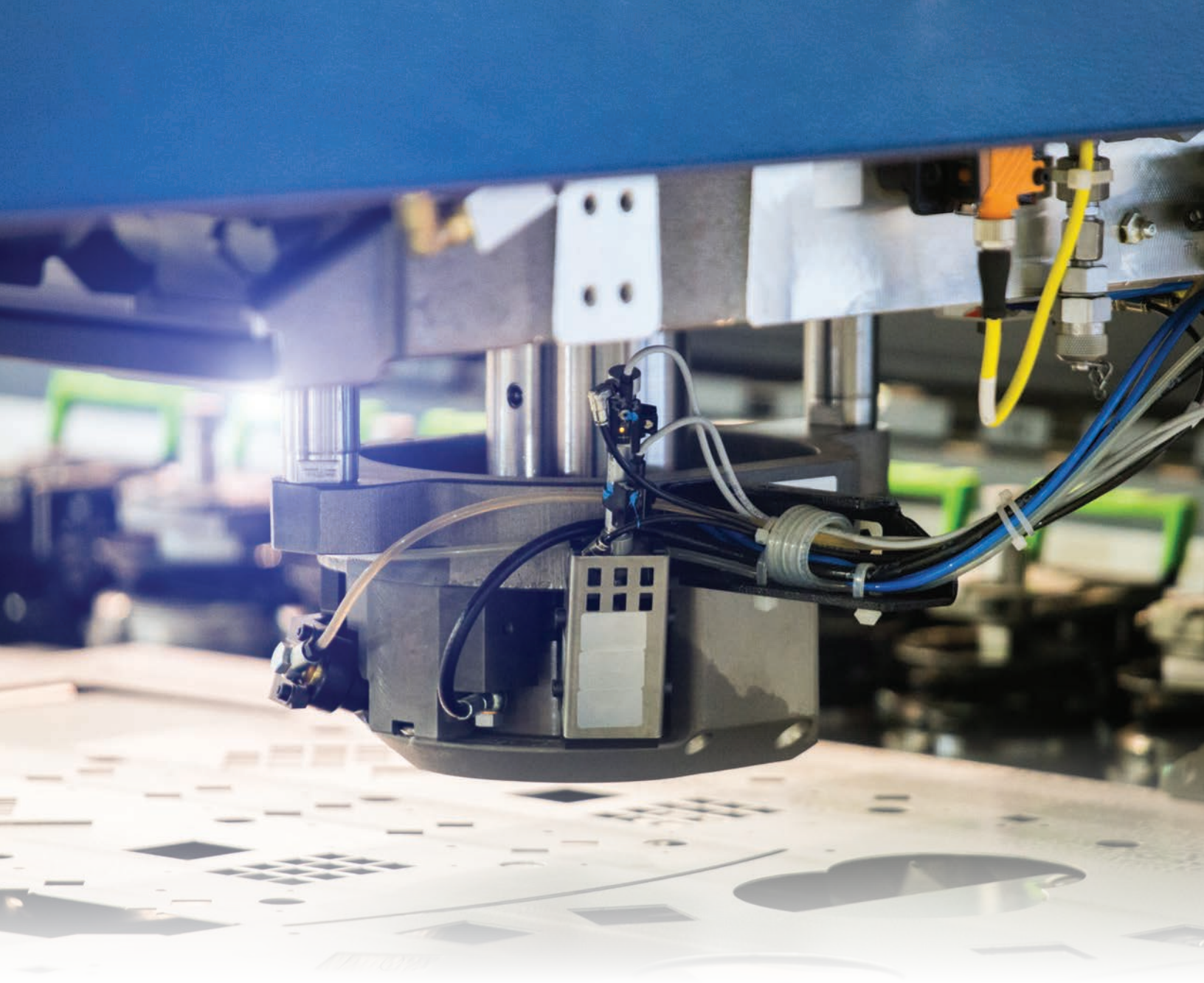

INDUSTRIAL PROCESS CONTROL

PCB PIEZOTRONICS
AN AMPHENOL COMPANY

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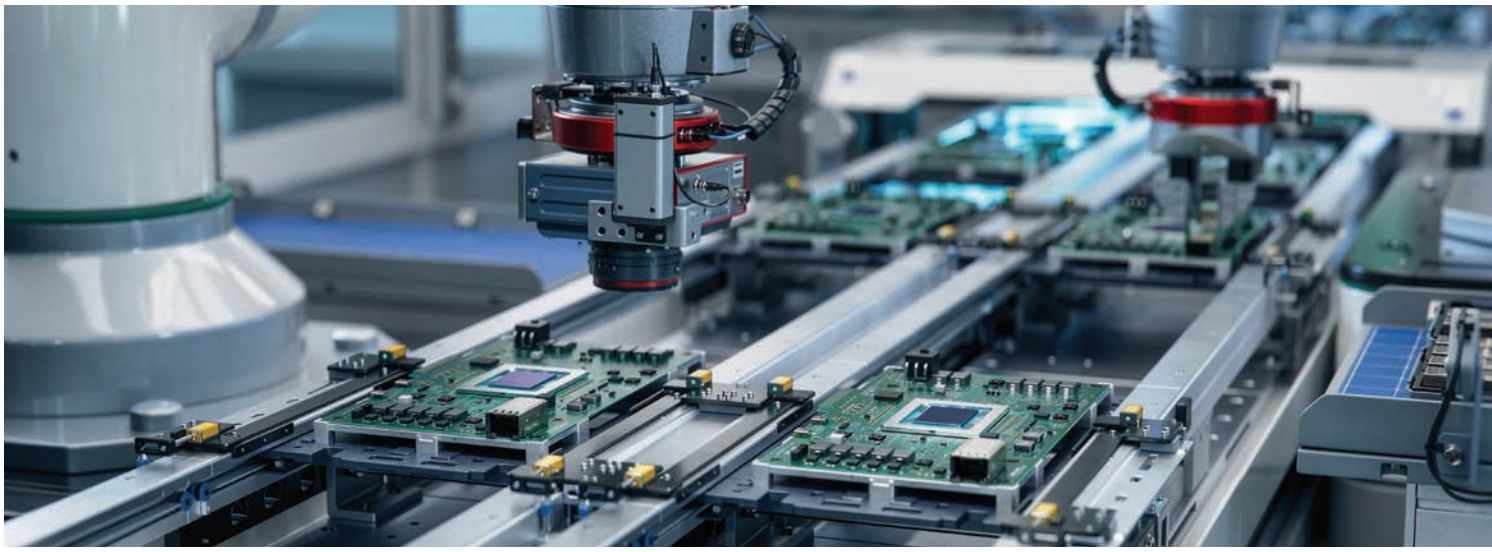


SENSORS AND ELECTRONICS FOR INDUSTRIAL PROCESS CONTROL

As production lines around the globe place increased emphasis on improved throughput and production capacity, the need for real-time monitoring and closed-loop control is more prevalent than ever. PCB Piezotronics' piezoelectric force and strain sensors deliver highly accurate and repeatable measurements that match the fast pace and high stakes of today's manufacturing environments.

PCB's world-class sensors are now available for integration into your smart factory. Through our partnership with Gantner Instruments, PCB's sensors for industrial process control can now be integrated into your digital factory with EtherCAT electronics to allow for simple, streamlined integration. In addition to a free software program for setup and operation, the EtherCAT hardware can be set up and managed with a wide variety of existing software programs.

SENSORS TO MEASURE FORCE

- Quartz ICP® Force Sensors
- Piezoelectric Charge Force Sensors

SENSORS TO MEASURE STRAIN

- ICP® Strain Sensors

DIGITAL ELECTRONICS

- ICP® ETHERCAT Electronics
- Charge ETHERCAT Electronics

ANALOG ELECTRONICS

- ICP® Electronics

COMMON APPLICATIONS:

- Wire cutting and connector crimping monitoring
- Stamping and press monitoring
- Injection molding control
- Spot welding monitoring
- Semiconductor production force monitoring

SENSORS TO MEASURE FORCE

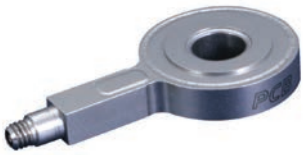
PIEZOELECTRIC ICP® FORCE SENSORS

Quartz ICP® force sensors are ideal for measuring microsecond duration events. The low impedance output and solid-state, hermetic construction make ICP® technology well suited for continuous, unattended force monitoring in harsh factory environments. Cost-per-channel is substantially lower than charge type, since they operate through standard coaxial cables without the need for expensive charge amplifiers.

