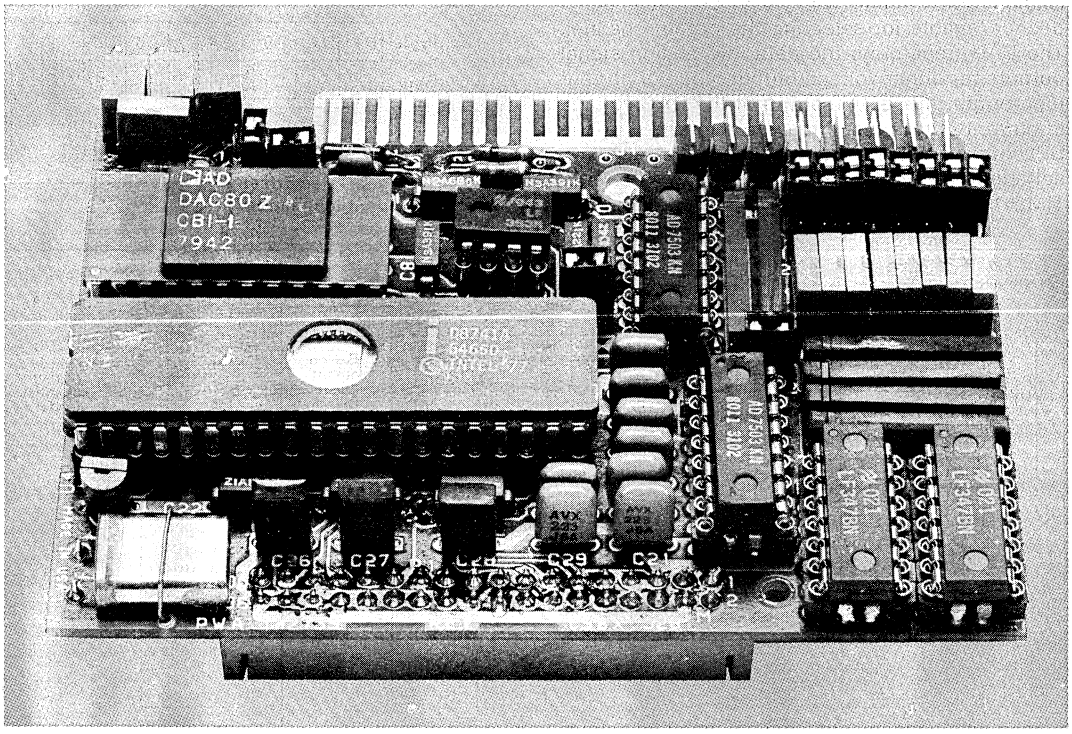
iSBX 328
ANALOG OUTPUT MULTIMODULE EXPANSION BOARD

- **Low cost analog output for iSBX MULTIMODULE compatible iSBC Boards**
- **8 channels output, current loop or voltage in any mix**
- **4–20 mA current loop; 5V unipolar or bipolar voltage output**
- **12-bit resolution**
- **0.035% full scale volage accuracy @ 25°C**
- **Connector compatible with iCS 910 Analog Termination Panel**
- **Intel design based on UPI control for high density and low cost**
- **Programmable offset adjust in current loop mode**

The Intel iSBX 328 MULTIMODULE board provides analog signal output for any iSBC board which has an iSBX compatible bus and connectors. The single-wide iSBX 328 plugs directly onto the iSBC board, providing eight independent output channels of analog voltage for meters, CRT control, programmable power supplies, etc. Voltage output can be mixed with current loop output for control of popular 4-20ma industrial control elements. By using an Intel single chip computer LSI (8041) for refreshing separate sample-hold amplifiers through a single 12 bit DAC, eight channels can be contained on a single MULTIMODULE board, for high density and low cost per channel. High quality analog components provide 12 bit resolution, 11 bit accuracy, and slew rates per channel of 0.1 volt per microsecond. Programming the iSBX 328 MULTIMODULE board is done via a simple two byte protocol over the iSBX bus. Maximum channel update rates are 5KHZ on a single channel to 1 KHZ on all eight channels. Outputs are compatable for screw termination of field wiring on the iCS 910 Analog Signal Conditioning/Termination Panel.



