

Model 3344-B1A

Four-channel Communication Interface

**INSTRUCTION MANUAL**

April, 1993

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**\*\*\*Special Option\*\*\***

Model 3344-S001

Four-channel Communication Interface

February, 1993

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*Model 3344-S001*

**\*\*\*Special Option\*\*\***

Model 3344-S001

The Model 3344-S001 is functionally identical to the Model 3344-B1A.

The difference is the 3344-S001 is RS-422 compatible while the 3344-B1A is RS-232 compatible.

Front Panel Connections

- 1 - -RTS
- 2 - -OUT
- 3 - GROUND
- 4 - -IN
- 5 - -CTS
- 6 - +RTS
- 7 - +OUT
- 8 - +IN
- 9 - +CTS

NOTE: The position connections are the same for all four channels.

February 19, 1993

**\*\*\*Special Option\*\*\***

Model 3344-S003

Four-channel Communication Interface

January, 1993

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Model 3344-S003

**\*\*\*Special Option\*\*\***

Model 3344-S003

The Model 3344-S003 is the same as the Model 3344-B1A with the following exception:

Channels 1 and 2 have a fixed BAUD rate to 31.25K to handle MIDI transmissions. The programmable BAUD rate as referenced in the configuration register does not apply to these two channels.

Channel 1 and 2 connector signal Pin #

|   |                 |
|---|-----------------|
| 1 | GND             |
| 2 | MIDI OUT SIGNAL |
| 3 | MIDI IN SIGNAL  |
| 4 | MIDI OUT RETURN |
| 5 | MIDI IN RETURN  |
| 7 | GND             |

NOTE: Straps SW1, SW2, SW3 and SW4 must be in the ground position.

KJC:rem  
January 28, 1993

**\*\*\*Special Option\*\*\***

Model 3344-S004

Four-channel Communication Interface

December, 1995

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Model 3344-S004

**\*\*\*Special Option\*\*\***

Model 3344-S004

The Model 3344-S004 is the same as the Model 3344-B1A with the following exception:

Whenever FIFO is READ and is Empty, (NO-G), the 14th bit (1, 2, 3.....) should be set. On FIFO Read, Bit 14 reflects Q STATUS. This will require a 1K FIFO.

**\*\*\*Special Option\*\*\***

Model 3344-S005

Four-channel Communication Interface

November, 1996

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Model 3344-S005

**\*\*\*Special Option\*\*\***

Model 3344-S005

The Model 3344-S005 is the same as the Model 3344-S003 with the following additional requirement:

This option has eight data rates available for channels 3 and 4: 150, 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400.

The following table shows the bit pattern for setting the data rate in configuration word 2:

| Bit |   |   |   | BAUD RATE                   |
|-----|---|---|---|-----------------------------|
| 4   | 3 | 2 | 1 |                             |
| 0   | 0 | 0 | 1 | 150 Characters per second   |
| 0   | 1 | 0 | 0 | 300 Characters per second   |
| 0   | 1 | 0 | 1 | 600 Characters per second   |
| 0   | 1 | 1 | 0 | 1200 Characters per second  |
| 0   | 1 | 1 | 1 | 2400 Characters per second  |
| 1   | 0 | 1 | 0 | 4800 Characters per second  |
| 1   | 1 | 0 | 0 | 9600 Characters per second  |
| 1   | 1 | 1 | 0 | 19200 Characters per second |
| 1   | 1 | 1 | 1 | 38400 Characters per second |

Model 3344-B1A  
(Rev.8/88)

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MLH:rem(3000 Ser. 13)  
February, 1988

# 4-channel Communication Interface

Reduces the CPU load by use of 1024-character buffers

3344

## Features

- Four independent RS-232 ports
- 16 transmission speeds from 50 to 19,200 Baud
- Hardware handshaking signals
- Programmable XON/XOFF handshaking
- Software-selectable control character recognition
- Programmable configuration parameters
- 1024 by eight character buffers on input and output

## Typical Applications

- Interface for a CRT terminal
- Interface for a modem communication link
- Data link between two CAMAC systems
- Interface to "smart" instruments
- Interface for character-oriented serial equipment

## General Description *(Product specifications and descriptions subject to change without notice.)*

The 3344 is a single-width CAMAC module that interfaces the CAMAC Dataway to as many as four separate RS-232 serial ports. Sixteen data rates are available: 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, and 19,200 Baud. Data rates are programmable from the Dataway on a per channel basis, as are the number of data bits (from five to eight), the number of stop bits (one or two) parity error checking, and control character recognition capabilities.

Two 1024 character buffers are provided for each channel, one for input and one for output. These buffers provide elastic communications between the Dataway and remote devices. As a diagnostic aid, input can be echoed back to the output as well as sent to the computer. The echo feature is programmable.

On output block transfers, the buffer is filled by performing Write commands until a Q = 0 response is detected. A Q = 0 response indicates that the buffer is full. The module will continue to transmit the block of data at its selected Baud rate until the output buffer is empty.

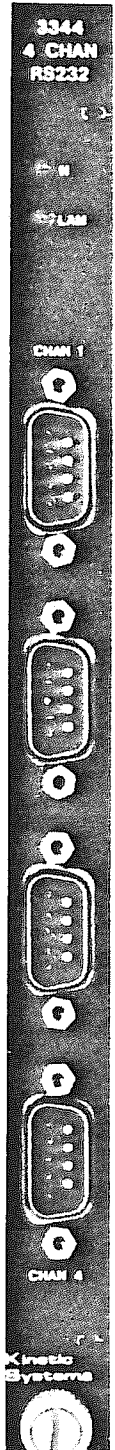
On input block transfers, the input buffer is filled and a LAM is set. The LAM is detected by the computer, which reads the input buffer until a Q = 0 response is detected. A Q = 0 response means that either the input buffer is empty or that the End-of-Block character has been read.

