MSI PC/104
Embedded PC Series

MSI-P416 ISOLATED ANALOG INPUT CARD

DESCRIPTION

The MSI-P416 is an isolated 16-bit analog input card designed specifically for measuring analog signals in harsh electrical environments in all PC/104 embedded systems. The unit is particularly useful in low frequency measurement applications requiring a high resolution such as those encountered in battery charging, RTU, SCADA, and industrial monitoring and control applications. Commonly encountered ground loop currents and large common-mode voltages associated with analog data acquisition are eliminated by onboard circuitry. The unit is implemented on a 4-layer card using low-power CMOS components for operating in a temperature range from -40°C to 85°C.

The card provides two isolated input channels by using individual onboard dc-to-dc converters for powering the A/D converters, voltage references, and opto-isolators of each channel. Each power converter also provides a 20 mA source at a minimum of 12 VDC for exciting transducer transmitters such as thermocouple, RTD, and strain gauge sensors for temperature, pressure, flow, level, and weight measurements. The unique design of the card routes the input analog signals directly to the A/D converter via selectable range resistors and surge suppressor components. This eliminates drift and stability errors of separate intermediate amplifiers for optimum performance. A highly stable reference source provides the span for each channel with a potentiometer adjustment of ±4%.

An Analog Devices AD7715 16-Bit sigma-delta A/D converter is used in each input channel. It contains a microcontroller with on-chip static RAM, a clock oscillator, a digital filter and a bi-directional serial communications port. It has a software calibration mode that both zeros and and spans (to the reference voltage) at the terminals of the converter. Other programmable functions include gains of 1, 2, 32 and 128; unipolar and bipolar input operation; buffered and unbuffered internal amplifier inputs; and a low-pass filter with output update rate.

FEATURES

- Two isolated 16-bit analog input channels.
- Conversion accuracy of ±1 LSB.
- Independently selectable input ranges of 0-5V, ±5V, 0-10V, ±10V, 0-50 mV, ±50 mV and 0-20 mA for each channel (Others available on request).
- Fused active 20 mA sources for powering inputs of transducer transmitters.
- Conversion rate of 60 samples per second.
- Isolation voltage of 750V from input-to-input and input to PC/104 Bus with surge protected inputs.
- Programmable gains of 1, 2, 32 and 128.
- Simple software calibration procedure.
- Programmable unipolar and bipolar input modes.
- 8-bit stackthrough PC/104 with jumper selectable I/O mapped 16-bit addressing.
- Single +5V power supply operation.
- Operating temperature range -40° C to 85° C.
- 100% testing and 48-hour burn-in.
- Two-year warranty from date of shipment.

The analog converter contains an integral buffer amplifier for buffering input signals associated with high internal impedance sources. The unbuffered mode accommodates input sources with internal impedances of up to 1200Ω with no offset or span error and a 0.0015% nonlinearity. A full 16-bit conversion accuracy is provided for

current (mA) and voltage (V) input ranges with 13-bit accuracy for mV ranges.   An Analog Devices AD780 provides the voltage reference with 3 ppm/°C maximum drift.

The card is I/O mapped using 16-bit addressing with SA5 thru SA15 specifying the base address of the card. Option jumpers are provided for address selection. The address of the communication register of channel 0 is at the base address and that of channel 1 is at the base address+1. All read and write operations are performed at these addresses.

SOFTWARE

Programming of the card requires reading and writing serial data to the communication registers of each channel. Each channel provides for data in (DIN), data out (DOUT), clock (CLK), and data ready (DRDY) using bits 0 and 1 of the communication register as follows:

Channel	Bit 0	Bit 1	IOR	IOW	SA0
0	DIN	DRDY	0	1	0
0	DOUT	CLK	1	0	0
1	DIN	DRDY	0	1	1
1	DOUT	CLK	1	0	1

Simple software programs perform all procedures necessary for device configuration, calibration, and data conversions with address SA0 determining the channel selected. A bit write operation is performed by writing the desired value to Bit 0 (DOUT) with Bit 1 (CLK) set to 0 followed by writing the desired value to Bit 0 with Bit 1 set to 1. The data is clocked into the A/D channel on the rising edge of Bit 1. Bytes are transferred by eight consecutive bit writes.

A bit read operation is performed by writing a 0 to Bit 1 followed by writing a 1 to Bit 1 and reading Bit 0 (DIN). Word reads are performed by sixteen consecutive bit reads. The status of the converter is determined by reading Bit 1 (DRDY). Programs are provided in 'C' and BASIC languages for performing all functions required for using the card.

Request the MSI-P416 User Manual for full harware and software documentation.

SPECIFICATIONS

PC/104	8-bit, stackthrough
Analog Inputs	
Channels	Two differential input
Converter	Analog Devices AD7715AN-5
Input Ranges	0-5V, ±5V, 0-10V, ±10V, 0-50mV, ±50mV, 0-20mA
Conversion Rate	60 per second
Isolation Voltage	750 V input-to input 750 input-to-PC/104 bus
Resolution	16-bit for V and mA ranges 13-bit for mV ranges
Accuracy	±1 LSB
Non-linearity	0.0015%
CMR	95 dB minimum 150 dB minimum @ 60 Hz
Coding	Binary
Surge Suppressor	Varistor/capacitor with 2W (1/8W) resistor
Connectors	AMP 103311-1 or equivalent (10-pin, 0.1" grid)
Voltage References	
Type	Analog Devices AD780BN
Drift	3 ppm/° C maximum
Noise	100nV/(Hz)1/2
Opto-Isolators	
Type	Hewlett-Packard HCPL0201
DC/DC Converters	
Type	Burr-Brown HPR102
Addressing	16-bit I/O mapped using SA5 thru SA15.
Option Jumpers	.025" square posts, 0.1" grid
Electrical & Environmental	
	+5V @ 200 mA typical -40° to 85° C