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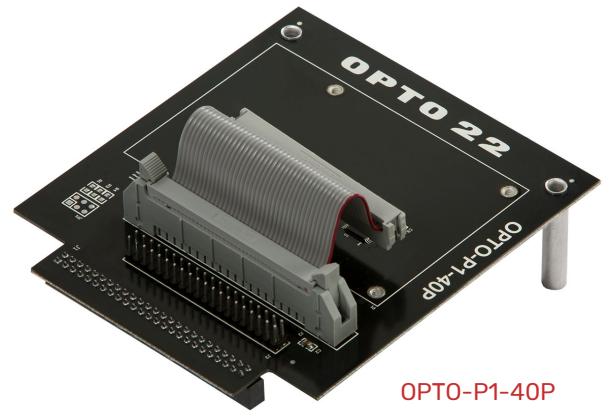
DIGITAL I/O CARRIER BOARD FOR RASPBERRY PI

Features

> Provides a GPIO interface between a Raspberry Pi® and digital I/O modules on select Opto 22 mounting racks

> Perfect for prototyping, proofs of concept, and environments in which an industrially hardened controller isn't required

> Auxiliary 40-pin connector supports HAT add-on boards using UART, SPI, or I^2C

> Includes interface cable, Pi board mounting standoffs, and spare fuses for mounting racks

> Code samples available at developer.opto22.com

OPTO-P1-40P

DESCRIPTION

Imagine safely and reliably sensing and switching 5-60 VDC, 120 VAC, and 240 VAC loads with a Raspberry Pi. Well, now you can!

With Opto 22's Digital I/O Carrier Board for Raspberry Pi, your Pi can harness the power and performance of world-class, industrially hardened digital input/output (I/O) modules. Use your Pi to switch industrial-level electrical loads far beyond the Pi's built in 3.3 VDC GPIO pins, and monitor and control electrical loads required for real-world devices like industrial motors, pumps, and sensors.

The Carrier Board works with any model Pi with a 40-pin header connector. Just insert the board's interface cable into your Pi's GPIO connector, and snap the board onto a compatible Opto 22 rack.

Use the rack's power supply to power the Pi, and then use your favorite Pi-supported programming language to read and write to up to 16 digital I/O points. (Mounting rack, power supply, and I/O modules are sold separately.)

Also, the Carrier Board's auxiliary 40-pin GPIO connector lets other Pi-compatible peripherals access the Pi's unused pins.

Specifications

Interface connectors	
Raspberry Pi:	Two 40-pin GPIO header connectors
I/O rack:	One 50-conductor header connector
Operating temperature	-20 to 70 °C
Storage Temperature	-40 to 85 °C
Relative Humidity	95%, non-condensing
Agency Approvals	CE, RoHS, DFARS
Warranty	30 months from date of manufacture

