

USB-1208LS

Analog and Digital I/O

User's Guide

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About this User's Guide

This user's guide describes the Measurement Computing USB-1208LS 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-1208LS hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- 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

Introducing the USB-1208LS

The USB-1208LS is a USB 1.1 low-speed device supported under popular Microsoft® Windows® operating systems. It is designed for USB 1.1 ports, and tested for compatibility with both USB 1.1 and USB 2.0 ports.

The USB-1208LS features eight analog inputs, two 10-bit analog outputs, 16 digital I/O connections, and one 32-bit external event counter.

The analog inputs are software configurable for either eight 11-bit single-ended inputs, or four 12-bit differential inputs. An on-board industry standard 82C55 programmable peripheral interface chip provides the 16 digital I/O lines in two 8-bit ports. You can configure each port independently for either input or output.

The USB-1208LS is powered by the +5 volt USB supply from your computer; no external power is required. I/O connections are made to the device screw terminals.

Functional block diagram

USB-1208LS functions are illustrated in the block diagram shown here.

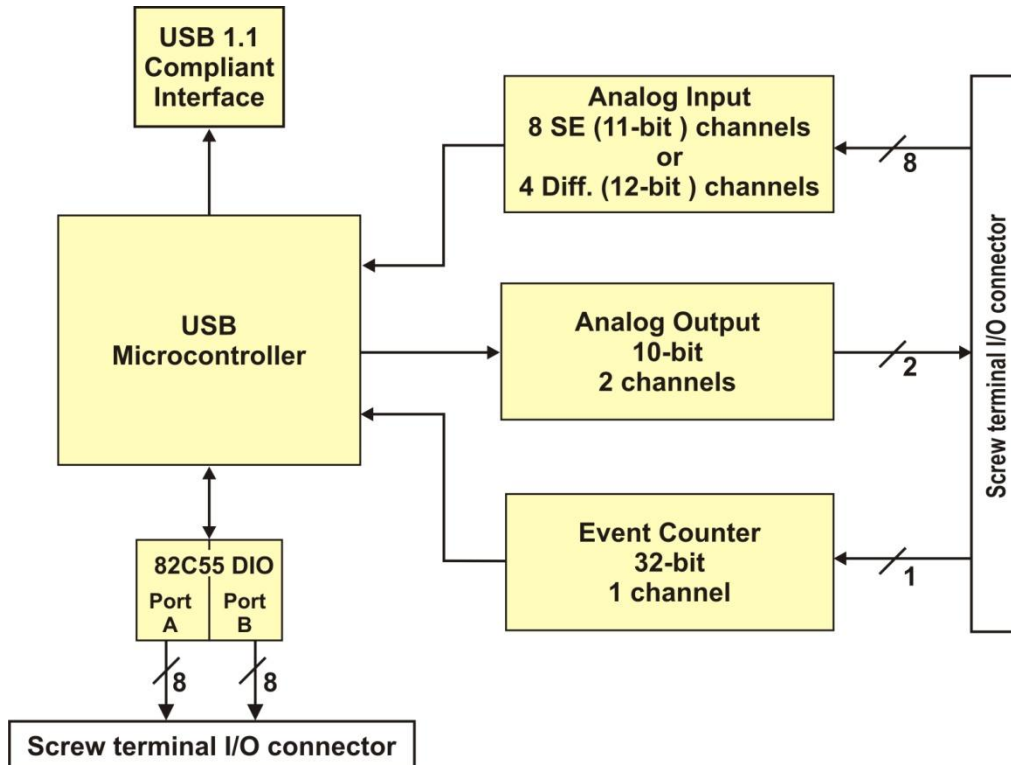


Figure 1. Functional block diagram

Connecting a USB-1208LS to your computer is easy

Installing a data acquisition device has never been easier.

- The USB-1208LS relies upon the Microsoft Human Interface Device (HID) class drivers. The HID class drivers ship with every copy of Windows that is designed to work with USB ports. We use the Microsoft HID because it is a standard, and its performance delivers full control and maximizes data transfer rates for your USB-1208LS. No third-party device driver is required.
- The USB-1208LS is plug-and-play. There are no jumpers to position, DIP switches to set, or interrupts to configure.
- You can connect the USB-1208LS before or after you install the software, and without powering down your computer first. When you connect an HID to your system, your computer automatically detects it and configures the necessary software. You can connect and power multiple HID peripherals to your system using a USB hub.
- You can connect your system to various devices using a standard four-wire cable. The USB connector replaces the serial and parallel port connectors with one standardized plug and port combination.
- You do not need a separate power supply module. The USB automatically delivers the electrical power required by each peripheral connected to your system.
- Data can flow two ways between a computer and peripheral over USB connections.

Installing the USB-1208LS

What comes with your shipment?

As you unpack your USB-1208LS, verify that the following components are included.

Hardware

The following items should be included with your shipment.

- USB-1208LS
- USB cable

Documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide*. This 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.

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the USB-1208LS 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, contact us immediately using one of the following methods:

- Knowledgebase: kb.mccdaq.com
- 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

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

Installing the software

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

Installing the hardware

Be sure you are using the latest system software

Before installing the device, run Windows Update to update your system with the latest HID and USB drivers.

To connect the USB-1208LS to your system, turn your computer on, and connect the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer. The USB cable provides power and communication to the device. When you connect the USB-1208LS for the first time, a **Found New Hardware** dialog opens when the operating system detects the device. Another dialog identifies the USB-1208LS as a USB Human Interface Device. When this dialog closes the installation is complete. The device LED should blink and then remain on, to indicate that communication is established between the device and your computer.

If the LED turns off

If the LED is on but then turns off, the computer has lost communication with the USB-1208LS. To restore communication, disconnect the USB cable from the computer, and then reconnect it. This should restore communication, and the LED should turn back on.

Functional Details

Analog input acquisition modes

The USB-1208LS can acquire analog input data in three different modes – software paced, hardware paced, and burst scan.

Software paced mode

You 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 and returned to the computer. You can repeat this procedure until you have the total number of samples that you want from one channel.

Software pacing is limited by the 20 mS round-trip requirement of a USB interrupt-type endpoint operation. The maximum throughput sample rate in software paced mode is 50 S/s.

Hardware paced mode

You acquire data from up to eight channels in continuous scan mode. The analog data is continuously acquired, converted to digital values, and written to an on-board FIFO buffer until you stop the scan. The FIFO buffer is serviced in blocks as the data is transferred from the USB-1208LS to the memory buffer on your computer.

