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MA01-XHXX0x00-V2(P) Differential Analog Series

Chengdu Ebyte Electronic Technology Co.,Ltd.

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1 Introduction

1.1 Product Overview

The MA01-XHXX differential analog input series is a high-precision differential analog input module based on the MODBUS RTU protocol, designed specifically for industrial automation, process control, and data acquisition systems. This series employs advanced differential signal input technology, effectively suppressing common-mode noise and significantly improving signal measurement accuracy and system reliability in complex electromagnetic environments.

Product design concept

This product is based on the concept of intelligent industrial manufacturing and is committed to providing users with highly reliable, high-precision, and easily integrated analog input solutions. Through a differential input architecture and multiple anti-interference designs, it ensures stable operation in harsh industrial environments.

Core Values

- **Wide market adaptability** : Offers 1 to 12 channels to meet the differential analog input needs of different application scenarios.
- **Leading anti-interference technology** : The differential input structure effectively suppresses common-mode noise, ensuring high stability and accuracy of signal acquisition.
- **Comprehensive product portfolio** : Filling product line gaps, building a complete analog input matrix covering both isolated and non-isolated types, and supporting system integration and expansion.

1.2 Application Areas

Industrial Automation

- PLC system analog signal expansion

- Distributed Control System (DCS)

Factory automation monitoring system

Process control

- Temperature, pressure, and flow monitoring

- Liquid level measurement and control

- Process parameter acquisition

Data acquisition system

- Environmental Monitoring Station

- Energy Management System

- Scientific research data collection

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Building Automation

HVAC system monitoring

- Lighting control system

- Security system integration

1.3 Functional Features

Signal processing characteristics

✧ **Differential input structure** : effectively resists common-mode interference, improves signal quality and system reliability.

✧ **Multi-signal compatibility** : Supports voltage signals (0-5V/0-10V) and current signals (0-20mA/4-20mA)

✧ **Configurable filtering** : Supports 1-16 levels of digital filtering, balancing response speed and stability.

✧ **High-speed sampling** : 40Hz sampling frequency, meeting real-time control requirements.

Communication characteristics

✧ **Standard Protocol** : Supports the MODBUS RTU protocol, ensuring compatibility with mainstream systems.

✧ **Flexible configuration** : Supports multiple baud rates (1200-115200 bps) and communication parameters.

✧ **Reliable transmission** : RS485 interface, supporting long-distance communication (up to 1200 meters).

✧ **Multi-device networking** : Supports bus-type network topology, with up to 247 devices.

Features of use

- **Plug and play** : Pre-configured with factory settings, ready to use upon power-up.
- **Easy to configure** : Provides dedicated configuration software with graphical parameter settings.
- **Easy maintenance** : LED status indicators provide intuitive fault diagnosis.
- **Flexible installation** : Standard DIN rail mounting saves installation space.

1.4 Product Model

Number of channels	Non-isolated models	Isolation model
Route 1	MA01-XHXX0100-V2	MA01-XHXX0100-V2P
Route 2	MA01-XHXX0200-V2	MA01-XHXX0200-V2P
Route 4	MA01-XHXX0400-V2	MA01-XHXX0400-V2P
Route 6	MA01-XHXX0600-V2	MA01-XHXX0600-V2P
Route 8	MA01-XHXX0800-V2	MA01-XHXX0800-V2P
Route 10	MA01-XHXX0A00-V2	MA01-XHXX0A00-V2P
Route 12	MA01-XHXX0C00-V2	MA01-XHXX0C00-V2P

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1.5 Selection Guide

Channel number selection

- Determined based on the actual number of measurement points; it is recommended to reserve a 10-20% margin for expansion.

- Considering the balance between system integration and cost

Isolation options

- Non-isolated type: Lower cost, suitable for clean power environments.

- Isolated type: High security, suitable for complex industrial environments, recommended as the preferred choice.

