PMD-1208LS

Personal Measurement Device™
for
Analog and Digital I/O

User's Guide

MEASUREMENT
COMPUTING™

Document Revision 5, January, 2004

Lifetime warranty

Every hardware product manufactured by Measurement Computing Corp. is warranted against defects in materials or workmanship for the life of the product, to the original purchaser. Any products found to be defective will be repaired or replaced promptly.

30 Day Money Back Guarantee

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Lifetime ***Harsh Environment Warranty®***

Any product manufactured by Measurement Computing Corp. that is damaged (even due to misuse) may be replaced for only 50% of the current list price. I/O boards face some tough operating conditions—some more severe than the boards are designed to withstand. When a board becomes damaged, just return the unit with an order for its replacement at only 50% of the current list price. We don't need to profit from your misfortune. By the way, we honor this warranty for any manufacturer's board that we have a replacement for.

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 PMD-1208LS device 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 that can also help you get the most out of this device.

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.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such those assigned to registers, bit settings, etc.

bold text **Bold text** is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:

1. Insert the disk or CD and click the **OK** button.

italic text *Italic text* is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:

- The *Insta*Cal installation procedure is explained in the *Software Installation Manual*.
- *Never* touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide information that can help you get the most out of your PMD-1208LS Personal Measurement Device™.

Documents on your local drive

When you install the software, the following electronic documents are copied to the default installation directory "C:\MCC\Documents" on your local drive:

- MCC's *Universal Library User's Guide* (SM UL USER'S GUIDE.pdf)
- MCC's *Universal Library Function Reference* (SM UL FUNCTION REF.pdf).
- MCC's *Universal Library for LabVIEW User's Guide* (SM-UL-LabVIEW.pdf)
- *PMD-1208LS User's Guide* (PMD-1208LS.pdf)

Documents on MCC's web site

The documents below are available on our web site at the address specified.

- MCC's *Specifications: PMD-1208LS* (the PDF version of Chapter 6 in this guide) is available on our web site at www.mccdaq.com/pdfs/PMD-1208LS.pdf.
- MCC's *PMD-LS Series OEM Software Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/PMD-LS-Library.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.

Introducing the PMD-1208LS

This user's guide contains all of the information you need to connect the PMD-1208LS measurement and automation device to your computer and to other data acquisition hardware. This device is part of the PMD-LS Series of data acquisition products.

The PMD-1208LS is a USB 1.1 low-speed device that is used for data acquisition and control. 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 PMD-1208LS device is supported under Microsoft Windows 98SE/ME/2000 and XP.

The PMD-1208LS features eight analog inputs, two 10-bit analog outputs, 16 digital I/O connections and one 32-bit external event counter. The device is powered by the +5 volt USB supply. No external power is required.

The PMD-1208LS's 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 discrete digital I/O lines. Each digital channel can be configured for either input or output.

The PMD-1208LS USB device is shown in Figure 1-1. All I/O connections are made to the screw terminals located along each side of the device.

Figure 1-1. PMD-1208LS USB device

PMD-1208LS block diagram

Figure 1-2 shows a block diagram of the PMD-1208LS device's functionality.

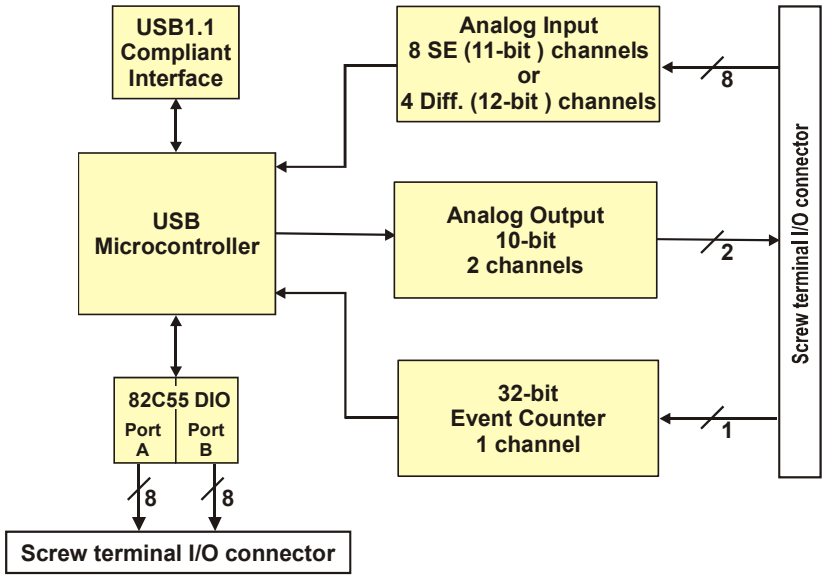


Figure 1-2. PMD-1208LS Functional Block Diagram

Software features

The PMD-1208LS device ships with the *Insta*Cal™ software utility package, Universal Library™ software, Universal Library for LabVIEW™ software, and SoftWIRE® MCC DAQ Controls for VB6 software. In addition, an OEM software library is available to download from our web site.

The easiest way to calibrate, configure and use the PMD-1208LS device is with *Insta*Cal and the Universal Library
The *Insta*Cal software is automatically installed when you install the Universal Library. The Universal Library is required to run the Universal Library for LabVIEW software and the SoftWIRE MCC DAQ Controls for VB6 software.

You can optionally download the OEM software library to develop custom applications that are independent from the Universal Library or *Insta*Cal.

InstaCal and the Universal Library

*Insta*Cal is a complete installation, calibration, and test program for MCC data acquisition devices and control boards. Complete with extensive error checking, *Insta*Cal guides you through the installation and setup of your personal measurement device, and creates the hardware configuration file for use by your program or application software package. *Insta*Cal provides the easiest way to calibrate and configure the PMD-1208LS device.

The Universal Library software provides access to PMD-1208LS functions from the full range of 32-bit Windows® programming languages. The Universal Library is a complete set of I/O libraries and drivers for all Measurement Computing boards and for all Windows-based languages. When using the Universal Library, you can switch boards or even programming languages, and the syntax remains constant. The Universal Library provides the easiest way to program the PMD-1208LS device.

Mini-applications
For systems with Microsoft's .NET Framework installed, mini-applications, such as a Strip Chart, are installed with the Universal Library software. Mini-applications are standalone programs that you can use to acquire data from your PMD-1208LS device right away. Each mini-application can be launched from *Insta*Cal, or directly by running the application from the "Applications" installation subdirectory. Not all of the mini-applications apply to all board types.

Universal Library for LabVIEW

The Universal Library for LabVIEW software includes a set of Universal Library VIs that you can use to create LabVIEW programs to control your PMD-1208LS device. LabVIEW must be installed before you can install the Universal Library for LabVIEW software.

SoftWIRE MCC DAQ Controls for VB6

The SoftWIRE MCC DAQ Controls for VB6 software includes a set of SoftWIRE data acquisition controls that you can use to create SoftWIRE programs to control your PMD-1208LS device. SoftWIRE 3.1 must be installed before you can install the SoftWIRE MCC DAQ Controls for VB6 software.

PMD-LS Series OEM Software Library and documentation are available
The OEM software provides source code that you can use to develop your own custom applications that are independent of *Insta*Cal or the Universal Library. You can develop programs in any environment that supports 32-bit DLL's, such as Microsoft's Visual C/C++ and Visual Basic®.
You can download the PMD-LS Series OEM Software Library from our web site at www.mccdaq.com/PMDregistration.asp.
Installation instructions and function explanations for the OEM Software Library are included in the *PMD-LS Series OEM Software Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/PMD-LS-Library.pdf).

What is a USB Human Interface Device (HID)?

The PMD-1208LS is a USB Human Interface Device (HID) class device. USB architecture offers the following advantages over other bus types:

- 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.
- A USB HID uses a Microsoft USB HID class driver to interface with the device. No third-party device driver is required.
- The USB HID is plug-and-play. There are no add-in boards to install, DIP switches to set, or interrupts to configure.
- You can connect the HID before or after you install software, and without powering down your computer first. When you connect an HID to your system, the PC automatically detects it and configures the necessary software. You can connect and power multiple HID peripherals to your system using a USB hub.
- 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 PMD-1208LS

What comes with your PMD-1208LS shipment?

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

Hardware

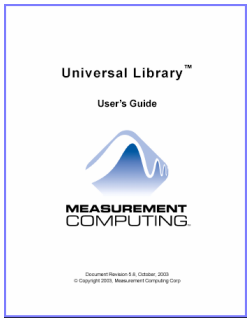
- PMD-1208LS device
- USB cable

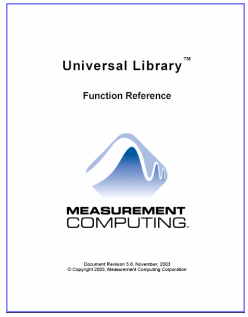
Software

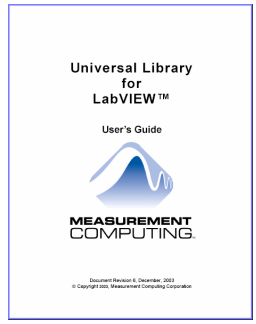
Installation CD, containing the *Insta*Cal utility, Universal Library™ Data Acquisition and Control Programming Tools, SoftWIRE MCC DAQ Controls for VB6, and UL for LabVIEW.

