DATAQ®
INSTRUMENTS

The way PC-based instrumentation should be

DI-2160

Event, State, and Count Data Logger

User's Manual

Manual Revision A

DATAQ
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Introduction

Congratulations on your purchase of the DI-2160 Event, State, and Count Data Logger. This documentation is designed to familiarize you with the features and functions of the hardware and software for the DI-2160 Event, State, and Count Data Logger.

The DI-2160 features programmable capture modes to detect events (when events happen), states (how long between events), and counts (how many events). An internal real-time clock provides time- and date-stamping for each captured quantity. Storage is accomplished to a USB drive. The data storage format is comma-separated value (CSV) so recorded files are human-readable and easily imported to other applications like Microsoft Excel.

The DI-2160 features eight high impedance (1MΩ) input channels. The channels may be connected to any ±5 to ±170V peak AC or DC source directly .

A USB interface is provided to allow the DI-2160 to be easily configured for specific measurements. The unit can be powered using the provided USB/AC power adaptor and the recording is protected by SuperCap. A color LED is provided to indicate Recording and USB connection.

Learn more about the DI-2160 Hardware
Learn more about the DI-2160 Software

Warranty and Service Policy

Product Warranty

DATAQ Instruments, Inc. warrants that this hardware will be free from defects in materials and workmanship under normal use and service for a period of one year from the date of shipment. DATAQ Instruments' obligations under this warranty shall not arise until the defective material is shipped freight prepaid to DATAQ Instruments. The only responsibility of DATAQ Instruments under this warranty is to repair or replace, at its discretion and on a free of charge basis, the defective material.

This warranty does not extend to products that have been repaired or altered by persons other than DATAQ Instruments employees, or products that have been subjected to misuse, neglect, improper installation, or accident. DATAQ Instruments shall have no liability for incidental or consequential damages of any kind arising out of the sale, installation, or use of its products.

Service Policy

1. All products returned to DATAQ Instruments for service, regardless of warranty status, must be on a freight-prepaid basis.

2. DATAQ Instruments will strive to achieve a 5-day turnaround on any repair or replacement of any defective product.

3. For in-warranty repairs, DATAQ Instruments will return repaired items to the buyer freight prepaid. Out of warranty repairs will be returned with freight prepaid and added to the service invoice.

Hardware

Features

The DI-2160 event, state, and count data logger is a portable, stand-alone data recording module that allows configuration through your computer's USB port and data storage to a USB drive. Power is derived from the provided USB/AC power adaptor. The device is designed specifically to record when, how long, and how many times events occur. Features include:

- 8 high impedance (1MΩ) voltage channels with a range of ±5 to ±170 V DC or peak AC
- Push-button to stop/start recording data to a USB drive
- Easy-to-read LED light clearly indicate instrument status
- Data is recorded directly to a USB drive
- Built-in USB (mini) interface for communications with any Windows 10 or higher PC
- Includes setup software and outputs data to a .csv file format that can be read by most spreadsheet programs like Microsoft Excel
- Programmable State, Event, AC Counter, or High Speed Counter functions available per channel

Signal Inputs

The DI-2160 features eight high impedance (1MΩ) voltage channels (±5 to ±170 V DC or peak AC) located on a single eight-position screw terminal block and clearly labeled for easy connection and operation.
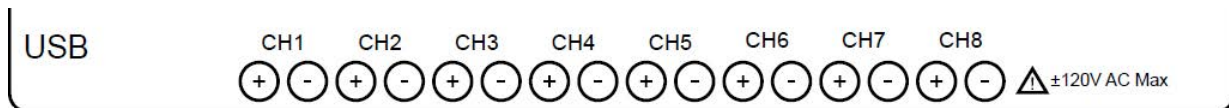
Specifications

Signal Inputs

High Impedance (1MΩ) Voltage Channels	
Number of Channels:	8
Working Range:	±5 to ±170 VDC, 120 Vrms
Software Schmitt Trigger Threshold:	3 Volts nominal, on rising edge
Max Input without Damage:	±170 V DC or peak AC

Operation

Programmable functions:	Event, State, Count (alternating current (AC) counter or high-speed (HS) counter
Counter Operation	
Reset condition:	Programmable interval timeout
Maximum count:	1 second interval: 4000 1 hour interval: 400,000,000
Maximum frequency:	4 KHz
Minimum pulse width:	>250 µs
HS Counter Operation:	Used whenever the need exists to account for and totalize each pulse that occurs within a sample interval
AC Counter Operation:	Optimized for 50/60 Hz power line frequencies. Designed to ignore power line transitions and to change state only when power is removed or applied.
State Operation	Determines the DURATION of an event. Records the state that exists upon termination of a sample interval.
Event Operation	Determines WHEN an event occurred, but does not yield the duration of the event. Records a single time-stamped data point when one or more events occur within a definable interval.
Min capture event pulse width:	> 250 µs
Programmable intervals (applies to all channels)	1,2,5,10,15,30 seconds; 1,2,3,4,5,10,15,30 minutes; 1,2,4,6,8,12,24 hours

Internal Date/Time Clock

Accuracy:	50 ppm
Sync Method:	via connected PC during setup

System Configuration

Method:	Via PC-based program; Uploaded via USB port
Parameters:	Enabled/disabled channels; Sample interval; Function ((AC) counter, (HS) counter, Event, Pulse); User annotation per channel

Data Memory

Type:	USB drive
Maximum memory size:	32 GB (FAT32 format)
Storage format:	ASCII comma separated value (.csv)

Controls, Indicators, and Connections

Interface:	USB 2.0 (mini-B style connector)
Storage:	Removable USB drive
Push button control:	Stop/Start recording to USB drive
Indicators (LED):	Active, USB, Recording
Input Connections:	One 16-position terminal strip

Power

Current drain:	120mA max @ 5VDC
AC adaptor:	100-240 VAC, 50-60 Hz
External Power:	via USB port or provided AC adaptor

