

# PowerDAQ Signal Conditioning

## Analog Signal Conditioning (5B modules)



### Features

- Isolated input modules for
  - 4–20 mA or 0–20 mA inputs
  - Millivolt inputs
  - Thermocouples
  - RTDs
  - Frequency Inputs
- Output modules for
  - Voltage output
  - 4–20 mA current output
  - 0–20 mA current output
- 1500V RMS continuous isolation
- Connects to any PowerDAQ PD2-MF, PD2-MFS, PD2-AO board
- Connect up to 64 analog input channels using PD-5BCONN
- Connect up to 32 analog output channels using PD-5BCONN
- Supports multiple PowerDAQ boards
- Backplanes available in groups of 4 (PD-5B-04), 8 (PD-5B-08) or 16 (PD-5B-01) channels

### General Description

The PD-5B Series is the industry-standard analog signal conditioning family for PC-based data-acquisition applications. The module family offers a wide variety of analog I/O ranges that interface to the PowerDAQ boards. The 5B Series includes all the options needed for a complete signal-conditioning subsystem including mix-and-match modules, 8- and 16-channel backplanes and power supplies. PowerDAQ high-density analog-input boards can measure up to 64 analog inputs in a non multiplexed configuration. Every module is laser-trimmed to ensure a lifetime of highly accurate measurements without the drawbacks of potentiometers.

The 5B series modules are ideally suited to applications requiring monitoring and control of temperature, pressure, flow, rotation and other analog signals.

Board Model	Configuration
<b>PD2-MF-16-xx</b> 16 analog inputs	PD-CBL-9626, PD-5B-01, PD-PSU-5/15
<b>PD2-MF-64-xx</b> Up to 64 analog inputs	PD-CBL-96, PD-5BCONN, PD-CBL-5B (Qty: Up to 4), PD-5B-01 (Qty: Up to 4), PD-PSU-5/15
<b>PD2-MFS-8-xx</b>	PD-CBL-9626, PD-5B-01, PD-PSU-5/15

Board Model	Configuration
<b>PD2-AO-16/16</b> Up to 16 analog outputs	PD-CBL-9626, PD-5B-01, PD-PSU-5/15
<b>PD2-AO-32/16</b> Up to 32 analog outputs	PD-CBL-96, PD-5BCONN, PD-CBL-5B (Qty: Up to 2), PD-5B-01 (Qty: Up to 2), PD-PSU-5/15

### Technical Specifications

#### PD-5B32 Current-Input Modules – 4-Hz Bandwidth

Part#	Input Range	Output Range
PD-5B32-01	4–20 mA	0–5V
PD-5B32-02	0–20 mA	0–5V

Accuracy	
Initial @ +25°C	±0.05% span ±0.05% $I_z$
Nonlinearity	±0.02% span
Input Offset vs. Temperature	±0.0025 of $I_z/°C$
Output Offset vs. Temperature	±20 $\mu V/°C$
Gain vs. Temperature	±0.0025% of reading/ $°C$

Common-Mode Rejection (CMR)	
1 k $\Omega$ source imbalance, 50/60 Hz	160 dB
Normal mode rejection 50/60 Hz	60 dB
<b>Power Supply Voltage</b>	+5V ±5%
<b>Power Supply Current</b>	30 mA

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### PD-5B30 and PD-5B31 Voltage-Input Modules – 4-Hz Bandwidth

Part#	Input Range	Output Range
PD-5B30-01	±10 mV	±5V
PD-5B30-02	±50 mV	±5V
PD-5B30-03	±100 mV	±5V
PD-5B30-04	±10 mV	0–5V
PD-5B30-05	±50 mV	0–5V
PD-5B30-06	±100 mV	0–5V
PD-5B31-01	±1 V	±5V
PD-5B31-02	±5 V	±5V
PD-5B31-03	±10 V	±5V
PD-5B31-04	±1 V	0–5V
PD-5B31-05	±5 V	0–5V
PD-5B31-06	±10 V	0–5V
PD-5B31-07	±20 V	±5V

