

# RAD-IO2 Series

## Isolated Analog, Digital or Temperature Interface to USB and CAN

### Key Features:

- Open I/O concept - works with:
  - CAN or CAN FD devices
  - Direct to neoVI USB ports
  - PC via USB
- Stackable, daisy chain up to 4 RAD-IO2 devices with RAD-IO2-CANHUB
- Works with Vehicle Spy, included app or Open APIs
- 1000Hz aggregate sampling rate
- Sturdy aluminum case
- 2.5 kV channel to channel and channel to USB isolation

The RAD-IO2 series is a family of ruggedized products that provide an isolated analog, digital or temperature interface to a PC via the PC's USB port. These tools can also be paired with Intrepid products that include a USB port such as neoVI ION, neoVI FIRE 2, and RAD-Gigalog. In addition, the RAD-IO2-CANHUB can power and convert the native UART signal to CAN or CAN FD for use in any CAN device.

The RAD-IO2 family communicates on an open source UART based serial communication protocol. Up to four devices can be daisy chained. The chain length is limited by current supplied to the chain through USB. All RAD-IO2 devices have input to output isolation, and 2.5kV isolation between each of the eight banks. Bank to bank isolation is important because it allows the common mode voltage of each input signal to be different than the other channels in other banks. (This is a major source of measurement error on non-isolated devices and can damage to the product.) Additionally, noise on one channel will not affect other channels.

### Product Family:

- **RAD-IO2-TC:** 8 Isolated banks, each with 1 isolated channel of K-type thermocouple
- **RAD-IO2-AIN:** 8 Isolated banks, 1 channel per bank selectable between a high or low voltage input
- **RAD-IO2-AOUT:** 8 Isolated analog output banks, each with 3 analog outputs per bank
- **RAD-IO2-PWRRLY:** 8 Isolated SPDT (single pole double throw) electro-mechanical relays
- **RAD-IO2-DIO:** 12 digital/analog inputs and 8 digital outputs
- **RAD-IO2-CANHUB:** CAN FD interface for up to 4 RAD-IO2 devices



# RAD-IO2 Series

## RAD-IO2-TC



- 8 banks of isolated K-type thermocouple interface; One channel per bank
- 0.2°C resolution
- Cold junction accuracy  $\pm 0.5\text{C}$  (0C to 70C)  $\pm 1.0\text{C}$  (-40 to 125C)
- 60Hz and 50Hz common mode rejection  $> 105\text{dB}$
- Standard MiniTC connector
- Second order 150Hz filter

## RAD-IO2-AIN



- 8 Banks of isolated analog inputs
- Each bank has two sets of inputs, low and high voltage; Only one can be accessed at a time as a channel.
- Low range:  $\pm 250\text{mV}$ ,  $\pm 1000\text{mV}$ , and  $\pm 5000\text{mV}$
- High range:  $\pm 8\text{V}$ ,  $\pm 16\text{V}$ , and  $\pm 42\text{V}$
- $> 800\text{k}$  Input impedance
- 50Hz/60Hz common mode rejection  $> 105\text{dB}$
- Second order 150Hz filter

## RAD-IO2-AOUT



- 8 Isolated digital to analog converters (DAC)
- Each DAC (Bank) has three 0-5V analog outputs and one common ground line per bank
- 8 banks of 3 channels each; 24 total
- 16bit DAC
- 76.3uV per bit
- 5mA output current



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## RAD-IO2-PWRRLY



- 8x 250VAC 5A relays
- Interface for NO/NC and Common
- Switching power 60W/62.5VA and switching voltage 220VDC/250VAC
- Dielectric and surge capability up to 2500Vrms between open contacts and 3000Vrms between coil and contacts
- High mechanical shock resistance up to 300g functional

## RAD-IO2-DIO



- Includes 8 isolated banks with one common ground per bank
- The first 4 banks are isolated inputs, with three 0-40V 12bit ADC inputs per bank (12 total) which can be configured as analog input or digital input with a programmable threshold (in 160mV steps).
- The second 4 banks have two digital outputs that can be configured as separate digital channels or as an H-Bridge output. 8 total.
- Each output can pass 5.5V to 40V at 6A (user supplied).
- PWM programmable output

