

groov DC INPUT MODULES

Features

- > 12 or 24 channels per module
- > Module cover with LED indicates module status
- > Touch-sensitive pad triggers display of module information on *groov* EPIC® processor's display
- > Channel-specific LEDs simplify troubleshooting
- > Operating temperature: -20 to 70 °C
- > 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.

The *groov* DC input modules in this data sheet are used to sense the on or off status for:

- 10–30 VDC, 15–30 VDC, or 10–25 VAC field devices such as proximity switches, push buttons, and auxiliary contacts,
- 2.5–30 VDC field devices that produce high-frequency signals.

Choose the module you need based on your requirements:

- The **GRV-IDC-24** is a leakage-tolerant DC input module. It can sense status for 15–30 VDC input devices. If you want a lower cost option for projects that require reading DC input state only, you may want to consider the **GRV-IDCS-24** module.
- The **GRV-IDCSW-12** module provides 12 channels of contact status input. It supplies power to an external dry contact switch and senses switch closure or opening. The channels can also be configured as DC inputs with a nominal range of 5–30 V.
- The **GRV-IDCI-12** is a leakage-tolerant AC or DC input module that includes channel-to-channel isolation. The 12 channels in these modules do not share any field signal connections inside the module. It can sense status for 10–30 VDC or 10–25 VAC field input devices. If you want a lower cost option for projects that require reading DC input state only, you may want to consider the **GRV-IDCIS-12** module.
- The **GRV-IDCIFQ-12** module provides 12 high-speed digital input channels capable of counting at frequencies up to 50 kHz when wired for quadrature, 200 kHz when wired for basic counting. It provides channel-to-channel isolation. The input channels can be configured to provide up to 4 axes of quadrature input with an index signal for each axis, running at up to 50 kHz.



GRV-IDC-24 Input Module



GRV-IDCI-12 Input Module



GRV-IDCSW-12 Input Module



For additional differences between the modules, see “Features” on page 2.

Part Numbers

Part	Description
GRV-IDC-24	DC digital input, 24 channels, 15–30 V
GRV-IDCS-24	DC digital input, 24 channels, 15–30 V, on/off status only
GRV-IDCSW-12	DC input, 12 channels, switch status
GRV-IDCI-12	AC/DC digital input, 12 channels, 10–30 VDC, 10–25 VAC, channel-to-channel isolation
GRV-IDCIS-12	DC digital input, 12 channels, 10–30 V, channel-to-channel isolation, on/off status only
GRV-IDCIFQ-12	DC digital input, 12 channels, 2.5–30 V, channel-to-channel isolation, high speed, quadrature

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.

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. Discrete modules also include channel-specific LEDs that display the on/off status of each channel.

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.

FEATURES AND SPECIFICATIONS

Features for all modules described in this data sheet are listed in the table below. Specifications for the following modules are on [page 3](#):

- GRV-IDC-24
- GRV-IDCS-24

- GRV-IDCI-12
- GRV-IDCIS-12
- GRV-IDCIFQ-12

Specifications for the GRV-IDCSW-12 module are on [page 5](#).

Features

Specifications are on the next few pages.

Feature	GRV-IDC-24	GRV-IDCS-24	GRV-IDCSW-12	GRV-IDCI-12	GRV-IDCIS-12	GRV-IDCIFQ-12
Number of Channels	24	24	12	12	12	12
Channel-to-Channel Isolation				●	●	●
Counting	●		●	●		●
Frequency Measurement	●		●	●		●
On/Off Latching	●		●	●		●
On/Off State	●	●	●	●	●	●
On/Off Totalization	●		●	●		●
Period Measurement	●		●	●		●
Pulse Measurement	●		●	●		●
Quadrature						●
Quality Indication						

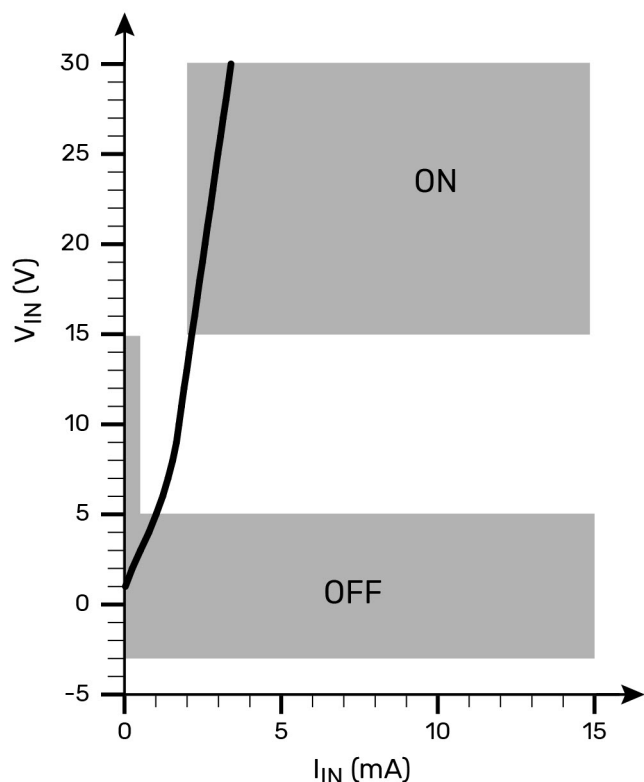
Specifications: GRV-IDC-24, GRV-IDCS-24, GRV-IDCI-12, GRV-IDCIS-12, GRV-IDCIFQ-12

