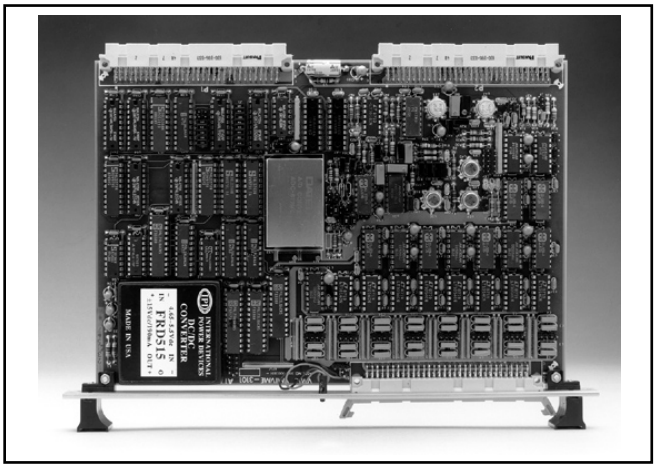
# VMIVME-3101A

## 12-bit, High-Speed Analog-to-Digital Converter Board with 32 Single-Ended or 16 Differential Channels

- 12-bit resolution
- 90 to 111 kHz sample rates (12-bit resolution)
- Provision for interleaved settling and short cycled conversion results in maximum throughput of 166 kHz
- Short settling/tracking feature decreases analog acquisition time to 6.0 µs at reduced accuracy
- Autocalibration option controls error to 1 LSB
- Up to 32 single-ended (pseudo-differential) or 16 differential front panel inputs
- Overvoltage protected inputs
- Fail-safe with power off
- Three full-scale input ranges available: 0 to +10 V, ±5 V, ±10 V
- Expandable to 1,056 channels utilizing VMIC multiplexer expansion boards
- Supports complete product line of VMIC multiplexer expansion boards
- Compatible with VMIC analog backplane (AMXbus™ option) for multiplexer expansion
- External trigger input
- Front panel fail LED
- VxWorks driver available



**INTRODUCTION** — The VMIVME-3101A board is a 32-channel, high-speed, analog-to-digital converter (ADC) board that is designed with the unique features of built-in-test (BIT) and autocalibration shown in Figure 1. As shown in Figure 2, the built-in-test hardware is designed with on-board precision voltages which may be read for fault detection and isolation. A front panel fail LED is provided that is automatically illuminated at power-up or upon system reset, and may be extinguished upon successful completion of board level diagnostics. The built-in-test concept supports off-line and real-time fault detection and isolation.

Each front panel input is monitored by an unbuffered built-in-test multiplexer. The built-in-test multiplexer provides a means of testing all inputs, and enables buffer amplifier offsets to be eliminated in software.

Additional built-in-test features are provided to support fault detection and isolation of other VMIC products. For additional information, the reader should refer to the Analog I/O Products (Built-in-Test) Configuration Guide, (Document No. 825-000000-005).

The autocalibration feature compensates for zero and gain errors. This feature allows the user at any time to read zero and gain errors and null them under software control.

This product may be manufactured with a variety of options as selected by the user. Options are shown in the ordering options. A wide variety of filter options are available and the board may be ordered with 16 single-ended/8 differential channels at a reduced cost. The board is designed to support up to 32 single-ended/16 differential input channels at full-scale ranges of 0 to +10 V, ±5 V, and ±10 V by user-selectable jumpers.

Acquisition and conversion time combined (excluding expansion multiplexers) is approximately 11 µs maximum, giving a maximum throughput rate of approximately 90 kHz with noninterleaved operation. The throughput rate may be increased to 111 kHz using the short settling mode.

Interleaved settling overlaps the next channel's analog acquisition/settling period with the previous channel's A/D conversion period. A maximum throughput rate of 166 kHz can be achieved by utilizing the interleaved settling/conversion and short settling features. Output coding is straight binary, offset binary, or two's complement.

