

5B37 Isolated Thermocouple Input

Functional Description

The 5B37 is a single-channel signal conditioning module that interfaces, amplifies and filters J, K, T, E, R, S, B, N, and C-type thermocouple and provides an isolated and protected precision output of 0 to +5 V.

Accurate and System-Ready

Internal cold-junction compensation largely corrects errors arising from parasitic thermocouples formed by thermocouple connection to the input screw terminals, providing an accuracy of $\pm 0.25^\circ\text{C}$ @ $+25^\circ\text{C}$ ambient temperature. The module generates a predictable upscale signal to indicate an open thermocouple; for a downscale response, connect a $47\text{ M}\Omega$, 0.25 W resistor across screw terminals 1 and 3.

The 5B37 protects the computer side from damage due to field-side overvoltage faults. All models withstand 240 V rms at their input terminals without damage, thereby shielding computer-side circuitry from field-side overvoltage conditions. Further, the 5B37 is mix-and-match and hot-swappable with other 5B Series modules, so can be inserted or removed from any socket in the same backplane without disrupting system power.



Inside the 5B37 Module

A chopper-stabilized input amplifier provides low drift and stable gain. At the amplifier input, a stable, laser-trimmed zero-scale input voltage is subtracted from the input signal to set the zero-scale value. For user convenience, the zero can be optionally factory-set to meet custom needs. This allows suppression of a zero-scale input value many times larger than the total span for precise expanded-scale measurements.

Internal multi-pole lowpass filtering with a four-Hz cutoff (-3 dB) provides 60 dB of normal-mode rejection (noise on signal) and enhancement of common-mode rejection (noise on signal return) at 60 Hz , enabling accurate measurement of small signals in high electrical noise.

Signal isolation by transformer coupling uses a proprietary modulation technique for linear, stable and reliable performance. The differential input circuit on the field side is fully floating, eliminating the need for any input grounding. A demodulator on the computer side of the signal transformer recovers the original signal, which is then filtered and buffered to provide a low-noise, low-impedance output signal. The output common must be kept within 3 V of power common.

Convenience Features

A series output switch eliminates the need for external multiplexing in many applications. The switch is turned on by an active-low enable input. The enable input should be grounded to power common if the output need not be switched, as on the 5B01 and 5B08 backplanes.

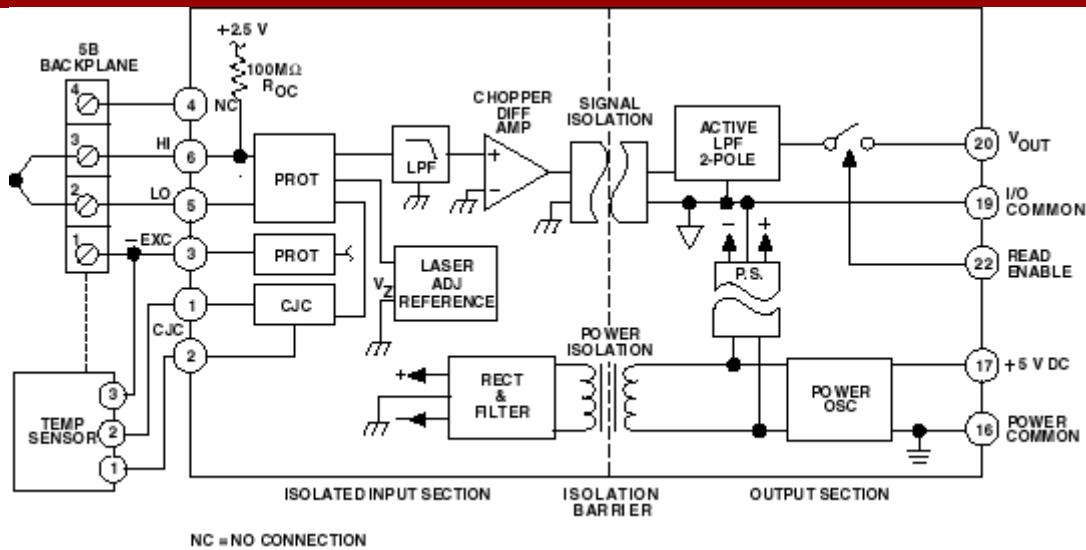


Figure 1. 5B37 Functional Block Diagram

Input Types

Thermocouple Types :
J, K, T, E, R, S, B, N, C

Output Range

0 to +5 V
(-5 V to +5 V - custom)