QUARTZ ICP® FORCE RING

Models 201B01, -02, -03, -04, -05

- Sensitivity:
  Models range from 500 mV/lb (112,405 (mV/kN) to 1 mV/lb (224.8)
- Measurement range:
  Models range from 10 lb (0.0445 kN) to 5,000 lb (22.24 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)



QUARTZ LOW PROFILE ICP® FORCE RING

Model 201B76

- Sensitivity:
  1 mV/lb (224.8 mV/nK)
- Measurement range:
  5,000 lb (22.24 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 202B

- Sensitivity:
  0.50 mV/lb (112.4 mV/kN)
- Measurement range: 10,000 lb
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 203B

- Sensitivity:
  0.35 mV/lb (56.2 mV/kN)
- Measurement range:
  20,000 lb (44.48 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 204C

- Sensitivity:
  0.12 mV/lb (27.0 mV/kN)
- Measurement range:
  40,000 lb (88.96 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 205C

- Sensitivity:
  0.08 mV/lb (18.0 mV/kN)
- Measurement range:
  60,000 lb (266.90 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 206C

- Sensitivity:
  0.06 mV/lb (13.5 mV/kN)
- Measurement range:
  80,000 lb (355.86 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

Model 207C

- Sensitivity:
  0.05 mV/lb (11.2 mV/kN)
- Measurement range:
  10,000 lb (444.80 kN)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

QUARTZ ICP® FORCE RING

209C Series

- Sensitivity:
  2,200 mV/lb (494,604 mV/kN)
- Measurement range:
  2.2 lb (0.00979 kN)
- Size: 0.375 in x 0.610 in
  (9.53 mm x 15.49 mm)
- Weight: 0.28 oz (8 gm)
- Temperature range:
  -65 to +250 °F (-54 to +121 °C)

PIEZOELECTRIC CHARGE OUTPUT SENSORS

Charge output models are available in the same sizes and ranges as our ICP® force sensors for use in higher operating temperatures of up to 400 °F (204 °C). They require the use of external charge amplifiers, which allow users to scale the amplitude of the output signal and reconfigure for specific discharge time constants. Ideal for use over extended force ranges and frequencies, and to measure events with varying pulse widths.

CHARGE OUTPUT FORCE QUARTZ RING

Model 211B

- Sensitivity: (±15%) 18 pC/lb (4,047 pC/kN)
- Measurement range: 5,000 lb (22.24 kN)
- Temperature range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

Model 212B

- Sensitivity: (±15%) 18 pC/lb (4,047 pC/kN)
- Measurement range: 5,000 lb (22.24 kN)
- Temperature range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

Model 213B

- Sensitivity: (±15%) 118 pC/lb (4,047 pC/kN)
- Measurement range: 10,000 lb (44.48 kN)
- Temperature range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

Model 214B

- Sensitivity: (±15%) 18 pC/lb (4,047 pC/kN)
- Measurement range: 20,000 lb (88.96 kN)
- Temperature range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

Model 215B

- Sensitivity: (±15%) 18 pC/lb (4047 pC/kN)
- Measurement range: 60,000 lb (177.92 kN)
- Temperature Range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

Model 216B

- Sensitivity: (±15%) 18 pC/lb (4047 pC/kN)
- Measurement range: 80,000 lb (266.90 kN)
- Temperature Range: -100 to +400 °F (-73 to +204 °C)

