INOVANCE

User Guide

GR10-8PBE

EtherCAT Slave Probe Module

19011255A01

1

Thank you for purchasing the GR10-8PBE EtherCAT touch probe module developed and manufactured independently by Inovance.

This module is an expansion module based on the EtherCAT bus. It supports 8-channel probe input and 6-channel output. The inputs include counter inputs, probe digital inputs and ordinary digital inputs and the outputs are all ordinary digital OC outputs. The easy-to-use module, which supports multiple high-precision probe capture modes, can be used as a technology module for EtherCAT-based multi-axis motion control applications. 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) for the latest version of the guide.

Safety Instructions

Safety information and precautions are identified into two grades: Warning and Caution. Please make sure to operate properly with adequate safety assurance.

WARNING : indicates that failure to comply may cause death or serious injury;

CAUTION : indicates that failure to comply with the notice will result in minor or moderate personal injury or equipment damage.

In some cases, failure to follow "Cautions" may also lead to serious consequences. Please make sure to follow both warnings and cautions, otherwise, it may cause death or serious injury, as well as product and relevant equipment and system damage.

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

WARNING

- Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
- Add 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.

CAUTION

- An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and a 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's 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's power supply input terminals, signal input terminals and output terminals and so forth, so as to avoid damage to the equipment.

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.
- Wire the module correctly after making clear of the connector type. 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.

Product Information

■ Model Number and Nameplate

G R 10 - 8 PB E

Mark	Description
G	General Module

Mark	Description
R	Remote module

Mark	Series
10	10

Mark	Aux. Function
E	EtherCAT communication

Mark	Type
PB	Probe

Mark	Channel
8	8

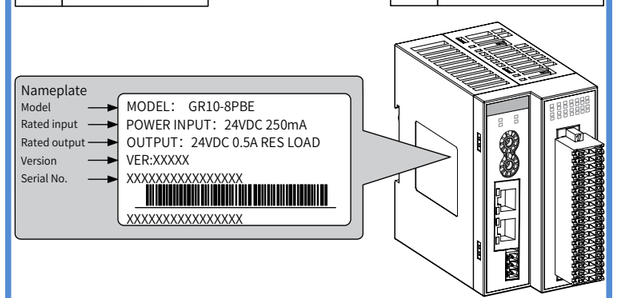


Figure 1 Description of model number and nameplate

Model	Category	Description
GR10-8PBE	EtherCAT slave touch probe module	GR10 series 8-channel EtherCAT touch probe module

■ External Interface

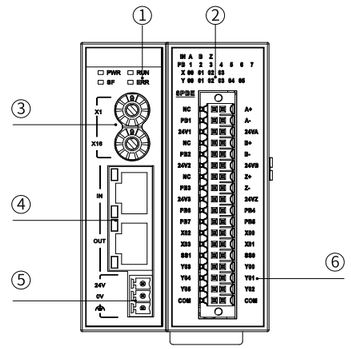


Figure 2 Diagram of module interfaces

Interface Name				
1.Signal indicator	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	Is ON when the module is faulty
	ERR	State machine error indicator	Red	Is ON when an error occurs in the state machine
2. I/O signal indicator	For input and output signals ON: signal active OFF: signal inactive			
3. Address DIP switch	Slave address setting switch: ADDR1/ ADDR0: address DIP switch, address is set in hexadecimal, slave decimal address = ADDR1*16+ADDR0*1 (address: 1-255)			
4. EtherCAT port	X1 IN: EtherCAT input			
	X2 OUT: EtherCAT output for connecting back-end EtherCAT slaves			
5. 24 V power supply	For module power supply input			
6. User output terminals	See "Electrical Design Reference" for details			

■ General Specifications

Item	Specifications
Power supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%), can be externally provided by the user
Communication protocol with the CPU module	EtherCAT
EtherCAT communication speed	Up to 100 Mbps to adapt to EtherCAT master communication speed
Network port/network cable	Standard Ethernet port with standard Ethernet cables (Cat 5e cable)
Station number range	1–255, the internal address is automatically arranged by the network bus connection sequence

■ Input specifications:

The inputs include 3 counter inputs, 8 probe digital inputs and 4 ordinary digital inputs, with a 24 VDC input voltage. The input signal can be bipolar voltage, that is, when the absolute value of the voltage is below 5.0 V, it is defined as OFF, and when the absolute value is above 15.0 V, it is defined as ON. 5.0 V–15.0V is undefined.

