

# **USB-7202**

Analog and Digital I/O

## **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 describes the Measurement Computing USB-7202 data acquisition device and lists device specifications.

### 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.

**bold text**      **Bold** text is used for the names of objects on the 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 the USB-7202 is available on our website at [www.mccdaq.com](http://www.mccdaq.com). You can also contact Measurement Computing Corporation by phone, fax, or email with specific questions.

- 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](mailto:techsupport@mccdaq.com)

## Introducing the USB-7202

This user's guide contains all of the information you need to connect the USB-7202 to your computer and to the signals you want to measure.

The USB-7202 is a USB 2.0 full-speed device that is supported under the following operating systems:

- Microsoft Windows 7/Vista/XP (32-bit or 64-bit)
- Microsoft Windows CE
- Macintosh (32-bit or 64-bit)
- Linux (32-bit or 64-bit)

The USB-7202 is compatible with both USB 1.1 and USB 2.0 ports.

The USB-7202 has one A/D converter per channel and provides true simultaneous sampling of up to eight channels of 16-bit single-ended analog input. The range of each channel is independently configurable via software. Eight digital IO lines are independently selectable as input or output. A 32-bit counter is capable of counting TTL pulses. The USB-7202 is powered by the +5 volt USB supply from your computer, and requires no external power.

A SYNC (synchronization) option allows you to synchronize two USB-7202 modules together to acquire data synchronously from 16 analog inputs.

The USB-7202 is shown in Figure 1.

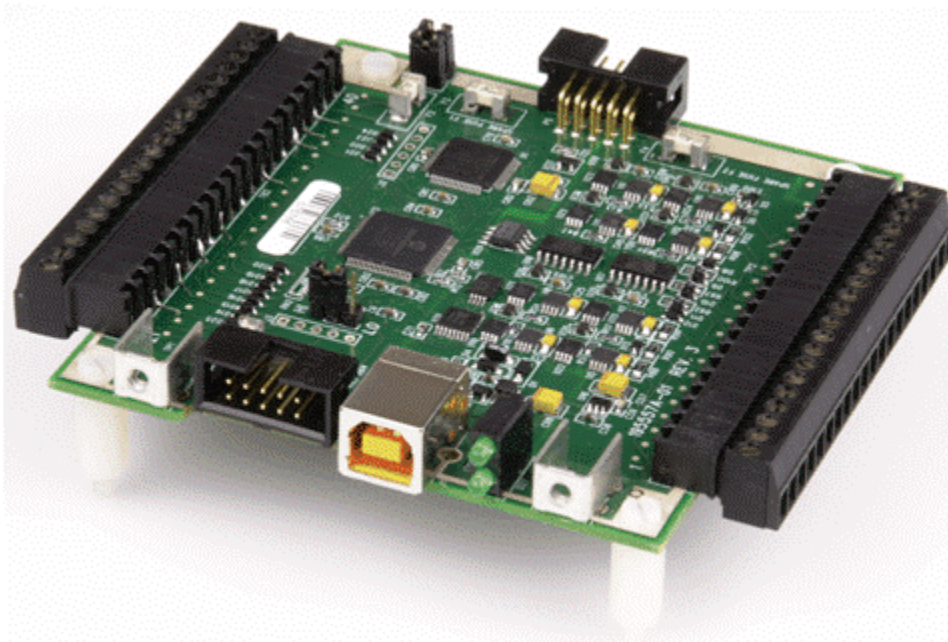


Figure 1. USB-7202

## USB-7202 block diagram

USB-7202 functions are illustrated in the block diagram shown here.

