in green, which is normal. Once the correct IO-Link device is connected, the indicator turns solid green, indicating normal communication.

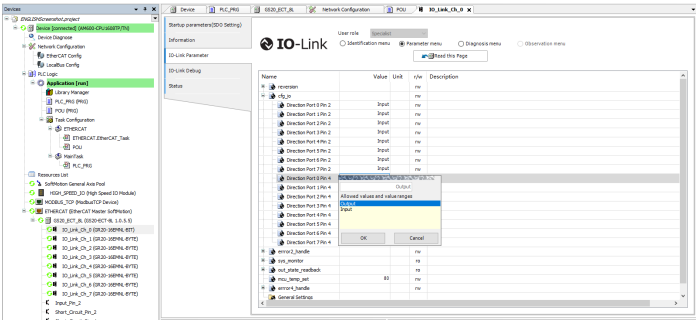
5.1.5 Configuring the GS20-16EMNL Slave

1. After the slave is loaded, this step is completed in the slot configuration phase. For details, see slot configuration in *"5.1.3 Configuring the Master" on page 44*.
2. Configure the GS20-16EMNL slave.
   a. Connect the master to Pin2 of the slave port (For details, see "Configuration of the I/O port of GS20-ECT-8L Master" in *"5.1.3 Configuring the Master" on page 44*).

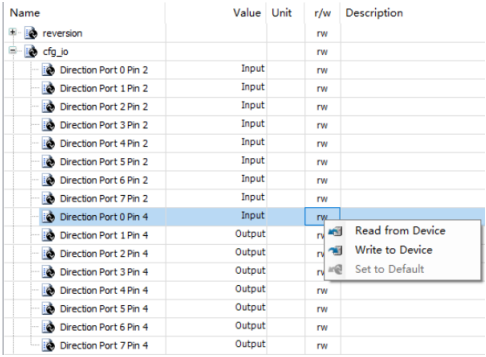
Note

Products manufactured after October 2024 require no I/O port configuration, support adaptive DIO and allow direct access to corresponding addresses.

   b. In the left project tree, click  to expand "ETHERCAT_C > GS20-ECT-8L_0". Double-click "IO_Link_Ch_0" to enter the slave I/O_Link configuration interface.
   c. Click "IO_Link Parameters", check the "Parameter Menu", and click "Read this page" to read the parameters. Click  to expand "cfg_io". Click a port of the slave to perform configuration, select "Output" or "Input", and click "OK".



d. Right-click the "Read/Write" column, select "Write to Device" to write the current configuration to the slave. After a pop-up window indicates the writing process is done, the configuration is succeeded.



3. Validate the correctness of slave configuration.

Note

This section takes the eight low bits (Pin2, configured as output) and eight high bits (Pin4, configured as input) of IO-Link slave GS20-16EMNL as an example, perform short connection to check whether ports 0 and 1 of GS20-ECT-8L are configured properly.

a. Short PIN2 and PIN4 of each port of GS20-16EMNL with a jumper bar.

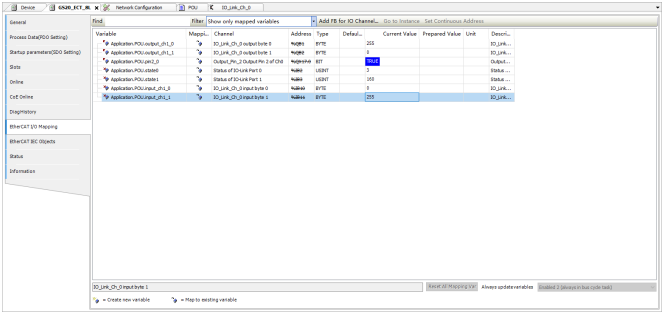
b. Verify whether port 0 of GS20-ECT-8L is correctly configured.

1). Connect the I/O-Link interface of the GS20-16EMNL to the port 0 of GS20-ECT-8L through the I/O-Link communication cable.

2). Double-click "GS20-ECT-8L" and click "EtherCAT I/O Mapping" in the pop-up window. Set the low 8 bits of port 0 of GS20-ECT-8L to "255" by byte, and output signal "1" to the eight I/O ports of IO-Link slave of GS20-16EMNL.

3). Check the state of the high 8 bits of input data of GS20-ECT-8L port and the I/O indicator of the I/O slave of GS20-16EMNL.

- If the high 8 bits of input data of port 0 of GS20-ECT-8L is "255" and the I/O indicator of the I/O-Link slave of GS20-16EMNL is all turned on, the configuration is correct.
- If not, the configuration is incorrect. In this case, check the connection of the device and validate again after a re-configuration.



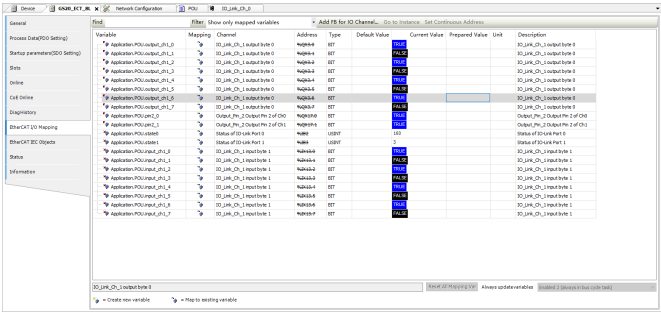
c. Validate whether port 1 of GS20-ECT-8L is configured correctly.

1). Connect the I/O-Link interface of the GS20-16EMNL to the port 1 of GS20-ECT-8L through the I/O-Link communication cable.

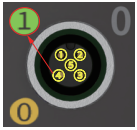
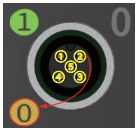
2). Double-click "GS20-ECT-8L" and click "EtherCAT I/O Mapping" in the interface that opens. The low 8 bits of output data of port 1 of GS20-ECT-8L are set by bit as shown in the following figure. Output "TRUE" or "FALSE" signals to the eight I/O ports of the IO-Link slave of GS20-16EMNL.

3). Check the high 8 bits of input data of port 1 of GS20-ECT-8L and the I/O indicator state of the IO-Link slave of GS20-16EMNL.

- If the high 8 bits of input data and the low 8 bits of output data of port 1 of the master (GS20-ECT-8L) are the same, and the I/O indicator of the I/O-Link slave of GS20-16EMNL is displayed the same as the low 8 bits of output data, the configuration is correct.
- If not, the configuration is incorrect. In this case, check the connection of the device and validate again after a re-configuration.



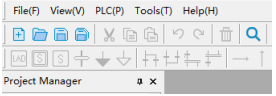
The port condition of GS20-16EMNL slave (port 0 as example) is shown below.