The maximum continuous scan rate of 1.2 kS/s is an aggregate rate. The total acquisition rate for all channels cannot exceed 1.2 kS/s. You can acquire data from one channel at 1.2 kS/s, two channels at 600 S/s and four channels at 300 S/s. You can start a continuous scan with either a software command or with an external hardware trigger event.

Burst scan mode

In burst scan mode, you acquire data using the full capacity of the USB-1208LS 4 k sample FIFO. You can initiate a single acquisition sequence of up to 4096 samples channels by either a software command or an external hardware trigger. Captured data is read from the FIFO and transferred to a user buffer in the host PC.

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. The maximum rates that you can acquire data using burst scan mode is 8 kS/s divided by the number of channels in the scan.

External components

The USB-1208LS external components are shown in Figure 2.

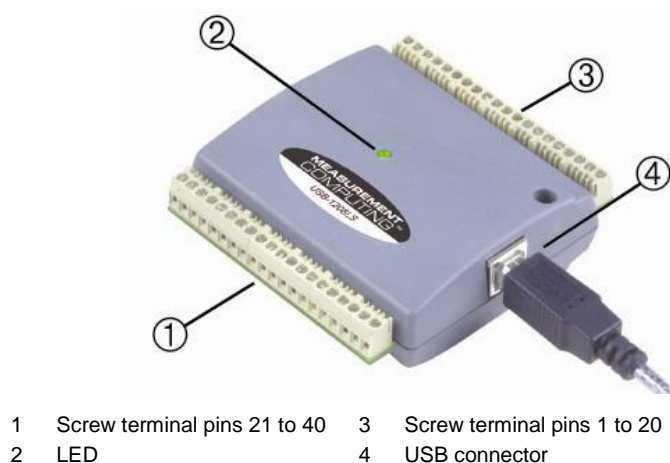


Figure 2. USB-1208LS external components

USB connector

The USB connector is on the right side of the USB-1208LS housing. This connector provides +5V power and communication. The voltage supplied through the USB connector is system-dependent, and may be less than 5V. No external power supply is required.

LED

The LED on the front of the housing indicates the communication status of the USB-1208LS. It uses up to 5 mA of current and cannot be disabled. The table below defines the function of the LED.

LED illumination

| LED Illumination | Indication |
|-----------------------|--|
| Steady green | The USB-1208LS is connected to a computer or external USB hub. |
| Blinks continuously | Data is being transferred. |
| Blinks three times | Initial communication is established between the USB-1208LS and the computer. |
| Blinks at a slow rate | The analog input is configured for external trigger. The LED stops blinking and illuminates steady green when the trigger is received. |

Screw terminal wiring

The screw terminals provide the following connections:

- Eight analog inputs (**CH0 IN** to **CH7 IN**)
- Two analog outputs (**D/A OUT 0** to **D/A OUT 1**)
- 16 digital I/O connections (**PortA0** to **Port A7**, and **Port B0** to **Port B7**)
- External trigger input (**TRIG_IN**)
- External event counter input (**CTR**)
- Power output (**PC+5 V**)
- Calibration output (**CAL**)
- Ground connections (**GND**)

Use 16 AWG to 30 AWG wire when making connections to the screw terminals. The single-ended mode pinout is shown in Figure 3.

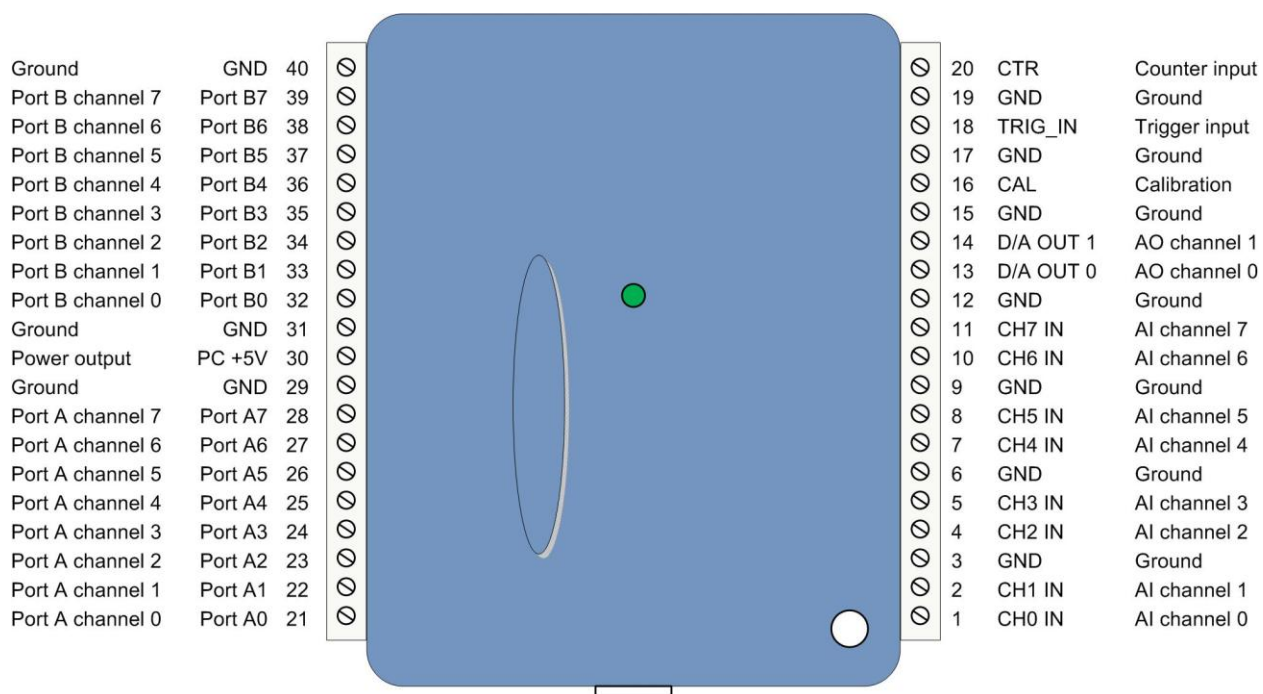


Figure 3. Single-ended mode pinout

The differential mode pinout is shown in Figure 4.

