



DI-145

4-Channel USB Data Acquisition Starter Kit

User's Manual

Manual Revision A

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1. Introduction

This manual contains information designed to familiarize you with the features and functions of the DI-145 USB data acquisition starter kit. These high-end Starter kits contain features and functionality normally reserved for more expensive data acquisition systems.

Features

The **DI-145** data acquisition instrument is a portable data recording module that communicates through your computer's USB port. Power is derived from the interface port so no external power is required. Features include:

- 4 fixed differential analog inputs protected to $\pm 150\text{V}$.
- Two dedicated digital I/O ports for Remote control protected to $\pm 30\text{V}$.
- $\pm 10\text{V}$ full scale measurement range.
- 240 samples per second maximum sampling rate.
- A push-button to tag remote events in WINDAQ software.
- Three status LEDs for easy notification of system status.
- Backwards compatible with the DI-194RS serial port data acquisition system protocol.

Analog Inputs

The **DI-145** features four differential channel inputs located on a single sixteen-position screw terminal block for easy connection and operation (other terminals used for digital I/O or reserved). Note: The DI-145 does not support Gain.

Utilize the functionality of WINDAQ software to experience all the features encased in these small, inexpensive instruments.

Digital Inputs

The DI-145 contains two digital lines (bits) for WINDAQ remote control operations (Remote Start/Stop and Remote Events). Connect switch closures or discrete levels with a maximum input of 30V and a threshold of 1.8V. The inputs float at 1 level, about 3.3V relative to the “-” terminal, and require sinking about 50uA to bring them down to 0.8V and guarantee a 0. When no Options Remote are enabled in WINDAQ, the Event input appears inverted in data bit 0 and the Record input appears inverted in data bit 1 of data for the first enabled channel.

Software

All software required to record and playback waveforms is included with the purchase of any DI-145 data acquisition starter kit via download.

WINDAQ® Recording and Playback Software

WINDAQ Acquisition and WINDAQ Waveform Browser allow you to record and playback data acquired through your instrument. WINDAQ software is an invaluable resource to record and analyze your data and is available for free from our web site (www.dataq.com).

WINDAQ Acquisition software (WINDAQ/Lite) can be used to record waveforms directly and continuously to disk while monitoring a real time display of the waveforms on-screen. It operates, displays, and records waveform signals in real time at the full sample rate of the DI-145 (240Hz maximum throughput).

WINDAQ Waveform Browser playback software (also known as “WWB”) offers an easy way to review and analyze acquired waveforms. A built-in data file translator allows the user to display multiple waveforms acquired by WINDAQ Acquisition software or any of a wide range of data acquisition packages. The software’s disk-streaming design allows data files of any length to be graphically displayed rapidly, in normal or reverse time directions. Seven standard cursor-based measurements, frequency domain, and statistical analysis functions help simplify waveform analysis and interpretation. WINDAQ Waveform Browser is free and installed when installing WINDAQ Software.

The DATAQ Instruments Hardware Manager

This software can be found in the Start menu under the WINDAQ program group called **DATAQ Instruments Hardware Manager**. Access WINDAQ Acquisition software and manage multiple DATAQ Instruments devices in this easy-to-use point and click environment. View the Help files by clicking on View Help in the Help menu or by pressing F1.

Help

All WINDAQ software utilizes context-sensitive help. Help may be accessed through the Help menu or by pressing the F1 key with any pull-down menu item selected. This will take you directly to the Help topic most relevant to that particular function or feature. Help topics discuss in detail each function available in the software.

2. Specifications

Analog Inputs

Number of Channels:	4
Channel Configuration:	Differential
Voltage Measurement Range:	$\pm 10\text{V}$ Full Scale
Input Impedance:	$1\text{M}\Omega$, each input to ground
Isolation:	none
Accuracy:	$\pm 0.25\%$ of FSR
Overall inaccuracy:	$\pm 64\text{mV}$ (at 25°C)
DC common mode rejection:	40 db (at 25°C)
Max input without damage:	$\pm 150\text{V}$ DC or peak AC
Max common mode voltage:	$\pm 10\text{V}$
Analog frequency response:	-3db @ 100 Hz

Digital Inputs

Number of Channels:	2
Pull-up value:	47 $\text{K}\Omega$ from + input to to 3.3V
Pull-down value:	4.7 $\text{K}\Omega$ from - input to USB ground
Input high voltage threshold:	1.8 V minimum
Input low voltage threshold:	1.4 V maximum
Absolute maximum values:	$\pm 30\text{ VDC}$

Reserved Inputs (Digital Inputs)

Digital In 0:	WINDAQ remote start/stop
Digital In 1:	WINDAQ remote events

ADC Characteristics

Resolution:	Overall: 1 part in 1,024 (10-bit) Above zero: 1 part in 511 Below zero: 1 part in 512 1 ADC Count = $\pm 19.5\text{ mV}$
Max. sample throughput rate:	240 Hz
Min. sample throughput rate:	0.44 samples per minute
Sample rate timing accuracy:	50 ppm

