



Technologies/Applications

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7B27 Isolated, Thermocouple Input

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Functional Description

The 7B27 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 (up to 100 V rms) 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. The 7B27 is mix-and-match and hot-swappable with other 7B Series input modules, so can be inserted or removed from any socket in the same [backplane](#) without disturbing power. Model 7B27 is rated to operate with a nominal +24 V DC supply.



Inside the 7B27 Module

The three input pins of Model 7B27 are protected up to ± 30 V DC. 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 (100 V rms, continuous). 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 @ 3 Hz), 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 down to $2 \text{ k}\Omega$.

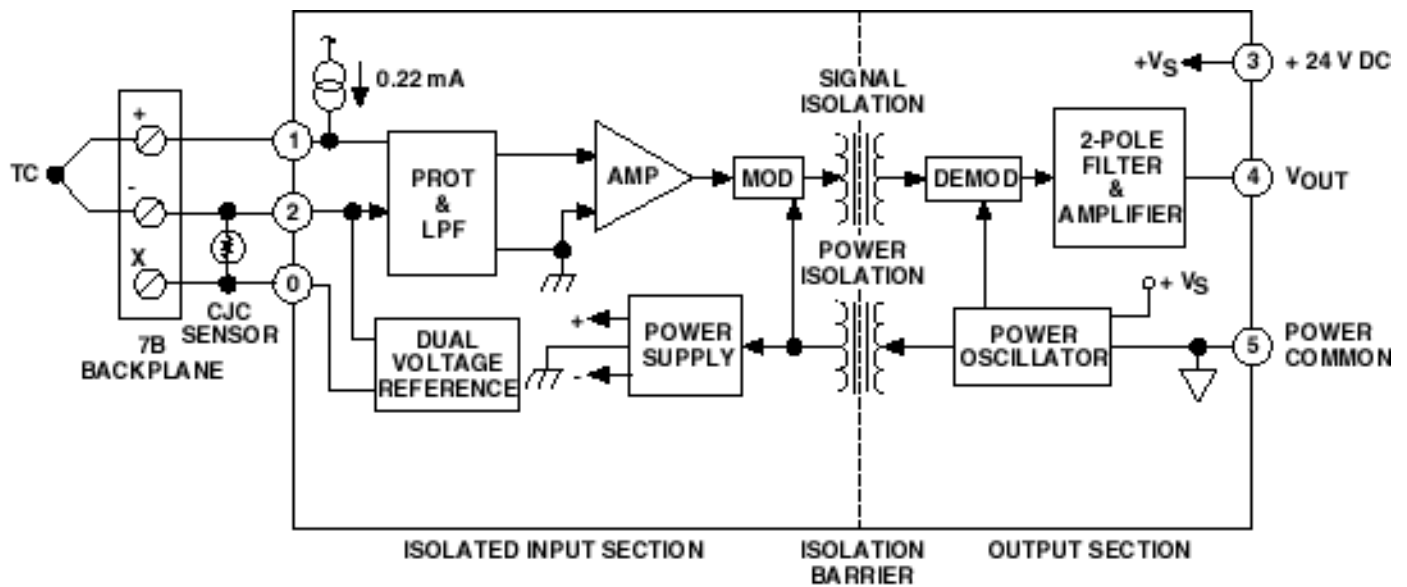


Figure 1. 7B27 Functional Block Diagram

Input

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

Output Options

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

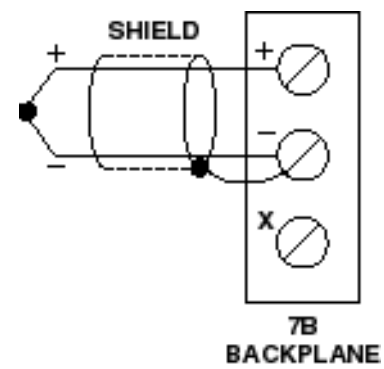


Figure 2. 7B27 Input Field Connections

7B27 Models Available

Model	Input Type	Input Range	Output Range
7B27-J-01-1	Type J	-100°C to +100°C (-148°F to +1400°F)	+1 V to +5 V
7B27-J-01-2	Type J	-100°C to +100°C (-148°F to +1400°F)	0 V to +10 V
7B27-J-10-1	Type J	0°C to +200°C (+32°F to +392°F)	+1 V to +5 V
7B27-J-10-2	Type J	0°C to +200°C (+32°F to +392°F)	0 V to +10 V
7B27-J-11-1	Type J	0°C to +400°C (+32°F to +752°F)	+1 V to +5 V
7B27-J-11-2	Type J	0°C to +400°C (+32°F to +752°F)	0 V to +10 V
7B27-J-12-1	Type J	0°C to +600°C (+32°F to +1112°F)	+1 V to +5 V
7B27-J-12-2	Type J	0°C to +600°C (+32°F to +1112°F)	0 V to +10 V
7B27-J-13-1	Type J	+300°C to +600°C (+572°F to +1112°F)	+1 V to +5 V
7B27-J-13-2	Type J	+300°C to +600°C (+572°F to +1112°F)	0 V to +10 V
7B27-K-02-1	Type K	-100°C to +1350°C (-148°F to +2462°F)	+1 V to +5 V
7B27-K-02-2	Type K	-100°C to +1350°C (-148°F to +2462°F)	0 V to +10 V
7B27-K-20-1	Type K	0°C to +300°C (+32°F to +572°F)	+1 V to +5 V
