



Technologies/Applications

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7B14 Non-Isolated, Linearized RTD Input

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Functional Description

The 7B14 is a low cost, single-channel signal conditioning module that interfaces, amplifies and filters input voltages from a wide variety of two- and three-wire platinum, copper and nickel Resistor Temperature Detectors (RTDs) and provides a precision output of either +1 V to +5 V or 0 V to +10 V, linear with temperature. Model 7B14 features a nonlinearity of $\pm 0.05\%$ maximum (Pt and Cu RTDs). RTD excitation current, three-wire lead resistance compensation and a predictable upscale open circuit indication provide a complete signal conditioning solution. Rated to operate with a nominal +24 V DC supply, Model 7B14 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 7B14 Series Module

The three input pins of Model 7B14 are fully protected up to ± 30 V DC. A 250 μ A excitation current for platinum and nickel RTDs and a 1 mA excitation current for copper RTDs is provided to create an input voltage to the 7B14. This current also provides the upscale open circuit indication. A one-pole 3 Hz filter preconditions the RTD signal prior to amplification, provided by a low drift input amplifier. The output section contains a two-pole low pass filter (-3 dB @ 3Hz) and a buffer amplifier. The two-pole output filter and subsequent buffer ensure that a low noise, low impedance ($< 1 \Omega$) signal is available at the output to drive loads to 2 k Ω minimum.

