ExxV3 Development Board Instruction Manual(For E8V3,E16V3,E24V3)

1. Overview

The ExxV3 is a high-performance development board designed for industrial automation and remote control applications. It features 8-24 input channels, 8-24 high-current relay output channels(according to your board model) , and supports MODBUS RTU communication protocol, providing flexible and reliable control solutions for various scenarios.

2. Key Specifications

Feature	Details
Input Channels	8-24 channels, compatible with 12-24V PNP/NPN wiring modes
Output Channels	8-24 channels, 16A high-current barrier-type relays
Communication Protocol	MODBUS RTU (supports 01, 05, 0F commands for remote I/O operation)
Address Setting	4 DIP switches (3 for SLAVE ID, 1 for control mode selection)
Default Baud Rate	38400 bps, 8 data bits, No parity, 1 stop bit (8,N,1)
Reset Function	Long-press RST button for 5 seconds to restore factory settings

3. Input Interface (8-24 Channels according to your board model)

3.1 Compatibility

The input channels support both PNP and NPN wiring modes, with a working voltage range of 12V-24V DC. This compatibility allows the board to connect with various types of sensors, switches, or other signal sources in industrial systems.

3.2 Wiring Notes

- Ensure the input voltage matches the 12-24V DC range to avoid damaging the board.
- Use shielded wires for input connections to reduce electromagnetic interference (EMI) in noisy industrial environments.

4. Output Interface (8-24 Channels according to your board model)

4.1 Relay Specifications

Each of the output channels is equipped with a 16A high-current barrier-type relay, suitable for driving high-power loads such as motors, pumps, valves, or lighting systems. The barrier-type design ensures secure wiring and prevents accidental short circuits.

4.2 Control Modes

The output control mode is determined by the 4th DIP switch (see Section 5 for DIP switch settings):

- **Local Control Mode**: When the 4th DIP switch is set to "OFF", the output terminals are controlled by the input terminals directly.
- **Remote I/O Mode**: When the 4th DIP switch is set to "ON", the entire output terminals work as remote I/O, controlled via the MODBUS RTU protocol.

5. DIP Switch Settings

The board is equipped with 4 DIP switches (labeled SW1-SW4) for configuring SLAVE ID and control mode.

5.1 Control Mode (4th DIP Switch)

4th DIP Switch State	Control Mode	Description
OFF	Local Control	Outputs are controlled by the input terminals
ON	Remote I/O Control	Outputs are controlled via MODBUS RTU (supports 01, 05, 0F commands)

5.2 SLAVE ID Configuration (1st-3rd DIP Switches: A0, A1, A2)

The 1st-3rd DIP switches (A0, A1, A2) are used to set the MODBUS RTU SLAVE ID. The SLAVE ID calculation follows this rule:
SLAVE ID = (Binary value of A0, A1, A2) + 10

Notes:

- If no DIP switches (A0-A2) are toggled (all OFF), the **default SLAVE ID is 1** (only when the 4th DIP switch is NOT set to ON).
- When the 4th DIP switch is set to ON, the SLAVE ID is determined by A0-A2 (calculated as above), and the default ID (1) is not applied.

SLAVE ID Calculation Examples:

A0 (1st Switch)	A1 (2nd Switch)	A2 (3rd Switch)	Binary Value	SLAVE ID (Binary + 10)
ON	OFF	OFF	001	1 + 10 = 11
OFF	ON	OFF	010	2 + 10 = 12
ON	ON	OFF	011	3 + 10 = 13
ON	OFF	ON	101	5 + 10 = 15

6. MODBUS RTU Communication

6.1 Default Communication Parameters

Parameter	Default Setting
Baud Rate	38400 bps
Data Bits	8
Parity	No (N)
Stop Bits	1

6.2 Supported Commands

The board supports the following MODBUS RTU commands for remote I/O control (when in Remote I/O Mode , Registers address from 0-15):