Item	Counter Input (A, B)	Probe Input (Z, PB1-PB3)	Probe Input (PB4-PB7)	Ordinary Input (X0-X3)
Digital Input Mode	Differential	Single-ended sink)	Single-ended (sink/ source)	

Item		Counter Input (A, B)	Probe Input (Z, PB1-PB3)	Probe Input (PB4-PB7)	Ordinary Input (X0-X3)
Electrical Data	Input voltage class	5 VDC, differential drive level compliant with EIA RS-422-A (equivalent to AM26LS31)	24 VDC (–15% to +20%)		
	Input impedance		3.3 k	3.3 k	4.3 k
	Input is ON		Input current is above 5 mA		
	Input is OFF		Input current is below 1.5 mA		
Filter	Digital filter	Single, up to 200 kHz Supports AB phase quadruple frequency, up to 800 kpps	None		
	ON/OFF response		1 us	1 us	10 ms
High-speed function			/	/	
Common terminal		Each terminal has a separate common terminal		SS0 and SS1, 4 terminals share one common terminal	

NOTE

- When all inputs are ON, the voltage must not exceed 26.4 V.
- Duty cycle is 40% -60% at high speed input
- A sink input is achieved by shorting the input common terminal with 24 V, and a source input is achieved by shorting the input common terminal with 0 V.

■ Output specification:

An active output ("ON") indicates a closed state, and an inactive output ("OFF") indicates an open state.

Item		Comparison Output (Y0–Y1)	Ordinary Output (Y2–Y5)
Circuit supply voltage		DC: 5 V–24 V	
Output type		Transistor NPN OC	
Insulation		Optocoupler isolation	
Open-circuit leakage current		Less than 0.1 mA/30 VDC	
Min. load		5 mA	
Max. output current	Resistive load	0.8 A/4 points; 0.5 A/point	
	Inductive load	12 W/24 VDC	
	Lamp load	1.5 W/24 VDC	
ON response time		1 us	0.5 ms
OFF response time			
high-speed output frequency		/	
Output common terminal		Three terminals share one common terminal, and groups are isolated with each other	
Fuse		None	

Mechanical Design Reference

■ Mounting Dimensions

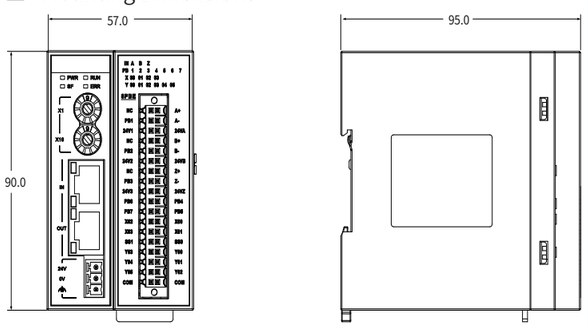
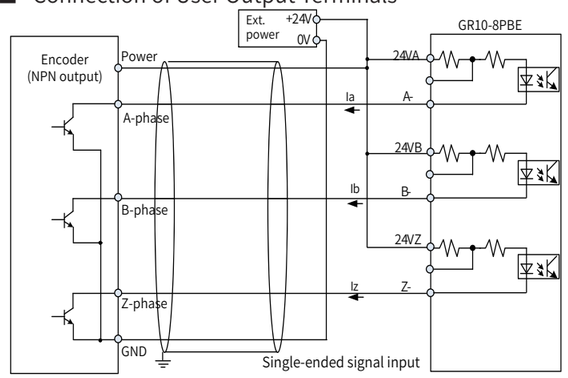
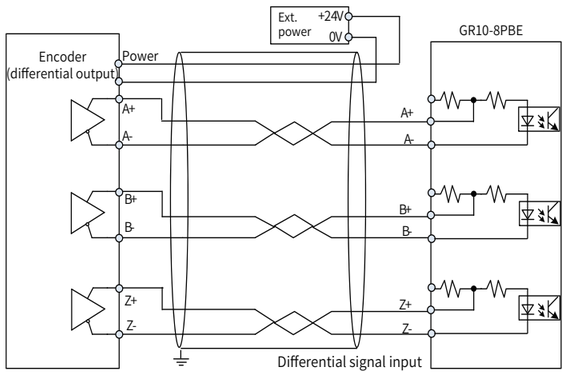


