



Technologies/Applications

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7B37 Isolated, Thermocouple Input

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Functional Description

The 7B37 is a single-channel signal conditioning module that interfaces, amplifies and filters input voltages from a J, K, T, E, R, S or B-type thermocouple and provides an isolated and protected precision output of either +1 V to +5 V or 0 V to +10 V, linear with input voltage. High accuracy internal cold junction compensation and a predictable upscale open circuit indication provide a complete signal conditioning solution. To accurately measure low level signals in electrically noisy environments, 1500 V rms of galvanic transformer-based isolation with a common mode rejection (CMR) of 160 dB @ 50/60 Hz and a normal mode rejection (NMR) of 60 dB @ 50/60 Hz are provided. Rated to operate with a nominal +24 V DC supply, Model 7B37 is mix-and-match and hot-swappable with other 7B Series input modules, so it can be inserted or removed from any socket in the same [backplane](#) without disturbing system power.



Inside the 7B37 Series Module

The three input pins of Model 7B37 are fully protected up to 120 V rms line voltages. A one-pole 3 Hz filter preconditions the thermocouple signal prior to amplification, provided by a low drift input amplifier. Cold junction compensation (CJC) is implemented using a thermistor temperature sensor embedded under the input screw terminal block on a 7B Series backplane. A voltage reference source acts to offset the thermocouple signal in accordance with the specified lower bound on the input temperature range. A current source provides the upscale open circuit indication. Amplitude modulation is used to implement transformer isolation (1500 V rms input-to-output and power). Isolated front-end circuitry power is supplied by a DC/DC converter. The output section contains a demodulator, a two-pole low pass filter (-3 dB @ 3Hz), a buffer amplifier and a power oscillator. The two-pole output filter and

subsequent buffer ensures that a low noise, low impedance ($<1 \Omega$) signal is available at the output to drive loads to $2 \text{ k}\Omega$ minimum.

