# 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 $I^2C$

- ⬈ Interface cable and Pi board mounting standoffs included

- ⬈ 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®, you can harness the power and performance of world-class, industrially hardened digital input/output (I/O) modules with your Raspberry Pi. 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.

Just insert the Carrier Board's interface cable into your Pi's 40-pin 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.)
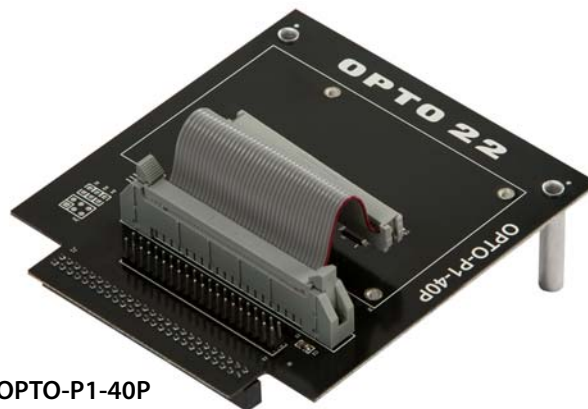
In addition, with the Carrier Board's auxiliary 40-pin GPIO connector, other Pi-compatible peripherals can access the Pi's unused pins.
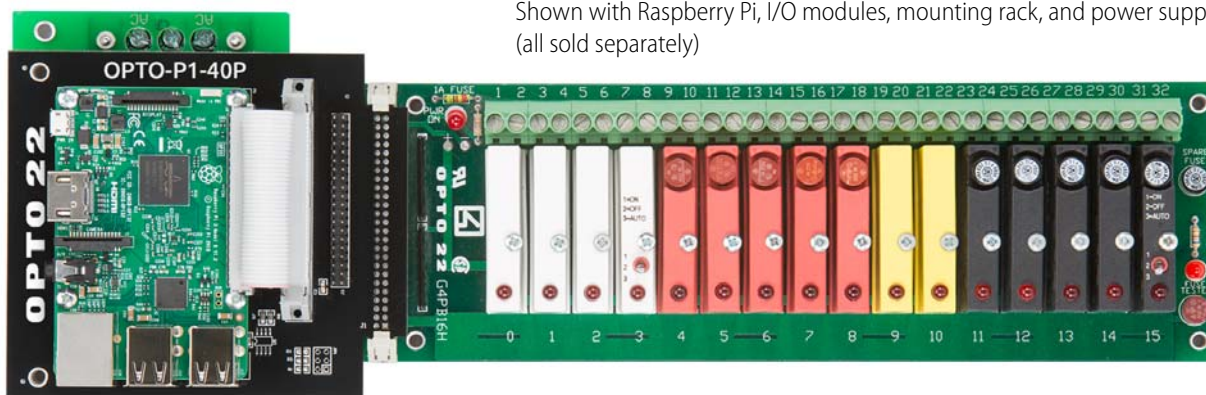
## I/O Mounting Racks

The Carrier Board supports the following mounting racks designed for G4 I/O modules. These racks can accommodate up to 10 AWG wire. The logic supply is fused with a 1 A fuse.

| Mounting Racks | |
|---|---|
| G4PB16H | holds 16 I/O modules |
| G4PB8H | holds 8 I/O modules |

For customers with SNAP, Quad Pak, or G1 I/O modules, the Carrier Board also supports the SNAP-D4M, PB16HQ, PB4H, and PB16H racks.

**Digital I/O Carrier Board for Raspberry Pi**
Shown with Raspberry Pi, I/O modules, mounting rack, and power supply (all sold separately)

## Part Number

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

**OPTO 22**

**Digital I/O Carrier Board for Raspberry Pi**

## Compatible I/O

Opto 22 I/O modules and mounting racks have been field-proven for nearly 40 years and are available worldwide. Most I/O modules carry Opto 22's lifetime warranty.

