PMC-12AIO
12-Bit PMC Analog Input/Output Board
With 32 Input Channels, 4 Output Channels, a 16-Bit Digital I/O Port
and 1.5 MSPS Input Conversion Rate

Features:

- 32 Single-Ended or 16 Differential 12-Bit Scanned Analog Input Channels
- 4 Analog Output Channels, 12-Bit D/A Converter per Channel
- 16-Bit Bi-directional Digital Port with Two Auxiliary I/O Lines
- Software-Selectable Analog Input/Output Ranges of ±10V, ±5V or ±2.5V
- Independent 32K-Sample Analog Input and Output FIFO Buffers
- 1.5 MSPS Conversion Rate in Single-Channel Mode;
  1.0 MSPS in Multichannel Scan Mode; (1.5 MSPS with Accelerated Scanning option)
- Low Crosstalk, Noise and Input Bias Current; Buffer Amplifiers on all Analog Input Lines
- 1.2 MSPS (Megasamples per Second) Aggregate Analog Output Clocking Rate (0.3 MSPS/Chan)
  (1.6 MSPS aggregate; 0.4MSPS/Chan with optional Accelerated Scanning)
- Supports Waveform and Arbitrary Function Generation; Continuous and One-shot Modes
- Internal Rate Generator Controls Input Sampling, Output Sampling, or Both Simultaneously
- Supports Multiboard Synchronization of Analog Inputs and Outputs
- Internal Auto calibration of Analog Input and Output Channels
- Continuous and Burst (One-Shot) Input and Output Modes
- DMA Engine Minimizes Host I/O Overhead

Applications Include:

- Acoustics Analysis
- Analog Inputs
- Data Acquisition Systems
- Voltage Measurement
- Process Monitoring
- Industrial Robotics
- Automatic Test Equipment
- Audio Waveform Analysis
- Environmental Test Systems
**Functional Description:**

The PMC-12AIO board provides cost effective high-speed 12-bit analog input/output resources on a standard single-width PMC module. Four analog output channels can be updated either synchronously or asynchronously, and support waveform generation. Internal autocalibration networks permit calibration to be performed without removing the board from the system. Software-controlled test configurations include a loopback mode for monitoring all analog output channels. Gain and offset correction of the analog input and output channels is performed by calibration DAC's that are loaded with channel correction values during autocalibration. A digital I/O port provides 16 bidirectional data lines and two auxiliary I/O lines.

The analog inputs are software-configurable either as 32 single-ended channels or as 16 differential signal pairs. Buffer amplifiers on all input lines eliminate multiplexer input switching noise, and minimize crosstalk and input bias currents. Analog input data accumulates in a 32K-sample buffer until retrieved by the PCI bus. Each of the four analog output channels contains a dedicated 12-bit D/A converter and an output range control network. The board receives analog output data from the PCI bus through a 32K-sample FIFO buffer.

![ PMC-12AIO; Functional Organization ](image)

This product is functionally compatible with the IEEE PCI local bus specification Revision 2.3, and supports the "plug-n-play" initialization concept. System input/output connections are made at the panel bracket through a high-density 68-pin connector. Power requirements consist of +5 VDC, in compliance with the PCI specification, and operation over the specified temperature range is achieved with conventional convection cooling.
ELECTRICAL SPECIFICATIONS

At +25 °C, with specified operating voltages

ANALOG INPUT CHANNELS

- **Input Characteristics:**
  - Configuration: 32 input lines, configurable as 32 single-ended or 16 differential channels
  - Voltage Ranges: Software configurable as ±10, ±5 or ±2.5 Volts
  - Input Impedance: 1.0 Megohms line-to-ground, 2.0 Megohms line-to-line, in parallel with 100Pfd. Independent of scan rate.
  - Bias Current: 80 nanoamps maximum
  - Noise: 0.7 LSB-RMS typical
  - Common Mode Rejection: 60 dB typical, DC-60 Hz, differential input mode
  - Common Mode Range: ±10 Volts; differential input configuration
  - Overvoltage Protection: Standard: ±30 Volts with power applied; ±15 Volts with power removed

