USB-1208LS

Analog and Digital I/O

User's Guide

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January 2013

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Table of Contents

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 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
- Knowledgebase: kb.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.

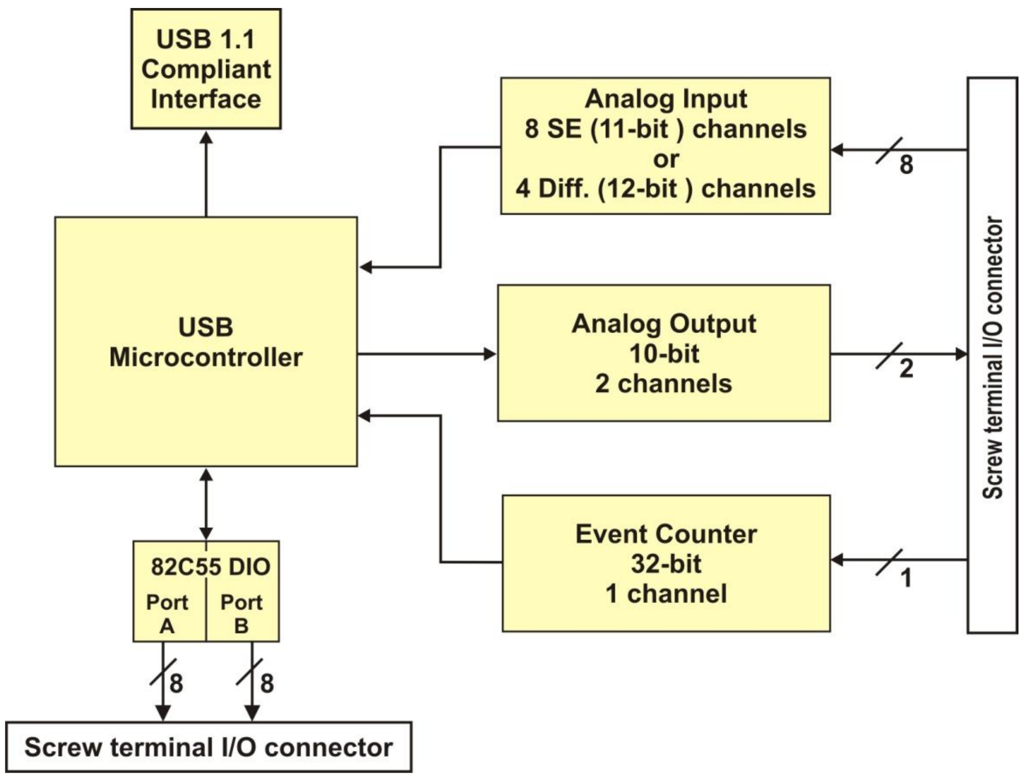


Figure 1. Functional block diagram

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 the USB-1208LS is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail. For international customers, contact your local distributor where you purchased the device.

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

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the 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 operating 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.

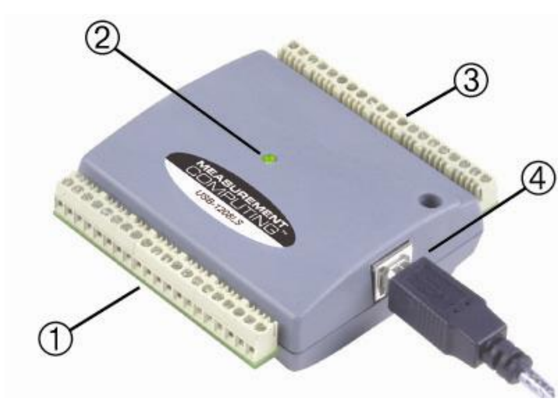
Burst scan mode

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.



1	Screw terminal pins 21 to 40	3	Screw terminal pins 1 to 20
2	LED	4	USB connector

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.

