

USB-SSR08

USB-based Solid-State 8 I/O Module Interface Device

User's Guide

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EU Declaration of Conformity, Legacy Hardware 21

About this User's Guide

What you will learn from this user's guide

This user's guide describes the Measurement Computing USB-SSR08 data acquisition device and lists device specifications.

Conventions in this user's guide

For more information

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

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 checkboxes.

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 the USB-SSR08 is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation by phone, fax, or email 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

For international customers, contact your local distributor. Refer to the International Distributors section on our website at www.mccdaq.com/International.

Introducing the USB-SSR08

The USB-SSR08 is a USB 2.0 full-speed device that provides the following features:

- Mounting rack for eight solid state relay (SSR) modules (backplane is divided into two groups of four modules each).
- Onboard switch to configure the module type (input or output) for each module group.
The following configurations are supported (you cannot mix input and output modules within a group):
 - Four input and four output modules
 - Eight input modules
 - Eight output modules
- Onboard switch to configure the control logic polarity (active high or low) for each module group.
- Onboard switch to configure the power-up state for output modules.
- Switch settings can be read back with software.
- Independent LEDs at each module position to indicate the on/off status of each module.
- Eight pairs of screw terminal banks for field wiring connections, with positive (+) and negative (-) relay contacts brought out to the terminals.
- 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.*
- Rugged enclosure that can mount on a DIN rail or on a bench

The USB-SSR08 is powered by an external 9 V, 1.67 A regulated power supply that is shipped with the device.

The USB-SSR08 is fully compatible with both USB 1.1 and USB 2.0 ports. Revision F and later devices are also compatible with USB 3.0 ports.

Compatible SSR modules

The USB-SSR08 has locations for eight solid state relay modules. The SSR modules use a standard color scheme so you can quickly identify what module type is installed. Mounting screw threads are provided for you to easily install the SSR modules.

MCC offers the following SSR modules that are compatible with the USB-SSR08:

- | | | | |
|---------------|----------------|---------------|---------------|
| ▪ SSR-IAC-05 | ▪ SSR-IDC-05 | ▪ SSR-OAC-05 | ▪ SSR-ODC-05 |
| ▪ SSR-IAC-05A | ▪ SSR-IDC-05NP | ▪ SSR-OAC-05A | ▪ SSR-ODC-05A |
| | | | ▪ SSR-ODC-05R |

Details on these SSR modules are available at www.mccdaq.com/products/signal_conditioning.aspx.

Remove the USB-SSR08 from the enclosure to install SSR modules

Remove the USB-SSR08 from the enclosure to access the solid-state relay module mounting positions.

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

Functional block diagram

USB-SSR08 functions are illustrated in the block diagram shown here.

