

# MSI PC/104 Embedded PC Series

# MSI-P415 ANALOG INPUT CARD

## FEATURES

- ◆ Up to 16 analog differential input channels, low cost, high performance.
- ◆ 12-bit resolution,  $\pm 1/2$  LSB linearity.
- ◆ Software selectable input ranges of 0-5V, 0-10V,  $\pm 5V$ ,  $\pm 10V$ , (0-20 mA with MSI-P910) for Model MSI-P415 requiring no jumper selections. Low level input ranges to 100 mV available for Model MSI-P415L.
- ◆ Input Impedance 1 M $\Omega$ .
- ◆ Single +5V power supply operation.
- ◆ 12  $\mu s$  total conversion time for a 83 kbps rate for each 8 channels (166 kbps for 16 channels).
- ◆ Two programmable power down modes .
- ◆ 8-bit stackthrough PC/104 with I/O mapped 16-bit addressing.
- ◆ Jumper selectable address and interrupt options.
- ◆ Complete hardware documentation with schematics.
- ◆ Operating temperature range -25° C to 85° C.
- ◆ Two-year warranty from date of shipment.

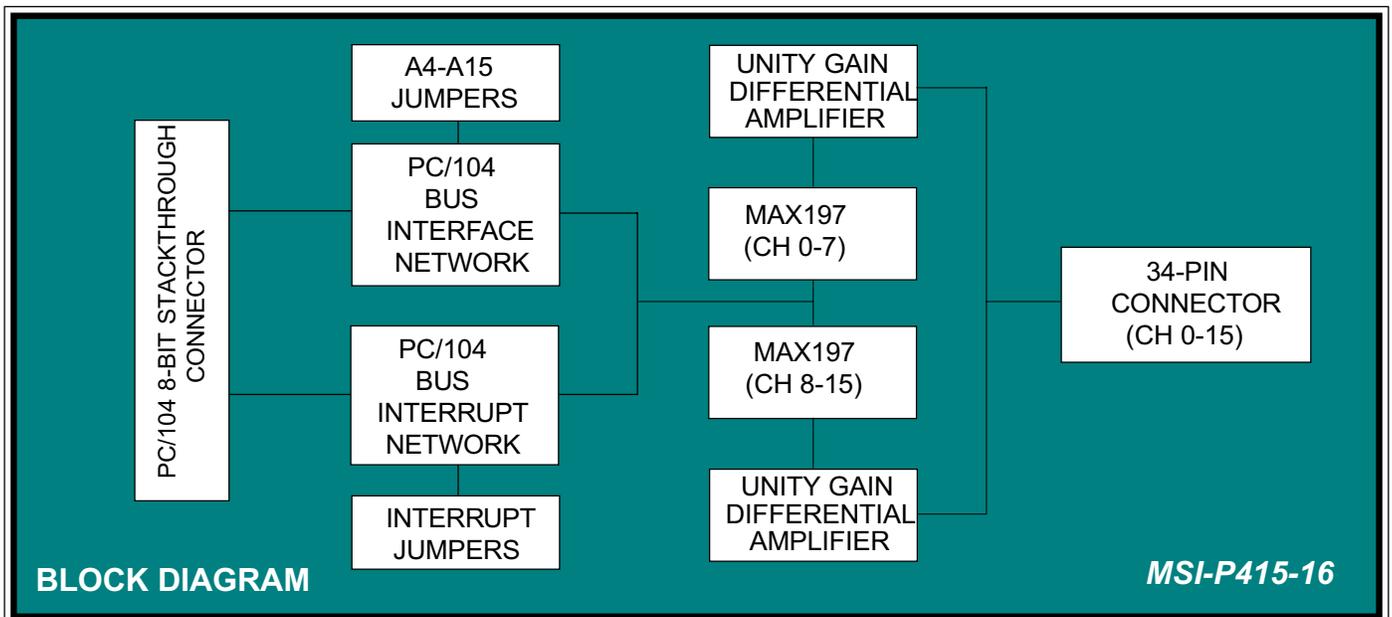
## DESCRIPTION

The MSI-P415 is a low cost, high performance 12-bit analog differential input card designed for use with all PC/104 embedded systems. Two



