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PS00007355A08

GR20-16EMNL
Digital Input and Output Module

User Guide

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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

The GR20-16EMNL is a transistor NPN module with 16 configurable digital inputs and outputs. Each of the 16 channels can be configured as either a sink-type input or output. The module can be used together with the Class A IO-Link master.

This guide describes the mechanical installation, electrical installation, configuration, commissioning, troubleshooting, and object list 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		Standards compliance
CE certification	EMC directive	2014/30/EU	**24 VDC products:** EN 61131-2 **220 VAC products:** EN 61131-2 EN 61000-3-2 EN 61000-3-3
	LVD directive	2014/35/EU	EN 61010-1 EN 61010-2-201
	RoHS directive	2011/65/EU amended by (EU) 2015/863	EN IEC 63000
UL/cUL certification	-		UL 61010-1 UL 61010-2-201 CAN/CSA-C22.2 No. 61010-1 CSA C22.2 NO. 61010-2-201
KCC certification	-		-
EAC certification	-		-

Certification	Directive		Standards compliance
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
GS20-ECT-8L Series High Protection IO-Link Master Module User Guide	PS00007354	This guide describes the product information, mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.
GR20-16EMNL Digital Input and Output Module User Guide (This guide)	PS00007355	This guide describes the mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.

■ Revision history

Date	Version	Revision
April 2026	A08	• Updated product images in *"2.1 Model and Nameplate" on page 19* and *"2.2 Components" on page 21*. • Updated *"1.1 General Safety Instructions" on page 7*.
November 2025	A07	• Updated product illustrations and product codes in *"2.1 Model and Nameplate" on page 19* and *"2.2 Components" on page 21*. • Updated the reference dimensions for cable connection in *"3.2 Installation Dimensions" on page 28*. • *"4.3 Terminal Wiring" on page 39* Added tightening torque specifications to "Terminal Wiring".
July 2025	A06	• Updated *"4.1 Cable Selection" on page 37*. • Made minor corrections.
December 2024	A05	**Addition** *" Appendix: Version Matching Information" on page 50*. **Revision** • Updated "Software specifications" in *"2.3 Technical Specifications" on page 23*. • Updated *" Troubleshooting" on page 43* . • Updated "0x49: Mode configuration (R/W)" in *"7.3 Product Data" on page 45*.

Date	Version	Revision
August 2024	A04	**Addition** Added *"3.1 Installation Precautions" on page 28*. **Revision** Updated "Undervoltage detection" in *"2.3 Technical Specifications" on page 23*.
November 2023	A03	Made minor corrections.
September 2023	A02	**Revision** • *" Troubleshooting" on page 43* Added the error code "0x7710" in the section. • *"7.3 Product Data" on page 45* Modified the index "0x42" and added the index "0x43" in the section.
January 2023	A01	Added environmental specifications. Made minor corrections.
November 2022	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

CAUTION

- 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

DANGER

- 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.

WARNING

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.

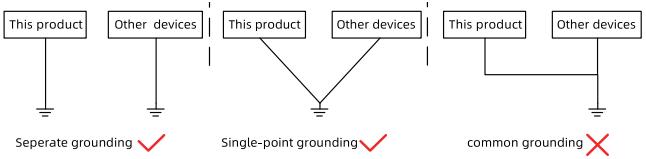


- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent the ventilation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



- 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.



- 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



- 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.



Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions:

- Always use the latest software version. If the product version is no longer supported or the latest version is not used, you will be exposed to increased risk of cyber attacks.
- Develop and maintain appropriate protective measures (including but not limited to antivirus software, firewalls, WAF, IPS/IDS, situational awareness system, identity authentication, data encryption) to prevent the files in mobile storage devices from being damaged by malware, and to protect the products, networks, systems, and interfaces from unauthorized access, tampering, hacking, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