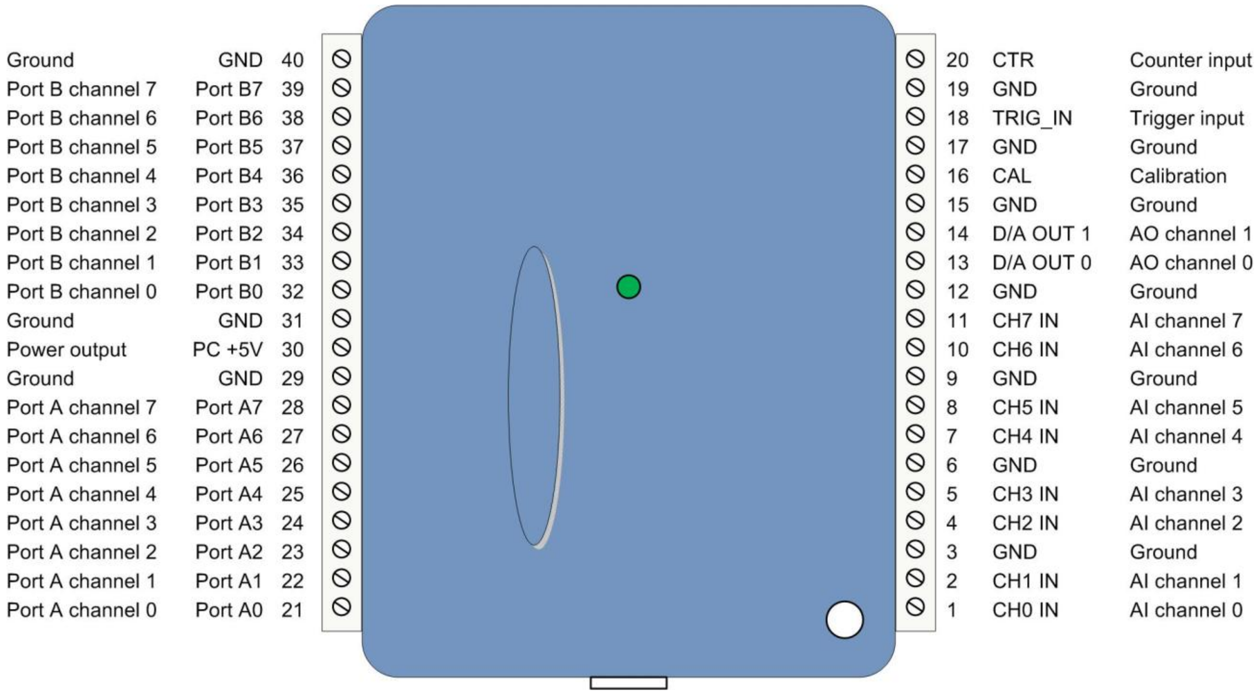


Figure 3. Single-ended mode pinout

The differential mode pinout is shown in Figure 4.

