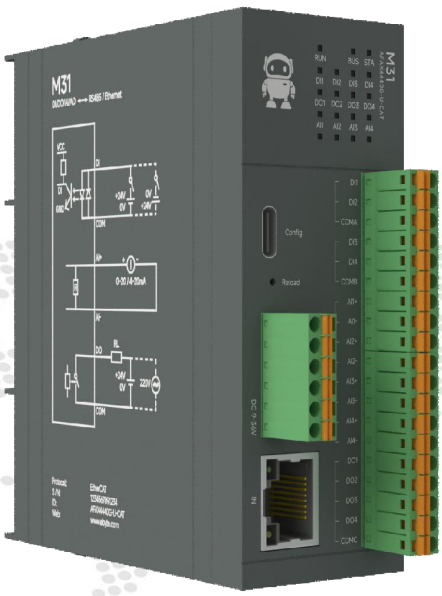
Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual



M31-U-CAT Series EtherCAT Distributed I/O Master

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Content

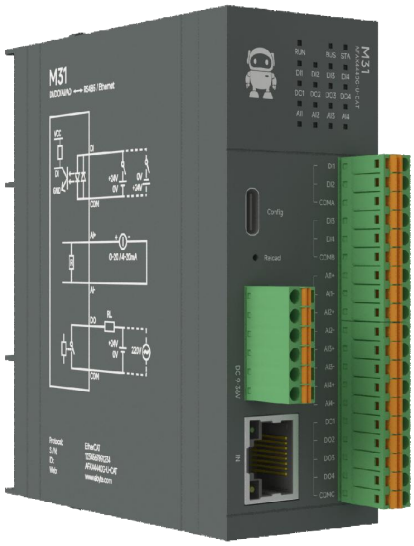
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Chapter 1 Product Overview

1.1 Product Introduction



The M31-U-CAT series distributed I/O master is a slave module that supports the EtherCAT protocol.

It adopts a modular design, allowing users to flexibly expand according to actual application requirements. The device supports multiple I/O types. When the existing configuration cannot meet specific application requirements, users can conveniently add compatible I/O expansion modules without replacing the entire system, thereby effectively reducing costs and simplifying on-site deployment.

This product supports connection of up to 16 I/O expansion modules (including the master itself). It is designed in compliance with EMC Level 3 protection standards. All I/O inputs/outputs and power supplies are fully isolated, providing excellent electromagnetic compatibility, outstanding performance, and high reliability, and it complies with CE certification standards.

1.2 Features

- Uses standard EtherCAT protocol for communication, enabling networking with PLCs, configuration software, and host computers
- Dual 100M Ethernet ports
- Modular structure with compact size and space-saving design
- Supports differential analog input with 16-bit resolution and accuracy within 0.1%
- Millisecond-level response, with internal bus speed up to 1 ms
- Supports up to 16 I/O expansion modules (including the master itself)
- Maximum I/O capacity up to 256 points
- Flexible combination of digital I/O and analog I/O
- Supports multiple I/O types: DI (NPN/PNP)、 AI (single-ended current)、 AI (differential current)、 AI (differential voltage)、DO（PNP）、DO (relay)、AO (current)、AO (voltage)
- Industrial-grade hardware design with multiple protections: ESD, lightning surge, EFT (Electrical Fast Transient), and reverse polarity protection
- Supports mounting via positioning holes or DIN rail
- Provides isolation for I/O and power supply, compliant with CE standards

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1.3 Product Model List

Model	Specification	DI	DO	AI	AO
M31-AFAX4440G-U-CAT	4DI+4DO+4AI	4（NPN、PNP）	4 (Relay)	4 (Differential Current)	—
M31-AXAX8080G-U-CAT	8DI+8DO	8（NPN、PNP）	8 (Relay)	—	—
M31-AXEX8080G-U-CAT	8DI+8DO	8（NPN、PNP）	8 (Transistor)	—	—

Supported I/O Expansion Modules (For detailed parameters, refer to the U series distributed I/O expansion module user manual)：

Model	Specification	DI	DO	AI	AO
M31-GAFAX4440-U	4DI+4DO+4AI	4（NPN、PNP）	4 (Relay)	4 (Differential Current)	—
M31-GAXAX8080-U	8DI+8DO	8（NPN、PNP）	8 (Relay)	—	—
M31-GAXXX8000-U	8DI	8（NPN、PNP）	—	—	—
M31-GAXXXA000-U	16DI	16（NPN、PNP）	—	—	—
M31-GAXEX8080-U	8DI+8DO	8（NPN、PNP）	8 (Transistor)	—	—
M31-GXXAX0080-U	8DO	—	8 (Relay)	—	—
M31-GXXAX00A0-U	16DO	—	16 (Relay)	—	—
M31-GXXEX00A0-U	16DO	—	16 (Transistor)	—	—
M31-GAXAX4040-U	4DI+4DO	4（NPN、PNP）	4 (Relay)	—	—
M31-GXFXX0800-U	—	—	—	8 (Differential Current)	—
M31-GXAXX0A00-U	—	—	—	16 (Single-ended Current)	—
M31-GXBXX0A00-U	—	—	—	16 (Single-ended Voltage)	—
M31-GXXXA0008-U	—	—	—	—	8 (Current)
M31-GXXXB0008-U	—	—	—	—	8 (Voltage)

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Chapter 2 Technical Specifications