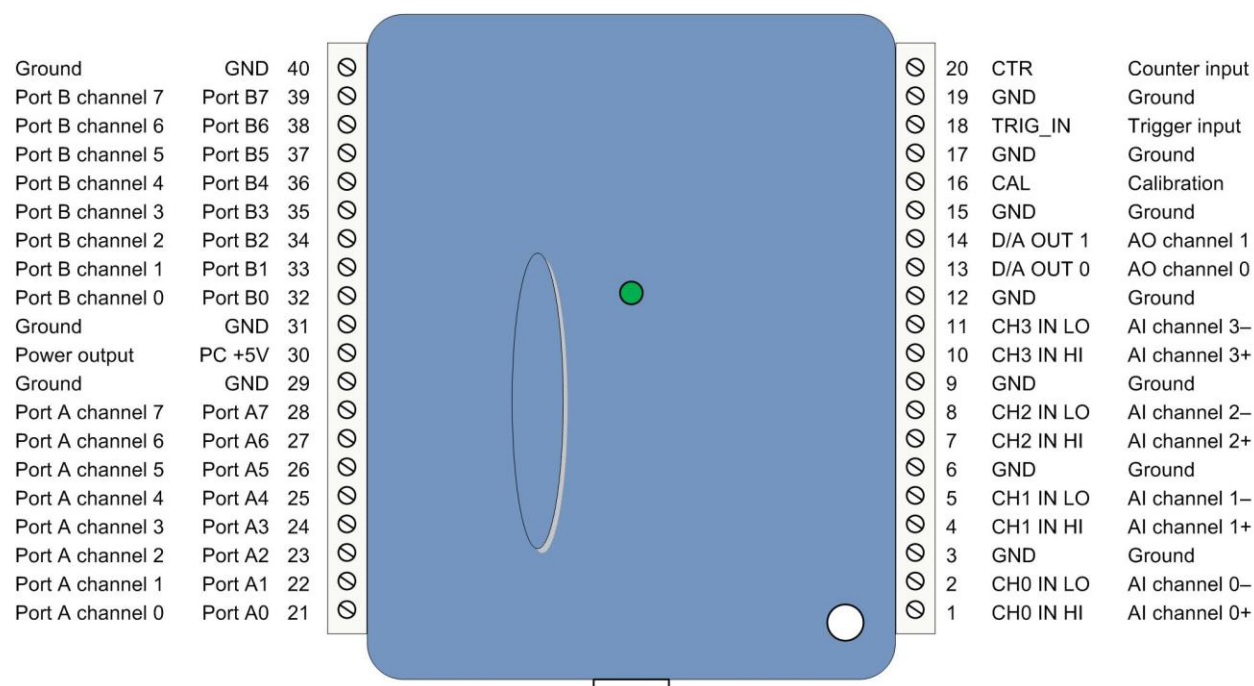


Figure 4. Differential mode pinout

Signal connections

Analog inputs

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

You can configure the analog input channels as eight single-ended channels or four differential channels. When configured for differential mode, each analog input has 12-bit resolution. When configured for single-ended mode, each analog input has 11-bit resolution, due to restrictions imposed by the A/D converter.

Single-ended configuration

When configured for single-ended input mode, eight analog channels are available. The input signal is referenced to signal ground (GND), and delivered through two wires:

- Connect the wire carrying the signal to be measured to **CH# IN**.
- Connect the second wire to **GND**.

The input range for single-ended mode is $\pm 10\text{V}$.

To perform a single-ended measurement using differential channels, connect the signal to the "**CH# IN HI**" input, and ground the associated "**CH# IN LO**" input.

Differential configuration

When configured for differential input mode, four analog channels are available. In differential mode, the input signal is measured with respect to the low input, and delivered through three wires:

- Connect the wire carrying the signal to be measured to **CH# IN HI**.
- Connect the wire carrying the reference signal to **CH# IN LO**.
- Connect the third wire to **GND**.

A low-noise precision programmable gain amplifier (PGA) is available on differential channels to provide gains of up to 20 and a dynamic range of up to 12-bits. Differential mode input voltage ranges are $\pm 20\text{ V}$, $\pm 10\text{ V}$, $\pm 5\text{ V}$, $\pm 4\text{ V}$, $\pm 2.5\text{ V}$, $\pm 2.0\text{ V}$, 1.25 V , and $\pm 1.0\text{ V}$.

In differential mode, the following two requirements must be met for linear operation:

- Any analog input must remain in the -10V to $+20\text{V}$ range with respect to ground at all times.
- The maximum differential voltage on any given analog input pair must remain within the selected voltage range.

The input [*common-mode voltage* + *signal*] of the differential channel must be in the -10 V to $+20\text{ V}$ range in order to yield a useful result. For example, you input a 4 V pp sine wave to CHHI, and apply the same sine wave 180° out of phase to CHLO. The common mode voltage is 0 V . The differential input voltage swings from $4\text{ V} - (-4\text{ V}) = 8\text{ V}$ to $-4\text{ V} - 4\text{ V} = -8\text{ V}$. Both inputs satisfy the -10 V to $+20\text{ V}$ input range requirement, and the differential voltage is suited for the $\pm 10\text{ V}$ input range (see Figure 5).

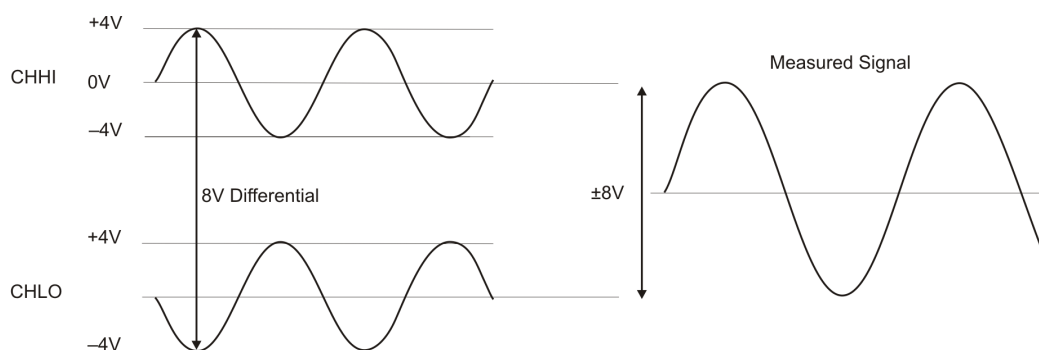


Figure 5. Differential voltage example: common mode voltage of 0 V

If you increase the common mode voltage to 11 V , the differential remains at $\pm 8\text{ V}$. Although the [*common-mode voltage* + *signal*] on each input now has a range of $+7\text{ V}$ to $+15\text{ V}$, both inputs still satisfy the -10 V to $+20\text{ V}$ input requirement (see Figure 6).

