

# PFI-9302 C Series Module

Analog Input/Output Module for Piezoelectric Sensors



- High-performance analog input/output modules for use in any National Instruments™ CompactDAQ™ or CompactRIO™ chassis
- Programmable charge amplifier optimized for piezoelectric sensors
- 2 channels per module
- T-Insertion simulates active sensors
- Tolerant of low shunt resistance associated with high temperature accelerometers
- 4 programmable ranges; up to 10,000 pC FS
- Isolated input mode compatible with grounded accelerometers
- 100 kHz bandwidth
- -40 to 70°C operating range



## Description

Precision Filters, Inc. Model PFI-9302 C Series module provides two channels of charge mode conditioning for piezoelectric sensors. The module outputs may be connected to any cDAQ™ or cRIO™ analog input A/D module to form a high performance vibration measurement system. The low noise, high sensitivity charge input stage combined with programmable gain allows the PFI-9302 to resolve charge signals as low as 0.15 pC while still allowing full scale input charge up to 10,000 pC. The module is fully compatible with National Instruments™ CompactDAQ or CompactRIO C-Series hardware family that features more than 50 measurement modules and several sizes of chassis and carriers for deployment.

The Precision Filters' PFI-9302 has two methods to assist system verification. First, built in "T-Insertion" capability electronically stimulates the attached piezoelectric sensor to output a charge signal. Charge output during T-Insertion is dependent on the exact impedance of the sensor and connecting cable and can be used as a sensor based test signal for true end-to-end system verification. The PFI-9302 also has built in shunt calibration. The NIST traceable measured value of the internal shunt calibration capacitor may be read from non-volatile memory allowing for in-situ NIST traceable calibration of the PFI-9302 and attached data acquisition system.

When measurements are made with grounded sensors, the 9302 ISO mode breaks the ground loops and references the sensed signal to the remote ground. This prevents power line pickup hum usually associated with grounded sensors.

Charge mode accelerometers are often used in harsh environments where the temperature of the test article disallows the use of IEPE type accelerometers. Charge mode accelerometers are available that perform at temperatures as high as 750°C; however, care must be taken when using these sensors.

One common characteristic of high temperature accelerometers is a decreasing resistance across the piezoelectric sensing element at high temperature. This low resistance must be accounted for in the design of the charge amplifier. If a general-purpose charge amplifier is used with high temperature accelerometers, low frequency gain peaking could be as high as 20 to 30 dB. This will cause excessive low frequency noise, gain errors, and in severe cases total saturation of the charge amplifier. The Precision PFI-9302 is compatible with high temperature accelerometers even with shunt resistance as low as 100 kOhm.

## PFI-9302 Applications

- Load, torque, dynamic force, dynamic pressure, shock, vibration and acoustic measurements
- Piezoelectric crash tests
- Ballistics shock testing
- Machine health monitoring
- Structural response tests
- Flight tests
- Wind tunnels
- Ultrasonic transducers

## Specifications

### Type:

Single-ended charge input for grounded or floating sensors

### Input Connectors: BNC

### Maximum Input: 10,000 pC

### Charge Sensitivity:

Four programmable ranges provide 0.5, 1.5, 5, and 15 mV/pC

### Frequency Response:

0.5 Hz to 100 kHz (-3 dB)  
5 Hz to 50 kHz ( $\pm 0.1$  dB)

### Charge Conversion Accuracy: 0.25%

### Shunt Calibration Capacitor:

2,000 pF  $\pm 1\%$  (Calibrated value stored in card EEPROM)

### Noise (100 kHz BW RTI): 0.15 pC + 0.002 pC/nF

### Source Capacitance: <10,000 pF to meet specs

### Source Resistance: >100 k $\Omega$ to meet specs

## Specifications (Continued)

### Ground Signal Level (ISO Mode):

$\pm 3$  V re. chassis ground

### Ground Signal Rejection (ISO Mode)

-50 dB 50 Hz to 1 kHz

### Isolation Resistance (ISO Mode)

10 k $\Omega$  input low to chassis ground

### Analog Filter:

#### Type:

3-pole Butterworth low pass filter (60 dB/Decade)

