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I. Overview

Thank you for purchasing the GR10-4DAE analog output remote module developed and manufactured independently by Inovance. This 4-channel analog output remote module is used with EtherCAT masters, such as AM600, for EtherCAT communication. It is powered by an external DC24V supply. It supports voltage and current output, with a resolution of up to 16 bits.

This guide describes the specifications, characteristics and using methods of the product. Please read this guide carefully before using to ensure safe usage. Visit our website ([www.inovance.com](http://www.inovance.com)) for the latest version of the guide.

II. Safety Instructions

Safety Precautions

1. Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
2. To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
3. The "CAUTION", "WARNING" and "DANGER" signs are only supplements to the safety instructions.
4. Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
5. Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

**WARNING** : Indicates that failure to comply with the notice may result in severe personal injuries or even death.

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

Please keep this guide well so that it can be read when necessary and forward this guide to the end user.

During control system design

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

- ◆ An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and an upper position limit and lower position limit interlocked circuit must be set in the external circuits of PLC to prevent damage to the machine.
- ◆ To ensure safe operation, for the output signals that may cause critical accidents, please design external protection circuit and safety mechanism;
- ◆ Once PLC CPU detects abnormality in the system, all outputs may be closed; however, when a fault occurs in the controller circuit, the output may not be under control. Therefore, it is necessary to design an appropriate external control circuit to ensure normal operation;
- ◆ If the PLC output units such as relays or transistors are damaged, the output may fail to switch between ON and OFF states according to the commands;
- ◆ The PLC is designed to be used in indoor electrical environment (overvoltage category II). The power supply must have a system-level lightning protection device, assuring that overvoltage due to lightning shock cannot be applied to the PLC power supply input terminals, signal input terminals and output terminals and so forth, so as to avoid damage to the equipment.

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Installation

- WARNING**
  - ◆ Installation must be carried out by the specialists who have received the necessary electrical training and understood enough electrical knowledge.
  - ◆ Disconnect all external power supplies of the system before removing/installing the module. Failure to do so may result in electric shock, module fault or malfunction.
  - ◆ Do not use the PLC where there are dust, oil smoke, conductive dust, corrosive or combustible gases, or exposed to high temperature, condensation, wind & rain, or subject to vibration and impact. Electric shock, fire and malfunction may also result in damage or deterioration to the product.
  - ◆ The PLC is open-type equipment that must be installed in a control cabinet with lock (cabinet housing protection >IP20). Only the personnel who have received the necessary electrical training and understood enough electrical knowledge can open the cabinet.

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

Wiring

- WARNING**
  - ◆ Wiring must be carried out by personnel who have received the necessary electrical training and understood enough electrical knowledge.
  - ◆ Disconnect all external power supplies of the system before wiring. Failure to comply may result in electric shock, module fault or malfunction.
  - ◆ Install the terminal cover attached to the product before power-on or operation after wiring is completed. Failure to comply may result in electric shock
  - ◆ Perform good insulation on terminals so that insulation distance between cables will not reduce after cables are connected to terminals. Failure to comply may result in electric shock or damage to the equipment.

- CAUTION**
  - ◆ Prevent dropping metal filings and wire ends drop into ventilation holes of the PLC at wiring. Failure to comply may result in fire, fault and malfunction.
  - ◆ The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.
  - ◆ To ensure safety of equipment and operator, use cables with sufficient diameter and connect the cables to ground reliably.
  - ◆ Ensure that all cables are connected to the correct interface. Failure to comply may result in module and external equipment fault.
  - ◆ Tighten bolts on the terminal block in the specified torque range. If the terminal is not tight, short-circuit, fire or malfunction may be caused. If the terminal is too tight, fall-off, short-circuit, fire or malfunction may be caused.
  - ◆ If the connector is used to connect with external equipment, perform correct crimping or welding with the tool specified by manufacturer. If connection is in poor contact, short-circuit, fire or malfunction may be caused.
  - ◆ A label on the top of the module is to prevent foreign matters entering the module. Do not remove the label during wiring. Remember to remove it before system operation, facilitating ventilation.
  - ◆ Do not bundle control wires, communication wires and power cables together. They must be run with distance of more than 100 mm. Otherwise, noise may result in malfunction.
  - ◆ Select shielded cable for high-frequency signal input/output in applications with serious interference so as to enhance system anti-interference ability.

