



Analog Signal Conditioning Panels

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

FEATURES

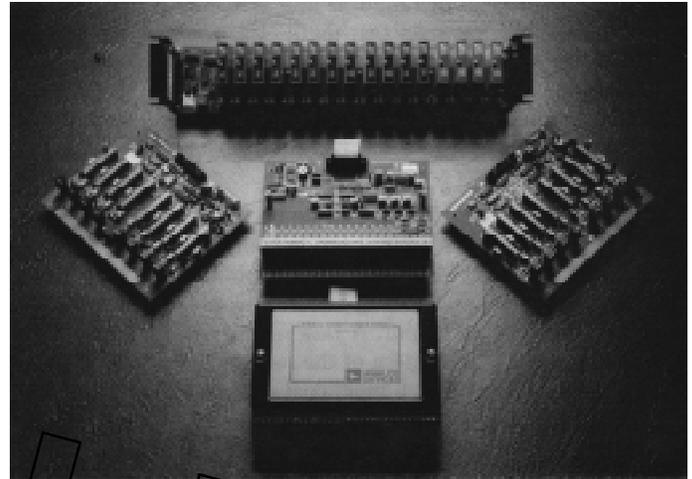
A Variety of Solutions for Analog Signal Interfacing
Isolated and Nonisolated Signal Conditioning
Interfacing Capabilities to a Wide Variety of Real-World
Sensors Including:

- Thermocouples
- RTDs
- Strain Gages
- Other Low Level Voltage Inputs
- Current Inputs
- High Level Voltage Inputs
- Current Outputs
- High Level Voltage Outputs

Panels Are Interchangeable Using Same Cables and
Addressing Scheme

I/O Modules or Screw Terminals Removable for Easy
Field Installation and Replacement

Modular Analog Expansion for RTI®-820
19" Rack Mountable



GENERAL DESCRIPTION

The Analog Devices family of multiplexed analog signal conditioning panels offers a variety of ways to connect real-world signals to data acquisition boards. The panels described in this data sheet can all be used with the RTI-820, and any other product that supports the Analog Devices multiplexed analog bus standard. These panels may be mixed and matched in an application since they are addressed in the same fashion by the RTI-820. Consult the appropriate RTI-820 data sheet to determine the maximum number of analog signal conditioning panels supported.

For all panels, field signals are brought in via screw terminal connectors. A screw terminal is also provided for the connection of the +5 V power supply. Other voltages required for the analog circuitry are produced on-board. The RTI products provide +5 V power capability for some extra panels. The PWR-01 power supply is recommended for the panels and provide ample +5 V power for most applications. Consult the RTI-820 data sheet for more information about powering the panels.

Interchangeability of the different panels is accomplished by use of a standard multiplexed analog bus developed by Analog Devices. This bus allows the high channel capacity possible for the RTI-820. The multiplexed analog signals are brought to the RTI-820 via the CAB-01 or CAB-01-2 cables.

5B Series signal conditioning modules are sealed for protection from harsh environments. The optional CV-01 cover may be used to protect each of the five STB panels.

The 5B02, STB-TCI and STB-HLI provide signal conditioning for those applications requiring high electrical isolation. The STB-TC, STB-AOT, and STB-HL02 panels provide nonisolated signal conditioning. This data sheet gives the description and specifications for each of these panels. In addition there is a panel selection guide for quick reference, an I/O comparison chart as a configuration aid and a mounting diagram at the end of the data sheet.

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5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

5B02

The 5B02 panel provides 16 sockets for 5B Series signal conditioning modules. The 5B Series provides isolated signal conditioning for thermocouples, RTDs, low and high level voltage inputs, current inputs and outputs, and strain gage inputs. A nonisolated voltage switch input is also available. A list of the different 5B Series modules that the RTI-820 supports is shown to the right. See the 5B Series modules data sheet for more detailed specifications. With the 5B02 and the 5B Series modules, any combination of the various inputs and outputs can be used on one panel, providing the most flexible analog I/O solution.

The 5B02 panel consists of sockets and screw terminals for sixteen 5B Series modules. Cold junction compensation for each module socket is provided for thermocouple modules. The panel contains the necessary decoding circuitry to address each position as an input or an output. A rack mount (AC1363) may be ordered separately. A diagram of the rack mount is shown at the end of the data sheet, and a functional diagram of the panel is shown in Figure 1.

When high performance, isolation and modularity of I/O are required, the 5B Series modules and the 5B02 are the best solution for data acquisition applications.

5B Series Signal Conditioning Modules

Model	Description
5B30	Isolated Millivolt Input
5B31	Isolated Volt Input
5B32	Isolated Current Input
5B34	Isolated RTD Input
5B35	Isolated 4-Wire RTD Input
5B36	Isolated Potentiometer Input
5B37	Isolated Thermocouple Input
5B47	Isolated Linearized Thermocouple Input
5B38	Isolated Strain Gage Input
5B39	Isolated Current Output
5B40	Isolated Wideband Millivolt Input
5B41	Isolated Wideband Volt Input
5B42	Isolated Loop-Powered Transmitter Input
AC1367	Nonisolated Voltage Switch Input

5B02-SPECIFICATIONS

For detailed specifications of the modules, see the 5B Series data sheet.