2.1 Specifications

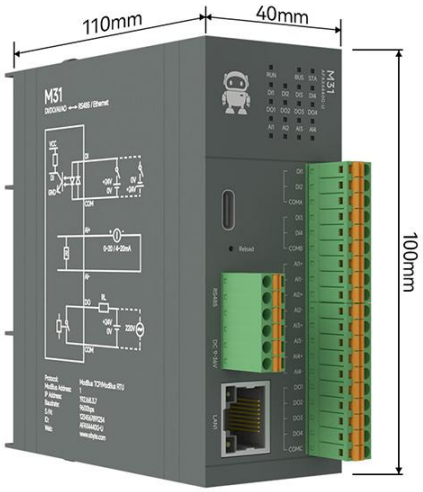
EtherCAT Distributed I/O Master		
Category	**Item**	**Specification**
Power	Operating Voltage	DC 9–36V, with reverse polarity protection
	Power Indicator	RUN red LED indicator
	Power Consumption	2～4W
Communication	Interface	RJ45 ×2 (dual Ethernet ports)
	Protocol	EtherCAT protocol
	Internal Bus	Up to 1 ms
DI Input	Input Type	NPN、PNP
	Input Range	DC 10～28V
	Isolation	Channel-to-channel optocoupler isolation
	Input Impedance	7.2kΩ
	Sampling Frequency	1000 Hz
	Counting Frequency	＜500Hz
	Filter Time	Default 6 ms
	Indicator	DI green LED
AI Input	Acquisition Mode	Single-ended / Differential (model dependent)
	Input Type	Single-ended current: 0–20 mA, 4–20 mA Differential current: 0–20 mA, 4–20 mA, ±20 mA Differential voltage: 0–5 V, ±5 V, 0–10 V, ±10 V Single-ended voltage: 0–5 V, 0–10 V
	Resolution	16-bit (differential)
	Accuracy	0.1% (differential) / 0.3% (single-ended)
	Refresh Rate	Max. 70 Hz
	Indicator	AI green LED
DO (Relay) Output	Output Type	Form A relay (NO)
	Output Mode	Level output, pulse output
	Contact Rating	5A 30VDC, 5A 250VAC (total current per COM ≤ 8A)
	Indicator	DO green LED
DO (PNP) Output	Output Type	PNP
	Output Mode	Level output, pulse output
	Output Capacity	0.5A per channel, 4A per COM (10–30V)

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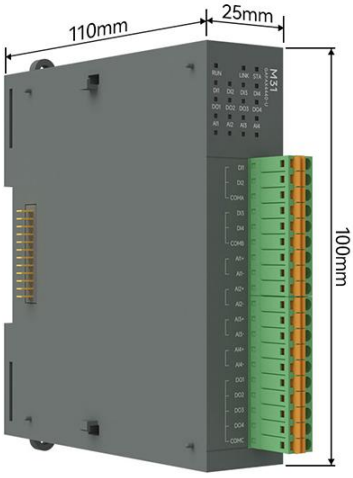
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	Indicator	DO green LED
AO Output	Output Type	0–20 mA, 4–20 mA / 0–5 V, 0–10 V (optional)
	Accuracy	0.1%
	Output Impedance	AOV: 40Ω, AOI: 656 kΩ
	Indicator	AO green LED
Others	Dimensions	110 × 40 × 100 mm (L × W × H)
	Operating Conditions	-40 to +85°C, 5–95% RH (non-condensing)
	Storage Conditions	-40 to +105°C, 5–95% RH (non-condensing)
	Installation	Mounting holes / DIN rail

2.2 Dimensions



主机



扩展模块

2.3 Ports, Buttons, and LED Indicators

2.3.1 M31-AFAX4440G-U-CAT

M31-AFAX4440G-U-CAT Port and Button Description：		
Label	Name	Description
DI1	DI1 Digital Input	Used with COMA
DI2	DI2 Digital Input	Used with COMA
COMA	DI Common	Shared by DI1–DI2

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DI3	DI3 Digital Input	Used with COMB
DI4	DI4 Digital Input	Used with COMB
COMB	DI Common	Shared by DI3–DI4
DO1	DO1 Digital Output	Used with COMC
DO2	DO2 Digital Output	Used with COMC
DO3	DO3 Digital Output	Used with COMC
DO4	DO4 Digital Output	Used with COMC
COMC	DO Common	Shared by DO1–DO4
AI1+	AI1 Analog Input+	Positive terminal of AI1, used with AI1-
AI1-	AI1 Analog Input-	Negative terminal of AI1, used with AI1+
AI2+	AI2 Analog Input+	Positive terminal of AI2, used with AI2-
AI2-	AI2 Analog Input-	Negative terminal of AI2, used with AI2+
AI3+	AI3 Analog Input+	Positive terminal of AI3, used with AI3-
AI3-	AI3 Analog Input-	Negative terminal of AI3, used with AI3+
AI4+	AI4 Analog Input+	Positive terminal of AI4, used with AI4-
AI4-	AI4 Analog Input-	Negative terminal of AI4, used with AI4+
Config	Type-C Interface	Device parameter configuration interface
Reload	Factory Reset / Auto Negotiation	Press and hold 5–10s to restore factory settings
PE	Ground	Protective earth
V-（DC9-36V）	Power Negative	DC power negative terminal
V+（DC9-36V）	Power Positive	DC power positive terminal
LAN1	Ethernet Port	Standard RJ45 interface
LAN2	Ethernet Port	Standard RJ45 interface

