

USB-ERB08

USB-based 8-Relay Module

User's Guide



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User's Guide



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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the USB-ERB08 so that you get the most out of its electromechanical relay features. This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on ...

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.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *InstaCal* installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide helpful information relevant to the operation of the USB-ERB08.

- MCC's *Specifications: USB-ERB08* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/USB-ERB08.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

USB-ERB08 User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/USB-ERB08.pdf.

Introducing the USB-ERB08

Overview: USB-ERB08 features

This user's guide contains all of the information you need to connect the USB-ERB08 to your computer and to the external devices you want to control. You can use the USB-ERB08 in your control applications to switch on and off a variety of devices, such as fans, blowers, pumps, etc.

The USB-ERB08 is a USB 2.0 full-speed, electromechanical relay module that is supported under popular Microsoft® Windows® operating systems.

The USB-ERB08 provides eight single-pole double-throw (SPDT) Form C electromechanical relays. The digital I/O lines on your MCC USB Series module directly control the relays on your USB-ERB08.

You connect your field wiring directly to the board's screw terminals. The screw terminals provide three connections to each relay – normally open (NO), normally closed (NC), and common (C).

You configure the relay control logic polarity and the relay power-on state with on-board switches. The relays are configurable as two banks of four. Switch settings can be read back with software.

The USB-ERB08 is powered by an external 9 V, 1 A regulated power supply that is shipped with the device. A USB cable is also included. Power OUT and USB OUT connectors let you power and control multiple MCC USB Series products from one external power source and one USB port in a daisy chain fashion. Depending on your load requirement, daisy chained boards may require a separate power supply.

The USB-ERB08 is shipped in a rugged enclosure that you can mount on a DIN rail or on a bench.



USB-ERB08 block diagram

USB-ERB08 functions are illustrated in the block diagram shown here.

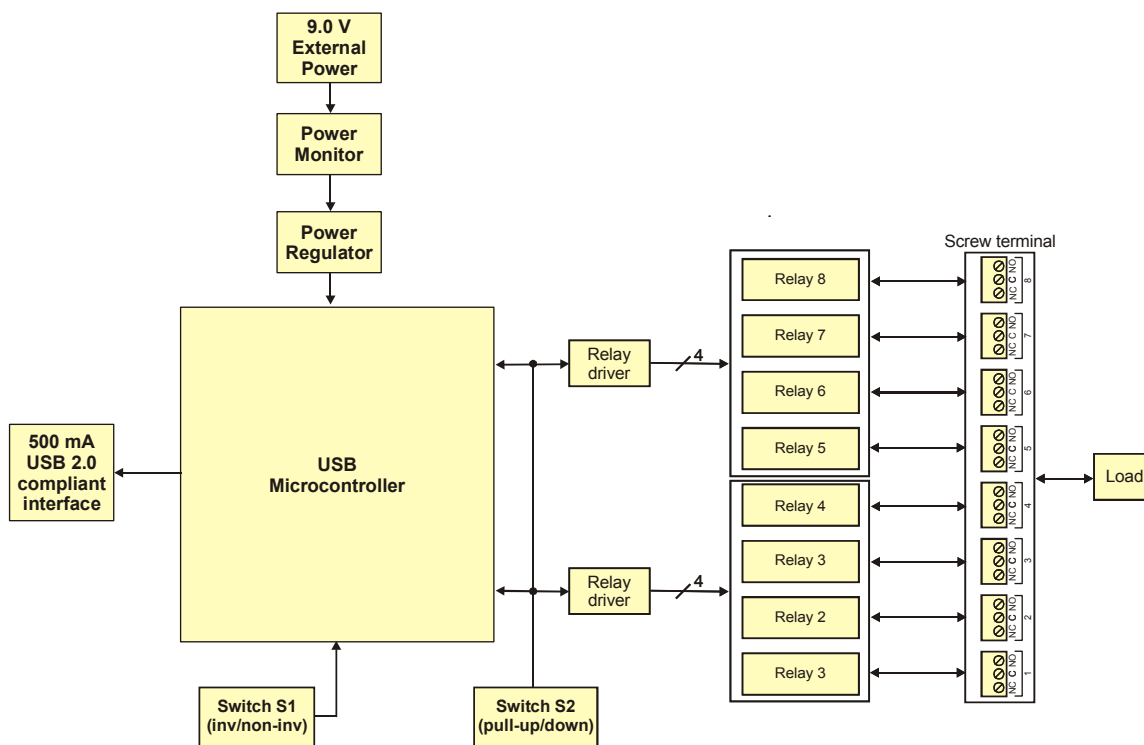


Figure 1-1. USB-ERB08 functional block diagram

Software features

For information on the features of *InstaCal* and the other software included with your USB-ERB08, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version or versions of the software supported under less commonly used operating systems.

