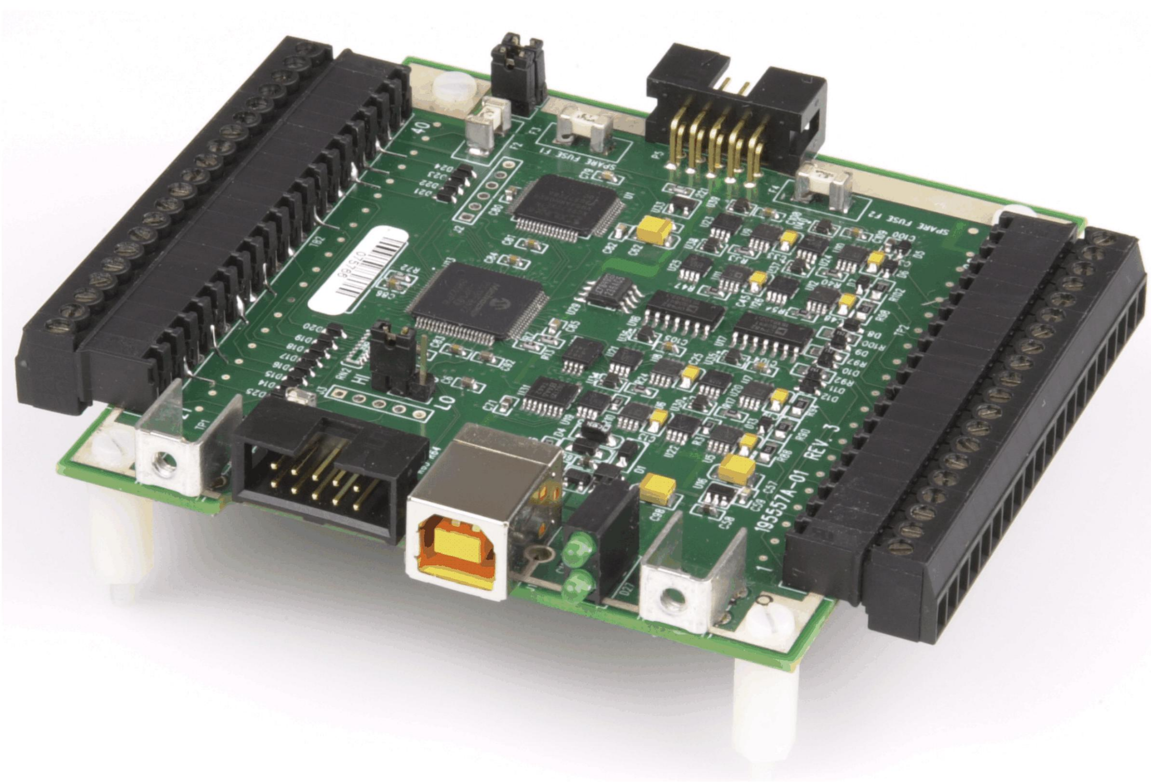
USB-7202

USB-based Analog and Digital I/O

User's Guide



MEASUREMENT COMPUTING™

USB-7202

USB-based Analog and Digital I/O Board

User's Guide

Document Revision 5, March, 2011

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Table of Contents

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-7202 so that you get the most out of its USB data acquisition 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.

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.

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 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 a USB 2.0 full-speed device. It is designed for USB 1.1 ports, and was tested for full compatibility with both USB 1.1 and USB 2.0 ports.

The USB-7202 offers true simultaneous sampling of up to eight channels of 16-bit single-ended analog input. This is accomplished through the use of one A/D converter per channel. 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. No external power is required.

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.