Indicators and Connections

Interface:	USB 2.0 (mini-B style connector)
Indicators (LED):	Power, Active, Digital
Input Connections:	One 16-position terminal strip

Power

Power Consumption: 0.30 watts, via USB interface

Environmental

Operating Temperature: 0°C to 35°C (32°F to 95°F)

Operating Humidity: 0 to 90% non-condensing

Storage Temperature: -20°C to 45°C (-4°F to 113°F)

Storage Humidity: 0 to 90% non-condensing

Physical Characteristics

Enclosure: Hardened Plastic

Mounting: Desktop; bulkhead

Dimensions: 2.625D × 5.5W × 1.53H in.
(6.67D × 13.97W × 3.89H cm.)

Weight: 3.6 oz.

Software Support

WINDAQ/Lite software: OS support: Windows XP (32-bit), Windows
Vista and Windows 7 (32- and 64-bit versions)
Sample Rate Limit: 240 Hz

Backwards compatibility: DI-194RS compatibility mode supports Linux and MatLab

Programming: [DATAQ Instruments SDK](#)

3. Installation

The following items are included with each WINDAQ Starter Kit. Verify that you have the following:

- A DI-145 USB data acquisition instrument.
- USB cable.
- A DATAQ Instruments screwdriver for signal lead connections.

If an item is missing or damaged, call DATAQ Instruments at 330-668-1444. We will guide you through the appropriate steps for replacing missing or damaged items. Save the original packing material in the unlikely event that your unit must, for any reason, be sent back to DATAQ Instruments.

Installing WINDAQ Software and the DATAQ Instruments Hardware Manager

All software for the DI-145 can be installed via a downloadable executable directly from the DATAQ Instruments web site. No CD is shipped with the device. You may burn the executable onto a CD to transport the software to a computer with no internet connection.

1. Disconnect all DATAQ Instruments USB devices from your Computer.



2. Go to www.dataq.com/145 in your web browser.
3. Click on the Download Now button.
4. Save the file to your local hard drive.
5. Double-click on the downloaded file (*dataq_145_install.exe*) to extract the program and begin software installation.
6. Follow the on-screen prompts and enter any required information.

7. Software installation is complete - you will now see a “Successful Installation” box - click **OK** to exit WINDAQ Installation.

You can now plug the device(s) into your PC. Click on the appropriate program group (specified above — default is Start > Programs > WINDAQ) and click on “DATAQ Instruments Hardware Manager” to access WINDAQ software.

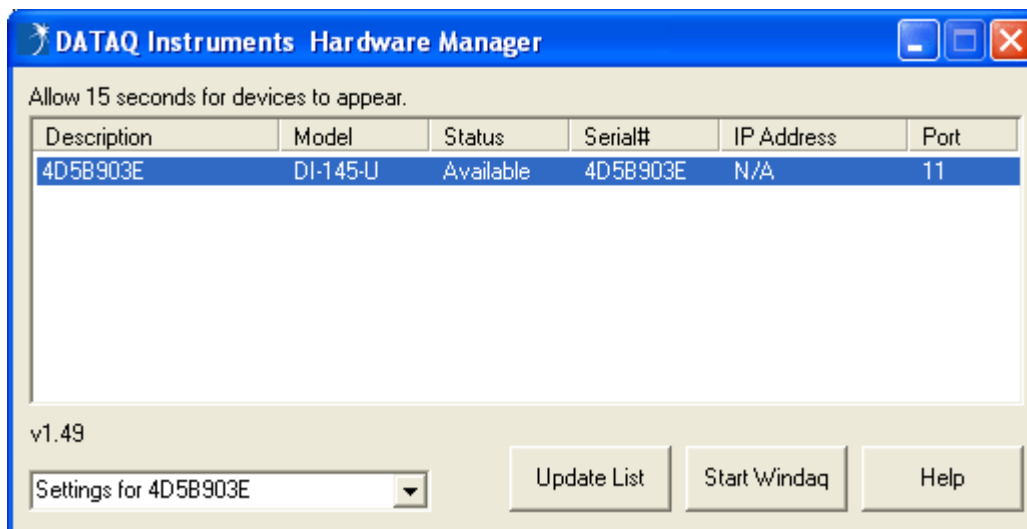
Connecting the Instrument to Your Computer

DI-145 instruments can be connected to your computer’s USB port using the provided USB cable. No external power is required. Connect one end of the communications cable to the instrument port and the other to your PC’s port.

Note: Use a powered USB hub or a USB port on your PC. Non-powered USB hubs may not have sufficient power to run the instrument.