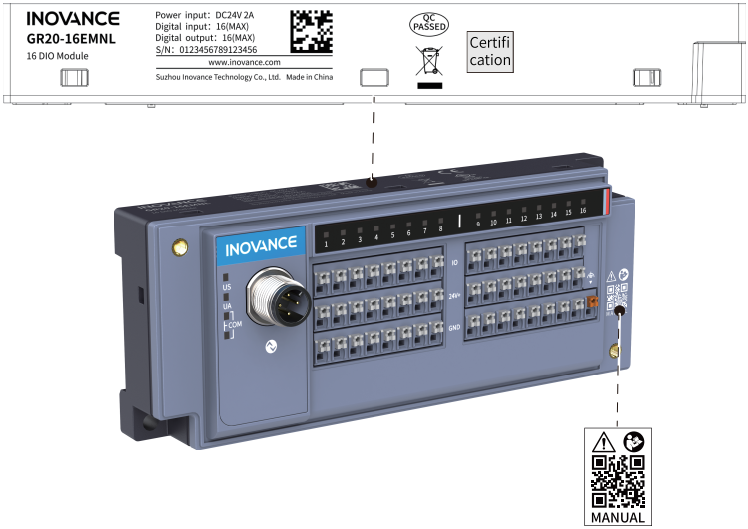
2 Product Information

2.1 Model and Nameplate

G R 20 - 16 E MN L

① ② ③ ④ ⑤ ⑥ ⑦

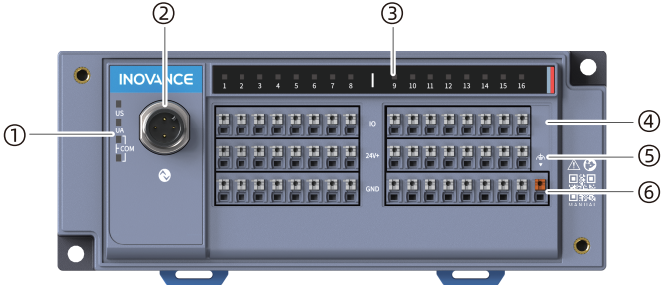
① **Product family** G: Inovance controller common module	⑤ **Module type** E: Logic I/O expansion module
② **Product type** R: Remote module	⑥ **I/O type** MN: Each channel can be configured as either a NPN input or output.
③ **Series** 20: 20 series	⑦ **Connection type** L: IO-Link
④ **Number of I/O channels** 16: 16 channels	-



Based on the above description of model number and nameplate, the relevant ordering data of this product is described in the table below.

Model	Description	Product code	Applicable model
GR20-16EMNL-INT	GR20 series transistor NPN module with configurable 16 digital outputs and inputs	01441068	Class A I/O-Link master

2.2 Components



No.	Name	Description			
①	Status indicator	US	System power supply indicator	Green	• Steady on: US power supply normal • Single flashing: 11 V < US voltage < 18 V • Flashing: US voltage > 30.2 V • Off: No power supply is provided.
		UA	Activator power supply indicator	Green	• Steady on: UA power supply normal • Single flashing: 11 V < UA voltage < 18 V • Flashing: UA voltage > 30.2 V • Off: No power supply is provided.
		COM	IO-Link communication indicator	Green/ Red	• Steady green: No communication • Slow flashing green: The IO-Link communication is normal. • Slow flashing red: The module has reported a fault. • Off: The module has no voltage.
②	IO-Link port	It is used for IO-Link data transmission. For details, see *"4.2 Terminal Assignment" on page 38*			
③	I/O indicator	1 to 16	I/O signal indicator	Green	• Solid on: State 1 • Off: State 0
④	I/O terminal	I/O	16 configurable terminals		

No.	Name	Description			
⑤	24 V terminal	24 V+	24 VDC power supply	-	-
⑥	Grounding terminal	• GND (gray) • PE (orange)	-	-	-

Note

- Single flashing: The indicator is on for 200 ms and off for 1000 ms, cycling continuously.
- Flashing: The indicator is on for 200 ms and off for 200 ms, cycling continuously.
- Slow flashing: The indicator is on for 900 ms and off for 100 ms, cycling continuously.

2.3 Technical Specifications

■ General specifications

Item	Specification
IP rating	IP20
Dimensions (W x H x D)	150 mm x 60 mm x 29 mm
Weight	152 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	2 A (@24 V)
US reverse polarity protection	Supported

Item	Specification
Undervoltage detection	Supported
Rated voltage of UA power supply	24 VDC (18 VDC to 30.2 VDC, common ground with US)
Maximum current of UA power supply	2 A (@24 V)
UA reverse polarity protection	Supported
Undervoltage detection	Supported

■ Input specifications

Item	Specification
Input type	Digital input
Input mode	NPN
Number of input channels	16
Input voltage class	24 VDC (18 VDC to 30.2 VDC)
Input current (typical)	4 mA (typical@24 V)
ON-state voltage	> 15 VDC
OFF-state voltage	< 5 VDC
Hardware response time (ON/OFF)	100 μs/100 μs
Input impedance	6.6 kΩ to 7.6 kΩ
Isolation	No
Input status display	When the drive state is inputted, the input indicator turns on.

■ Output specifications

Item	Specification
Output type	Digital output; transistor output
Output mode	NPN
Output channel	16

Item	Specification
Output voltage class	24 VDC (18 VDC to 30.2 VDC)
Output load (resistive load)	0.5 A/channel; 2 A/module
Output load (inductive load)	7.2 W/channel; 12 W/module
Output load (lamp load)	5 W/channel; 9 W/module
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.

