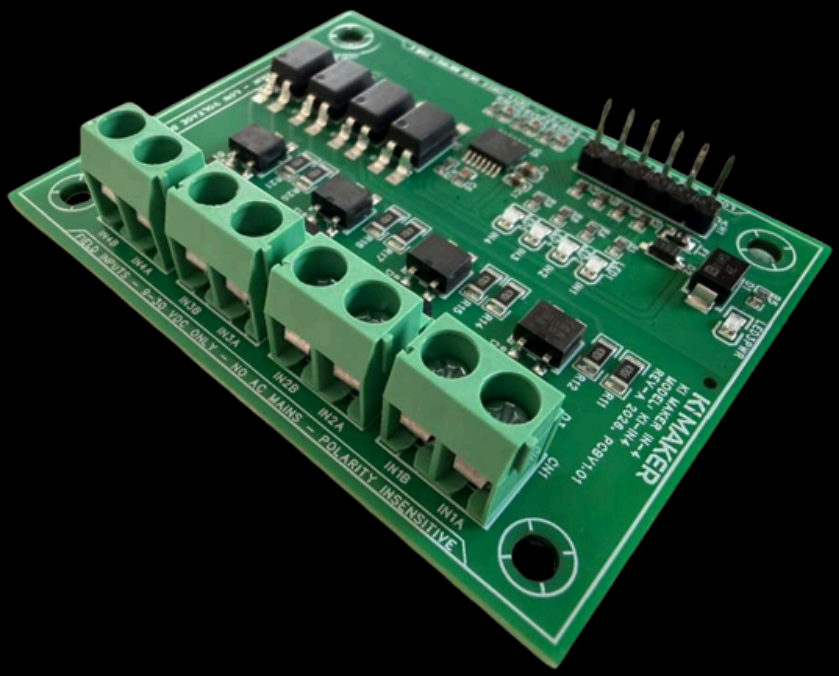
KI MAKER

IN-4

User Manual

Protected 4-Channel Opto-Isolated DC Input Board

For Arduino, ESP32, Raspberry Pi, STM32, CNC controllers, PLC-style DC signals, and maker automation projects.



9-30 VDC FIELD INPUTS

3.3 V / 5 V LOGIC

LOGIC OUTPUTS ONLY

NO AC MAINS | FIELD INPUT PAIRS ARE POLARITY-INSENSITIVE | OUTx_LOGIC = ACTIVE HIGH

Model: KI-IN4-RevA
Date: 09/03/2026
Revision: v1.0 Released
PCB Version: PCBV1.01
Board Revision: Rev-A

WARNING - LOW VOLTAGE DC MODULE ONLY

NOT A CERTIFIED SAFETY DEVICE

READ THIS FIRST

Before wiring or applying power

- Use only low-voltage DC field signals on CN1-CN4. Rev-A is specified for 9-30 VDC field inputs.
- Never connect AC mains, 120 VAC, or 240 VAC anywhere on the board.
- Power H1 VLOGIC from the controller or KI Maker power board only: 3.3 V or 5 V logic side only.
- OUT1-OUT4 are logic outputs for microcontroller input pins only. They are not load outputs.
- Field input pairs INxA/INxB are polarity-insensitive for normal DC input use.
- This board is not for medical, life-safety, automotive safety, emergency-stop, mains-control, or fail-safe applications.
- Mount the bare PCB on insulated standoffs. Keep it away from conductive surfaces and debris.

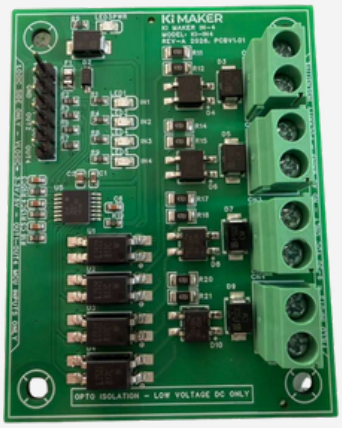
IMPORTANT

The IN-4 protects microcontroller inputs from common low-voltage DC field wiring mistakes. It does not make wiring safe automatically. Verify supply voltage, polarity, sensor type, and controller pin configuration before use.