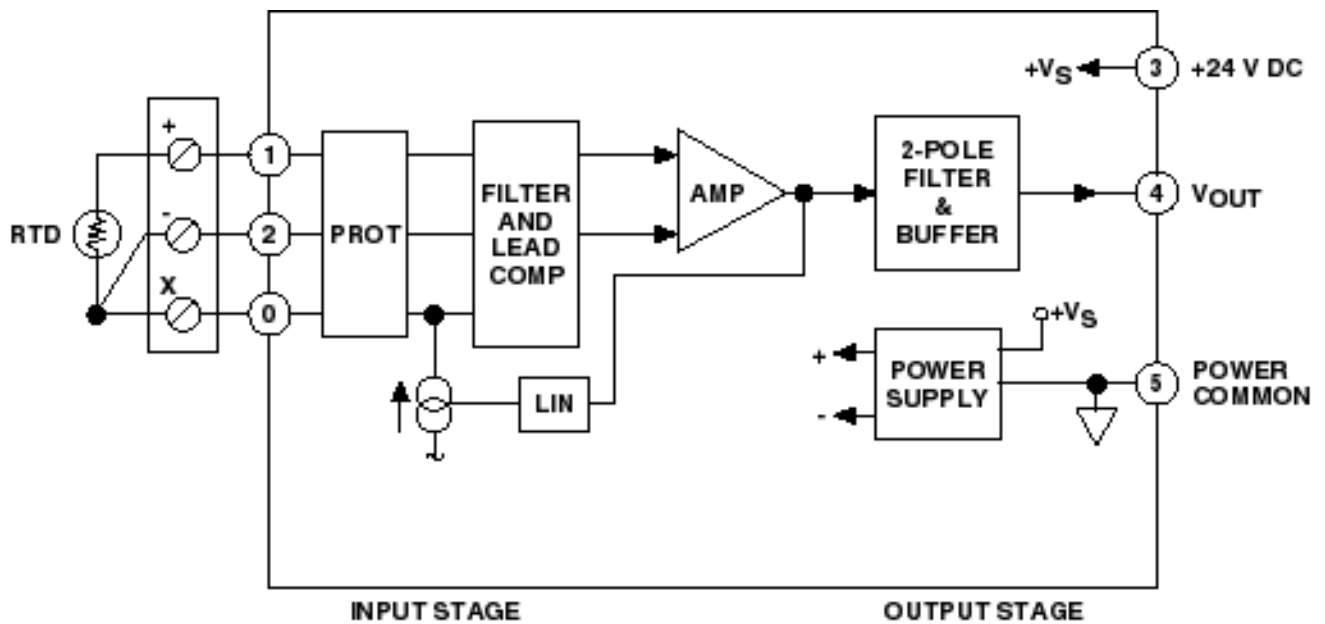


Figure 1. 7B14 Functional Block Diagram

Input Types

- 100 Ω Platinum RTDs
- 120 Ω Nickel RTDs
- 10 Ω Copper RTDs

Output Options

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

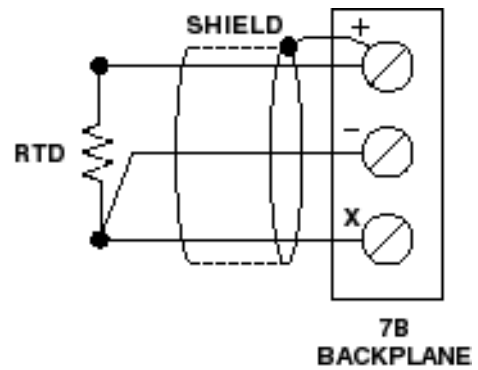


Figure 2. 7B14 Input Field Connections



7B14 Models Available

Model	RTD Sensor (2- or 3-wire)	Input Range	Output Range	Nonlinearity (maximum)	Accuracy (maximum)
7B14-01-1	100 Ω Pt, $\alpha = 0.00385$	-100°C to +100°C	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 0.15\%$ span
7B14-01-2	100 Ω Pt, $\alpha = 0.00385$	-100°C to +100°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 0.15\%$ span
7B14-02-1	100 Ω Pt, $\alpha = 0.00385$	0°C to +100°C	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 0.2\%$ span
7B14-02-2	100 Ω Pt, $\alpha = 0.00385$	0°C to +100°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 0.2\%$ span
7B14-03-1	100 Ω Pt, $\alpha = 0.00385$	0°C to +200°C	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 0.15\%$ span
7B14-03-2	100 Ω Pt, $\alpha = 0.00385$	0°C to +200°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 0.15\%$ span
7B14-04-1	100 Ω Pt, $\alpha = 0.00385$	0°C to +600°C	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 0.1\%$ span
7B14-04-2	100 Ω Pt, $\alpha = 0.00385$	0°C to +600°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 0.1\%$ span
7B14-05-1	100 Ω Pt, $\alpha = 0.00385$	-50°C to +350°C	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 0.1\%$ span
7B14-05-2	100 Ω Pt, $\alpha = 0.00385$	-50°C to +350°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 0.1\%$ span

Model	RTD Sensor (2- or 3-wire)	Input Range	Output Range	Nonlinearity (maximum)	Accuracy (maximum)
7B14-C-02-1	10 Ω Cu, $\alpha = 0.004274$	0°C to +120°C (10 Ω @ +25°C)	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 1.0\%$ span
7B14-C-02-2	10 Ω Cu, $\alpha = 0.004274$	0°C to +120°C (10 Ω @ +25°C)	0 V to +10 V	$\pm 0.05\%$ span	$\pm 1.0\%$ span

Model	RTD Sensor (2- or 3-wire)	Input Range	Output Range	Nonlinearity (maximum)	Accuracy (maximum)
7B14-N-01-1	120 Ω Ni, $\alpha = 0.00672$	0°C to +300°C	+1 V to +5 V	$\pm 0.12\%$ span	$\pm 0.03\%$ span
7B14-N-01-2	120 Ω Ni, $\alpha = 0.00672$	0°C to +300°C	0 V to +10 V	$\pm 0.12\%$ span	$\pm 0.03\%$ span
7B14-N-02-1	120 Ω Ni, $\alpha = 0.00672$	0°C to +200°C	+1 V to +5 V	$\pm 0.14\%$ span	$\pm 0.03\%$ span
7B14-N-02-2	120 Ω Ni, $\alpha = 0.00672$	0°C to +200°C	0 V to +10 V	$\pm 0.14\%$ span	$\pm 0.03\%$ span

7B14 Specifications

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

Description	Model 7B14
Input Ranges	
RTD Types	100 Ω Platinum, 2-, 3-wire, $\alpha = 0.00385$ 120 Ω Nickel, 2-, 3-wire, $\alpha = 0.00672$ 10 Ω Copper, $\alpha = 0.004274$
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	Refer to Model Table
Nonlinearity ²	Refer to Model Table
Input Offset vs. Temperature	±1 µV/°C
Zero Suppression vs. Temperature	±0.002% (R _Z /R _{span}) ³ /°C
Span vs. Temperature	±60 ppm/°C
Output Offset vs. Temperature	±0.002% Span/°C
Lead Resistance Effect	±0.02°C/Ω
Output Noise	
5 MHz Bandwidth	1 mV peak
10 Hz to 100 Hz Bandwidth	0.4 mV rms
0.1 Hz to 10 Hz Bandwidth	0.6 µV peak
Bandwidth, -3 dB	3 Hz
Output Rise Time	250 ms
Normal Mode Rejection @ 50/60 Hz	60 dB
Input Protection	±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	±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	
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.

³R_z is the value of the RTD resistance at the lowest measurement point. R_{span} is the change in resistance over the measurement span.

Specifications subject to change without notice.

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