Specification	GRV-IDC-24	GRV-IDCS-24	GRV-IDCI-12	GRV-IDCIS-12	GRV-IDCIFQ-12
Input Voltage	15–30 VDC	15–30 VDC	10–30 VDC 10–25 VAC	10–30 VDC	2.5–30 VDC
IEC Input Type	Type I	Type I	Type III	Type III	N/A
Turn ON Characteristic	15 V, > 2 mA	15 V, > 2 mA	10 V, > 2 mA	10 V, > 2 mA	2.5 V
Turn OFF Characteristic	5 V, < 0.5 mA	5 V, < 0.5 mA	5 V, < 1.5 mA	5 V, < 1.5 mA	1.8 V
Input Impedance ($\pm 5\%$)	See note ^a	See note ^a	See note ^a	See note ^a	1.1 K at 5 V, 2.2 K at 12 V, 3.5 K at 24 V
Max. On/Off Frequency (DC Input, 50% square wave)	1000 Hz (24 V _{p-p})	1000 Hz (24 V _{p-p})	1000 Hz (24 V _{p-p})	1000 Hz (24 V _{p-p})	Counting: 200 kHz, Quadrature: 50 kHz
Max. On/Off Frequency (AC Input, 24 VAC, 60 Hz)	N/A	N/A	10 Hz	N/A	N/A
Operating Frequency for AC Input	N/A	N/A	45–100 Hz	N/A	N/A
Isolation (field-to-logic)	300 V working, 1500 V transient (1 minute)	300 V working, 1500 V transient (1 minute)	300 V working, 1500 V transient (1 minute)	300 V working, 1500 V transient (1 minute)	300 V working, 1500 V transient (1 minute)
Isolation (channel-to-channel)	None	None	300 V working	300 V working	300 V working
Number of Channels	24	24	12	12	12
Chassis Power Consumption	1.2 W	1.2 W	1.2 W	1.2 W	1.0 W
Minimum <i>groov</i> EPIC Firmware Version	1.0.0	1.0.0	1.0.0 (3.3.0 for VAC input)	1.0.0	1.3.0
Minimum PAC Project Version	10.0000	10.0000	10.0000 (10.4000 for VAC input)	10.0000	10.2000
Minimum Library Package for CODESYS Version	1.0.0.0	1.0.0.0	1.0.0.0 (2.0.3.0 for VAC input)	1.0.0.0	1.0.0.0 (2.0.1.0 for quadrature)
Wire Size	28–14 AWG	28–14 AWG	28–14 AWG	28–14 AWG	28–14 AWG
Wire Strip Length	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)	2.5 in-lb (0.28 N-m)	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)	3.5 in-lb (0.4 N-m)	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	-20 °C to +70 °C	-20 °C to +70 °C	-20 °C to +70 °C
Temperature (storage)	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Relative Humidity (non-condensing)	5–95%	5–95%	5–95%	5–95%	5–95%
MTBF (minimum, 25 °C)	1.2 Mhrs	1.2 Mhrs	1.2 Mhrs	1.2 Mhrs	1.2 Mhrs
Agency Approvals	UL/cUL (Class 1, Div 2) ^b ; CE: ATEX (Category 3, Zone 2) and RoHS; DFARS; CB Scheme; UKCA				
Warranty	Lifetime	Lifetime	Lifetime	Lifetime	Lifetime

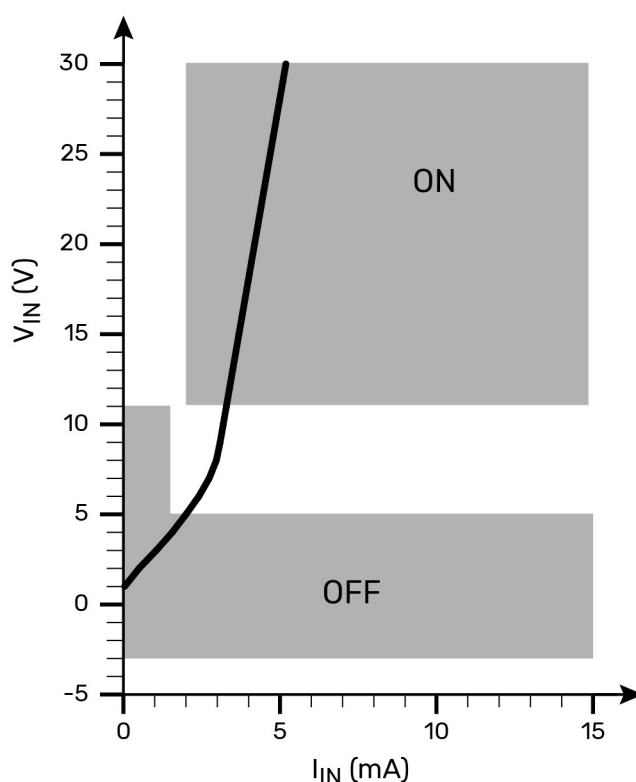
a. IEC inputs have non-linear impedance. See the tables for typical V-I curves.

b. 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).

IEC 61131-2 Type 1 DC Input
GRV-IDC-24



IEC 61131-2 Type 3 DC Input
GRV-IDCI-12



GRV-IDCIFQ-12: Determining Max RPM

The GRV-IDCIFQ-12 quadrature input module can resolve up to four axes of rotating position information from quadrature encoders. For each axis, the module converts a quadrature signal to counts used to keep track of direction and position. To calculate the maximum RPM that the GRV-IDCIFQ-12 module can measure, review the

specifications of your encoder, specifically the number of cycles per turn (pulses per revolution or PPR), and then enter it into the following formula:

$$\frac{3,000,000}{PPR} = \text{RPM}$$

Specifications: GRV-IDCSW-12

Specification	GRV-IDCSW-12
Open Circuit Voltage (Switch Open)	> 20 V
Channel Current Limit	2.0 mA \pm 25%
Channel Operating Current	0.7 mA typical
Minimum Off Resistance	50 KOhms
Maximum On Resistance	10 KOhms
Minimum ON Voltage	4.5 V
Maximum OFF Voltage	1.5 V
Maximum Continuous Survivable Input Voltage	32 V
Input Impedance	3.9 KOhms
Max. Freq. (50% square wave)	80 Hz
Debounce Time	> 500 microseconds
Isolation (field-to-logic)	300 V working, 1500 V transient (1 minute)
Isolation (channel-to-channel)	None
Number of Channels	12
Chassis Power Consumption	2.4 W
Minimum <i>groov</i> EPIC Firmware Version	1.4.2
Minimum PAC Project Version	10.2003
Minimum Library Package for CODESYS Version	1.0.2.0
Wire Size	28–14 AWG
Wire Strip Length	0.315–0.354 inches (8–9 mm)
Torque, connector screw	2.5 in-lb (0.28 N-m)
Torque, hold-down screw	3.5 in-lb (0.4 N-m)
Temperature (operating)	-20 °C to +70 °C
Temperature (storage)	-40 °C to +85 °C
Relative Humidity (non-condensing)	5–95%
Agency Approvals	UL/cUL (Class 1, Div 2) ^a ; CE: ATEX (Category 3, Zone 2) and RoHS; DFARS; CB Scheme; UKCA
Warranty	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 “Description of Module Parts” on page 15.

Mounting 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.

