PCB PIEZOTRONICS
AN AMPHENOL COMPANY

Model 410D01

ICP® Signal cond., 35mm DIN-rail mount, peak&hold, clamping and waveform analog output, AC/DC coupling, gain, setup configurable via USB communications.

Installation and Operating Manual

For assistance with the operation of this product,
contact the PCB Piezotronics, Inc.

Toll-free: 716-684-0001
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com

Model Number 410D01	ICP® SENSOR SIGNAL CONDITIONER WITH PEAK HOLD & CLAMP OUTPUT	Revision: NR ECN #: 52618

SIGNAL

Performance	ENGLISH	SI	
Channels	1	1	
Sensor Input Type(s)	ICP®	ICP®	
Voltage Gain(+/- 10%)Software Selectable)	X1 X2 X4 X8 X10 X16 X20	X1 X2 X4 X8 X10 X16 X20	
Output Range(Digital)(Peak Hold)	0 to 10 V	0 to 10 V	
Output Range(Analog Signal)	± 10 V	± 10 V	
Low Frequency Response(+/- 10 %)(AC mode)	1.0 Hz	1.0 Hz	
Low Frequency Response(DC mode)	Governed by Sensor DTC	Governed by Sensor DTC	
High Frequency Response(+/- 5%)	1 kHz	1 kHz	
Control Interface			
Digital Control Interface	USB	USB	
Human Interface	Downloadable Software Configurator	Downloadable Software Configurator	
Display	None	None	
Environmental			
Temperature Range	-40 to 158 °F	-40 to 70 °C	
Electrical			
DC Power(± 10 %)	24 VDC	24 VDC	
DC Power(Maximum)	350 mA	350 mA	
Excitation Voltage(To Sensor)	20 VDC	20 VDC	[1]
DC Offset(After reset)	≤ 70 mV	≤ 70 mV	[1]
Constant Current Excitation(To Sensor)	4 mA	4 mA	[1]
Discharge Time Constant(AC mode)	0.6 sec	0.6 sec	[1]
Broadband Electrical Noise(1 to 10 kHz) (Gain x1)	20 µV rms	20 µV rms	[1]
Input(Reset)	Optically Isolated	Optically Isolated	
Polarity(Tension/Compression)	Software Selectable	Software Selectable	
Physical			
Electrical Connector(ICP® Sensor Input)	BNC Jack	BNC Jack	
Electrical Connector(Peak Analog Output)	Screw Terminal	Screw Terminal	
Electrical Connector(Wave Form Analog Output)	Screw Terminal	Screw Terminal	
Electrical Connector(Analog Output Common)	Screw Terminal	Screw Terminal	[2]
Electrical Connector(Input Reset)	Screw Terminal	Screw Terminal	
Electrical Connector(USB Interface)	Type B	Type B	
Mounting	DIN Rail	DIN Rail	
Size (Height x Length x Width)	3.9 in x 4.46 in x 1.78 in	99 mm x 113.3 mm x 45.2 mm	
Weight	0.46 lb	208 gm	[1]

CE

UK CA [3]

All specifications are at room temperature unless otherwise specified.
In the interest of constant product improvement, we reserve the right to change specifications without notice.
ICP® is a registered trademark of PCB Piezotronics, Inc.

OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

NOTES:

[1]Typical.
[2]Optically isolated contact closure.
[3]See PCB Declaration of Conformance PS024 for details.

SUPPLIED ACCESSORIES:

Model 100-16427-40 USB 2.0 Cable A to B Male

Entered: ND	Engineer: gs	Sales: KWW	Approved: BAM	Spec Number:
Date: 09/11/2025	Date: 09/11/2025	Date: 09/11/2025	Date: 09/11/2025	74543

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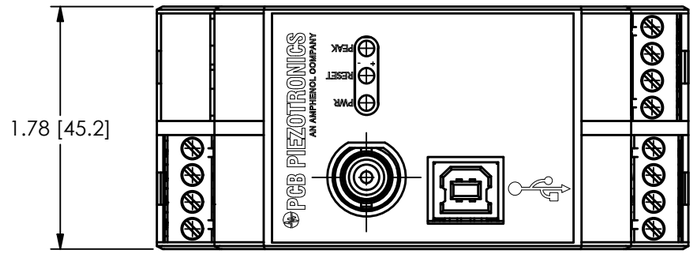
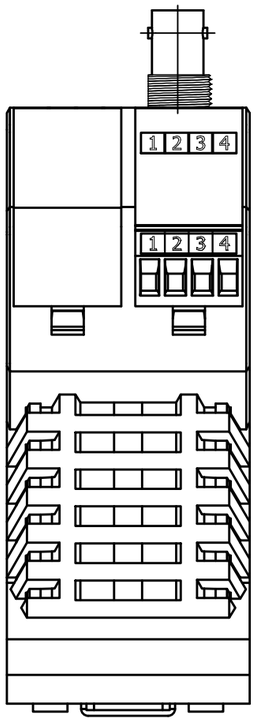
3425 Walden Avenue, Depew, NY 14043

