

### FEATURES

Interfaces, isolates, & filters frequency inputs.

The 3B45 accepts full-scale inputs from 25 to 1100 Hz

The 3B46 accepts full-scale inputs from 520 Hz to 25 kHz.

Modules provide simultaneous precision voltage and current outputs.

Modules circuitry can withstand 130v rms at the input screw terminals.

All 3B45 & 3B46 series modules are mix-and-match and Hot Swappable.

### APPLICATIONS

Industrial signal conditioning

Industrial signal isolation

Industrial signal filtering

### PRODUCT OVERVIEW

The 3B Series of Signal Conditioning I/o Subsystems provide a low-cost, versatile method of transferring analog transducer signals to a data acquisition, monitoring or control system without the inherent noise, non-linearity, drift and extraneous voltages. The modules are designed to directly accept analog signals from Thermocouples, RTD's, AC and DC Strain Gages, Torque Transducers, Frequency Transducers, LVDTs, millivolt or process current signals. The modules amplify, isolate, linearize and convert the transducer output signals to standardized analog inputs for high-level analog I/O subsystems. The 3B Series Subsystem consists of a 10" relay rack with universal mounting backplane and a family of plug-in (up to 16 per rack) input and output signal conditioning modules.

Eight and four channel backplanes are also available. Each backplane incorporates screw terminals for sensor inputs and current outputs and a 26-pin connector for high-level single-ended voltage outputs to the user's equipment.

The input modules feature complete signal conditioning circuitry optimized for specific sensors or analog signals and provide two simultaneous high-level analog outputs: 0 to +10V (or  $\pm 10V$ ) and 4-20 mA (or 0-20 mA).

#### Rev. 0

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective companies.

### FUNCTIONAL BLOCK DIAGRAM

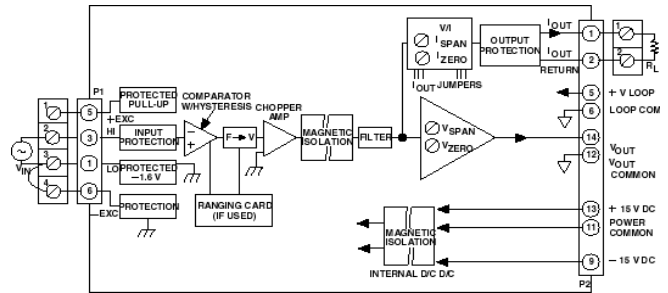


Figure 1. 3B45 & 3B46 Functional Block Diagram

Output modules accept 0 to +10V (or  $\pm 10V$ ) single-ended signals and provide an isolated 4-20 mA (or 0-20 mA) process signal. All modules feature a universal pin-out and may be readily hot-swapped under full power and interchanged without disrupting field wiring.

The Analog Devices 3B Series Signal Conditioning Subsystem is designed to easily handle signal conditioning problems in measurement and control applications. Some typical uses are in microcomputer-based data acquisition systems, programmable controllers, analog recorders, dedicated control systems, and any other applications where monitoring of temperature, pressure, flow and analog signals are required. Since each input module features two simultaneous outputs, the voltage output can be used to provide an input to a microprocessor-based data acquisition or control system while the current output can be used for analog transmission, operator interface, or an analog backup system.

Each input module is a single-channel signal conditioner which plugs into a socket on the backplane and accepts its signal from the input screw terminals. All input modules provide input protection, amplification and filtering of the input signal, accuracy of  $\pm 0.1\%$ , low drift of  $\pm 1 \mu V / ^\circ C$  (low-level input modules), and feature two high-level analog outputs that are compatible with most process instrumentation. The isolated input modules also provide  $\pm 1500 V$  peak isolation.

The choice of a specific 3B module depends upon the type of input signal. Input modules are available to accept millivolt, volt, process current, thermocouple, RTD, AC and DC strain gage, frequency and LVDT inputs. The voltage output of each module is available from the system I/O connector while the current output is available on the output screw terminals.