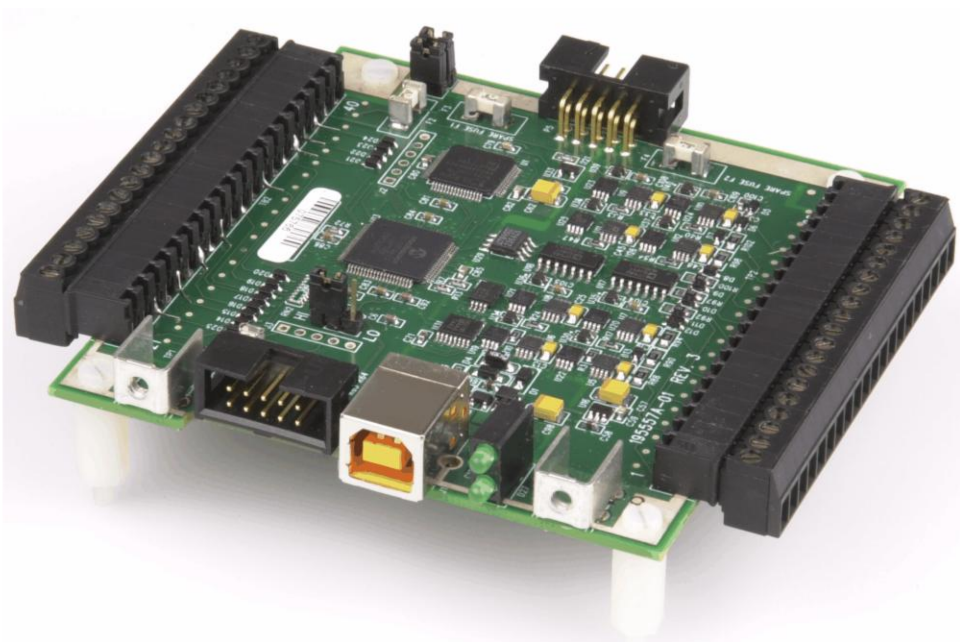


Figure 1. USB-7202

USB-7202 block diagram

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

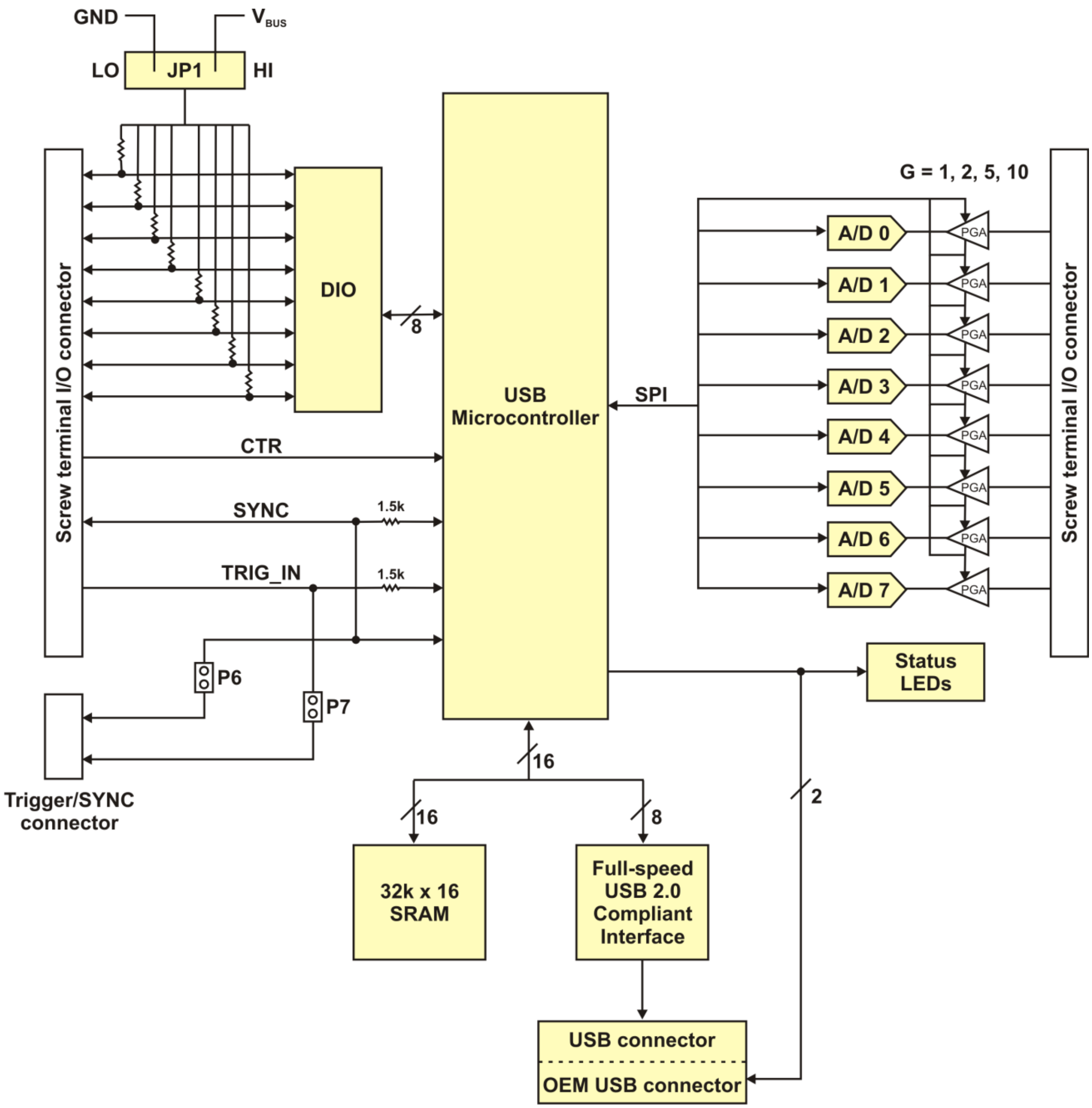


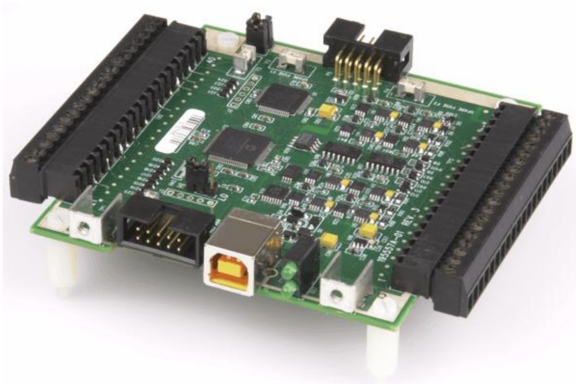
Figure 2. USB-7202 functional block diagram

Installing the USB-7202

What comes with your USB-7202 shipment?

