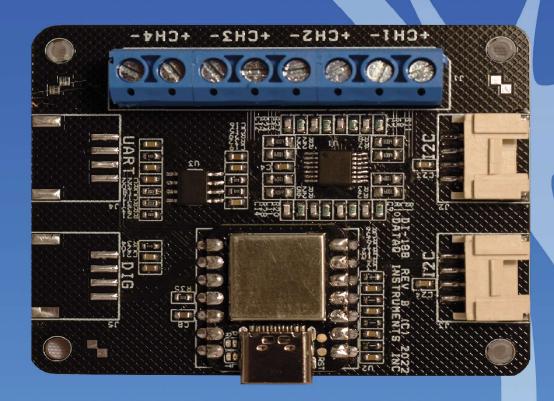# DI-188 Open Source Data Acquisition (DAQ) System

- ✓ **Four armored analog differential inputs**
    - ✓ **Up to ±30 V without damage**
    - ✓ **Fixed measurement range of ±10 V full scale**
- ✓ **12-bit analog-to-digital resolution**
- ✓ **Max 8 kHz throuput rate**
- ✓ **Optional I²C Grove ports at extra cost**
    - ✓ **Integrate Arduino-compatible sensors to Windaq**
- ✓ **Wide-ranging software support includes:**
    - ✓ **Ready-to-run WinDaq software**
    - ✓ **Open Source Arduino sketch for customization and expansion**
    - ✓ **Seeeduino XIAO module inside**

**DATAQ®
INSTRUMENTS**

DI-188 Description

Hardware Overview

The DI-188 is a new release in a long line of low-cost starter kits from DATAQ Instruments. It's an open source USB data acquisition starter kit based on Seeed Studio's XIAO module.
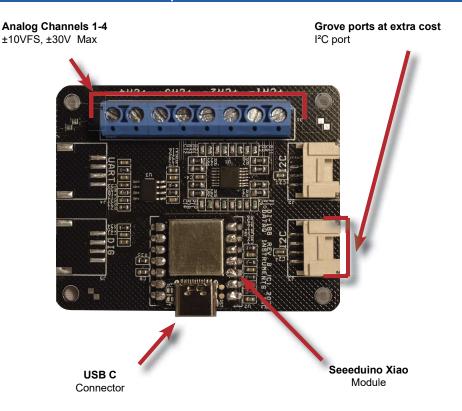
Suitable for measuring preamplified analog signals, the DI-188 in tandem with the included WinDaq software allows real time data acquisition, playback, and analysis performance equal to or better than other products that cost many times its low price. Predecessors of this instrument have been sold to over 35,000 hobbyists and professionals for countless data acquisition applications around the world. The DI-188 continues this legacy with the expandability while retaining its noise-cancelling differential analog inputs that are level-protected to ±30 VDC or peak AC. It is the first open-source Arduino®-compatible product that gives the Arduino users the capability to integrate various Arduino®-compatible addon sensors to WinDaq. This is our most flexible, and value-oriented starter kit ever. The DI-188 offers four analog input and an optional I²C grove port at extra cost. The analog inputs offer a fixed measurement range of ±10VFS, and are multiplexed to an integrated 12-bit ADC. I²C ports are 3.3 V dc compatible. Sample rates as slow as 0.01 Hz and as fast as 8 kHz with a single enabled channel are supported.

Software Overview

Model DI-188 starter kit is provided with comprehensive software support. For point-and-click, ready-to-run applications the DI-188 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 simultaneously to both the real time display and disk. Record only a few readings, or as many as 4 GB. The DI-188's open source approach allows I²C sensors to be integrated into the data stream for WinDaq software. WinDaq also includes software to review recorded data files, including waveform analysis and data file export to Microsoft Excel and other addon applications.

Sometimes, you need a more focused application. Consider a production application where an instrument makes the same measurements and generates the same results repeatedly. This situation defines the need for a custom program, and the DI-188 supplies the open source codes you need to get it done. For other applications the DI-188's device protocol is fully transparent in open source codes

DI-188 Close-up

Analog Channels 1-4
±10VFS, ±30V Max

Grove ports at extra cost
I²C port

USB C
Connector

Seeeduino Xiao
Module

Four Analog Input Channels

Measure as many as four system variables at once with a fixed ±10 V full scale range.