Connecting a USB-ERB08 to your computer is easy

Installing a data acquisition device has never been easier.

- The USB-ERB08 relies upon the Microsoft Human Interface Device (HID) class drivers. The HID class drivers ship with every copy of Windows that is designed to work with USB ports. We use the Microsoft HID because it is a standard, and its performance delivers full control and maximizes data transfer rates for your USB-ERB08. No third-party device driver is required.
- You can connect the USB-ERB08 before or after you install the software, and without powering down your computer first. When you connect an HID to your system, your computer automatically detects it and configures the necessary software. You can connect multiple HID peripherals to your system using a USB hub.
- You can connect your system to various devices using a standard four-wire cable. The USB connector replaces the serial and parallel port connectors with one standardized plug and port combination.
- Data can flow two ways between a computer and peripheral over USB connections.

Installing the USB-ERB08

What comes with your USB-ERB08 shipment?

The following items are shipped with the USB-ERB08.

Hardware

The following items should be included with your shipment.

- USB-ERB08



- External power supply and cord (CB-PWR-9) – 9 volt, 1 amp DC power supply



- USB cable (2 meter length)



Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your USB-SSR08 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Unpacking the USB-ERB08

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the USB-ERB08 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.

If your USB-ERB08 is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail. For international customers, contact your local distributor where you purchased the USB-ERB08.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the USB-ERB08

Before you connect the USB-ERB08 to your computer, configure the hardware and then connect the external power supply that was shipped with the device.

Configuring the hardware switches

The USB-ERB08 has two on-board switches that you set to configure the relay control logic polarity and relay power-on state. Factory-configured default settings are listed in Table 2-1. Refer to Figure 3-1 for the location of each switch on the USB-ERB08.

Table 2-1. Default switch configuration

Board label	Description	Default setting
INVERT NON-INVERT S1	Configures the relay control logic parity per relay bank for invert or non-invert logic.	Non-invert
Pull DOWN PULL UP S2	Configures the relay power-on state per relay bank for pull-up or pull-down.	Pull down

Each DIP switch sets the configuration of one relay group. The switch labeled **CL** configures relays 1 through 4, the switch labeled **CH** configures relays 5 through 8.

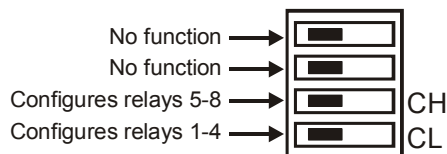


Figure 2-2. Typical board switch

Port CL consists of relays 1 through 4, and Port CH consists of relays 5 through 8.

Remove from the enclosure to access the on-board switches

To change the configuration of a switch, you must first remove the USB-ERB08 from the enclosure.

Relay control logic parity

Configure the **Invert/non-invert** switch (S1) to set the relay control logic polarity for each relay bank for invert or non-invert. By default, this switch is shipped with all banks configured for non-inverted logic, as shown in Figure 2-3.

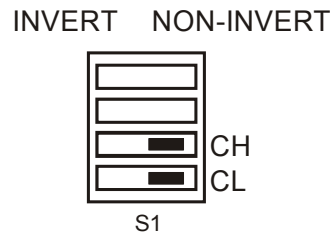


Figure 2-3. Invert/non-invert switch (S1)

- **NON-INVERT** mode: when "0" is written or read back via the USB bus, the relays are not energized.
- **INVERT** mode: when "0" is written or read back via the USB bus, the relays are energized.

Switch settings for polarity can be read back via software through the USB bus. Switch settings for S1 do not affect the power-on condition.

