

FEATURES

Isolated Current Input.

Interfaces with two-wire transmitters, providing an isolated, regulated 20 V supply voltage.

Measure process-current input signal of 4-20 mA .

Generates an output of +1 to +5V or +2 to 10V.

Module circuitry can withstand 240v rms at the input screw-terminals.

All 5B42 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

Rev. 0

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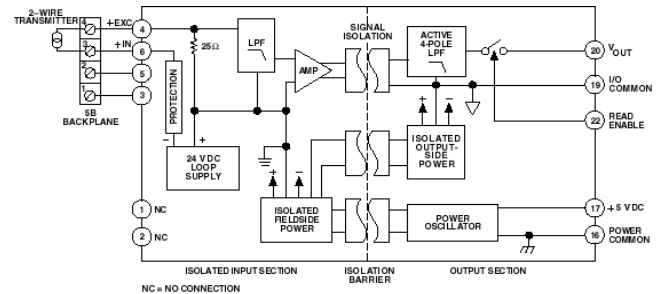


Figure 1. 5B42 Functional Block Diagram

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 "nonincendive" 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 (EMC) 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.

GENERAL DESCRIPTION

The 5B42 is a single-channel signal conditioning module that interfaces with two-wire transmitters, providing an isolated, regulated 20V supply voltage. The module filters and amplifies the 4-to-20 mA process-current input to produce an accurately scaled, low-noise low-impedance output of +1 to +5 V or +2 to +10 V.

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, 250V rms between power and output – no return path is required between the power and signal output commons.

Accurate and Stable Performance – The 5B42 maintains accuracy over the wide operating temperature range of -40°C to +85°C through design for low parameter drift. This enables the module to provide output offset drift of only ± 5 uV/°C and gain drift of just ± 25 ppm/°C

Why an Internal Current Sense Resistor? – The 5B42 offers significant advantages over signal conditioners that require an external current sense resistor. First, an external resistor is not protected from accidental connection to a 240 V rms power line. Next, the external resistor tolerance must be added to the

conditioners specified errors. In contrast, the 5B42 is calibrated and specified with its internal 25 Ω sense resistor. Further, the 5B42 signal input, loop supply and the sense resistor are all protected against accidental application of excess voltages up to 240V rms. Finally, there is no need to install an external sense resistor on the backplane, but if one is installed it will not affect 5B42 performance.

Filtering and Protection – The 5B42 contains an optimized five-pole low-pass filter with a -3 dB bandwidth at 100Hz that provides a low-overshoot step response and exceptionally low noise of 200 uV pk-pk in a 100kHz bandwidth. Attenuation (normal mode rejection) increases at a 90 dB/decade rate beyond 100 Hz.

The module protects the computer side from damage due to field-side over-voltage faults. The module withstands 240 V rms at the input terminals without damage, thereby shielding the internal computer-side circuitry from field-side over-voltage conditions. In addition, the 5B42 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.

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

5B42 Models Available

Model	Input Range	Output Range
5B42-01	4 mA to 20 mA	+1 V to +5 V
5B42-02	4 mA to 20 mA	+2 V to +10 V
5B42-Custom	*	*

* Custom Input/Output ranges are available.

5B42 Specifications (typical @ +25°C and $V_s = +5$ V dc)

Description	Model 5B42
Input Ranges	
Standard Ranges	4 mA to 20 mA (Refer to Model Table)
Custom Ranges	0 mA to 20 mA (Refer to Ordering Section)
Isolated Loop Supply Voltage	20 V @ 4 mA to 20 mA Input
Output Ranges ($R_L > 50$ k Ω)	+1 V to +5 V; +2 V to +10 V
Accuracy¹	
Initial @ +25°C	$\pm 0.05\%$ Span ± 4 μ A RTI
Nonlinearity	$\pm 0.01\%$ Span
Input Offset vs. Temperature	± 0.5 μ V/°C
Output Offset vs. Temperature	± 5 μ V/°C
Gain vs. Temperature	$\pm 0.0025\%$ of Reading/°C
Input Sense Resistor ²	25 Ω
Noise	
Input, 0.1 Hz to 10 Hz Bandwidth	10 nA rms
Output, 100 kHz Bandwidth	200 μ V peak-peak
Bandwidth, -3 dB	100 Hz
Output Step Rise Time, 10% to 90% Span	4 ms
Common-Mode Voltage (CMV)	
Output-to-Input, Continuous	1500 V rms, maximum
Input-to-Power, Continuous	1500 V rms, maximum
Output-to-Power, Continuous ³	250 V rms, maximum
Transient	ANSI/IEEE C37.90.1-1989
Common Mode Rejection (CMR)	
1 k Ω Source Imbalance, 50/60 Hz	140 dB
Normal Mode Rejection (NMR)	-3 dB @ 100 Hz (90 dB per decade > 100 Hz)
Input, Excitation, and Sense Resistor 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	± 20 mA
Output Selection Time	6 μ s to ± 1 mV of V_{out} @ $C_{load} = 0$ to 2,000 pF

Output Enable Control³

Max Logic "0"	+0.8 V
Min Logic "1"	+2.4 V
Max Logic "1"	+36 V
Input Current "0", "1"	0.5 μ A
Power Supply Voltage	+5 V dc $\pm 5\%$

Power Supply Current

@ Transmitter Load of 20 mA	200 mA
@ Transmitter Load of 4 mA	100 mA
Power Supply Sensitivity, RTI	± 1 μ V/% 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 95% @ +60°C, non-condensing
RFI Susceptibility	$\pm 0.5\%$ Span error @ 400 MHz, 5 Watt, 3 ft

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

²A precision 25 Ω current-sense input resistor is internal to the 5B42 - refer to block diagram.

