Isolated, Wide-Bandwidth Strain Gage Input

5B38

FEATURES

Wide-bandwidth Single-Channel Signal Conditioning
Interfaces, Amplifies, and Filters signals from full-bridge and half-bridge strain-gage transduces between 300Ω and 10kΩ.
Isolated Precision Output of -5V to +5V.
10 kHz bandwidth of the 5B38 ideally suits to measure signals that vary rapidly with time.
Module circuitry can withstand 240v rms at the input screw-terminals.
All 5B38 series modules are mix-and-match and Hot Swappable.

APPLICATIONS

Industrial signal conditioning
Industrial signal isolation
Industrial signal filtering

PRODUCT OVERVIEW

The 5B Series represents an innovative generation of low cost, high performance plug-in signal conditioners. Designed for industrial applications, these modules incorporate highly reliable transformer-based isolation and automated surface-mount manufacturing technology. They are compact, economical components whose performance exceeds that available from more expensive devices. Combining 1500 V rms continuous isolation, +0.05% calibrated accuracy, small size and low cost, the 5B Series is an attractive alternative to expensive signal conditioners and in-house designs

All modules are potted and identical in pin-out and size (2.27" x 2.32" x 0.595"). They can be mixed and matched, permitting users to address their exact needs, and may be "hot swapped without disturbing field wiring or power. The isolated input modules provide 0 to +5V or +5V outputs and accept J, K, T, E, R, S, N, or B type thermocouples.

These modules feature complete signal conditioning functions including 240 V rms input protection, filtering, chopper stabilized low drift +1 uV/oC amplification, 1500 V rms isolation, and sensor excitation when required.

All modules feature excellent common mode rejection and meet industrial transient surge withstand specifications.

FUNCTIONAL BLOCK DIAGRAM

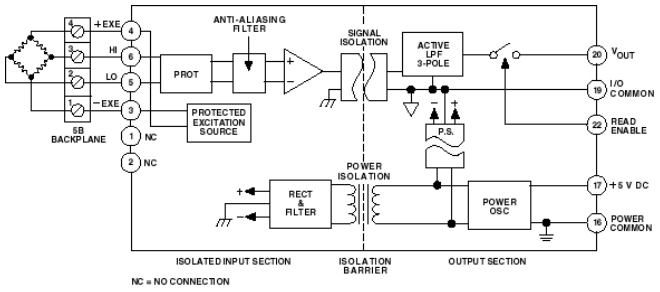

Figure 1. 5B38 Functional Block Diagram

There are also a number of backplanes and mounting sockets which provide a complete signal conditioning solution for end users. Each backplane incorporates screw terminals for field wiring inputs and outputs and cold junction sensors for thermocouple applications.

These signal conditioners are designed to provide an easy and convenient solution to signal conditioning problems of both designers and end users in measurement and control applications. Typical uses include microcomputer-based measurement systems, standard data acquisition systems, programmable controllers, analog recorders and dedicated control systems. The 5 B series modules are ideally suited to applications where monitoring and control of temperature, pressure, flow, rotation and other analog signals are required.

The 5B Series modules and backplanes are approved by Factory Mutual (FM) and the 5B Series modules are approved by the Canadian Standards Association (CSA) for use in Class 1, Division 2, Groups A, B, C, and D locations. These approvals certify that the 5B Series is suitable for use in locations where a hazardous concentration of flammable gas may exist only under fault conditions of operation. Equipment of this category is called "non-incendive" and they need no special enclosures or other physical safeguards.

The 5B series modules and backplanes have been tested and passed the stringent heavy industrial requirements of the European Union's electromagnetic compatibility (ENC) directive – EN50082-1 and EN50081-2. When used according to installation directions (refer to 5B series User Manual), any errors caused by EMI/RFI interference will be less than 0.1% of the full scale 5B measurement range for field strengths up to 10 V/M and frequencies up to 1 GHz.