CHARGE OUTPUT FORCE QUARTZ RING

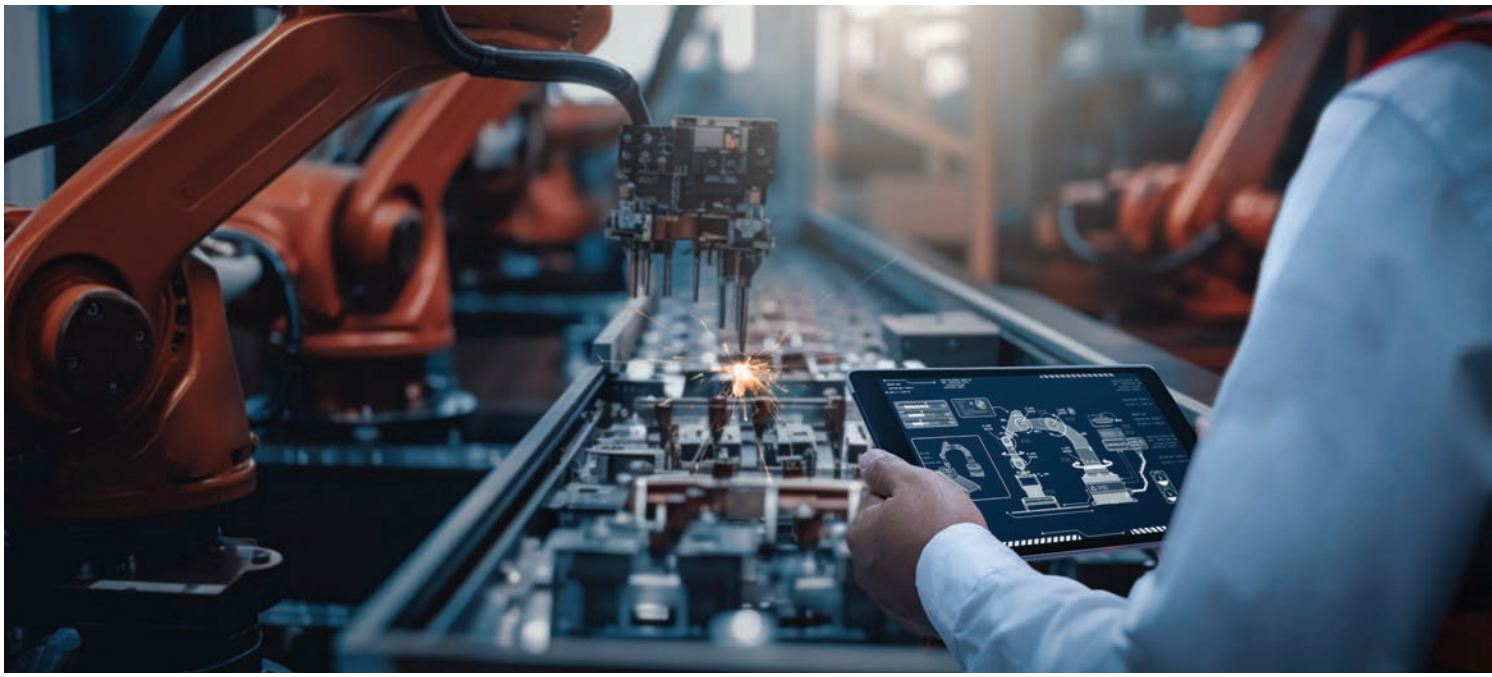
Model 217B

- Sensitivity: (±15%) 17 pC/lb (3822 pC/kN)
- Measurement range: 100,000 lb (488.80 kN)
- Temperature Range: -100 to +400 °F (-73 to +204 °C)

MOLD INJECTOR PIN FORCE SENSOR

Model 219A05

- Sensitivity: 20 pC/lb (4497 pC/kN)
- Measurement range: 560 lb (2.491 kN)
- Temperature Range: -300 to +400 °F (-184 to +204 °C)
- Ideal for measuring injection molding cavity pressure and compression forces



SENSORS TO MEASURE STRAIN

ICP® STRAIN SENSORS

Simple, ready-to-use monitoring systems that use piezoelectric quartz ICP® strain sensors and signal conditioners are ideal for product quality assurance applications that require the measurement of repetitive cycles. ICP® strain sensors feature high stiffness, sensitivity stability, repeatability, high resolution, extremely long life, and robust packaging for harsh industrial environments. Strain sensor signals may be used to protect machinery from excessive forces, trend tool wear, capture process deviations, and document the process to help ensure delivery of high-quality parts with zero defects.

