EA Control Tech

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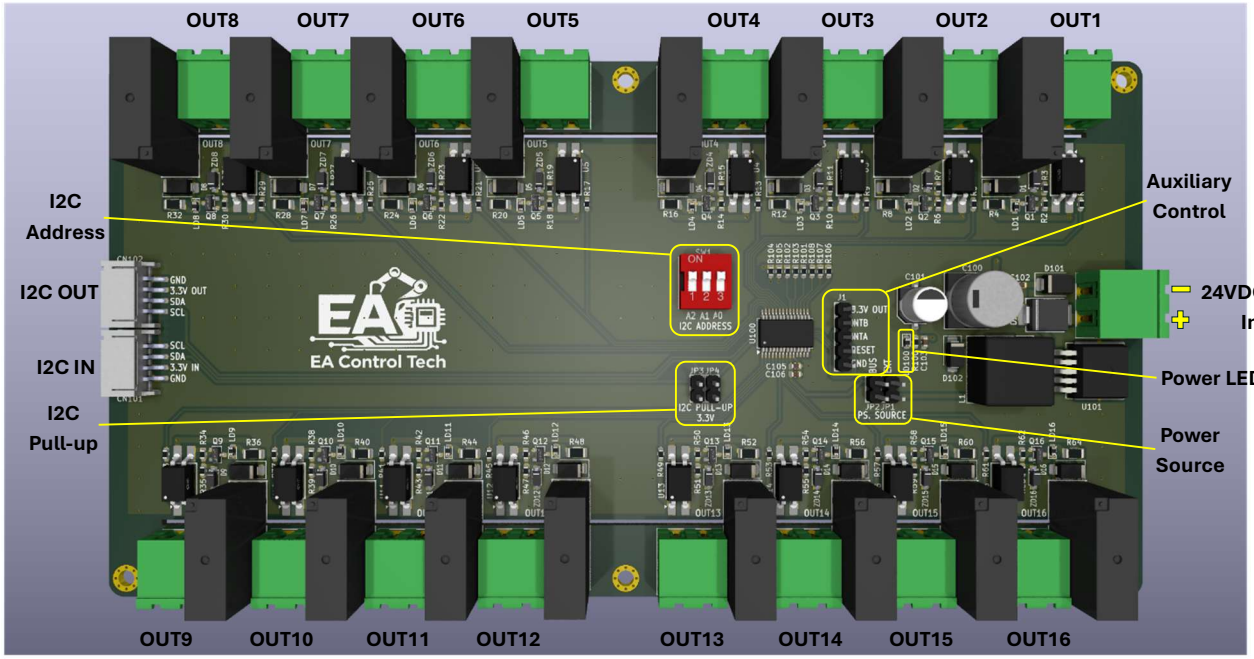
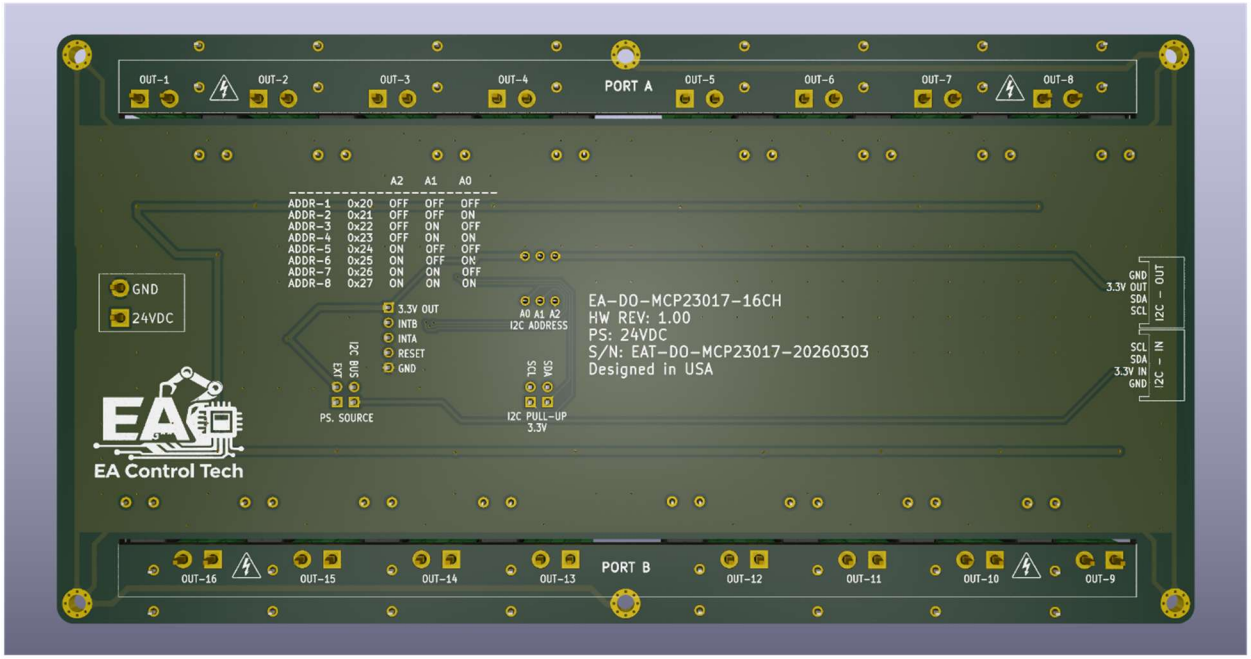
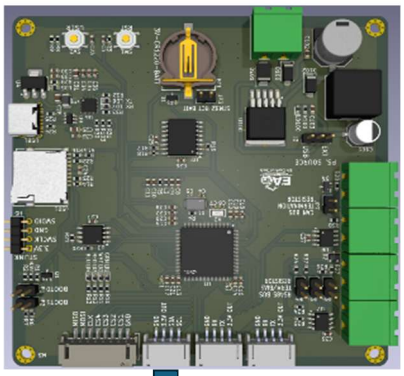
16-Channel 24VDC Relay Output Module
with Optocoupler Drivers