■ Software specifications

Item	Specification
Input/output configuration	The I/O channel of the module can be configured as input or output based on the actual application.
Output state mode during fault stop	Output zero, last value, or preset value
Preset output value during fault stop	0 or 1
State reverse	The I/O channel state of the module can be inverted based on the actual I/O channel state. For example, assume that the external input is 0x00. When the state inversion function is disabled, the input process data is 0x00. When the state reverse function is enabled, the input process data is 0xFF.
Output status feedback	When the module is used for output, the output status is fed back to the master through aperiodic data.

Item	Specification
Undervoltage detection	When the voltage of the activator power supply and system power supply is below 18 V, the status is fed back to the master through aperiodic data. bit2 and bit3 indicate the activator power supply state, and bit0 and bit1 indicate the system power supply state.
Module type and basic information reading	When the master communicates with the slave normally, the master can read the basic information of the slave through the index. The basic information includes the Vendor ID, Device ID. Vendor name, Vendor text, Product name, Product ID, Hardware Revision, and Firmware Revision.
Mode configuration	The 0x49 parameter allows you to configure the work mode of the module. • Simple mode: Parameter configurations are not required and the parameter configuration function is invalid. All I/O channels can be used as inputs or outputs. • Expert mode: All parameters can be configured. By default, 16 inputs are configured. The I/O channels can be quickly configured as 8 inputs and 8 outputs or 16 outputs.
Diagnostic information acquisition (application layer)	Errors, alarms, and maintenance data are obtained through events and are sent from the slave to the master.
Diagnostic information acquisition (link layer)	The diagnostic information is acquired through aperiodic data.

2.4 Environmental Specifications

Item	Operation specification	Tranport specification	Storage specification
IP rating	IP20		
Pollution degree	2		
Overvoltage category	II		
Temperature	-20°C to +55°C	-40°C to +70°C	-25°C to +70°C

Item		Operation specification	Tranport specification	Storage specification
Humidity		10% to 95% RH, non-condensing		
Vibration	Frequency	5 Hz to 200 Hz	2 M2	1 M2
	Displacement	3.5 mm (direct installation) (< 9 Hz)		
	Acceleration	1 g (direct installation) (> 9 Hz)		
	Direction	3-axial directions		
Shock (collision)		15 g, 11 ms, half sine wave, 3 axial directions		
Altitude/air pressure		0 m to 2000 m	0 m to 3000 m (> 70 kPa)	

3 Mechanical Installation

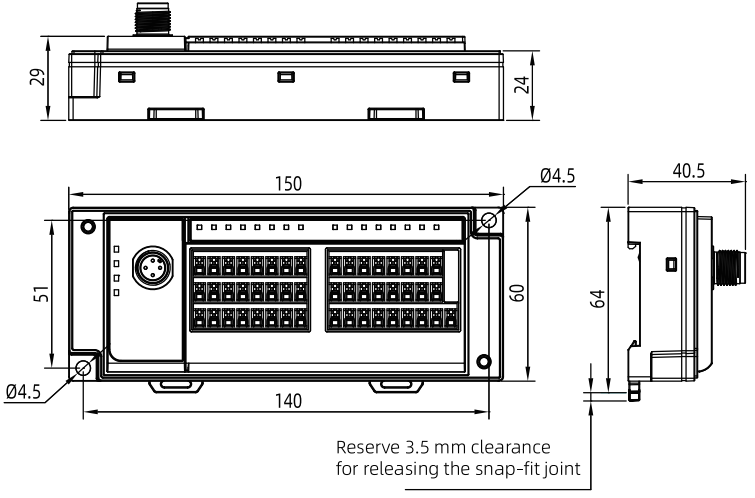
3.1 Installation Precautions

- Before installing or removing the module, ensure that the module is powered off.
- Do not hot swap the modules. Otherwise, the modules may be damaged by overcurrent or overvoltage, and the communication interface module or PLC may be subject to restart, user data loss or corruption.
- Do not let the casing or terminals of the module drop or be impacted to prevent module damage.

3.2 Installation Dimensions

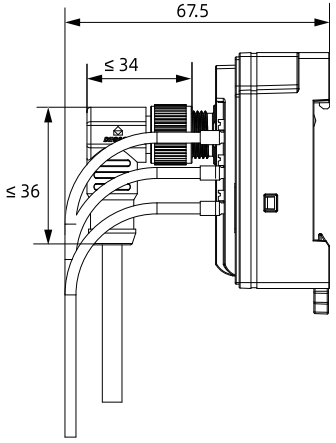
■ Module

The following figure describes the module installation dimensions (in mm).



