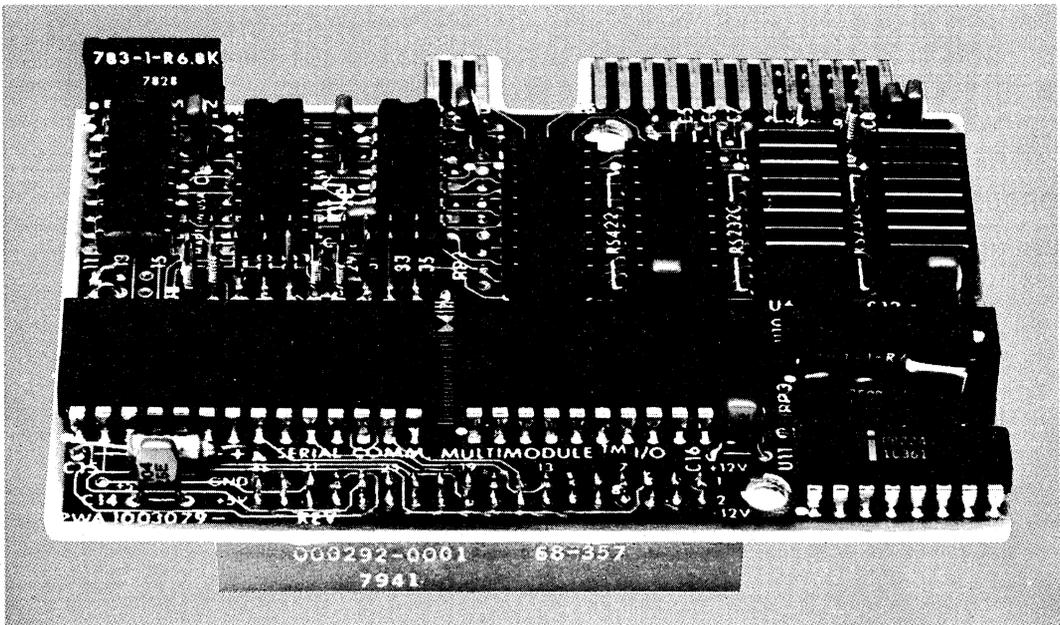




iSBX™ 351 SERIAL I/O MULTIMODULE™ BOARD

- iSBX™ bus compatible I/O expansion
- Programmable synchronous/asynchronous communications channel with RS232C or RS449/422 interface
- Software programmable baud rate generator
- Two programmable 16-bit BCD or binary timers/event counters
- Four jumper selectable interrupt request sources
- Accessed as I/O port locations
- Low power requirements
- Single +5V when configured for RS449/422 interface
- iSBX bus on-board expansion eliminates MULTIBUS® system bus latency and increases system throughput

The Intel® iSBX 351 Serial I/O MULTIMODULE board is a member of Intel's new line of iSBX bus compatible MULTIMODULE products. The iSBX MULTIMODULE board plugs directly into any iSBX bus compatible host board offering incremental on-board I/O expansion. The iSBX 351 module provides one RS232C or RS449/422 programmable synchronous/asynchronous communications channel with software selectable baud rates. Two general purpose programmable 16-bit BCD or binary timers/event counters are available to the host board to generate accurate time intervals under software control. The iSBX board is closely coupled to the host board through the iSBX bus, and as such, offers maximum on-board performance and frees MULTIBUS system traffic for other system resources. In addition, incremental power dissipation is minimal requiring only 3.0 watts (assumes RS232C interface).



FUNCTIONAL DESCRIPTION

Communications Interface

The iSBX 351 module uses the Intel® 8251A Universal Synchronous/Asynchronous Receiver/Transmitter (USART) providing one programmable communications channel. The USART can be programmed by the system software to individually select the desired asynchronous or synchronous serial data transmission technique (including IBM Bi-Sync). The mode of operation (i.e. synchronous or asynchronous), data format, control character format, parity, and baud rate are all under program control. The 8251A provides full duplex, double buffered transmit and receive capability. Parity, overrun,

and framing error detection are all incorporated in the USART. The command lines, serial data lines, and signal ground lines are brought out to a double edge connector configurable for either an RS232C or RS449/422 interface (see Figure 3). In addition, the iSBX 351 module is jumper configurable for either point-to-point or multidrop network connection.

