



INNOVATIVE PC Data Acquisition Solutions

**UDAS-1001E Series
Hardware User Manual
for the
Multifunction Data Acquisition System**

A Burr-Brown Company



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**UDAS-1001E Series User Manual
Revision History**

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Chapter 1 **UDAS-1001E Series Data Acquisition Systems**

1.1 Introduction

The UDAS-1001E Series Data Acquisition Systems are stand-alone, multifunction, plug-and-play data acquisition systems that connect to the Universal Serial Bus and operate using power supplied through either the USB connector or an external power supply.

All of the systems feature analog inputs (8 differential, 16 single-ended), digital I/O (Two 8-bit ports, each port configurable to input or output), and one counter channel. Selected models include an analog output section.

The UDAS Models include:

UDAS-1001E-1

This is a stand alone unit for use with standard termination products.

UDAS-1001E-1G

This model is similar to the UDAS-1001E-1, without the housing for use in OEM applications or other situations where a bare board is appropriate.

UDAS-1001E-2

This is a stand alone unit for use with standard termination products. It includes a two-channel analog output with wave form generation.

UDAS-1001E-2G

This model is similar to the UDAS-1001E-2, without the housing for use in OEM applications or other situations where a bare board is appropriate.

UDAS-1001E-3

This model has a multifunction data acquisition system with built-in termination.

UDAS-1001E-4

This model is similar to the UDAS-1001E-3, with built-in termination and analog outputs.

1.1.1 Features

Features and basic specifications of the UDAS units are listed below. Specifications of each UDAS unit are listed in Appendix A, *Specifications*. The UDAS system block diagram is shown below.

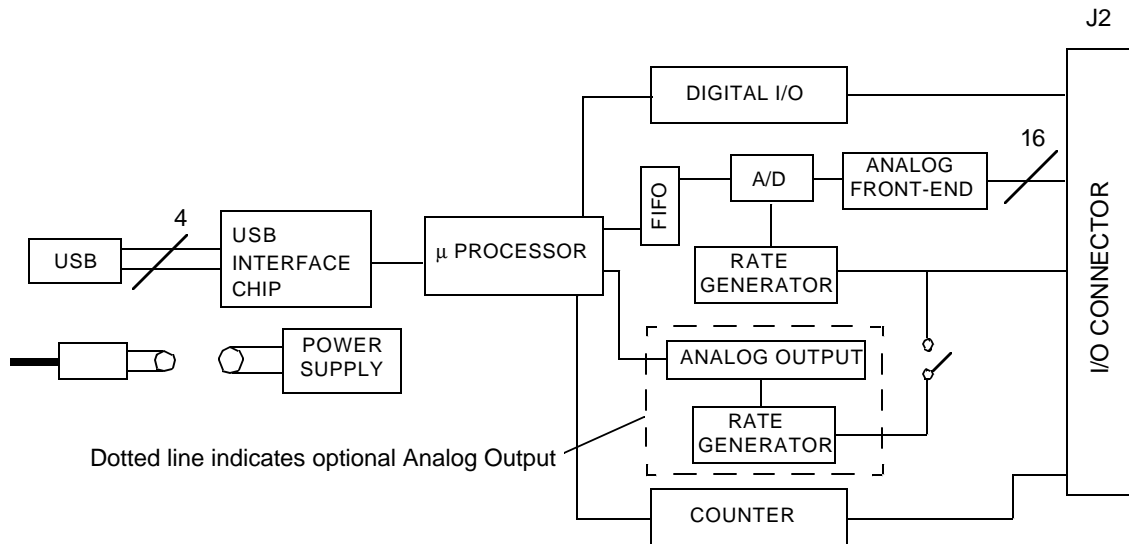


FIGURE 1.1 UDAS Series Block Diagram

SoftwareSupport Library

The software support library is included with the UDAS.

UDAS Support Software includes:

- UDAS SYSCHECK
- U-Link Software Libraries for Windows 98
- LabView 5.0 Support Library
- UDAS Device Driver
- Visual Designer Support Library

UDAS SYSCHECK

The SYSCHECK application enables you to verify the UDAS installation is functioning properly. SYSCHECK can also be used during the calibration procedure and for simple data acquisition.

U-Link Software Libraries for Windows 98

These function libraries allow custom application development using C/C++ and Visual Basic.

LabView 5.0 Support Library

Allows the use of UDAS with LabVIEW.

UDAS Device Driver

To use the UDAS unit, Microsoft Windows requires the UDAS device driver.

Visual Designer Support Library

The Visual Designer Support Library allows the use of the UDAS device in Visual Designer 4.0 applications.

Analog Input

The UDAS unit features:

- 16 Single-ended or 8 Differential Analog Inputs
(± 0.05 V, ± 0.1 V, ± 0.5 V, ± 1 V, ± 5 V, ± 10 V, and 0-0.1 V, 0-1.0 V, 0-10V programmable input ranges).
- Analog Input resolution: 12-bit (1 part in 4096).
- Up to 100 kHz input sample rate (built-in timebase generator).
- Analog Trigger function to start analog-to-digital conversions.

Analog Output

The UDAS unit features:

- Up to 100 kHz output rate (built-in timebase generator).
- 2 analog outputs at 12-bit resolution (± 10 V output range, 1 part in 4096).
- Waveform generation

Digital Input/Output

- 16 Programmable digital I/O channels. Groups of 8 separately programmable for input or output.
- Digital inputs can be programmed to read digital signal status, detect a change-of-state or to perform low speed event counting (up to 2 kHz).
- Digital outputs can drive TTL level signals.
- 8 of the 16 I/O channels can be configured for preset direction and output state levels for safe power-up and reset situations.

Counter

One 16-bit counter channel performs general purpose event counting and frequency measurement up to 20 MHz up to 2 MHz for high-speed event counting.

Termination

The UDAS-1001E-3 and UDAS-1001E-4 units have built-in depluggable termination blocks for connecting I/O signals. The UDAS-1001E-1 and UDAS-1001E-2 units have a 50-pin I/O connector for attaching external termination. Information on termination panels is provided in Appendix B, *Accessories*.

1.2 UDAS 1001E Series Functional Description

This section provides information on the following data acquisition functions:

- Analog input
- High-speed analog input
- Acquisition pacing and triggering
- Power supplied by the USB port or by an external power supply

1.2.1 Data Acquisition Functions

Analog Input

The A/D converter on the UDAS device is a 12-bit converter with a throughput rate of 100 kHz.

For analog input:

- Programmable input voltage ranges are 0-10 V, ± 5 V, and ± 10 V.

-
- Programmable gains are 1, 10, and 100 which translate to a full-scale input of 0-10 V, 0-1.0 V, 0-0.1 V, ± 10 V, ± 1.0 V, ± 0.1 V, ± 5 V, ± 0.5 V, and ± 0.05 V.
 - The analog input section has 16 single-ended or 8-differential analog input channels.

The analog input section has a first-in-first-out (FIFO) buffer for high-speed capturing of data up to 100 kHz.

An analog trigger is also provided to initiate high-speed conversions based on a voltage transition on a selected analog input channel, or on an external TTL level signal. A programmable crystal-based rate generator regulates high-speed conversions.

High-Speed Analog Input Mode

High-speed mode uses the rate generator (described below), or an external input to start data conversions. The use of the rate generator or an external signal to start conversions is referred to as *pacing*.

On the UDAS unit, the rate generator is able to provide rates from 0.477 conversions per second to 100,000 conversions per second. These conversions are either performed on a single input channel, or performed on a range of input channels by using the channel scanner (described below).

When the conversion is complete on the current channel, the channel scanner automatically selects the next channel. The term *high-speed* refers to the use of pacing to automatically begin the conversions. The speed of the actual rate of conversions can be controlled by using the rate generator. See *Rate Generator*, on page 1-6.

Starting and Stopping the High-Speed Analog Input Mode

There are several methods to start and stop conversions available on the UDAS:

- Start with trigger, Stop with software
- Start with trigger, Stop after N samples
- Start with software, Stop N samples after trigger
- Start with software, Stop with software
- Start with software, Stop after N samples

Starting Conversions

To start the conversions, use either a trigger or a software command. The trigger can be an external digital TTL level input, or an analog input. For an external TTL signal, the slope (rising edge or falling edge) must be specified. Use the external input pin to provide this input.

If an analog input is used for the trigger, specify the trigger level, analog input channel, and slope. Use analog output channel 1 for setting the trigger level.

<p>Note: When using analog input channel 1 for a trigger, do not use this channel for any other purpose.</p>

When an input signal on the selected channel of the proper slope (rising or falling voltage) crosses the trigger level, the conversion process begins.

Stopping Conversions

To stop a conversion, use either a software command, an *N samples* counter, or a combination of a trigger and an *N samples* counter.

Use the *N samples* counter to specify the number of samples that you want to capture.

When the trigger is used to stop a conversion, and the *N samples* counter is used, a post-triggering function occurs. In this mode, software is used to start conversions and continue indefinitely until a trigger event occurs. When a trigger event occurs, N additional samples are captured.

Rate Generator

The UDAS unit contains an on-board 24-bit rate generator for analog input pacing. The base clock for the rate generator is an 8 MHz clock derived from a crystal which provides 125 ns resolution and a frequency range of 0.4768371 Hz to 4 MHz.

The I/O connector has a rate generator output pin that is driven by either the Analog Input Rate Generator or the Analog Output Rate Generator.

Channel Scanner

When the channel scanner is enabled, immediately after the conversion on the current channel finishes, the next analog input channel to be converted is automatically selected.

The UDAS device incorporates a 0 to N scanner. This allows analog conversions on all of the input channels from channel 0 to channel N, where the value of N is programmable.

The scanner selects each channel for conversion, beginning with channel 0, incrementing to channel N. After the conversion on channel N is complete, the scanner selects channel 0 and the process repeats.

The scanner operates with the built-in analog channels, or with the optional AI-MAX. The AI-MAX allows up to 256 analog input channels to be connected to a single UDAS device.

Note: The scanner begins on the selected trigger channel and not channel 0 when the start on trigger mode is used with an analog input trigger.

High-Speed Analog Input Triggering

To start or stop conversions, use triggering in the High-Speed Analog Input mode in the UDAS device. The trigger signal can be either an analog input or a digital input.

When using an analog input as the trigger, the start on trigger mode causes the scanner to start on the trigger channel. For example, if the trigger channel is set to 5, the N channel of the 0 to N scanner is set to 7, the return data is as follows:

channel 5
channel 6
channel 7
channel 0
channel 1
...
channel 7
channel 0
...

When using the stop on trigger mode and the trigger is from an analog input channel, the trigger signal is sampled only when the trigger channel is the active scanner channel. Although this allows any channel to be used for triggering, it imposes some restrictions on the characteristic of the trigger signal.

The duration of the trigger signal must be long enough to cause the unit to trigger. Use the following formula to calculate the length of a signal to ensure that the signal is long enough to activate the trigger: **(Total channels scanned)/(scan rate in Hz)**.

Example:

If 9 channels are being scanned at a rate of 100Hz and the slope is low to high, the trigger signal must remain below the trigger level for 9/100 of a second, and above the trigger level for 9/100 of a second to ensure that a trigger event occurs. When using External Input as the trigger, this restriction does not apply.

When using an analog input channel for triggering, analog output channel 1 is used to set the trigger level.

<p>Note: Do not use analog output channel 1 for any other purpose while analog triggering is in use.</p>

Due to the internal configuration of the unit, the voltage appears on the analog output 1 pin as the negative value of the desired trigger voltage. Connecting this pin to another signal, or shorting it out causes the trigger voltage to be incorrect.

Auto Zero

When in auto zero mode, the inputs to the Analog input circuit are internally grounded, disabling the input multiplexers. This enables a known 0 volt signal to be measured, and the value read can be used to compensate for input offset errors.

Analog Output

The UDAS device has two analog output channels. Each output channel has 12-bit resolution and a ± 10 V output range. A FIFO is available for waveform generation.

This FIFO can be used as a circular buffer for either or both analog output channels to allow repetitive waveform generation and supports waveforms of up to 512 points (single channel) or 256 points (dual channel). The unit also supports non-repetitive wave forms.

