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USB-PDISO8

USB-based Isolated Input and Relay Output

User's Guide

September 2017. Rev 7
© Measurement Computing Corporation

MEASUREMENT COMPUTING™

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About this User's Guide

What you will learn from this user's guide

This user's guide describes the Measurement Computing USB-PDISO8 data acquisition device and lists device specifications.

Conventions in this user's guide

For more information

Text presented in a box signifies additional information related to the subject matter.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

Bold text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

Italic text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about USB-PDISO8 hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- Tech support form: www.mccdaq.com/support/support_form.aspx
- Email: techsupport@mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support

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Introducing the USB-PDISO8

The USB-PDISO8 is a USB 2.0 full-speed device that provides the following features:

- Eight single pole double throw (SPDT) Form C relay outputs that provide 6 A outputs at 240 VAC or 28 VDC.
- Eight isolated high voltage digital inputs that can monitor up to 30 V AC or DC inputs
- An optional input filter available on each isolated input (input filters are enabled and disabled by software)
- Two screw terminal banks for field wiring connections
- USB out and power out connections support powering and controlling multiple MCC USB devices from one external power source and one USB port in a daisy-chain configuration.[1]
- Rugged enclosure that can mount on a DIN rail or on a bench

The USB-PDISO8 is powered by an external 9 V, 1 A regulated power supply that is shipped with the device.

Functional block diagram

USB-PDISO8 functions are illustrated in the block diagram shown here.

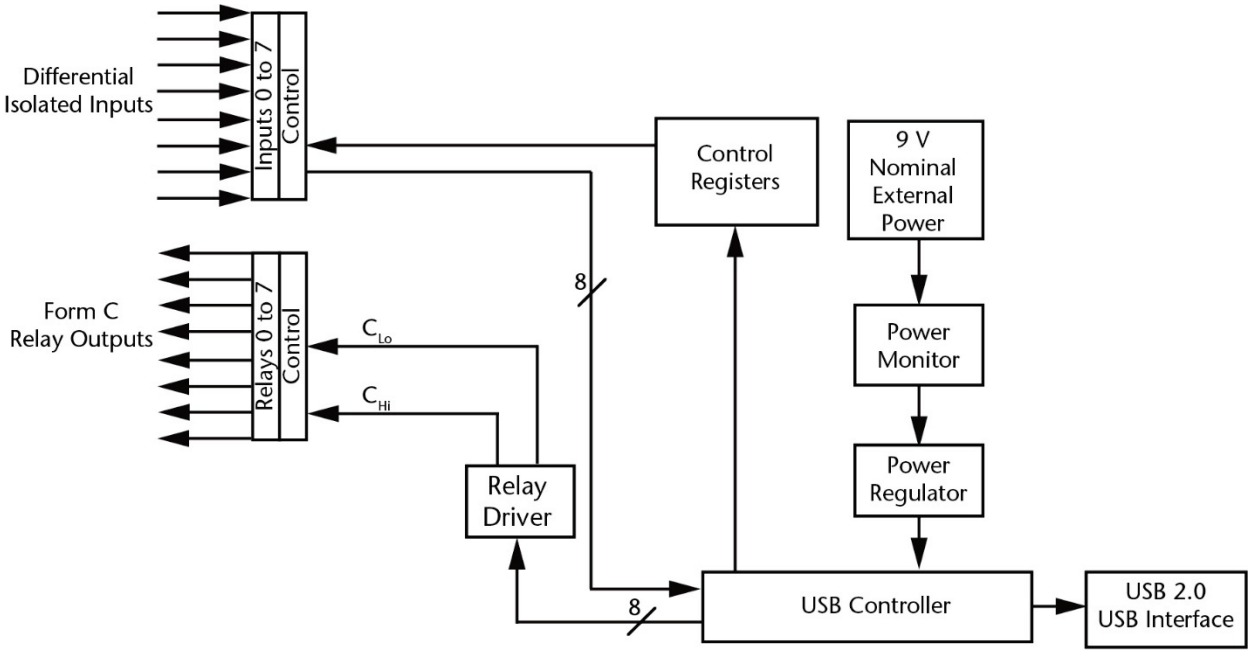


Figure 1. USB-PDISO8 functional block diagram

1 Depending on your load requirements, daisy-chained devices may require a separate power supply.

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Installing the USB-PDISO8

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the device from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

Contact us immediately if any components are missing or damaged.

Installing the software

Refer to the *MCC DAQ Quick Start* and the USB-PDISO8 product page on our website for information about the software supported by the USB-PDISO8.

Install the software before you install your device

The driver needed to run the USB-PDISO8 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Connecting the external power supply

Power to the USB-PDISO8 is provided with the +9 V external power supply (CB-PWR-9). You must connect the external power supply before connecting the USB cable to the USB-PDISO8 and your computer.