The software-selectable End-of-Block character allows the user to specify a single bit pattern or character (a carriage return, for example) which, when detected, can be used to generate a LAM. This LAM is defined by the user and can indicate a variety of things (as with the carriage return, that a line of text is available to be read by the host computer).

Clear To Send (CTS) and Request to Send (RTS) control signals establish an automatic handshake with the remote RS-232 device. For incoming data streams, the CTS output signal is negated if the input buffer becomes full and cannot accept another character. CTS is reasserted once the input buffer is read and adequate storage space is available for more data. For outgoing data streams, data transmission is halted if the remote device negates the CTS signal and commences again (assuming there is still data to be transmitted) when CTS is reasserted. The 3344 requests the transmission of a data byte by asserting the RTS signal. Additionally, the XON/XOFF protocol can be enabled and disabled from the Dataway. Once enabled, this protocol performs a software handshake similar to hardware CTS/RTS handshake and is transparent to the user.

## Front-panel Connectors and Indicators

An N LED on the module's front panel flashes whenever the module is addressed. The L LED is on whenever a LAM is pending in the module. Connections to the remote RS-232 devices are made through four 9-pin "D" connectors mounted on the front panel of the module.

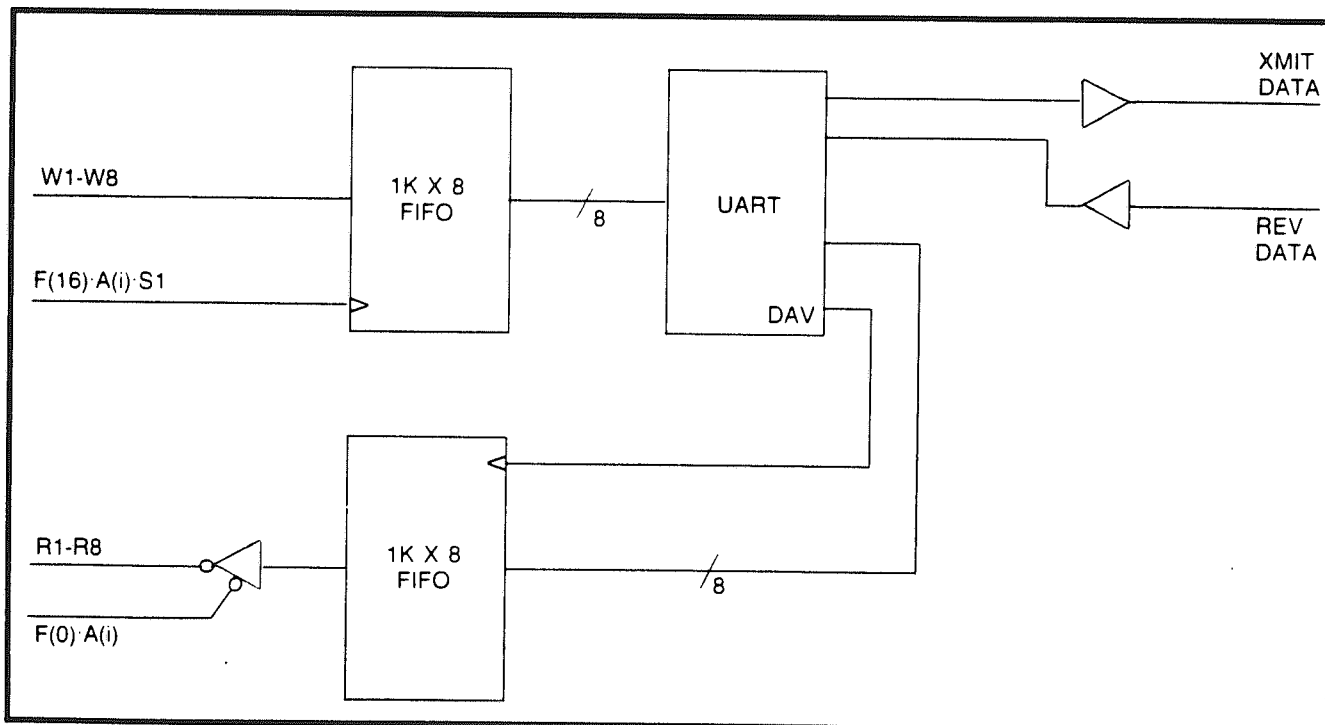


## Function Codes

| Command                        | Q | Action   |
|--------------------------------|---|--|
| F(0)·A(i) RD1 $\overline{BE}$  |   | Reads the character buffer for Channel i.  |
| F(1)·A(i) RD2 1                |   | Reads Configuration Word 1 for Channel i.  |
| F(1)·A(i+4) RD2 1              |   | Reads Configuration Word 2 for Channel i.  |
| F(1)·A(10) RD2 1               |   | Reads the Error Status register.   |
| F(1)·A(12) RD2 1               |   | Reads the LAM Status register.   |
| F(1)·A(14) RD2 1               |   | Reads the LAM Request register.  |
| F(8)·A(15) TLM LAM             |   | Tests for the presence of a LAM Request.   |
| F(9)·A(i) CL1 1                |   | Clears the UART, FIFO buffers, Error Status register, and resets XON/XOFF circuitry for Channel i. |
| F(16)·A(i) WT1 $\overline{BF}$ |   | Writes the character buffer for Channel i.   |
| F(17)·A(i) WT2 1               |   | Writes Configuration Word 1 for Channel i.   |
| F(17)·A(i+4) WT2 1             |   | Writes Configuration Word 2 for Channel i.   |
| F(19)·A(i) SS2 1               |   | Writes the LAM Mask register for Channel i.  |
| F(23)·A(12) SC2 1              |   | Selectively clears the LAM Status register.  |
| Z CZ 0                         |   | Clears all Channels - UART, FIFO buffers, Error Status register, and resets XON/XOFF.              |

**Notes:** 1. X = 1 for all valid addressed commands.  
 2. Subaddress (i) ranges from 0 to 3 for Channels 1 to 4, respectively.  
 3.  $\overline{BE}$  = Buffer not empty or no EOB character detected.  
 4. LAM = LAM Request present.  
 5.  $\overline{BF}$  = Buffer not full.

