

5B35 Isolated, Linearized 4-Wire RTD Input

Functional Description

The 5B35 is a single-channel signal conditioning module that amplifies, filters, isolates and protects a wide variety of four-wire RTDs. The module provides a linearized, highly accurate output of 0 to +5V.

Accurate and Stable Performance

The four-wire configuration of the 5B35 supplies RTD excitation from a precision, protected current source: two RTD wires carry the excitation current and two wires serve as signal-input leads that measure the voltage across the RTD. Because no excitation current flows through the signal-input leads, the length or resistance of the leads creates little or no RTD measurement error. A low-drift chopper-stabilized differential amplifier allows use of very low excitation current to minimize error due to RTD self-heating. The amplifiers low input offset drift of $\pm 0.01^{\circ}\text{C}/^{\circ}\text{C}$ and gain drift of ± 30 ppm/ $^{\circ}\text{C}$ assure accuracy over the full operating temperature range.



True Three-Port Isolation

The floating, differential input circuit on the field side eliminates the need for any input grounding. Signal and power 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 signal. True three-port isolation (Input-Output-Power) includes common-mode ratings of : 1500 V rms between input and output and input and power; 250 V rms between power and output - no return path is required between the power and signal output commons.

Filtering and Protection

An optimized five-pole Butterworth filter (with a 4-Hz bandwidth) provides 116 dB of normal-mode rejection (noise on signal) at 60 Hz and 108 dB at 50 Hz. Output noise is an exceptionally low 0.3 mV p-p in a 100 kHz bandwidth and 6 mV p-p in a 5 MHz bandwidth. The 5B35 protects the computer side from damage due to field-side overvoltage faults. The module withstands 240 V rms at the input terminals without damage, thereby shielding the internal computer-side circuitry from field-side overvoltage conditions. In addition, the 5B35 is mix-and-match and hot swappable with all other 5B Series modules, so can be inserted or removed from any socket in the same backplane without disrupting system power.

Convenience Features

A series output switch eliminates the need for external multiplexing in many applications. The switch is turned on by an active-low enable input. If the switch is to be on at all times, the enable-input should be connected to output common.

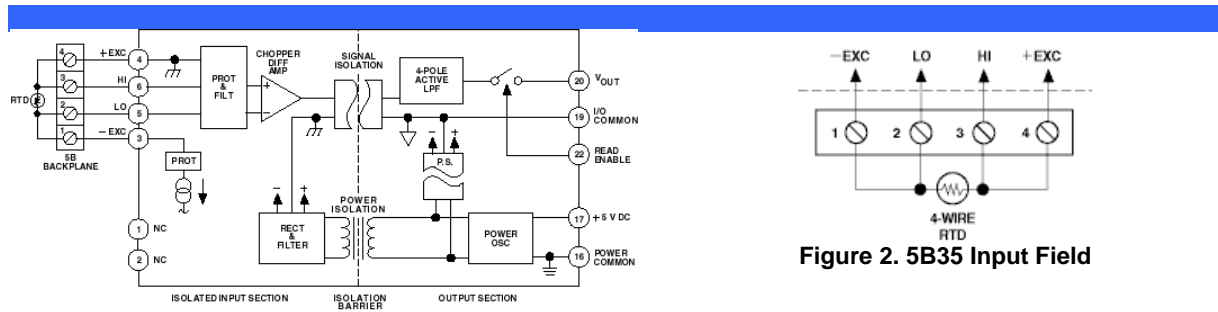


Figure 1. 5B35 Functional Block Diagram

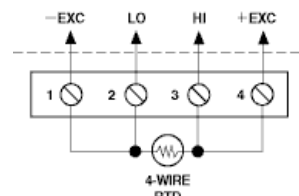


Figure 2. 5B35 Input Field

Input Types

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

Output Range

0 to +5 V

5B35 Models Available

Model	Input Range	Output Range	Accuracy
5B35-01	100 Ω Platinum, $\alpha = 0.00385^*$ -100 $^{\circ}\text{C}$ to +100 $^{\circ}\text{C}$ (-148 $^{\circ}\text{F}$ to +212 $^{\circ}\text{F}$)	0 V to +5 V	$\pm 0.26^{\circ}\text{C}$
5B35-02	0 $^{\circ}\text{C}$ to +100 $^{\circ}\text{C}$ (+32 $^{\circ}\text{F}$ to +212 $^{\circ}\text{F}$)	0 V to +5 V	$\pm 0.13^{\circ}\text{C}$
5B35-03	0 $^{\circ}\text{C}$ to +200 $^{\circ}\text{C}$ (+32 $^{\circ}\text{F}$ to +392 $^{\circ}\text{F}$)	0 V to +5 V	$\pm 0.26^{\circ}\text{C}$
5B35-04	0 $^{\circ}\text{C}$ to +600 $^{\circ}\text{C}$ (+32 $^{\circ}\text{F}$ to +1112 $^{\circ}\text{F}$)	0 V to +5 V	$\pm 0.78^{\circ}\text{C}$
5B35-05	-100 $^{\circ}\text{C}$ to +200 $^{\circ}\text{C}$ (-148 $^{\circ}\text{F}$ to +392 $^{\circ}\text{F}$)	0 V to +5 V	$\pm 0.60^{\circ}\text{C}$