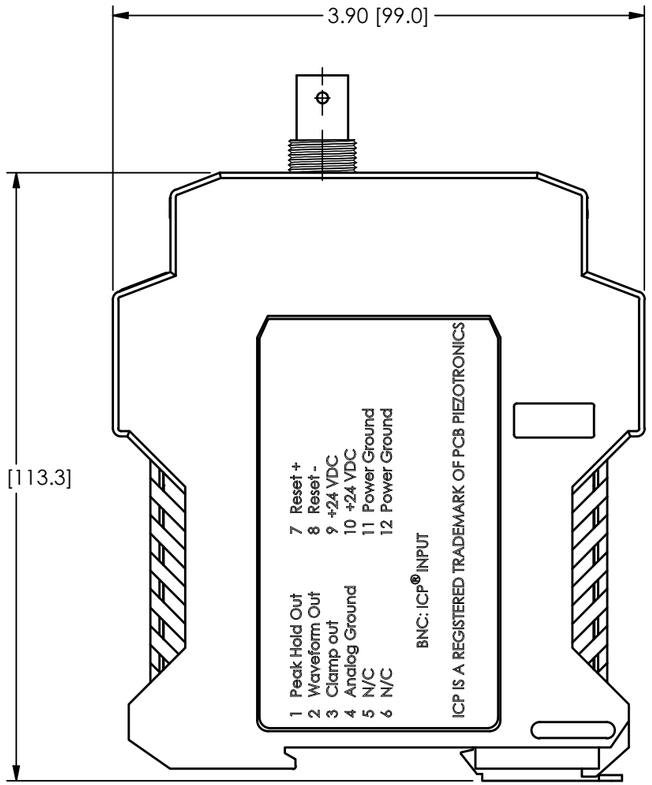
74545

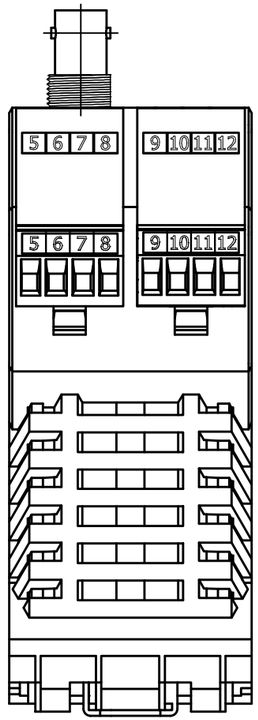
REVISIONS		
REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	52618

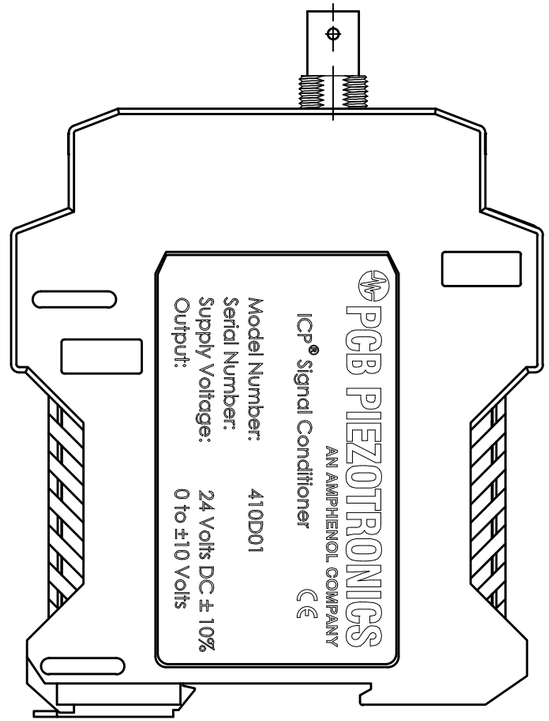


TERMINAL	CONNECTION
1	PEAK HOLD OUT
2	WAVEFORM OUT
3	CLAMP OUT
4	ANALOG GROUND
5	N/C
6	N/C
7	RESET +
8	RESET -
9	+ 24 VDC
10	+ 24 VDC
11	POWER GROUND
12	POWER GROUND









UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:	
DIMENSIONS IN INCHES DECIMALS XX ±.03 XXX ±.010 ANGLES ± 2 DEGREES	DIMENSIONS IN MILLIMETERS [IN BRACKETS] DECIMALS X ± 0.8 XX ± 0.25 ANGLES ± 2 DEGREES
CABLE TOLERANCES IN ENGLISH 1"≤ LENGTH < 1' = +1"/ - 0 1'≤ LENGTH < 5' = +2"/ - 0 5'≤ LENGTH < 100' = +6"/ - 0 100'≤ LENGTH = +1'/ - 0	CABLE TOLERANCES IN METRIC 2.54cm ≤ LENGTH < 30.5cm = +2.54cm/ - 0 30.5cm ≤ LENGTH < 1.5m = +5.1cm/ - 0 1.5m ≤ LENGTH < 30.5m = +15.2cm/ - 0 30.5m ≤ LENGTH = +30.5cm/ - 0
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13

DRAWN		CHECKED		ENGINEER	
KRG	9/10/25	JCM	9/10/25	GGS	9/10/25

TITLE

OUTLINE DRAWING
ICP SENSOR SIGNAL CONDITIONER
AC/DC & CLAMP

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CODE IDENT. NO.	SIZE	DWG. NO.
52681	B	74545
SCALE: .9X		SHEET 1 OF 1

Operating Guide with Enclosed Warranty Information

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Manual Number:76193

Manual Revision: NR

ECN Number 52618

Table of Contents

Introduction

PCB Model 410D01 Series Signal Conditioner is designed to condition and amplify output signals generated by ICP® sensors, such as force and strain sensors and accelerometers. The signals are converted to a ±10 V analog output that is relative to the force, strain, or motion applied to the transducer. The unit is typically integrated with a PLC or data acquisition system for process and/or quality control, however the 410D01 can utilized as a standalone single channel signal conditioner for ICP® sensors.