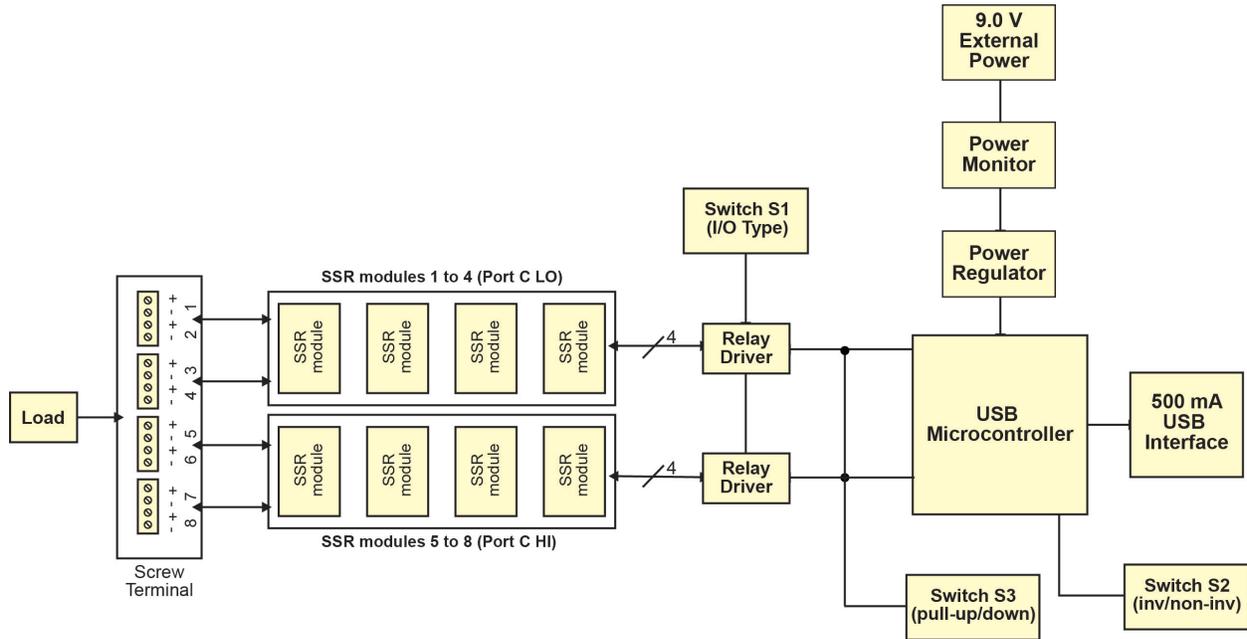


Figure 1. USB-SSR08 functional block diagram

Installing the USB-SSR08

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-SSR08 product page on our website for information about the software supported by the USB-SSR08.

Install the software before you install your device

The driver needed to run the USB-SSR08 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Installing the hardware

Before you connect the USB-SSR08 to your computer, connect the external power supply that was shipped with the device.

You can connect up to four compatible MCC USB Series devices in a daisy chain configuration to a single USB 2.0 port on your computer. If your system has a USB 1.1 port, you can connect up to two MCC USB Series devices.

Configuring the hardware switches

The USB-SSR08 has three onboard switches that configure the I/O module type, relay logic polarity, and relay power-up state. Configure these switches before you connect the external power supply to the USB-SSR08. Factory-configured default settings are listed in the table below. Refer to Figure 6 on page 11 for the location of each switch.

Default switch configuration

PCB label	Description	Default setting
IN OUT (S1)	Configures the I/O type per module group for input or output.	OUT (output)
NON INVERT INVERT (S2)	Configures the relay logic parity per module group for invert or non-invert logic.	NON INVERT (active low)
P/UP P/DN (S3)	Configures the power-up state of output relays for pull-up or pull-down.	P/UP (Pull-up)

Each DIP switch configures one module group. The switch labeled **CL** configures modules 1 through 4, and the switch labeled **CH** configures modules 5 through 8.

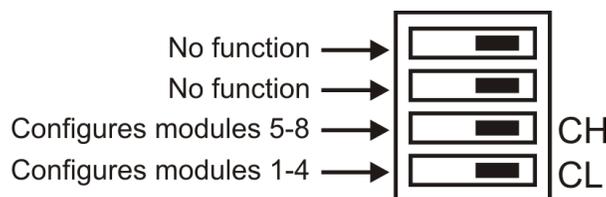


Figure 2. Typical PCB switch

You can use InstaCal to read the current configuration of each switch.

Remove from the enclosure to access the onboard switches

To change the configuration of a switch, you must first remove the USB-SSR08 from the enclosure. Turn external power off before changing the switch settings

I/O module type

Use switch **S1** to configure the type of each module group for input or output. By default, switch S1 is shipped with all banks configured for output modules, as shown in Figure 3.

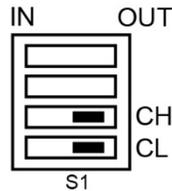


Figure 3. I/O module type switch (S1)

You cannot mix input and output modules within a group.

Control logic polarity

Configure switch **S2** to set the control logic polarity for each module group for inverted (active high) or non-inverted (active low, default) logic. By default, switch S2 is shipped with all banks configured for non-inverted logic, as shown in Figure 4.