Rev. 0

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GENERAL DESCRIPTION

The 5B38 is a wide-bandwidth single-channel signal conditioning module that interfaces, amplifies, and filters signals from full-bridge and half-bridge strain-gage transducers between 300Ω and 10kΩ. The module provides an isolated bridge excitation of +10V and a protected, isolated precision output of -5V to +5V. The 10 kHz bandwidth of the module ideally suits to measure signals that vary rapidly with time, such as strain on an automobile chassis during a crash test.

The 5B38 protects the computer side from damage due to field-side over-voltage faults. The module withstands 240V rms at its input terminals without damage, thereby shielding computer-side circuitry from field-side over-voltage conditions. In addition, the 5B38 is mix-and-match and hot-swappable with all 5B Series modules, so can be inserted or removed from any socket in the same backplane without disrupting system power.

The 5B38-04 contains bridge completion circuitry, so can function with half-bridge strain gages. For quarter-bridge requirements, the user must complete the bridge input to the half-bridge level externally. The factory can configure the module for a wide range of input ranges (sensitivities).

A signle-pole anti-aliasing filter resides at each modules input. A three-pole, low-pass filter in the output stage sets the bandwidth and yields optimal noise performance for accurate measurement of small signals in high electrical noise. A chopper-stabilized input amplifier provides low drift and stable gain.

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. An additional benefit, the output section acts as a third floating port, eliminating possible problems from ground loops and power-supply noise. The output common must be kept within ±3V of power common.

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 grounded to power common as it is on the 5B01 and 5B08 backplanes..

Figure 2

5B38 Models Available

Model	Input Bridge Type	Bridge Range	Excitation	Sensitivity	Output Range
5B38-02	Full Bridge	300 Ωto 10 kΩ	+10.0 V	3 mV/V	-5 V to +5 V
5B38-04	Half Bridge	300 Ωto 10 kΩ	+10.0 V	3 mV/V	-5 V to +5 V
5B38-05	Full Bridge	300 Ωto 10 kΩ	+10.0 V	2 mV/V	-5 V to +5 V
5B38-Custom	*	300 Ωto 10 kΩ	+10.0 V	*	-5 V to +5 V

* Custom Input/sensitivity ranges are available. Refer to configuration guide.

5B38 Specifications

Description	Model 5B38 Full Bridge	Model 5B38 Half Bridge
	Input Ranges	
Standard Ranges	±20 mV (2 mV/V Sensitivity) ±30 mV (3 mV/V Sensitivity)	±30 mV (3 mV/V Sensitivity)
Custom Ranges	±10 mV to ±500 mV	*
Output Ranges (R_L > 50 kΩ)	-5 V to +5 V	*
	Accuracy[2]	
Initial @ +25°C	±0.08% Span ±10 µV RTI	±0.08% Span ±1 mV RTI
Nonlinearity	±0.02% Span	*
Input Offset vs. Temperature	±1 µV/°C	*
Output Offset vs. Temperature	±40 µV/°C	*
Gain vs. Temperature	±25 ppm of Reading/°C	*
Excitation Voltage Output @ full load	+10 V ±3 mV	*
Load Range	10 kΩ, minimum; 300 Ω, maximum	*
Load Regulation	±5 ppm/mA	*
vs. Temperature	±15 ppm/°C	*
Half Bridge Voltage Level	N/A	+5 V ±1 mV
Half Bridge Voltage vs. Temperature	N/A	±15 ppm/°C
Input Bias Current	±3 nA	*
	Input Resistance	
Power On	20 MΩ, minimum	*
Power Off	40 kΩ, minimum	*
Overload	40 kΩ, minimum	*
	Noise	
Input, 0.1 Hz to 10 Hz Bandwidth	0.4 µV rms	2 µV rms
Input, 10 kHz Bandwidth	±70 nV/$\sqrt{}$ Hz	±250 nV/$\sqrt{}$ Hz
Output, 100 kHz Bandwidth	10 mV peak-peak	*