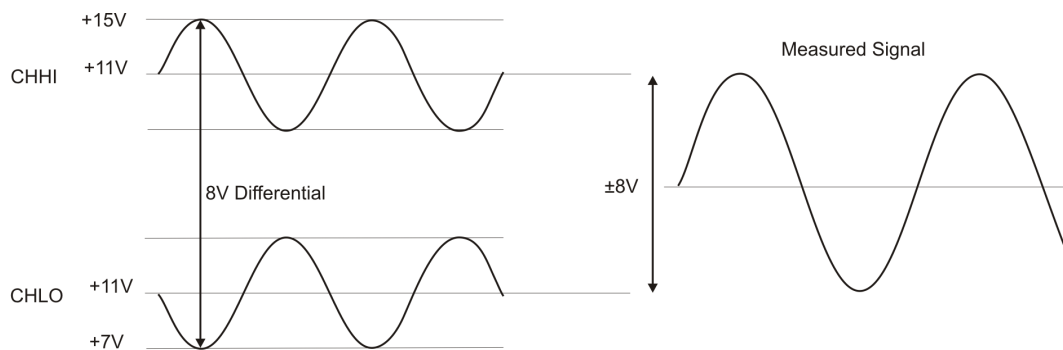


Figure 6. Differential voltage example: common mode voltage of 11 V

If you decrease the common-mode voltage to -7 V , the differential stays at $\pm 8\text{ V}$. However, the solution now violates the input range condition of -10 V to $+20\text{ V}$. The voltage on each analog input now swings from -3 V to -11 V . Voltages between -10 V and -3 V are resolved, but those below -10 V are clipped (see Figure 7).

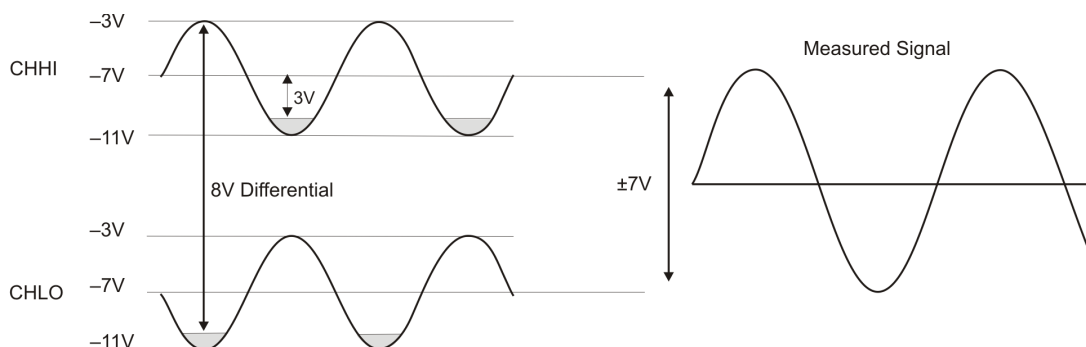


Figure 7. Differential voltage example: common mode voltage of -7 V

Since the analog inputs are restricted to a -10 V to $+20\text{ V}$ signal swing with respect to ground, all ranges *except* $\pm 20\text{ V}$ can realize a linear output for any differential signal with zero common mode voltage and full scale signal inputs. The $\pm 20\text{ V}$ range is the exception. You cannot put -20 V on CHHI and 0 V on CHLO since this violates the input range criteria.

The table below shows some possible inputs and the expected results.

Sample Inputs and Differential Results

| CHHI | CHLO | Result |
|----------------|----------------|----------------|
| -20 V | 0 V | Invalid |
| -15 V | $+5\text{ V}$ | Invalid |
| -10 V | 0 V | -10 V |
| -10 V | $+10\text{ V}$ | -20 V |
| 0 V | $+10\text{ V}$ | -10 V |
| 0 V | $+20\text{ V}$ | -20 V |
| $+10\text{ V}$ | -10 V | $+20\text{ V}$ |
| $+10\text{ V}$ | 0 V | $+10\text{ V}$ |
| $+15\text{ V}$ | -5 V | $+20\text{ V}$ |
| $+20\text{ V}$ | 0 | $+20\text{ V}$ |

For more information on analog signal connections

For more information on single-ended and differential inputs, refer to the *Guide to DAQ Signal Connections* (this document is available on our web site at www.mccdaq.com/signals/signals.pdf.)

Channel-Gain queue

The channel gain queue feature allows you to set up a scan sequence with a unique per-channel gain setting and channel sequence. The gain settings are stored in a channel-gain queue list that is written to local memory on the device.

The channel-gain queue list can contain up to 8 elements in any order. An example of a four-element list is shown in the table below.

Sample channel-gain queue list

| Element | Channel | Range |
|---------|---------|--------|
| 0 | CH0 | BIP10V |
| 1 | CH0 | BIP5V |
| 2 | CH3 | BIP10V |
| 3 | CH2 | BIP1V |

When a scan begins with the gain queue enabled, the USB-1208LS reads the first element, sets the appropriate channel number and range, and then acquires a sample. The properties of the next element are then retrieved, and another sample is acquired. This sequence continues until all elements in the gain queue have been selected. When the end of the channel list is detected, the sequence returns to the first element in the list. This sequence repeats until the specified number of samples is acquired.

Carefully match the gain to the expected voltage range on the associated channel or an over range condition may occur. Although this condition does not damage the device, it does produce a useless full-scale reading, and can introduce a long recovery time due to saturation of the input channel.

Digital I/O

You can connect up to 16 digital I/O lines to the screw terminal containing pins 21 to 40 (**Port A0** to **Port A7**, and **Port B0** to **Port B7**.) You can configure each digital port for either input or output.

When you configure the digital bits for input, you can use the digital I/O terminals to detect the state of any TTL level input.

Refer to the schematic shown in Figure 8. If the switch is set to the +5 V input, Port A0 reads *TRUE* (1). If you move the switch to GND, Port A0 reads *FALSE*.