models provide input capacities of 8 or 16 channels which operate from a single +5V supply. Software programmable input ranges are 0-5V, 0-10V,  $\pm 5V$  and  $\pm 10V$  (MSI-P415) with a linearity of  $1/2$  LSB. Input ranges of 100 mV are also available (MSI-415L). In addition, a fault condition on any channel will not effect the conversion result on the selected channel.

**A/D Converters** - The card employs up to two MAX197 eight-channel A/D converters that incorporate a precision 2.5V reference source with buffer amp, an internal 1.56 MHz clock,



and successive approximation and internal input span and offset errors result in no adjustments being required for these functions. Typical total conversion times of 12 us gives a sample rate of 83 ksps for each group of eight channels yielding rates up to 166 ksps for 16 input channels.

**Card Addressing** - The card is I/O mapped using 16-bit addressing to select the input channels and device status. Option jumpers are provided for specifying the card **base** address (A4 - A15). The address of the control word/ input data (C/I) and status for each channel is

Channels	C/I Address	Status Address
0-7	base + 0 (lo) base + 1 (hi)	base + 8 (bit 0)
8-15	base + 2 (lo) base + 3 (hi)	base + 8 (bit 1)
16-23	base + 4 (lo) base + 5 (hi)	base + 8 (bit 2)
24-31	base + 6 (lo) base + 7 (hi)	base + 8 (bit 3)

**Interrupts** - Interrupt processing is provided for IRQ4 thru IRQ7 and IRQ9 using options jumpers.

**Programming** - Performing conversions is very simple. A control byte is written to the desired channel group lo byte specifying the channel within the group (bits 0-2), input range (bit 3), polarity (bit 4), mode (bit 5), and the clock and power down selection (bits 6-7). The status bit of the channel group indicates when the conversion is complete. The data is then read, D0-D7 at the lo address of the channel group and D8-D11 at the hi address of the channel group, bits 0-3. The read operation can be performed under software polling or by using interrupt processing.

**Models & Unit Price** - The MSI-P415 comes in four models as shown.

MSI-P415-8	8 input channels
MSI-P415-16	16 input channels
MSI-P415L-8	8 input channels
MSI-P415L-16	16 input channels

## SPECIFICATIONS

**PC/104** 8-bit, stackthrough

### Analog Inputs

Channels	8 to 16 in groups of 8
Converter	MAXIM MAX197
Input Ranges	
MSI-P415	0-5V, 0-10V, $\pm 5V$ , $\pm 10V$ 0-20 mA with MSI-P910
MSI-P415L	0-100mV, 0-200mV, $\pm 100mV$ , $\pm 200mV$
Resolution	12 bits
Conversion Rate	82 ksps per 8 channels
Non-linearity	$\pm 1/2$ LSB
Offset Error	< 0.5% Span
Gain Error	< 0.5% Span
Signal-to-Noise	70 dB min
Input Resistance	
MSI-P415	1 M $\Omega$
MSI-P415L	40 K $\Omega$

### Card Addressing

16-Bit I/O Mapped Base address set by option jumpers for A4 thru A15.

### Internal Reference

Ref Out Voltage	4.096 V $\pm 1.5\%$ max.
Temp. Coeff.	40 ppm/ $^{\circ}C$

### Connectors

MSI-P414-8	One (1) 3M 30316-5002 or eq. (16-pin)
MSI-P414-16	One (1) 3M 30334-5002 or eq. (34-pin)

### Interrupts

Channels	One, sharing with tri-state buffer for IRQ4-7, 9
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### Option Jumpers

.025" square posts, 0.1" grid

### Electrical & Environmental

+5V @ 70 mA typical
-25 $^{\circ}$ to 85 $^{\circ}$ C



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