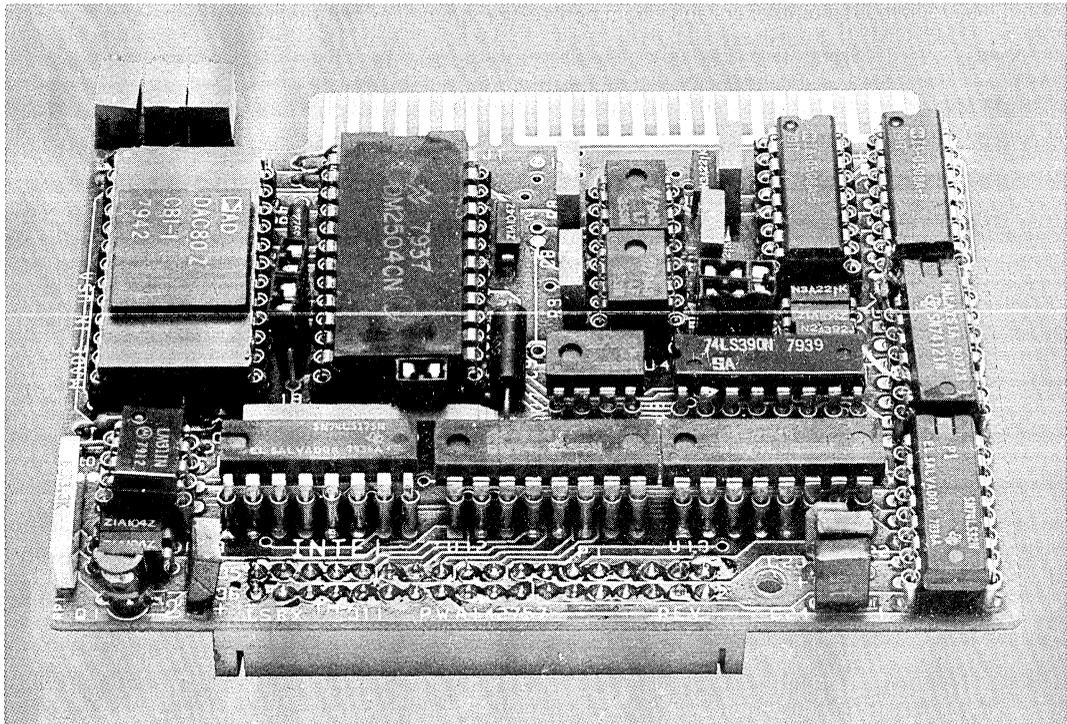




iSBX 311 ANALOG INPUT MULTIMODULE BOARD

- Low cost analog input for iSBX MULTIMODULE compatible iSBC boards
- 8 differential/16 single-ended, fault protected inputs
- 20 mV to 5V full scale input range, resistor gain selectable
- Unipolar (0 to +5V) or bipolar (-5V to +5V) input, jumper selectable
- 12-bit resolution analog-to-digital converter
- 0.035% full scale accuracy (11 bits) at 25°C
- 18 kHz samples per second throughput to memory
- Connector compatible with iCS 910 Analog Termination Panel

The Intel iSBX 311 Analog Input MULTIMODULE board provides simple interfacing of non-isolated analog signals to any iSBC board which has an iSBX compatible bus and connectors. The single-wide iSBX 311 plugs directly onto the iSBC board, providing data acquisition of analog signals from eight differential or sixteen single-ended voltage inputs, jumper selectable. The iSBX 311 MULTIMODULE is connector and pinout compatible with the Intel iCS 910 Analog Signal Conditioning/Termination panel so that field wiring can easily be terminated and current loop-to-voltage conversion resistors can be mounted for current loop analog signal monitoring. Resistor gain selection is provided for both low level (20mv full scale range) and high level (5 volt FSR) signals. Incorporating the latest high quality IC components, the iSBX 311 MULTIMODULE board provides 12 bit resolution, 11 bit accuracy, and a simple programming interface, all on a low cost iSBX MULTIMODULE board.



iSBX 311

FUNCTIONAL DESCRIPTION

The iSBX 311 Analog Input MULTIMODULE board is a member of Intel's growing family of MULTIMODULE expansion boards, designed to allow quick, easy, and inexpensive expansion for the Intel single board computer product line. The iSBX 311 Analog Input MULTIMODULE Board shown in figure 1, is designed to plug onto any host iSBC microcomputer that contains an iSBX bus connector (P1). The board provides 8 differential or 16 single-ended analog input channels that may be jumper-selected as the application requires. The MULTIMODULE board includes a user-configurable gain, and a user-selectable voltage input range (0 to +5 volts, or -5 to +5 volts). The MULTIMODULE board receives all power and control signals through the iSBX bus connector to initiate channel selection, sample and hold operation, and analog-to-digital conversion.