DC ONLY	9-30 VDC	3.3/5 V	ACTIVE HIGH	POWER OFF
No AC mains	Field inputs	Logic side	OUTx behavior	Before wiring

Welcome to the KI Maker Family!

Congratulations on acquiring the KI Maker IN-4 Protected Input Board. This manual is your guide to setting up, wiring, testing, and safely using the board to read real-world low-voltage DC switches and sensors from Arduino, ESP32, Raspberry Pi, STM32, CNC, and PLC-style control systems.



This manual is written to be practical: clear wiring rules, honest ratings, realistic warnings, and measurement points you can actually use.

Inside this manual

KI MAKER PROMISE

Clear wiring, honest ratings, and maker-friendly documentation. If a rating is not finalized, the manual says so instead of overstating it.

Quick Start: Read This Before Wiring

This section is the short version for first-time users. It does not replace the rest of the manual. Use it to prevent the most common input-board wiring mistakes before applying power.

1. Place the board on an insulated surface or standoffs.
2. Connect H1 VLOGIC to the controller logic rail: 3.3 V or 5 V only.
3. Connect H1 GND_LOGIC to the controller ground reference.
4. Leave field input wires disconnected first. Verify PWR LED behavior.
5. Connect OUT1_LOGIC to a controller input pin and configure the pin as an input.
6. Apply one known 12 V or 24 V DC signal across IN1A/IN1B and verify LED1 and OUT1_LOGIC.
7. Repeat one input channel at a time before connecting all sensors.

Before you continue

DC supply only No AC input	**Field pair** Signal across INxA/INxB	**VLOGIC required** 3.3 V / 5 V only
OUTx = HIGH When input is active	**One channel** Test first	**Power off** Before wiring changes

WARNING - POWER OFF BEFORE WIRING

Always remove input power before wiring field signals, moving controller connections, changing logic voltage, or attaching probes to uncertain nodes.

Product Overview

The KI Maker IN-4 Rev-A is a compact low-voltage DC input-conditioning board intended to let low-power control electronics read real-world 12 V and 24 V style switches and sensors cleanly. It is designed for maker projects, small control panels, benchtop systems, enclosure accessories, CNC add-ons, robotics, 3D printer modifications, and educational builds.

Each input channel accepts a DC voltage across a two-terminal field input pair. The channel is protected, polarity-insensitive, opto-isolated, filtered, and cleaned up through a Schmitt trigger. The final customer-facing logic output is active high.

Primary functions

- Accepts four independent field input channels.
- Reads switches, limit switches, relay contacts, and DC sensor outputs.
- Provides active-high OUT1-OUT4 logic signals.
- Works with 3.3 V and 5 V controller logic supplies.
- Uses clear screw terminals and silkscreen labels.
- Includes a VLOGIC power LED and input activity LEDs.

Protection / conditioning features

- Per-channel SMBJ33CA TVS clamps on field input pairs.
- Per-channel MB10S bridge rectifiers for polarity-insensitive DC wiring.
- Two 4.7 kOhm 1206 input resistors per channel for LED current limiting.
- LTV-817 optocouplers separate field side from logic side.
- 22 kOhm pull-ups and 10 nF filters feed SN74HC14 Schmitt cleanup.
- 220 Ohm series resistors protect final logic outputs.

CUSTOMER-FACING BEHAVIOR

Field input OFF = OUTx_LOGIC LOW and channel LED OFF. Valid field input ON = OUTx_LOGIC HIGH and channel LED ON. This active-high behavior is intentional because it matches beginner expectations for an active input.

Typical Users and Boundaries

Typical users

- Makers building 12 V / 24 V accessory systems.
- Arduino, ESP32, Raspberry Pi, Pico, Teensy, and STM32 users reading field signals
- CNC and 3D printer users reading end stops and limit switches.
- Robotics builders reading float switches, door switches, and sensor outputs.
- Technicians evaluating low-voltage DC control wiring.
- Educators demonstrating input isolation and signal conditioning.