When the unit is powered-on and the analog outputs are not enabled, the output voltage is 0 V. This provides a known voltage when the UDAS unit is powered-up.

Analog output channel 1 is also used to support the analog trigger function for hardware-paced analog input conversions (as described above).

Digital I/O

The digital data acquisition circuit consists of two 8-bit digital I/O ports providing 16 digital I/O bits and one 32-bit counter. Output power-on states are configured for Port 1 through an internal DIP switch. The digital I/O is configured as 2 ports (0 and 1) of eight bits each.

Digital I/O signals are TTL-compatible and perform functions such as reading digital inputs, driving digital outputs, and detecting input change-of-state.

Digital I/O direction is programmable separately for each port through software. A nine-position DIP switch is provided inside of the unit to select the power-up direction of Digital I/O Port 1 (input/output) and to individually set power-up output states for each bit.

Counters

One counter input line is connected to a 32-bit counter for high-speed counting (up to 2 MHz). This counter supports event counting and frequency measurement.

An event counter counts pulses occurring at its input. For frequency measurement mode, the pulses are captured over an internally generated gate time. The frequency is calculated from the captured count and the gate time. The gate time can be set to 1ms, 10ms, 100ms, or 1s through software.

Termination

The UDAS unit provides the user with several options for connecting to I/O signals. You can use a 50-pin ribbon cable to connect signals directly to the UDAS unit.

There are many termination products available from Intelligent Instrumentation with a 50-pin interface. See our catalog for a variety of termination options. For the UDAS-1001E-3 and UDAS-1001E-4 models, use the built-in termination to connect signals directly to the unit.

The built-in termination panel is directly mounted to the back plate of the UDAS unit, providing easy access to all I/O signals (FIGURE 1.2, *UDAS-1001E-4 dimensional drawing*). The connections are made using pluggable 5mm terminal strips to simplify the wiring. A cold junction compensation circuit (CJC) is incorporated on the board to allow the use of thermocouples.

To use the CJC circuit, you must enable it by setting the jumpers. The jumpers are located on the back side of the termination panel and require removal of the panel to gain access. For information on the jumpers, reference Chapter 2, *Configuration and Installation*, and see TABLE 2.1, *CJC Jumper Positions*.

<p>Note: When the CJC is enabled, differential channel 0 is used. Do not connect anything to Analog Input 0 or Analog Input 8.</p>

A diagram of the termination panel for the UDAS-1001E-4 unit is shown below.

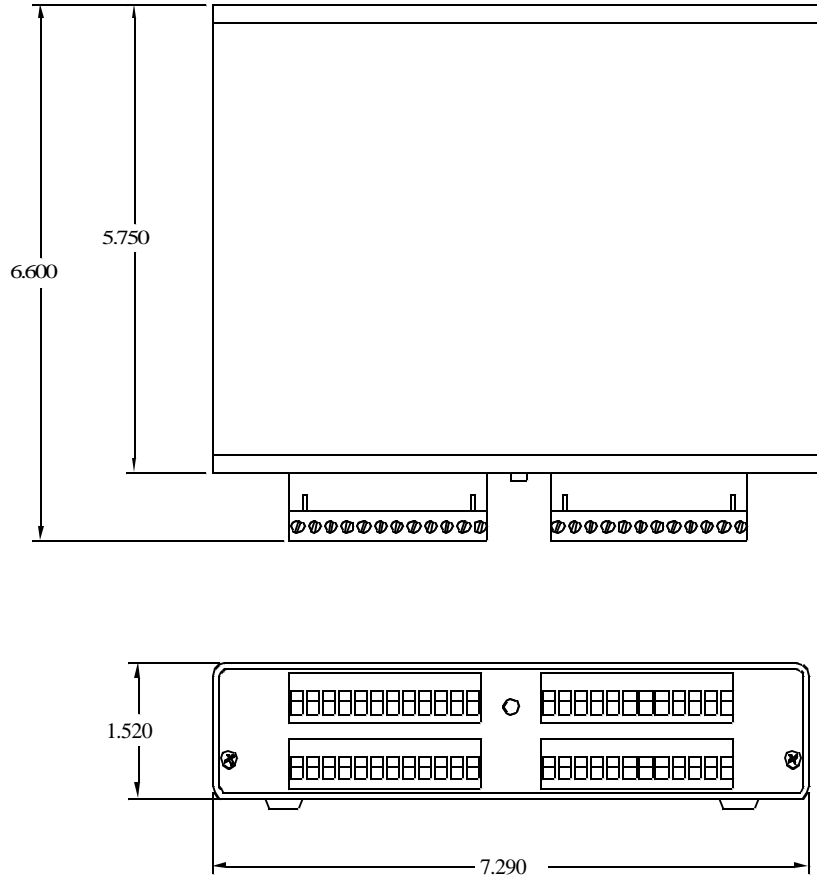


FIGURE 1.2 UDAS-1001E-4 dimensional drawing

1.2.2 Power

The UDAS unit normally uses power from the host computer via the USB cable. Power can also be obtained from an external power supply that is available (See Appendix B, *Accessories*). When the UDAS unit is connected to a power source, the computer controls the power. The unit does not have a power switch. There is an LED labeled **PWR** located on the front panel that indicates power to the unit, regardless of its source.

The USB specification imposes strict requirements on power usage. If an external power supply is used, up to 200 mA at +5 VDC is available to external termination circuits (available at pin-26 and pin-48 of the unit's 50-pin I/O connector).

See section 1.3, *Software Support and Accessories* or Appendix B, *Accessories* for the part numbers of the available Power Adapters. If the power is supplied from the PC through the USB port, care must be taken to limit the load from the external termination panel to less than 20 mA.

1.3 Software Support and Accessories

1.3.1 Software Support

Diagnostic

UDAS SYSCHECK

UDAS SYSCHECK software for Windows is an easy-to-use system assurance and diagnostic utility package. UDAS SYSCHECK is a useful tool for quickly verifying the hardware is functioning properly. This program also performs basic data acquisition tasks. UDAS SYSCHECK is provided on the UDAS-1001E Data Acquisition System CD, or is available to download, free of charge, from Intelligent Instrumentation's Web site (www.instrument.com).

Development

Visual Designer Application Generator

Visual Designer is a powerful, easy-to-use application generator that supports all of Intelligent Instrumentation's data acquisition hardware and is available from Intelligent Instrumentation. Use Visual Designer to develop custom Windows applications for collecting remote data using a graphical block diagram development environment.

To create custom applications in a fraction of the time it takes when using a programming language, Visual Designer is able to combine built-in professional screen displays and user interface elements with powerful data acquisition and processing blocks.

Visual Designer UDAS Support Library

This support package provides the block functions necessary to acquire data and output data using the UDAS device. To use Visual Designer or the Visual Designer Evaluation Version with an UDAS unit, the Visual Designer UDAS Support Library must be installed on the computer.

LabVIEW UDAS Support Library

This support package enables the development of customized UDAS data acquisition and control applications under the LabVIEW environment. To use this software, National Instruments LabVIEW software (version 5.0 or higher is supported) must be installed on the computer.

Chapter 2 Configuration and Installation

2.1 Introduction

This chapter contains instructions on the configuration and installation of the UDAS unit.

2.2 Power-on Default Digital I/O Configuration

In some situations, it is important to have the digital output port on a UDAS unit initialize at power-on to a particular state. For example, if the digital output port controls a piece of mechanical equipment, safety regulations may require the digital output port bits to have values of 0000 0011 when power is first applied. Port 1 on the UDAS unit provides the ability to set the power-on direction to output and the states of all of the bits. A switch block located on the main board of the UDAS unit accomplishes this task. Since the default switch states configure the port for input, you may not need to change the switch settings.

This section contains instructions for setting the power-on default Digital I/O configuration, if applicable.

CAUTION:

Use proper static-sensitive device handling procedures (such as the use of grounded wrist-strap) when opening the unit, as damage to the equipment may occur.

Removing the Cover

1. Unplug the power supply to the UDAS unit.
2. Using a Phillips head screwdriver, remove the two Phillips head screws on the front face plate of the UDAS unit I/O cover. The front face plate contains the power and status indicators and the USB connector.
3. Carefully separate the face plate from the cover.
4. Slide the cover towards the open end of the unit to free it from the back termination plate, removing the cover from the UDAS unit.

Setting the Configuration

Switches 1-8 set the initial levels of the port's channels 0-7 if the port is set for output operation. A switch set to the *On* position sets the corresponding port's output channel to a high level (TTL +5V) on power-up.

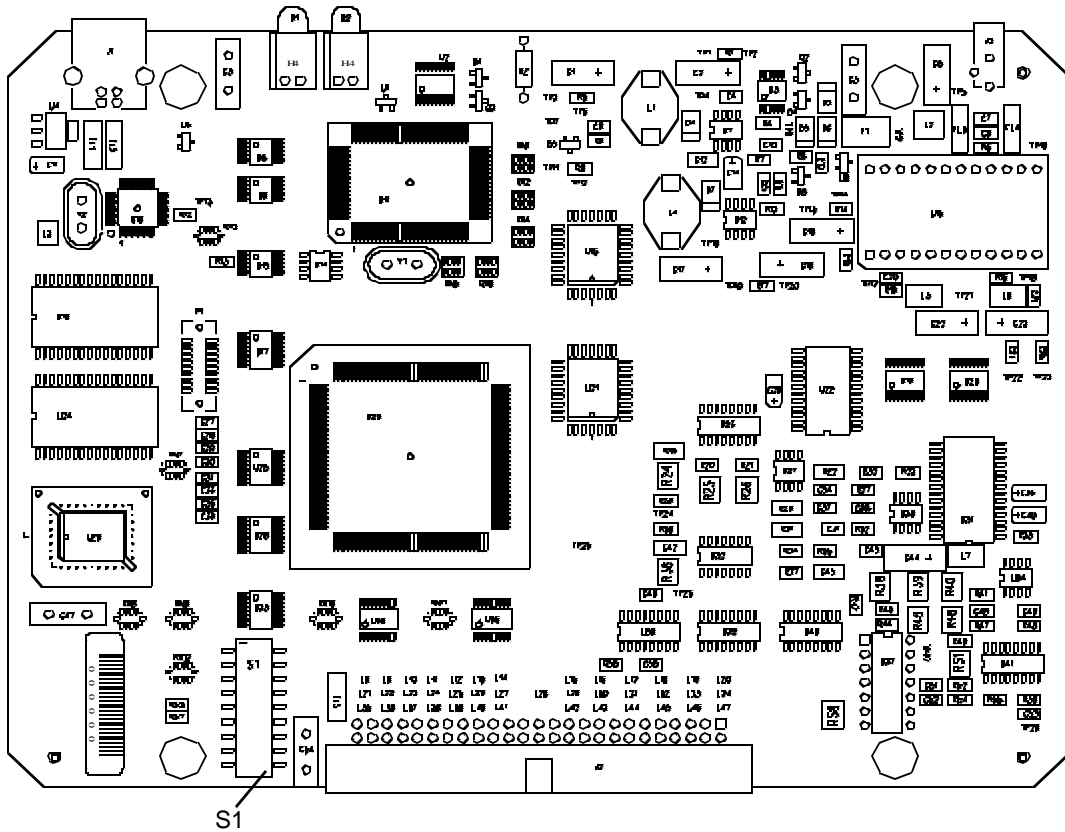


FIGURE 2.1 UDAS Switch S1

If you plan to use any of the digital I/O ports for output control in your application(s), note the following Caution statement:

CAUTION:

For applications using UDAS units to generate output signals for control or other sensitive purposes, the status or level of outputs during power-up may be of critical importance. Integrated circuits and other devices powered by supply voltages are subject to possible transients or an indeterminate status while the power supply voltages are making the transition from zero to their steady-state values.

Locate switch S1 shown in FIGURE 2.1, *UDAS Switch S1* in the lower left-hand corner of the board.

1. Set the direction for Port 1. The default setting is input (*Off*).
To designate Port 1 as an output port: set switch 9 to the *On* position.
To designate Port 1 as an input port: set switch 9 to the *Off* position.
2. To set the initial data for Port 1, set switches 1-8.
On = 5 V
Off = 0 V

Note: You can reconfigure any of the ports through software after the unit is powered-up. Port 0 always powers-up as an input port.

