EA Control Tech

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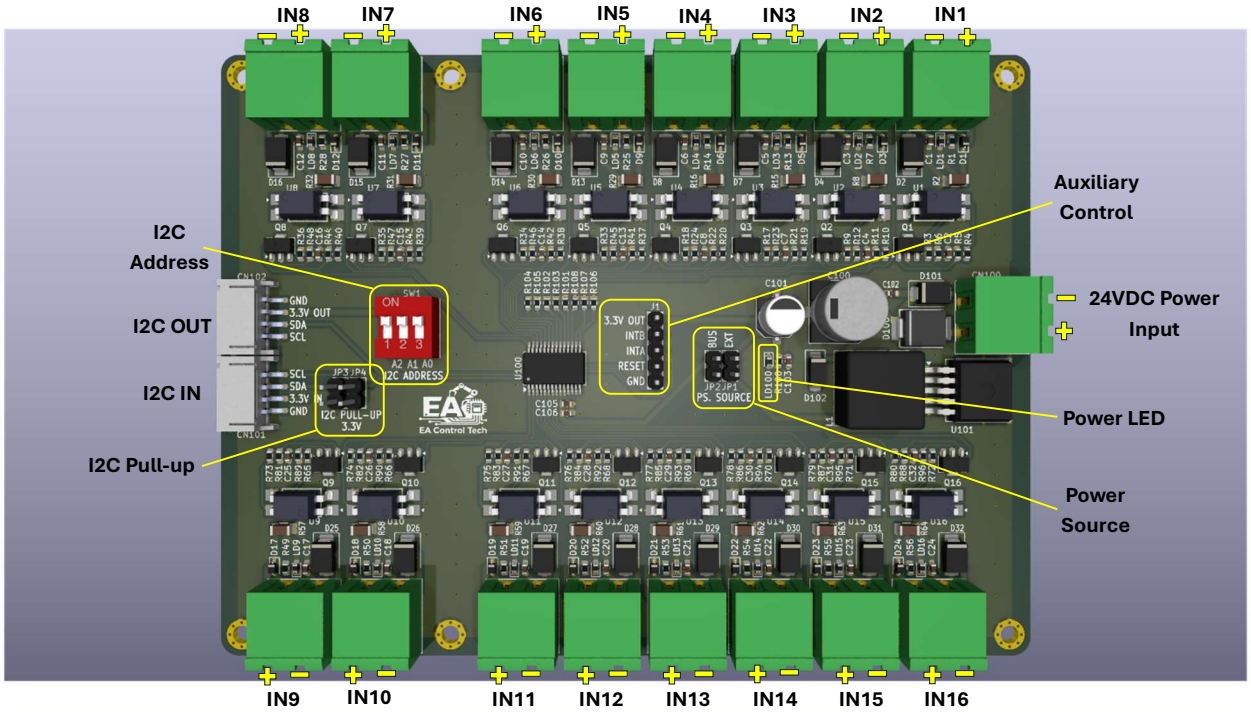