Operation and Maintenance

- WARNING**
  - ◆ Maintenance & inspection must be carried out by personnel who have the necessary electrical training and experience.
  - ◆ Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
  - ◆ Disconnect all external power supplies of the system before cleaning the module or re-tightening screws on the terminal block or screws of the connector. Failure to comply may result in electric shock.
  - ◆ Disconnect all external power supplies of the system before removing the module or connecting/removing the communication wirings. Failure to comply may result in electric shock or malfunction.

- CAUTION**
  - ◆ Get with the guide and ensure safety before online modification, forcible output, and RUN/STOP operation.
  - ◆ Disconnect the power supply before installing/removing the extension card.

Disposal

- CAUTION**
  - ◆ Treat scrapped module as industrial waste. Dispose the battery according to local laws and regulations.

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III. Product Information

Model Number and Nameplate

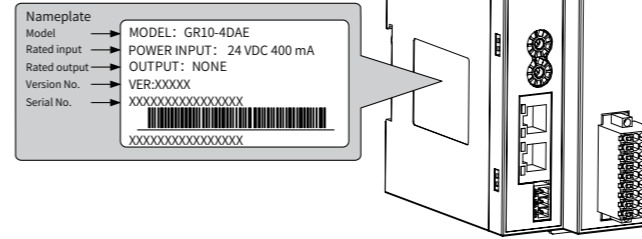
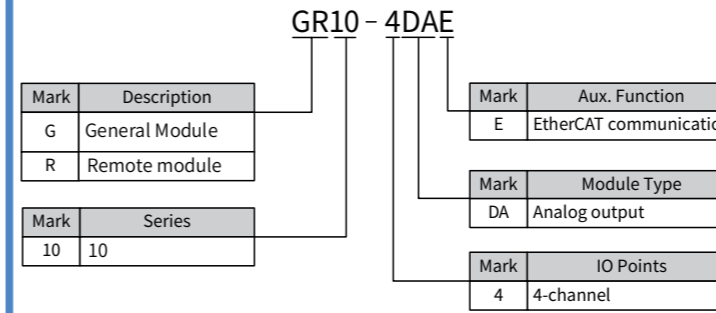
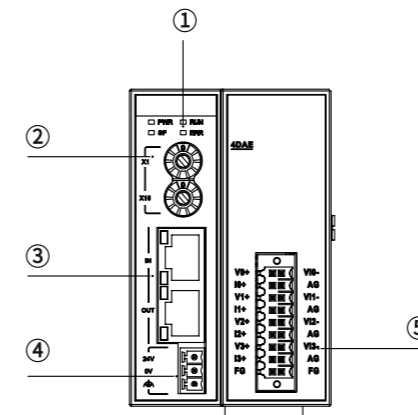


Figure1 Description of model and nameplate

Model	Category	Description	Applicable Model
GR10-4DAE	EtherCAT analog output module	4-channel AD remote module, supporting voltage/current analog output	AM600 series

External Interface



No.	Interface Name	Function
①	Signal indicators	PWR Power indicator Green ON when power supply is switched on
		RUN Running status indicator Green ON when the module is in normal operation
		SF Fault indicator Red ON when the module is faulty
		ERR State machine error indicator Red ON when an error occurs in the state machine
②	Address DIP switch	Slave address setting switch: ADDR1/ADDR0: address DIP switch, address is set in hexadecimal, slave decimal address = ADDR1*16+ADDR0*1 1-255
③	EtherCAT communication port	X1 IN: EtherCAT input X2 OUT: EtherCAT output for connecting back-end EtherCAT slaves
④	24 V power input terminal	For module power supply input
⑤	User output terminals	See "Electrical Design Reference" for details

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General Specifications

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

The specific performance indicators are as follows:

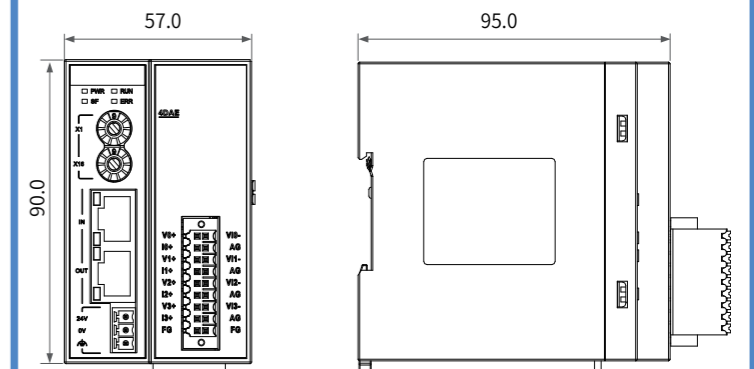
Item	Specifications
Communication protocol	EtherCAT protocol
Service supported	CoE (PDO, SDO)
Min. sync period	500 us (TYP)
Synchronization mode	Input and output synchronization or DC-distributed clock
Physical layer	100BASE-TX
Baud rate	100 Mbit/s (100Base-TX)
Duplex mode	Full duplex
Topological structure	Linear topological structure
Transmission medium	Network cables, see "Electrical Design Reference"
Transmission distance	Less than 100 m between two nodes
EtherCAT frame length	44-1,498 bytes
Process data	Max. 1486 bytes per frame
Synchronization jitter of two slave stations	< 1us
Update time	Approx. 500 us