Not intended for

- AC mains or line-voltage wiring anywhere on the board.
- Certified safety, emergency-stop, medical, life-support, or automotive safety systems
- Industrial PLC compliance claims or safety-rated isolation claims.
- High-speed encoder, frequency-counting, CAN, RS-485, I2C, or serial data inputs.
- Driving relays, motors, lights, or loads directly from OUTx_LOGIC.
- Use without an enclosure where fingers, tools, dust, or conductive debris can contact

Does

- Lets small controllers read real 9-30 VDC signals.
- Keeps field wiring cleaner than loose optocouplers or breadboard circuits.
- Provides four matching input channels.
- Makes each channel easy to test using LEDs and H1 pins.

Does not

- Does not generate 3.3 V or 5 V logic power by itself.
- Does not output relay-contact behavior.
- Does not certify field wiring as safe.
- Field inputs are specified for 9-30 VDC; operation below 9 V is not a published rating.

LOGIC OUTPUT WARNING

OUT1_LOGIC through OUT4_LOGIC are intended for microcontroller input pins only. Use the KI Maker OUT-4 or another proper driver board when you need to switch real loads.

Specifications

These values are the released Rev-A / PCB V1.01 specifications. The 9-30 VDC field-input range has been validated across all four channels on multiple prototype boards, including normal and reversed field polarity.

Category	Item	Specification / status
Electrical	Field input channels	4 independent two-terminal input pairs
Electrical	Field input range	9-30 VDC released Rev-A range
Electrical	Nominal field use	12 V / 24 V switches, sensors, and relay contacts
Electrical	Input polarity	Polarity-insensitive DC field input pairs via bridge rectifiers
Electrical	Logic supply	3.3 V or 5 V user-supplied VLOGIC at H1
Electrical	Output behavior	OUT1-OUT4 active high; field input active = logic HIGH
Electrical	Output purpose	Microcontroller input pins only; not load outputs
Protection	Field transient clamp	SMBJ33CA TVS diode per input channel
Protection	Input conditioning	LTV-817 optocoupler per channel, 22 kOhm pull-up, 10 nF filter
Protection	Output cleanup	SN74HC14 Schmitt-trigger buffer and 220 Ohm series output resistors
Protection	Logic rail protection	Fused VLOGIC input with TVS/Schottky protection network
Mechanical	Board size	50.00 mm x 65.00 mm
Mechanical	Mounting	Four M3 mounting holes, insulated standoffs recommended
Environmental	Use condition	Indoor low-voltage maker/control electronics; protect from conductive debris
Validation	Below 9 V operation	Not a published rating; released field-input specification is 9-30 VDC

CURRENT / LOAD NOTE

The IN-4 outputs are signal outputs only. For load switching, use a proper output driver such as the KI Maker OUT-4.

How One IN-4 Channel Works

Each channel uses the same conditioning chain. The field side accepts a low-voltage DC signal across INxA and INxB. The logic side converts that signal into a clean active-high OUTx_LOGIC signal for the controller.

IMPORTANT WIRING RULE

Apply the field voltage across the matching input pair: IN1A/IN1B, IN2A/IN2B, IN3A/IN3B, or IN4A/IN4B. Do not connect mains voltage. Do not use OUTx_LOGIC to power loads.

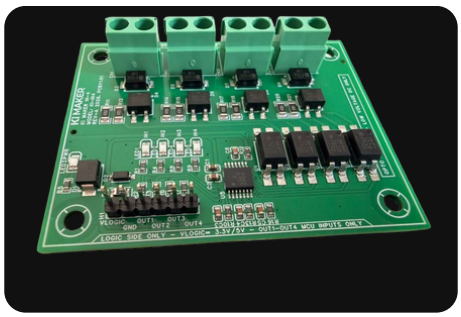
Why polarity-insensitive input pairs help

The bridge rectifier makes each field-input pair polarity-insensitive for normal DC operation. Either orientation across INxA/INxB is accepted within the released 9-30 VDC field-input range.