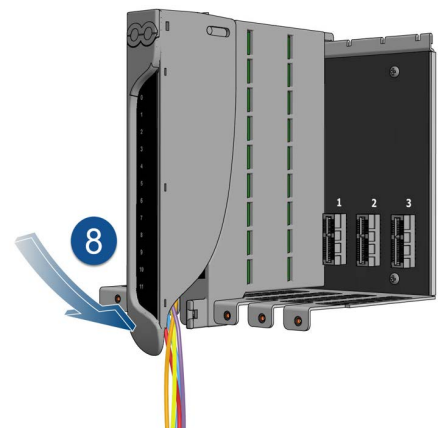
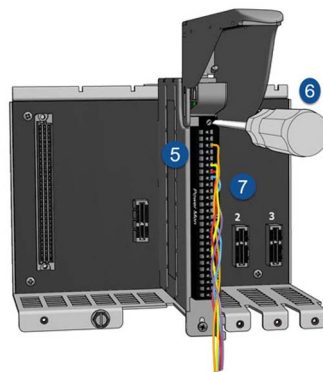
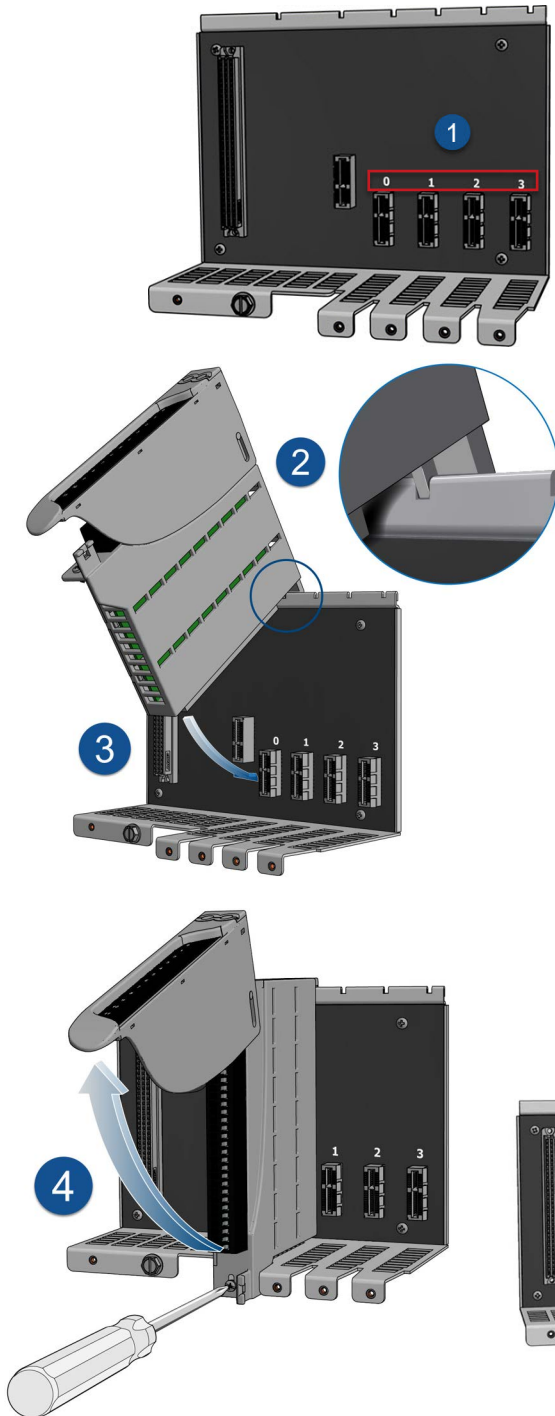
CAUTION: Do not over-tighten. See the torque specs in the “Specifications” table.

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

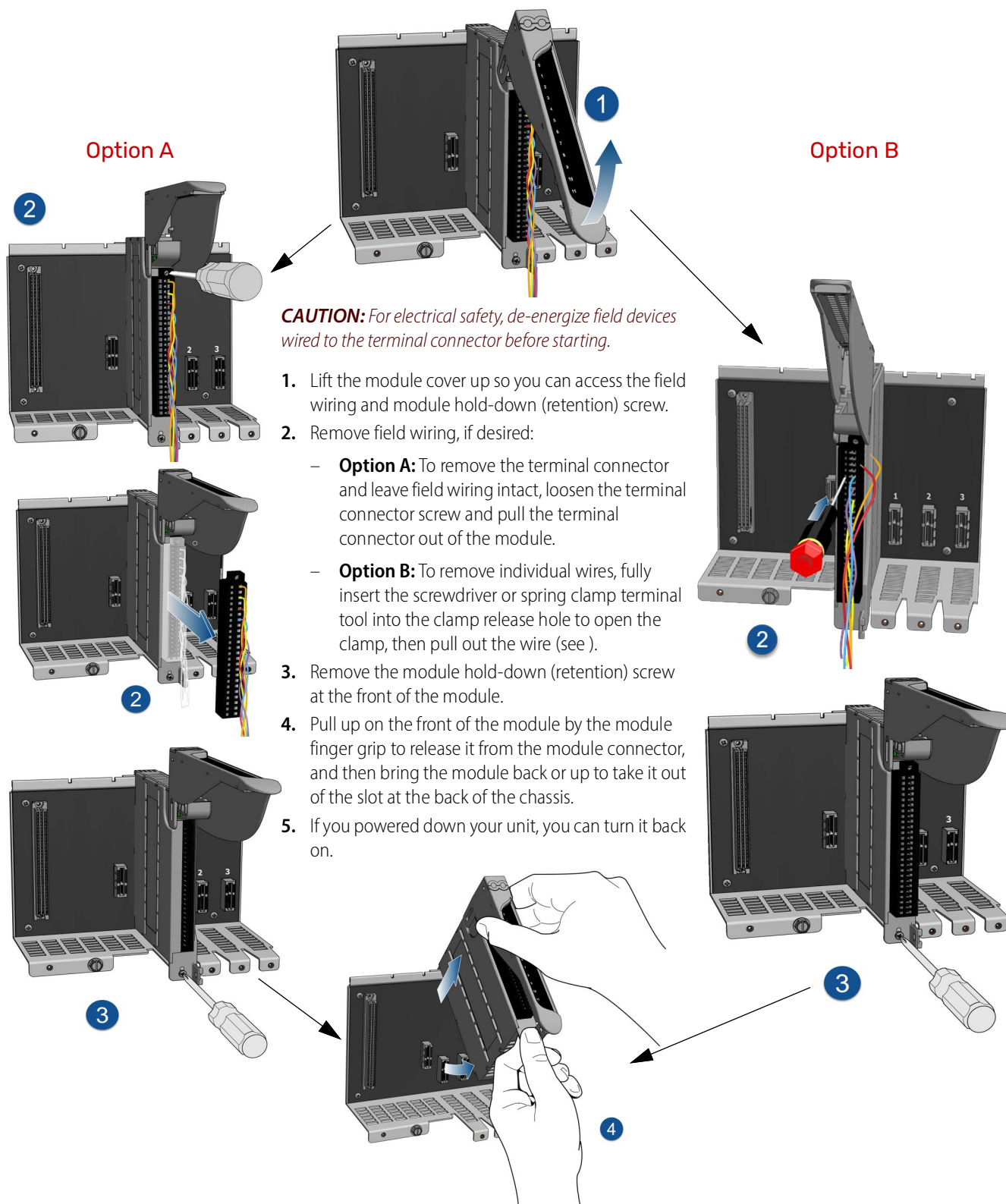
CAUTION: Do not over-tighten. See the torque specs in the “Specifications” table.