DATAQ Instruments Hardware Manager

The DATAQ Instruments Hardware Manager is installed when installing any DI-145 instrument. This software allows you to effectively manage multiple devices installed on the same PC. The DATAQ Instruments Hardware Manager may be accessed through the Windows Program Manager Group as specified during installation (default is Start > Programs > WINDAQ > DATAQ Instruments Hardware Manager). All available devices will automatically appear in the list box when you run the software.

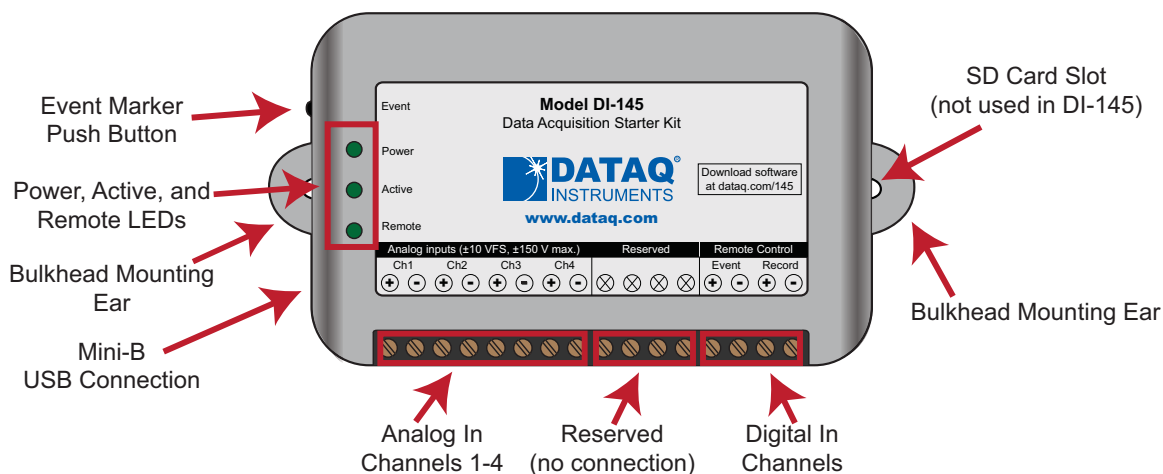


The Hardware Manager allows you to start WINDAQ Acquisition software (select the device and click on the **Start Windaq** button) and must be used when multiple DATAQ Instruments devices are installed. It also provides crucial information about your device needed for custom programming (Serial # and COM Port).

Please note: The description of DI-145 models cannot be modified.

Click on the Help button for help with the DATAQ Instruments Hardware Manager.

4. Controls, Indicators, and Connections



Please note: The SD card slot is not used in the DI-145. Allowing foreign materials to enter the device through the SD card slot may result in damage to the instrument.

Mini-B USB Connection

Use the supplied USB cable to connect and power the instrument through your computer's USB port.

Connecting Input Signals

All input signal connections are made to the 16-port screw terminals. Each terminal is labeled directly on the instrument case.

DI-145 Signal Connections

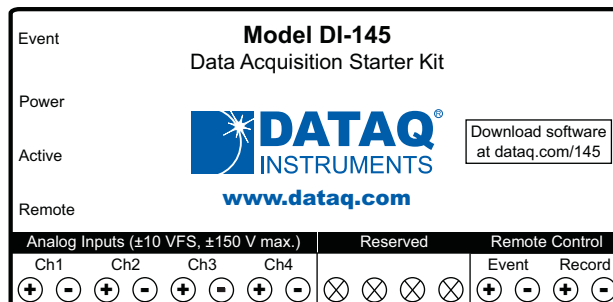
Refer to the following for screw terminal port identification.

Ch#: Analog channels 1-4 ($\pm 10V$ full scale, $\pm 150V$ max)

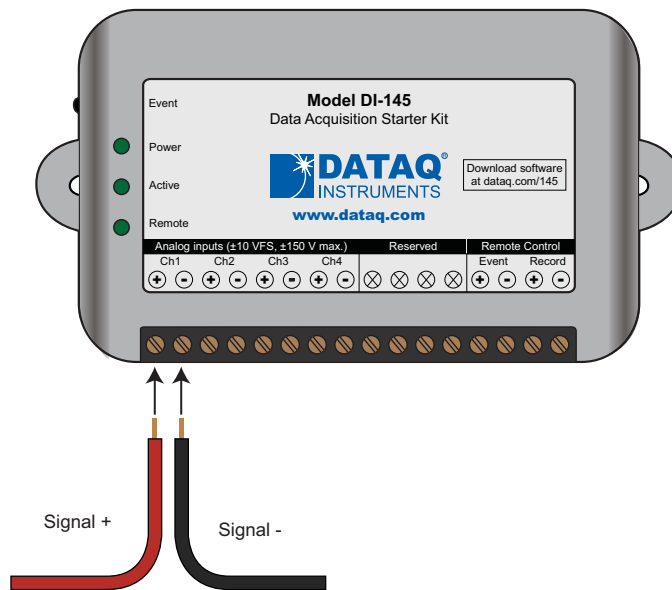
Remote Control Event: Digital Input bit 0—Remote Event Marker

Remote Control Record: Digital Input bit 1—Remote Start/Stop

Reserved NC: No connection—reserved.