Number of Channels	16 (Using Input or Output Plug-In Modules)
Channel-to-Channel Isolation	1500 V _{rms} (Modules)
Input Voltage Protection	240 V _{rms} (Modules)
Physical Dimensions	3.5" × 17.4" × 3.2"
Operating Temperature Range	-40°C to +85°C

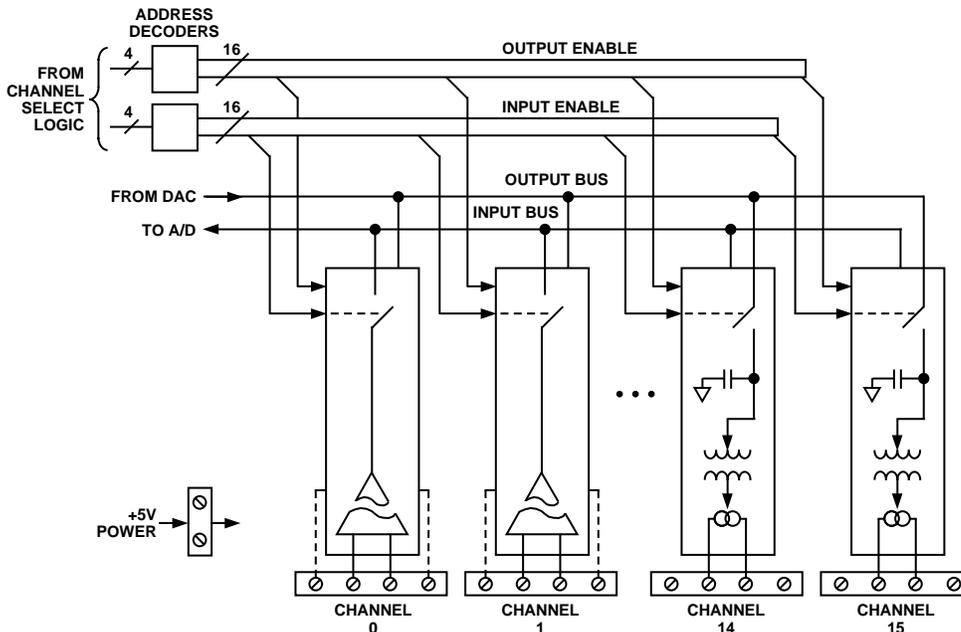


Figure 1. 5B02 Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

STB-TCI

The STB-TCI isolated thermocouple panel provides the means to interface up to eight low level voltage signals requiring high electrical isolation. Low level signals, including thermocouple voltages, can be read with high accuracy even in noisy environments. Standard thermocouple types such as J, K, T, E, R, B and S can be used with the panel, and cold junction compensation is provided. Each input channel is provided with user selectable gains of 50, 100, 200 and 1000, permitting signal ranges of ± 5 mV, ± 25 mV, ± 50 mV and ± 100 mV. Each channel has a quick-disconnect screw terminal connector making field installation and replacement easy. A cover (CV-01) and a rack mount (RM-02) may be ordered separately.

Each input signal on the STB-TCI panel passes through a 3-pole low-pass filter with a cutoff frequency of 4 Hz. This filter reduces noise that may be present at the analog inputs. Break detect circuitry is also present to determine if a thermocouple or cable has been disconnected. Each channel has an isolation amplifier that provides 750 V rms of channel-to-system and channel-to-channel isolation. Overvoltage input protection of 240 V is provided as well. A functional diagram of the STB-TCI is shown in Figure 2.

The STB-TCI, or the 5B02 with 5B30, 5B37, 5B40, or 5B47 modules, should be used instead of the STB-TC panel when high isolation is required for a harsh environment. The STB-TCI panel may be used instead of 5B Series modules when an application has many low level inputs and single channel modularity is not required.

STB-TCI—SPECIFICATIONS

(typical @ +25°C and +5 V dc)

Number of Input Channels	8
Isolation	750 V rms Channel-to-Channel and Channel-to-System
Input Impedance	50 M Ω
Input Voltage Range	± 5 mV, ± 25 mV, ± 50 mV, ± 100 mV
Input Overvoltage Protection	240 V ac rms
Gain Range	50, 100, 200, 1000 Jumper Configurable per Channel
Gain Accuracy ¹	$\pm 0.05\%$ (at Factory Adjusted Gain of 100)
Output Offset ¹	± 3 mV
Offset Drift vs. Temperature (Referred to Input)	± 3.25 μ V/ $^{\circ}$ C (at Gain of 100)
CJC Accuracy	$\pm 1^{\circ}$ C
Low-Pass Filter Frequency	4 Hz
Common-Mode Rejection	130 dB
Power Requirements	± 5 V $\pm 5\%$ @ 300 mA
Physical Dimensions Without Optional Cover	8.25" \times 6.8" \times 1.97" (20.95 cm \times 17.27 cm \times 5.0 cm)
With Optional Cover	8.25" \times 6.8" \times 2.14" (20.95 cm \times 17.27 cm \times 5.45 cm)
Operating Temperature Range	0 $^{\circ}$ C to +60 $^{\circ}$ C

NOTES

¹Adjustable to zero.

Specifications subject to change without notice.