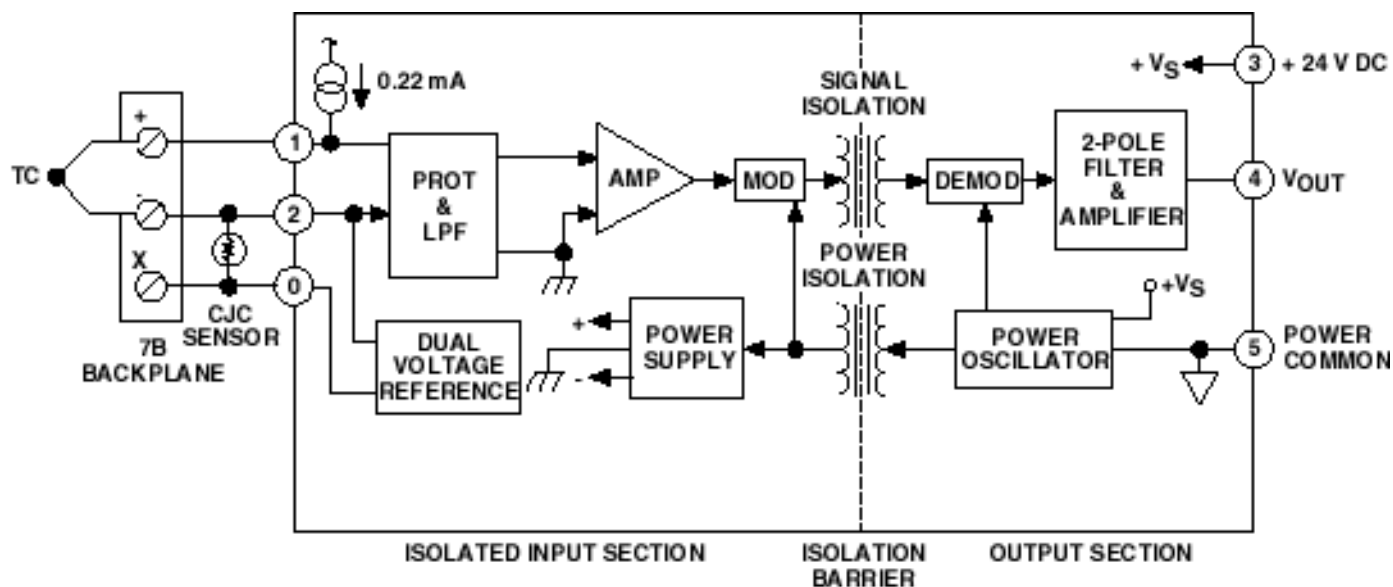


Figure 1. 7B37 Functional Block Diagram

Inputs

- Thermocouples J, K, T, E, R, S, B

Output Options

- +1 V to +5 V
- 0 V to +10 V

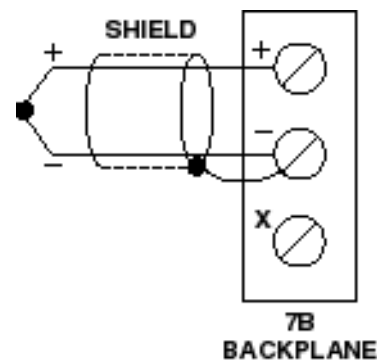


Figure 2. 7B37 Input Field Connections

7B37 Models Available

Model	Input Type	Input Range	Output Range
7B37-J-01-1	Type J	-100°C to +100°C (-148°F to +1400°F)	+1 V to +5 V
7B37-J-01-2	Type J	-100°C to +100°C (-148°F to +1400°F)	0 V to +10 V
7B37-J-10-1	Type J	0°C to +200°C (+32°F to +392°F)	+1 V to +5 V
7B37-J-10-2	Type J	0°C to +200°C (+32°F to +392°F)	0 V to +10 V
7B37-J-11-1	Type J	0°C to +400°C (+32°F to +752°F)	+1 V to +5 V
7B37-J-11-2	Type J	0°C to +400°C (+32°F to +752°F)	0 V to +10 V
7B37-J-12-1	Type J	0°C to +600°C (+32°F to +1112°F)	+1 V to +5 V

7B37-J-12-2	Type J	0°C to +600°C (+32°F to +1112°F)	0 V to +10 V
7B37-J-13-1	Type J	+300°C to +600°C (+572°F to +1112°F)	+1 V to +5 V
7B37-J-13-2	Type J	+300°C to +600°C (+572°F to +1112°F)	0 V to +10 V
7B37-K-02-1	Type K	-100°C to +1350°C (-148°F to +2462°F)	+1 V to +5 V
7B37-K-02-2	Type K	-100°C to +1350°C (-148°F to +2462°F)	0 V to +10 V
7B37-K-20-1	Type K	0°C to +300°C (+32°F to +572°F)	+1 V to +5 V
7B37-K-20-2	Type K	0°C to +300°C (+32°F to +572°F)	0 V to +10 V
7B37-K-21-1	Type K	0°C to +600°C (+32°F to +1112°F)	+1 V to +5 V
7B37-K-21-2	Type K	0°C to +600°C (+32°F to +1112°F)	0 V to +10 V
7B37-K-22-1	Type K	0°C to +1200°C (+32°F to +2192°F)	+1 V to +5 V
7B37-K-22-2	Type K	0°C to +1200°C (+32°F to +2192°F)	0 V to +10 V
7B37-K-23-1	Type K	+600°C to +1200°C (-148°F to +1400°F)	+1 V to +5 V
7B37-K-23-2	Type K	+600°C to +1200°C (-148°F to +1400°F)	0 V to +10 V
7B37-T-03-1	Type T	-100°C to +400°C (-148°F to +752°F)	+1 V to +5 V
7B37-T-03-1	Type T	-100°C to +400°C (-148°F to +752°F)	0 V to +10 V
7B37-E-04-1	Type E	0°C to +900°C (+32°F to +1652°F)	+1 V to +5 V
7B37-E-04-2	Type E	0°C to +900°C (+32°F to +1652°F)	0 V to +10 V
7B37-R-05-1	Type R	0°C to +1750°C (+32°F to +3182°F)	+1 V to +5 V
7B37-R-05-2	Type R	0°C to +1750°C (+32°F to +3182°F)	0 V to +10 V
7B37-S-06-1	Type S	0°C to +1750°C (+32°F to +3182°F)	+1 V to +5 V
7B37-S-06-2	Type S	0°C to +1750°C (+32°F to +3182°F)	0 V to +10 V
7B37-B-07-1	Type B	0°C to +1800°C (+32°F to +3272°F)	+1 V to +5 V
7B37-B-07-2	Type B	0°C to +1800°C (+32°F to +3272°F)	0 V to +10 V