**Ordering Options**

| Oct. 2, 2002 800-103101-000 C | A | B | C | – | D | E | F |
|---|---|---|---|---|---|---|---|
| VMIVME-3101A – | | | | – | | | |

**A = Number of Channels***
- 0 = No P3 inputs
- 1 = 6 SE Channels (8 Differential Channels)
- 2 = 32 SE Channels (16 Differential Channels)

**B = Operational Options***
- 0 = No Precision Voltage Standards and No Autocalibration
- 1 = Precision Voltage Standards and Autocalibration
- 2 = Precision Voltage Standards Only (No Autocalibration)

**C = Filter Options**
- 0 = No Filter
- 1 = 6 Hz
- 2 = 9 Hz
- 3 = 36 Hz

**Notes**

* Autocalibration DACs (two 12-bit DACs) must be initialized under software control. Jumpers are provided to disable autocalibration and/or manual calibration.

**Connector Data**

| | |
|---|---|
| Compatible Cable Connector | Panduit No. 120-964-435E |
| Strain Relief | Panduit No. 100-000-032 |
| PC Board Header Connectors | Panduit No. 120-964-033A |

**For Ordering Information, Call:**
**1-800-322-3616 or 1-256-880-0444 • FAX (256) 882-0859**
**E-mail: info@vmic.com Web Address: www.vmic.com**

This product also supports VMIC's expansion multiplexer product line which is based on an analog multiplexer bus (AMXbus). The AMXbus backplane is installed in the same physical location as the P2 VME expansion backplane. Several subsystem configurations using the AMXbus and/or analog output boards are shown in Figures 3 through 5.

**SYSTEM THROUGHPUT USING MULTIPLEXER EXPANSION BOARDS —** The VMIVME-3101A supports a wide variety of multiplexer expansion boards which affect the total system throughput. The total system throughput (Fs) may be calculated using the formula shown below:

$$Fs = \frac{1}{N\,(T_1 + T_2 + T_3)}$$ Samples per second, where:

N is the number of channels.
$T_1$ is the remote multiplexer settling time.
$T_2$ is the VMIVME-3101A amplifier settling and tracking time.
$T_3$ is the VMIVME-3101A A/D conversion time.

$T_1$ is a variable that is provided on each multiplexer expansion board data sheet. The VMIVME-3101A also supports interleaved (pipelined) measurement, in which $T_3$ is eliminated to produce maximum throughput.

A wide variety of multiplexer expansion boards are supported by the VMIVME-3101A ADC board. An AMXbus is available as a standard product to support the low-cost expansion concept.

**BUILT-IN-TEST —** The VMIVME-3101A board supports a wide variety of VMIC's analog I/O (AIO) products that are designed to support fault detection and isolation to the board level. The VMIVME-3101A employs an internal precision voltage generator (precision voltage standards) to support testing the VMIVME-3101A as a stand-alone board. The VMIVME-3101A also contains a dedicated input test multiplexer that supports loopback testing of a variety of VMIC's analog output boards.

In addition, the VMIVME-3101A supports the built-in-test concept of the VMIVME-3200 multiplexer. For a thorough understanding of possible subsystem configurations using VMIC's built-in-test concepts, the reader should refer to Analog I/O Products (with Built-in-Test) Configuration Guide, VMIC's Document No. 825-000000-005.

## FUNCTIONAL CHARACTERISTICS

**Compliance:** This product complies with the VMEbus specification Rev. C. 1 with the following mnemonics:

A16:D16, D08 (EO): 29, 2D:Slave
6U form factor

**Board Address:** The address for the board is determined by board jumpers. This board can be plugged into any available slot (except slot 1) in the backplane.

**Channel Selection:** Control and status register (CSR) bits D00 through D04 are used to select which of the 32 channels on the front panel connector is to be sampled in the normal mode. In the test mode, these same bits select which of several test voltages are to be sampled. In the external multiplexer sampling mode, the channel being sampled is determined by control data previously transmitted to an expansion multiplexer board (VMIVME-32XX series or VMIVME-4500A). The five CSR bits have no effect in this mode.

When utilizing the external multiplexer mode, the ADC and up to 18 multiplexer boards share an AMXbus. The AMXbus backplane utilizes the user I/O pins on the P2 expansion bus and is available in a variety of slot widths.