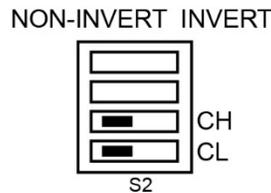


Figure 4. Relay logic switch (S2)

- For input modules, **invert** mode returns a "1" when the modules are active. **Non-invert** mode returns a "0" when the modules are active.
- For output modules, **invert** mode allows you to write a "1" to activate the module. **Non-invert** mode allows you to write a "0" to activate the module.

Relay power-up state

Configure switch **S3** to set the state of the output relays at power-up. By default, switch S3 is shipped with all banks configured for pull-up (modules inactive on power-up), as shown in Figure 5. When switched to **PULL DN** (pull-down), modules are active on power-up. Switch settings can be read back via software.

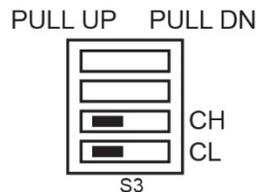


Figure 5. Relay power-up state switch (S3)

Connecting the external power supply

Power to the USB-SSR08 is provided with the 9 V external power supply (CB-PWR-9). Connect the external power supply before connecting the USB connector to the USB-SSR08.

To connect the power supply to your USB-SSR08, complete the following steps:

1. Connect the external power cord to the power connector labeled **POWER IN** on the USB-SSR08 enclosure (**PWR IN** on the PCB).
2. Plug the AC adapter into a power outlet.

The **PWR** LED turns on (green) when 9 V power is supplied to the USB-SSR08. If the voltage supply is less than 6.0 V or more than 12.5 V, the **PWR** LED does not turn on.

Do not connect external power to the **POWER OUT** connector

The power connector labeled **POWER OUT** on the enclosure (**PWR OUT** on the PCB) is used to provide power to an additional MCC USB Series device. If you connect the external power supply to the **POWER OUT** connector, the USB-SSR08 does not receive power, and the **PWR** LED does not turn on.

Connecting the USB-SSR08 to your system

To connect the USB-SSR08 to your system, do the following.

1. Turn your computer on.
2. Connect the USB cable to the USB connector labeled **USB IN** on the USB-SSR08.
3. Connect the other end of the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer.

Windows finds and installs the device driver automatically, and notifies you that the device is ready to use.

When installation is complete, the **USB** LED flashes and then remains lit to indicate communication is established between the USB-SSR08 and the computer. Refer to Figure 6 on page 11 for the location of the **USB** LED.

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.

If the system does not detect the USB-SSR08

If a USB device not recognized message displays when you connect the USB-SSR08, complete the following steps:

1. Unplug the USB cable from the USB-SSR08.
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-SSR08.

Your system should now properly detect the USB-SSR08.

Contact technical support if your system still does not detect the USB-SSR08.

