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USB-ERB24

USB-based 24-Channel Electromechanical Relay Interface Device

User's Guide

June 2021. Rev 9
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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-ERB24 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 — **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text — *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-ERB24 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

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

Introducing the USB-ERB24

The USB-ERB24 is a USB 2.0 full-speed device that provides the following features:

- 24 single-pole double-throw (SPDT) Form C electromechanical relays directly controlled by digital I/O lines
- Supports configurations as two banks of eight and two banks of four
- Onboard switches to configure the logic polarity (active high or low) and power-on state for each relay group.
- Switch settings can be read back with software.
- Screw terminals for field wiring connections with three connections to each relay – normally open (NO), normally closed (NC), and common (C).
- USB out and power out connections support powering and controlling multiple MCC USB devices that support daisy-chaining 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-ERB24 is powered by an external 9 V regulated power supply that is shipped with the device.

USB-ERB24 block diagram

USB-ERB24 functions are illustrated in the block diagram shown here.

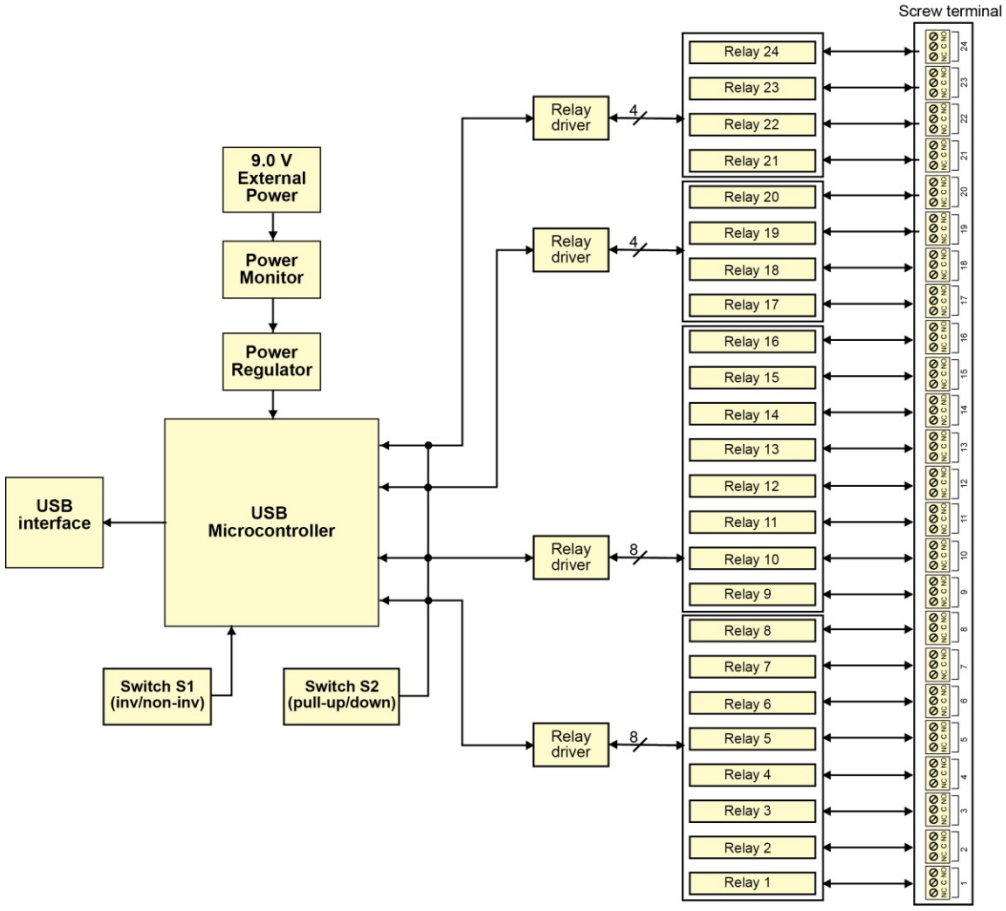


Figure 1. USB-ERB24 functional block diagram

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

Installing the USB-ERB24

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-ERB24 product page on our website for information about the available software.