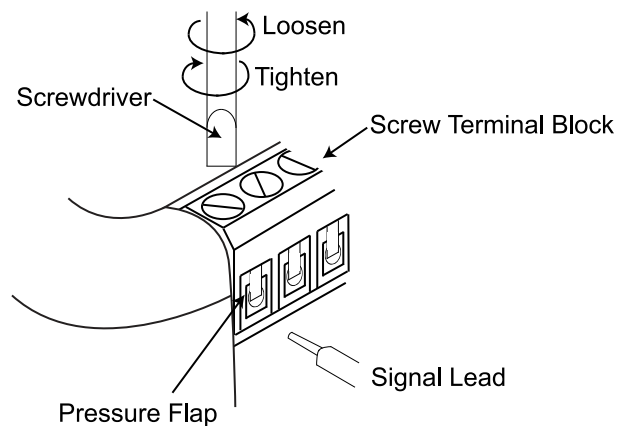
Use the following diagram to connect Analog Input Channel 1.



Connecting Signal Leads

To connect signal leads to the DI-145:

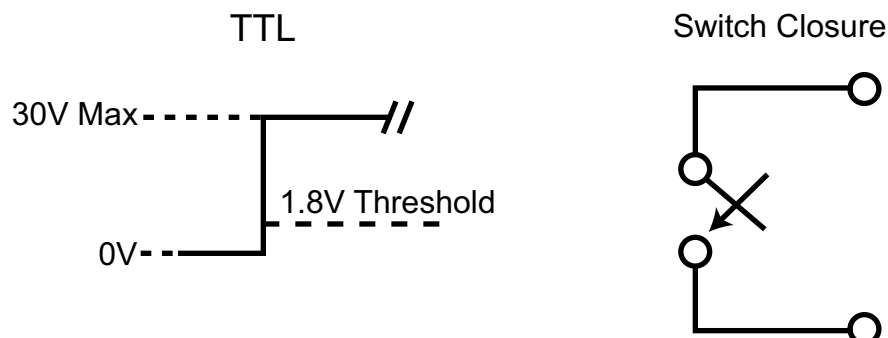
1. Insert the stripped end of a signal lead into the desired terminal directly under the screw.
2. Tighten the pressure flap by rotating the screw clockwise with a small screwdriver. Make sure that the pressure flap tightens only against the signal wire and not the wire insulation. Do not over-tighten.
3. Tug gently on the signal lead to ensure that it is firmly secured.



When an input signal is connected and WINDAQ Acquisition software is run, WINDAQ's real time display immediately reveals the input waveform on your computer's monitor.

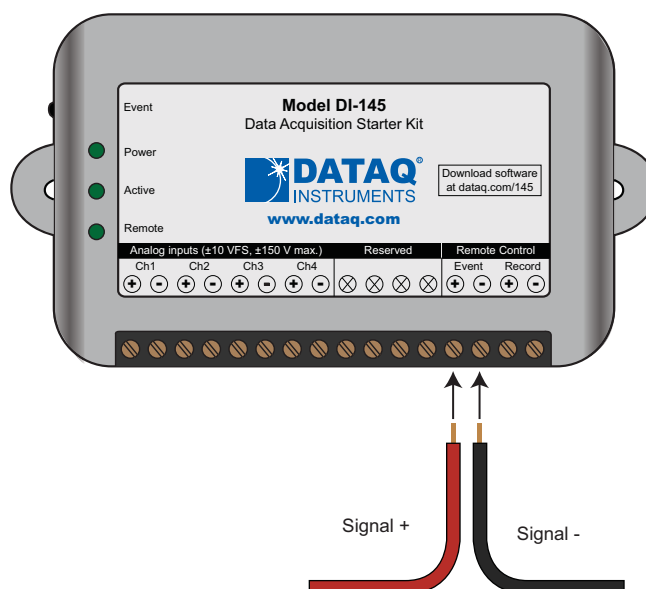
WINDAQ Remote Controls (Digital Inputs)

The DI-145 contains 2 digital inputs for WINDAQ Remote Events (inserts an Event Marker) and Remote Storage (Record data). Valid remote record and event signals are switch closures or discrete levels with a maximum input of 30 V and a threshold of 1.8 V.