Output specification

Item	Specifications
Output channels	4
Output connection method	Leaf spring terminal
Voltage output load	1 kΩ to 1 MΩ
Current load impedance	100 Ω to 600 Ω
Output voltage range	Bipolar: ±5 V, ±10 V; Unipolar: +5 V, +10 V
Output current range	4 mA to 20 mA, 0 mA to 20 mA
Resolution	16 bits
Conversion time	500 us/4 channels
Accuracy (normal temperature: 25° C)	Voltage: ±0.1%, current: ±0.1% (full ranges)
Accuracy (ambient temperature: 0 to 55° C)	Voltage: ±0.3%, current: ±0.8% (full ranges)
Voltage limits	±15 V
Current limits	±30 mA (transient), ±24 mA (average)
Maximum common mode voltage between channels	30 VDC
Isolation mode	I/O terminals isolated from power supply; Non-isolation between channels.
Output short-circuit protection	Yes

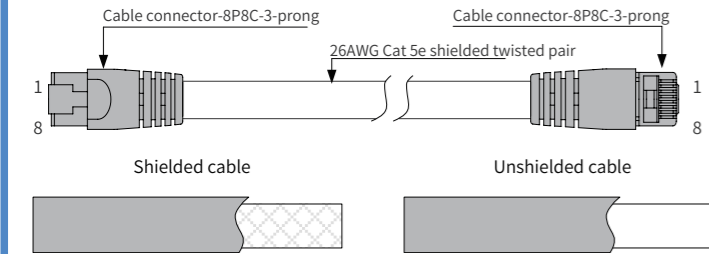
IV. Mechanical Design Reference

Mounting Dimensions



## V. Electrical Design Reference

### ■ Cable Preparation



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

### ■ Signal pins

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

### ■ Length requirements:

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

### ■ Technical requirements:

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

Item	Specifications
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Complied standards:	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI A Bulletin TSB, EIA/TIA SB40-A&TSB36
Conductor cross section	AWG26
Conductor type	Twisted pair
Pair	4

### ■ Communication Wiring

#### 1) EtherCAT connection

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

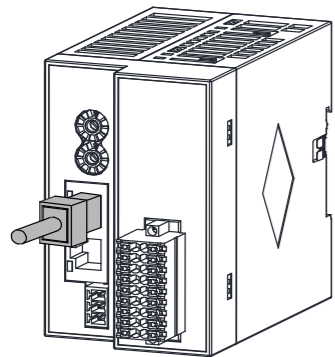
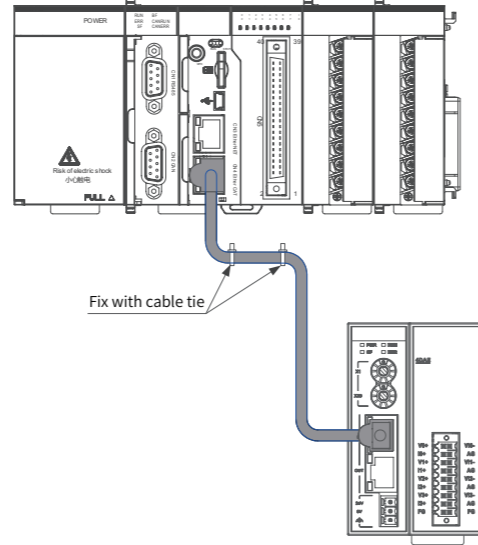


Figure2 Cable connection diagram

#### 2) Requirements for securing communication cable

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



### 3) Fault Indication and troubleshooting for EtherCAT remote communication expansion module

EtherCAT slave station:

LED indicator	Indication	Solution
RUN	OFF	No connection between EtherCAT master and slave Check configuration and parameter assignment; Check the communication address Check that the length and other specifications of the network cable are as specified.
	Blinking	EtherCAT slave is in a state other than OP Check slave configuration for any missing, faulty or unconfigured module.
ERR	Blinking	No data exchange between EtherCAT master and slave Check that the cable connector is inserted correctly; Check that the network cable is intact; Re-power on.
SF	Steady ON	Output channel is faulty Check the output channel for short circuit or overtemperature.