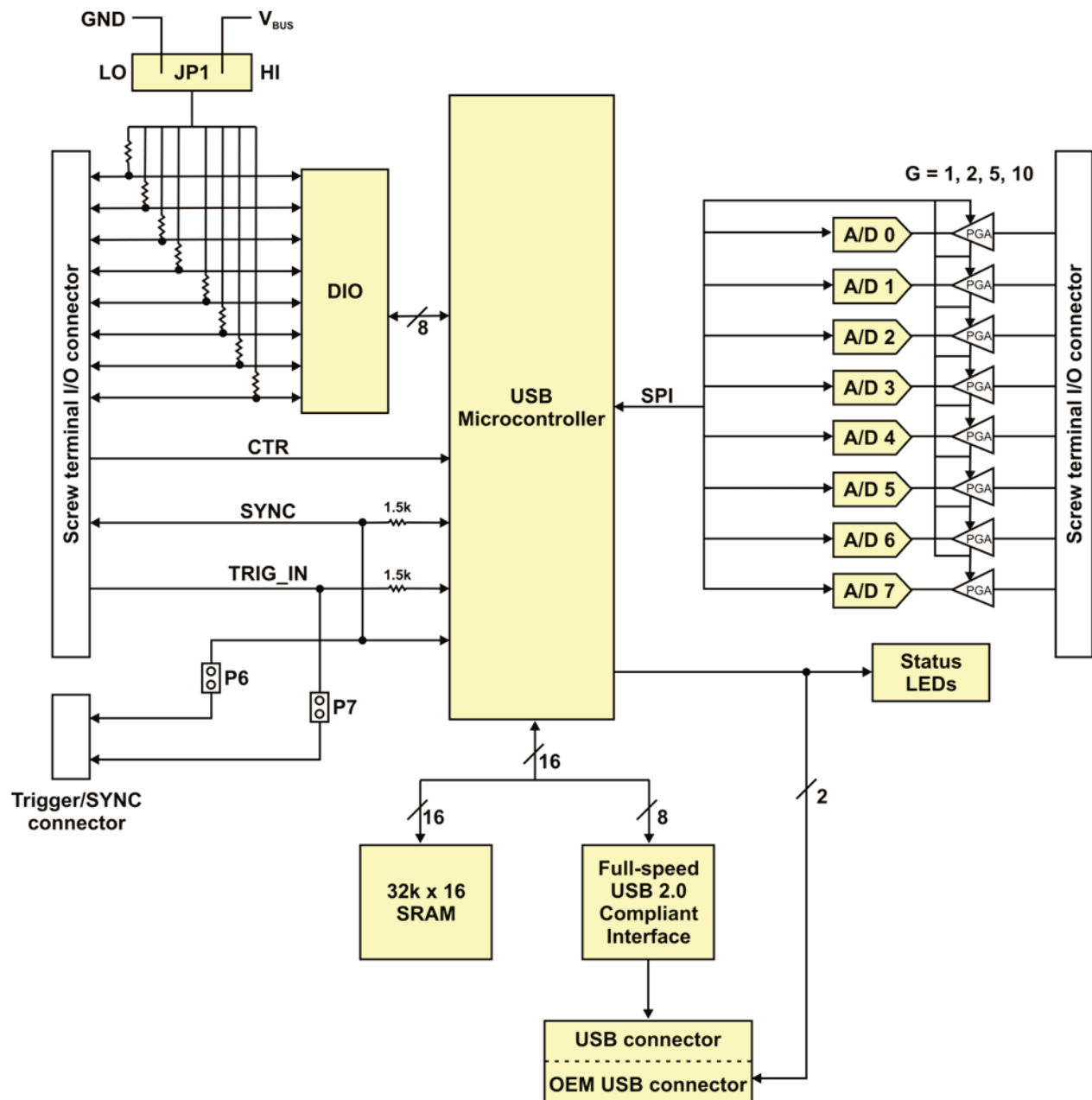


Figure 2. USB-7202 functional block diagram

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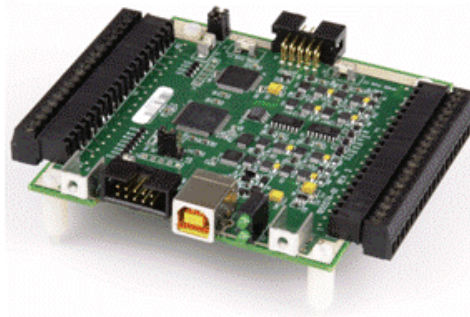
## Installing the USB-7202

### What comes with your USB-7202 shipment?

The following items are shipped with the USB-7202.

#### Hardware

- USB-7202



- USB cable (2 meter length)



#### Optional hardware

- OEM connector cable

#### Documentation

##### MCC DAQ Quick Start Guide

The Quick Start Guide booklet provides an overview of the MCC DAQ software you received with the device, and includes information about installing the software. Please read this booklet completely before installing any software or hardware.

##### Insert

The operating systems that are supported by the device are listed on the insert, and includes the internet location where you can download DAQFlex software, and the locations where you can learn more about DAQFlex software and MCC DAQ software.

## Unpacking the USB-7202

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the USB-7202 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 any components are missing or damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail:

- 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](mailto:techsupport@mccdaq.com)



## Installing the software

**Note:** Before installing the USB-7202 hardware, you must install the software you plan to use with the device.

The USB-7202 is supported by DAQFlex software and Universal Library software. You can install both software packages on your computer.

### DAQFlex

Install DAQFlex software when you want to develop data acquisition applications that can be deployed across multiple operating systems and custom embedded systems.

DAQFlex software for each supported operating system is available from the DAQFlex download page at [www.mccdaq.com/DAQFlexDL](http://www.mccdaq.com/DAQFlexDL). Refer to the *DAQFlex Software User's Guide* at [www.mccdaq.com/pdfs/manuals/DAQFlex%20Software.pdf](http://www.mccdaq.com/pdfs/manuals/DAQFlex%20Software.pdf) for instructions about installing DAQFlex software.

### Universal Library and InstaCal

Install Universal Library and InstaCal when you want to develop data acquisition applications using Windows programming languages.

Universal Library and InstaCal software are included on the CD that ships with the device. Refer to the *Quick Start Guide* booklet for instructions about installing Universal Library and InstaCal software.

## Installing the hardware

### Install the software before you install your device

A driver needed to run the USB-7202 is installed when you install the software. Therefore, you need to install the software package you plan to use before you install the hardware.

For operation on a Windows operating system, we recommend that you run Windows Update to update your operating system with the latest USB drivers.

There are two ways to connect the USB-7202 to your system:

- Connect a USB cable from the **USB** connector to either a USB port on the computer or to an external USB hub connected to the computer. No external power is required.

or

- Use a 2.54 mm (0.1 in.) box header to connect with the OEM connector. The connector pinout is shown here:

| Pin | Signal Name                               | Pin | Signal Name |
|-----|---|-----|-------------|
| 1   | N/C                                       | 2   | VBUS        |
| 3   | N/C                                       | 4   | D-          |
| 5   | N/C (do not connect anything to this pin) | 6   | D+          |
| 7   | N/C (do not connect anything to this pin) | 8   | GND         |
| 9   | N/C (do not connect anything to this pin) | 10  | SHIELD      |

When you connect the USB-7202 for the first time on a computer running Windows, a **Found New Hardware** message opens as the device is detected. The installation is complete when the message closes.

After the USB-7202 is installed, the **Power** LED remains on to indicate that communication is established between the USB-7202 and your computer.

**Caution!** Do not disconnect **any** device from the USB bus while the computer is communicating with the USB-7202, or you may lose data and/or your ability to communicate with the USB-7202.

### If the Power LED turns off

If the **Power** LED is on but then turns off, the computer has lost communication with the USB-7202. To restore communication, disconnect the USB cable from the computer, and then reconnect it. This should restore communication, and the **Power** LED should turn on.

## Programming and developing applications

You can program and develop applications for the USB-7202 using MCC DAQ software and DAQFlex software. OEM users can create a custom driver for use with the message-based firmware to interface with the device.

- Refer to the *Quick Start Guide* for information about the Universal Library and InstaCal.
- Refer to the [DAQFlex Software User's Guide](#) for information about DAQFlex software.
- Refer to the [Message-based Firmware Specification](#) for information about the message-based firmware.

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## Functional Details

### Analog input acquisition modes

The USB-7202 can acquire analog input data in software paced, continuous scan, and burst scan modes.

#### Software paced mode

You can acquire one analog sample at a time in software paced mode. You initiate the A/D conversion by calling a software command. The analog value is converted to digital data and returned to the computer. You can repeat this procedure for each channel desired until you have the total number of samples that you want from each channel.

The maximum throughput sample rate in software paced mode is about 250 S/s, but may vary depending on your system. You may receive `OVERRUN` errors at higher rates on some platforms. Using the `BURSTIO` mode should resolve these problems.

#### Continuous scan mode

You can acquire data from up to eight channels simultaneously in continuous scan mode. The analog data is continuously acquired and converted to digital values until you stop the scan. Data is transferred in blocks of up to 32 samples from the USB-7202 to the memory buffer on your computer.

The maximum sampling rate is an aggregate rate, where the total sample rate for all channels is 100 kS/s divided by the number of channels, with a maximum rate of 50 kS/s for any channel. Using this equation, you can acquire data with the USB-7202 from one channel at 50 kS/s, two channels at 50 kS/s each, four channels at 25 kS/s each, and so on, up to eight channels at 12.5 kS/s each. You can start a continuous scan with either a software command or with an external hardware trigger event.

#### BURSTIO scan mode

In `BURSTIO` scan mode, you can acquire data with the USB-7202 using the full capacity of its 32K sample FIFO. The acquired data is then read from the FIFO and transferred to a user memory buffer on the computer. You can initiate a single acquisition sequence for any number of input channels by either a software command or an external hardware trigger.

Burst scans are limited to the depth of the on-board memory, as the data is acquired at a rate faster than it can be transferred to the computer. The maximum sampling rate is an aggregate rate, where the total acquisition rate for all channels is 200 kS/s divided by the number of channels. The maximum rate for each channel is 50 kS/s. The maximum rate that you can acquire data using burst scan mode is 50 kS/s per channel for one, two, or four channels, and 25 kS/s per channel for 8 channels.

