USB DIO and Relay Datasheet

USB-PDISO8, USB-ERB, and USB-SSR24

USB-PDISO8 Series

USB-ERB Series

USB-SSR24

Highlighted Features

- USB-PDISO8 Series
  - 8 Form C relays
  - 8 functionally isolated AC or DC Inputs
- USB-ERB Series
  - 8 or 24 Form C single-pole double-throw electromechanical relays.
- USB-SSR24
  - 24 input or output channels to control and monitor solid state relays.
- Screw terminal or header connectors
- Heavy-duty chassis with integrated mounting slots
- Includes external power supply (required for all devices)
- Supported Operating Systems
  - Windows 11/10, 32&64-bit
  - Linux®

Overview

Measurement Computing DIO and relay USB product offerings include the USB-PDISO8 Series, USB-ERB Series, and USB-SSR24.

The USB-PDISO8 Series offers eight functionally isolated AC or DC inputs and eight electromechanical relays in a single digital I/O system. The USB-ERB Series enables a PC or laptop to control eight to 24 electromechanical relays.

The USB-SSR24 can monitor and control 24 standard size solid state relay (SSR) I/O modules (relays sold separately).

All devices in these series come in a heavy-duty metal enclosure with integrated mounting slots, which ensures that the devices are rugged enough for any DAQ application.

1 Features

Relay Contacts and Connectors

The USB-PDISO8 and USB-ERB Series devices provide screw terminal connections to the relay contacts.

Each relay has a normally closed (NC), common (C), and normally open (NO) contact. Relays on all devices are controlled by digital I/O lines.

SSR Digital I/O Control Modules

The USB-SSR24 provides mounting locations for 24 SSR digital I/O modules.

SSR digital I/O modules are relay control modules. Digital input modules sense AC/DC voltages from field devices and convert them to digital TTL signals. Digital output modules use TTL signals to switch and control AC/DC loads.

A wide selection of SSR digital I/O modules are available to switch or sense a large range of AC or DC voltages. The SSR modules use a standard color scheme to help quickly identify the module type installed.

I/O Module Type Switch

USB-SSR24 devices have an onboard switch to configure each module group for either input or output.

Devices are shipped with all modules configured for output. Input and output modules cannot be mixed within a group.

Positive and negative relay contacts are brought out to screw terminals for field wiring connections.

Relay Configuration Switches

USB-SSR24 and USB-ERB Series devices have two onboard switches for configuring the relay logic polarity and output relay power-up state for each relay bank/SSR module group. The current configuration of each switch can be read back with software.

Devices are shipped with all relay banks/module groups configured for non-inverted logic and pull-up (relays/modules inactive on power-up).

Differential Digital Inputs

All eight inputs on USB-PDISO8 Series devices can be driven by either AC (50 Hz to 1000 Hz) or DC voltage, and can be read back as a single byte.

Each input has a software-selectable filter with a time constant of 5 ms (200 Hz). The filter is required for AC inputs, and recommended for most DC inputs.

Each module group can be set to either input or output (default). Input and output modules cannot be mixed within a group.

Up to eight optically functionally isolated digital input connection pairs are available from the signal I/O connector on USB-PDISO8 Series devices. Each signal is applied to a bridge rectifier so that the input is not polarity-sensitive.

USB-PDISO8, USB-ERB, and USB-SSR24 Selection Chart

Model	Relay Channels	Signal I/O Connector
USB-PDISO8	8 Form C (SPDT)	40-pin screw terminal
USB-ERB08	8 Form C (SPDT)	24-pin screw terminal
USB-ERB24	24 Form C (SPDT)	72-pin screw terminal
USB-SSR24	24 Solid State Relay Modules	48-pin screw terminal

Note: All devices provide Daisy Chain support. Use the standard/included USB cable for communications daisy chain; a user-supplied custom cable is required to daisy chain power.

2 Software Support

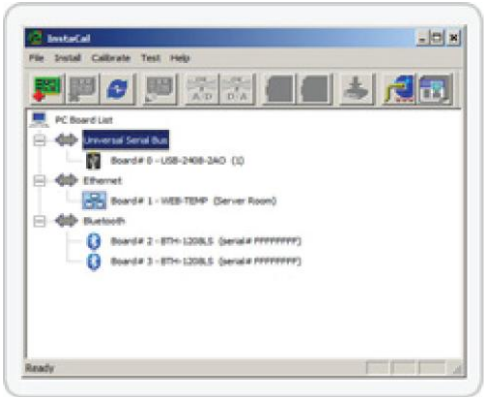
The USB-PDISO8, USB-ERB, and USB-SSR24 devices are supported by a wide variety of software.