Input Capacity

Sixteen separate analog signals may be randomly or sequentially sampled in single-ended mode with the sixteen input multiplexers and a common

ground. For noisier environments, differential input mode can be configured to achieve 8 separate differential signal inputs, or 16 pseudo-differential inputs.

Resolution

The iSBX 311 MULTIMODULES provide 12-bit resolution with a successive approximation analog-to-digital converter. For bipolar operation (-5 to +5 volts) it provides 11 bits plus sign.

Speed

The A-to-D converter conversion speed is 35 microseconds (28KHZ samples per second). Combined with the sample and hold, settling times and the programming interface, maximum throughput via the iSBX bus and into memory will be 54 microseconds per sample, or 18 KHZ samples per second, for a single channel, a random channel, or a sequential channel scan. A-to-D conversion is initiated via the iSBX connector and programmed command from the iSBC base board. Interrupt on end-of-conversion is a standard feature to ease programming and timing constraints.

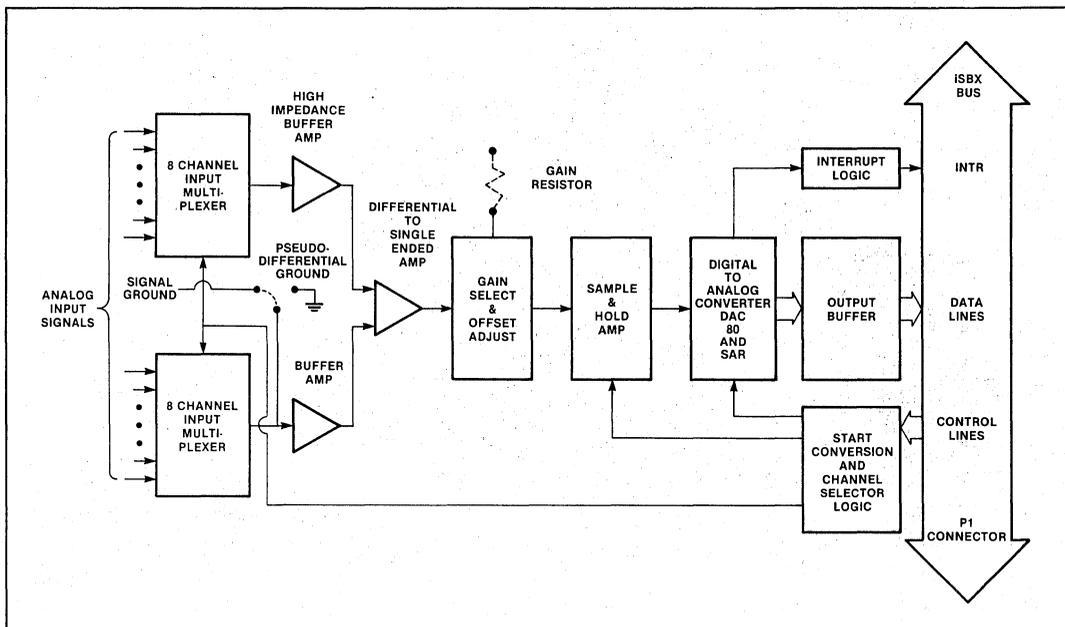


Figure 1. iSBX 311 Analog Input MULTIMODULE Board

iSBX 311

Accuracy

High quality components are used to achieve 12 bits resolution and accuracy of .035% full scale range $\pm 1/2$ LSB. Offset and gain are adjustable to $\pm 0.024\%$ FSR $\pm 1/2$ LSB accuracy at any fixed temperature between 0°C (gain = 1). See specifications for other gain accuracies.

Gain

To allow sampling of millivolt level signals such as strain gauges and thermocouples, gain is made configurable via user inserted gain resistors up to $250 \times$ (20 millivolts, full scale input range). User can select any other gain range from 1 to 250 to match his application.

