

# **Isolated Thermocouple Input**

**7B27** 

### **FEATURES**

Interfaces, amplifies and filters input voltages from a J, K, T, E, R, S or B-type thermocouple.

Provides an isolated and protected precision output of either +1 V to +5 V or 0 V to +10 V.

Operates with a nominal +24 VDC supply. All 7B27 series modules are mix-and-match and Hot Swappable.

#### **APPLICATIONS**

Industrial signal conditioning Industrial signal isolation Industrial signal filtering

#### **PRODUCT OVERVIEW**

The 7B Series of signal conditioners feature small size, low cost and a wide output voltage range for a variety of applications including process control and factory-floor environments. The single-channel 7B modules accept inputs from a range of transducers and are fully rated over the extended -40°C to +85°C industrial temperature range. All 7B Series modules are rated for a nominal power supply input of +24 VDC; and, for maximum flexibility, they will accept supply voltages in the +14 VDC to +35 VDC range. The input modules, with the exception of the 7B21, provide a high-level output voltage that is factory configured for either the +1 V to +5 V or 0 V to +10 V range. The 7B21 is a unity gain, isolated input module with an input/output range of +10V. Output modules are available that provide either isolated process current or isolated bipolar voltage output. Model 7B39 converts either a +1 V to +5 V input to a 4 to 20 mA output or a 0 V to +10 V input to a 0-20 mA output. The input/output ranges of the 7B39 are factory configured. The 7B22 is a unity gain module that provides an isolated +10V output signal. All modules have a universal pinout and may be readily hot-swapped under full power without disrupting field wiring. Each module accepts analog transducer signals and transfers them to a process control or factory data collection system without the inherent noise, non-linearity, drift and extraneous voltages which frequently accompany the signals.

#### **FUNCTIONAL BLOCK DIAGRAM**

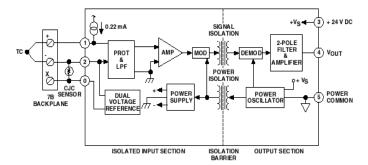


Figure 1. 7B27 Functional Block Diagram

The modules feature a maximum nonlinearity of  $\pm 0.02\%$  and are factory calibrated to guarantee a maximum accuracy specification of  $\pm 0.1\%$ .

The 7B Series offers up to 1500~V rms continuous common mode voltage isolation and 120~V rms of field wiring input protection. The power supplies necessary to drive each of the individual module's input circuitry are internally isolated, enabling the 7B Series modules to offer true channel-to-channel isolation of the input signals.

The modules directly accept analog signals from thermocouples, RTDs, current loop powered transmitters, and other process control signals. The 7B Series modules amplify, linearize, isolate, protect and convert the transducer output signals to standardized analog inputs for high-level analog I/O subsystems. The 7B Series Subsystem consists of 19-inch rackcompatible hardware (model AC 1363), with universal mounting backplane and a family of plug-in (up to 16 per backplane) input and output signal conditioning modules. Four-, eight-, and sixteen-channel backplanes are available. Each backplane incorporates screw terminals for easy power connections and field wiring, and includes a 25-pin D-type connector for interfacing the high-level single-ended voltage outputs to the user's equipment. Gold-plated sockets are provided on each channel of the backplane to ensure the reliability of each module's electrical connection.

### **GENERAL 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 +10V, 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 VDC supply.

The three input pins of Model 7B27 are protected up to  $\pm 30$  VDC. 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 frontend 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 k $\Omega$ .



Figure 2

### **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	Туре К	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	Туре К	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	Туре К	+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 @  $+23^{\circ}$ C  $\pm 5^{\circ}$ C and  $V_s = +24 \text{ V dc}$ )

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 ( $R_L > 2 \text{ k}\Omega$ ) +1 V to +5 V or 0 V to +10 V

Accuracy<sup>1</sup>

Initial @ +25°C ±0.01% Span (±0.1% Span, maximum)

Nonlinearity<sup>2</sup> ±0.02% Span, maximum

Input Offset vs. Temperature  $\pm 0.5 \mu V/^{\circ}C$ 

Zero Suppression vs. Temperature  $\pm 0.005\% (V_z)^3/^{\circ}C$ Span vs. Temperature  $\pm 35 \text{ ppm/}^{\circ}C$ Output Offset vs. Temperature  $\pm 0.002\% \text{ Span/}^{\circ}C$ 

**Cold Junction Compensation** 

Accuracy<sup>4</sup> over +5°C to +45°C ambient ±1.0°C, maximum

Input Bias Current -25 nA

Input Resistance

Power ON 10  $M\Omega$ 

Power OFF 30 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 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 ±30 V dc, continuous

Input Transient Protection ANSI/IEEE C376.90.1-1989IEEE-STD 472IEC 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 ±0.0001%/% of Vs

**Mechanical Dimensions** 1.663" x 2.11" x 0.563"(42.24 mm x 53.6 mm x 14.3 mm)

Environmental

Temperature Range

-40°C to +85°C Operating Storage -40°C to +85°C

Relative Humidity, 24 hours 0 to 90% @ +60°C non-condensing

ESD Sensitivity IEC 801-2, Level 2

RFI Susceptibility ±0.5% Span error @ 400 MHz, 5 Watt, 3 ft

Specifications subject to change without notice.

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.

³Vz 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.

### PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS

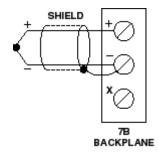


Figure 3 7B27 Input Field Connections

Table 1. Pin Function Descriptions—

Pin No.	Input Module Function	Output Module Function
0	SENSOR INPUT	NOT USED
1	INPUT HIGH	OUTPUT HIGH
2	INPUT LOW	OUTPUT LOW
3	POWER SUPPLY (DC)	POWER SUPPLY (DC)
4	OUTPUT VOLTAGE	INPUT VOLTAGE
5	OUTPUT & POWER COMMON	INPUT AND POWER COMMON

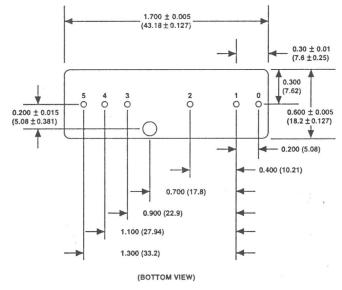


Figure 4 . Model 7B Series Module, with pin-out assignments.

### **ESD CAUTION**

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



## **OUTLINE DIMENSIONS**

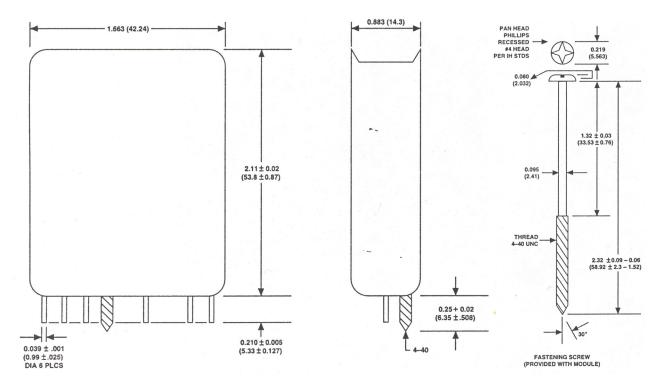


Figure 5. Outline Dimensions

NOTES