Reinstalling the Cover

1. Insert the cover onto the rails located on both sides of the base of the UDAS unit and slide the cover towards the back panel until the cover is seated into the frame on the back panel.
2. Place the face plate over the edges of the cover and unit's frame.
3. Align the screw holes on the cover with the unit, insert each Phillips screw on the face plate and tighten the screws into place.

Enabling the CJC

To enable the CJC:

- Install jumpers A, C and D on JP1.

The CJC circuit uses differential channel 0 to report compensation information to the UDAS. When using the CJC circuit, verify there is no external signal connected to channel 0/8.

Channels connected to a thermocouple must be connected to bias resistors for proper operation. Use jumpers JP2 and JP3.

Note: When monitoring thermocouples, always use differential channels.

To select the jumpers for each channel that you plan to use for thermocouples, use TABLE 2.1, *CJC Jumper Positions* shown below.

Differential	JP1 Jumper Position	JP2 Jumper Position
Channel #		
1	AI 1	AI 9
2	AI 2	AI 10
3	AI 3	AI 11
4	AI 4	AI 12
5	AI 5	AI 13
6	AI 6	AI 14
7	AI 7	AI 15

TABLE 2.1 CJC Jumper Positions

2.3 Connecting the UDAS Unit

Making the Initial Connection

1. With the computer powered up, connect the USB cable to the computer or hub.
2. Connect the other end of the USB cable to the UDAS unit.
3. Verify the red **PWR** LED located on the face plate of the UDAS unit illuminates.
4. The system builds a driver information database, and then the *Add New Hardware Wizard* dialog appears on the computer monitor. The wizard searches for new drivers for the unknown device. Click the *Next* button.
5. Select *Search for the best driver*, and click the *Next* button.
6. Insert the UDAS-1001E Data Acquisition System CD in the computer's CD ROM drive.
7. In the *Add New Hardware Wizard* dialog, select the *CD-ROM* drive by clicking on the check box. Deselect the check boxes for the *Floppy Disk* drive (default setting), *Microsoft Windows Update*, and *Specify Location Options*. Click *Next* to continue.
8. The Wizard finds the TAOSDRV.INF file and displays a message stating the file has been found. Click the *Next* button.
The Wizard copies the driver and rebuilds the driver database.
9. After the installation process is complete, click the *Finish* button.
The unit's driver is now installed.
10. Verify the red **STATUS** LED located on the face plate of the UDAS unit is illuminated.
11. Verify the system is operating correctly using the UDAS SYSCHECK software. UDAS SYSCHECK software is included on the UDAS-1001E Data Acquisition System CD and can also be found on Intelligent Instrumentation's web site. See Section 1.3.1, *Software Support*, on page 1-11 in Chapter 1, *UDAS-1001E Series Data Acquisition Systems*.
12. For information on using SYSCHECK, see Chapter 3, *Checking the System* in this manual.

Chapter 3 Checking the System

3.1 Introduction

This chapter contains instructions for installing and using the UDAS SYSCHECK software. The software contains diagnostic features that verify the UDAS unit is functioning.

WARNING!

Use extreme caution when using SYSCHECK.

The UDAS SYSCHECK software could cause unexpected results in the equipment that you connect to the UDAS unit.

Depending on the type of equipment that you have connected to the UDAS unit, severe damage to equipment and/or bodily harm may occur while conditions of the UDAS are in transition.

Large unisolated voltages may damage the UDAS unit. UDAS analog output will not drive low impedance loads.

The UDAS digital I/O inputs and outputs must be TTL compliant.

UDAS analog inputs in excess of 20 V may cause permanent damage to the UDAS unit.

UDAS counter inputs must be TTL compliant.

SYSCHECK is only an interface to the UDAS unit(s). The way that you interface input or outputs to the UDAS can be a complicated issue.

Since a variety of termination panels are available for the UDAS units, refer to the documentation provided with the termination panel for the exact I/O configuration of the specific panel that you purchased.

Termination options are discussed in Appendix B, *Accessories* in this manual.

3.2 Installing and Running UDAS SYSCHECK

UDAS SYSCHECK provides an easy-to-use graphical interface for using and displaying the I/O capabilities of the UDAS unit.

System Requirements

- UDAS SYSCHECK 1.0 only runs on Windows 98.
- The installation requires approximately 1 Mbyte of free disk space.

Installing SYSCHECK

1. To install UDAS SYSCHECK, insert the UDAS-1001E Data Acquisition System CD into the CD ROM drive on the computer.
2. From the Windows 98 desktop, click *Start*, select *Run* and type:
 <Use your CD drive letter>:\Syscheck\SETUP.EXE<ENTER>
3. Follow the software installation instructions in the dialogs (to stop the installation press *ESC* or click *Cancel*).

When the installation is complete, UDAS SYSCHECK files are copied to a newly created folder on the computer's hard drive. A new folder with shortcuts to the UDAS SYSCHECK program appears on the Start menu.

3.3 SYSCHECK Operation

When SYSCHECK runs, it queries the Universal Serial Bus (USB) to locate all of the UDAS units that are attached to the host. UDAS SYSCHECK reports the number of UDAS units detected and tracks the UDAS units by a unique serial number assigned to each unit. The serial number is provided on the outside of the unit, and internally in the UDAS unit's firmware.

In the UDAS SYSCHECK window, the main menu contains three selection tabs, Unit Info, System Check, and Paced Analog Input as shown in FIGURE 3.1, *Unit Info dialog*.

In the Unit Info dialog, select one UDAS unit from the drop-down list. After making your selection, other features of the software allow you to display inputs to, or manipulate outputs from, the selected UDAS unit.

3.3.1 Unit Info

The Unit Info dialog displays the number of UDAS units detected and has a drop down list containing the serial number for each UDAS unit detected by SYSCHECK.

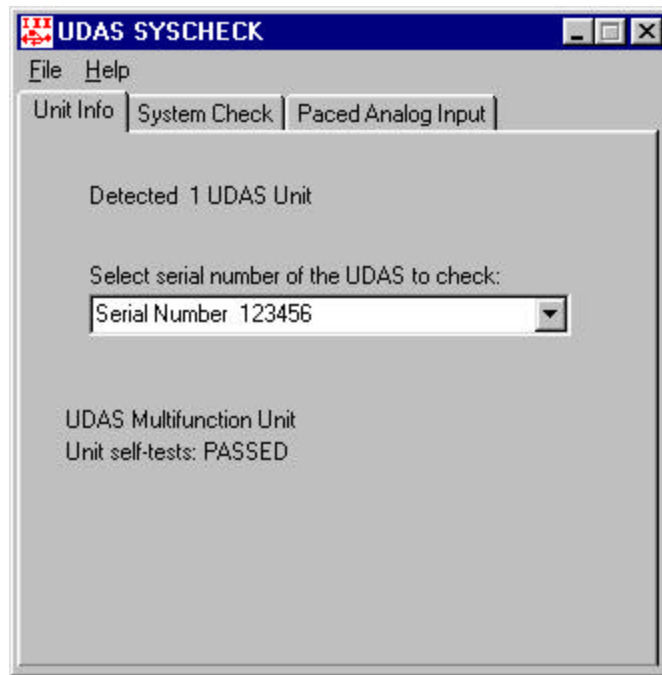


FIGURE 3.1 Unit Info dialog

If there is only one UDAS unit, the message shown beneath the drop down list displays the unit type and self-test results. When the self-test reads PASSED, the unit is operable.

If multiple UDAS units are being used, to select a unit for testing, click the desired serial number in the list. This selection process updates the description and the self-test results to reflect the state of the currently selected unit.

After you select a unit's serial number from the list, the SYSCHECK and paced analog input operations are performed on the selected unit.

3.3.2 System Check

When the System Check tab is selected, a dialog containing buttons used to execute a variety of system test programs appears as shown in FIGURE 3.2, *UDAS SYSCHECK System Check dialog*.

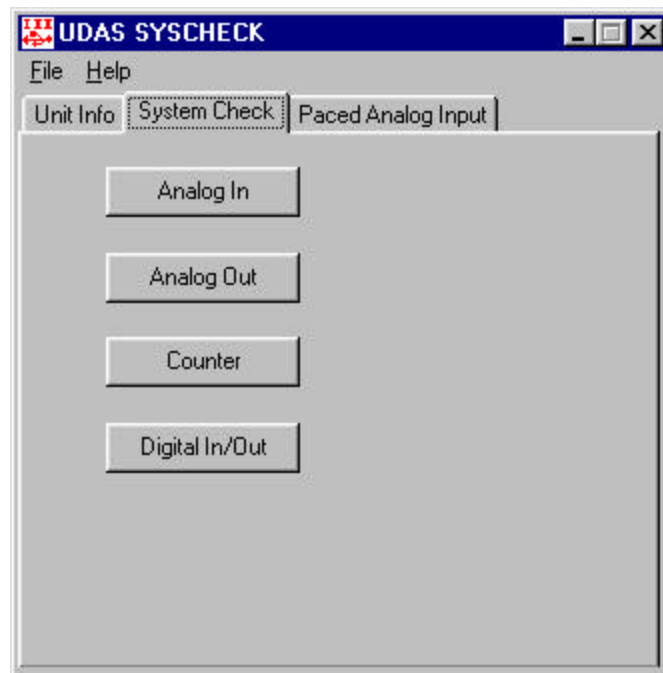


FIGURE 3.2 UDAS SYSCHECK System Check dialog

The *System Check* tabbed dialog displays four major sub-functions possible on the UDAS units. These include Analog Input, Analog Output, Counter, and Digital Input/Output. Click one of these buttons to open a dialog to manipulate and/or display the desired sub-function on the selected UDAS unit.

To test each of the I/O types listed in the dialog, click the corresponding button to launch a new window for testing that I/O type on the UDAS unit. Examples of each I/O test are provided in the next two sections.

3.3.2.1 Analog Input Test

Click the *Analog In* button to access a new window specific to analog input. The UDAS SYSCHECK ANALOG INPUT dialog shown in FIGURE 3.3, *UDAS SYSCHECK Analog Input Test of a UDAS unit* appears.

The analog input test performs software-based reading of the first 8 analog input channels on UDAS units.

Select from the drop-down lists to select the Range, Gain, Single Ended/Differential configuration, and Average (the number of readings to average from each channel).

Select either the *Volts* or *Counts* radio button to display the channel data in volts or counts.

Click the *Read Channels* button to acquire the input voltages to the UDAS unit. Each time that you click the *Read Channels* button, the channel data is read by the UDAS unit and the display is updated.

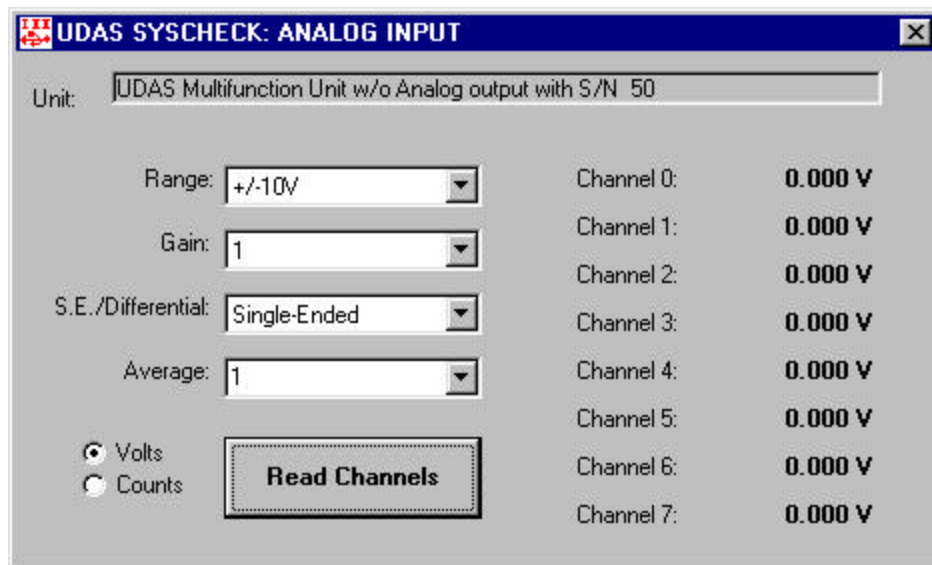


FIGURE 3.3 UDAS SYSCHECK Analog Input Test of a UDAS unit

3.3.2.2 Analog Output Test

The analog output test controls the voltage on the analog output channels of the UDAS unit.