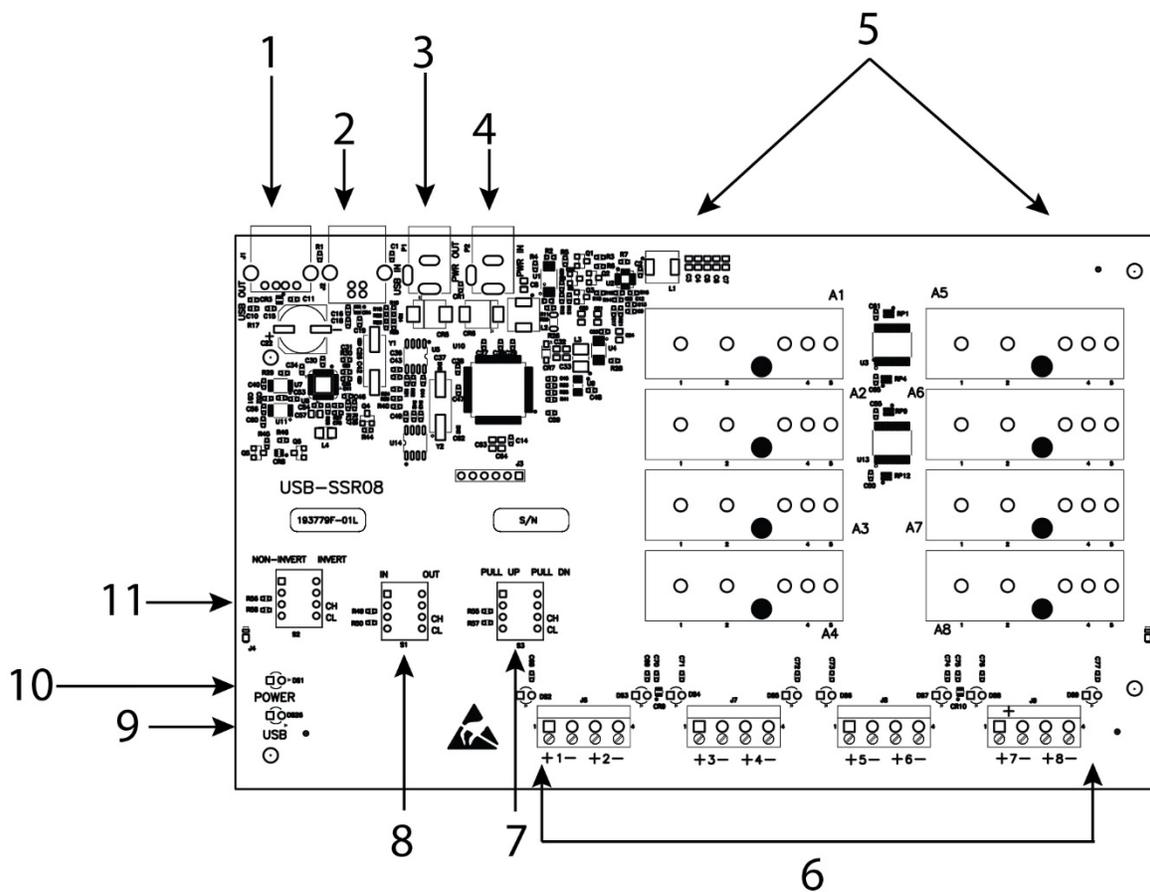
Caution! Do not disconnect any device from the USB bus while the computer is communicating with the USB-SSR08, or you may lose data and/or your ability to communicate with the USB-SSR08.

Functional Details

Components

The USB-SSR08 has the following internal components, as shown in Figure 6.

- Two (2) USB connectors
- Two (2) external power connectors
- PWR LED
- USB LED
- I/O module type switch (**S1**)
- Control logic polarity switch (**S2**)
- Power-up state configuration switch (**S3**)
- Screw terminals (eight pairs) and module status LEDs



- | | | | |
|---|---|----|---|
| 1 | USB output connector (USB OUT) | 7 | Power-up state configuration switch (S3) |
| 2 | USB input connector (USB IN) | 8 | I/O module-type switch (S1) |
| 3 | Power output connector (POWER OUT 9 VDC) | 9 | USB LED |
| 4 | Power input connector (POWER IN) | 10 | PWR LED |
| 5 | Relays | 11 | Control logic polarity switch (S2) |
| 6 | Relay screw terminals and module status LEDs | | |

Figure 6. USB-SSR08 components

USB in connector

The USB in connector is labeled **USB IN** on the enclosure and on the PCB. 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, USB 2.0 devices.

USB out connector

The USB out connector is labeled **USB OUT** on the enclosure and on the PCB. This connector is a downstream hub output port intended for use with other MCC USB devices 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 multiple USB-SSR08 devices* on page 14.

External power connectors

The USB-SSR08 has two external power connectors labeled **POWER IN** and **POWER OUT** on the enclosure. The **POWER IN** connector is labeled **PWR IN** on the PCB, and the **POWER OUT** connector is labeled **PWR OUT** on the PCB.

Connect the **POWER IN** connector to the supplied +9 V external power supply. External power is required to operate the USB-SSR08.

Use the **POWER OUT** connector to power additional daisy-chained MCC USB devices from a single external power supply. Depending on your load requirements, daisy-chained devices may require a separate power supply. Refer to *Power limitations using multiple USB-SSR08 devices* on page 14 for more information.

A user-supplied custom cable is required to daisy chain multiple devices.