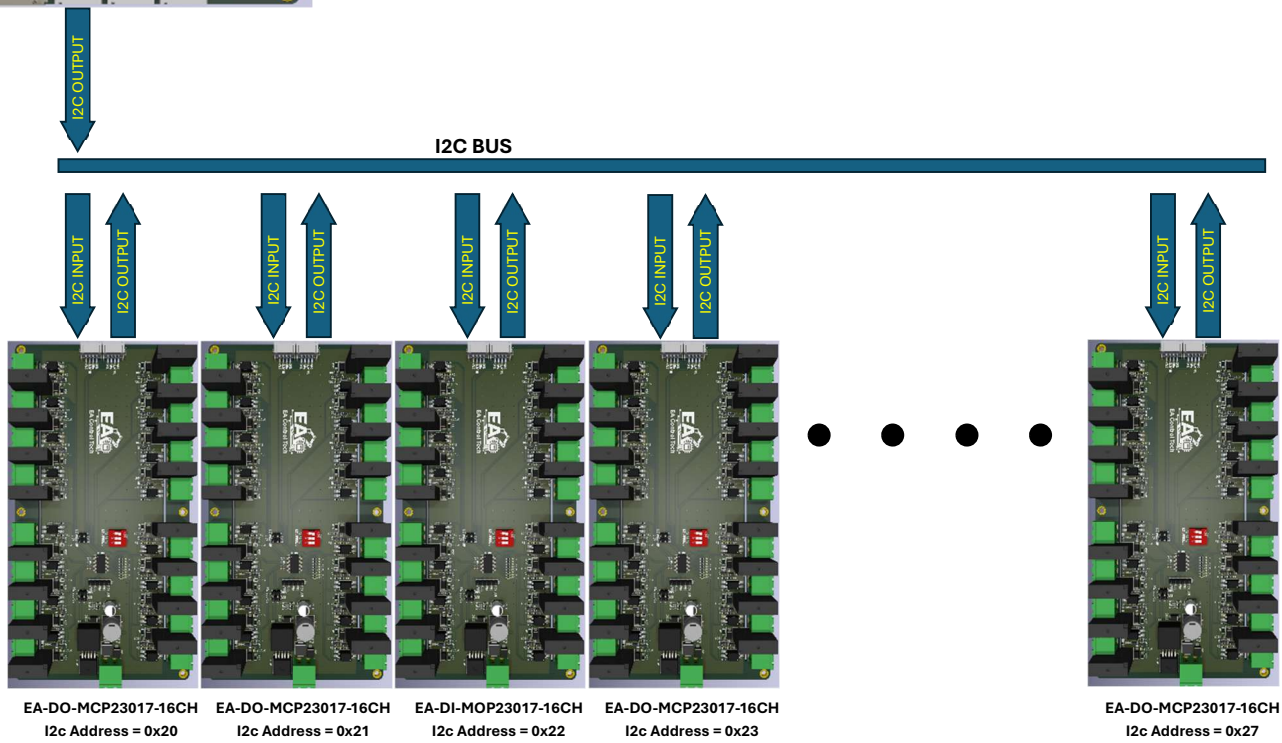
Model: EA-DO-MCP23017-16CH
Hardware Revision: V1.0