Relay power-on state

Configure the **Pull-up/pull-down** switch (S2) to set the state of each relay bank at power-up. By default, this product is shipped with the switch for all banks configured for pull-down (relays inactive at power up), as shown in Figure 2-4.

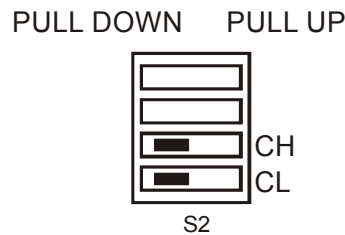


Figure 2-4. Pull-up/pull-down switch (S2)

When set to pull-up, the relays are put into an energized state at power-up, regardless of the state of switch S1. When set to pull-down, the relays are put into a non-energized state at power-up.

Switch settings can be read back via software through the USB bus.

Connecting the external power supply

Power to the USB-ERB08 is provided with the 9 V, 1 A external power supply (CB-PWR-9). You must connect the external power supply *before* connecting the USB connector to the USB-ERB08.

To connect the power supply to your USB-ERB08, do the following:

1. Connect the external power cord to the power connector labeled **POWER IN** on the USB-ERB08 enclosure (**PWR IN** on the board). Refer to Figure 3-1 for the location of this connector.
2. Plug the AC adapter into a power outlet.

The **PWR** LED illuminates green when 9 V power is supplied to the USB-ERB08. If the voltage supply is less than 6.0 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 Series product. If you connect the external power supply to the **POWER OUT** connector, the USB-ERB08 does not receive power, and the **PWR** LED will not illuminate.

Connecting the USB-ERB08 to your system

To connect the USB-ERB08 to your system, turn your computer on, and connect the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer. The USB cable provides communication to the USB-ERB08.

When you connect the USB-ERB08 for the first time, a **Found New Hardware** popup balloon (Windows XP) or dialog (other Windows versions) opens as the USB-ERB08 is detected.



When this balloon or dialog closes, the installation is complete. The **USB LED** should flash and then remain lit. This indicates that communication is established between the USB-ERB08 and your computer.

If you are running Windows XP and connect the USB-ERB08 to a USB 1.1 port, a balloon displays the message "**Your USB device can perform faster if you connect to a USB 2.0 port.**" You can ignore this message. The USB-ERB08 will function properly when connected to a USB 1.1 port.

Caution! Do not disconnect **any** device from the USB bus while the computer is communicating with the USB-ERB08, or you may lose data and/or your ability to communicate with the USB-ERB08.

If the LED turns off

If the LED is lit but then turns off, the computer has lost communication with the USB-ERB08. To restore communication, disconnect the USB cable from the computer, and then reconnect it. This should restore communication, and the LED should turn back *on*.

Functional Details

Internal components

The USB-ERB08 has the following internal components, as shown in Figure 3-1.

- Two (2) USB connectors
- Two (2) external power connectors
- PWR LED
- USB LED
- Invert/non-invert switch S1 — sets the relay control logic polarity
- Pull-up/pull-down switch S2 — sets the relay power-on state
- Screw terminals