ICP® STRAIN SENSOR

RHM240A01

- Sensitivity: 100 Mv/με
- Measurement range: 50 pk/με
- Temperature range: -65 to +250 °F (-54 to +121 °C)
- RoHS compliant

ICP® STRAIN SENSOR

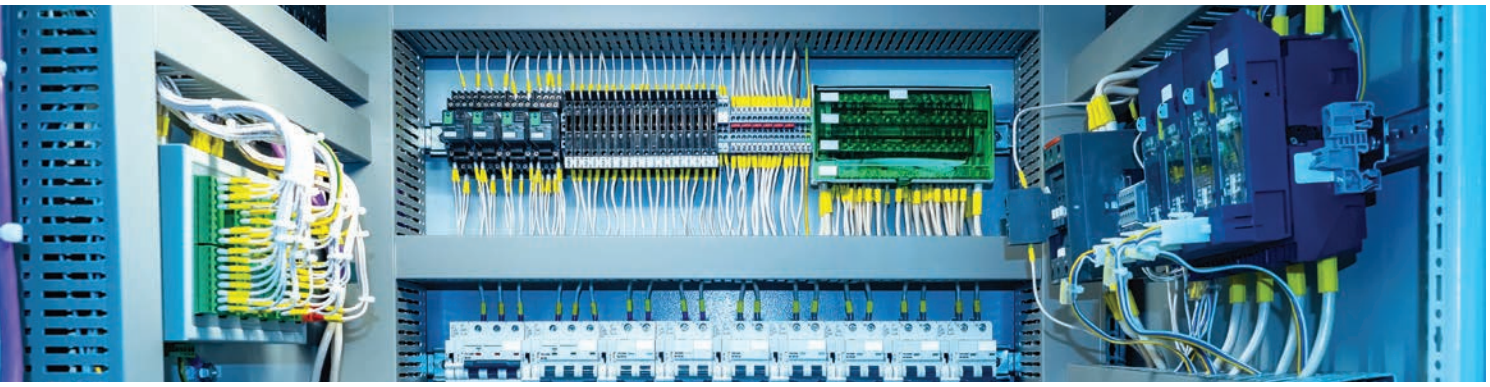
RHM240A02

- Sensitivity: 50 Mv/με
- Measurement range: 100 pk/με
- Temperature range: -65 to +250 °F (-54 to +121 °C)
- RoHS compliant

ICP® STRAIN SENSOR

RHM240A02

- Sensitivity: 10 Mv/με
- Measurement range: 300 pk/με
- Temperature range: -65 to +250 °F (-54 to +121 °C)
- RoHS compliant



ELECTRONICS FOR INDUSTRIAL PROCESS CONTROL

Electronics	XE A111 + Bus Coupler	XE A141 + Bus Coupler	410C01
	Sensor Inputs		
ICP®	X		X
Charge		X	
	Sensor Outputs		
EtherCAT	X	X	
0-10 V			X
	Features		
Peak hold			X
Remote reset	X	X	X
Selectable Gain	X	X	X
AC Coupling for ICP® Sensors	X		X
DC Coupling for ICP® Sensors	X		X
Adjustable high pass filters	X	X	
Adjustable low pass filters	X	X	
Adjustable time constant		X	
Number of channels	1-4	1-4	1

PCB® offers multiple types of signal conditioning for both ICP® and Charge mode sensors. With both analog and digital output options PCB can support a wide range of applications, and offers customization options for unique requirements.

DIGITAL ELECTRONICS

GANTNER INSTRUMENTS ETHERCAT X SERIES

PCB® is proud to partner with Gantner Instruments to offer XE BC Bus Couplers for signal conversion of ICP® sensor or charge modules from analog to EtherCAT. Gantner Instruments' Q.bloxx XE measurement modules possess integrated signal conditioning and arithmetic functions, packaged in modular, DIN Rail mountable enclosures that easily snap together for system expansion, and are capable of measuring up to 100 kHz per channel with short cycle times and low jitter for accurate synchronization.

