WinSystems[®] PC/104 MODULE

PCM-MIO-G 16-Bit A/D, 12-Bit D/A and 48-Lines of Digital I/O

FEATURES

- Multifunction Analog and Digital I/O Module
- Standard configuration: 16-bit A/D, 12-bit D/A, 48-lines of digital I/O
- Special OEM configurations available for 16-bit D/A and other analog and digital I/O combinations
- No adjustment potentiometers or calibration needed
- Software programmable interrupt configuration
- Standard 0.100" headers for easy cable access
- I/O pinout compatible with WinSystems' PCM-ADIO
- Free software drivers in C, Windows[®], and Linux
- Operating temperature: -40°C to +85°C
- +5Vdc operation
- Small size: 90mm x 96mm (3.6" x 3.8")

Analog Input Section

- 16-bit Analog-to-Digital (A/D) converter with sample-and-hold circuit
- Conversion speed: up to 100k samples/sec., throughput or about 85k samples/sec. (processor dependent)
- Analog input ranges: 0-5V, 0-10V, ±5V, and ±10V
- Any combination of up to 16 single-ended input channels and up to 8 differential input channels
- ±25V input protection on each channel
- Each channel independently software programmable for input type and range
- No missing codes over full range
- Low noise DC/DC converter
- High-precision, low drift reference
- DMA or interrupt I/O supported
- Supports industry standard signal conditioners

Analog Output Section

- Eight, 12-bit Digital-to-Analog (D/A) converters
- Output ranges: 0-5V, 0-10V, ±5V, ±10V

FUNCTIONAL CAPABILITY

The PCM-MIO-G is a versatile, PC/104-based analog input, analog output, and digital I/O board designed to meet customer demands for high-accuracy and high-channel count analog and digital I/O. The board is based upon Linear Technologies' precision converters and voltage references which require no external calibration. The digital I/O provided uses WinSystems' versatile WS16C48, that used on many of our SBCs and other I/O products.

The PCM-MIO-G operates over the industrial temperature range of -40° to $+85^{\circ}$ Centigrade. This board is





- Each channel independently software programmable
- Output channels can be updated and cleared individually or simultaneously
- Interrupt I/O supported
- Supports industry standard signal conditioners

Digital Input/Output Section

- 48 bi-directional TTL-compatible digital I/O (DIO) lines with 24 capable of event-sense interrupt generation
- 12 mA sink current per line
- Pinout compatible with industry-standard, optically isolated, digital I/O racks

pinout compatible with other WinSystems' PC/104 analog conversion modules.

Analog Input Section - Two analog-to-digital converters (ADCs) are used on the board. Each contains an 8-channel multiplexer with ±25V protection. The 8-channel multiplexer on each ADC can be programmed for single-ended inputs or pairs of differential inputs or combinations of both. Using on-chip resistors and switches, it provides attenuation and offset that can be programmed for each channel on the fly. The precision trimmed attenuators ensure accurate input ranges.



PCM-MIO-G BLOCK DIAGRAM

All channels are fault protected so that a problem on one channel will not affect the conversion result of another channel. Also overrange protection is provided on unselected channels so that an unused channel will not affect the conversion result on the selected channel.

Analog Input Range - The PCM-MIO-G supports four input voltage ranges. Any input range is independently software selectable for each channel. No jumpers are required.

Unipolar	Bipolar
0 - 5V	±5V
0 - 10V	±10V

Input Voltage Ranges for PCM-MIO

The board will support up to 16 single-ended input channels, 8 differential input channels or various combinations of both. This means that under software control, any channel can be set for either single-ended or differential along with its voltage range. For example, Channels 0 and 1 could be set as 0-10V single-ended, Channel 2 set as $\pm 5V$ differential, Channels 4 and 5 set as 0-5V single-ended, Channel 6 set as $\pm 10V$ differential, etc.

In the differential input mode, only input pairs beginning with the even channel numbers are used. The input signal is applied between the even channel number and the next odd channel input pin. The input polarity is software programmable.

Channel 0	1	2	GND
Channel 1	3	4	GND
Channel 2	5	6	GND
Channel 3	7	8	GND
Channel 4	9	10	GND
Channel 5	11	12	GND
Channel 6	13	14	GND
Channel 7	15	16	GND
Channel 8	17	18	GND
Channel 9	19	20	GND
Channel 10	21	22	GND
Channel 11	23	24	GND
Channel 12	25	26	GND
Channel 13	27	28	GND
Channel 14	29	30	GND
Channel 15	31	32	GND
GND	33	34	GND

Analog Input Connector Pinout

All analog input channels are wired to a 34-pin connector that uses standard 0.100-inch pins.

The entire input channel configuration is done under software control using a command protocol.

Software drivers are available in C, Windows[®] CE, Windows[®] XPe, and Linux. Contact an applications engineer or visit our web site for details.

Analog Output Section - The PCM-MIO uses two Linear Technologies SoftSpanTM quad Digital-to-Analog converters (DACs). They are software programmable for either unipolar or bipolar mode plus specific voltage range on a per channel basis.