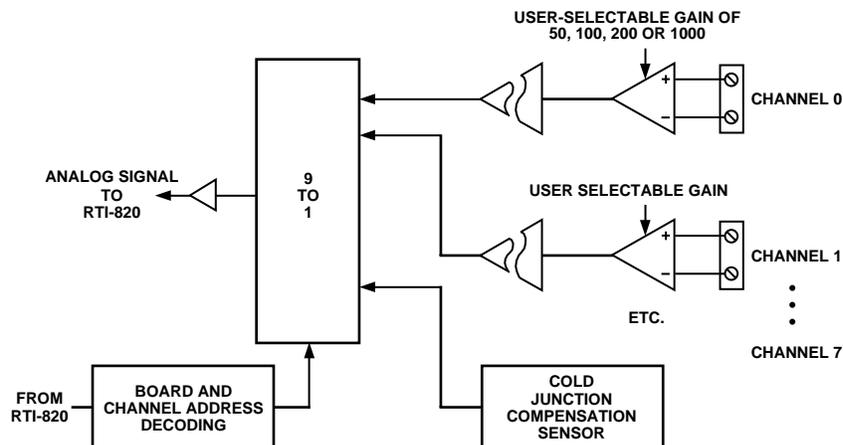


Figure 2. STB-TCI Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

STB-HLI

The STB-HLI isolated high level panel provides eight inputs for interfacing high level voltage signals that require high electrical isolation. This panel is for use in harsh environments where large common-mode voltages are present. Each input channel is provided with user selectable gains of 0.5 and 1 permitting signal ranges of ± 5 V or ± 10 V. Each channel has a quick-disconnect screw terminal connector making field installation and replacement easy. An optional cover (CV-01) and a rack mount kit (RM-02) are also available.

Each input signal on the STB-HLI panel passes through a single pole low-pass filter with a cutoff frequency of 500 Hz. This filter reduces high frequency noise that may be present at the analog inputs. A precision input amplifier conditions each analog signal. Each channel has an isolation amplifier that provides 750 V rms of channel-to-system and channel-to-channel isolation. Over-voltage input protection of 240 V is provided as well. A functional diagram of the STB-HLI is shown in Figure 3.

The STB-HLI, or the 5B02 with 5B31 or 5B41, modules should be used instead of the STB-HL02 panel when isolation is required. The STB-HLI may be used instead of 5B Series modules when an application has many high level inputs and single channel modularity is not required.

STB-HLI—SPECIFICATIONS

(typical @ +25°C and +5 V dc)

Number of Input Channels	8
Isolation	750 V rms Channel-to-Channel and Channel-to-System
Input Voltage Range	± 5 V, ± 10 V
Input Accuracy ¹	0.05% of Span (Factory Adjusted Gain of 1)
Input Protection	240 V ac rms
Gain Range	1, 0.5 Jumper Configurable per Channel
Output Offset ¹	± 3 mV
Offset Drift vs. Temperature (Referred to Output)	100 μ V/°C
Input Impedance	500 k Ω
Low-Pass Filter Frequency	500 Hz
Common-Mode Rejection	86 dB
Power Requirements	+5 V \pm 5% @ 300 mA
Physical Dimensions	
Without Optional Cover	8.25" \times 6.8" \times 1.97" (20.95 cm \times 17.27 cm \times 5.0 cm)
With Optional Cover	9.25" \times 6.8" \times 2.14" (20.95 cm \times 17.27 cm \times 5.43 cm)
Operating Temperature Range	0°C to +60°C

NOTES

¹Adjustable to zero.

Specifications subject to change without notice.

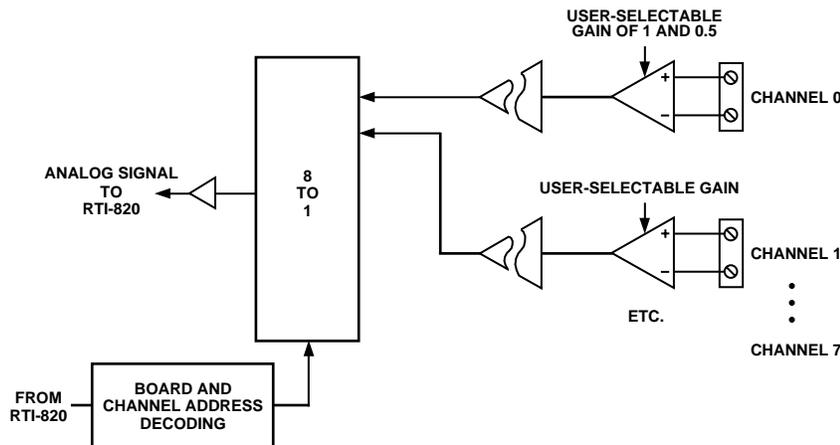


Figure 3. STB-HLI Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

STB-TC

The STB-TC thermocouple panel provides sixteen low level voltage inputs or fifteen thermocouple inputs with cold junction compensation. The range of the inputs can be set to be all +5 V, ±100 mV, ±50 mV, ±25 mV, ±10 mV or ±5 mV range. A dip switch is used to select a gain of 1, 50, 100, 200, 500 or 1000 to provide these ranges. At each channel, users can also add an 8 Hz low-pass filter to block out high frequency noise, a return path for bias currents and break detect circuitry. All these options are enabled through split-pad connections. The analog signals are connected to the panel via removable screw terminals for easy installation and field replacement. An optional cover (CV-01) and a rack mount kit (RM-02) are also available. A functional diagram of the STB-TC is shown in Figure 4.