## Simplified Block Diagram



## Power Requirements

|            |         |
|------------|---------|
| +5 volts:  | 1800 mA |
| +24 volts: | 36 mA   |
| -24 volts: | 31 mA   |

## Ordering Information

Model 3344-B1A Communications Interface, 4 channels

## Related Products

Model 5930-Z1A Mating Connector

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(Rev. 4/89)

## **OPERATION**

The operation of the 3344 is controlled by reading and writing various registers on the module. The data formats for these registers are outlined on page 11 of this manual and are described in detail. Except where noted, access to these registers is available through CAMAC Subaddresses A(0) to A(3), corresponding to RS-232 channels one to four.

## **CHARACTER BUFFERS**

The Character Buffers are used to transfer desired information between the CAMAC Dataway and the remote RS-232 device or terminal. There are two buffers per channel: one for data received from the remote device, and one for data to be sent to the remote device. Each buffer is 1024 bytes in length, permitting a great deal of efficiency in transferring large strings of information.

CAMAC block transfers, based on the Q-Stop technique, can be used to send or receive data. For sending data to the remote device, the channel may be written (using the F(16) command) repeatedly until the module responds with a Q = 0, indicating that the output buffer is full. The buffer is emptied by the channel's transmitter at a rate consistent with the selected baud rate (see the discussion of the Configuration Words, below). Similarly, the channel's receive buffer is filled at a rate consistent with both the baud rate and message traffic from the remote device. The buffer may be read using the F(0) command until a Q = 0 response is encountered, indicating that the receive buffer is empty or that an End-of-Block character has been encountered. The End-of-Block (or Control) character is discussed, in the section on the Configuration Words.

To prevent either the remote devices or the channels on the Model 3344 from being overrun with data, the module incorporates a Clear-To-Send/Request-To-Send hardware handshake protocol on each channel. For character streams being received by the module, the RTS output signal remains asserted until the receiver's buffer becomes half full. At this time, the RTS signal is negated, telling the remote device not to start transmitting any new data. Once the receiver's buffer has been read, and the buffer is less than half full, RTS is asserted again to signal the remote device that the channel is ready to accept new data. Similarly, the channel will send data to the remote device as long as the CTS signal is asserted. If the 3344 channel detects the negation of the CTS signal, it will stop transmitting any new data until CTS is asserted again. The operation of the RTS/CTS signals is transparent to (and requires no intervention from) the host computer.

For those devices which do not make use of the RTS/CTS handshake, an equally transparent, software handshake protocol (XON/XOFF) is also incorporated in the module. XON/XOFF functions in exactly the same way that RTS/CTS does, but must be enabled by setting bit 15 in Configuration Word 1 for the channel. The operation of the RTS/CTS feature may also be disabled by the

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 (Rev. 4/89)

appropriate placement of option straps on the board. These option straps place the RTS and CTS signals into a permanently asserted state. Refer to page 12 of this manual for the location and placement of these option straps.

The format of the data fields in the Character Buffers is as follows:

| <u>Bit Positions</u> | <u>Meaning</u>   |
|----------------------|--|
| 1 thru 8             | This field contains the character that has been received or is to be transmitted, with the LSB in bit position 1 and the MSB in bit position 8.  |
| 9 thru 14            | This field is not used. It is read as zeros and is ignored on write commands.  |
| 15                   | If this bit is set to a "1", it indicates that the character just read has been detected as the End-of-Block character, as established in Configuration Word 1. This bit is ignored on write commands.   |
| 16                   | If this bit is set, it indicates that an error was detected in the current byte of the incoming character string. The cause of the error may be determined by examining the Error Status Register which is described on page 7 of this manual. |

As an example, assume that the following words have been read from the Channel 2 buffer with an F(0)·A(1) command:

| <u>Bit Pattern</u>                | <u>Q</u> |
|-----------------------------------|----------|
| 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 | 1        |
| 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 0 | 1        |
| 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 1 | 1        |
| 0 0 0 0 0 0 0 0 0 0 1 1 0 0 1 0 0 | 1        |
| 0 1 0 0 0 0 0 0 0 0 0 0 1 1 0 1   | 0        |

You would have received the character string "Abcd(Carriage Return)", and that the last byte (Carriage Return) was the Control Character as set up in Configuration Word 1. In sending the above string out to a remote device, the upper eight bits of each word are ignored by the 3344.

**CONFIGURATION WORDS**

The Configuration Words are used to control the operating characteristics of the four RS-232 channels. Each channel has its own pair of configuration words so that each channel can operate at the level of efficiency required by the remote device to which it is connected. The F(1) command is used to read

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the configuration words, and the F(17) command is used to write data into the configuration words. Access to Configuration Word 1 for each channel is made through Subaddress A(0) to A(3); through Subaddress A(4) to A(7) for Configuration Word 2.