■ Cable connection

The following figure describes the dimensions of the M12A four-conductor cable with the female 90 degree angle connector (in mm).



Note

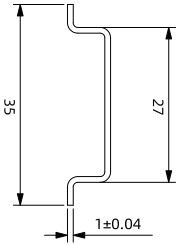
If you perform the wiring, ensure the installation height of IO-Link cables does not exceed 34 mm, as shown in the figure above. Failure to comply may result in improper installation of the dust cover (GR20-FCZ).

3.3 Module Installation

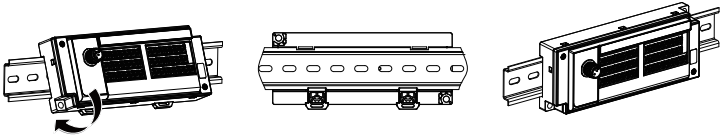
■ Module installation

You can install the module by using the DIN rail or by using screws.

- **DIN guide rail-based installation**
  The DIN rail must comply with IEC 60715 (width: 35 mm, thickness: 1 mm). The dimensions (unit: mm) are shown below.

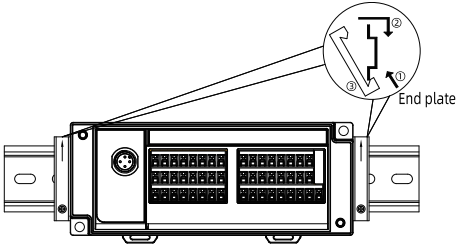


Hang the slot at the top of the module on the DIN rail and rotate the module backward until you hear a click, as shown in the following figure.



Note: After the module is installed, the DIN rail snap-fit joint will automatically move upwards to lock the module to the rail. If the snap-fit joint does not move upwards, press the top of the snap-fit joint upwards to lock the module.

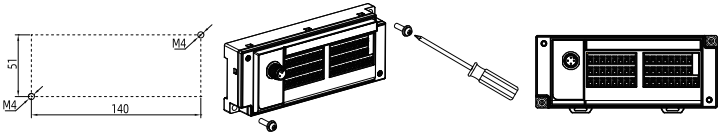
Mount a DIN rail end plate on both ends of the module. When you install a rail retainer, hook the bottom of the retainer to the bottom of the rail, rotate the retainer to make its top hook the top of the rail, and then tighten the screw to fasten the rail retainer, as shown in the figure below.



- **Screw-based installation**

  Screws and washers (optional) specifications: M4 screw length: ⩾ 14 mm; washer diameter: ⩽ 9 mm. Screw mounting hole specifications: 140 mm x 51 mm

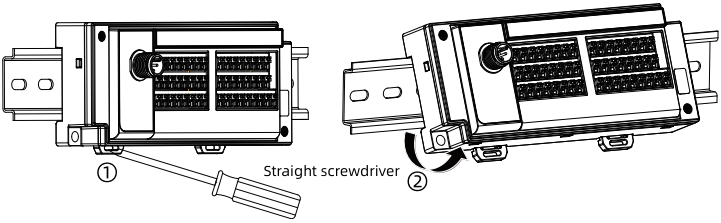
diagonal holes. See the following mounting hole dimensions and mounting diagram.



■ Module removal

- **DIN rail-based removal**

  Pry the DIN rail latch downwards with a tool such as a slotted screwdriver, and then rotate the module outward to remove it, as shown in the following figure.



- **Screw-based removal**

  Remove the M4 screws using a screwdriver, and then detach the module.

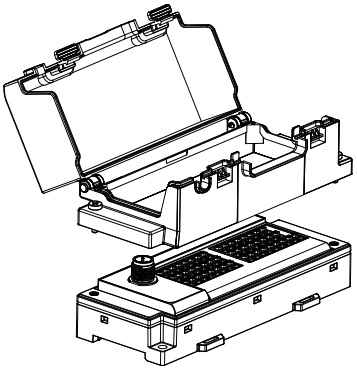
3.4 Dust Cover Installation (Optional)

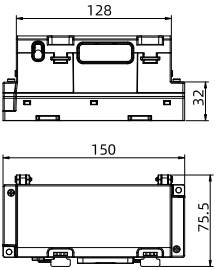
The GR20-FCZ series dust cover is available. The order data is shown in the following table.

Model	Description	Product code
GR20-FCZ	GR20-FCZ series dust cover	01480038

The dust cover is designed to prevent dust, splashing, and impact. It is made of transparent PC, which allows you to observe the running state of the module at any time. It is suitable for non-standard equipment and intelligent production lines.

Install the dust cover on the top of the module. Reserve cable outlet space for IO-Link and input/output cables. This allows you to open/close the dust cover without tools and maintain the module without removing the dust cover. The following figure shows the product diagram and dimensions.