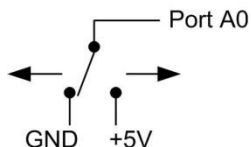


Figure 8. Schematic showing switch detection by digital channel Port A0

For more information on digital signal connections

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

Trigger input

The **TRIG_IN** terminal is an external digital input that you can configure for either TTL level high or low.

Counter input

The **CTR** terminal is a 32-bit event counter that can accept frequency inputs up to 1 MHz. The internal counter increments when the TTL levels transition from low to high.

Calibration output

The **CAL** terminal is an output used only to calibrate the device. Calibration is software-controlled via InstaCal.

Power output

The **PC +5V** terminal is a 5 volt output that is supplied by the computer. You can use this terminal to supply power to external devices or circuitry.

Caution! The **PC +5V** terminal is an output. Do not connect to an external power supply or you may damage the USB-1208LS and possibly the computer.

The maximum total output current that can be drawn from all USB-1208LS 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.

Just connecting the USB-1208LS to your computer draws 20 mA of current from the USB +5 V supply. Once you start running applications, each DIO bit can draw up to 2.5 mA, and each analog output can draw 30 mA. The maximum amount of +5 V current available for experimental use, over and above that required by the device, is the difference between the *total current requirement* of the USB device (based on the application), and the *allowed current draw* of the PC platform (500 mA for desktop PCs and self-powered hubs, or 100 mA for bus-powered hubs and notebook computers).

With all outputs at their maximum output current, the total current requirement of the USB +5 V is:

$$(\text{USB-1208LS @ 20 mA}) + (16 \text{ DIO @ 2.5 mA ea}) + (2 \text{ AO @ 30 mA ea}) = 120 \text{ mA}$$

For an application running on a PC or powered hub, the maximum available excess current is 500 mA–120 mA = 380 mA. This number is the total maximum available current at the PC+5V screw terminals. Cole-Parmer 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 300–320 mA range.

Since laptop computers typically allow up to 100 mA, the USB-1208LS in a fully-loaded configuration may be above that allowed by the computer. In this case, you must determine the per-pin loading in the application to ensure that the maximum loading criteria is met. The per-pin loading is calculated by simply dividing the +5 V by the load impedance of the pin in question.

Ground terminals

The **GND** connections are identical and provide a common ground for all device functions.

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 "12-bits" or "1 part in 4096" does indicate what can be resolved, it provides little insight into the quality of an absolute measurement. Accuracy specifications describe the actual results that can be realized with a measurement device.

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

- offset
- gain
- nonlinearity.

The primary error sources in the USB-1208LS are offset and gain. Nonlinearity is small in the USB-1208LS, and is not significant as an error source with respect to offset and gain.

Figure 9 shows an ideal, error-free, USB-1208LS transfer function. The typical calibrated accuracy of the USB-1208LS is range-dependent, as explained in the "[Specifications](#)" chapter of this document. We use a ± 10 V range here as an example of what you can expect when performing a measurement in this range.

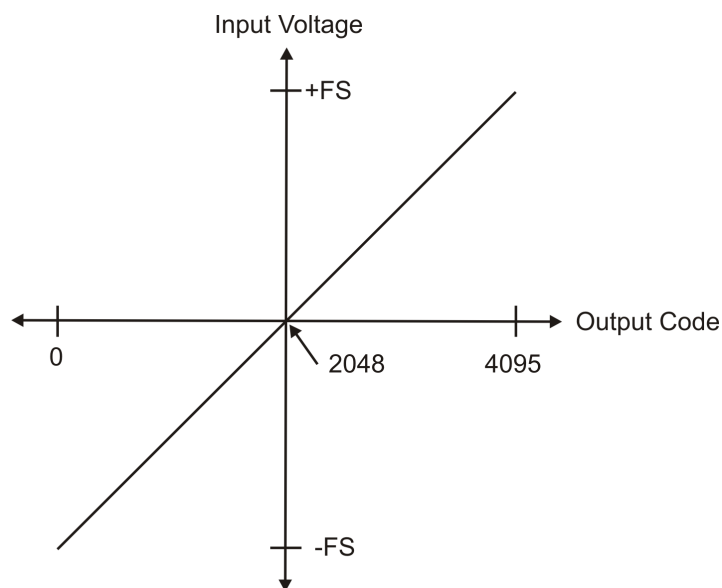


Figure 9. Ideal ADC transfer function

The USB-1208LS offset error is measured at mid-scale. Ideally, a zero volt input should produce an output code of 2048. Any deviation from this is an offset error. Figure 10 shows the USB-1208LS transfer function with an offset error. The typical offset error specification on the ± 10 V range is ± 9.77 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 10 are drawn for clarity and are not drawn to scale.

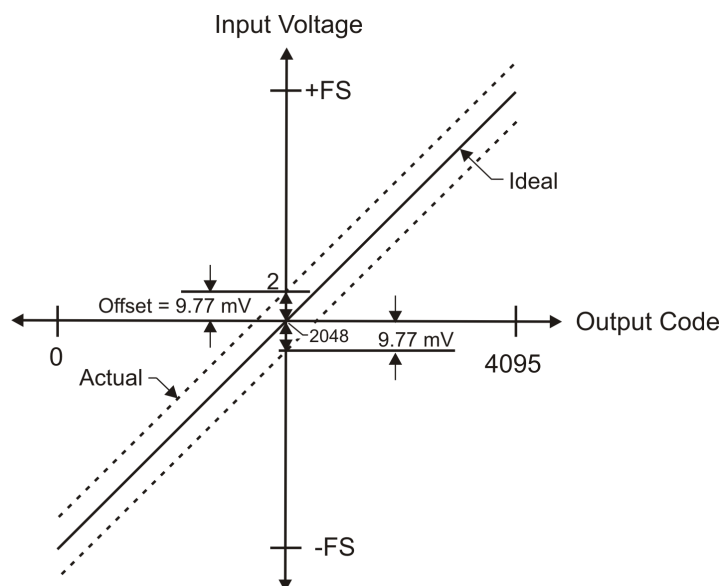


Figure 10. ADC transfer function with offset error

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 11 shows the USB-1208LS transfer function with gain error. Gain error is easily converted to voltage by multiplying the full-scale (FS) input by the error.

The accuracy plots in Figure 11 are drawn for clarity and are not drawn to scale.