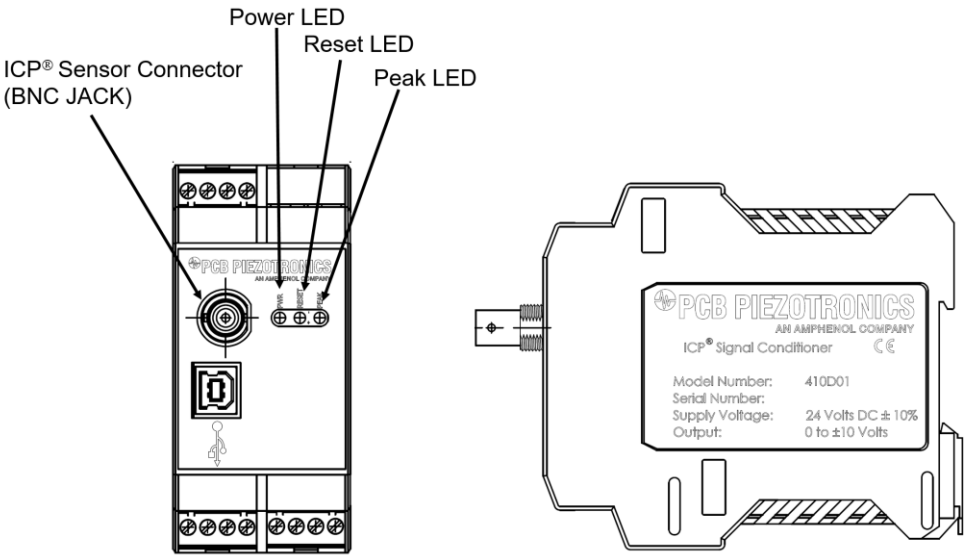
Two analog outputs are available; a ±10 V "Continuous" Waveform Output, which is the post gained output from the output of the signal conditioner, and a 0-10 VDC "Peak Hold", which is suitable for high-speed processes to capture and hold the highest analog output. Peak hold can be reset to a typical value of ≤ 70mV with the use of the "Reset" Function to synchronize with machine cycle times.

Contact PCB regarding specific product or application related questions.

Installation

The Model 410D01 ICP® Sensor Signal Conditioner is designed to be installed on a standard 35 mm DIN rail in an electrical cabinet. The recommended mounting location would be in the low voltage area of the cabinet to minimize potential for induced magnetic noise from high voltage sources, solenoids, etc. Do not install in a harsh area where it would be exposed to cleaning fluids or machine oils. Mount the conditioner within ≤100 feet of the ICP® sensor as not to attenuate frequency response characteristics of the system. For cable length greater than 100 feet, please contact PCB at (716) 684-0001.

For complete specifications, please refer to the enclosed Specification Sheet. This equipment is designed to be installed in an indoor environment at -40°F to +158°F (-40°C to +70°C), having <85% relative humidity. The 410D01 requires customer supplied 24 VDC +/- 10% with 350 mA to operate. Optionally PCB offers a DIN rail mount 24 VDC power supply model 682B01, 100 to 240 VAC input.



The Power LED is Green, which turns on when the unit is powered. The Reset LED is Green which turns on when both terminals of Reset (Reset + and Reset – are electrically connected to one another). The Peak Hold LED remains Green as long as the unit is powered and not in Reset Mode.

Connector and Pinout Diagram

The 410D01 uses plug-in type screw terminal connectors for all input and output connections.

Strip off 8mm of insulation from the connection wire ends. Using a screwdriver, remove the terminal block from the enclosure in either the up or down direction, terminate the wire in the correct location. The torque range is 0.5-0.6Nm. Re-install the terminal block.

This easy to assemble connection method allows devices to be exchanged easily and the electrical connection to be visibly isolated.

Pin Descriptions:

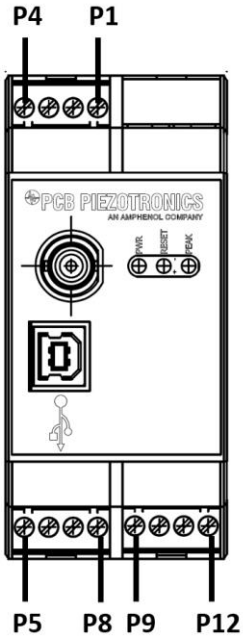
DC Power – Pins 9 to 12:
- **Pin 9** +24 VDC
- **Pin 10** +24 VDC
- **Pin 11** Power Ground
- **Pin 12** Power Ground

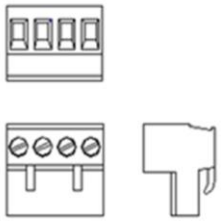
Waveform Output – Pins 2 & 4:
- **Pin 2** Waveform Out
- **Pin 4** Analog Ground

