PCB PIEZOTRONICS
AN AMPHENOL COMPANY

Model 410C01

ICP® sensor signal cond., 35mm DIN-rail mount, peak track hold and waveform analog output, AC/DC coupling, gain, setup configurable via USB or Ethernet communications.

Installation and Operating Manual

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

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24-hour SensorLine: 716-684-0001
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Operating Guide with Enclosed Warranty Information

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Table of Contents

Introduction	**Page 3**
Installation	**Page 3**
Connector and Pinout Diagram	**Page 4**
Typical System Wiring Diagram	**Page 5**
24-Volt DC Supply Power	**Page 5**
Configuration Software	**Page 5**
Waveform Output (±10 V Analog)	**Page 6**
Peak Hold Output (0-10 VDC)	**Page 6**
Peak Reset	**Page 6**
Output Polarity	**Page 6**
AC/DC Coupling	**Page 7**
Gain Selection	**Page 8**
Log Viewer	**Page 8, 9**
Maintenance	**Page 10**
Troubleshooting	**Page 10, 11**
Contact Information	**Page 11**

Introduction

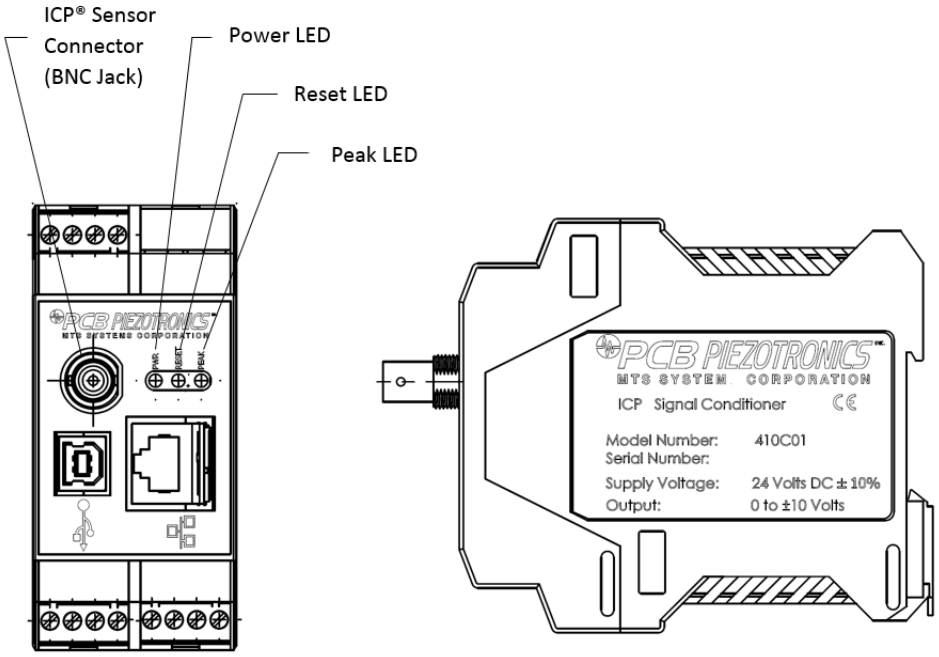
PCB Model 410C01 Series Signal Conditioner is designed to condition and amplify output signals generated by ICP® sensors, such as force and strain sensors and accelerometers. The signals are converted to a ±10 V analog output that is relative to the force, strain, or motion applied to the transducer. The unit is typically integrated with a PLC or data acquisition system for process and/or quality control, however the 410C01 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 buffered from the output of the sensor, 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 value ≤ 50mV 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 410C01 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.



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 410C01 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. Do not exceed a torque of 0.5Nm. 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.