The STB-TC is the right solution for applications with low level signals or thermocouples which require no electrical isolation. The STB-TCI, or 5B02 with 5B Series signal conditioning modules, should be used if electrical isolation is required or if a mix of thermocouple types is to be used.

STB-TC—SPECIFICATIONS

(typical @ +25°C and +5 V dc)

Number of Inputs	16 Differential (Accepts 15 Thermocouples Plus 1 Input of CJC)
Input Voltage Range	±5 V, ±100 mV, ±50 mV, ±25 mV, ±10 mV, ±5 mV
Input Overvoltage Protection	±30 V
Input Resistance ¹	1 GΩ
Gain Range	1, 50, 100, 200, 500, 1000 User Defined
Gain Accuracy ²	±0.05%
Input Offset ²	±15 μV
Output Offset ²	±2.5 mV
CJC Accuracy	±1°C
Low-Pass Filter Frequency ³	8 Hz
Common-Mode Rejection ⁴	100 dB
Power Requirements	+5 V @ 200 mA
Physical Dimensions	
Without Optional Cover	8.25" × 6.8" × 1.97" (20.95 cm × 17.27 cm × 5.0 cm)
With Optional Cover	8.25" × 6.8" × 2.14" (20.95 cm × 17.27 cm × 5.43 cm)
Operating Temperature Range	0°C to +60°C

NOTES

¹With break detect and bias return split pads open.

²Adjustable to zero.

³Removable.

⁴CMRR according to factory configuration of gain of 100 (at gain of 1, 80 dB; at gain 200 or greater, 110 dB).

Specifications subject to change without notice.

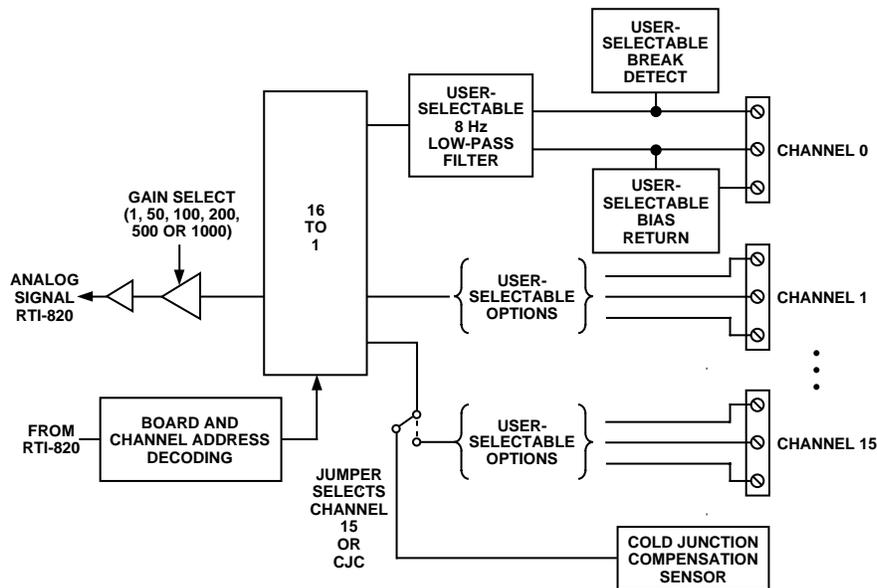


Figure 4. STB-TC Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

STB-HL02

The STB-HL02 high level voltage panel provides sixteen high level voltage inputs and four voltage outputs. The input levels can be selected to be all ± 5 V or ± 10 V range. An offset of ± 5 V developed from output channel 0 can also be applied to the ± 5 V input signal allowing a wider range of input signals to be accommodated. At each input circuit, positions are provided for users to add their own resistors or capacitors for filtering or signal attenuation. The voltage output channels are ± 5 V or 0 V–5 V, with a maximum current of 5 mA per channel. Output values are held by use of a sample-and hold amplifier at each channel. The output range selection is made at the RTI-820 and is applicable to all channels. All signals are connected to the panel via removable screw terminals for easy installation and field replacement. An optional cover (CV-01) and rack mount kit (RM-02) are also available. A functional diagram of the STB-HL02 is shown in Figure 5.

The STB-HL02 is the right solution for signals that require no electrical isolation such as transmitters and other preconditioned high level signals. The STB-HLI or 5B02 with 5B Series signal conditioning modules should be used if electrical isolation is required for high level signals.

STB-HL02—SPECIFICATIONS

(typical @ +25°C and +5 V dc)

Number of Input Channels	16 Single-Ended
Input Voltage Range ¹	± 5 V, ± 10 V
Input Accuracy	0.05% of Span
Input Protection ²	± 35 V (Powered), ± 20 V (Unpowered)
Input Resistance	1 G Ω
Number of Output Channels	4
Output Voltage Range	± 5 V, 0 V–5 V @ 5 mA
Output Accuracy	0.05% of Span
Output Noise	1 mV rms, 10 kHz Bandwidth
Power Requirements	+5 V @ 350 mA
Physical Dimensions	
Without Optional Cover	8.25" \times 6.8" \times 1.97" (20.95 cm \times 17.27 cm \times 5.0 cm)
With Optional Cover	8.25" \times 6.8" \times 2.14" (20.95 cm \times 17.27 cm \times 5.43 cm)
Operating Temperature Range	0°C to +60°C

NOTES

¹The STB-HL02 has the capability to apply an offset from output Channel 0 to a ± 5 V signal to accommodate different input range (such as 0 V to +10 V).