OPERATIONAL DESCRIPTION

The host iSBC microcomputer addresses the iSBX 311 MULTIMODULE board by executing IN or OUT instructions to the iSBX 311 MULTIMODULE as one of the legal port addresses. Analog-to-digital conversions can be programmed in either of two modes: 1. start conversion and poll for end-of-conversion (EOC), or 2. start conversion and wait for interrupt (INTRO/) at end of conversion. When conversion is complete as signaled by one of the above techniques, INput instructions read two bytes (low and high bytes) containing the 12 bit data word plus status information as shown below.

OUTPUT Command — Select input channel and start conversion.

Bit Position	7	6	5	4	3	2	1	0
Input Channel					C3	C2	C1	C0

Input Data — Read converted data and status (low byte) or Read converted data (high byte). Reads can be with or without reset of interrupt request line (INTRO/).

Bit Position	7	6	5	4	3	2	1	0
Low/status Byte	D3	D2	D1	D0		start/busy/	EOC/	

High Byte	D11	D10	D9	D8	D7	D6	D5	D4
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Fastest data conversion and transfer to memory can be obtained by dedicating the microcomputer to setting the channel address/starting conversion, polling the status byte for EOC/, and when it comes true, read the two bytes of the conversion and send the start conversion/next channel address command. For multitasking situations it may be more convenient to use the interrupt mode, reading in data only after an interrupt signals end of conversion.

SPECIFICATIONS

Inputs — 8 differential. 16 single-ended. Jumper selectable.

Full Scale Input

Voltage Range — -5 to +5 volts (bipolar). 0 to +5 volts (unipolar). Jumper selectable.

Gain — User-configurable through installation of two resistors. Factory-configured for gain of X1; gains above 250 not recommended.

Resolution — 12 bits over full scale range (1.22 mv at 0-5 v, 5 μ v at 0-20 mv)

Accuracy —

Gain	Accuracy at 25°C
1	$\pm 0.035\% \pm 1/2$ LSB
5	$\pm 0.035\% \pm 1/2$ LSB
50	$\pm 0.035\% \pm 1/2$ LSB
250	$\pm 0.035\% \pm 1/2$ LSB

NOTE:

Figures are in percent of full scale reading. At any fixed temperature between 0° and 60°C, the accuracy is adjustable to $\pm 0.035\%$ of full scale.

Dynamic Error — $\pm 0.015\%$ FSR for transitions

Gain TC (at Gain = 1): 30 PPM per degree centigrade (typical); 56 PPM per degree centigrade (max).

iSBX 311

Offset TC (in percent of FSR/°C):

Gain	Offset
1	.0018
5	.0036
50	.024
250	.116

Offset is measured with user-supplied 10 PPM/°C gain resistors installed.

Input Protection — ± 30 volts.

Input Impedance — 20 megohms (minimum).

Conversion Speed — 50 microseconds (nominal).

Common Mode Rejection Ratio — 60 db (minimum).

Sample and hold — sample time 15 microseconds.

Aperature — hold aperature time: 120 nanoseconds.

Connectors —

Interface	Pins (Qty)	Centers		Mating Connectors
		in	cm	
P1 iSBX Bus	36	0.1	0.254	iSBC iSBX connector
J1 8/16 channels analog	50	0.1	0.254	3m 3415-000 or T1 H312125 or iCS 910 cable.

Physical Characteristics

Width — 9.40 cm (3.7 inches)

Length — 6.35 cm (2.5 inches)

Height — 2.03 cm (0.80 inch) MULTIMODULE board only

2.82 cm (1.13 inches) MULTIMODULE and iSBC board

Weight — 68.05 gm (2.4 ounces)

Electrical Characteristics (from iSBX connector)

$V_{CC} = \pm 5$ volts ($\pm 0.25V$), $I_{CC} = 250$ mAmax

$V_{DD} = +12$ volts ($\pm 0.6V$), $I_{DD} = 50$ mAmax

$V_{SS} = -12$ volts ($\pm 0.6V$), $I_{SS} = 55$ mAmax

Environmental Characteristics

Operating Temperature — 0° to 60°C (32° to 140°C)

Relative Humidity — to 90% (without condensation)

Shock Tested At — Class B Specification

Reference Manuals

142913-001 — iSBX 311 Analog Input MULTIMODULE Board Hardware Reference Manual (NOT SUPPLIED)

Manuals may be ordered from any Intel sales representative, distributor office or from Intel Literature Department, 3065 Bowers Avenue, Santa Clara, California 95051.

ORDERING INFORMATION

Part Number	Description
SBX 311	Analog Input MULTIMODULE Board