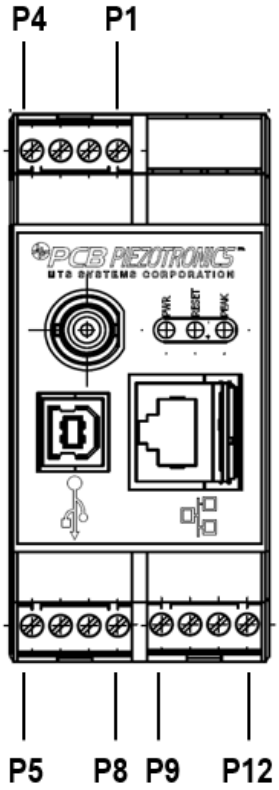
Pin Descriptions:

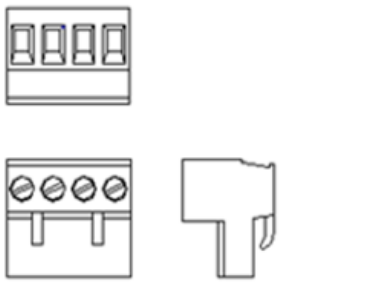
DC Power – Pins 9 to 12:
- **Pin 9** +24 VDC
- **Pin 10** +24 VDC
- **Pin 11** Power Ground
- **Pin 12** Power Ground

Waveform Output – Pins 2 & 3:
- **Pin 2** Waveform Out
- **Pin 3** Analog Ground

Peak Hold Output – Pins 1 & 3
- **Pin 1** Peak Hold Out
- **Pin 3** Analog Ground