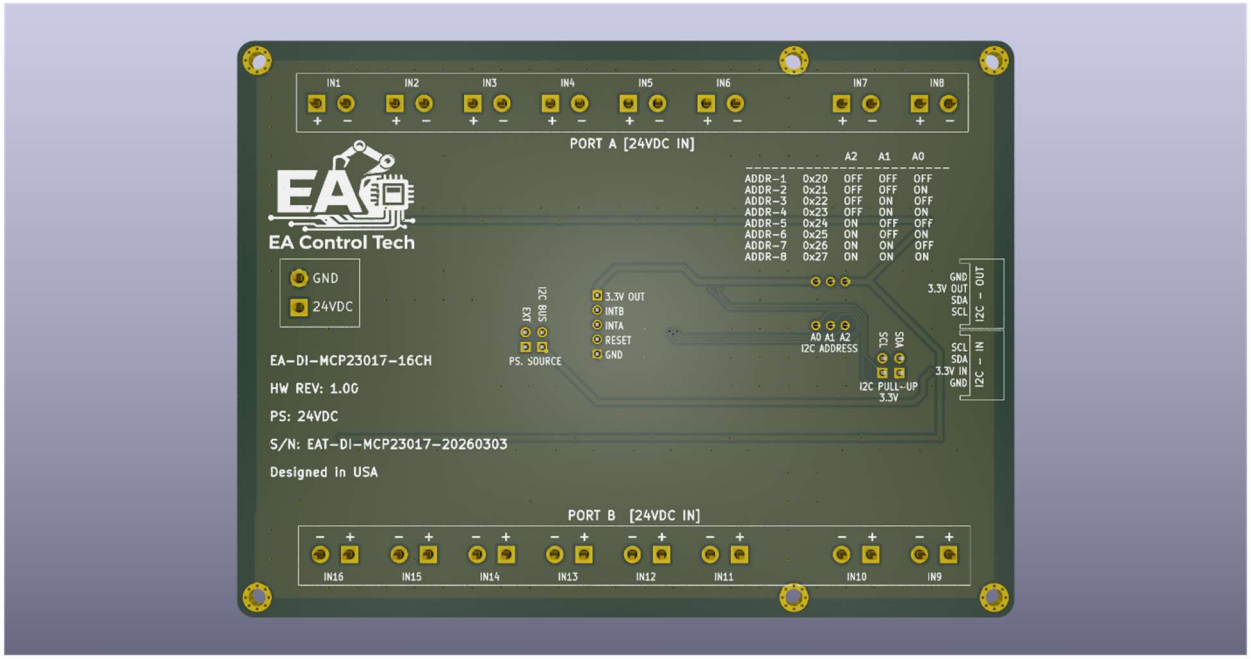
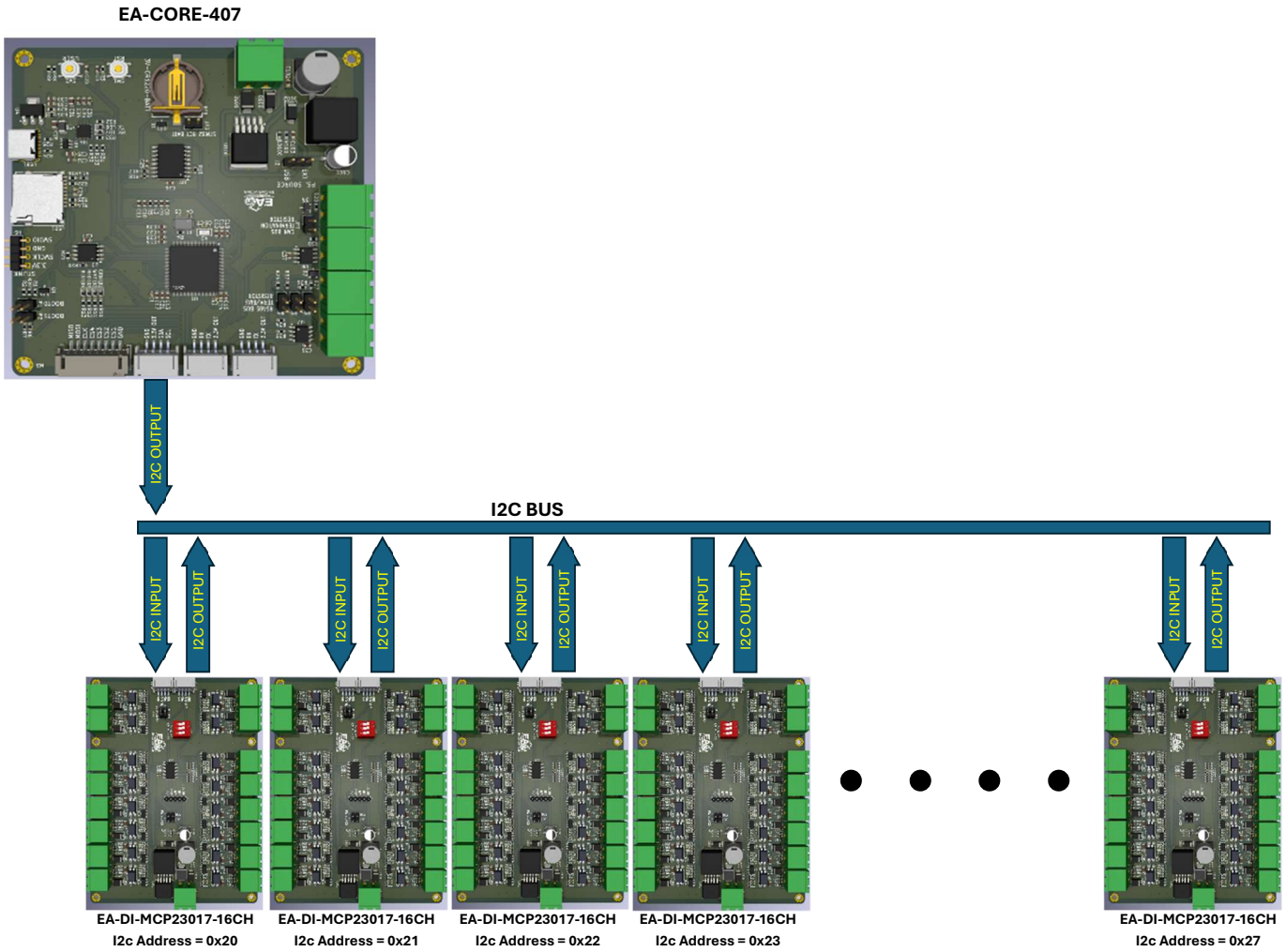
16-Channel 24VDC Opto-Isolated Digital Input Module