M31-AFAX4440G-U-CAT LED Indicators		
Label	Name	Description
RUN	Device Status LED	Red LED; ON: OP mode; Slow flash (5Hz): not in OP mode; OFF: abnormal
BUS	Bus Status LED	Yellow LED; ON: normal; OFF: fault; Flashing: possible abnormal
STA	Communication LED	Blue LED; Flashing: data exchange; OFF: no communication
DI1	DI1 Input LEDs	Green; ON: valid input; OFF: no input
DI2	DI2 Input LEDs	Green; ON: valid input; OFF: no input
DI3	DI3 Input LEDs	Green; ON: valid input; OFF: no input
DI4	DI4 Input LEDs	Green; ON: valid input; OFF: no input
DO1	DO1 Output LEDs	Green; ON: relay closed; OFF: relay open
DO2	DO2 Output LEDs	Green; ON: relay closed; OFF: relay open
DO3	DO3 Output LEDs	Green; ON: relay closed; OFF: relay open
DO4	DO4 Output LEDs	Green; ON: relay closed; OFF: relay open
AI1	AI1 Input LEDs	Green; ON: ≥1% range; OFF: no input; Fast flash: >110% range
AI2	AI2 Input LEDs	Green; ON: ≥1% range; OFF: no input; Fast flash: >110% range
AI3	AI3 Input LEDs	Green; ON: ≥1% range; OFF: no input; Fast flash: >110% range
AI4	AI4 Input LEDs	Green; ON: ≥1% range; OFF: no input; Fast flash: >110% range

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2.3.2 M31-AXAX8080G-U-CAT

M31-AXAX8080G-U-CAT Port and Button Description		
Label	Name	Description
DO1	DI1 Digital Inputs	DI1 digital input interface, used together with COMA
DI2	DI2 Digital Inputs	DI2 digital input interface, used together with COMA
DI3	DI3 Digital Inputs	DI3 digital input interface, used together with COMA
DI4	DI4 Digital Inputs	DI4 digital input interface, used together with COMA
COMA	DI Common	Common terminal for DI1–DI4
DI5	DI5 Digital Input	DI5 digital input interface, used together with COMB
DI6	DI6 Digital Input	DI6 digital input interface, used together with COMB
DI7	DI7 Digital Input	DI7 digital input interface, used together with COMB
DI8	DI8 Digital Input	DI8 digital input interface, used together with COMB
COMB	DI Common	Common terminal for DI5–DI8
DO1	DO1 Digital Output	DO1 digital output interface, used together with COMC
DO2	DO2 Digital Output	DO2 digital output interface, used together with COMC
DO3	DO3 Digital Output	DO3 digital output interface, used together with COMC
DO4	DO4 Digital Output	DO4 digital output interface, used together with COMC
DO5	DO5 Digital Output	DO5 digital output interface, used together with COMC
DO6	DO6 Digital Output	DO6 digital output interface, used together with COMC
DO7	DO7 Digital Output	DO7 digital output interface, used together with COMC
DO8	DO8 Digital Output	DO8 digital output interface, used together with COMC
COMC	DO Common	Common terminal for DO1–DO8
Config	Type-C Port	Device parameter configuration interface
Reload	Factory Reset / Auto Negotiation	Press and hold for 5–10 seconds to restore factory settings
PE	Protective Earth	Grounding
V-（DC9-36V）	Power Negative	Negative terminal of DC 9–36V power supply
V+（DC9-36V）	Power Positive	Positive terminal of DC 9–36V power supply
LAN1	Ethernet Port	Standard RJ45 Ethernet interface
LAN2	Ethernet Port	Standard RJ45 Ethernet interface

M31-AXAX8080G-U-CAT LED Indicator Description		
Label	Name	Description
RUN	Device Running Indicator	Red LED; Solid ON: device in OP mode; Slow flashing (5Hz): not in OP mode; OFF: device running abnormally
BUS	Bus Status Indicator	Yellow LED; ON: internal bus operating normally; OFF: internal bus completely abnormal; Flashing: possible bus abnormality
STA	Communication Indicator	Blue LED; Flashing: data exchange between master and expansion module; OFF: no data exchange

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DI1	DI1 Input Indicator	Green LED; ON: DI1 valid input; OFF: DI1 invalid input
DI2	DI2 Input Indicator	Green LED; ON: DI2 valid input; OFF: DI2 invalid input
DI3	DI3 Input Indicator	Green LED; ON: DI3 valid input; OFF: DI3 invalid input
DI4	DI4 Input Indicator	Green LED; ON: DI4 valid input; OFF: DI4 invalid input
DI5	DI5 Input Indicator	Green LED; ON: DI5 valid input; OFF: DI5 invalid input
DI6	DI6 Input Indicator	Green LED; ON: DI6 valid input; OFF: DI6 invalid input
DI7	DI7 Input Indicator	Green LED; ON: DI7 valid input; OFF: DI7 invalid input
DI8	DI8 Input Indicator	Green LED; ON: DI8 valid input; OFF: DI8 invalid input
DO1	DO1 Output Indicator	Green LED; ON: DO1 relay closed; OFF: DO1 relay open
DO2	DO2 Output Indicator	Green LED; ON: DO2 relay closed; OFF: DO2 relay open
DO3	DO3 Output Indicator	Green LED; ON: DO3 relay closed; OFF: DO3 relay open
DO4	DO4 Output Indicator	Green LED; ON: DO4 relay closed; OFF: DO4 relay open
DO5	DO5 Output Indicator	Green LED; ON: DO5 relay closed; OFF: DO5 relay open
DO6	DO6 Output Indicator	Green LED; ON: DO6 relay closed; OFF: DO6 relay open
DO7	DO7 Output Indicator	Green LED; ON: DO7 relay closed; OFF: DO7 relay open
DO8	DO8 Output Indicator	Green LED; ON: DO8 relay closed; OFF: DO8 relay open