Environmental

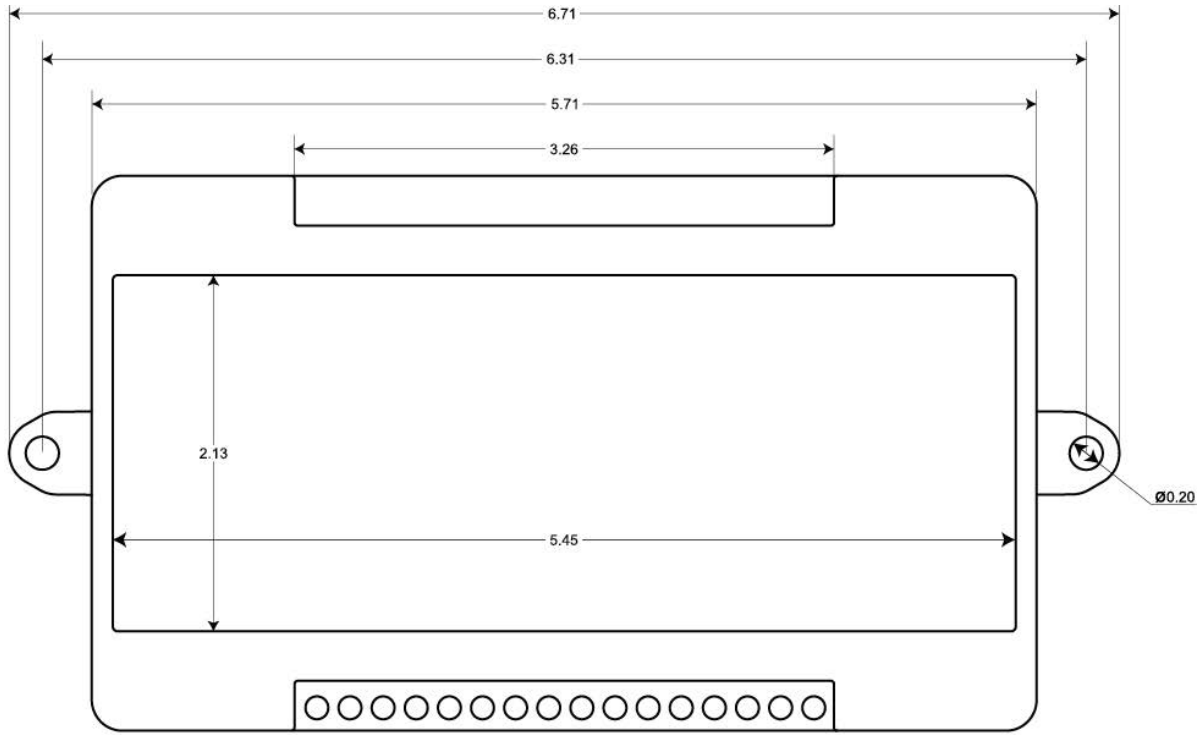|	
Operating Temperature:	-0°C to 50°C
Operating Humidity:	0 to 90% non-condensing
Storage Temperature:	-20°C to 60°C
Storage Humidity:	0 to 90% non-condensing

Physical Characteristics

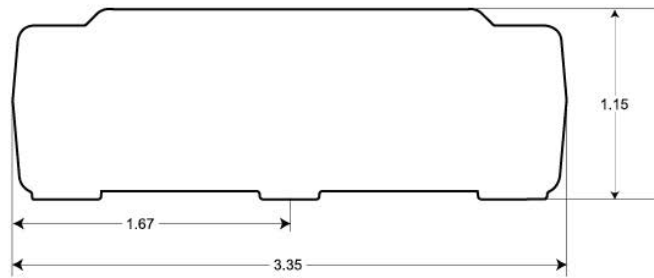|	
Enclosure:	Hardened Plastic
Mounting:	Desktop
Dimensions:	6.68W × 3.28D × 1.13H in (169.67W × 83.31D × 28.7H mm)
Weight:	5.7oz.

OS Compatibility

Setup software:	Windows 10 and higher

Dimensional Drawing

Top View

Side View

All dimensions in inches

Unpacking the Device

The following items are included with each DI-2160 Event, State, and Count Data Logger. Verify that you have the following:

- Your DI-2160 Instrument
- Mini-B USB cable for device setup
- AC Power Adapter to record data in the field (the USB cable connects to the AC power adapter)
- A 32GB USB drive
- DATAQ Instruments screw driver for signal connections
- Downloadable WinDaq installation from run.dataq.com

If an item is missing or damaged, call DATAQ Instruments at 330-668-1444. DATAQ support 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.

Connecting Input Signals

All input signal connections are made to the 16-port screw terminal. Each terminal is labeled directly on the top of the instrument case.
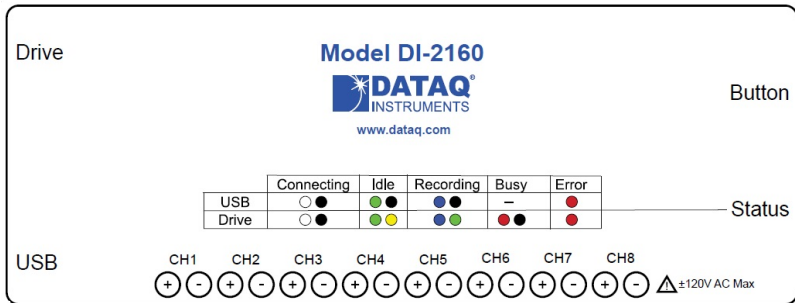
Use the following diagram to connect channel 1.
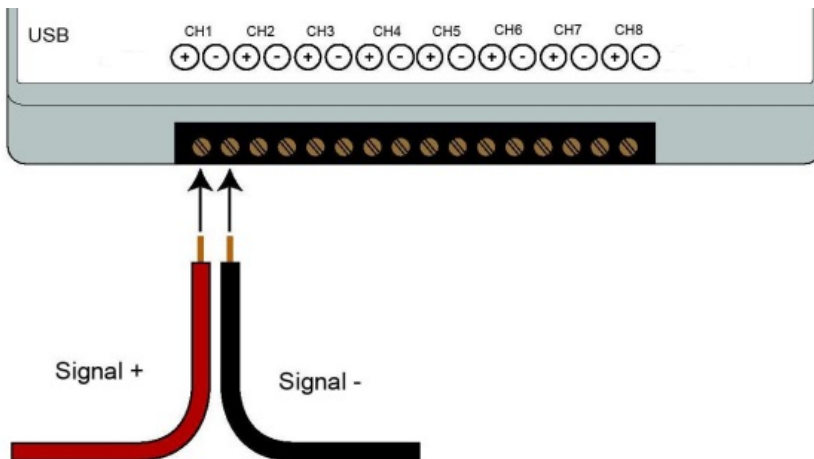
To connect signals to the DI-2160:

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.
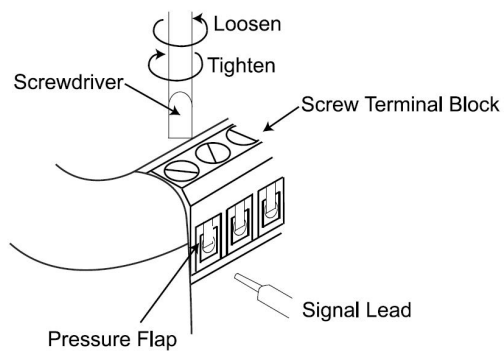
Applying Power

1. Connect the Mini-B USB connection to the DI-2160 Unit.

2. Connect the other end of the USB cable to your PC for configuration or the provided AC power supply for stand-alone operation.

3. Plug the AC power supply into any appropriate power source (if not connected to your PC).
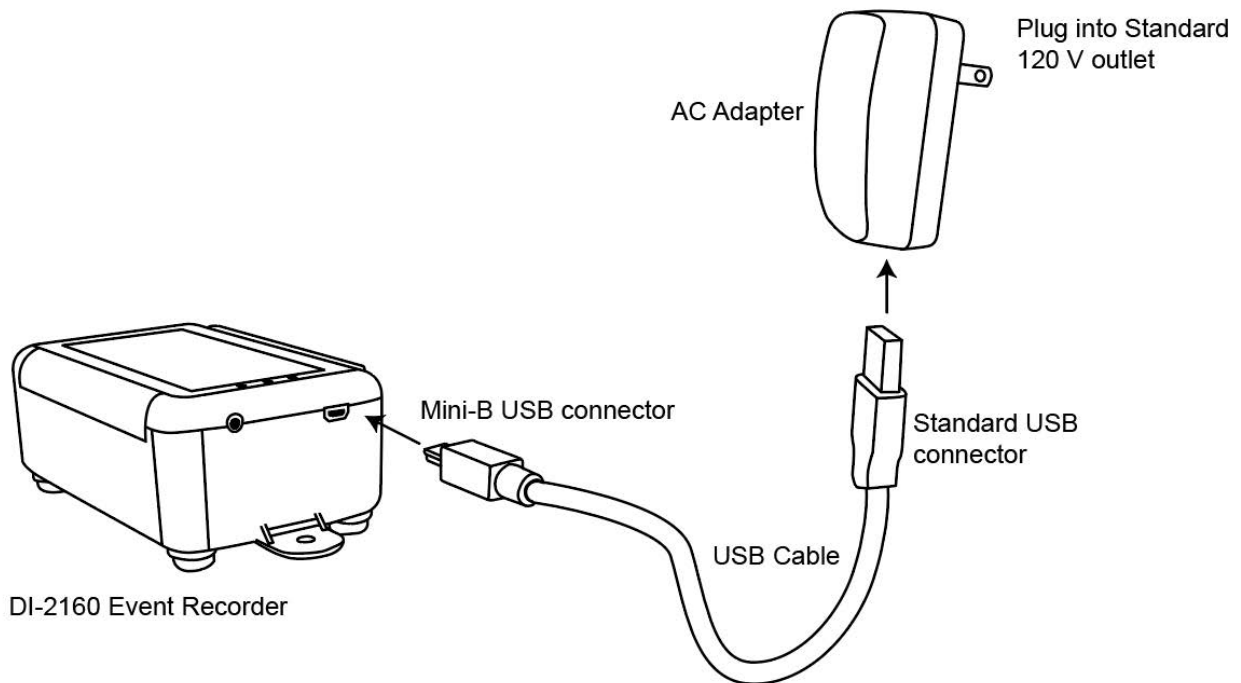
Indicator and Control

The DI-2160 Data Logger has 1 color indicator and 1 push-button control (for start/stop recording to USB drive).

Status LED

The Status LED flashes different color patterns to indicate logger's status. Please see the overlay for description
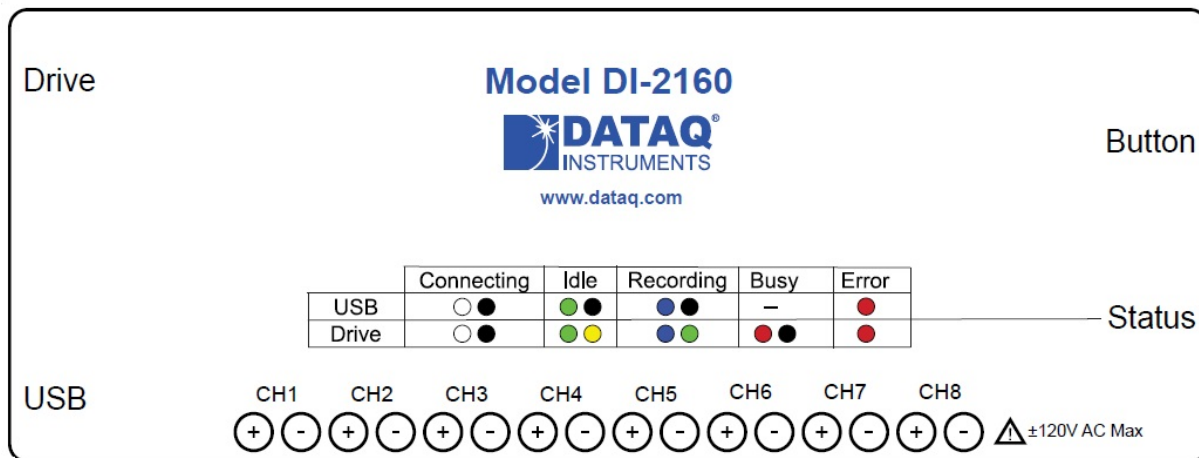
Start/Stop Push Button

The Start/Stop button is located on the side of the device. Use this button to manually start/stop recording when your device is NOT connected to your PC.