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






EA-CORE-407
I2C OUTPUT
I2C BUS
I2C INPUT
I2C OUTPUT
EA-DI-MCP23017-16CH
I2c Address = 0x20
EA-DI-MCP23017-16CH
I2c Address = 0x21
EA-DI-MCP23017-16CH
I2c Address = 0x22
EA-DI-MCP23017-16CH
I2c Address = 0x23
EA-DI-MCP23017-16CH
I2c Address = 0x27

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Product Overview

The EA-DI-MCP23017-16CH is a 16-channel 24VDC digital input module based on the MCP23017 I^2C GPIO expander. The board provides robust industrial input conditioning with opto-isolation, surge protection, and filtering per channel.

Digital input state is read by the MCP23017 over I^2C at 3.3V logic level. Each active field input results in a logic HIGH at the MCP23017 input pin.

Intended Applications

Typical applications include:

- PLC / embedded controller digital input expansion
- 24VDC PNP sensor interfacing (sourcing inputs)
- Panel monitoring and discrete status acquisition
- Industrial automation I/O nodes
- Remote I/O and distributed input collection

Key Features

- 16 × 24VDC digital inputs
- Opto-isolated field inputs (field side isolated from logic side)
- Input protection: reverse polarity diode + TVS suppression
- Per-channel input filtering for noise reduction
- MCP23017 I^2C interface (3.3V logic)
- I^2C address selection via A0/A1/A2 DIP switch
- Optional I^2C pull-up enable jumper
- INT A / INT B interrupt outputs exposed
- RESET signal exposed
- Separate I^2C IN and I^2C OUT connectors (daisy-chain capable)
- On-board 24V → 3.3V buck regulator (LM2596-3.3V)
- Power-source selection: on-board 3.3V or external 3.3V input
- PCB size: 100 mm × 135 mm, M3 mounting

Electrical Characteristics (Preliminary – HW Rev 1.0)

Power Input

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

Digital Inputs (Per Channel)

Parameter	Value
Input Type	24VDC sourcing (PNP-style)
Isolation	Opto-isolated field inputs
Input Polarity	Active-high at MCP23017 (24V applied → logic HIGH)
Protection	TVS + reverse polarity + series resistance
Filtering	RC filtering at input stage

Input Current (Computed)

At 24VDC applied to one channel, the input draws approximately:

- ~6.8 mA per channel @ 24V (typical)

Worst case (all 16 inputs ON):

- ~108 mA total field-side input draw

(This is current drawn from the input sources/field wiring, not from the 3.3V logic rail.)

Practical ON/OFF Voltage Guidance

Recommended levels for robust detection:

- ON (recommended): ≥ 12 VDC
- OFF (recommended): ≤ 5 VDC
- Typical detection begins around ~8 VDC (component dependent)

Mechanical Specifications

Parameter	Value
PCB Size	100 mm × 135 mm
Mounting	M3 holes
Input Count	16 channels

Input Architecture (Functional Description)

Each input channel includes:

- Reverse polarity protection diode
- TVS surge clamp to field return
- Series current-limiting resistor feeding an optocoupler LED
- Filtering capacitor for transient/noise reduction
- Logic-side transistor stage presenting a clean 3.3V digital signal to the MCP23017

Isolation boundary:

- Field input terminals are isolated from logic ground via the optocoupler.

Operating Limits and Safe Use

- The module is designed for 24VDC discrete inputs.
- Use sourcing inputs (PNP sensors or 24V source applied to IN+).

Recommended practice:

- Do not exceed the intended input voltage level for the channel (24VDC nominal systems).
- Verify wiring polarity per input terminal marking (+ / −).
- Power down before rewiring in field environments.

Connector Interfaces

Power Input

Signal Order (as printed):

- GND
- 24VDC

This input powers:

- Field-side input circuitry (24V domain)
- On-board 3.3V buck regulator

Digital Input Terminals

The board provides 16 opto-isolated 24VDC digital inputs divided into two ports.