Bandwidth, -3 dB	10 kHz	*
Output Rise Time, 10% to 90% Span	40 µs	*
Output Settling Time, to 0.1%	250 µs	7 ms
	Common-Mode Voltage (CMV)	
Input-to-Output, Continuous	1500 V rms, maximum	*
Output-to-Power, Continuous[2]	±3 V, maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
	Common-Mode Rejection (CMR)	
1 kΩ Source Imbalance, 50/60 Hz	100 dB	*
Normal Mode Rejection, 50/60 Hz	-3 dB @ 10 kHz	*
	Input Protection, Signal and Excitation Voltage	
Continuous	240 V rms maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
Output Resistance	50 Ω	*
Voltage Output Protection	Continuous Short to Ground	*
Output Selection Time	6 µs @ 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	200 mA, Full Load; 120 mA, No Load	*
Power Supply Sensitivity	25 ppm reading/% ±2.5µV RTI/%	*
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 non-condensing	*
RFI Susceptibility	±0.5% Span error @ 400 MHz, 5 Watt, 3 ft	*

* Same as full-bridge version.
[1] Includes the combined effects of repeatability, hysteresis, and nonlinearity. Loads heavier than 50 kΩ will degrade nonlinearity and gain temperature coefficient.
[2] The output common must be kept within ±3 V of power common.
Specifications subject to change without notice.

PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS

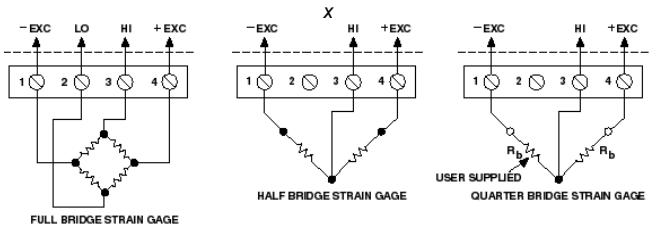

Figure 3 5B38 Input Field Connections

Table 1. Pin Function Descriptions—

Pin No.	Description
1	-EXC
2	LO
3	HI
4	+EXC

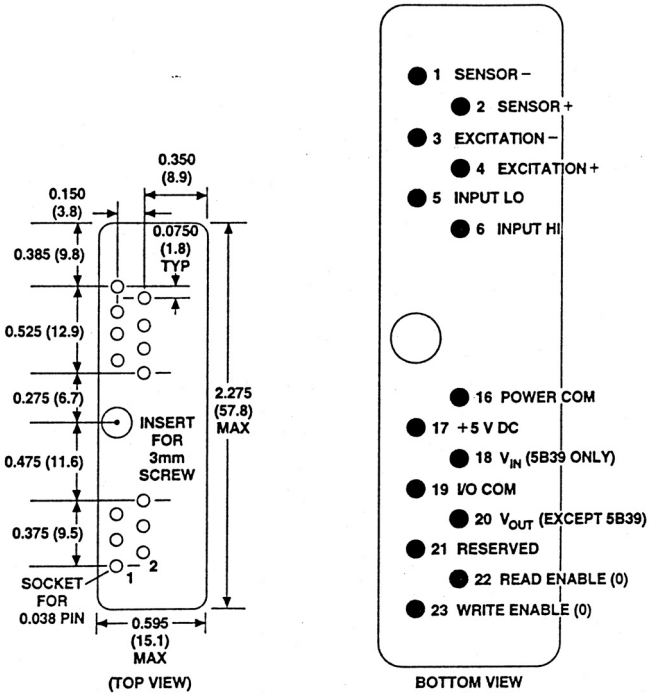

Figure 4 . Model 5B Series Module, with pin-out assignments.