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2 Product Functions

2.1 Core Functions

Analog signal acquisition : High-precision differential analog signal acquisition

Signal conversion : Supports voltage and current signal types

Data communication : Data transmission based on the MODBUS RTU protocol

Parameter configuration : Flexible channel configuration and parameter settings

Status indicators : LED indicator lights show the operating status of the equipment.

2.2 Supported Signal Types

voltage signal

- 0-5V (Differential Input)
- 0-10V (differential input)

Current signal

- 0-20mA (differential input)
- 4-20mA (differential input)

2.3 Communication Function

- **Protocol Standard** : MODBUS RTU
- **Supported function codes** : 0x03, 0x04, 0x06, 0x10
- **Device address** : 0-247 (configurable)
- **Baud rate** : 1200-115200 bps (configurable)

2.4 Communication Performance Indicators

Communication reliability

Error detection: CRC-16 checksum

- Automatic retransmission: Supports error retransmission mechanism

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Network Topology

- Maximum number of nodes: 247 devices

- Maximum communication distance: 1200 meters (using standard RS485 cable)

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3 Technical Specifications

3.1 Basic Parameters

Parameter Items	Technical indicators
power supply voltage	DC 8-28V
Operating temperature	-40°C ~ +85°C
Storage temperature	25 °C
relative humidity	5% to 95% RH

3.2 Analog Input Parameters

Parameter Items	Technical indicators
Input type	Differential input
Number of input channels	Routes 1/2/4/6/8/10/12
Voltage measurement range	0-5V / 0-10V
Current measurement range	0-20mA / 4-20mA
Measurement accuracy	3‰
resolution	16-bit
Sampling frequency	40Hz
Input impedance	260 Ω

3.3 Communication Parameters

Parameter Items	Technical indicators
Communication interface	RS485
Communication Protocol	MODBUS RTU
baud rate	1200/2400/4800/9600/19200/38400/57600/115200 bps
Data bits	8-bit
Stop bit	1 person
Check bit	No parity/even check
Device address	0-247

3.4 Mechanical Parameters

Number of channels	External dimensions (± 0.5mm)	weight
Route 1/2	53.8*110.0 mm	72.5 ± 2 g
Route 4/6	90.0*116.5 mm	118.5 ± 2 g
Routes 8/10/12	90.0*116.5 mm	162.0 ± 2 g

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4 Quick Start

4.1 Unpacking and Inspection

- Check that the packaging is intact and undamaged.
- Verify that the product model matches the order.
- Check that the following items are complete:

  ☐Main unit × 1

  Terminal block × 1 set

4.2 Quick Connection

4.2.1 Power Supply Connection

Connect a DC 8-28V power supply to the power terminal.

Pay attention to the power polarity to prevent reverse connection.



Image 1 Power connection diagram

4.2.2 Signal Wiring

Connect the analog signal to the AI terminals (AI+, AI-).

Ensure the signal type matches the device configuration.

4.2.3 Communication Connection

Connect the RS485 communication cable to the corresponding terminals (A to A; B to B).

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4.2.4 Power-on test

Turn on the power and observe the status of the SYS indicator light.

Under normal circumstances, the indicator light should remain constantly on.



Image 2 Power indicator light

4.2.5 Communication Test

Use host computer software to search for devices.

Communication confirmed to be normal



Image 3: Software search configuration

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5 Installation and Wiring

4.1 Installation Environment Requirements

- **Installation location** : Avoid direct sunlight and keep away from heat sources.
- **Ventilation requirements** : Maintain good ventilation and heat dissipation.
- **Vibration limitation** : Avoid environments with strong vibrations.
- **Electromagnetic environment** : Keep away from sources of strong electromagnetic interference.

4.2 Terminal Wiring Instructions

4.2.1 Power terminals

Terminal markings	Connection instructions
VCC+	Positive power supply (DC 8-28V)
VCC-	Negative power supply terminal (GND)

4.2.2 RS485 communication terminal

Terminal markings	Connection instructions
A+	RS485 A+
B-	RS485 B-
GND	Communication location (optional)

4.2.3 Analog Input Terminals

Terminal markings	Connection instructions
AI1+	The positive terminal of the first analog input
AI1-	The negative terminal of the first analog input channel.
AI2+	Second analog input positive terminal
AI2-	Negative terminal of analog input channel 2
…	…

4.2.4 Wiring Precautions

- Disconnect the power supply before wiring.

