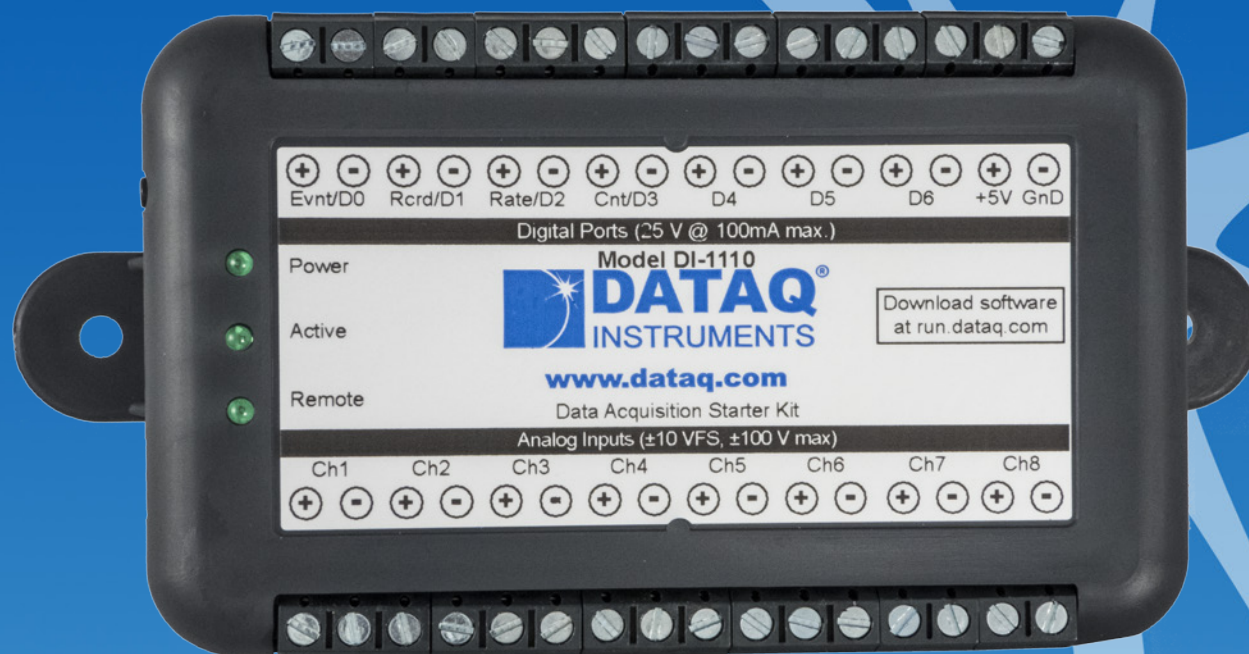


DI-1110 Low-cost USB Data Acquisition (DAQ) System



- ✓ Eight armored analog differential inputs*
 - ✓ Up to ± 100 V without damage
 - ✓ Fixed measurement range of ± 10 V full scale
- ✓ 12-bit analog-to-digital resolution
- ✓ 160 kHz sample throughput rate
- ✓ Seven digital ports*
 - ✓ Programmable per port as input or switch
 - ✓ Support for rate measurements to 50 kHz
 - ✓ Support for 16-bit counter
- ✓ Wide-ranging software support includes:
 - ✓ Ready-to-run WinDaq software
 - ✓ .NET Classes for Visual Studio program development
 - ✓ Published protocol for software development in non-Windows operating systems

* WinDaq/Unlock required to record more than four total channels when using WinDaq software.



DI-1110 Description

Overview

The DI-1110 is a new release in a long line of low-cost starter kits from DATAQ Instruments, and an updated and improved replacement for model DI-149 starter kit. The DI-1110, in tandem with the included WinDaq software, allows real time data acquisition, playback, and analysis performance that covers an incredibly broad array of measurements in both laboratory and industrial settings.

Analog Subsystem

Model DI-1110 delivers premium analog performance at a surprisingly affordable price. Eight analog input channels provide differential measurement flexibility over a ± 10 V range. The differential input configuration provides noise rejection, easily adapts to single-ended signal sources, and is protected to ± 100 V so that inevitable measurement mishaps will not harm the instrument. The front end feeds a 12-bit ADC with a maximum sampling throughput rate of the 160 kHz to provide pure data acquisition power at an unmatched price point.