To Start recording to your USB drive, press and hold the button. The status LED will flash blue once every second when recording to USB drive.

To Stop recording to your USB drive, press and hold the button. The status LED will fall back idle mode

USB Drive

Use any USB drive formated in FAT32, up to 32 GB in size, to record your data. Remove the USB drive and insert into computers to access the data files. You can open the file in any spreadsheet program that accepts CSV file format (see Reported Data to view sample output). Each recording session creates a new file.

Note: *Do not remove the USB drive during recording*

Software

The DI-2160 Event Recorder setup software is included with the purchase of your DI-2160 Event, State, and Count Data Logger. Configure channels, sync the clock to your PC, and set the sample interval with the WinDaq Dashboard.

Install the software through online download (via the DI-2160 Event Recorder product page) .

Software Installation

Disconnect ALL DATAQ Instruments USB devices from your computer.

Download WinDaq software installation suite from run.dataq.com, run it and follow the instruction.

Main Screen of WinDaq Dashboard

Plug the DI-2160 into a PC and run WinDaq Dashboard.

Once open, the main window will display DI-2160 in its list box.
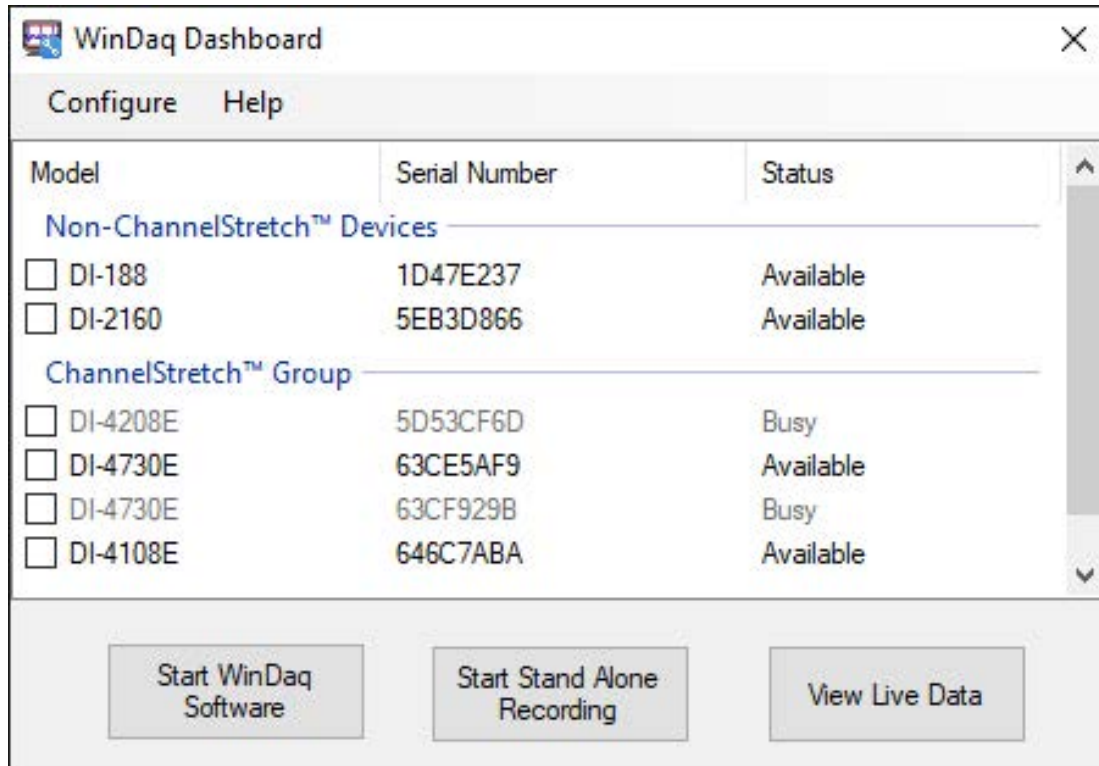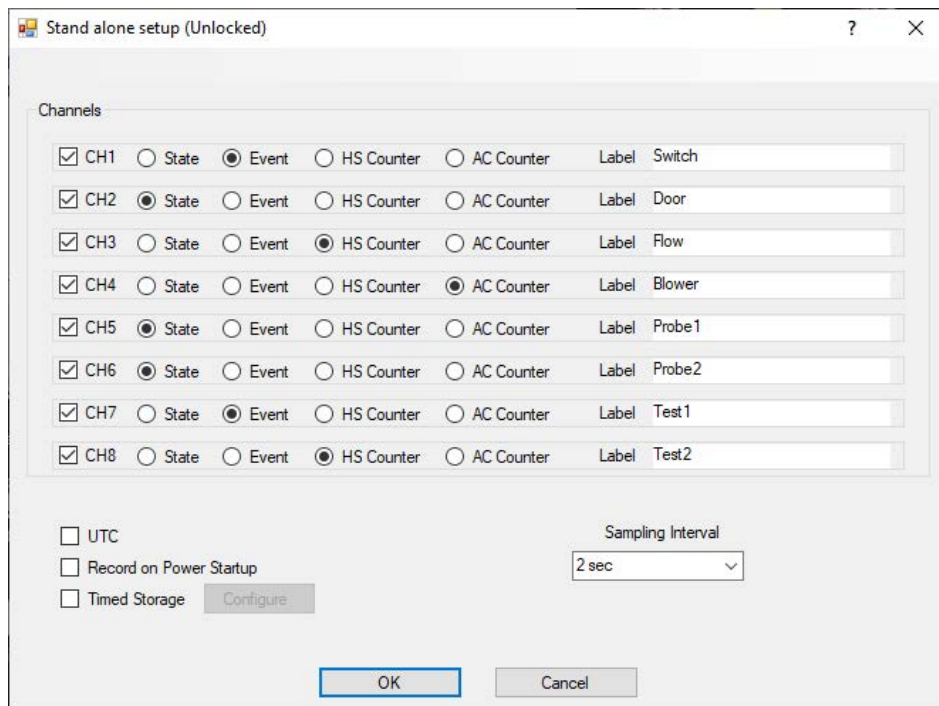
Configuration