**VMEbus Access:** Address modifier bits are decoded to support short nonprivileged I/O and/or short supervisory I/O access (jumper selectable). The board is factory configured for short supervisory I/O access.

**VMEbus Reply:** DTACK is generated from data strobes (DS0 or DS1) and the board address.

**Data Transfer Type:** D8, D16

**Data Conversion:** Conversion is initiated under program control or upon receipt of an externally generated trigger pulse. Mode selection control is available to enable or disable the external trigger feature. A channel can be selected and conversion can be initiated by writing a single word.

**Mode Selection:** Several operational modes of the board are selectable under program control:

a. Select channel or test voltages
b. Enable on-board multiplexers
c. Initiate analog-to-digital conversion

d. Select single-ended or differential inputs via on-board multiplexers
e. Enable external start conversion trigger
f. Select board built-in-test
g. Controls fail LED
h. Short settling/tracking time (6.0 µs maximum)
i. Board reset

**Test Mode:** The board is designed with seven precision voltages which can be used for fault detection and isolation. Furthermore, each front panel input is monitored by an unbuffered built-in-test multiplexer. The built-in-test multiplexer provides a means of testing all inputs and enables buffer amplifier offsets to be eliminated in software. It also supports off-line and real-time fault detection and isolation of a wide variety of other VMIC products. For a thorough understanding of possible subsystem configurations, the reader should refer to the VMIC Analog I/O Configuration Guide (Document No. 825-000000-005).

**Board Failure:** The front panel fail LED is illuminated at power-up and is extinguished under program control after successful execution of user diagnostics.

**Digital Data Format:** The 12-bit digital data format is jumper selectable for offset binary, straight binary, or two's complement and can represent either a unipolar or bipolar range.

**Channels:** Thirty-two single-ended input channels or 16 differential input channels are available as front panel inputs on this board. This board also supports VMIC's full line of external multiplexer boards which requires the use of VMIC's AMXbus. The AMXbus backplane is installed in the same physical location as the P2 expansion bus.

## ELECTRICAL SPECIFICATIONS[1]

**Resolution:** 12-bit (or jumper-selected 11 or 10 bits)

**Analog Input Ranges[2] (Jumper-Selected):** Offered in either 3 voltage ranges (0 to 10 V, ±5 V, ±10 V). Factory jumpered and calibrated for ±10 V.

**Conversion Time:** 3 µs - 12-bit resolution
2.6 µs - 10-bit resolution

**Analog Acquisition Time (Includes Sample-and-Hold Time):** 8.0 µs default for standard ranges; shorter acquisition settling/tracking time of 6.0 µs is software selectable.

**Monotonicity:** Monotonic over full operating temperature range

**Common-Mode Range:** ±11 V (maximum)

**Common-Mode Rejection:** 82 dB

**Accuracy:** 0.05 percent of FSR[3] with manual calibration of gain and offset errors.
0.03 percent with autocalibration over full temperature range.

**Input Impedance:** 10 MΩ (minimum)

**Input Offset Voltage:**
8 mV (maximum)
1.0 mV with manual calibration
0.5 mV with autocalibration

**Precision Test Voltages:** 0.0000 V, ±9.971 V, ±4.986 V, ±2.493 V

**Input Overvoltage Protection:** ±40 V

**Optional Single-Pole Analog Input Filter[4]:** -3 dB @ 6 , 9 , or 36 Hz

**Power Requirements:** 2 A (maximum) @ +5 V

## PHYSICAL/ENVIRONMENTAL

**Dimensions:** Standard VME double height board (160 mm x 233.5 mm)

**VMEbus Connector:** Two 96-pin DIN connectors. VMIC utilizes the user I/O pins on the P2 connector to support an AMXbus. A variety of AMXbus backplanes are available from VMIC as standard products.

**Analog Input Connector (32 SE/16 D Analog Inputs):** Board connector (P3) - Panduit male connector type 120-964-435E.
Input cable connector - female type 120-964-033A.