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

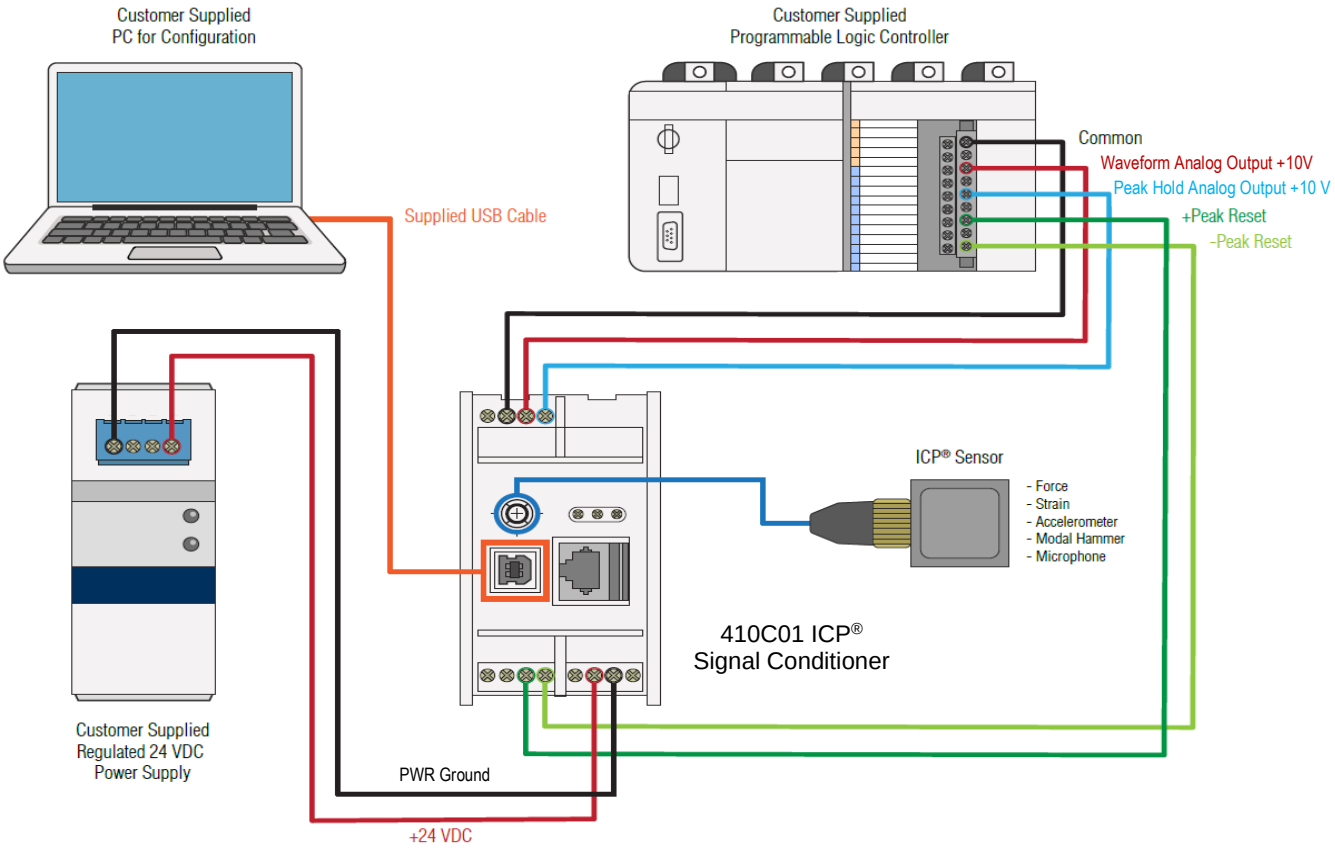




Removable Screw Terminals

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 410C01 requires a regulated 24-volt DC power supply that is capable of providing up to 200 mA of current per unit connected to pins 10 (+) and 11 (-). For best results, it is highly recommend that the power supply have power line filters and low amount of ripple.

Configuration Software

The 410C01 setup and configuration is completely done through use of the PCB SignalCapture software, which is downloadable from www.PCB.com/410C01 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 Track Hold Output (0-10 VDC)

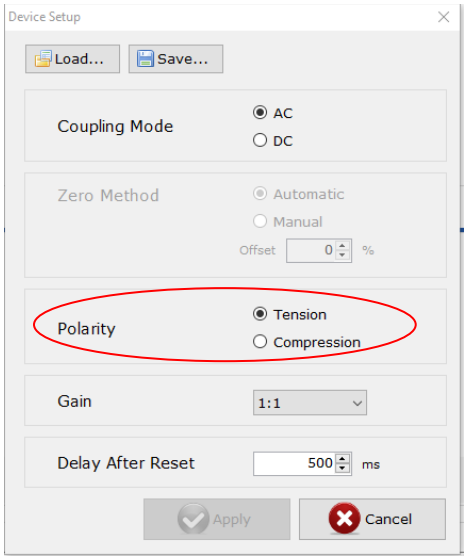
Optionally connect the “Peak Hold” analog output to the host system (ensure polarity is correct for proper operation). The Peak Track Hold output is designed to synchronize with machine cycle times in process monitoring / control applications. This output will continually track the output of an ICP®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

Peak Reset

Reset is necessary if the Peak Hold Output is used. The model 410C01 will hold the analog output indefinitely until there is a Reset, which will reset the output back to a value ≤50mV, 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. 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

The supplied software for the 410C01, allows the end user to optionally configure the 410C01 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.



AC/DC Coupling

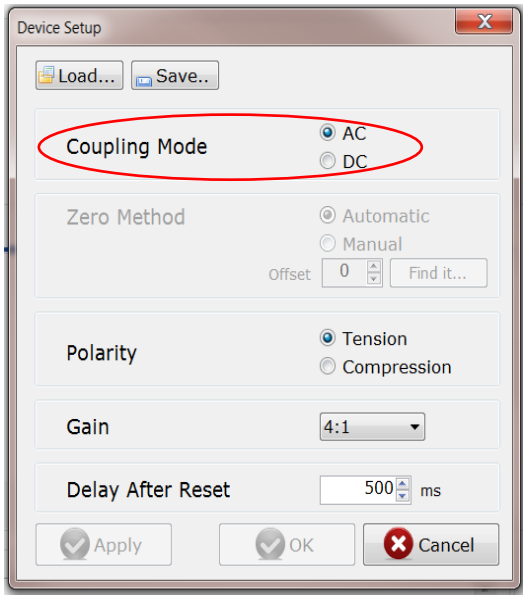
The downloadable software for the 410C01, allows the option to configure unit for AC or DC coupling as seen in the figure shown below. For High-Speed applications, where the signal pulse widths are ≤ 0.01 seconds, configure the unit to AC Coupling. For slower measurement, applications (i.e. long cycle times from 11 to 60 seconds) configure the unit to DC Coupling. Please reference the Help menu 1 in the software when utilizing this function.