²The STB-HL02 panel provides three sockets per input channel for user installed resistor attenuators or low-pass filter circuits.

Specifications subject to change without notice.

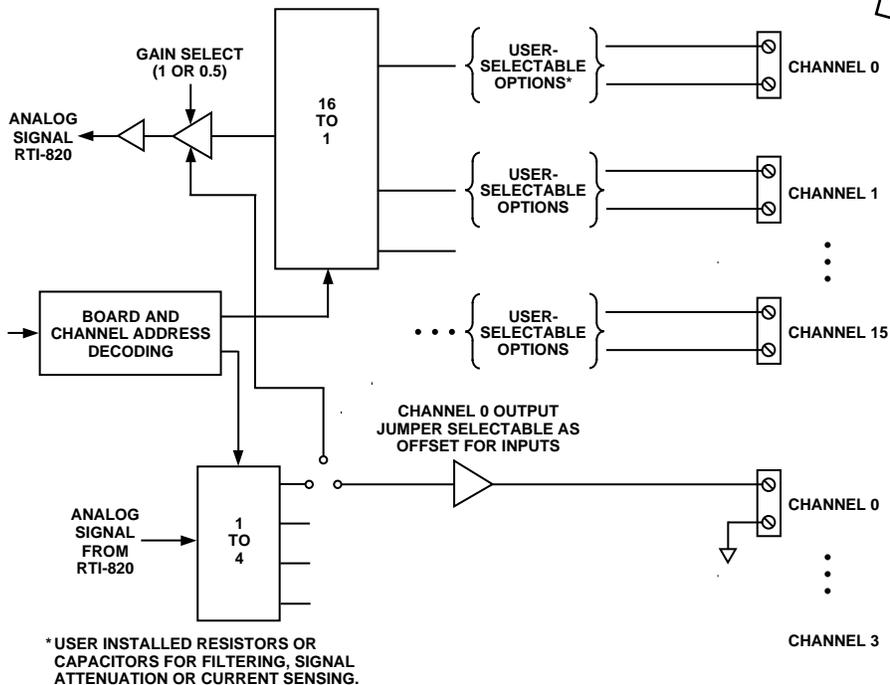


Figure 5. STB-HL02 Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

STB-AOT

The STB-AOT analog output panel provides eight channels of nonisolated analog output. The STB-AOT supports four voltage and two current output ranges which are jumper-selectable on a per channel basis. The six ranges are ± 5 V, 0 V–5 V, ± 10 V, 0 V–10 V, 0 mA–20 mA and 4 mA–20 mA. Each output channel has a sample-and-hold amplifier which holds the output values sent by the digital-to-analog converter constant. The output accuracy for both voltage and current output is $\pm 0.05\%$ of span. The loop power for current outputs can be provided by an on-board dc-to-dc or supplied by an external dc voltage source (V_{LOOP}) of between 18 V and 32 V. The compliance voltage is 10.5 V when using the internal power source and $V_{LOOP} - 5$ V when using an external power source. Each channel has a quick-disconnect screw terminal connector making field installation and replacement easy. An optional cover (CV-01) and a rack mount kit (RM-02) are also available. A functional diagram of the STB-AOT is shown in Figure 6.

The STB-AOT is the best solution for applications that do not require analog output isolation. The output channels can be used to control material transfer rates, fluid flow, motor speed, or to provide setpoints to loop controllers. If isolation is required, the 5B02 with 5B39 signal conditioning modules should be used.

STB-AOT—SPECIFICATIONS

(typical @ +25°C and +5 V dc)

Number of Input Channels	8
Voltage Output Ranges ¹	± 5 V, 0 V–5 V, ± 10 V, 0 V–10 V
Current Output Ranges ¹	0 mA–20 mA ² , 4 mA–20 mA
Output Accuracy	$\pm 0.05\%$ of Span
Output Drive Current	
(V_{OUT} Options)	± 5 mA
Output Noise	1.0 mV rms, 10 kHz Bandwidth
Compliance Voltage	10.5 V (Internal Loop Power) $V_{LOOP} - 5$ V (External Loop Power)
Slew Rate	
Voltage	0.01 V/ μ s
Current	10 μ A/ μ s
Droop Rate	
Voltage	30 mV/sec
Current	60 μ A/sec
Power Requirements	+5 V @ 1.2 A (Internal Loop Power) +5 V @ 0.4 A (External Loop Power)
Physical Dimensions	
Without Optional Cover	8.25" \times 6.8" \times 1.97" (20.95 cm \times 17.27 cm \times 5.0 cm)
With Optional Cover	8.25" \times 6.8" \times 2.14" (20.95 cm \times 17.27 cm \times 5.43 cm)
Operating Temperature Range	0°C to +70°C

NOTES

¹Output ranges are jumper selectable.

²The default output range is 0 mA–20 mA.

Specifications subject to change without notice.