Install the software before you install your device

The driver needed to run the USB-ERB24 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Configuring the hardware switches

The USB-ERB24 has banks of onboard switches that configure the relay logic polarity and relay power-up state. Configure these switches before you connect the external power supply to the USB-ERB24. Factory-configured default settings are listed in the table below. Refer to Figure 5 on page 9 for the location of each switch.

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 configures one relay group. The DIP switch labeled **A** configures relays 1 to 8, the switch labeled **B** configures relays 9 to 16, the switch labeled **CL** configures relays 17 to 20, and the switch labeled **CH** configures relays 21 to 24 (refer to Figure 2 below).

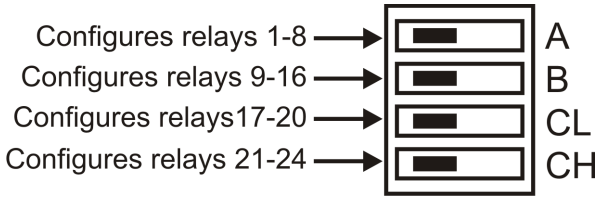


Figure 2. Typical board switch

Port A consists of relays 1 through 8, Port B consists of relays 9 through 16, Port CL consists of relays 17 through 20, and Port CH consists of relays 21 through 24.

Remove the device from the enclosure to access the onboard switches

To change the configuration of a switch, you must first remove the USB-ERB24 from the enclosure.

Relay control logic polarity switch (S1)

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 3.

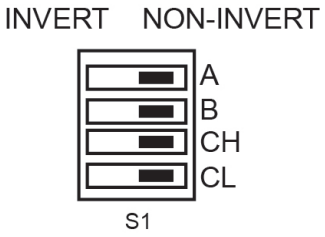


Figure 3. Relay logic polarity switch S1

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

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

Relay power-on state switch (S2)

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

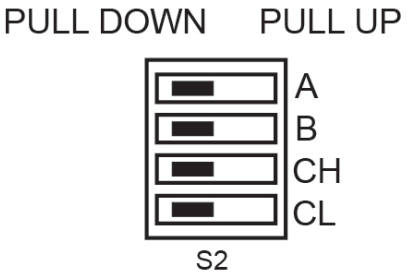


Figure 4. Resistor pull-up/down switch S2

- **PULL-UP**: the relays are put into an energized state at power-up, regardless of the state of switch S1
- **PULL-DOWN**: the relays are put into a non-energized state at power-up.

Connecting the external power supply

Power to the USB-ERB24 is provided with the 9 V, 3 A external power supply (CB PWR-9V3A). You must connect the external power supply *before* connecting the USB connector to the USB-ERB24.

To connect the power supply to your USB-ERB24, complete the following steps:

1. Connect the external power cord to the power connector labeled **POWER IN** on the USB-ERB24 enclosure (**PWR IN** on the board). Refer to Figure 5 for the location of this connector.
2. Plug the AC adapter into a power outlet.

The **PWR** LED turns on when 9 V power is supplied to the USB-ERB24. 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 board) is used to provide power to additional MCC USB devices. If you connect the external power supply to the **POWER OUT** connector, the USB-ERB24 does not receive power, and the **PWR** LED does not turn on.

Installing the hardware

To connect the USB-ERB24 to your system, complete the following steps.

1. Turn your computer on.
2. Connect the USB cable to the USB connector labeled **USB IN** on the USB-ERB24.
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.

The **USB** LED turns on. Refer to Figure 5 on page 9 for the location of the **USB** LED.

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

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 your system does not detect the USB-ERB24

If a *USB device not recognized* message displays when you connect the USB-ERB24, complete the following steps:

1. Unplug the USB cable from the USB-ERB24.
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-ERB24.

Your system should now properly detect the USB-ERB24.

Contact technical support if your system still does not detect the USB-ERB24.