## Components

The USB-7202 components are shown in Figure 3.

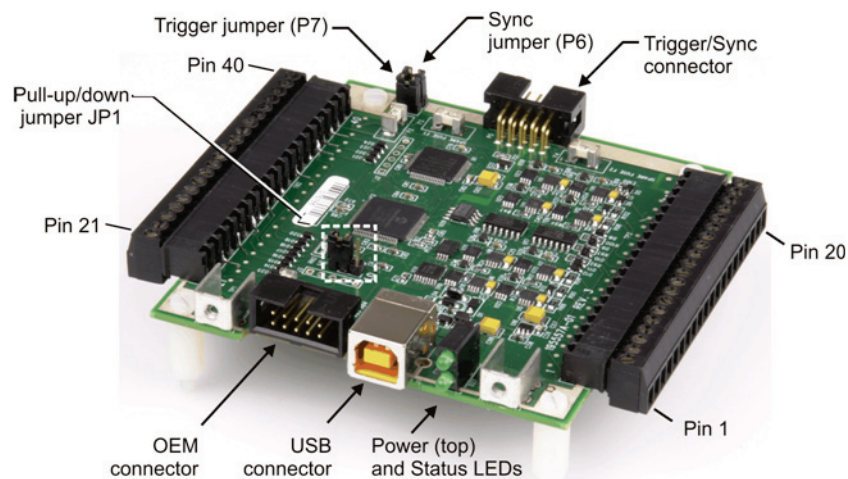


Figure 3. USB-7202 components

### USB connector

The USB connector provides +5 V power and communication. The voltage supplied through the USB connector is system-dependent, and may be less than 5 V. No external power supply is required.

This connector operates in parallel with the OEM connector — do not connect to both the USB connector and the OEM connector.

### OEM connector

The OEM connector operates in parallel with the USB connector — do not connect to both the USB connector and the OEM connector.

The OEM connector is a 0.1" box header. Pins 2, 4, 6, 8, and 10 provide a USB connection, as listed in the connector pinout below:

OEM connector pinout

| Pin | Signal Name                               | Pin | Signal Name |
|-----|---|-----|-------------|
| 1   | N/C                                       | 2   | VBUS        |
| 3   | N/C                                       | 4   | D-          |
| 5   | N/C (do not connect anything to this pin) | 6   | D+          |
| 7   | N/C (do not connect anything to this pin) | 8   | GND         |
| 9   | N/C (do not connect anything to this pin) | 10  | SHIELD      |

#### Modifications are required in order to use the OEM connector

We recommend that you return the device to the factory for this modification.

Should you have the capabilities to perform the modifications, the following change is required: in order to create a USB connection via the OEM connector, locations R30 and R36 must be populated. We recommend that you populate with 0603 size 0  $\Omega$  resistors or provide solder bridges to close the gaps.

### Trigger/Sync connector

The Trigger/Sync connector provides two signals — **SYNC** and **TRIG\_IN**. These signals are also available on the screw terminal (see page 15 for details about these signals).

Trigger/Sync connector pinout

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1   | TRIG_IN     | 2   | GND         |
| 3   | N/C         | 4   | GND         |
| 5   | SYNC        | 6   | GND         |
| 7   | N/C         | 8   | GND         |
| 9   | N/C         | 10  | N/CD        |

Use a 0.1" box header when making connections to the Trigger/Sync connector.

The Trigger/Sync connector internally connects its SYNC and TRIG\_IN pins to the screw terminal via jumpers **P6** and **P7**.

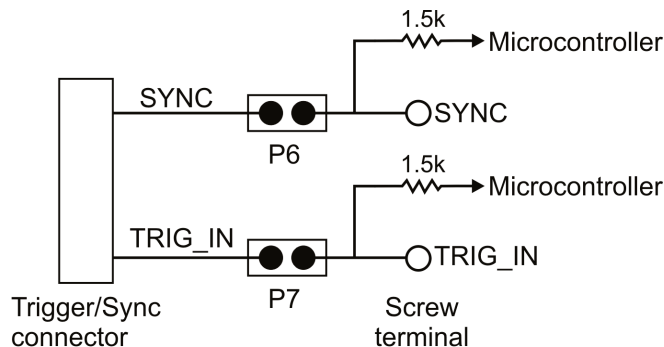


Figure 4. Jumper P6 and P7 schematic

### Sync jumper (P6)

The Sync jumper internally connects the SYNC pin on the Trigger/Sync connector to the SYNC pin on the screw terminal. Remove this jumper on boards that will not send/receive the SYNC signal through the SYNC/TRIG connector. Refer to Figure 3 on page 12 for the location of this jumper.

### Trigger jumper (P7)

The Trigger jumper internally connects the TRIG\_IN pin on the Trigger/Sync connector to the TRIG\_IN pin on the screw terminal. Remove this jumper on boards that will not send/receive the TRIG signal through the SYNC/TRIG connector. Refer to Figure 3 on page 12 for the location of this jumper.

## LED indicators

The USB-7202 has LEDs for power and communication status. See Figure 3 for the location of each LED.

| LED type | Indication   |
|----------|--|
| Power    | Steady green: The device's microcontroller is connected to a computer or external USB hub. |
| Status   | Blinking green: data is being transferred over the USB bus.                                |

## Screw terminals

The device's two screw terminal blocks each provide 20 pins. Screw terminal pins 1 to 20 provide the following connections:

- Analog input connections **CH0 IN** to **CH7 IN**
- Analog ground connections (**AGND**)

Screw terminal pins 21 to 40 provide the following connections:

- Digital I/O connections (**DIO0** to **DIO7**)
- External trigger source (**TRIG\_IN**)
- External event counter connection (**CTR**)
- Power connection (**+5V<sub>USER</sub>**)
- SYNC terminal for external clocking and multi-unit synchronization (**SYNC**)
- Ground connections (**GND**)

## Signal connections

Use 16 AWG to 30 AWG when making screw terminal connections. The pinout for each screw terminal is shown in Figure 5.