- **01 Command**: Read Coils Status (check the state of output relays)
- **05 Command**: Force Single Coil (control a single output relay ON/OFF)
- **0F Command**: Force Multiple Coils (control multiple output relays ON/OFF simultaneously)

DEMO FRAME :6.2 Supported Commands(Example for E16V3)

The board supports the following MODBUS RTU commands for remote I/O control (when in Remote I/O Mode). Below are **command frame examples** and corresponding response frames, using **SLAVE ID = 1** (consistent with the default SLAVE ID when no DIP switches (A0-A2) are toggled and the 4th DIP switch is set to ON for Remote I/O Mode).
All frames follow the standard MODBUS RTU structure:
[SLAVE ID] + [Function Code] + [Data Segment] + [CRC Check (2 bytes, little-endian)]

6.2.1 01 Command: Read Coils Status

Purpose: Read the ON/OFF status of specified output relays (coils). The ExxV3 maps output channels to Coil Addresses **1 - (8~24)** (1-based) or **0 -**

(7~23) (0-based, note: MODBUS RTU typically uses 1-based addressing for coils in user interactions).

Example: Read status of all 16 output relays (Coil 0001 - 0016 for E16V3)

- **Request Frame** (hexadecimal):

01 01 00 00 00 10 3D 0A

Field	Hex Value	Description
Slave ID	01	Target device address (set to 1 in this example)
Function Code	01	Read Coils Status command code
Starting Address (Hi)	00	High byte of the starting coil address (0001 in 1-based = 0000 in 0-based)
Starting Address (Lo)	00	Low byte of the starting coil address
Quantity of Coils (Hi)	00	High byte of the number of coils to read (16 coils total)
Quantity of Coils (Lo)	10	Low byte of the number of coils to read (10_{16} = 16_{10})
CRC Check (Lo)	3D	Low byte of CRC-16 checksum (calculated for the entire frame)
CRC Check (Hi)	0A	High byte of CRC-16 checksum

- **Response Frame** (hexadecimal, example: Coils 0001=ON, 0002=OFF, ..., 0016=ON):

01 01 02 01 80 B8 3A

Field	Hex Value	Description

Slave ID	01	Responding device address (matches the request’s Slave ID)
Function Code	01	Echo of the request’s function code (confirms command type)
Byte Count	02	Number of data bytes following (16 coils = 2 bytes: 16 bits / 8 bits/byte)
Data Byte 1	01	Status of Coils 0001–0008 (bit 0=Coil0001, bit7=Coil0008; $01_{16}=00000001_2$ → Coil0001=ON)
Data Byte 2	80	Status of Coils 0009–0016 (bit0=Coil0009, bit7=Coil0016; $80_{16}=10000000_2$ → Coil0016=ON)
CRC Check (Lo)	B8	Low byte of CRC-16 checksum
CRC Check (Hi)	3A	High byte of CRC-16 checksum

6.2.2 05 Command: Force Single Coil

Purpose: Control the ON/OFF state of a single output relay (coil).

Example 1: Turn ON Output Relay 0005 (Coil 0005 = ON)

- **Request Frame** (hexadecimal):

01 05 00 04 FF 00 8C 3A

Field	Hex Value	Description

Slave ID	01	Target device address
Function Code	05	Force Single Coil command code
Coil Address (Hi)	00	High byte of the target coil address (0005 in 1-based = 0004 in 0-based)
Coil Address (Lo)	04	Low byte of the target coil address
Coil State (Hi)	FF	High byte for "ON" state (standard MODBUS: FF00 = ON, 0000 = OFF)
Coil State (Lo)	00	Low byte for "ON" state
CRC Check (Lo)	8C	Low byte of CRC-16 checksum
CRC Check (Hi)	3A	High byte of CRC-16 checksum

- **Response Frame** (hexadecimal):
  01 05 00 04 FF 00 8C 3A
  Note: For 05 command, the response frame is identical to the request frame (confirms the command was received and executed).