Part Number

Part	Description
OPTO-P1-40P	Digital I/O Carrier Board for Raspberry Pi

Digital I/O Carrier Board for Raspberry Pi

Shown with Raspberry Pi, G4 I/O modules, mounting rack, and power supply (all sold separately).
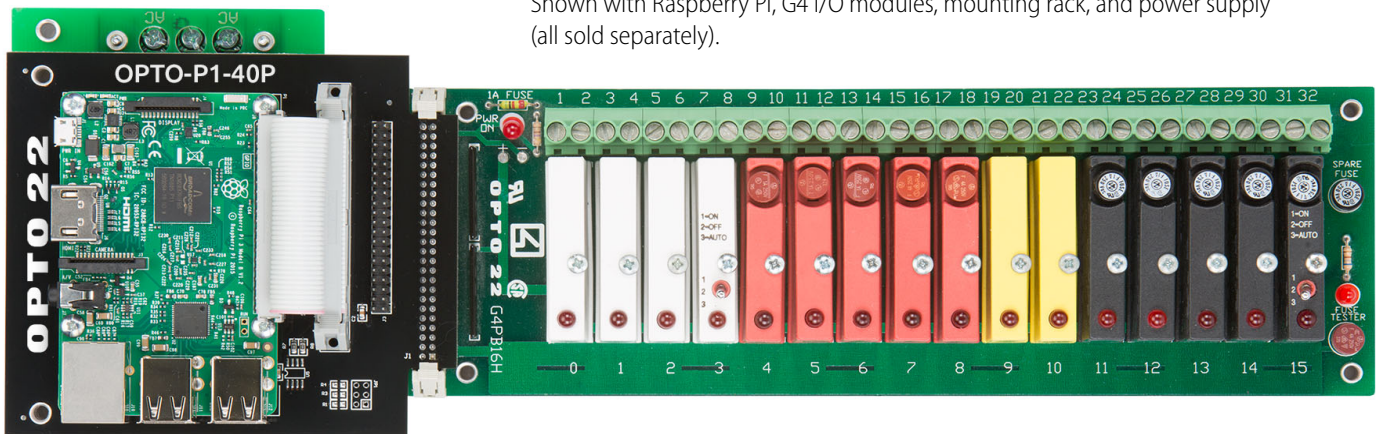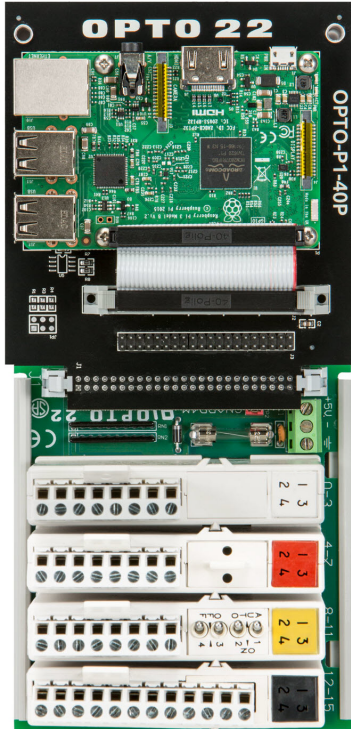

Raspberry Pi® is a trademark of the Raspberry Pi Foundation.

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Digital I/O Carrier Board for Raspberry Pi

Shown with Raspberry Pi, SNAP I/O modules, and mounting rack (all sold separately).

HERE'S WHAT YOU NEED

Raspberry Pi (any model with a 40-pin GPIO header connector, including Raspberry Pi Models A+ and B+, Pi 2 Model B, Pi 3 Model B, and Pi Zero)

Digital I/O Carrier Board for Raspberry Pi

I/O mounting rack

I/O modules

Power supply

G4 or SNAP?

If you don't already have I/O for your project, base your choice on the sensors and actuators you plan to use.

Opto 22 G4 I/O has 1 point per module. Input modules are used to sense field signals. Each output module is individually fused and can switch up to 3 A.
(For G4 I/O see page 3.)

Opto 22 SNAP I/O takes up less space with 4 points per module and costs less per point. Most output modules can switch up to 0.75 A per point or a total of 3 A per module. SNAP-OMR6 modules can switch up to 6 A.
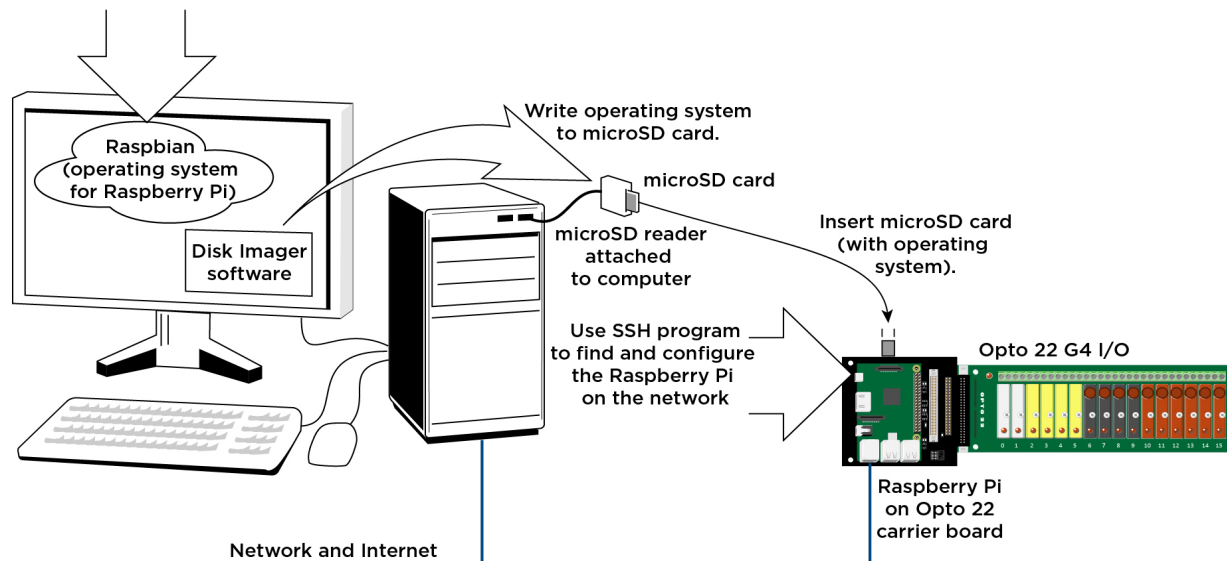(For SNAP I/O, see page 4.)