The fields within Configuration Word 1 are defined as follows:

| <u>Bit Positions</u> | <u>Meaning</u>   |
|----------------------|--|
| 1 thru 8             | This field is used to establish a Control or End-of-Block character (bit pattern) which will be compared to incoming characters from the remote device and, if enabled, will cause a LAM to be generated on the Dataway. This feature allows an entire character string to be received by the module before it is read by the host computer.   |
| 9 thru 13            | This field is not used. It is read as zeros and is ignored on write commands.  |
| 14                   | When set to a "1", this bit enables the Echo feature on the module. This causes data received from the remote device to be turned around and sent back immediately.  |
| 15                   | This bit position is used to control the generation of XON and XOFF (CTRL-Q and CTRL-S) characters by the channel. When set to a "1" (enabled), the channel will send out the XOFF character once the receiver's 1 Kbyte character buffer becomes half-full (i.e., contains 512 characters). The XON character will be sent out after the character buffer has been read and the becomes less than half-full. The XON/XOFF feature is a software version of the RTS/CTS capabilities described on page 3 and allows the module to signal the remote device to stop sending new data until the previously sent data has been read. The module will always respond to XON/XOFF received from the remote device in the manner described above, regardless of the state of this bit. |
| 16                   | This bit controls the detection of the End-of-Block character written into bit positions 1 through 8. Setting the bit to a "1" enables the control character recognition, and resetting it to a "0" disables recognition.  |

A typical Configuration Word 1, written to channel 3 with an F(17)·A(2) command, might look like:

1 1 0 X X X X X 0 0 0 0 1 1 0 1

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which would indicate that Control Character Recognition has been enabled, the XON/XOFF protocol is enabled, the Echo feature is disabled, and that a Carriage Return pattern has been selected as the Control Character.

The fields within Configuration Word 2 are defined as follows:

| <u>Bit</u><br><u>Positions</u> | <u>Meaning</u>  |
|--------------------------------|---|
| 1 thru 4                       | This field is used to establish the Baud Rate to be used by both the Send and Receive portions of the channel. The bit patterns and their corresponding Baud Rates are: |

| <u>Bit</u><br><u>4 3 2 1</u> | <u>Baud Rate</u>            |
|------------------------------|-----------------------------|
| 0 0 0 0                      | 50 Characters per second    |
| 0 0 0 1                      | 75 Characters per second    |
| 0 0 1 0                      | 110 Characters per second   |
| 0 0 1 1                      | 134.5 Characters per second |
| 0 1 0 0                      | 150 Characters per second   |
| 0 1 0 1                      | 300 Characters per second   |
| 0 1 1 0                      | 600 Characters per second   |
| 0 1 1 1                      | 1200 Characters per second  |
| 1 0 0 0                      | 1800 Characters per second  |
| 1 0 0 1                      | 2000 Characters per second  |
| 1 0 1 0                      | 2400 Characters per second  |
| 1 0 1 1                      | 3600 Characters per second  |
| 1 1 0 0                      | 4800 Characters per second  |
| 1 1 0 1                      | 7200 Characters per second  |
| 1 1 1 0                      | 9600 Characters per second  |
| 1 1 1 1                      | 19200 Characters per second |

5 and 6 These two bits select either 5, 6, 7 or 8 data bits per character as shown below:

| <u>Bit</u><br><u>6 5</u> | <u>Data Bits</u>     |
|--------------------------|----------------------|
| 0 0                      | 5 bits per character |
| 0 1                      | 6 bits per character |
| 1 0                      | 7 bits per character |
| 1 1                      | 8 bits per character |

7 The setting of this bit determines the number of Stop Bits. A "0" selects 1 stop bit; a "1" selects 2 stop bits. The selection of 2 stop bits when the channel is set to generate characters with 5 data bits results in the generation of 1.5 stop bits.



- 8 This is the Parity Disable bit. A "1" in this bit position disables the parity bit from being transmitted; transmission of the last data bit is immediately followed by the stop bit(s). In addition, the receiver portion of the channel requires that the stop bit(s) are received immediately following the last data bit. The Parity Error bit in the Error Status Register is forced to a "0" setting (see the description of the Error Status Register, below).
- 9 The state of this bit determines the parity mode for both the transmitter and receiver portions of the channel. Setting the bit to a "0" selects Odd parity, and setting the bit to a "1" selects Even parity. Parity must be enabled by resetting bit 8 to the "0" state.

A typical Configuration Word 2 might look like

X 1 1 1 1 1 1 1 0

indicating that Parity is disabled, there are two Stop Bits per byte, eight Data Bits per byte, and that the channel is set to transmit and receive data at a rate of 9600 bits per second.

**ERROR STATUS REGISTER**

The Error Status Register records any error conditions that have occurred in the incoming message streams. On a per channel basis, each character is checked for parity, framing and over run errors. The logical OR of these conditions is recorded in the receiver character buffer for that channel along with the character. Once set, these status indicators remain set until an F(9) Clear command is issued to that channel (e.g., F(9)·A(2) for Channel 3).

The Error Status Register is a read-only register that contains error information for all four channels on the module. The register is read with an F(1)·A(10) command. The fields within the register, representing the four channels, are laid out as follows:

| <u>Bit Positions</u> | <u>Meaning</u>                 |
|----------------------|--------------------------------|
| 1 thru 3             | Error Indicators for Channel 1 |
| 5 thru 7             | Error Indicators for Channel 2 |
| 9 thru 11            | Error Indicators for Channel 3 |
| 13 thru 15           | Error Indicators for Channel 4 |

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Although error indicators for all four channels are returned in only one word, error handling can be facilitated by masking off all but the appropriate channel's error field from the returned word. Within each field, the error indicators are defined as follows:

| <u>Bit Positions</u> | <u>Meaning</u>   |
|----------------------|--|
| 1                    | If this bit is set to a "1", it indicates that a Receiver Over Run has occurred. This could happen if the Receiver Character Buffer were to become filled and yet one more character was received. |
| 2                    | This is the Framing Error indicator. It will be set to a "1" if the received character has no valid stop bit.  |
| 3                    | This is the Parity Error indicator. It will be set to a "1" if the received character's parity bit does not agree with the parity selected in Configuration Word 2.                                |

#### **LAM and INTERRUPT CAPABILITIES**

For each of the channels on the 3344 module, there are four different events which may be used to generate a LAM on the CAMAC Dataway. The LAMs may then be used to interrupt the computer through the Crate Controller and computer interface's interrupt mechanism. The four events are the Transmitter Character Buffer becoming empty, the Receiver Character Buffer becoming full or an End-of-Block character being detected by the receiver, the reception of a character at a previously empty Receiver Character Buffer, and the detection of an error condition on an incoming byte.