Gantner offers their GI.Bench Software free to configure and setup the hardware. There is a small one-time license fee to add the capability to transfer EtherCAT setup files.

KEY FEATURES:

- RS-485, 2-wire, EtherCAT (LVDS)
- FoE (file access over EtherCAT, ETG.1000.5) and CoE (CAN over EtherCAT, ETG.50001.1)
- Configurable PDO mapping to optimize the data throughput
- Electromagnetic compatibility according to EN61000-4 and EN55011
- Power supply from 10 VDC to 30 VDC and DIN rail mounting (EN60715)

Q.BLOXX XE A111 BNC MEASUREMENT MODULE FOR ICP® SENSORS

- 4 galvanic-isolated analog input channels for voltages and ICP® sensors
- High-accuracy digitization: 24-bit ADC, 100 kHz sample rate per channel
- Signal conditioning: 16 virtual channels, linearization, digital filter, average, scaling, min/max storage, RMS, arithmetic, alarm
- Configurable input ranges: ±100 mV, ±1 VDC, ±10 VDC
- Galvanic isolation: 500 VDC channel-to-channel, channel-to-power supply, and bank

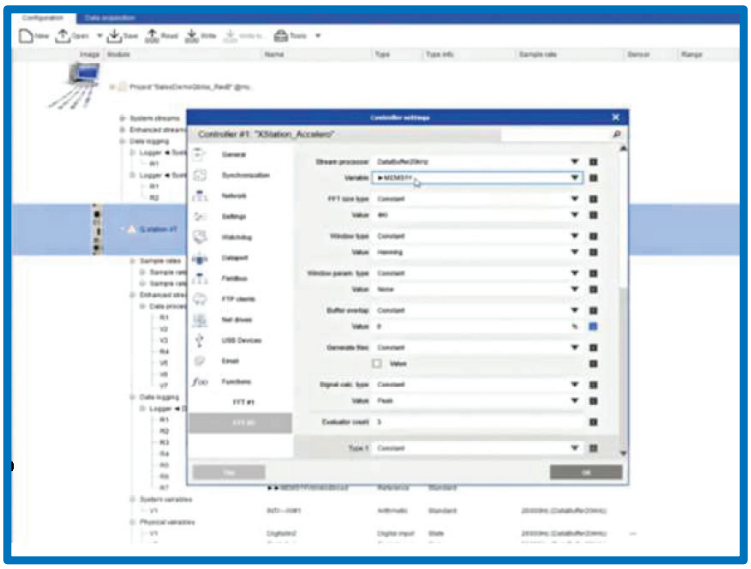
Q.BLOXX XE A141 CHARGE AMPLIFIER MODULE FOR PIEZOELECTRIC SENSORS

- 4-channel charge amplifier for piezoelectric sensors
- High-accuracy digitization: 24-bit ADC 100 kHz sample rate per channel
- Signal conditioning: Linearization, digital filter, average, scaling, min/max storage, arithmetic, alarm
- Measurement ranges from 1000 to 1000000 pC
- Galvanic isolation: 500 VDC channel-to-channel, channel-to-power supply, and channel-to-bus

Q.BLOXX XE BC BUS COUPLER FOR CONNECTION TO ETHERCAT MODULES

- Bus coupler for connection of the modules Q.bloxx EC: Converting of the defined by EtherCAT LVDS (Low Voltage Differential Signal) on standard Ethernet
- Power supply and interface link for up to 10 I/O-modules (up to 80 measuring channels) via the rear industry-standard connectors
- EtherCAT IN/OUT: 2x RJ45 connectors
- USB interface for configuration: Micro USB to configure the Q.bloxx EC measurement and I/O modules using the configuration software GI.bench
- Power supply for the bus coupler and a maximum of 10 connected measurement and I/O modules