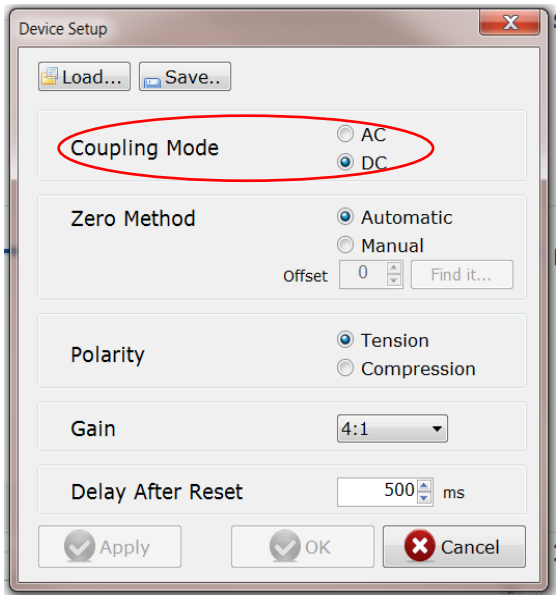
Additional Details:

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 coupling 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 410C01 offers to two options to remove of the sensor bias for zero based measurements. To accomplish, select automatic or manual zero method.

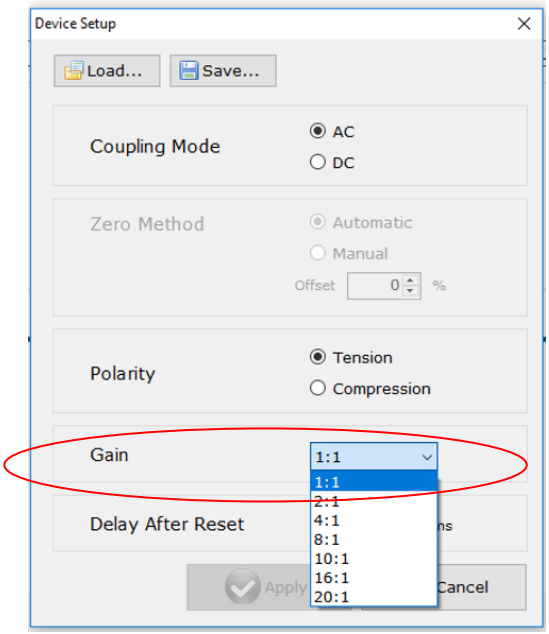
The automatic zero method, normally recommended, nulls the zero within +/- 50 mV. For more precise zero, use the manual method thru use of the “Find it” function in conjunction manual offset control.





