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 ±10V) and 4-20 mA (or 0-20 mA).

FUNCTIONAL BLOCK DIAGRAM

Output modules accept 0 to +10V (or ±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
interrupting 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 ±0.1%, low drift of ±1 uV/°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 ±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 +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 (Vt) and hysteresis (Vh). Signals of virtually any wave shape that exceed the combined threshold and hysteresis levels (Vt ± Vh) 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 ±4V by removing the jumper that is installed on the AC1310 ranging card shipped with each unit.

Figure 2
### 3B45 and 3B46 Models Available

<table>
<thead>
<tr>
<th>Model</th>
<th>Input Range</th>
<th>Output Ranges¹</th>
<th>Step Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3B45-00</td>
<td>Externally Programmable²</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td></td>
</tr>
<tr>
<td>3B45-01</td>
<td>0 Hz to 25 Hz</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td>1.6 sec</td>
</tr>
<tr>
<td>3B45-02</td>
<td>0 Hz to 300 Hz</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td>0.6 sec</td>
</tr>
<tr>
<td>3B45-Custom</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Model</th>
<th>Input Range</th>
<th>Output Ranges¹</th>
<th>Step Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3B46-00</td>
<td>Externally Programmable²</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td></td>
</tr>
<tr>
<td>3B46-01</td>
<td>0 kHz to 1.5 kHz</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td>0.07 sec</td>
</tr>
<tr>
<td>3B46-02</td>
<td>0 kHz to 3 kHz</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td>0.03 sec</td>
</tr>
<tr>
<td>3B46-03</td>
<td>0 kHz to 25 kHz</td>
<td>0 V to +10 V &amp; 0 mA to 20 mA</td>
<td>0.03 sec</td>
</tr>
<tr>
<td>3B46-Custom</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Output current range may be user programmed to 4 mA to 20 mA using jumper supplied.
² 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)

<table>
<thead>
<tr>
<th>Description</th>
<th>Model 3B45</th>
<th>Model 3B46</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Ranges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Ranges</td>
<td>Refer to Model Table</td>
<td>Refer to Model Table</td>
</tr>
<tr>
<td>Custom Ranges</td>
<td>25 Hz span, min : 1100 Hz span, max.</td>
<td>520 Hz span, min : 25 kHz span, max.</td>
</tr>
<tr>
<td><strong>Output Ranges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage (R&lt;sub&gt;L&lt;/sub&gt; &gt; 2 kΩ)</td>
<td>0 V to +10 V</td>
<td>*</td>
</tr>
<tr>
<td>Current (R&lt;sub&gt;L&lt;/sub&gt; + 0 to 850 Ω)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>4 mA to 20 mA or 0 mA to 20 mA</td>
<td>*</td>
</tr>
<tr>
<td>Maximum Current Output Span</td>
<td>0 mA to 31 mA</td>
<td>*</td>
</tr>
<tr>
<td><strong>Accuracy&lt;sup&gt;2&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial @ +25°C</td>
<td>±0.1% Span</td>
<td>*</td>
</tr>
<tr>
<td>Nonlinearity</td>
<td>±0.02% Span</td>
<td>*</td>
</tr>
</tbody>
</table>

### Stability vs. Temperature

<table>
<thead>
<tr>
<th>Description</th>
<th>Model 3B45</th>
<th>Model 3B46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Zero</td>
<td>±500 μV/°C</td>
<td>*</td>
</tr>
<tr>
<td>Span</td>
<td>±50 ppm of Reading/°C</td>
<td>*</td>
</tr>
<tr>
<td>Current Output&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero</td>
<td>±25 ppm of Span/°C</td>
<td>*</td>
</tr>
<tr>
<td>Span</td>
<td>±25 ppm of Reading/°C</td>
<td>*</td>
</tr>
<tr>
<td><strong>Zero and Span Adjustment Range&lt;sup&gt;4&lt;/sup&gt;</strong></td>
<td>±5% of Span</td>
<td></td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>+3 nA</td>
<td>*</td>
</tr>
</tbody>
</table>

| Input Resistance                 |                                                 |                                                 |
| Small Signal, V<sub>n</sub> < 4 V pk-pk | 15 MΩ                                           | *                                               |
Large Signal, $V_{in} > 4 \, V$ pk-pk      
Noise

Output, 100 kHz Bandwidth      
75 µV rms

Output, Ripple      
10 mV rms @ 10% $F_{span}$, maximum

Output Step Response Time
Refer to Model Table

Common-Mode Voltage (CMV)
Input-to-Output, Continuous      
±1500 V peak, maximum

Transient
ANSI/IEEE C37.90.1-1989

Common-Mode Rejection (CMR)
1 kΩ Source Imbalance, 50/60 Hz      
100 dB

Input Protection
Continuous      
220 V rms maximum

Transient
ANSI/IEEE C37.90.1-1989

Voltage Output Protection
Continuous Short to Ground

Current Output Protection
130 V rms, continuous

Power Supply Voltages

±15 V dc Supplies
Rated Operation      
±(11.5 V dc to 16.5 V dc)

Current      
±16 mA ±19 mA

Sensitivity      
±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      
±0.0002% span/V

Mechanical Dimensions
3.15" x 3.395" x 0.775"
(80.0 mm x 86.2 mm x 19.7 mm)

Environmental

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      
±0.5% Span error @ 400 MHz, 5 Watt, 3 ft

* Specifications same as model 3B45.
1 For a 0 to 20 mA range, a typical minimum output current is 10 µA.
2 Includes the combined effects of repeatability, hysteresis, and nonlinearity.
3 With respect to the voltage output.
4 A wide range of custom zero suppression and span is available with the 3B45-00 and 3B46-00 models, using the AC1310 ranging card.
5 ±24 V dc loop power is required for driving the current output at loads up to 850Ω. If a current output load of 400Ω 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

![PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS](image)

Table 1. Pin Function Descriptions

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PROT PULL-UP</td>
</tr>
<tr>
<td>2</td>
<td>HI</td>
</tr>
<tr>
<td>3</td>
<td>LO</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>

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