The following items are shipped with the USB-7202.

- USB-7202



- USB cable (2 meter length)

Optional hardware

- OEM connector cable

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

Installing the software

DAQFlex software for each supported operating system is available for download from the DAQFlex download page at www.mccdaq.com/DAQFlexDL. Refer to the *DAQFlex Software User's Guide* for instructions on installing the DAQFlex software.

Installing the hardware

Install the DAQFlex software before you install your board

The driver needed to run your board is installed with the DAQFlex software. Therefore, you need to install the DAQFlex software before you install your board.

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 external USB hub connected to the computer.

or

- Use a 0.1" box header to connect with the OEM connector. The connector pin out is shown below:

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 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 lit 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 lit 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 back *on*.

Programming and developing applications

Refer to the *Programming and developing applications* topic in the Message-based Firmware Specification for information on how to communicate with the USB-7202 using either the device software or firmware API.

Functional Details

Theory of operation - analog input acquisition modes

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

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.

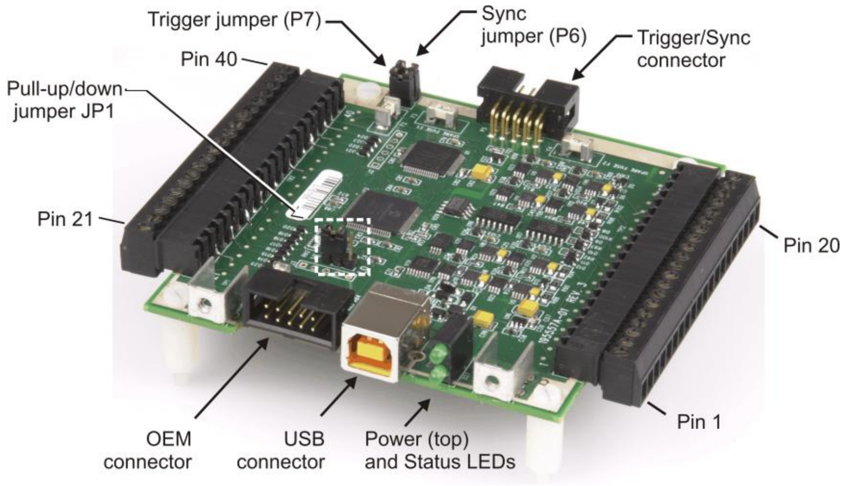


Figure 3. USB-7202 components

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 pin out below:

OEM connector pin out

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 Ω resistors or provide solder bridges to close the gaps.

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.

Trigger/Sync connector

The Trigger/Sync connector provides two signals—SYNC and TRIG_IN.

The **SYNC** connection (pin 5) is a bidirectional I/O signal. You can use it for two purposes:

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

The **TRIG_IN** connection (pin 1) is an external digital trigger input. You can configure this terminal with software for either rising or falling edge.

Use a 0.1" box header to connect with the Trigger/Sync connector. The connector pin out is shown below:

Trigger/Sync connector pin out

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

These signals are also available on the screw terminal.

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

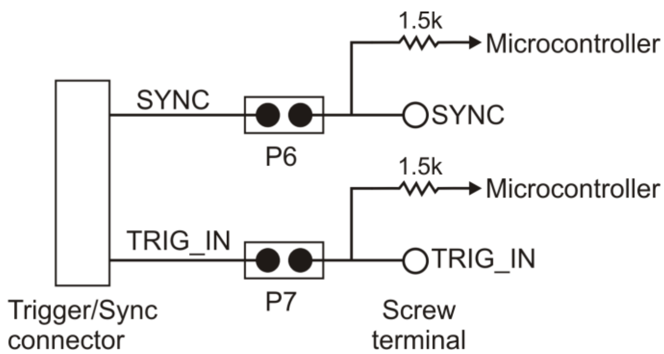


Figure 4. Jumper P6 and P7 schematic

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.