In the UDAS SYSCHECK Test Category Selection Window, click the *Analog Out* button and the UDAS SYSCHECK ANALOG OUTPUT dialog shown in FIGURE 3.4, *UDAS SYSCHECK Analog Output Test of a UDAS unit* opens.

In the Channel 0 and Channel 1 fields, click to insert the cursor and enter the desired value (volts or counts) in any of the four data entry fields.

After replacing the old value with a new value, press the *Enter* key to update both analog outputs from the UDAS unit.

Clicking the *Disable Outputs* check box grounds both of the analog output channels.

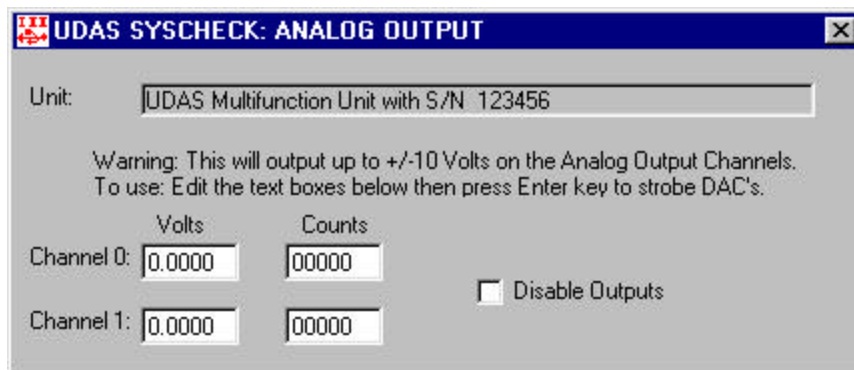


FIGURE 3.4 UDAS SYSCHECK Analog Output Test of a UDAS unit

3.3.2.3 Counter Test

The counter test monitors TTL transitions that are connected to the counter input of the UDAS unit. Depending on the mode that you select, the TTL level of the gate pin may effect the readings.

For all of the modes except *Measure frequency*, data is automatically read and displayed four times per second.

For the *Measure frequency* mode, the rate of display updates may be slower depending on the gate time selection.

Checking the *Reset counts every display* check box causes the counter to reset to zero after every read and display cycle. The interface is shown in FIGURE 3.5, *UDAS SYSCHECK Counter Test in Count Mode*.

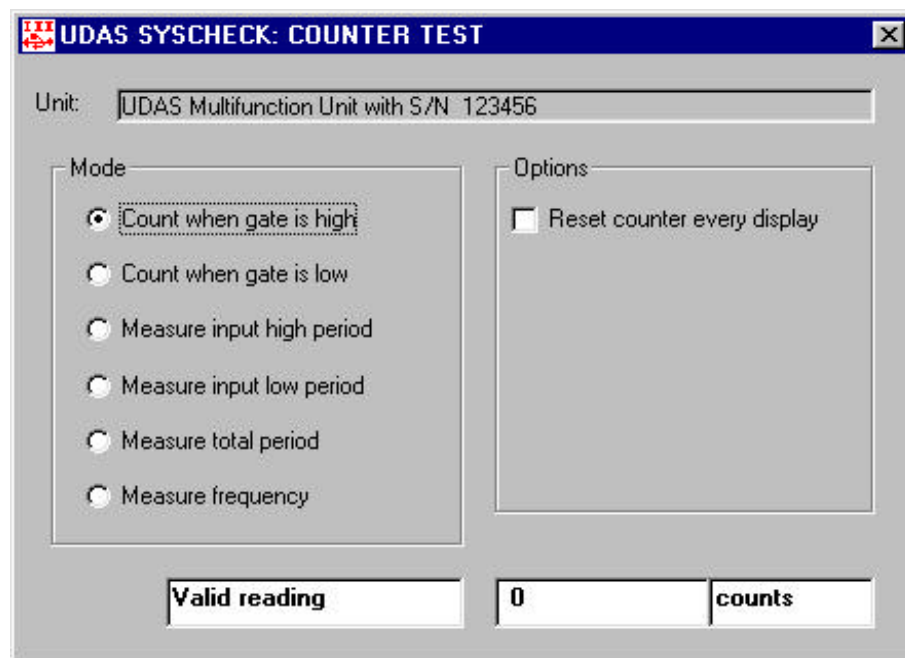


FIGURE 3.5 UDAS SYSCHECK Counter Test in Count Mode

For the *Count when gate is high* and the *Count when gate is low* modes, the TTL level of the gate enables or disables counting, depending on the mode that you set. If there is no input connected to the gate input, use the *Count when the gate is in high mode*.

For the modes *Measure input high period*, *Measure input low period*, and *Measure total period*, the data displays shown at the bottom portion of the dialog provide the status and the time between the most recent appropriate edges as shown in FIGURE 3.6, *UDAS SYSCHECK Counter Test: Measure Input High Mode*.

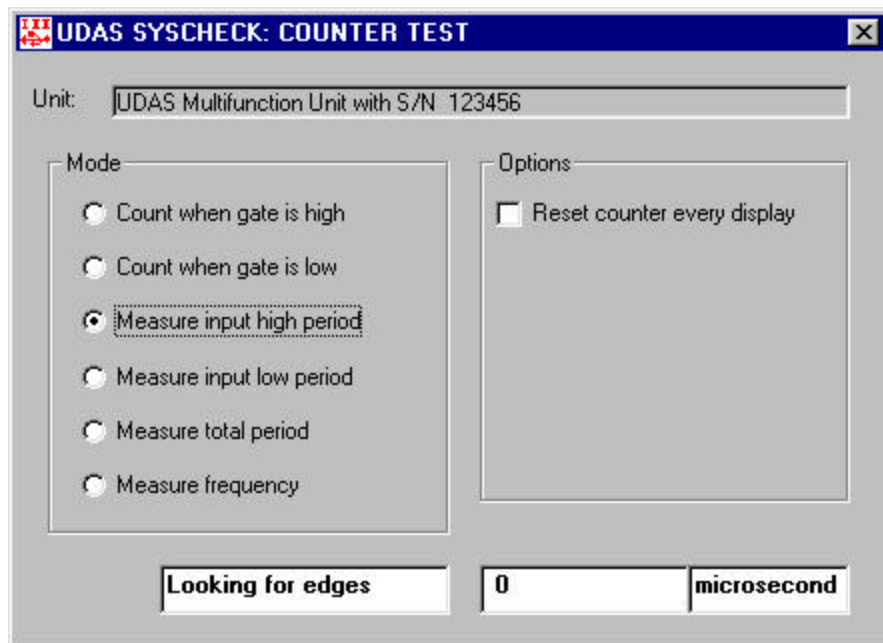


FIGURE 3.6 UDAS SYSCHECK Counter Test: Measure Input High Mode

The status field is looking for TTL transitions.

Select the *Measure frequency* radio button and the dialog shown in FIGURE 3.7, *UDAS SYSCHECK Counter Test: Measure Frequency Mode* opens.

Select the desired Gate Time. The data displays shown at the lower portion of the dialog provide the status and the frequency in hertz.

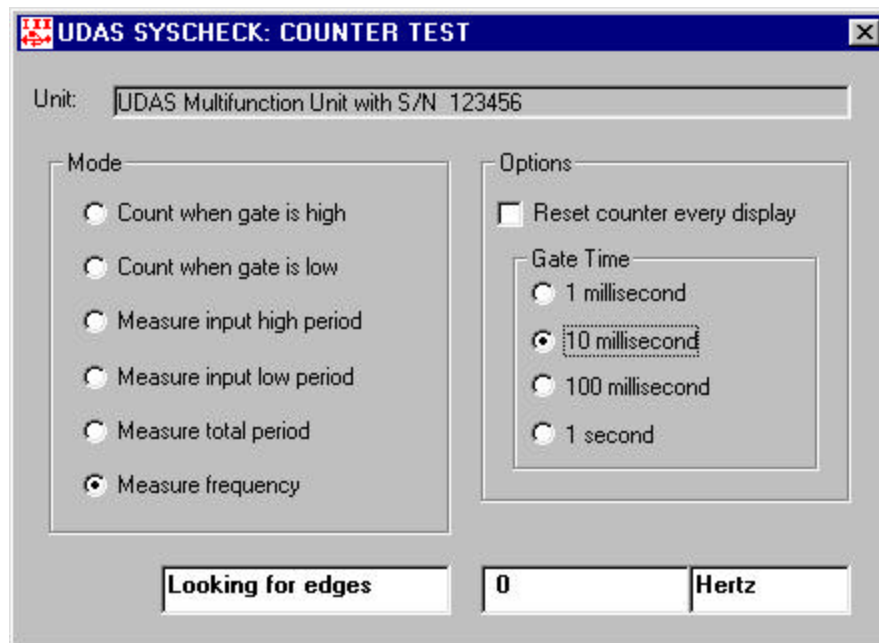


FIGURE 3.7 UDAS SYSCHECK Counter Test: Measure Frequency Mode

The gate time is the amount of time that UDAS uses to count TTL transitions. This time base allows frequency to be calculated by the software.

Longer gate times result in frequency calculations with more significant digits because a greater number of transitions are gathered. Shorter gate times result in frequency calculations with fewer significant digits because a smaller number of transitions are gathered.

Digital I/O Test

The Digital Input/Output test enables you to read data from, or write data to, either 8-bit Digital I/O port on a UDAS unit. FIGURE 3.8, *UDAS SYSCHECK Digital I/O Test* shows an example test of the UDAS unit that has two 8-bit digital I/O ports.

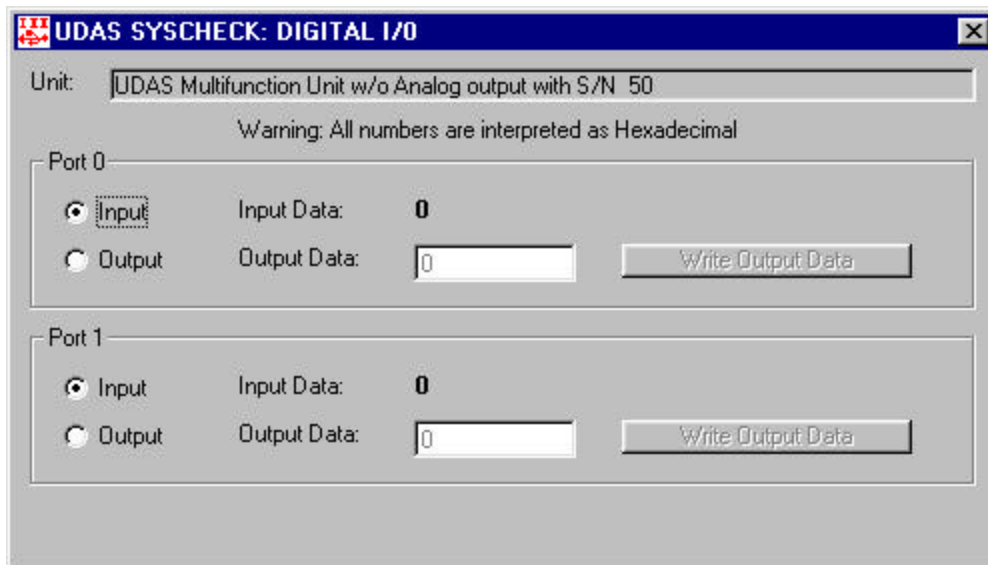


FIGURE 3.8 UDAS SYSCHECK Digital I/O Test

Use the *Input* and *Output* radio buttons to select the direction of a port.

The input and output data is displayed in Hexadecimal (0-FF).

Input ports are read and displayed four times per second.

Output data is written to the port only after clicking the *Write Output Data* button.

