

**groov ANALOG THERMOCOUPLE/  
MILLIVOLT INPUT MODULE****Features**

- > 8 or 12 channels per module
- > Module cover with LED indicates module status
- > Touch-sensitive pad triggers display of module information on *groov* EPIC® processor's display
- > UL Hazardous Locations approved and ATEX compliant
- > Guaranteed for life

**DESCRIPTION**

*groov* I/O modules are part of the *groov* EPIC® (Edge Programmable Industrial Controller) system. Wired directly to field devices (sensors and actuators), *groov* I/O translates the electrical signals from those devices into the digital language computers understand—so you can monitor and control devices and use their data wherever you need it, in your local computer network or in cloud services.

Both modules provide input channels for millivolt or thermocouple field devices. Each channel is individually configurable for  $\pm 1200$  mV,  $\pm 600$  mV,  $\pm 300$  mV,  $\pm 150$  mV,  $\pm 75$  mV,  $\pm 50$  mV,  $\pm 25$  mV or Type B, E, J, K, N, R, S, or T thermocouples.

- The **GRV-ITM-12** analog module provides 12 channels of input. There is no isolation between channels; however, the 12 channels are divided into two zones, with one zone isolated from the other zone.
- The **GRV-ITMI-8** analog module provides 8 channels of input. The eight channels on the module are isolated from each other. Since these channels do not share any common connections, grounded sensors and field devices may be used with them.

Wiring is simplified with a top-mounted connector, which provides spring-clamp terminals for common, power, and field wiring. The connector is held in place by a single, captive retention screw but can be removed with the field wiring intact for wiring in advance or easier module field replacement.

A swinging, two-position cover protects wiring from inadvertent contact, as does the dead-front design. The two positions of the cover offer the option of more space to accommodate larger wire. The module cover provides a touch-sensitive pad; touch the pad and the *groov* EPIC processor displays information about the module, including specifications and a wiring diagram.

The module pivots into place and is held securely in place by a captive hold-down (retention) screw.

**GRV-ITMI-8****GRV-ITM-12**

*groov* I/O modules are hot swappable (which means they can be installed or removed without turning off power to the unit) and self-identifying—as soon as you mount the module to the chassis, it communicates to the processor and identifies itself.

Each *groov* I/O module cover provides a large module LED to indicate module health at a glance.

All *groov* power supplies, voltage converters, pass-through power adapters, I/O modules, and processors are UL/cUL listed and compliant with the ATEX, Low Voltage, and EMC CE and UKCA directives. Each module is factory tested twice before shipment and most modules are guaranteed for life.

**groov**  
**EPIC**
**Part Numbers**

Part	Description
GRV-ITM-12	Analog input, 12 channels, thermocouple or mV
GRV-ITMI-8	Analog input, 8 channel, thermocouple or mV, channel-to-channel isolation

## FEATURES AND SPECIFICATIONS

### Features

Features	GRV-ITM-12	GRV-ITMI-8
Number of Channels	12	8
Channel-to-Channel Isolation		●
Analog Totalizing	●	●
Average Filter Weight	●	●
Minimum/Maximum Values	●	●
Offset and Gain	●	●
Quality Indication	●	●
Scaling	●	●
Simple Moving Average	●	●

### Specifications

Specification	GRV-ITM-12 and GRV-ITMI-8
Millivolt Input Ranges	$\pm 1200.0$ mV, $\pm 600.0$ mV, $\pm 300.0$ mV, $\pm 150.0$ mV, $\pm 75.0$ mV, $\pm 50.0$ mV, $\pm 25.0$ mV
Over-range Limits ( $\pm 10\%$ )	$\pm 1320.0$ mV, $\pm 660.0$ mV, $\pm 330.0$ mV, $\pm 165.0$ mV, $\pm 82.5$ mV, $\pm 55.0$ mV, $\pm 27.5$ mV
Resolution	mV Range / 1,048,576 (20 bits)
Accuracy 0.1% of Range	$\pm 1200$ $\mu$ V, $\pm 600$ $\mu$ V, $\pm 300$ $\mu$ V, $\pm 150$ $\mu$ V, $\pm 75$ $\mu$ V, $\pm 50$ $\mu$ V, $\pm 50$ $\mu$ V
Thermocouple ITS90 Types	Accuracy (Default) / Accuracy (User-Calibrated) / Resolution
<b>B:</b> 90 °C to 1,820 °C	5.0 °C / 3.0 °C @ 250 °C / 0.05 °C
<b>E:</b> -270 °C to 1,000 °C	2.0 °C / 0.5 °C @ 0.0 °C / 0.05 °C
<b>J:</b> -210 °C to 1,200 °C	2.0 °C / 0.5 °C @ 0.0 °C / 0.05 °C
<b>K:</b> -270 °C to 1,372 °C	2.0 °C / 0.5 °C @ 0.0 °C / 0.05 °C
<b>N:</b> -270 °C to 1,300 °C	3.0 °C / 0.8 °C @ 0.0 °C / 0.05 °C
<b>R:</b> -50 °C to 1,768 °C	5.0 °C / 2.5 °C @ 250 °C / 0.05 °C
<b>S:</b> -50 °C to 1,768 °C	5.0 °C / 3.0 °C @ 250 °C / 0.05 °C
<b>T:</b> -270 °C to 400 °C	3.0 °C / 0.5 °C @ 0.0C / 0.05 °C

Specifications continue on next page.