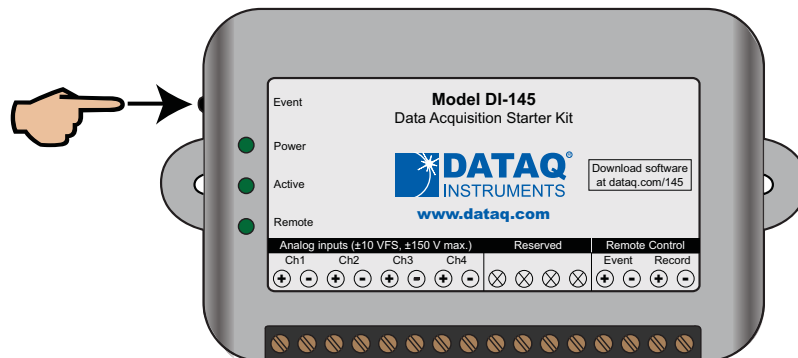
WINDAQ Remote Events

To use a switch closure or TTL signal to record WINDAQ Event Markers, connect signal leads to the appropriate Remote Control Event terminals on the DI-145 as shown below.



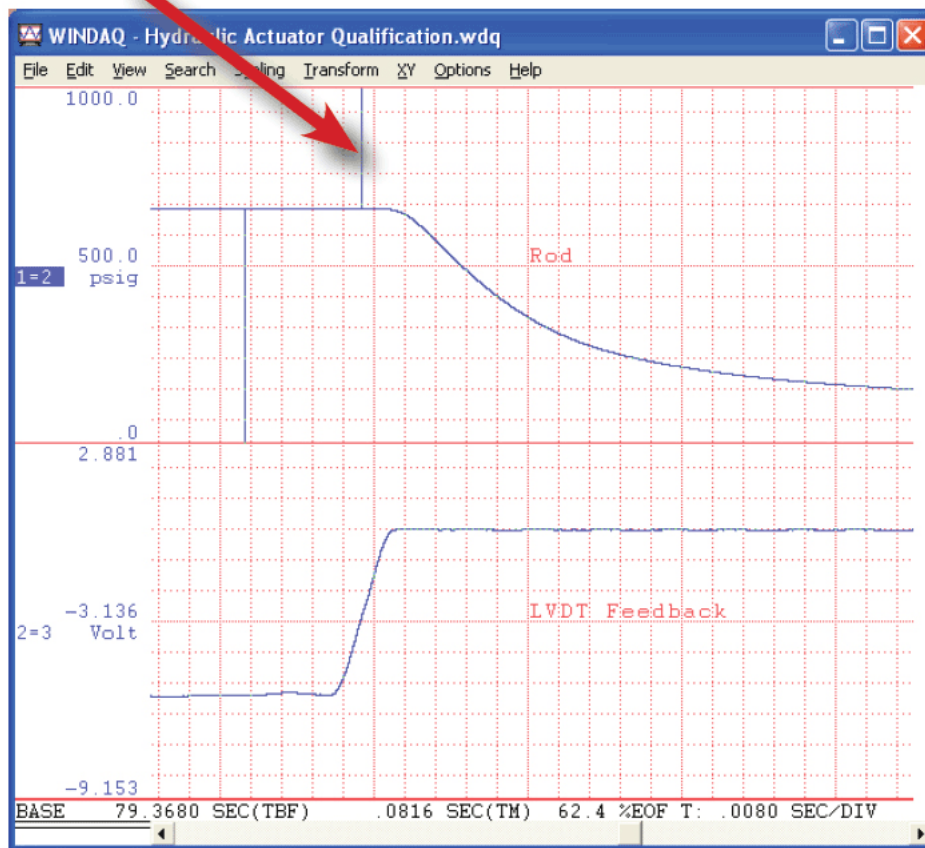
Once the switch closure or TTL signal is connected, activate Remote Events through WINDAQ Acquisition Software. Events may be automatically placed on the rising or falling edge of the trigger signal. Use the menu command **Options > Remote Events +** to set WINDAQ to place event markers on low-to-high transitions of the Event input. Use the menu command **Options > Remote Events -** to set WINDAQ to place event markers on high-to-low transitions of the Event input.

Event markers may also be placed in your data file manually by pressing the push button on the DI-145 Instrument. You must enable Remote Events in WINDAQ to use the button (use the menu command **Options > Remote Events** +or **Options > Remote Events -**).



An example event marker in a WINDAQ data file is shown below.

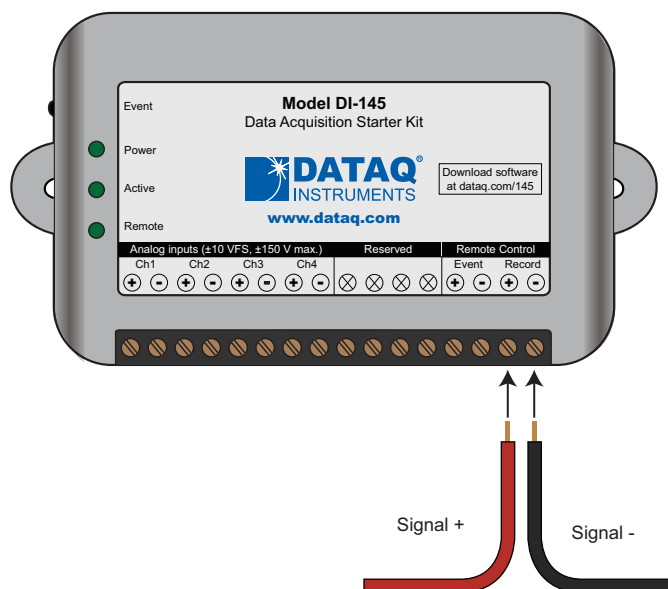
Event Marker*



**Please Note: Event Markers do not display in the real-time WINDAQ acquisition software - they only display in the WINDAQ playback software (WWB).*