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 (**PC+5 V**)
- SYNC terminal for external clocking and multi-unit synchronization (**SYNC**)
- Ground connections (**GND**)

Signal I/O connections

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

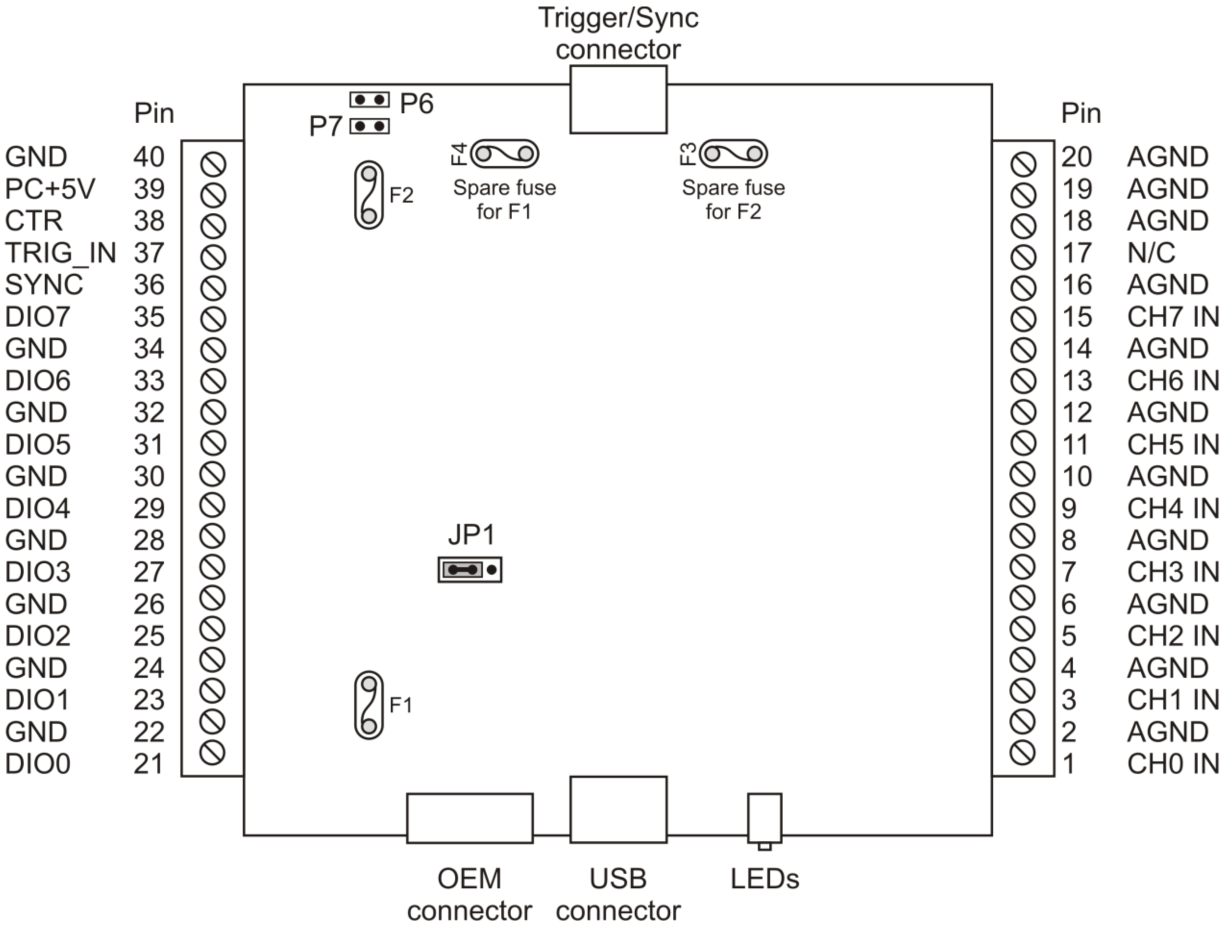


Figure 5. USB-7202 pin orientation

Analog input terminals

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. Refer to Figure 5 above for the location of the analog input pins.

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 ±10 V, ±5 V, ±2.0 V, ±1.0 V.

Digital I/O terminals

The USB-7202 provides eight DIO bits (**DIO0** to **DIO7**). Each bit is configurable as either input or output. Refer to Figure 5 on page 14 for the location of the DIO pins.

Pull up/down configuration

You can configure each digital bit for either input or output. 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.

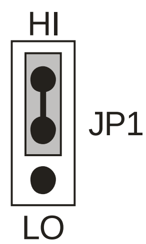


Figure 6. Jumper JP1 configuration

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).

SYNC terminal

The **SYNC** connection (pin 36) is a bidirectional I/O signal. Refer to Figure 5 on page 14 for the location of this pin. You can use it for two purposes:

- 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. For more information on synchronizing multiple units, refer to page 19.

The SYNC pin on the screw terminal is internally connected to the SYNC pin on the Trigger/Sync connector. Refer to the *Trigger/Sync connector* discussion on page 13 for more information.

Trigger terminal

The **TRIG_IN** connection (pin 37) is an external digital trigger input. You can configure this terminal with software for either rising or falling edge. Refer to Figure 5 on page 14 for the location of this pin.

The TRIG_IN pin on the screw terminal is internally connected to the TRIG_IN pin on the Trigger/Sync connector. Refer to the *Trigger/Sync connector* discussion on page 13 for more information.

Counter terminal

The **CTR** connection (pin 38) is a TTL-level input to a 32-bit event counter. Refer to Figure 5 on page 14 for the location of this pin.