16-Bit Interval Timers

The iSBX 351 module uses an Intel 8253 Programmable Interval Timer (PIT) providing 3 fully programmable and independent BCD and binary 16-bit

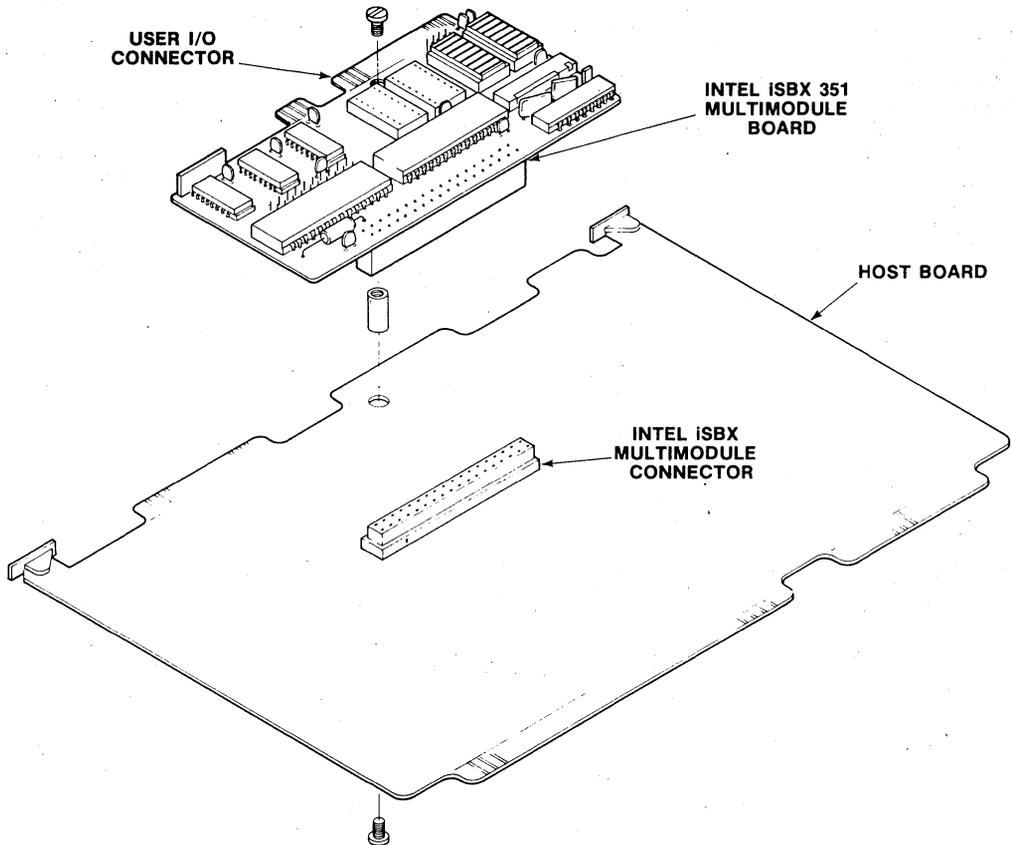


Figure 1. Installation of iSBX® 351 Module on a Host Board

interval timers. One timer is available to the system designer to generate baud rates for the USART under software control. Routing for the outputs from the other two counters is jumper selectable to the host board. In utilizing the iSBX 351 module, the systems designer simply configures, via software, each timer independently to meet system requirements. Whenever a given baud rate or time delay is needed, software commands the programmable timers to select the desired function. The functions of the timers are shown in Table 1. The contents of each counter may be read at any time during system operation.