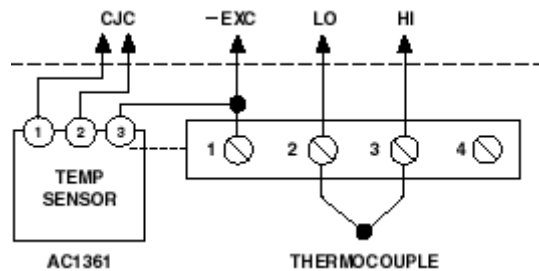


Figure 2. 5B37 Input Field Connections

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

* Custom Input/Output ranges are available. Refer to configuration guide.

5B37 Specifications

(typical @ +25°C and $V_s = +5$ V dc)

Description	Model 5B37
Input Ranges	
Standard Ranges	Refer to Model Table
Custom Ranges	± 5 mV to ± 500 mV
Output Range ($R_L > 50$ kΩ)⁴	-5 V to +5 V or 0 to +5 V
Accuracy²	
Initial @ +25°C	$\pm 0.05\%$ Span ± 10 μ V RTI $\pm 0.05\%$ of V_z^1 +CJC Sensor Error
Nonlinearity	$\pm 0.02\%$ Span
Input Offset vs. Temperature	± 1 μ V/°C
Output Offset vs. Temperature	± 20 μ V/°C
Gain vs. Temperature	$\pm 0.0025\%$ of Reading/°C
Cold Junction Compensation	
Initial Accuracy @ +25°C ³	$\pm 0.25^\circ$ C ($\pm 0.75^\circ$ C, maximum)
Accuracy, +5°C to +45°C	$\pm 0.5^\circ$ C ($\pm 0.0125^\circ$ C/°C)
Input Bias Current	-25 nA
Input Resistance	
Power On	5 M Ω
Power Off	40 k Ω
Overload	40 k Ω
Noise	
Input, 0.1 Hz to 10 Hz Bandwidth	0.2 μ V rms
Output, 100 kHz Bandwidth	200 μ V rms
Bandwidth, -3 dB	4 Hz
Output Rise Time, 10% to 90% Span	200 ms
Common-Mode Voltage (CMV)⁴	
Input-to-Output, Continuous	1500 V rms, maximum
Output-to-Power, Continuous	± 3 V, maximum
Transient	ANSI/IEEE C37.90.1-1989
Common Mode Rejection (CMR)	
1 k Ω Source Imbalance, 50/60 Hz	160 dB
Normal Mode Rejection (NMR), 50/60 Hz	60 dB
Input Protection	
Continuous	240 V rms, maximum
Transient	ANSI/IEEE C37.90.1-1989
Output Resistance	50 Ω
Voltage Output Protection	Continuous Short to Ground
Output Selection Time	6 μ s @ $C_{load} = 0$ to 2,000 Pf

Output Enable Control	
Max Logic "0"	+1 V
Min Logic "1"	+2.5 V
Max Logic "1"	+36 V
Input Current "0"	0.4 mA
Open Input Response	Upscale
Open Input Response Time	10 seconds
Power Supply Voltage	+5 V \pm 5%
Power Supply Current	30 mA
Power Supply Sensitivity, RTI	\pm 2 μ V/% of V_s
Mechanical Dimensions	2.275" x 2.375" x 0.595" (57.8 mm x 59.1 mm x 15.1 mm)
Environmental	
Temperature Range	
Rated Performance	-25°C to +85°C
Operating	-40°C to +85°C
Storage	-40°C to +85°C
Relative Humidity	0 to 93% @ +40°C noncondensing
RFI Susceptibility	\pm 0.5% Span error @ 400 MHz, 5 Watt, 3 ft

¹ V_z is the nominal input voltage that results in a 0 V output.

²Includes the combined effects of repeatability, hysteresis, and nonlinearity and assumes $R_L > 50 \text{ k}\Omega$. Loads heavier than $50 \text{ k}\Omega$ will degrade nonlinearity and gain temperature coefficient.

³When used with the model AC1361 CJC sensor (see Accessories section), which is provided on each channel of 5B Series backplanes and mounting cards.

⁴The output common must be kept within $\pm 3 \text{ V}$ of power common.