The internal counter increments when the TTL level transitions from low to high. The counter can count frequencies of up to 1 MHz.

Power terminal

The **PC +5 V** connection (pin 39) draws power from the USB connector. Refer to Figure 5 on page 14 for the location of this pin.

The +5 V screw terminal is a 5 volt output that is supplied by the computer.

Caution! The +5 V terminal is an output. Do not connect to an external power supply 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:

(USB-7202 @ 150 mA) + (8 DIO @ 2.5 mA ea) = 170 mA

For an application running on a computer or powered hub, the maximum available excess current is 500 mA − 170 mA = 330 mA. This number is the total maximum available current at the PC+5 V screw terminals. 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 250-300 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 terminals

The 11 analog ground connections provide a common ground for all USB-7202 input channels. Eight ground connections provide a common ground for the **DIO**, **TRIG_IN**, **CTR**, **SYNC** and **PC +5 V** connections. Refer to Figure 5 on page 14 for the location of the **AGND** and **GND** terminal pins.

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 65536" 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 21. We use a ±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.**

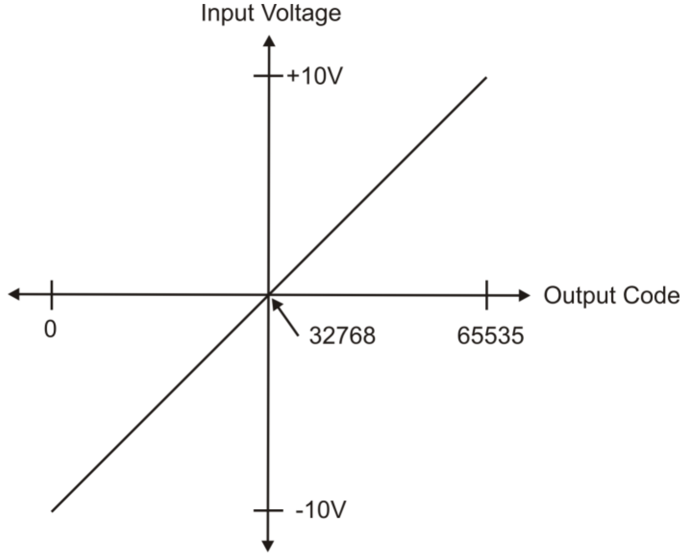


Figure 7. Ideal ADC transfer function

The USB-7202 offset error is measured at mid-scale. Ideally, a zero volt input should produce an output code of 32768. 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 ±10 V range is ±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.

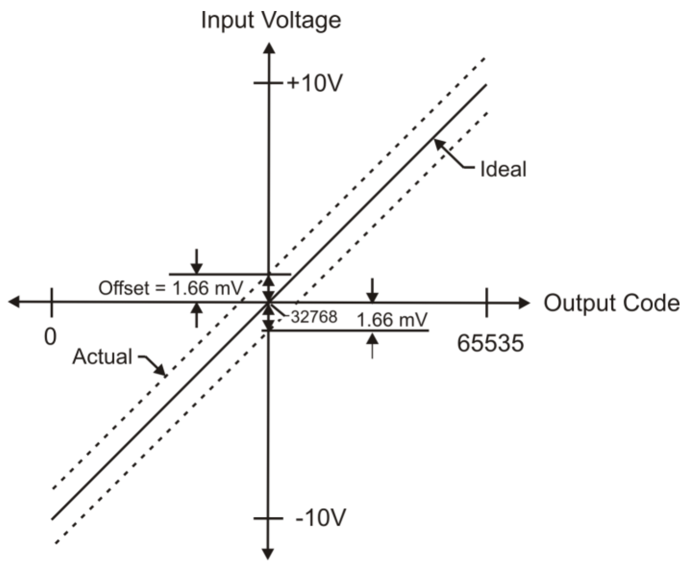


Figure 8. ADC transfer function with offset error

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 (±10 V) by the error.

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

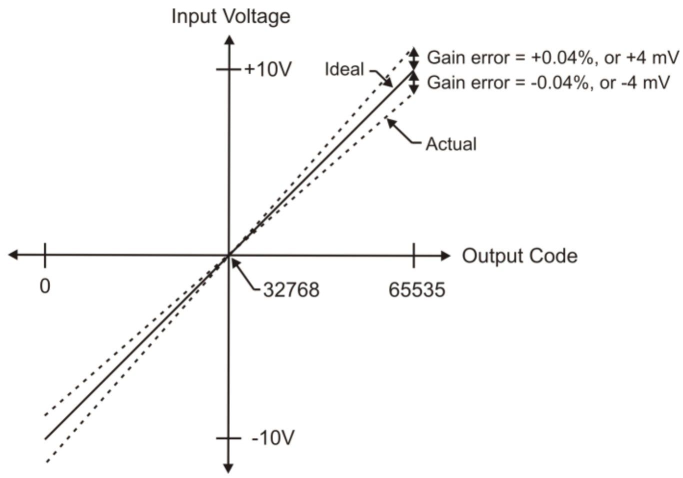


Figure 9. ADC Transfer function with gain error

For example, the USB-7202 exhibits a typical calibrated gain error of ±0.04% on all ranges. For the ±10 V range, this would yield 10 V × ±0.0002 = ±4 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 ±FS (±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 ±full scale (±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.