3.3.3 Paced Analog Input

The Paced Analog Input dialog enables you to configure a hardware-paced analog input process.

Select the number of channels to include in the data run, select the gain, and select the single-ended/differential from drop-down lists in each field. See FIGURE 3.9, *UDAS SYSCHECK Paced Analog Input Window*.

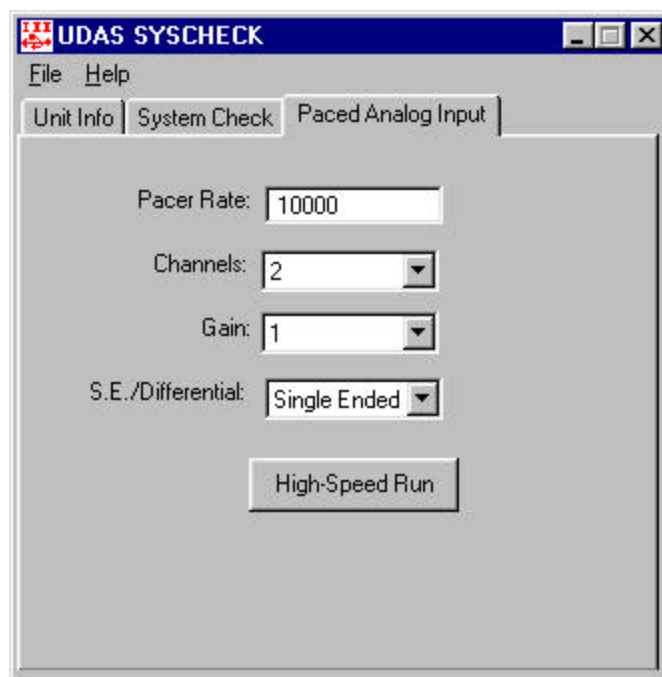


FIGURE 3.9 UDAS SYSCHECK Paced Analog Input Window

The pacer rate controls the clock rate of an on-board clock generator.

This clock can be configured for frequencies from 1 to 100,000 hertz. The pacer rate and number of channels determine the sample rate for each channel in the run.

Clicking the *High-Speed Run* button (shown in FIGURE 3.9, *UDAS SYSCHECK Paced Analog Input Window*) configures and starts the process. This launches a full screen window that displays the results of the run.

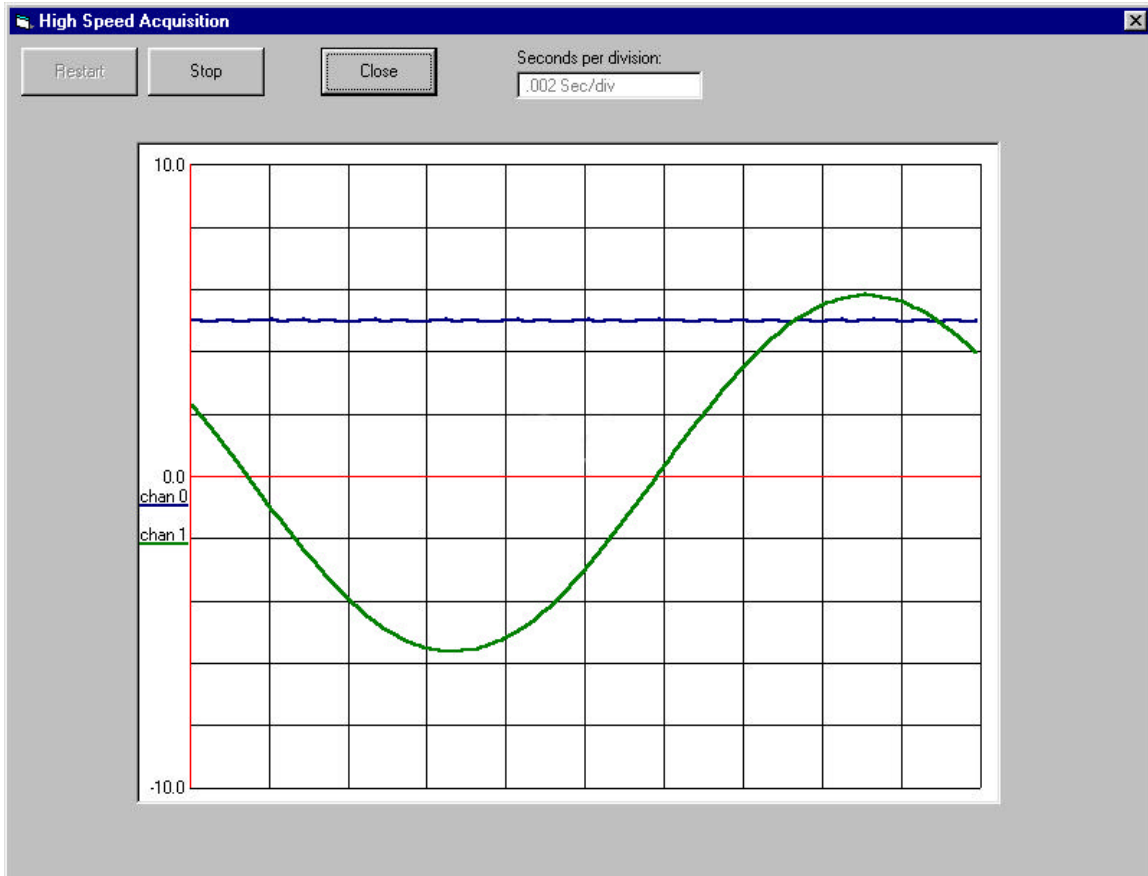


FIGURE 3.10 High-Speed Acquisition Sample

The time base is displayed on the x-axis and the voltages are displayed on the y-axis. A sample screen is shown in FIGURE 3.10, *High-Speed Acquisition Sample*. Slow pacer rates may have slow screen update rates.

3.4 Troubleshooting Tips

3.4.1 Basic Troubleshooting

If you are unable to successfully communicate with the UDAS unit, this section contains troubleshooting hints which may help identify the problem.

Verify that all of the proper connections have been made between the computer, UDAS unit(s), and the equipment being monitored. If running SYSCHECK displays a message on the computer monitor in a pop-up window as shown in FIGURE 3.11, *System Error message window*, reference section 3.4.1.1, *Verify Lower Level Drivers*.

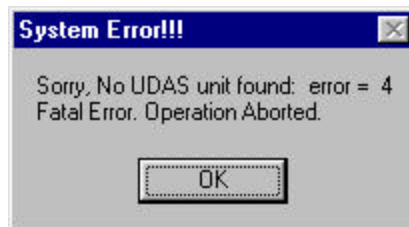


FIGURE 3.11 System Error message window

3.4.1.1 Verify Lower Level Drivers

To verify that low-level drivers are functional, check the USB port, UDAS driver, and power.

USB Port

Verify the system has a USB port that is properly installed from the Windows' Start menu by following these steps:

1. From the *Start* button, click *Settings*, then click *Control Panel*.
2. Double-click on the *System* icon.
3. Click the *Device Manager* tab.
4. Click the *View devices by type* radio button.

If you do not see the *Universal serial bus controller*, resolve the problem with the USB port before continuing.

UDAS Drivers

Verify the UDAS system driver is properly installed by following the instructions for the USB Port (above).

Click on the plus sign (+) located next to the *Universal serial bus controller*. When the directory opens, double-click *III Taos USB Data Acquisition System*. A pop-up window appears displaying a message that reads, *This device is working properly*.

If the III Taos USB Data Acquisition System icon does not appear in the USB devices list, verify that both of the LEDs located on the front panel of the UDAS unit are illuminated. Verify that your external equipment is not consuming excessive power. Refer to the power test in the next section.

Power Test

For proper operation, the power test requires:

- the UDAS device be powered.
- the UDAS device be connected to the USB.
- the UDAS device pass its power on self-test (POST).
- the UDAS device be initialized by the host computer.

To perform the power test:

1. Unplug the USB cable from the UDAS port.
2. Plug the USB unit cable back into the UDAS port.
 - One LED illuminates immediately, indicating power.
 - The computer monitor may display the *Busy* hourglass icon while the UDAS unit initializes.
 - The UDAS status LED illuminates after POST and host enumeration.
3. Verify the UDAS unit has two LEDs illuminated.

Troubleshooting Errors

If the two LEDs do not illuminate:

- Disconnect the I/O signals from the unit.
- Unplug the unit for several seconds then reconnect the unit to see if the LEDs illuminate. Some built-in tests may fail if the board was incompletely reset, even for components that are functioning normally.
- Verify the unit is receiving power and the power LED is illuminated.

-
- Check the wiring and cables for shorts or damage.

Note: For units with USB cables connected directly to the computer as a power source, when the computer's power is off or if the computer is in a suspended mode, the UDAS unit shuts down.

If errors still persist after repeatedly checking the unit, check the technical support links on Intelligent Instrumentation's web site <http://www.instrument.com> for the most current support information and contact addresses.

Appendix A Specifications

A.1 UDAS-1001E Series Hardware Specifications

All specifications are typical at 25°C unless otherwise noted.

Note: When powered from an external source, the on-board power supply circuit can supply up to 200mA at 5V DC to termination panels through the 50-pin I/O connector.
--

PARAMETER	CONDITIONS	SPECIFICATION
Analog Inputs		
Number of Channels	Single-ended	16
	Differential	8
Resolution		12-bits (1 part in 4096)
Voltage Ranges		0 - 10 V, ± 10 V, ± 5 V
Overvoltage Protection	Power on or off	± 20 V
Software Programmable Gains		1, 10, 100
Gain Accuracy	Gain = 1	0.02%
	Gain = 10	0.05%
	Gain = 100	0.08%
Input Offset Voltage		3mV
Input Bias Current		500 pA
Input Impedence		10^{+9} ohms/50 pF
Common Mode Input Range		± 10 V
Common Mode Rejection	60 Hz, 100 ohm imbalance	
	Gain = 1	-85dB
	Gain ≥ 10	-90dB

TABLE A.1 Hardware Specifications

Specifications

PARAMETER	CONDITIONS	SPECIFICATION
Noise	Input grounded at connector (RMS)	
	Gain ≤ 10	1.0 LSB
	Gain = 100	1.2
DC Accuracy		No missing codes, guaranteed
Linearity Error		$\pm 0.024\%FS$ ($\pm 1LSB$)
Throughput		100 k Samples/second
Analog Trigger (with AO option)		
Range		$\pm 10 V$
Hysteresis		28 mV
Resolution		4.88 mV nominal
Slope		Pos/Neg
Analog Outputs (Optional)		
Number of Channels		2
Resolution		12 bits (1 part in 4096)
Voltage Ranges		$\pm 10 V$
Throughput		100 k Samples/second
Digital I/O		
Number of Ports	8 channels (bits) per port	2
Input Levels		TTL-compatible
Input Current	High Level / Low Level	23 μA / 1 μA
Output Levels		TTL-compatible
Source/Sink	Vout = High/Low	15mA / 12mA
High-Speed Counter		

TABLE A.1 Hardware Specifications (Continued)

PARAMETER	CONDITIONS	SPECIFICATION
Resolution		32-Bit
Number of Channels		1
Max Input frequency	TTL-level input	2 MHz
TimeBase Generator		
Type	Crystal-based	Rate Generator (24-Bit)
Number		2 (1 analog input, 1 analog output)
Resolution		125 ns
Output Frequency Range		0.5 Hz to 1 Mhz
Output Levels		TTL-compatible
Bus Interface		
Type		USB
Power		
Voltage Range	USB or External	+5 V
Current Available (*1)	+5 V	200 mA maximum
Current Requirements	USB powered	<500 mA
Physical Characteristics		
Size		5.75" D x 7.25" W x 1.60" H (approximately) 14.61 cm D x 18.42 cm W x 4.06 cm H
Operating Temperature Range		0 - 50 C
All Specifications are typical at 25 C unless otherwise noted. Note (*1): When powered from an external source, the on-board power supply circuit can supply up to 200mA at 5VDC to termination panels through the 50-pin I/O connector.		