WINDAQ Remote Storage (Record)

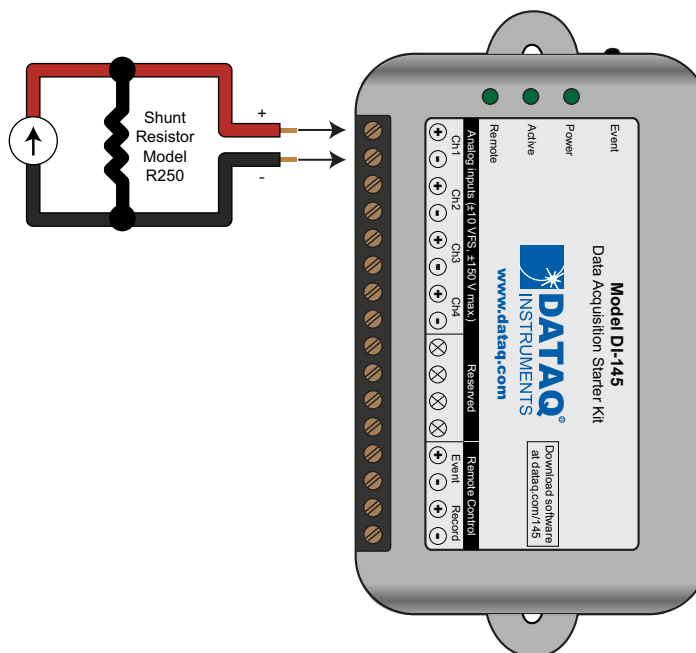
To use a switch closure or TTL signal to begin recording data remotely, connect signal leads to the appropriate Remote Control Record terminals on the DI-145 as shown below.



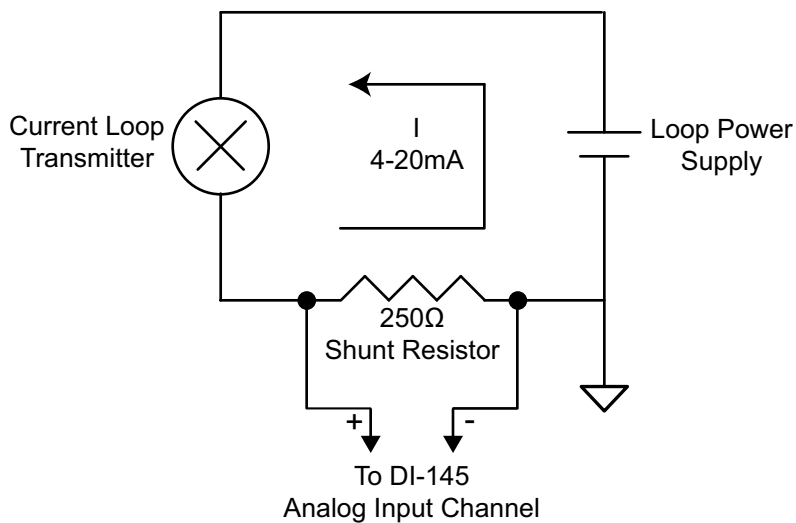
Once the switch closure or TTL signal is connected, activate Remote Storage (Record) through WINDAQ Acquisition Software. Storage to Disk may be automatically placed on the rising or falling edge of the trigger signal. Use the menu command **Options > Remote Storage 1** to set WINDAQ to begin recording on low-to-high transitions of the Record input. Use the menu command **Options > Remote Storage 0** to set WINDAQ to begin recording on high-to-low transitions of the Record input.

4-20mA Current Loop Measurements

Use the following diagram for 4-20mA current loop measurement connections.



The shunt resistor should be placed on the low side of the circuit as shown below:



Set the engineering units as desired and define low/high calibration values in WINDAQ as 1V = 4mA for the low value and 5V = 20mA for the high value. For example, when using WINDAQ Acquisition software, in the Channel 1 Low Calibration dialog box:

Channel 1 Low Calibration

Input Level = 1 Volt ☐ Use Previous Cal.