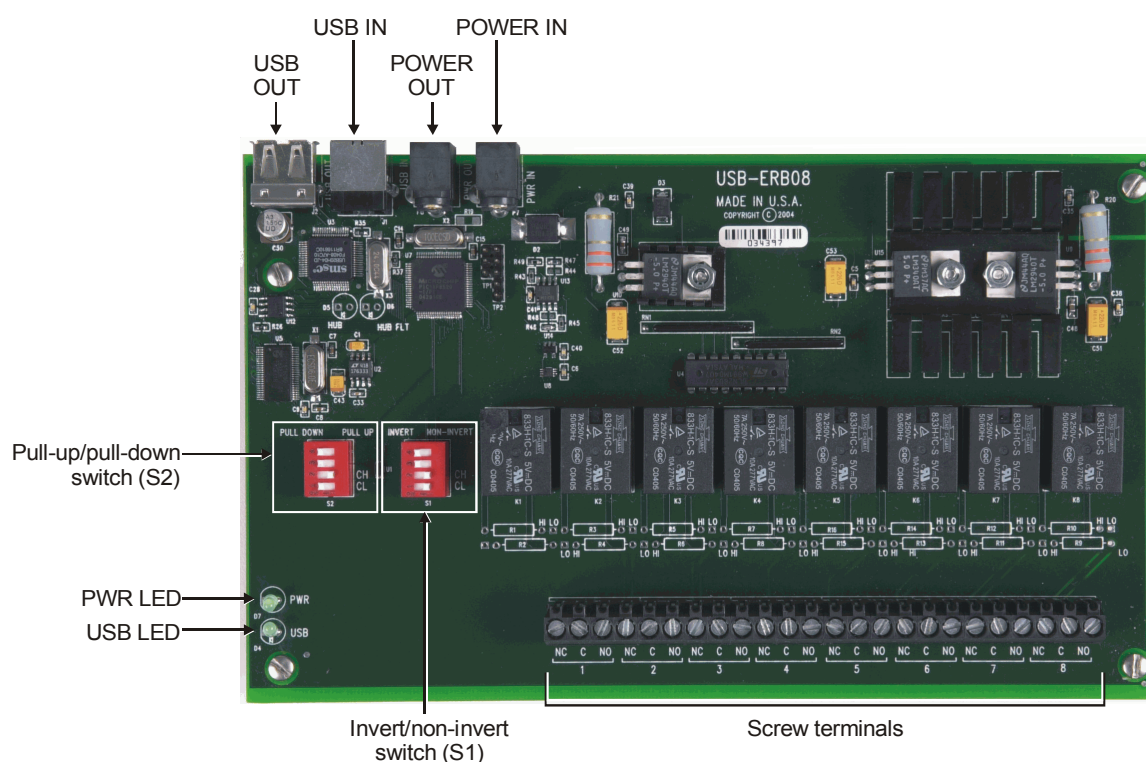


Figure 3-1. USB-ERB08 components

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.

USB out connector

The USB out connector is labeled **USB OUT** on the board and enclosure. This connector is a downstream hub output port intended for use with other MCC USB Series 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 Series products, refer to [Daisy chaining additional modules to the USB-ERB08](#) on page 3-3.

External power connectors

The USB-ERB08 has two external power connectors labeled **POWER IN** and **POWER OUT** on the enclosure. The **POWER IN** connector is labeled **PWR IN** on the board, and the **POWER OUT** connector is labeled **PWR OUT** on the board.

Connect the **POWER IN** connector to the supplied +9 V external power supply. External power is required to operate the USB-ERB08. The **POWER OUT** connector lets you power additional daisy chained MCC USB Series products from a single external power supply. Depending on your load requirements, daisy chained products may require a separate power supply. Refer to "[Power limitations using multiple USB-ERB08 devices](#)" on page 3-4 for more information.

USB LED

The **USB** LED indicates the communication status of the USB-ERB08. It uses up to 5 mA of current and cannot be disabled. Table 3-2 explains the USB LED function.

Table 3-2. USB LED Illumination

USB LED illumination	Indication
Steady green	The USB-ERB08 is connected to a computer or external USB hub.
Pulsing green	Initial communication is established between the USB-ERB08 and the computer, or data is being transferred.

PWR LED

The USB-ERB08 incorporates an on-board voltage supervisory circuit that monitors the external 9 V power. If the input voltage falls outside of the specified range, the **PWR** LED shuts off. Table 3-3 explains the function of the PWR LED.

Table 3-3. PWR LED Illumination

PWR LED illumination	Indication
Steady green	External power is supplied to the USB-ERB08.
Off	Power is not supplied by the external 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).

Invert/Non-invert switch (S1)

The Invert/non-invert switch (S1) sets the relay control logic per relay bank to either inverted or non-inverted. By default, switch S1 is configured for non-invert (see Figure 2-3).

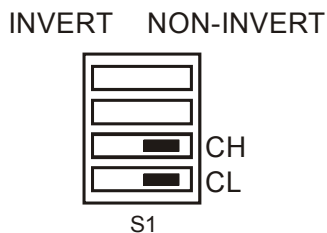


Figure 3-2. Switch S1 default configuration

The switch labeled **CL** configures relays 1 through 4, the switch labeled **CH** configures relays 5 through 8.

- **NON-INVERT**: when "0" is written or read back via the USB bus, the relays are not energized.
- **INVERT**: when "0" is written or read back via the USB bus, the relays are energized.