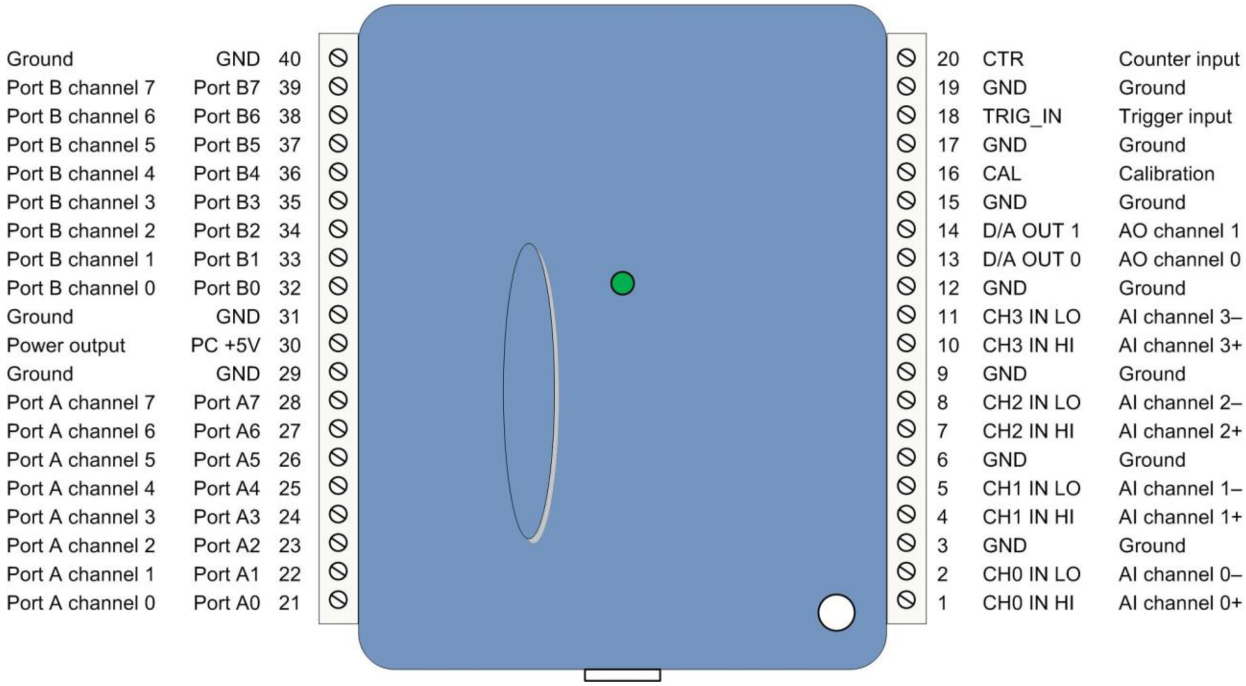


Figure 4. Differential mode pinout

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 ±10V.

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 ±20 V, ±10 V, ±5 V, ±4 V, ±2.5 V, ±2.0 V, 1.25 V, and ±1.0 V.

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

- Any analog input must remain in the −10V to +20V 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 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 V – (–4 V) = 8 V to –4 V – 4 V = –8V. Both inputs satisfy the –10 V to +20 V input range requirement, and the differential voltage is suited for the ±10 V input range (see Figure 5).