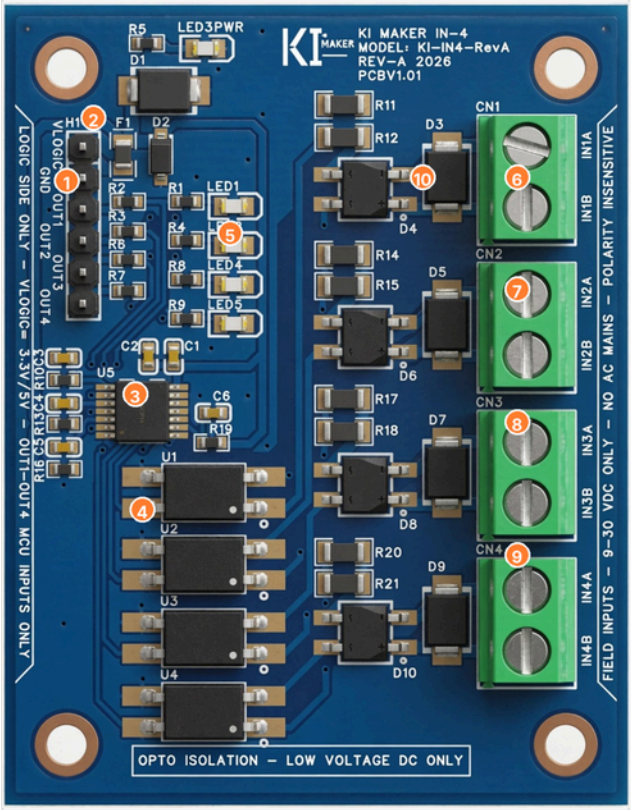
Why the logic connection matters

VLOGIC powers the logic-side buffer and LEDs. GND_LOGIC is the controller-side reference. The controller reads OUT1_LOGIC through OUT4_LOGIC relative to GND_LOGIC.

Field input	Optocoupler	Final output	LED
OFF / no valid voltage	OFF	LOW	OFF
ON / valid voltage	ON	HIGH	ON



Connector Map and Board Labels



#	Label	Function	Wiring note
1	H1	Logic connector	VLOGIC, GND_LOGIC, OUT1-OUT4
2	F1/D1/D2	Logic-side protection	Fused VLOGIC input and clamps
3	U5	Schmitt trigger	Cleans opto outputs
4	U1-U4	Optocouplers	Field-to-logic signal isolation
5	LED1/2/4/5	Input activity LEDs	ON when final logic output is active
6	CN1	Channel 1 field input	IN1A / IN1B
7	CN2	Channel 2 field input	IN2A / IN2B
8	CN3	Channel 3 field input	IN3A / IN3B
9	CN4	Channel 4 field input	IN4A / IN4B
10	D3-D10 / R11-R21	Field protection and current limit	TVS, bridge, and opto LED resistors

BOARD SILKSCREEN REMINDER

The PCB marks LOGIC SIDE ONLY, VLOGIC - 3.3V/5V, FIELD INPUTS - 9-30 VDC ONLY, NO AC MAINS, POLARITY INSENSITIVE, and OPTO ISOLATION - LOW VOLTAGE DC ONLY. Treat those markings as wiring rules, not decoration.

Connector Pinout Table

Use this table when wiring the board. Connector names and pin labels match the PCB silkscreen and Rev-A schematic naming.

Connector	Pin / label	Net / function	User connection guidance
H1	VLOGIC	Logic supply input	Connect to controller 3.3 V or 5 V. This board does not generate logic power.
H1	GND	GND_LOGIC	Connect to controller ground.
H1	OUT1	OUT1_LOGIC	Controller input pin for channel 1. Active high.
H1	OUT2	OUT2_LOGIC	Controller input pin for channel 2. Active high.
H1	OUT3	OUT3_LOGIC	Controller input pin for channel 3. Active high.
H1	OUT4	OUT4_LOGIC	Controller input pin for channel 4. Active high.
CN1	IN1A	CH1 field input A	Apply 9-30 VDC field signal across IN1A/IN1B.
CN1	IN1B	CH1 field input B	Polarity-insensitive for normal DC input use.
CN2	IN2A	CH2 field input A	Apply 9-30 VDC field signal across IN2A/IN2B.
CN2	IN2B	CH2 field input B	Polarity-insensitive for normal DC input use.
CN3	IN3A	CH3 field input A	Apply 9-30 VDC field signal across IN3A/IN3B.
CN3	IN3B	CH3 field input B	Polarity-insensitive for normal DC input use.
CN4	IN4A	CH4 field input A	Apply 9-30 VDC field signal across IN4A/IN4B.
CN4	IN4B	CH4 field input B	Polarity-insensitive for normal DC input use.