-3 dB BW: 100 kHz

#### Conformance to Theoretical Response:

$\pm 0.05$  dB, 10 Hz to 50 kHz,

$\pm 0.2$  dB, 50 kHz to 100 kHz

### Test Modes:

**Run:** Normal operating mode

#### Shunt CAL:

Connects front panel Test Input to charge stage through 2,000 pF calibrated capacitor (Measured value stored in EEPROM)

#### T-Insert:

Sensor and cable capacitance stimulated with buffered front panel test input. Stimulus charge =  $V (\text{Test In}/2) * C$  (cable and accelerometer)

### Output:

**Type:** Single-ended

**Level:**  $\pm 5$  Vpk,  $\pm 5$  mApk

**Impedance:** 10  $\Omega$  || 10 pF

**Crosstalk:** -80 dB DC to 50 kHz

### Programming:

There are two methods of controlling the settings of the PFI-9302.

- PFI supplied LabView™ Driver VI to control the module from a LabView project.
- Alternately, stand-alone turnkey signal conditioning systems supplied by Precision Filters can be controlled using PFI executable GUI requiring no software programming. Stand-alone system requires use of NI 9146 4-slot or 9149 8-slot chassis.

### Power:

1 W maximum internal power dissipation

### Physical:

National Instruments cRIO and cDAQ C-Series Compatible

**Charge Input Connector:** 2 ea. BNC Female

**Output Connector:** 2 ea. SMB jack

**Test Bus Connector:** 2 ea. SMB jack. Two connectors are paralleled to facilitate daisy chaining test signal to multiple modules

**Weight:** 6 oz.

### Certifications:

CE, RoHS, Ex European Union Hazardous Locations

#### Safety Standards

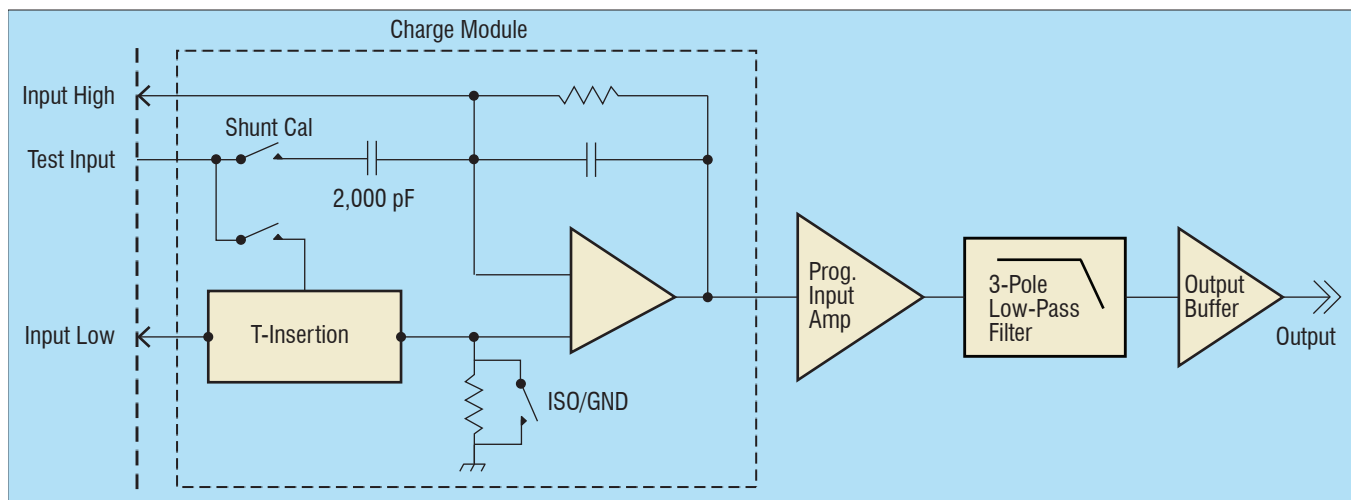
EN 61010-1

#### EMC Standards

EN 61326-1

#### Hazardous Location Standards:

EN 60079-0 & EN 60079-15



PFI-9302 Channel Block Diagram