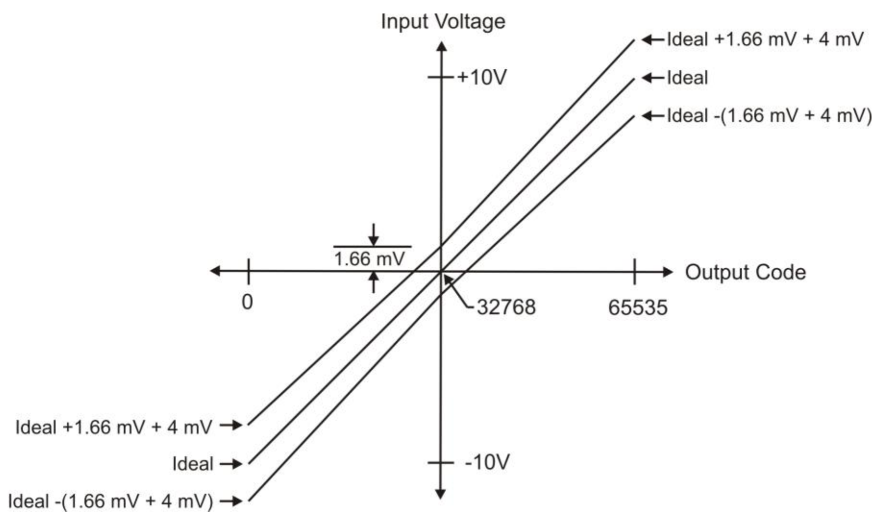


Figure 10. Error band plot

Synchronizing multiple units

You can connect the SYNC pin of two USB-7202 units together in a master/slave configuration and acquire data synchronously from up to 16 channels. The SYNC pin is available on both the screw terminal connector and on the Trigger/SYNC connector (when jumper P6 is installed).

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.

You set the function of the SYNC pin for pacer input or pacer output with a software command. By default, the SYNC pin is set for pacer input.

For example, when running the DAQFlex API library, follow the steps below to synchronize a master USB-7202 with a slave USB-7202 and acquire data from up to 16 channels:

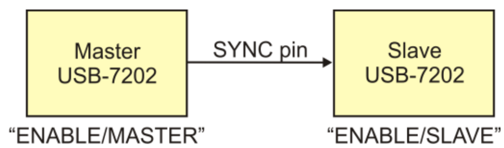
1. Configure the SYNC pin of the master USB-7202 for pacer output:

   Send the message "AISCAN:EXTPACER=ENABLE/MASTER".

1. Configure the SYNC pin of the slave USB-7202 for pacer input:

   Send the message "AISCAN:EXTPACER=ENABLE/SLAVE".

2. Connect the SYNC pin on the master USB-7202 to the SYNC pin on the slave USB-7202.



When operating one USB-7202, do not set the EXTPACER option unless you are using an external clock for A/D pacing.