With the Digital I/O Carrier Board for Raspberry Pi, you can read and write to any of these G4 digital I/O modules (sold separately):

| Model | Input | Output | Field Voltage | Special Features |
|---|---|---|---|---|
| G4IAC5 | ● | | 90–140 VAC/DC | |
| G4IAC5A | ● | | 180–280 VAC/DC | |
| G4IAC5L | ● | | 90–140 VAC/DC | Low input resistance |
| G4IAC5MA | ● | | 90–140 VAC/DC | Diagnostic switch |
| G4IDC5 | ● | | 10–32 VDC 12–32 VAC | |
| G4IDC5B | ● | | 4–16 VDC | Higher speed |
| G4IDC5D | ● | | 2.5–28 VDC | High speed |
| G4IDC5G | ● | | 35–60 VDC/AC | |
| G4IDC5K | ● | | 2.5–16 VDC | Highest speed |
| G4IDC5MA | ● | | 10–32 VDC 12–32 VAC | Diagnostic switch |
| G4SWIN | ● | | NA | Simulates input |
| G4OAC5 | | ● | 12 VAC–140 VAC @ 3 A | |
| G4OAC5FM | | ● | 12 VAC–140 VAC @ 3 A | |
| G4OAC5A | | ● | 24 VAC–280 VAC @ 3 A | |
| G4OAC5AFM | | ● | 24 VAC–280 VAC @ 3 A | |
| G4OAC5A5 | | ● | 24 VAC–280 VAC @ 3 A | Normally closed |
| G4OAC5A5FM | | ● | 24 VAC–280 VAC @ 3 A | Normally closed |
| G4OAC5MA | | ● | 12 VAC–140 VAC @ 3 A | Diagnostic switch |
| G4OAC5AMA | | ● | 24 VAC–280 VAC @ 3 A | Diagnostic switch |
| G4ODC5 | | ● | 5–60 VDC @ 3 A | |
| G4ODC5FM | | ● | 5–60 VDC @ 3 A | |
| G4ODC5A | | ● | 5–200 VDC @ 3 A | |
| G4ODC5AFM | | ● | 5–200 VDC @ 3 A | |
| G4ODC5MA | | ● | 5–60 VDC | Diagnostic switch |

| Model | Input | Output | Field Voltage | Special Features |
|---|---|---|---|---|
| G4ODC5R | | ● | NA | Dry contact, normally open (reed relay) |
| G4ODC5RFM | | ● | NA | Dry contact, normally open (reed relay) |
| G4ODC5R5 | | ● | NA | Dry contact, normally closed (reed relay) |
| G4ODC5R5FM | | ● | NA | Dry contact, normally closed (reed relay) |
| G4SWOUT | | ● | NA | Simulates output |

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

Each compatible I/O module provides single-channel flexibility and has a built-in LED status indicator to display the point's on/off status. Output modules can switch up to a 3 amp load and have a built-in fuse. Opto 22 input modules are designed to limit input current—you don't need current-limiting resistors.

## Power Supplies

Although it's possible to power the rack and I/O modules from the Pi, Opto 22 recommends powering the Pi from the rack's power supply to ensure sufficient, consistent, and reliable power to all devices connected to the Pi.

| Power Supplies | |
|---|---|
| PBSA | 120 VAC input |
| PBSB | 220 VAC input |
| PBSC | 12/24 VDC input |