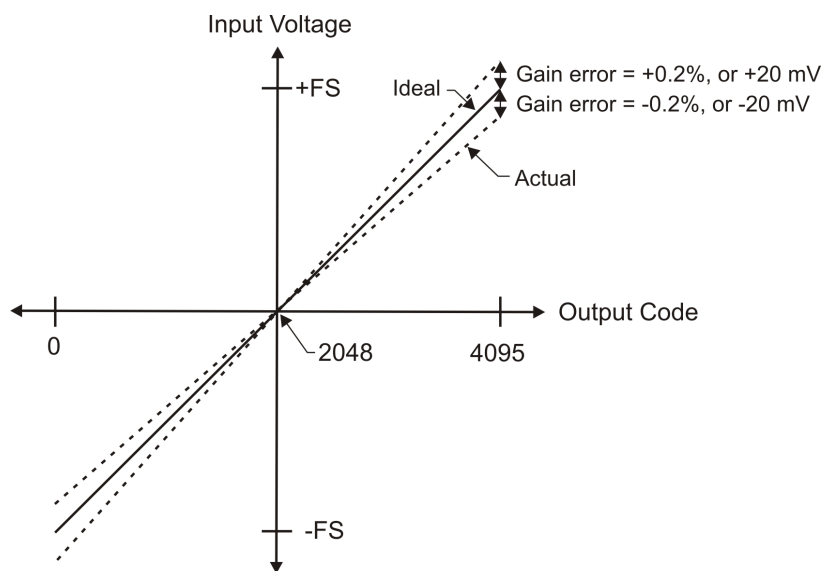


Figure 11. ADC Transfer function with gain error

For example, the USB-1208LS exhibits a typical calibrated gain error of $\pm 0.2\%$ on all ranges. For the $\pm 10\text{ V}$ range, this would yield $10\text{ V} \times \pm 0.002 = \pm 20\text{ mV}$. This means that at full scale, neglecting the effect of offset for the moment, the measurement would be within 20 mV of the actual value. Note that gain error is expressed as a ratio. Values near $\pm\text{FS}$ 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 12, we have a plot of the error band of the USB-1208LS for the ± 10 V range. This is a graphical version of the typical accuracy specification of the product.

The accuracy plots in Figure 12 are drawn for clarity and are not drawn to scale.