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

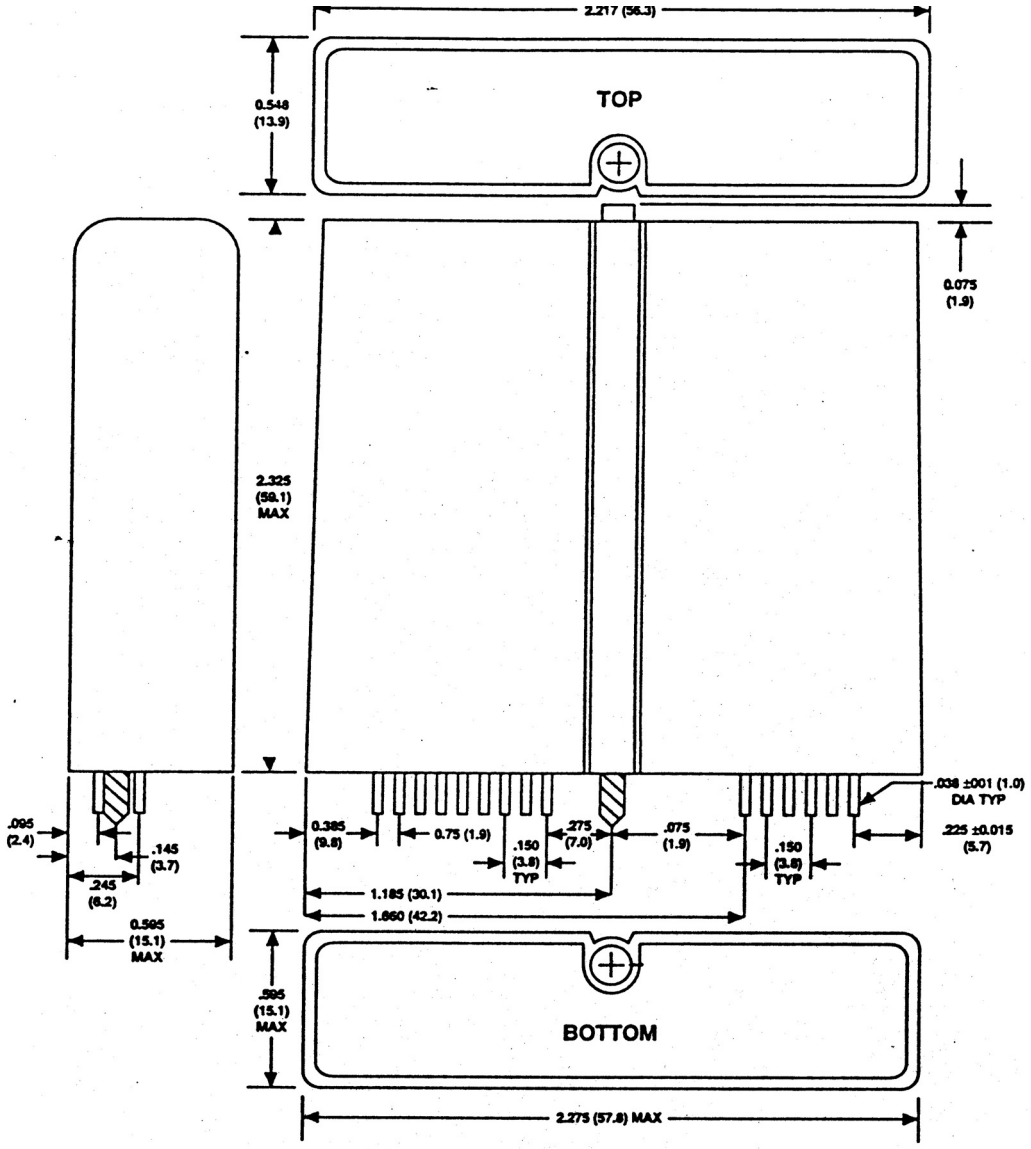

Figure 5. Outline Dimensions

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