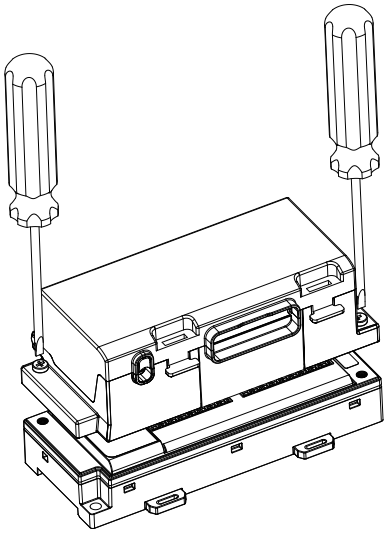




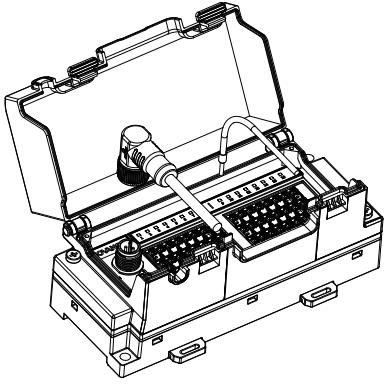
The dust cover comes with two captive screws. It supports two installation scenarios: Cable disconnection before installation and cable connection before installation.

■ Cable disconnection before installation

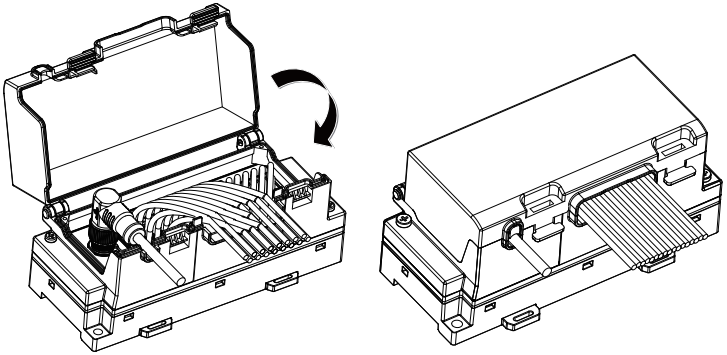
1. Use a Phillips screwdriver to secure the dust cover (torque: 5 kgf.cm) to the module with two screws.



2. Connect the IO-Link communication, I/O, 24 V power supply+, and grounding cables.

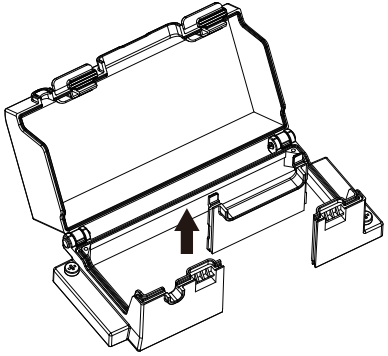


3. Rotate the upper cover of the dust cover in the direction of the arrow and lock the cover.

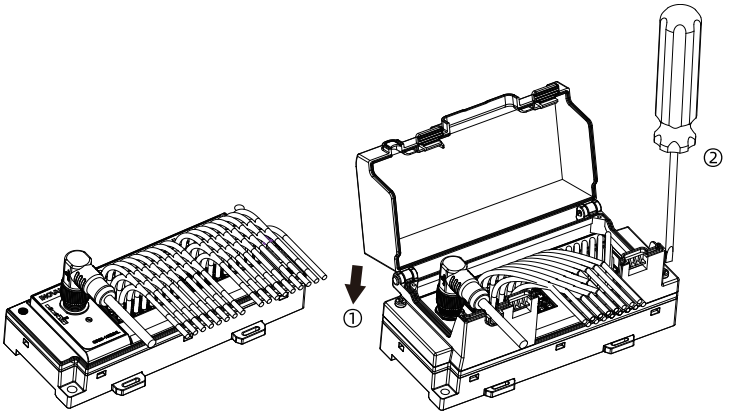


■ Cable connection before installation

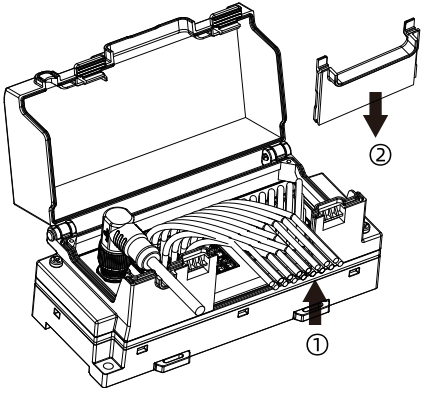
1. Take out the side cover of the dust cover in the direction indicated by the arrow.