PORT A — 24VDC Inputs

Channels:

- IN1 (+ / –)
- IN2 (+ / –)
- IN3 (+ / –)
- IN4 (+ / –)
- IN5 (+ / –)
- IN6 (+ / –)
- IN7 (+ / –)
- IN8 (+ / –)

Wiring Type:
Sourcing (PNP-style)

- "+" terminal → 24V signal
- "–" terminal → Field return

Applying 24V to the "+" terminal results in logic HIGH at the MCP23017.

PORT B — 24VDC Inputs

Channels:

- IN9 (+ / –)
- IN10 (+ / –)
- IN11 (+ / –)
- IN12 (+ / –)
- IN13 (+ / –)
- IN14 (+ / –)
- IN15 (+ / –)
- IN16 (+ / –)

Same electrical behavior as PORT A.

I²C Interface — I²C IN

Signal Order (Top → Bottom):

- SCL
- SDA
- 3.3V IN
- GND

Used to connect the board to the host controller.

I²C Interface — I²C OUT (Daisy Chain)

Signal Order (Top → Bottom):

- GND
- 3.3V OUT
- SDA
- SCL

Allows cascading multiple modules on the same I²C bus.

Control / Interrupt Header (J1)

Signal Order (Top → Bottom):

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

Provides access to:

- Both MCP23017 interrupt outputs
- Hardware reset line
- 3.3V reference
- Ground

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)

Operating Limits and Safe Use

System Voltage

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

- Intended for nominal 24VDC field signals.
- Use only within standard 24V industrial environments.

Applying voltages outside typical 24VDC system levels is not supported.

Input Usage

- Inputs are designed for sourcing (PNP-style) 24VDC signals.

- Applying 24VDC to the "+" terminal of a channel results in:
  - Optocoupler activation
  - Logic HIGH at the MCP23017 input

Each channel draws approximately:

- ~6.8 mA at 24VDC (typical)

Isolation Boundary

- Field inputs are opto-isolated from logic circuitry.
- 24V field ground is isolated from GNDD (logic ground).
- Do not intentionally connect field ground to logic ground.

I^2C Bus Considerations

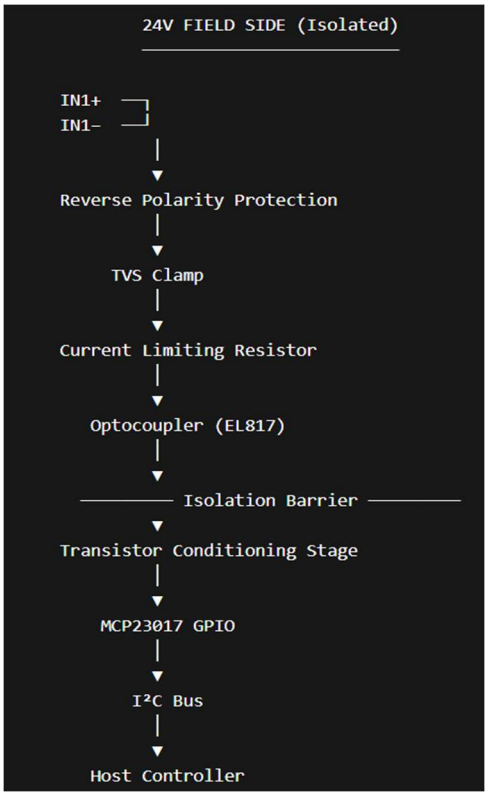
- I^2C operates at 3.3V logic level.
- Enable onboard pull-ups only if the bus does not already include pull-ups.
- Ensure unique I^2C address per module.

General Safety Notes

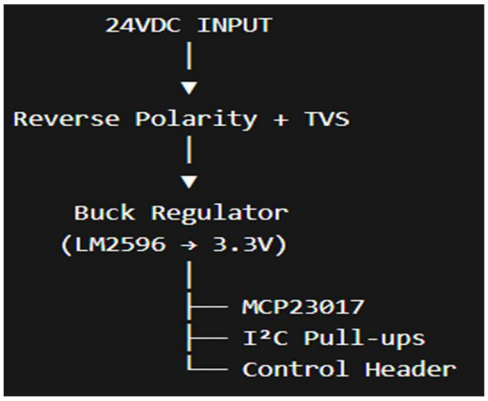
- Disconnect power before wiring changes.
- Verify correct polarity at each input terminal.
- Use appropriate industrial wiring practices.
- Ensure enclosure and grounding meet system-level safety requirements.

Functional Block Diagram

System Architecture Overview



Power Architecture



Signal Behavior Summary

Field Condition	Optocoupler	MCP23017 Input
24V Applied	ON	Logic HIGH
No Voltage	OFF	Logic LOW

PCB Layout and Mechanical Dimensions