Interrupt Request Lines

Interrupt requests may originate from four sources. Two interrupt requests can be automatically generated by the USART when a character is ready to be transferred to the host board (i.e. receive buffer is full) or a character has been transmitted (i.e. transmit buffer is empty). In addition, two jumper selectable requests can be generated by the programmable timers.

Installation

The iSBX 351 module plugs directly into the female iSBX connector on the host board. The module is then secured at one additional point with nylon

hardware to insure the mechanical security of the assembly (see Figures 1 and 2).

Table 1. Programmable Timer Functions

Function	Operation
Interrupt on terminal count	When terminal count is reached, an interrupt request is generated. This function is useful for generation of real-time clocks.
Programmable one-shot	Output goes low upon receipt of an external trigger edge and returns high when terminal count is reached. This function is retriggerable.
Rate generator	Divide by N counter. The output will go low for one input clock cycle, and the period from one low going pulse to the next is N times the input clock period.
Square-wave rate generator	Output will remain high until one-half the count has been completed, and go low for the other half of the count.
Software triggered strobe	Output remains high until software loads count (N). N counts after count is loaded, output goes low for one input clock period.
Hardware triggered strobe	Output goes low for one clock period N counts after rising edge counter trigger input. The counter is retriggerable.
Event counter	On a jumper selectable basis, the clock input becomes an input from the external system. CPU may read the number of events occurring after the counting "window" has been enabled or an interrupt may be generated after N events occur in the system.

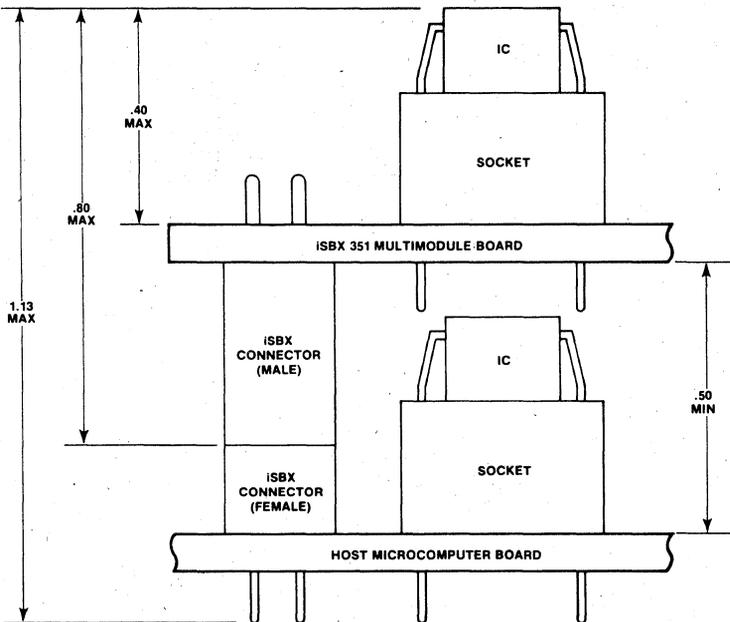


Figure 2. Mounting Clearances (inches)

