I/O Products

IC697VAL264/IC697VAL232/IC697VAL216

High-Performance 16-bit Analog-to-Digital Converter (ADC)

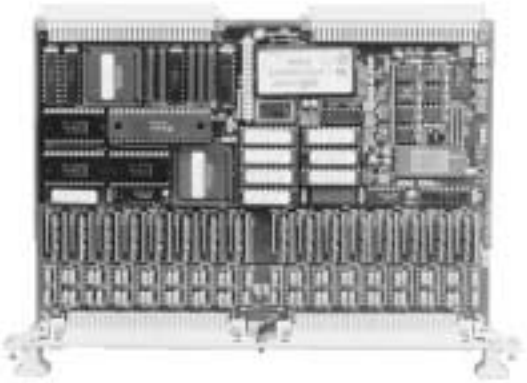
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Introduction

This product is designed to support up to 64 channels of differential wide range (±250mV to ±10V) analog inputs.

Features

- Differential analog inputs
- 16-bit A/D conversion
- Software-selectable conversion rate (100kHz maximum)
- Program-selectable scanning of 16, 32, or 64 channels
- Continually digitizes selected input channels and stores the results
- Three trigger modes
  - Software trigger
  - External trigger
  - Interval timer trigger
- Three scan modes
  - Autoscan
  - Single scan
  - Random access
- Programmed VMEbus interrupts
- User-programmable interval timer
- Software-programmable gain 1 and 10
- External trigger to synchronize multiple boards simultaneously
- Jumper-selectable A/D ranges of 0 to +5V, 0 to +10V, ±2.5V, ±5V, and ±10V
- Overvoltage protected inputs
- Word data buffer (16-word deep buffer per channel)
- Selectable output coding
- Powers up in autoscanning mode with unity gain



Applications

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

The board supports the following operating modes which are described on page 2:

Trigger Modes

Software Trigger

External Trigger

Interval Timer Trigger

Scan Modes

Autoscan

Single Scan

Random Access

Related Products and Applications

GE Fanuc offers a broad range of Analog Input (AI) products for VMEbus systems, and supports these products with comprehensive application information. Contact GE Fanuc for a description of current products and a list of application guides. The Analog Input Board can be ordered in a several configurations depending on

the type of board needed. Below is a list of the available products.

Table 1. Related Products

IC697VAL264	Analog Voltage Input; 64 Channels, 16-bit
IC697VAL232	Analog Voltage Input; 32 Channels, 16-bit
IC697VAL216	Analog Voltage Input; 16 Channels, 16-bit

There are 1,024 dual-port Data Registers to provide storage for continuous scanning of all channels. The trigger and scanning modes are executed automatically at power up, system reset, or are entered under program control. The dual-port registers allow VMEbus access at any time to read the latest stored data.

Channel gain is under software control and can be fixed at x1 or x10 or each channel individually programmed for either gain.

Conversion rate is selectable up to 100kSPS (thousand samples/s). Low pass input filters are available.

A functional block diagram is provided in Figure 1.

Functional Characteristics

(At +25°C and rated power supplies, unless otherwise stated.)

Operating Modes:

Trigger Mode:

Software Trigger: The selected scan mode is initiated by writing to the software trigger address.

External Trigger: An external trigger, received on the P2 connector, initiates the selected scan mode.

Interval Timer Trigger: The selected scan mode is initiated each time the programmed time interval expires.

Scan Mode:

Autoscan: This is the default scan mode. All active channels are scanned continuously in sequential order.

Single Scan: A single data burst (scan of all selected channels) is initiated by the selected trigger mode. After all selected channels have been scanned, the scanning process stops and waits for another trigger.

Random Access: A single channel can be selected, digitized, and stored each time the selected trigger mode is enabled.

Channel Autogain: The unique gain code for each channel is loaded from the VMEbus into a gain buffer. The assigned code is retrieved from the buffer in real-time for each channel acquisition.

Synchronization: A single scan or burst can be initiated by an external TTL trigger through the P2 connector (external trigger), or locally through the CSR (software trigger). Either event generates a P2 trigger output, which can be used to synchronize up to 15 boards.

VMEbus Access: Response to address modifiers is jumper selectable as:

A32, A24, or A16 address space

Supervisory, user privilege, or both

VMEbus Compliance: This product complies with VMEbus Specification ANSI/IEEE STD 1014-1987 IEC 821 and 297 with the following mnemonics:

A32/A24/A16:D16/D8 (EO) DTB Slave
Interrupter I(1 to 7) ROAK (DYN)
Interrupter Vector: D08 (O) (DYN)
6U form factor

VMEbus Interrupt: An interrupt request can be generated at the end or middle of a buffer scan. The request can also be initiated after a specific number of samples (1 to 65,535) have been acquired. Response vectors are controlled through Interrupt Vector Registers.