Specification	GRV-ITM-12	GRV-ITMI-8
Cold Junction Compensation	Automatic	Automatic
Analog Data Filtering	-3 dB @ 14 Hz -25 dB @ 60 Hz	-3 dB @ 14 Hz -25 dB @ 60 Hz
<b>Software Data Filtering:</b>		
• Simple Moving Average (SMA)	• 1 to 32 readings	• 1 to 32 readings
• Weighted Average	• 1 to 4096	• 1 to 4096
Data Refresh Time	mV Ranges = 0.9 s T/C Ranges = 1.2 s	mV Ranges = 100 ms T/C Ranges = 200 ms
Step Input Response Time	1.2 s x SMA value (38.4 s @ 32 SMA, Default SMA = 6)	16.5 ms x SMA value (0.53 s @ 32 SMA, Default SMA = 8)
Common Mode Rejection	> -120 dB	> -120 dB
Input Resistance	100 megohm	100 megohm
Quality Indications	out of range, open thermocouple	out of range, open thermocouple
Isolation (field-to-logic)	300 V working, 1500 V transient (1 minute)	300 V working, 1500 V transient (1 minute)
Isolation (channel-to-channel)	300 V between channel group 0-5 and channel group 6-11. None within a group.	300 V working, 1500 V transient (1 minute)
Number of Channels	12	8
Chassis Power Consumption	1.3 W	1.4 W
Minimum <i>groov</i> EPIC Firmware Version	1.4.2	1.0.0
Minimum PAC Project Version	10.2003	10.0000
Minimum Library Package for CODESYS Version	1.0.2.0	1.0.0.0
Wire Size	28–14 AWG	28–14 AWG
Wire Strip Length	0.315–0.354 inches (8–9 mm)	0.315–0.354 inches (8–9 mm)
Torque, connector screw	2.5 in-lb (0.28 N-m)	2.5 in-lb (0.28 N-m)
Torque, hold-down screw	3.5 in-lb (0.4 N-m)	3.5 in-lb (0.4 N-m)
Temperature (operating)	-20 °C to +70 °C	-20 °C to +70 °C
Temperature (storage)	-40 °C to +85 °C	-40 °C to +85 °C
Relative Humidity (non-condensing)	5–95%	5–95%
MTBF (minimum, 25 °C)	1.2 Mhrs	1.2 Mhrs
Agency Approvals	UL/cUL (Class 1, Div 2) <sup>a</sup> ; CE: ATEX (Category 3, Zone 2) and RoHS; DFARS; CB Scheme; UKCA	
Warranty Period	Lifetime	Lifetime

a. For use in hazardous locations, equipment must be mounted in an enclosure that meets the requirements of the National Electrical Code, ANSI/NFPA 70, and ANSI/ISA-61010-1 (82.02.01).

## Mounting

Mount *groov* I/O modules onto a *groov* EPIC chassis (see the [groov EPIC Chassis Data Sheet](#) (form 2247) for instructions). To learn the names and physical features of the parts of the module, see .

## Installing the module

The numbers on the diagrams correspond to the numbered steps in these instructions.

**CAUTION:** For electrical safety, de-energize field devices wired to the terminal connector before starting.

1. Orient the *groov* EPIC chassis so that the module connector numbers are right-side up, with 0 on the left as shown in the diagram.
2. Hold the module at a 45° angle, and line up the alignment tab on the back tip of the module with the slot at the back of the chassis.
3. Pivot the front of the module down to the module connector on the chassis, and push to snap the module into the connector.
4. Lift the module cover up to access the module hold-down (retention) screw, and tighten the screw to secure the module into position.

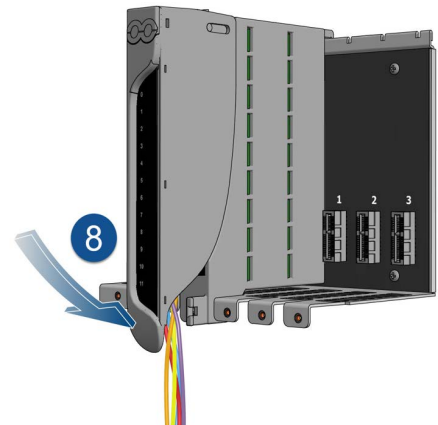
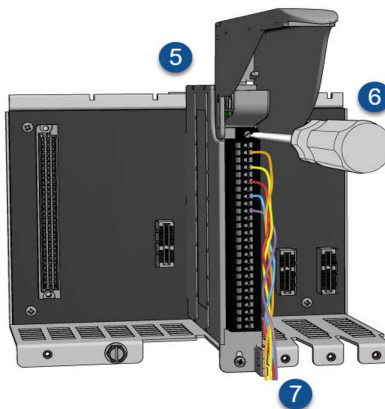
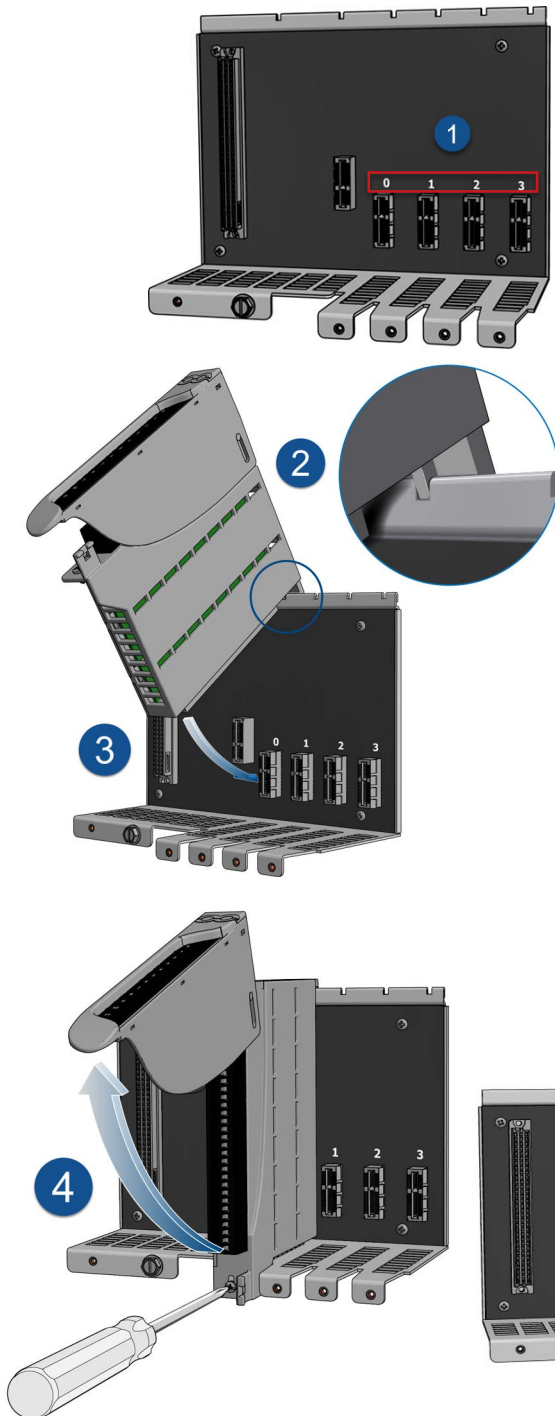
**CAUTION:** Do not over-tighten. See the torque specs in the "Specifications" table.