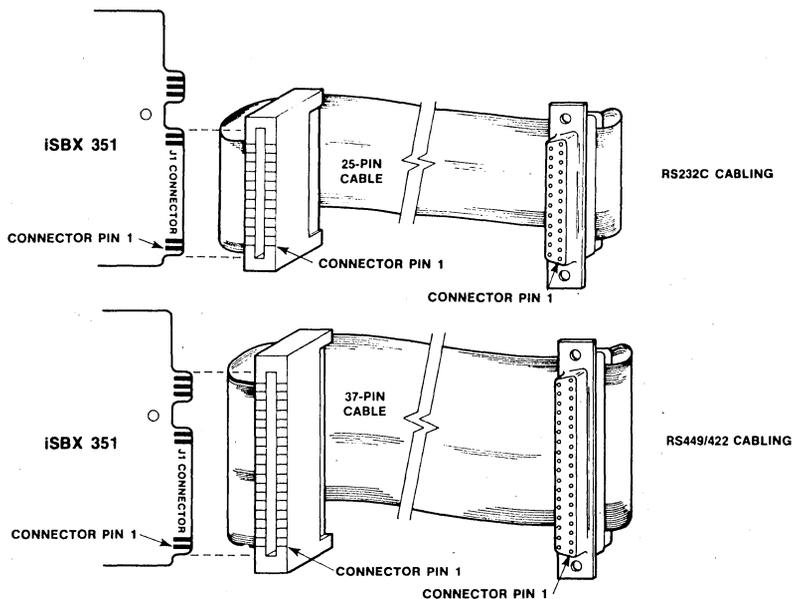


Figure 3. Cable Construction and Installation for RS232C and RS449/422 Interface

SPECIFICATIONS

Word Size

Data — 8 bits

I/O Addressing

I/O Address for an 8-bit host	I/O Address for a 16-bit host	Chip Select	Function
X0, X2, X4 or X6	Y0, Y4, Y8 or YC	8251A USART	Write: Data Read: Data
X1, X3, X5 or X7	Y2, Y6, YA or YE	MCS0/Activated (True)	Write: Mode or command Read: Status
X8 or XC	Z0 or ZB	8253 PIT	Write: Counter 0 Load: Count (N) Read: Counter 0
X9 or XD	Z2 or ZA	MCS1/Activated (True)	Write: Counter 1 Load: Count N Read: Counter 1
XA or XE	Z4 or ZC		Write: Counter 2 Load: Count (N) Read: Counter 2
XB or XF	Z6 or ZE		Write: Control Read: None

Notes: X = The iSBX base address that activates MCS0/ & MCS1 for an 8-bit Host.
 Y = The iSBX base address that activates MCS0/ for a 16-bit host.
 Z = The iSBX base address that activates MCS1/ for a 16-bit host.
 The first digit, X, Y, or Z, is always a variable, since it will depend on the type of host microcomputer used. Refer to the Hardware Reference Manual for your host microcomputer to determine the first digit of the I/O base address.

NOTE: The first digit of each port I/O address is listed as "X" since it will change depending on the type of host iSBC microcomputer used. Refer to the Hardware Reference Manual for your host iSBC microcomputer to determine the first digit of the I/O address.

Access Time

Read — 250 nsec max

Write — 300 nsec max

Note Actual transfer speed is dependent upon the cycle time of the host microcomputer.

Serial Communications

Synchronous — 5 - 8-bit characters; internal character synchronization; automatic sync insertion; even, odd or no parity generation/detection.

Asynchronous — 5 - 8-bit characters; break character generation and detection; 1, 1½, or 2 stop bits; false start bit detection; even, odd or no parity generation/detection.

Sample Baud Rate:

8253 PIT Frequency ¹ (kHz, Software Selectable)	8251 USART Baud Rate (Hz) ²	
	Synchronous	Asynchronous
	÷ 16	÷ 64
307.2	—	19200 4800
153.6	—	9600 2400
76.8	—	4800 1200
38.4	38400	2400 600
19.2	19200	1200 300
9.6	9600	600 150
4.8	4800	300 75
2.4	2400	150 —
1.76	1760	110 —

NOTES: 1. Frequency selected by I/O writes of appropriate 16-bit frequency factor to Baud Rate Register.
 2. Baud rates shown here are only a sample subset of possible software-programmable rates available. Any frequency from 18.75 Hz to 614.4 kHz may be generated utilizing on-board crystal oscillator and 16-bit Programmable Interval Timer (used here as frequency divider).