EA-CORE-407




I2C OUTPUT
I2C BUS
I2C INPUT
I2C OUTPUT
I2C INPUT
I2C OUTPUT
I2C INPUT
I2C OUTPUT
I2C INPUT
I2C OUTPUT
EA-DO-MCP23017-16CH
I2c Address = 0x20
EA-DO-MCP23017-16CH
I2c Address = 0x21
EA-DI-MOP23017-16CH
I2c Address = 0x22
EA-DO-MCP23017-16CH
I2c Address = 0x23
EA-DO-MCP23017-16CH
I2c Address = 0x27

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Product Overview

The EA-DO-MCP23017-16CH is a 16-channel relay output module designed for industrial 24VDC control systems.

The module is based on the MCP23017 I^2C GPIO expander and allows a host controller to control external loads through sixteen relay outputs.

Each output channel includes:

- optocoupler-driven control circuitry
- transistor driver stage
- relay output contact
- output status indicator
- flyback protection for the relay coil

The module communicates with the host system through an I^2C interface and is suitable for applications requiring reliable switching of AC or DC loads such as relays, solenoids, lamps, or other control devices.

Intended Applications

Typical applications include:

- PLC and embedded controller output expansion
- Industrial automation control systems
- Relay and contactor control
- Alarm and signaling systems
- Remote I/O systems
- Distributed equipment control

Key Features

- 16 × relay outputs (SPST normally open)
- MCP23017 I^2C GPIO expander
- 3.3V logic interface
- Optocoupler-driven relay control for improved signal integrity
- Flyback protection for relay coils
- Output status LEDs
- I^2C address selection via DIP switch (A0, A1, A2)
- Interrupt outputs available (INTA / INTB)
- Hardware reset pin available
- I^2C IN and I^2C OUT connectors for bus expansion

- On-board 24V → 3.3V buck regulator
- Optional external 3.3V supply
- Industrial screw terminal connectors
- PCB size: 100 mm × 193.5 mm

System Architecture

The module consists of three main functional blocks:

- I^2C Communication Interface
- Relay Driver Circuitry
- Relay Output Contacts

The MCP23017 GPIO expander receives commands from the host controller via the I^2C bus and controls the relay driver circuitry through optocouplers.

The relay drivers energize the relay coils, which in turn switch the external load connected to the output terminals.

Electrical Characteristics (Preliminary – HW Rev 1.0)

Power Supply

Parameter	Value
Nominal Supply	24 VDC
Supply Type	External DC
Protection	Reverse polarity diode, TVS suppression
On-board regulation	Buck regulators (3.3 V & analog rail)

3.3V Source Selection: The board supports selecting either:

- On-board generated 3.3V, or
- External 3.3V input (3.3V-Ext)

Logic Interface

Parameter	Value
Communication	I^2C
Logic Level	3.3V
Device	MCP23017
Interrupts	INTA, INTB exposed
Reset	RESET exposed

Relay Outputs

Parameter	Value
Number of Outputs	16
Relay Type	SPST Normally Open
Contact Rating	5 A
Maximum Load Voltage	30 VDC / 250 VAC

Relay Characteristics

Parameter	Value
Coil Voltage	24 VDC
Coil Resistance	2.88 kΩ
Coil Power	~200 mW
Coil Current	~8.3 mA
Operating Temperature	−40°C to +85°C
Contact Material	Silver Alloy (Cd-Free)