Like the Error Status Register, most of the LAM handling information is contained in single registers, with fields within the registers devoted to the individual channels. The LAM Source Register is read with an F(1)·A(12) command. This register contains information on whether or not the events have occurred which could cause a LAM to be generated. The LAM Request Register, which is the logical AND of the LAM Source and LAM Mask registers, is read with an F(1)·A(14) command. The F(23)·A(12) command is used to perform a Selective Clear function on the LAM Source bits. There is a unique LAM Mask Register for each channel on the module: F(19)·A(i), where i can range from 0 to 3, corresponding to channels 1 to 4. The LAM Mask Register is used to mask the LAM Source bits ON.

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The field within the LAM Source, LAM Mask and Selective Clear registers are defined as follows:

| <b>Bit Positions</b> | <b>Meaning</b>                |
|----------------------|-------------------------------|
| 1 thru 4             | LAM Information for Channel 1 |
| 5 thru 8             | LAM Information for Channel 2 |
| 9 thru 12            | LAM Information for Channel 3 |
| 13 thru 16           | LAM Information for Channel 4 |

The bit patterns within these fields, and for the LAM Mask Register, are as follows:

| <b>Bit Positions</b> | <b>Meaning</b>   |
|----------------------|--|
| 1                    | This bit indicates that the Transmitter Character Buffer has become empty (all data in the buffer has been sent out on the RS-232 port). The LAM source bit is cleared by loading the channel's Transmitter Buffer with another byte of data, by issuing the F(23)A(12) command to the module with data equal to $2^{((n-1) \cdot 4+0)}$ , where (where "n" is the channel number), or by issuing a crate-wide Initialize command (Z). |
| 2                    | This bit indicates that the Receiver Character Buffer has become full or (if enabled) an End-of-Block character has been detected by the receiver circuitry. The LAM Source bit is cleared by reading data from the Receiver Character Buffer, by issuing the F(23)A(12) command to the module with data equal to $2^{((n-1) \cdot 4+1)}$ , (where "n" is the channel number), or by issuing a crate-wide Initialize command (Z).      |
| 3                    | This bit indicates that a previously empty Receiver Character Buffer has been filled with at least one byte of data. The LAM Source bit is cleared by reading data from the Receiver Character Buffer, by issuing the F(23) A(12) command to the module with data equal to $2^{((n-1) \cdot 4+2)}$ , or by issuing a crate-wide Initialize command (Z).  |
| 4                    | This bit indicates that an error condition has been detected in the incoming character stream. The LAM Source bit is cleared by issuing the F(23)A(12) command to the module with data equal to $2^{((n-1) \cdot 4+3)}$ , or by issuing a crate-wide Initialize command (Z).   |

### RS-232 CONNECTIONS

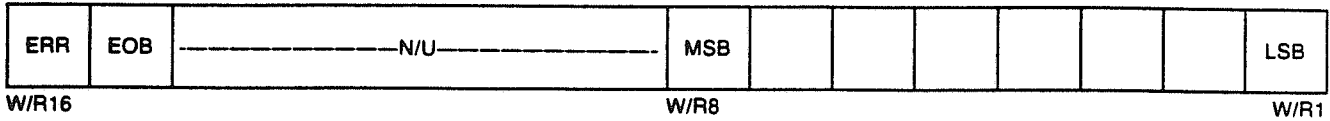
For each channel, there is a 9-pin "D" type connector (DE9P) mounted on the module's front panel. The wiring for each connector is the same, with the signal-to-pin relationships shown below:

| Pin Number                                     | Signal Name                         |
|--|-------------------------------------|
| 1  | Chassis Ground                      |
| 2  | Transmit Data to the Remote Device  |
| 3  | Receive Data from the Remote Device |
| 4  | Data Terminal Ready Output (RTS)    |
| 5  | DATA Set Ready Input (CTS)          |
| 7  | Signal Ground                       |
| Pins 6, 8 and 9 on the connector are not used. |                                     |

## DATA FORMATS

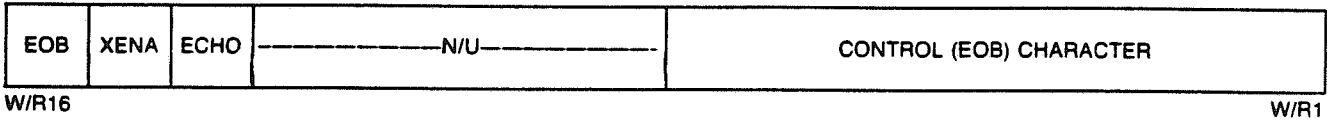
### CHARACTER BUFFER

F(0)·A(i), F(16)·A(i)



### CONFIGURATION WORD 1

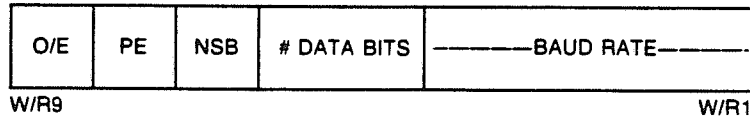
F(1)·A(i), F(17)·A(i)