**Temperature:**
0 to +55 °C, operating
20 to +85 °C, storage

**Humidity:**
20 to 80 percent relative, noncondensing

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1. At 25 °C unless specified otherwise.
2. Refer to ordering options for available analog input ranges.
3. FSR means full scale range and is equal to 20 V for a ±10 V range.
4. Contact VMIC for special filter requirements.

**INTERFACING TO VMIC'S 3V/5V SERIES SIGNAL CONDITIONERS —** The 3V/5V series modular signal conditioners convert a wide variety of low-level voltages, thermocouples, RTDs, etc., to high-level voltages. In addition, many of the modules provide up to ±1,500 Vrms continuous isolation. Up to 16 of these modules may be installed in a signal conditioning backplane with an optional 19-inch rack mount kit. The high-level outputs are routed to a 26-pin connector, from which a ribbon cable connects the signal conditioning backplane to the front panel of the VMIVME-3101A ADC board.

The 3V/5V series signal conditioning subsystem, in conjunction with the VMIVME-3101A ADC board, provides a complete solution enabling almost any type of sensor data to be available to the VMEbus. The following input modules are available: low-level (mV), AC, thermocouple, RTD, current, frequency, strain gage, LVDT, and high-level (V) inputs.

## TRADEMARKS



**APPLICATION AND CONFIGURATION GUIDES —** The following application and configuration guides are available from VMIC to assist the user in the selection, specification, and implementation of systems based on VMIC's products.

| Title | Document No. |
|---|---|
| Analog I/O Products (with Built-in-Test) Configuration Guide | 825-000000-005 |
| Connector and I/O Cable Application Guide | 825-000000-006 |