Peak Hold Output – Pins 1 & 4
- **Pin 1** Peak Hold Out
- **Pin 4** Analog Ground

Clamp Output – Pins 3 & 4
- **Pin 3** Clamp Out
- **Pin 4** Analog Ground

Reset Input – Pins 7 & 8
- **Pin 7** Reset +
- **Pin 8** Reset -

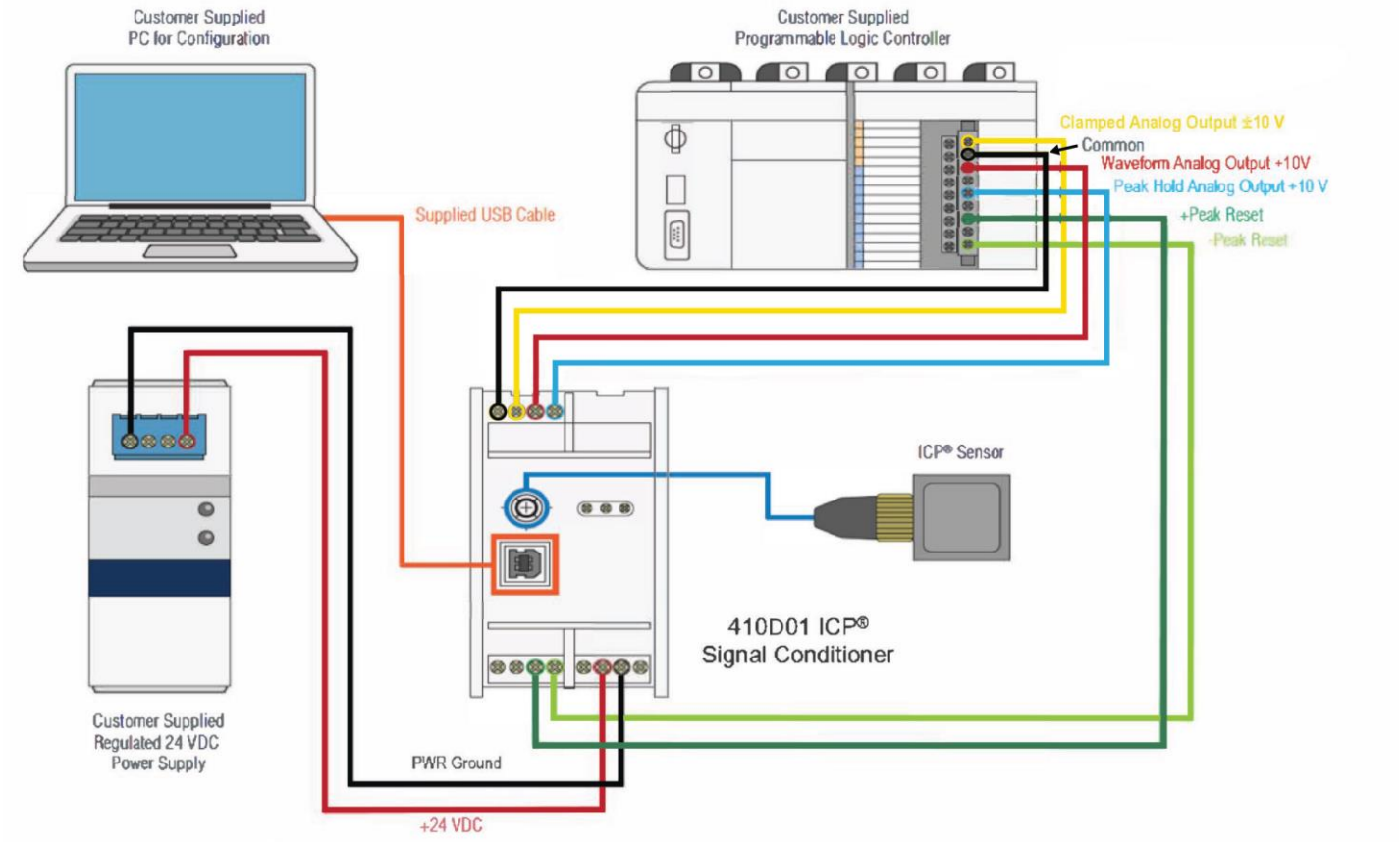




Removable Screw Terminals

AC and DC input signals and power supply voltages could be hazardous. DO NOT connect live wires to screw terminal plugs, and DO NOT insert, remove, or handle screw terminal plugs with live wires connected.

Typical System Wiring Diagram



24 VDC Supply Power

The 410D01 requires a regulated 24-volt DC power supply that is capable of providing up to 350 mA of current per unit connected to pins 10 (+) and 11 (-). For best results, it is highly recommended that the power supply have power line filters and low amount of ripple.

Configuration Software

The 410D01 setup and configuration is completely done through use of the PCB SignalCapture software, which is downloadable from www.PCB.com/410D01 at no charge. A USB cable, type A to B, is included for easy connection to a customer provided PC.

The SignalCapture software includes a communications status bar, which indicates connection status as well as data traffic. The status bar turns green and displays **Connected** when a connection to the device is established and valid data is received. If there is no response from the device, the status bar will turn yellow and display **Connecting…** until valid data is received

Waveform Output (±10 V Analog)

Optionally connect the Waveform output to the host system (ensure polarity is correct for proper operation). The waveform output is a live active output and represents the force, strain, or motion imparted to the connected ICP® sensor. This output is typically connected to a recording device such as oscilloscope or data acquisition system.