INL and DNL are accurate to one LSB over the industrial temperature range in both unipolar and bipolar modes. The device includes an internal deglitcher circuit that reduces the glitch impulse to less than 2nV-s (typical).

There are eight independent 12-bit, D/A channels that each have four programmable output voltage ranges. They are asynchronously cleared to 0V for all ranges when reset.

Unipolar	Bipolar
0 - 5V	±5V
0 - 10V	±10V

Output Voltage Ranges for the DAC channels

Each of the four output channels are wired to a 10-pin connector. There are two connectors on board. The pinout for each is shown in the chart below.

Channel 0	1	2	GND
Channel 1	3	4	GND
Channel 2	5	6	GND
Channel 3	7	8	GND
GND	9	10	GND

J1 - Channels 0 - 3 D/A Connector Pinout

Channel 4	1	2	GND
Channel 5	3	4	GND
Channel 6	5	6	GND
Channel 7	7	8	GND
GND	9	10	GND

J3 - Channels 4 - 7 D/A Connector Pinout

Onboard DC/DC Power Supplies - There is an ultra low noise, ± 15 V-power supply on board. It is based upon an LT1533 switching regulator designed to reduce both conducted and radiated EMI. This is achieved by independent control of voltage and slew rates for both the positive and negative voltages plus careful layout techniques. A separate regulator is used to generate an analog +5V supply for the converters. This is done to minimize digital switching noise since converters inherently have low power supply rejection (PSRR). The result is less than 300uV p-p (typical) from DC to 1MHz on all analog supply voltages.

Calibration - No input or output calibration is required since the Linear Technology parts are factory trimmed

Isolated Analog Signal Conditioning - WinSystems' PCM-MIO-G is compatible with the Dataforth[®] SensorLex[®] 8B Isolated Signal Conditioners. These are small, cost-effective modules designed to protect, filter, and isolate input signals from electrical transients and industrial equipment power-line voltages, while reducing electrical noise in measured signals. There are many models to interface to a wide variety of voltage, current, temperature, position, frequency, and strain measuring devices.

The modules measure 1.11 x 1.65 x 0.4 inches (28.1 x 41.9 x 10.22mm) and operate from -40° to $+85^{\circ}$ C.

They can be mounted in backpanels or on DIN rails. For more information, go to <u>www.dataforth.com/8b</u>.

Digital Input/Output Section - The PCM-MIO-G contains WinSystems' highly versatile WS16C48, 48-line digital I/O controller. There are 48 bits of TTL-compatible digital I/O divided into two, 8-bit x 3 ports. Each I/O line is individually programmable for input, output, or output with read-back operation. Each output channel is latched and has an open collector driver (with a pull-up resistor) capable of sinking 12mA of current. This allows direct control of up to 48 opto-isolated signal conditioning modules to a single card for high-density I/O support.

The major feature of the WS16C48 controller is its ability to monitor the 24 of lines of Port 0, 1, and 2 for either rising or falling digital edge transitions, latch them and then interrupt the host processor notifying it that a changeof-input status has occurred. Transition polarity is programmable and enabled on a bit-by-bit basis. Each line's transition is latched by the event so that even short duration pulses will be recognized. An interrupt ID register is maintained for each line for writing more efficient Interrupt Service Routines. This is an efficient way of signaling the CPU of real-time events without the burden of polling the digital I/O points.

I/O Connectors - The WS16C48 has its I/O lines connected to two, 50-pin connectors. Twenty-four data lines are alternated with 24 ground lines for reduced noise and crosstalk. Also a +5 volt source can be jumper enabled on pin 49 of each connector to supply logic power for an I/O module rack or other interface electronics. The optional CBL-115-4, 50-pin conductor ribbon cable, connects the PCM-MIO-G to one I/O rack.

The pinout is compatible with the industry standard 4 to 24 position I/O module mounting racks (Dataforth, Opto-22[®], etc.) for use with high-level AC and DC opto-isolated solid state relays.

Isolated Digital I/O Modules - A broad line of solid state, miniature digital I/O modules are available in four basic types: AC input, DC input, AC output, and DC output. Each module provides a safe and reliable way to interface the PCM-MIO-G to industrial applications. The module's isolation barrier is good to 4kV between the field wiring and PCM-MIO-G board. These modules are UL listed, CSA certified and CE compliant. Input modules incorporate filtering for transient-free switching.