Switch settings do not affect the power-on condition. Use *InstaCal* to read the current logic setting for each module group.

Pull-up/Pull-down switch (S2)

The Pull-up/pull-down switch (S2) sets the power-on state of each relay bank. By default, switch S2 is configured for pull-down (relays inactive at power-up - see Figure 3-3).

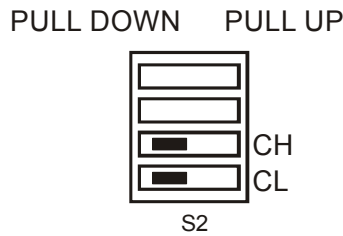


Figure 3-3. Switch S2 default configuration

The switch labeled **CL** configures relays 1 through 4, the switch labeled **CH** configures relays 5 through 8.

- **PULL UP:** The relay energizes at power-up, regardless of the state of switch S1.
- **PULL DOWN:** The relays are not energized at power-up.

Use *InstaCal* to read the current power-on state setting for each module group.

Screw terminals

Connect external devices to the relay contacts using the USB-ERB08 board's eight sets of screw terminals. Each relay has a normally closed (NC), common (C), and normally open (NO) contact. Figure 3-4 shows the screw terminals on a typical relay channel.



Figure 3-4. 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-ERB08, and make sure that the signal wires do not contain live voltages.

Wire gauge

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.

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.

Daisy chaining additional relays to the USB-ERB08

Daisy chained MCC USB Series products connect to the USB bus through the high-speed hub on the USB-ERB08. You can daisy chain a maximum of four MCC USB Series products to a single USB 2.0 port or USB 1.1 port on your computer.

MCC USB Series products are USB 1.1 full-speed devices that provide a signaling bit rate of 12 Mb/s. The throughput rate is shared by all devices connected to the USB bus. Use the supplied cable or an equivalent cable when daisy chaining MCC USB Series products.

To daisy chain two or more USB-ERB08 modules, follow the steps below. This procedure assumes you already have one USB-ERB08 connected to a computer and to an external power source. The USB-ERB08 already connected to the computer is referred to as the *connected module*. The USB-ERB08 you want to daisy chain to the connected module is referred to as the *new module*.

1. Connect the **POWER OUT** connector on the connected module to the **POWER IN** connector on the new module.
This step is required only if you plan to daisy chain power to another module.
2. Connect the **USB OUT** connector on the connected module to the **USB IN** connector on the new module.
3. To add another module, repeat steps 1-2, with the module you just connected now being the *connected module*.

A daisy chain example is shown in Figure 3-5. Note that the last board in the chain is supplied with external power.

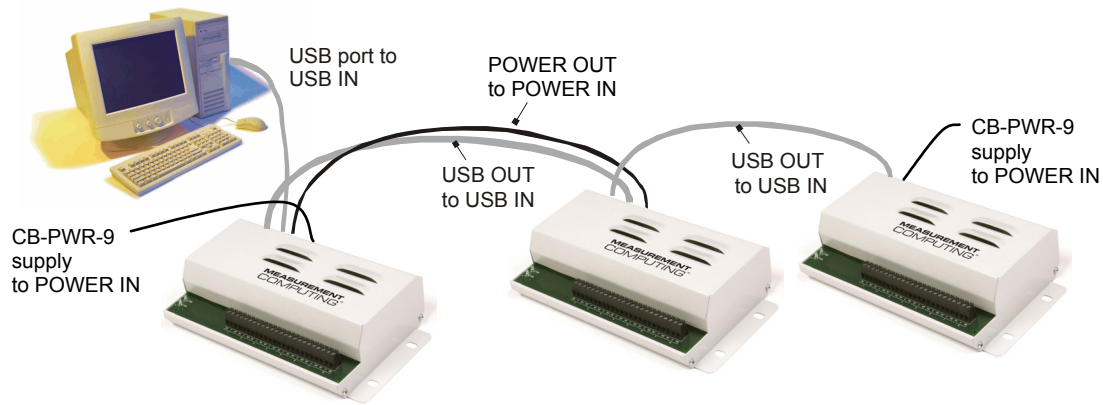


Figure 3-5. Daisy chain connections

Power limitations using multiple USB-ERB08 devices

When daisy chaining additional MCC USB Series products to the USB-ERB08, you must ensure that you provide adequate power to each board that you connect. The USB-ERB08 is powered with a 9 VDC nominal, 1.0 A external power supply.