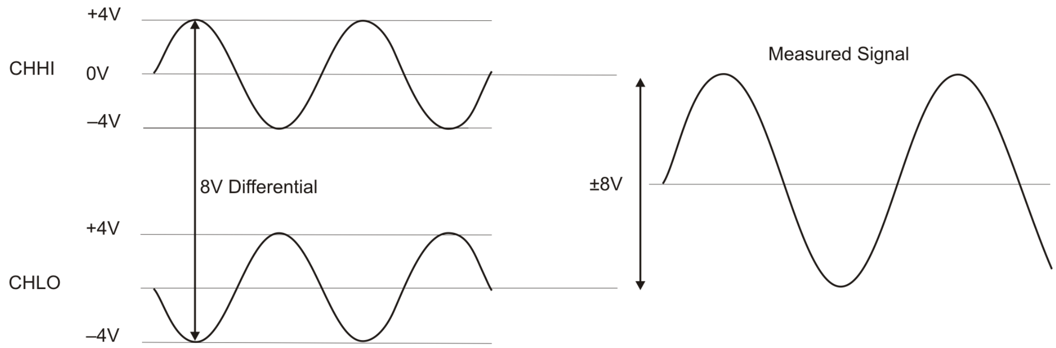


Figure 5. Differential voltage example: common mode voltage of 0 V

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

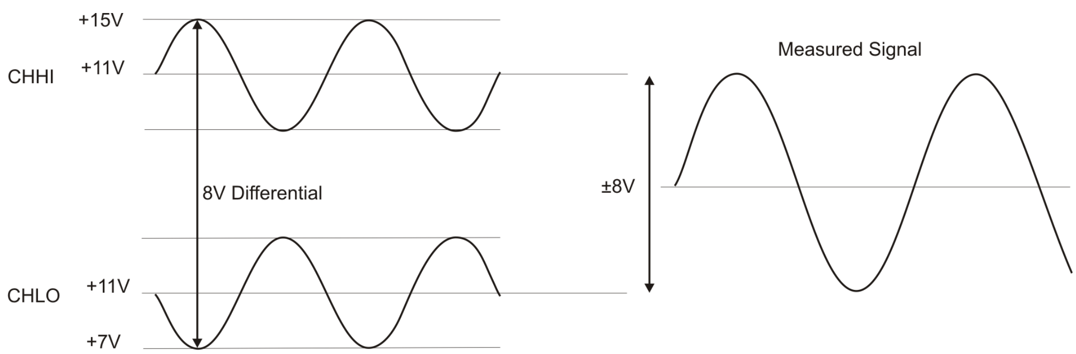


Figure 6. Differential voltage example: common mode voltage of 11V

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

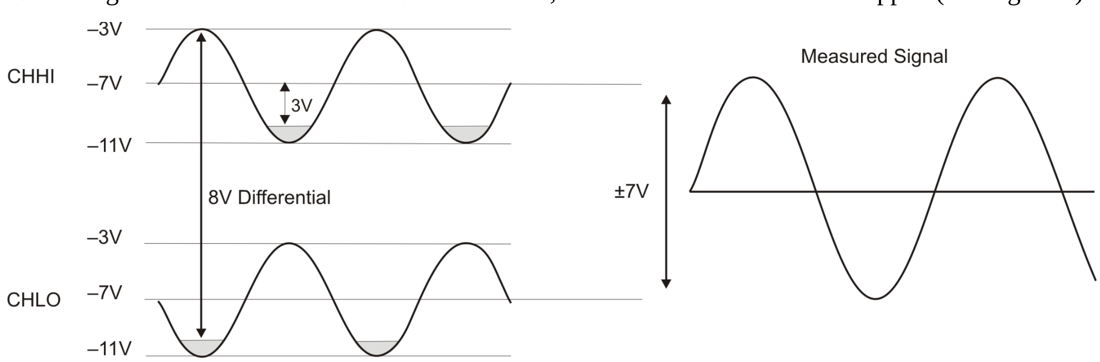


Figure 7. Differential voltage example: common mode voltage of –7 V

Since the analog inputs are restricted to a −10 V to +20 V signal swing with respect to ground, all ranges *except* ±20V can realize a linear output for any differential signal with zero common mode voltage and full scale signal inputs. The ±20 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 V	Invalid
–10 V	0 V	–10 V
–10 V	+10 V	–20 V
0 V	+10 V	–10 V
0 V	+20 V	–20 V
+10 V	–10 V	+20 V
+10 V	0 V	+10 V
+15 V	–5 V	+20 V
+20 V	0	+20 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*.

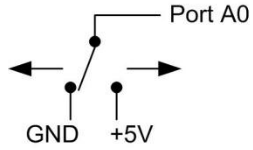


Figure 8. Schematic showing switch detection by digital channel Port A0

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:

(USB-1208LS @ 20 mA) + (16 DIO @ 2.5 mA ea) + (2 AO @ 30 mA ea) = 120 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.

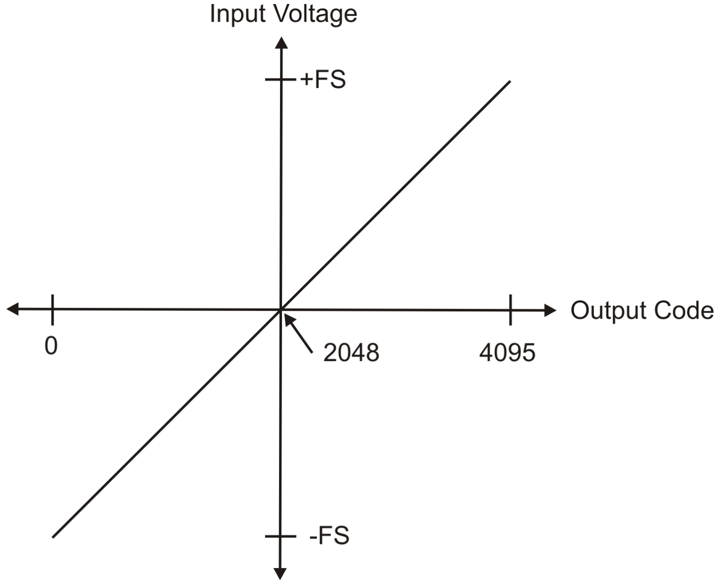


Figure 9. Ideal ADC transfer function

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.

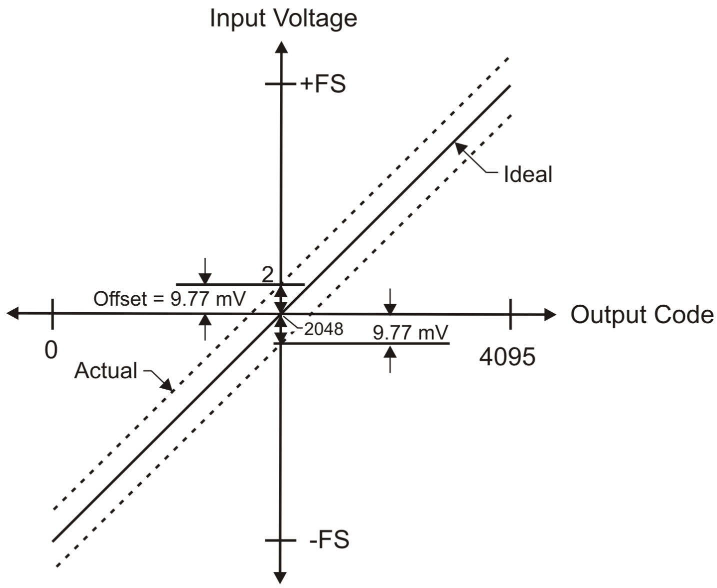


Figure 10. ADC transfer function with offset error

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.