EOB = End-of-Block Enable (using Control Character pattern)  
 XENA = XON/XOFF Enable  
 ECHO = Echo Enable

### CONFIGURATION WORD 2

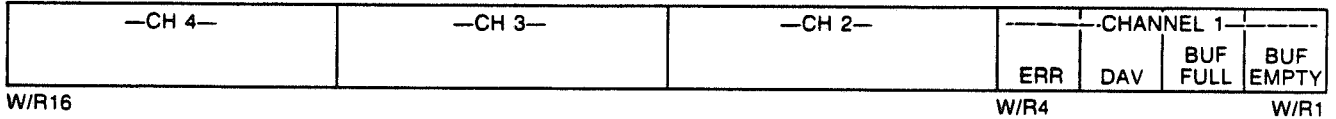
F(1)·A(i + 4), F(17)·A(i + 4)



O/E = Odd or Even parity (0 = Odd, 1 = Even)  
 PE = Parity Enable  
 NSB = Number of Stop Bits (0 = 1 Stop Bit, 1 = 2 Stop Bits)

### LAM STATUS/LAM REQUEST REGISTERS

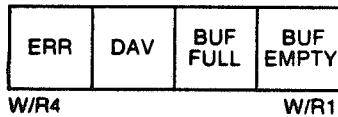
F(1)·A(12), F(1)·A(14), F(23)·A(12)



ERR = Error condition (see Error Status Register)  
 DAV = Data available on input port  
 BUF FULL = Input buffer full or EOB character detected at buffer input  
 BUF EMPTY = Output buffer empty

### LAM MASK REGISTER

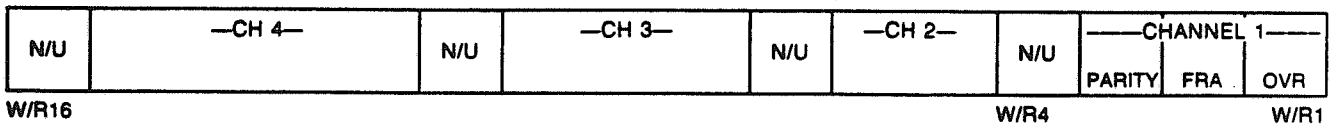
F(19)·A(i)



These mnemonics are the same as for the LAM STATUS/REQUEST REGISTERS

### ERROR STATUS REGISTER

F(1)·A(10)

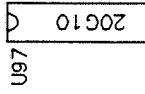


PARITY = Parity error  
 FRA = Framing error  
 OVR = Overrun error

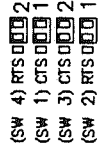
SW1  
SW2  
SW3  
SW4  
SW5  
SW6  
SW7  
SW8

Channel 1  
Channel 1  
Channel 2  
Channel 3  
Channel 3  
Channel 4  
Channel 4

CTS ENA  
RTS ENA  
CTS ENA  
RTS ENA  
CTS ENA  
RTS ENA  
CTS ENA  
RTS ENA



U97

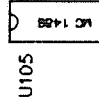


U101

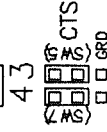


K 148

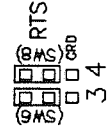
All straps are in the ENABLE position for the individual signals



U105



U106



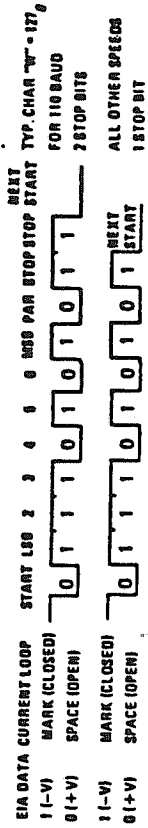
U107

Moving a strap to ground (GRD) permanently sets the signal as true.