From WinDaq Dashboard, check DI-2160, follow drop-down menu item Configure->Stand Alone Setup to bring up the configuration dialogue box. Check the box in front of CHn to enable a channel, then select recording methods (State, Event, HS Counter or AC Counter), and optionally assign a label (Channel Annotation) for the channel.

DI-2160's real-time clock can be synced to UTC or local clock

DI-2160 can be configured to start logging upon powering up, or scheduled to start and stop at certain time.

Channel Mode

The channel mode can be configured for State, Event, HS Counter, or AC Counter.

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

STATE means the channel is configured for the State Mode.

EVENT means the channel is configured for the Event Mode.

HS COUNTER means the channel is configured for the High Speed Counter Mode.

AC COUNTER means the channel is configured for the AC Counter Mode.

See Choosing Channel Configuration Mode to determine which mode to select for a given channel.

Channel Annotation (Label)

User-defined (up to 6 characters) channel annotation is optional

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

Time Setting

The user-specified time setting is displayed in the upper left-hand portion of the main window just under "Function." Local or UTC (Coordinated Universal Time) date and time stamps can be displayed and stored to data files.

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

Use the Channel Settings dialog to change the time setting.

Time and Date Stamp

The time and date stamp of each data sample is displayed in the left-most column in the main window. Date/Time is shown in either UTC or Local (setting can be changed in the Channel Settings dialog). The time configuration is displayed directly above the time/date stamps.

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

Spreadsheet Data Display

Sampled data is shown in the following format in spreadsheet.

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

Change the Sample Interval
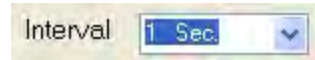
Interval [1 Sec.]

Select a new sample interval from the drop-down box. Select from the following: 1 Sec., 2 Sec., 5 Sec., 10 Sec., 15 Sec., 30 Sec.; 1 Min., 2 Min., 3 Min., 4 Min., 5 Min., 10 Min., 15 Min., 30 Min.; 1 Hr., 2 Hr., 4 Hr., 6 Hr., 8 Hr., 12 Hr., 24 Hr. All channels will report values based on the selected sample interval.

Set the Time

☑ UTC

The time stamp reported by the device can be synchronized with your PC or stay in standard UTC time.

Uncheck the UTC checkbox to sync the device with your PC.

Check the UTC checkbox to leave the device at UTC time.

Configure a Channel

CHN1   ☑ 1   ⦿ State   ○ Event   ○ HS Counter   ○ AC Counter

Click in the label text box to change the channel annotation.

Channel Annotation Text Box

CHN1   ☑ 1   ⦿ State   ○ Event   ○ HS Counter   ○ AC Counter

Click on the channel checkbox to enable/disable a channel.

Channel Enable/Disable Checkbox

CHN1   ☑ 1   ⊙ State   ○ Event   ○ HS Counter   ○ AC Counter

Select a radio button to set the channel function. Configure each channel as either a State, Event, High Speed Counter, or AC Counter. Only 3 total channels may be counter channels (AC or HS) while channels 4 and 8 cannot be configured as counter channels. See Choosing Channel Configuration Mode to determine which mode to select for a given channel.

Channel Function Selection Radio Buttons

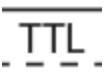CHN1   ☑ 1   ⊙ State   ○ Event   ○ HS Counter   ○ AC Counter

Configure the Device

Click on the **OK** button to save the settings to the device.

Choosing Channel Configuration Mode

Use the following chart to determine which mode to select for which channel:

						DI-2160 Channel Configuration Mode if you want to know...		
Applied Signal								
Type	**Description**	**Range**	**Threshold**			**When**	**How Long**	**How Many**
⎯ ⎯ ⎯	DC Level Change	0 to ±170V	3V		✓	Event	State	HS Counter
⊓⎽	Pulse (8 KHz max, > 125 µs)	0 to ±170V	3V		✓			
∿	AC Line (50/60 Hz)	120 Vrms max.	3V		✓		Event	AC Counter
⤹	Switch closure	n/a	n/a		✓			
⌐TTL⌐	TTL level changes	0-170V	3V		✓		State	HS Counter
⎍TTL	TTL Pulse (8 KHz max, >125 µs)	0-170V	3V		✓			