FUNCTIONAL DESCRIPTION

The iSBX 328 MULTIMODULE board, shown in figure 1 is designed to plug onto any host iSBC microcomputer that contains an iSBX bus connector. The board uses an 8041 UPI device to control eight analog output channels that may be user-configured through jumpers to operate in either bipolar voltage output mode (−5 to +5 volts), unipolar voltage output mode (0 to +5 volts), or current loop output mode (4 to 20 mA) applications. Channels may be individually wired for simultaneous operation in both current loop output and voltage output applications. The outputs from 50-pin edge connector J1 on the MULTIMODULE board are pin-compatible with the iCS 910 Signal Conditioning/Termination Panel.

Interfacing Through the Intel iSBX Bus

All data to be output through the MULTIMODULE board is transferred from the host iSBC microcomputer to the MULTIMODULE board via the iSBX bus connector. The UPI device on the MULTIMODULE board accepts the binary digital data and generates a 12-bit data word for the Digital-to-Analog Converter (DAC) and a four bit channel decode/enable for selecting the output channel. The DAC transforms the data into analog signal outputs for either voltage output mode or current loop output mode. Offsetting of the DAC voltage in current output mode may be performed by the UPI software offset routine or by the hardware offset adjustments included on the board. The MULTIMODULE board status is available via the iSBX bus connector, to determine if the UPI is ready to receive updates to analog output channels.

OPERATIONAL DESCRIPTION

The host iSBC microcomputer addresses the MULTIMODULE board by executing IN or OUT instructions specifying the iSBX 328 MULTIMODULE as a port address. The UPI on the iSBX 328 is initialized to select whether software or hardware offset is to be used and how many channels will be active. Then a 2 byte transfer to each active channel sets the 12 bit output value, the channel selected and the current or voltage mode.

Commands

OUTput Command — Initialization of UPI/iSBX 328

7							0 Bit
			N	N	D2	D1	D0

last channel to be output

NN: 0,0 = unipolar configuration software current offset
0,1 = no mixing
1,0 = bipolar configuration software current offset

OUTput Command — Data Bytes

	7							0 Bit
High Byte	D11	D10	D9	D8	D7	D6	D5	D4
Low Byte	D3	D2	D1	D0	A3	A2	A1	V/C

DAC Data — DAC channel to receive data

0 = UPI generates offset
1 = SBC generates offset in current loop mode

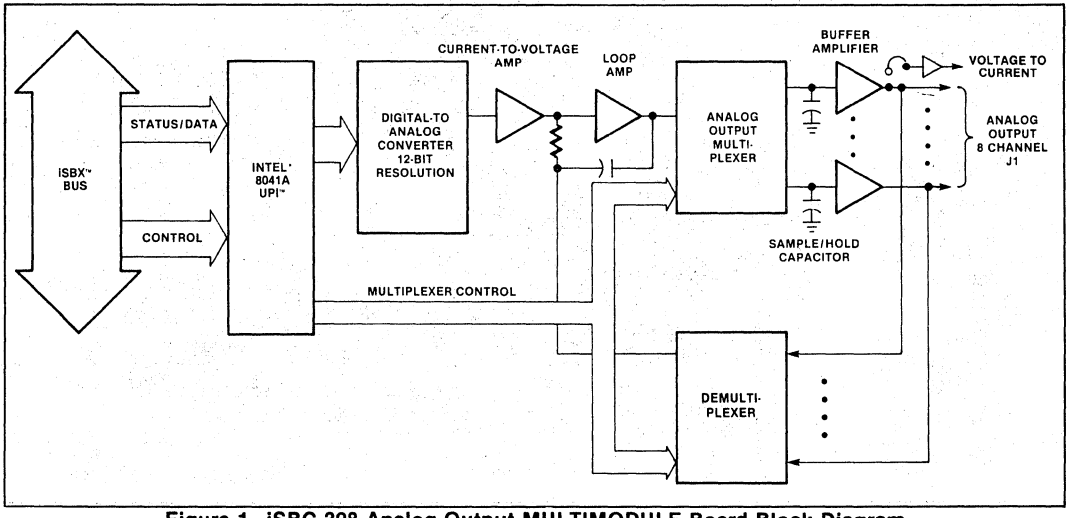
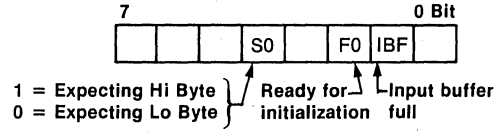