TABLE A.1 Hardware Specifications (Continued)

A.2 UDAS-1001E-3, UDAS-1001E-4 Dimensions

UDAS units are housed in standard metal enclosures made of a rugged extruded aluminum base (connected to chassis ground) with a vinyl-clad steel cover. Interior tracks on side rails hold the circuit board securely in place. This page provides the dimensions of each unit with the connectors.

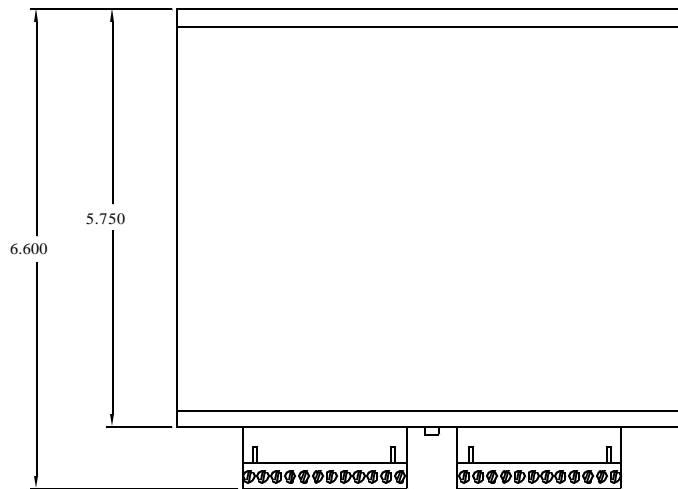


FIGURE A.1 Dimensions of the UDAS unit (Top view)

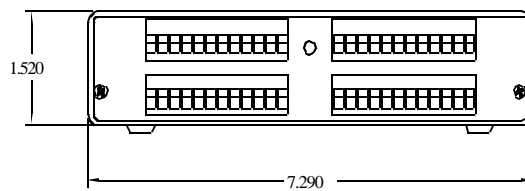


FIGURE A.2 Dimensions of the UDAS unit (Rear panel)

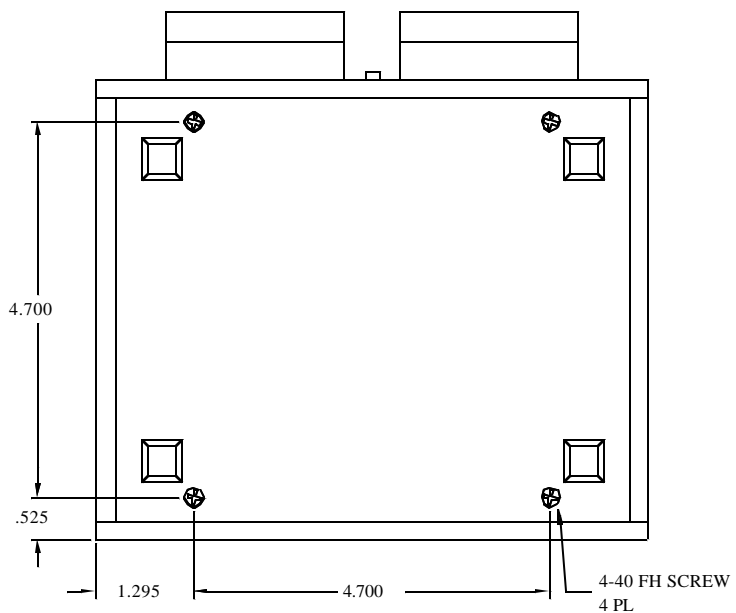


FIGURE A.3 Dimensions of the UDAS unit (Bottom view)

Specifications

The dimensions of the UDAS PC board are shown below in FIGURE A.4 *Dimensional Drawing of the UDAS series PCB.*

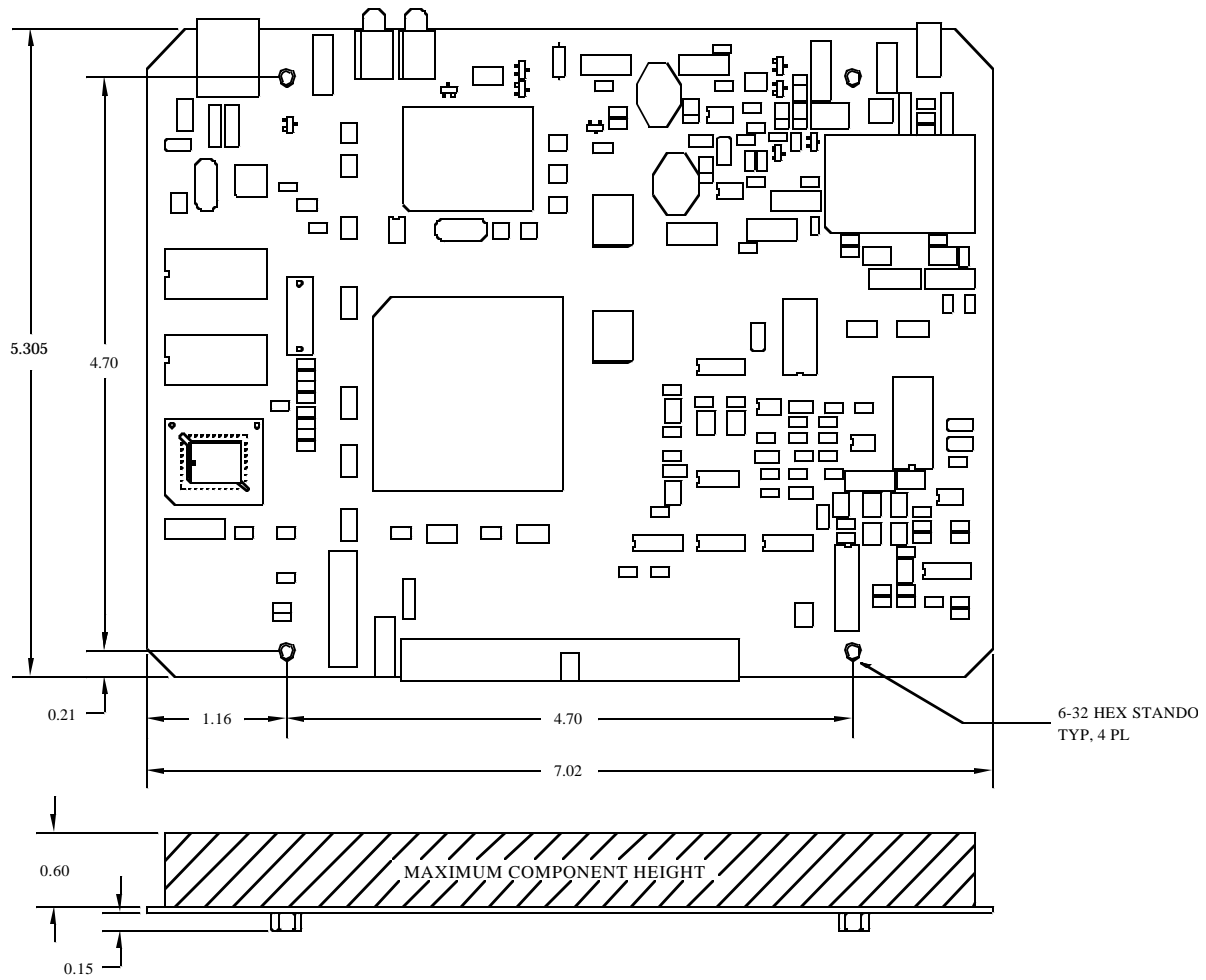


FIGURE A.4 Dimensional Drawing of the UDAS series PCB

A.3 UDAS I/O Connectors

Signal Name	Pin	Single Ended Input Function	Differential Input Function
AI0	1	Analog Input Channel 0	Analog Input Channel 0+
AI1	5	Analog Input Channel 1	Analog Input Channel 1+
AI2	7	Analog Input Channel 2	Analog Input Channel 2+
AI3	11	Analog Input Channel 3	Analog Input Channel 3+
AI4	13	Analog Input Channel 4	Analog Input Channel 4+
AI5	17	Analog Input Channel 5	Analog Input Channel 5+
AI6	19	Analog Input Channel 6	Analog Input Channel 6+
AI7	23	Analog Input Channel 7	Analog Input Channel 7+
AI8	2	Analog Input Channel 8	Analog Input Channel 0-
AI9	4	Analog Input Channel 9	Analog Input Channel 1-
AI10	8	Analog Input Channel 10	Analog Input Channel 2-
AI11	10	Analog Input Channel 11	Analog Input Channel 3-
AI12	14	Analog Input Channel 12	Analog Input Channel 4-
AI13	16	Analog Input Channel 13	Analog Input Channel 5-
AI14	20	Analog Input Channel 14	Analog Input Channel 6-
AI15	22	Analog Input Channel 15	Analog Input Channel 7-
Analog Ground	3	Analog Ground	**
Analog Ground	6	Analog Ground	**
Analog Ground	9	Analog Ground	**
Analog Ground	15	Analog Ground	**
Analog Ground	18	Analog Ground	**
Analog Ground	24	Analog Ground	**
+5V	26	5V Supply	**
+5V	48	5V Supply	**

TABLE A.2 UDAS I/O Connectors

Signal Name	Pin	Single Ended Input Function	Differential Input Function
AO 0	21	Analog Output Channel 0	**
AO 1	21	Digital I/O bit	**
Digital Port 0 bit 0	27	Digital I/O bit	**
Digital Port 0 bit 1	28	Digital I/O bit	**
Digital Port 0 bit 2	29	Digital I/O bit	**
Digital Port 0 bit 3	30	Digital I/O bit	**
Digital Port 0 bit 4	31	Digital I/O bit	**
Digital Port 0 bit 5	32	Digital I/O bit	**
Digital Port 0 bit 6	33	Digital I/O bit	**
Digital Port 0 bit 7	34	Digital I/O bit	**
Digital Port 1 bit 0	35	Digital I/O bit	**
Digital Port 1 bit 1	36	Digital I/O bit	**
Digital Port 1 bit 2	37	Digital I/O bit	**
Digital Port 1 bit 3	38	Digital I/O bit	**
Digital Port 1 bit 4	39	Digital I/O bit	**
Digital Port 1 bit 5	40	Digital I/O bit	**
Digital Port 1 bit 6	41	Digital I/O bit	**
Digital Port 1 bit 7	42	Digital I/O bit	**
Counter Clock	43	Counter input	**
Counter Gate	44	Counter gate input	**
Rate Generator Out	46	Analog In or Analog Out (selectable) Rate Generator output	**

TABLE A.2 UDAS I/O Connectors (Continued)

Signal Name	Pin	Single Ended Input Function	Differential Input Function
External Input	47	External Trigger or Pacer input	**
Digital Ground	49	Ground	**
Digital Ground	50	Ground	**
Unused	12		**
Unused	45		**

TABLE A.2 UDAS I/O Connectors (Continued)

Appendix B Accessories

This appendix includes information on the termination and mounting accessories that are available separately from Intelligent Instrumentation for the UDAS unit.

TABLE B.1, *Accessories for the UDAS-1001E Series* provides the model numbers for the UDAS units, the cables, and the power adapters.

UDAS Model #	Description
UDAS-1001-E-1	Multi-function USB data acquisition system.
UDAS-1001-E-2	Multi-function USB data acquisition system, with Analog Outputs.
UDAS-1001E-3	Multi-function USB data acquisition system, with built-in Termination.
UDAS-1001E-4	Multi-function USB data acquisition system, with built-in Termination and Analog Outputs.
OEM Versions (Board Only)	
UDAS-1001E-1G	Multi-function USB data acquisition system.
UDAS-1001E-2G	Multi-function USB data acquisition system, with Analog Outputs.
Cables	
50-pin to standard cables	Cables used to connect the UDAS unit to the termination panel at your equipment.
USB cable	Connects the UDAS unit to the computer.
UDAS Power Adapters	
UDAS-1006A-1	5 V DC (110 VAC input)
UDAS-1006A-2	5 V DC (230 VAC input)

TABLE B.1 Accessories for the UDAS-1001E Series

B.1 UDAS Termination Panels

The Termination Panel plugs directly into the I/O connectors of the UDAS unit, providing 32 channels of digital I/O through four screw-type terminal strips. Stand-off nuts on the UDAS unit secure the termination panel in place.