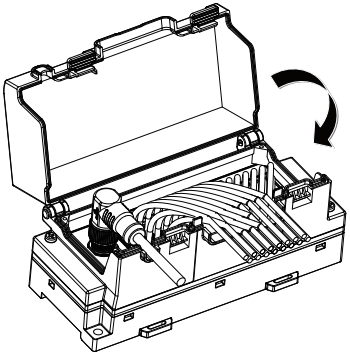
2. Route the IO-Link communication cable through the left front slot of the dust cover and route the I/O, 24 V power supply+, and grounding cables through the opening of the dust cover. Use a Phillips screwdriver to secure the dust cover to the module with two screws (torque: 5 kgf.cm).

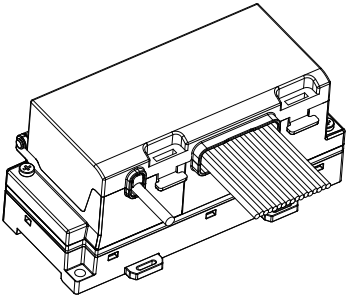


3. Lift up the I/O, 24 V power supply +, and grounding cables from the opening of the dust cover, insert the side cover back to the dust cover, and then route the cables through the cable slot of the side cover.



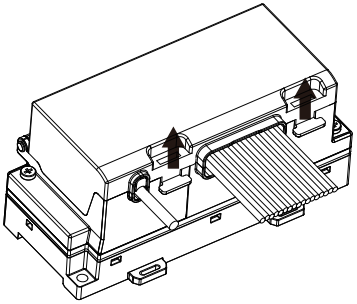
4. Rotate the upper cover of the dust cover in the direction of the arrow and lock the cover.

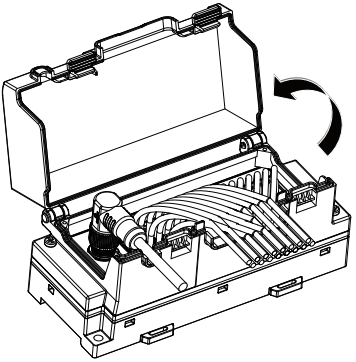




■ Cable maintenance

To maintain the cable, lift up the two snap-fit joints and open the upper cover of the dust cover.





4 Electrical Installation

4.1 Cable Selection

■ IO-Link cable

The GR20-FCZ dust cover must be used with Inovance cables or assembled CON-M12AFL4-L connectors. The M12A four-conductor cable with the female 90° angle connector is used, as described below.

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

Note

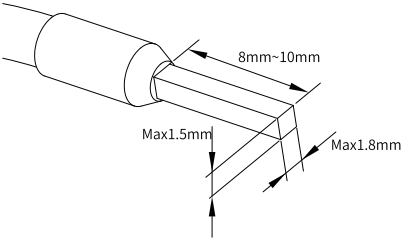
If you have additional requirements for IO-Link cables, contact Inovance for customization.

■ IO/24 V power supply +/grounding cable

The cable lug and sizes in the following table are provided for reference only. Adjustments can be made based on actual usage after proper calculation.

Supporting material	Cable diameter		KST		Suzhou Yuanli	
	mm^2	AWG	Model	Crimping tool	Model	Crimping tool
Tubular lug	0.3	22	E0308	KST2000L	0308	YAC-5
	0.5	20	E0508		0508	
	0.75	18	E7508		7508	
	1.0	18	E1008		1008	

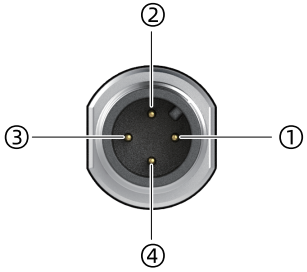
If another type of tubular lug is used, crimp the lug onto the stranded wire. The lug must meet the shape and dimensional requirements shown in the figure below.