If you are connecting more than one MCC USB device, make sure that you provide adequate power to each device. Refer to Power limitations using multiple USB-PDISO8 devices on page 13.

To connect the power supply to your USB-PDISO8, connect the external power cord to the power connector labeled **POWER IN** on the USB-PDISO8 enclosure (**PWR IN** on the board). Refer to Figure 2 on page 8 for the location of this connector.

The green **PWR** LED lights when +9 V power is supplied to the USB-PDISO8. If the voltage supply is less than +6.5 V or more than +12.5 V, the **PWR** LED does not light.

Do not connect external power to the POWER OUT connector

The power connector labeled **POWER OUT** on the enclosure (**PWR OUT** on the board) is used to provide power to an additional MCC USB device. If you connect the external power supply to the **POWER OUT** connector, the USB-PDISO8 does not receive power, and the **PWR** LED does not light.

Installing the hardware

Connect the USB-PDISO8 using the cable provided to a USB port on a computer running Windows. Windows finds and installs the device driver automatically, and notifies you that the device is ready to use.

The **USB** LED turns on after the device is successfully installed.

You can connect up to four compatible MCC USB products in a daisy-chain configuration to a USB port on your computer.

If the USB LED turns off

If communication is lost between the device and the computer, the **USB** LED turns off. To restore communication, disconnect the USB cable from the computer and then reconnect it. This should restore communication, and the **USB** LED should turn on.

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If your system does not detect the USB-PDISO8

If a USB device not recognized message displays when you connect the USB-PDISO8, complete the following steps:

1. Unplug the USB cable from the USB-PDISO8.
2. Unplug the external power cord from the **POWER IN** connector on the enclosure.
3. Plug the external power cord back into the **POWER IN** connector.
4. Plug the USB cable back into the USB-PDISO8.

Your system should now properly detect the USB-PDISO8.

Contact technical support if your system still does not detect the USB-PDISO8.

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Functional Details

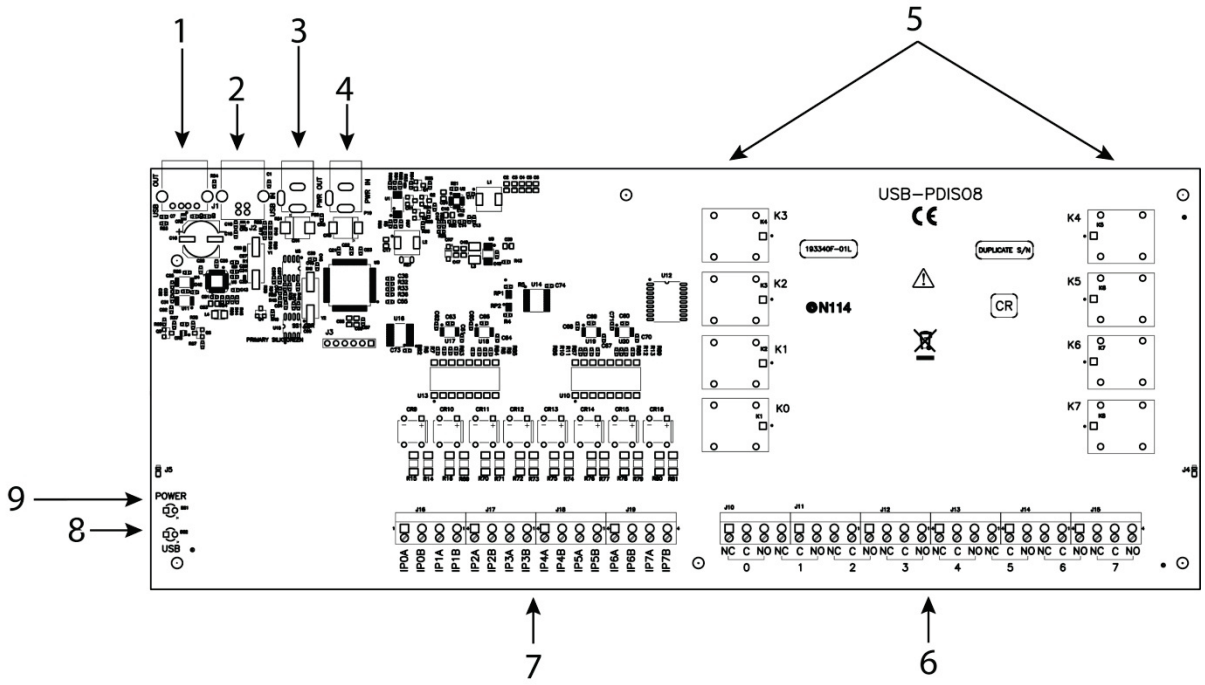
The USB-PDISO8 provides SPDT relay control and isolated inputs in a plug-and-play package. Screw terminals provide easy field wiring to the three output lines for each of the eight onboard relays (see Main connector and pin out on page 10).