CONNECTOR WIRING RULE

VLOGIC goes to the controller logic rail. OUTx_LOGIC goes to controller input pins. Field signals go only across matching INxA/INxB pairs. Never connect field voltage directly to H1 OUT pins.

LEDs and Measurement Points

LEDs and Indicators

Indicator	Meaning	Normal behavior
LED3 PWR	VLOGIC power present	ON when H1 VLOGIC is powered through the logic-side protection path.
LED1 IN1	Channel 1 active	ON when a valid field signal on CN1 makes OUT1_LOGIC HIGH.
LED2 IN2	Channel 2 active	ON when a valid field signal on CN2 makes OUT2_LOGIC HIGH.
LED4 IN3	Channel 3 active	ON when a valid field signal on CN3 makes OUT3_LOGIC HIGH.
LED5 IN4	Channel 4 active	ON when a valid field signal on CN4 makes OUT4_LOGIC HIGH.

Measurement points

Point	Use
H1 VLOGIC to H1 GND	Verify 3.3 V or 5 V logic supply before connecting field inputs.
H1 OUT1-OUT4 to H1 GND	Verify each output is LOW with no field input and HIGH when the matching field input is active.
CNx INxA to INxB	Verify field input voltage is within 9-30 VDC before connecting.
Channel LEDs	Use LEDs for quick status, then confirm with a meter at H1 if troubleshooting.
Internal nodes	Do not probe tiny internal nodes unless necessary and only with appropriate tools.

METER RULE

Measure voltage between the target point and H1 GND_LOGIC. Start with VLOGIC powered and no field inputs installed. Then test one field channel at a time with a known 12 V or 24 V signal.

Example Wiring

All examples use the same pattern: power the logic side from the controller, read OUTx_LOGIC with a controller input pin, and apply the external field signal across the matching INxA/INxB pair.

Dry contact / switch

- +24 V -> switch -> IN1A
- 0 V -> IN1B
- OUT1_LOGIC -> controller input

Switch closes = OUT1 HIGH

PNP sourcing sensor

- Brown -> +24 V
- Blue -> 0 V
- Black output -> IN2A
- IN2B -> 0 V

Sensor active = OUT2 HIGH

NPN sinking sensor

- Brown -> +24 V
- Blue -> 0 V
- +24 V -> IN3A
- Black output -> IN3B

Sensor active = OUT3 HIGH

Relay contact

- +24 V -> contact -> IN4A
- 0 V -> IN4B
- OUT4_LOGIC -> controller input

Contact closes = OUT4 HIGH

KI MAKER ECOSYSTEM EXAMPLE

The KI Maker Power Interface PCB can provide 24 V field power and 3.3 V / 5 V logic power. The IN-4 reads field switches and sensors. A controller reads OUT1-OUT4, then drives loads through the KI Maker OUT-4.