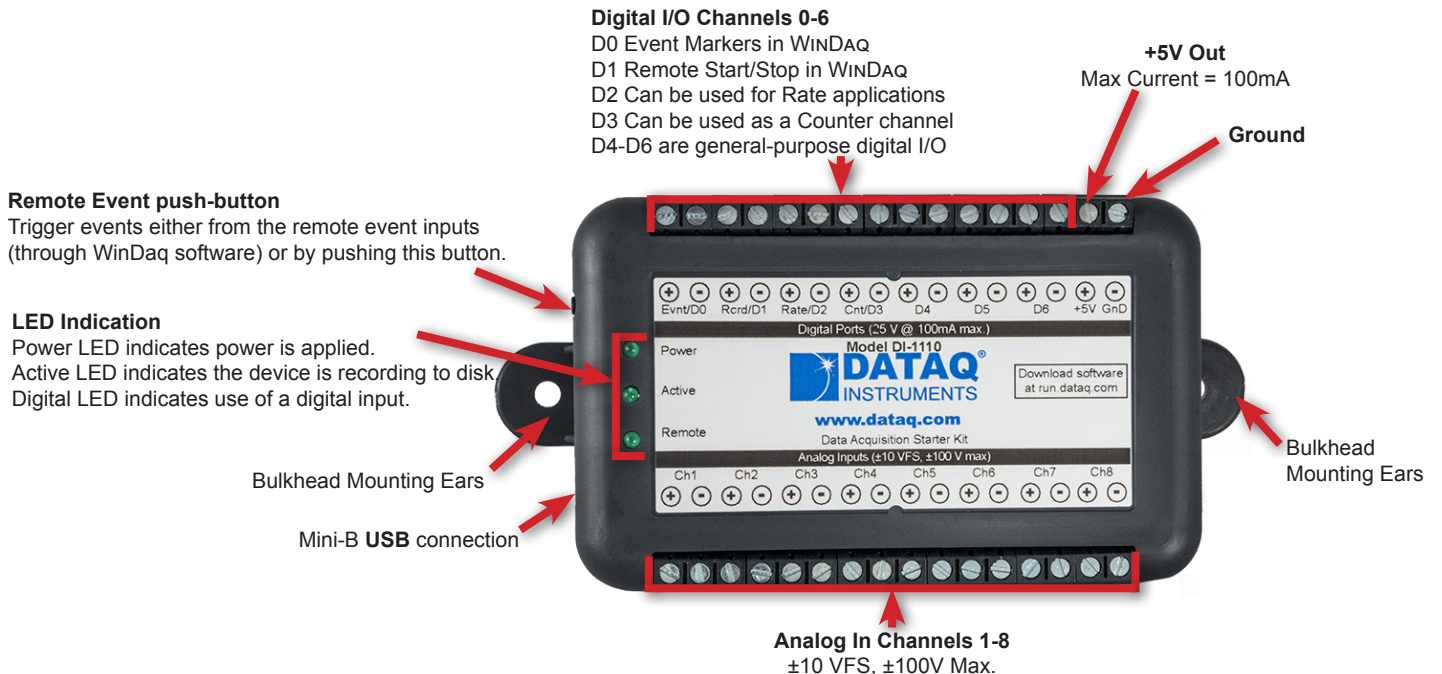
Digital I/O Subsystem

The DI-1110 provides 7 digital ports, each configurable as an input or a switch. Input protection is provided to 25 V. When activated as inputs, two ports allow dual functionality as discrete inputs, or can be programmed as a counter or rate input respectively. The rate input features a 50 kHz maximum measurement allocated over twelve programmable measurement ranges (10 Hz to 50 kHz full scale.) The counter input provides 16-bit resolution and a terminal count value of 65,535. The discrete, counter, and rate inputs are members of the same internal scan list used by the analog input channels. So, all enabled elements are acquired synchronously, which allows meaningful comparisons between analog and digital channels. For example, the rate input measuring engine speed allows rpm data to be acquired in lock-step with analog data. Configured as a switch a digital port can be used to control external loads up to 25 V @ 100 mA, and the switch can be controlled asynchronously during scanning.

Software Overview

Model DI-1110 starter kit is provided with comprehensive software support. For point-and-click, ready-to-run applications the DI-1110 is supplied with our popular WinDaq software. WinDaq allows a real time display of any combination of analog channels, and the ability to stream acquired data to disk in recorder-like fashion, even at the fastest rate supported by the hardware. This is true streaming performance, continuous, without gaps, and simultaneous to both the real time display and disk. Record only a few readings, or as many as 4 GB. The DI-1110 reserves two digital inputs for WinDaq software that are dedicated for remote stop/start and remote event operations. WinDaq also includes software to review recorded data files, including waveform analysis and data file export to Microsoft Excel and other applications. The WinDaq/Unlock option is required to record more than four total channels when using WinDaq software. Custom programming the DI-1110 is supported through its .Net class and protocol documentation.

DI-1110 Close-up



DI-1110 Major Features and Benefits

Eight Analog Input Channels*

Measure as many as eight system variables at once, each with a measurement range of ± 10 V full scale.

Differential Analog Input Configuration

Enhanced noise immunity, and tolerates common mode voltages.

12-bit Measurement Resolution

Measure changes in signal amplitude as small as 5 mV.

Armored Inputs Absorb Mistakes

Both analog and digital inputs are protected to ± 100 V and 25 V respectively.

Fast, 160 kHz Sample Throughput Rate

Observe fast phenomena that other products in the DI-1110's price range would miss.

Included .Net DLLs

The .Net class for the Windows programming environment is included to support any .Net programming language.

Seven Digital Input Ports*

Folds discrete I/O into the measurements process. Each bit is programmable as an input or as a switch and protected to 25 V.

Asynchronous Digital Switches

Control external processes seamlessly while acquiring data.

Counter Channel

Tallies the number of pulses applied. Useful for integrating rate information, like flow rate to volume, or simply the number of definable events.

Rate Measurement Channel

Measures pulse rate where frequency carries information. For example rpm or flow measurements.

Published Instrument Command Protocol

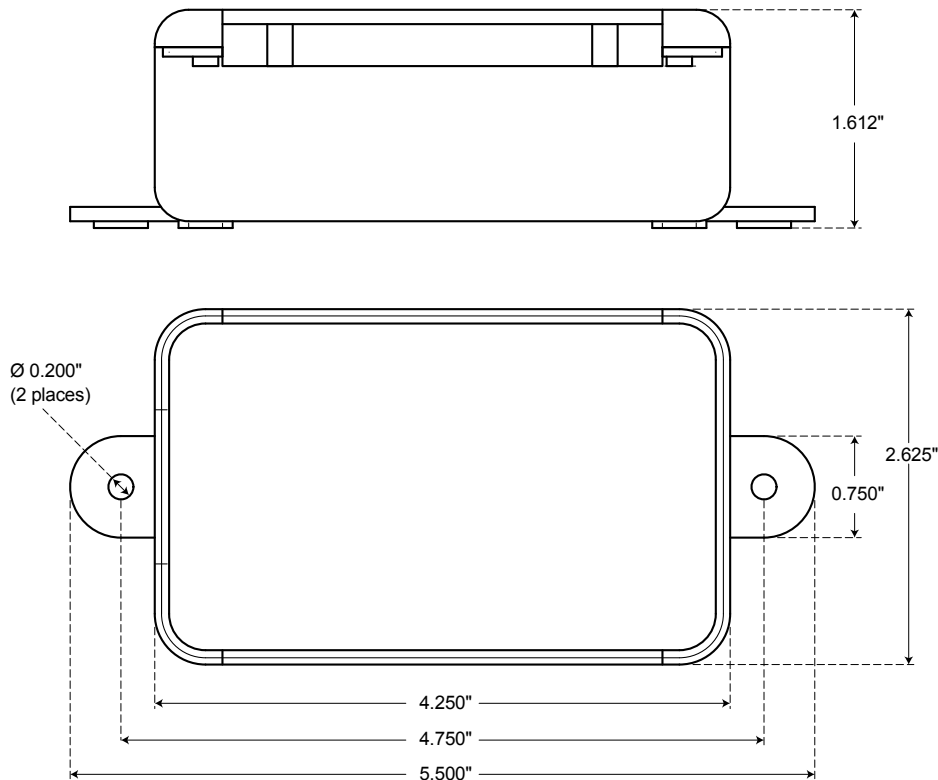
The protocol allows measurements using the DI-1110 under any operating system.

Ready-to-run Software Support

Provided with ready-to-run WinDaq software for point-and-click DAQ performance with a real time display, disk-streaming recording, and playback and analysis.