Drawing	Process data	Port indicator	Port pin
	BYTE1	1 indicator (ch0 to ch7)	Pin4 (ch0 to ch7)
	BYTE0	0 indicator (ch0 to ch7)	Pin2 (ch0 to ch7)

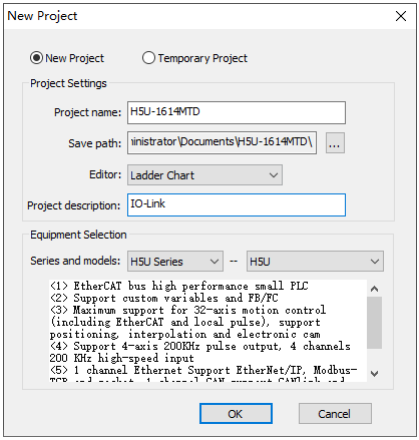
5.2 Configuring IO-Link in AutoShop

5.2.1 Creating a Project

1. Double-click the AutoShop desktop shortcut to start the AutoShop software.
2. Click "File -> New Project", or click to create a new project.

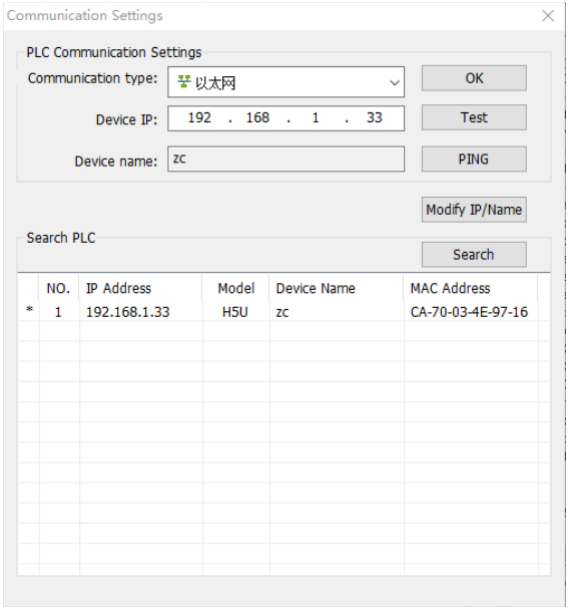


3. In the "New Project" interface, complete the corresponding settings and click "OK" to complete the new project creation.



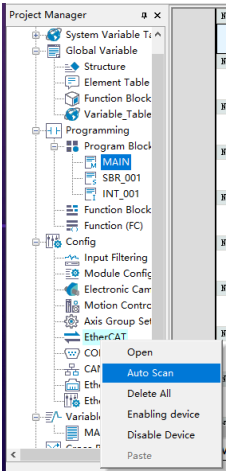
Item		Description
Project type		• New project • Temporary project
Project settings	Project name	User-defined
	Storage path	User-defined
	Editor	• Ladder diagram: It is a programming language similar to that of the relay circuit, which is commonly used in PLC program design. • LiteST: Provides excellent sequential logic control through graphic type programming. • Sequential function diagram: The structure text language is the most widely used language in CodeSYS. It can greatly reduce the amount of codes used in complex control systems and simplify complex problems.
	Project description	Project description
	Device model selection	Select series and device model

4. Click in the shortcut menu, select the corresponding "Communication Type", click "Search", and select the corresponding device in the list below. Click "Test" and you can see that the PLC device displays 0 alternately, indicating that the connection is good. Click "OK" to complete the connection.

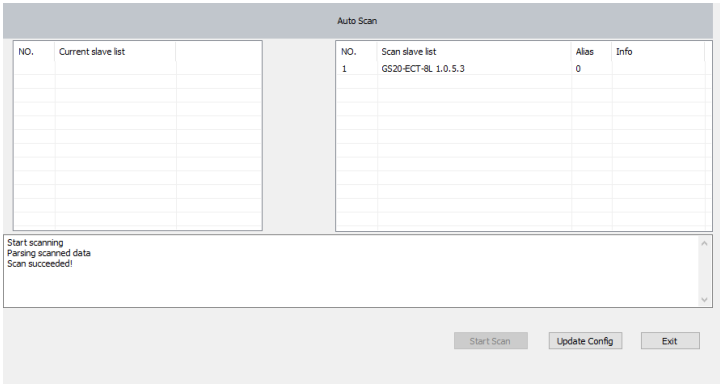


5.2.2 Loading the Master

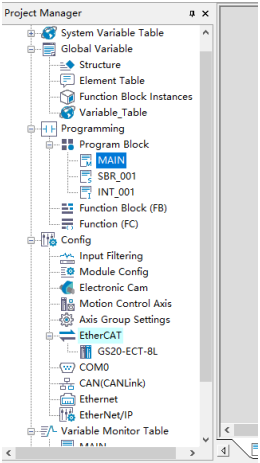
1. In the navigation tree of "Project Manager" on the left, click to expand the "Config" group, then right-click on "EtherCAT" and select "Auto Scan".



2. Click "Start Scan" in the pop-up window. After the scan is complete, select the device from the slave list and click "Update Config" to complete the addition of the master device.

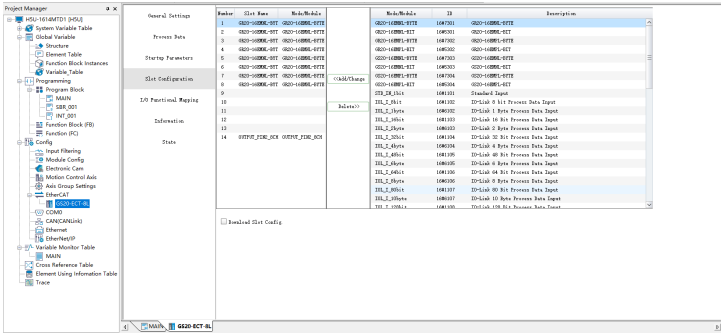


3. After adding the master, click in the "Project Management" on the left to expand "EtherCAT" to view the device model added.



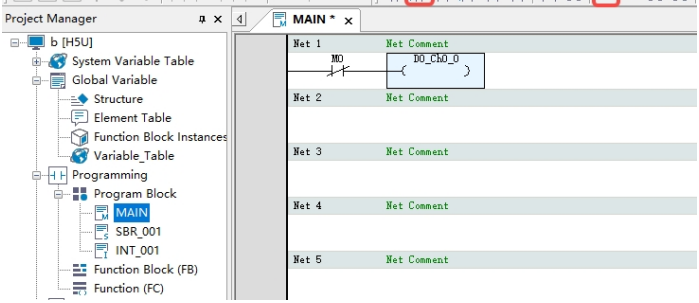
5.2.3 Configuring the Master

1. In the navigation tree of "Project Manager" on the left, click to expand "Config -> EtherCAT". Double-click the master "GS20-ECT-8L" and click "Slot Configuration" function, and then select the corresponding slot and click "Delete" to delete the original slot configuration.
2. For the slots with configurations deleted (where "Mode/Module" corresponding to "Slot Name" is empty), you can select the device to be inserted on the right side. After selection, click "Add/Change" to complete the corresponding slot configuration.

