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 5 RAD-IO2 devices
- Works with Vehicle Spy, included app or Open APIs
- 2000Hz aggregate sampling rate
- Sturdy aluminum case
- 2.5 kV 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, RAD-Galaxy, 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 eight 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 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 8 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 +/-0.5C (0C to 70C) +/- 1.0C (-40 to 125C)
- 60Hz and 50Hz common mode rejection > 105dB
- 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: ±5V, ±4V, ±2V, ±1V, ±500mV, and ±250mV
- High range: ±45V, ±36V, ±18V, ±9V, ±4.5 V, and ±2.2V
- >800k Input impedance
- 50Hz/60Hz common mode rejection > 105dB
- 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).
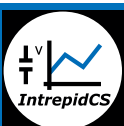- PWM programmable output

RAD-IO2-CANHUB

- CAN FD interface for RAD-IO2
- Supports up to 8 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

Cables: Includes either a PC to USB-C OR a USB-C to USB-C jumper
Thermocouples: Not included
Accessories: Jumper cable to connect

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Specifications:

- Sampling rate: Max 2000 sps aggregate across all daisy chained modules, max 100 Hz per channel. For example, 24 channels would yield 2000 / 24 = ~83 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, all others 250 mA
    - RAD-IO2-CANHUB can supply up to 3 Amps via DB9 connector
    - PC USB current supply varies – USB 2 supplies ~500 mA; USB 3 supplies ~900 mA
- 2.5 kV channel to channel and channel to USB isolation
- Direct to neoVI USB feature: neoVI ION, neoVI PLASMA, RAD-Galaxy*, neoVI FIRE 2*
- Dimensions: 208.8mm x 80.0 mm x 31.9 mm (8.22" x 3.15" x 1.26")
- Weight: 500 g (1.1 lbs)
- Includes: Diagnostic and calibration program, APIs and examples for Python, C, C++, and Java
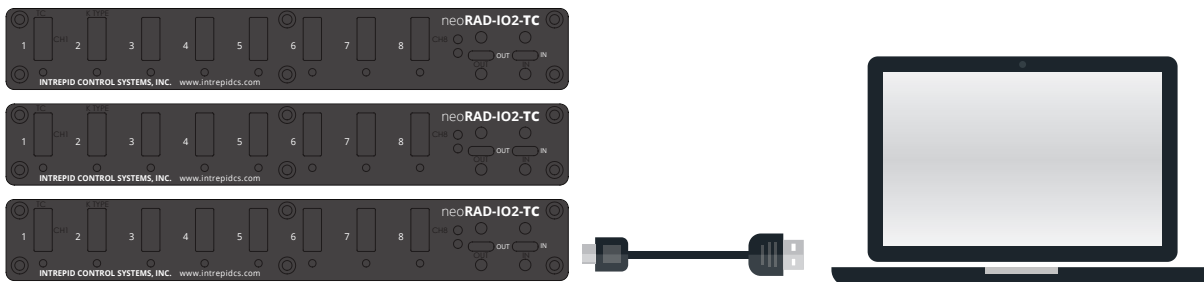
* Future with software update

Accessory and cable notes:

- The push-in mating connector for all modules (except the thermocouple module) are included.   If spares are needed, use P/N 1778858 from Phoenix Contact.
- All RAD-IO2 module purchases include a either a USB-A cable (PC) to USB-C cable or a jumper cable.
- The PC to RAD-IO2 ruggedized cable is part number: neoRAD-IO2 USB-C USB-A
- If you wish to daisy chain units together, please select the high temperature ruggedized USB-C to USB-C jumper cable Part number: neoRAD-IO2-JMP
- Thermocouples are not included with the purchase of the TC module

Possible Configurations:

- Single or Multiple RAD-IO2 units to PC

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

Banana Jacks

4.5-40 Volt/3 Amp capable supply

DB9 with CAN/CAN FD

CANHUB cable; capable of 2 Amps
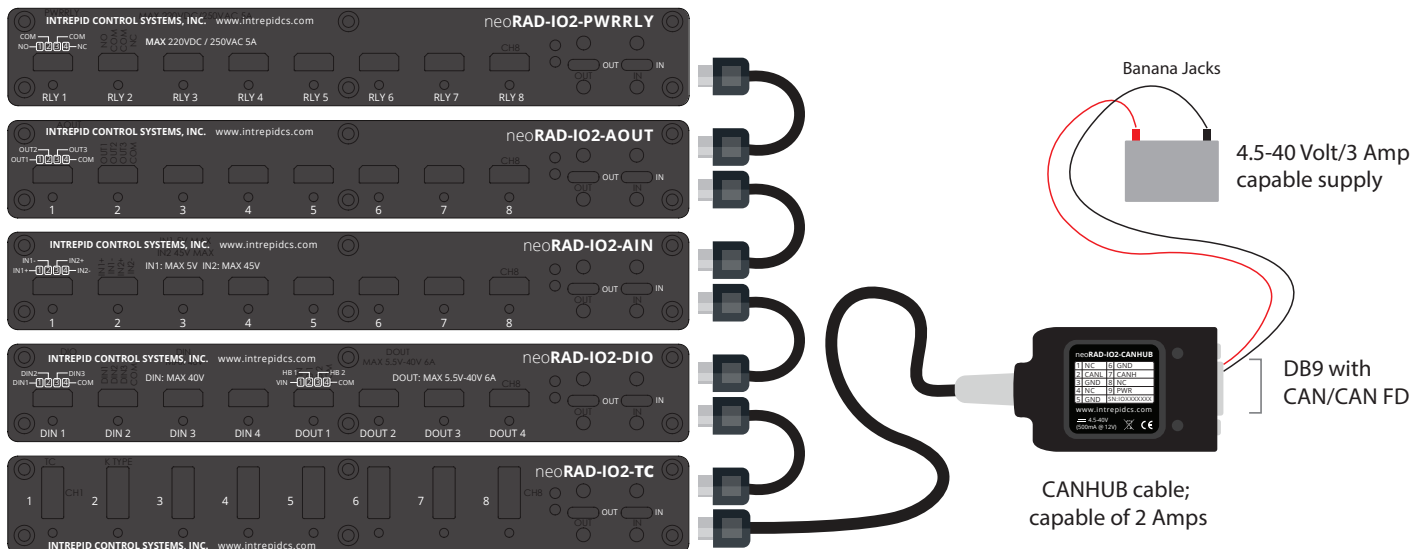
- Single or multiple RAD-IO2 units to neoVI ION, neoVI PLASMA, RAD-Galaxy or neoVI FIRE 2 (neoVI ION available Q3 of 2018; neoVI FIRE 2 and RAD-Galaxy available Q4)
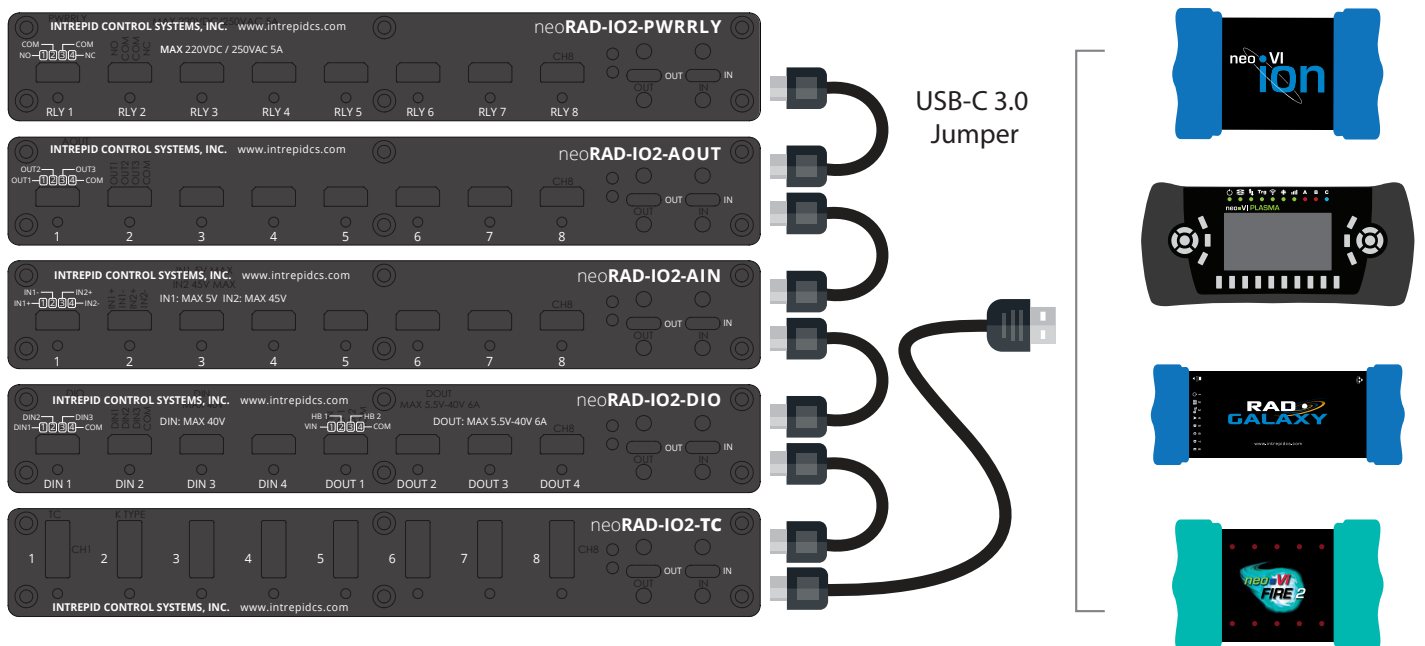
USB-C 3.0 Jumper

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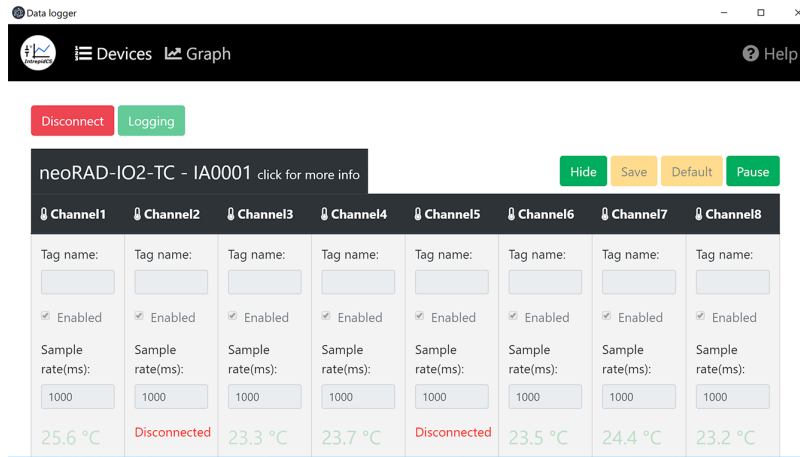
Diagnostic Screen

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-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, one side with a screw
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 cable, both sides with a screw
RAD-IO2-CH-PWRC	DB9F to DB9M with retractable color coded banana jacks to allow external powering of RAD-IO2-CANHUB	One DB9 cable with flying banana power leads

Rev. 20181019