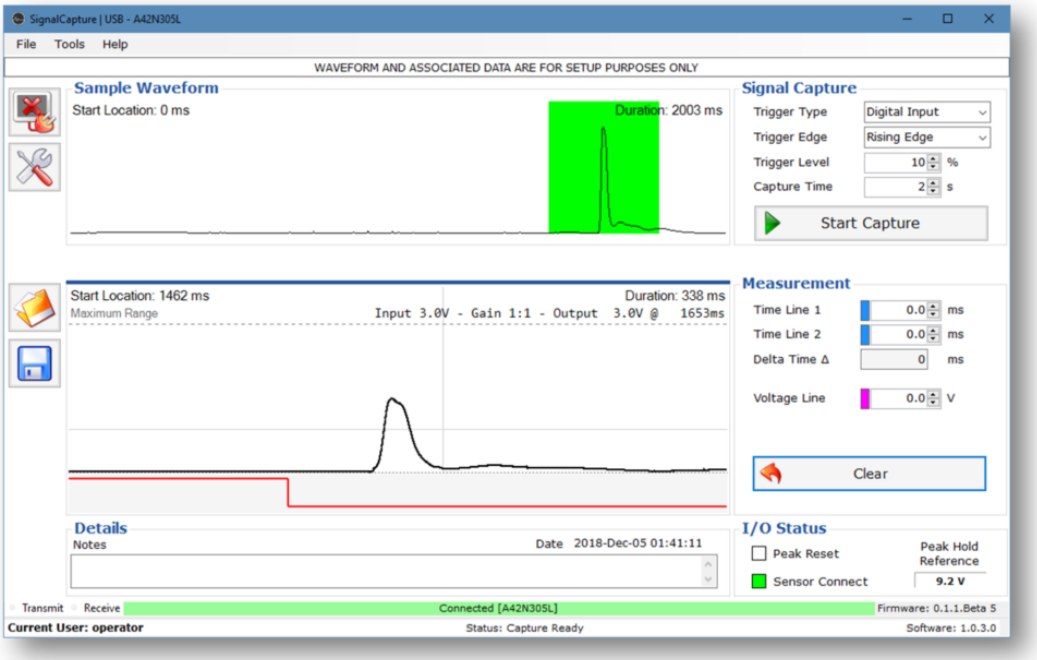
Gain Selections

The supplied software for the 410C01, 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.



Log Viewer (continued)

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

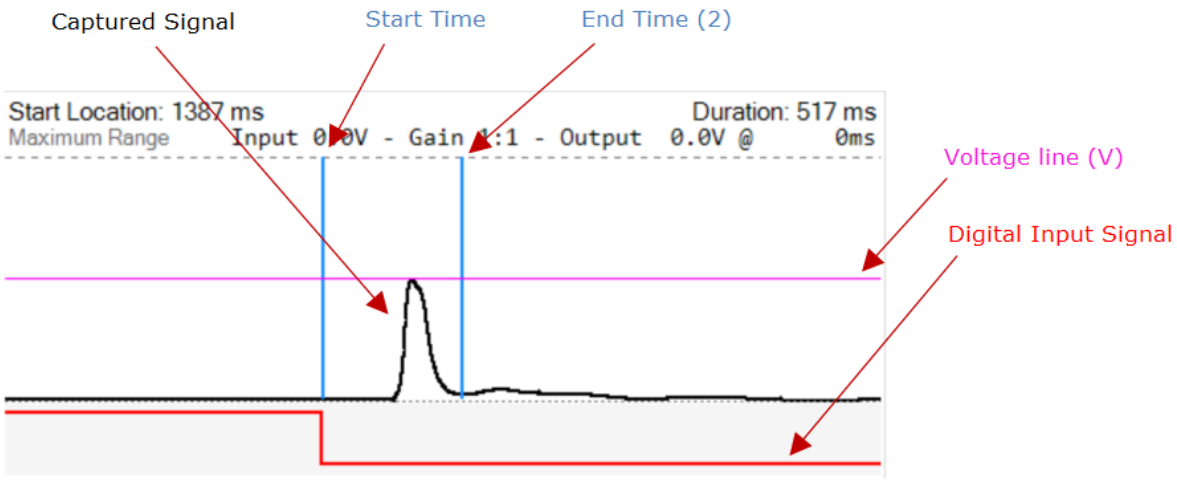
Clear: Click the Clear button to reset voltage and time lines

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…



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).