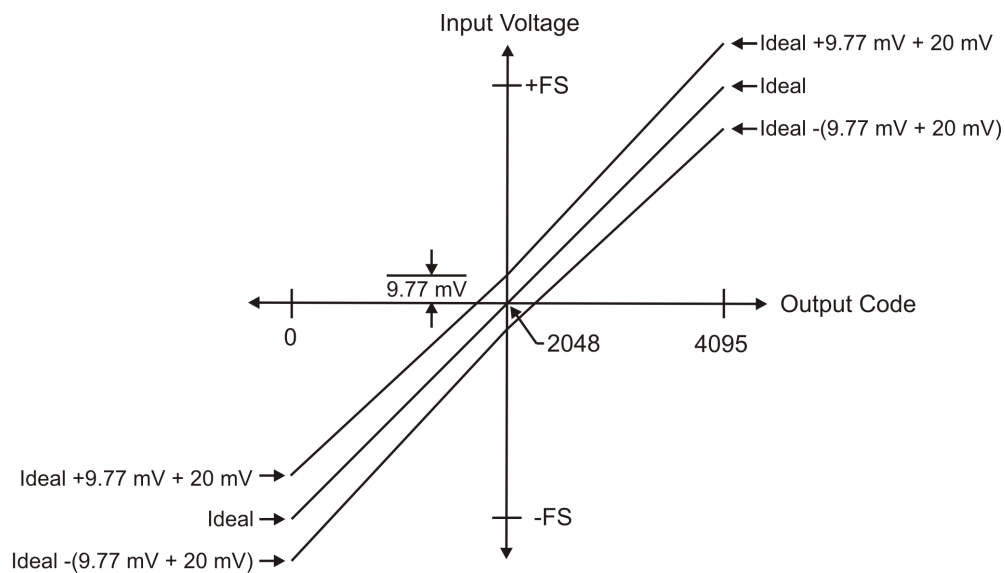


Figure 12. Error band plot

Mechanical drawings

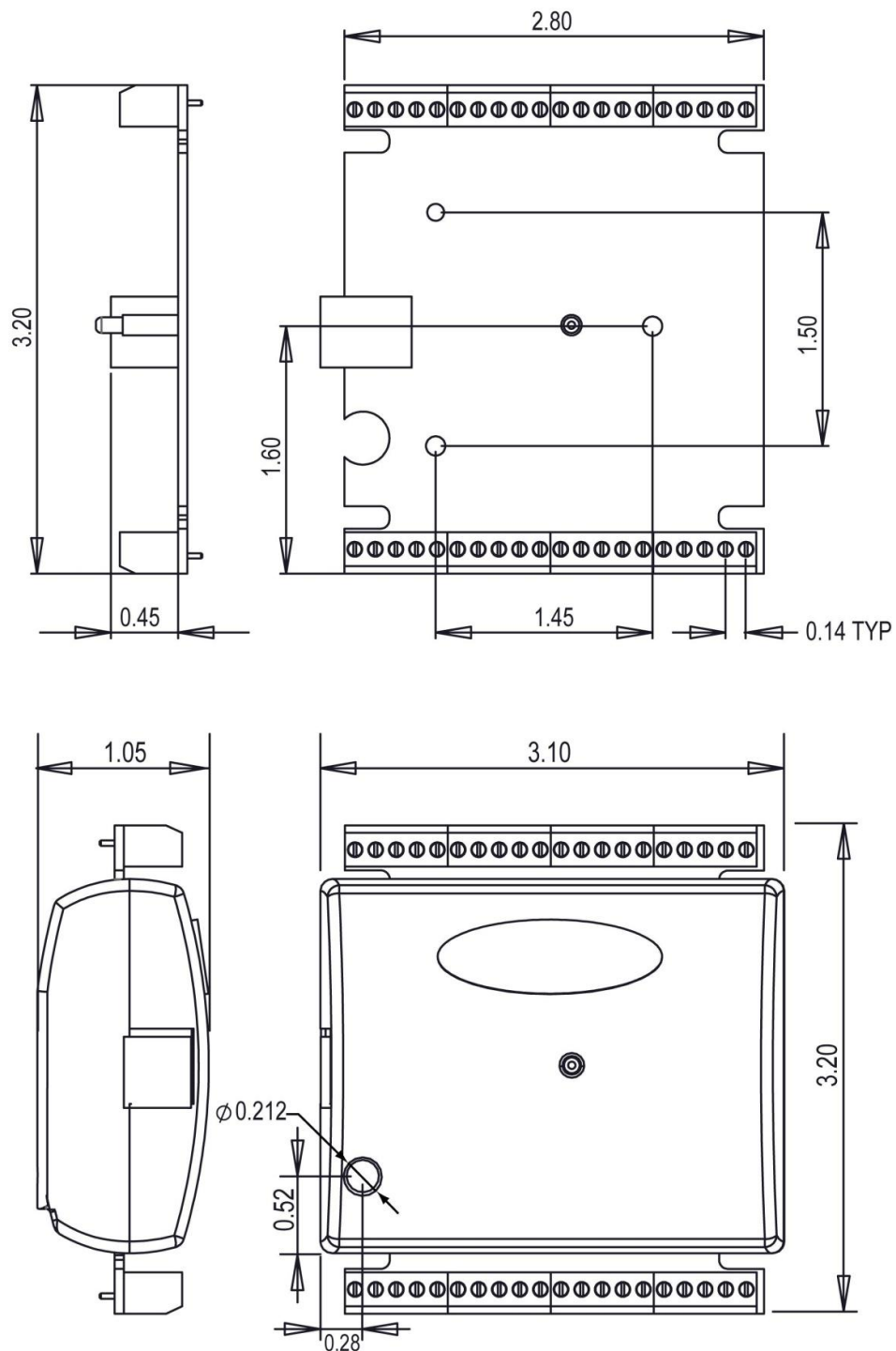


Figure 13. Circuit board (top) and enclosure dimensions

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 | | Successive approximation type |
| Input voltage range for linear operation, single-ended mode | CHx to GND | ±10 V max |
| Input common-mode voltage range for linear operation, differential mode | CHx to GND | −10 V min, +20 V max |
| <i>Absolute maximum input voltage</i> | <i>CHx to GND</i> | <i>±40V max</i> |
| Input current (Note 1) | V _{in} = +10 V | 70µA typ |
| | V _{in} = 0V | −12µA typ |
| | V _{in} = −10 V | −94µA typ |
| <i>Input impedance</i> | | <i>122 kΩ</i> |
| Number of channels | | 8 single ended / 4 differential, software selectable |
| Input ranges | Single-ended mode | ±10V, G=2 |
| | Differential mode | ±20V, G=1 ±10V, G=2 ±5V, G=4 ±4V, G=5 ±2.5V, G=8 ±2.0V, G=10 ±1.25V, G=16 ±1.0V, G=20 Software selectable |
| Throughput | Software paced | 50 S/s |
| | Hardware paced | 1.2 kS/s |
| | Burst scan to 4 K sample FIFO | 8 kS/s |
| Channel gain queue | Up to 8 elements | Software configurable channel, range, and gain. |
| Resolution (Note 2) | Differential | 12 bits, no missing codes |
| | Single ended | 11 bits |
| CAL accuracy | CAL = 2.5V | ±0.05% typ, ±0.25% max |
| Integral linearity error | | ±1 LSB typ |
| Differential linearity error | | ±0.5 LSB typ |
| Repeatability | | ±1 LSB typ |
| CAL current | Source | 5 mA max |
| | Sink | 20 µA min, 200 nA typ |
| Trigger Source | Software selectable | External digital: TRIG_IN |

Note 1: Input current is a function of applied voltage on the analog input channels. For a given input voltage, V_{in}, the input leakage is approximately equal to (8.181*V_{in} − 12) µA.

Note 2: The AD7870 converter only returns 11-bits (0 to 2,047 codes) in single-ended mode.

Table 2. Accuracy, differential mode

| Range | Accuracy (LSB) |
|---------|----------------|
| ±20 V | 5.1 |
| ±10 V | 6.1 |
| ±5 V | 8.1 |
| ±4 V | 9.1 |
| ±2.5 V | 12.1 |
| ±2 V | 14.1 |
| ±1.25 V | 20.1 |
| ±1 V | 24.1 |

Table 3. Accuracy, single-ended mode

| Range | Accuracy (LSB) |
|-------|----------------|
| ±10 V | 4.0 |

Table 4. Accuracy components, differential mode – all values are (±)

| Range | % of Reading | Gain Error at FS (mV) | Offset (mV) | Accuracy at FS (mV) |
|---------|--------------|-----------------------|-------------|---------------------|
| ±20 V | 0.2 | 40 | 9.766 | 49.766 |
| ±10 V | 0.2 | 20 | 9.766 | 29.766 |
| ±5 V | 0.2 | 10 | 9.766 | 19.766 |
| ±4 V | 0.2 | 8 | 9.766 | 17.766 |
| ±2.5 V | 0.2 | 5 | 9.766 | 14.766 |
| ±2 V | 0.2 | 4 | 9.766 | 13.766 |
| ±1.25 V | 0.2 | 2.5 | 9.766 | 12.266 |
| ±1 V | 0.2 | 2 | 9.766 | 11.766 |

Table 5. Accuracy components, single-ended mode – all values are (±)

| Range | % of Reading | Gain Error at FS (mV) | Offset (mV) | Accuracy at FS (mV) |
|-------|--------------|-----------------------|-------------|---------------------|
| ±10 V | 0.2 | 20 | 19.531 | 39.531 |

Analog output

Table 6. Analog output specifications

| Parameter | Conditions | Specification |
|----------------------------|----------------|---|
| D/A converter type | | PWM |
| Resolution | | 10-bits, 1 in 1024 |
| Maximum output range | | 0 V to 5 V |
| Number of channels | | 2 voltage output |
| Throughput | Software paced | 100 S/s single channel mode 50 S/s dual channel mode |
| Power on and reset voltage | | Initializes to 000h code |
| Maximum voltage (Note 3) | No load | Vs |
| | 1 mA load | 0.99 * Vs |
| | 5 mA load | 0.98 * Vs |
| Output drive | Each D/A OUT | 30 mA |
| Slew rate | | 0.14 V/mS typ |

Note 3: Vs is the USB bus +5V power. The maximum analog output voltage is equal to Vs at no-load. V is system dependent and may be less than 5 volts.