## RAD-IO2-CANHUB



- CAN FD interface for RAD-IO2 (one channel CAN FD)
- Supports up to 4 RAD-IO2 devices
- Needed to interface RAD-IO2 devices to CAN bus
- Powered from VBAT input on DB9 connector
- CAN-HUB accepts 4.5VDC-40VDC
- Cable to power CAN-HUB and extend CAN to DB9 is optional

**Cables:** Includes a USB Type A to USB-C cable, and a USB-C to USB-C jumper

**Thermocouples:** Not included

**Accessories:** Additional USB-C to USB-C jumper cables are available



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# RAD-IO2 Series

## Specifications:

- Sampling rate: Max 1000 sps aggregate across all daisy chained modules, max 100 sps per channel. For example, 24 channels would yield  $1000 / 24 = \sim 41$  samples per second.
- Required voltage: 5VDC, supplied by USB PC port or powered from the RAD-IO2-CANHUB (4.5VDC-40VDC)
- Current Requirements:
  - Max current per module: RAD-IO2-RELAY: 500 mA if all coils are energized, all others 250 mA
  - RAD-IO2-CANHUB can supply up to 2 Amps via DB9 connector
  - PC USB current supply varies – USB 2 supplies  $\sim 500$  mA; USB 3 supplies  $\sim 900$  mA
- 2.5 kV channel to channel and channel to USB isolation
- Direct to neoVI USB feature: neoVI ION, neoVI PLASMA, neoVI FIRE 2
- Dimensions: 208.8mm x 80.0 mm x 31.9 mm (8.22" x 3.15" x 1.26")
- Temperature Range:  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- Weight: 500 g (1.1 lbs)
- Includes: Diagnostic and calibration program, APIs and examples for Python, C, C++, and Java

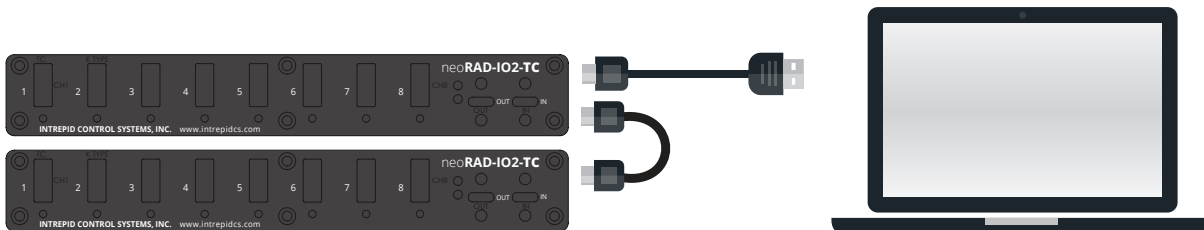
\* Future with software update

## Accessory and cable notes:

- All RAD-IO2 module purchases include one ruggedized cable with USB-A to USB-C to connect from the RAD-IO2 to the PC, neoVI FIRE 2, neoVI ION, and neoVI PLASMA. If more cables are required, the part number is neoRAD-IO2 USB-C USB-A.
- All RAD-IO2 module purchases include one ruggedized USB-C to USB-C jumper cable to daisy chain units together. Part number: neoRAD-IO2-JMP
- The push-in mating connector for all modules (except the thermocouple module) are included. If spares are needed, use P/N 1778858 and purchase from one of many Phoenix Contact distributors.
- Thermocouples are not included with the purchase of the TC module.
- Brackets with fasteners are included with each module to firmly attach multiple modules.
- The CAN-HUB is powered from the DB9 connector. A cable to power it and access the CAN outputs is sold separately or users can easily make one. P/N: RAD-IO2-CH-PWRC

## Possible Configurations:

- Single or Multiple RAD-IO2 units to PC  
(Note: The specification for USB type A is 500mA, so unless a powered hub is used, users may be limited to 2 modules per USB port if the laptop adheres to the spec.)