Troubleshooting (continued)

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

Advanced Troubleshooting Procedure

The 410C01 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
Email: info@pcb.com
Website: www.pcb.com

Model Number 410C01	ICP® SENSOR SIGNAL CONDITIONER WITH PEAK HOLD OUTPUT SIGNAL	Revision: NR ECN #: 49765

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)	0.5 Hz	0.5 Hz	
Low Frequency Response(DC mode)	Governed by Sensor DTC	Governed by Sensor DTC	
High Frequency Response(+/- 5%)	10 kHz	10 kHz	
Control Interface			
Digital Control Interface	USB, Ethernet	USB, Ethernet	
Human Interface	Downloadable Software Configurator	Downloadable Software Configurator	
Display	None	None	
Environmental			
Temperature Range	60 to 110 °F	15 to 45 °C	
Electrical			
DC Power(± 10 %)	24 VDC	24 VDC	
DC Power(Maximum)	200 mA	200 mA	
Excitation Voltage(To Sensor)	20 VDC	20 VDC	[1]
DC Offset(After reset)	≤ 50 mV	≤ 50 mV	
Constant Current Excitation(To Sensor)	4 mA	4 mA	[1]
Discharge Time Constant	1 sec	1 sec	[1]
Broadband Electrical Noise(1 to 10 kHz)(Gain x1)	200 µV rms	200 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(Ethernet)	RJ45	RJ45	
Electrical Connector(Input Reset)	Screw Terminal	Screw Terminal	
Electrical Connector(USB Interface)	Type B	Type B	
Mounting	DIN Rail	DIN Rail	
Size - Height	3.9 in	99 mm	
Size - Width	1.78 in	45.2 mm	
Size - Length	4.46 in	113.3 mm	
Weight	0.46 lb	208 gm	[1]

CE[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: LK	Engineer: gs	Sales: KWW	Approved: BAM	Spec Number:
Date: 07/29/2019	Date: 07/29/2019	Date: 07/29/2019	Date: 07/29/2019	68839

PCB PIEZOTRONICS
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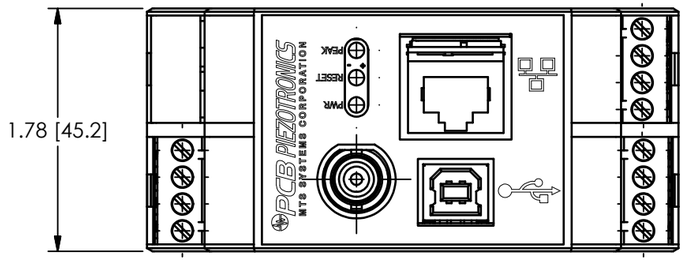
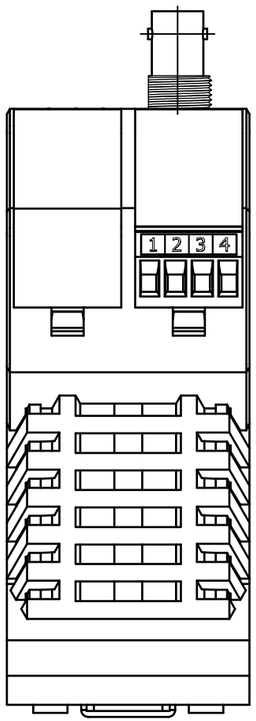
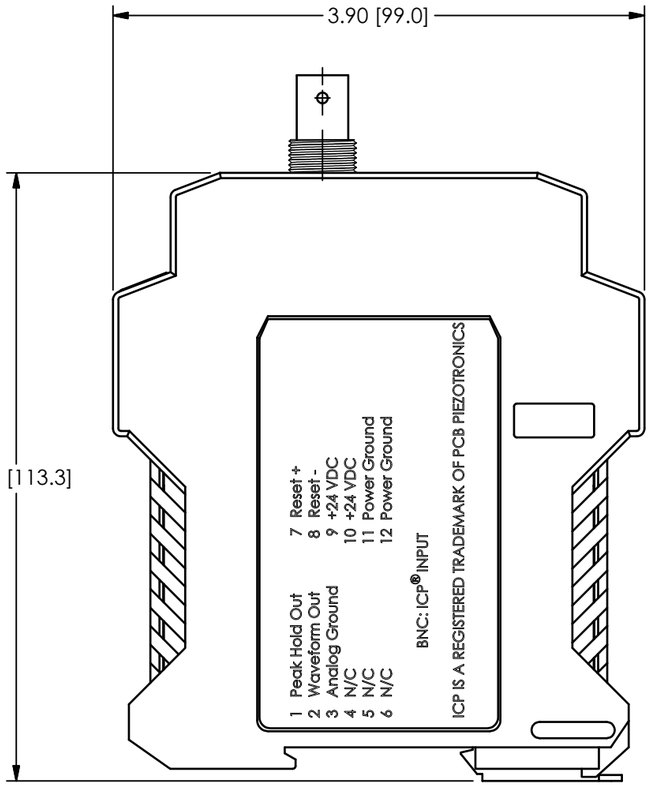
68841