7B37 Specifications

(typical @ +23°C ±5°C and $V_s = +24$ V dc)

Description	Model 7B37
Input Ranges	
Thermocouple Types	J, K, T, E, R, S, B
Standard Temperature Ranges	Refer to Model Table
Custom Ranges	Not Available*
Output Range Options ($R_L > 2$ kΩ)	+1 V to +5 V or 0 V to +10 V
Accuracy¹	
Initial @ +25°C	±0.01% Span (±0.1% Span, maximum)
Nonlinearity ²	±0.02% Span, maximum
Input Offset vs. Temperature	±0.5 μ V/°C
Zero Suppression vs. Temperature	±0.005% (V_z) ³ /°C

Span vs. Temperature	± 35 ppm/ $^{\circ}\text{C}$
Output Offset vs. Temperature	$\pm 0.002\%$ Span/ $^{\circ}\text{C}$
Cold Junction Compensation	
Accuracy ⁴ , over $+5^{\circ}\text{C}$ to $+45^{\circ}\text{C}$ ambient	$\pm 1.0^{\circ}\text{C}$
Input Bias Current	$+25$ nA
Input Resistance	
Power ON	$10\text{ M}\Omega$
Power OFF	$30\text{ k}\Omega$, minimum
Output Noise	
5 MHz Bandwidth	6 mV peak
10 Hz to 100 kHz Bandwidth	0.4 mV rms
0.1 Hz to 10 Hz Bandwidth	0.6 μV peak
Bandwidth, -3 dB	3 Hz
Output Rise Time, 10% to 90% Span	150 ms
Common-Mode Voltage (CMV)	
Input-to-Output and Power	1500 V rms, continuous
Common Mode Rejection (CMR)	
Input-to-Output and Power @ 50/60 Hz	160 dB
Normal Mode Rejection @ 50/60 Hz	60 dB
Input Protection	120 V rms, continuous ± 35 V dc, continuous
Input Transient Protection	ANSI/IEEE C376.90.1-1989 IEEE-STD 472 IEC 255-4, Class II
Output Resistance	$< 1\ \Omega$
Voltage Output Protection	Continuous Short to Ground
Power Supply	
Voltage Range, Operating	+14 V dc to +35 V dc
Current	+25 mA, maximum
Sensitivity	$\pm 0.0001\%$ /% of V_s
Mechanical Dimensions	1.663" x 2.11" x 0.563" (42.24 mm x 53.6 mm x 14.3 mm)
Weight	60 grams
Environmental	
Temperature Range	

Operating	-40°C to +85°C
Storage	-40°C to +85°C
Relative Humidity, 24 hours	0 to 90% @ +60°C noncondensing
ESD Sensitivity	IEC 801-2, Level 2
RFI Susceptibility	±0.5% Span error @ 400 MHz, 5 Watt, 3 ft

Warm-up time required to meet specifications is approximately 10 minutes.

* Contact factory for OEM requirements.

¹Includes the combined effects of repeatability, hysteresis, and nonlinearity.

²Nonlinearity is calculated using best-fit straight line method.

³V_z is the nominal input voltage that results in a 0 V output.

⁴ When used with the CJC temperature sensor provided on each channel of 7B Series [backplanes](#).

Specifications subject to change without notice.

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