4.2 Terminal Assignment

■ IO-Link port pins

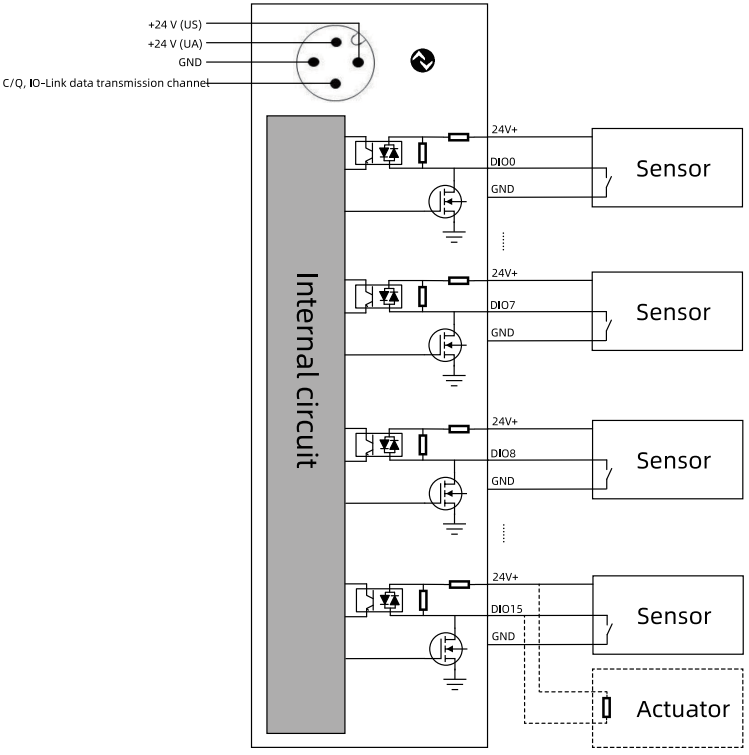
The IO-Link port is an M12A male port. The following figure describes pin numbers and the following table describes pins in details.



No.	Description
①	System and sensor power supply US, +24V
②	Activator power supply UA, +24V
③	GND
④	C/Q, IO-Link data transmission

4.3 Terminal Wiring

When the sensor is connected, configure the port as an input channel. When the activator is connected, configure the port as an output channel.



Note

This product adopts M12 A-coded connectors for 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.

Note

This module supports the ADP (adaptive DIO) technology developed by Inovance. Based on the type of devices connected:

- When a DI device is connected, the input state can be read by directly assigning a value to the variable "IO_Link_CHN_input byte" in the PLC program.
- When a DO device is connected, the output state can be read by directly assigning a value to the variable "IO_Link_CHN_output byte" in the PLC program.

The ADP technology automatically adapts to the port function. You can access the corresponding variables in the program without modifying the hardware configuration or adjusting the jumper.

5 Commissioning Examples

The configuration and commissioning are described when the module is used together with the GS20-ECT-8L high protection IO-Link master and the medium-sized PLC of Inovance. For details, see the configuration and commissioning section in the GS20-ECT-8L High Protection IO-Link Master Module User Guide.

6 Troubleshooting

The following table lists the error codes and their definitions.

Fault code	Type	Name	Remedy
0x4210	Warning	Overtemperature	The ambient temperature is high. Lower down the temperature before using the module.
0x4220	Warning	Low temperature	The ambient environment is low. Increase the temperature before using the module.
0x5011	Error	Loss of data for which retention upon power-off is configured	Configuration of retention upon power-off fails. Re-configure the parameter for retention upon power-off.
0x5100	Error	Device power supply error	The UA power supply of the module fails. Enable the power supply to pin 2 on the master or use the external UA power supply.
0x5110	Warning	System power supply overvoltage	The US power supply voltage of the module is higher than the normal operating voltage. Reduce the US power supply voltage.
0x5111	Warning	System power supply undervoltage	The US power supply voltage of the module is lower than the normal operating voltage. Increase the US power supply voltage.
0x7710	Error	Short circuit	The module encounters short circuit. Check the external wiring.
0x6320	Error	Incorrect parameter	The module parameters have been configured incorrectly. Configure the parameters correctly according to the product data.
0x6321	Error	Missing parameter	In expert mode, an input signal is detected for a channel configured as output. Modify the input/output configuration parameter 0x41 according to actual usage.

7 Object List

7.1 Protocol Stack Data

Baud rate	COM2 (38.4 kbaud)
Minimum cycle period	3 ms
IO-Link version	1.1.3
Minimum cycle time for process data	3 ms
Vendor ID	0x0659
Device ID	-

7.2 Process Data

Input data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
-	Input data refers to the data sent from the slave to the master.								

Output data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
-	Output data refers to the data sent by the master to the slave.								