2.3.3 M31-AXEX8080G-U-CAT

M31-AXEX8080G-U-CAT Port and Button Description		
Label	Name	Description
DI1	DI1 Digital Input	DI1 digital input interface, used together with COMA
DI2	DI2 Digital Input	DI2 digital input interface, used together with COMA
DI3	DI3 Digital Input	DI3 digital input interface, used together with COMA
DI4	DI4 Digital Input	DI4 digital input interface, used together with COMA
COMA	DI Common	Common terminal for DI1–DI4
DI5	DI5 Digital Input	DI5 digital input interface, used together with COMB
DI6	DI6 Digital Input	DI6 digital input interface, used together with COMB
DI7	DI7 Digital Input	DI7 digital input interface, used together with COMB
DI8	DI8 Digital Input	DI8 digital input interface, used together with COMB
COMB	DI Common	Common terminal for DI5–DI8
DO1	DO1 Digital Output	DO1 digital output interface, used together with COMC
DO2	DO2 Digital Output	DO2 digital output interface, used together with COMC
DO3	DO3 Digital Output	DO3 digital output interface, used together with COMC
DO4	DO4 Digital Output	DO4 digital output interface, used together with COMC
DO5	DO5 Digital Output	DO5 digital output interface, used together with COMC
DO6	DO6 Digital Output	DO6 digital output interface, used together with COMC
DO7	DO7 Digital Output	DO7 digital output interface, used together with COMC
DO8	DO8 Digital Output	DO8 digital output interface, used together with COMC
COMC	DO Common	Common terminal for DO1–DO8
Config	Type-C Port	Device parameter configuration interface

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Reload	Factory Reset / Auto Negotiation	Press and hold for 5–10 seconds to restore factory settings
PE	Protective Earth	Grounding
V-（DC9-36V）	Power Negative	Negative terminal of DC 9–36V power supply
V+（DC9-36V）	Power Positive	Positive terminal of DC 9–36V power supply
LAN1	Ethernet Port	Standard RJ45 Ethernet interface
LAN2	Ethernet Port	Standard RJ45 Ethernet interface

M31-AXEX8080G-U-CATLED Indicator Description		
丝印	名称	说明
RUN	Device Running Indicator	Red LED; Solid ON: device in OP mode; Slow flashing (5Hz): not in OP mode; OFF: device running abnormally
BUS	Bus Status Indicator	Yellow LED; ON: internal bus operating normally; OFF: internal bus completely abnormal; Flashing: possible bus abnormality
STA	Communication Indicator	Blue LED; Flashing: data exchange between master and expansion module; OFF: no data exchange
DI1	DI1 Input Indicator	Green LED; ON: DI1 valid input; OFF: DI1 invalid input
DI2	DI2 Input Indicator	Green LED; ON: DI2 valid input; OFF: DI2 invalid input
DI3	DI3 Input Indicator	Green LED; ON: DI3 valid input; OFF: DI3 invalid input
DI4	DI4 Input Indicator	Green LED; ON: DI4 valid input; OFF: DI4 invalid input
DI5	DI5 Input Indicator	Green LED; ON: DI5 valid input; OFF: DI5 invalid input
DI6	DI6 Input Indicator	Green LED; ON: DI6 valid input; OFF: DI6 invalid input
DI7	DI7 Input Indicator	Green LED; ON: DI7 valid input; OFF: DI7 invalid input
DI8	DI8 Input Indicator	Green LED; ON: DI8 valid input; OFF: DI8 invalid input
DO1	DO1 Output Indicator	Green LED; ON: DO1 transistor ON; OFF: DO1 transistor OFF
DO2	DO2 Output Indicator	Green LED; ON: DO2 transistor ON; OFF: DO2 transistor OFF
DO3	DO3 Output Indicator	Green LED; ON: DO3 transistor ON; OFF: DO3 transistor OFF
DO4	DO4 Output Indicator	Green LED; ON: DO4 transistor ON; OFF: DO4 transistor OFF
DO5	DO5 Output Indicator	Green LED; ON: DO4 transistor ON; OFF: DO5 transistor OFF
DO6	DO6 Output Indicator	Green LED; ON: DO4 transistor ON; OFF: DO6 transistor OFF
DO7	DO7 Output Indicator	Green LED; ON: DO4 transistor ON; OFF: DO7 transistor OFF
DO8	DO8 Output Indicator	Green LED; ON: DO4 transistor ON; OFF: DO8 transistor OFF

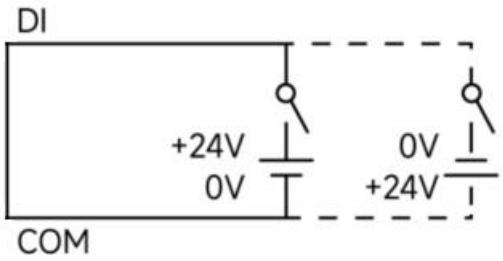
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Chapter 3 Wiring Instructions