Port 2 Bit 7	1	2	GND
Port 2 Bit 6	3	4	GND
Port 2 Bit 5	5	6	GND
Port 2 Bit 4	7	8	GND
Port 2 Bit 3	9	10	GND
Port 2 Bit 2	11	12	GND
Port 2 Bit 1	13	14	GND
Port 2 Bit 0	15	16	GND
Port 1 Bit 7	17	18	GND
Port 1 Bit 6	19	20	GND
Port 1 Bit 5	21	22	GND
Port 1 Bit 4	23	24	GND
Port 1 Bit 3	25	26	GND
Port 1 Bit 2	27	28	GND
Port 1 Bit 1	29	30	GND
Port 1 Bit 0	31	32	GND
Port 0 Bit 7	33	34	GND
Port 0 Bit 6	35	36	GND
Port 0 Bit 5	37	38	GND
Port 0 Bit 4	39	40	GND
Port 0 Bit 3	41	42	GND
Port 0 Bit 2	43	44	GND
Port 0 Bit 1	45	46	GND
Port 0 Bit 0	47	48	GND
5V (jumpered)	49	50	GND

J9 - Digital I/O Connector Pinout

Various input modules can sense voltage ranges of 10-60, 90-140, and 180-280VAC; and also 3.3-32 and 10-60VDC. Models with low noise, fast switching and other special features are available. They conform to the industry-standard footprint and pinout.

Output modules support different ranges including 12-140 and 24-280VAC plus 0-50, 3-60, and 5-200VDC. Fast switching and other special options are available. Contact Dataforth at www.dataforth.com.

PC/104 Interface - The PCM-MIO is I/O mapped. The analog converters and digital I/O controller require 32 sequential port addresses. The addresses are jumper selectable from 0 to 3FF hex on any even 32-port boundary. The control, data, and power signals are wired to a 16-bit stackthrough PC/104 connector.

Interrupts - Interrupts are generated by the ADCs, DACs, and WS16C48 I/O controller. Each interrupt is routed to the Lattice MegaPAL so that various interrupt options can

Port 5 Bit 7	1	2	GND
Port 5 Bit 6	3	4	GND
Port 5 Bit 5	5	6	GND
Port 5 Bit 4	7	8	GND
Port 5 Bit 3	9	10	GND
Port 5 Bit 2	11	12	GND
Port 5 Bit 1	13	14	GND
Port 5 Bit 0	15	16	GND
Port 4 Bit 7	17	18	GND
Port 4 Bit 6	19	20	GND
Port 4 Bit 5	21	22	GND
Port 4 Bit 4	23	24	GND
Port 4 Bit 3	25	26	GND
Port 4 Bit 2	27	28	GND
Port 4 Bit 1	29	30	GND
Port 4 Bit 0	31	32	GND
Port 3 Bit 7	33	34	GND
Port 3 Bit 6	35	36	GND
Port 3 Bit 5	37	38	GND
Port 3 Bit 4	39	40	GND
Port 3 Bit 3	41	42	GND
Port 3 Bit 2	43	44	GND
Port 3 Bit 1	45	46	GND
Port 3 Bit 0	47	48	GND
5V (jumpered)	49	50	GND
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J8 - Digital I/O Connector Pinout

be selected by the user under software control. This increases flexibility and reduces the need for on board jumpers. Each interrupt source can be individually enabled or disabled. The PCM-MIO can be programmed to select the IRQ line assignment on the PC/104 bus on channels 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, and 15. From 1 to 5 separate IRQ lines can be driven by the PCM-MIO if required by the application.

DMA - Direct Memory Access is supported for 8-bit command and 16-bit data transfers for both A/D and D/A. A DOS driver is available that supports DMA.

Special Configurations - WinSystems can depopulate this board to meet special OEM applications. For example, all the A/D channels or perhaps all the D/A channels could be removed. Also for lower cost product, a 12-bit A/D converter can be installed rather that the 16-bit device. Please contact an applications engineer with your requirements.

SPECIFICATIONS

Electrical

PC/104 Bus:	16-bit, stackthrough
Voltage:	+5V ±5% @ 500mA (Typ.)
	All outputs unloaded

A/D Section

Input:	Up to 16 channels single-ended,
-	8 channels of differential or
	combination thereof
Range:	0-5V, 0-10V, ±5V, and ±10V
Resolution:	16-bits (PCM-MIO-1)
Monotonicity:	Guaranteed over temperature range
Differential:	Non-linearity: No missing codes
	to 15-bits
Input impedance:	42k (typ.) unipolar mode
	31k (typ.) bipolar mode

D/A Section

Output:	8 channels
Range:	0-5V, 0-10V, ±5V, ±10V
Resolution:	12-bits, no missing codes
Settling time:	2μ S to 0.1% full scale step
Output Current:	±10mA per output typical with
	±30mA maximum per board

Digital I/O

Type:	48-bits organized in six, 8-byte
	segments
Logic:	TTL-compatible with 12mA source
	and sink for each pin

Mechanical

Dimensions: Weight: 3.6" x 3.8" (90mm x 96mm) 19.45 oz.

Connectors

A/D:	One, 34-pin on 0.100" grid
D/A:	Two, 10-pin on 0.100" grid
Digital I/O:	Two, 50-pin on 0.100" grid
PC/104:	64-pin, 0.100" (32-pin double row)
	40-pin, 0.100" (20-pin double row)
Jumpers:	0.020" square posts on 2mm centers

Environmental

Operating Temperature: -40° to +85° Celsius Non-condensing relative humidity: 5% to 95%

ORDERING INFORMATION

PCM-MIO-G-1 16-bit A/D, 12-bit D/A, and 48-lines of digital I/O

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