Mechanical drawings

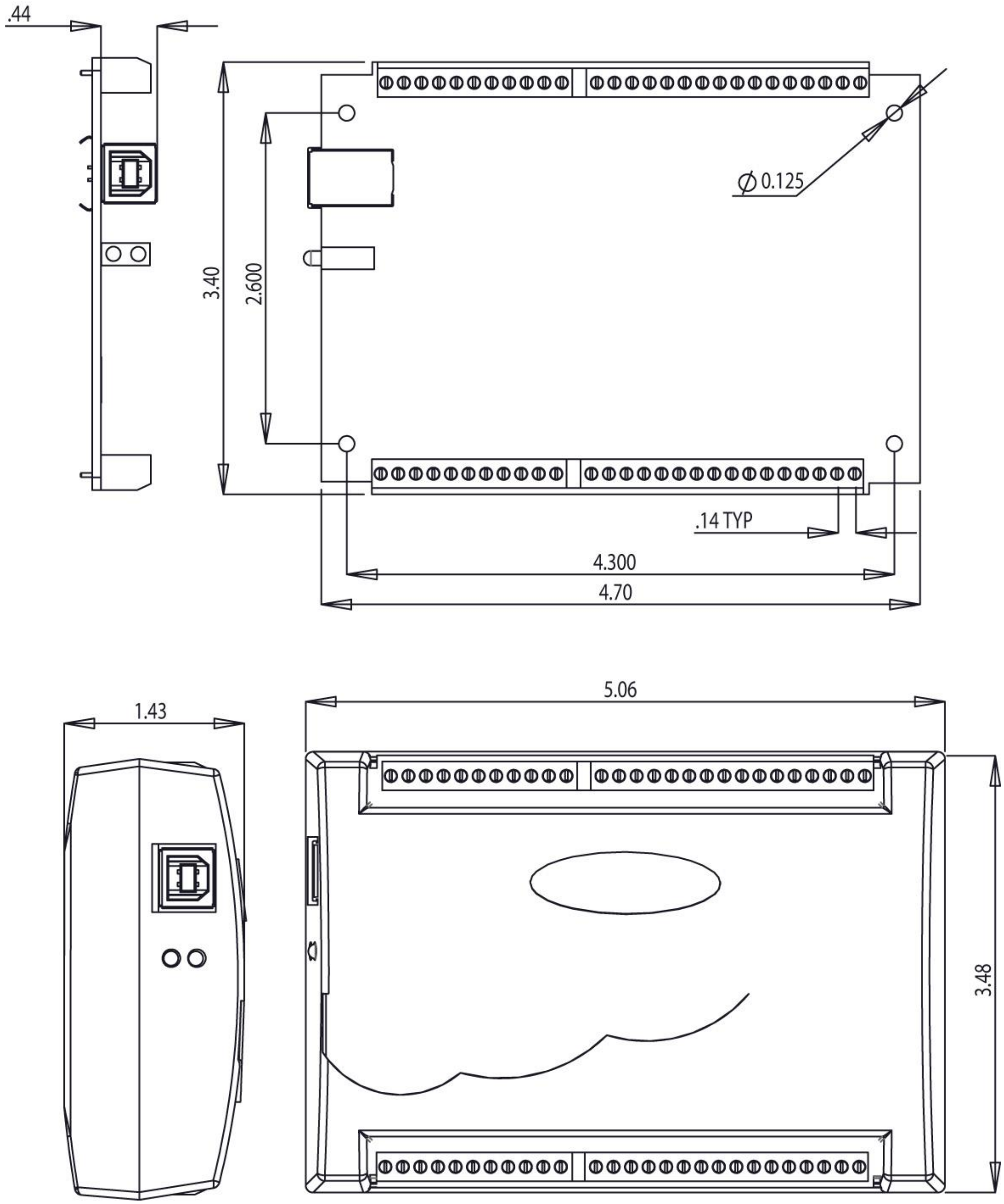


Figure 11. Circuit board (top) and housing dimensions

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 section

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
Absolute maximum input voltage	*CHx IN to GND*	*±15 V maximum*
Input impedance		100 MOhm minimum
Input ranges	Software selectable	±10 V, ±5 V, ±2 V, ±1 V
Sampling rate	Scan to PC memory	0.6 S/s to 50 kS/s, software programmable
	Burst scan to 32 k sample FIFO	20 S/s to 50 kS/s, software programmable
Throughput	Software paced	500 S/s all channels, system-dependent
	Scan to PC 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
No missing codes		*15 bits*
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 PC 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 minimum, 5.5 V absolute maximum
Input low voltage	0.8 V maximum, –0.5 V absolute minimum
Output high voltage (IOH = –2.5 mA)	3.8 V minimum
Output low voltage (IOL = 2.5 mA)	0.7 V maximum
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 µs maximum
Trigger pulse width		1µs minimum
Input high voltage		4.0 V minimum, 5.5 V absolute maximum
Input low voltage		1.0 V maximum, –0.5 V absolute minimum
Input leakage current		*±1.0 µA*

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, maximum
Clock pulse width	Input	1µs minimum
	Output	5µs minimum
Input leakage current		*±1.0µA*
Input high voltage		4.0 V minimum, 5.5 V absolute maximum
Input low voltage		1.0 V maximum, –0.5 V absolute minimum
Output high voltage (Note 3)	IOH = –2.5 mA	3.3 V minimum
	No load	3.8 V minimum
Output low voltage (Note 3)	IOL = 2.5 mA	1.1 V maximum
	No Load	0.6 V maximum

Note 3: SYNC is a Schmitt trigger input and is over-current protected with a 1.5 kOhm series resistor.

Counter section

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
Schmidt trigger hysteresis	*20 mV to 100 mV*
Input leakage current	*±1µA*
Maximum input frequency	1 MHz
High pulse width	*500 ns minimum*
Low pulse width	*500 ns minimum*
Input high voltage	4.0 V minimum, 5.5 V absolute maximum
Input low voltage	1.0 V maximum, –0.5 V absolute minimum

Note 4: CTR is a Schmitt trigger input protected with a 1.5K Ohm series resistor.