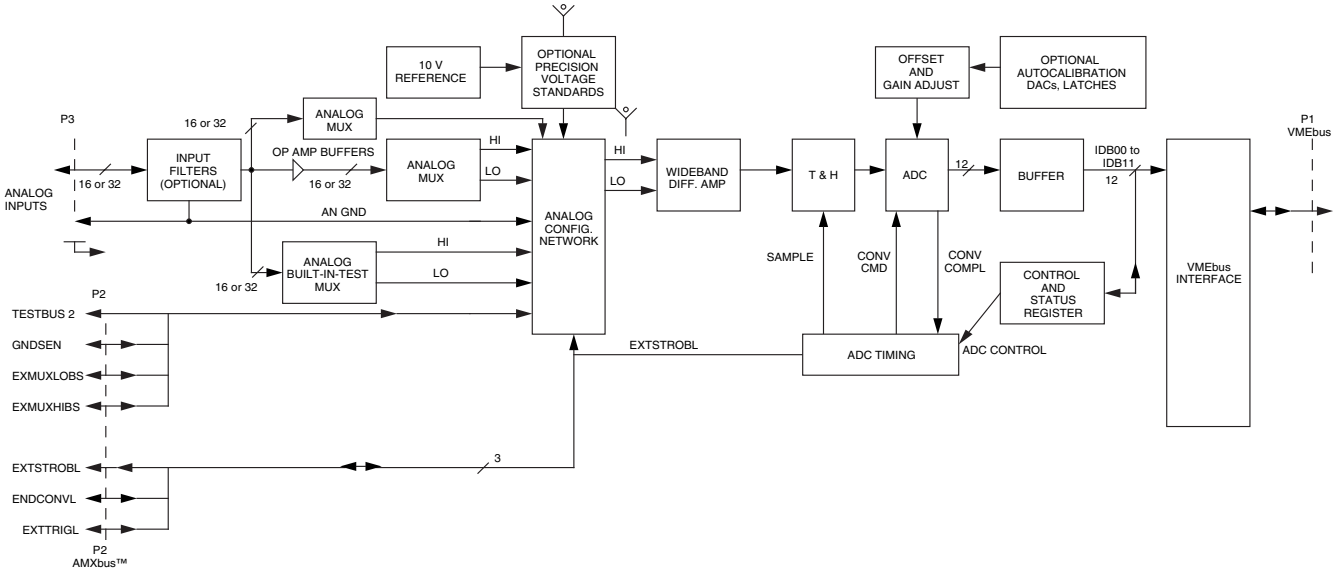



**Figure 1. VMIVME-3101A Functional Block Diagram**

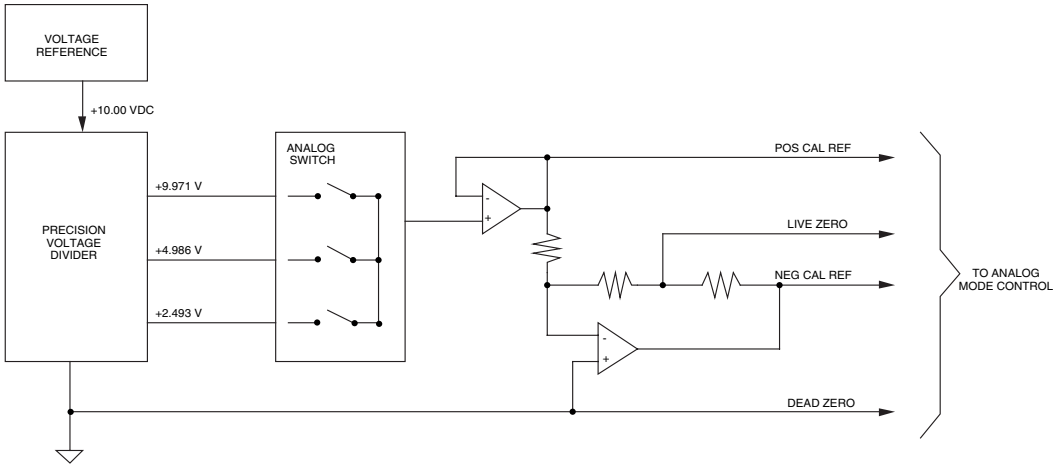
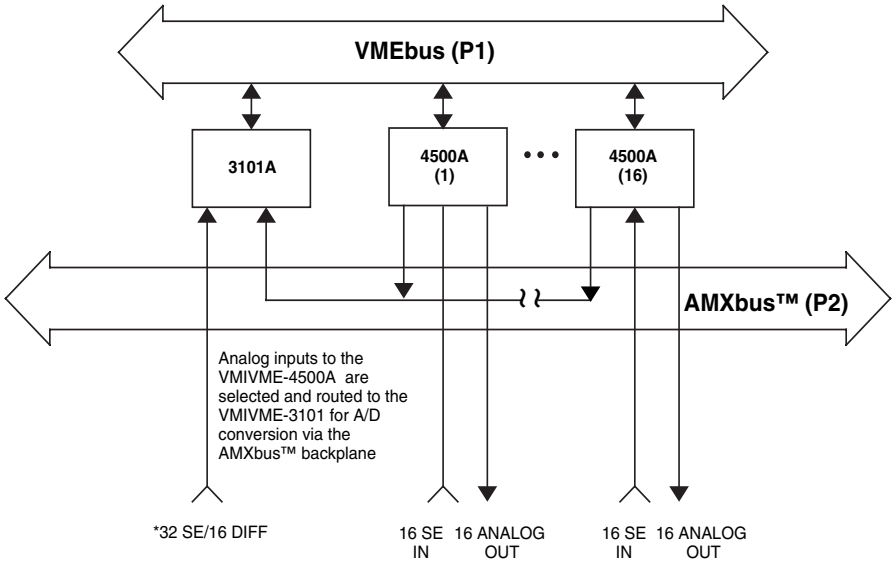
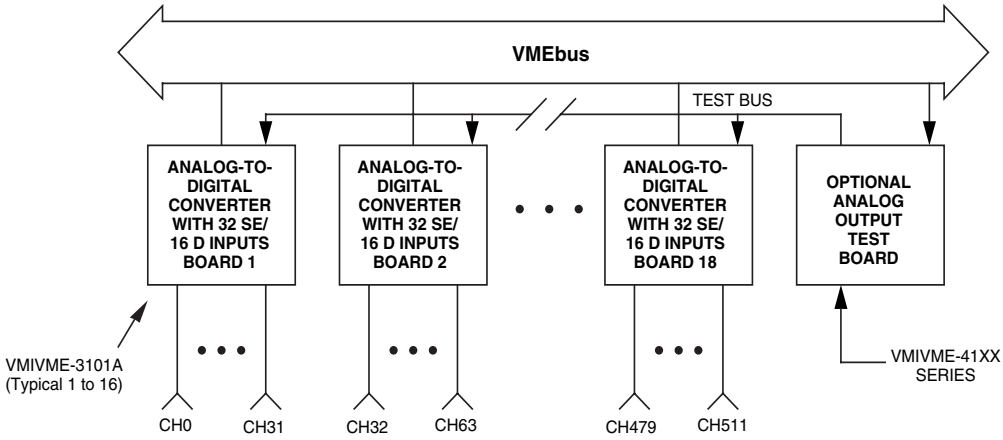