Figure 1. iSBC 328 Analog Output MULTIMODULE Board Block Diagram

INput Command — Status Buffer Read



Interrupts

No interrupts are issued from the iSBX 328 to the host iSBC microcomputer. Data coordination is handled via iSBC software polls of the status buffer.

SPECIFICATIONS

Outputs — 8 non-isolated channels, each independently jumpered for voltage output or current loop output mode.

Voltage Ranges — 0 to +5 volts (unipolar operation)
−5 to +5 volts (bipolar operation)

Current Loop Range — 4 to 20 mA (unipolar operation only)

Output Current — ±5 mA maximum (voltage mode-bipolar operation)

Load Resistance — 0 to 250 ohms with on-board iSBX power. 1000 ohms minimum with 30 VDC max. external supply

Compliance Voltage — 12 V using on-board iSBX power. If supplied by user, up to 30 VDC max

Resolution — 12 bits bipolar or unipolar

Slew Rate — 0.1 volt per microsecond minimum

Single Channel Update Rate — 5KHz

Eight Channel Update Rate — 1KHz

Accuracy —

Mode	Accuracy	Ambient Temp
Voltage-Unipolar, typical	±0.025% FSR	@ 25°C
Voltage-Unipolar, maximum	±0.035% FSR	@ 25°C
Voltage-Unipolar, typical	±0.08% FSR	@ 0° to 60°C
Voltage-Unipolar, maximum	±0.19% FSR	@ 0° to 60°C
Voltage-Bipolar, typical	±0.025% FSR	@ 25°C
Voltage-Bipolar, maximum	±0.035% FSR	@ 25°C
Voltage-Bipolar, typical	±0.09% FSR	@ 0° to 60°C
Voltage-Bipolar, maximum	±0.17% FSR	@ 0° to 60°C
Current Loop, typical	±0.07% FSR	@ 25°C
Current Loop, maximum	±0.08% FSR	@ 25°C
Current Loop, typical	±0.17% FSR	@ 0° to 60°C
Current Loop, maximum	±0.37% FSR	@ 0° to 60°C

Output Impedance — 0.1 ohm. Drives capacitive loads up to 0.05 microfarads. (approx. 1000 foot cable)

Temperature Coefficient — 0.005%/°C

Connectors —

Interface	Pins (Qty)	Centers in	Centers cm	Mating Connectors
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 — 1.4 cm (0.56 inch) MULTIMODULE board only
2.82 cm (1.13 inches) MULTIMODULE and iSBC board.

Weight — 85.06 gm (3.0 ounces)

Electrical Characteristics

Vcc = ±5 volts (±0.25V), Icc = 140 ma max

Vdd = ±12 volts (±0.6V), Idd = 45 ma max
(voltage mode)
= 200 ma max
(current loop mode)

Vss = −12 volts (±0.6V), Iss = 55 ma max

Environmental Characteristics

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

Relative Humidity — to 90% (without condensation)

Shock Tested At — Class B specifications

Reference Manuals

142914-001 — iSBX 328 Analog Output 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 328	Analog Output MULTIMODULE Board