### ■ Cable Selection

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

### ■ Cable preparing procedures:

Remove the insulation of the cable so that a length of 11-14 mm of the conductor is exposed, and put the cable through a cable marking sleeve.

Insert the exposed end into the hole of the cable lug, and then crimp it with recommended crimping tool.

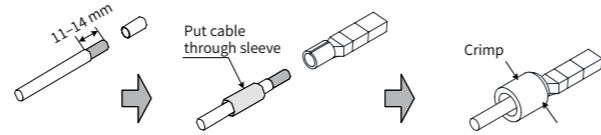
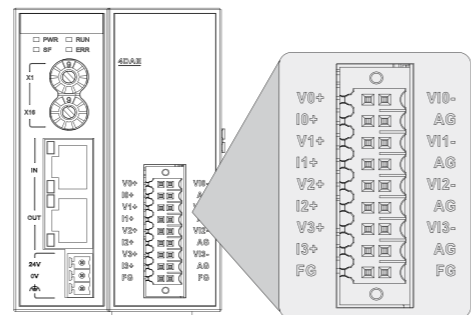


Figure3 Cable preparation

### ■ Terminal Layout

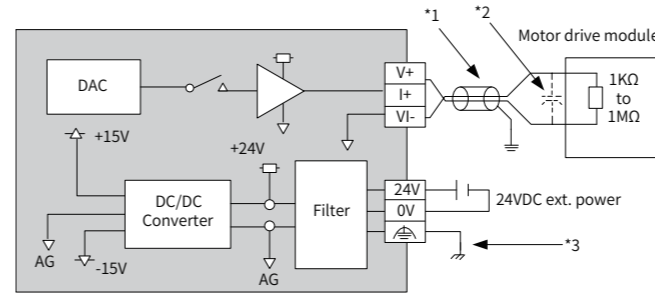


## ■ Terminal Definition

No.	Network Name	Type	Function	Remarks
1	V0+	Output	V+ of channel 0	Voltage output
2	VI0-	Output	V-/I- of channel 0	Voltage/current output
3	I0+	Output	I+ of channel 0	Current output
4	AG		Analog ground	Internal analog ground
5	V1+	Output	V+ of channel 1	Voltage output
6	VI1-	Output	V-/I- of channel 1	Voltage/current output
7	I1+	Output	I+ of channel 1	Current output
8	AG		Analog ground	Internal analog ground
9	V2+	Output	V+ of channel 2	Voltage output
10	VI2-	Output	V-/I- of channel 2	Voltage/current output
11	I2+	Output	I+ of channel 2	Current output
12	AG		Analog ground	Internal analog ground
13	V3+	Output	V+ of channel 3	Voltage output
14	VI3-	Output	V-/I- of channel 3	Voltage/current output
15	I3+	Output	I+ of channel 3	Current output
16	AG		Analog ground	Internal analog ground
17	FG	-	Shielding ground	Internally connected to housing ground
18	FG	-	Shielding ground	Internally connected to housing ground

### ■ External Wiring

#### (a) Voltage output



#### (b) Current output

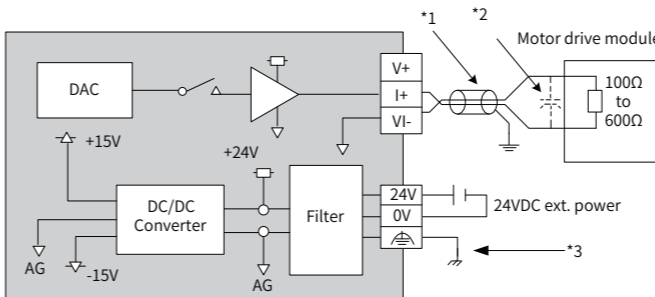


Figure4 Module wiring diagram

\*1 Use 2-core shielded twisted pair cable for analog signal.

\*2 If noises or ripples are generated in external wiring, connect a capacitor of 0.1 to 0.47 μ F25V between terminals V+/I+ and VI-.

\*3 The module should be mounted on a metal bracket. Ensure that the metal spring piece at the bottom of the module is in good contact with the bracket grounded and the ground terminal of the module is reliably connected.

### ■ Wiring Precautions

Do not bundle the cable together with AC cable, main lines, high voltage cable and so forth, otherwise it may result in an increased noise, surge and induction.