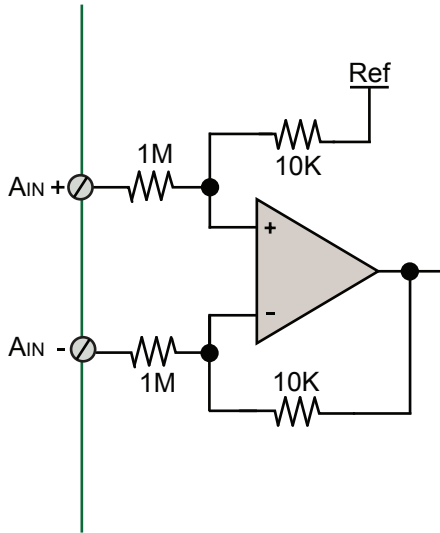
* WinDaq/Unlock required to record more than four total channels when using WinDaq software.

DI-1110 Dimensional Drawing

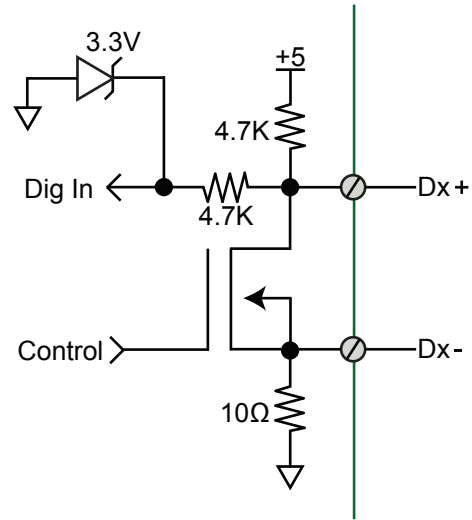


DI-1110 I/O Equivalent Circuits

Analog Input



Digital Input Port



DI-1110 Scan List Flexibility

The DI-1110 maintains an internal scan list of as many as eleven different items at once. The scan list provides an internal list of inputs to be scanned at any defined sample throughput rate. The use of scan lists allows measurements to be synchronized across available input points and independent of latencies that often occur in the operating system of the connected PC. The scan list can be populated with any combination of analog input channels and digital input ports, including rate and count.

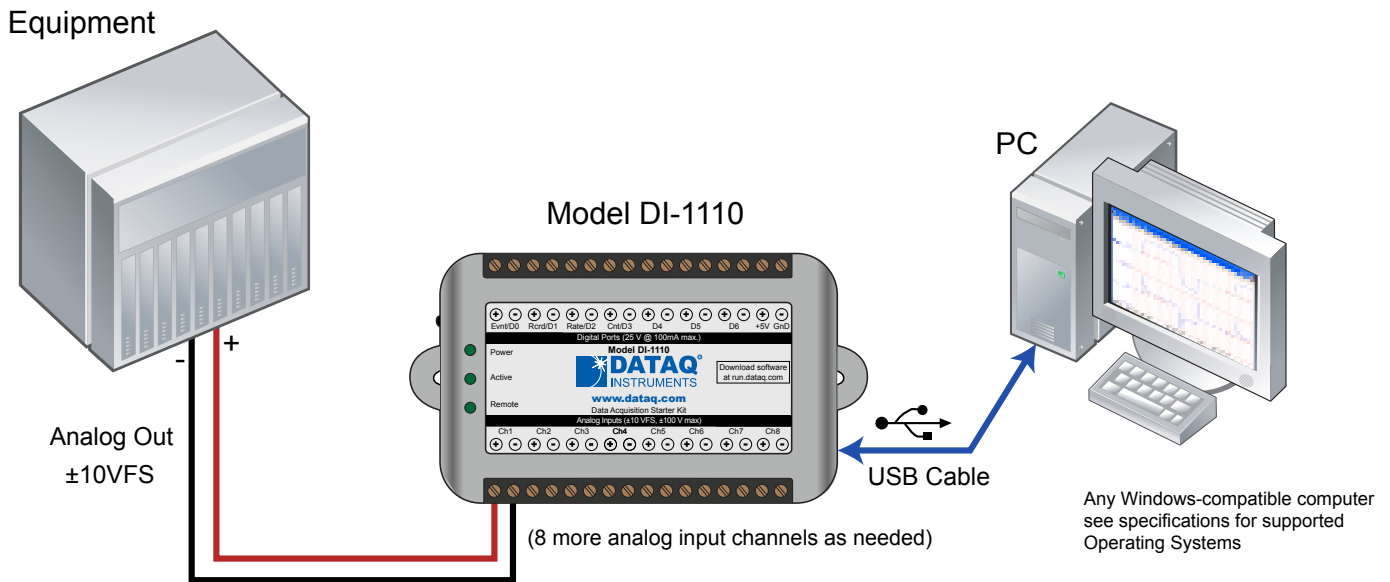
Item	Scan List Positions	Comments
Analog channels	Up to eight	One scan list position is consumed for each enabled analog channel. The scan entry defines the physical channel number and the full scale range of the measurement.
Digital inputs	One	All seven digital ports are read simultaneously with one entry in the scan list. The scan list entry can also configure input port D2 and D3 for rate and count respectively (see below.)
Rate input	One	If D2 is configured for rate, one scan list position is reserved for that measurement.
Count input	One	If D3 is configured for count, one scan list position is reserved for that measurement

DI-1110 Analog Measurements

Eight analog input channels each with a measurement range of ± 10 V full scale are supported by the DI-1110. Though not isolated inputs, each offers differential input capability with some rejection of common mode voltages (those that appear simultaneously and in-phase on both inputs.) These channels are also hardened to tolerate excessive voltages to protect against wiring mishaps.

Traditional Chart Recorder Replacement

Digitize and record measurements from instruments with high-level analog outputs.