Low Cal Value 4

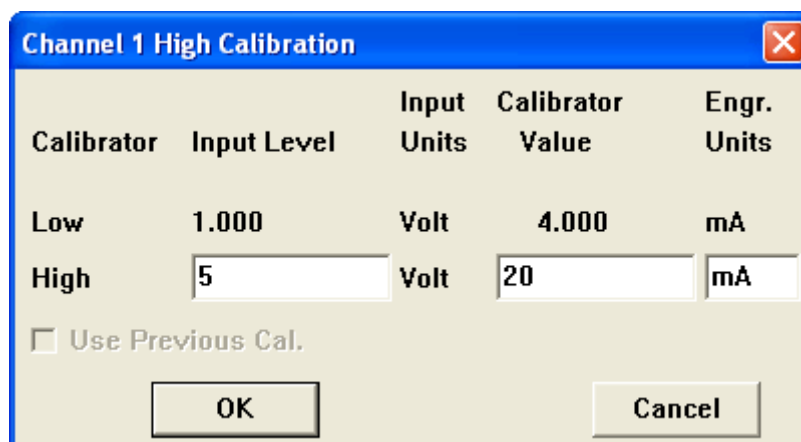
Engr. Units = mA

OK Cancel

Enter the following values:

Input Level =	1
Low Cal Value	4
Engr. Units =	mA

In the High Calibration dialog box:



The dialog box titled "Channel 1 High Calibration" contains a table with the following data:

Calibrator	Input Level	Input Units	Calibrator Value	Engr. Units
Low	1.000	Volt	4.000	mA
High	5	Volt	20	mA

Below the table is a checkbox labeled "Use Previous Cal." which is unchecked. At the bottom are "OK" and "Cancel" buttons.

Enter the following values (the Low Cal values are displayed):

Calibrator	Input Level	Input Units	Calibrator Value	Engr. Units
Low	1	Volt	4	mA
High	5	Volt	20	mA

You can also associate these values to a physical measurement such as pressure, load, flow, torque, etc. Read the Help files for more information regarding Waveform Calibration.

LED Indicators

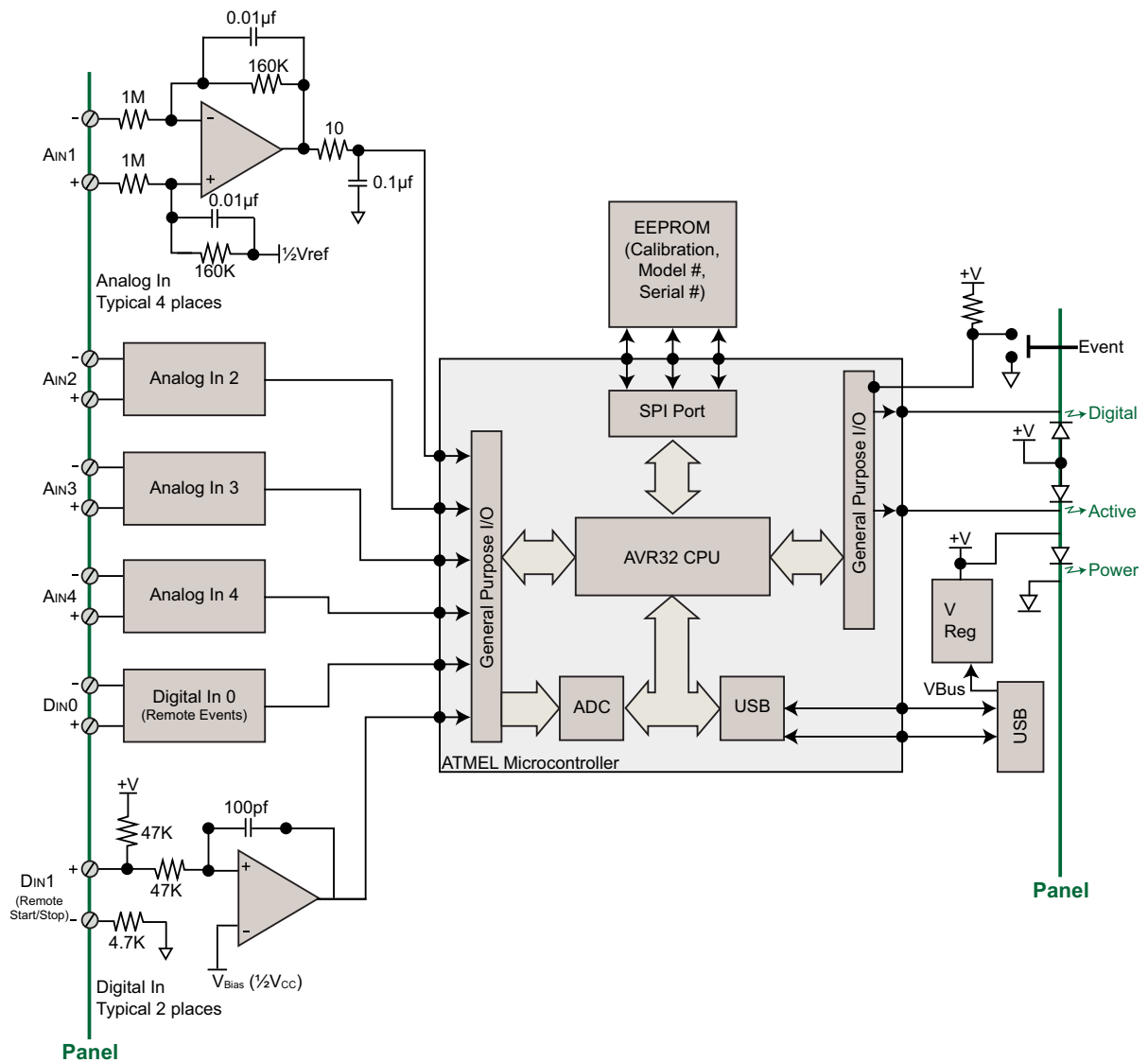
The DI-145 provides three green LEDs for instrument status and notification.