Peak Hold Output (0-10 VDC)

Optionally connect the "Peak Hold" analog output to the host system (ensure polarity is correct for proper operation). The Peak Track Hold output is designed to synchronize with machine cycle times in process monitoring / control applications. This output will continually track the output of an ICP® sensor and hold the highest observed output until a reset is command via hardware or software.

Clamp Output (0-10 VDC)

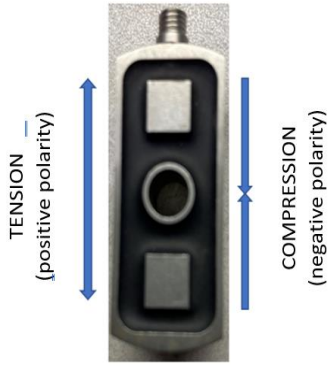
The clamped analog output is designed to automatically keep pulsating sensor output signalsground based (within 35 mV negative undershoot) and positively poled. This clamp is useful in stabilizing output signals when interfacing with instrumentation that requires repetitive pulse train signals be zero based and of one polarity (usually positive). When the waveform output is used, which is not clamped, a repetitive pulse train will gradually drift downward and stabilize in time with equal areas above and below signal ground when set to AC coupling.

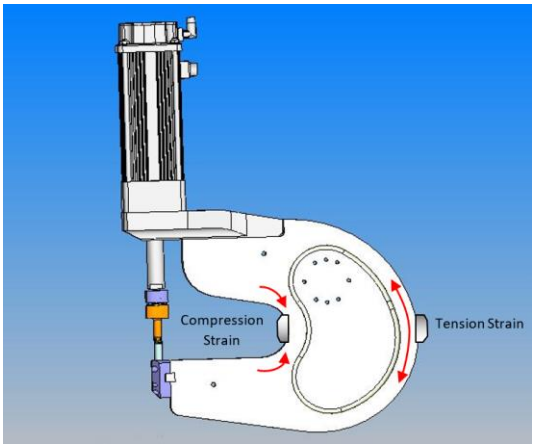
Peak Reset

Reset is necessary if the Peak Hold Output is used. The model 410D01 will hold the analog output indefinitely until there is a Reset, which will reset the output back to a typical value of ≤70mV, or the value from the sensor at the time of reset. The Peak Hold Output function can also be activated after a set amount of time after the Reset has been turned on. This function is described as the "Delay After Reset" which is found in the software. For best-case performance, it's recommended to set the delay to 10 seconds to allow time for the output signal to stabilize. Please reference the Help menu in the software when utilizing this function. To activate the Reset function, connect a dry contact from Reset+ to Reset. The Reset LED will turn Green, which indicates that the Reset Function is ON and will turn OFF when there is no electrical connection between Reset+ and Reset-.

Output Polarity (strain sensor installations only)

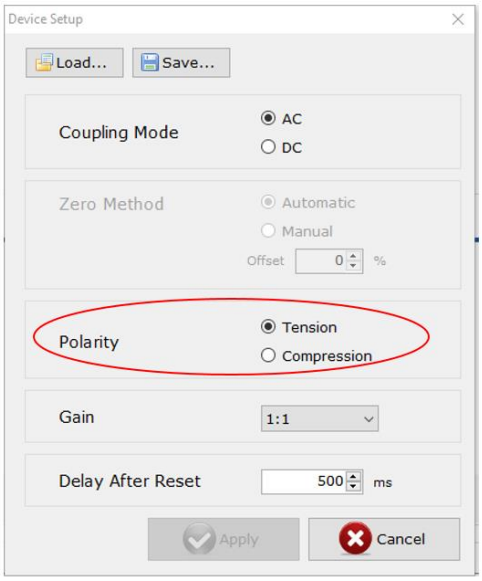
When utilizing the 410D01 with ICP® piezoelectric strain sensors (RHM240 series) its recommend that the end user take note of sensor installation as the location will determine if the sensor is either tension or compression.





Output Polarity (strain sensor installations only, continued)

The supplied software for the 410D01, allows the end user to optionally configure the 410D01 Waveform Output to either Tension or Compression as seen in the figure shown below. Please reference the Help menu in the software when utilizing this function.



Cables

For powering the 410D01, PCB recommends 052ACAD assembly, for connecting the ICP® sensor to the 410D01 PCB recommends using 002CXX or 098QXX series cables (10-32 plug to BNC). For connecting the outputs (Peak, Analog, and clamp, PCB recommends using 002ACAD series cables.

AC/DC Coupling

The downloadable software for the 410D01 allows the end user to configure the signal condition for either AC or DC coupling as seen in the figure shown below. For High-Speed applications, where the signal pulse widths are ≤ 0.01 seconds, configure the unit to AC Coupling. For slower measurement, applications configure the unit to DC Coupling. Please reference the Help menu 1 in the software when utilizing this function.

Additional Details:

When AC coupled, the output signal is free of any DC content and the system discharge time constant (DTC) will be approximately 1 second permitting use in high-speed applications where event pulse widths are ≤ 0.01 seconds or ≥ 100 Hz.