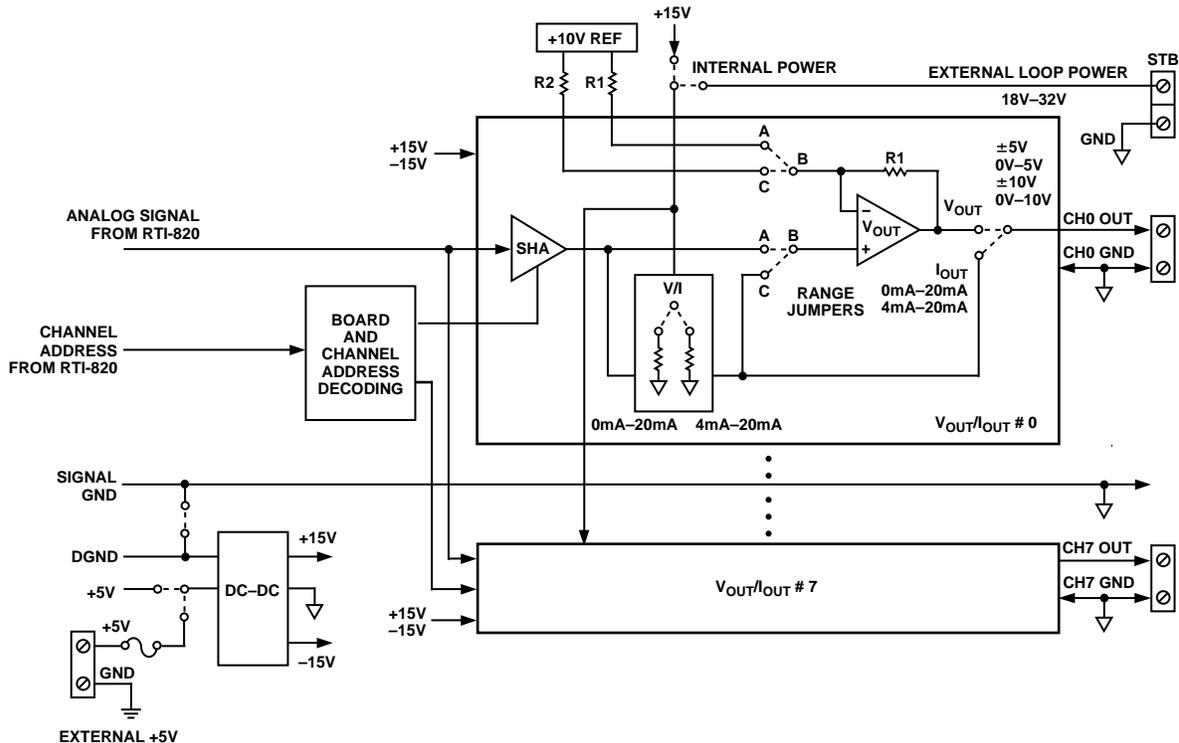


Figure 6. STB-AOT Block Diagram

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

ANALOG SIGNAL CONDITIONING PANEL SELECTION GUIDE

Model #	Channel Capacity	Input Types	Output Types	Isolation	Power Required	Rack Mount Kit	Cover
5B02	16 I/O	Thermocouples RTDs Strain Gage Current Low Level Voltage High Level Voltage	Current	1500 V rms	Dependent on Modules	AC1363	None
STB-TCI	8 AIN	Thermocouples Low Level Voltage	None	750 V rms	+5 V @ 300 mA	RM-02	CV-01
STB-HLI	8 AIN	High Level Voltage In	None	750 V rms	+5 V @ 300 mA	RM-02	CV-01
STB-TC	16 AIN (DE)	Thermocouples Low Level Voltage	None	No	+5 V @ 200 mA	RM-02	CV-01
STB-HL02	16 AIN (SE) 4 AOT	High Level Voltage	High Level Voltage	No	+5 V @ 350 mA	RM-02	CV-01
STB-AOT	8 AOT	None	Current High Level Voltage	No	+5 V @ 1.2 A	RM-02	CV-01

I/O CONFIGURATION CHART

Model #	I/O Types	Range	I/O Resolution*
5B02			
5B Modules:	Inputs: Thermocouples		
5B37-J-01	J	-100°C to +760°C	0.21°C
5B37-K-02	K	-100°C to +1350°C	0.35°C
5B37-T-03	T	-100°C to +400°C	0.12°C
5B37-E-04	E	0°C to +900°C	0.22°C
5B37-R-05	R	0°C to +1750°C	0.43°C
5B37-S-05	S	0°C to +1750°C	0.43°C
5B37-B-06	B	0°C to +1800°C	0.44°C
	RTDs		
5B34-01	100 Pt	-100°C to +100°C	0.05°C
5B34-02		0°C to +100°C	0.02°C
5B34-03		0°C to +200°C	0.05°C
5B34-04		0°C to +600°C	0.15°C
5B34-C-01	10 Cu	0°C to +120°C (10 Ω @ 0°C)	0.03°C
5B34-C-02		0°C to +120°C (10 Ω @ +25°C)	0.03°C
5B34-N-01	120 Ni Current In	0°C to +300°C	0.07°C
5B32-01		4 mA–20 mA	3.91 µA
5B32-02		0 mA–20 mA	4.88 µA
	Low Level Voltage (0 Hz–4 Hz)		
5B30-01		±0.01 V	4.88 µV
5B30-02		±0.05 V	24.4 µV
5B30-03		±0.10 V	48.8 µV
5B30-04		±0.01 V	4.88 µV
5B30-05		±0.05 V	24.4 µV
5B30-06		±0.10 V	48.8 µV
5B40-01	(0 Hz–10 kHz)	±0.01 V	4.88 µV
5B40-02		±0.05 V	24.4 µV
5B40-03		±0.10 V	48.8 µV
5B40-04		±0.01 V	4.88 µV
5B40-05		±0.05 V	24.4 µV
5B40-06		±0.10 V	48.8 µV