In addition, two terminals are provided for the differential input signals associated with each of the eight isolated inputs.

Components

The USB-PDISO8 has the following internal components, as shown in Figure 2.

- Two USB connectors
- Two external power connectors
- USB LED
- PWR LED
- Two screw terminal banks



1 USB output connector (**USB OUT**)
2 USB input connector (**USB IN**)
3 Power output connector (**POWER OUT 9 VDC**)
4 Power input connector (**POWER IN**)
5 Relays
6 Relay screw terminals
7 Digital input screw terminals
8 **USB** LED
9 **PWR** LED

Figure 2. USB-PDISO8 components

USB IN connector

The USB in connector is labeled **USB IN** on the board and enclosure. This connector is a USB 2.0 full-speed input connector that you connect to the USB port on your computer (or USB hub connected to your computer). This connector supports USB 1.1 and USB 2.0 devices.

Hardware revision F and later are also compatible with USB 3.0 ports. The board revision may be determined from the part number label on the enclosure that states "197241X-01," where X is the board revision.

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USB OUT connector

The **USB OUT** connector is a downstream hub output port intended for use with other MCC USB products only. The USB hub is self-powered, and can provide 100 mA maximum current at 5 V.

For information on daisy chaining to other MCC USB devices, refer to Daisy chaining additional devices to the USB-PDISO8 on page 12.

POWER IN connector

The USB-PDISO8 requires between 6.5 V and 12.5 V of external power. An external power connection is required to activate the relays and to run tests in InstaCal.

To supply external power, connect the **POWER IN** connector to the supplied +9 V external power supply (CB-PWR-9).

The USB specification allows high-power devices to draw up to 725 mA. When all eight relays are energized, the combined current draw exceeds the maximum allowed for high-power USB devices. Therefore, external power is required.

POWER OUT connector

Use the **POWER OUT** connector to provide power to additional daisy chained MCC USB devices from a single external power supply. The CB PWR-9V3A cable is available from MCC to connect additional MCC USB products.

Refer to Power limitations using multiple USB-PDISO8 devices on page 13 for more information.

USB LED

The **USB** LED indicates the communication status of the USB-PDISO8. This LED uses up to 5 mA of current and cannot be disabled. The following table explains the function of the USB LED.

USB LED Indications

USB LED	Indication
On steadily	The USB-PDISO8 is connected to a computer or external USB hub.
Blinking	Initial communication is established between the USB-PDISO8 and the computer, or data is being transferred.

PWR LED

The USB-PDISO8 incorporates an onboard voltage supervisory circuit that monitors the USB VBUS (5 V) and the external 9 V power supply. If the input voltage falls outside of the specified ranges the **PWR** LED shuts off (see the following table).

PWR LED Indications

PWR LED	Indication
On	USB +5 V power or +9 V external power is supplied to the USB-PDISO8.
Off	Input power is not supplied, or a power fault has occurred. A power fault occurs when the input power falls outside of the specified voltage range: ■ USB VBUS (+5 V): 4.75 V to 5.25 V ■ External power: (+9 V): 6.5 V to 12.5 V

Screw terminals and relays

The USB-PDISO8 has two groups of screw terminals in a single row. The group on the left has 16 terminals representing eight isolated digital inputs, and the group on the right has 24 terminals representing eight relay outputs.

Screw terminals, signal labels, and relays are shown in Figure 2 on page 8 and are explained in Main connector and pin out on page 10.

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The screw terminals on the bottom-left connect to the differential isolated digital inputs. No additional components are required to terminate any of the input or output signals.

Main connector and pin out

Connector specifications

Connector type	Screw terminal
Wire gauge range	12 AWG to 22 AWG

Screw terminal pin out

Pin		Signal Name	Pin		Signal Name
IP0A		Input 0 terminal A	IP4A		Input 4 terminal A
IP0B		Input 0 terminal B	IP4B		Input 4 terminal B
IP1A		Input 1 terminal A	IP5A		Input 5 terminal A
IP1B		Input 1 terminal B	IP5B		Input 5 terminal B
IP2A		Input 2 terminal A	IP6A		Input 6 terminal A
IP2B		Input 2 terminal B	IP6B		Input 6 terminal B
IP3A		Input 3 terminal A	IP7A		Input 7 terminal A
IP3B		Input 3 terminal B	IP7B		Input 7 terminal B
Relay Channel					
0	NC	Relay 0 Normally Closed contact	4	NC	Relay 4 Normally Closed contact
	C	Relay 0 Common contact		C	Relay 4 Common contact
	NO	Relay 0 Normally Open contact		NO	Relay 4 Normally Open contact
1	NC	Relay 1 Normally Closed contact	5	NC	Relay 5 Normally Closed contact
	C	Relay 1 Common contact		C	Relay 5 Common contact
	NO	Relay 1 Normally Open contact		NO	Relay 5 Normally Open contact
2	NC	Relay 2 Normally Closed contact	6	NC	Relay 6 Normally Closed contact
	C	Relay 2 Common contact		C	Relay 6 Common contact
	NO	Relay 2 Normally Open contact		NO	Relay 6 Normally Open contact
3	NC	Relay 3 Normally Closed contact	7	NC	Relay 7 Normally Closed contact
	C	Relay 3 Common contact		C	Relay 7 Common contact
	NO	Relay 3 Normally Open contact		NO	Relay 7 Normally Open contact