The following graphic may help to further demonstrate the relationships between channel modes.
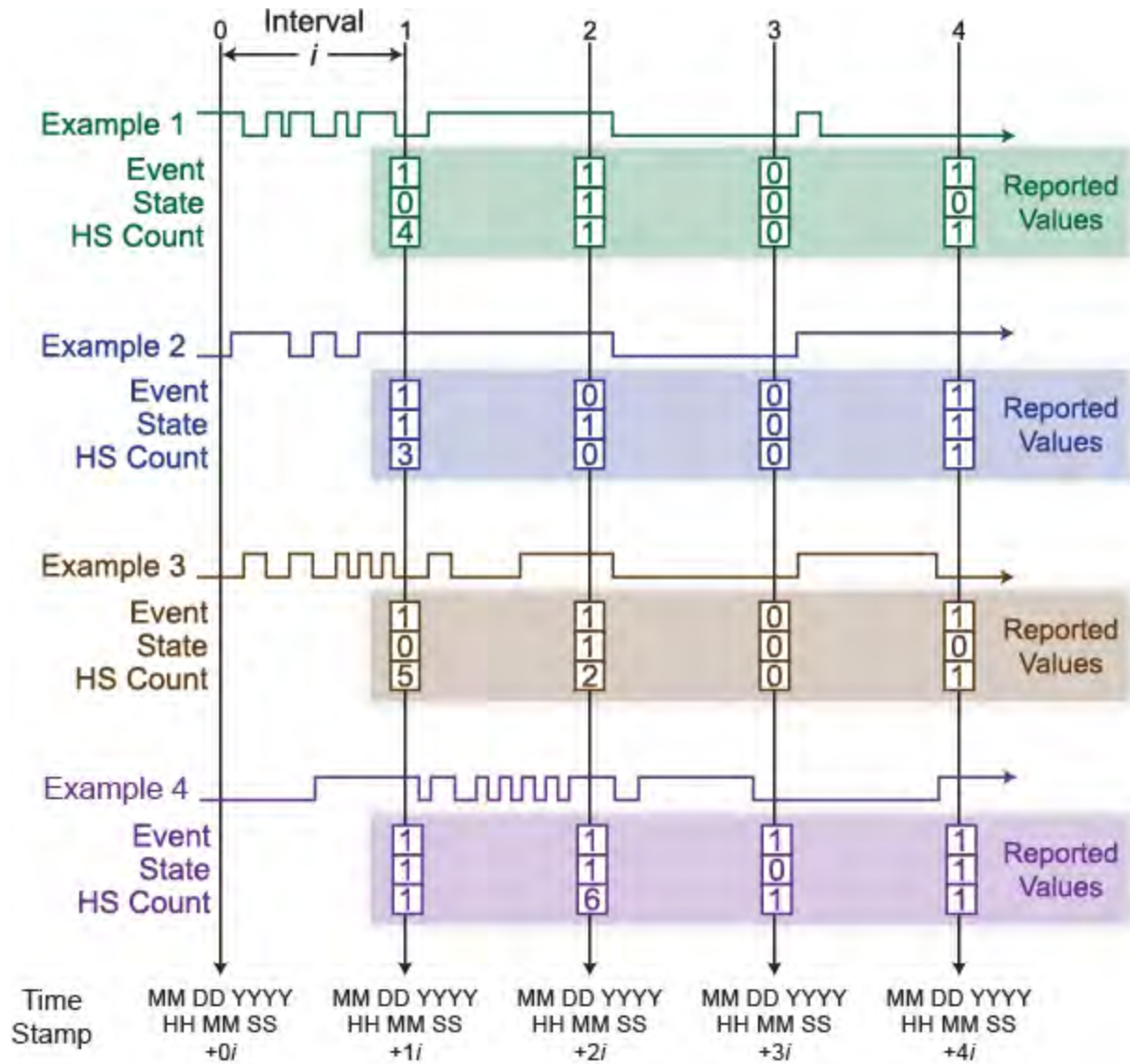
State Mode

Use the State Mode to determine how long an event lasts. A channel configured in the State mode only samples at the end of a sample interval. An example would be a machine was powered on at 9:00 AM, and remained on until 12:00PM. It was powered back on at 1:00 PM and remained on until 5:00 PM.

State mode only reports a 0 or 1 for each sample interval.

Use the following graphic as an example:
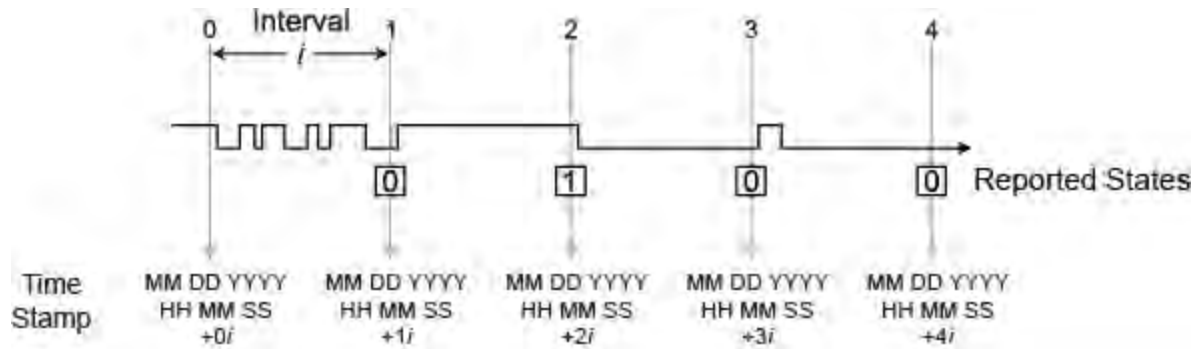
Note: *When sampling an AC line waveform, should the value of the applied waveform be approximately lower than the trigger threshold when the sample interval times out, the DI-2160 will erroneously indicate that power was removed for the entire sample interval. To overcome this problem use the Event Mode to reliably report on/off times when monitoring an AC waveform.*
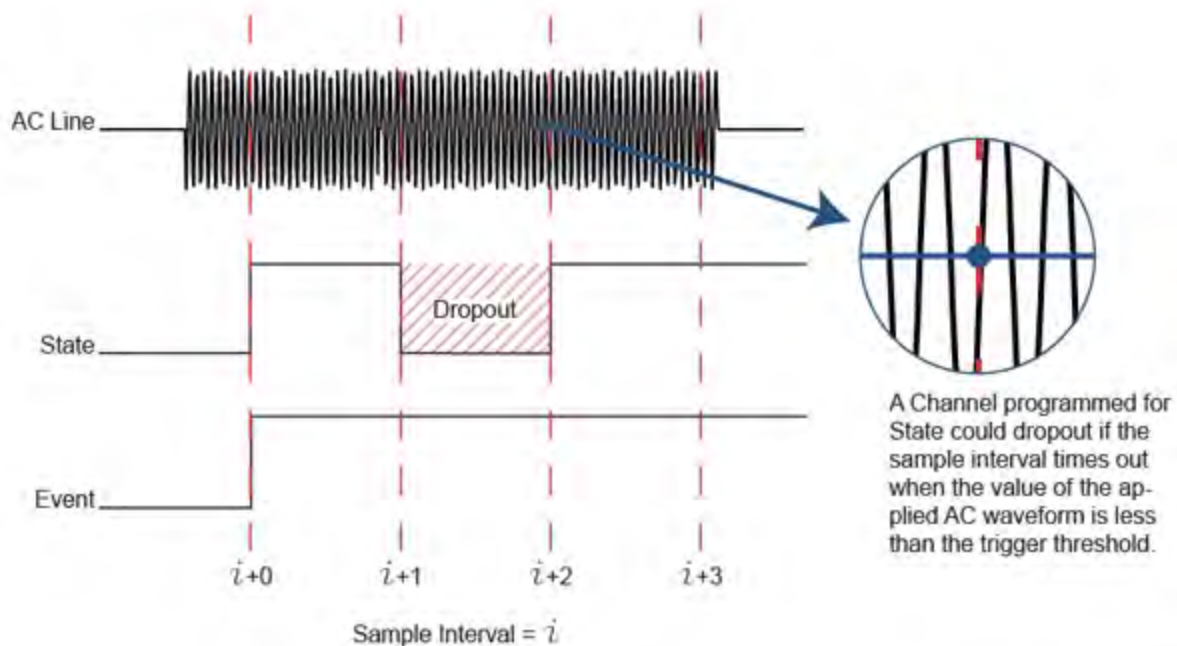
Event Mode