3.1 Wiring Instructions

3.1.1 DI Connection

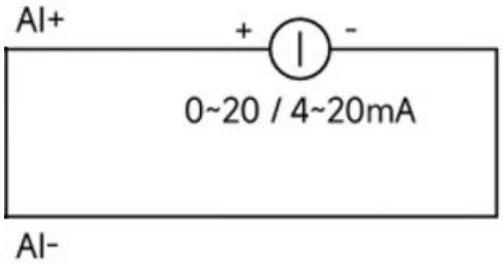


PNP input **NPN input**

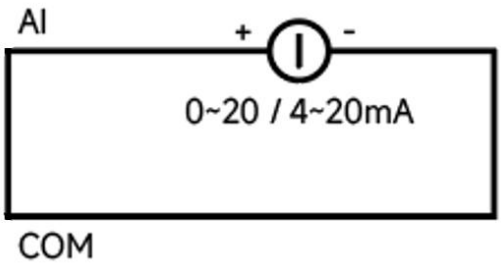
Note: DI supports both NPN and PNP active inputs. The supported voltage range is **10V–28V only**.

3.1.2 AI Connection

Differential Analog Current Acquisition:



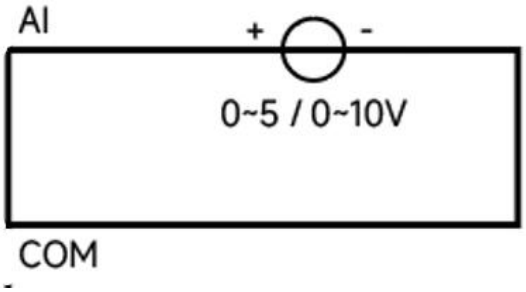
Single-ended Analog Current Acquisition:



Single-ended Analog Voltage Acquisition:

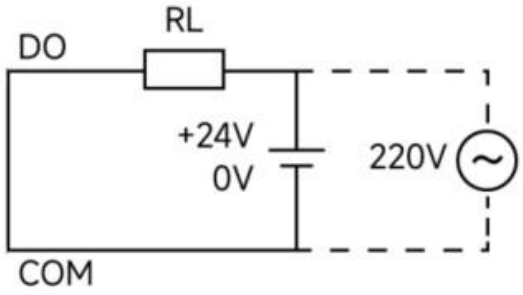
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3.1.3 DO Connection

3.1.3.1 **Relay Type**

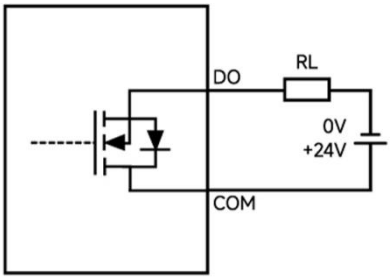


Note:

1.The maximum current for a single relay is **5A**.

2.The total current for each group (same COM terminal) is **up to 8A**.

3.1.3.2 **Transistor Type**



Note:

1. The maximum current for a single channel is **0.5A**.

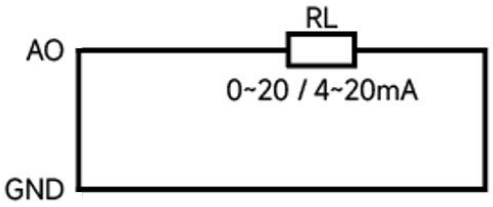
2. The total current for each group (same COM terminal) is **up to 4A**, with a voltage range of **10–30V**.

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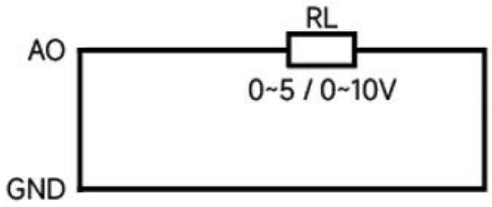
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3.1.4 AO Connection

Current-type AO:



Voltage-type AO:



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Chapter 4 TwinCAT 3 Device Loading Guide

4.1 Preparation Before Connection

1. Prepare the required XML file as shown below:
   EBYTE-M31-ESI-20260115.xml

4.2 Adding EtherCAT Device File

1. Copy the XML configuration file **EBYTE-M31-ESI-20260115.xml** to the TwinCAT installation directory:
   C:\TwinCAT\3.1\Config\Io\EtherCAT