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.



Un-mounting the Module



PINOUTS AND WIRING

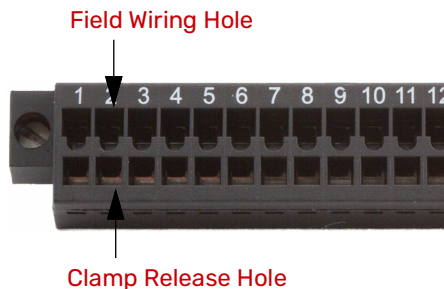
Before you begin wiring your field devices to your *groov* I/O module, make sure you select and prepare the appropriate wires and review how to use the spring clamps on terminal connectors:

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 3](#) or [page 5](#). 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.

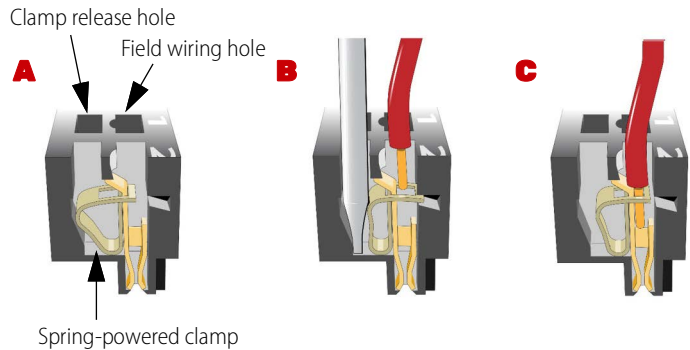
Use the right tool. To open the spring clamps, make sure to use either:

- 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. 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**.



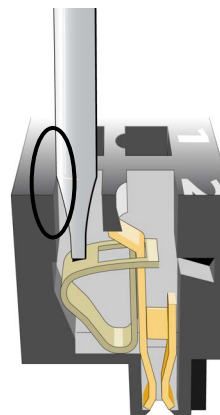
A spring-powered clamp sits between the clamp release hole and the field wiring hole (A). When you push the correct screwdriver (see above for dimensions) or the *groov* spring-clamp tool straight down into the clamp release hole, the diameter of the screwdriver or tool displaces the spring laterally, 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.



Inserting Wires

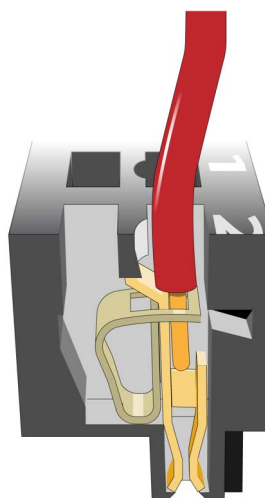
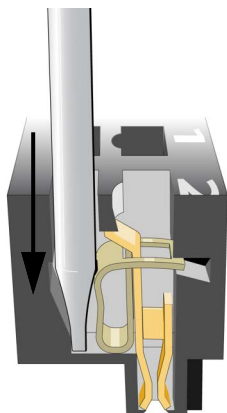
CAUTION: For electrical safety, before starting, de-energize field devices wired to the terminal connector.

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.

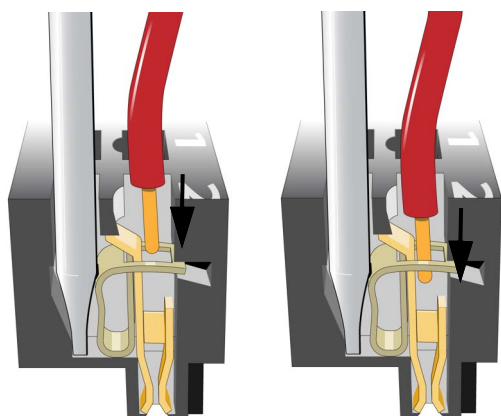
Important: Let the shape of the tool, as it is pressed straight down, open the clamp. Do not rock or wiggle the tool because it may damage the clamp.



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.