Use the Event mode to record when an event occurs. An Event is a single occurrence within a sample interval. Even though multiple events may occur within a sample interval, only one will be recorded. Only leading edge transitions are reported. Falling edge transitions are ignored. For example, a machine gets turned on dur-ing the sample interval.

Event mode only reports a 0 or 1 (whether or not a signal was on during the sample interval) for each sample interval.

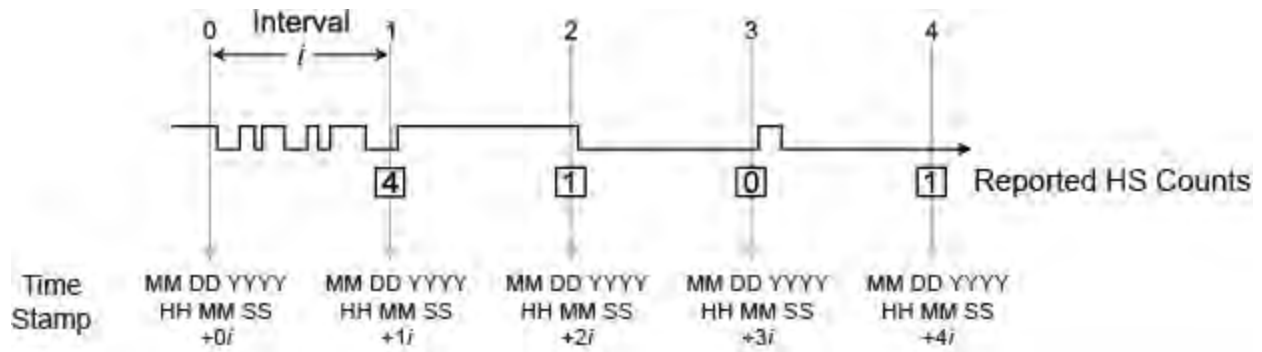Use the following graphic as an example:
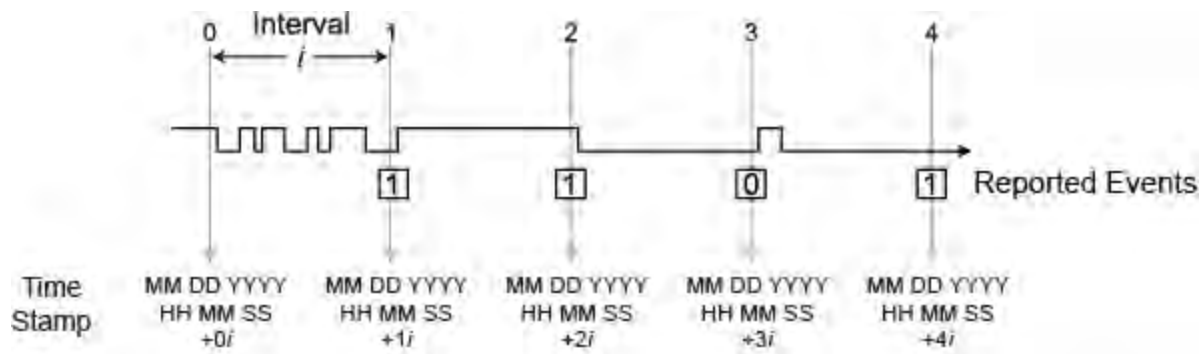
High Speed Counter Mode

Use the High Speed Counter Mode to find the sum of the number of events occurring within a sample interval. For example, a machine produces an average of 80 parts per minute over 420 total minutes of operating time (7 hours). The maximum and minimum run rates were 120 and 62 parts per minute respectively.

High Speed Counter mode reports an integer from 0 to 21,600,000.

Use the following graphic as an example:
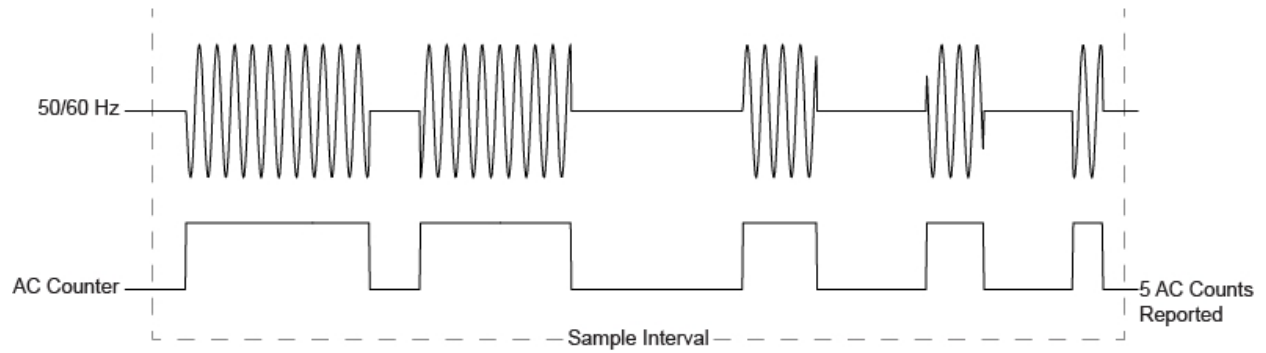

See also: HS vs. AC Counter Modes

AC Counter Mode

Use the AC Counter Mode to count AC power on/off within a sample interval. This mode is optimized to ignore 50/60 Hz power line transitions and to change state only when power is removed or applied. For example, a 120 VAC pump turned on 5 times during a sample interval of 30 minutes.