2.1 DAQami™

Data acquisition companion software with drag-and-drop interface that is used to acquire, view, and log data, and generate signals. DAQami can be configured to log analog, digital, and counter channels, and to view that data in real-time or post-acquisition on user-configurable displays. Logged data can be exported for use in Excel®, MATLAB®, or Windows.

DAQami is included with the free MCC DAQ Software bundle.

2.2 InstaCal™



An interactive installation, configuration, and test utility for MCC hardware for Windows.

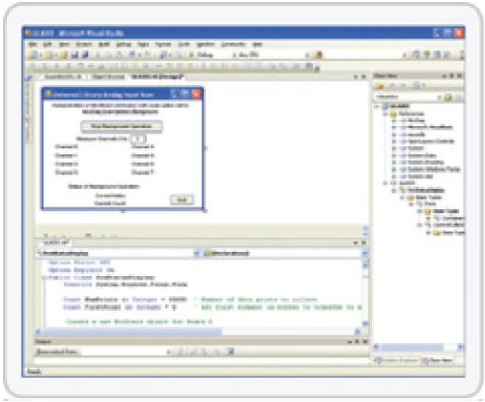
InstaCal is included with the free MCC DAQ Software bundle.

2.3 TracerDAQ™ and TracerDAQ Pro[1]

Virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. Supported features may vary by hardware. The Pro version provides enhanced features. Available on Windows.

TracerDAQ is included with the free MCC DAQ Software bundle. TracerDAQ Pro is available as a free software download.

2.4 Universal Library™ for Windows



Library for developing applications in C, C++, VB, C# .Net, VB .Net, and Python on Windows.

The UL for Windows is included with the free MCC DAQ Software bundle.

The UL Python API for Windows is available on GitHub (github.com/mccdaq/mcculw).

2.5 Universal Library™ for Linux®

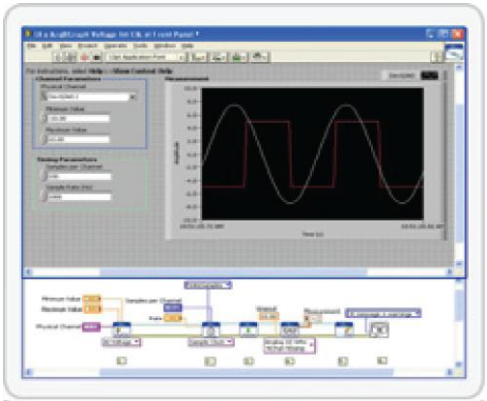
Library for developing applications in C, C++, and Python on Linux.

The Universal Library for Linux is available on GitHub (github.com/mccdaq/uldaq).

Open-source, third-party Linux drivers are also available for supported MCC devices.

[1] TracerDAQ and TracerDAQ Pro only support USB-PDISO8 Series digital inputs; they do not support the USB-ERB Series or USB-SSR24 devices.

2.6 ULx for NI LabVIEW™



A comprehensive library of VIs and example programs for NI LabVIEW that is used to develop custom applications that interact with most MCC devices, available for Windows.

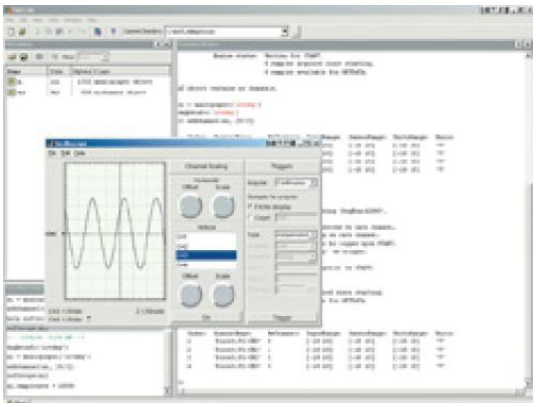
ULx for NI LabVIEW is included with the free MCC DAQ Software bundle.

2.7 DASYLab™

Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming, available for Windows.

DASYLab is available as a purchased software download. An evaluation version is available for 28 days.

2.8 MATLAB® Driver



High-level language and interactive environment for numerical computation, visualization, and programming. The Mathworks Data Acquisition Toolbox™ allows users to acquire data from most MCC PCI and USB devices.