Differential Analog Input Configuration

Enhanced noise immunity and common mode volt tolerance.

12-bit Measurement Resolution

Yields measurement resolution of ±4.8 mV across its ±10 V range.

Armored Inputs Absorb Mistakes

Analog inputs are protected to ±50 V dc.

Fast Analog Channel Sample Rate

Observe fast phenomena that other products in the DI-188's price range would miss. Maximum sample rate per channel is a function of the number of enabled channels:

Enabled Channels	Sample Rate per Channel
1	8 kHz
2	4 kHz
4	2 kHz

I²C Grove Ports at extra cost

Allows user to add Arduino I²C sensor to WinDaq data stream.

Each port is 3.3 V dc compatible.

Supports 4-20 mA Measurements

Process current (current loop) measurements are possible using an external shunt resistor (model R250 sold separately.)

USB-powered

The instrument is powered directly from the connected USB port to eliminate the need for clumsy external power supplies.
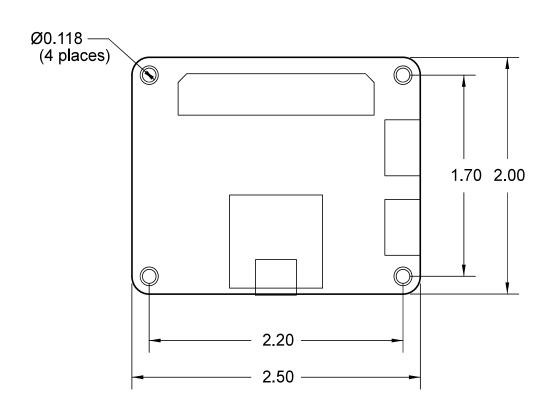
Comprehensive Programming Support

The instrument is offered with a open source codes for user modification and function expansion. Its device protocol is fully transparent.

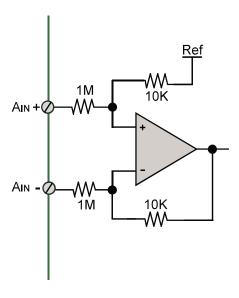### Ready-to-run Software Support

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.

DI-188 Dimensional Drawing

Ø0.118
(4 places)

1.70 2.00

2.20

2.50

Analog Input

DI-188 Scan List Flexibility

The DI-188 maintains an internal scan list of as many as four different items at once. The scan list provide an internal menu of the analog channels to be scanned. It operates at any desired throughput rate, and allows multi-channel analog measurements to synchronize, independent of operating system and other latencies.
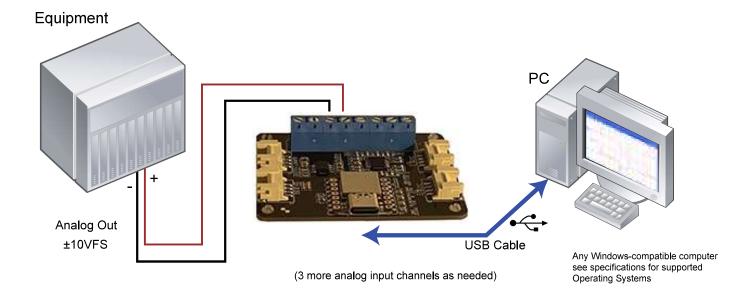
Item	Scan List Positions	Comments
Analog channels	Up to four	One scan list position is consumed for each enabled analog channel

Four analog input channels with a fixed measurement range of ±10 V full scale are supported by the DI-188. 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 (see specifications).