Data Ready Flag: A data ready flag in the CSR is set when the data buffer is filled (endscan) or half-filled (midscan).

Interval Timer: Timed intervals of up to 687 seconds are provided by a programmable interval timer.

Reset Operations: Board reset occurs in response to a system reset or by writing to the Software Reset Address. For programming-free initial operation, a reset operation automatically establishes the following default conditions:

Autoscanning Mode

64-, 32-, or 16-channel block size, depending on product selected

64-, 32-, or 16-channel data buffer, depending on product selected

Channel Gain = x1

Rate = 100kHz conversion

The ADC will go through a calibration cycle on either RESET condition. The calibration cycle takes 41ms after a RESET operation has been initiated.

PGA: Channel gains of x1 and x10 are selected through a Programmable Gain Amplifier (PGA). PGA gain can be software configured for a single gain on all channels, or it can be controlled in real-time with unique gains assigned for each channel.

Panel Indicator: Program-controlled front panel LED is energized during reset, and is extinguished through the CSR.

Board Identification: A Board Identification Register (BIR) contains the board identification code.

Input Characteristics

Number of Input Channels: 64, 32, or 16 differential input channels

Full-Scale A/D Ranges: ±2.5V, ±5V, ±10V, 0 to +5V, 0 to +10V; jumper selectable

Channel Gain: Software configured for x1 or x10

Full-Scale Input Range: Gain = 1: ±1 to ±10V Bipolar; 0 to +5V, 0 to +10V Unipolar
Gain = 10: ±250mV to ±1V Bipolar; 0 to +0.5V Unipolar

Accuracy: Maximum error = ±0.005% Reading ±0.005% range ±100µV

Example: For a +7.000V reading in the ±10V range: maximum Error = ±350µV ±1mV ±100µV = ±1.45mV

Stability: Temperature drift, per degree Celsius = ±10PPM (ADC reading) plus ±7.5PPM (ADC range) plus ±2.5µV

Example: For a +7.000V reading in the ±10V range: Temperature drift = ±70µV ±150µV ±2.5µV = ±222.5µV

Input Noise: (0.4 + 0.3/G)mV; where: G = PGA Gain
Noise is dependent on the 500Hz filter

Input Bias Current: 40nA maximum at zero input

Input Impedance: 5MΩ minimum in parallel with 50pF

Interchannel Crosstalk (DC to 1 kHz):

Option	Adjacent Channel	Alternate Channel
Standard Performance (100kSPS)	-50dB	-90dB
Standard Performance (35kSPS)	-90dB	-96dB

Common-Mode Voltage Range ($|V_{CM}| + |V_{IN}|.G$): <10V

Where: V_{CM} = the common-mode voltage
V_{IN} = the input voltage
G = the gain

Common-Mode Rejection: DC to 60Hz with 350Ω source imbalance

Gain	Min	Typical
1	90dB	100dB
10	100dB	120dB

Common-Mode Rejection for the ±2.5V and 0 to +5V scale is a minimum of 75dB. This can be field-trimmed to the same common-mode rejection as the gain of 1.

Overvoltage Protection: ±35V, sustained
Power On/power Off
±80V, transient (1s maximum)

Input Filter: Low pass single-pole filters: -3dB at 500Hz

The value applies to the differential inputs. The cutoff frequency has a tolerance of ±25%. Typical no filter input bandwidth (20Vpp) is 5kHz .

Common-Mode/Floating Input Protection: The user must control the common-mode voltage and not let inputs float.

Transfer Characteristics

Resolution: 16 bits

Input Sampling: Sequential, starting at channel 00

Input Transfer Function:

$$E_{IN} = E_{LO} + E_{FSR} \times \frac{N_{ADC}}{65{,}536}$$

Where: E_{IN} = Input Voltage
E_{LO} = Lower End of Input Range
E_{FSR} = Full-Scale Input Range
N_{ADC} = A/D Converter Reading

Example: For a N_{ADC} value of D99A HEX (55,706 decimal) in the ±10V range:

$E_{IN} = -10 + [20.000 \times (55{,}706/65{,}536)] = +7.000$

Integral Nonlinearity: ±0.005% maximum; from best straight line

Differential Nonlinearity: ±0.0015%
No missing codes at 16-bit resolution

A/D Conversion Rate: 381 to 100kSPS; reset default, 100kSPS

Channel Sample Rate (Maximum): 100kSPS (100kSPS ÷ number of channels in scanning block, 1 channel minimum)

Timed Interval: 305µs to 687s

Data Coding: Program selectable as two's complement, or straight/offset binary

Data Buffer Memory

Buffer Size: 16 to 1,024 contiguous 16-bit data words; program controlled

Block Size: 1, 8, 16, 32, or 64 channels; program controlled

Access Time:

Nonscanning: 600ns maximum
Scanning: 600ns typical, 1.2µs maximum
Maximum access time in scanning mode will occur only when VMEbus access occurs in ADC sample window.