Accuracy	PD-5B30	PD-5B31
Initial @ +25°C	±0.05% span ±10 μV RTI ±0.05% (V <sub>2</sub> )	05% Span ±0.2 mV RTI ±0.05% (V <sub>2</sub> )
Nonlinearity	±0.02% Span	
Input Offset vs. Temperature	±1 μV/°C	±20 μV/°C
Output Offset vs. Temperature	±20 μV/°C	
Gain vs. Temperature	±25 ppm of reading/°C	±50 ppm of reading/°C
Input Bias Current	±3 nA	±0.2 nA

Common-Mode Rejection	PD-5B30	PD-5B31
1 kΩ Source Imbalance, 50/60 Hz	160 dB (all ranges)	160 dB (span < ±2V) 150 dB (span = ±10V)
Normal Mode Rejection, 50/60 Hz	60 dB	
Power Supply Voltage	+5V ±5%	
Power Supply Current	30 mA	

### PD-5B39 Current-Output Modules

Part#	Input Range	Output Range
PD-5B39-01	0–5V	4–20 mA
PD-5B39-02	±5V	4–20 mA
PD-5B39-03	0–5V	0–20 mA
PD-5B39-04	±5V	0–20 mA

Common-Mode Rejection (CMR)	
1 kΩ Source Imbalance, 50/60 Hz	90 dB
Power Supply Voltage	+5V ±5%
Power Supply Current	170 mA

Accuracy	
Initial @ +25°C	±0.05% span
Nonlinearity	±0.02% span
Zero vs. Temperature	±0.5 μA/°C
Span vs. Temperature	±0.002% of reading/°C

### PD-5B38 Isolated Strain-Gauge Input Modules

Part#	Input Bridge Type	Bridge Range	Excitation	Sensitivity	Output Range
PD-5B38-02	Full	300Ω to 10 kΩ	+10.0V	3 mV/V	±5V
PD-5B38-04	Half	300Ω to 10 kΩ	+10.0V	3 mV/V	±5V
PD-5B38-05	Full	300Ω to 10 kΩ	+10.0V	2 mV/V	±5V

Accuracy	Full Bridge	Half Bridge
Initial @ +25°C	±0.08% span ±10 μV RTI	±0.08% span ±1 mV RTI
Nonlinearity	±0.02% span	
Input Offset vs. Temperature	±1 μV/°C	
Output Offset vs. Temperature	±40 μV/°C	
Gain vs. Temperature	±25 ppm of reading/°C	
Half Bridge Voltage vs. Temperature	N/A	±15 ppm/°C
Excitation Voltage Output @ Full Load	+10 V ±3 mV	
Load Range	10 kΩ min; 300Ω max	
Load Regulation vs. Temperature	±5 ppm/mA ±15 ppm/°C	
Half Bridge Voltage Level	N/A	+5V ±1 mV
Half Bridge Voltage vs. Temperature	N/A	±15 ppm/°C
Common-Mode Rejection (CMR)	100 dB	
1 kΩ Source Imbalance, 50/60 Hz	100 dB	
Power Supply Voltage	+5V ±5%	
Power Supply Current	200 mA full load; 120 mA no load	

# PowerDAQ Signal Conditioning

## Analog Signal Conditioning (5B modules)

### PD-5B37 Thermocouple Input Modules with Cold-Junction Compensation

Part#	Input Type	Input Range	Output Range
PD-5B37-J-01	Type J	-100°C to +760°C (-148°F to +1400°F)	0–5V
PD-5B37-K-02	Type K	-100°C to +1350°C (-148°F to +2462°F)	0–5V
PD-5B37-T-03	Type T	-100°C to +400°C (-148°F to +752°F)	0–5V
PD-5B37-E-04	Type E	0°C to +900°C (+32°F to +1652°F)	0–5V
PD-5B37-R-05	Type R	0°C to +1750°C (+32°F to +3182°F)	0–5V
PD-5B37-S-05	Type S	0°C to +1750°C (+32°F to +3182°F)	0–5V
PD-5B37-B-06	Type B	0°C to +1800°C (+32°F to +3272°F)	0–5V
PD-5B37-N-08	Type N	0°C to +1300°C (+32°F to +2372°F)	0–5V

Accuracy	
Initial @ +25°C	±0.05% span ±10 $\mu$ V RTI ±0.05% of $V_z$ +CJC sensor error
Nonlinearity	±0.02% span
Input Offset vs. Temperature	±1 $\mu$ V/°C
Output Offset vs. Temperature	±20 $\mu$ V/°C
Gain vs. Temperature	±0.0025% of reading/°C