Traditional Chart Recorder Replacement

Digitize and record measurements from instruments with high-level analog outputs. Examples of "Equipment" include gas chromatographs, liquid chromatographs, spectrometers, bio-amplifiers*, etc.
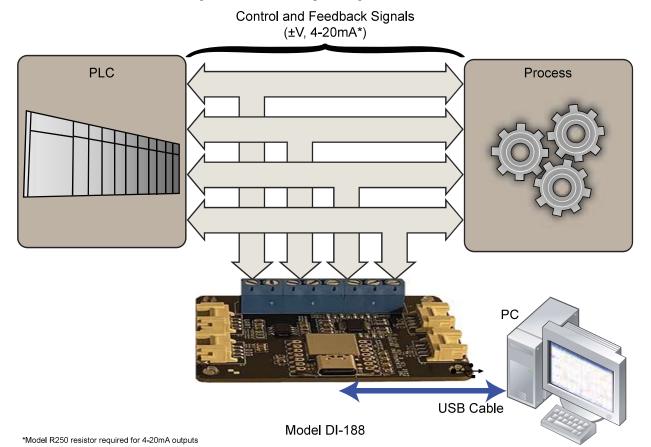

Equipment

PC

Analog Out
±10VFS

− +

USB Cable

(3 more analog input channels as needed)

Any Windows-compatible computer see specifications for supported Operating Systems

* 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.

Control and Feedback Signals
(±V, 4-20mA*)

PLC

Process

PC

USB Cable

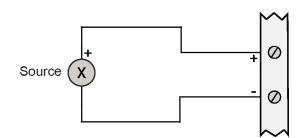Model DI-188

*Model R250 resistor required for 4-20mA outputs

Any Windows-compatible computer
see specifications for supported
Operating Systems

Typical Analog Measurements
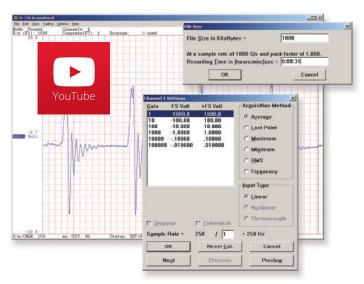
4-20mA current (low-side shunt)

Sensor

i

R250*

*Optional (see ordering guide)
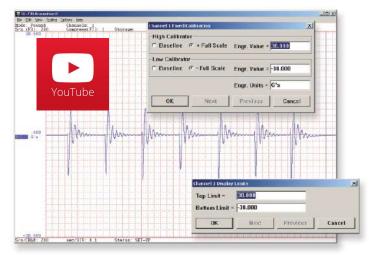
Voltage source

Source

Setup

Double-click and enter the channels you want to acquire into the WɪɴDᴀǫ scan list. Click to select signal averaging, true RMS, frequency, and peak or valley detection per channel. Click to define a single to 4-channel display — either triggered sweep (oscilloscope-like) or scrolling (chart recorder-like). Click again to define a sample rate ranging from one sample every 2.2 hours to 20 kHz per channel with all four channels enabled.
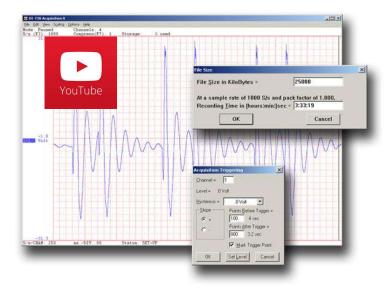
Calibrate

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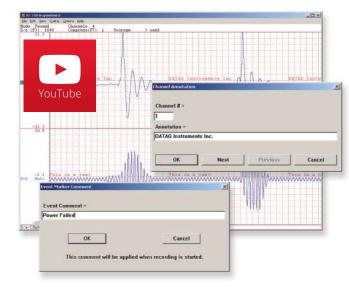
Record

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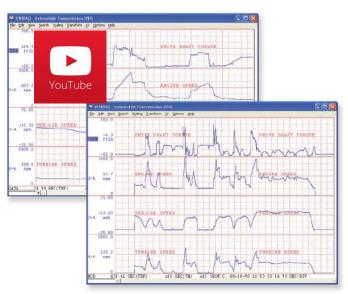
Annotate

Of course, you can label any channel with text that describes it — "Motor 1," "Engine speed," "Vertical position," etc. But WɪɴDᴀǫ 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.

