Applications

- High performance signal conditioning front end to any NI C-series analog to digital converter
- Static or dynamic strain measurements using a Wheatstone bridge
- Full bridge pressure sensor measurements
- Piezo-resistive accelerometer measurements
- Load cell conditioner
- MEMs accelerometer measurements
- Piezo-resistive microphone measurements

Description

Precision Filters, Inc. Model PFI-9102 C Series module provides two channels of high-performance programmable signal conditioning for bridge type transducers that require constant voltage excitation. 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 module outputs may be connected to a suitable National Instruments C-Series analog input A/D module to form a complete high performance signal measurement system.

The PFI-9102 has a fully programmable bipolar excitation supply with remote sense to compensate for voltage drops in the leads to the bridge. Each channel supports measurements for full or half bridges. The module inputs are compatible with NI 9944/45 completion accessories to support ¼-Bridge 120 or 350 ohm gage completion for single-arm bridge measurements. On-the-fly monitoring of sensor excitation and resistance is supported for real time sensor health indication.

The bridge balance circuit automatically zeros the bridge output or may be operated in a manual control mode to establish an initial bridge output other than 0 V. Shunt calibration may be used as a verification of the bridge and to create a known unbalance to verify bridge span.

A fully programmable distributed gain amplifier is provided for out-of-band noise protection and a precision fixed frequency 100 kHz 3-pole low-pass filter is supplied for alias protection. Via the 9102 test bus, calibration signals may be injected at the module input to verify system performance without disconnecting any signal cables.
Specifications

Input Characteristics:

Type:
- Balanced DC coupled differential input with programmable AC/DC coupling

Input Impedance:
- 10 MΩ || 10 pF per side

Programmable AC Coupling Frequency:
- 0.25 Hz (~3.01 dB)

Max Level:
- ±0.5 Vpk for f ≤ 100 kHz; ±0.5 Vpk x (100 kHz/f) for f >100 kHz

Max Common Mode Level: 5 V

Protection:
- 15 V continuous, 50 Vpk for 1 mS, 10% duty cycle

Noise:
- 13 nV per root Hz at 1 kHz and gain >x100

Drift: 2 μV/°C, RTI

CMRR:
- DC Coupled: 100 dB, DC to 500 Hz; 80 dB 500 Hz to 10 kHz
- AC Coupled: 80 dB 50 Hz to 10 kHz

Sensor MUTE Mode:
- Terminate unused channels or channels with faulty sensors to quietest state

Excitation:

Type: Bipolar (zero centered)

Maximum Output:
- 10 V, 10 mA with remote sense

Steps:
- Programmable from 0 to 10 V in 5 mV steps

Accuracy: ±0.05%; ±500 μV

Noise: 100 μVrms, 3 Hz to 100 kHz

Drift: ±0.0025%/°C of setting or ±50 μV/°C, whichever is greater

Bridge Completion:

Type:
- Programmable full bridge or half bridge completion.

Internal Half Bridge Zero Drift:
- 12.5 ppm/°C of excitation setting

Quarter Bridge Completion:
- ¼-Bridge supported via NI 9944/45 ¼ Bridge
- 120 or 350 ohm completion accessory

Shunt Calibration:
- Precision 100 kΩ, 0.1%, 25 ppm resistor applied across plus and minus shunt pins under program control

Sensor Health Monitor:

Sensor Excitation Monitor:
- Transducer excitation voltage is measured and reported on the fly.

Sensor Resistance Monitor:
- Transducer resistance is measured and reported on the fly.

Sensor Open/Short Monitor:
- Transducer open or short condition is monitored and reported.

Amplifier:

Programmable Gain: x10, 30, 100, 300

DC Accuracy:
- ±0.05%

Temperature Coefficient of DC Gain:
- ±0.001% /°C

DC Linearity:
- 0.01% re: Full-scale, relative to best straight line

Automatic Bridge Balance:

Type:
- Voltage insertion at amplifier input.

Range:
- 51.2 mV per V of excitation

Resolution:
- 1 μV per V RTI,
- Bridge output zeroed to less than 1 mV per V RTO

Analog Filter:

Type:
- Three-Pole Butterworth (60 dB/Decade),
- −3.01 dB at 100 kHz

Conformance to Theoretical Response:
- ±0.05 dB, DC to 50 kHz,
- ±0.2 dB, 50 kHz to 100 kHz
Specifications (Continued)

Test Modes:

Amplifier Short:
A switch at the amplifier input is utilized to ground the input stage for measurement of noise and DC offset.

Test Bus:
A switch at the channel input allows for automated injection of an external calibration signal via front panel SMB connectors. A second SMB connector allows the test bus signal to be daisy chained across multiple modules.

Output:

Type:
Single-ended

Impedance:
10 Ω // 10 pF

Max Output:
±5 Vpk, ±0.5 mApk

DC Offset:
<5 mV after auto adjust at any gain setting

Offset Drift:
2 μV/°C, RTI + 150 μV/°C RTO

Crosstalk:
–90 dB DC to 100 kHz

Noise:
6 μVrms RTI + 80 μVrms RTO

Programming:
There are two methods of controlling the settings of the PFI-9102.

A) PFI supplied LabView™ Driver VI to control the module from a LabView project.

B) 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:
950 mW maximum

Physical:
NI C-Series Compatible

Input Connector:
2 ea. RJ50 (10P10C)

Output Connector:
2 ea. SMB Jack

Test Bus Connector:
2 ea. SMB Jack

Weight:
6 oz.

PFI-9102 Channel Block Diagram
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

Accessories:

Quarter Bridge Completion for PFI-9102 Bridge Conditioner:
120 Ω: National Instruments NI9944
P/N 194738-01 (Qty 4)
350 Ω: National Instruments NI9945
P/N 194739-01 (Qty 4)

Screw Terminal Input Adapter for PFI-9102 Bridge Conditioner:
National Instruments NI9949
P/N 196809-01 (Qty 4)

RJ50 Input Cables for PFI-9102 Bridge Conditioner:
CB-RJ50/RJ50-6: RJ50 to RJ50 shielded cable, 6 feet
CB-RJ50/RJ50-30: RJ50 to RJ50 shielded cable, 30 feet
CB-RJ50/RJ50-Pigtail-6: RJ50 to pigtail, prepped/tinned leads, 6 feet
CB-RJ50/RJ50-Pigtail-30: RJ50 to pigtail, prepped/tinned leads, 30 feet

Module Output Cables:
CB-SMB/BNCM-L: SMB plug to BNC male cable;
L = 0.5, 1, 3, 10 feet
CB-SMB/PIGTAIL-L: SMB plug to prepped/tinned leads for NI screw terminal connections;
L = 0.5, 1, 3, 10 feet
CB-16XSMB/DC37S-L: 16 SMB plug to DC37 sockets for connection to NI 9220; L = 1, 3 feet
CB-SMB/SMB-L: SMB plug to SMB cable for bussing test input; L = 0.5, 1 feet