Interval Timer and Baud Rate Generator

Input Frequency (selectable):

1.23 MHz $\pm 0.1\%$ (813 μ sec period nominal)

153.6 kHz $\pm 0.1\%$ (6.5 μ sec period nominal)

Output Frequency:

	Rate Generator (Frequency)		Real-Time Interrupt (Interval)	
	Min.	Max.	Min.	Max.
Single Timer ¹	18.75 Hz	614.4 kHz	1.63 μ sec	53.3 msec
Single Timer ²	2.34 Hz	76.8 kHz	13.0 μ sec	426.7 msec
Dual Timer ³ (Counters 0 and 1 in series)	0.000286 Hz	307.2 kHz	3.26 μ sec	58.25 min
Dual Timer ⁴ (Counters 0 and 1 in series)	0.0000358 Hz	38.4 kHz	26.0 μ sec	7.77 hrs

- NOTES:** 1. Assuming 1.23 MHz clock input.
 2. Assuming 153.6 kHz clock input.
 3. Assuming Counter 0 has 1.23 MHz clock input.
 4. Assuming Counter 0 has 153.6 kHz clock input.

Interrupts

Interrupt requests may originate from the USART (2) or the programmable timer (2).

Interfaces

ISBX Bus — all signals TTL compatible.

Serial — configurable for EIA Standards RS232C or RS449/422

EIA Standard RS232C signals provided and supported:

- Clear to Send (CTS)
- Data Set Ready (DSR)
- Data Terminal Ready (DTR)
- Request to Send (RTS)
- Receive Clock (RXC)
- Receive Data (RXD)
- Transmit Clock (DTE TXC)
- Transmit Data (TXD)

EIA Standard RS449/422 signals provided and supported:

- Clear to Send (CS)
- Data Mode (DM)
- Terminal Ready (TR)
- Request to Send (RS)
- Receive Timing (RT)
- Receive Data (RD)
- Terminal Timing (TT)
- Send Data (SD)

Physical Characteristics

- Width** — 7.24 cm (2.85 inches)
- Length** — 9.40 cm (3.70 inches)
- Height*** — 2.04 cm (0.80 inches)
 - ISBX 351 Board
 - 2.86 cm (1.13 inches)
 - ISBX 351 Board and Host Board
- Weight** — 51 grams (1.79 ounces)

* (See Figure 2)

Serial Interface Connectors

Configuration	Mode ²	MULTIMODULE Edge Connector	Cable	Connector ⁸
RS232C	DTE	26-pin ⁵ , 3M-3462-0001	3M ³ -3349/25	25-pin ⁷ , 3M-3482-1000
RS232C	DCE	26-pin ⁵ , 3M-3462-0001	3M ³ -3349/25	25-pin ⁷ , 3M-3483-1000
RS449	DTE	40-pin ⁶ , 3M-3464-0001	3M ⁴ -3349/37	37-pin ¹ , 3M-3502-1000
RS449	DCE	40-pin ⁶ , 3M-3464-0001	3M ⁴ -3349/37	37-pin ¹ , 3M-3503-1000

- NOTES:** 1. Cable housing 3M-3485-4000 may be used with the connector.
 2. DTE — Data Terminal mode (male connector), DCE — Data Set mode (female connector).
 3. Cable is tapered at one end to fit the 3M-3462 connector.
 4. Cable is tapered to fit 3M-3464 connector.
 5. Pin 26 of the edge connector is not connected to the flat cable.
 6. Pins 37, 39, and 40 of the edge connector are not connected to the flat cable.
 7. May be used with cable housing 3M-3485-1000.
 8. Connectors compatible with those listed may also be used.

Electrical Characteristics

DC Power Requirements

Mode	Voltage	Amps (Max.)
RS232C	+5V \pm 0.25V	460 mA
	+12V \pm 0.6V	30 mA
	-12V \pm 0.6V	30 mA
RS449/422	+5V \pm 0.25V	530 mA

Environmental Characteristics

Temperature — 0 - 55°C, free moving air across the base board and MULTIMODULE board.

Reference Manual

9803190-01 — ISBX 351 Serial I/O MULTIMODULE Manual (NOT SUPPLIED)

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

ORDERING INFORMATION

Part Number	Description
SBX 351	Serial I/O MULTIMODULE Board