If you prefer to use Quad Pak or G1 I/O digital modules, the Carrier Board also supports the PB16HQ, PB4H, PB8H and PB16H racks.

Opto 22 I/O has been field-proven for nearly 40 years and is available worldwide. Most I/O modules carry Opto 22's Limited Lifetime Warranty. For details, see

Physical Setup

OPTO 22

G4 I/O MOUNTING RACKS

These racks can accommodate up to 10 AWG wire. The logic supply is fused with a 1 A fuse.

G4 Mounting Racks	
G4PB16H	Holds 16 I/O modules
G4PB8H	Holds 8 I/O modules

G4 I/O MODULES

G4 I/O modules have a built-in LED status indicator to display the point's on/off status.

NOTE: 15 and 24 VDC logic modules are not supported.

G4 Inputs		
Model	**Field Voltage**	**Special Features**
G4IAC5	90–140 VAC/VDC	
G4IAC5A	180–280 VAC/VDC	
G4IAC5L	90–140 VAC/VDC	Low input resistance
G4IAC5MA	90–140 VAC/VDC	Diagnostic switch
G4IDC5	10–32 VDC 12–32 VAC	
G4IDC5D	2.5–28 VDC	Low voltage input
G4IDC5G	35–60 VDC/VAC	
G4IDC5MA	10–32 VDC 12–32 VAC	Diagnostic switch
G4SWIN	NA	Simulates input

G4 Outputs		
Model	**Field Voltage**	**Special Features**
G4OAC5	12–140 VAC @ 3 A	
G4OAC5A	24–280 VAC @ 3 A	
G4OAC5A5	24–280 VAC @ 3 A	Normally closed
G4OAC5MA	12–140 VAC @ 3 A	Diagnostic switch
G4OAC5AMA	24–280 VAC @ 3 A	Diagnostic switch
G4ODC5	5–60 VDC @ 3 A	
G4ODC5A	5–200 VDC @ 3 A	
G4ODC5MA	5–60 VDC	Diagnostic switch
G4SWOUT	NA	Simulates output

G4 POWER SUPPLIES

Although it's possible to power the rack and I/O modules from the Pi, Opto 22 recommends powering the components from the rack's

power supply to ensure sufficient, consistent, and reliable power to all devices connected to the Pi.

| G4 Power Supplies	Input Voltage	Output Current
PBSC	12/24 VDC	1.5 A

Powering Peripherals

If your Pi uses USB-powered peripherals (like hard drives or WiFi dongles), you'll need a power supply that puts out more current:

- Connect a 5 V power supply rated 2.5 A to 5 A to the G4 rack's power terminals.
- Replace the G4 rack's standard 1 A fuse with the 5 A fuse (part FUSE05B—10 pack) included with the Carrier Board.