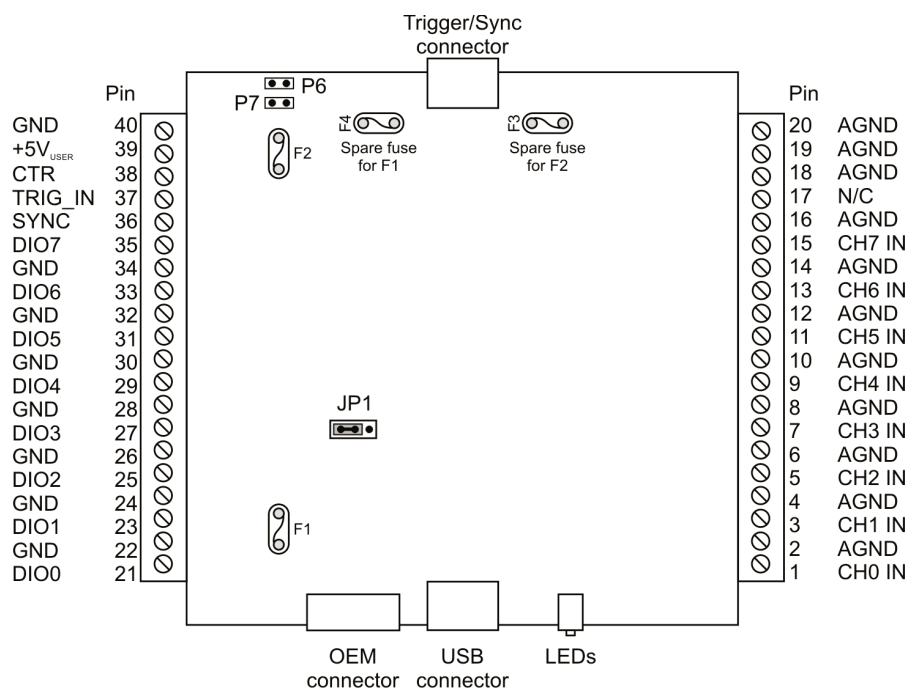


Figure 5. USB-7202 pin orientation

## Analog input

You can connect up to eight analog input connections to the screw terminal containing pins 1 to 20 (**CH0 IN** through **CH7 IN**.) Connect unused analog input terminals to ground terminals during operation.

### Input configuration

All of the analog input channels are configured for single-ended input mode. Each analog signal is referenced to signal ground (AGND), and requires two wires:

- The wire carrying the signal to be measured connects to CH# IN.
- The second wire connects to AGND.

The input voltage ranges are  $\pm 10$  V,  $\pm 5$  V,  $\pm 2.0$  V,  $\pm 1.0$  V.

## Digital I/O

The USB-7202 provides eight DIO bits on the screw terminal containing pins 21 to 40 (**DIO0** to **DIO7**). Each digital bit is configurable as either input or output.

### Pull up/down configuration

The digital pins are configurable via jumper **JP1** for pull-up to USB +5 V (HI) or pull-down to ground (LO). On power up and reset the DIO pins are driven high.

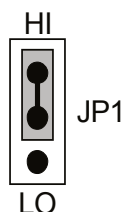


Figure 6. Jumper JP1 configuration

When configured for input, the digital I/O terminals can be used to detect the state of any TTL-level input.

**For more information on signal connections**

For general information regarding digital signal connections and digital I/O techniques, refer to the *Guide to Signal Connections* (available on our web site at [www.mccdaq.com/signals/signals.pdf](http://www.mccdaq.com/signals/signals.pdf)).

## SYNC I/O

The **SYNC** connection is a bidirectional I/O signal that can be configured as an input (default) or an output.

- Configure as an external clock input to pace the A/D conversions from an external source. The SYNC terminal supports TTL-level input signals of up to 50 kHz.
- Configure as an output that may be used to pace conversions on a second USB-7202.

The SYNC pin on the screw terminal is internally connected to the SYNC pin on the Trigger/Sync connector (see page 12).

## Trigger input

The digital trigger input (**TRIG\_IN**) lets you start an acquisition when a signal's rising or falling edge is detected. This pin is internally connected to the TRIG\_IN pin on the Trigger/Sync connector (see page 12).

## Counter input

The **CTR** connection is a TTL-level input to a 32-bit event counter. The internal counter increments when the TTL level transitions from low to high. The counter can count frequencies of up to 1 MHz.

## Power output

The **+5V<sub>USER</sub>** connection is a 5 volt output that is supplied by the host computer.

**Caution!** Do not connect to an external power supply to this terminal or you may damage the USB-7202 and possibly the computer.

The maximum total output current that can be drawn from all USB-7202 connections (power, analog, and digital outputs) is 500 mA. This maximum applies to most personal computers and self-powered USB hubs. Bus-powered hubs and notebook computers may limit the maximum available output current to 100 mA.

The USB-7202 alone draws 150 mA of current from the USB +5 V supply. Once you start running applications with the USB-7202, each DIO bit can draw up to 2.5 mA. The maximum amount of +5 V current available for experimental use, over and above that required by the USB-7202, is the difference between the *total current requirement* of the USB-7202 (based on the application) and the *allowed current draw* of the computer platform (500 mA for desktop computers and self-powered hubs). It shall not exceed 375 mA, based on the Slo-Blo Fuse current rating connected to the +5V terminal.

With all outputs at their maximum output current, you can calculate the total current requirement of the USB-7202 USB +5 V as follows:

$$(\text{USB-7202 @ 150 mA}) + (8 \text{ DIO @ 2.5 mA ea}) = 170 \text{ mA}$$

For an application running on a computer or powered hub, the maximum available excess current is  $500 \text{ mA} - 170 \text{ mA} = 330 \text{ mA}$ . This number is the total maximum available current at the **+5V<sub>USER</sub>** screw terminal. Measurement Computing highly recommends that you figure in a safety factor of 20% below this maximum current loading for your applications. A conservative, safe user maximum in this case would be in the 250 mA to 300 mA range.

Since some laptop computers running on battery power only allow up to 100 mA, the USB-7202 may be above that allowed by the computer. In this case, you must either purchase a self-powered hub or operate the laptop computer from an external power adapter.

## Ground

The analog ground (**AGND**) terminals provide a common ground for all analog channels.

The digital ground (**GND**) terminals provide a common ground for the digital, trigger, counter, and sync channels and the power terminal.

## Accuracy

The overall accuracy of any instrument is limited by the error components within the system. Quite often, resolution is incorrectly used to quantify the performance of a measurement product. While "16-bits" or "1 part in 65,536" does indicate what can be resolved, it provides little insight into the quality, or accuracy, of an absolute measurement. Accuracy specifications describe the actual measurement that can be relied upon with a USB-7202.

There are three types of errors which affect the accuracy of a measurement system:

- offset
- gain
- nonlinearity

The primary error sources in the USB-7202 are offset and gain. Nonlinearity is small in the USB-7202, and is not significant as an error source with respect to offset and gain.

Figure 7 shows an ideal, error-free, USB-7202 transfer function. The typical calibrated accuracy of the USB-7202 is range-dependent, as explained in the *Specifications* chapter on page 20. We use a  $\pm 10$  V range as an example of what you can expect when performing a measurement in this range.