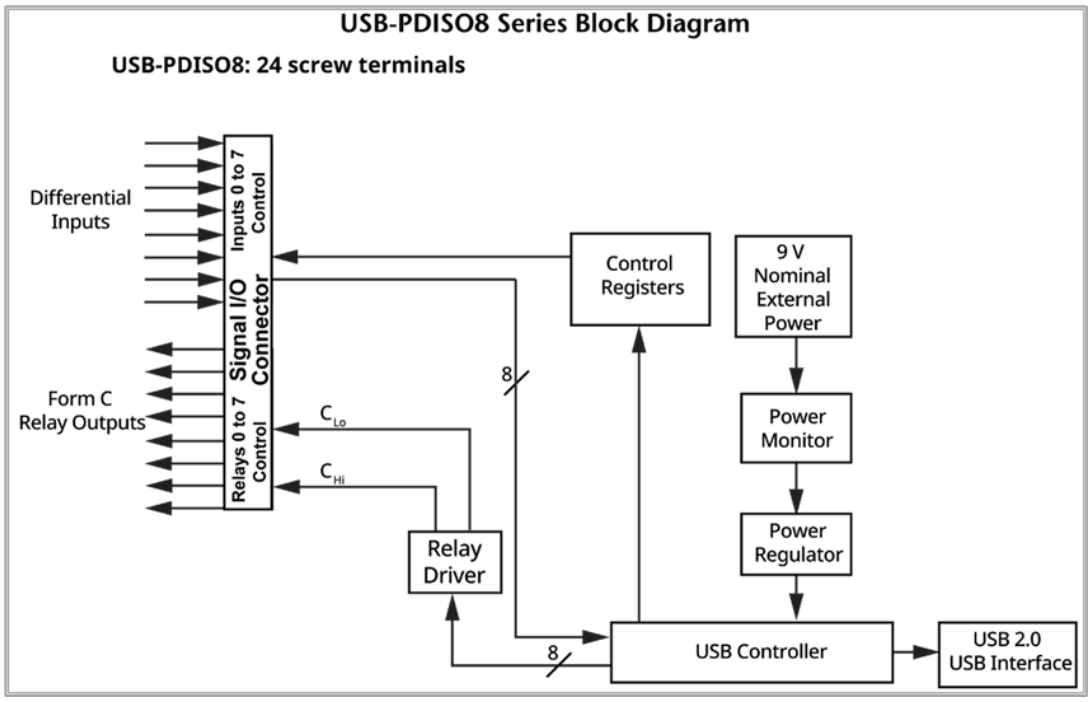
Visit https://www.mathworks.com/ for more information about the Data Acquisition Toolbox.

3 USB DIO and Relay Specifications

All specifications are subject to change without notice. Specifications not assigned to one particular device within a series are valid for all devices within that series.
These specifications are typical for 25 °C unless otherwise stated.

3.1 USB-PDISO8 Series

Block Diagram



Relay Output Specification

Number	8
Contact configuration	8 FORM C (SPDT) normally open (NO), normally closed (NC), and Common available at connector
Contact rating	6 A @ 30 VAC or 28 VDC resistive[1]
Contact resistance	100 mΩ max
Operate time	10 ms max
Release time	USB-PDISO8: 5 ms max
Vibration	10 Hz to 55 Hz (dual amplitude 1.5 mm)
Life expectancy	10 million mechanical operations, min
Power on RESET state	Not energized, NC in contact to Common

[1] Maximum allowable voltage connection to a USB-PDISO8 is 30VAC/28VDC; not certified for use with hazardous voltages.

Inputs Specification

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

Power

USB-PDISO8 Series devices require between 6.5 V and 12.5 V of external power. An external power connection using the included external power supply is required to activate relays and SSR modules, and to run tests in software.

A 9 V, 1.67 A external power supply (CB-PWR-9) ships with each USB-PDISO8 Series device.

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 @ 1.67 A	
Voltage supervisor limits - PWR LED	**6.5 V > V_{ext} or V_{ext} > 12.5 V:** **6.5 V ≤ V_{ext} < 12.5 V:**	PWR LED = Off (power fault)[1] PWR LED = On
External power consumption	**All relays on, 100 mA downstream hub power:** **All relays off, 0 A downstream hub power:**	820 mA typ, 900 mA max 200 mA typ, 230 mA max

[1] USB-PDISO8 Series devices monitor 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

The daisy chain power output option allows multiple MCC 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 ensure the last device in the chain receives at least 6.5 VDC. A user-supplied custom cable is required to daisy chain multiple devices.