USB LED

The **USB LED** indicates the communication status of the USB-SSR08. This LED uses up to 5 mA of current and cannot be disabled. The table below explains the function of the USB LED.

USB LED Indications

USB LED	Indication
On steadily	The USB-SSR08 is connected to a computer or external USB hub.
Blinking	Initial communication is established between the USB-SSR08 and the computer, or data is being transferred.

PWR LED

The USB-SSR08 incorporates an onboard voltage supervisory circuit that monitors the external 9 V power. If the input voltage falls outside of the specified ranges the **PWR LED** shuts off. The table below explains the function of the PWR LED.

PWR LED Indications

PWR LED	Indication
Steady green	External power is supplied to the USB-SSR08.
Off	Power is not supplied by the external power supply, or a power fault has occurred. A power fault occurs when the input power falls outside of the specified voltage range of the external supply (6.0 V to 12.5 V).

I/O module type switch (S1)

Switch **S1** is a four-position switch that sets the type of each module group for input or output (default). You cannot mix input and output modules within a group. You can use InstaCal to read the current I/O type configuration for each module group. Figure 7 shows switch S1 configured with its default settings.

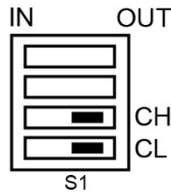


Figure 7. Switch S1 default configuration

Control logic polarity switch (S2)

Switch **S2** is a four-position switch that sets the control logic polarity for each module group for either inverted (active high) or non-inverted (active low, default). You can use InstaCal to read the current logic configuration for each module group. Figure 8 shows switch S2 configured with its default settings.

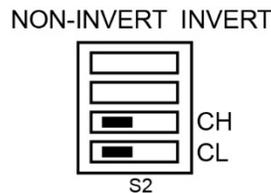


Figure 8. Switch S2 default configuration

Relay power-up state switch (S3)

Switch **S3** is a four-position switch that sets the state of the output relays at power-up. You can use InstaCal to read the current resistor configuration for each module group. Figure 9 shows switch S3 configured with its default settings (modules inactive on power-up).

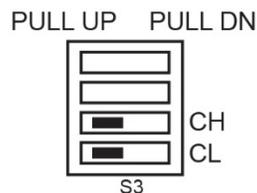


Figure 9. Switch S3 default configuration

Main connector and pin out

The table below lists the device connector specifications.

Connector type	Screw terminal
Wire gauge range	12-22 AWG

The USB-SSR08 has eight screw terminal pairs to connect external devices to the SSR modules. Two terminals are dedicated to each module (one positive and one negative terminal). Each screw terminal is identified with a label on the PCB and on the underside of the enclosure lid.

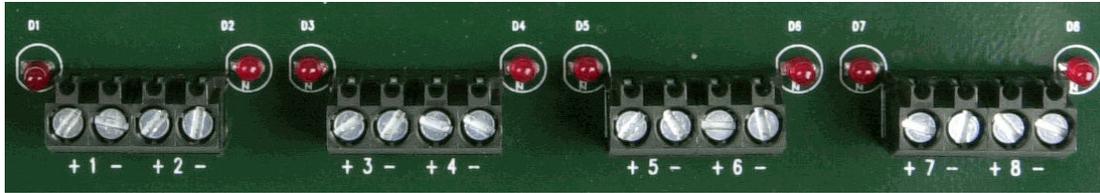


Figure 10. Screw terminals

Caution! Before connecting wires to the screw terminals, turn off the power to the USB-SSR08, and make sure that the signal wires do not contain live voltages.

Use 12-22 AWG wire for your signal connections. Properly insulate the wires to avoid any short circuit to the other channels, ground, or other points on the device.

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 to 7.0 mm (0.215" to 0.275") long.

Pin	Signal Name	Pin	Signal Name
1+	Module 1+	5+	Module 5+
1-	Module 1-	5-	Module 5-
2+	Module 2+	6+	Module 6+
2-	Module 2-	6-	Module 6-
3+	Module 3+	7+	Module 7+
3-	Module 3-	7-	Module 7-
4+	Module 4+	8+	Module 8+
4-	Module 4-	8-	Module 8-

Module status LEDs

Independent red LEDs next to each module screw terminal pair indicate the on/off status of each module. The LED turns on when an output module is active or when an input module detects an input voltage (logic high).