Documentation (PDF format)

- *Universal Library User's Guide,* and *Universal Library Function Reference*
- *Universal Library for LabVIEW User's Guide* (installing the UL for LabVIEW software is optional)







Unpacking the device

The PMD-1208LS device is shipped in an antistatic container to prevent damage by an electrostatic discharge. To avoid such damage, perform the following procedure when unpacking and handling your board:

1. Before opening the antistatic container, ground yourself with a wrist-grounding strap or by holding onto a grounded object (such as the computer chassis).
2. Touch the antistatic container to the computer chassis before removing the device from the container.
3. Remove the device from the container.

If any components are missing or damaged, notify Measurement Computing Corp. 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@measurementcomputing.com

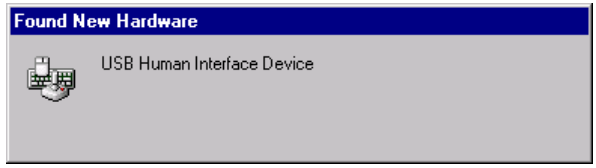
Installing the device

To connect the PMD-1208LS device to your system, do the following:

- With your computer on, connect the USB cable into a USB port on your computer or into an external USB hub that is connected to the computer. The USB cable provides power and communication to the PMD-1208LS device.

  When you connect the device for the first time, the **Found New Hardware** dialog windows appears. When running Windows XP, this dialog is replaced by a notification in the lower right side of your screen.

  A second **Found New Hardware** window appears after the first closes. When running Windows XP, this dialog is replaced by a notification in the lower right side of your screen.



When the second window closes, the installation is complete. The LED on the PMD-1208LS should flash three times and then remain lit. This indicates that communication is established between the PMD-1208LS device and the PC.

Caution! Do not disconnect **any** device from the USB bus while the host is communicating with the PMD-1208LS, or you may lose data and/or your ability to communicate with the device.

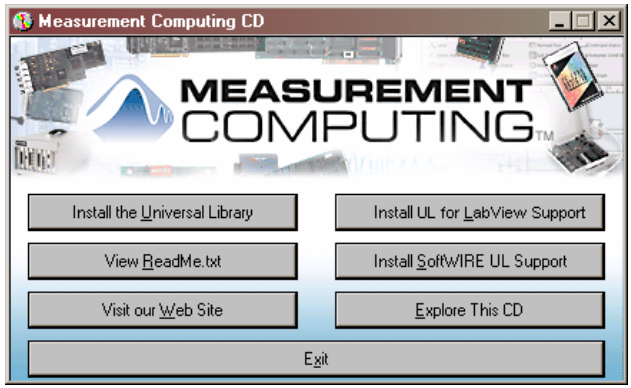
If the LED turns off
If the LED is illuminated but then turns off, the host has lost communication with the device. To restore communication, disconnect the USB cable from the host, and then reconnect it. This action resets the LED to *on* and restores communication.

Installing the software

The installation CD contains the Universal Library, *Insta*Cal configuration and calibration software, Universal Library for LabVIEW™, and SoftWIRE® MCC DAQ Controls for VB6 software.

To install the Universal Library and *Insta*Cal software, do the following:

1. Insert the installation CD into your CD drive. The following window displays.



2. Click on the **Install the Universal Library** button and follow the instructions as prompted.

   The *Insta*Cal software is automatically installed with the Universal Library software.

3. When the installation is complete, you are prompted to restart your computer. If you want to install the optional software (see below), you can wait to reboot the computer until after that software is installed.

The installation CD contains the following optional software that you can install for use with your PMD-1208LS device. The Universal Library must be installed to run these optional software packages.

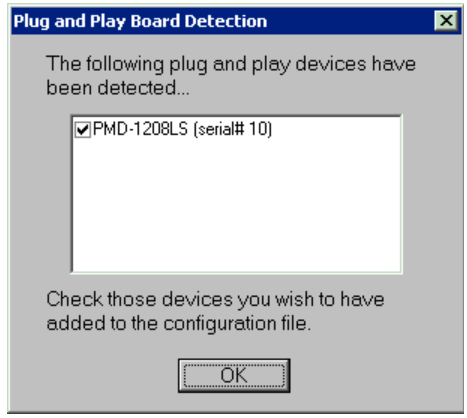
- SoftWIRE MCC DAQ Controls for VB6 - To use the PMD-1208LS device with SoftWIRE 3.1 data acquisition controls, click on the **Install SoftWIRE UL Support** button and follow the instructions as prompted. SoftWIRE 3.1 must be installed before you can install the SoftWIRE MCC DAQ Controls for VB6 software.
- UL for LabVIEW - To use the PMD-1208LS device with LabVIEW, click on the **Install the UL for LabVIEW Support** button and follow the instructions as prompted. LabVIEW must be installed before you can install the UL for LabVIEW software.

Configuring the device

All device configuration options on the PMD-1208LS are software-controlled. You can configure some of the options using *Insta*Cal, such as the analog input mode (eight single-ended or four differential channels) and the serial number of a connected device. To configure these options with *Insta*Cal, perform the following procedure:

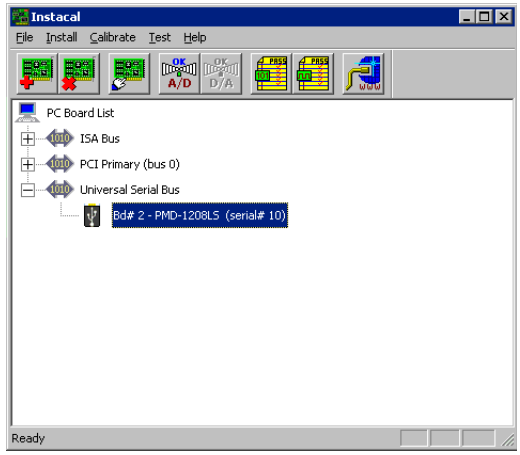
1. Click on **Start > Measurement Computing > InstaCal** to launch the *Insta*Cal software.

   A **Plug and Play Board Detection** dialog appears, listing the PMD-1208LS. This dialog only displays when you first install the device, or if you reinstall the device.



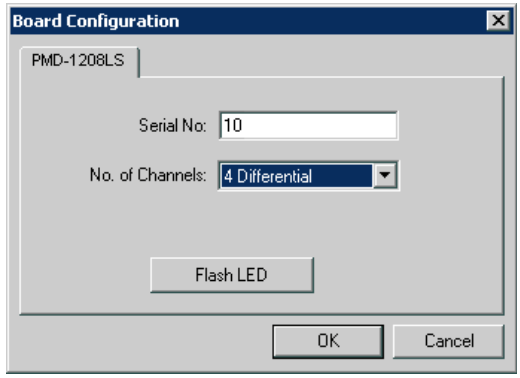
2. Leave the check box next to the PMD-1208LS item checked, and click the **OK** button to close the dialog.

   The dialog closes, and the PMD-1208LS is added to the **PC Board List** on the **Instacal** main window.



3. Double-click on the PMD-1208LS item listed below **Universal Serial Bus**.

   The **Board Configuration** dialog appears.



If you have a numbering scheme that you want to implement for your USB devices, change the number in the **Serial No.** box to the serial number you want to assign to the device.

4. Pull down the **No. of Channels** list box and select either *4 Differential* or *8 Single Ended* as the analog input configuration.

   If you installed more than one PMD-1208LS, you can click the **Flash LED** button to identify the device you are configuring. The device's LED blinks three times.

5. Click on the **OK** button to close the window.

You can launch mini-applications from *Insta*Cal
You can launch a mini-application, such as the Strip Chart, from *Insta*Cal's **Applications** menu and take measurements from your PMD-1208LS device right away. You must have Microsoft's .NET Framework installed to run a mini-application. Not all of the mini-applications apply to all board types.

6. If you are done using *Insta*Cal, select **Exit** from the **File** menu to close *Insta*Cal.

Programming and Software Applications

After following the installation instructions in Chapter 2, "Installing the PMD-1208LS," your device should now be installed and ready to use.

Programming languages

Universal Library

Measurement Computing's Universal Library™ provides complete access to PMD-1208LS functions from the full range of 32-bit Windows® programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, refer to the *Universal Library User's Guide* and the *Universal Library Function Reference*. These documents are copied to *C:\MCC\Documents\ SM UL USER'S GUIDE.pdf* and *C:\MCC\Documents\ SM UL FUNCTION REF.pdf* by default during installation.

OEM Software Library

Measurement Computing's PMD-LS Series OEM Software Library provides the source code with which you can develop your own custom applications without being dependent on *Insta*Cal or the Universal Library. Use this software to write custom user applications that communicate with and control the PMD-1208LS. You can develop programs in any environment that supports 32-bit DLL's, such as Microsoft's Visual C/C++ and Visual Basic®.

The PMD-LS Series OEM Software Library is available to download from our web site. Refer to http://www.mccdaq.com/PMDregistration.asp for more information.