External Power Output Current Range	4.0 A max
External Power Output drop[1]	0.5 V max

USB Specification

USB Type-B connector	Input
USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0, USB 3.0[2]
USB Type-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

Mechanical

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

Environmental

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

[1] Voltage drop between power input and daisy chain power output

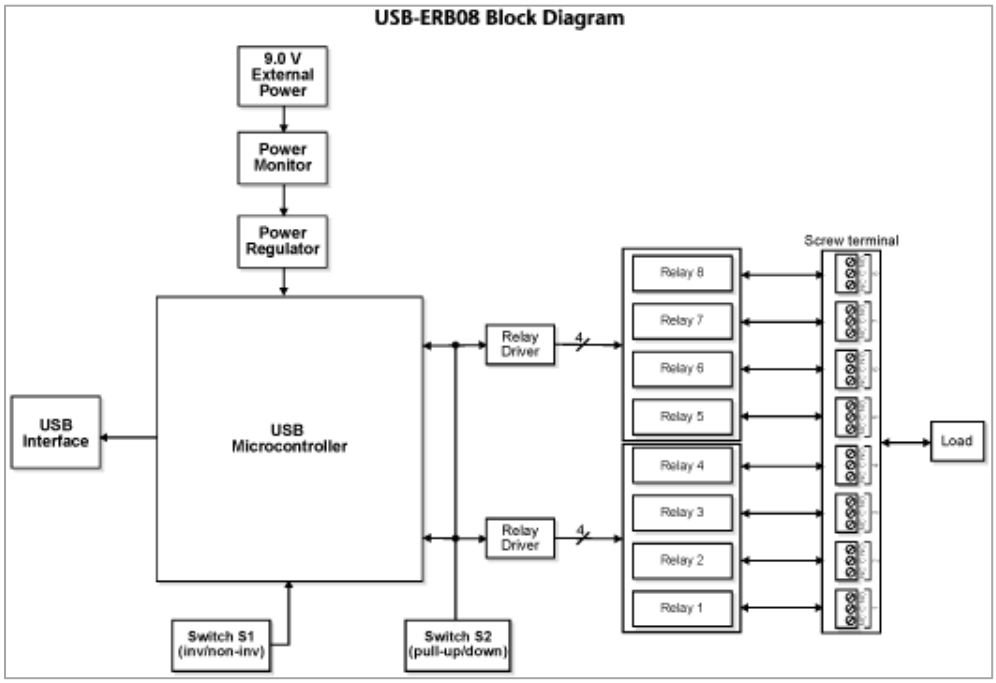
[2] USB-PDISO8 hardware revision F and later are also compatible with USB 3.0.
The revision is indicated on the part number label on the housing – *197241X-01* – where *X* is the hardware revision.