Daisy chaining multiple USB-SSR08 devices

Daisy-chained USB-SSR08 devices connect to the USB bus through the high-speed hub on the USB-SSR08. 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.

Perform the following procedure to daisy chain multiple devices together. A user-supplied custom cable is required to daisy chain multiple devices.

- The device connected to the computer is referred to as the *host device*.
- Each additional device that you want to daisy chain to the host USB-SSR08 is referred to as a *slave device*.

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

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.

Note that the last device in the chain is supplied with external power.

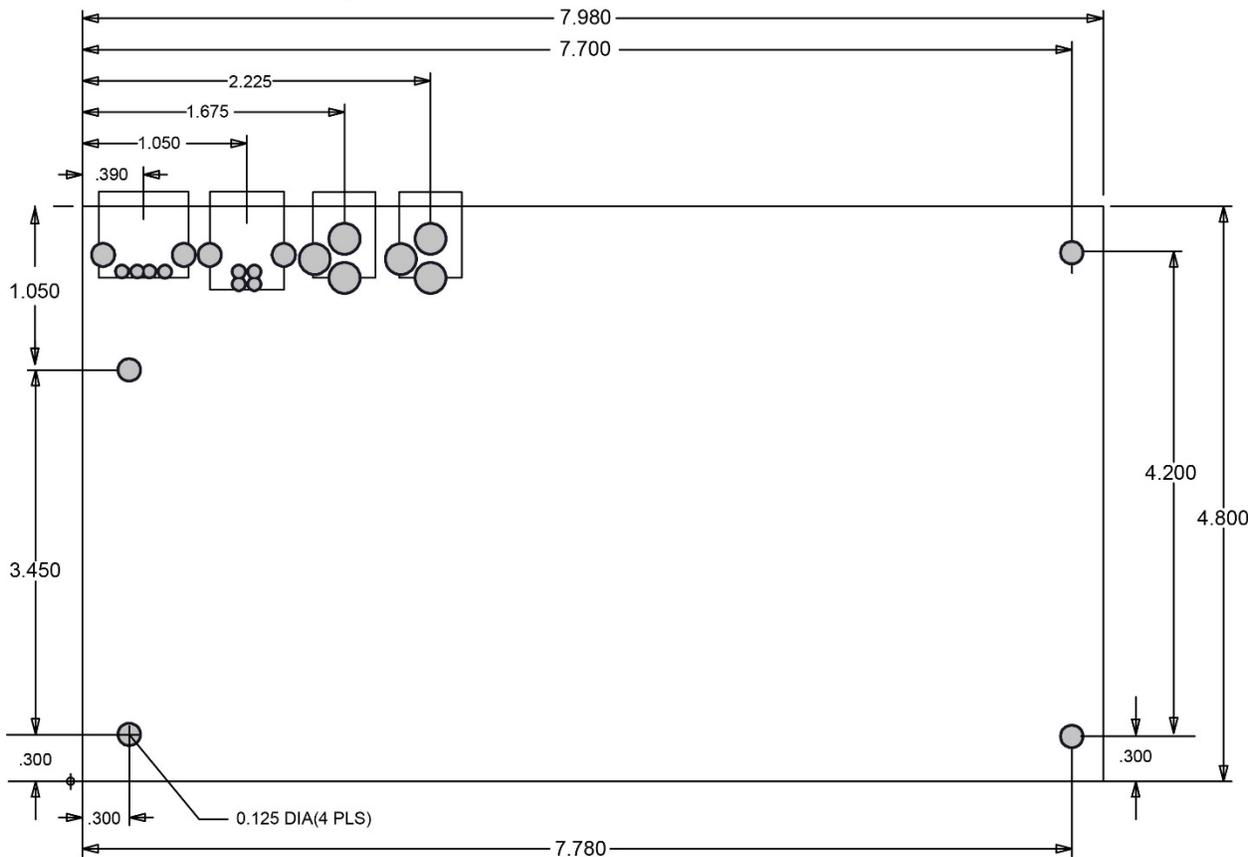
Power limitations using multiple USB-SSR08 devices

When daisy chaining additional MCC USB devices to the USB-SSR08, make that you provide adequate power to each device that you connect. The USB-SSR08 is powered with a 9 VDC nominal, 1.67 A external power supply.