7B27-K-20-2	Type K	0°C to +300°C (+32°F to +572°F)	0 V to +10 V
7B27-K-21-1	Type K	0°C to +600°C (+32°F to +1112°F)	+1 V to +5 V

7B27-K-21-2	Type K	0°C to +600°C (+32°F to +1112°F)	0 V to +10 V
7B27-K-22-1	Type K	0°C to +1200°C (+32°F to +2192°F)	+1 V to +5 V
7B27-K-22-2	Type K	0°C to +1200°C (+32°F to +2192°F)	0 V to +10 V
7B27-K-23-1	Type K	+600°C to +1200°C (-148°F to +1400°F)	+1 V to +5 V
7B27-K-23-2	Type K	+600°C to +1200°C (-148°F to +1400°F)	0 V to +10 V
7B27-T-03-1	Type T	-100°C to +400°C (-148°F to +752°F)	+1 V to +5 V
7B27-T-03-2	Type T	-100°C to +400°C (-148°F to +752°F)	0 V to +10 V
7B27-E-04-1	Type E	0°C to +900°C (+32°F to +1652°F)	+1 V to +5 V
7B27-E-04-2	Type E	0°C to +900°C (+32°F to +1652°F)	0 V to +10 V
7B27-R-05-1	Type R	0°C to +1750°C (+32°F to +3182°F)	+1 V to +5 V
7B27-R-05-2	Type R	0°C to +1750°C (+32°F to +3182°F)	0 V to +10 V
7B27-S-06-1	Type S	0°C to +1750°C (+32°F to +3182°F)	+1 V to +5 V
7B27-S-06-2	Type S	0°C to +1750°C (+32°F to +3182°F)	0 V to +10 V
7B27-B-07-1	Type B	0°C to +1800°C (+32°F to +3272°F)	+1 V to +5 V
7B27-B-07-2	Type B	0°C to +1800°C (+32°F to +3272°F)	0 V to +10 V

7B27 Specifications

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

Description	Model 7B27
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 ($R_L > 2$ k Ω)	+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/°C
Output Offset vs. Temperature	±0.002% Span/°C
Cold Junction Compensation	
Accuracy ⁴ over +5°C to +45°C ambient	±1.0°C, maximum
Input Bias Current	+25 nA
Input Resistance	
Power ON	10 M Ω
Power OFF	30 k Ω , 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 μ V peak
Bandwidth, -3 dB	3 Hz
Output Rise Time, 10% to 90% Span	150 ms
Common-Mode Voltage (CMV)	
Input-to-Output and Power	100 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	\pm 30 V dc, continuous
Input Transient Protection	ANSI/IEEE C376.90.1-1989 IEEE-STD 472 IEC 255-4, Class II
Output Resistance	< 1 Ω
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)
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	\pm 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.

³ V_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.