Installation instructions and function explanations for the OEM Software Library are detailed in the *PMD-LS Series OEM Software Library User's Guide*. This document is available on our web site at www.mccdaq.com/PDFmanuals/PMD-LS-Library.pdf.

Software Applications

Universal Library for LabVIEW

With MCC's Universal Library for LabVIEW software, you can construct your own LabVIEW programs using Universal Library VIs with the PMD-1208LS device.

The *Universal Library for LabVIEW User's Guide* is copied to C:\MCC\Documents\SM-UL-LabVIEW.pdf by default.

SoftWIRE MCC DAQ Controls for VB6

Measurement Computing's DAQ Controls provide a collection of data acquisition controls that you can use to develop custom applications with SoftWIRE that read to and write from your PMD-1208LS's analog and digital channels.

MCC mini-applications

For systems on which Microsoft's .NET Framework is installed, mini-applications, such as a Strip Chart, are installed with the Universal Library software. Each mini-application is a fully-configured and ready-to-run application that you can use to acquire data from your PMD-1208LS device. You can launch each mini-application from *Insta*Cal's **Applications** menu. Mini-applications are installed in the *C:\MCC\Applications* subdirectory by default. Online help is available from the **Help** menu within each mini-application.

Not all of the mini-applications apply to all board types.

Functional Details

Theory of operation - analog input acquisition modes

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

Software paced mode

In software paced mode, the PMD-1208LS gathers data in a single acquisition or as a group of single acquisitions. An analog-to-digital conversion is initiated with a software command, and the single data point result is returned to the host. This operation may be repeated until the required number of samples is obtained for the channel (or channels) in use. Software pacing is limited by the 20 mS round-trip requirement of a USB interrupt-type endpoint operation. This yields a maximum throughput in software paced mode of 50 S/s.

Continuous scan mode

In continuous scan mode, the PMD-1208LS gathers data in a single-channel or multi-channel sequence. This sequence converts, transfers, and stores data to a user buffer until the scan is stopped. In this mode, digitized data is continuously written to an on-board FIFO buffer. This FIFO is serviced in blocks as the data is transferred from the PMD-1208LS to the user buffer in the host PC.

It is important to note that the maximum continuous scan rate of 1.2 kS/s is an aggregate rate. That is, the total acquisition rate for all channels cannot exceed 1.2 kS/s. Following this requirement, a PMD-1208LS can acquire one channel at 1.2 kS/s, two channels at 600 S/s and four channels at 300 S/s. You can initiate a continuous scan by either a software command or an external hardware trigger event.

Burst scan mode

In burst scan mode, the PMD-1208LS gathers data using the full capacity of its 4K sample FIFO buffer. You can initiate a single acquisition sequence of one, two, or four channels by either a software command or an external hardware trigger. The captured data is then read from the FIFO and transferred to a user buffer in the host PC.

Since the data is acquired at a rate faster than it can be transferred to the host, burst scans are limited to the depth of the on-board memory. As with continuous mode, the maximum sampling rate is an aggregate rate. Consequently, the maximum burst mode rates are 8 kS/s, 4 kS/s and 2 kS/s for one, two and four channels, respectively.

External components

The PMD-1208LS device has the following external components, as shown in Figure 4-1.

- USB connector
- LED
- Screw terminal banks (2)

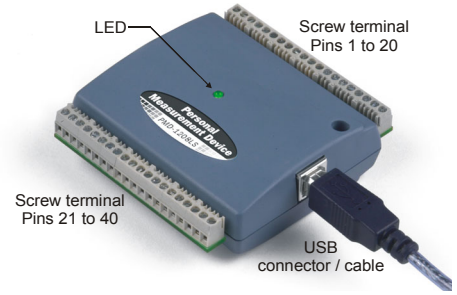


Figure 4-1. PMD-1208LS USB Device

USB connector

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

LED

The LED located on the front of the housing indicates the communication status of the PMD-1208LS. It uses up to 5 mA of current and cannot be disabled. Table 4-1 defines the function of the PMD-1208LS device's LED.

Table 4-1. LED Illumination

LED Illumination	Indication
Steady green	The PMD-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 PMD-1208LS device and the host PC.
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 PMD-1208LS device has two banks of screw terminals – one bank on the top edge of the housing, and one bank on the bottom edge. Each screw terminal bank provides 20 connections. Pin numbers are identified in Figure 4-2.

Figure 4-2. PMD-1208LS Screw terminal pin numbers

Screw terminal – pins 1-20

The screw terminals on the top edge of the PMD-1208LS (pins 1 to 20) provide the following connections:

- Eight analog input connections (**CH0 IN** to **CH7 IN**)
- Two analog output connections (**D/A OUT 0** to **D/A OUT 1**)
- One external trigger source (**TRIG_IN**)
- One external event counter connection (**CTR**)
- Seven GND connections (**GND**)
- One calibration terminal (**CAL**)

Screw terminal – pins 21-40

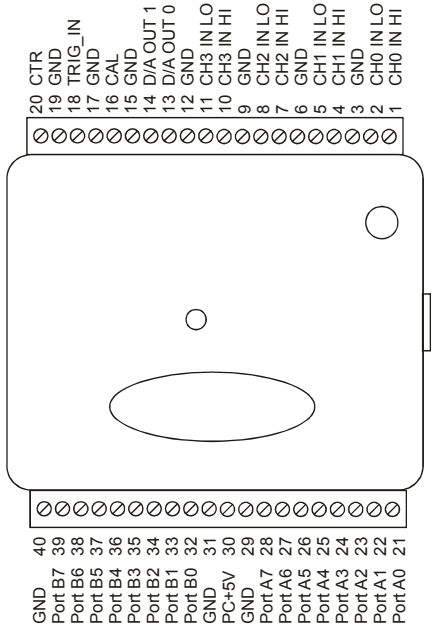
The screw terminals on the bottom edge of the device (pins 21 to 40) provide the following connections:

- 16 digital I/O connections (**PortA0** to **Port A7**, and **Port B0** to **Port B7**)
- One power connection (**PC+5 V**)
- Three ground connections (**GND**)

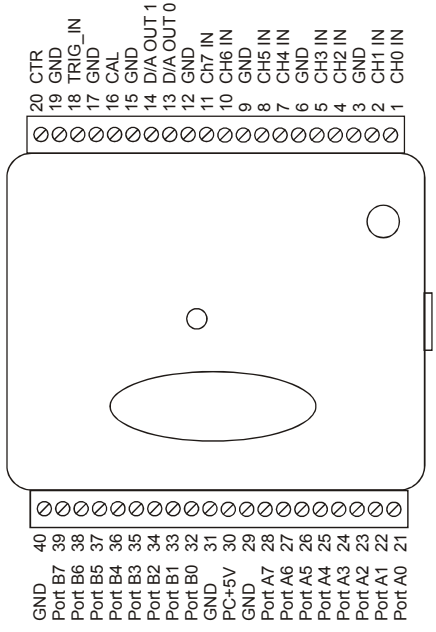
Main connector and pin out

Connector type	Screw Terminal
Wire gauge range	16 AWG to 30 AWG

4-Channel differential mode pinout



8-Channel single-ended mode pinout



Analog input terminals (CH0 IN - CH7 IN)

Connect up to eight analog input connections to the screw terminal containing pins 1 to 20 (**CH0 IN** through **CH7 IN**.) Refer to the pinout diagrams on page 4-4 for the location of these pins.

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 all of the analog input channels are 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:

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

The input range for single-ended mode is ±10V. No other ranges are supported in single-ended mode. Figure 4-3 illustrates a typical single-ended measurement connection.

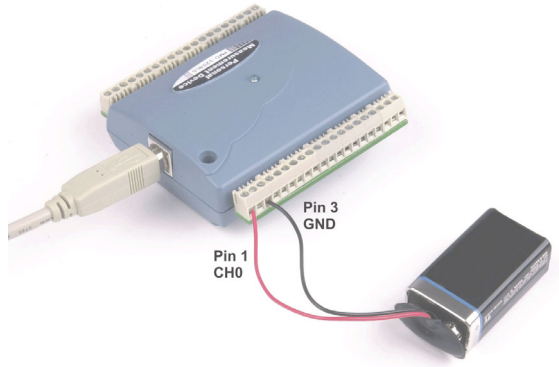


Figure 4-3. Single-Ended Measurement Connection

Single-ended measurements using differential channels

To perform a single-ended measurement using differential channels, connect the signal to “CHn IN HI” input, and ground the associated “CHn IN LO” input.

Differential configuration

When all of the analog input channels are configured for differential input mode, four analog channels are available. In differential mode, the input signal is measured with respect to the low input.

The input signal is delivered through three wires:

- The wire carrying the signal to be measured connects to CH0 IN HI, CH1 IN HI, CH2 IN HI, or CH3 IN HI.
- The wire carrying the reference signal connects to CH0 IN LO, CH1 IN LO, CH2 IN LO, or CH3 IN LO.
- The third wire connects 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 16-bits. Differential mode input voltage ranges are ±20V, ±10V, ±5V, ±4V, ±2.5V, ±2.0V, 1.25V, and ±1.0V.