**The accuracy plots in Figure 7 are drawn for clarity and are not drawn to scale.**

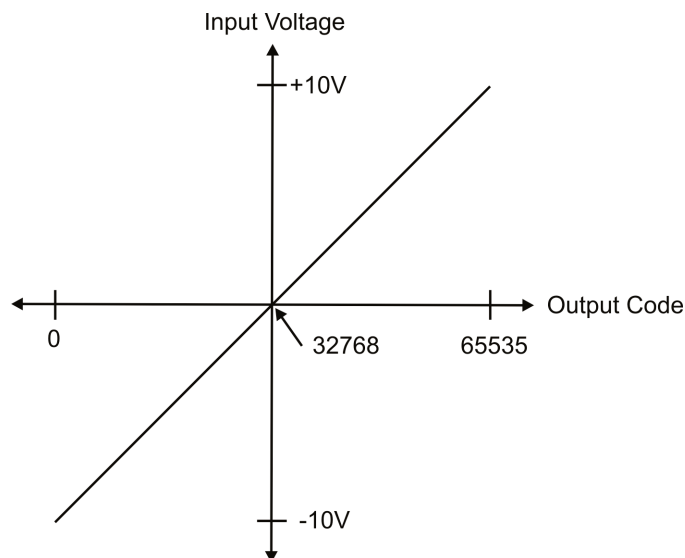


Figure 7. Ideal ADC transfer function

The USB-7202 offset error is measured at mid-scale. Ideally, a zero volt input should produce an output code of 32,768. Any deviation from this is an offset error. Figure 8 shows the USB-7202 transfer function with an offset error. The typical offset error specification for the USB-7202 on the  $\pm 10$  V range is  $\pm 1.66$  mV. Offset error affects all codes equally by shifting the entire transfer function up or down along the input voltage axis.



The accuracy plots in Figure 8 are drawn for clarity and are not drawn to scale.

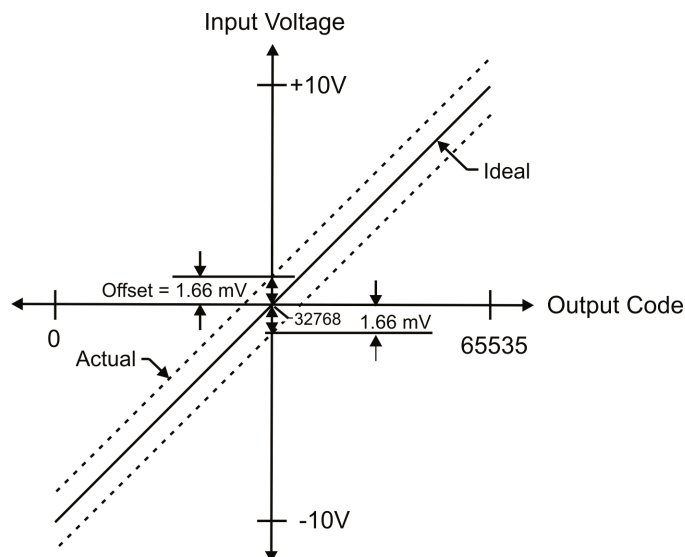


Figure 8. ADC transfer function with offset error

Gain error is a change in the slope of the transfer function from the ideal, and is typically expressed as a percentage of full-scale. Figure 9 shows the USB-7202 transfer function with gain error. Gain error is easily converted to voltage by multiplying the full-scale input ( $\pm 10$  V) by the error.

The accuracy plots in Figure 9 are drawn for clarity and are not drawn to scale.

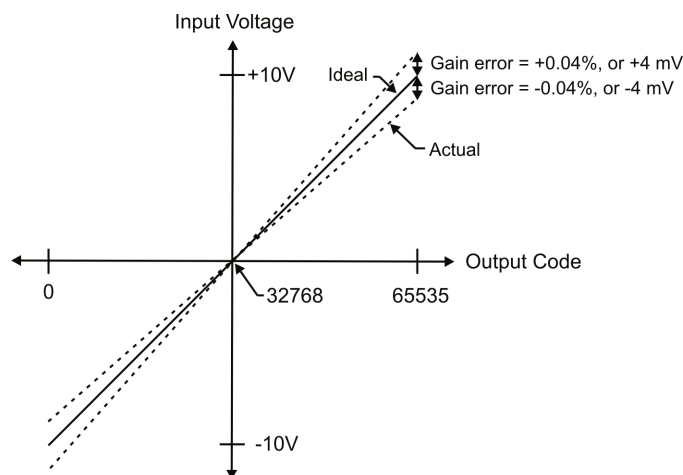


Figure 9. ADC Transfer function with gain error

For example, the USB-7202 exhibits a typical calibrated gain error of  $\pm 0.04\%$  on all ranges. For the  $\pm 10$  V range, this would yield  $10 \text{ V} \times \pm 0.0002 = \pm 4 \text{ mV}$ . This means that at full scale, neglecting the effect of offset for the moment, the measurement would be within 4 mV of the actual value. Note that gain error is expressed as a ratio. Values near  $\pm \text{FS}$  ( $\pm 10$  V) are more affected from an absolute voltage standpoint than are values near mid-scale, which see little or no voltage error.

Combining these two error sources in Figure 10, we have a plot of the error band of the USB-7202 at  $\pm$ full scale ( $\pm 10$  V). This plot is a graphical version of the typical accuracy specification of the product.

The accuracy plots in Figure 10 are drawn for clarity and are not drawn to scale.

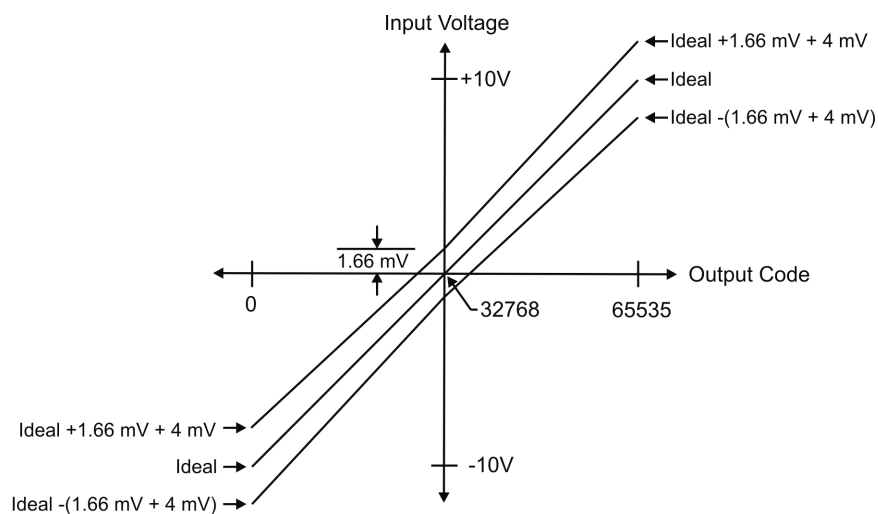


Figure 10. Error band plot

## Synchronized operations

You can connect the SYNC pin of two USB-7202 devices together in a master/slave configuration and acquire data from the analog inputs of both devices using one clock. When the SYNC pin is configured as an output, the internal A/D pacer clock signal is sent to the screw terminal. If jumper P6 is installed, you can output the clock to the SYNC pin of a second USB-7202 configured for A/D pacer input.

The SYNC pin is available on both the screw terminal connector and on the Trigger/SYNC connector (when jumper P6 is installed). Refer to page 15 for more information about the SYNC pin.