- Confirm that the signal type matches the channel configuration.

- Use cables of appropriate specifications

- Ensure the wiring is secure and prevent it from becoming loose.

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6 Configuration Settings

6.1 Jumper Cap Configuration

Each input channel has a corresponding jumper cap for selecting the signal type:

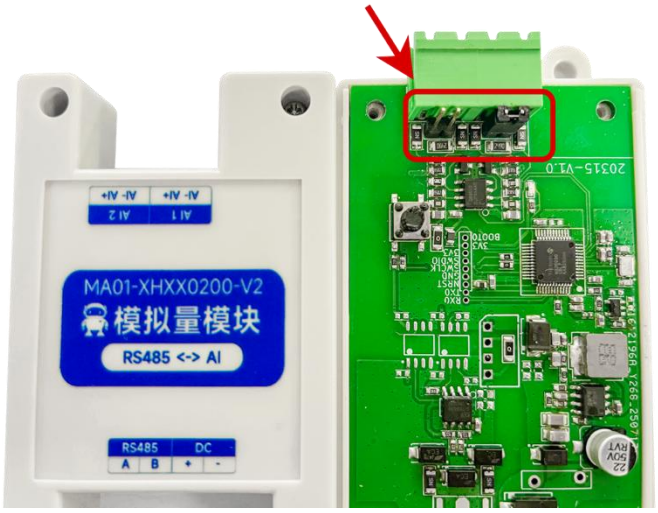


Image 4: Jumper cap

jumper cap status	signal type	Range status
Floating	voltage signal	0-10V (configuration required)
Short circuit	Current signal	0-20mA (factory default)

6.2 Channel Configuration Instructions

6.2.1 Current Signal Configuration

Configuration value 0 : 0-20mA range

Configuration value 1 : 4-20mA range

Special Note:

- When configured for 4-20mA, values below 3.5mA will display as 0.

- Displayed as 4mA within the 3.5-4mA range

- Maximum current withstand 25mA (exceeding this limit may damage the equipment).

6.2.2 Voltage Signal Configuration

Configuration value 3 : 0-5V range

Configuration value 5 : 0-10V range

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6.2.3 Filter Parameter Settings

Setting range : 1-16

Default value : 6

Note : The larger the value, the more stable the output, but the slower the response.

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7 Using the Host Computer Software

7.1 Software Download and Installation

Find the relevant configuration software on the download page of the relevant product.



Image 5 Configuration Tool

7.2 Device Connection

7.2.1 Search Devices

To configure the software, you first need to set the communication interface to serial port.

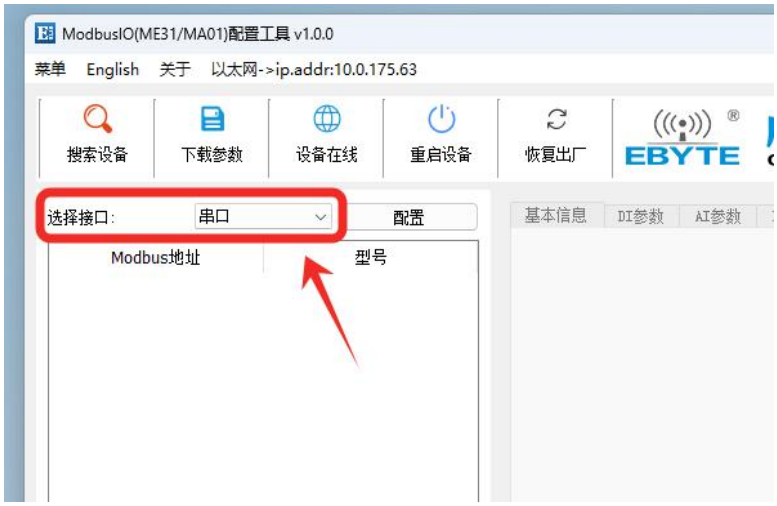


Image 6: Setting up the communication interface

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Configure the serial port parameters to ensure that the parameters can communicate correctly with the device.