Use the following graphic as an example:

AC vs HS Counter Modes

The decision to apply the DI-2160's HS (high-speed) or AC (alternating current) counter mode depends upon what information is desired from the measurement. The high-speed counter mode is used when you need to total each pulse that occurs within a sample interval. A flow sensor with a pulsed output is a good example, where each pulse represents an incremental flow value and therefore carries information. But what if you're interested only in the number of times a 120V/60Hz fan by was activated within a six-hour sample interval? Use of the HS counter mode in this situation yields the number of 60 Hz pulses that occurred during that time – not exactly what you want. The AC counter mode is optimized to ignore 50/60 Hz power line transitions and to change state only when power is removed or applied. Applying the AC Counter mode to the fan application provides exactly the information you need – the number of times the fan activated within successive six-hour periods.
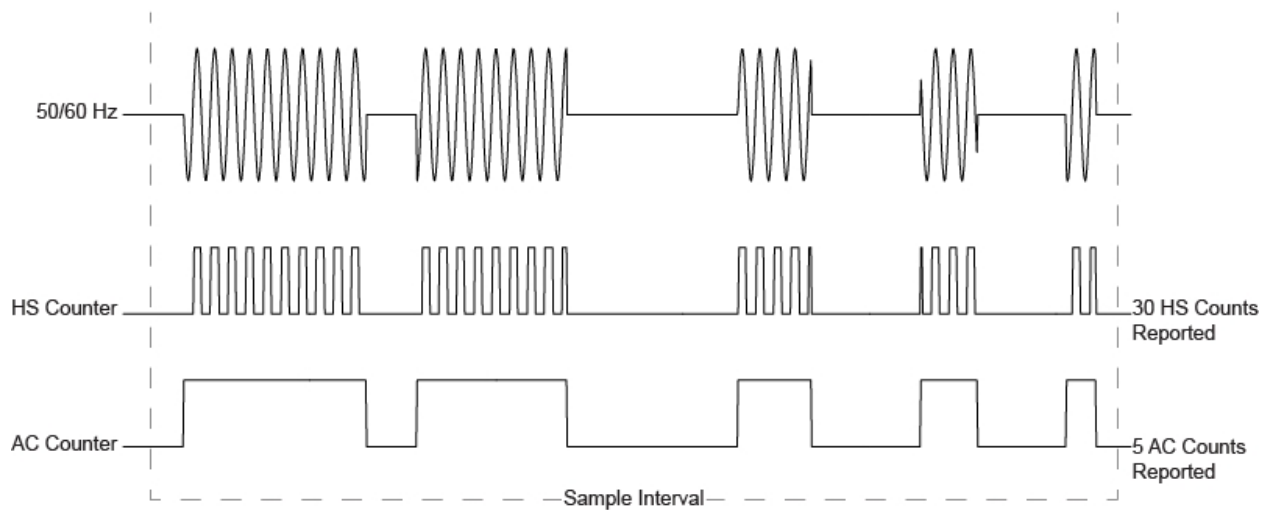
Reported Data

Access recorded data by removing the USB drive from the DI-2160 and inserting it into USB port of the computer. The .csv output file is formatted to allow easy analysis of your recorded data. The first rows contain general information including the file name, device name, and sample interval. Rows 6-8 contain channel information like the channel number, annotation, and mode. The rest of the file is the recorded data and corresponding time stamps.

	A	B	C	D	E	F	G	H	I
1	Start time: 2023-05-24 18:02:49								
2	Start due to push button								
3	Device ID:								
4	LOCAL TIME	Switch	Door	Flow	Blower	Probe1	Probe2	Test1	Test2
5	Time Stamp	EVENT	STATE	COUNT	AC	STATE	STATE	STATE	STATE
6	2023-05-24 18:02:50	1	0	23	2	0	1	1	1
7	2023-05-24 18:02:52	0	0	23	1	0	1	0	0
8	2023-05-24 18:02:54	1	1	54	2	1	0	0	0
9	2023-05-24 18:02:56	0	0	5	2	0	0	0	0
10	2023-05-24 18:02:58	0	1	58	0	0	1	1	1
11	2023-05-24 18:03:00	1	0	545	4	1	0	0	0
12	2023-05-24 18:03:02	0	0	5	0	0	0	0	0
13	2023-05-24 18:03:04	0	1	5	0	0	1	1	1
14	2023-05-24 18:03:06	0	0	0	0	0	0	0	0
15	2023-05-24 18:03:08	0	0	0	0	0	0	0	0
16	2023-05-24 18:03:10	0	0	0	0	0	0	0	0
17	2023-05-24 18:03:12	0	0	0	0	0	0	0	0
18	2023-05-24 18:03:14	0	0	0	0	0	1	1	1
19	2023-05-24 18:03:16	0	0	0	0	0	0	0	0
20	2023-05-24 18:03:18	0	0	0	0	0	0	0	0

Start Recording to USB Drive

Record to USB drive with the start/stop push button. Or, when selected, record to USB drive upon powering up DI-2160

Technical Support

Post all technical support issues through our support ticket system. Our support team monitors the ticket system Monday through Friday 9-5 Eastern Time.

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Product Links

Data Acquisition | Data Logger | Chart Recorder