B.1.1 PCI-20429T-1 Multifunction Termination Panel

This termination panel plugs directly into the 50-pin I/O connector of the UDAS unit. Screw terminals are provided on the panel to interface all analog and digital I/O lines with external signals or devices. The PCI-20429T-1 secures to the UDAS unit's back panel using the mounting screws provided.

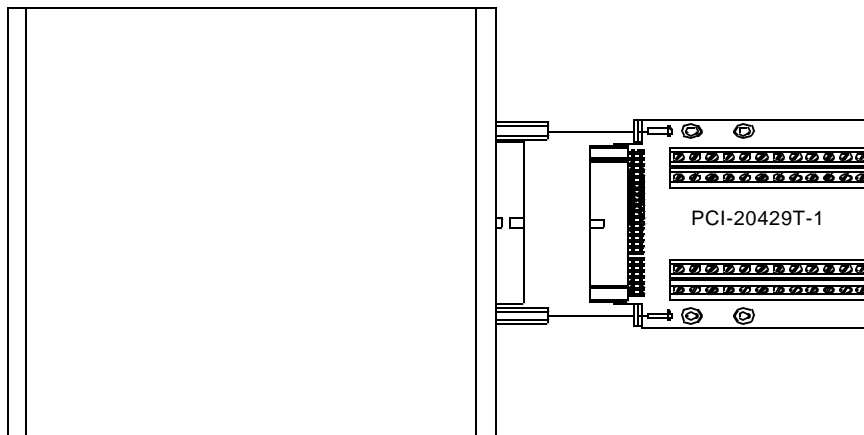
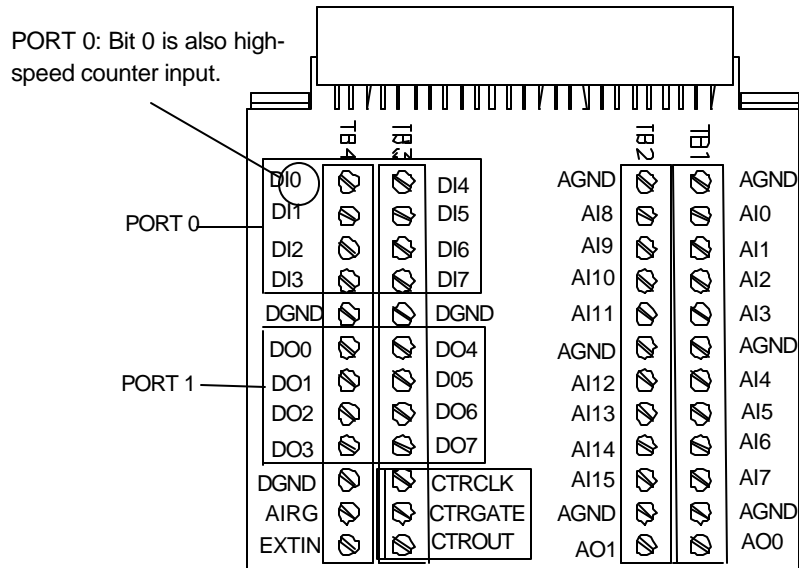


FIGURE B.1 Securing the PCI-20429T-1 to the UDAS unit

Access to all signals on the 50-pin I/O connector, except for +5 V, is provided through four 12-position terminal blocks. Two of these terminal blocks are used for analog input and output connections while the other two are used for digital I/O, counter, rate generator out and external input connections. Screw terminals enable signal wires to be securely fastened to the terminal blocks.

FIGURE B.2, *PCI-20429T-1 Multifunction Termination Panel* shows the signals assigned to each terminal block on this panel.



PORTs 0 and 1 on the UDAS-1001-E can be independently configured for input or output.

The CTRCLK, CTRGATE, and CTROUT terminations are not used (N/C) on the EDAS-1002-E.

FIGURE B.2 PCI-20429T-1 Multifunction Termination Panel

B.1.2 UDAS Termination and Signal Conditioning Options

FIGURE B.3, *UDAS-1001E Termination Options* uses the various UDAS-compatible termination panels currently available from Intelligent Instrumentation. Also reference FIGURE B.4, *UDAS-1001E Termination Options (continued)*.

The EDAS-1010T-1 Analog I/O Termination Panels and EDAS-1011T-1 Digital I/O Termination Panels are designed for ease-of-use with UDAS units.

The PCI-20430A-1 Adapter (available separately) and appropriate cables permit the UDAS unit to be used with a wide variety of termination products.

FIGURE B.5, *Diagram of the PCI-20430A-1's connectors and cables* shows a diagram of the PCI-20430A-1's connectors and compatible cables.

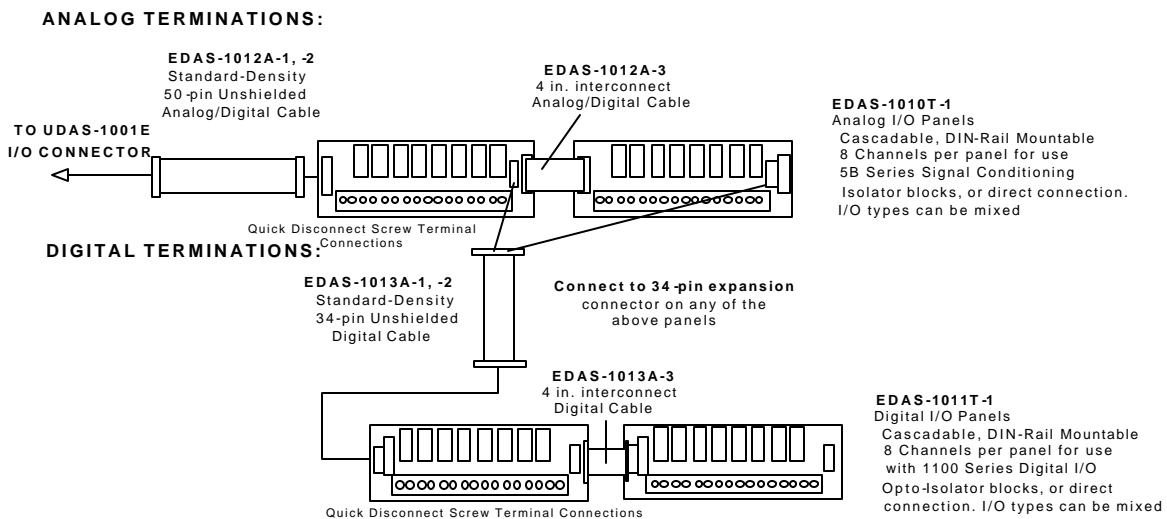


FIGURE B.3 UDAS-1001E Termination Options

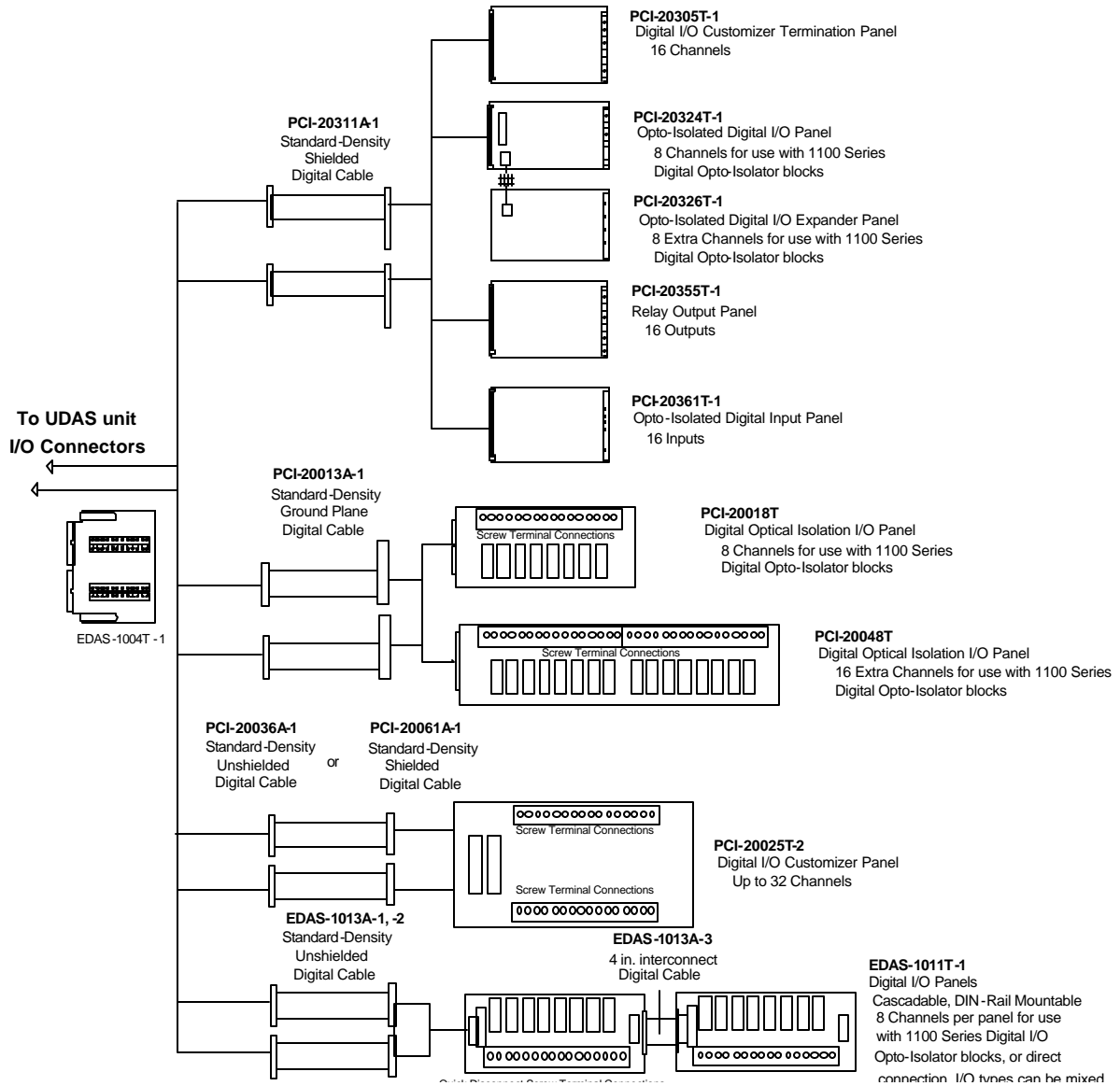


FIGURE B.4 UDAS-1001E Termination Options (continued)

B.1.3 Isolator Blocks

PCI-1100 Series Digital Opto-Isolator Blocks

The PCI-1100 Series are digital, optically isolated, signal conditioning blocks. A separate opto-block is used for each channel, allowing complete I/O flexibility.

The twelve different opto-blocks are divided into two groups: *standard* and *slim-line*.

Both standard and slim-line models can be used on EDAS-1011T-1 Panels.

- Only standard models (PCI-1101 through PCI-1106) can be used with the PCI-20018T-1 and PCI-20048T-1 termination panels.
- Only slimline models, PCI-1107 through PCI-1112, can be used with 3U sized termination panels (PCI-20324T-1 and PCI-20326T-1).

Summary of Features

- All input models accept both AC and DC voltages.
- Each provides a TTL output to drive a standard digital input.
- Different models are provided for AC and DC outputs.
- Units convert TTL outputs from the data acquisition system to switch higher voltage and current loads.
- DC output devices present an open collector NPN transistor to the load.
- AC output units contain zero crossing circuitry and switch their loads with triacs.
- All models provide 4000 V isolation input to output.

Various combinations of the available opto-blocks can be intermixed on one termination panel. Each contiguous group of eight channels must contain only input or output opto-blocks since the digital channels on the Digital I/O UDAS are programmable as inputs or outputs in byte-size (8 bits) units.