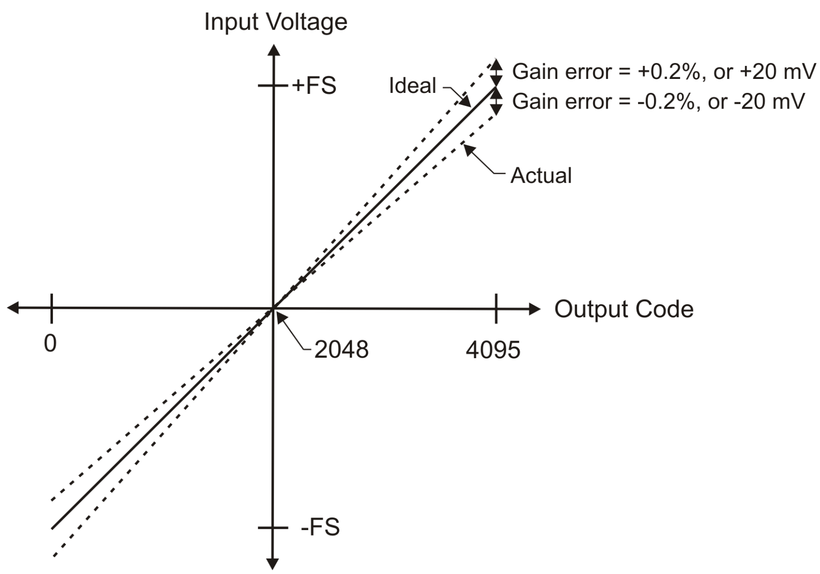


Figure 11. ADC Transfer function with gain error

For example, the USB-1208LS exhibits a typical calibrated gain error of ±0.2% on all ranges. For the ±10 V range, this would yield 10 V × ±0.002 = ±20 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 ±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.