- **Transfer Characteristics:**
  - Resolution: 12 Bits; 0.0244 percent of FSR
  - Maximum Conversion Rate: 1500K conversions per second, minimum in single-channel mode, 1000K in multichannel modes (1500K with 'Accelerated Scanning' factory option).
  - Channels per scan: 2, 4, 8, 16, or 32 Channels per scan (32 channels available only in single-ended mode)
  - Maximum Scan Rate: 1500K scans/sec in single-channel mode. 31K-500K scans per second in scanning modes (47K-750K scans per second with Accelerated Scanning option).
  - Minimum Scan Rate: 458 scans per second, using a single internal rate generator; 0.007SPS using both generators. Zero, using a software sync flag or an externally supplied sync input.
  - DC Accuracy: (Maximum composite error, referred to inputs)
    - ±10V: ±4.2mV ±8.4mV
    - ±5V: ±3.5mV ±5.2mV
    - ±2.5V: ±2.5mV ±4.0mV
  - Crosstalk Rejection: 75dB, DC-10kHz
  - Integral Nonlinearity: ±0.024 percent of FSR, maximum
  - Differential Nonlinearity: ±0.024 percent of FSR, maximum

- **Analog Input Operating Modes and Controls**
  - Analog Input Modes:
    - Single Scan: A software or hardware sync initiates a single scan of all active channels at the maximum conversion rate. As many as three target boards can be synchronized to a single initiator board.
    - Continuous Scan: Inputs are scanned continuously at the selected scan rate.
    - Selftest: Reference and loopback tests; autocalibration

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Phone: (256) 880-8787 or (800) 653-9970  FAX: (256) 880-8788  Email: Solutions@GeneralStandards.com
Analog Input Modes (Cont.):

Multiple-Channel: 2, 4, 8, 16 or 32 channels per scan
Single-Channel: Any single-channel can be selected for digitizing at the maximum conversion rate.

Input Data Buffer: 32K-sample FIFO with 0000h-7FFEh adjustable threshold flag; DMA is supported

ANALOG OUTPUT CHANNELS

Output Characteristics:
- Configuration: Four single-ended output channels. (Ordering option)
- Voltage Ranges: Same as selected for analog inputs; ±10, ±5 or ±2.5 Volts
- Output Resistance: 1.0 Ohm, maximum
- Output protection: Withstands sustained short-circuiting to ground
- Load Current: Zero to ±3ma per channel
- Load Capacitance: Stable with zero to 2000 pF shunt capacitance
- Noise: 2.0mV-RMS, 10Hz-100KHz typical
- Glitch Impulse: 5 nV-Sec typical, ±2.5V range

Transfer Characteristics:
- Resolution: 12 Bits (0.0244 percent of FSR)
- Output Sample Rate: Software adjustable from 458SPS to 400KSPS per channel with optional accelerated scanning; 366SPS to 300KSPS standard; 0.007SPS to 400KSPS (300KSPS standard) using both internal rate generators. DC to 400KSPS (DC-300KSPS standard) with hardware or software sync.

DC Accuracy:
- Range: ±10V, ±5V, ±2.5V
- Midscale Accuracy: ±4.0mV, ±3.1mV, ±2.0mV
- Fullscale Accuracy: ±7.5mV, ±4.7mV, ±3.5mV
- Settling Time: 8us to 1LSB, typical with 50-percent fullscale step
- Crosstalk Rejection: 65 dB minimum, DC-1000Hz
- Integral Nonlinearity: ±0.025 percent of FSR, maximum
- Differential Nonlinearity: ±0.015 percent of FSR, maximum

Analog Output Operating Modes and Controls

Clocking Modes:
- Simultaneous Continuous Mode: Channel values in a designated channel group are stored in an intermediate buffer, and then are transferred to the output DAC's when an output clock occurs. The clock can be generated either by the internal rate generator, by a software flag, or by an external hardware trigger. As many as three target boards can be clock-synchronized to a single initiator board.
- Simultaneous Burst Mode: A single function (i.e.: burst) is initiated by a software or hardware sync. During a burst, channel values in a designated channel group are stored in a transfer buffer, and then are transferred to the output DAC's each time a clock pulse is generated by the internal rate generator. The burst terminates when a Burst End flag is encountered.
Clocking Modes (Cont.): Channel-Sequential Modes: Same as simultaneous modes, but each value in the data buffer is written immediately to the associated output DAC. The group-end flag is ignored in this mode.

Channel Assignment: A 2-bit field in the output buffer assigns the associated data field to a specific output channel.

Group End: A single bit in the output buffer indicates the last value in a channel group.