Power: Indicates power is applied via the USB cable.

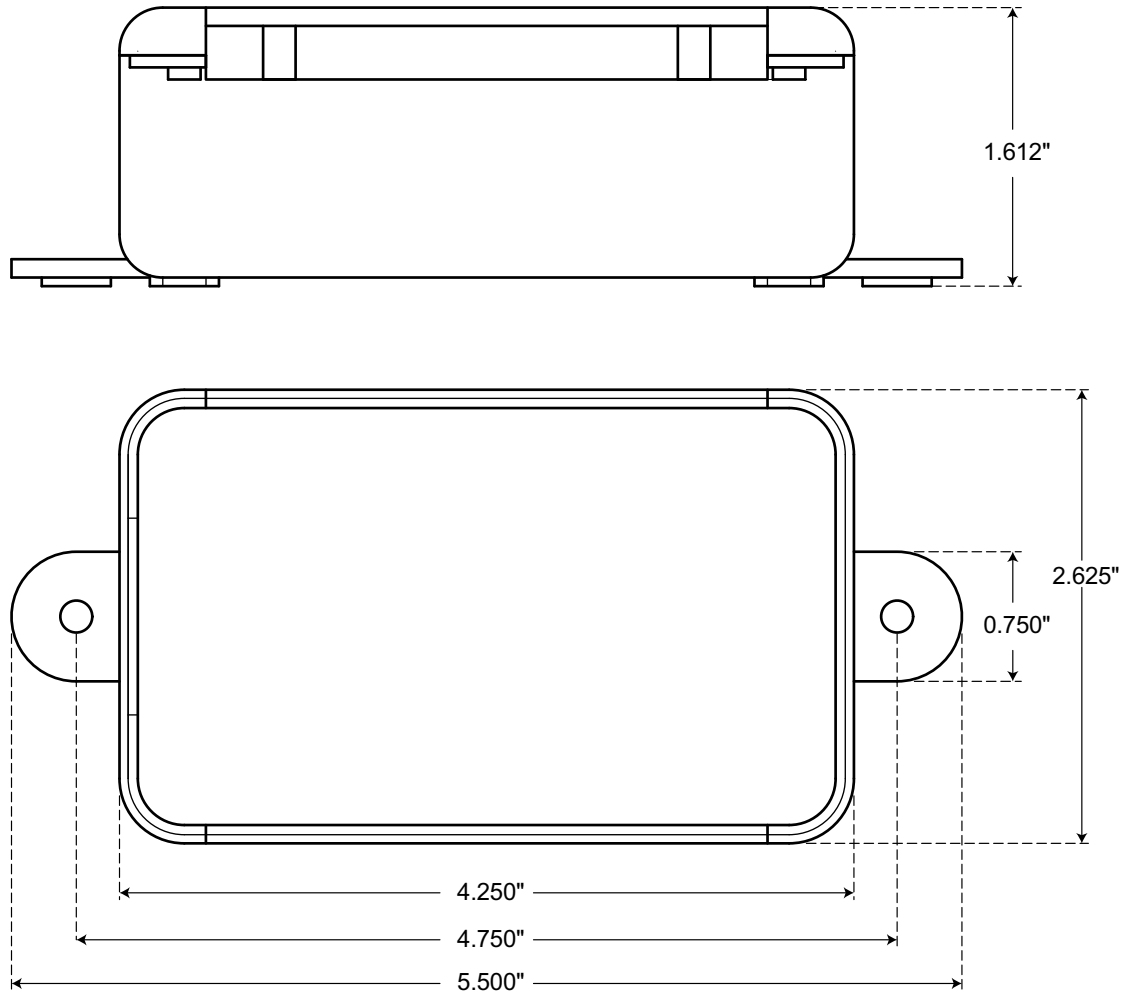
Active: Indicates the device is in use either by WINDAQ Acquisition Software or a custom user-developed program.

Remote: Indicates when the Event Button is pushed or the Event terminals are connected via a relay contact or digital input.

5. DI-145 Block Diagram



6. Dimensional Drawing





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