Voltage drop

A drop in voltage occurs with each device connected in a daisy-chain configuration. The voltage drop between the 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 6.0 VDC is provided to the last device in the chain.

Mechanical drawings



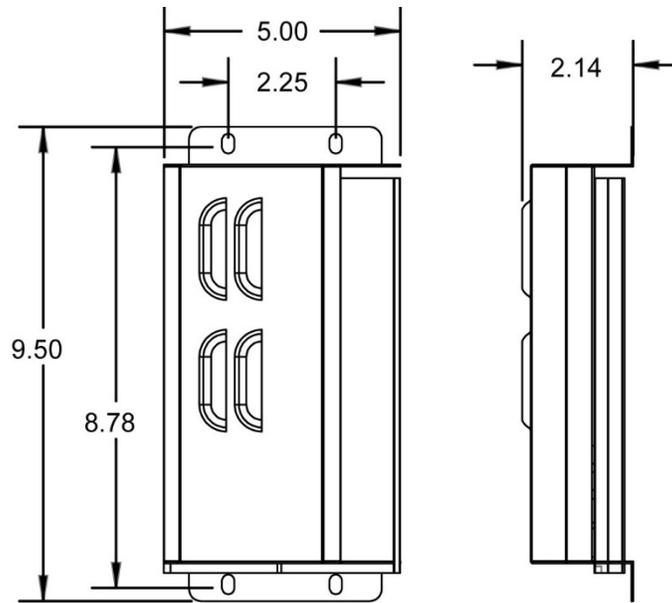


Figure 11. Circuit board (top) and housing dimensions

Specifications

Typical for 25 °C unless otherwise specified.
Specifications in *italic text* are guaranteed by design.

I/O module configuration

Table 1. I/O module configuration specifications

Parameter	Specification
Modules 1-4	Selectable with switch S1 in the <i>CL</i> 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 four.
Modules 5-8	User-selectable with switch S1 <i>CH</i> 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 four.
Pull-up/pull-down on digital I/O lines	Configurable with switch S3 with 2.2 K ohm resistor network. Switch settings for pull-up/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.
I/O module logic polarity	Selectable with switch S2. Switch settings for polarity can be read back via software. Default to non-inverted. For input modules, invert mode returns a <i>1</i> when module is active; non-invert mode returns a <i>0</i> when module is active. For output modules, invert mode allows users to write a <i>1</i> to activate the module; non-invert mode allows users to write a <i>0</i> to activate the module.

Power

Table 2. Power specifications

Parameter	Conditions	Specification
USB +5 V input voltage range.		4.75 V min to 5.25 V max
USB +5 V supply current	All modes of operation	<100 mA
External power supply (included)	MCC p/n CB-PWR-9	9 V @ 1.67 A
Voltage supervisor limits - PWR LED	$6.0\text{ V} > V_{\text{ext}} > 12.5\text{ V}$	PWR LED = Off (power fault)
	$6.0\text{ V} < V_{\text{ext}} < 12.5\text{ V}$	PWR LED = On
External power consumption	All modules off, 0 A downstream hub power	180 mA typ, 220 mA max
	All modules on, 100 mA downstream hub power	300 mA typ, 360 mA max

External power input

Table 3. External power input specifications

Parameter	Conditions	Specification
External power input		+6.0 VDC to 12.5 VDC (9 VDC power supply included)
Voltage supervisor limits - PWR LED (Note 1)	$6.0\text{ V} > V_{\text{ext}}$ or $V_{\text{ext}} > 12.5\text{ V}$	PWR LED = Off (power fault)
	$6.0\text{ V} < V_{\text{ext}} < 12.5\text{ V}$	PWR LED = On
External power adapter (included)	MCC p/n CB-PWR-9	9 V @ 1.67 A

Note 1: The USB-SSR08 monitors the external +9 V power supply voltage with a voltage supervisory circuit. If this power supply exceeds its specified limit, the PWR LED will turn off, indicating a power fault condition.