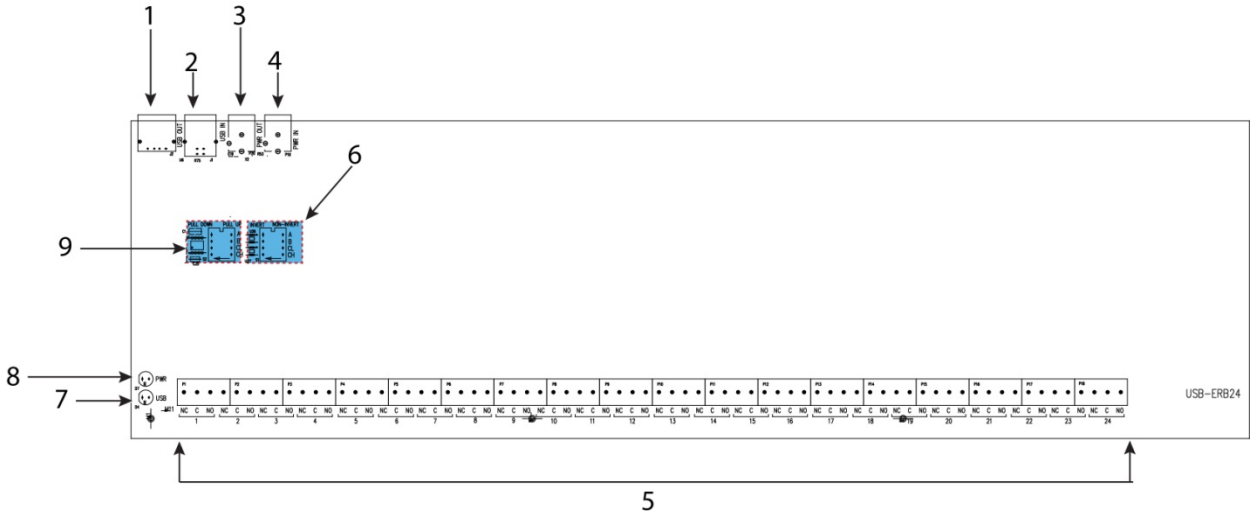
Caution! Do not disconnect any device from the USB bus while the computer is communicating with the USB-ERB24, or you may lose data and/or your ability to communicate with the USB-ERB24.

Functional Details

Components

The USB-ERB24 has the following internal components, as shown in Figure 5.

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



1	USB output connector (**USB OUT**)	6	Invert/non-invert switch (**S1**)
2	USB input connector (**USB IN**)	7	**USB** LED
3	Power output connector (**POWER OU**T	8	**PWR** LED
4	Power input connector (**POWER IN**)	9	Pull-up/down switch (**S2**)
5	Screw terminals		

Figure 5. USB-ERB24 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 G 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 "193773X-01L," where X is the board revision.

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 devices that support daisy chaining. 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 relays to the USB-ERB24* on page 13.

POWER IN connector

The USB-ERB24 requires between 6.0 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-9V3A).

POWER OUT connector

Use the **POWER OUT** connector to provide power to additional daisy chained MCC USB devices 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-ERB24 devices* on page 13 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-ERB24. It uses up to 5 mA of current and cannot be disabled. The table below explains the USB LED function.

USB LED Indications

USB LED	Indication
On	The USB-ERB24 is connected to a computer or external USB hub.
Blinking	Initial communication is established between the USB-ERB24 and the computer, or data is being transferred.

PWR LED

The USB-ERB24 incorporates an onboard 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. The table below explains the function of the PWR LED.

PWR LED Indications

PWR LED	Indication
On	External power is supplied to the USB-ERB24.
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 6).

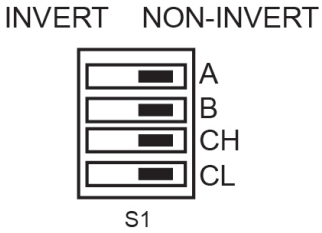


Figure 6. Switch S1 default configuration

The switch labeled **A** configures relays 1 through 8, the switch labeled **B** configures relays 9 through 16, the switch labeled **CH** configures relays 17 through 20, the switch labeled **CL** configures relays 21 through 24.

- **NON-INVERT**: When *0* is written or read back through the USB bus, the relays are not energized.
- **INVERT**: When *0* is written or read back through 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/down switch (S2)

The pull-up/down switch (S2) sets the power-on state of each relay bank. By default, switch S2 is configured for pull-down (relays are inactive at power-up – see Figure 7).