## GENERAL DESCRIPTION

The 3B45 and 3B46 are single-channel isolated frequency input modules which produce simultaneous precision voltage and current outputs proportional to input frequency. Model 3B45 accepts full-scale inputs ranging from 25 Hz to 1100 Hz, while Model 3B46 accepts full-scale input from 520 Hz to 25kHz. Both models enable the user to set the threshold to either 0 V (for zero crossing signals) or +1.6 V (for positive level signals), and the hysteresis to either 0 or  $\pm 4$  V. Hysteresis can be set for any value within this range using the supplied AC1310 ranging card. The 3B45 and 3B46 shield their computer side outputs from damage and loss of signal integrity from field-side over-voltage faults, withstanding up to 220 V rms at their input terminals. The current output withstands 130 V rms without damage and interfaces user equipment through screw terminal connections. In addition, all 3B45 and 3B46 models are plug-in, mix-and-match and hot-swappable, so each can be inserted or removed from any socket in the same backplane without disrupting system power.

3B Series Custom-Ranging Program – Externally-programmable Model 3B45-00 and 3B46-00 enable the user to configure a special input range by using the supplied plug-on AC1310 ranging card, which houses user-supplied resistors to determine hysteresis, zero and span. To facilitate selecting resistors, a Windows program, 3B-CUSTOM, calculates resistor values based on the user-desired input/output ranges.

The 3B45 and 3B46 compare the input signal to the user-

selected threshold ( $V_t$ ) and hysteresis ( $V_h$ ). Signals of virtually any wave shape that exceed the combined threshold and hysteresis levels ( $V_t \pm V_h$ ) will trigger a comparator at a rate determined by the input frequency. The comparator output is then transmitted across a proprietary transformer-coupled isolation barrier. 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 voltage; this output also drives a voltage-to-current (V/I) converter to provide a simultaneous current output for interfacing versatility.

Setting the threshold value is a simple matter of externally wiring to the 3B Series backplane screw terminals. The threshold for measuring a zero-crossing voltage waveform (such as sine waves) can be set to 0 volts by connecting terminal 3 to terminal 4. The threshold for a positive level signal (such as a TTL or pulse train waveform) can be set at +1.6 V by connecting terminals 1 and 2. Hysteresis for both input signal types is set at 0 V, but can be changed to  $\pm 4$  V by removing the jumper that is installed on the AC1310 ranging card shipped with each unit.



Figure 2

## 3B45 and 3B46 Models Available

Model	Input Range	Output Ranges <sup>1</sup>	Step Response
<b>3B45-00</b>	Externally Programmable <sup>2</sup>	0 V to +10 V & 0 mA to 20 mA	
<b>3B45-01</b>	0 Hz to 25 Hz	0 V to +10 V & 0 mA to 20 mA	1.6 sec
<b>3B45-02</b>	0 Hz to 300 Hz	0 V to +10 V & 0 mA to 20 mA	0.6 sec
<b>3B45-Custom</b>	*	*	

Model	Input Range	Output Ranges <sup>1</sup>	Step Response
<b>3B46-00</b>	Externally Programmable <sup>2</sup>	0 V to +10 V & 0 mA to 20 mA	
<b>3B46-01</b>	0 kHz to 1.5 kHz	0 V to +10 V & 0 mA to 20 mA	0.07 sec
<b>3B46-02</b>	0 kHz to 3 kHz	0 V to +10 V & 0 mA to 20 mA	0.03 sec
<b>3B46-03</b>	0 kHz to 25 kHz	0 V to +10 V & 0 mA to 20 mA	0.03 sec
<b>3B46-Custom</b>	*	*	

<sup>1</sup> Output current range may be user programmed to 4 mA to 20 mA using jumper supplied.

<sup>2</sup> Requires AC1310 ranging card.