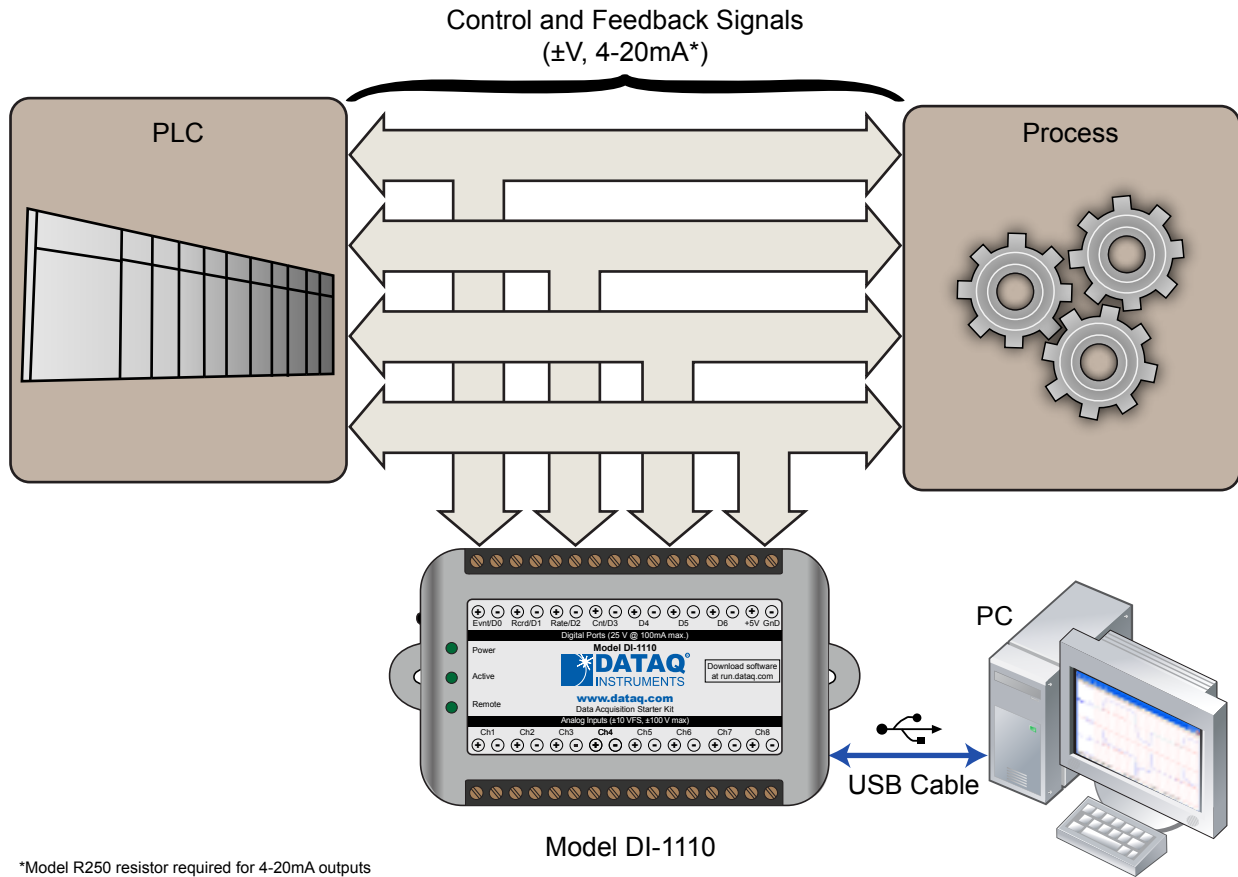


Examples of "Equipment" above include gas chromatographs, liquid chromatographs, spectrometers, bio-amplifiers*, etc.

* DATAQ Instruments' hardware and software products are NOT designed to be used in the diagnosis and treatment of humans, nor are they to be used as critical components in any life support systems whose failure to perform can reasonably be expected to cause injury to humans.

Process Monitoring

Trend plot and record control and feedback signals to troubleshoot process glitches.

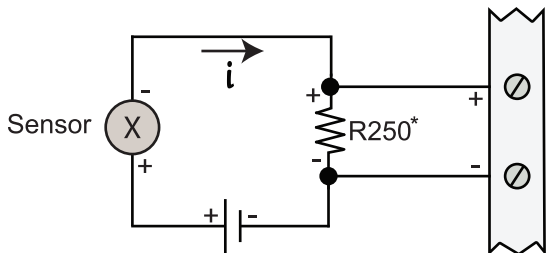


*Model R250 resistor required for 4-20mA outputs

Any Windows-compatible computer
see specifications for supported
Operating Systems

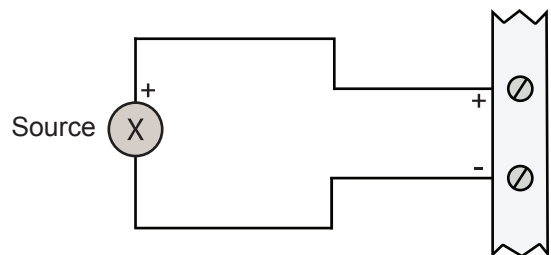
Typical Analog Measurements

4-20mA current (low-side shunt)



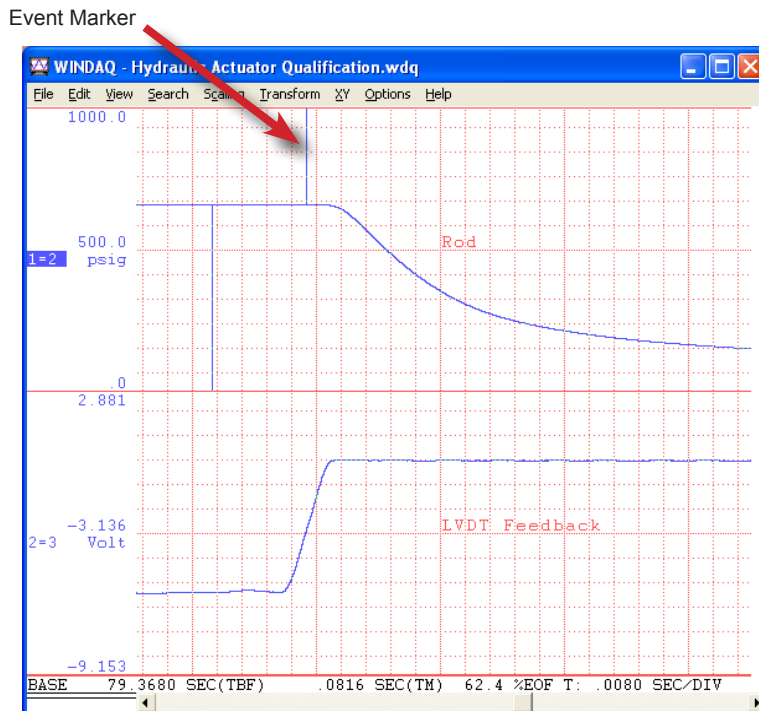
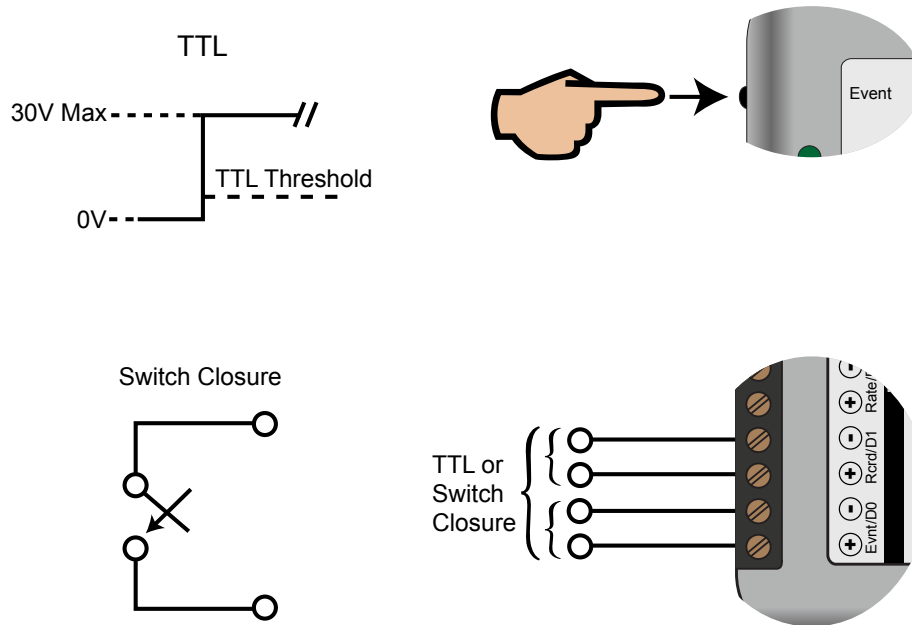
*Optional (see ordering guide)