**Figure 2. VMIVME-3101A Precision Voltage Standards Network**




* Not supported by IIOC product line.

**Figure 3. Typical Low-Cost AIO Configuration with Built-in-Test**




**NOTE**

Utilizing an ADC per 32 SE channels provides up to 1,600,000 samples/sec and 512 analog input channels. The high conversion rate is obtained by starting conversion on all 18 boards sequentially, followed by reading converted data sequentially CH0 Bd No. 1, CH32 Bd No. 2, etc.).

**Figure 4. VMIVME-3101A High Performance Analog-to-Digital Configuration with Built-in-Test**

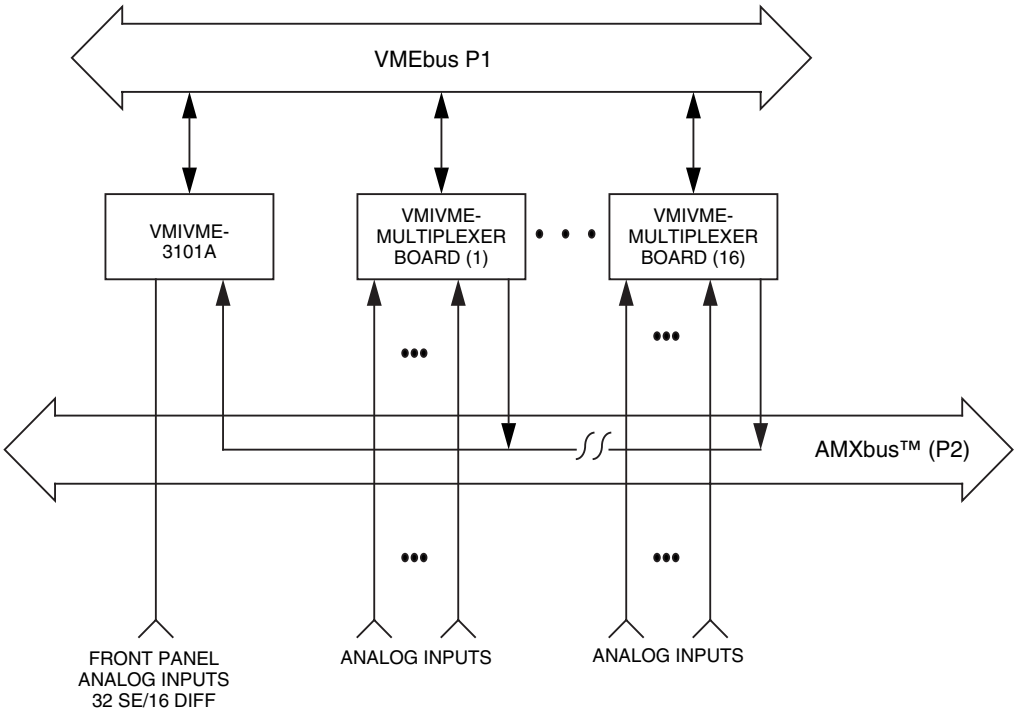



**Figure 5. VMIVME-3101A Typical Configuration with Multiplexer Expansion**