5. If the module does not have a terminal connector, install one.
6. Secure the terminal connector by tightening the terminal connector screw.

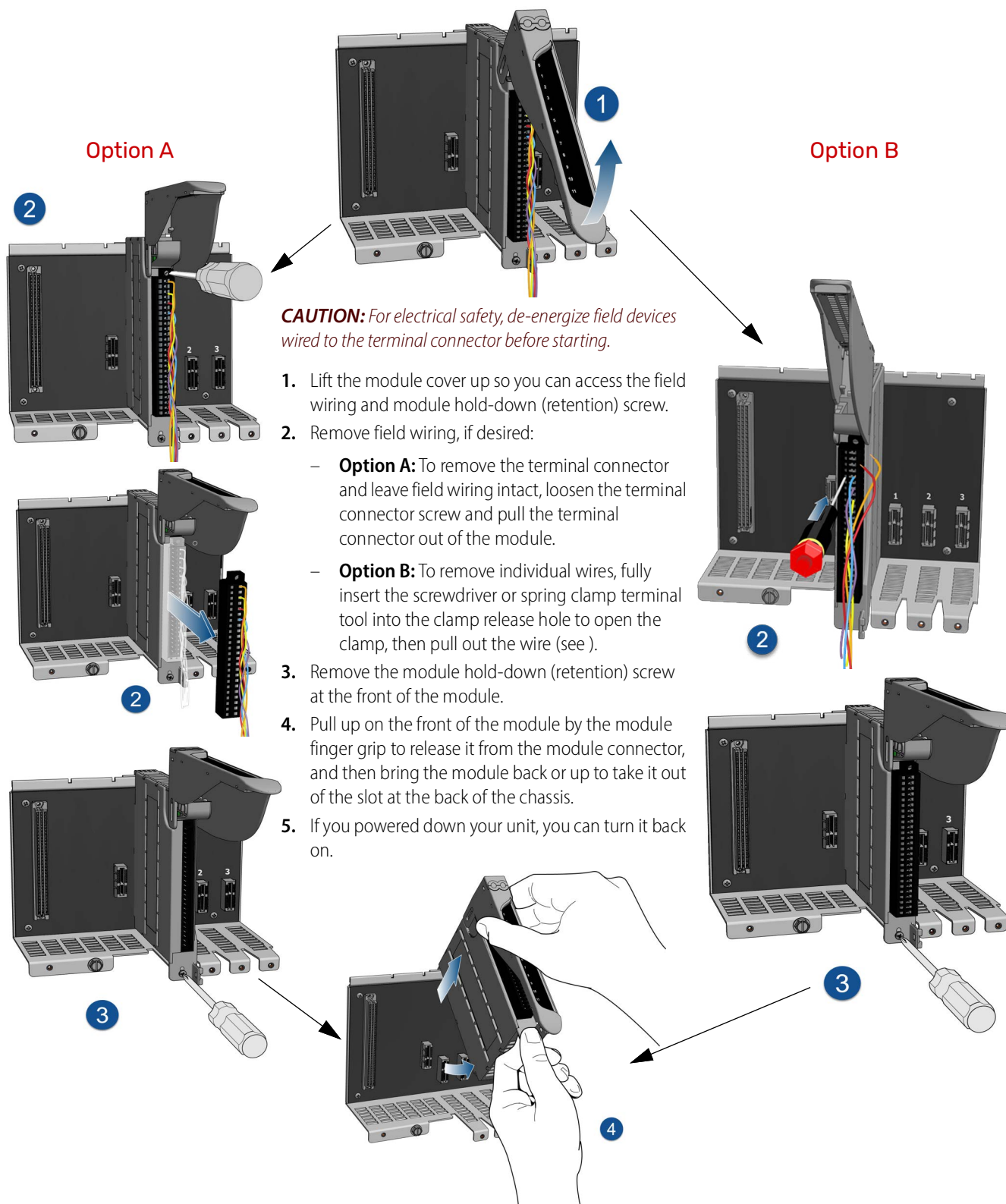
**CAUTION:** Do not over-tighten. See the torque specs in the "Specifications" table.

7. Follow the wiring instructions in the "Pinout and Wiring" section to wire your field devices to the channels on the terminal connector.
8. When wiring is complete, bring the module cover back down to cover the wires. If the wires are too thick to close the module cover easily, lift the module cover, raise the back of the module cover up to the higher position, and then bring the module cover back down to cover the wires.

If you powered down your unit, you can turn it back on when you are done installing modules and wiring.



## Removing the module





## PINOUTS AND WIRING

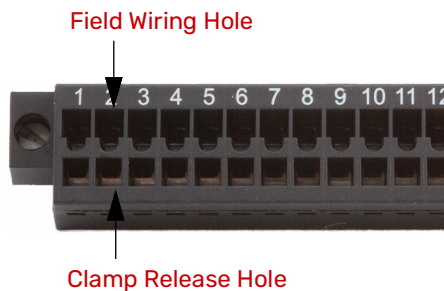
Before you begin wiring your field devices to your *groov* I/O module, make sure you select and prepare the appropriate wires and review how to use the spring clamps on terminal connectors:

**Select and prepare the appropriate wire.** The terminal connectors are rated for 28–14 AWG wire. Strip the wire according to the Wire Strip Length listed in the Specifications table on [page 2](#). If you're using stranded wire, twist or tin the strands or add ferrules to make it easier to insert the wire and create a stronger connection.