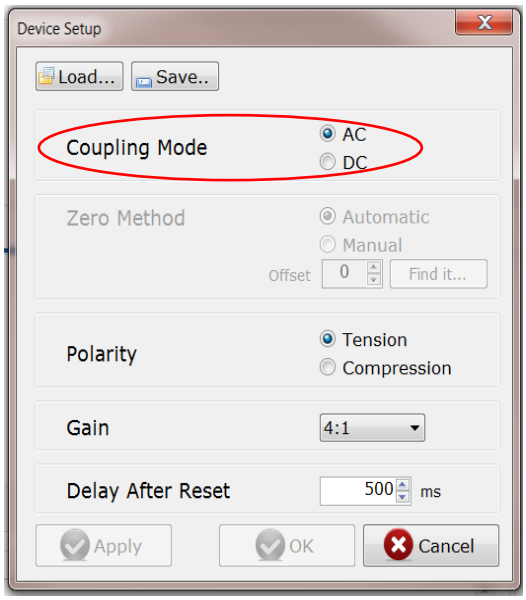
For slower events or longer signal pulse widths, select DC coupling to take advantage of the associated sensors long DTC which is typically 10 to 2,000 seconds, sensor model dependent. When DC coupled, a decoupling capacitor is removed from the circuit resulting in a DC offset equal to the sensors bias (typically 8 to 14 volts). To remove the bias

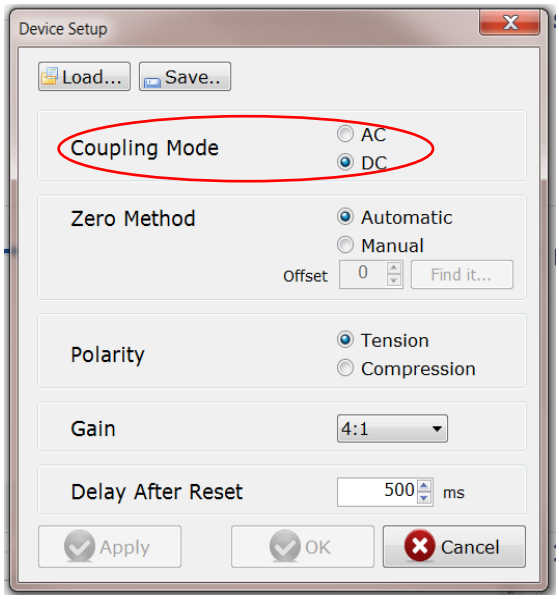
voltage while taking advantage of the sensors long DTC, the 410D01 offers to two options to remove of the sensor bias for zero based measurements. To accomplish, select automatic or manual zero method.

The automatic zero method, normally recommended, nulls the zero within +/- 70 mV. For more precise zero, use the manual method thru use of the “Find it” function in conjunction manual offset control.

AC/DC Coupling (continued)

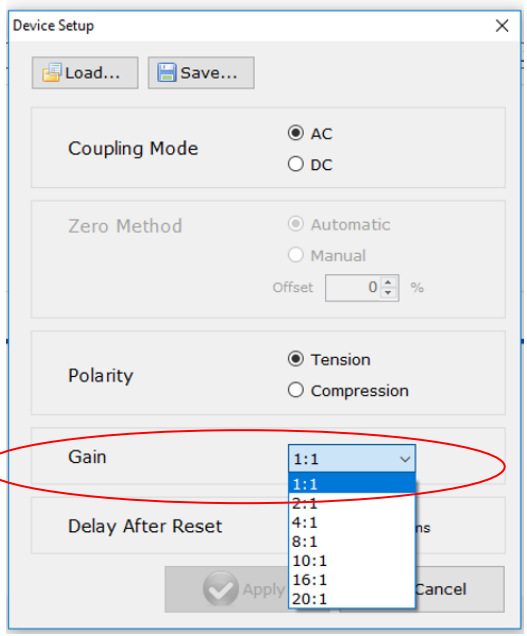
The below screenshots depict selection of AC or DC coupling in the 410D01 SignalCapture software.