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

I/O CONFIGURATION CHART (Continued)

Model #	I/O Types	Range	I/O Resolution*	
5B31-01	High Level Voltage (0 Hz-4 Hz)	±1 V	0.49 mV	
5B31-02		±5 V	2.44 mV	
5B31-03		±10 V	4.88 mV	
5B31-04		±1 V	0.49 mV	
5B31-05		±5 V	2.44 mV	
5B31-06		±10 V	4.88 mV	
5B41-01		(0 Hz-10 kHz)	±1 V	0.49 mV
5B41-02			±5 V	2.44 mV
5B41-03			±10 V	4.88 mV
5B41-04			±1 V	0.49 mV
5B41-05			±5 V	2.44 mV
5B41-06			±10 V	4.88 mV
5B38-02		Strain Gage 10.0 V Excitation	±30 mV	7.32 µV
5B38-04			±30 mV	7.32 µV
5B38-05			±20 mV	9.76 µV
5B39-01		Outputs: Current	4 mA-20 mA	3.91 µA
5B39-02			4 mA-20 mA	3.91 µA
5B39-03			0 mA-20 mA	4.88 µA
5B39-04	0 mA-20 mA		4.88 µA	
STB-TCI	Thermocouples	E	-100°C to +1000°C	0.27°C
		J	0°C to +760°C	0.19°C
		K	0°C to +1250°C	0.31°C
		T	-200°C to +400°C	0.15°C
		S	0°C to +1750°C	0.43°C
		Low Level Voltage In	±0.005 V	2.44 µV
	±0.025 V	12.21 µV		
	±0.05 V	24.41 µV		
	±0.10 V	48.83 µV		
STB-HLI	High Level Voltage In	±5 V	2.44 mV	
		±10 V	4.88 mV	
STB-TC	Thermocouples	E	-100°C to +1000°C	0.27°C
		J	0°C to +760°C	0.19°C
		K	0°C to +1250°C	0.31°C
		T	-200°C to +400°C	0.15°C
		S	0°C to +1750°C	0.43°C
		Low Level Voltage In	±0.1 V	48.83 µV
	±0.05 V	24.41 µV		
	±0.025 V	12.21 µV		
	±0.01 V	4.88 µV		
	±0.005 V	2.44 µV		
STB-HL02	High Level Voltage In	±5 V	2.44 mV	
		±10 V	4.88 mV	
	High Level Voltage Out	0 V-5 V	1.22 mV	
		±5 V	2.44 mV	
STB-AOT	High Level Voltage Out	±10 V	4.88 mV	
		±5 V	2.44 mV	
		0 V-5 V	1.22 mV	
	Current Out	0 V-10 V	2.44 mV	
		0 mA-20 mA	4.88 µA	
		4 mA-20 mA	3.91 µA	

*Numbers shown reflect use with RTI-820 with 12-bit D/A or A/D resolution. The 5B Series modules listed are the standard ranges. Special ranges are available upon request.