## Mechanical drawing

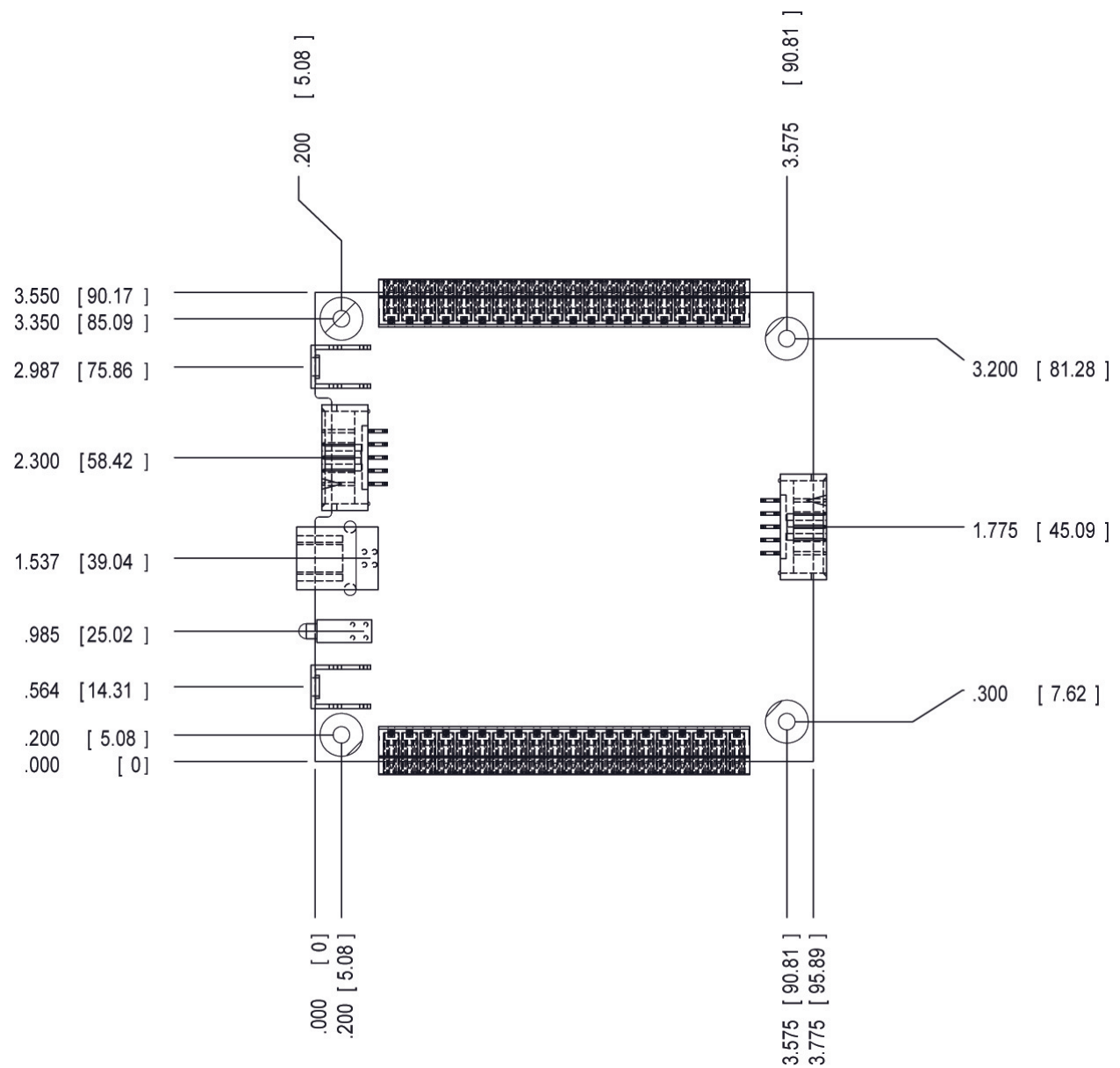


Figure 11. Circuit board dimensions

# Specifications

All specifications are subject to change without notice.

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

## Analog input

Table 1. Analog input specifications

| Parameter                             | Conditions                       | Specification   |
|---------------------------------------|----------------------------------|---|
| A/D converter type                    |                                  | 16-bit successive approximation type  |
| Number of channels                    |                                  | 8 single-ended  |
| Input configuration                   |                                  | Individual A/D per channel  |
| Sampling method                       |                                  | Simultaneous  |
| <i>Absolute maximum input voltage</i> | <i>CHx IN to GND</i>             | <i>±15 V max</i>  |
| Input impedance                       |                                  | 100 MOhm min  |
| Input ranges                          | Software-selectable              | ±10 V, ±5 V, ±2 V, ±1 V   |
| Sampling rate                         | Scan to system memory            | 0.6 S/s to 50 kS/s, software-selectable   |
|                                       | Burst scan to 32 k sample FIFO   | 20 S/s to 50 kS/s, software-selectable  |
| Throughput                            | Software paced                   | 500 S/s all channels, system-dependent  |
|                                       | Scan to system memory (Note 1)   | (100 kS/s) / (# of channels); maximum of 50 kS/s for any channel                              |
|                                       | BURSTIO scan to 32 k Sample FIFO | = (200 kS/s) / (# of channels), maximum of 50 kS/s for any channel                            |
| Resolution                            |                                  | 16 bits   |
| <i>No missing codes</i>               |                                  | <i>15 bits</i>  |
| Crosstalk                             | Signal DC–25 kHz                 | –80 dB  |
| Trigger source                        | Software-selectable              | External digital: TRIG_IN   |
| Calibration                           |                                  | Cal factors stored in firmware. Cal factors must be applied to data via application software. |

**Note 1:** Maximum throughput scanning to system memory is machine dependent.

Table 2. Calibrated absolute accuracy

| Range | Accuracy (mV) |
|-------|---------------|
| ±10 V | 5.66          |
| ±5 V  | 2.98          |
| ±2 V  | 1.31          |
| ±1 V  | 0.68          |

Table 3. Accuracy components - All values are (±)

| Range | % of Reading | Gain error at FS (mV) | Offset (mV) |
|-------|--------------|-----------------------|-------------|
| ±10 V | 0.04         | 4.00                  | 1.66        |
| ±5 V  | 0.04         | 2.00                  | 0.98        |
| ±2 V  | 0.04         | 0.80                  | 0.51        |
| ±1 V  | 0.04         | 0.40                  | 0.28        |

Table 4 summarizes the noise performance for the USB-7202. Noise distribution is determined by gathering 50 K samples with inputs tied to ground at the user connector. Samples are gathered at the maximum specified sampling rate of 50 kS/s.