Burst End: A single bit in the output buffer indicates the last value in an output burst sequence.

Output Data Buffer: 32K-sample FIFO with 0000h-7FFEh adjustable threshold flag; DMA is supported

**RATE GENERATORS**

Analog outputs and inputs can be clocked from either of two independent rate generators, or both inputs and outputs can be synchronized to a single generator. Each rate generator uses a 16-bit adjustable frequency divider, and the two generators can be operated in series to provide very low clocking rates.

**DIGITAL I/O PORT**

The digital I/O port consists of 16 bidirectional data lines, one auxiliary input line and one auxiliary output line. An interrupt request can be generated in response to the auxiliary input. The data lines are organized as two data bytes, each of which can be configured independently as either an input or output byte. Standard TTL logic levels apply, with 20 ma current-sink capability per output line.

**PCI INTERFACE**

- **Compatibility:** Conforms to PCI Specification 2.3, with D32 read/write transactions.
  - Supports "plug-n-play" initialization.
  - Provides one multifunction interrupt.
  - Supports DMA transfers as bus master.

**MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS**

- **Power Requirements**
  
  +5VDC ±0.2 VDC at 1.3 Amps, maximum
  
  Maximum Power Dissipation: 5.5 Watts, Side 1; 1.0 Watt, Side 2

- **Physical Characteristics**

  Height: 13.5 mm (0.53 in)
  Depth: 149.0 mm (5.87 in)
  Width: 74.0 mm (2.91 in)
  Shield: Optional EMI shield available for Side 1.

- **Environmental Specifications**

  Ambient Temperature Range: Operating: 0 to +65 degrees Celsius inlet air
  Storage: -40 to +85 degrees Celsius

  Relative Humidity: Operating: 0 to 80%, non-condensing
  Storage: 0 to 95%, non-condensing

  Altitude: Operation to 10,000 ft.
  Cooling: Conventional convection cooling.
ORDERING INFORMATION

Specify the basic product model number followed by an option suffix "-ABCD", as indicated below. For example, model number PMC-12AIO-41A describes a board with 4 output channels, a bezel and EMI shield, accelerated scanning, and no custom features.

<table>
<thead>
<tr>
<th>Optional Parameter</th>
<th>Value</th>
<th>Specify Option As:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Analog Outputs</td>
<td>No Output Channels</td>
<td>A = 0</td>
</tr>
<tr>
<td></td>
<td>4 Output Channels</td>
<td>A = 4</td>
</tr>
<tr>
<td>EMI Shield (Recommended in high-noise environments)</td>
<td>No bezel or shield</td>
<td>B = 0</td>
</tr>
<tr>
<td></td>
<td>Bezel &amp; shield installed</td>
<td>B = 1</td>
</tr>
<tr>
<td>Accelerated Scanning</td>
<td>No acceleration</td>
<td>C = N (or Blank)</td>
</tr>
<tr>
<td>Custom Feature</td>
<td>Accelerated Scanning</td>
<td>C = A</td>
</tr>
</tbody>
</table>

* Numeric code, determined by specific feature. Blank or zero (0) if no custom feature applies.

SYSTEM I/O CONNECTIONS

Table 1. System Connector Pin Functions

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>ANA INP0 HI</td>
</tr>
<tr>
<td>33</td>
<td>ANA INP0 LO *</td>
</tr>
<tr>
<td>32</td>
<td>ANA INP0 HI</td>
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<tr>
<td>31</td>
<td>ANA INP02 LO</td>
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<tr>
<td>30</td>
<td>ANA INP04 HI</td>
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<tr>
<td>29</td>
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<td>28</td>
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<td>18</td>
<td>INPUT RTN</td>
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<td>ANA INP16 HI</td>
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<td>ANA INP30 HI</td>
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<tr>
<td>1</td>
<td>ANA INP30 LO</td>
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</tbody>
</table>

* Analog inputs are shown for the differential input mode. In single-ended mode, LO inputs become consecutive odd-numbered channels, beginning with ANA INP 01 replacing ANA INP 00 LO.

Figure 2. System Input/Output Connector

System Mating Connector:
68-Pin 2-row 0.050" dual-ribbon cable socket connector: Robinson Nugent #P50E-068-S-TG, or equivalent.

Contact factory for availability of the 68-pin AMP SCSI-3 connector.

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