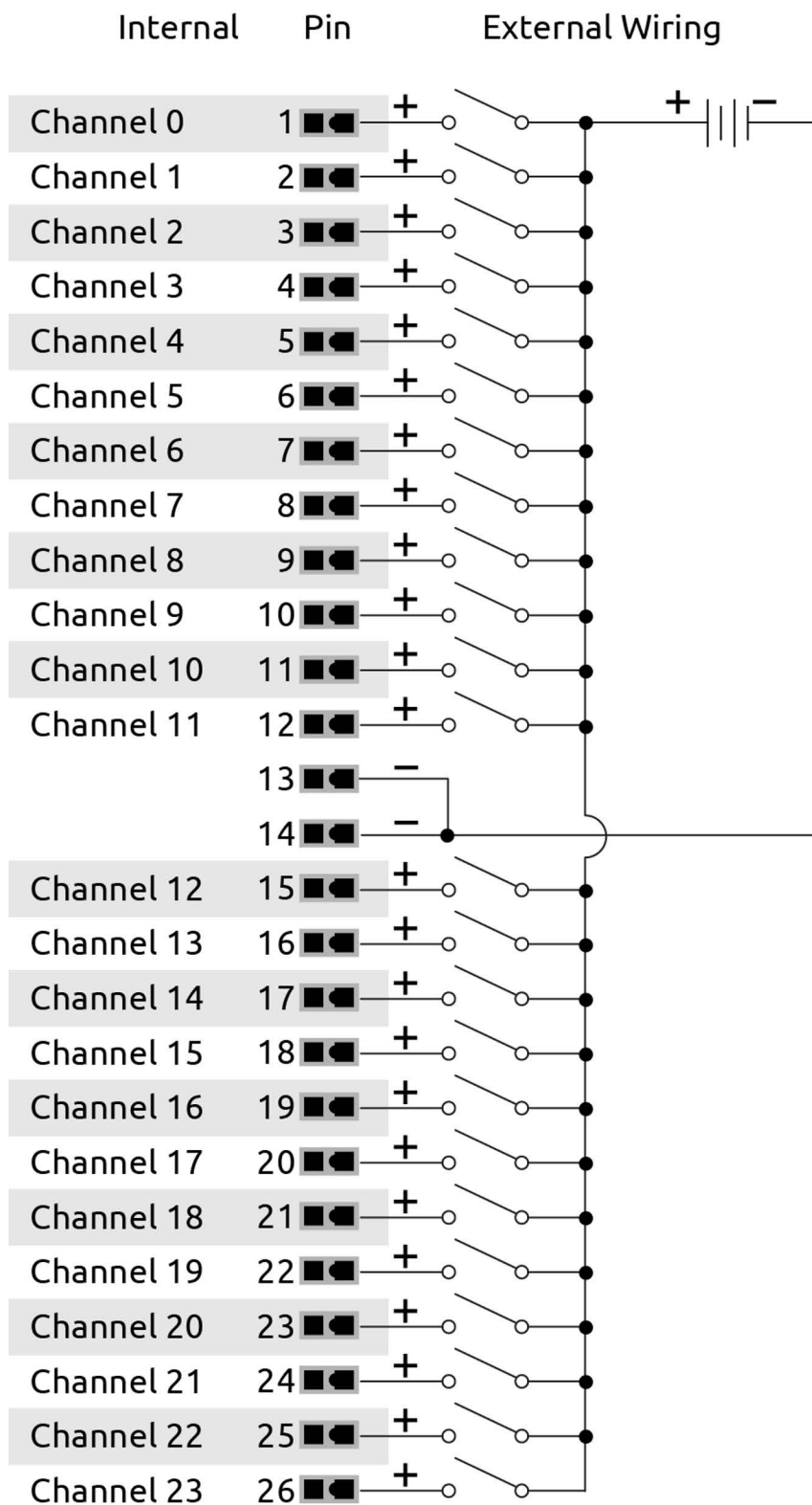


Removing Wires

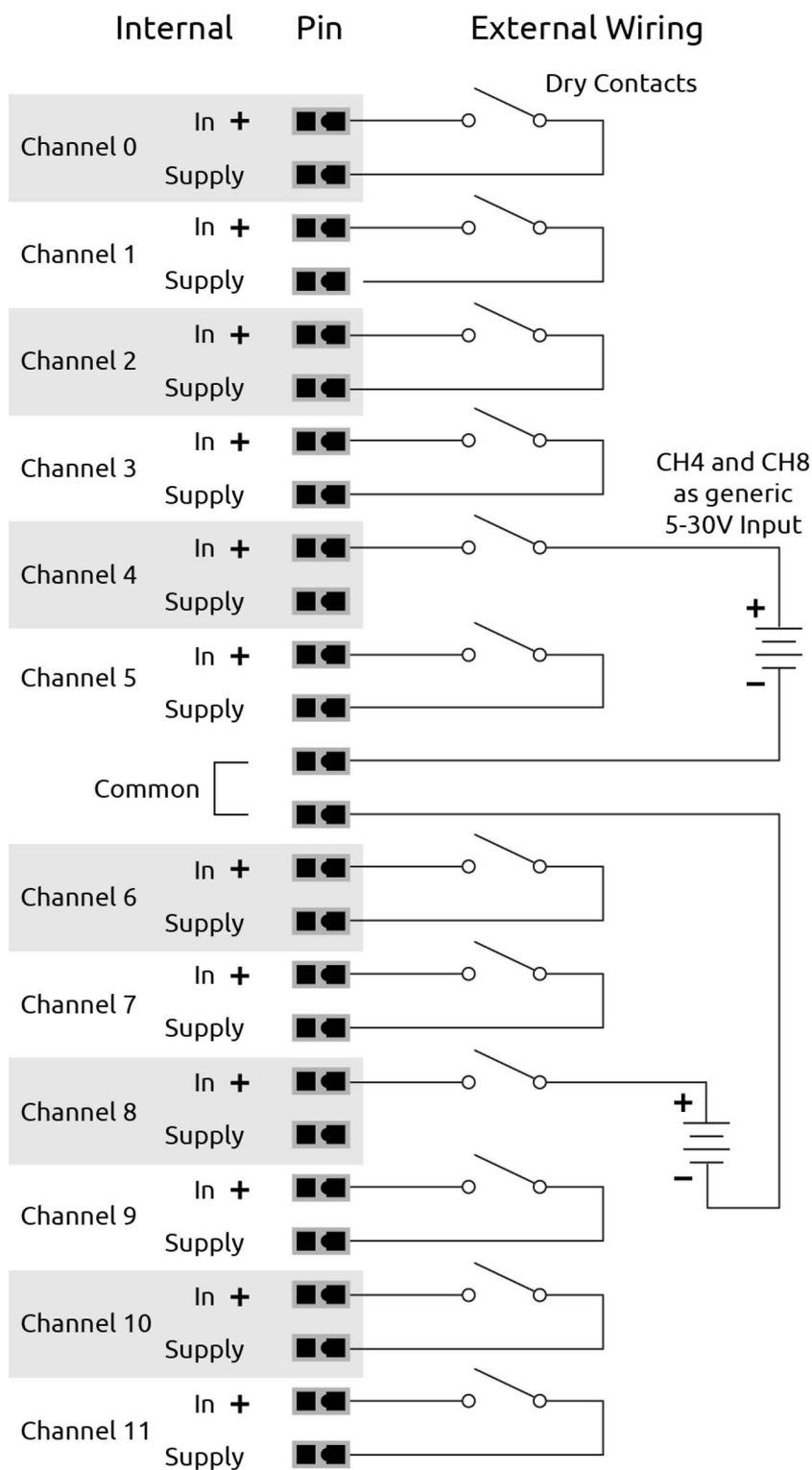
1. Insert the screwdriver or spring-clamp terminal tool into the clamp release hole, pressing the tool against the side of the hole furthest from the terminal numbers.
2. Press straight down firmly until you feel the screwdriver or tool reach the bottom.
3. Pull the wire out.
4. Pull out the screwdriver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