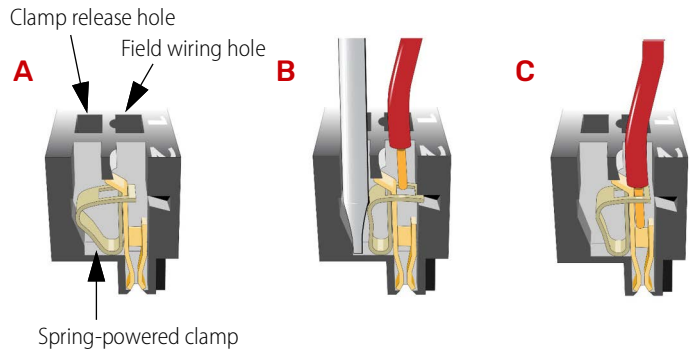
**Use the right tool.** To open the spring clamps, make sure to use either:

- a flathead screwdriver with a tip dimension of 2.5 mm x 0.4 mm, **or**
- the *groov* spring-clamp terminal tool, typically supplied with a *groov* EPIC chassis. You can order a replacement spring-clamp terminal tool on our website [www.opto22.com](http://www.opto22.com). Search for GRV-TEX-SCTOOL.

**Familiarize yourself with the spring clamps.** On the terminal connector, each terminal number has a corresponding **clamp release hole** and **field wiring hole**.



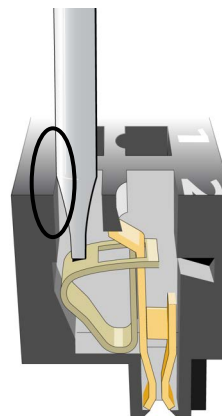
A spring-powered clamp sits between the clamp release hole and the field wiring hole (A). When you push the correct screwdriver (see above for dimensions) or the *groov* spring-clamp tool straight down into the clamp release hole, the diameter of the screwdriver or tool displaces the spring laterally, which exposes the hole through which you can insert the wire (B). When you pull the screwdriver or spring-clamp tool straight up, the spring returns to its original position, which causes the clamp to hold the wire. (C). You can view [a video](#) that explains how to wire your field devices and demonstrates how the spring clamp works on our website, [www.opto22.com](http://www.opto22.com).



## Inserting Wires

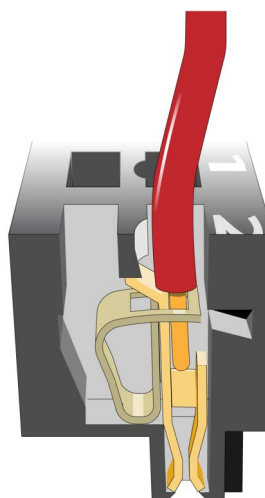
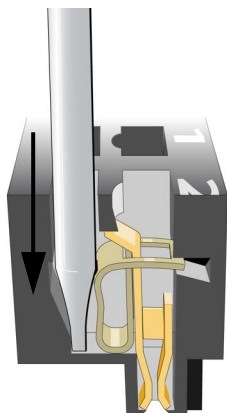
**CAUTION:** For electrical safety, before starting, de-energize field devices wired to the terminal connector.

1. Orient the module or terminal connector to match the wiring diagrams on .
2. To make it easier to handle the screwdriver or the spring-clamp terminal tool and the field wires, secure the module or terminal connector:
  - If you are working with the terminal connector while it is attached to the module, make sure the module is screwed securely to the chassis.
  - If you are working only with the terminal connector, secure the terminal connector with a clamp.
3. Open the spring clamp:
  - a. Insert the screwdriver or spring-clamp terminal tool into the clamp release hole, pressing the tool against the side of the hole furthest from the terminal numbers.



- b. Press straight down firmly until you feel the screwdriver or tool reach the bottom.

*Important: Let the shape of the tool, as it is pressed straight down, open the clamp. Do not rock or wiggle the tool because it may damage the clamp.*

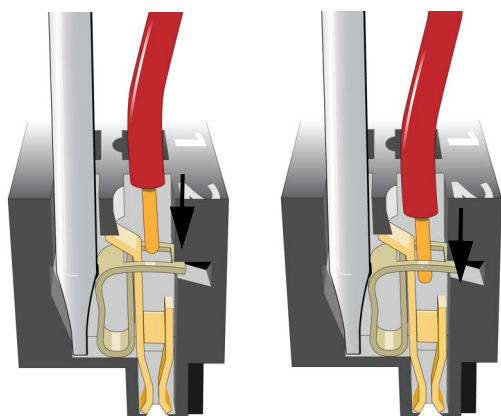


6. Test that the wire is secure by gently pulling on it. If the wire pulls out, repeat steps 3 and 4.

- c. You can confirm that the clamp is open by looking into the field wiring hole.

- If the hole is dark, the clamp is open. You can go to the next step.
  - If you see a shiny surface, repeat steps a through c.
- Important:** Do not rock or wiggle the tool to try to open the clamp because it may damage the clamp.