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 −10V to +20V range in order to yield a useful result.

For example, you input a 4Vpp sine wave to CHHI, and apply the same sine wave 180° out of phase to CHLO. The common mode voltage is 0V. The differential input voltage swings from 4V-(-4V) = 8V to -4V-4V = -8V. Both inputs satisfy the -10V to +20V input range requirement, and the differential voltage is suited for the ±10V input range (see Figure 4-4).

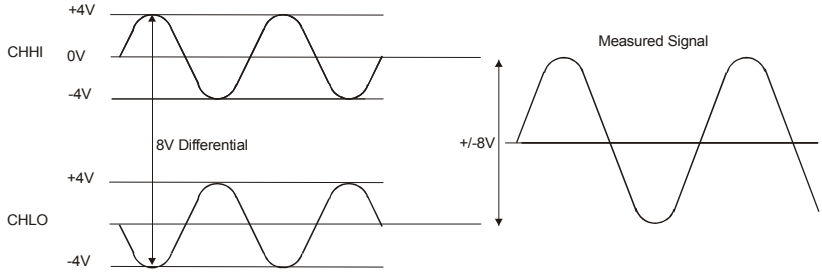


Figure 4-4. Differential Voltage Example: Common Mode Voltage of 0V

If you increase the common mode voltage to 11V, the differential remains at ±8V. Although the [*common-mode voltage* + *signal*] on each input now has a range of +7V to +15V, both inputs still satisfy the -10V to +20V input requirement (see Figure 4-5).

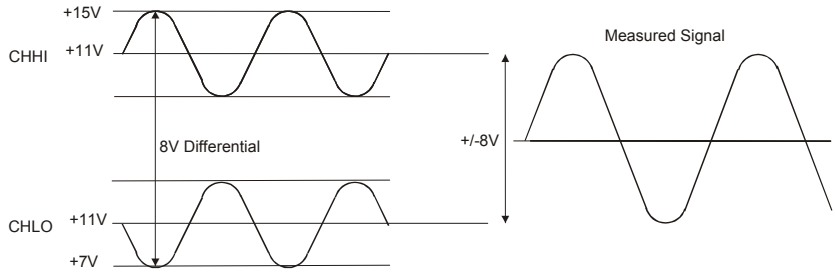


Figure 4-5. Differential Voltage Example: Common Mode Voltage of 11V

If you decrease the common-mode voltage to -7V, the differential stays at ±8V. However, the solution now violates the input range condition of -10V to +20V. The voltage on each analog input now swings from -3V to -11V. Voltages between -10V and -3V are resolved, but those below -10V are clipped (see Figure 4-6).

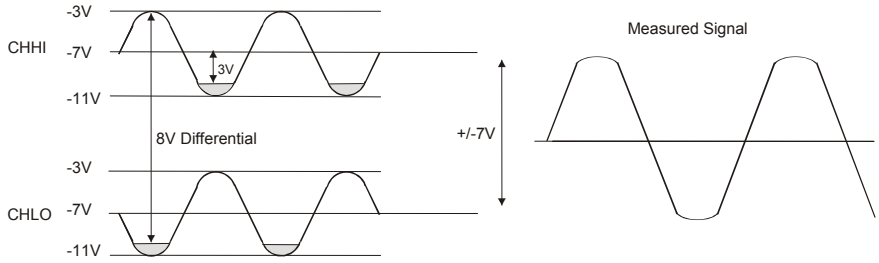


Figure 4-6. Differential Voltage Example: Common Mode Voltage of −7V

Since the analog inputs are restricted to a −10V to +20V 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 ±20V range is the exception. You cannot put −20V on CHHI and 0V on CHLO since this violates the input range criteria.

Table 4-2 shows some possible inputs and the expected results.

Table 4-2. Sample Inputs and Differential Results

CHHI	CHLO	Result
-20V	0V	Invalid
-15V	+5V	Invalid
-10V	0V	-10V
-10V	+10V	-20V
0V	+10V	-10V
0V	+20V	-20V
+10V	-10V	+20V
+10V	0V	+10V
+15V	-5V	+20V
+20V	0	+20V

Additional information on analog signal connections
For general information regarding single-ended and differential inputs, refer to the *Guide to Signal Connections* (available on our web site at www.mccdaq.com/signals/signals.pdf).

Digital I/O terminals (Port A0 to A7, and Port B0 to B7)

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**.) Refer to the pinout diagrams on page 4-4 for the location of these pins. You can configure each digital port for either input or output.

When configured for input, you can use the device's digital I/O terminals to detect the state of any TTL level input. Refer to the switch shown in Figure 4-7 and the schematic shown in Figure 4-8. If the switch is set to the +5V input, Port A0 reads *TRUE* (1). If you move the switch to GND, Port A0 reads *FALSE*.

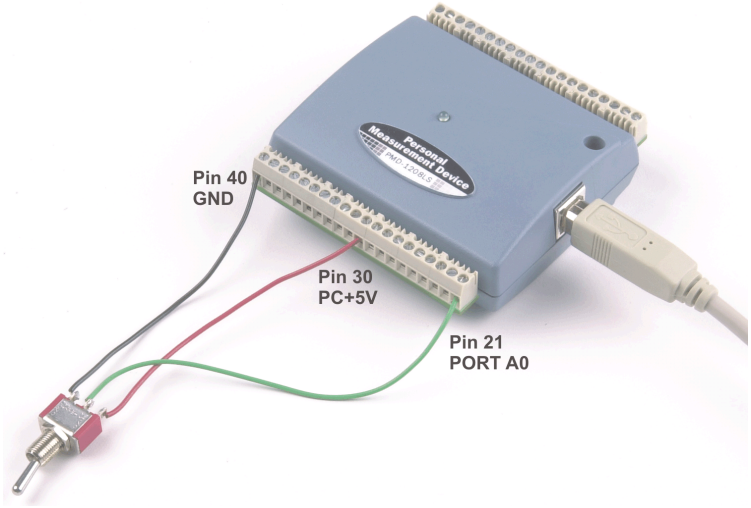


Figure 4-7. Digital connection Port A0 detecting the state of a switch

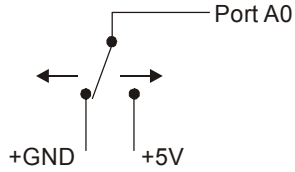


Figure 4-8. Schematic showing switch detection by digital channel Port A0

Additional information on digital 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).

Power terminals

The **PC +5V** connection is located at pin 30 on the screw terminal at the bottom edge of the device. Refer to the pinout diagrams on page 4-4 for the location of this pin. This terminal draws power from the USB connector. The +5V screw terminal is a 5 volt output that is supplied by the host computer.

Caution! The +5V terminal is an output. Do not connect to an external power supply or you may damage the device and possibly the host computer.

The maximum total output current that can be drawn from all PMD-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 PMD-1208LS to your computer draws 20 mA of current from the USB +5V supply. Once you start running applications with the device, each DIO bit can draw up to 2.5 mA, and each analog output can draw 30 mA. The maximum amount of +5V current available to the user is the difference between the *total current requirement* of the PMD (based on the application), and the *allowed current draw* of the PC platform (again, 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, you can calculate the total current requirement of the PMD-1208LS device's USB +5V as follows:

(PMD-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, this value yields a maximum user current of 500 mA−120 mA = 380 mA. This number is the total maximum available current at the PC+5V 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 300-320 mA range.

Since laptop computers typically allow up to 100 mA, the PMD-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 +5V by the load impedance of the pin in question.

Ground terminals

There are 10 identical ground connections that provide a common ground for all PMD-1208LS functions. Refer to the pinout diagrams on page 4-4 for the location of the **GND** terminal pins.

Calibration terminal

The **CAL** connection is located at pin 16 on the screw terminal at the bottom edge of the device. Refer to the pinout diagrams on page 4-4 for the location of this pin. This terminal is only used for calibration purposes. Calibration of the PMD-1208LS is software-controlled via *Insta*Cal. Refer to the chapter "Calibrating the Device" for calibration instructions.

Counter terminal

The input to the 32-bit external event counter is via pin 20 (**CTR**) on the screw terminal at the top edge of the device. Refer to the pinout diagrams on page 4-4 for the location of this pin.

The internal counter increments whenever the CTR input voltage changes from less than 1 volt to greater than 4 volts. The counter can count frequencies of up to 1 MHz.

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

Figure 4-9 shows an ideal, error-free, PMD-1208LS transfer function. The typical calibrated accuracy of the PMD-1208LS is range-dependent, as explained in the "Specifications" chapter of this document. We use a ±10V range here as an example of what you can expect when performing a measurement in this range.

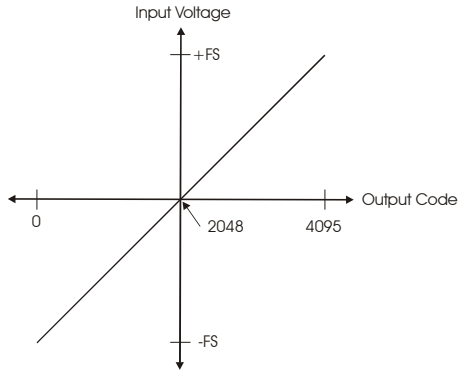


Figure 4-9. Ideal ADC transfer function

The PMD-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 4-10 shows the PMD-1208LS transfer function with an offset error. The typical offset error specification for the product on the ±10V range is ±9.77mV. Offset error affects all codes equally by shifting the entire transfer function up or down along the input voltage axis.