Voltage source



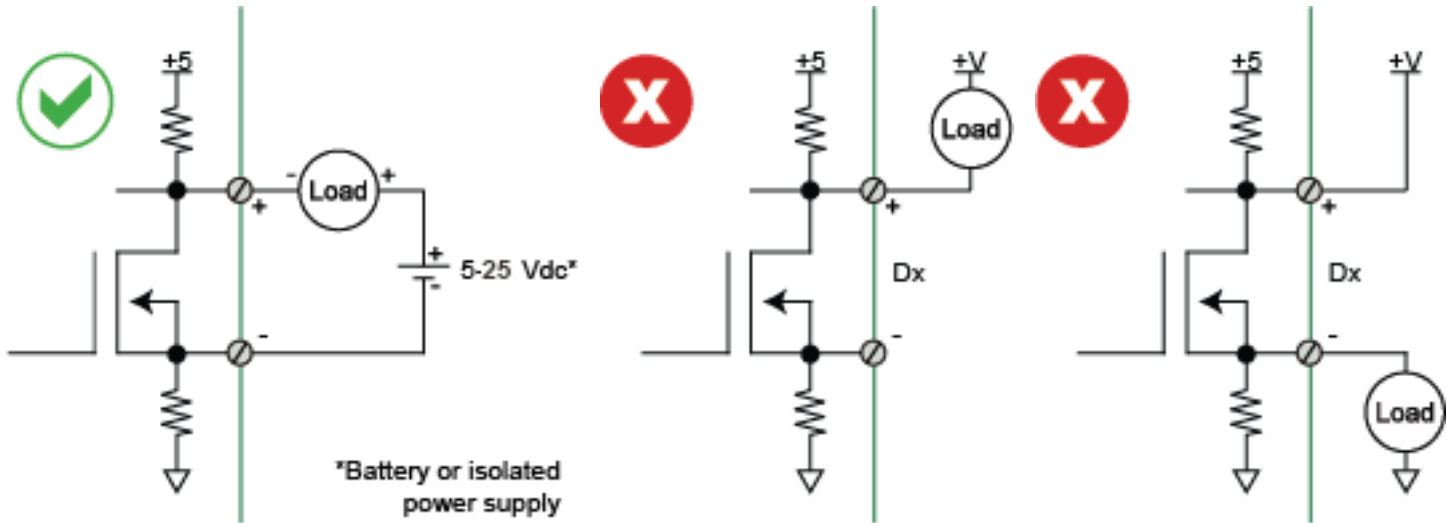
Remote Control Close Up

The DI-1110 supports several methods to increase measurement flexibility and data record interpretation. The remote record feature allows you to synchronize WinDaq recordings to external processes by remotely enabling and disabling WinDaq's stream-to-disk feature. Remote events allow you to insert an event marker in the data stream (see inset) to identify when an event occurred relative to recorded waveform activity. Events can be activated by the pushbutton on the DI-1110 enclosure, though a keyboard keystroke (which also allows you to record a description), or remotely via the remote event input. The stream-to-disk function can also be controlled through the keyboard, or through the remote record input. Valid remote record and event signals are switch closures, or discrete levels with a maximum input of 30 V. Finally, each port is internally pulled-up, so it's easy to use with external dry-contact switches.



General-purpose Digital Port Operation

Each DI-1110 digital port can be configured as a digital input or used as a switch to control an external load. Ports are configured by a MOSFET that defines the port's function, where the MOSFET is either on or off. When the MOSFET is off the port is available as a discrete input. Turning the MOSFET on allows the port to function like a switch for loads up to 25 V and 100 mA. Care should be exercised when configuring the load to be switched to ensure that the digital port is not damaged:

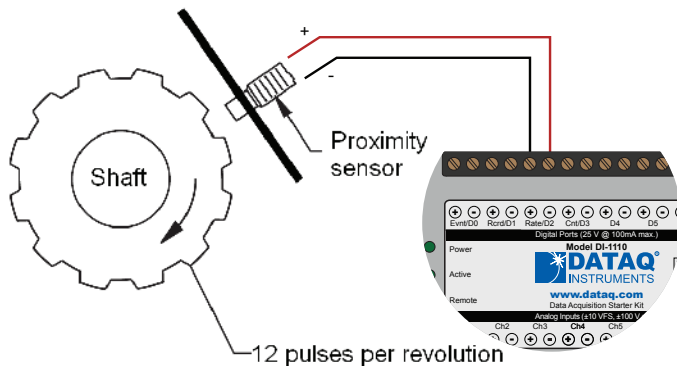


DI-1110 Rate and Count Measurements

Digital ports D2 and D3 can be programmed for multiple functions. Both can be programmed as discrete input or outputs. In addition, port D2 as a rate input and port D3 as a counter input. When programmed to measure rate or count the DI-1110 adds these measurements to its internal scan list along with any other analog and other digital data so that all measurements are acquired in the same time frame. Rate measurements in the range of 10 Hz to 50 kHz are possible across twelve programmable full scale ranges. Use the rate input to extract rpm data from a rotating device, or to acquire flow information from a pulse-type flow sensor. Count measurements up to 65,536 are supported by the D3 port. Use count to integrate flow to get volume, or use it simply to tally events in a given process.