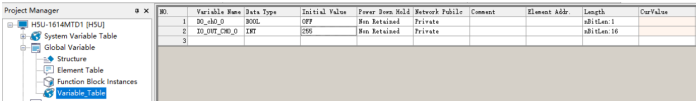


3. GS20-ECT-8L master IO configuration (taking Pin2 of port 0 of the master as an example)

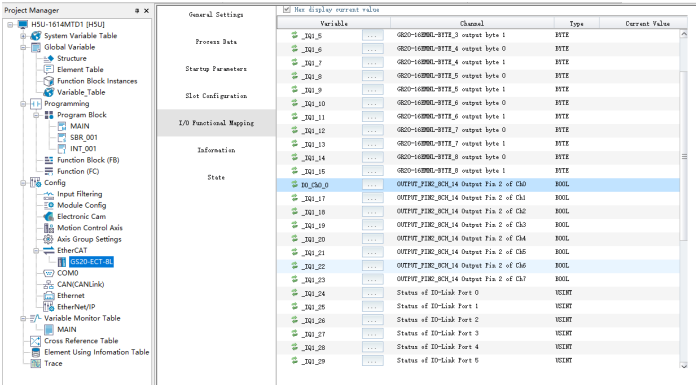
a. In the navigation tree of "Project Manager" on the left, click ⊞ to expand "Programming > Program Blocks", double-click "MAIN" to open the programming interface, and add network component as shown in the figure below.



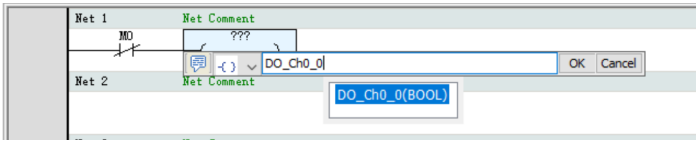
b. In the navigation tree of "Project Manager" on the left, click ⊞ to expand "Global Variable", and double-click "Variable_Table" to add the corresponding variable (e.g., D0_Ch0_0). Then click "Data Type" and "Initial Value" to set the corresponding parameters.



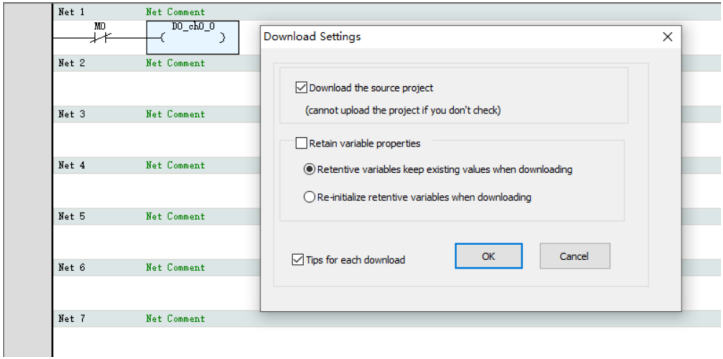
c. After the parameter setting, in the navigation tree of "Project Manager" on the left, click ⊞ to expand "Config -> EtherCAT" sequentially. Then click the master device "GS20-ECT-8L", select "I/O Functional Mapping" in the configuration interface, locate the port that needs mapping, click ... in the "Variable" column, and enter the variable name (D0_Ch0_0) added in the previous step to complete the port mapping.



d. Configure the coil ???() in the programming interface by double-clicking the component and entering the variable name (D0_Ch0_0) added in the previous step into the variable field. Click "OK" to complete the configuration.



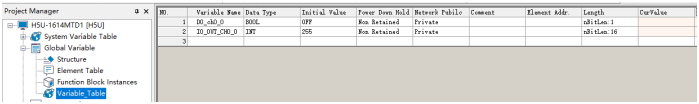
4. To download the program, click the icon in the menu bar to open the "Download Settings" interface. Check "Download the project source code" and "Retentive variables keep existing values when downloading", and click "OK" to download.



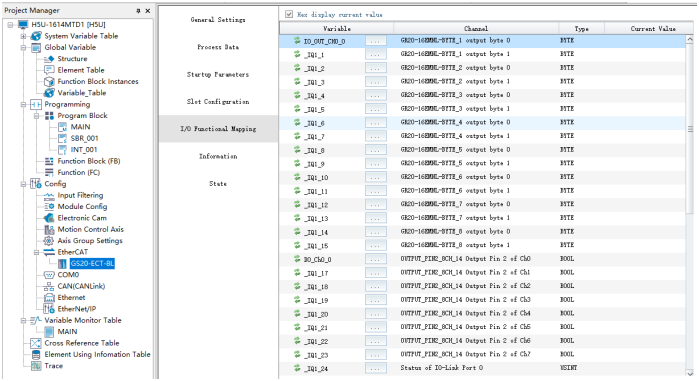
5. Check Pin2 output indicator of port 0 of "GS20-ECT-8L".
   - The indicator lights up, which indicates that the configuration is successful.
   - The indicator is off, which indicates that the configuration is incorrect. Check the connection and configure it again.

5.2.4 Configuring the GS20-16EMNL Slave

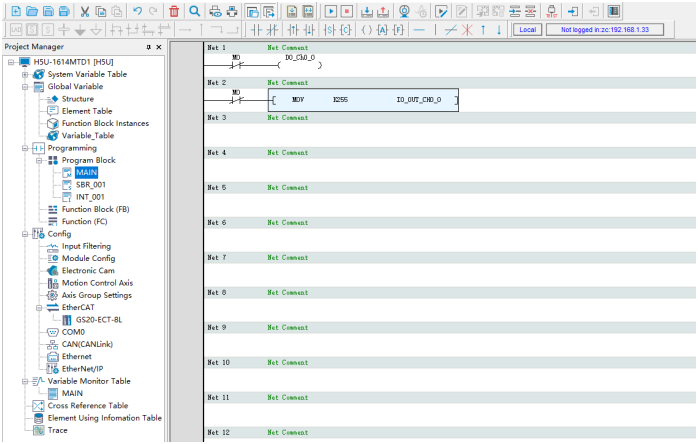
1. After the slave is loaded, this step is completed in the slot configuration phase. For details, see slot configuration in *"5.2.3 Configuring the Master" on page 66*.
2. I/O operation of the slave port of GS20-16EMNL (connect the master port 0 to the slave, take slave BYTE0 as output and slave BYTE1 as input to short the output and input)
   a. In the navigation tree of "Project Manager" on the left, click to expand "Global Variable", and click "Variable_Table" to add an INT-type variable (e.g., IO_OUT_CH0_0) and set the variable parameters.



b. In the navigation tree of "Project Manager" on the left, click ⊞ to expand "Configuration > EtherCAT", select the master device "GS20-ECT-8L", and click "I/O Functional Mapping" in the configuration interface, then click ... of the channel to be mapped and input the variable name added in the previous step (IO_OUT_CH0_0) to complete port mapping.



c. In the navigation tree of "Project Manager" on the left, click ⊞ to expand "Programming > Program Blocks", double-click "MAIN" to open the programming interface, and configure "Net 2" as shown in the figure below.



d. Click  to download the program and observe the I/O condition of the slave port after running. Check the input data state of the high 8 bits of port 0 of GS20-ECT-8L and the I/O slave indicator of GS20-16EMNL.