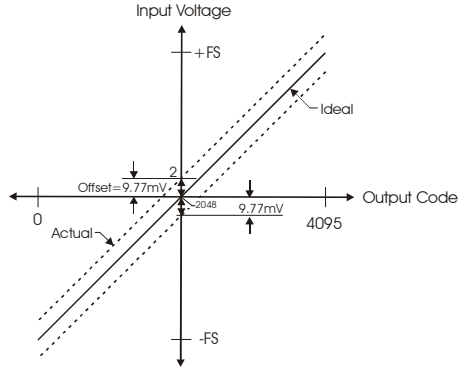


Figure 4-10. ADC transfer function with offset error

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 4-11 shows the PMD-1208LS transfer function with gain error. Gain error is easily converted to voltage by multiplying the full-scale (FS) input by the error.

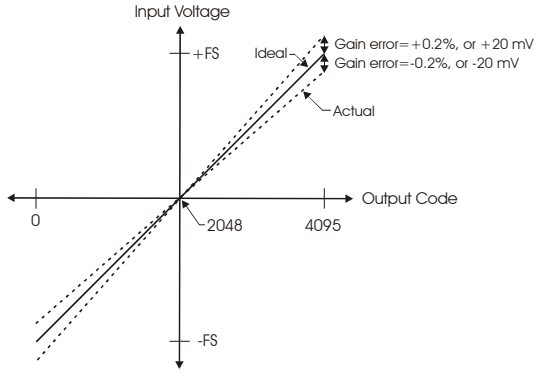


Figure 4-11. ADC Transfer function with gain error

For example, the PMD-1208LS exhibits a typical calibrated gain error of ±0.2% on all ranges. For the ±10V range, this would yield 10V × ±0.002 = ±20mV. This means that at full scale, neglecting the effect of offset for the moment, the measurement would be within 20mV 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 4-12 below, we have a plot of the error band of the PMD-1208LS for the ±10V range. This is a graphical version of the typical accuracy specification of the product.

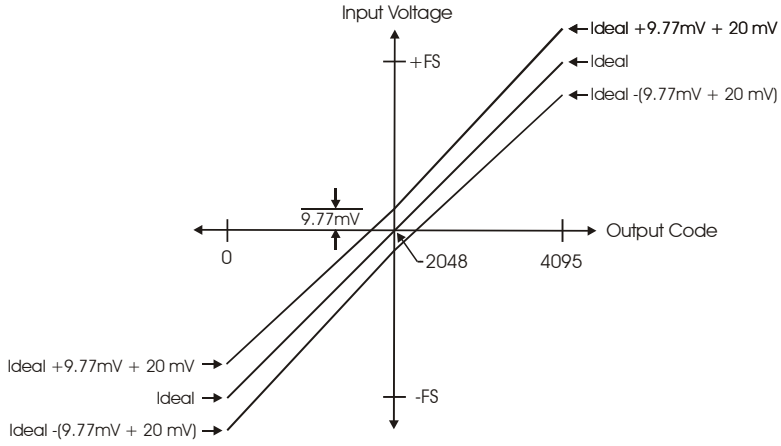


Figure 4-12. Error band plot

The plots shown in Figure 4-9 through Figure 4-12 are drawn for clarity and are not to scale.

PMD-1208LS channel gain queue feature

The PMD-1208LS's channel gain queue feature allows you to set up a scan sequence with a unique per-channel gain setting and sequence order. A scan run without the gain queue feature simply involves a fixed range and an ascending channel sequence bounded by a start channel and a stop channel—for example, a scan from channel 0 to channel 3 at a fixed ±10V range for each channel.

The channel gain queue feature removes the restriction of using an ascending channel sequence at a fixed gain. This feature creates a channel list which is written to local memory on the PMD-1208LS. This list is made up of a channel number and range setting. An example of a four-element list would look something like this:

Table 4-3. Sample channel gain queue list

Element	Channel	Range
0	CH0	BIP10V
1	CH0	BIP5V
2	CH7	BIP10V
3	CH2	BIP1V

When a scan begins with the gain queue enabled, the PMD-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 gathered. You must carefully match the gain to the expected voltage range on the associated channel—otherwise, an over range condition can occur. Although this condition does not damage the PMD-1208LS, it does produce a useless full-scale reading. It can also introduce a long recovery time from saturation, which can affect the next measurement in the queue.

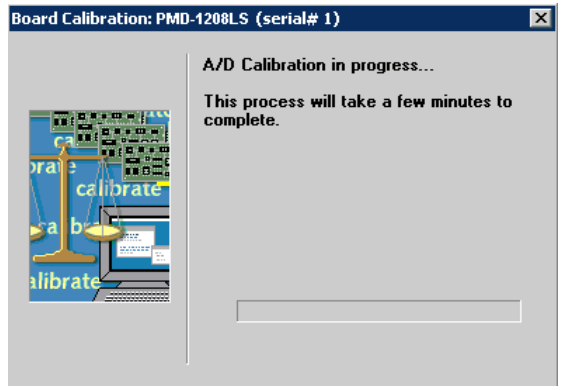
Calibrating and Testing the Device

Calibrating with *Insta*Cal

*Insta*Cal's calibration procedures calibrate the offset and gain corrections for the PMD-1208LS's inputs. These corrections are stored in nvRAM. You should calibrate the PMD-1208LS every six months.

To calibrate the PMD-1208LS device, follow the steps below.

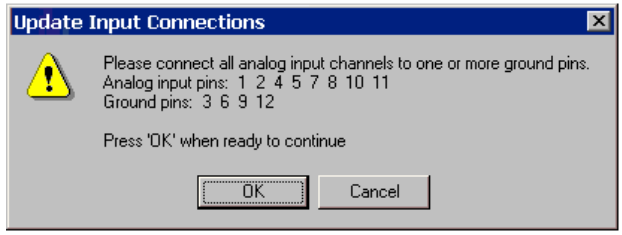
1. Click on **Start > Measurement Computing > InstaCal** to launch the *Insta*Cal software. The *Insta*Cal main window appears.
2. Pull down the **Calibrate** menu and select **A/D**. The **Board Calibration** dialog appears, followed by the first of three dialogs. Each dialog displays wiring instructions.



The pin numbers and associated signals on the PMD-1208LS are specified below for differential mode operation. Refer to this information when performing the following calibration procedures.

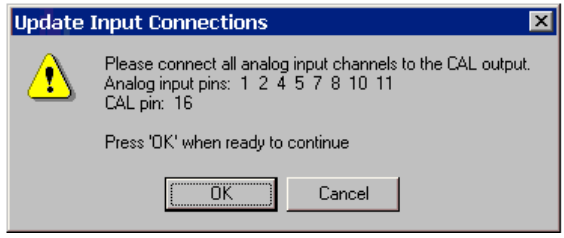
Pin	Signal Name	Pin	Signal Name
1	CH0 IN HI	21	Port A0
2	CH0 IN LO	22	Port A1
3	GND	23	Port A2
4	CH1 IN HI	24	Port A3
5	CH1 IN LO	25	Port A4
6	GND	26	Port A5
7	CH2 IN HI	27	Port A6
8	CH2 IN LO	28	Port A7
9	GND	29	GND
10	CH3 IN HI	30	PC+5V
11	CH3 IN LO	31	GND
12	GND	32	Port B0
13	D/A OUT 0	33	Port B1
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

The first **Update Input Connections** dialog prompts you to connect all analog input terminals to GND terminals. This procedure calibrates the offset corrections for all inputs.



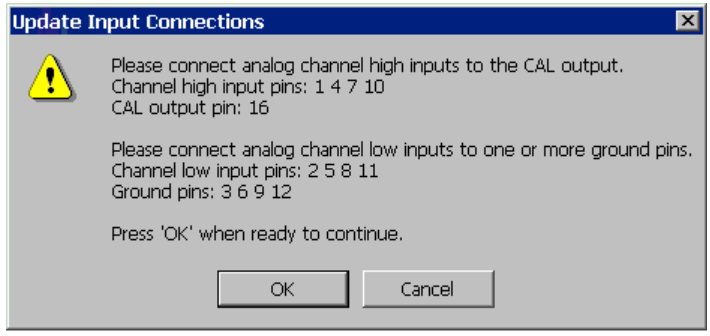
3. Connect each analog input channel (pin 1, 2, 4, 5, 7, 8, 10 and 11) to a **GND** terminal and press **OK**.

After automatically calibrating the offset corrections, the second **Update Input Connections** dialog appears. This dialog prompts you to connect all analog inputs to the **CAL** terminal. This procedure calibrates the gain corrections for the single-ended inputs.



4. Connect each analog input channel (pin 1, 2, 4, 5, 7, 8, 10 and 11) to the **CAL** output terminal (pin 16) and press **OK**.