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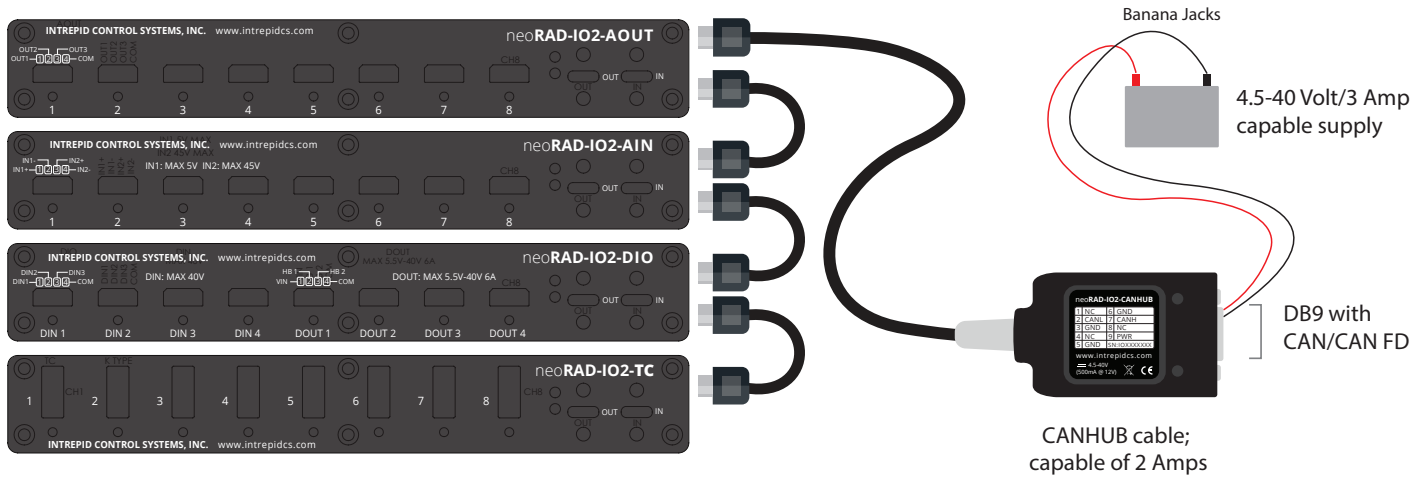
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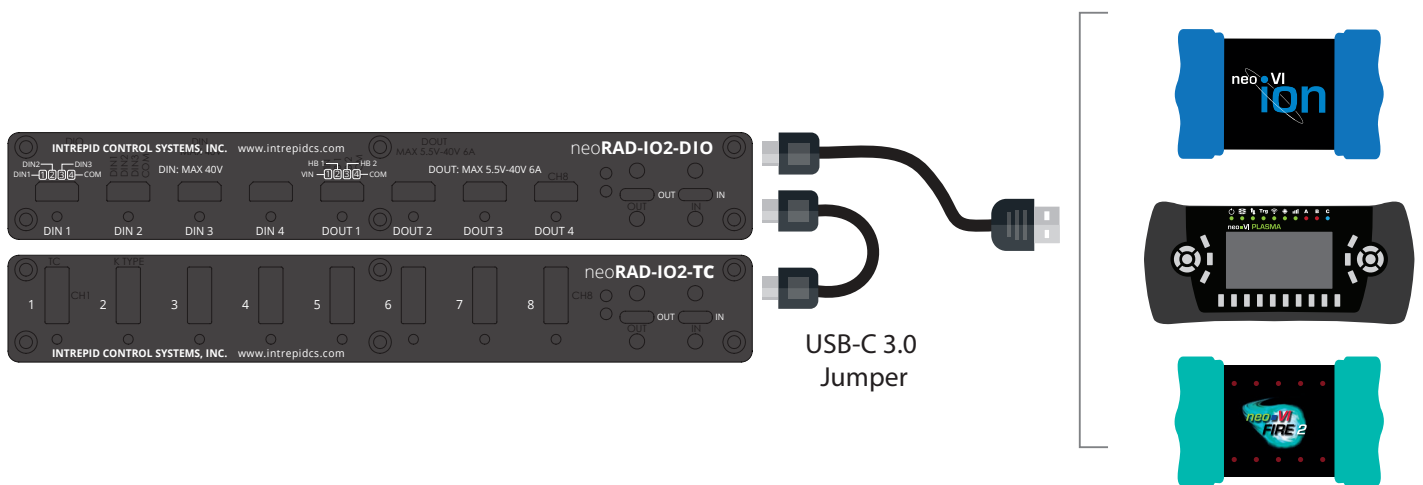
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# RAD-IO2 Series