Figure 3 Mounting dimensions (in mm)

Electrical Design Reference

■ Connection of User Output Terminals





※Cable Selection

Material Name	Model	Cable Diameter		Manufacturer	Crimping Tool
		MM2	AWG		
Tubular lug	GTVE07512	0.75	21	Suzhou Yuanli	YAC-5

Those cable lugs are applicable to this module, and the cable rated temperature is required to be above 75°C.

■ Cable Preparing Procedures

1) 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.
2) Insert the exposed end into the hole of the cable lug, and then crimp it with recommended crimping tool.

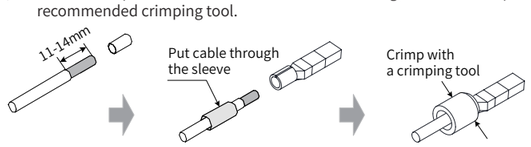


Figure 4 Diagram of cable preparing

■ Terminal Layout

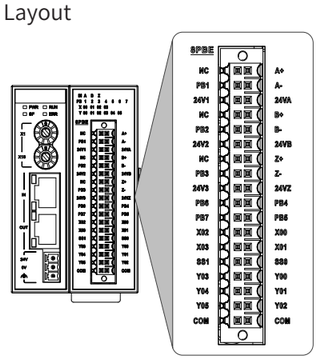
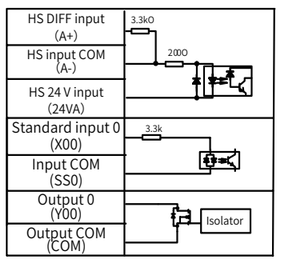


Figure 5 Terminal layout

■ External Wiring

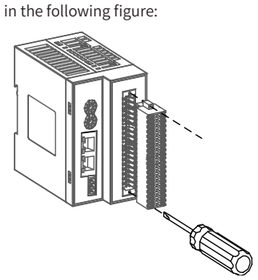
Ext. Wiring	Signal Column B	No.		Signal Column A	Ext. Wiring
24VDC	Disconnected (NC)	2	1	HS DIFF input (A+)	24VDC
	SE Probe input 1 (PB1)	4	3	HS DIFF input (A-)	
	24V COM (24V1)	6	5	PH-A 24V SE input (24VA)	
24VDC	Disconnected (NC)	8	7	HS DIFF input (B+)	24VDC
	SE Probe input 2 (PB2)	10	9	HS DIFF input (B-)	
	24V COM (24V2)	12	11	PH-B 24V SE input (24VB)	
24VDC	Disconnected (NC)	14	13	HS DIFF input (Z+)	24VDC
	SE Probe input 3 (PB3)	16	15	HS DIFF input (Z-)	
	24V COM (24V3)	18	17	PH-Z 24V SE input (24VZ)	
24VDC	Probe input 6 (PB6)	20	19	Probe input 4 (PB4)	24VDC
	Probe input 7 (PB7)	22	21	Probe input 5 (PB5)	
	Standard input (DI X02)	24	23	Standard input (DI X00)	
	Standard input (DI X03)	26	25	Standard input (DI X01)	
	Input COM (SS1)	28	27	Input COM (SS0)	
Load Load Load 24VDC	Standard output (DO Y03)	30	29	Standard output (DO Y00)	Load Load Load 24VDC
	Standard output (DO Y04)	32	31	Standard output (DO Y01)	
	Standard output (DO Y05)	34	33	Standard output (DO Y02)	
	Output COM (COM)	36	35	Output COM (COM)	

■ Internal Equivalent Circuit



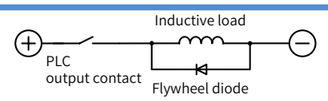
● Precautions

After the I/O terminal block is mounted to the user terminal, fix it with a torque of 0.2–0.25 Nm, as shown in the following figure:



● Contact protection in the case of inductive load:

when the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, you can use a parallel flywheel diode with the load to extend the lifetime of the product. The freewheel diode must satisfy: ① reverse voltage is 5 to 10 times of load voltage; ② forward current is larger than load current.