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

Voltage drop

A drop in voltage occurs with each board connected in a daisy chain system. 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 board in the chain.

Relay configuration

You can install a pull-up or pull-down resistor at the NO and NC terminals on each relay. Note that the pull-up resistors are tied to the 5 V power and should be considered when calculating the power budget. The relay configuration is illustrated in the following schematic.

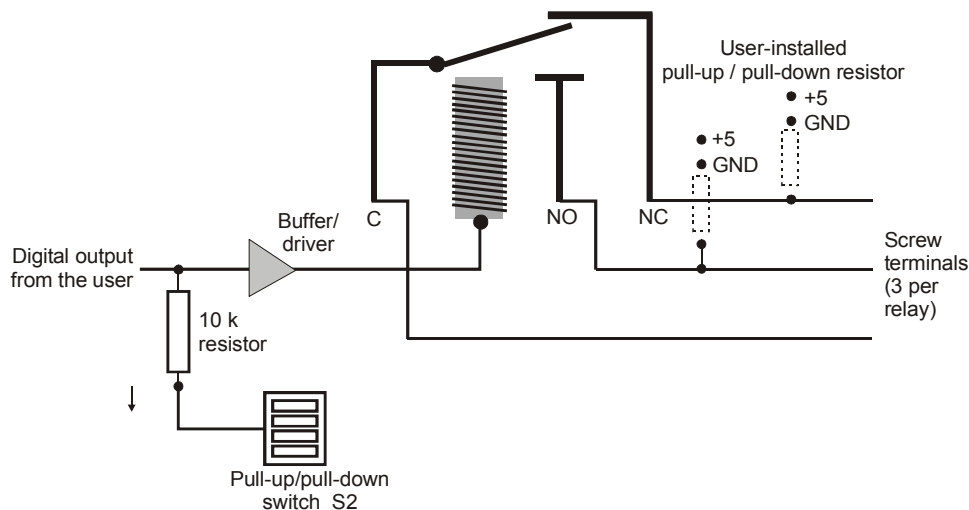


Figure 3-6. Relay configuration

The relay contacts associated that are with each relay location are listed in Table 3-4.

Table 3-4. Relay locations and associated contacts

R1, R3, R5, R7, R10, R12, R14, R16	Relays NO contact pull-up (to USB +5 V) / pull-down
R2, R4, R6, R8, R9, R11, R13, R15	Relays NC contact pull-up (to USB +5 V) / pull-down

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 3-7. For AC loads, install a metal oxide varistor (MOV).