- Single or multiple RAD-IO2 units to RAD-IO2-CANHUB



- Single or multiple RAD-IO2 units to neoVI ION, neoVI PLASMA, or neoVI FIRE 2.



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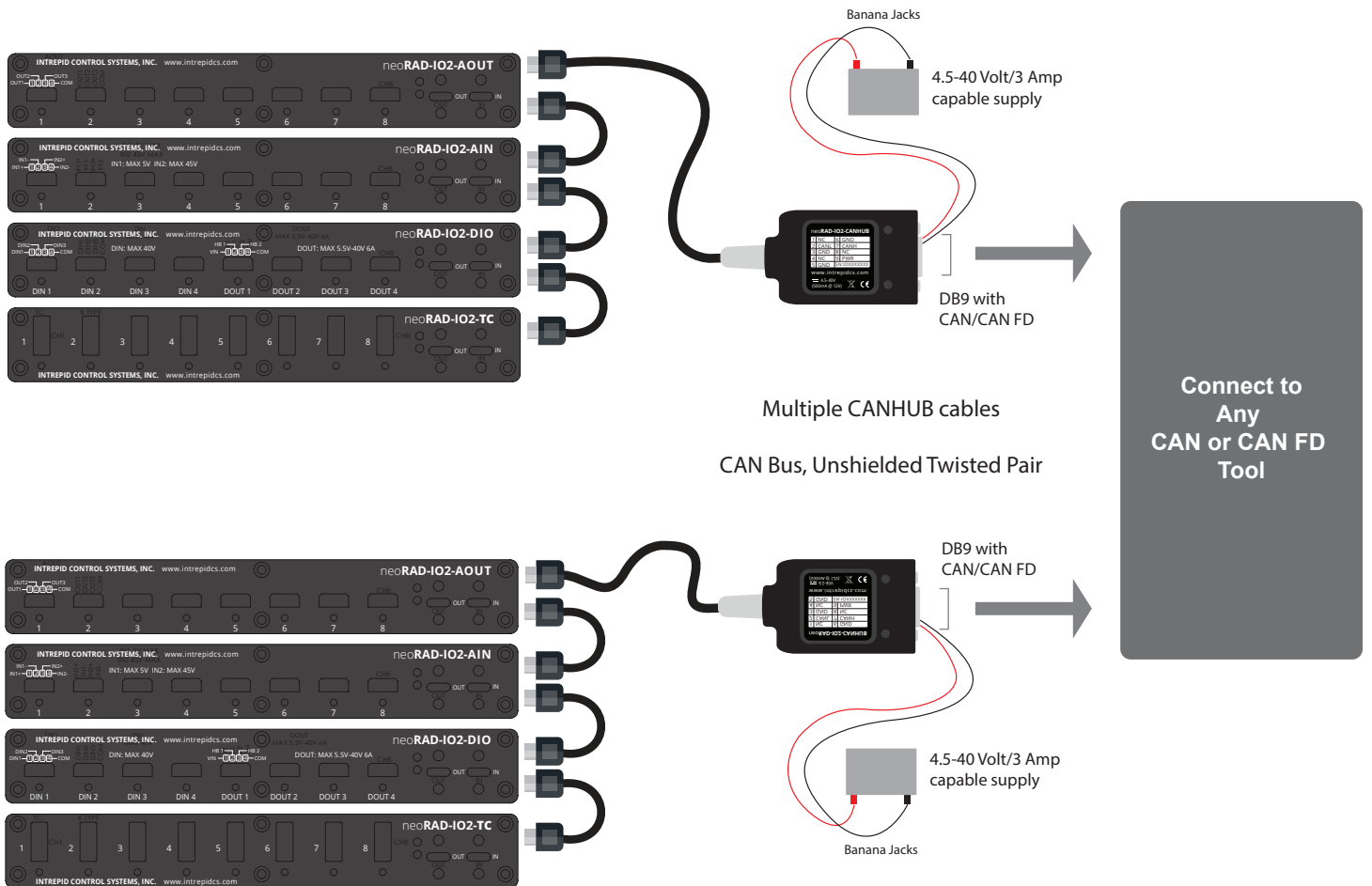
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# RAD-IO2 Series