## Carrier Board Specifications

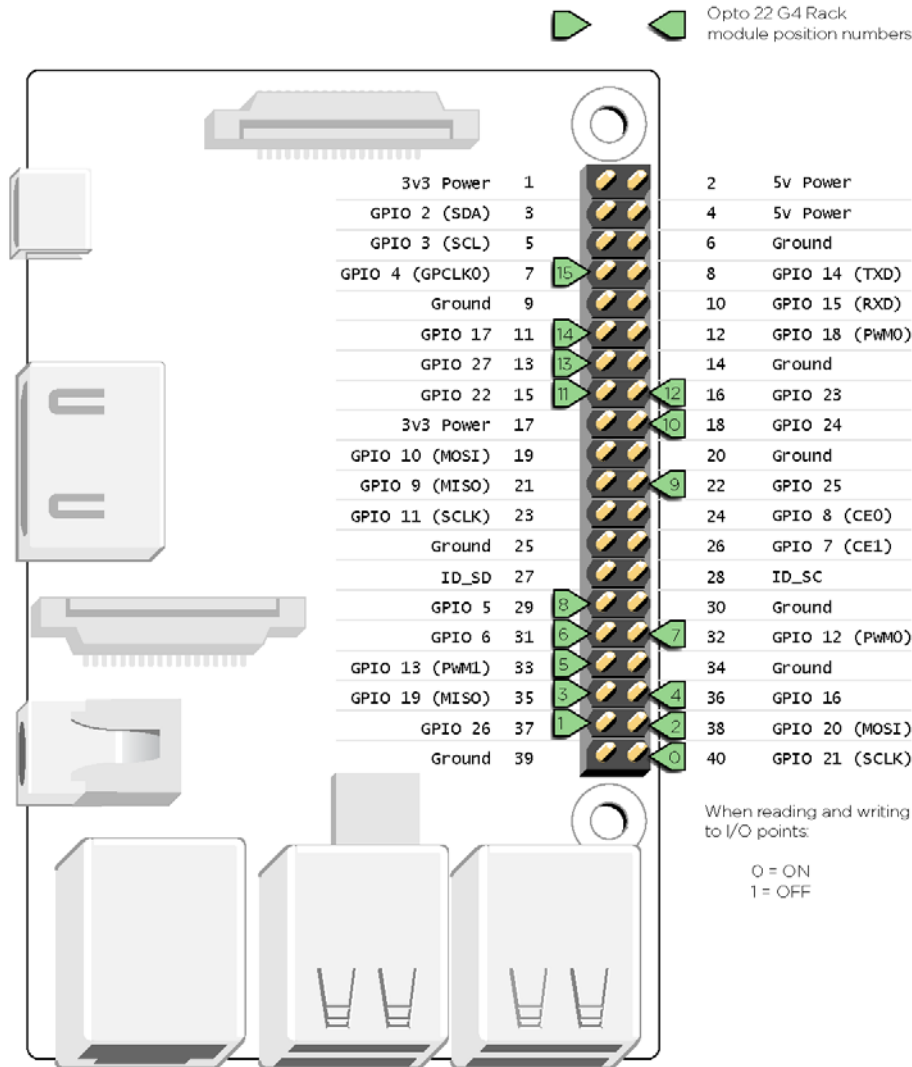| Interface connectors | |
|---|---|
| • Raspberry Pi | Two 40-pin GPIO header connectors |
| • I/O rack | One 50-conductor header connector |
| Operating temperature | -20 to 70 °C |
| Storage Temperature | -40 to 85 °C |
| Relative Humidity | 95%, non-condensing |
| Agency Approvals | CE, RoHS, DFARS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

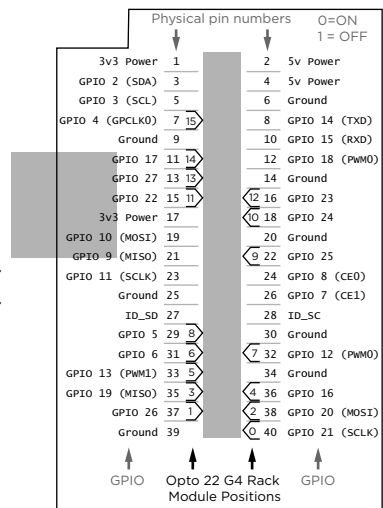# Digital I/O Carrier Board for Raspberry Pi

## Read and Write with Pi

It's easy to read and write to Opto 22 I/O points using your favorite Pi-supported language.

This Pin-to-Point mapping diagram shows the 16 GPIO pins that are mapped to I/O points (according to their rack positions).