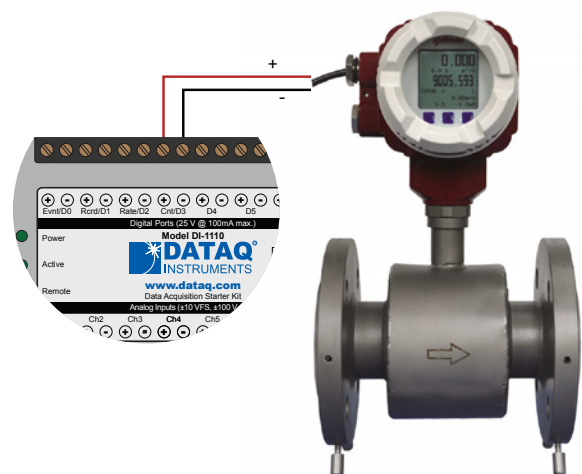
Rpm from rate

The DI-1110's Rate input is used to acquire a frequency representing rpm, flow, or any other pulse stream.



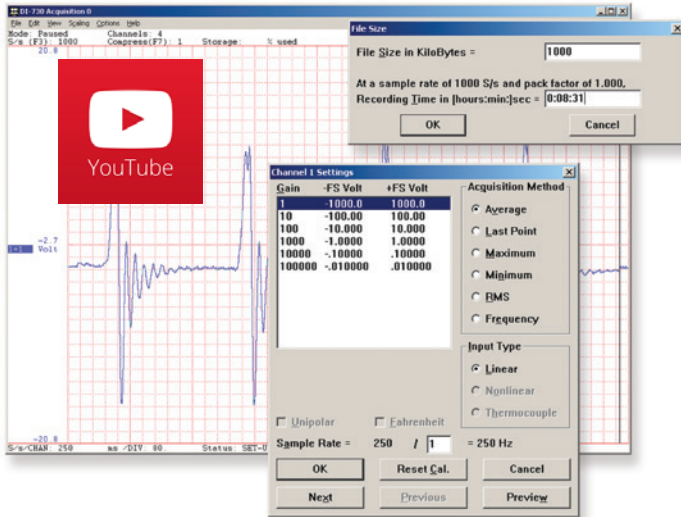
Flow/volume

Use the DI-1110's Count input to accumulate a tally of applied discrete pulses to track test cycles, extract volume from flow, or any other general-purpose totalizing application.



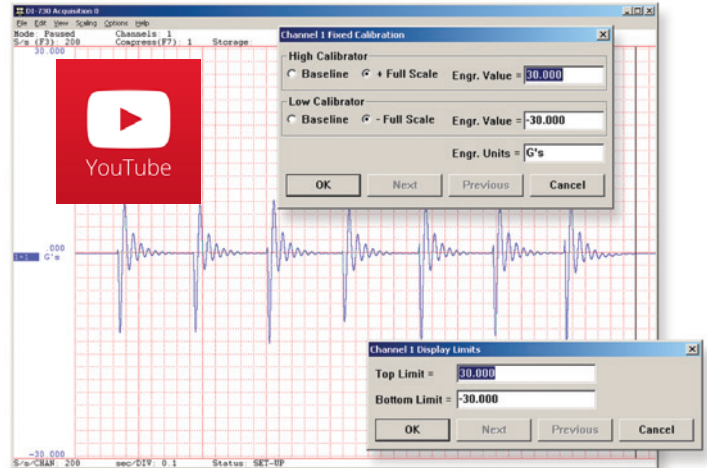
Setup*

Double-click and enter the channels you want to acquire into the WinDac scan list. Click to select an analog, rate, or count channel. Click to define a single to 8-channel display — either triggered sweep (oscilloscope-like) or scrolling (chart recorder-like). Click again to define a sample rate ranging from 2.2 samples per hour to 160,000 samples per second.



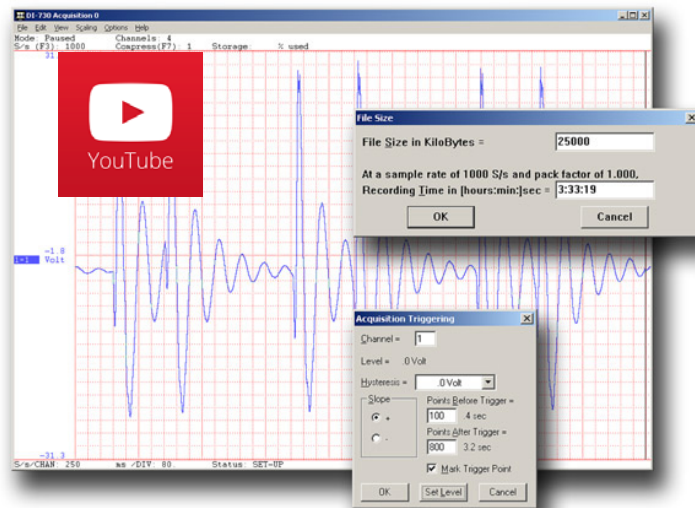
Calibrate

Define calibration per channel to display waveform values in meaningful units such as psi, °F or °C, amps, rpm, watts, horsepower — any unit of measure you need.



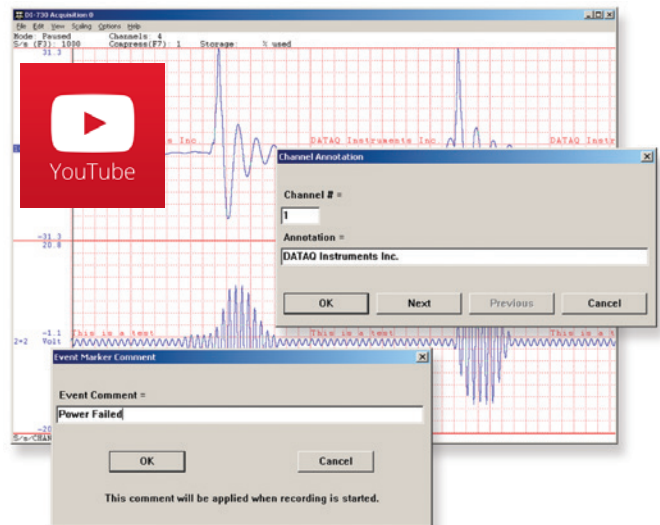
Record

Choose a continuous waveform recording mode or the triggered mode with selectable trigger level, slope, and post-trigger times. WINDAQ automatically time- and date-stamps, then streams acquired data to disk — record as much data as you need. At the same time, WINDAQ supplies a real-time graphical display of any or all channels so you always know where you are and where you're going.