- Connect multiple RAD-IO2-CANHUB units to any CAN or CAN FD tool.  
Reduce data acquisition wiring in big systems by placing the modules near the test sensors.



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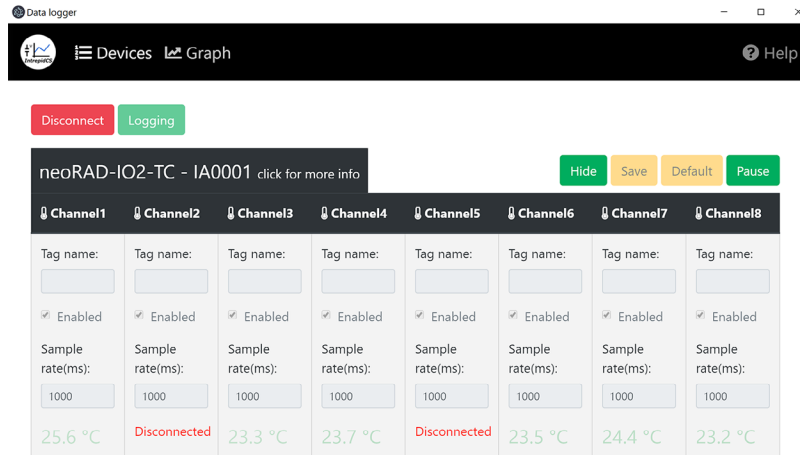
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# RAD-IO2 Series



*Diagnostic  
Screen*

## Ordering Information

Part Number	Description	Includes
RAD-IO2-TC	Eight channel isolated thermocouple input module	One module and one USB-C to USB-A Cable
RAD-IO2-AIN	Eight channel isolated analog input module	One module and one USB-C to USB-A Cable, and 8 push-in screw terminal connectors
RAD-IO2-AOUT	24 channel analog output module	One module and one USB-C to USB-A Cable or jumper, and 8 push-in screw terminal connectors
RAD-IO2-PWRRLY	Eight channel isolated relay module	One module and one USB-C to USB-A Cable, and 8 push-in screw terminal connectors
RAD-IO2-DIO	Digital input and output module	One module and one USB-C to USB-A Cable, and 8 push-in screw terminal connectors
RAD-IO2-CAN-HUB	RAD-IO2 module to CAN FD converter	One module with integrated cable
RAD-IO2-CH-PWRC	DB9F to DB9M with color coded banana jacks to allow external powering of RAD-IO2-CANHUB	One DB9 cable with flying banana power leads
RAD-IO2-JMP	High temperature ruggedized USB-C to USB-C jumper suitable for in-vehicle use that screws into the IN and OUT of the RAD-IO2 modules for daisy chaining	One jumper is included with each purchased module, both sides with a screw
RAD-IO2-USB-C-USB-A	High temperature ruggedized USB-C to USB-A connector suitable for in-vehicle use that screws into the IN of the RAD-IO2 module and connects to the USB-A port of a PC	One cable is included with each purchased module, one side with a screw

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