Example 2: Turn OFF Output Relay 0005 (Coil 0005 = OFF)

- **Request Frame** (hexadecimal):
  01 05 00 04 00 00 CD CA

Field	Hex Value	Description
Coil State (Hi)	00	High byte for "OFF" state
Coil State (Lo)	00	Low byte for "OFF" state

CRC Check (Lo)	CD	Low byte of CRC-16 checksum
CRC Check (Hi)	CA	High byte of CRC-16 checksum

- **Response Frame** (hexadecimal):
  01 05 00 04 00 00 CD CA
  Identical to the request frame (confirms OFF command execution).

6.2.3 0F Command: Force Multiple Coils

Purpose: Control the ON/OFF state of multiple output relays (coils) in a single command.

Example: Turn ON Coils 0002, 0004, 0007 and OFF all other coils (Coils 0001 - 0008)

- **Request Frame** (hexadecimal):
  01 0F 00 00 00 08 01 2A 4C 07

Field	Hex Value	Description
Slave ID	01	Target device address
Function Code	0F	Force Multiple Coils command code
Starting Address (Hi)	00	High byte of starting coil address (0001 in 1-based = 0000 in 0-based)
Starting Address (Lo)	00	Low byte of starting coil address
Quantity of Coils (Hi)	00	High byte of number of coils to control (8 coils total)
Quantity of Coils (Lo)	08	Low byte of number of coils to control (08_{16} = 8_{10})

Byte Count	01	Number of data bytes (8 coils = 1 byte)
Data Byte	2A	Coil states ($2A_{16}$ = 00101010_2 → bits 1,3,6=1 → Coils 0002,0004,0007=ON)
CRC Check (Lo)	4C	Low byte of CRC-16 checksum
CRC Check (Hi)	07	High byte of CRC-16 checksum

- **Response Frame** (hexadecimal):

01 0F 00 00 00 08 4C 07

Field	Hex Value	Description
Slave ID	01	Responding device address
Function Code	0F	Echo of request function code
Starting Address (Hi)	00	Echo of request’s starting address (Hi)
Starting Address (Lo)	00	Echo of request’s starting address (Lo)
Quantity of Coils (Hi)	00	Echo of request’s quantity of coils (Hi)
Quantity of Coils (Lo)	08	Echo of request’s quantity of coils (Lo)
CRC Check (Lo)	4C	Low byte of CRC-16 checksum
CRC Check (Hi)	07	High byte of CRC-16 checksum
The response confirms		

the number of coils controlled and the starting address, but not the individual coil states (use 01 command to verify states).		

7. Factory Reset

If you forget the communication parameters (e.g., baud rate) or SLAVE ID settings, you can restore the board to its factory default settings by:

1. Ensuring the board is powered on.
1. Long-pressing the **RST button** for 5 seconds.
1. Releasing the RST button; the board will reboot with default settings (baud rate: 38400, 8,N,1; SLAVE ID: 1 if no DIP switches are toggled).

8. Installation & Wiring Precautions

1. **Power Supply**: Use a stable 12-24V DC power supply that matches the board's input requirements. Avoid overvoltage to prevent component damage.
1. **Relay Loads**: Do not exceed the 16A current rating of each relay. For inductive loads (e.g., motors), add a surge protector to extend relay life.
1. **Grounding**: Ensure proper grounding of the board to reduce EMI and improve signal stability.
1. **Wiring**: Use appropriate wire gauges (recommended: 16-22 AWG for inputs, 10-14 AWG for high-current outputs) and secure connections with the barrier terminals.

9. how to change baud rate:

step1: modbus 06 command write address 2 (data:0-4　　0：4800，1：9600，2：19200，3：38400，4：57600)

step2: modbus 05 command write address 501 = true will save the config.

step3: power off->on of board.

if forget the setting. hold on the "RESET" button > 3 seconds, it will auto set to default setting with 38400bps.