³The 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 5B42 is installed on a 5B Series backplane.

Specifications subject to change without notice.

PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS

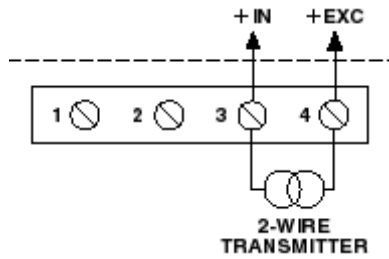


Figure 3 5B42 Input Field Connections

Table 1. Pin Function Descriptions—

Pin No.	Description
3	+IN
4	+EXC

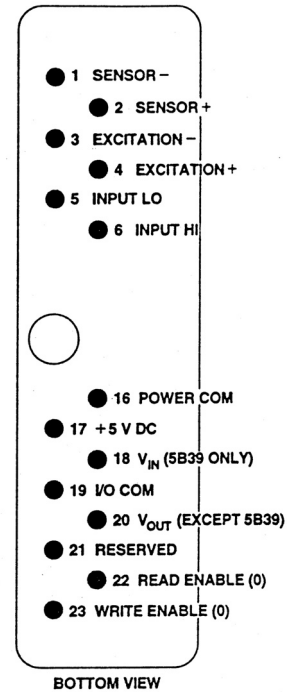


Figure 4 . Model 5B Series Module, with pin-out assignments.

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

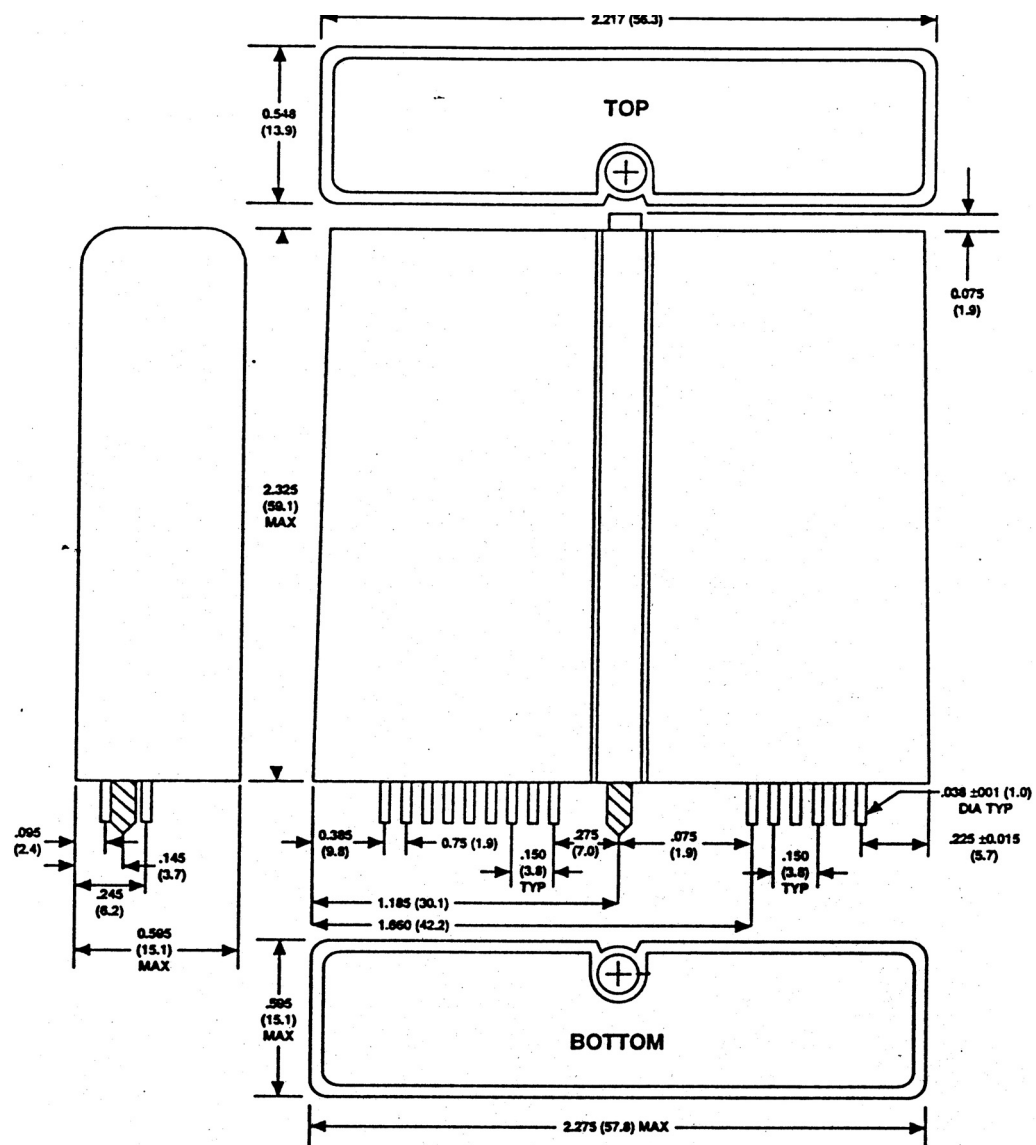


Figure 5. Outline Dimensions

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