Cold Junction Compensation	
Initial Accuracy @ +25°C	±0.25°C (±0.75°C max)
Accuracy, +5°C to +45°C	±0.5°C (±0.0125°C/°C)
Normal Mode Rejection 50/60 Hz	60 dB
Common-Mode Rejection (CMR)	
1 k $\Omega$ Source Imbalance, 50/60 Hz	160 dB
<b>Power Supply Voltage</b>	+5V ±5%
<b>Power Supply Current</b>	30 mA

### PD-5B40 and PD-5B41 Wide-Bandwidth Millivolt and Voltage Input Modules

Part#	Input Range	Output Range
PD-5B40-01	±10 mV	±5V
PD-5B40-02	±50 mV	±5V
PD-5B40-03	±100 mV	±5V
PD-5B40-04	±10 mV	0–5V
PD-5B40-05	±50 mV	0–5V
PD-5B40-06	±100 mV	0–5V
PD-5B41-01	±1V	±5V
PD-5B41-02	±5V	±5V
PD-5B41-03	±10V	±5V
PD-5B41-04	±1V	0–5V
PD-5B41-05	±5V	0–5V
PD-5B41-06	±10V	0–5V
PD-5B41-07	±20V	±5V

Accuracy	PD-5B40	PD-5B41
Initial @ +25°C	±0.05% span ±10 $\mu$ V RTI ±0.05% ( $V_z$ )	±0.05% span ±0.05% ( $V_z$ )
Nonlinearity	±0.02% Span	
Input Offset vs. Temperature	±1 $\mu$ V/°C	±20 $\mu$ V/°C
Output Offset vs. Temperature	±40 $\mu$ V/°C	
Gain vs. Temperature	±25 ppm of reading/°C	±50 ppm of reading/°C
Input Bias Current	±3 nA	±0.2 nA
Common-Mode Rejection		
1 k $\Omega$ Source Imbalance, 50/60 Hz	100 dB	90 dB
<b>Power Supply Voltage</b>	+5V ±5%	
<b>Power Supply Current</b>	30 mA	

### PD-5B45 and PD-5B46 Frequency Input Modules

Part#	Input Range	Output Range	Rise/Fall Time	Step Response
PD-5B45-01	0–500 Hz	0–5V	80 ms	150 ms
PD-5B45-02	0–1 kS/s	0–5V	60 ms	140 ms
PD-5B45-03	0–2.5 kS/s	0–5V	50 ms	130 ms
PD-5B45-04	0–5 kS/s	0–5V	50 ms	130 ms
PD-5B45-05	0–10 kS/s	0–5V	50 ms	130 ms
PD-5B46-01	0–25 kS/s	0–5V	15 ms	44 ms
PD-5B46-02	0–50 kS/s	0–5V	7 ms	22 ms
PD-5B46-03	0–100 kS/s	0–5V	4 ms	12 ms
PD-5B46-04	0–250 kS/s	0–5V	4 ms	9 ms

Accuracy	
Initial @ +25°C	±0.05% span (±0.1% span max)
Nonlinearity	±0.005% span (±0.015% span max)
Output Offset vs. Temperature	±20 $\mu$ V/°C
Gain vs. Temperature	±20 ppm/°C

Common-Mode Rejection (CMR)	
1 k $\Omega$ Source Imbalance, 50/60 Hz	120 dB
<b>Power Supply Current</b>	70 mA
<b>Power Supply Sensitivity, RTO</b>	±0.005% of span/% of $V_s$

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## Analog Signal Conditioning (5B modules)