- If the high 8 bits of input data and low 8 bits of output data of the port 0 of the GS20-ECT-8L are the same, and the IO-Link slave I/O indicator of GS20-16EMNL is displayed according to the low 8 bits of output data, the configuration is correct.
- Otherwise, the configuration is incorrect. Check the connection again and perform the preceding steps again.

6 Troubleshooting

6.1 Solutions to Common Faults

Fault 1: When the GS20-ECT-8L master connects to an IO-Link slave, the UA and US indicators of the master are solid on, but the UA, US, and COM indicators of the slave are off.

Analysis:

- Cause: The GS20-ECT-8L module is not in safe-operational (SAFEOP) or operational (OP) state.
- Description: The GS20-ECT-8L module needs to enter SAFEOP or OP state to power the slave. Otherwise, the module cannot supply power normally.

Solution:

After downloading the PLC program, ensure that the GS20-ECT-8L module is in OP state (with the RUN indicator solid on). If the module fails to run, see *"6.2 EtherCAT Diagnosis" on page 74* for troubleshooting.

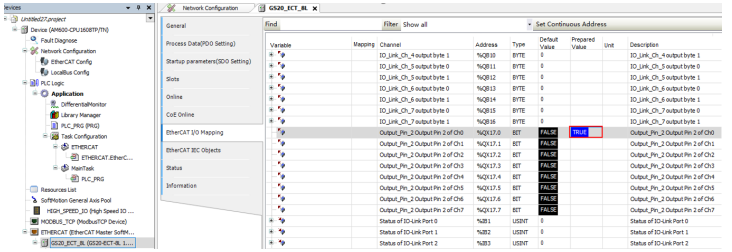
Fault 2: When the GS20-ECT-8L master connects to a GS20/GR20 slave, the UA, US, and RUN indicators of the master are solid on, while the US indicator of the slave is solid on, the UA indicator is off, and the COM indicator is flashing in red.

Analysis:

- Cause: The Pin 2 of the port corresponding to the IO-Link master is not enabled.
- Description: When the IO-Link master connects to the GS20/GR20 slave, it is necessary to set the Pin 2 of the corresponding master port to high level in the PLC program to provide I/O side power to the slave.

Solution:

1. Log in to the PLC device and open the configuration interface of the master. Click "EtherCAT I/O Mapping" to enable the Pin 2 of the corresponding master port (by setting the "Output_Pin_2 Output Pin 2 of Chn" variable to TRUE).



2. Observe the state of master/slave:
   - Master: The UA indicator is solid on.
   - Slave: The US and UA indicators are solid on, and the COM indicator is flashing in green.
   - If the indicators are as above, it indicates that communication has been successfully established and is available for normal use.
3. If the indicators are not as above, check whether the IO-Link communication cable connection between the master and slave is secure and undamaged; check whether the power cable of the master is damaged.

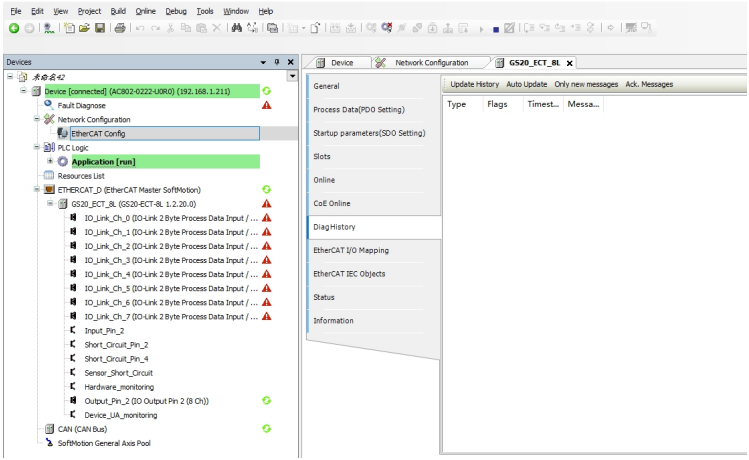
6.2 EtherCAT Diagnosis

LED indicators		Definition	Possible cause	Solution
RUN	Off	The EtherCAT slave is in the initialization state.	The EtherCAT master station is not connected to the EtherCAT slave station.	• Check that the configuration and parameter assignment are correct. • Check that the communication address configuration is correct. • Check that the network cable specifications (M12 interface, with a shielded Cat5e network cable) and length (within 100 m) meet the requirements.
	Flashing green	The EtherCAT slave is in the pre-operational state.	The EtherCAT slave station is in a non-OP state.	• Check that the EtherCAT slave configuration is correct. • Check that the slave is not faulty. • Check that all EtherCAT slaves are configured.
	Single flashing in green	The EtherCAT slave is in the safe operational state.		

LED indicators		Definition	Possible cause	Solution
ERR	Flashing red	The EtherCAT communication network is abnormal.	• No data exchange between EtherCAT master and slave • EtherCAT receives status conversion instructions that cannot be executed • The EtherCAT has a synchronization error. • A watchdog error occurs in EtherCAT communication	• Check that the M12 network cable plug is correctly inserted. • Check that the network cable is intact. • Check that the PDO configuration is correct. • Restart the power supply.

Note

You can view specific diagnostic information via the "Historical Diagnostics" of the master (applicable only to medium-sized PLCs).



The following table lists the error codes and their definitions.

Type	Fault code	Definition
System	0x0002	US supply overvoltage
	0x0003	US supply undervoltage
	0x0004	UA supply overvoltage
	0x0005	UA supply undervoltage
	0x0006	MCU temperature over 80°C
	0x000c	Pin2 short circuit
IO-Link master station	0x1800	Port connection to no device
	0x1801	Parameter loading failure
	0x1802	Invalid vendor ID
	0x1803	Invalid device ID
	0x1804	Pin4 short circuit
	0x1805	PHY chip overtemperature
	0x1806	Pin1 short circuit
	0x1807	Pin1 overcurrent
	0x1808	Slave device event overflow
	0x1811	Pin4 short circuit (DO mode)
	0x1813	Pin4 overcurrent (DO mode)
	0x6000	Invalid cycle time
	0x6001	Incorrect version for slave station

7 Object List

7.1 EtherCAT Object Dictionary Data (CoE Object)

The object dictionary of the EtherCAT IO-Link master station contains SDO-based addressing objects and the standard objects and manufacturer objects supported by the IO-Link master station. The ETG.1000.6: Application Layer protocol specification describes standard objects and ETG.5001-6220 describes the modular equipment profile objects. In addition, the manufacturer objects can be addressed by combination of indexes and sub-indexes. Sub-index 0 indicates the number of sub-indexes or highest-level sub-indexes.