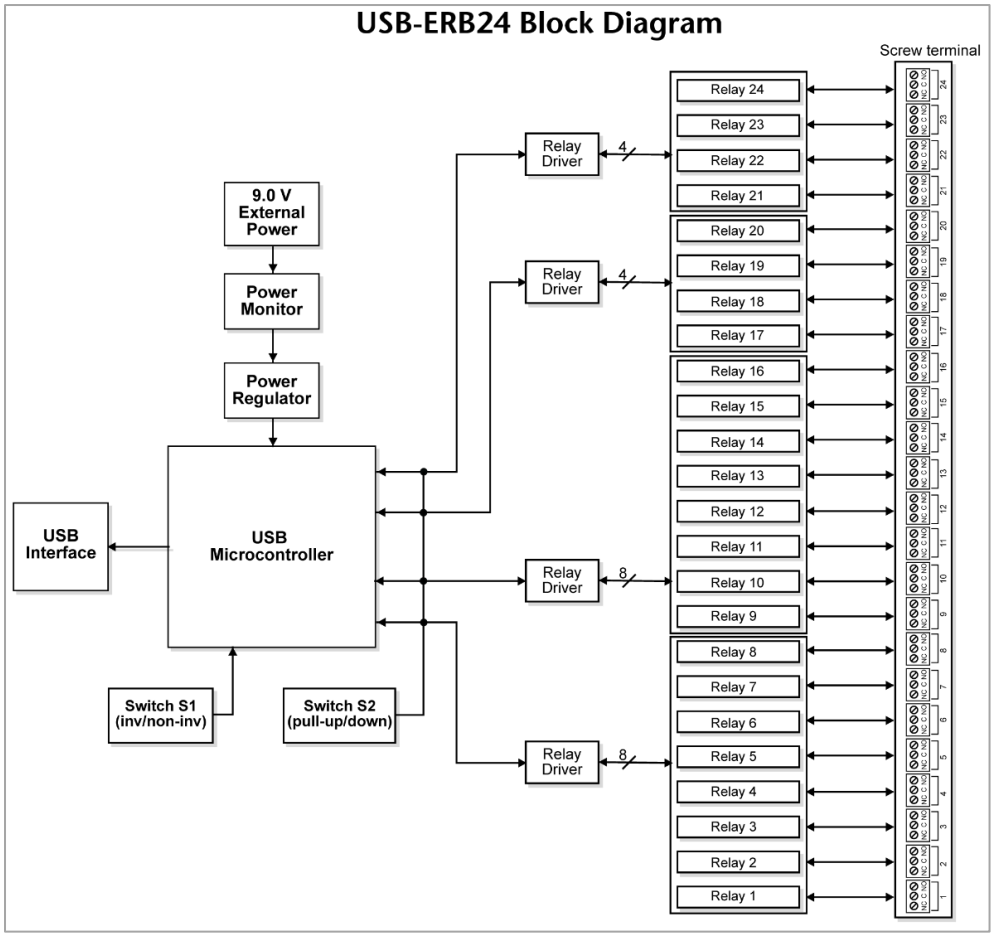
Main Connector

Connector type	Screw terminal
Wire gauge range	12 AWG to 22 AWG
Max current	1 A

3.2 USB-ERB Series

Block Diagrams





Output Specification

	USB-ERB08	USB-ERB24
Number of Relays	8	24
Relay Configuration	2 banks of 4	2 banks of 8 and 2 banks of 4
Contact Configuration	8 Form C (SPDT) normally open (NO), normally closed (NC) and common (C) available at screw terminals	24 FORM C (SPDT) NO, NC and C available at screw terminals
Contact Rating	5 A @ 30 VAC or 28 VDC resistive	
Contact Resistance	100 mΩ max (initial value)	
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	**Between relay open contact:** Functional isolation **Between PCB output lines:** Functional isolation	

Life expectancy	10 million mechanical operations, min
Power on RESET state	**S2 = pull-up:** Energized. Normally Open in contact with Common **S2 = pull-down:** Not energized. Normally Closed in contact with Common
Relay control logic polarity[1]	**Non-invert mode:** When *0* is written or read back via USB, relays are not energized **Invert mode:** When *0* is written or read back via USB, relays are energized
Pull-up/pull-down (controls relay power on state)[2]	Pull-down puts the relays in non-energized mode on power up Pull-up puts the relays in energized mode on power up

Power

USB-ERB Series devices require between 6.0 V and 12.5 V of external power. An external power connection using the included external power supply is required to activate relays and SSR modules, and to run tests in software. A 9 V external power supply ships with each USB-ERB Series device.

USB +5 V input voltage range	4.75 V min to 5.25 V max	
USB +5 V supply current	All modes of operation: 10 mA max	
Voltage supervisor limits - PWR LED	**6.0 V > V_{ext} or V_{ext} > 12.5 V:** **6.0 V ≤ V_{ext} < 12.5 V:**	PWR LED = Off (power fault) PWR LED = On
External power consumption	**All relays on,** **100 mA downstream hub power:** **All relays off,** **100 mA downstream hub power:**	USB-ERB08: 750 mA typical, 850 mA max USB-ERB24: 1.5 A typical, 1.8 A max USB-ERB08: 170 mA typical, 200 mA max USB-ERB24: 230 mA typical, 270 mA max

External Power Input

	USB-ERB08	USB-ERB24
External Power Input	+6.0 VDC to 12.5 VDC (9 VDC power supply included)	
External Power Supply (included)	**CB-PWR-9:** 9 V @ 1.67 A	**CB-PWR-9V3A:** 9 V ±10% @ 3 A

External Power Output

USB-ERB Series devices monitor 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.

The daisy chain power output option allows multiple MCC 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

[1] User-configurable per bank through switch S1 for invert or non-invert (default). Switch settings for polarity can be read back with software over the USB bus. Switch settings do not affect the power-on condition.