Playback

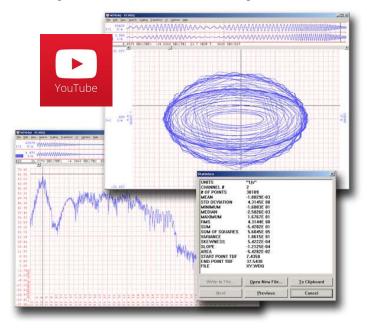Recording is only half the solution. WinDaq's Waveform Browser playback software allows you to graphically manipulate waveforms in ways you've never seen on a PC. Compress an entire recording to one screen-width for a bird's eye view, then expand around an area of interest for a closer look. Use the 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.
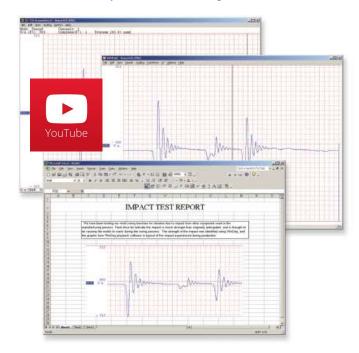

Analyze

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.
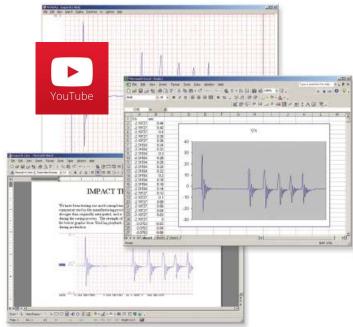

Export

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 need to customize your application, such as adding an I²C sensor to data stream. Since DI-188 is an open source project based on Seeeduino's XIAO module, you can develop your own firmware to perform in precisely the way you need.

Included open-source Seeeduino XIAO's sketch

All you need is to download the sketch from Github and modify or branch it anyway you want. The rich resoureces from Arduino® community and well commented sketch exposes every aspect of the hardware, forming a foundation for you to get your own applications up and running quickly and painlessly.

Included DI-188 source codes

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-188 (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-188 Specifications

Signal I/O

Analog Inputs

Number of Channels:	4
Configuration:	Differential
Full Scale Range:	±10 V full scale fixed
Input impedance:	1MΩ
Isolation:	none
Typical accuracy: @ 25°C, excluding common mode error	±50mV @ 25°C
Absolute maximum input without damage:	±30V peak, continuous
System noise:	7.8 mV rms
Maximum common mode+differential voltage:	± 10 V
Common mode rejection ratio:	40 dB (dc - 60 Hz)
Channel-to-channel crosstalk rejection:	-80 dB

I²C and Grove Port

Number of ports:	None installed.Please order parts and install them yourself
Type:	3.3V logic
Threshold levels:	TTL-compatible
Absolute maximum applied voltage (V):	3.3 V dc

Power

Power Consumption:	<0.2Watt, via USB interface

ADC Characteristics

Resolution:	12-bit Above zero ADC counts: 2,047 Below zero ADC counts: 2,048
Maximum sample rate per channel:	8 kHz, 1 enabled channel 4 kHz, 2 enabled channels 2 kHz, 4 enabled channels
Minimum sample throughput:	0.1 Hz
Sample rate timing accuracy:	50 ppm

Indicators and Connections

Interface:	USB-C connector
Indicator lights:	Four LEDs, Green power, Blue transmit, Blue receive and Yellow user defined
Input Connections:	One 8-position terminal strip. Optioanl Grove ports at extra cost

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:	None
Dimensions:	2.0D × 2.5W × 0.55H in. (5.08D × 6.35W × 1.40H cm.)
Weight:	0.8 oz.(without optonal Grove connector)

Software Support

WINDAQ software:	OS support: View Online (http://www.dataq.com/products/windaq/windows-compatibility/)
Programming:	Open source. Instrument protocol

Ordering Guide

Description	Order No.
DI-188 USB Data Acquisition (DAQ) System Includes instrument, and WinDaq software via Internet download (run.dataq.com) Note: Grove Ports, USB-C cable and screw driver are available at extra cost	DI-188
250Ω 4-20 mA shunt resistor ±0.1%, 0.5 Watts max., ±50 ppm/°C	R250

DATAQ®
INSTRUMENTS

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Akron, Ohio 44333
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Fax: 330-666-5434

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