Image 7 Setting serial port parameters

Click the "Search Devices" button , wait a moment, and the device will be found.



Image 8 Search Device

7.2.2 Connection Confirmation

Once you confirm that the device address is correct, click to enter the configuration page.



Image 9 Connection confirmed

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7.2.3 Parameter Configuration

Communication parameter settings

- **Device address** : 1-247
- **Baud rate** : 9600 (default)
- **Data bits** : 8
- **Stop bit** : 1
- **Check digit** : None (default)



Image 10 Communication parameter configuration

Channel parameter settings

- **Signal type** : Voltage/Current
- **Measuring range selection** : 0-5V/0-10V/0-20mA/4-20mA
- **Filtering parameters** : 1-16

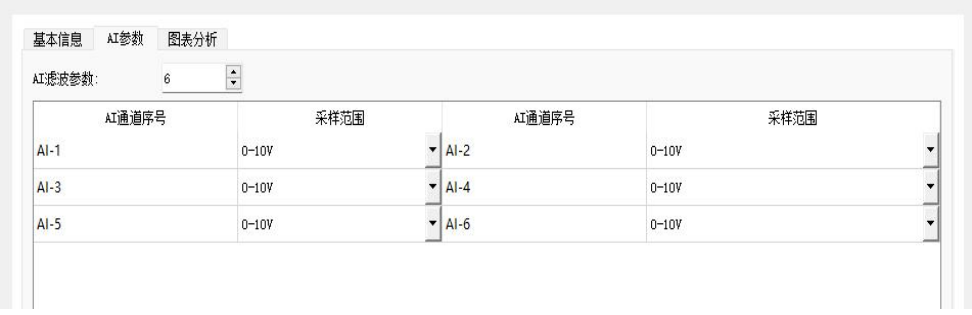


Image 11 AI Channel Parameter Configuration

7.2.4 Data Monitoring

Real-time display

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Numerical display : Real-time display of measurement values for each channel.

Line chart : Historical data curve display

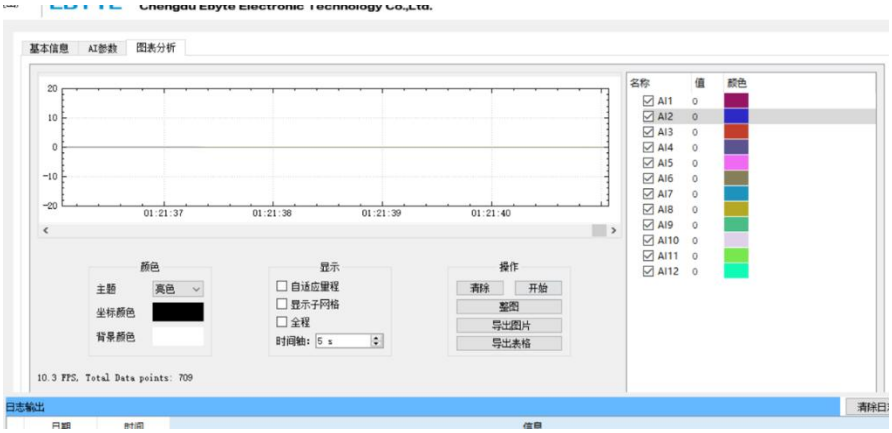


Image 12: Curve Graph

Dashboard : Intuitive dashboard display



Image 13 Dashboard monitoring

7.2.5 Data Recording

The monitoring data can be directly **exported** and **reports generated in the configuration** :



Image 14 Data Export

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7.3 Reboot and Factory Reset

In the configuration software, the top control bar allows you to control the device to restart and restore factory settings.