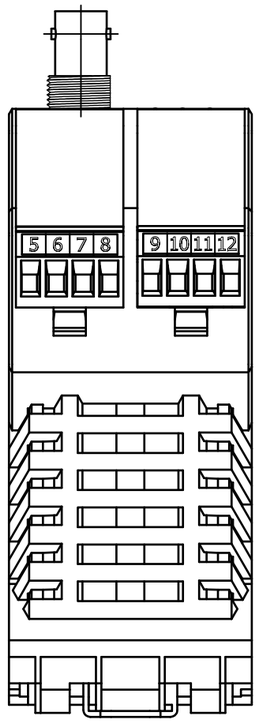
REVISIONS		
REV	DESCRIPTION	DIN
A	UPDATED GND IN TABLE	49884

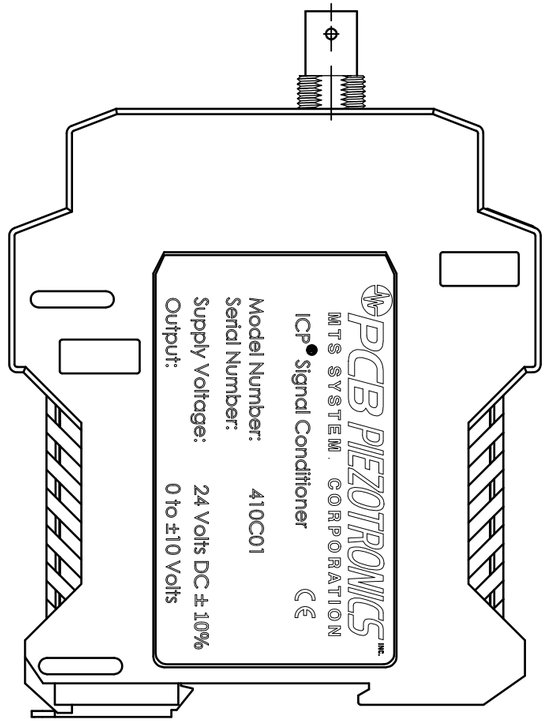


TERMINAL	CONNECTION
1	PEAK HOLD OUT
2	WAVEFORM OUT
3	ANALOG GND
4	N/C
5	N/C
6	N/C
7	RESET (-)
8	RESET (+)
9	+ 24V
10	+ 24V
11	POWER GND
12	POWER GND









UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER		PCB PIEZOTRONICS
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	JES	8/22/19	JDM	8/22/19	GGS	8/22/19	3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13	TITLE OUTLINE DRAWING ICP SENSOR SIGNAL CONDITIONER AC/DC						CODE IDENT. NO. 52681 / DWG. NO. 68841
								SCALE: .9X / SHEET 1 OF 1