External power output

Table 4. External power output specifications

Parameter	Conditions	Specification
External power output - current range		4.0 A max
External power output (Note 2)	Voltage drop between power input and daisy chain power output	0.5 V max

Note 2: The daisy chain power output option allows multiple Measurement Computing 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.

USB specifications

Table 5. USB specifications

Parameter	Specification
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 Series devices
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 "193779X-01L," where X is the board revision.

Digital I/O transfer rates

Table 6. Digital I/O transfer rate specifications

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

Mechanical

Table 7. Mechanical specifications

Parameter	Specification
Board dimensions without modules (L × W × H)	8.0 × 4.8 × 0.885 in. (203.2 × 121.9 × 22.5 mm)
Enclosure dimensions (L × W × H)	9.50 × 5.00 × 2.14 in. (241.3 × 127.0 × 54.4 mm)

Environmental

Table 8. Environmental specifications

Parameter	Specification
<i>Operating temperature range</i>	<i>0 to 70 °C</i>
<i>Storage temperature range</i>	<i>-40 to 85 °C</i>
<i>Humidity</i>	<i>0 to 90% non-condensing</i>

Main connector

Table 9. Connector specifications

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

Screw terminal pinout

Terminal #	Label
1+	Module 1+
1-	Module 1-
2+	Module 2+
2-	Module 2-
3+	Module 3+
3-	Module 3-
4+	Module 4+
4-	Module 4-
5+	Module 5+
5-	Module 5-
6+	Module 6+
6-	Module 6-
7+	Module 7+
7-	Module 7-
8+	Module 8+
8-	Module 8-

CE EU 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: October 19, 2016, Norton, Massachusetts USA
Test Report Number: EMI4221.05 and Addendum

Measurement Computing Corporation declares under sole responsibility that the product

USB-SSR08, Board Revision F* or later

is in conformity with the relevant Union Harmonization Legislation and complies with the essential requirements of the following applicable European Directives:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU
Low Voltage Directive 2014/35/EU
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)
- EN 61000-4-4 :2012 (IEC61000-4-4:2012)
- EN 61000-4-5 :2005 (IEC61000-4-5:2005)
- EN 61000-4-6 :2013 (IEC61000-4-6:2013)
- EN 61000-4-11:2004 (IEC61000-4-11:2004)

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

*The board revision may be determined from the part number label on the board that states "193779X-01L", where X is the board revision.



EU Declaration of Conformity, Legacy Hardware

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
Norton, MA 02766
USA

Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

USB-SSR08, Earlier than Revision F*

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EU EMC Directive 89/336/EEC: Electromagnetic Compatibility, EN 61326 (1997) Amendment 1 (1998)

Emissions: Group 1, Class A

- EN 55011 (1990)/CISPR 11: Radiated and Conducted emissions.

Immunity: EN61326, Annex A

- IEC 1000-4-2 (1995): Electrostatic Discharge immunity, Criteria C.
- IEC 1000-4-3 (1995): Radiated Electromagnetic Field immunity Criteria C.
- IEC 1000-4-4 (1995): Electric Fast Transient Burst immunity Criteria A.
- IEC 1000-4-5 (1995): Surge immunity Criteria C.
- IEC 1000-4-6 (1996): Radio Frequency Common Mode immunity Criteria A.
- IEC 1000-4-8 (1994): Magnetic Field immunity Criteria A.
- IEC 1000-4-11 (1994): Voltage Dip and Interrupt immunity Criteria A.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in June, 2005. Test records are outlined in Chomerics Test Report #EMI4221.05.

We hereby declare that the equipment specified conforms to the above Directives and Standards.

Carl Haapaoja, Director of Quality Assurance

*The board revision may be determined from the part number label on the board that states "193779X-01L", where X is the board revision.

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