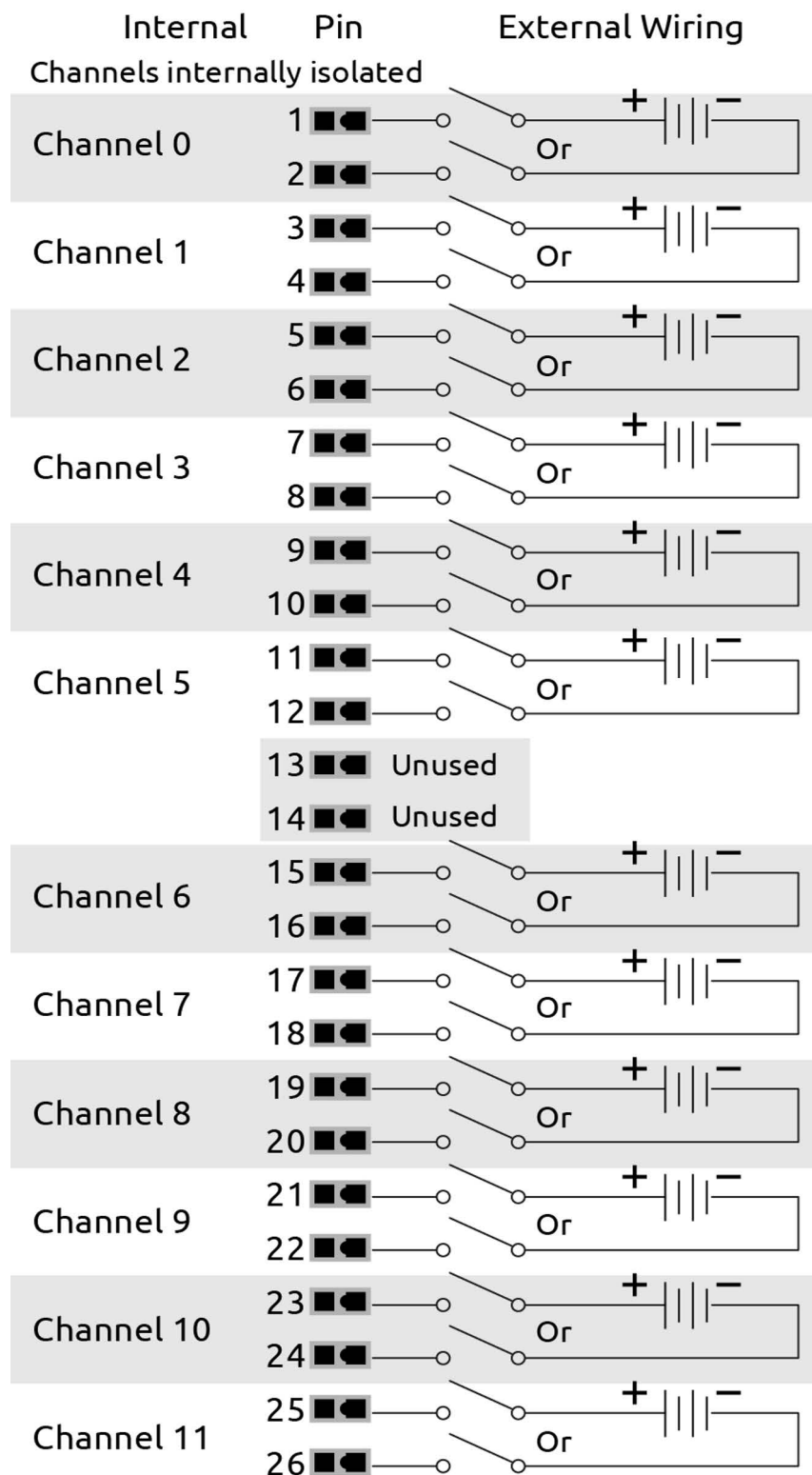
WIRING: GRV-IDC-24, GRV-IDCS-24



WIRING: GRV-IDCSW-12

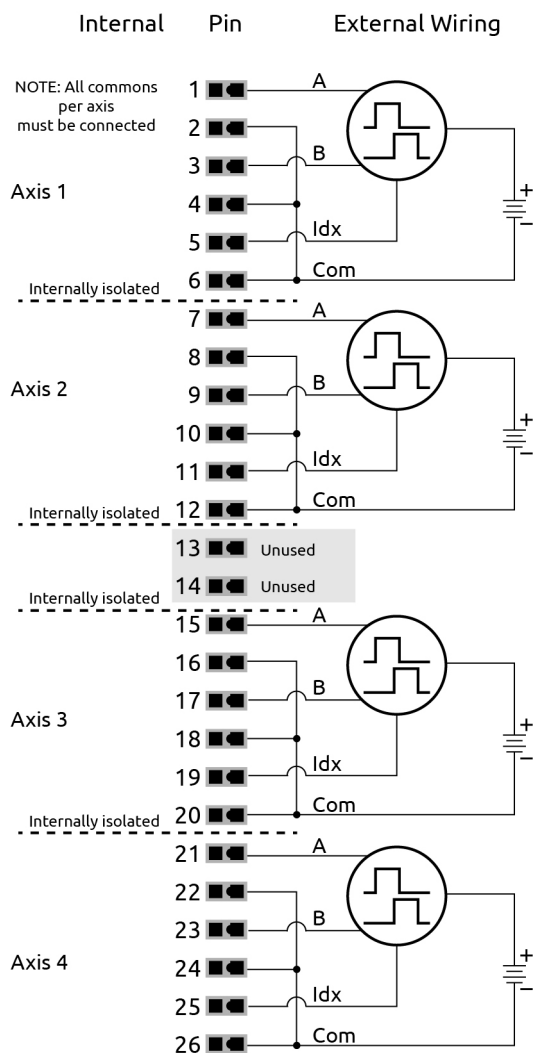


WIRING: GRV-IDCI-12, GRV-IDCIS-12

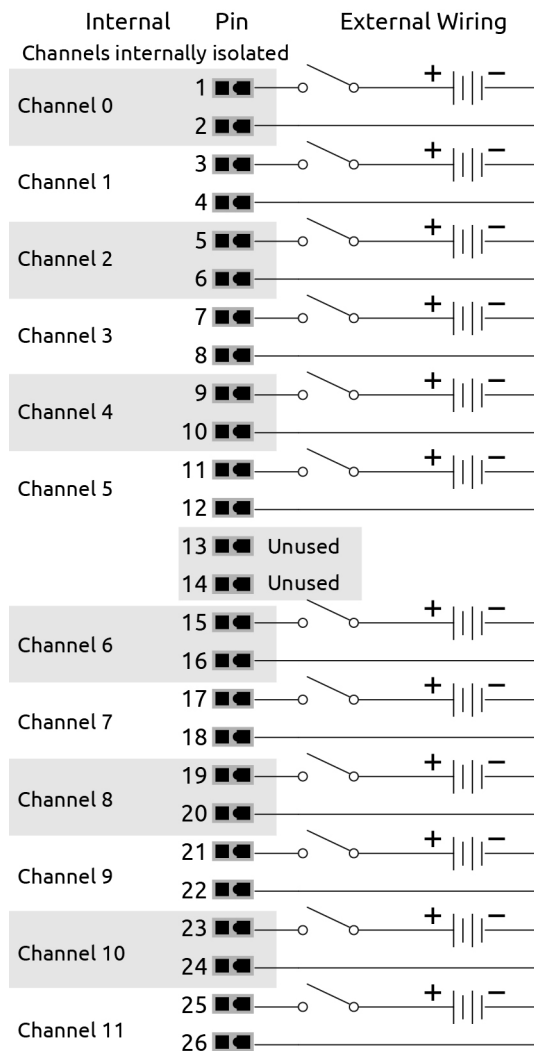


WIRING: GRV-IDCIFQ-12

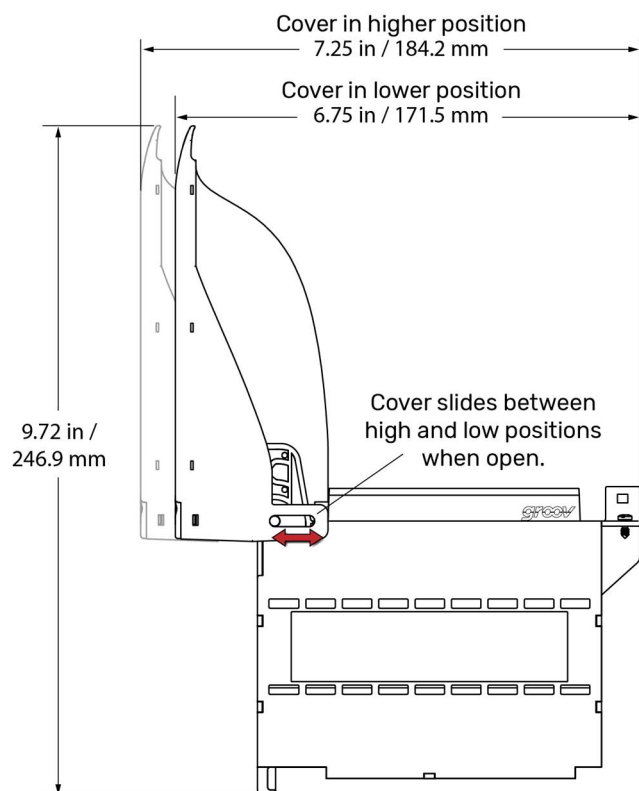
Wiring to quadrature encoders



Wiring to typical (signal) sources



DIMENSIONS: GRV-IDC-24, GRV-IDCS-24, GRV-IDCSW-12, GRV-IDCI-12, GRV-IDCIFQ-12, GRV-IDCIS-12

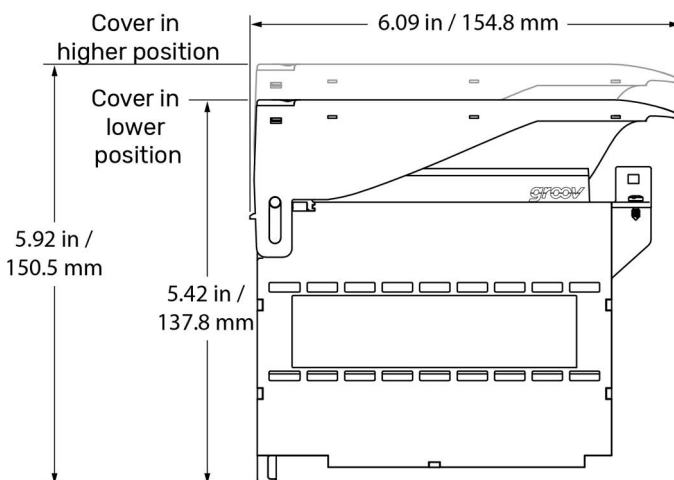
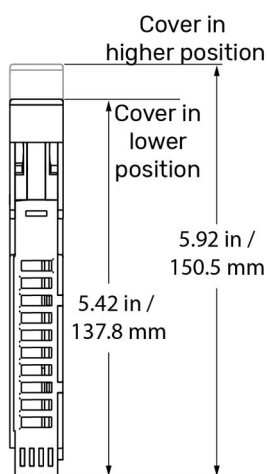


The module cover pivots and can be adjusted to two different heights (positions). The higher position provides more space to accommodate thicker wires.

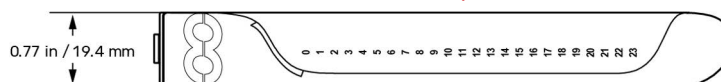
To switch between higher and lower position, lift the cover to at least a 45° angle. Grasp the hinged end of the module cover and do one of the following:

- 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.

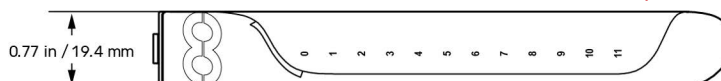
You cannot switch between the higher and lower positions while the cover is closed.