*NOTE: Opto 22 I/O modules use negative true logic (a zero bit means On and a 1 bit means Off).*
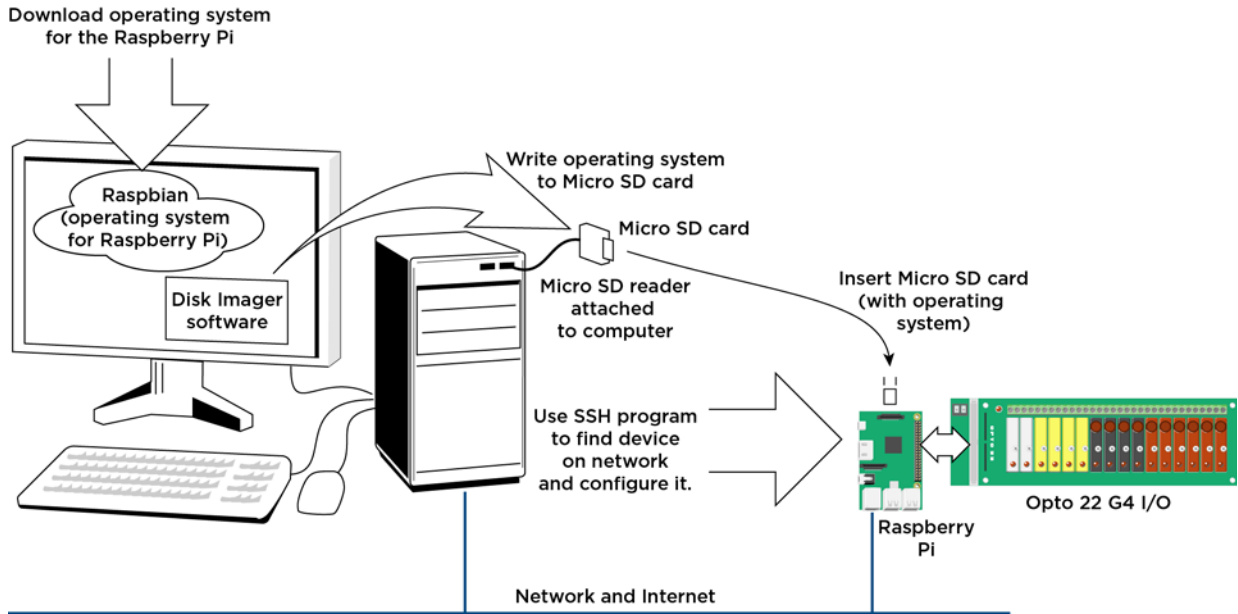*When reading and writing to I/O points, remember that 0 is On and 1 is Off.*

Opto 22 G4 Rack
module position numbers

| Pin | | Pin | |
|---|---|---|---|
| 3v3 Power | 1 | 2 | 5v Power |
| GPIO 2 (SDA) | 3 | 4 | 5v Power |
| GPIO 3 (SCL) | 5 | 6 | Ground |
| GPIO 4 (GPCLK0) | 7 [15] | 8 | GPIO 14 (TXD) |
| Ground | 9 | 10 | GPIO 15 (RXD) |
| GPIO 17 | 11 [14] | 12 | GPIO 18 (PWM0) |
| GPIO 27 | 13 [13] | 14 | Ground |
| GPIO 22 | 15 [11] | [12] 16 | GPIO 23 |
| 3v3 Power | 17 | [10] 18 | GPIO 24 |
| GPIO 10 (MOSI) | 19 | 20 | Ground |
| GPIO 9 (MISO) | 21 | [9] 22 | GPIO 25 |
| GPIO 11 (SCLK) | 23 | 24 | GPIO 8 (CE0) |
| Ground | 25 | 26 | GPIO 7 (CE1) |
| ID_SD | 27 | 28 | ID_SC |
| GPIO 5 | 29 [8] | 30 | Ground |
| GPIO 6 | 31 [6] | [7] 32 | GPIO 12 (PWM0) |
| GPIO 13 (PWM1) | 33 [5] | 34 | Ground |
| GPIO 19 (MISO) | 35 [3] | [4] 36 | GPIO 16 |
| GPIO 26 | 37 [1] | [2] 38 | GPIO 20 (MOSI) |
| Ground | 39 | [0] 40 | GPIO 21 (SCLK) |