Digital input/output

Table 7. DIO specifications

| Parameter | Specification |
|-------------------------------------|--|
| Digital type | 82C55 |
| Number of I/O | 16 (Port A0 through A7, Port B0 through B7) |
| Configuration | 2 banks of 8 |
| Pull up/pull-down configuration | All pins pulled up to Vs via 47 k Ω resistors (default). Positions available for pull down to ground. Hardware selectable via zero ohm resistors as a factory option. |
| 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) | 3.0 V min |
| Output low voltage (IOL = 2.5 mA) | 0.4 V max |

External trigger

Table 8. Trigger input specifications

| Parameter | Conditions | Specification |
|-------------------------|---------------------|---|
| Trigger source (Note 4) | External digital | TRIG_IN |
| Trigger mode | Software selectable | Level sensitive: user configurable for TTL level high or low input. |
| Trigger latency | Burst | 25 μ s min, 50 μ s max |
| Trigger pulse width | Burst | 40 μ s min |
| Input high voltage | | 3.0 V min, 15.0 V absolute max |
| Input low voltage | | 0.8 V max |
| Input leakage current | | $\pm 1.0 \mu$ A |

Note 4: TRIG_IN is protected with a 1.5KOhm series resistor.

Counter

Table 9. Counter specifications

| Parameter | Specification |
|----------------------------|----------------------------|
| Counter type | Event counter |
| Number of channels | 1 |
| Input source | CTR screw terminal |
| Input type | TTL, rising edge triggered |
| Resolution | 32 bits |
| Schmidt trigger hysteresis | 20 mV to 100 mV |
| Input leakage current | $\pm 1 \mu$ A |
| Maximum input frequency | 1 MHz |
| High pulse width | 500 ns min |
| Low pulse width | 500 ns min |
| Input low voltage | 0 V min, 1.0 V max |
| Input high voltage | 4.0 V min, 15.0 V max |

Non-volatile memory

Table 10. Memory specifications

| Parameter | Specification | | |
|----------------------|-----------------|------------|-----------------------|
| Memory size | 8192 bytes | | |
| Memory configuration | Address Range | Access | Description |
| | 0x0000 – 0x17FF | Read/Write | A/D data (4K samples) |
| | 0x1800 – 0x1EFF | Read/Write | User data area |
| | 0x1F00 – 0x1FEF | Read/Write | Calibration data |
| | 0x1FF0 – 0x1FFF | Read/Write | System data |

Power

Table 11. Power specifications

| Parameter | Conditions | Specification |
|----------------------------------|-------------------------------|------------------------|
| Supply current (Note 5) | | 20 mA |
| +5V USB power available (Note 6) | Connected to self-powered hub | 4.5 V min, 5.25 V max |
| | Connected to bus-powered hub | 4.1 V min, 5.25 V max |
| Output current (Note 7) | Connected to bus-powered hub | 450 mA min, 500 mA max |
| | Connected to bus-powered hub | 50 mA min, 100 mA max |

Note 5: This is the total current requirement for the USB-1208LS which includes up to 5mA for the status LED.

Note 6: Self-powered refers to USB hubs and hosts with a power supply. Bus-powered refers to USB hubs and hosts without their own power supply.

Note 7: This refers to the total amount of current that can be sourced from the USB +5V, analog outputs and digital outputs.

General

Table 12. General specifications

| Parameter | Conditions | Specification |
|----------------------------|---------------|-------------------|
| USB controller clock error | 25 °C | ±30 ppm max |
| | 0 °C to 70 °C | ±50 ppm max |
| Device type | | USB 1.1 low-speed |
| Device compatibility | | USB 1.1, USB 2.0 |

Environmental

Table 13. 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 14. Mechanical specifications

| Parameter | Specification |
|------------------------|--|
| Dimensions (L × W × H) | 79 × 82 × 27 mm (3.10 × 3.20 × 1.05 in.) |
| USB cable length | 3 m (9.84 ft) max |
| User connection length | 3 m (9.84 ft) max |

Signal connector

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

4-channel differential mode pinout

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | CH0 IN HI | 21 | Port A0 |
| 2 | CH0 IN LO | 22 | Port A1 |
| 3 | GND | 23 | Port A2 |
| 4 | CH1 IN HI | 24 | Port A3 |
| 5 | CH1 IN LO | 25 | Port A4 |
| 6 | GND | 26 | Port A5 |
| 7 | CH2 IN HI | 27 | Port A6 |
| 8 | CH2 IN LO | 28 | Port A7 |
| 9 | GND | 29 | GND |
| 10 | CH3 IN HI | 30 | PC+5V |
| 11 | CH3 IN LO | 31 | GND |
| 12 | GND | 32 | Port B0 |
| 13 | D/A OUT 0 | 33 | Port B1 |
| 14 | D/A OUT 1 | 34 | Port B2 |
| 15 | GND | 35 | Port B3 |
| 16 | CAL | 36 | Port B4 |
| 17 | GND | 37 | Port B5 |
| 18 | TRIG_IN | 38 | Port B6 |
| 19 | GND | 39 | Port B7 |
| 20 | CTR | 40 | GND |

8-channel single-ended mode

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | CH0 IN | 21 | Port A0 |
| 2 | CH1 IN | 22 | Port A1 |
| 3 | GND | 23 | Port A2 |
| 4 | CH2 IN | 24 | Port A3 |
| 5 | CH3 IN | 25 | Port A4 |
| 6 | GND | 26 | Port A5 |
| 7 | CH4 IN | 27 | Port A6 |
| 8 | CH5 IN | 28 | Port A7 |
| 9 | GND | 29 | GND |
| 10 | CH6 IN | 30 | PC+5V |
| 11 | CH7 IN | 31 | GND |
| 12 | GND | 32 | Port B0 |
| 13 | D/A OUT 0 | 33 | Port B1 |
| 14 | D/A OUT 1 | 34 | Port B2 |
| 15 | GND | 35 | Port B3 |
| 16 | CAL | 36 | Port B4 |
| 17 | GND | 37 | Port B5 |
| 18 | TRIG_IN | 38 | Port B6 |
| 19 | GND | 39 | Port B7 |
| 20 | CTR | 40 | GND |

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-1208LS

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 must be properly grounded.
- 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

Measurement Computing Corporation
10 Commerce Way
Suite 1008
Norton, Massachusetts 02766
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@mccdaq.com
www.mccdaq.com