Index 0x1000 EtherCAT slave device type					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
1000:00	Device type	Device type of EtherCAT slave	UDINT	RO	0x1389 (5001dec)
Index 0x1001 error register					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
1001:00	Error register	Error register	USINT	RO	0x00
Index 0x1001 EtherCAT slave device name					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
1008:00	Device name	Device name	STRING(11)	RO	GS20-ECT-8L-INT
Index 0x1008 EtherCAT slave hardware version information					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
1009:00	Hardware version	Hardware version of EtherCAT slave	STRING(16)	RO	A00.01
Index 0x100A EtherCAT slave protocol stack software version information					

Index	Name	Definition	Data type	Flag	Default value
100A:00	Slave version	Software version of EtherCAT slave protocol stack	STRING(4)	RO	5.13
Index 0x100B IO-Link master product version information					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
100B:00	Software version	Highest sub-indexes supported	USINT	RO	0x04
100B:01	App version	Application software version	UDINT	RO	0x10100000
100B:02	FPGA version	FPGA software version	UDINT	RO	0x10100000
100B:03	IOLM version	Software version of IO-Link master	UDINT	RO	0x0305
Index 0x1018 EtherCAT slave identification information					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
1018:00	Identity	Highest sub-indexes supported	USINT	RO	0x04 (4dec)
1018:01	Vendor ID	Vendor ID of EtherCAT slave	UDINT	RO	0x00100000
1018:02	Product code	Product code of EtherCAT slave	UDINT	RO	0x10F42EE1

1018:03	Revision	Firmware version of product application	STRING(11)	RO	1.1.0.0
1018:04	Serial number	Production serial number	UDINT	RO	0x15FA66
Index 0x10F3 diagnosis history					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
10F3:00	Diagnosis history	Highest sub-indexes supported	USINT	RO	0x16
10F3:01	Maximum message	Maximum number of diagnosis messages	USINT	RO	0x14 (20dec)
10F3:02	Newest message	Sub-index of the latest diagnosis message	USINT	RO	0x00000000 (0dec)
10F3:03	Newest acknowl-edged message	Latest acknowl-edged message	USINT	RW	0x00000000 (0dec)
10F3:04	New message available	New diagnosis information	BOOL	RO	0
10F3:05	Flags	Settings for sending and storing diagnosis messages	UINT	RW	0x00000000 (0dec)
10F3:06	Diagnosis message 01	Diagnosis message 1	ARRAY [0..27] OF BYTE	RO	0x00000000 (0dec)
. . .	. . .	. . .	. . .	. . .	. . .

10F3:40	Diagnosis message 64	Diagnosis message 64	ARRAY [0..27] OF BYTE	RO	0x00000000 (0dec)
Index 0x3010 ESC Port 0 error counter					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
3010:00	Port0 error counter	Highest sub-indexes supported	USINT	RO	0x04 (4dec)
3010:01	Port0 invalid frame counter	Number of invalid frames for ESC port 0	USINT	RO	0x00 (0dec)
3010:02	Port0 Rx error counter	Number of error frames for ESC port 0	USINT	RO	0x00 (0dec)
3010:03	Port0 forwarded Rx error counter	Number of loopback error frames for ESC port 0	USINT	RO	0x00 (0dec)
3010:04	Port0 lost link counter	Number of lost frames for ESC port 0	USINT	RO	0x00 (0dec)
Index 0x3011 ESC port 0 error counter					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
3011:00	Port1 error counter	Highest sub-indexes supported	USINT	RO	0x04 (4dec)
3011:01	Port1 invalid frame counter	Number of invalid frames for ESC port 1	USINT	RO	0x00 (0dec)
3011:02	Port1 Rx error counter	Number of error frames for ESC port 1	USINT	RO	0x00 (0dec)

3011:03	Port1 forwarded Rx error counter	Number of loopback error frames for ESC port 1	USINT	RO	0x00 (0dec)
3011:04	Port1 lost link counter	Number of lost frames for ESC Port 1	USINT	RO	0x00 (0dec)
Index 0x3012 ESC error counter					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
3012:00	ESC error counter	Highest sub-indexes supported	USINT	RO	0x04 (4dec)
3012:01	ECAT Processing unit error counter	ECAT processing unit error counter	USINT	RO	0x00 (0dec)
3012:02	PDI error counter	PDI error counter	USINT	RO	0x00 (0dec)
3012:03	Watchdog counter process data	Number of watchdogs for process data	USINT	RO	0x00 (0dec)
3012:04	Watchdog counter PDI	Number of PDI watchdogs	USINT	RO	0x00 (0dec)
Index 0x3016 station address					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
3016:00	Station address	Highest sub-indexes supported	USINT	RO	0x04 (4dec)
3016:01	Rotary switch value	Values set by DIP switch	USINT	RO	0x00 (0dec)
3016:02	Configured station address	Configured station address	USINT	RO	0x00 (0dec)

3016:03	Configured station alias	Configured station alias	USINT	RO	0x00 (0dec)
3016:04	Alias in EEPROM	Alias in EEPROM	USINT	RO	0x00 (0dec)

The following table lists configuration data of the IO-Link port.

Index 0x80n0 Ch.n IO-Link port configuration data (for 0 ⩽ n ⩽ 7)					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
0x80-n0:00	IO Settings Ch.1- 8	Highest sub-indexes supported	USINT	RW	0x28 (40dec)
0x80-n0:04	Device ID	Device ID of IO-Link device	UDINT	RW	0x00000000 (0dec)
0x80-n0:05	VendorID	Vendor ID of IO-Link device	UDINT	RW	0x00000000 (0dec)
0x80-n0:06	Product ID	Product ID of IO-Link device	USINT	RW	0x00000000 (0dec)
0x80-n0:08	Serial number	Serial number of IO-Link device	USINT	RW	0x00000000 (0dec)
0x80-n0:20	IO-Link revision	Revision of specification for IO-Link device communication • Bits 0 to 3: Minor version • Bits 4 to 7: Major version	USINT	RW	0x00 (0dec)
0x80-n0:21	Frame capability	Reserved	USINT	RW	0x00 (0dec)
0x80-n0:22	Min cycle time	Cycle time① between IO-Link master and slave, transmitted by IO-Link data frames of minimum cycle • Bit 6 and Bit 7: Time base • Bits 0 to 5: Ratio • 0x00: The IO-Link master automatically uses the update time of the IO-Link device.	USINT	RW	0x00 (0dec)

0x80-n0:23	Offset time	Reserved	USINT	RW	0x00 (0dec)
0x80-n0:24	Process data in length	Number of bits in input process data transmitted by IO-Link data frames, recorded as 255 for 256 bits	USINT	RW	0x00 (0dec)
0x80-n0:25	Process data out length	Number of bits in output process data transmitted by IO-Link data frames, recorded as 255 for 256 bits	USINT	RW	0x00 (0dec)
0x80-n0:26	Compati-ble ID	Reserved	UINT	RW	0x0000 (0dec)
0x80-n0:27	Reserved	Reserved	UINT	RW	0x0000 (0dec)

