



Technologies/Applications

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5B30/5B31 Millivolt and Voltage Input

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Functional Description

The 5B30 and 5B31 are single-channel signal conditioning modules that amplify, protect, filter and isolate analog input voltages.

The 5B30 and 5B31 protect the computer side from damage due to field-side overvoltage faults. All models withstand 240 V rms at their input terminals without damage thereby shielding computer-side circuitry from field-side overvoltage conditions. In addition, 5B30 and 5B31 Series modules are mix-and-match and hot swappable, so can be inserted or removed from any socket in the same backplane without disrupting system power.



Inside 5B30/5B31 Modules

A chopper-stabilized input amplifier provides low drift and stable gain. At the amplifier input, a stable, laser-trimmed zero-scale input voltage is subtracted from the input signal to set the zero-scale value. For user convenience, the zero can be optionally factory-set to meet custom needs. This allows suppression of a zero-scale input value many times larger than the total span for precise expanded-scale measurements.

Internal multi-pole lowpass filtering with a four-Hz cutoff (-3dB) enhances normal-mode (noise on signal) and common-mode (noise on signal return) rejection at 50/60 Hz, enabling accurate measurement of small signals in high electrical noise.

Signal isolation by transformer coupling uses a proprietary modulation technique for linear, stable and reliable performance. The differential input circuit on the field side is fully floating, eliminating the need for any input grounding. 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. The output common must be kept within ± 3 V of power common.

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. The enable input should be grounded to power common if the output need not be switched.

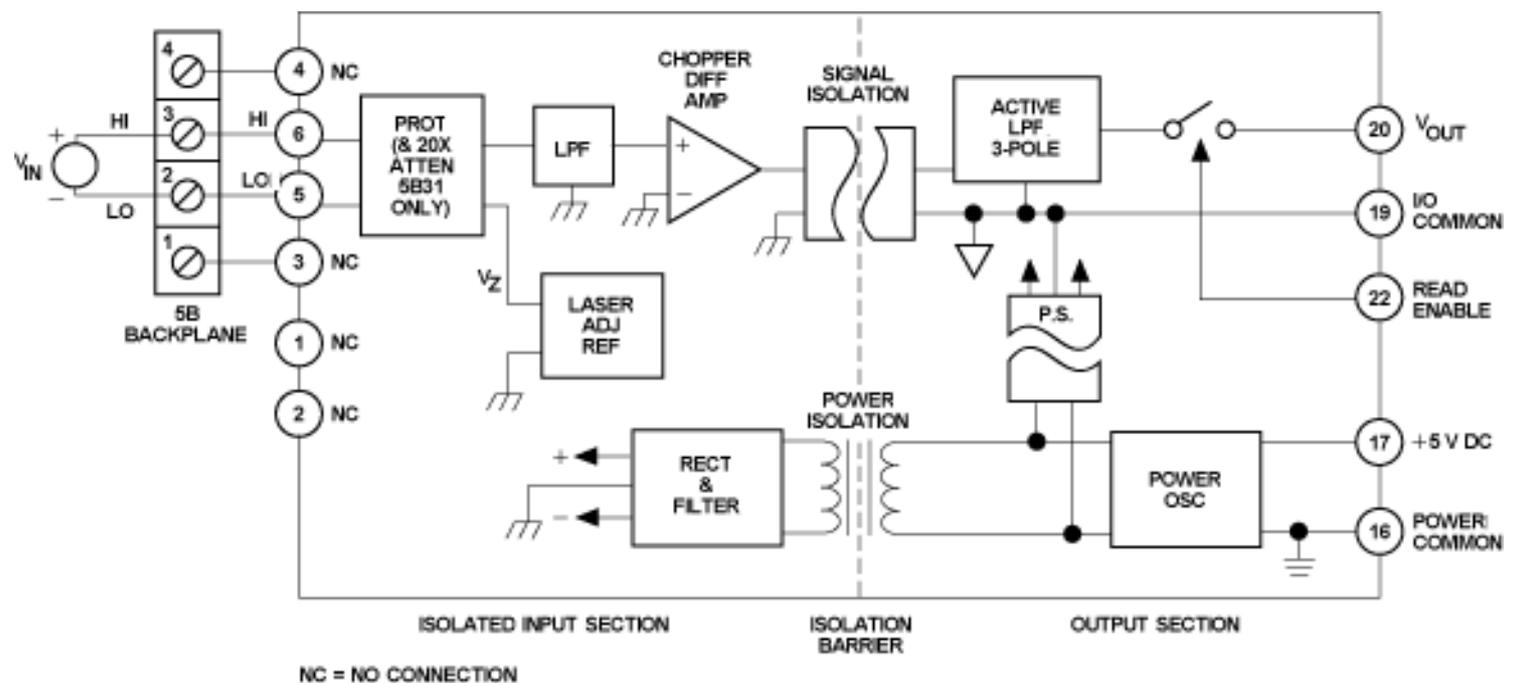


Figure 1. 5B30 and 5B31 Functional Block Diagram

Input Ranges

- 5B30 mV Input:
 ± 10 to ± 100 mV
 (± 5 to ± 500 mV - custom)
- 5B31 V Input:
 ± 1 to ± 20 V
 (± 0.5 to ± 20 V - custom)