[2] User-configurable per bank through switch S2 for pull-down (default) or pull-up. Switch settings can be read back with software.

input and the daisy-chain output is 0.5 V maximum. Users must plan for this drop to ensure the last device in the chain receives at least 6.0 VDC. A user-supplied custom cable is required to daisy chain multiple devices.

External Power Output Current Range	4.0 A max
External Power Output voltage drop[1]	0.5 V max

USB Specification

USB Type-B connector	Input
USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0, USB 3.0[2,3]
USB Type-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

Relay Contact Pull-Up/Down Option

	USB-ERB08	**USB-ERB24**
Relays NO contact pull-up (to USB +5 V)/pull-down, user installed	R1, R3, R5, R7, R10, R12, R14, R16	R35, R36, R41, R43, R45, R47, R49, R51, R87, R89, R91, R93, R96, R98, R100, R102, R103, R105, R107, R109, R112, R114, R116, R118
Relays NC contact pull-up (to USB +5 V)/pull-down, user installed	R2, R4, R6, R8, R9, R11, R13, R15	R37, R40, R42, R44, R46, R48, R50, R52, R88, R90, R92, R94, R95, R97, R99, R101, R104, R106, R108, R110, R111, R113, R115, R117

Mechanical

USB-ERB08 PCB Dimensions (L x W x H)	203.2 × 121 × 20.0 mm (8.0 × 4.8 × 0.8 in.)
USB-ERB08 Enclosure Dimensions (L x W x H)	241.3 × 125.7 × 58.9 mm (9.50 × 4.95 × 2.32 in.)
USB-ERB24 PCB Dimensions (L x W x H)	431.8 × 121 × 20.3 mm (17.0 × 4.8 × 0.8 in.)
USB-ERB24 Enclosure Dimensions (L x W x H)	482.6 × 125.7 × 58.9 mm (19.00 × 4.95 × 2.32 in.)

[1] Voltage drop between power input and daisy chain power output

[2] USB-ERB08 hardware revision E and later are also compatible with USB 3.0.
The revision is indicated on the part number label on the housing – *193776X-01L* – where *X* is the hardware revision.

[3] USB-ERB24 hardware revision G and later are also compatible with USB 3.0.
The revision is indicated on the part number label on the housing – *193773X-01L* – where *X* is the hardware revision.

Main Connector

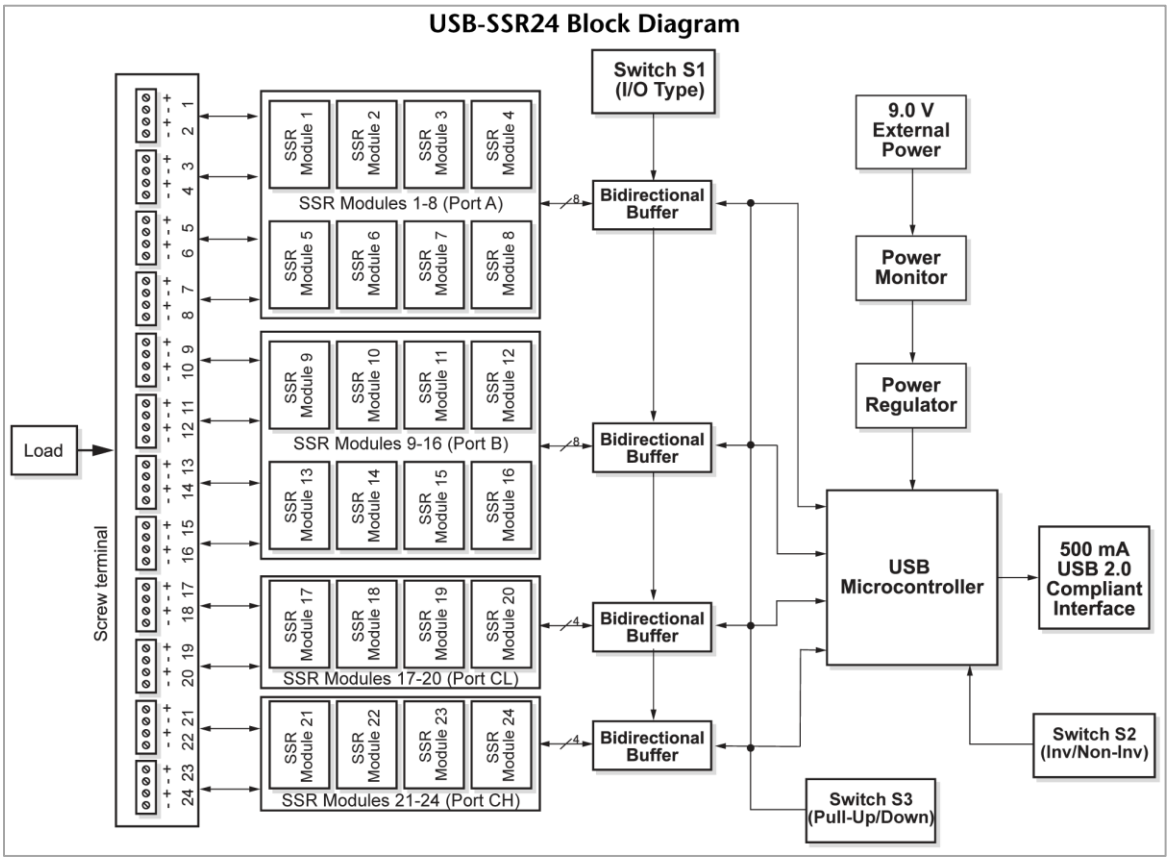
Connector type	Screw terminal
Wire gauge range	12 AWG to 22 AWG