### 3344 STRAP LOCATIONS

# The ASCII Code

BASED ON ANSI X3.4 1968



| Decimal | Penity Space or Hex | Character | Control Keybd. Equiv. | Alternate Code Names            | Hex | Character | Alternates                               | Decimal | Penity Space or Hex | Character | Alternates |
|---------|---------------------|-----------|-----------------------|---------------------------------|-----|-----------|--|---------|---------------------|-----------|------------|
| 000     | Even                | NUL       | @                     | NULL, CTRL SHIFT P, TAPE LEADER | 20  | SP        | SPACE, BLANK                             | 040     | Odd                 | 0         |            |
| 001     | Odd                 | SOH       | A                     | START OF HEADER, SOM            | 21  | !         |  | 041     | Even                | 1         |            |
| 002     | Even                | STX       | B                     | START OF TEXT, EOA              | 22  | ."        |  | 042     | Odd                 | 2         |            |
| 003     | Even                | ETX       | C                     | END OF TEXT, EOM                | 23  | #         |  | 043     | Even                | 3         |            |
| 004     | Odd                 | EOT       | D                     | END OF TRANSMISSION, END        | 24  | \$        |  | 044     | Even                | 4         |            |
| 005     | Even                | END       | E                     | ENQUIRY, WRU, WHO ARE YOU       | 25  | %         |  | 045     | Odd                 | 5         |            |
| 006     | Even                | ACK       | F                     | ACKNOWLEDGE, RU, ARE YOU        | 26  | &         |  | 046     | Even                | 6         |            |
| 007     | Odd                 | BEL       | G                     | BELL                            | 27  | '         | APOSTROPHE                               | 047     | Even                | 7         |            |
| 010     | Odd                 | BS        | H                     | BACKSPACE, FE0                  | 28  | (         |  | 050     | Even                | 10        |            |
| 011     | Even                | HT        | I                     | HORIZONTAL TAB, TAB             | 29  | )         |  | 051     | Odd                 | 11        |            |
| 012     | Even                | LF        | J                     | LINE FEED, NEW LINE, NL         | 2A  | *         |  | 052     | Even                | 12        |            |
| 013     | Odd                 | VT        | K                     | VERTICAL TAB, VTAB              | 2B  | +         |  | 053     | Odd                 | 13        |            |
| 014     | Even                | FF        | L                     | FORM FEED, FORM, PAGE           | 2C  | ,         | COMMA                                    | 054     | Even                | 14        |            |
| 015     | Odd                 | CR        | M                     | CARRIAGE RETURN, EOL            | 2D  | -         | MINUS                                    | 055     | Odd                 | 15        |            |
| 016     | Odd                 | SO        | N                     | SHIFT OUT, RED SHIFT            | 2E  | .         |  | 056     | Even                | 16        |            |
| 017     | Even                | SI        | O                     | SHIFT IN, BLACK SHIFT           | 2F  | /         |  | 057     | Odd                 | 17        |            |
| 020     | Odd                 | DLE       | P                     | DATA LINK ESCAPE, DC0           | 30  | 0         | NUMBER ZERO                              | 060     | Even                | 20        |            |
| 021     | Even                | DC1       | Q                     | XON, READER ON                  | 31  | 1         | NUMBER ONE                               | 061     | Odd                 | 21        |            |
| 022     | Even                | DC2       | R                     | TAPE, PUNCH ON                  | 32  | 2         |  | 062     | Even                | 22        |            |
| 023     | Odd                 | DC3       | S                     | XOFF, READER OFF                | 33  | 3         |  | 063     | Odd                 | 23        |            |
| 024     | Even                | DC4       | T                     | TAPE, PUNCH OFF                 | 34  | 4         |  | 064     | Even                | 24        |            |
| 025     | Odd                 | NAK       | U                     | NEGATIVE ACKNOWLEDGE, ERR       | 35  | 5         |  | 065     | Odd                 | 25        |            |
| 026     | Odd                 | SYN       | V                     | SYNCHRONOUS IDLE, SYNC          | 36  | 6         |  | 066     | Even                | 26        |            |
| 027     | Even                | ETB       | W                     | END OF TEXT BUFFER, LEM         | 37  | 7         |  | 067     | Odd                 | 27        |            |
| 030     | Even                | CAN       | X                     | CANCEL, CANCEL                  | 38  | 8         |  | 070     | Even                | 30        |            |
| 031     | Odd                 | EM        | Y                     | END OF MEDIUM                   | 39  | 9         |  | 071     | Odd                 | 31        |            |
| 032     | Odd                 | SUB       | Z                     | SUBSTITUTE                      | 3A  | :         |  | 072     | Even                | 32        |            |
| 033     | Even                | ESC       | [                     | ESCAPE, PREFIX                  | 3B  | ;         |  | 073     | Odd                 | 33        |            |
| 034     | Odd                 | FS        | \                     | FILE SEPARATOR                  | 3C  | <         | LESS THAN                                | 074     | Even                | 34        |            |
| 035     | Even                | ID        | ]                     | GROUP SEPARATOR                 | 3D  | =         | EQUAL                                    | 075     | Odd                 | 35        |            |
| 036     | Even                | RS        | ^                     | RECORD SEPARATOR                | 3E  | >         | GREATER THAN                             | 076     | Even                | 36        |            |
| 037     | Odd                 | US        | _                     | UNIT SEPARATOR                  | 3F  | ?         |  | 077     | Odd                 | 37        |            |
| 100     | Odd                 | 0         |                       |                                 | 40  | @         |  | 100     | Odd                 | 100       |            |
| 101     | Even                | 1         |                       |                                 | 41  | A         |  | 101     | Even                | 101       |            |
| 102     | Even                | 2         |                       |                                 | 42  | B         |  | 102     | Even                | 102       |            |
| 103     | Odd                 | 3         |                       |                                 | 43  | C         |  | 103     | Odd                 | 103       |            |
| 104     | Even                | 4         |                       |                                 | 44  | D         |  | 104     | Even                | 104       |            |
| 105     | Odd                 | 5         |                       |                                 | 45  | E         |  | 105     | Odd                 | 105       |            |
| 106     | Even                | 6         |                       |                                 | 46  | F         |  | 106     | Even                | 106       |            |
| 107     | Even                | 7         |                       |                                 | 47  | G         |  | 107     | Even                | 107       |            |
| 110     | Odd                 | 10        |                       |                                 | 48  | H         |  | 110     | Odd                 | 110       |            |
| 111     | Even                | 11        |                       |                                 | 49  | I         | LETTER I                                 | 111     | Even                | 111       |            |
| 112     | Odd                 | 12        |                       |                                 | 4A  | J         |  | 112     | Odd                 | 112       |            |
| 113     | Even                | 13        |                       |                                 | 4B  | K         |  | 113     | Even                | 113       |            |
| 114     | Odd                 | 14        |                       |                                 | 4C  | L         |  | 114     | Odd                 | 114       |            |
| 115     | Even                | 15        |                       |                                 | 4D  | M         |  | 115     | Even                | 115       |            |
| 116     | Even                | 16        |                       |                                 | 4E  | N         |  | 116     | Even                | 116       |            |