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8 Troubleshooting

8.1 Common Faults and Solutions

8.1.1 Communication failure

Symptom: Unable to communicate with the device

- ☐ Check if the RS485 wiring is correct.
- ☐ Check if the communication parameter settings match.
- ☐ Confirm device address settings
- ☐ Check terminating resistor configuration
- ☐ Verify that the power supply is normal.

Phenomenon: Unstable communication

- ☐ Check the length and quality of the communication cable.
- ☐ Adjust baud rate settings
- ☐ Check the electromagnetic interference environment
- ☐ Confirm grounding connection

8.1.2 Measurement Fault

Phenomenon: Inaccurate measurement values

- ☐ Check if the signal source is normal.
- ☐ Confirm signal type configuration
- ☐ Check jumper cap settings
- ☐ Calibrate measuring instruments–

☐ Check that the wiring is secure.

Phenomenon: Measurement values fluctuate

- ☐ Adjust filter parameters
- ☐ Check signal source stability
- ☐ Investigate electromagnetic interference
- ☐ Check grounding connection

8.1.3 Power supply failure

Symptom: The device cannot be powered on.

- ☐ Check the power supply voltage range (8-28V DC)

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- ☐ Confirm power polarity connection
- ☐ Check power line connections
- ☐Measure the power supply output voltage

Symptom: Device restarts automatically

- ☐ Check power supply stability
- ☐ Confirm load current
- ☐ Check operating temperature
- ☐ Troubleshoot power interference

8.2 Indicator Light Status Diagnosis

Lighting status	Equipment status	processing method
Chang Liang	Normal operation	No processing required
Flashing (60ms period)	Communicating	Normal phenomenon
Not lit	Power failure	Check power connection

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8.3 Reboot and Factory Reset

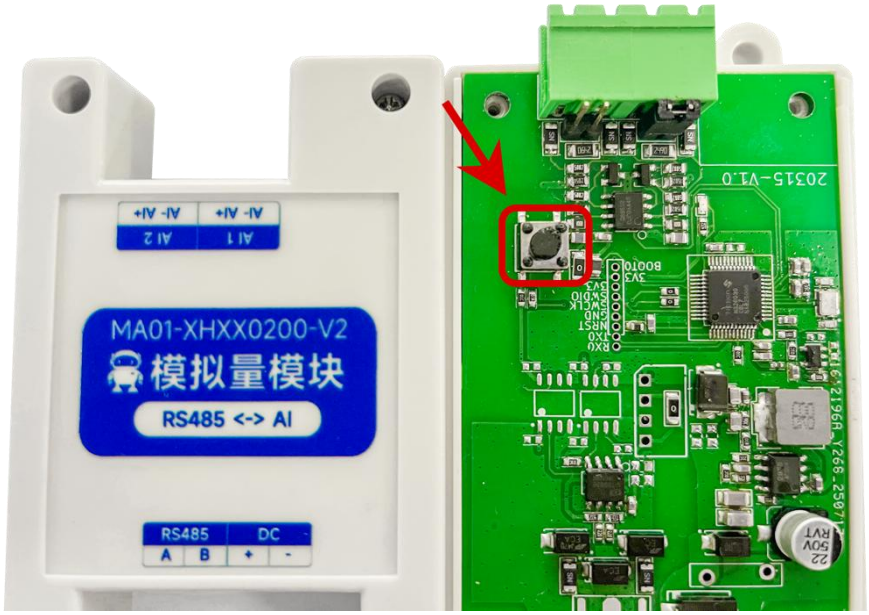


Image 15: Restart and Factory Reset Buttons

If the device is completely unable to communicate, you can try to restore it using the hardware's reserved restart and factory reset buttons.

- **Short press** (50ms-1.5s): Device restart
- **Long press** (5s-10s): Restore factory settings
- **Timeout protection** : Key presses will be ineffective after 10 seconds.