0x80-n0:28	Master control	**Bits 0 to 3:** 0: Port not used 1: Port configured as DI mode 2: Port configured as DO mode 3: Port configured as the IO-Link automatic mode 4: Port configured as IO-Link verification mode **Bits 4 to 7:** 0: Process data invalid upon network disconnection 1: Output 0 upon network disconnection 2: Output last cycle upon network disconnection **Bits 8 to 15:** 0: Device parameter verification disabled 1: V1.0 verification for Vendor/ Device ID 2: V1.1 verification for Vendor/ Device ID 3: Slave configuration data backup and restoration enabled 4: Slave configuration data restoration only enabled *V1.0 and V1.1 indicate the IO-Link slave protocol stack versions. *When using modes 3 and 4, the port must be configured as configuration mode.	UINT	RW	0x0000 (0dec)

Index 0x90n0 Ch.n IO-Link port configuration data (for 0 ⩽ n ⩽ 7)

Index	Name	Definition	Data type	Flag	Default value

0x90-n0:00	IO Settings Ch.1- 8	Highest sub-indexes supported	USINT	R	0x28 (40dec)
0x90-n0:04	Device ID	Retrieved device ID of IO-Link slave	UDINT	R	0x00000000 (0dec)
0x90-n0:05	VendorID	Retrieved vendor ID of IO-Link slave	UDINT	R	0x00000000 (0dec)
0x90-n0:06	Product ID	Obtained product ID of the IO-Link slave device (not supported)	USINT	R	0x00000000 (0dec)
0x90-n0:08	Serial number	Obtained serial number of the IO-Link slave device (not supported)	USINT	R	0x00000000 (0dec)
0x90-n0:20	IO-Link revision	Revision of specification for IO-Link device communication • Bits 0 to 3: Minor version • Bits 4 to 7: Major version	USINT	R	0x00 (0dec)
0x90-n0:21	Frame capability	Reserved	USINT	R	0x00 (0dec)
0x90-n0:22	Min cycle time	Cycle time① between IO-Link master and slave, transmitted by IO-Link data frames of minimum cycle • Bit 6 and Bit 7: Time base • Bits 0 to 5: Ratio	USINT	R	0x00 (0dec)
0x90-n0:23	Offset time	Reserved	USINT	R	0x00 (0dec)
0x90-n0:24	Process data in length	Obtained number of bits in the input process data transmitted by IO-Link slave station data frames, which is displayed as 255 for 256 bits	USINT	R	0x00 (0dec)
0x90-n0:25	Process data out length	Obtained number of bits in the output process data transmitted by IO-Link slave station data frames, which is displayed as 255 for 256 bits	USINT	R	0x00 (0dec)

0x90-n0:26	Compati-ble ID	Reserved	UINT	R	0x0000 (0dec)
0x90-n0:27	Reserved	Reserved	UINT	R	0x0000 (0dec)

①For the cycle time, see the table below.

Time base code	Time base value	Calculation formula	Cycle time
00	0.1 ms	Multiplier x Time base	0.4 ms to 6.3 ms
01	0.4 ms	6.4 ms + Multiplier x Time base	6.4 ms to 31.6 ms
10	1.6 ms	32.0 ms + Multiplier x Time base	32.0 ms to 132.8 ms
11	Reserved	Reserved	Reserved

7.2 Configuration Data for Process Data Communication

In EtherCAT PDO communication, management is divided into three parts: PDO assignment, PDO mapping, and process data object dictionary. PDO assignment and PDO mapping are described and sampled as follows:

■ PDO assignment

PDO assignment is used to configure PDO mapping, and is divided into two object dictionaries: Receive PDO assignment and Transmit PDO assignment, with corresponding indexes of 0x1C12 and 0x1C13 respectively.

Index 0x1C12 RxPDO assignment				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1C12:00	Sub-index 00	Output process data assignment	USINT	0x08 (8dec)
0x1C12:01	Sub-index 01	Index 1 output process data assignment	DT1C12ARR	0x1600 (5632dec)
0x1C12:02	Sub-index 02	Index 2 output process data assignment	DT1C12ARR	0x1601 (5633dec)

0x1C12:03	Sub-index 03	Index 3 output process data assignment	DT1C12ARR	0x1602 (5634dec)
0x1C12:04	Sub-index 04	Index 4 output process data assignment	DT1C12ARR	0x1603 (5633dec)
0x1C12:05	Sub-index 05	Index 5 output process data assignment	DT1C12ARR	0x1604 (5634dec)
0x1C12:06	Sub-index 06	Index 6 output process data assignment	DT1C12ARR	0x1605 (5635dec)
0x1C12:07	Sub-index 07	Index 7 output process data assignment	DT1C12ARR	0x1606 (5634dec)
0x1C12:08	Sub-index 08	Index 8 output process data assignment	DT1C12ARR	0x1607 (5635dec)
Index 0x1C13 TxPDO assignment				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1C13:00	Sub-index 00	Input process data assignment	USINT	0x08 (8dec)
0x1C13:01	Sub-index 01	Index 1 input process data assignment	DT1C13ARR	0x1A00 (6656dec)
0x1C13:02	Sub-index 02	Index 2 input process data assignment	DT1C13ARR	0x1A01 (6657dec)
0x1C13:03	Sub-index 03	Index 3 input process data assignment	DT1C13ARR	0x1A02 (6657dec)
0x1C13:04	Sub-index 04	Index 4 input process data assignment	DT1C13ARR	0x1A03 (6658dec)

0x1C13:05	Sub-index 05	Index 5 input process data assignment	DT1C13ARR	0x1A04 (6658dec)
0x1C13:06	Sub-index 06	Index 6 input process data assignment	DT1C13ARR	0x1A05 (6659dec)
0x1C13:07	Sub-index 07	Index 7 input process data assignment	DT1C13ARR	0x1A06 (6659dec)
0x1C13:08	Sub-index 08	Index 8 input process data assignment	DT1C13ARR	0x1A07 (6660dec)

■ PDO mapping

PDO mapping is used to map the process data object dictionary required for communication. The mapping types are categorized into Receive PDO mapping (RxPDO mapping) and Transmit PDO mapping (TxPDO mapping), with index ranges of 0x1600-0x17FF and 0x1A00-0x1BFF respectively.

The object dictionary for PDO mapping contains the indexes, sub-indexes, and data lengths of process data objects required for PDO communication. Its basic structure is as follows:

Bit	31	...	16	15	...	8	7	...	0
Definition	Index			Sub-index			Object length		

Index 0x1A0n Ch.n input process data mapping (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1A0n:00	Sub-index 00	Input process data mapping	USINT	0x00 (0dec)
0x1A0n:01	Sub-index 01	Index 1 input process data mapping	UDINT	0x70n0:01,08
. . .	...	...	...	...