Mapping: GPIO Pins to G4 Modules

When reading and writing to I/O points:

0 = ON 1 = OFF

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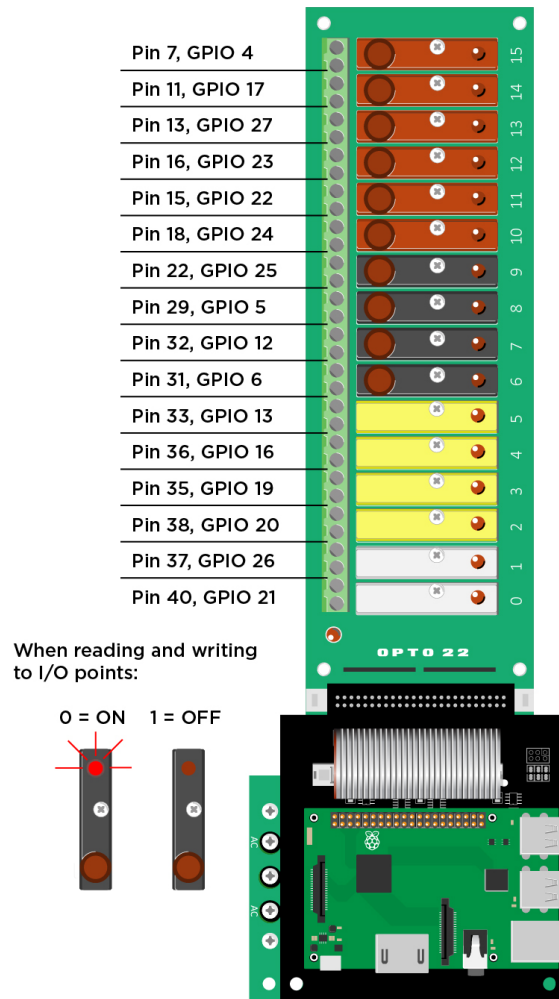
SNAP I/O Mounting Rack

If you've decided to use SNAP I/O modules in your Pi project, the Carrier Board works with the SNAP-D4M mounting rack. The SNAP-D4M holds 4 SNAP I/O modules (a total of 16 points).

The rack ships with a 1 A fuse. If you are using USB peripherals, replace it with a 4 A fuse. For convenience, one is included with the OPTO-P1-40P Carrier Board.

SNAP I/O MODULES

SNAP I/O modules have four points, and each point has an LED to indicate its status.

SNAP Inputs		
Model	**Field Voltage**	**Special Features**
SNAP-IAC5	90–140 VAC/VDC	
SNAP-IAC5A	180–280 VAC/VDC	
SNAP-IAC5MA	120 VAC/VDC	4 isolated channels, manual/auto switches
SNAP-IDC5	24 VAC/VDC	
SNAP-IDC5D	5 VDC	
SNAP-IDC5G	48 VAC/VDC	
SNAP-IDC5-HT	24 VAC/VDC	Leakage-tolerant
SNAP-IDC5MA	24 VAC/VDC	4 isolated channels, manual/auto switches
SNAP-IDC5-SW	15 VDC	Dry contact, normally open
SNAP-IDC5-SW-NC	15 VDC	Dry contact, normally closed