4. Insert the wire into the field wiring hole.

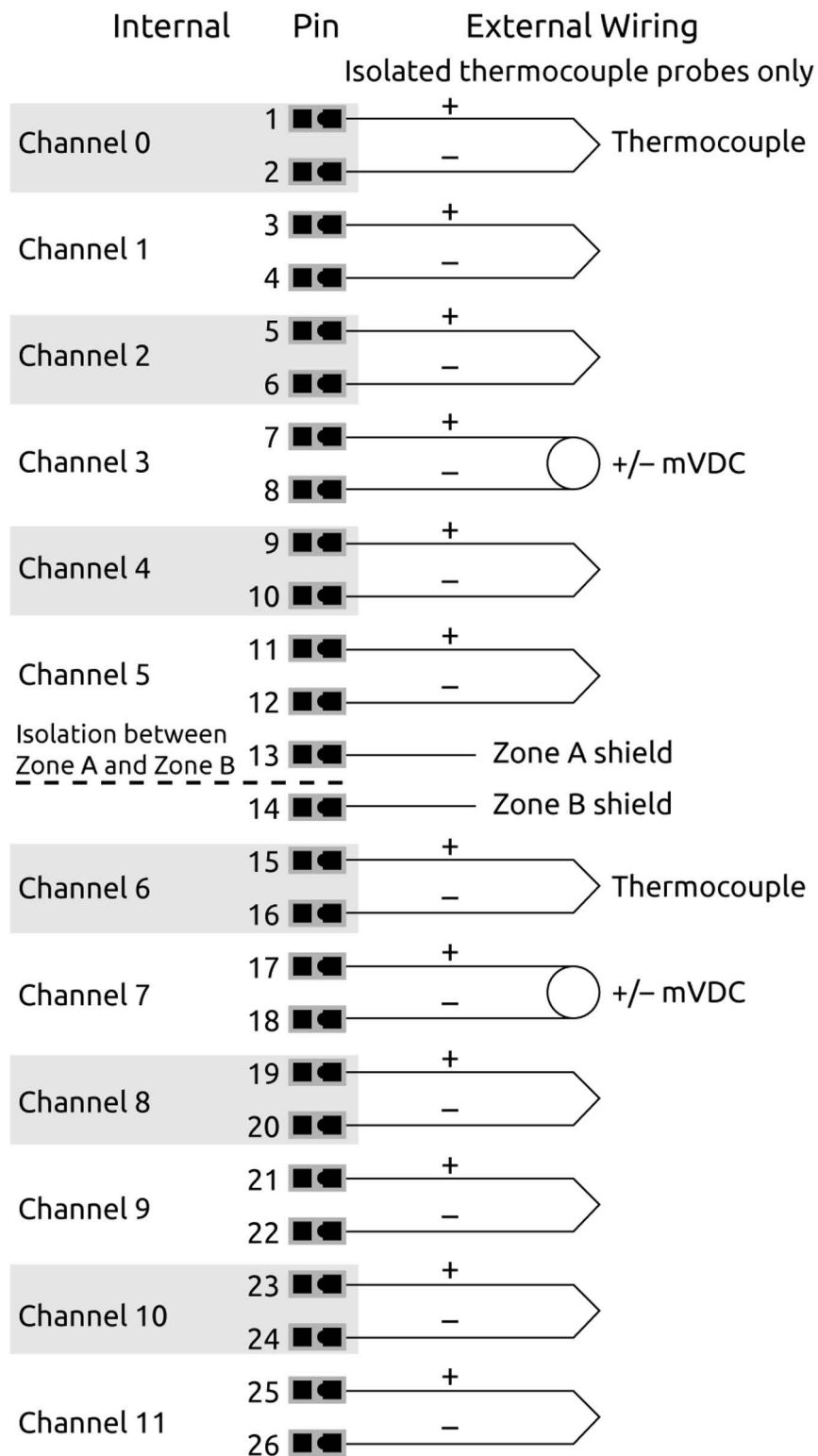


## Removing Wires

1. Insert the screwdriver or spring-clamp terminal tool into the clamp release hole, pressing the tool against the side of the hole furthest from the terminal numbers.
2. Press straight down firmly until you feel the screwdriver or tool reach the bottom.
3. Pull the wire out.
4. Pull out the screwdriver or spring-clamp terminal tool. The spring returns to its original position.

5. Pull out the screwdriver or spring-clamp terminal tool. The spring returns to its original position and clamps down on the wire.

