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VMIVME-4514
16-Channel Scanning Analog I/O Board with Built-in-Test and P2 I/O

- Continually digitizes all input channels and stores the results in a dedicated channel dual-port register (autoscanning mode)
- Three A/D operating modes
  - — Autoscanning mode (entered on powerup)
  - — Random polling mode
  - — Scanning poll mode
- P2 I/O connection
- Built-in-Test on-board
  - — Tests 100 percent of active components
  - — Semiconductor output switches
  - — Do not compromise accuracy (0.1 Ω output impedance)
- 16 SE/Diff analog input channels
  - — 12-bit A/D converter
  - — Unipolar (0 to +10 V, 0 to +5 V) or bipolar (±2.5 V, ±5 V, ±10 V)
  - — 40 kHz A/D throughput
  - — Optional low pass filter
  - — Overvoltage protected
  - — Fail-safe with power off
- 16 S&H analog output channels
  - — 12-bit D/A converter
  - — Output short circuit protected
  - — Unipolar (0 to +10 V, 0 to +5 V) or bipolar (±2.5, ±5 V, ±10 V)
  - — Program-selectable scan rates provide improved response for complex output functions 10 mA outputs
- Powerup board replacement

APPLICATIONS

- Factory automation and instrumentation
- Process control
- Laboratory instrumentation
- Machine monitoring
- Data acquisition system
- Simulation and training

INTRODUCTION — This product provides the user with 16 analog outputs and 16 analog input channels. The resolution of inputs and outputs is 12 bits. The analog outputs are designed with an S&H output per channel. The 16 analog inputs are digitized by a 12-bit Analog-to-Digital Converter (ADC) controlled by a scanner which scans and stores data in a dual port memory.

The VMIVME-4514 Analog I/O (AIO) Board provides 16 high quality analog output channels which can be programmed with on-board jumpers to operate in a variety of voltage ranges. Each output can source or sink 10 mA at ±10 V. For off-line testing, the analog outputs can be disconnected from the I/O connector.

The product also accepts 16 differential or pseudo-differential (single-ended) analog inputs. The on-board 12-bit ADC may be jumpered for several analog input ranges. The board supports the following ADC operating modes that are described below:

Autoscanning Mode
Random Polling Mode
Scanning Poll Mode

PHOTO NOT AVAILABLE

A 16-word dual port memory provides storage for a continuous scan of all channels. The scanning modes are executed automatically at power up, system reset, or via program control. The dual port registers allow VMEbus access at any time to read the latest stored data.

A functional block diagram is provided in Figure 1 and the Ordering Options are provided on the first page of this specification.

FUNCTIONAL CHARACTERISTICS

Operating Modes:

Autoscanning Mode: The mode is executed by a powerup system reset, or program selection. All channels are continuously scanned and the digitized data is stored in sixteen 16-bit dual port registers. No

Ordering Options

December 6, 1994 800-004514-000 F	A	B	C	–	D	E	F
VMIVME-4514 –		0	0	–			

A = Input Filter Options
0 = No Filter
1 = Reserved
2 = Reserved
3 = 36 Hz (3 dB Cutoff Frequency)
B = 00 (Options reserved for future use)

Note

Contact the factory for other I/O options.

I/O Connector Data

Connecting Component	*Panduit*
Mating Cable Connector	No. 120-964-435E
Strain Relief	No. 100-000-032
Board I/O Connector	No. 120-964-033A

For Ordering Information, Call:
1-800-322-3616 or 1-256-880-0444 • FAX (256) 882-0859
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other programming is required other than a read from the dual port register.

Random Polling Mode: This mode requires the controlling program to generate a single conversion. End-of-conversion is determined by polling an end-of-conversion status bit.

Scanning Poll Mode: This is a scanning mode which executes a single scan of all channels. An end-of-scan control bit is polled to determine when the scan is completed.

Board Address: The physical address for the board may be selected by on-board jumpers. VMEbus address lines A06 through A15 are decoded for board selection.

VMEbus Access: Address modifier bits are jumper-selected and decoded to support both nonprivileged short I/O, supervisory short I/O, or both. The board is factory configured for supervisory short I/O.