Screw terminals and relays

Connect external devices to the relay contacts using the 24 screw terminals on the USB-PDISO8. Each relay has a normally closed (NC), common (C), and normally open (NO) contact. Figure 3 shows the screw terminals on a typical relay channel.



Figure 3. Typical relay channel

Each screw terminal is identified with a label on the board and on the underside of the enclosure lid.

Caution! Before connecting wires to the screw terminals, turn off the power to the USB-PDISO8, and make sure that the signal wires do not contain live voltages.

Use 12 AWG to 22 AWG wire to connect field devices. Properly insulate the wires to avoid any short circuit to the other connections, ground, or other points on the board.

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Caution! Keep the length of stripped wire at a minimum to avoid a short to the enclosure! When connecting your field wiring to the screw terminals, use the strip gage on the terminal strip, or strip to 5.5 - 7.0 mm (0.215" to 0.275") long.

Form C relay output

A schematic for Form C relay contacts is shown in Figure 4. The Form C relay has a C, NO, and NC contact.

- When a (0) is written to the output bit, the C and NC are in contact.
- When a (1) is written to the output bit, the C and NO are in contact.

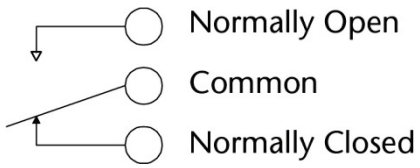


Figure 4. Form C SPDT relay

Differential isolated digital input terminals (IP0A to IP7B)

Connect up to eight isolated digital input signals using the following screw terminal pairs:

- Input 0 terminal A and input 0 terminal B (IP0A and IP0B)
- Input 1 terminal A and input 1 terminal B (IP1A and IP1B)
- Input 2 terminal A and input 2 terminal B (IP2A and IP2B)
- Input 3 terminal A and input 3 terminal B (IP3A and IP3B)
- Input 4 terminal A and input 4 terminal B (IP4A and IP4B)
- Input 5 terminal A and input 5 terminal B (IP5A and IP5B)
- Input 6 terminal A and input 6 terminal B (IP6A and IP6B)
- Input 7 terminal A and input 7 terminal B (IP7A and IP7B)

A schematic of a single channel is shown in Figure 5. Each signal is applied to a bridge rectifier so that the input is not polarity-sensitive. Each input channel can be driven by either AC (50 - 1000 Hz) or DC voltage.

The eight optically isolated (500 V) inputs can be read back as a single byte. Each input has a software-controlled filter with a time constant of 5 ms (200 Hz). The filter is required for AC inputs, and recommended for almost all DC inputs. Unless you have a good reason to turn off a filter, MCC recommends that you enable it.

You can enable and disable (default) each input filter by selecting the device and then selecting **Install»Configure** in InstaCal.

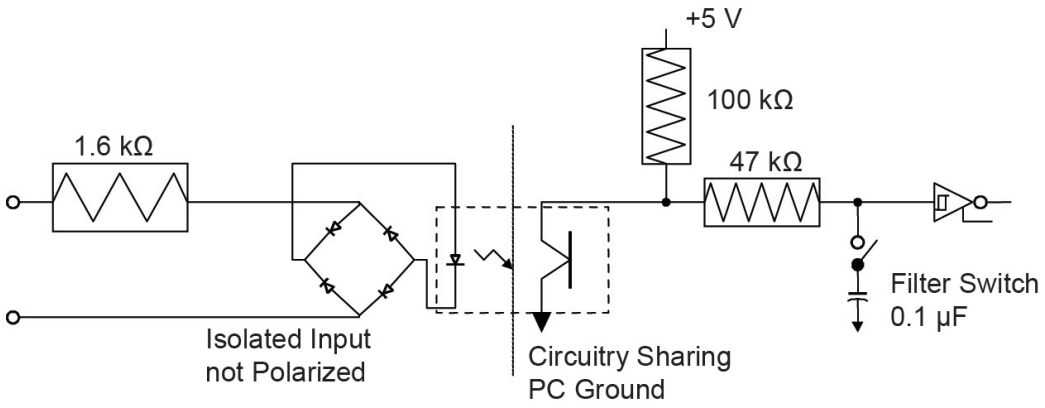


Figure 5. USB-PDISO8 single-channel configuration

Figure 6 shows a schematic of a simple connection from a +9 V battery to the relay 4 terminals. When the relay is energized, the relay 4 NO terminal connects the battery voltage to the input 4 terminal (IP4B).