Table 4. Noise performance

| Range | Typical counts | LSBrms |
|-------|----------------|--------|
| ±10 V | 10             | 1.52   |
| ±5 V  | 10             | 1.52   |
| ±2 V  | 11             | 1.67   |
| ±1 V  | 14             | 2.12   |

## Digital input/output

Table 5. Digital I/O specifications

| Parameter                           | Specification  |
|-------------------------------------|--|
| Digital type                        | CMOS   |
| Number of I/O                       | 8 (DIO0 through DIO7)  |
| Configuration                       | Independently configured for input or output                               |
| Pull-up/pull-down configuration     | All pins configurable via jumper (JP1) to Vs or Ground via 47 K resistors. |
| Input high voltage                  | 2.0 V min, 5.5 V absolute max  |
| Input low voltage                   | 0.8 V max, -0.5 V absolute min   |
| Output high voltage (IOH = -2.5 mA) | 3.8 V min  |
| Output low voltage (IOL = 2.5 mA)   | 0.7 V max  |
| Power on and reset state            | Input  |

## External trigger

Table 6. External trigger specifications

| Parameter               | Conditions          | Specification   |
|-------------------------|---------------------|---|
| Trigger source (Note 2) | External digital    | TRIG_IN   |
| Trigger mode            | Software-selectable | Edge sensitive: user configurable for CMOS compatible rising or falling edge. |
| Trigger latency         |                     | 10 $\mu$ s max  |
| Trigger pulse width     |                     | 1 $\mu$ s min   |
| Input high voltage      |                     | 4.0 V min, 5.5 V absolute max   |
| Input low voltage       |                     | 1.0 V max, -0.5 V absolute min  |
| Input leakage current   |                     | $\pm 1.0 \mu$ A   |

**Note 2:** TRIG\_IN is a Schmitt trigger input protected with a 1.5K Ohm series resistor.

## External clock input/output

Table 7. External clock I/O specifications

| Parameter                     | Conditions    | Specification                                  |
|-------------------------------|---------------|--|
| Pin name                      |               | SYNC   |
| Pin type                      |               | Bidirectional                                  |
| Software-selectable direction | Output        | Outputs internal A/D pacer clock.              |
|                               | Input         | Receives A/D pacer clock from external source. |
| Input clock rate              |               | 50 kHz, max                                    |
| Clock pulse width             | Input         | 1 $\mu$ s min                                  |
|                               | Output        | 5 $\mu$ s min                                  |
| <i>Input leakage current</i>  |               | $\pm 1.0\mu A$                                 |
| Input high voltage            |               | 4.0 V min, 5.5 V absolute max                  |
| Input low voltage             |               | 1.0 V max, -0.5 V absolute min                 |
| Output high voltage (Note 3)  | IOH = -2.5 mA | 3.3 V min                                      |
|                               | No load       | 3.8 V min                                      |
| Output low voltage (Note 3)   | IOL = 2.5 mA  | 1.1 V max                                      |
|                               | No load       | 0.6 V max                                      |

**Note 3:** SYNC is a Schmitt trigger input and is over-current protected with a 1.5 k $\Omega$  series resistor.

## Counter

Table 8. Counter specifications

| Parameter                         | Specification                  |
|-----------------------------------|--------------------------------|
| Pin name (Note 4)                 | CTR                            |
| Counter type                      | Event counter                  |
| Number of channels                | 1                              |
| Input type                        | TTL, rising edge triggered     |
| Input source                      | CTR screw terminal             |
| Resolution                        | 32 bits                        |
| <i>Schmitt trigger hysteresis</i> | 20 mV to 100 mV                |
| <i>Input leakage current</i>      | $\pm 1\mu A$                   |
| Input frequency                   | 1 MHz max                      |
| <i>High pulse width</i>           | 500 ns min                     |
| <i>Low pulse width</i>            | 500 ns min                     |
| Input high voltage                | 4.0 V min, 5.5 V absolute max  |
| Input low voltage                 | 1.0 V max, -0.5 V absolute min |

**Note 4:** CTR is a Schmitt trigger input protected with a 1.5 k $\Omega$  series resistor.

## Memory

Table 9. Memory specifications

| Parameter            | Specification                |               |                               |
|----------------------|------------------------------|---------------|-------------------------------|
| Data FIFO            | 32,768 samples, 65,536 bytes |               |                               |
| EEPROM               | 1,024 bytes                  |               |                               |
| EEPROM configuration | <b>Address range</b>         | <b>Access</b> | <b>Description</b>            |
|                      | 0x000-0x1FF                  | Reserved      | 512 bytes system and Cal data |
|                      | 0x200-0x3FF                  | Read/write    | 512 bytes user area           |

## Microcontroller

Table 10. Microcontroller specifications

| Parameter      | Specification                               |
|----------------|---|
| Type           | High performance 8-bit RISC microcontroller |
| Program memory | 32,768 words                                |
| Data memory    | 3,936 bytes                                 |

## Indicator LEDs

Table 11. Indicator LED specifications

| Parameter       | Specification  |
|-----------------|--|
| Power LED (top) | Indicates that the device's microcontroller has power and is configured. |
| Status LED      | Blinks to indicate USB communications.                                   |
| OEM power       | OEM Connector; LED sink current up to 5 mA per LED @ 5 V <sub>max</sub>  |

## Power

Table 12. Power specifications

| Parameter                                    | Conditions   | Specification         |
|--|--|-----------------------|
| Supply current                               | USB enumeration  | < 100 mA              |
|  | Continuous mode  | 150 mA (Note 5)       |
| +5V <sub>USER</sub> power available (Note 6) | <ul style="list-style-type: none"> <li>Connected to self-powered hub</li> <li>Connected to externally-powered root port hub</li> </ul> | 4.5 V min, 5.25 V max |
| Output current (Note 7)                      |  | 350 mA max            |
| Fuse F1, (F4 spare)                          | <a href="#">0452.500</a> - Littelfuse 0.5A NANO <sup>2</sup> ® Slo-Blo® Subminiature Surface Mount Fuse                                |                       |
| Fuse F2, (F3 spare)                          | <a href="#">0452.375</a> - Littelfuse 0.375A NANO <sup>2</sup> ® Slo-Blo® Subminiature Surface Mount Fuse                              |                       |

**Note 5:** This is the total current requirement for the USB-7202, which includes up to 10 mA for the status LED.

**Note 6:** "Self-powered hub" refers to a USB hub with an external power supply. Self-powered hubs allow a connected USB device to draw up to 500 mA. "Root port hubs" reside in the computer USB host Controller. The USB port(s) on your computer are root port hubs. All externally-powered root port hubs (desktop computers) provide up to 500 mA of current for a USB device. Battery-powered root port hubs provide 100 mA or 500 mA, depending upon the manufacturer. A laptop computer that is not connected to an external power adapter is an example of a battery-powered root port hub. If your laptop computer is constrained to the 100 mA maximum, you need to purchase a self-powered hub.

**Note 7:** This is the total amount of current that can be sourced from the +5V<sub>USER</sub> and digital outputs. Fuse for +5V terminal is rated at 375 mA.