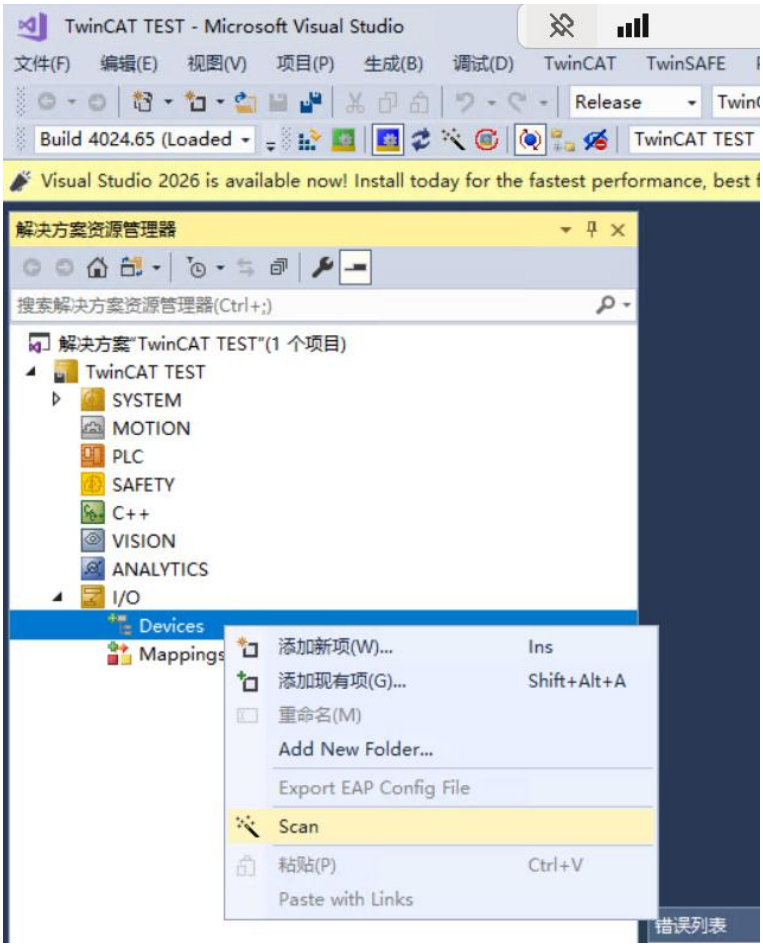
4.3 Adding EtherCAT IO Devices to the Project

The following example demonstrates adding the **M31-AFAX4440G-U-CAT master** and the **M31-GAXAX8080-U expansion module**:

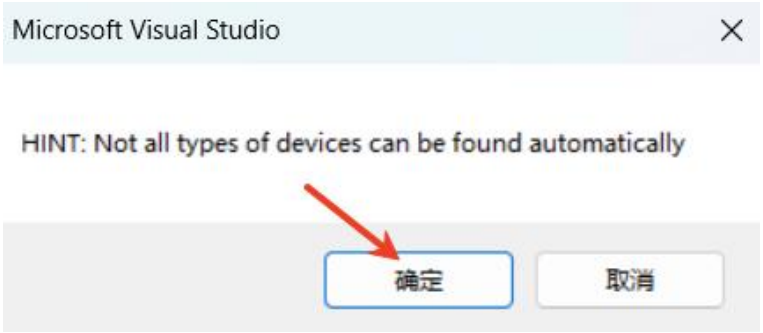
1. The following example demonstrates adding the **M31-AFAX4440G-U-CAT master** and the **M31-GAXAX8080-U expansion module**:

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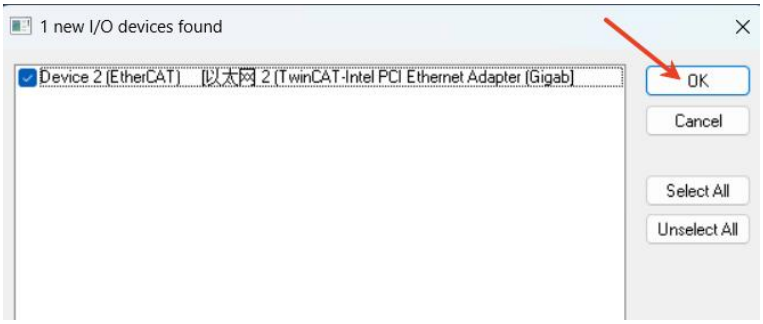
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2. Click **"OK"**.



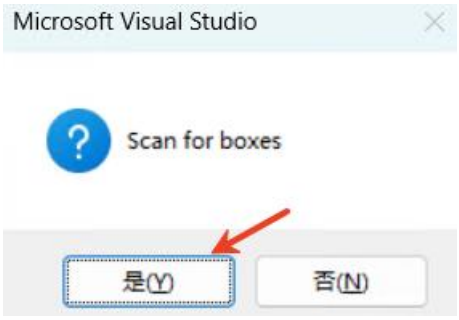
3. Select the detected network adapter and click **"OK"**.



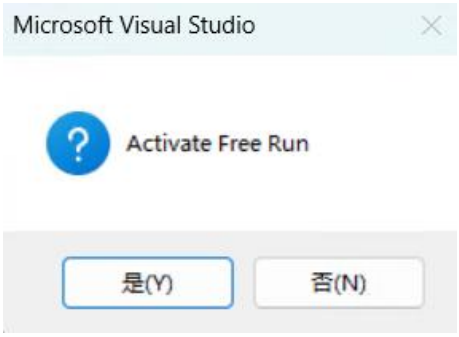
4. In the **"Scan for boxes"** pop-up window, click **"Yes (Y)"**.