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

## 3B45 and 3B46 Specifications

(typical @ +25°C and ±15 V dc, and +24 V dc Power)

Description	Model 3B45	Model 3B46
<b>Input Ranges</b>		
Standard Ranges	Refer to Model Table	Refer to Model Table
Custom Ranges	25 Hz span, min : 1100 Hz span, max.	520 Hz span, min : 25 kHz span, max.
<b>Output Ranges</b>		
Voltage ( $R_L > 2 \text{ k}\Omega$ )	0 V to +10 V	*
Current ( $R_L + 0$ to $850 \Omega$ ) <sup>1</sup>	4 mA to 20 mA or 0 mA to 20 mA	*
Maximum Current Output Span	0 mA to 31 mA	*
<b>Accuracy<sup>2</sup></b>		
Initial @ +25°C	±0.1% Span	*
Nonlinearity	±0.02% Span	*
<b>Stability vs. Temperature</b>		
Voltage Output		
Output Zero	±500 $\mu\text{V}/^\circ\text{C}$	*
Span	±50 ppm of Reading/ $^\circ\text{C}$	*
Current Output <sup>3</sup>		
Zero	±25 ppm of Span/ $^\circ\text{C}$	*
Span	±25 ppm of Reading/ $^\circ\text{C}$	*
<b>Zero and Span Adjustment Range<sup>4</sup></b>	±5% of Span	*
Input Bias Current	+3 nA	*
<b>Input Resistance</b>		
Small Signal, $V_{in} < 4 \text{ V pk-pk}$	15 M $\Omega$	*

Large Signal, $V_{in} > 4$ V pk-pk	82 k $\Omega$	*
	<b>Noise</b>	
Output, 100 kHz Bandwidth	75 $\mu$ V rms	*
Output, Ripple	10 mV rms @ 10% $F_{span}$ , maximum	*
<b>Output Step Response Time</b>	Refer to Model Table	*
	<b>Common-Mode Voltage (CMV)</b>	
Input-to-Output, Continuous	$\pm 1500$ V peak, maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
	<b>Common-Mode Rejection (CMR)</b>	
1 k $\Omega$ Source Imbalance, 50/60 Hz	100 dB	*
	<b>Input Protection</b>	
Continuous	220 V rms maximum	*
Transient	ANSI/IEEE C37.90.1-1989	*
<b>Voltage Output Protection</b>	Continuous Short to Ground	*
<b>Current Output Protection</b>	130 V rms, continuous	*
	<b>Power Supply Voltages<sup>5</sup></b>	
$\pm 15$ V dc Supplies		
Rated Operation	$\pm(11.5$ V dc to 16.5 V dc)	*
Current	$\pm 16$ mA	$\pm 19$ mA
Sensitivity	$\pm 0.01\%$ span/V	*
+24 V dc Loop Supply		
Rated Operation	+13.5 V dc to +30 V dc	*
Current	+27 mA @ $I_{out} = 20$ mA	*
Sensitivity	$\pm 0.0002\%$ span/V	*
<b>Mechanical Dimensions</b>	3.15" x 3.395" x 0.775" (80.0 mm x 86.2 mm x 19.7 mm)	*
	<b>Environmental</b>	
Temperature Range		
Rated Performance	-25°C to +85°C	*
Storage	-55°C to +85°C	*
Relative Humidity	0 to 95% @ +60°C noncondensing	*
RFI Susceptibility	$\pm 0.5\%$ Span error @ 400 MHz, 5 Watt, 3 ft	*

\* Specifications same as model 3B45.

<sup>1</sup> For a 0 to 20 mA range, a typical minimum output current is 10  $\mu$ A.

<sup>2</sup> Includes the combined effects of repeatability, hysteresis, and nonlinearity.

<sup>3</sup> With respect to the voltage output.

<sup>4</sup> A wide range of custom zero suppression and span is available with the 3B45-00 and 3B46-00 models, using the AC1310 ranging card.

<sup>5</sup> +24 V dc loop power is required for driving the current output at loads up to 850 $\Omega$ . If a current output load of 400 $\Omega$  or less is applied, +15 V dc is sufficient for loop power. If only voltage output is used, loop power is not required.

Specifications subject to change without notice.

## PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS

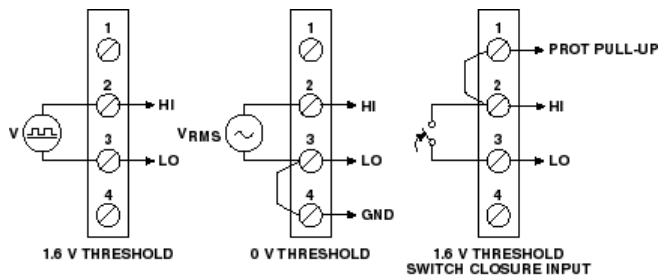


Figure 3 3B45 & 3B46 Input Field Connections

Table 1. Pin Function Descriptions—

Pin No.	Description
1	PROT PULL-UP
2	HI
3	LO
4	GND

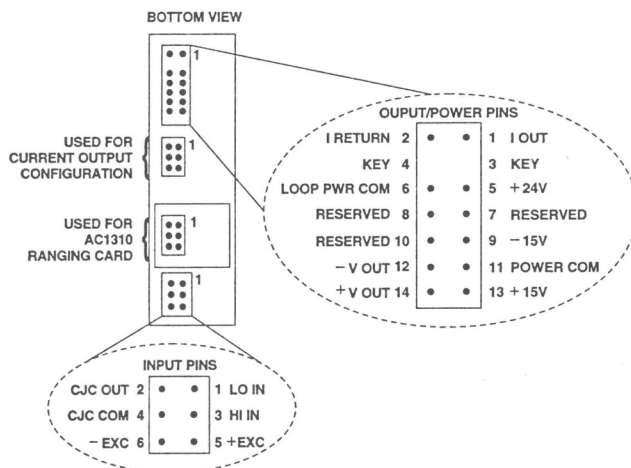


Figure 4 . Model 3B Series Module, with pin-out assignments.

### 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

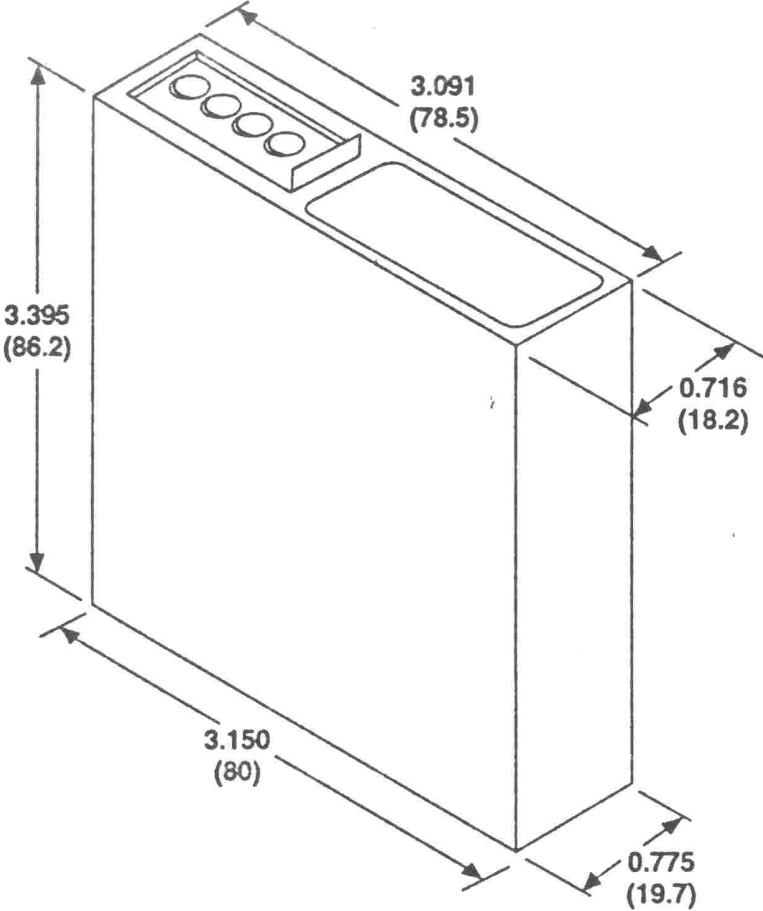


Figure 5. Outline Dimensions

**NOTES**

**NOTES**