   The third **Update Input Connections** dialog appears. This dialog prompts you to connect all HI analog inputs to the **CAL** terminal, and all LO analog inputs to a **GND** terminal. This procedure calibrates the gain corrections for the differential inputs.



5. Connect all HI input channels (pins 1, 4, 7 and 10) to the **CAL** terminal (pin 16), and all LO input channels (pin 2, 5, 8 and 11) to one or more **GND** terminals and press **OK**.

When all gain and offset corrections are calibrated, a **Calibration Complete** dialog appears. Press the **OK** button to exit the calibration procedure.

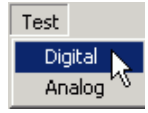
Testing with *Insta*Cal

*Insta*Cal provides test procedures that you can perform to verify that the PMD-1208LS device's analog and digital functions are working properly. To test the PMD-1208LS, select the device in *Insta*Cal, pull down the **Test** menu, and select either **Digital** or **Analog**, depending on the type of test you want to perform.

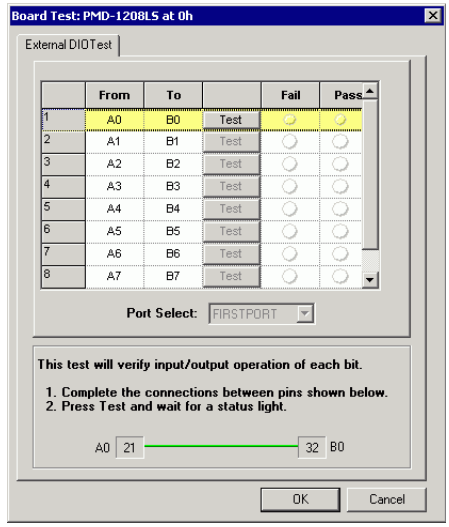
Testing the digital functions

You can verify the input/output operation of the PMD-1208LS device's digital I/O channels by performing an External DIO test. To test the device's digital functions, do the following:

1. From *Insta*Cal's main window, pull down the **Test** menu and select the **Digital** option.



2. The **Board Test: PMD-1208LS at 0h** dialog's **External DIO Test** tab displays.

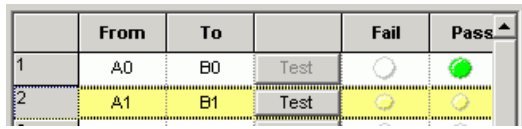


Row 1 is highlighted – this is where you begin the test.

3. Connect the signals as listed in row **1** of the dialog. Pin numbers are specified in the illustration at the bottom of the dialog.

For example, wire signal **A0** (pin 21) to signal **B0** (pin 32) and press the **Test** button.

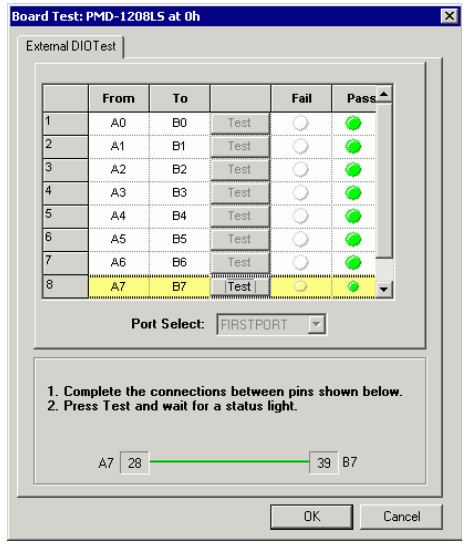
- The **Pass** status light illuminates green to indicate a successful test, and the next row is automatically highlighted for the next signal test.



- If the **Fail** status LED turns red, the test on the connection failed, and the following dialog displays.

Click **OK**, check your connections, and repeat the test. If you verify the connection and the test still fails, contact Measurement Computing's Technical Support.

4. Repeat the test in each row until all of the signals have been tested. The dialog below shows the External DIO Test dialog after successfully passing all of the digital signal tests.



5. When you are done testing the digital channels, click on the **OK** button to return to *Insta*Cal's main window.

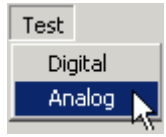
Testing the analog functions

There are two tests you can perform on the device's analog channels – a loop back test and an advanced scan test.

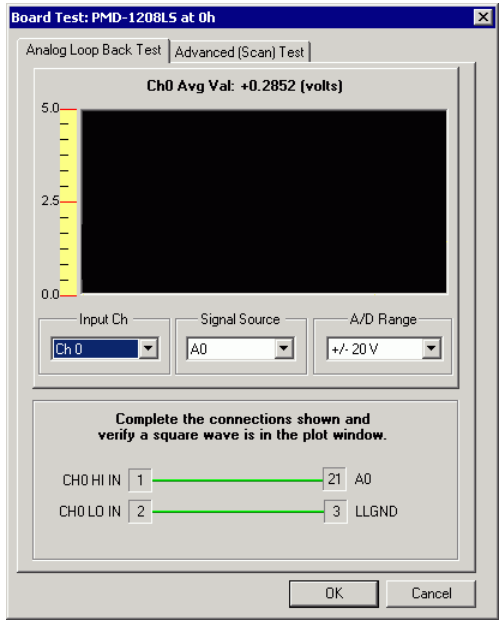
- For the loop back test, you wire an input channel to a signal source and verify the wave that displays on the plot window.
- With the advanced scan test, selected analog channels are sampled.

To test the device's analog functions, do the following:

1. From *Insta*Cal's main window, pull down the **Test** menu and select **Analog**.



2. The **Board Test: PMD-1208LS at 0h** dialog displays with two tabs – the **Analog Loop Back Test** tab and the **Advanced (Scan) Test** tab. The dialog is shown below with its default settings.



3. Click on the tab of the test you want to perform and follow the applicable procedure.

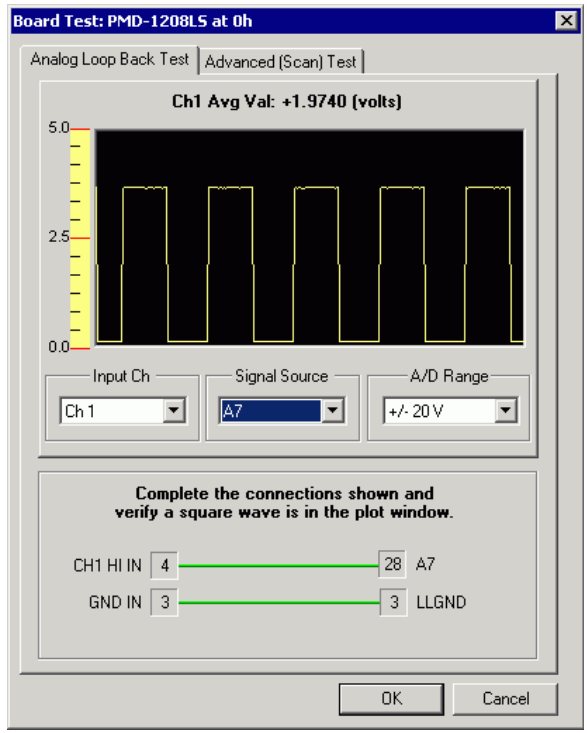
Loop Back test

With the Loop Back test, you connect an input channels to a signal source and verify the wave that displays.

To perform this test, do the following:

1. Select the input channel (CH0 to CH4), signal source (A0-A7, B0-B7, External, DAC0 or DAC1) and range to test.
2. Connect a wire between the signals, as shown by the wire illustration on the dialog. The pin numbers are specified in the illustration at the bottom of the dialog.
3. Verify that the correct wave is appears on the plot window.

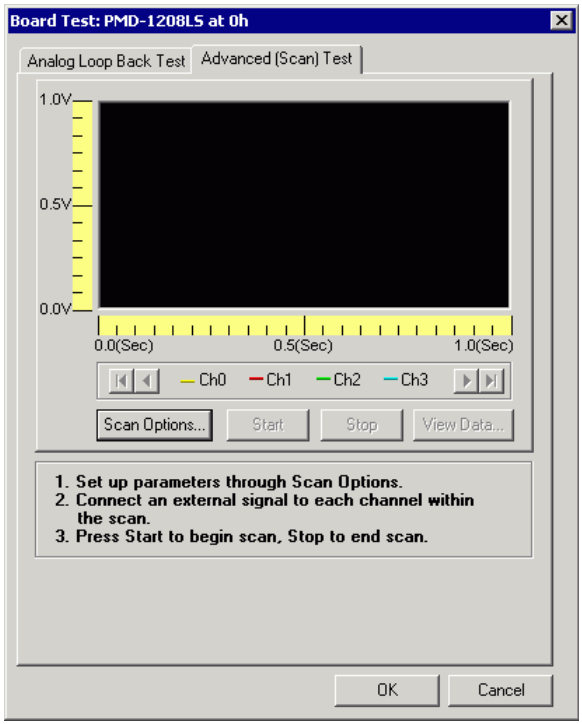
   For example, in the dialog below, pin 4 (signal CH0 IN HI) is connected to pin 28 (signal A7). This connection generates a square wave in the plot window.