Troubleshooting

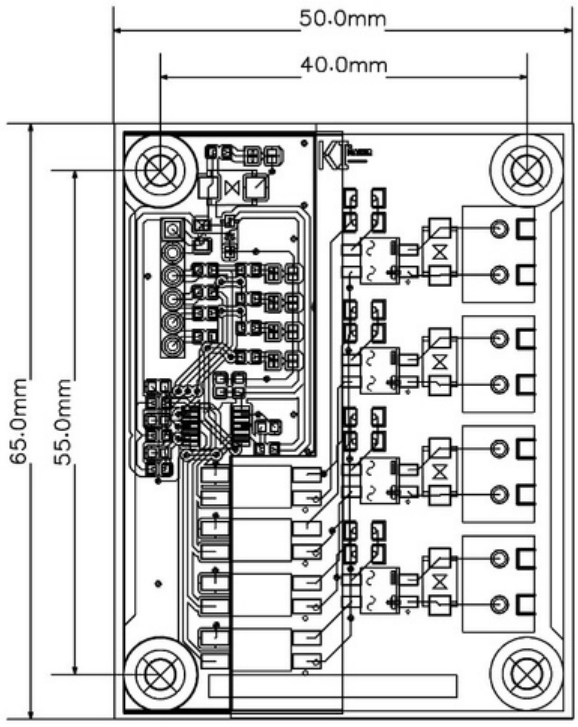
Issue	What to check first
PWR LED does not turn on	Check H1 VLOGIC voltage, H1 GND, controller power, F1 state, and whether VLOGIC is 3.3 V or 5 V only.
Input LED does not turn on	Check field voltage across the matching INxA/INxB pair, field supply path through the sensor/contact, and 9-30 VDC range.
LED turns on but controller does not read input	Check OUTx_LOGIC pin, controller ground, input pin mode, logic voltage level, and whether firmware expects active-low.
Output stays high	Check field voltage still present, sensor leakage, wiring short across input pair, noise pickup, or component damage from overvoltage.
Input flickers	Check mechanical switch bounce, long unshielded cables, weak sensor output, noisy field supply, and firmware debounce.
False triggers near loads	Separate field input wiring from motor/solenoid wiring. Add firmware debounce and external filtering if needed.
Board gets hot	Remove power. Check field voltage over 30 V, wrong wiring, continuous overvoltage, solder bridges, or damaged protection parts. At 24–30 VDC with several channels on, the field-side resistor strip (the two 4.7 kΩ 1206s per channel) runs warm. That is normal. Remove power only if the heat is on the logic side, a single part is far hotter than the others, field voltage is above 30 V, or you smell/see damage.

Troubleshooting order

- Power off first, then visually inspect wiring.
- Apply VLOGIC only and confirm PWR LED.
- Measure H1 VLOGIC to H1 GND.
- Apply one known field input at a time and confirm matching LED.
- Measure OUTx_LOGIC to H1 GND and compare to controller reading.
- Only after one channel works, connect the remaining field devices.

Mechanical and Board Dimensions

Use the mechanical drawing for enclosure planning and standoff placement. Verify against the final fabrication drawing before ordering drilled panels or machined enclosures.



Board outline: 50.00 mm x 65.00 mm

Dimensions

- Total board size: 50.00 mm x 65.00 mm.
- Mounting-hole spacing: 40.00 mm horizontal center-to-center.
- Mounting-hole spacing: 55.00 mm vertical center-to-center.
- Mounting hardware: M3 standoffs recommended.
- Mounting method: insulated standoffs only; do not mount directly to conductive metal.
- Board orientation: keep terminals accessible and allow screwdriver access.

Mounting guidance

- Use the four M3 mounting holes with insulated standoffs.
- Keep wiring strain off the screw terminals.
- Use an enclosure for public, child-accessible, dusty, or conductive-debris environments.
- Check board temperature after installation, especially in enclosed or warm environments.

ENCLOSURE PLANNING NOTE

The image shows mounting-hole center spacing, not a full enclosure cutout template. Keep clearance around screw terminals, wire bend radius, standoff heads, and any cover or lid.

Revision History and Support

Revision history

Item	Value
Product	KI Maker IN-4 Protected Input Board
Model	KI-IN4-RevA
Board Revision	Rev-A
PCB Version	PCBV1.01
Manual Revision	v1.0 Released
Manual Date	09/03/2026
Manual status	Released documentation; 9-30 VDC field-input range validated on two prototype boards, all four channels, normal and reversed polarity.

When asking for support, include

Wiring photo
Show H1, field inputs, and controller

LED behavior
PWR and channel LEDs

Logic voltage
3.3 V or 5 V at H1

Field voltage
Measured across INxA/INxB

Controller type
Arduino/ESP32/RPi/etc.

Sensor details
Dry contact, PNP, NPN, relay contact

Include clear photos of your wiring, field input supply, sensor type, controller type, LED behavior, and voltage readings at H1 and the relevant field input pair. This helps identify wiring and sensor-type issues faster.

LOW-VOLTAGE DC ONLY | NOT FOR AC MAINS | POLARITY-INSENSITIVE FIELD INPUTS | VERIFY FIELD INPUT VOLTAGE