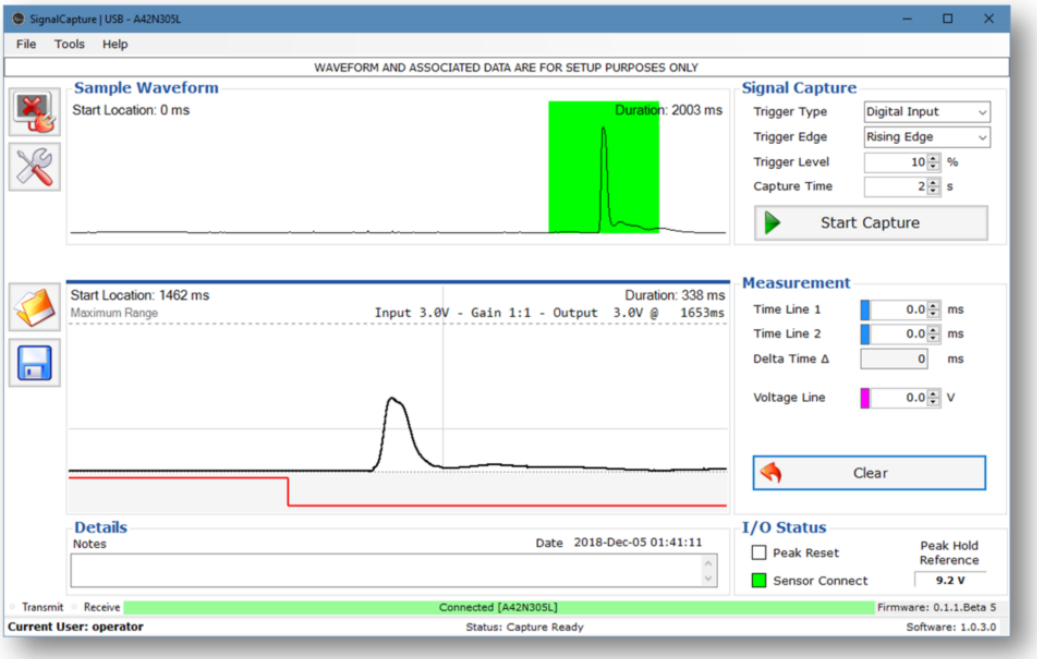
Gain Selections

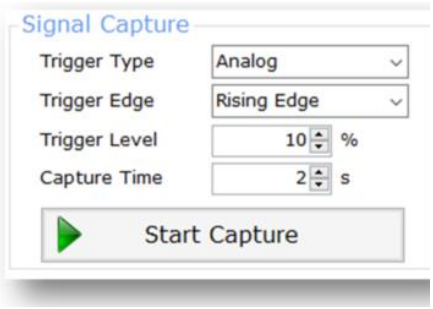
The supplied software for the 410D01, allows the option to configure the gain levels of the Waveform Output in steps of 1X, 2X, 4X,8X,10X,16X and 20X as seen in the figure shown below. The module is factory supplied with a gain of 1X. Please reference the Help menu on the software when utilizing the Gain function.



Log Viewer

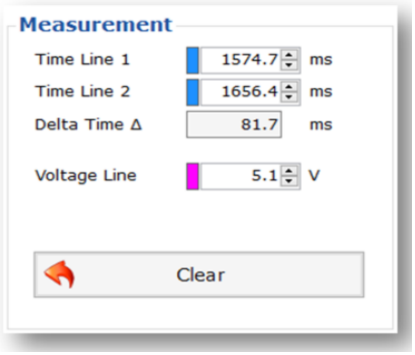
This feature allows the customer to view, save, and export (CSV format) and compare a sample dataset from 1 to 30 seconds in duration for purposes of confirming sensor / machine setup. User selectable configurations includes trigger type, trigger edge, trigger level, and capture time. The associated data set includes user adjustable markers to determine the amplitude and duration of the associated waveform.





Capture Parameters

Trigger Type: Choose between Analog and Digital
Trigger Edge: Choose between Rising and Falling Edge
Trigger Levels: Enter a percentage of maximum voltage level
Capture Time**:** Enter number of seconds to capture real-time data
Start Capture**:** Click the **Start Capture** button to begin capturing and downloading real-time data to the computer



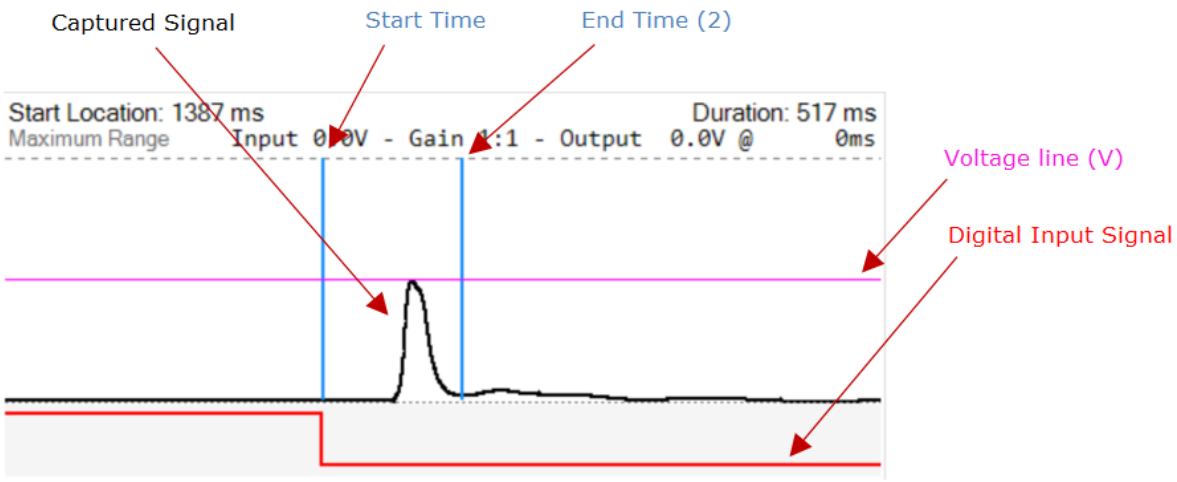
Measurement Parameters

Time Line 1: Sets, in milliseconds, the "Start" Time (1) marker
Time Line 2: Sets, in milliseconds, the "End" Time (2) marker
Delta Time: Shows the difference in milliseconds between Time Line 1 and Time Line 2
Voltage line: Sets the voltage level measurement line
Clear: Click the Clear button to reset voltage and time lines

Log Viewer (continued)