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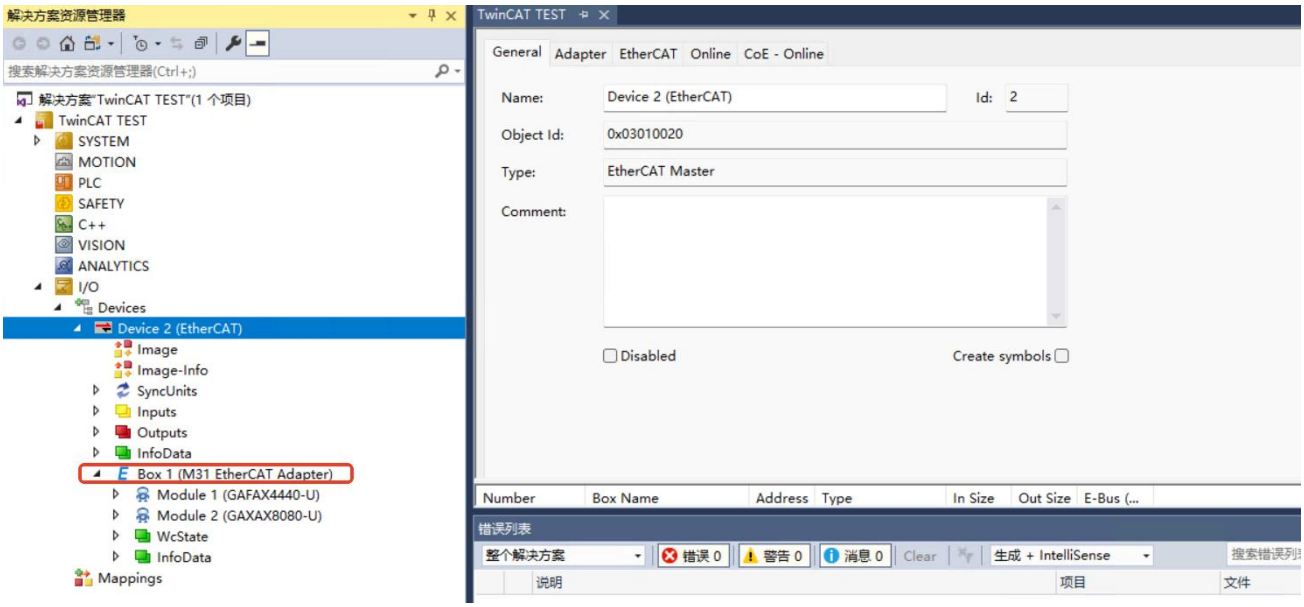
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5. In the **"Activate Free Run"** window, click **"Yes (Y)"**.



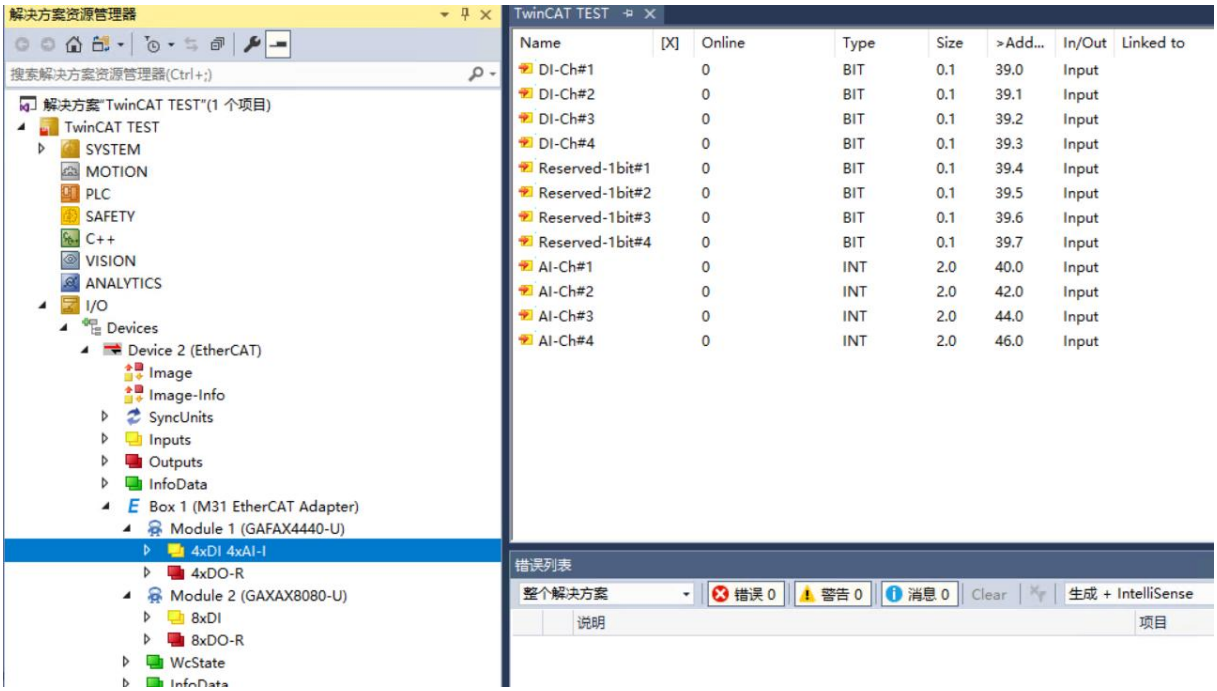
6. After completing the above steps, all connected modules will be scanned (assembled devices will be configured automatically), and can be directly operated via TwinCAT.