0x1A0n:40	Sub-index 64	Index 64 input process data mapping	UDINT	0x70n0:40,08
Index 0x1A10 Pin2 input process data mapping (8 Ch)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1A10:00	Sub-index 00	Pin2 input process data mapping	USINT	0x08 (8dec)
0x1A10:01	Sub-index 01	Pin2 input process data mapping through channel 0	Bit	0x2000:01,01
0x1A10:02	Sub-index 02	Pin2 input process data mapping through channel 1	Bit	0x2010:01,01
0x1A10:03	Sub-index 03	Pin2 input process data mapping through channel 2	Bit	0x2020:01,01
0x1A10:04	Sub-index 04	Pin2 input process data mapping through channel 3	Bit	0x2030:01,01
0x1A10:05	Sub-index 05	Pin2 input process data mapping through channel 4	Bit	0x2040:01,01
0x1A10:06	Sub-index 06	Pin2 input process data mapping through channel 5	Bit	0x2050:01,01

0x1A10:07	Sub-index 07	Pin2 input process data mapping through channel 6	Bit	0x2060:01,01
0x1A10:08	Sub-index 08	Pin2 input process data mapping through channel 7	Bit	0x2070:01,01
Index 0x1A13 Pin1 short circuit process data mapping (8 Ch)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1A13:00	Sub-index 00	Pin1 short-circuit status process data mapping	USINT	0x08 (8dec)
0x1A13:01	Sub-index 01	Pin1 short-circuit status process data mapping through channel 0	Bit	0x2001:02,01
0x1A13:02	Sub-index 02	Pin1 short-circuit status process data mapping through channel 1	Bit	0x2011:02,01
0x1A13:03	Sub-index 03	Pin1 short-circuit status process data mapping through channel 2	Bit	0x2021:02,01

0x1A13:04	Sub-index 04	Pin1 short-circuit status process data mapping through channel 3	Bit	0x2031:02,01
0x1A13:05	Sub-index 05	Pin1 short-circuit status process data mapping through channel 4	Bit	0x2041:02,01
0x1A13:06	Sub-index 06	Pin1 short-circuit status process data mapping through channel 5	Bit	0x2051:02,01
0x1A13:07	Sub-index 07	Pin1 short-circuit status process data mapping through channel 6	Bit	0x2061:02,01
0x1A13:08	Sub-index 08	Pin1 short-circuit status process data mapping through channel 7	Bit	0x2071:02,01
Index 0x1A14 system hardware status monitoring process data mapping				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1A14:00	Sub-index 00	System hardware monitoring status process data mapping	USINT	0x03(3dec)

0x1A14:01	Sub-index 01	System power supply voltage monitoring status process data mapping	UDINT	0x2A02:01,08
0x1A14:02	Sub-index 02	Actuator power supply voltage monitoring status process data mapping	UDINT	0x2A02:02,08
0x1A14:03	Sub-index 03	MCU internal temperature monitoring status process data mapping	UDINT	0x2A02:03,08
Index 0x1A80 master and slave station communication status monitoring process data mapping				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1A81:00	Sub-index 00	Master-slave communication status monitoring process data mapping	USINT	0x08 (8dec)
0x1A81:01	Sub-index 01	Master-slave communication status monitoring process data mapping through channel 0	UDINT	0xF100:01,08

0x1A81:02	Sub-index 02	Master-slave communication status monitoring process data mapping through channel 1	UDINT	0xF100:02,08
0x1A81:03	Sub-index 03	Master-slave communication status monitoring process data mapping through channel 2	UDINT	0xF100:03,08
0x1A81:04	Sub-index 04	Master-slave communication status monitoring process data mapping through channel 3	UDINT	0xF100:04,08
0x1A81:05	Sub-index 05	Master-slave communication status monitoring process data mapping through channel 4	UDINT	0xF100:05,08
0x1A81:06	Sub-index 06	Master-slave communication status monitoring process data mapping through channel 5	UDINT	0xF100:06,08

0x1A81:07	Sub-index 07	Master-slave communication status monitoring process data mapping through channel 6	UDINT	0xF100:07,08
0x1A81:08	Sub-index 08	Master-slave communication status monitoring process data mapping through channel 7	UDINT	0xF100:08,08
Index 0x160n Ch.n output process data mapping (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x160n:00	Sub-index 00	Output process data mapping	USINT	0x00 (0dec)
0x160n:01	Sub-index 01	Index 1 output process data mapping	UDINT	0x60n0:01,08
. . .	...	...	...	...
0x160n:20	Sub-index 32	Index 32 output process data mapping	UDINT	0x60n0:40,08
Index 0x1620 Pin2 output process data mapping (8 Ch)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x1620:00	Sub-index 00	Pin2 output process data mapping	USINT	0x08 (8dec)
0x1620:01	Sub-index 01	Pin2 output process data mapping through channel 0	Bit	0x3008:01,01

0x1620:02	Sub-index 02	Pin2 output process data mapping through channel 1	Bit	0x3018:01,01
0x1620:03	Sub-index 03	Pin2 output process data mapping through channel 2	Bit	0x3028:01,01
0x1620:04	Sub-index 04	Pin2 output process data mapping through channel 3	Bit	0x3038:01,01
0x1620:05	Sub-index 05	Pin2 output process data mapping through channel 4	Bit	0x3048:01,01
0x1620:06	Sub-index 06	Pin2 output process data mapping through channel 5	Bit	0x3058:01,01
0x1620:07	Sub-index 07	Pin2 output process data mapping through channel 6	Bit	0x3068:01,01
0x1620:08	Sub-index 08	Pin2 output process data mapping through channel 7	Bit	0x3078:01,01

7.3 IO-Link Slave Configuration Data

As an industrial automation innovation protocol, IO-Link enables transparent device communication via a single cable. Its core interaction unit ISDU (Index Service Data Unit) supports the following functions:

- Parameter interaction: Master (PLC) reads/writes slave device (IO-Link device) parameters via the ISDU protocol.
- Status control: Real-time adjustment of device operation modes and diagnostic data acquisition.

The Inovance GS20-ECT-8L module sets and reads parameters of the connected IO-Link device via the EtherCAT object dictionary (shown in the table below). For specific parameter addresses and their meanings, see the IO-Link equipment guide.