Annotate

Of course, you can label any channel with text that describes it — “Motor 1,” “Engine speed,” “Vertical position,” etc. But WINDAQ also allows you to supply commented event markers while you record — “Beginning test phase 1,” “Small vibrations noticed,” “Starting cool-down cycle,” etc. Your comments and our acquired data combine to form a complete diary of your data acquisition session.



* WinDac/Unlock required to record more than four total channels when using WinDac software.

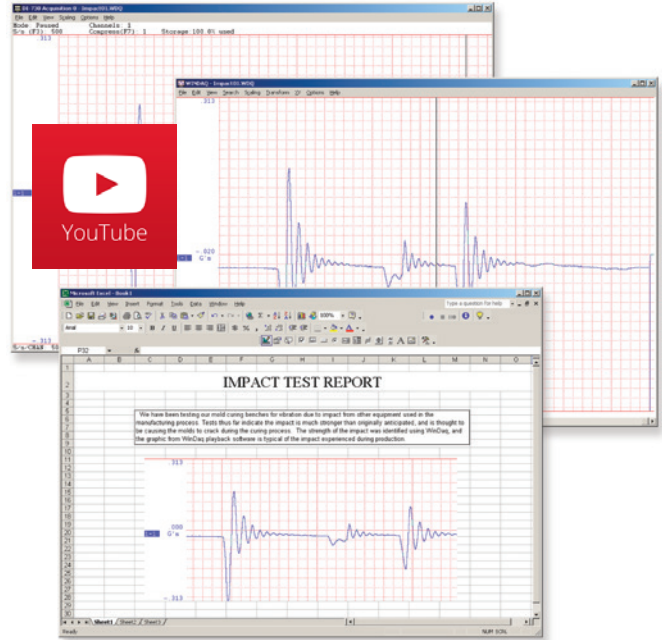
Playback

Recording is only half the solution. WINDAQ's Waveform Browser playback software allows you to graphically manipulate waveforms in ways you've never seen on a PC. Compress an entire recording to one screen-width for a bird's eye view, then expand around an area of interest for a closer look. Use the cursor to measure amplitudes and timing with precision. Move to any event marker with the click of a mouse button.



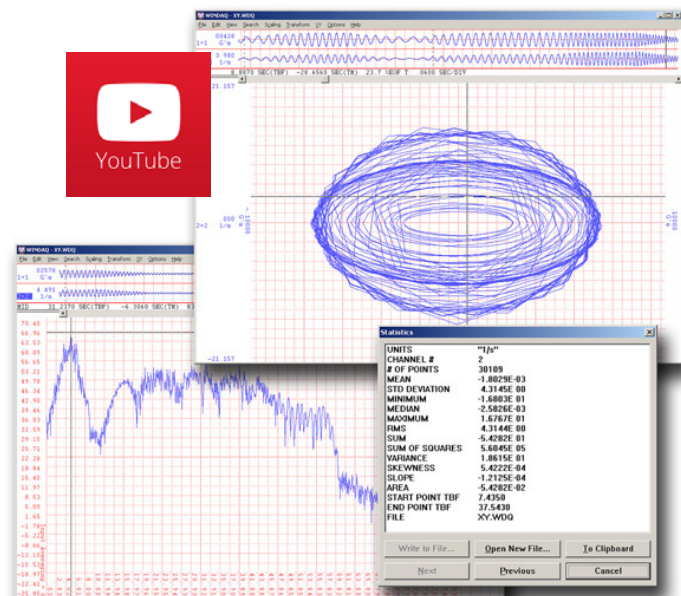
Multitask

Double your productivity and let WINDAQ record while you review last week's results from your spreadsheet, or compose a memo with your word processor. You can even play back data already stored to disk while you're still recording.



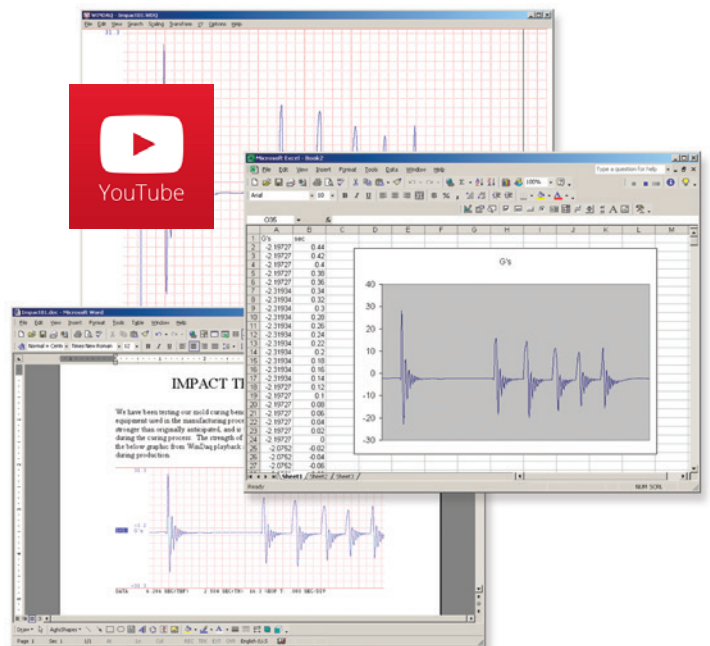
Analyze

Waveform interpretation is easy with our built-in analysis functions. Apply frequency and filtering analysis with the WINDAQ Waveform Browser FFT and DFT functions. Analyze any range of waveform data with the statistics function. Use X-Y plotting to examine the relationship of one channel to another. Optional Advanced CODAS analysis functions allow waveform peak detection, integration, differentiation, arithmetic operations, and more.



Export

The WINDAQ Waveform Browser can export any range of data to your spreadsheet, or any other analysis or presentation package you use. You can even copy a graphical image displayed by the WINDAQ Waveform Browser and paste it directly into a word processing document. Finally, export any range of waveform graphics to your printer for a hard copy record.