When you change the input channel or signal source, the wire illustration dynamically updates the pin numbers to connect and the type of wave that should display.

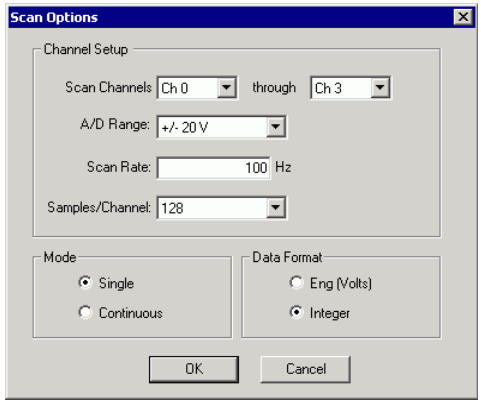
Advanced (Scan) test

Click on the **Advanced (Scan) Test** tab to scan selected channels. The **Advanced (Scan) Test** dialog is shown below configured with its default settings.



1. Click on the **Scan Options** button.

The **Scan Options** dialog displays. The dialog is shown with its default settings.

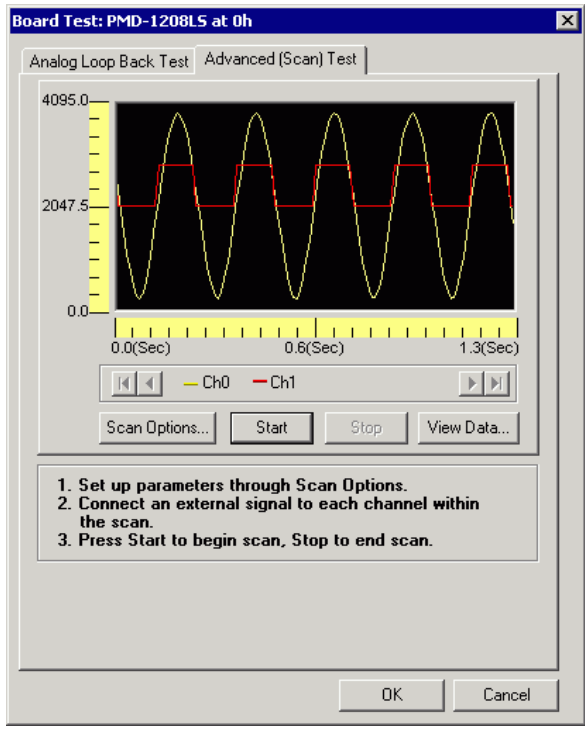


2. Select the channel(s) to scan, range, rate that you want to perform the scan test on and click **OK**.

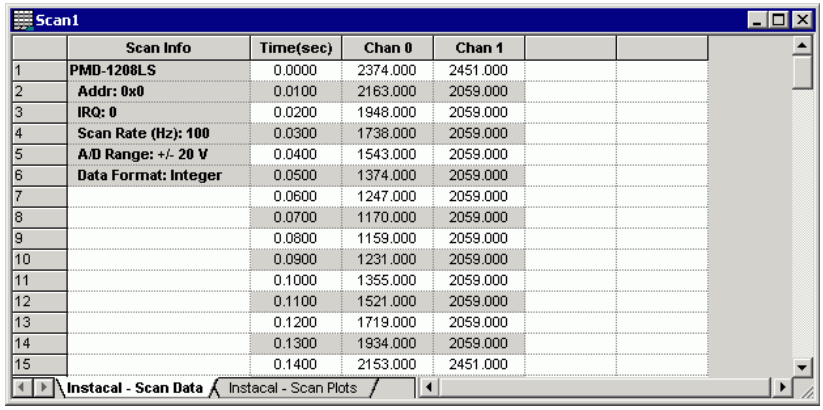
3. Connect an external signal to the channels to scan.

4. Press the **Start** button and verify the wave that displays in the plot window.

   For example, in the dialog below, channel 0 generates a sine wave, and channel 1 generates a square wave when connected to an external signal.



Click the **View Data** button to launch the **ScanView** utility program and display the data in a spreadsheet. ScanView is included with the Universal Library software.

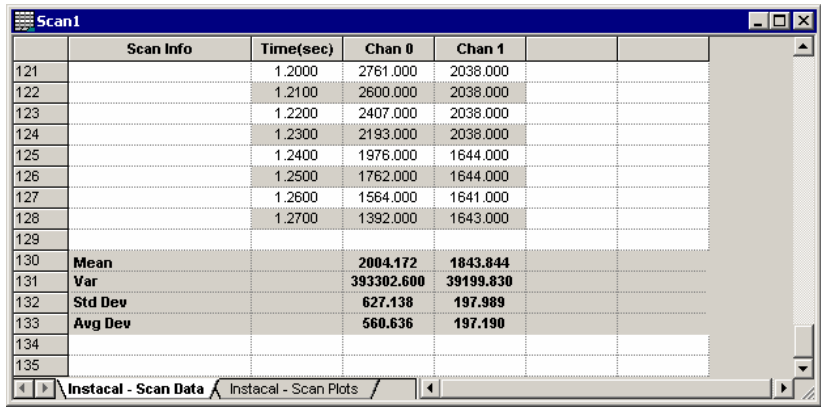


Scan1

	Scan Info	Time(sec)	Chan 0	Chan 1
1	PMD-1208LS	0.0000	2374.000	2451.000
2	Addr: 0x0	0.0100	2163.000	2059.000
3	IRQ: 0	0.0200	1948.000	2059.000
4	Scan Rate (Hz): 100	0.0300	1738.000	2059.000
5	A/D Range: +/- 20 V	0.0400	1543.000	2059.000
6	Data Format: Integer	0.0500	1374.000	2059.000
7		0.0600	1247.000	2059.000
8		0.0700	1170.000	2059.000
9		0.0800	1159.000	2059.000
10		0.0900	1231.000	2059.000
11		0.1000	1355.000	2059.000
12		0.1100	1521.000	2059.000
13		0.1200	1719.000	2059.000
14		0.1300	1934.000	2059.000
15		0.1400	2153.000	2451.000

Instacal - Scan Data | Instacal - Scan Plots

You can scroll to the bottom of the spreadsheet to view a summary of the data.



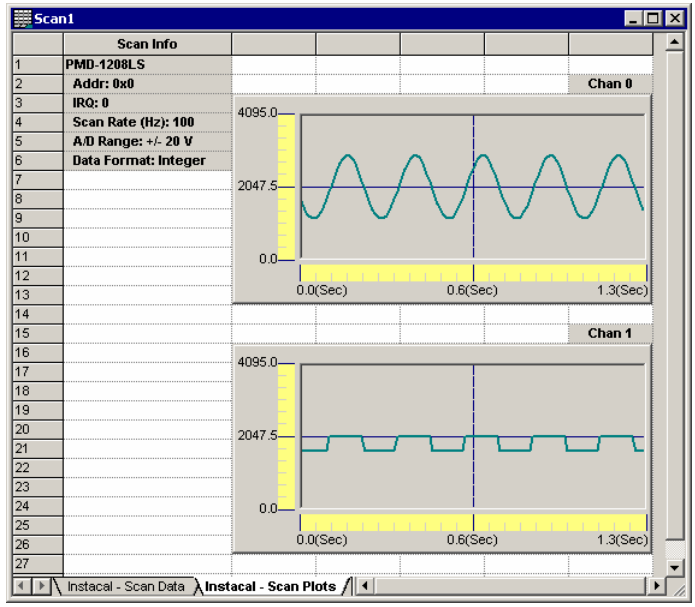
Scan1

	Scan Info	Time(sec)	Chan 0	Chan 1
121		1.2000	2761.000	2038.000
122		1.2100	2600.000	2038.000
123		1.2200	2407.000	2038.000
124		1.2300	2193.000	2038.000
125		1.2400	1976.000	1644.000
126		1.2500	1762.000	1644.000
127		1.2600	1564.000	1641.000
128		1.2700	1392.000	1643.000
129				
130	**Mean**		**2004.172**	**1843.844**
131	**Var**		**393302.600**	**39199.830**
132	**Std Dev**		**627.138**	**197.989**
133	**Avg Dev**		**560.636**	**197.190**
134				
135				

Instacal - Scan Data | Instacal - Scan Plots

You can print the data, or save it as a ScanView file (*.dvw).

You can click on the **InstaCal – Scan Plots** tab to display a graph of each channel.



Click the X in the upper right corner of the dialog to return to the Advanced (Scan) Test dialog.

5. When you are finished testing the PMD-1208LS device's analog channels, click **OK** to exit the dialog.

Specifications

Typical for 25 °C unless otherwise specified.