Index 0x40n0 Ch.n IO-Link port slave configuration parameter read/write (for 0 ≤ n ≤ 7)					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
0x40-n0:00	subindex0	Highest sub-indexes supported	USINT	RO	0x07 (7dec)
0x40-n0:01	Control	• 0: No operation • 0→2: Write parameter • 0→3: Read parameter	UDINT	RW	0x00 (0dec)
0x40-n0:02	Status	• 0x00: No error • 0x02: Read success • 0x40: Error	UDINT	RW	0x00 (0dec)
0x40-n0:03	Index	Slave index	USINT	RW	0x00 (0dec)
0x40-n0:04	Subindex	Slave sub-index	USINT	RW	0x00 (0dec)
0x40-n0:05	Length	Data length (unit: byte)	UINT	RW	0x00 (0dec)

0x40-n0:06	Data	Data	ARRAY [0..31] OF BYTE	RW	0x00 (0dec)
0x40-n0:07	Error Code	• 0x1: Operation not supported • 0x3: Device access failure • 0x4: Operation unauthorized • 0x5: Slave device not in OP state • 0x34: Length error • 0x36: Invalid operation due to busy master station • 0x39: Port disabled	UINT	RO	0x00 (0dec)

7.4 Process Data

The input data of the IO-Link master represents the TxPDO of the IO-Link slave. If an IO-Link slave with TxPDO is connected, the IO-Link master port must be configured with a mode with input data. For the definition of TxPDO data of the IO-Link slave, see the following table. N represents the port number of the IO-Link master.

Index 0xF100 Status of IO-Link Port n (Channel n IO-Link communication status) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0xF100: 00	Sub-index 00	Highest sub-index supported	USINT	0x08 (8dec)

0xF100: 01	Sub-index 01	Status of communication between the master station and the slave station **Bit 0 to Bit 3: IO-Link status** 0: Port inactive 1: Input mode 2: Output mode 3: Communication OP 4: Communication fault **Bit 4 to Bit 7: Fault codes** 00: No error 1: Watchdog error 2: Buffer overflow 3: Invalid device ID 4: Invalid vendor ID 5: Invalid version 6: Invalid frame function 7: Invalid cycle time 8: Invalid length for input process data 9: Invalid output process data length 10: No device detected 11: None	USINT	0x00 (0dec)
...	...		...	...
0xF100: 08	Sub-index 08		USINT	0x00 (0dec)
Index 0x20n0 Input_Pin_2 Input Pin 2 of Chn (Ch.n Pin2 pin status monitoring input process data) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**

0x20n0: 00	Sub-index 00	Highest sub-index supported	USINT	0x02 (2dec)
0x20n0: 01	Sub-index 01	Pin2 input process data • 0: Inactive • 1: Active	USINT	0x00 (0dec)
Index 0x20n0 Short_Circuit_Pin_2 Actor short circuit Pin 2 of Chn (Ch.n Pin2 pin status monitoring input short circuit data) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x20n0: 02	Sub-index 02	Short circuit status upon Pin2 configuration as output • 0: No short circuit information • 1: Short circuit	USINT	0x00 (0dec)
Index 0x20n1 Short_Circuit_Pin_4 Actor short circuit Pin 4 of Chn (Ch.n Pin4 pin short circuit status monitoring) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x20n1: 00	Sub-index 00	Highest sub-index supported	USINT	0x02 (2dec)
0x20n1: 01	Sub-index 01	Short circuit status upon Pin4 configuration as output • 0: No short circuit information • 1: Short circuit	USINT	0x00 (0dec)
Index 0x20n1 Sensor_Short_Circuit Sensor supply short circuit of Chn (Ch. n Pin1 pin short circuit status monitoring) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**

0x20n1: 02	Sub-index 02	Pin1 short circuit status • 0: No short circuit information • 1: Short circuit	USINT	0x00 (0dec)
Index 0x2A02 System hardware monitor (System hardware status monitoring)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x2A02: 00	Highest sub-index supported	Highest sub-index supported	USINT	0x03(3dec)
0x2A02: 01	Activator power supply voltage detection	• 00: 18 V < UA < 30.2 V • 01: 11 V < UA < 18 V • 10: UA > 30.2 V • 11: US < 11 V	USINT	0x00 (0dec)
0x2A02: 02	System power supply voltage detection	• 00: 18 V < US < 30.2 V • 01: 11 V < US < 18 V • 10: US > 30.2 V • 11: US < 11 V	USINT	0x00 (0dec)
0x2A02: 03	MCU internal temperature detection	• 00: 0°C < Internal temperature < 85° C • 01: Internal temperature < 0°C • 10: Internal temperature > 85° C • 11: Reserved	USINT	0x00 (0dec)
Index 0x2A03 Device UA monitoring (Device UA power supply status monitoring)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x2A03	Device UA power supply status monitoring	• 0: Normal • 1: Abnormal	BOOL	0

Index 0x30n8 Output_Pin_2 Output Pin 2 of Chn (Ch.n Pin2 pin DO mode output process data) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x30n8: 00	Sub-index 00	Highest sub-index supported	USINT	0x01 (1dec)
0x30n8: 01	Sub-index 01	Pin2 output data • 0: Inactive • 1: Active	Bit	0
Index 0x60n0 IO_Link_Ch_n input (Ch.n IO-Link input process data) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x60n0: 00	Sub-index 00	Highest sub-index supported	USINT	0x00 (0dec)
0x60n0: 01	TxPDO 01	IO-Link input process data [00]	UDINT	0x00 (0dec)
...	...	...	...	...
0x60n0: 20	TxPDO 32	IO-Link input process data [32]	UDINT	0x00 (0dec)
Index 0x70n0 IO_Link_Ch_n output (Ch.n output process data) (for 0 ⩽ n ⩽ 7)				
Index	**Name**	**Definition**	**Data type**	**Default value**
0x70n0: 00	Sub-index 00	Highest sub-index supported	USINT	0x00 (0dec)
0x70n0: 01	RxPDO 01	IO-Link output process data [00]	UDINT	0x00 (0dec)
...	...	...	...	...
0x70n0: 20	RxPDO 32	IO-Link output process data [32]	UDINT	0x00 (0dec)

The following table lists configuration data of the IO-Link port.

Index 0x20n3 Ch.n Pin4 parameters in DO mode (for 0 ⩽ n ⩽ 7)					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**

0x20n3: 00	I/O setting of channels 1 to 8	Highest sub-indexes supported	USINT	RW	0x1 (1dec)
0x20n3: 01	Pin4 safety state	Pin4 is configured as the preset value for the safety state upon output. • 0x00: Output 0 upon communication error • 0x01: Output 1 upon a communication error • 0x02: Last output value used upon communication error	UDINT	RW	0x00 (0dec)
Index 0x20n2 Ch.n Pin2 parameters in DO mode (for 0 ⩽ n ⩽ 7)					
Index	**Name**	**Definition**	**Data type**	**Flag**	**Default value**
0x20n2: 00	I/O setting of channels 1 to 8	Highest sub-indexes supported	USINT	RW	0x1 (1dec)
0x20n2: 01	Pin2 safety state	Bit0 to Bit1 • 0: Output 0 upon communication error • 1: Output 1 upon communication error • 2: Last output value used upon communication error Bit 2 • 0: DO controlled by process data upon normal communication • 1: DO forced output upon normal communication	UDINT	RW	0x00 (0dec)

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.