Environmental

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

3.3 USB-SSR24

Block Diagrams



I/O Module Configuration

The USB-SSR24 provides mounting locations for 24 SSR digital I/O modules.

SSR digital I/O modules are relay control modules that provide optical functional isolation. Digital input modules sense AC/DC voltages from field devices and convert them to digital TTL signals. Digital output modules use TTL signals to switch and control AC/DC loads.

Modules 1-8	Selectable with switch S1 in the A position as either input or output (default) modules Switch settings for direction can be read back with software. Do not mix input and output modules within this bank of eight.
Modules 9-16	Selectable with switch S1 in the B position as either input modules or output (default) modules. Switch settings for direction can be read back with software. Do not mix input and output modules within this bank of eight.
Modules 17-20	Selectable with switch S1 in the CL position as either input or output (default) modules. Switch settings for direction can be read back with software. Do not mix input and output modules within this bank of four.
Modules 21-24	Selectable with switch S1 in the CH position as either input or output (default) modules. Switch settings for direction can be read back with software. Do not mix input and output modules within this bank of four.
I/O Module Logic Polarity	Selectable with switch S2. Switch settings for polarity can be read back with software. Default to non-inverted. For input modules, invert mode returns a *1* when module is active; non-invert mode returns a *0* when module is active. For output modules, invert mode allows users to write a *1* to activate the module; non-invert mode allows users to write a *0* to activate the module.
Pull-up/Pull-down on Digital I/O Lines	Configurable with switch S3 with 2.2 kΩ resistor network. Switch settings for pull-up/pull-down selection can be read back with software. Default to pull-up. Switch settings are applicable during power up conditions of output modules only. Modules are active Low. When switch to Pull-up, modules are inactive on power up. When switched to pull-down, modules are active on power up.

Power

USB +5 V Input Voltage Range		4.75 V min to 5.25 V max
USB +5 V Supply Current (all modes of operation)		**USB-SSR24:** 10 mA max
Voltage Supervisor Limits - PWR LED		**6.0 V > V_{ext} or V_{ext} > 12.5 V:** PWR LED = Off (power fault) **6.0 V ≤ V_{ext} < 12.5 V:** PWR LED = On
External Power Consumption	**All relays on, 100 mA downstream hub power:**	USB-SSR24: 800 mA typical, 950 mA max
	All relays off, 0 mA downstream hub power:	USB-SSR24: 200 mA typical, 220 mA max

External Power Input

The USB-SSR24 device requires between 6.0 V and 12.5 V of external power. An external power connection using the included external power supply is required to activate relays and SSR modules, and to run tests in software. The USB-SSR24 device 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.

The USB-SSR24 device is powered by a 9 V, 1.67 A external power supply (CB-PWR-9) that ships with each device.

External Power Input	+6.0 VDC to 12.5 VDC (9 VDC power supply included)
External Power Supply (included; required for USB-SSR24)	MCC p/n CB-PWR-9: 9 V @ 1.67 A

External Power Output

The daisy chain power output option allows multiple MCC USB boards to be powered from a single external power source in a daisy chain fashion. The voltage drop between the module power supply input and the daisy chain output is 0.5 V max. Users must plan for this drop to assure the last module in the chain receives at least 6.0 VDC. A user-supplied custom cable is required to daisy chain multiple devices.