Analog input section

Parameter	Conditions	Specification
A/D converter type		Successive Approximation type
Input voltage range for linear operation, Single Ended Mode	CHx to GND	±10V max
Input common-mode voltage range for linear operation, Differential Mode	CHx to GND	-10V min, +20V max
Absolute maximum input voltage	CHx to GND	±40V max
Input current (Note 1)	Vin = +10V	70µA typ
	Vin = 0V	-12µA typ
	Vin = -10V	-94µA typ
Number of channels		8 single ended / 4 differential, software selectable
Input ranges, Single Ended Mode		±10V, G=2
Input ranges, 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
	Continuous scan	1.2 kS/s
	Burst scan to 4K 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

Parameter	Conditions	Specification
Integral Linearity Error		±1 LSB typ
Differential Linearity Error		±0.5 LSB typ
Repeatability		±1 LSB typ
CAL current	Source	5mA max
	Sink	20µA min, 200nA 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 (0-2047 codes) in single-ended mode.

Table 6-1. Accuracy, Differential Mode

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

Table 6-2. Accuracy, Single-Ended Mode

Range	Accuracy (LSB)
±10V	4.0

Table 6-3. Accuracy Components, Differential Mode - All values are (±)

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

Table 6-4. Accuracy Components, Single-Ended Mode - All values are (±)

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

Analog output section

Parameter	Conditions	Specification
D/A converter type		PWM
Resolution		10-bits, 1 in 1024
Maximum output range		0 -5 Volts
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
	1mA Load	0.99*Vs
	5mA Load	0.98*Vs
Output drive	Each D/A OUT	30mA
Slew rate		0.14V/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

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 47K resistors (default). Positions available for pull down to ground. Hardware selectable via zero ohm resistors as a factory option.
Input high voltage	2.0V min, 5.5V absolute max
Input low voltage	0.8V max, –0.5V absolute min
Output high voltage (IOH = -2.5mA)	3.0V min
Output low voltage (IOL = 2.5mA)	0.4V max

External trigger

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	25µs min, 50µs max
Trigger pulse width	Burst	40µs min
Input high voltage		3.0V min, 15.0V absolute max
Input low voltage		0.8V max
Input leakage current		±1.0µA

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

Counter section

Counter type	Event counter
Number of Channels	1
Input source	CTR screw terminal
Resolution	32 bits
Schmidt Trigger Hysteresis	20mV to 100mV
Input Leakage Current	±1µA
Maximum input frequency	1 MHz
High pulse width	500ns min
Low pulse width	500ns min
Input low voltage	0V min, 1.0V max
Input high voltage	4.0V min, 15.0V max

Non-volatile memory

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

Parameter	Conditions	Specification
Supply Current (Note 5)		20mA
+5V USB power available (Note 6)	Connected to Self-Powered Hub	4.5V min, 5.25V max
	Connected to Bus-Powered Hub	4.1V min, 5.25V max
Output Current (Note 7)	Connected to Self-Powered Hub	450mA min, 500mA max
	Connected to Bus-Powered Hub	50mA min, 100mA max

Note 5: This is the total current requirement for the PMD-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

Parameter	Conditions	Specification
USB Controller Clock Error	25 °C	±30 ppm max
	0 to 70 °C	±50 ppm max
	-40 to 85 °C	±100 ppm max
Device type		USB 1.1 low-speed
Device compatibility		USB 1.1, USB 2.0

Environmental

Operating Temperature Range	-40 to 85 °C
Storage Temperature Range	-40 to 85 °C
Humidity	0 to 90% non-condensing

Mechanical

Dimensions	79mm(L) x 82mm(W) x 25mm(H)
USB Cable Length	3 Meters max
User Connection Length	3 Meters max

Main connector and pin out

Connector type	Screw Terminal
Wire gauge range	16 AWG to 30 AWG

4-channel differential mode

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

Verifying the Installation

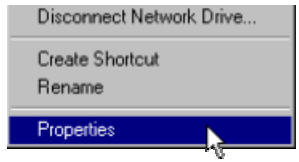
To make sure that your PMD-1208LS device was detected correctly by your operating system, perform the procedure that is applicable to the operating system running on your computer.

Verifying the installation on Windows 98 or ME

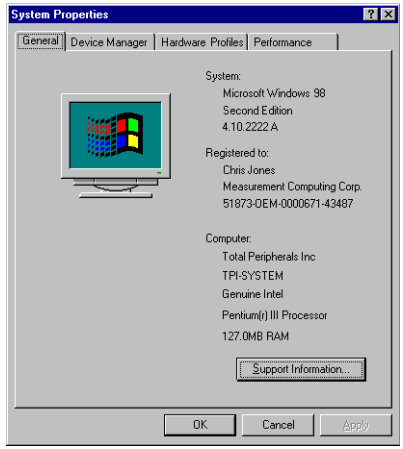
To verify your device installation on Windows 98 or Windows ME, follow the steps below.

1. On your desktop, click the right mouse button on the **My Computer** icon. A popup menu appears next to the icon.

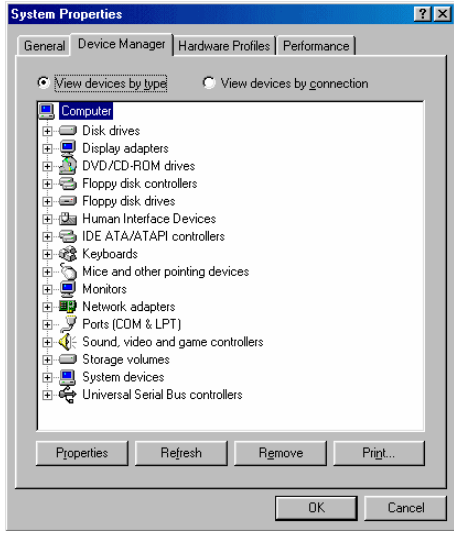
2. From the popup menu, select the **Properties** option.



The **System Properties** screen appears, as shown below.



3. Click on the **Device Manager** tab to display the device property page. The screen shown below shows a typical display. Depending on your computer setup, some entries may vary.



4. Click on the ⊞ symbol next to the **Human Interface Devices** to expand that entry.

There is one **USB Human Interface Device** listed for each PMD-1208LS device connected to the system.

5. Double-click on the **USB Human Interface Device** entry. The **USB Human Interface Device Properties** window appears.

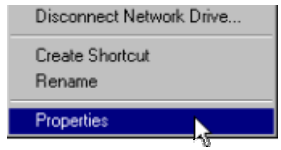
6. Verify that the **Location** specifies the PMD-1208LS, and that the **Device status** reads **This device is working properly**.

Verifying the installation on Windows 2000 or XP

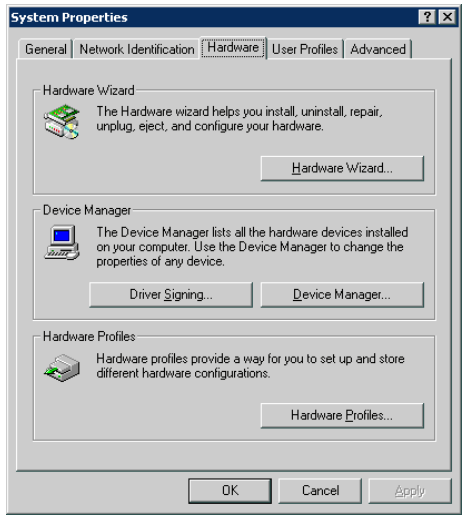
To verify your device installation on Windows 2000 or Windows XP, follow the steps below.

1. Click the right mouse button on the **My Computer** icon.

2. From the popup menu, select the **Properties** option.

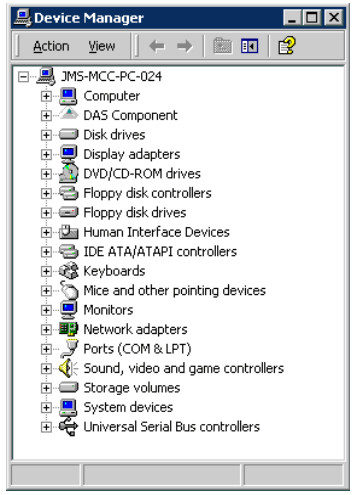


The **System Properties** screen appears, as shown below.



3. Click on the **Hardware** tab and then on the **Device Manager** button.

A **Device Manager** screen similar to the one shown below appears. Depending on your computer setup, some entries may vary.



4. Click on the ⊞ symbol next to the **Human Interface Devices** to expand that entry.

There is one **USB Human Interface Device** entry listed for each PMD-1208LS device connected to the system.

EC Declaration of Conformity

We, Measurement Computing Corporation, declare under sole responsibility that the product

PMD-1208LS	USB-based analog and digital I/O Personal Measurement Device™
Part Number	*Description*

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other informative documents:

- EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.
- EN 55022 Class B (1995): Radiated and conducted emission requirements for information technology equipment.
- ENV 50204 (1995): Radio-frequency electromagnetic field immunity.
- EN 55024 (1998): EC generic immunity requirements.
- EN 50082-1 (1997): EC generic immunity requirements.
- EN 61000-4-3 (1997) ENV 50204 (1996): RF immunity.
- EN 61000-4-4 (1995): Electric fast transient burst immunity.
- EN 61000-4-5 (1995): Surge immunity.
- EN 61000-4-6 (1996): Radio frequency common mode immunity.
- EN 61000-4-8 (1994): Power frequency magnetic field immunity.
- EN 61000-4-11 (1994): Voltage dip and interrupt immunity.

Carl Haapaoja, Vice-President of Design Verification

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