Mechanical Specifications

Parameter	Value
PCB Size	100 mm × 193.5 mm
Mounting	M3 holes
Output Count	16 channels

Output Operation

When a GPIO pin of the MCP23017 is set HIGH:

- The optocoupler LED turns on
- The optocoupler transistor activates
- The MOSFET driver stage switches ON
- The external load is energized

When the GPIO pin is LOW:

- Optocoupler is OFF
- Output transistor is OFF
- Load is de-energized

Inductive Load Protection

Each output includes a flyback diode across the load driver to protect the switching transistor when driving inductive loads such as:

- relay coils
- solenoids
- contactors

Output Terminals

Outputs are divided into two ports.

PORT A

Channels:

- OUT1
- OUT2
- OUT3
- OUT4
- OUT5
- OUT6
- OUT7
- OUT8

PORT B

Channels:

- OUT9
- OUT10
- OUT11
- OUT12
- OUT13
- OUT14
- OUT15
- OUT16

I²C Interface

I²C IN

Signal order:

- SCL
- SDA
- 3.3V IN
- GND

I²C OUT

Signal order:

- GND
- 3.3V OUT
- SDA
- SCL

Allows cascading multiple modules on the same I²C bus.

Control Header

Signals available:

- 3.3V OUT
- INTB
- INTA
- RESET
- GND

I²C Address Selection Auxiliary Control & Status Signals

Address	A2	A1	A0
0x20	OFF	OFF	OFF
0x21	OFF	OFF	ON
0x22	OFF	ON	OFF
0x23	OFF	ON	ON
0x24	ON	OFF	OFF
0x25	ON	OFF	ON
0x26	ON	ON	OFF
0x27	ON	ON	ON
0x20	OFF	OFF	OFF
0x21	OFF	OFF	ON
0x22	OFF	ON	OFF
0x23	OFF	ON	ON
0x24	ON	OFF	OFF

Up to 8 modules may share the same I²C bus.

I²C Pull-Up Configuration

JP3 / JP4 allow enabling onboard 3.3V pull-up resistors for:

- SDA
- SCL

Disable pull-ups if the bus already includes pull-ups elsewhere.

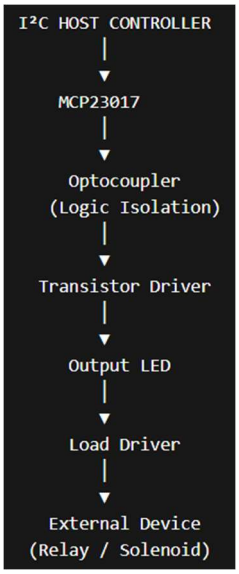
Power Source Selection (JP1 / JP2)

PS SOURCE jumper selects:

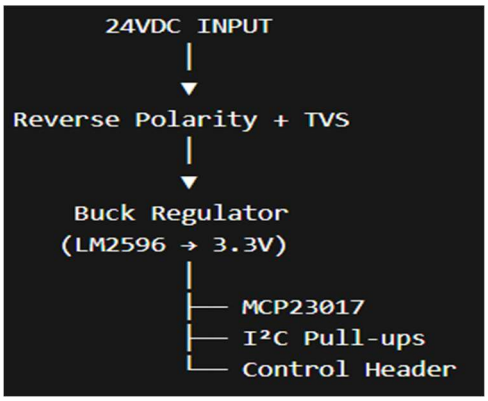
- BUS (use 3.3V from I²C bus), or
- EXT (use onboard 24V → 3.3V regulator)

Functional Block Diagram

System Architecture Overview



Power Architecture



Operating Limits

This module is designed for use in 24VDC industrial control systems.

Recommended loads:

- relays
- solenoids
- lamps
- PLC inputs

Use appropriate wiring practices and disconnect power before modifying connections.

Output Rating

Maximum load current: 5 A per channel
Maximum load voltage:

- 30 VDC
- 250 VAC

Relay Type

Relay: **G5NB-1A-E-24VDC**
Contact type: SPST Normally Open
Coil voltage: 24 V
Coil current: ~8.3 mA

Connector

Output connector: WJ2EDGRC-5.08-2P
Typical rating: ~15 A per contact

PCB Layout and Mechanical Dimensions