Memory

Table 9. Memory specifications

<table>
<tr><th>Parameter</th><th colspan="3">Specification</th></tr>
<tr><td>Data FIFO</td><td colspan="3">32,768 samples, 65,536 bytes</td></tr>
<tr><td>EEPROM</td><td colspan="3">1,024 bytes</td></tr>
<tr><td rowspan="3">EEPROM configuration</td><td>Address range</td><td>Access</td><td>Description</td></tr>
<tr><td>0x000-0x1FF</td><td>Reserved</td><td>512 bytes system and Cal data</td></tr>
<tr><td>0x200-0x3FF</td><td>Read/write</td><td>512 bytes user area</td></tr>
</table>

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_{max}

Power

Table 12. Power specifications

Parameter	Conditions	Specification
Supply current	USB enumeration	< 100 mA
	Continuous mode	150 mA (Note 5)
+5 V_{USER} power available (Note 6)	▪ Connected to self-powered hub ▪ Connected to externally-powered root port hub	4.5 V minimum, 5.25 V maximum
Output current (Note 7)		350 mA maximum
Fuse F1, (F4 spare)	0452.500 - Littelfuse 0.5A NANO2® Slo-Blo® Subminiature Surface Mount Fuse	
Fuse F2, (F3 spare)	0452.375 - Littelfuse 0.375A NANO2® 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 PC's USB host Controller. The USB port(s) on your PC are root port hubs. All externally-powered root port hubs (desktop PC's) 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 PC that is not connected to an external power adapter is an example of a battery-powered root port hub. If your laptop PC 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 +5 V_{USER} 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 High channel = 0 Samples = 1000 Rate = 1000 Range = ±10 V Pacer = Disabled (Slave) Transfer mode = BlockIO Trigger = Disabled Status = Idle
	AITrig	Trigger polarity = Rising
	CTR	Value = 0

Environmental

Table 14. Environmental specifications

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

Mechanical

Table 15. Mechanical specifications

Parameter	Specification
Dimensions	3.55" (L) x 3.75" (W) x 0.5" (H) 4.40" (L) with detachable screw terminals connected
USB cable length	*3 meters maximum*
User connection length	*3 meters maximum*

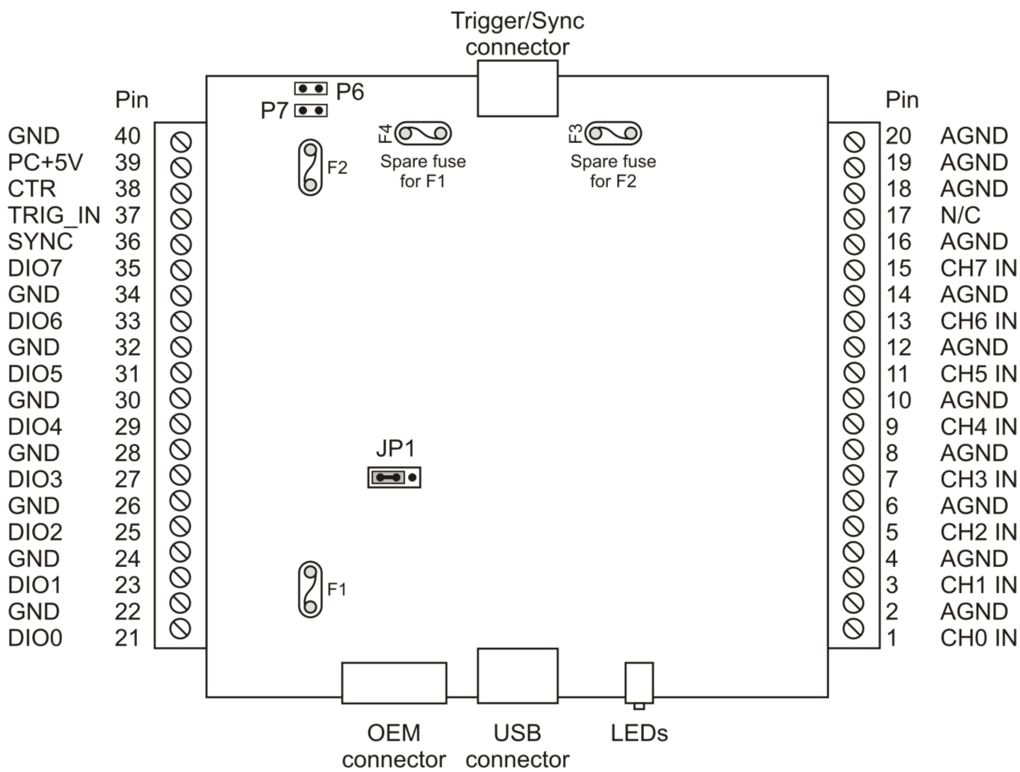
Main connector and pin out

Table 16. Main connector specifications

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

Table 17. Main connector pin out

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 (do not connect anything to this pin)	37	TRIG_IN
18	AGND	38	CTR
19	AGND	39	+5V$_{USER}$ output
20	AGND	40	GND



OEM connector and pin out (P4)

Table 18. OEM connector specifications

Parameter	Specification
Connector type	10 position 0.1" box header

Table 19. OEM connector pin out

Pin	Signal Name	Pin	Signal Name
1	N/C	2	V_{BUS} (fuse protected)
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

Trigger/Sync connector and pin out (P5)

Table 20. Trigger/Sync connector specifications

Parameter	Specification
Connector type	10 position 0.1" box header

Table 21. Trigger/Sync connector pin out

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

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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