## General

Table 13. General specifications

| Parameter   | Specification   |
|---|---|
| Device type   | USB 2.0 (full-speed)  |
| Device compatibility  | USB 1.1, USB 2.0  |
| DEFAULTS for programmable options and "DEV:RESET/DEFAULT" message | AInScan      Low channel = 0<br>High channel = 0<br>Samples = 1000<br>Rate = 1000<br>Range = $\pm 10$ V<br>Pacer = Disabled (Slave)<br>Transfer mode = BlockIO<br>Trigger = Disabled<br>Status = Idle |
|   | AITrig      Trigger polarity = Rising   |
|   | CTR      Value = 0  |
|   |   |

## Environmental

Table 14. Environmental specifications

| Parameter                   | Specification            |
|-----------------------------|--------------------------|
| Operating temperature range | 0 °C to 70 °C            |
| Storage temperature range   | –40 °C to 70 °C          |
| Humidity                    | 0% to 90% non-condensing |

## Mechanical

Table 15. Mechanical specifications

| Parameter              | Specification   |
|------------------------|---|
| Dimensions (L × W × H) | 90.17 × 95.25 × 12.70 mm (3.55 × 3.75 × 0.5 in.)<br>111.76 mm (4.40 in.) length with detachable screw terminals connected |
| USB cable length       | 3 m (9.84 ft) max   |
| User connection length | 3 m (9.84 ft) max   |



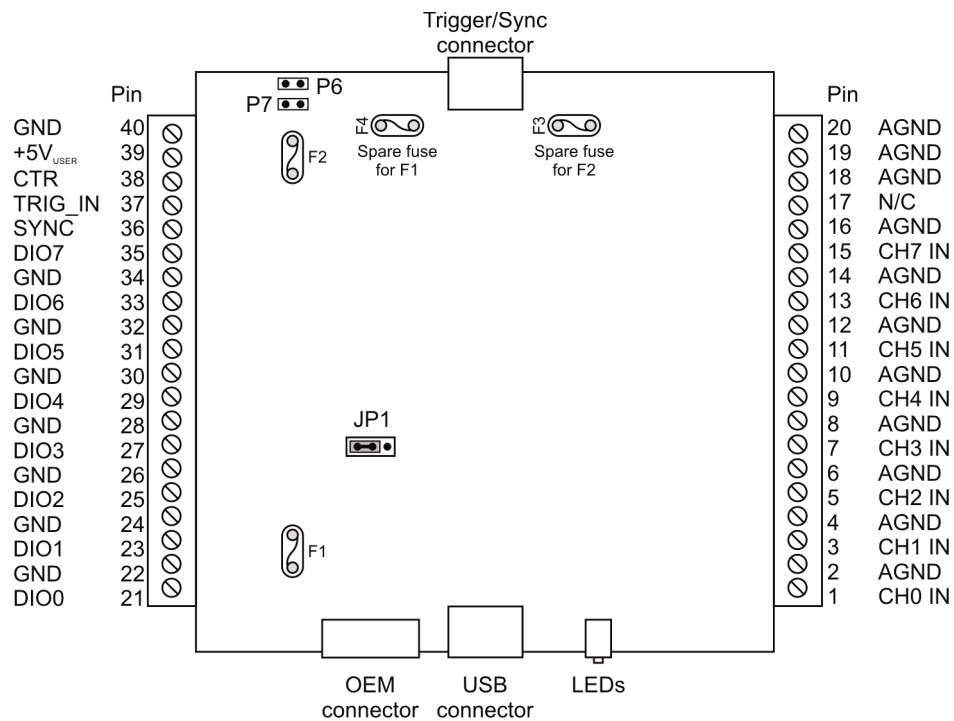
## Main connector and pinout

Table 16. Main connector specifications

| Parameter        | Specification             |
|------------------|---------------------------|
| Connector type   | Detachable screw terminal |
| Wire gauge range | 16 AWG to 30 AWG          |

Table 17. Main connector pinout

| Pin | Signal Name      | Pin | Signal Name         |
|-----|------------------|-----|---------------------|
| 1   | CH0 IN           | 21  | DIO0                |
| 2   | AGND             | 22  | GND                 |
| 3   | CH1 IN           | 23  | DIO1                |
| 4   | AGND             | 24  | GND                 |
| 5   | CH2 IN           | 25  | DIO2                |
| 6   | AGND             | 26  | GND                 |
| 7   | CH3 IN           | 27  | DIO3                |
| 8   | AGND             | 28  | GND                 |
| 9   | CH4 IN           | 29  | DIO4                |
| 10  | AGND             | 30  | GND                 |
| 11  | CH5 IN           | 31  | DIO5                |
| 12  | AGND             | 32  | GND                 |
| 13  | CH6 IN           | 33  | DIO6                |
| 14  | AGND             | 34  | GND                 |
| 15  | CH7 IN           | 35  | DIO7                |
| 16  | AGND             | 36  | SYNC                |
| 17  | N/C (no connect) | 37  | TRIG_IN             |
| 18  | AGND             | 38  | CTR                 |
| 19  | AGND             | 39  | +5V <sub>USER</sub> |
| 20  | AGND             | 40  | GND                 |



## OEM connector and pinout (P4)

Table 18. OEM connector specifications

| Parameter      | Specification                            |
|----------------|--|
| Connector type | 10 position 2.54 mm (0.1 in.) box header |

Table 19. OEM connector pinout

| Pin | Signal Name                               | Pin | Signal Name                       |
|-----|---|-----|-----------------------------------|
| 1   | N/C                                       | 2   | V <sub>BUS</sub> (fuse protected) |
| 3   | N/C                                       | 4   | D <sup>-</sup>                    |
| 5   | N/C (do not connect anything to this pin) | 6   | D <sup>+</sup>                    |
| 7   | N/C (do not connect anything to this pin) | 8   | GND                               |
| 9   | N/C (do not connect anything to this pin) | 10  | SHIELD                            |

## Trigger/Sync connector and pinout (P5)

Table 20. Trigger/Sync connector specifications

| Parameter      | Specification                            |
|----------------|--|
| Connector type | 10 position 2.54 mm (0.1 in.) box header |

Table 21. Trigger/Sync connector pinout

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1   | TRIG_IN     | 2   | GND         |
| 3   | N/C         | 4   | GND         |
| 5   | SYNC        | 6   | GND         |
| 7   | N/C         | 8   | GND         |
| 9   | N/C         | 10  | N/C         |

# CE Declaration of Conformity

Manufacturer: Measurement Computing Corporation  
Address: 10 Commerce Way  
Suite 1008  
Norton, MA 02766  
USA  
Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

## USB-7202

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

EC EMC Directive 2004/108/EC: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class A
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class A

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.

To maintain compliance to the standards of this declaration, the following conditions must be met.

- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer or embedded system must be properly grounded.
- The equipment must be assembled in a properly shielded enclosure that provides ESD protection.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in May, 2004. Test records are outlined in Chomerics Test Report #EMI3876.04. Further testing was conducted by Chomerics Test Services, Woburn, MA. 01801, USA in December, 2008. Test records are outlined in Chomerics Test report #EMI5215B.08.

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



Carl Haapaoja, Director of Quality Assurance

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