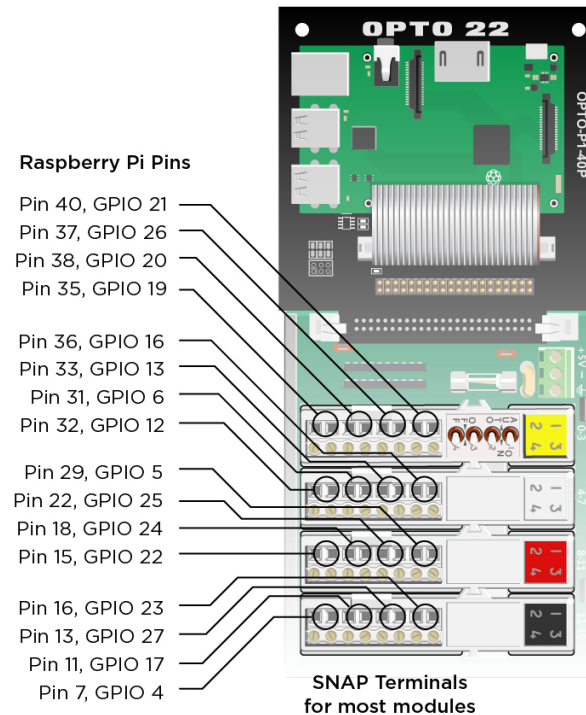| SNAP Outputs		
Model	**Field Voltage**	**Special Features**
SNAP-OAC5	12–250 VAC	
SNAP-OAC5-I	12–250 VAC	4 isolated channels
SNAP-OAC5MA	12–250 VAC	4 isolated channels, manual/auto switches
SNAP-ODC5SRC	5–60 VDC	Load sourcing
SNAP-ODC5SNK	5–60 VDC	Load sinking
SNAP-ODC5ASNK	5–200 VDC	Load sinking
SNAP-ODC5MA	5–60 VDC	4 isolated channels, manual/auto switches
SNAP-ODC5-I	5–60 VDC	4 isolated channels
SNAP-ODC5A-I	5–200 VDC	4 isolated channels
SNAP-OMR6-C	5–30 VDC 0–250 VAC	Mechanical Power Relay, Form C

SNAP Outputs (Continued)		
Model	**Field Voltage**	**Special Features**
SNAP-OMR6T-C	5–30 VDC 0–250 VAC	Mechanical Power Relay, Form C, with integrated transient suppression

Powering a Pi and SNAP I/O

When using the SNAP-D4M with your Pi and SNAP I/O, attach a 5 VDC @ 200 mA (max.) power supply to the rack. Powering the components from the rack's power supply ensures sufficient, consistent, and reliable power to all devices connected to the Pi.

Mapping: GPIO Pins to SNAP I/O Modules

Raspberry Pi Pins

Pin 40, GPIO 21
Pin 37, GPIO 26
Pin 38, GPIO 20
Pin 35, GPIO 19

Pin 36, GPIO 16
Pin 33, GPIO 13
Pin 31, GPIO 6
Pin 32, GPIO 12

Pin 29, GPIO 5
Pin 22, GPIO 25
Pin 18, GPIO 24
Pin 15, GPIO 22

Pin 16, GPIO 23
Pin 13, GPIO 27
Pin 11, GPIO 17
Pin 7, GPIO 4

SNAP Terminals for most modules

Read and Write with Pi

It's easy to read and write to Opto 22 I/O points using your favorite Pi-supported language like Python, Node-RED, Pi Terminal, Pi Filesystem GPIO, and many more.
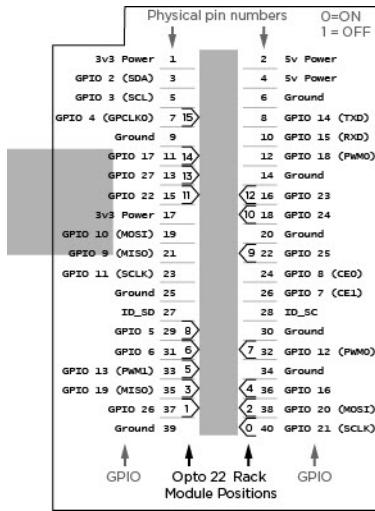
Visit developer.opto22.com for code samples and tips for using your Pi to read and write to Opto 22 I/O modules.

NOTE: Opto 22 I/O modules use negative true logic; that is, a zero bit means On and a 1 bit means Off.