### PD-5B34/35 2-, 3-, or 4-Wire RTD Input Modules

Part#	Input Range	Output Range	Accuracy
PD-5B34-01	100Ω Platinum, $\alpha=0.00385$ -100°C to +100°C (-148°F to +212°F)	0-5V	±0.32°C
PD-5B34-02	0°C to +100°C (+32°F to 212°F)	0-5V	±0.13°C
PD-5B34-03	0°C to +200°C (+32°F to 392°F)	0-5V	±0.26°C
PD-5B34-04	0°C to +600°C (+32°F to 1112°F)	0-5V	±0.78°C
PD-5B34-C-01	10Ω Copper, $\alpha=0.004274$ 0°C to +120°C (10Ω @ 0°C) (+32°F to +248°F)	0-5V	±0.23°C
PD-5B34-C-02	0°C to +120°C (10Ω @ 25°C)(+32°F to +248°F)	0-5V	±0.23°C
PD-5B34-N-01	120Ω Nickel, $\alpha=0.00672$ 0°C to +300°C (+32°F to +572°F)	0-5V	±0.40°C
PD-5B35-01	-100°C to +100°C (-148°F to +212°F)	0-5V	±0.26°C
PD-5B35-02	0°C to +100°C (+32°F to +212°F)	0-5V	±0.13°C
PD-5B35-03	0°C to +200°C (+32°F to +392°F)	0-5V	±0.26°C
PD-5B35-04	0°C to +600°C (+32°F to +1112°F)	0-5V	±0.78°C
PD-5B35-05	-100°C to +200°C (-148°F to +392°F)	0-5V	±0.60°C
PD-5B35-C-01	0°C to +120°C (10Ω @ 0°C) (+32°F to +248°F)	0-5V	±0.23°C
PD-5B35-C-02	0°C to +120°C (10Ω @ 25°C)(+32°F to +248°F)	0-5V	±0.23°C

Accuracy	
Initial @ +25°C	±0.05% span ±0.04Ω ±0.05 (R <sub>2</sub> )
Conformity Error <sub>3</sub>	±0.05% span
Input Offset vs. Temperature	±0.02°C/°C
Output Offset vs. Temperature	±20 μV/°C
Gain vs. Temperature	±0.005% of reading/°C

Sensor Excitation Current	
100Ω Pt, 120Ω Ni	0.25 mA
10Ω Cu	1.0 mA
Normal Mode Rejection 50/60 Hz	60 dB
Common-Mode Rejection (CMR)	
1 kΩ Source Imbalance, 50/60 Hz	160 dB
<b>Power Supply Voltage</b>	+5V ±5%
<b>Power Supply Current</b>	30 mA

### PD-5B47 Linearized Thermocouple Input Modules with Cold Junction Compensation

Part#	Input Type	Input Range	Output Range	Accuracy
PD-5B47-J-01	Type J	0°C to +760°C (+32°F to +1400°F)	0-5V	±1.1°C
PD-5B47-J-02	Type J	-100°C to +300°C (-148°F to +572°F)	0-5V	±0.5°C
PD-5B47-J-03	Type J	0°C to +500°C (+32°F to +932°F)	0-5V	±0.6°C
PD-5B47-K-04	Type K	0°C to +1000°C (+32°F to +1832°F)	0-5V	±1.3°C
PD-5B47-K-05	Type K	0°C to +500°C (+32°F to +932°F)	0-5V	±0.6°C
PD-5B47-T-06	Type T	-100°C to +400°C (-148°F to +752°F)	0-5V	±1.4°C
PD-5B47-T-07	Type T	0°C to +200°C (+32°F to +392°F)	0-5V	±0.5°C
PD-5B47-E-08	Type E	0°C to +1000°C (+32°F to +1832°F)	0-5V	±1.7°C
PD-5B47-R-09	Type R	+500°C to +1750°C (+932°F to +3182°F)	0-5V	±2.5°C
PD-5B47-S-10	Type S	+500°C to +1750°C (+932°F to +3182°F)	0-5V	±2.4°C
PD-5B47-B-11	Type B	+500°C to +1800°C (+932°F to +3272°F)	0-5V	±5.1°C

Accuracy	
Initial @ +25°C	See model table
Input Offset vs. Temperature <sub>2</sub>	±1 μV/°C
Output Offset vs. Temperature	±20 μV/°C
Gain vs. Temperature	±0.0025% of reading/°C

Cold Junction Compensation	
Initial Accuracy @ +25°C <sub>3</sub>	±0.25°C (±0.75°C max)
Accuracy, +5°C to +45°C	±0.5°C (±0.0125°C/°C)
Common-Mode Rejection (CMR)	
1 kΩ Source Imbalance, 50/60 Hz	160 dB
<b>Power Supply Voltage</b>	+5V ±5%
<b>Power Supply Current</b>	30 mA