VMEbus Access: D8 or D16

Availability: Accessible at any time from the VMEbus. Buffer and block sizes are controlled through a Configuration Control Register (CCR).

Physical/Environmental

Temperature: 0 to +65°C (standard VME slot), operating; -40 to +85°C, storage

Humidity: 0 to 80% relative, noncondensing

Altitude: Operation to 3,000m

Cooling: Forced air convection (standard VME slot)

Dimensions: Double height Eurocard (6U) board, 160 x 233.35mm

Weight: 700g, maximum

Input Connectors (P3, P4): Input connectors P3 and P4 are 96-pin DIN nonlatching connectors. The 96-pin nonlatching connectors offer the center row as ground.

Power Requirements: 7.0A (maximum) at +5VDC

MTBF: 135,900 hours (MIL STD 217F)

Agency Approvals: UL1604 with C-UL

Certification by Underwriters Laboratory for use in Class 1, Div. 2, Groups A, B, C, D Hazardous Locations. Board complies with applicable CSA Standards as evaluated by UL. The C-UL mark is accepted throughout Canada.

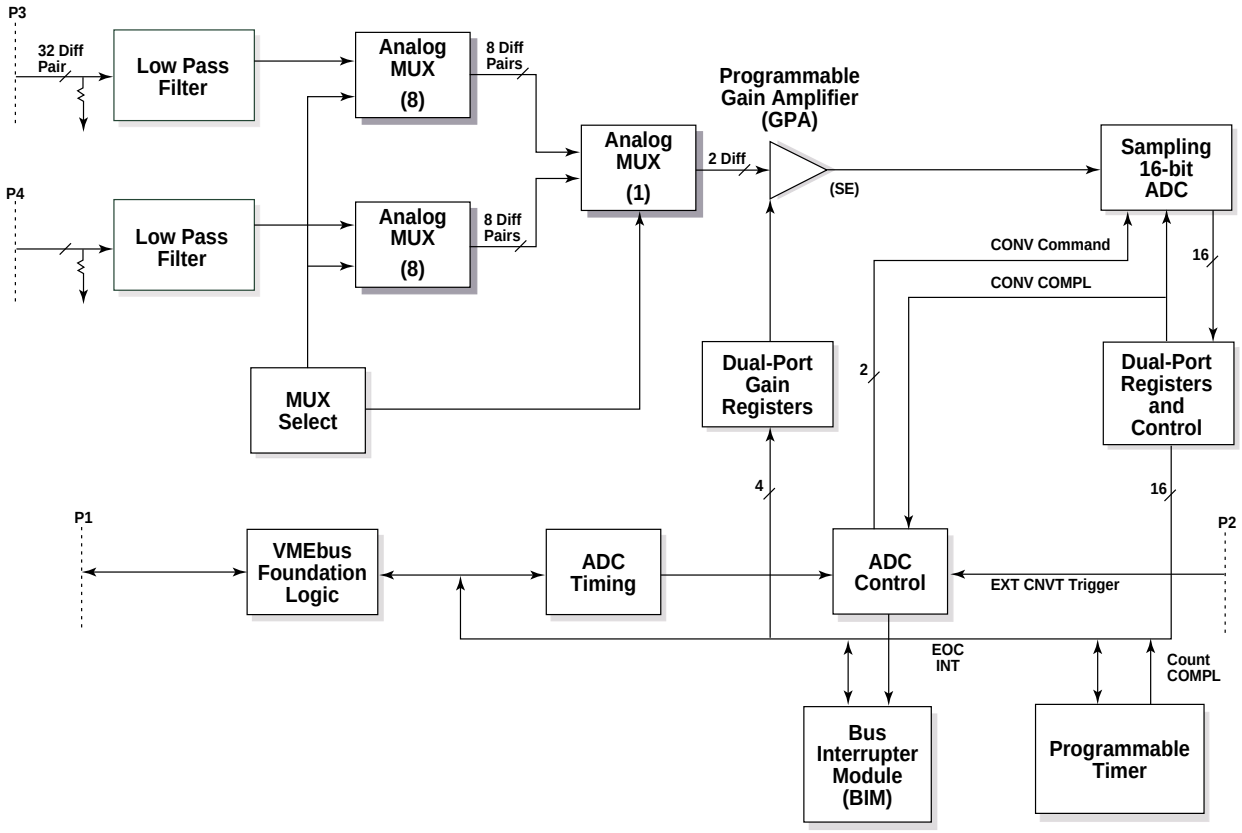


Figure 1. IC697VAL264/IC697VAL232/IC697VAL216 Functional Block Diagram