

# 7B14 Non-Isolated, Linearized RTD Input

## 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  $\pm 30$  V DC. A 250  $\mu$ 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 $\Omega$  minimum.

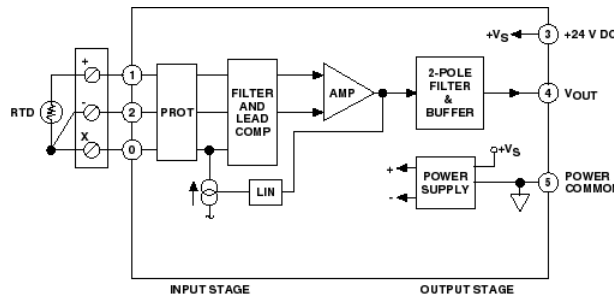


Figure 1. 7B14 Functional Block Diagram

### Input Types

- 100  $\Omega$  Platinum RTDs
- 120  $\Omega$  Nickel RTDs
- 10  $\Omega$  Copper RTDs

### Output Options

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

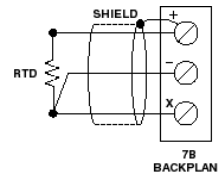


Figure 2. 7B14 Input Field Connections

## 7B14 Models Available

Model	RTD Sensor (2- or 3-wire)	Input Range	Output Range	Nonlinearity (maximum)	Accuracy (maximum)
7B14-01-1	100 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ 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 $\Omega$ Cu, $\alpha = 0.004274$	0°C to +120°C (10 $\Omega$ @ +25°C)	+1 V to +5 V	$\pm 0.05\%$ span	$\pm 1.0\%$ span
7B14-C-02-2	10 $\Omega$ Cu, $\alpha = 0.004274$	0°C to +120°C	0 V to +10 V	$\pm 0.05\%$ span	$\pm 1.0$

Model	RTD Sensor (2- or 3-wire)	Input Range	Output Range	Nonlinearity (maximum)	Accuracy (maximum)
7B14-N-01-1	120 $\Omega$ Ni, $\alpha = 0.00672$	0°C to +300°C	+1 V to +5 V	$\pm 0.12\%$ span	$\pm 0.3\%$ span
7B14-N-01-2	120 $\Omega$ Ni, $\alpha = 0.00672$	0°C to +300°C	0 V to +10 V	$\pm 0.12\%$ span	$\pm 0.3\%$ span
7B14-N-02-1	120 $\Omega$ Ni, $\alpha = 0.00672$	0°C to +200°C	+1 V to +5 V	$\pm 0.14\%$ span	$\pm 0.3\%$ span
7B14-N-02-2	120 $\Omega$ Ni, $\alpha = 0.00672$	0°C to +200°C	0 V to +10 V	$\pm 0.14\%$ span	$\pm 0.3\%$ span

### 7B14 Specifications

(typical @ +23°C  $\pm 5^\circ\text{C}$  and  $V_s = +24\text{ V dc}$ )

Description	Model 7B14
<b>Input Ranges</b>	
RTD Types	100 $\Omega$ Platinum, 2-, 3-wire, $\alpha = 0.00385$ 120 $\Omega$ Nickel, 2-, 3-wire, $\alpha = 0.00672$ - 10 $\Omega$ Copper, $\alpha = 0.004274$
Temperature Ranges	Refer to Model Table
Custom Ranges	Not Available*
<b>Output Range Options (<math>R_L &gt; 2\text{ k}\Omega</math>)</b>	+1 V to +5 V or 0 V to +10 V
<b>Accuracy<sup>1</sup></b>	
Initial @ +25°C	Refer to Model Table
Nonlinearity <sup>2</sup>	Refer to Model Table
Input Offset vs. Temperature	$\pm 1\ \mu\text{V}/^\circ\text{C}$
Zero Suppression vs. Temperature	$\pm 0.002\% (R_z/R_{\text{span}})^3/^\circ\text{C}$
Span vs. Temperature	$\pm 60\text{ ppm}/^\circ\text{C}$
Output Offset vs. Temperature	$\pm 0.002\% \text{ Span}/^\circ\text{C}$
<b>Lead Resistance Effect</b>	$\pm 0.02^\circ\text{C}/\Omega$
<b>Output Noise</b>	
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 $\mu\text{V}$ peak
<b>Bandwidth, -3 dB</b>	3 Hz
<b>Output Rise Time</b>	250 ms
<b>Normal Mode Rejection @ 50/60 Hz</b>	60 dB
<b>Input Protection</b>	$\pm 30\text{ V dc}$ , continuous
<b>Input Transient Protection</b>	ANSI/IEEE C376.90.1-1989 - IEEE-STD 472 - IEC 255-4, Class II
<b>Output Resistance</b>	$< 1\ \Omega$
<b>Voltage Output Protection</b>	Continuous Short to Ground
<b>Power Supply</b>	
Voltage Range, Operating	+14 V dc to +35 V dc
Current	+25 mA, maximum
Sensitivity	$\pm 0.0001\%/%$ of $V_s$
<b>Mechanical Dimensions</b>	1.663" x 2.11" x 0.563" - (42.24 mm x 53.6 mm x 14.3 mm)
<b>Environmental</b>	
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