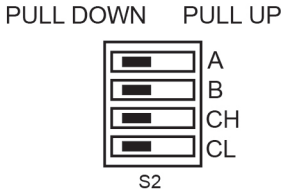


Figure 7. Switch S2 default configuration

The switch labeled **A** configures relays 1 through 8, the switch labeled **B** configures relays 9 through 16, the switch labeled **CH** configures relays 17 through 20, the switch labeled **CL** configures relays 21 through 24.

- **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 and relays

Connect external devices to the relay contacts using the USB-ERB24 set of 24 screw terminals. Each relay has a normally closed (NC), common (C), and normally open (NO) contact. Figure 8 shows the screw terminals on a typical relay channel.



Figure 8. 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-ERB24, 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 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 in.) long.

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 shown in Figure 9

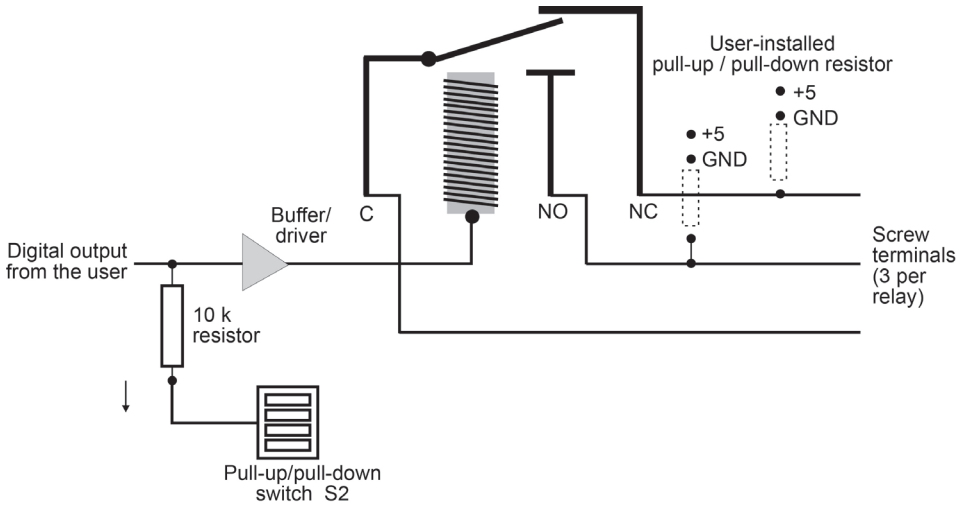


Figure 9. Relay configuration

The relay contacts associated that are with each relay location are listed in the table below.

Relay locations and associated contacts

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 NO contact pull-up (to USB +5 V) / pull-down, user installed.
R37, R40, R42,R44, R46, R48, R50, R52, R88, R90, R92, R94, R95, R97, R99, R101, R104, R106, R108, R110, R111, R113, R115, R117	Relays NC contact pull-up (to USB +5 V) / pull-down, user installed

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 10. For AC loads, install a metal oxide varistor (MOV).

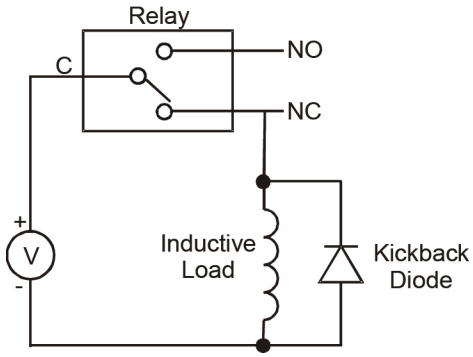


Figure 10. Relay contact protection circuit

Daisy chaining additional relays to the USB-ERB24

Daisy-chained USB-ERB24 devices connect to the USB bus through the high-speed hub on the USB-ERB24. 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.

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

Perform the following procedure to daisy chain multiple devices together.

- 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-ERB24 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.

1. Connect the **USB OUT** connector on the host device to the **USB IN** connector on the slave device.
2. 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-ERB24 devices

When daisy chaining the USB-ERB24 to other MCC USB devices, make sure that you provide adequate power to each device that you connect. The USB-ERB24 is powered with a 9 VDC nominal, 3.0 A external power supply.