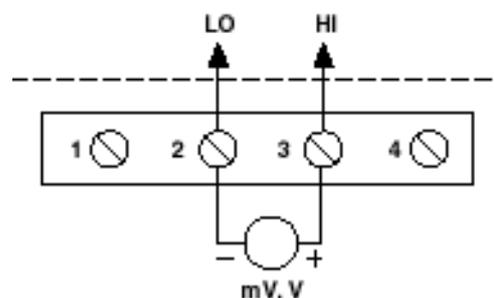


Figure 2. 5B30 and 5B31 Input Field Connections

Output Ranges

- 5B30/5B31:
 -5 V to $+5$ V or 0 to $+5$ V

5B30 and 5B31 Models Available

Model	Input Range	Output Range
5B30-01	-10 mV to +10 mV	-5 V to +5 V
5B30-02	-50 mV to +50 mV	-5 V to +5 V
5B30-03	-100 mV to +100 mV	-5 V to +5 V
5B30-04	-10 mV to +10 mV	0 V to +5 V
5B30-05	-50 mV to +50 mV	0 V to +5 V
5B30-06	-100 mV to +100 mV	0 V to +5 V
5B30-Custom	*	*

Model	Input Range	Output Range
5B31-01	-1 V to +1 V	-5 V to +5 V
5B31-02	-5 V to +5 V	-5 V to +5 V
5B31-03	-10 V to +10 V	-5 V to +5 V
5B31-04	-1 V to +1 V	0 V to +5 V
5B31-05	-5 V to +5 V	0 V to +5 V
5B31-06	-10 V to +10 V	0 V to +5 V
5B31-07	-20 V to +20 V	-5 V to +5 V
5B31-Custom	*	*

*Custom Input/Output ranges are available. Refer to [ordering guide](#).

5B30 and 5B31 Specifications

Description	Model 5B30	Model 5B31
Input Ranges		
Standard Ranges	±10 mV to ±100 mV	±1 V to ±20 V
Custom Ranges	±5 mV to ±500 mV	±0.5 V to ±20 V
Output Ranges ($R_L > 50 \text{ k}\Omega$)⁴	-5 V to +5 V or 0 V to +5 V	*
Accuracy²		
Initial @ +25°C	±0.05% Span ±10 μV RTI ±0.05% (V_Z) ¹	±0.05% Span ±0.2 mV RTI ±0.05% (V_Z) ¹
Nonlinearity	±0.02% Span	*
Input Offset vs. Temperature	±1 $\mu\text{V}/^\circ\text{C}$	±20 $\mu\text{V}/^\circ\text{C}$
Output Offset vs. Temperature	±20 $\mu\text{V}/^\circ\text{C}$	*
Gain vs. Temperature	±25 ppm of Reading/ $^\circ\text{C}$	±50 ppm of Reading/ $^\circ\text{C}$
Input Bias Current	±3 nA	±0.2 nA
Input Resistance		
Power On	5 M Ω	650 k Ω
Power Off	40 k Ω	650 k Ω
Overload	40 k Ω	650 k Ω
Noise		
Input, 0.1 Hz to 10 Hz Bandwidth	0.2 μV rms	2 μV rms
Output, 100 kHz Bandwidth	200 μV rms	*
Bandwidth, -3 dB	4 Hz	*

Output Rise Time, 10% to 90% Span	200 ms	*
Common-Mode Voltage (CMV)³		
Input-to-Output, Continuous	1500 V rms maximum	*
Output-to-Power, Continuous	±3 V maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
Common-Mode Rejection (CMR)		
1 k Ω Source Imbalance, 50/60 Hz	160 dB (all ranges)	160 dB (span < ±2 V) 150 dB (span = ±10 V)
Normal Mode Rejection, 50/60 Hz	60 dB	*
Input Protection		
Continuous	240 V rms maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
Output Resistance⁴	50 Ω	*
Voltage Output Protection	Continuous Short to Ground	*
Output Selection Time	6 μ s @ C _{load} = 0 to 2,000 pF	*
Output Enable Control		
Max Logic "0"	+1 V	*
Min Logic "1"	+2.5 V	*
Max Logic "1"	+36 V	*
Input Current "0"	0.4 mA	*
Power Supply Voltage	+5 V ±5%	*
Power Supply Current	30 mA	*
Power Supply Sensitivity, RTI	±2 μ V/Vs%	±0.4 mV/Vs%
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	-25°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	±0.5% Span error @ 400 MHz, 5 Watt, 3 ft	*

* Specifications same as model 5B30.

¹ V_Z is the nominal input voltage that results in a 0 V output.

² Includes the combined effects of repeatability, hysteresis, and nonlinearity and assumes $R_L > 50 \text{ k}\Omega$.

³ The output common must be kept within $\pm 3 \text{ V}$ of power common.

⁴ Loads heavier than $50 \text{ k}\Omega$ will degrade nonlinearity and gain temperature coefficient.

Specifications subject to change without notice.

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