When reading and writing
to I/O points:

0 = ON
1 = OFF

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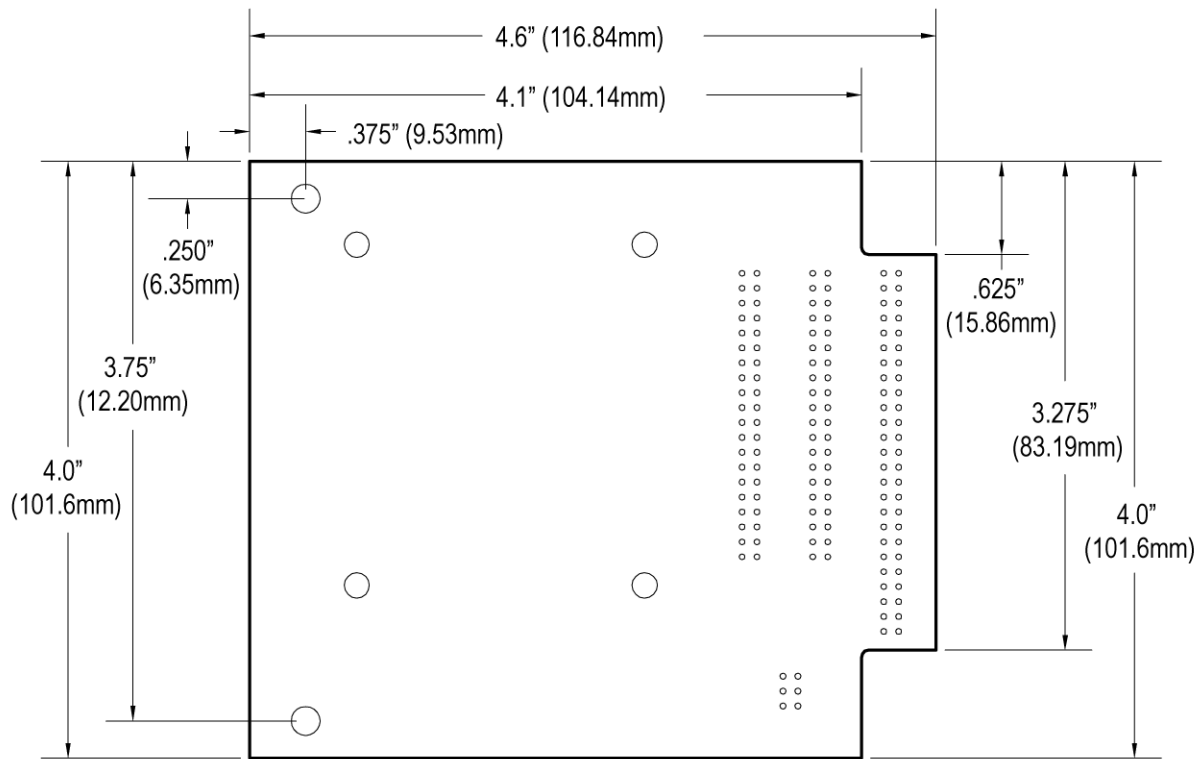You can download the template from developer.opto22.com.

Physical pin numbers    0=ON
1 = OFF

| Pin | | Pin | |
|---|---|---|---|
| 3v3 Power | 1 | 2 | 5v Power |
| GPIO 2 (SDA) | 3 | 4 | 5v Power |
| GPIO 3 (SCL) | 5 | 6 | Ground |
| GPIO 4 (GPCLK0) | 7 [15] | 8 | GPIO 14 (TXD) |
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GPIO      Opto 22 G4 Rack      GPIO
Module Positions

## Physical Setup



## Dimensional Drawing

### OPTO-P1-40P

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