5B35-C-01	10 Ω Copper, $\alpha=0.004274$ 0°C to +120°C (10 Ω @ 0°C) (+32°F to +248°F)	0 V to +5 V	$\pm 0.23^\circ\text{C}$
5B35-C-02	0°C to +120°C (10 Ω @ 25°C)(+32°F to +248°F)	0 V to +5 V	$\pm 0.23^\circ\text{C}$
5B35-N-01	120 Ω Nickel, $\alpha=0.00672$ 0°C to +300°C (+32°F to +572°F)	0 V to +5 V	$\pm 0.40^\circ\text{C}$
5B35-Custom	*	*	
5B35-C-Custom	*	*	
5B35-N-Custom	*	*	

* Custom Input/Output ranges are available including versions for the 100 Ω Platinum RTD with $\alpha=0.003916$.

5B35 Specifications

(typical @ +25°C and $V_s = +5$ V dc)

Description	Model 5B35
Input Ranges	
Standard Ranges	Refer to Model Table
Custom Ranges	-200°C to +850°C (100 Ω Platinum, $\alpha = 0.00385$) -80°C to +320°C (120 Ω Nickel, $\alpha = 0.00672$) -100°C to +260°C (10 Ω Copper, $\alpha = 0.004274$)
Output Range ($R_L > 50$ kΩ)	0 V to +5 V
Accuracy¹	
Initial @ +25°C	Refer to Model Table
Conformity Error	$\pm 0.05\%$ Span
Input Offset vs. Temperature	$\pm 0.01^\circ\text{C}/^\circ\text{C}$
Output Offset vs. Temperature	± 20 $\mu\text{V}/^\circ\text{C}$
Gain vs. Temperature	$\pm 0.003\%$ of Reading/ $^\circ\text{C}$
Input Resistance	
Power On	> 1000 M Ω
Power Off	200 k Ω
Overload	200 k Ω
Noise	
Input, 0.1 Hz to 10 Hz Bandwidth	0.2 μV rms
Output, 100 kHz Bandwidth	100 μV rms (0.3 mV peak-peak)
Output, 1 MHz Bandwidth	1.5 mV peak-peak
Output, 5 MHz Bandwidth	6 mV peak-peak
Bandwidth, -3 dB	4 Hz
Output Rise Time, 10% to 90% Span	100 ms
Common-Mode Voltage (CMV)	
Input-to-Output, Continuous	1500 V rms, maximum
Input-to-Power, Continuous	1500 V rms, maximum
Output-to-Power, Continuous ²	250 V rms, maximum
Transient	ANSI/IEEE C37.90.1-1989
Common Mode Rejection (CMR)	
1 k Ω Source Imbalance, 50/60 Hz	190 dB (180 dB, Model 5B35-04)
Normal Mode Rejection (NMR)	116 dB @ 60 Hz; 108 dB @ 50 Hz
Sensor Excitation Current	
100 Ω Pt, 120 Ω Ni	0.25 mA

10 Ω Cu	1.0 mA
Lead Resistance Effect	
100 Ω Pt, 120 Ω Ni	$\pm 0.00001^\circ\text{C}/\Omega$
10 Ω Cu	$\pm 0.0001^\circ\text{C}/\Omega$
Input Protection	
Continuous	240 V rms, maximum
Transient	ANSI/IEEE C37.90.1-1989
Output Resistance	25 Ω
Voltage Output Protection	Continuous Short to Ground
Output Current Limit	± 9 mA
Output Selection Time	6 μs to ± 1 mV of V_{out} @ $C_{\text{load}} = 0$ to 2,000 pF
Output Enable Control²	
Max Logic "0"	+0.8 V
Min Logic "1"	+2.4 V
Max Logic "1"	+100 V
Input Current "0", "1"	0.5 μA
Power Supply Voltage	+5 V dc $\pm 5\%$
Power Supply Current	15 mA
Power Supply Sensitivity, RTI	$\pm 0.2^\circ\text{C}/\%$ of V_s
Mechanical Dimensions	2.275" x 2.375" x 0.595" (57.8 mm x 59.1 mm x 15.1 mm)
Environmental	
Temperature Range	
Rated Performance	-40°C to +85°C
Operating	-40°C to +85°C
Storage	-40°C to +85°C
Relative Humidity	0 to 93% @ +40°C noncondensing
RFI Susceptibility	$\pm 0.5\%$ Span error @ 400 MHz, 5 Watt, 3 ft

¹Includes the combined effects of repeatability, hysteresis, and conformity error. Loads heavier than 50 k Ω will degrade conformity and gain temperature coefficient.

²The user's board layout must separate Power Common from Output Common. When the output switch is not used, connect the Enable Input to the Output Common. Output Common is connected to power common when the 5B35 is installed on a 5B Series backplane.