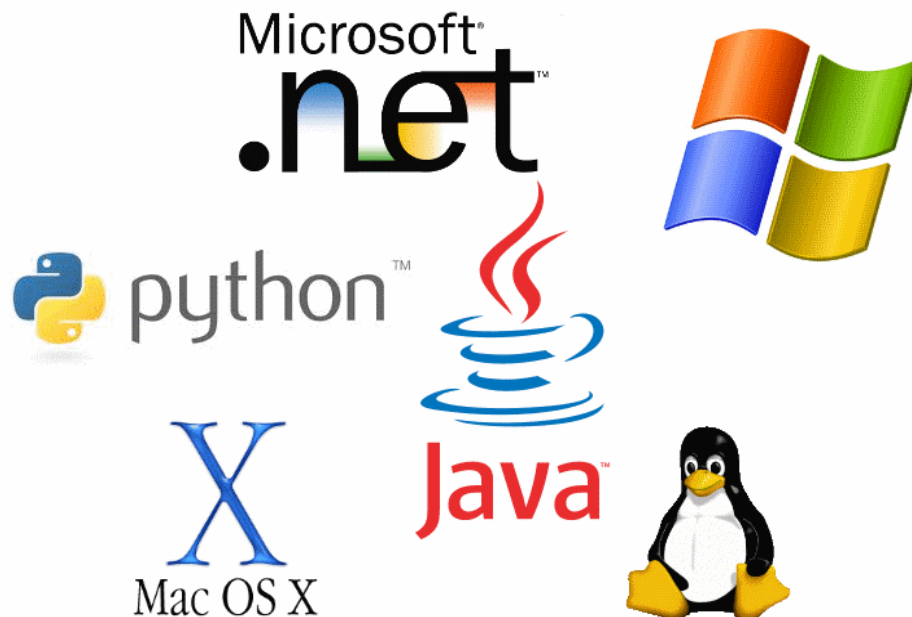
Sometimes you can't use a ready-to-run application like WinDaq. You need to develop your own software to perform in precisely the way you need. That requirement defines the need for programming support so you have the tools necessary to move forward.

Included .NET Class

Microsoft's object-oriented programming languages commonly referred to as .NET ("Dot Net") offer a powerful and free environment to develop custom applications for the DI-1110. All of the .NET languages are supported by our included class library, which supports all DI-1110 features. Well commented example programs exercise every aspect of the hardware, forming a foundation for you to get your own applications up and running quickly and painlessly.

Included DI-1110 Protocol Documentation

As you probably suspect when you run our point-and-click WinDaq data acquisition software, there's a lot going on beneath the surface. WinDaq software needs to take the data acquisition configuration that you design using its menu system and communicate that to the hardware. These are things such as sample rate, the number of channels enabled, the specific channel numbers enabled, etc. Diving down to the lowest level of program activity, past the WinDaq user interface, beyond the device driver to the actual commands sent to the data acquisition hardware and the format of the responses they evoke, is the protocol. The protocol defines the exact set of commands a program can send to the hardware, and how the hardware will react as a result. So, if you know the command and response definitions for the DI-1110 (i.e. its protocol), the instrument can be folded into virtually any operating system and any programming language: Python, C++, Linux, Windows, OSX, etc., etc. The choice is yours.



DI-1110 Specifications

Signal I/O

Analog Inputs

Number of Channels: 8
 Configuration: Differential
 Full Scale Range: ± 10 V full scale fixed
 Input impedance: $1\text{M}\Omega$
 Isolation: none
 Absolute accuracy: ± 12.5 mV @ 25°C
 (excluding common mode error)
 Absolute maximum input without damage: ± 75 V peak, continuous
 ± 100 V peak, one minute or less
 System noise: 7.8 mV rms
 Maximum common mode voltage: ± 10 V
 Common mode rejection ratio: 40 dB (dc - 60 Hz)
 Channel-to-channel crosstalk rejection: -80 dB

Digital Ports

Total port count: 7
Programmed as a Switch
 Maximum drain voltage: 25 V
 Maximum sink current: 100 mA
Count/Rate/Inputs
 Digital port assignment: Count: Port 2
 Rate: Port 3
 Internal pull-up value: 4.7 k Ω
 Input high voltage threshold: 2.4 V
 Input low voltage threshold: 0.8 V
 Terminal count: 65,535
 Maximum rate frequency: 50 KHz with one enabled channel,
 20 KHz with 2-4 enabled channels,
 10 KHz with 5-8 enabled channels,
 else 5 KHz
 Minimum rate frequency: 0.5 Hz
 Maximum count frequency: 50 kHz
Reserved Digital Inputs
 Port 1: WinDaq remote events
 Port 2: WinDaq remote start/stop

ADC Characteristics

Resolution: 12-bit
 Above zero ADC counts: 2,047
 Below zero ADC counts: 2,048
 Voltage resolution: 4.86 mV
 (excluding noise)
 4-20 mA resolution: 818 adc counts with $250\ \Omega$ shunt
 (excluding noise)
 Max sample throughput: 160 kHz
 Min sample throughput: 20 Hz (2.2 samples per hour with WinDaq)
 Sample rate timing accuracy: 50 ppm

Indicators and Connections

Interface: USB 2.0 (mini-B style connector)
 Indicator lights: Three LEDs: Power, Active, Event
 Input Connections: Two 16-position terminal strips

Power

Power consumption: <1.0 Watt, via USB interface

Environmental

Operating Temperature: 0 to 50°C
 Operating Humidity: 0 to 90% RH non-condensing
 Storage Temperature: -20 to 60°C
 Storage Humidity: 0 to 90% non-condensing

Physical Characteristics

Enclosure: Polycarbonate ABS, 0.080 inch thickness
 Mounting: Desktop; bulkhead
 Dimensions: $2.625\text{D} \times 5.5\text{W} \times 1.53\text{H}$ in.
 ($6.67\text{D} \times 13.97\text{W} \times 3.89\text{H}$ cm.)
 Weight: 5.7 oz. (162 grams)

Software Support

WINDAQ software: OS support: View Online (<http://www.dataq.com/products/windaq/windows-compatibility/>)
 Programming: DATAQ .NET Class, Instrument protocol, ActiveX Control

Ordering Guide

Description	Order No.
DI-1110 USB Data Acquisition (DAQ) System Includes instruments, 6-ft. USB cable, screwdriver, and WinDaq software via Internet download (run.dataq.com)	DI-1110
250Ω 4-20 mA shunt resistor $\pm 0.1\%$, 0.5 Watts max., ± 50 ppm/ $^\circ\text{C}$	R250
WinDaq/Unlock Required to record more than four total (analog or digital) channels when using WinDaq software.	WinDaq/Unlock-1110



241 Springside Drive
 Akron, Ohio 44333
 Phone: 330-668-1444
 Fax: 330-666-5434

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