Setting Measurement Markers

1. Zoom into the desired location of the top Sample Waveform chart, which shows the entire captured data signal. To zoom, left-click the mouse down as a starting point and drag the mouse to the left (or right) to select the amount of signal data to zoom – then release the mouse button.
2. The selected portion of the waveform will appear in the bottom chart showing the **Start Location** in milliseconds at the top-left on the chart, and the Duration at the top right on the chart.
3. Hover mouse pointer over the bottom chart to see the cross-hairs marking the timing and voltage intersect; then right-click the mouse over the appropriate location to place the Start and End time markers as well as the Voltage line marker; see below…



Saving Captured Data

Click the disk icon on the SignalCapture main screen to save the captured data to file (up to 30 seconds), select file location, enter a file name. Note format extension is fixed as .pvmcap.xml

The saved data file includes the following general information in addition to the captured data samples:

1. Source file location and date the data was captured
2. Software and hardware release information
3. Device configuration (coupling, polarity, zero method, zero offset, gain setting)
4. Capture settings (trigger type, trigger edge, trigger level, capture level, capture time, actual capture time
5. Measurement settings (time1, time 2, trigger voltage)

Log Viewer (continued)

Open Saved Captured Data

Click the file icon on the SignalCapture main screen open and view a previously saved captured data file, select file location and name and double click to open.

File Export

Export to CSV – Click to select a capture file for exporting to CSV format file. If Microsoft Excel is installed, it will automatically open the file, otherwise the file explorer will open showing the folder location.

Maintenance

This product does not require maintenance or calibration and there are no adjustments with the exception of software selection of Gain and Attenuation.

ICP® Sensors are extremely sensitive devices. If the sensor torque is changed (i.e. transducer removed/re-installed), for certain applications it may be necessary to confirm the scaling in the host monitoring and control system.

Periodic Inspection

✓ Ensure that the cable connections are tight. Inspect the cable connector on the transducer to ensure that it is tight.
✓ Inspect sensor cable for excessive wear and replace as necessary
✓ Avoid shorting sensor fable to ground, or to high voltage circuits
✓ As a precaution, disconnect 24VDC supply power when removing, replacing sensors, cables, etc.
✓ Sensor coax cables can be installed and routed through existing wire-ways with control wiring, but at a distance from high voltage cables (>110VAC)
✓ The signal conditioner should be mounted to a DIN rail in the low voltage area of the cabinet

Troubleshooting

Proper installation of this unit will result in reliable performance. However, if problems occur, following installation or operation, review the following basic checks first:

Basic Checks

✓ Configure polarity correctly for positive or negative output polarity
✓ Configure correctly for AC or DC coupled sensor output
✓ Configure Gain level correctly
✓ Power ON to module – confirm 24VDC Supply LED is ON
✓ Analog output connected properly to hose monitoring system to an unloaded, high impedance 0-10VDC input

Problem 1: Analog Output is too low or non-existent following cycle of machine

Potential Cause & Solution

✓ Confirm all checks listed under "Basic Checks"
✓ Review sensor mounting location. If this is a new application, the sensor may need to be relocated to optimize signal.
✓ Increase the gain level accordingly using the software

Problem 2: No Peak Hold Analog Output

Potential Cause & Solution

✓ Confirm all checks listed under "Basic Checks"

✓ Confirm that the Peak Hold Reset input is OFF when attempting to monitor this input. (The LED on the signal conditioner will confirm this input status).
✓ If necessary, increase the gain using the software (The peak must be at least 500mV to enable the Peak Hold Mode)

Problem 3: Analog output is too high

Potential Cause & Solution
✓ Confirm all checks listed under "Basic Checks"
✓ Reduce output Gain using the software

Problem 4: No variation/sensitivity in Analog Output

Potential Cause & Solution
✓ Confirm all checks listed under "Problem 1"
✓ The Analog output is optimal in the 25-75% range (2.5-7.5 VDC). Re-configure the gain settings accordingly utilizing the software.
✓ Introduce variation to the process (i.e. increase/decrease the force while observing the relative change to output from the signal conditioner to correlate force variation to the 0-10 VDC output from the signal conditioner).

Problem 5: Too much variation in Analog Output

Potential Cause & Solution
✓ Confirm if the process has excessive process variation. "Go to advanced troubleshooting procedures".
✓ Review sensor mounting location as listed in "Problem 1". Determine if the sensor could be detecting mechanical machine or process "noise". Relocate sensor accordingly.
✓ Increase the gain level accordingly using the software

Troubleshooting (continued)

The 410D01 Signal Conditioner is designed for high-speed processes, which are sometimes more difficult to troubleshoot. Problems are often application related and the best approach is to monitor and evaluate these processes with an oscilloscope.

Connect the oscilloscope directly to the 0-10 VDC output from the signal conditioner. When properly set up, a characteristic waveform should be displayed on the scope following each machine cycle. This waveform or "signature" is representative of the force versus time relative to the work performed on the part. Variations to this signature are normal, however, significant variation to the signature can often be correlated to quality defects or process problems.

Contact Information

For product application, technical information, or service, contact:

PCB Piezotronics, Inc.
3425 Walden Avenue, Depew, New York
14043-2495 USA
Toll-free telephone: 800-828-8840 or 716-684-0001
Fax: 716-684-8877
24-Hour Sensor line Sensorline℠ 716-684-0001
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