7.3 Product Data

Index	Sub-index	Object name	Length	Range	Default value
0x07	-	Vendor ID	2 bytes	-	0x0659
0x08	-	Device ID	2 bytes		0xF42D10
0x10	0	Vendor name	8 bytes		INOVANCE
0x11	-	Vendor text	16 bytes		www.inovance.com
0x12	-	Product name	21 bytes		GR20-16EMNL
0x13	-	Product ID	7 bytes		01440355
0x14	-	Product text	23 bytes		GL20-16DIO:IO Sensor/Actuator Hub IP20 16Bit
0x16	-	Hardware Revision	4 bytes		1.0.0.0
0x17	-	Firmware Revision	4 bytes		1.0.0.0
0x40	0	Inversion	2 bytes	0x0000 to 0xFFFF	0x0000
0x41	0	Configuration Input/Output	2 bytes	0x0000 to 0xFFFF	0x0000
0x42	0	DIO0-DO07 Safe State	2 bytes	0x0000 to 0xFFFF	0x0000
0x43	0	DIO8-DIO15 Safe State	2 bytes	0x0000 to 0xFFFF	0x0000
0x44	0	Under Voltage	2 bytes	0x0000 to 0xFFFF	0x0000
0x47	0	Feedback	2 bytes	0x0000 to 0xFFFF	0x0000
0x48	0	Temperature detection	2 bytes	0x0000 to 0xFFFF	0x0050
0x49	0	Mode configurable	2 bytes	0x0000 to 0xFFFF	0x0000

Input data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8

Output data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8

0x40: Status reverse (R/W)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Default	0	0	0	0	0	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Default	0	0	0	0	0	0	0	0
	0 = Disable reverse; 1 = Enable reverse								

0x41: Input and output configuration (R/W)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Default	0	0	0	0	0	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Default	0	0	0	0	0	0	0	0
	0: Input; 1: Output								

0x42: Action of DIO0 to DIO7 (R/W) when a fault occurs	Byte	0						
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO3		DIO2		DIO1		DIO0	
	Subindex	4		3		2		1	
	Default	00		00		00		00	
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7		DIO6		DIO5		DIO4	
	Subindex	8		7		6		5	
	Default	00		00		00		00	
	00: Low level; 01: High level; 10: Last state; 11: Reserved								

0x43: Action of DIO8 to DIO15 (R/W) when a fault occurs	Byte	0						
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO11		DIO10		DIO9		DIO8	
	Subindex	4		3		2		1	
	Default	00		00		00		00	
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15		DIO14		DIO13		DIO12	
	Subindex	8		7		6		5	
	Default	00		00		00		00	
	00: Low level; 01: High level; 10: Last state; 11: Reserved								

0x44: System monitoring (R)	Byte	0						
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	-	-	T
	Default	-	-	-	-	-	-	-	0
	Byte	1						
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	UA		US	
	Default	-	-	-	-	0	0	0	0
	US: System power supply voltage. 00: Normal; 01: Below 18 V; 10: Above 30.2 VDC; 11: Reserved.								
	UA: Actuator power supply voltage. 00: Normal; 01: Below 18 V; 10: Above 30.2 VDC; 11: Reserved.								
	T: MCU temperature. 0: MCU temperature below setpoint; 1: MCU temperature above setpoint.								
	-: Reserved								

0x47: Output state feedback (R)	Byte	0						
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Subindex	8	7	6	5	4	3	2	1
	Default	0	0	0	0	0	0	0	0
	Byte	1						
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Subindex	16	15	14	13	12	11	10	9
	Default	0	0	0	0	0	0	0	0
	0: 0 is output; 1: 1 is output.								

0x48: MCU temperature setting (R/W)	Byte	1								0							
	Bit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pin	-		-		-		-		-		-		-		-	
	Subindex	-		-		-		-		-		-		-		-	
	Default	0x50															
	Function	Set MCU operating temperature detection upper limit (not storage temperature): 120°C															

0x49: Mode configuration (R/W)	Byte	0						
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	0016	0808	Mode configuration
	Default	-	-	-	-	-	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	-	-	-
	Default	-	-	-	-	-	-	-	-
	Mode configuration: 0 = Simple mode; 1 = Expert mode For pin 0808, 0 indicates quick configuration is disabled; 1 indicates quick configuration as 8 outputs and 8 inputs. This feature is valid only in expert mode. Pins 1 to 8 are set to the input mode, and Pins 9 to 16 are set to the output mode. When pin 0808 is configured, the configuration parameter 0x41 becomes invalid. For pin 0016, 0 indicates quick configuration is disabled; 1 indicates quick configuration as 16 outputs. This feature is valid only in expert mode. Pins 1 to 16 are set to the output mode. When pin 0016 is configured, the configuration parameter 0x41 becomes invalid. All parameters are available in expert mode, while in simple mode, parameters 0x41 to 0x43 are unavailable. If the configuration is not set as mentioned above, a 0x6320 error is reported, requiring you to revert to the last valid configuration.							

8 Appendix: Version Matching Information

You can get the firmware of the module and the firmware of communication interface module from Inovance technical support, and get InoProShop from *https://www.inovance.com*. The following table describes the version matching information.

Module Firmware Version	InoProShop Version
1.3.0.0	V1.7.3 SP2 or later

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.

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