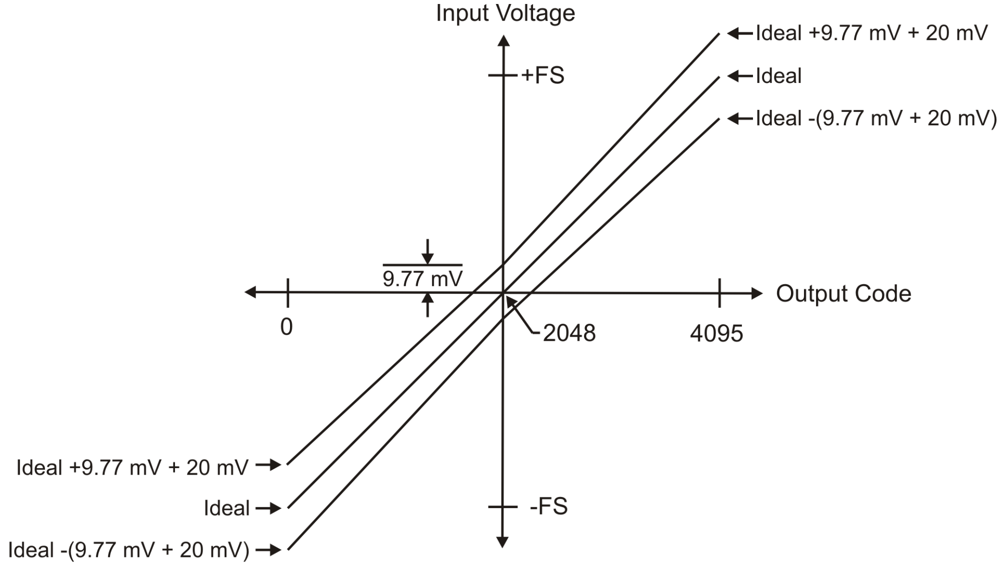


Figure 12. Error band plot

Mechanical drawings

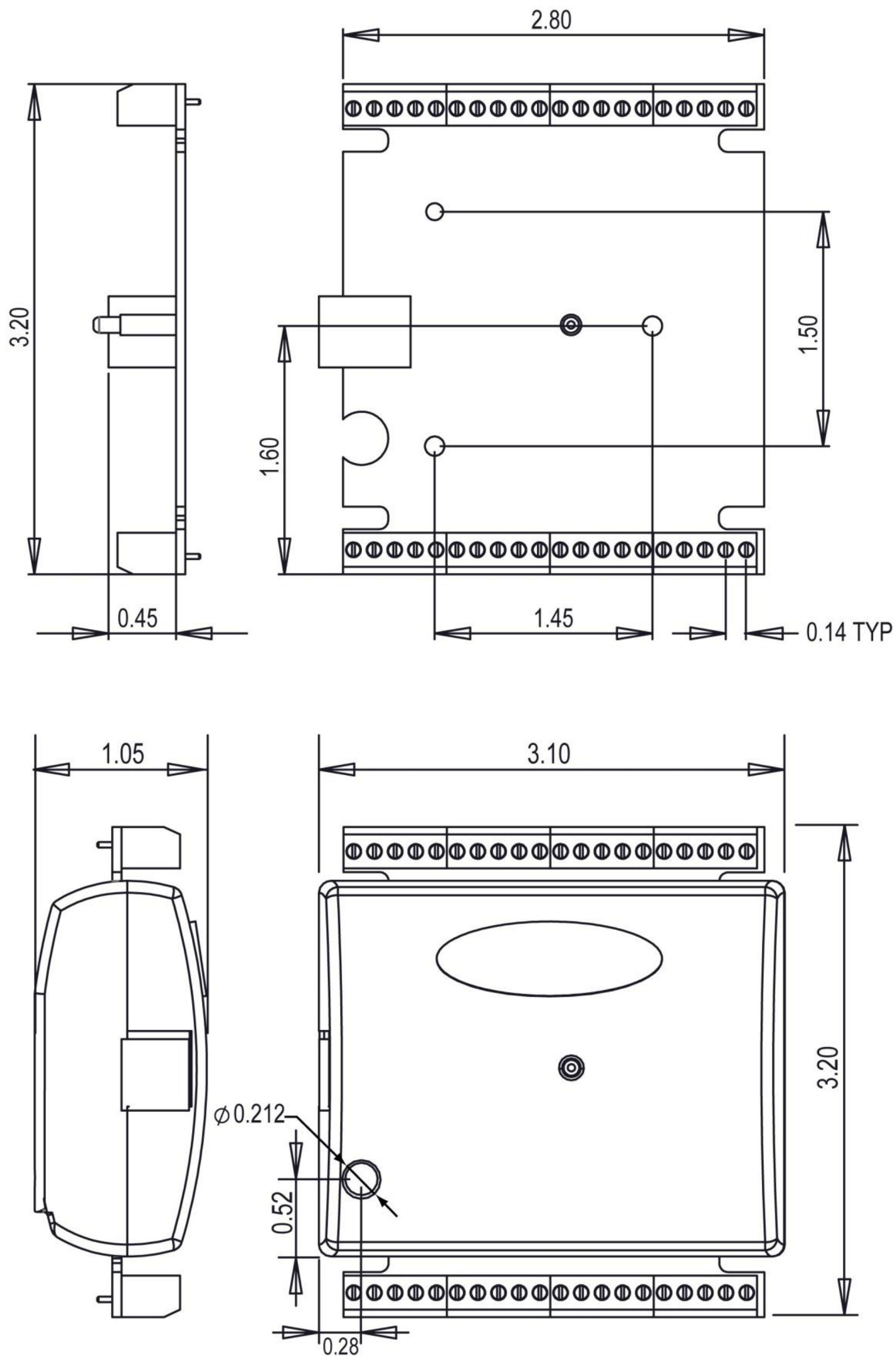


Figure 13. Circuit board (top) and enclosure dimensions

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
Absolute maximum input voltage	*CHx to GND*	*±40V max*
Input current (Note 1)	Vin = +10 V	70µA typ
	Vin = 0V	–12µA typ
	Vin = –10 V	–94µA typ
Input impedance		*122 k*Ω
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, Vin, the input leakage is approximately equal to (8.181*Vin – 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 kΩ 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 µs min, 50 µs max
Trigger pulse width	Burst	40 µs min
Input high voltage		3.0 V min, 15.0 V absolute max
Input low voltage		0.8 V max
Input leakage current		*±1.0 µA*

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	*±1 µA*
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

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

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