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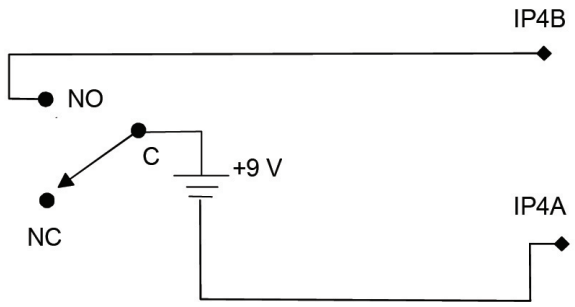


Figure 6. Schematic of battery-to-relay connection

Extending the input range

You can extend the input range beyond the 5 to 30 V specified by adding an external resistor. Figure 7 shows the external resistor (R_{ext}).

The equation $R_{ext} = 100 * (V_{in} – 30)$ calculates the resistor value for a given V_{in}.

Make sure the external resistor is capable of handling the power generated by the input. Calculate the power requirement in watts (P_w) using the equation $P_w = R_{ext}/10000$.

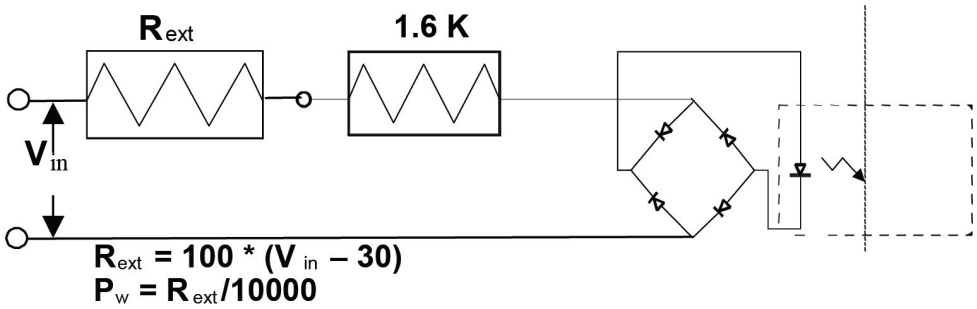


Figure 7. External resistor added to extend the input range

Daisy chaining additional devices to the USB-PDISO8

Daisy-chained USB-PDISO8 devices connect to the USB bus through the high-speed hub on the USB-PDISO8. You can daisy chain up to four MCC USB devices that support daisy-chain configurations to a single USB 2.0 port or USB 1.1 port on your computer.

Use the supplied cable or an equivalent full-speed cable when daisy chaining to other MCC USB devices.

- The device already connected to the computer is referred to as the host device.
- The additional device(s) that you want to daisy chain to the host USB-PDISO8 is referred to as the slave device.

This procedure assumes you already have a host device connected to a computer and to an external power source.

To daisy chain MCC USB devices, complete the following steps:

1. Connect the **POWER OUT** connector on the host device to the **POWER IN** connector on the slave device.

   This step is required only if you plan to daisy chain power to another device.
2. Connect the **USB OUT** connector on the host device to the **USB IN** connector on the slave device.
3. To add another device, repeat steps 1-2 by connecting the slave device to another slave device.

A daisy chain example is shown in Figure 8.

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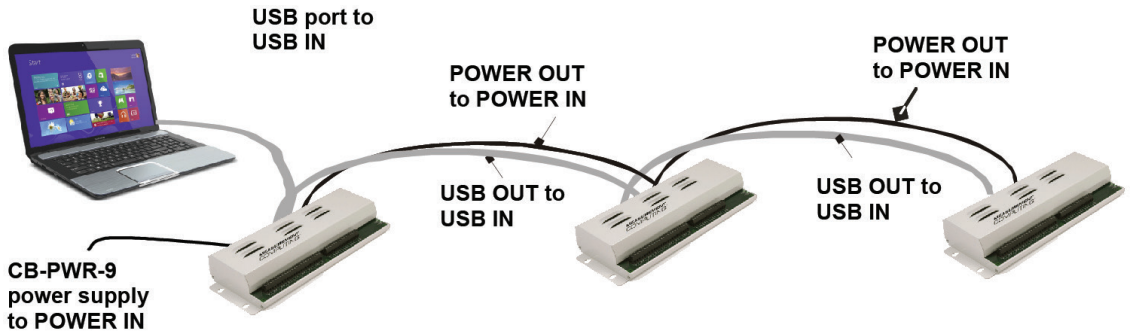


Figure 8. USB-PDISO8 daisy-chain connections (configuration not near full power load)

Power limitations using multiple USB-PDISO8 devices

When daisy chaining additional MCC USB products to the USB-PDISO8, make sure that you provide adequate power to each device that you connect. The USB-PDISO8 is powered with a 9 VDC nominal, 1.0 A external power supply.