External Power Output (current range)	4.0 A max
External Power Output voltage drop[1]	0.5 V max

USB Specification

USB Type-B connector	Input
USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0, USB 3.0[2]
USB Type-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

Digital I/O Transfer Rates

Digital I/O transfer rate (software paced):	System dependent, 33 to 1000 port reads/writes or single bit reads/writes per second typical

[1] Voltage drop between power input and daisy chain power output

[2] USB-SSR24 hardware revision F and later are also compatible with USB 3.0.
The revision is indicated on the part number label on the housing – *93782X-01L* – where *X* is the hardware revision.

Mechanical

PCB Dimensions (L x W x H)	431.8 × 121.9 × 22.5 mm (17.0 × 4.8 × 0.885 in.)
Enclosure Dimensions (L x W x H)	482.6 × 125.7 × 58.9 mm (19.00 × 4.95 × 2.32 in.)

Main Connector

Connector type	Screw terminal
Wire gauge range	12 to 22 AWG

Environmental

Operating temperature range	0 °C to 70 °C
Storage Temperature Range	-40 °C to 85 °C
Humidity	0% to 95% non-condensing

SSR Digital I/O Modules

The USB-SSR24 provides mounting locations for 24 SSR digital I/O modules.

SSR digital I/O modules are relay control modules that provide optical functional isolation. Digital input modules sense AC/DC voltages from field devices and convert them to digital TTL signals. Digital output modules use TTL signals to switch and control AC/DC loads.

A wide selection of SSR digital I/O modules are available to switch or sense AC or DC voltages. Make sure voltages connected stay within 30 VAC or 60 VDC to earth ground.

The SSR modules use a standard color scheme to help quickly identify the module type installed.

Input Sensing Modules

MCC Part Number	WRC Akron Part Number	Description
SSR-IDC-05	1781-IB5S	DC input, 3 to 30VDC, 5V logic, slim module[1]
SSR-IDC-05NP	1781-IN5S	DC input, 10 to 30VDC, 5V logic, slim module, non-polarized[1]

Output Switch Modules

MCC Part Number	WRC Akron Part Number	Description
SSR-OAC-05	1781-OA5S	AC output, 24 to 30VAC, 5V logic, slim module[1]
SSR-ODC-05	1781-OB5S	DC output, 3 to 60VDC, 5V logic, slim module[1]

4 Ordering Information and Purchasing Options

USB-PDISO8 Series

USB-ERB Series

USB-SSR24

Associated Digilent Part Numbers:

- 6069-410-197 – USB-PDISO8
  - One USB-based eight Form C relay and eight functionally isolated input interface device. Includes power supply and USB cable.
- 6069-410-200 – USB-SSR24
  - One USB-based solid-state 24 I/O module interface device. Includes power supply and USB cable.
- 6069-410-056 – USB-ERB08
  - One USB-based 8-channel electromechanical relay interface device. Includes power supply and USB cable.
- 6069-410-031 – USB-ERB24
  - One USB-based 24-channel electromechanical relay interface device. Includes power supply and USB cable.

[1] Do not connect to voltages above these levels. The USB-SSR24 is not certified for use with hazardous voltages.

5 Recommended Accessories

- 6069-300-005 – PS-9V1AEPS230V
  - 9 VDC, 1.67 A, replacement power supply for the USB-ERB08, USB-PDISO8, USB-SSR24. *(Not for use with the USB-ERB24.)*

6 Additional Resources

- DASYLab – Icon-based data acquisition, graphics, control, and analysis software

7 About Digilent

Digilent, part of the NI Product Family, has been at the forefront of innovation since 2000, crafting hardware and software solutions that empower engineers, researchers, educators, and scientists to design and test with unparalleled flexibility. Our customizable solutions cater to both seasoned professionals and emerging engineers, accelerating development while maintaining a low barrier to entry.

We're committed to making engineering accessible, offering competitive pricing, portable products, and comprehensive documentation. With a global presence spanning three continents, Digilent ensures speedy and cost-effective access to our products through an extensive distribution network. Specializing in USB-based test and measurement devices, flexible and intuitive software, low-cost data acquisition and data logging tools, and AMD-based FPGA development boards, our products' design philosophy champions your creativity. By providing world class documentation and support and keeping our hardware and software flexible and practical, we are continuing to provide the building blocks while you bring the brilliance.