GRV-IDC-24 and GRV-IDCS-24 Input Module

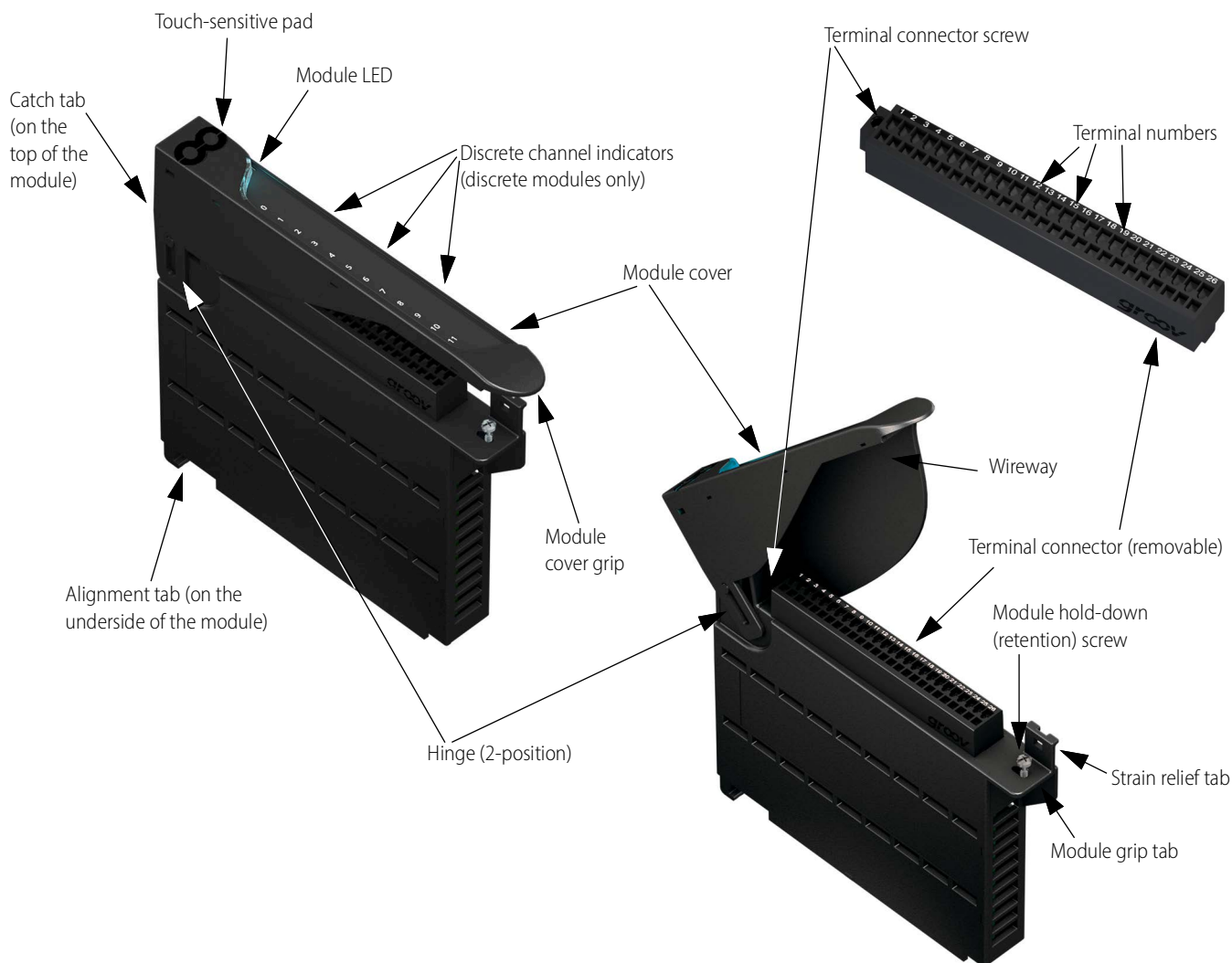


GRV-IDCSW-12, GRV-IDCI-12, GRV-IDCIFQ-12, and GRV-IDCIS-12 Input Module



DESCRIPTION OF MODULE PARTS

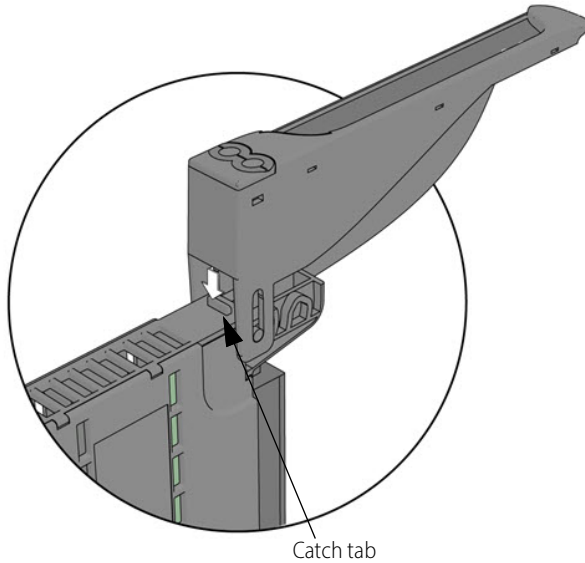
The following diagram identifies the parts of the modules. The installation instructions in the documentation rely on these terms to describe how to handle the module.



Some parts offer unique features:

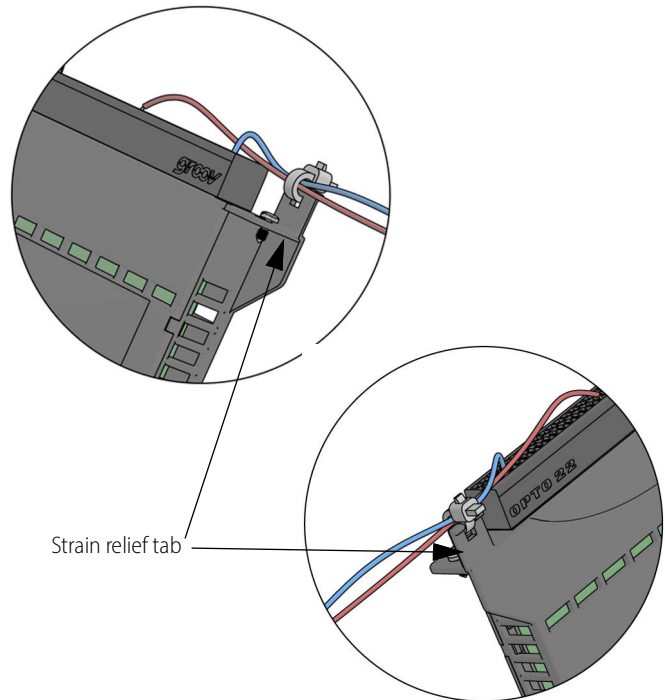
- **Module LED:** Provides a visual indication of the health of the module. For example, if it is blue, the module is operating normally. If it is blinking blue, the module's information is being displayed on the *groov* EPIC processor's screen. For a complete list of the various colors that this LED might display, see the [groov EPIC User's Guide](#) (form 2267).
- **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.