Output Data Transfer: Data for each analog output channel is written directly into an on-board RAM location dedicated to a specific channel. The data is then periodically retrieved from the RAM and converted to an analog voltage which is transferred to one of 16 output sample-and-hold buffers.

Analog Input Format: Analog inputs are first digitized, then the 12-bit digital values (D11 to D00) are read at a single memory word location from a channel dedicated dual-port register. The upper four bits (D15, D14, D13, and D12) are read as the sign extension of the 12-bit digital value in two's complement mode; otherwise, they are read as logical *zeros*.

Analog I/O Test Mode: Built-in-Test logic provides the user with the capability to test all of the active components on the board including the output switches. The test logic supports real-time and off-line testing. This test scheme utilizes the on-board ADC multiplexers as shown in Figure 1.

Memory Test: This product is designed with dual port on-board memory that may be tested by executing a memory diagnostic for additional operational verification.

System Reset: Application of the system reset signal through the VMEbus initializes the board into a state with all analog outputs disconnected from the output connector (P2).

Front Panel Fail LED: If an error condition occurs during diagnostics, a software-controlled LED may be illuminated to visually indicate a failure. The LED is illuminated by system reset at power up and is extinguished upon successful diagnostic execution.

(Typical at +25 °C and rated power supplies unless otherwise stated.)

ANALOG INPUTS

No. of Input Channels: Thirty-two, including 16 which are used for loopback testing of 16 analog output channels. Sixteen undedicated differential (or pseudo-differential) analog inputs are available.

Input Type: Sixteen differential or 16 single-ended

A/D Conversion Time: 15 µs

Analog Input Acquisition Time: 10 µs

A/D Throughput: 40 kHz (maximum)

Monotonicity: Monotonic over full temperature range

Common-Mode Range: ±11 V (maximum)

Common-Mode Rejection: 82 dB

Channel Conversion Rate: 40 kHz ÷ number of scanned channels

Accuracy: 0.04 percent of range ±2 mV, may be calibrated to 0.02 percent ±0.5 mV

Input Bias Current: 2 nA (maximum)

Optional Single Pole Analog Input Filter: -3 dB at 36 Hz

Full-Scale Input Ranges: ±2.5 V, ±5 V, ±10 V, 0 to +5 V, or 0 to +10 V

Analog Input Code: 12 bits, right-justified in a 16-bit word

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Input Overvoltage Protection: ±40 V, maximum

Data Transfer Type: D16

ANALOG OUTPUTS

Number of Output Channels: Sixteen

Full-Scale Analog Output (Jumper-Selectable):
Unipolar: 0 to +10 V, 0 to 5 V
Bipolar: ±2.5 V, ±5.0 V, ±10.0 V

Analog Output Code: The 12-bit ADC accepts digital codes in straight binary and offset binary.

Output Load Current: 10 mA, maximum at full accuracy

Resolution: 12 bits, S&H per channel

Output Impedance: 0.1 Ω

Total Error: 0.05 percent of full-scale range

Maximum Settling Time to 1 LSB: 1.7 ms

Refresh Update Rate[1]**:** 550 Hz (default); 1,600 Hz (FAST REFRESH). The FAST REFRESH rate provides a filtered output for complex functions; whereas, the 550 Hz rate provides settling to 0.01 percent for stepped outputs at each update. The 1,600 Hz rate provides settling to 0.2 dB (2.3 percent). Both rates provide settling to 0.01 percent in 1.7 ms.

Output Short Circuit Protection: Indefinite short to common; momentary short to ±25 V

Monotonicity: Monotonic over the full temperature range

BUS INTERFACE

Compatibility: This board complies with the VMEbus specification Rev. C. 1 with the following mnemonics:

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

PHYSICAL/ENVIRONMENTAL

Dimensions: Standard VME double width board 160 x 233.5 mm

Temperature: 0 to 55 °C, operating
-25 to +85 °C, storage

Relative Humidity: 20 to 80 percent, noncondensing

Cooling: Convection

Power Requirements: +5 VDC (±5 percent) at 5.6 A maximum, 3.0 A typical

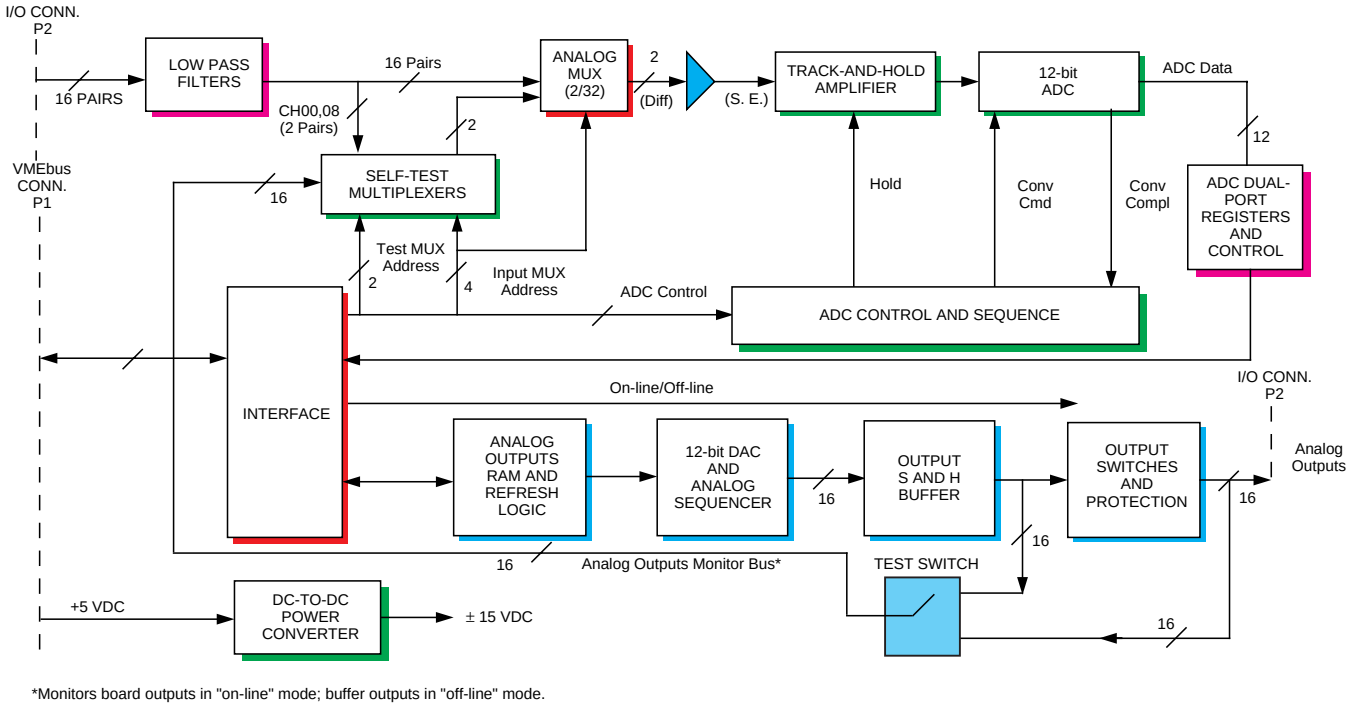
Output and Input Connector: Standard P2 user I/O (Extended ground pins on P1 and P2)

TRADEMARKS

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1. The output refresh temporarily halts when the input analog-to-digital conversion is taking place; therefore, the output refresh rate decreases as the rate of analog-to-digital conversions increases. The worst-case is Autoscanning Mode in which the output refresh rate is 300 Hz (default) or 900 Hz (fast refresh).

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*Monitors board outputs in "on-line" mode; buffer outputs in "off-line" mode.

Figure 1. VMIVME-4514 Functional Block Diagram

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.
Digital Input Board Application Guide	825-000000-000
Change-of-State Board Application Guide	825-000000-002
Digital I/O (with Built-in-Test) Product Line Description	825-000000-003
Synchro/Resolver (Built-in-Test) Subsystem Configuration Guide	825-000000-004
Analog I/O Products (with Built-in-Test) Configuration Guide	825-000000-005
Connector and I/O Cable Application Guide	825-000000-006

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