When connecting multiple devices, power supplies with higher current capability, such as the CB PWR-9V3A, are available from MCC.

Supply current

Running one USB-PDISO8 with all relays on draws 820 mA from the 1 A supply. When using the USB-PDISO8 under full load conditions, you cannot daisy chain additional MCC USB products unless you supply external power to each device in the chain.

If you are not sure how much current your application requires, we recommend that you provide separate power to each MCC USB product that you connect.

Voltage drop

A drop in voltage occurs with each device connected in a daisy chain system. The voltage drop between the module power supply input and the daisy chain output is 0.5 V maximum. Factor in this voltage drop when you configure a daisy chain system to ensure that at least 6.5 VDC is provided to the last device in the chain. Always provide a separate power supply when the USB-PDISO8 is the last device in the chain.

Relay contact protection circuit for inductive loads

When you connect an inductive load to a relay, energy stored in the inductive load can induce a large voltage surge when you switch the relay. This voltage can severely damage the relay contacts. To limit the voltage surge across the inductive load in a DC circuit, install a kickback diode across the inductive load. Refer to the contact protection circuit in Figure 9. For AC loads, install a metal oxide varistor (MOV).

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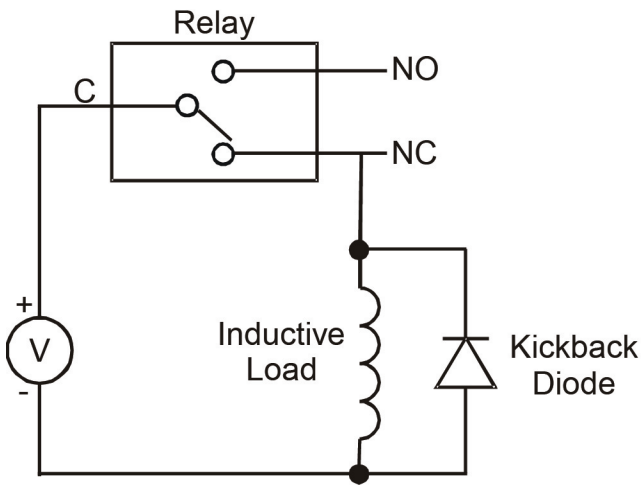


