5B42 Isolated, Process Current Input

Functional Description

The 5B42 is a single-channel signal conditioning module that interfaces with two-wire transmitters, providing an isolated, regulated 20 V 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; 250 V 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 µV/°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 Ωsense resistor. Further, the 5B42 signal input, loop supply and the sense resistor are all protected against accidental application of excess voltages up to 240 V 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 100-Hz that provides a low-overshoot step response and exceptionally low noise of 200 µV pk-pk in a 100 kHz 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 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 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.

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

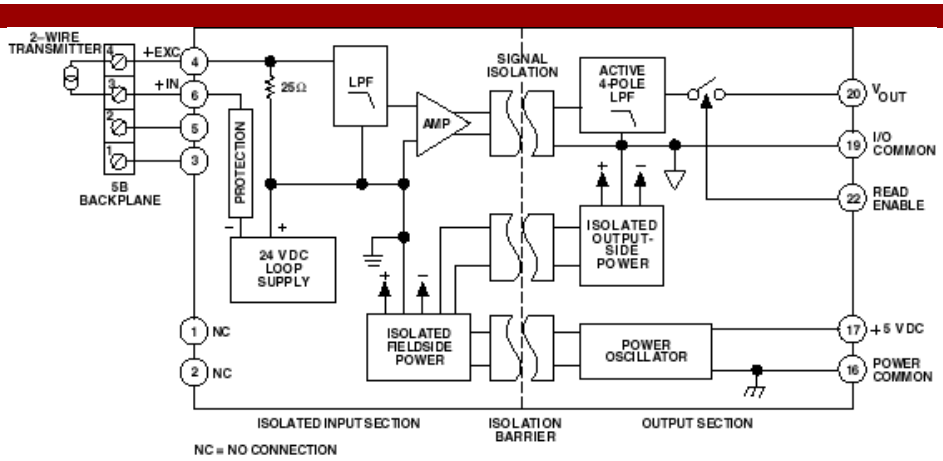

Figure 1. 5B42 Functional Block Diagram

Input Ranges

Two-Wire Transmitters 4 to 20 mA
(0 to 20 mA - custom)

Output Range

+1 to +5 V or +2 to +10 V
(0 to +10 V - custom)

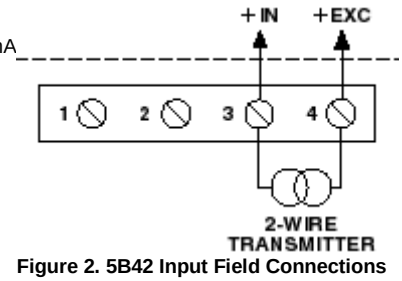

Figure 2. 5B42 Input Field Connections

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. Refer to ordering guide.

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
Accuracy[1]	
Initial @ +25°C	±0.05% Span ±4 µA RTI
Nonlinearity	±0.01% Span
Input Offset vs. Temperature	±0.5 µV/°C
Output Offset vs. Temperature	±5 µV/°C
Gain vs. Temperature	±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 µV 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 µs to ±1 mV of V_{out} @ C_{load} = 0 to 2,000 pF
Output Enable Control[3]	
Max Logic "0"	+0.8 V
Min Logic "1"	+2.4 V
Max Logic "1"	+36 V
Input Current "0", "1"	0.5 µA
Power Supply Voltage	+5 V dc ±5%
Power Supply Current	
@ Transmitter Load of 20 mA	200 mA
@ Transmitter Load of 4 mA	100 mA
Power Supply Sensitivity, RTI	±1 µV/% 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, noncondensing
RFI Susceptibility	±0.5% Span error @ 400 MHz, 5 Watt, 3 ft