

Functional Description

The **3B47** is a single-channel isolated thermocouple signal-conditioning module which interfaces, amplifies, isolates, protects, linearizes and filters analog input voltages from a J, K, T, E, R, S or B-type thermocouple. The thermocouple input signal is internally linearized to provide an output voltage which is linear with temperature. 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 peak 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. This plug-in, mix-and-match, hot-swappable module is easily field calibrated via front-panel zero and span adjustments.

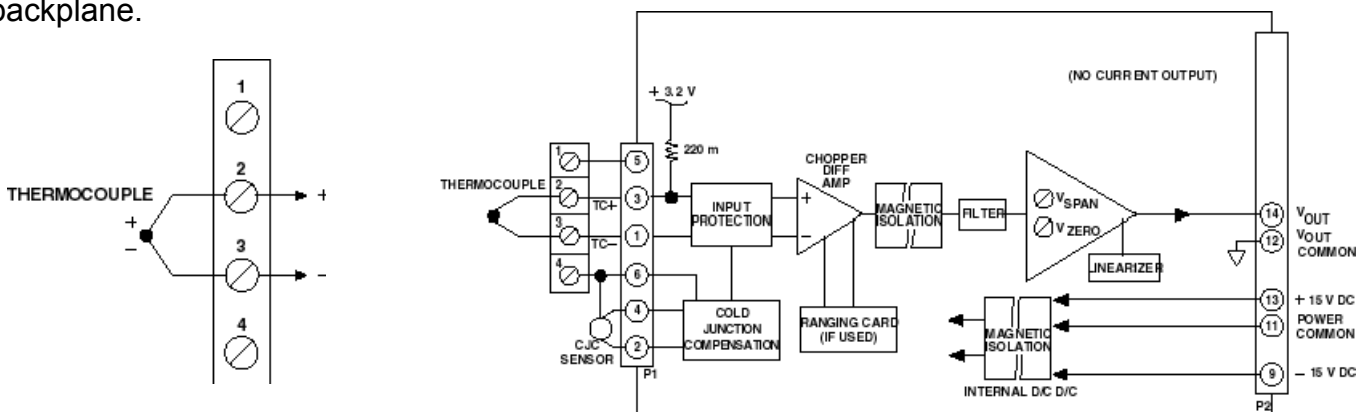


Inside the 3B47 Module

A chopper-stabilized low-drift input amplifier assures stable long-term stability. At the amplifier input, a zero-scale input voltage is subtracted from the input signal to set the zero-scale value. For user convenience, the zero and span optionally can be factory configured to meet custom needs (Model 3B37-CUSTOM). Zero suppression can exceed 100% of the input range. This enables suppression of a zero-scale input value many times larger than the total span for precise expanded-scale measurements of a selection portion of an input signal. The differential input circuit on the field side is fully floating, eliminating the need for any input grounding. Signal isolation by transformer coupling uses a proprietary modulation technique for linear, stable and reliable performance. 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 voltage.

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 $\pm 0.5^\circ\text{C}$ over the $+5^\circ\text{C}$ to $+45^\circ\text{C}$ ambient temperature range. The module generates a predictable upscale signal to indicate an open thermocouple; for a downscale response, connect a $47\text{ M}\Omega$, 0.25 Watt resistor across screw terminals 2 and 4 on the 3B Series backplane.



Input Types

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

Output Range

0 to +10 V

3B47 Models Available

Model	Input Type	Input Range	Output Range	Accuracy ¹
3B47-J-01	Type J	0°C to +760°C (32°F to +1400°F)	0 V to +10 V	0.76°C
3B47-J-02	Type J	-100°C to +300°C (-148°F to +572°F)	0 V to +10 V	0.4°C
3B47-J-03	Type J	0°C to +500°C (+32°F to +932°F)	0 V to +10 V	0.36°C
3B47-K-04	Type K	0°C to +1000°C (+32°F to +1832°F)	0 V to +10 V	1.0°C
3B47-K-05	Type K	0°C to +500°C (+32°F to +932°F)	0 V to +10 V	0.38°C
3B47-T-06	Type T	-100°C to +400°C (-148°F to +752°F)	0 V to +10 V	1.1°C
3B47-T-07	Type T	0°C to +200°C (+32°F to +392°F)	0 V to +10 V	0.3°C
3B47-E-08	Type E	0°C to +1000°C (+32°F to +1832°F)	0 V to +10 V	1.5°C
3B47-R-09	Type R	+500°C to +1750°C (+932°F to +3182°F)	0 V to +10 V	1.6°C
3B47-S-10	Type S	+500°C to +1750°C (+932°F to +3182°F)	0 V to +10 V	1.5°C
3B47-B-11	Type B	+500°C to +1800°C (+932°F to +3272°F)	0 V to +10 V	3.3°C
3B47-Custom	Type J, K, T, E, R, S, or B	*	*	*

¹The CJC sensor accuracy (refer to specification table) should be added to the module accuracy when computing system accuracy.

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

3B47 Specifications

(typical @ +25°C and ±15 V dc, and +24 V dc Power)

Description	Model 3B47
Input Ranges	
Thermocouple Types	J, K, T, E, R, S, B
Standard Ranges	Refer to Model Table
Custom Ranges	±5 mV to ±500 mV
Output Range¹	
Voltage ($R_L > 2\text{ K}\Omega$)	0 V to +10 V
Accuracy²	
Initial @ +25°C	See Model Table
Stability vs. Temperature	
Voltage Output	
Zero	±0.02°C/°C
Span	±25 ppm of Reading/°C
Zero and Span Adjustment Range³	±5% of Span
Cold Junction Compensation (CJC)⁴	
Initial Accuracy @ +25°C	±0.5 °C

Accuracy vs. Temperature, +5°C to +45°C	±0.5°C (±0.0125°C/°C)
Input Bias Current	+15 nA
Input Resistance	15 M Ω
Noise	
Input, 0.1 Hz to 10 Hz Bandwidth	0.2 μ V rms
Output, 100 kHz Bandwidth	100 μ V rms
Bandwidth, -3 dB	3 Hz
Output Rise Time, 10% to 90% Span	200 ms
Open Input Response	Upscale
Open Input Detection Time	10 seconds
Common-Mode Voltage (CMV)	
Input-to-Output, Continuous	±1500 V peak, 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, 50/60 Hz	60 dB
Input Protection	
Continuous	220 V rms maximum
Transient	ANSI/IEEE C37.90.1-1989
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130 V rms, continuous
Power Supply Voltages	
Rated Operation	±(11.5 V dc to 16.5 V dc)
Current	+16 mA, -14 mA
Sensitivity	±0.01% span/V
Mechanical Dimensions	3.15" x 3.395" x 0.775" (80.0 mm x 86.2 mm x 19.7 mm)
Environmental	
Temperature Range	
Rated Performance	-25°C to +85°C
Storage	-55°C to +85°C
Relative Humidity	0 to 95% @ +60°C noncondensing
RFI Susceptibility	±0.5% Span error @ 400 MHz, 5 Watt, 3 ft

¹ Current output is not available with model 3B47.

² Includes the combined effects of repeatability, hysteresis, and nonlinearity.

³ A wide range of zero suppression and span adjustment is available to enable field calibration.

⁴ When used with the CJC temperature sensor provided on the 3B Series backplane. *Specifications subject to change without notice.*