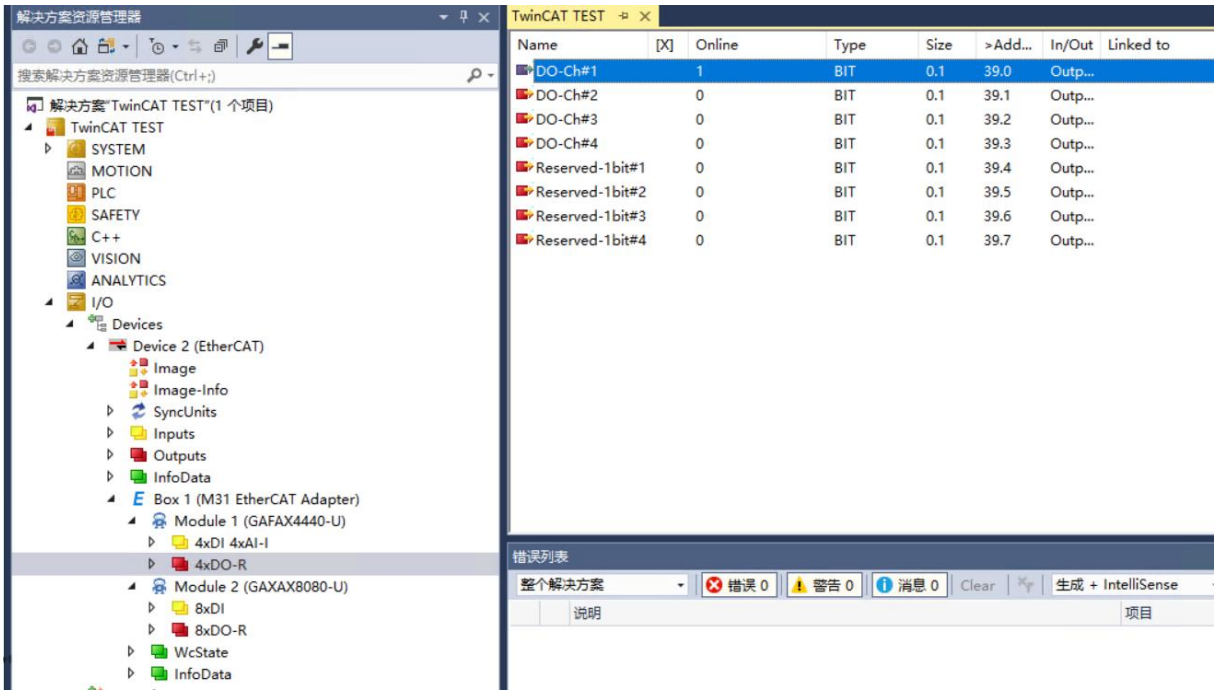
7. In the input area, real-time status can be monitored directly.

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8. Right-click the corresponding output point to control outputs by writing values.



4.4 Instructions for Using I/O Functions

Note: Parameter configuration must be performed using our upper computer software via the device **Type-C (Config) interface**.

1. Offline IO Fault Output Enable

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0 – Disabled: When communication fails, all outputs will **maintain their current state**

1 – Enabled: When communication fails, all outputs will **operate according to the preset fault output state**

2. DI Parameters



DI Filter Parameter:

Each DI channel can be configured individually.

Range: **1–65535 ms**

Default: **6 ms**

3. AI Parameters



AI Filter Parameter:

Each AI channel can be configured individually.

Range: **0–4** (higher level = longer filtering time)

Default: **0**

AI Sampling Range:

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- Current type: **0–20 mA, 4–20 mA, -20–20 mA**
- Voltage type: **0–5 V, 0–10 V, -5–5 V, -10–10 V**

4. DO Parameters



DO Fault Output State Setting:

Each DO channel can be configured individually when a bus fault occurs.

0 – Hold state: Maintain the current DO output state during fault

1 – Output OFF: Reset DO output (OFF) during fault

2 – Output ON: Set DO output (ON) during fault

5. AO Parameters



AO Output Range:

- Current type: **0–20 mA, 4–20 mA**
- Voltage type: **0–5 V, 0–10 V**

AO Power-on Output:

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After power-on, AO channels automatically output a preset fixed value.

AO Fault Output Value:

When communication interruption, bus abnormality, or module fault is detected, AO channels switch to a predefined emergency output value.

AO Fault Output Enable:

Controls whether the AO fault output function is enabled:

- Enabled: AO outputs the preset **fault value** during faults
- Disabled: AO maintains the **last valid output value** during faults

4.5 Description of Error Types

8000：01 Bus error code	Bus communication error
8000：02 Error bits	Slave device error code

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Chapter 5 Product Features

5.1 IO Channel Expansion

Note: Do **NOT** connect or assemble devices while powered on, otherwise it may cause device damage.

This product supports connection of up to **15 expansion modules**. The master can synchronize all 15 IO expansion modules with a fastest cycle time of approximately **1 ms**.

The **M31-U-CAT series distributed IO master** adopts a scalable structural design.
The IO expansion modules can be easily extended with the M31-U-CAT series master. Simply align the IO expansion module with the master slot, then slide the locking latch downward to securely connect the module to the master.

Operation steps are as follows:

- Ensure that the master device is **powered off**. Set the latch to the **UNLK** position, then insert the IO expansion module into the master, as shown in the figure.



- After inserting the IO expansion module, set the latch to the **LOCK** position, and then power on the master.
- The device supports **automatic configuration**. Simply perform a scan in the host software to detect the connected modules.

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Chapter 6 Precautions

(1) Do **NOT** assemble or connect devices while powered on, otherwise there is a risk of device damage.

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Revision History

Version	Date	Description	Maintainer
1.0	2026-1-29	Initial version	LT

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