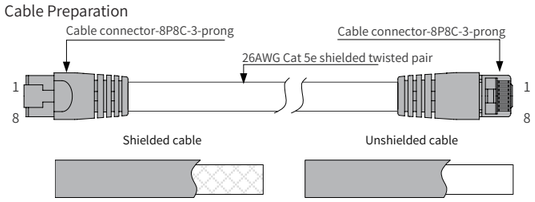


NOTE

1) Do not bundle the terminal connection cables together with power cables (high voltage, large current) which produce strong interference signals. Separate it from other cables and avoid cabling in parallel.
2) Use recommended cables and adapter boards. It is recommended to use shielded cables as terminal cables for increased anti-interference ability.

■ EtherCAT Cable Selection

● Cable Preparation



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

● Signal pins

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

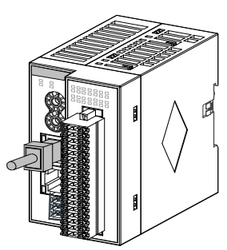
Length requirements: According to FastEthernet technology, when an EtherCAT bus is used, the length of the cable between devices must not exceed 100 meters. Exceeding this length will attenuate the signal and affect communication.

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:

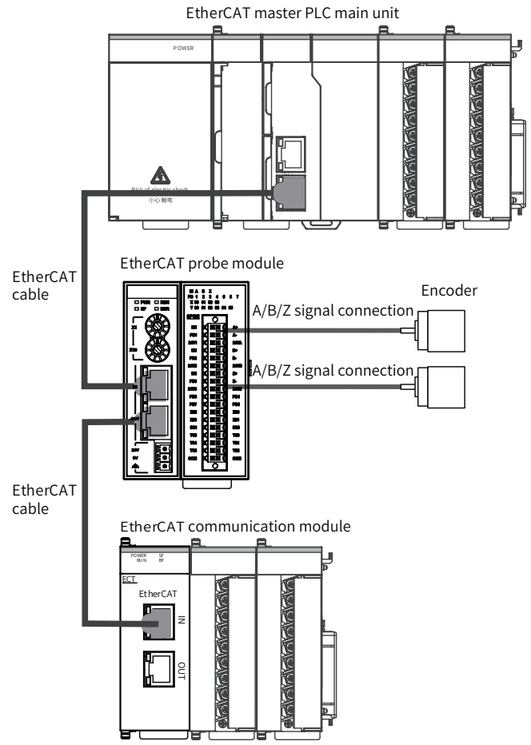
Item	Specifications
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Complied standards:	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Conductor type	Twisted pair cable
Pair	4

■ Communication Wiring

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



● Wiring diagram of the communication system



NOTE

To protect the communication cable from any tension and to ensure communication stability, fix the cable end which is near the device before communication.

■ Fault Indication and Troubleshooting for EtherCAT Slave Station Module

LED indicator		Indication	Solution
RUN	OFF	EtherCAT master and slaves are initialized	Check configuration and parameter assignment; check comm. address Check that the length and other specs 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	Comm. error btw. EtherCAT master and slave	Check that the master and slave parameter configurations are correct.
SF	Steady ON	Output channel is faulty	For details, see the application manual of the module.

INOVANCE Warranty Agreement

The warranty period of the product is 18 months (The period is subject to the date information indicated by the barcode on the product, or the terms and conditions of the purchase contract if otherwise specified). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inovance will be responsible for free maintenance.
Within the warranty period, maintenance will be charged for the damages due to:

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 Manual provided by Inovance
5) Faults and damages caused by factors outside of the product (such as peripheral devices)

If there is any failure or damage to the product, correctly fill out the Product Warranty Card.
The maintenance fee is charged as the latest Maintenance Price List of Inovance.
The Product Warranty Card is not re-issued. Keep the card and present it to the maintenance personnel 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 Inovance.

Suzhou Inovance Technology Co., Ltd.
Address: No.16 Youxiang Road, Yuexi, Wuzhong District,
Suzhou, 215104
Service hotline: 4000-300124
Website: http://www.inovance.com