Figure 9. Relay contact protection circuit

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Mechanical drawings

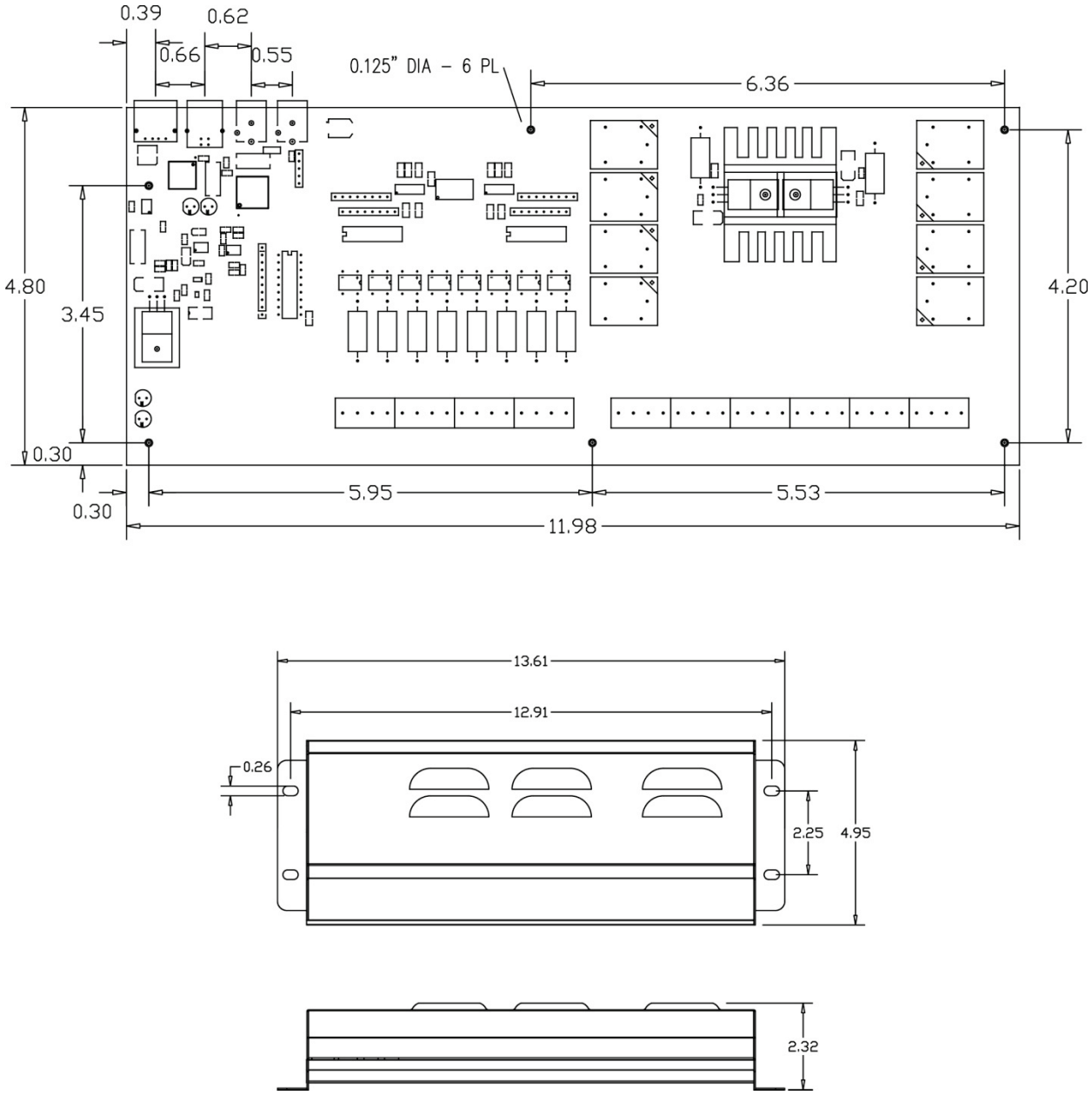


Figure 10. Circuit board (top) and housing dimensions

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Specifications

All specifications are subject to change without notice.
Typical for 25°C unless otherwise specified.
Specifications in italic text are guaranteed by design.

Relay specifications

Table 1. Relay output specifications

Number	8
Contact configuration	8 FORM C (SPDT) NO, NC and Common available at connector
Contact rating	6 A @ 240 VAC or 28 VDC resistive
Contact resistance	100 mΩ max
Operate time	10 ms max
Release time	5 ms max
Vibration	10 Hz to 55 Hz (dual amplitude 1.5 mm)
Shock	10 G (11 ms)
Dielectric isolation	500 V (1 minute)
Life expectancy	10 million mechanical operations, min
Power on RESET state	Not energized. NC in contact to Common.

Isolated inputs

Table 2. Isolated input specifications

Number	8	
Isolation	500 V	
Resistance	1.6 KΩ min	
Voltage range	DC	Input high: +5.0 VDC min or –5.0 VDC min
		Input low: +1.5 VDC max or –1.5 VDC max
		Input range: 30 VDC max
	AC (with filter)	Input high: 6.0 V_{rms} min (50 Hz to 1000 Hz)
		Input low: 1.5 V_{rms} max (50 Hz to 1000 Hz)
Response	Filter disabled	20 µs
	Filter enabled	5 ms
Filters	Time constant	5 ms (200 Hz)
	Filter control	Software-selectable for each input.
	Power-up /reset	Filters disabled

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Power

Table 3. Power specifications

Parameter	Conditions	Specification
USB +5 V input voltage range		4.75 V to 5.25 V
USB +5 V supply current	All modes of operation	10 mA max
External power input		9 V nominal
External power supply (required)	MCC p/n CB-PWR-9	9 V ±10% @ 1 A
Voltage supervisor limits - PWR LED	6.5 V > V_{ext} or V_{ext} > 12.5 V (Note 1)	PWR LED = Off (power fault)
	6.5 V ≤ V_{ext} < 12.5 V	PWR LED = On
External power consumption	All relays on, 100 mA downstream hub power	820 mA typ, 900 mA max
	All relays off, 0 A downstream hub power	200 mA typ, 230 mA max

Note 1: The USB-PDISO8 monitors the external +9 V power supply voltage with a voltage supervisory circuit. If this power supply exceeds its specified limit, the **PWR** LED turns off, indicating a power fault condition.

External power output

Table 4. External power output specifications

Parameter	Conditions	Specification
External power output - current range (Note 2)		4.0 A max
External power output	Voltage drop between power input and daisy chain power output	0.5 V max
Compatible cable(s) for daisy chain	CB PWR-9V3A	X= 2, 3, or 6 feet

Note 2: The daisy chain power output option allows multiple Measurement Computing USB products with a USB hub output port to be powered from a single external-power source in a daisy-chain fashion. The voltage drop between the device power supply input and the daisy-chain output is 0.5 V maximum Users must plan for this drop to assure the last device in the chain receives at least 6.5 VDC.