10-30 VDC
Power Supply



Gantner GI.Bench Setup Software

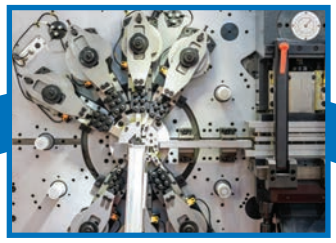
Gantner ICP® / Charge modules + 1 EtherCAT bus coupler

Charge or ICP® Sensors

EtherCAT Master / Gateway

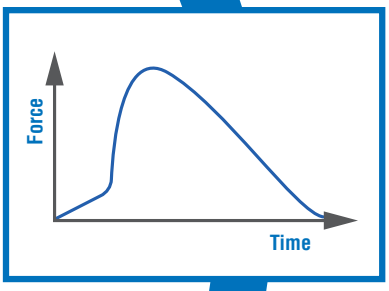
SCADA / HMI / CLOUD

IPC PROCESS



STEP 1

Parts enter machine and process begins

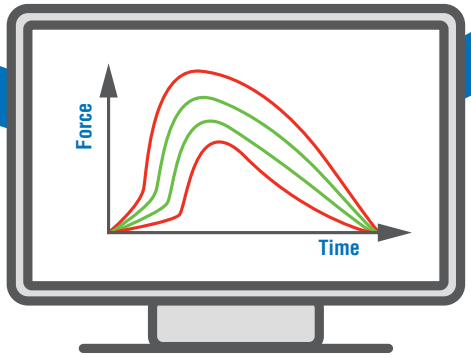


STEP 2

Process begins, sensor captures data, electronics send high speed signal to SCADA / HMI / Control system

STEP 3

SCADA / HMI / Control system reads digital signal and determines if part is good/bad by comparing signal from sensor to deviation of ideal signal and boundary conditions



STEP 4

System ejects parts, resets and restarts at Step 1

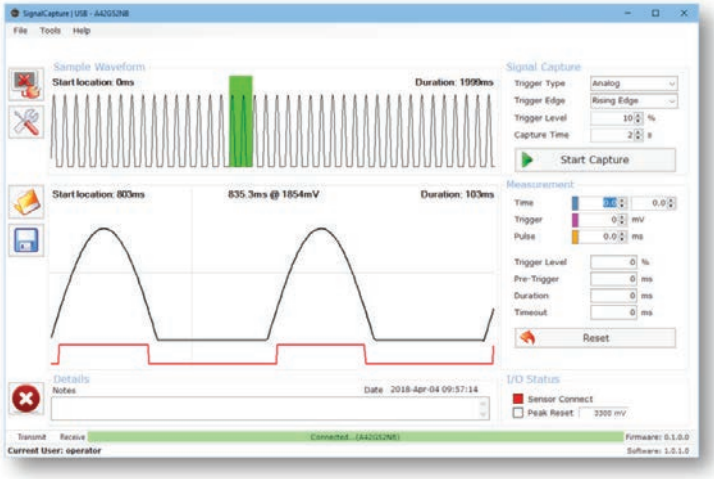
ANALOG ELECTRONICS

PCB PIEZOTRONICS 410C01 ICP®
SIGNAL CONDITIONER WITH REMOTE RESET

Model 410C01 signal conditioner from PCB Piezotronics is designed for operation with ICP® sensors and is ideally suited for monitoring manufacturing processes associated with assembly and product testing. With a choice of AC or DC coupling and a high frequency response, both quasi-static and dynamic measurements up to 10 kHz are possible. The unit synchronizes with machine cycles through a reset feature while analog and peak hold outputs allow for real-time monitoring with machine control devices. Requires a regulated low-noise 24-volt power source for proper operation.

KEY FEATURES:

- Delivers excitation power for ICP® sensors
- Provides peak track hold and waveform analog output signals, 0 to 10 volts
- Offers AC or DC signal coupling and choice of 7 gain settings



SIGNAL CAPTURE SOFTWARE FEATURES:

- Integrated user's guide
- Selectable features include coupling mode, signal polarity, zero, and gain
- Sample waveform data (up to 30 seconds of time) may be saved for future reference
- Indicators for sensor connect and peak reset are provided for reference purposes
- Pulse-width and amplitude measurable with scope tool

PCB PIEZOTRONICS
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