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-A0T

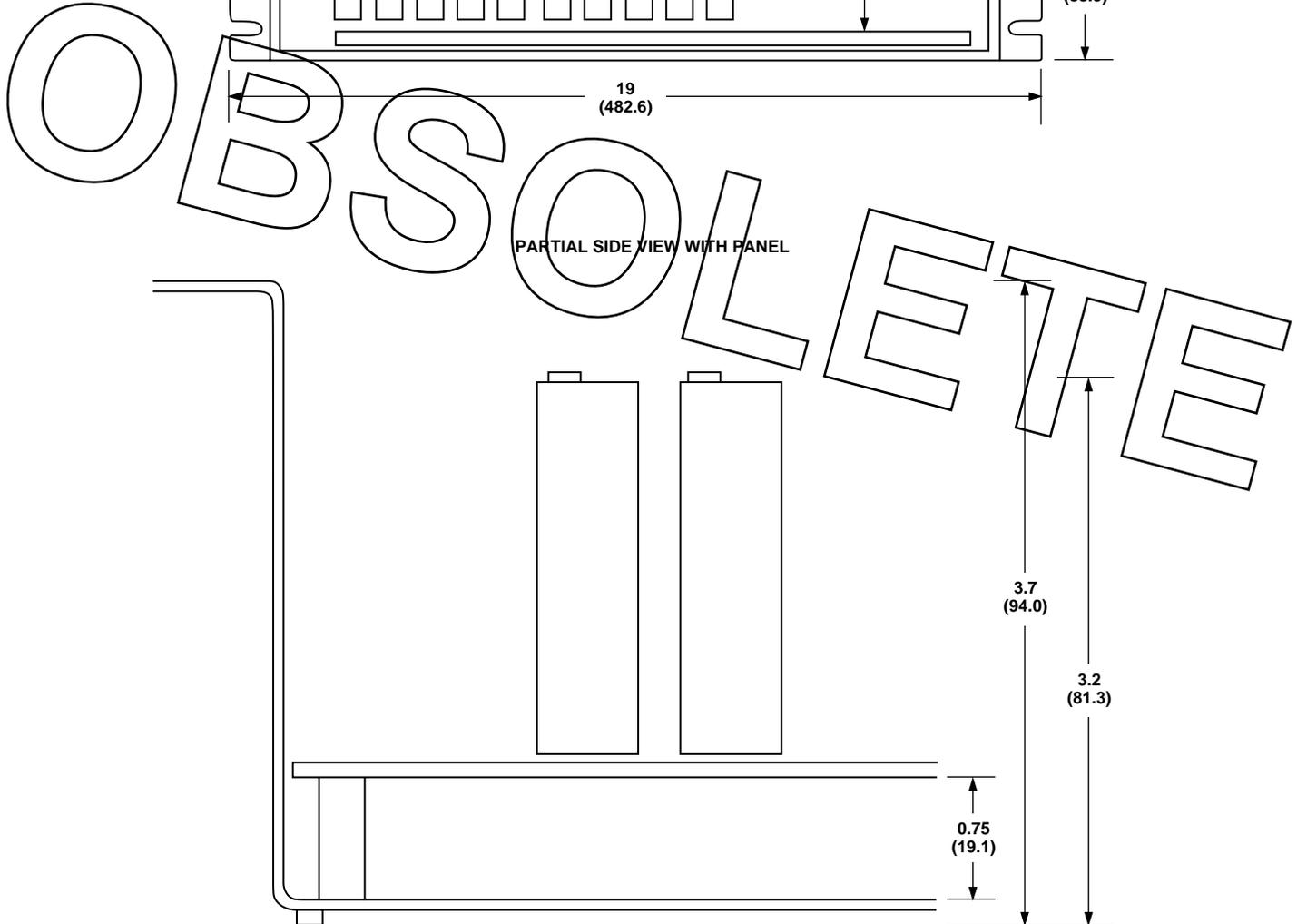
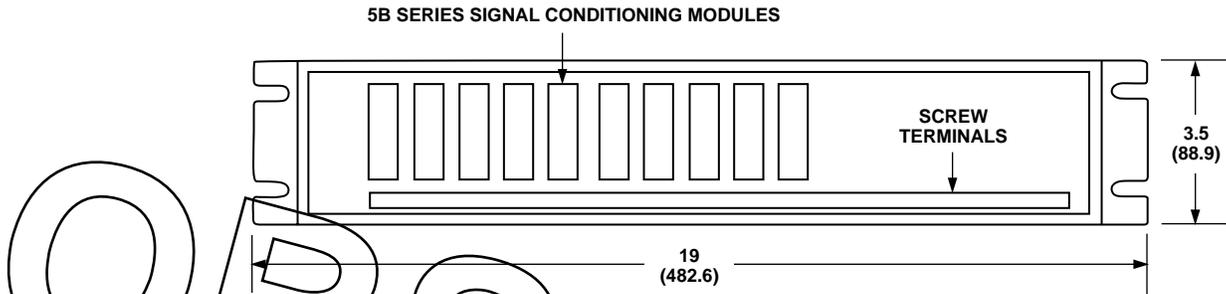
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

RACK MOUNT AC1636

For Use with 5B02

TOP VIEW OF RACK WITH PANEL



OBSOLETE

5B02, STB-TCI, STB-HLI, STB-TC, STB-HL02, STB-AOT

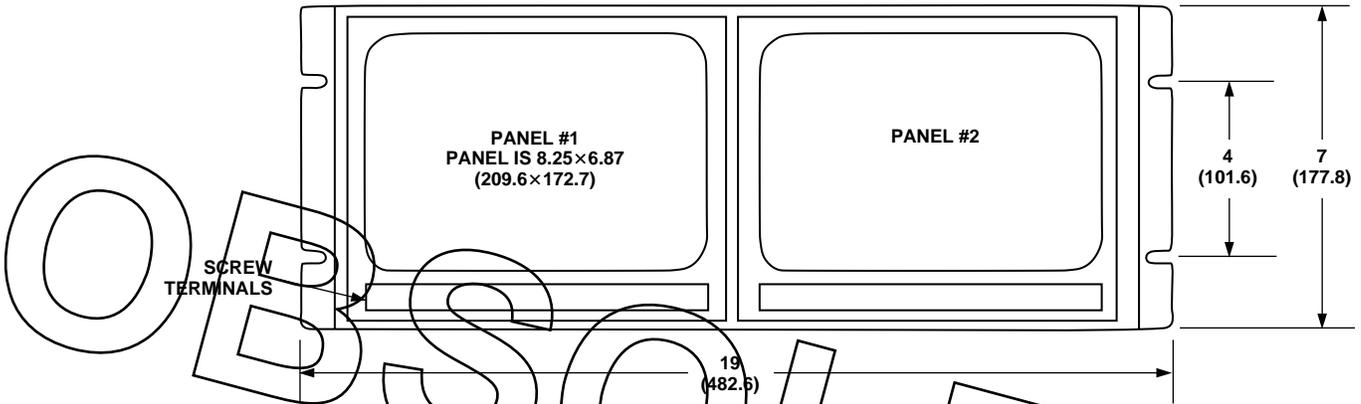
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

RACK MOUNT RM-02

For Use with STB-TCI, STB-HLI, STB-TC, STB-AOT, and STB-HL02

TOP VIEW



PARTIAL SIDE VIEW WITH PANEL