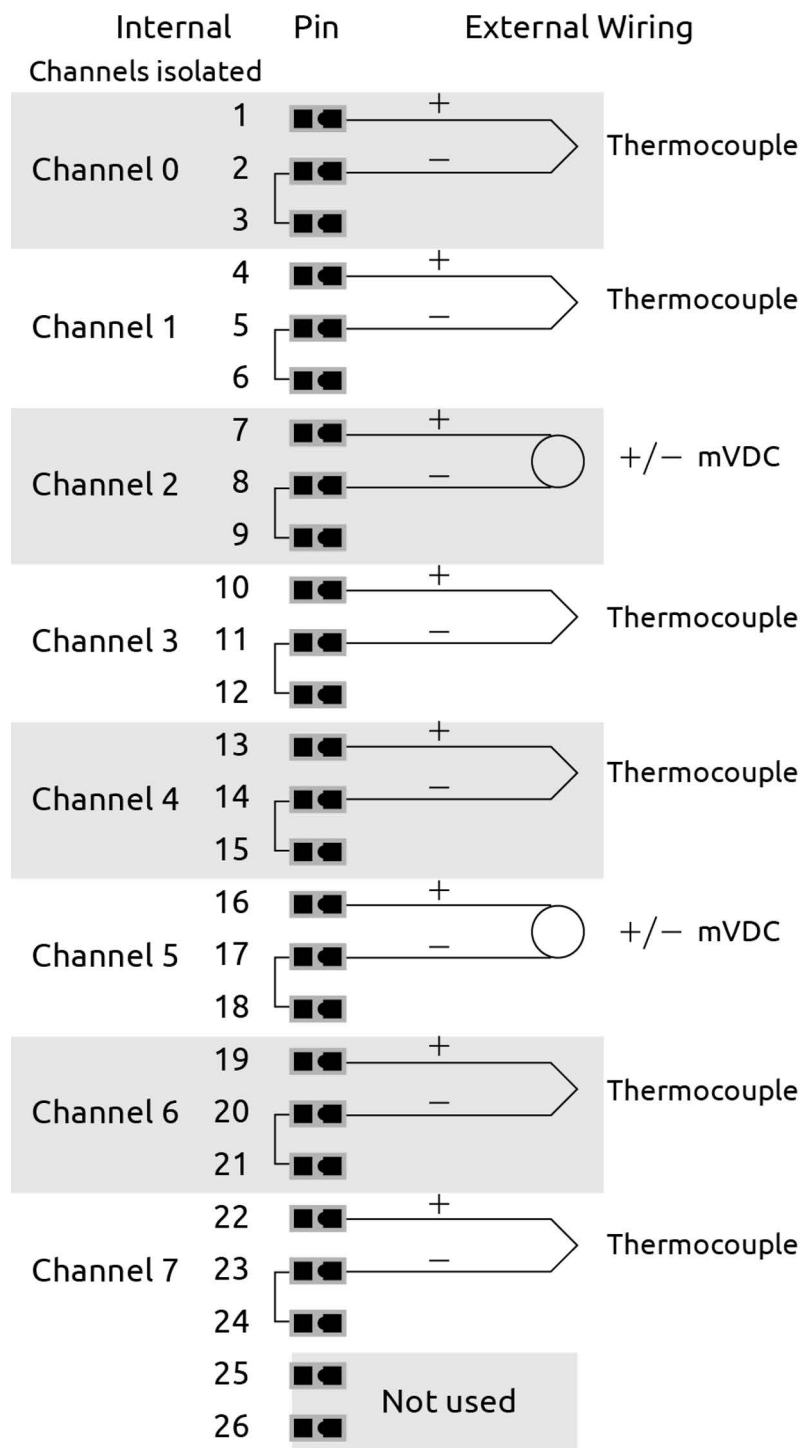
## WIRING: GRV-ITM-12



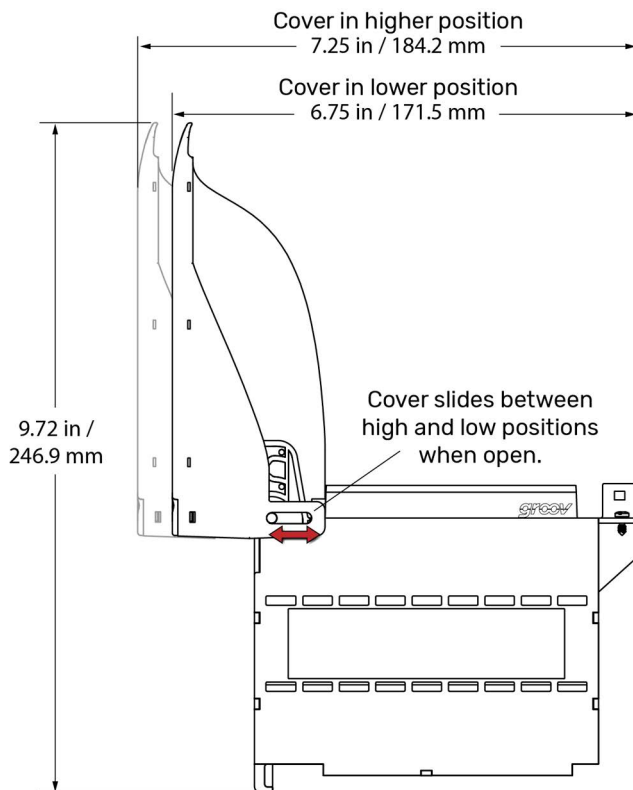


## WIRING: GRV-ITMI-8

The loads shown on the external wiring side of the diagram are examples. Each channel can accept either a thermocouple or millivolt input device.



## DIMENSIONS: GRV-ITM-12, GRV-ITMI-8

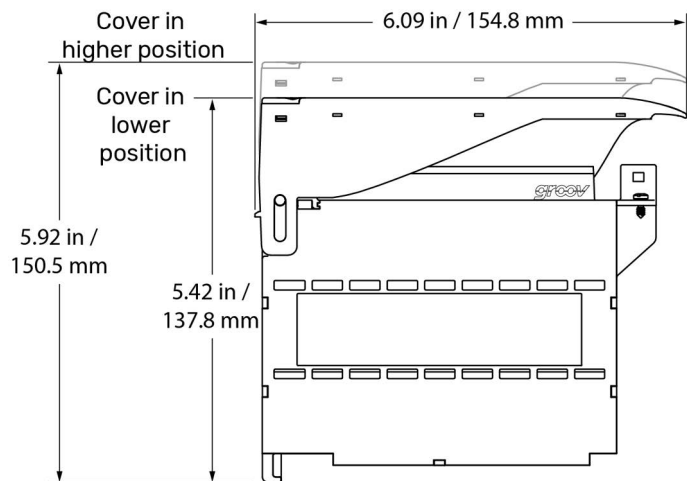
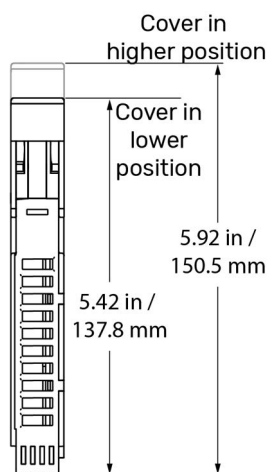


The module cover pivots and can be adjusted to two different heights (positions). The higher position provides more space to accommodate thicker wires.

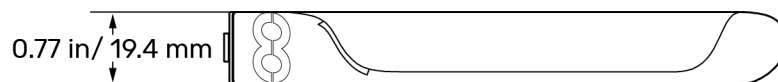
To switch between higher and lower position, lift the cover to at least a 45° angle. Grasp the hinged end of the module cover and do one of the following:

- Pull up on the back hinge to slide it to the higher position.
- Push down on the back hinge to slide it to the lower position.

You cannot switch between the higher and lower positions while the cover is closed.