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.

Specifications

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

Output specifications

Table 1. Output specifications

Number of relays		24
Relay configuration		2 banks of 8 and 2 banks of 4
Contact configuration		24 Form C (SPDT) Normally Open, Normally Closed and Common available at screw terminals
Contact rating		*5 A @ 240 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 (amplitude 1.5 mm)*
Shock		*10 G (11 ms)*
Dielectric isolation (between relay open contact)		*300 VAC, 50/60 Hz (1 minute)*
Dielectric isolation (between PCB output lines)		*500 VAC, 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		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)	CB PWR-9V3A	9 V ±10% @ 3 A
Voltage supervisor limits - PWR LED	$V_{ext} < 6.0$ V, $V_{ext} > 12.5$ 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	1.5 A typ, 1.8 A max
	All relays off, 100 mA downstream hub power	230 mA typ, 270 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 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 supply (included)	CB PWR-9V3A	+9 V ±10%, @ 3 A

Note 1: The USB-ERB24 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		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 MCC USB products 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 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 (hardware revision G and later are also compatible with USB 3.0; see Note 1 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 1: The board revision may be determined from the part number label on the housing that states "193773X-01L," where X is the board revision.

Relay contact pull-up/down option

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

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 NO contact pull-up (to USB +5 V) / pull-down, user installed.
R37, R40, R42, R44, R46, R48, R50, R52, R88, R90, R92, R94, R95, R97, R99, R101, R104, R106, R108, R110, R111, R113, R115, R117	Relays NC contact pull-up (to USB +5 V) / pull-down, user installed

Mechanical

Table 7. Mechanical specifications

Board dimensions (L × W × H)	431.8 × 121 × 20.3 mm (17.0 × 4.8 × 0.8 in.)
Enclosure dimensions (L × W × H)	482.6 × 125.7 × 58.9 mm (19.00 × 4.95 × 2.32 in.)

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 pinout

Table 10. Screw terminal pinout

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
9-NC	Relay 9 Normally Closed contact
9-C	Relay 9 Common contact
9-NO	Relay 9 Normally Open contact
10-NC	Relay 10 Normally Closed contact
10-C	Relay 10 Common contact
10-NO	Relay 10 Normally Open contact
11-NC	Relay 11 Normally Closed contact
11-C	Relay 11 Common contact
11-NO	Relay 11 Normally Open contact
12-NC	Relay 12 Normally Closed contact
12-C	Relay 12 Common contact
12-NO	Relay 12 Normally Open contact
13-NC	Relay 13 Normally Closed contact
13-C	Relay 13 Common contact
13-NO	Relay 13 Normally Open contact
14-NC	Relay 14 Normally Closed contact
14-C	Relay 14 Common contact
14-NO	Relay 14 Normally Open contact
15-NC	Relay 15 Normally Closed contact
15-C	Relay 15 Common contact
15-NO	Relay 15 Normally Open contact
16-NC	Relay 16 Normally Closed contact
16-C	Relay 16 Common contact
16-NO	Relay 16 Normally Open contact
17-NC	Relay 17 Normally Closed contact
17-C	Relay 17 Common contact
17-NO	Relay 17 Normally Open contact
18-NC	Relay 18 Normally Closed contact
18-C	Relay 18 Common contact

Pin	Signal Name
18-NO	Relay 18 Normally Open contact
19-NC	Relay 19 Normally Closed contact
19-C	Relay 19 Common contact
19-NO	Relay 19 Normally Open contact
20-NC	Relay 20 Normally Closed contact
20-C	Relay 20 Common contact
20-NO	Relay 20 Normally Open contact
21-NC	Relay 21 Normally Closed contact
21-C	Relay 21 Common contact
21-NO	Relay 21 Normally Open contact
22-NC	Relay 22 Normally Closed contact
22-C	Relay 22 Common contact
22-NO	Relay 22 Normally Open contact
23-NC	Relay 23 Normally Closed contact
23-C	Relay 23 Common contact
23-NO	Relay 23 Normally Open contact
24-NC	Relay 24 Normally Closed contact
24-C	Relay 24 Common contact
24-NO	Relay 24 Normally Open contact

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-ERB24

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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