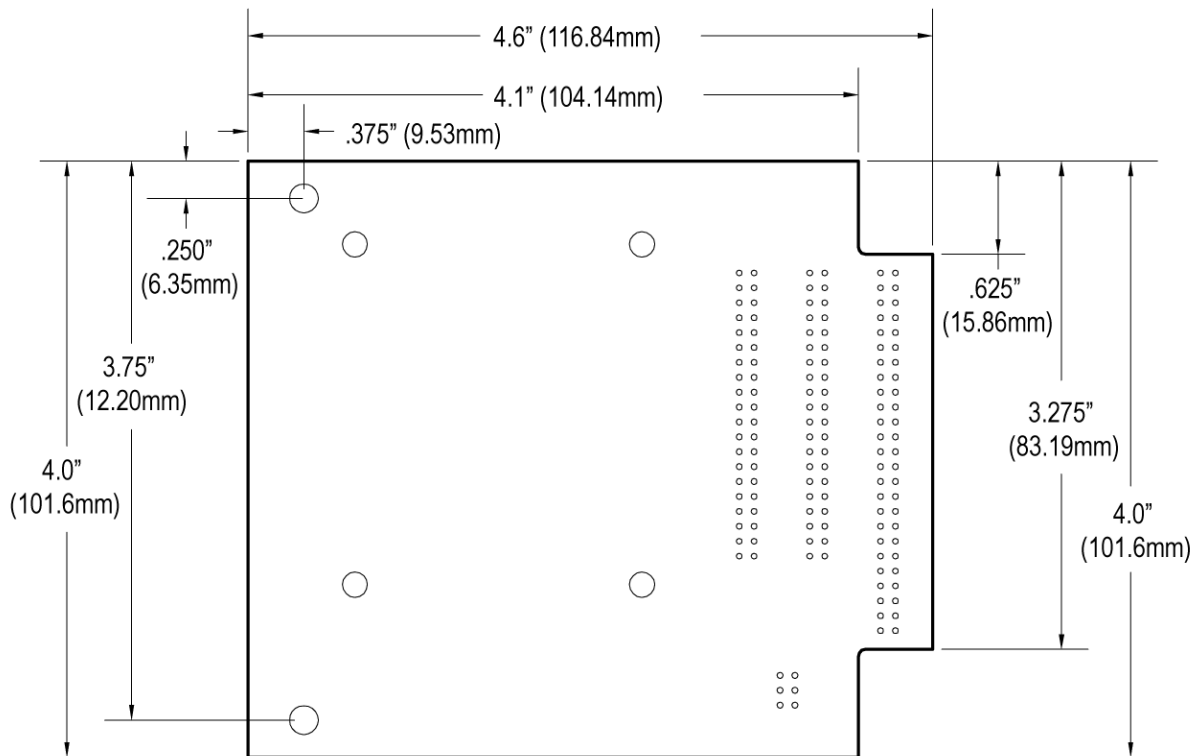*When reading and writing to I/O points, remember that 0 is On and 1 is Off.*

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MAPPING OVERLAY FOR RASPBERRY PI

Place this overlay over your Pi's GPIO pins for a handy mapping reference. You can download the template from developer.opto22.com.

DIMENSIONAL DRAWING

OPTO-P1-40P

More about Opto 22

PRODUCTS

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

groov EPIC® System

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

groov EPIC I/O

groov I/O connects locally to sensors and equipment with up to 24 channels on each I/O module. 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 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.

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 or on a monitor connected via the HDMI or USB ports.

groov EPIC Software

Software included in the *groov* EPIC processor:

- PAC Control engine to run PAC Control and PAC Display
- CODESYS Runtime engine to run IEC61131-3 compliant programs built with CODESYS Development System
- Optional access to the Linux operating system through a secure shell (SSH) to download and run custom applications
- *groov* View for building your own device-independent HMI, viewable on the touchscreen, PCs, and mobile devices
- Node-RED for creating simple logic flows from pre-built nodes
- Ignition Edge® from Inductive Automation®, with OPC-UA drivers to Allen-Bradley®, Siemens®, and other control systems, and MQTT communications with Sparkplug for efficient IIoT data transfer

groov RIO

groov RIO revolutionizes remote I/O by offering a single, compact, PoE-powered industrial package with web-based configuration, commissioning, and flow logic software built in, plus support for multiple OT and IT protocols.

Standing alone, it meets the needs of small, variable I/O count applications, especially those that require data logging or data communications, commonly found in IIoT applications. *groov* RIO can also be used with a Modbus/TCP master or as remote I/O for a *groov* EPIC system.

Older products

From solid state relays (our first products) to world-famous G4 and SNAP I/O, to SNAP PAC controllers, older Opto 22 products are still supported and still doing the job at thousands of installations worldwide. You can count on us to give you 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.

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