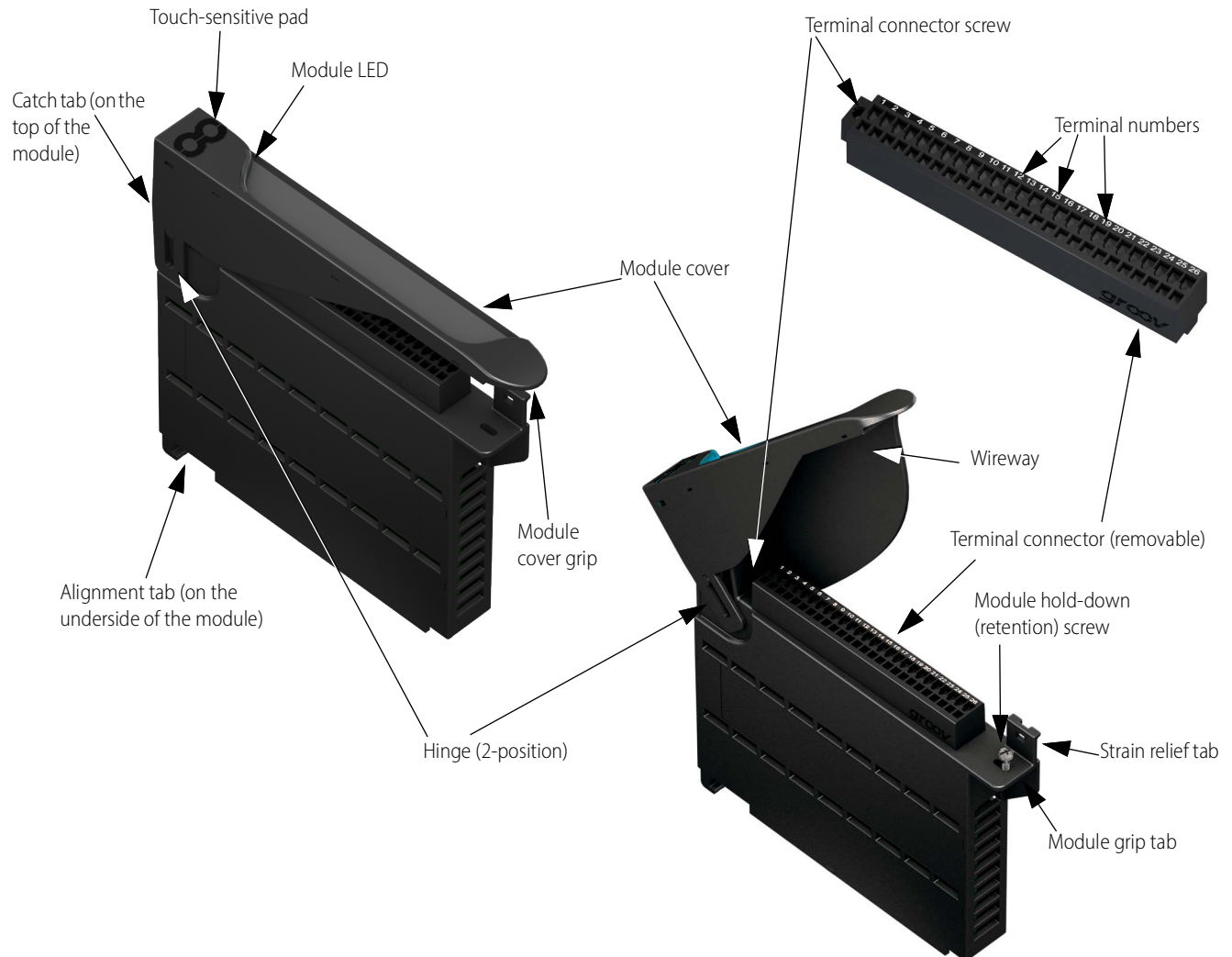


### GRV-ITM-12, GRV-ITMI-8



## DESCRIPTION OF MODULE PARTS

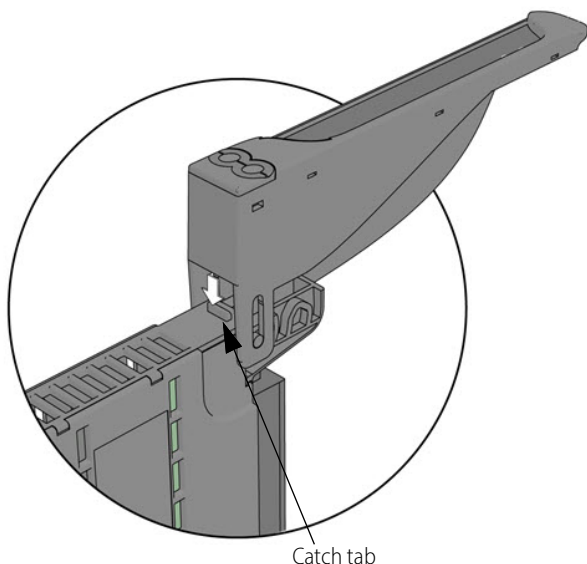
The following diagram identifies the parts of the modules. The installation instructions in the documentation rely on these terms to describe how to handle the module.



Some parts offer unique features:

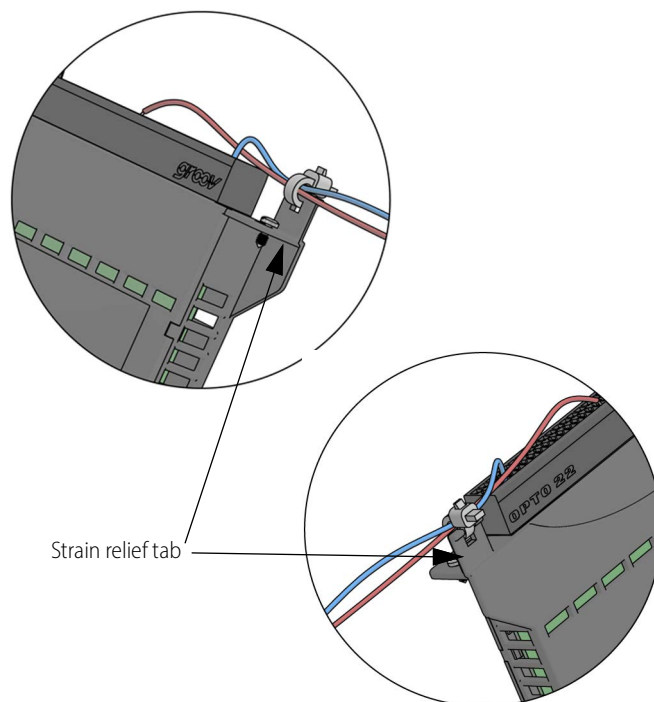
- **Module LED:** Provides a visual indication of the health of the module. For example, if it is blue, the module is operating normally. If it is blinking blue, the module's information is being displayed on the *groov* EPIC processor's screen. For a complete list of the various colors that this LED might display, see the [groov EPIC User's Guide](#) (form 2267).
- **Terminal connector:** Specially designed for *groov* I/O modules, it provides a spring-clamp wiring system to securely connect the wires from your field devices to the module. To learn how to use a spring-clamp wiring system, see the "Pinouts and Wiring" section.
- **Hinge and Wireway:** These two features work together to provide more space for wires. The hinge can be adjusted between a lower position and a higher position. The wireway is the space underneath the module cover. To increase this space, you can raise the hinge to the higher position.
- **Touch-sensitive pad:** Offers a convenient way to display the module's information on the *groov* EPIC processor. Press on the pad for approximately two seconds and the processor displays that module's information on the screen, as well as changing the module LED to a blinking blue light.

- **Catch tab:** Located at the top of the module, the catch tab provides a place for the cover to “catch” or stop. This prevents the cover from closing so that you can work on attaching or detaching wires to the terminal connector.



- **Strain relief tab:** This tab offers a way to collect wires into a bundle and secure them to the module. Attaching the wires to the strain relief tab can help hold the wires in a semi-fixed position, preventing them from interfering while you work on a nearby module. It also prevents strain on the part of the wire attached to the terminal connector.

Collect the wires into a bundle, pull a zip tie through the hole in the tab, wrap the zip tie around the bundle and tab, and then clip the excess zip tie.



## PRODUCTS

Opto 22 develops and manufactures reliable, easy-to-use, open standards-based hardware and software products. Industrial automation, process control, remote monitoring, data acquisition, and industrial internet of things (IIoT) applications worldwide all rely on Opto 22.

### groov RIO®

[groov RIO edge I/O](#) offers a single, compact, PoE-powered industrial package with web-based configuration and IIoT software built in, support for multiple OT and IT protocols, and security features like a device firewall, data encryption, and user account control.

Standing alone, *groov* RIO connects to sensors, equipment, and legacy systems, collecting and securely publishing data from field to cloud. Choose a universal I/O model with thousands of possible field I/O configurations, with or without Ignition from Inductive Automation®, or a [RIO EMU energy monitoring unit](#) that reports 64 energy data values from 3-phase loads up to 600 VAC, Delta or Wye.

You can even write an IEC 61131-3 compliant control program to run on *groov* RIO, using CODESYS. You can also use *groov* RIO with a Modbus/TCP master or as remote I/O for a *groov* EPIC system.

### groov EPIC® System

Opto 22's [groov Edge Programmable Industrial Controller \(EPIC\)](#) system gives you industrially hardened control with a flexible Linux®-based processor with gateway functions, guaranteed-for-life I/O, and software for your automation and IIoT applications.

#### groov EPIC Processor

The heart of the system is the *groov* EPIC processor. It handles a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

In addition, the EPIC provides secure data communications among physical assets, control systems, software applications, and online services, both on premises and in the cloud. No industrial PC needed.

Configuring and troubleshooting I/O and networking is easier with the EPIC's integrated high-resolution color touchscreen. Authorized users can manage the system locally on the touchscreen, on a monitor connected via the HDMI or USB ports, or on a PC or mobile device with a web browser.

#### groov EPIC I/O

*groov* I/O connects locally to sensors and equipment. Modules have a spring-clamp terminal strip, integrated wireway, swing-away cover, and LEDs indicating module health and discrete channel status. *groov* I/O is hot swappable, UL Hazardous Locations approved, and ATEX compliant.

### groov EPIC Software

The *groov* EPIC processor comes ready to run the software you need:

- Programming: Choose flowchart-based PAC Control, CODESYS Development System for IEC61131-3 compliant programs, or secure shell access (SSH) to the Linux OS for custom applications
- Node-RED for creating simple IIoT logic flows from pre-built nodes
- Efficient MQTT data communications with string or Sparkplug data formats
- Multiple OPC UA server options
- HMI: *groov* View to build your own HMI viewable on touchscreen, PCs, and mobile devices; PAC Display for a

Windows HMI; Node-RED dashboard UI

- Ignition or Ignition Edge® from Inductive Automation (requires license purchase) with OPC-UA drivers to Allen-Bradley®, Siemens®, and other control systems, and MQTT communications

### Older products

From solid state relays, to world-famous G4 and SNAP I/O, to SNAP PAC controllers, older Opto 22 products are still supported and working hard at thousands of installations worldwide. You can count on us for the reliability and service you expect, now and in the future.

## QUALITY

Founded in 1974, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California.

Because we test each product twice before it leaves our factory rather than testing a sample of each batch, we can afford to guarantee most solid-state relays and optically isolated I/O modules for life.

## FREE PRODUCT SUPPORT

Opto 22's California-based Product Support Group offers free technical support for Opto 22 products from engineers with decades of training and experience. Support is available in English and Spanish by phone or email, Monday–Friday, 7 a.m. to 5 p.m. PST.

Support is always available on our website, including [free online training](#) at OptoU, how-to [videos](#), [user's guides](#), the Opto 22 KnowledgeBase, and [OptoForums](#).

## PURCHASING OPTO 22 PRODUCTS

Opto 22 products are sold directly and through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at **800-321-6786** (toll-free in the U.S. and Canada) or **+1-951-695-3000**, or visit our website at [www.opto22.com](http://www.opto22.com).