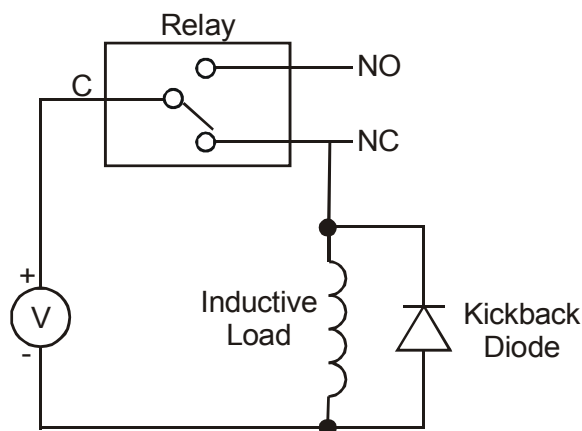


Figure 3-7. Relay contact protection circuit

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

Output specifications

Table 1. Output specifications

Number of relays		8
Relay configuration		2 banks of 4
Contact configuration		8 Form C (SPDT) Normally Open, Normally Closed and Common available at screw terminals
Contact rating		6 A @ 240 VAC or 28 VDC resistive
Contact resistance		100 milliohms max (initial value)
Operate time		10 milliseconds max
Release time		5 milliseconds max
Vibration		10 to 55 Hz (amplitude 1.5 mm)
Shock		10 G (11 milliseconds)
Dielectric isolation (between relay open contact)		300 VAC, 50/60 Hz (1 minute)
Dielectric isolation (between PCB output lines)		500VAC, 50/60 Hz (1 minute)
Life expectancy		10 million mechanical operations, min
Power on state	S2 = pull-up	Energized. NO in contact with Common
	S2 = pull-down	Not energized. NC in contact to Common
Relay control logic polarity		User-configurable per bank via switch S1 for invert or non-invert (default). Switch settings for polarity can be read back via software through the USB bus. Switch settings do not affect the power on condition. Non-invert mode: when "0" is written or read back via the USB bus, relays are not energized. Invert mode: when "0" is written or read back via the USB bus, relays are energized.
Pull-up / pull-down (controls relay power on state)		User-configurable per bank via switch S2 for pull-down (default) or pull-up. Switch settings can be read back via software. Pull-down will put the relays in non-energized mode on power up. Pull-up will put the relays in energized mode on power up.

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	10 mA max
External power supply (required)	MCC p/n CB-PWR-9	9 V $\pm$ 10% @ 1 A
Voltage supervisor limits - PWR LED	$V_{ext} < 6.0 \text{ V}$, $V_{ext} > 12.5 \text{ V}$	PWR LED = Off (power fault)
	$6.0 \text{ V} < V_{ext} < 12.5 \text{ V}$	PWR LED = On
External power consumption	All relays on, 100 mA downstream hub power	750 mA typ, 850 mA max
	All relays off, 100 mA downstream hub power	170 mA typ, 200 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 $\pm 10\%$, @ 1 A

Note 1: The USB-ERB08 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
Compatible cable(s) for daisy chain	C-MAPWR-x	x = 2, 3, or 6 feet

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 ensure the last module in the chain will receive at least 6.0 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
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.

Relay contact pull-up/down option

Table 6. Relay pull-up/pull-down specifications

R1, R3, R5, R7, R10, R12, R14, R16	Relays NO contact pull-up (to USB +5V) / pull-down
R2, R4, R6, R8, R9, R11, R13, R15	Relays NC contact pull-up (to USB +5V) / pull-down

Mechanical

Table 7. Mechanical specifications

Card dimensions	203.2 mm (L) x 121 mm (W) x 20.0 mm (H)
	8.0" (L) x 4.8" (W) x 0.8" (H)
Enclosure dimensions	241.3 mm (L) x 125.7 mm (W) x 58.9 mm (H)
	9.50" (L) x 4.95" (W) x 2.32" (H)

Environmental

Table 8. Environmental specifications

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

Main connector

Table 9. Main connector specifications

Connector type	Screw terminal
Wire gauge range	12 to 22 AWG

Screw terminal pin out

Table 10. Screw terminal pin out

Pin	Signal Name
1-NC	Relay 1 Normally Closed contact
1-C	Relay 1 Common contact
1-NO	Relay 1 Normally Open contact
2-NC	Relay 2 Normally Closed contact
2-C	Relay 2 Common contact
2-NO	Relay 2 Normally Open contact
3-NC	Relay 3 Normally Closed contact
3-C	Relay 3 Common contact
3-NO	Relay 3 Normally Open contact
4-NC	Relay 4 Normally Closed contact
4-C	Relay 4 Common contact
4-NO	Relay 4 Normally Open contact
5-NC	Relay 5 Normally Closed contact
5-C	Relay 5 Common contact
5-NO	Relay 5 Normally Open contact
6-NC	Relay 6 Normally Closed contact
6-C	Relay 6 Common contact
6-NO	Relay 6 Normally Open contact
7-NC	Relay 7 Normally Closed contact
7-C	Relay 7 Common contact
7-NO	Relay 7 Normally Open contact
8-NC	Relay 8 Normally Closed contact
8-C	Relay 8 Common contact
8-NO	Relay 8 Normally Open contact



Declaration of Conformity

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
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USA

Measurement Computing Corporation declares under sole responsibility that the product

USB-ERB08

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 A.
- IEC 1000-4-4 (1995): Electric Fast Transient Burst immunity Criteria B.
- IEC 1000-4-5 (1995): Surge immunity Criteria A.
- 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 April, 2005. Test records are outlined in Chomerics Test Report #EMI3931.04.

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

Carl Haapaoja, Director of Quality Assurance

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