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9 Safety Instructions

9.1 Precautions before use

☐ **Please read this manual carefully** to understand the product's performance and usage.

☐ **Confirm that the product model** matches the application requirements.

☐ Check whether **the working environment meets the technical requirements.**

☐ **Prepare necessary tools** and testing instruments

9.2 Installation Safety

☐ **Power outage procedures** : Power must be disconnected before any wiring operations.

☐ **Anti-static precautions** : Take precautions against static electricity during operation.

☐ **Tool check** : Use qualified electrician tools.

☐ **Professionals** : Installation is recommended to be carried out by professional technicians.

9.3 Operational Safety

☐ **Power requirements** : Strictly adhere to power supply specifications (DC 8-28V)

☐ **Polarity protection** : Pay attention to the power supply polarity. Although there is reverse connection protection, caution is still required.

☐ **Overload protection** : Do not exceed the equipment's rated parameters.

☐ **Environmental requirements** : Ensure the working environment meets technical specifications.

9.4 Maintenance and Safety

☐ **Regular inspection** : Regularly check the tightness of the wiring.

☐ **Cleaning and maintenance** : Clean the device casing with a clean, dry cloth.

☐ **Avoid liquids** : Prevent liquids from entering the equipment.

☐ **Professional Repair** : Please contact a professional technician in case of equipment failure.

9.5 Emergency Handling

If any abnormal phenomena are detected, please immediately: 1. Disconnect the power supply ; 2. Stop operation ; 3. Contact technical support ; 4. Record the fault symptoms.

9.6 Environmental protection requirements

☐ **Proper disposal** : When equipment is scrapped, please dispose of it in accordance with environmental protection

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requirements.

☐ **Material recycling** : Metal materials can be recycled.

☐ **Avoid pollution** : Do not discard electronic devices carelessly.

Important Warning :

- Do not use in flammable or explosive environments.

- There are no user-serviceable parts inside the device; please do not disassemble it yourself.

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10 Maintenance and Care

10.1 Routine Maintenance

10.1.1 Visual Inspection

Inspection frequency : once a month

Inspection content :

☐Is the outer casing damaged or deformed?

Are the indicator lights working properly ?

☐ Are the terminal connections secure?

Is the signage clear ?

10.1.2 Functional Check

Inspection frequency : once per quarter

Inspection content :

Is the communication function working properly ?

measurement accuracy meet the requirements?

Are all channels functioning properly ?

☐ Should the parameter settings be retained?

10.2 Regular maintenance

10.2.1 Semi-annual maintenance

☐Comprehensive Functionality Testing

☐ Wiring tightness check

☐ Communication performance test

☐Parameter Backup

10.2.2 Annual Maintenance

☐ Precision verification

☐ Deep cleaning

Firmware update check

☐ Maintenance record archive

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10.3 Cleaning and Maintenance

10.3.1 Cleaning Requirements

Cleaning frequency : Clean regularly according to environmental conditions.

Cleaning tools : a clean, dry cloth or an anti-static cloth.

10.3.2 Cleaning Procedure

A. Disconnect the power

B. Cleaning the outer casing: Wipe the surface of the outer casing with a dry cloth.

C. Terminal cleaning: Remove dust and dirt from the terminals.

D. Check connections: After cleaning, check that all connections are secure.

10.3.3 Storage Requirements

If the equipment will not be used for an extended period of time, please store it properly.

Temperature range : 15～25 °C

Humidity requirement : 30% to 45% RH

Packaging requirements : Store in original packaging

Environmental requirements : dry, well-ventilated, and free of corrosive gases.

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Important Announcement

- Ebyte reserves the right to the final interpretation and modification of all contents in this manual.
- As the hardware and software of the product continue to improve, this instruction manual may be subject to change without notice. The latest version of the instruction manual shall prevail.
- Users of this product should visit the official website to follow product updates so that they can get the latest information about the product in a timely manner.

Revision History

Version	Revision Date	Revision Notes	maintainer
1.0	2025-9-16	Initial version	Hugh

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