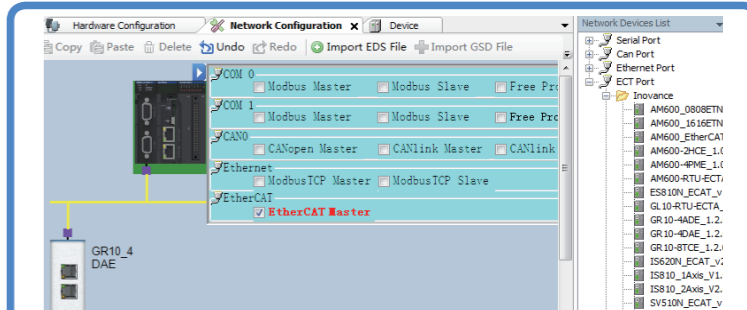
Apply single-point grounding for the shielding of shielded cable and solder sealed cable.

Tubed and solderless crimp terminal cannot be used with terminal block. Using marking sleeve or insulation sleeve to cover the cable connector part of the crimp terminals is recommended.

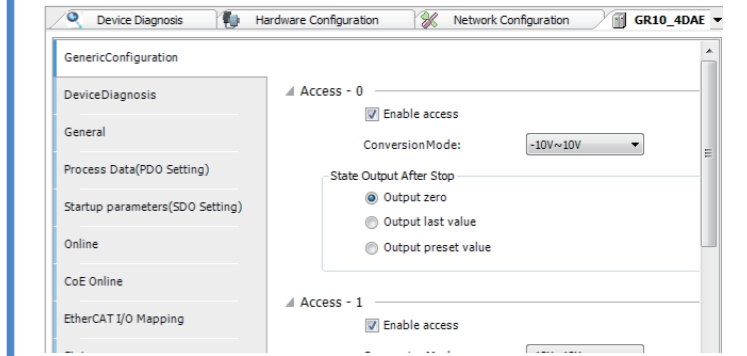
## VI. Programming Example for GR10-4DAE Module

The following is an example where AM600 is used as the main control module and GR10-4DAE channel 0 outputs +10V:

#### 1) Create a project and configure hardware as follows:



2) In "General Configuration", enable Channel-0, and configure "Conversion Mode" as "-10 V~10 V" voltage output. "Channel filter coefficient".

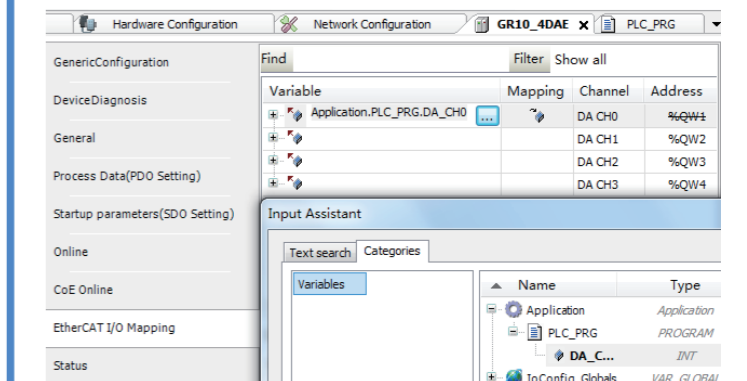


3) Program with ST programming language as shown in the figure below. First define a variable DA\_CH0 and assign 20000 to it. As -10 V~10 V correspond to the numbers from -20000 to 20000, the output voltage of channel 0 will be +10 V.

```

Network Configuration
PLC_PRG x GR10_4DAE
1 PROGRAM PLC_PRG
2 VAR
3   DA_CH0:INT;
4 END VAR
1 DA_CH0 := 20000;
    
```

4) Map DA\_CH0 to channel 0 of the configured 4DAE module.



5) After successful compiling, download the project and run it.

## INVANCE Warranty Agreement

The warranty period of the product is 18 months (subject to information indicated by the barcode on the product). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Invance will be responsible for free maintenance.

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

- 1) Improper use or uninstallation/repair/modification without prior permission
- 2) Fire, flood, abnormal voltage, other disasters, and secondary disasters
- 3) Hardware damage caused by dropping or transportation after procurement
- 4) Failure to operate the product by observing the User Guide provided by Invance
- 5) Faults and damages caused by external factors (such as peripheral devices)

The maintenance fee is charged according to the latest Maintenance Price List of Invance. The Product Warranty Card is not re-issued. Keep the card and present it to the maintenance personnel when seeking maintenance.

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

You are assumed to agree on terms and conditions of this warranty agreement by purchase of the product. This agreement shall be interpreted by Suzhou Invance Technology Co., Ltd.

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