| 117     | Odd                 | 17        |                       |                                 | 4F  | O         | LETTER O                                 | 117     | Odd                 | 117       |            |
| 120     | Even                | 20        |                       |                                 | 50  | P         |  | 120     | Even                | 120       |            |
| 121     | Odd                 | 21        |                       |                                 | 51  | Q         |  | 121     | Odd                 | 121       |            |
| 122     | Even                | 22        |                       |                                 | 52  | R         |  | 122     | Even                | 122       |            |
| 123     | Even                | 23        |                       |                                 | 53  | S         |  | 123     | Even                | 123       |            |
| 124     | Odd                 | 24        |                       |                                 | 54  | T         |  | 124     | Odd                 | 124       |            |
| 125     | Even                | 25        |                       |                                 | 55  | U         |  | 125     | Even                | 125       |            |
| 126     | Even                | 26        |                       |                                 | 56  | V         |  | 126     | Even                | 126       |            |
| 127     | Odd                 | 27        |                       |                                 | 57  | W         |  | 127     | Odd                 | 127       |            |
| 130     | Odd                 | 30        |                       |                                 | 58  | X         |  | 130     | Odd                 | 130       |            |
| 131     | Even                | 31        |                       |                                 | 59  | Y         |  | 131     | Even                | 131       |            |
| 132     | Even                | 32        |                       |                                 | 5A  | Z         |  | 132     | Even                | 132       |            |
| 133     | Odd                 | 33        |                       |                                 | 5B  | [         | SHIFT K                                  | 133     | Odd                 | 133       |            |
| 134     | Even                | 34        |                       |                                 | 5C  | \         | SHIFT L                                  | 134     | Even                | 134       |            |
| 135     | Odd                 | 35        |                       |                                 | 5D  | ]         | SHIFT M                                  | 135     | Odd                 | 135       |            |
| 136     | Odd                 | 36        |                       |                                 | 5E  | ^         | SHIFT N                                  | 136     | Odd                 | 136       |            |
| 137     | Even                | 37        |                       |                                 | 5F  | _         | SHIFT O, UNDERSCORE                      | 137     | Even                | 137       |            |
| 140     | Even                | 60        |                       |                                 | 60  | .         | ACCENT GRAVE                             | 140     | Even                | 140       |            |
| 141     | Odd                 | 61        |                       |                                 | 61  | a         |  | 141     | Odd                 | 141       |            |
| 142     | Even                | 62        |                       |                                 | 62  | b         |  | 142     | Even                | 142       |            |
| 143     | Even                | 63        |                       |                                 | 63  | c         |  | 143     | Even                | 143       |            |
| 144     | Odd                 | 64        |                       |                                 | 64  | d         |  | 144     | Odd                 | 144       |            |
| 145     | Even                | 65        |                       |                                 | 65  | e         |  | 145     | Even                | 145       |            |
| 146     | Even                | 66        |                       |                                 | 66  | f         |  | 146     | Even                | 146       |            |
| 147     | Odd                 | 67        |                       |                                 | 67  | g         |  | 147     | Odd                 | 147       |            |
| 150     | Odd                 | 68        |                       |                                 | 68  | h         |  | 150     | Odd                 | 150       |            |
| 151     | Even                | 69        |                       |                                 | 69  | i         |  | 151     | Even                | 151       |            |
| 152     | Even                | 70        |                       |                                 | 6A  | j         |  | 152     | Even                | 152       |            |
| 153     | Odd                 | 68        |                       |                                 | 6B  | k         |  | 153     | Odd                 | 153       |            |
| 154     | Even                | 6C        |                       |                                 | 6C  | l         |  | 154     | Even                | 154       |            |
| 155     | Odd                 | 6D        |                       |                                 | 6D  | m         |  | 155     | Odd                 | 155       |            |
| 156     | Odd                 | 6E        |                       |                                 | 6E  | n         |  | 156     | Odd                 | 156       |            |
| 157     | Even                | 6F        |                       |                                 | 6F  | o         |  | 157     | Even                | 157       |            |
| 160     | Odd                 | 70        |                       |                                 | 70  | p         |  | 160     | Odd                 | 160       |            |
| 161     | Even                | 71        |                       |                                 | 71  | q         |  | 161     | Even                | 161       |            |
| 162     | Even                | 72        |                       |                                 | 72  | r         |  | 162     | Even                | 162       |            |
| 163     | Odd                 | 73        |                       |                                 | 73  | s         |  | 163     | Odd                 | 163       |            |
| 164     | Even                | 74        |                       |                                 | 74  | t         |  | 164     | Even                | 164       |            |
| 165     | Odd                 | 75        |                       |                                 | 75  | u         |  | 165     | Odd                 | 165       |            |
| 168     | Even                | 76        |                       |                                 | 76  | v         |  | 168     | Even                | 168       |            |
| 167     | Even                | 77        |                       |                                 | 77  | w         |  | 167     | Even                | 167       |            |
| 170     | Even                | 78        |                       |                                 | 78  | x         |  | 170     | Even                | 170       |            |
| 171     | Odd                 | 79        |                       |                                 | 79  | y         |  | 171     | Odd                 | 171       |            |
| 172     | Odd                 | 7A        |                       |                                 | 7A  | z         |  | 172     | Odd                 | 172       |            |
| 173     | Even                | 78        |                       |                                 | 7B  | {         |  | 173     | Even                | 173       |            |
| 174     | Odd                 | 7C        |                       |                                 | 7C  |           |  | 174     | Odd                 | 174       |            |
| 175     | Even                | 7D        |                       |                                 | 7D  | }         |  | 175     | Even                | 175       |            |
| 176     | Even                | 7E        |                       |                                 | 7E  | ~         | VERTICAL SLASH<br>ALT MODE<br>(ALT MODE) | 176     | Even                | 176       |            |
| 177     | Odd                 | 7F        |                       |                                 | 7F  | DEL       | DELETE, RUBOUT                           | 177     | Odd                 | 177       |            |

To transmit any control code (first column), depress "CTRL" then the character on the same line under Keyboard Equivalent. If desired parity is different from that shown, add 200 (octal) or 80 (hexadecimal) to the character code.

DEC 1976