USB specifications

Table 5. USB specifications

USB "B" connector	Input
USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0 (hardware revision F and later are also compatible with USB 3.0; see Note 3 for information on how to determine the hardware revision)
USB "A" connector	Downstream hub output port
USB hub type	Supports USB 2.0 high-speed, full-speed and low-speed operating points
	Self-powered, 100 mA max downstream VBUS capability
Compatible products	MCC USB products with a USB hub output port
USB cable type (upstream and downstream)	A-B cable, UL type AWM 2527 or equivalent. (min 24 AWG VBUS/GND, min 28 AWG D+/D-)
USB cable length	3 meters max

Note 3: The board revision may be determined from the part number label on the housing that states "197241X-01," where X is the board revision.

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Mechanical

Table 6. Mechanical specifications

Board dimensions (L × W × H)	304.3 × 121.9 × 20.0 mm (12.0 × 4.8 × 0.8 in.)
Enclosure dimensions (L × W × H)	342.9 × 125.7 × 58.9 mm (13.5 × 4.95 × 2.32 in.)

Environmental

Table 7. Environmental specifications

Operating temperature range	0 °C to 70 °C
Storage temperature range	-40 °C to 100 °C
Humidity	0% to 95% non-condensing

Main connector

Table 8. Main connector specifications

Connector type	Screw terminal
Wire gauge range	12 AWG to 22 AWG

Screw terminal pinouts

Pin	Signal Name	Pin	Signal Name
IP0A	Input 0 terminal A	IP4A	Input 4 terminal A
IP0B	Input 0 terminal B	IP4B	Input 4 terminal B
IP1A	Input 1 terminal A	IP5A	Input 5 terminal A
IP1B	Input 1 terminal B	IP5B	Input 5 terminal B
IP2A	Input 2 terminal A	IP6A	Input 6 terminal A
IP2B	Input 2 terminal B	IP6B	Input 6 terminal B
IP3A	Input 3 terminal A	IP7A	Input 7 terminal A
IP3B	Input 3 terminal B	IP7B	Input 7 terminal B
0-NC	Relay 0 Normally Closed contact	4-NC	Relay 4 Normally Closed contact
0-C	Relay 0 Common contact	4-C	Relay 4 Common contact
0-NO	Relay 0 Normally Open contact	4-NO	Relay 4 Normally Open contact
1-NC	Relay 1 Normally Closed contact	5-NC	Relay 5 Normally Closed contact
1-C	Relay 1 Common contact	5-C	Relay 5 Common contact
1-NO	Relay 1 Normally Open contact	5-NO	Relay 5 Normally Open contact
2-NC	Relay 2 Normally Closed contact	6-NC	Relay 6 Normally Closed contact
2-C	Relay 2 Common contact	6-C	Relay 6 Common contact
2-NO	Relay 2 Normally Open contact	6-NO	Relay 6 Normally Open contact
3-NC	Relay 3 Normally Closed contact	7-NC	Relay 7 Normally Closed contact
3-C	Relay 3 Common contact	7-C	Relay 7 Common contact
3-NO	Relay 3 Normally Open contact	7-NO	Relay 7 Normally Open contact

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CE Declaration of Conformity
According to ISO/IEC 17050-1:2010

Manufacturer:	Measurement Computing Corporation
Address:	10 Commerce Way Norton, MA 02766 USA
Product Category:	Electrical equipment for measurement, control and laboratory use.
Date and Place of Issue:	May 3, 2016, Norton, Massachusetts USA
Test Report Number:	EMI4221.05

Measurement Computing Corporation declares under sole responsibility that the product

USB-PDISO8

Complies with the essential requirements of the following applicable European Directives:

Electromagnetic Compatibility (EMC) Directive 2004/108/EC
Low Voltage Directive 2006/95/EC
RoHS Directive 2011/65/EU

Conformity is assessed in accordance to the following standards:

EMC:

Emissions:

- EN 61326-1:2013 (IEC 61326-1:2012), Class A
- EN 55011: 2009 + A1:2010 (IEC CISPR 11:2009 + A1:2010), Group 1, Class A

Immunity:

- EN 61326-1:2013 (IEC 61326-1:2012), Controlled EM Environments
- EN 61000-4-2:2008 (IEC 61000-4-2:2008)
- EN 61000-4-3 :2010 (IEC61000-4-3:2010)

Safety:

- EN 61010-1 (IEC 61010-1)

Environmental Affairs:

Articles manufactured on or after the Date of Issue of this Declaration of Conformity do not contain any of the restricted substances in concentrations/applications not permitted by the RoHS Directive.



Carl Haapaoja, Director of Quality Assurance

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