PCI-1100 Models Standard/Slimline	Description
PCI-1101/1107	AC/DC input (15-32V), TTL out
PCI-1102/1108	AC/DC input (90-140V), TTL out
PCI-1103/1109	DC output (5 - 60V at 3A), TTL in
PCI-1104/1110	AC output (12-140V at 3A), TTL in
PCI-1105/1111	AC/DC input (180-280V), TTL out
PCI-1106/1112	AC output (24-280V), TTL in

Appendix C Analog Input and Output Calibration Procedures

C.1 UDAS Analog Input Circuit Calibration Procedures

The analog input section of each UDAS unit is calibrated at the factory prior to shipment. If your application requires periodic calibration checks or if inaccuracies occur, use the procedures below to calibrate the UDAS unit. This calibration is accomplished by the adjustment of potentiometers on the UDAS unit's printed circuit board.

This calibration procedure requires the utility software provided with the unit, or some other software such as Visual Designer for displaying the Analog to Digital converter (A/D) results in counts format and for setting required gains and ranges.

Equipment Required:

- Precision voltmeter accurate to 100 μ V over a range of ± 10 V.
- Precision voltage calibrator accurate to 1.0 μ V over a range of ± 1 V and accurate to 100 μ V over a range of ± 10 V.
- Termination panel for connecting signals and test instruments. A termination panel is built in to models UDAS-1001E-3 and UDAS-1001E-4.
- 1.4 mm flat-head insulated screwdriver for adjusting potentiometers.
- #1 Phillips screwdriver for opening the unit's case.
- USB equipped host computer.

CAUTION:

Static sensitive device warning! To avoid damage to the unit from static electricity, always use proper static protective procedures (such as use of a grounded wrist strap) when handling or adjusting this device.

C.1.1 Removing the UDAS Unit's Cover

1. Disconnect the unit from the host computer or any external power supply.
2. Using a #1 Phillips screw driver, remove the two small screws at the far left and right ends of the unit's front panel next to the USB and power connectors.
3. Remove the front panel, then slide the case cover towards the front of the unit.

4. Connect the UDAS to the host computer and allow at least a 15 minute warm-up period before performing the adjustments.

CAUTION:
The unit may become damaged if you use an uninsulated screwdriver and accidentally touch other components.

FIGURE C.1 Locations of Potentiometers for Adjusting Analog Circuits on page C-2 shows the locations of the potentiometers used to adjust the analog circuits on a UDAS unit.

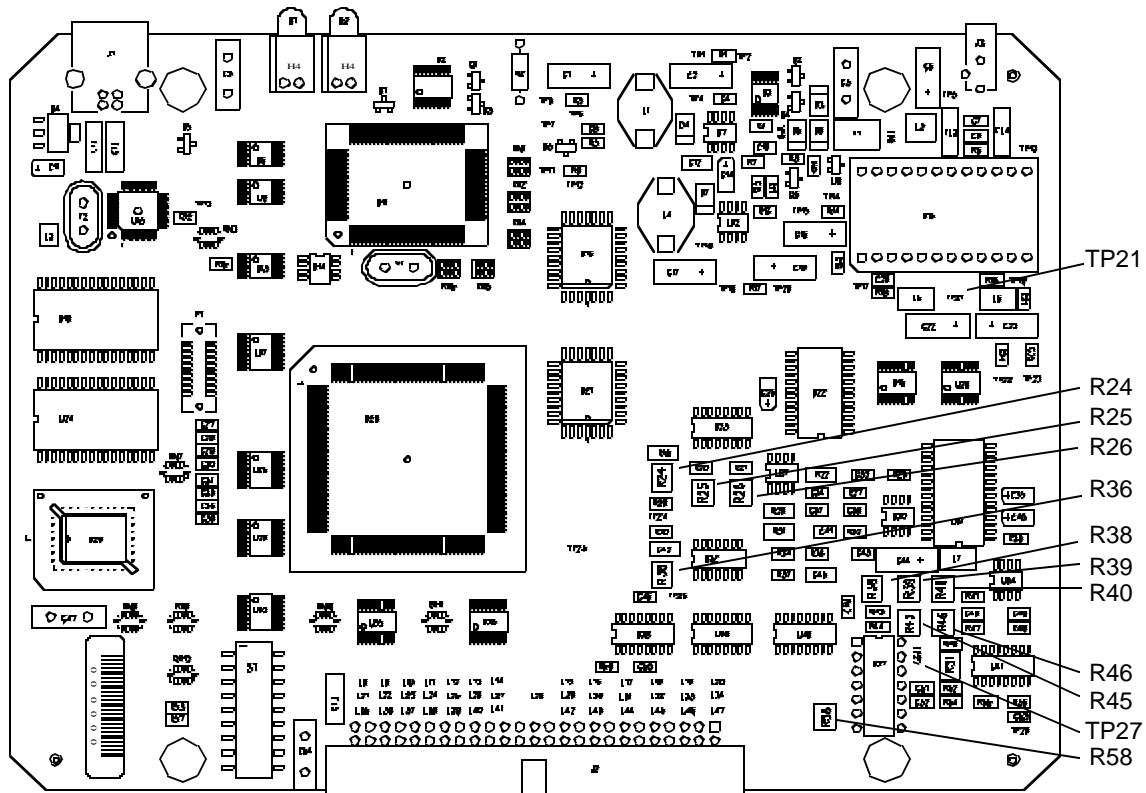


FIGURE C.1 Locations of Potentiometers for Adjusting Analog Circuits

C.1.2 Analog Input Calibration Procedure

Calibrating the analog input section requires adjusting the input offset voltage, the $\pm 10\text{V}$ range, $\pm 5\text{V}$ range, and the 0 to 10V range. The procedures are listed separately, but should be performed during a single calibration session.

Note: The input offset voltage must be adjusted and in specified limits *before* the other adjustments are performed.

Adjust Input Offset Voltage

1. Attach the termination panel to 50-pin connector of UDAS, unless the unit has built-in termination.
2. Ground analog input channel 0 to analog ground, not digital ground, on the termination panel.
3. Connect a precision voltmeter between TP27 and analog ground, TP21.
4. Run a program, such as SYSCHECK, to configure the UDAS for single-ended operation, bipolar input ($\pm 10\text{V}$) and a gain of 1.
5. Read the voltage from the voltmeter.
6. Reconfigure the UDAS for a gain of 100. Adjust R58 so that the offset voltage read from the voltmeter is equal to the voltage read in step 4.
7. Repeat steps 4 and 5 to minimize the offset difference observed between the two gain settings. The offset difference observed between the two gain settings should be within $\pm 0.5\text{ mV}$. If possible, try to achieve less than $\pm 0.2\text{ mV}$ offset difference.
8. Reconfigure the UDAS to a gain of 10 and verify the offset value is less than 0.5 mV different from the last value read at a gain of 1.

Adjust Offset and Gain for $\pm 10\text{V}$ Input Range

1. Verify the termination panel is attached to the 50-pin connector of the UDAS device. Begin with step 2 if the unit has built-in termination.
2. Attach a voltage calibrator to channel 0 with all of the other channels grounded.
3. Run a program, such as SYSCHECK, to configure the UDAS for a range of $\pm 10\text{V}$ and gain of 1.
4. Set the calibrated input to 0 V, or short channel 0 to analog ground.
5. Set SYSCHECK or other program to average 50 readings. Manually or automatically take readings repeatedly.
6. Adjust Pot R51 until the software displays 0 V.

Note: On all adjustments, there is likely a range of adjustment resulting in the proper reading. Determine this range and leave the adjustment in the center of the range.

7. Set the calibrated input to 9.5068 V.
8. Adjust Pot R46 for 9.5068 V.
9. Repeat the procedure and verify the adjustments are correct.

Note: These adjustment steps are interactive and may require several iterations.

10. Set the precision voltage source to -9.95117 V and check for a reading of -9.95117.

Note: If the value you read is more than 0.039 V different from -9.95117, then the following Alternate Bipolar Calibration must be used.

Adjust Offset and Gain for ± 5 Volt Input Range

1. Verify the termination panel is connected to a 50-pin connector of the UDAS unit. Begin with step 2 if the unit has built-in termination.
2. Attach a voltage calibrator to channel 0 with all other channels grounded.
3. Run a program, such as SYSCHECK, to configure the UDAS for a range of ± 5 V and gain of 1.
4. Set calibrated input to 0 V, or short channel 0 to analog ground.
5. Set SYSCHECK or other program to average 50 readings. Manually or automatically take readings repeatedly.
6. Adjust Pot R39 until the software displays 0 V.

Note: On all adjustments there will be a range of adjustment that results in the proper reading. Determine this range and leave the adjustment in the center of the range.

7. Set the calibrated input to 4.5734 V.
8. Adjust Pot R40 for 4.5734 V.

-
- Repeat the procedure and verify the adjustments are correct.

Note: These adjustment steps are very interactive and may require several iterations.

Adjust Offset and Gain for 0 to 10 Volt Range

- Verify the termination panel is attached to the 50-pin connector of a UDAS unit. Begin with step 2 if the unit has built-in termination.
- Attach a voltage calibrator to channel 0 with all of the other channels grounded.
- Run a program to configure the UDAS for a range of 0-10 V and a gain of 1.
- Set the calibrated input to 0.02441 V.
- Set SYSCHECK or other program to average 50 readings. Manually or automatically take readings repeatedly.
- Adjust Pot R38 for 0.02441 V.

Note: On all adjustments there will be a range of adjustment that results in the proper reading. Determine this range and leave the adjustment in the center of the range.

- Set the calibrated input to 9.97558 V.
- Adjust Pot R45 for 9.7558 V.
- Repeat steps 4 through 8. There will be a very slight interaction in these adjustments.
- After calibrating the unit, slide the unit's cover back on and refasten the front panel using the screws removed earlier.

C.2 UDAS Analog Output Circuit Calibration Procedure

This section applies to models UDAS-1001E-2, UDAS-1001E-2G, and UDAS-1001E-4 that are equipped with the analog output feature.

The analog output channels on the UDAS unit are calibrated at the factory. If your application requires periodic calibration checks or if you suspect inaccuracies, use the following procedures to calibrate the unit. This calibration is accomplished by adjustment of potentiometers on the unit's printed circuit board.

Note: This calibration procedure requires the utility software provided with the unit, or some other software such as Visual Designer for setting the Analog Output levels.

Equipment Required:

- Precision Voltmeter accurate to 100 μ V over a range of ± 10 V.
- Termination panel for connecting signals and test instruments.
- 1.4 mm flat-head insulated screwdriver for adjusting potentiometers.
- #1 Phillips screwdriver and a small wrench or nut driver for opening the unit's case.
- USB equipped host computer.

CAUTION:
STATIC SENSITIVE DEVICE WARNING! To avoid damage to the unit from static electricity, always use proper static protective procedures (such as use of a grounded wrist strap) when handling or adjusting this device.

Instructions for opening the unit's case are listed at the beginning of section C.1.1 *Removing the UDAS Unit's Cover* on page C-1.

Connect the UDAS to the host computer and allow at least a 15 minute warm-up period before making any adjustments. See FIGURE C.1 *Locations of Potentiometers for Adjusting Analog Circuits* on page C-2.

CAUTION:
The unit may become damaged if you use an uninsulated screwdriver and accidentally touch other components.

Analog Output Channel 0 Offset and Gain

1. Verify the termination panel is attached to a 50-pin connector of a UDAS unit. Begin with step 2 if the unit has built-in termination.
2. Attach a multimeter to analog output channel 0.
3. Use SYSCHECK or other software to set analog output channel 0 to -10.000 V.
4. Adjust Pot R26 for -10.000 V (± 0.2 mV).
5. Set analog output channel 0 to 9.9951 V.
6. Adjust Pot R36 for 9.9951 V (± 0.2 mV).
7. Repeat these steps to verify the results.

Analog Output Channel 1 Offset and Gain

1. Verify the termination panel is attached to a 50-pin connector of a UDAS unit.
2. Attach a multimeter to analog output channel 1.
3. Use SYSCHECK or your calibration software to set analog output channel 1 to -10.000 V.
4. Adjust Pot R24 for -10.000 V (± 0.2 mV).
5. Set analog output channel 1 to 9.9951 V.
6. Adjust Pot R25 for 9.9951 V (± 0.2 mV).
7. Repeat these steps to verify the results.

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