# CHAPTER 2

## INSTALLATION AND POWER-UP INSTRUCTIONS

This chapter provides unpacking, preparation-for-use, installation, and power-up instructions for the MEX68KECB. The board has been designed to require a minimum of hardware modifications; however, the proper serial port baud rates must be selected and the proper cables used to ensure trouble-free start-up. Please read and follow the instructions in this chapter to provide quick start-up and to avoid possible damage to the board.

# CHAPTER 2

# INSTALLATION AND POWER-UP INSTRUCTIONS

## 2.1 UNPACKING INSTRUCTIONS

NOTE

If shipping carton is damaged on receipt, request carrier's agent be present during unpacking and inspection of the module.

Unpack the computer board from its shipping carton. Save the packing material for storing or reshipping the board. Refer to the packing list and verify that all items are present. As shipped, the MEX68KECB includes:

a. MEX68KECB Educational Computer Board

b. Four 6-32x1/4" screws

c. Four threaded 6-32x3/4" nylon standoffs

d. Four banana jacks (including hex nuts and solder lugs)

e. Seven plastic cap jumpers

After verifying that items (including any optional parts) are present, inspect the board for damage. Ensure that there are no broken, damaged, or missing parts, and that there is no physical damage to the printed circuit board.

CAUTION

WHEN HANDLING THE BOARD, AVOID TOUCHING AREAS OF MOS CIRCUITRY; STATIC DISCHARGE CAN DAMAGE INTEGRATED CIRCUITS.

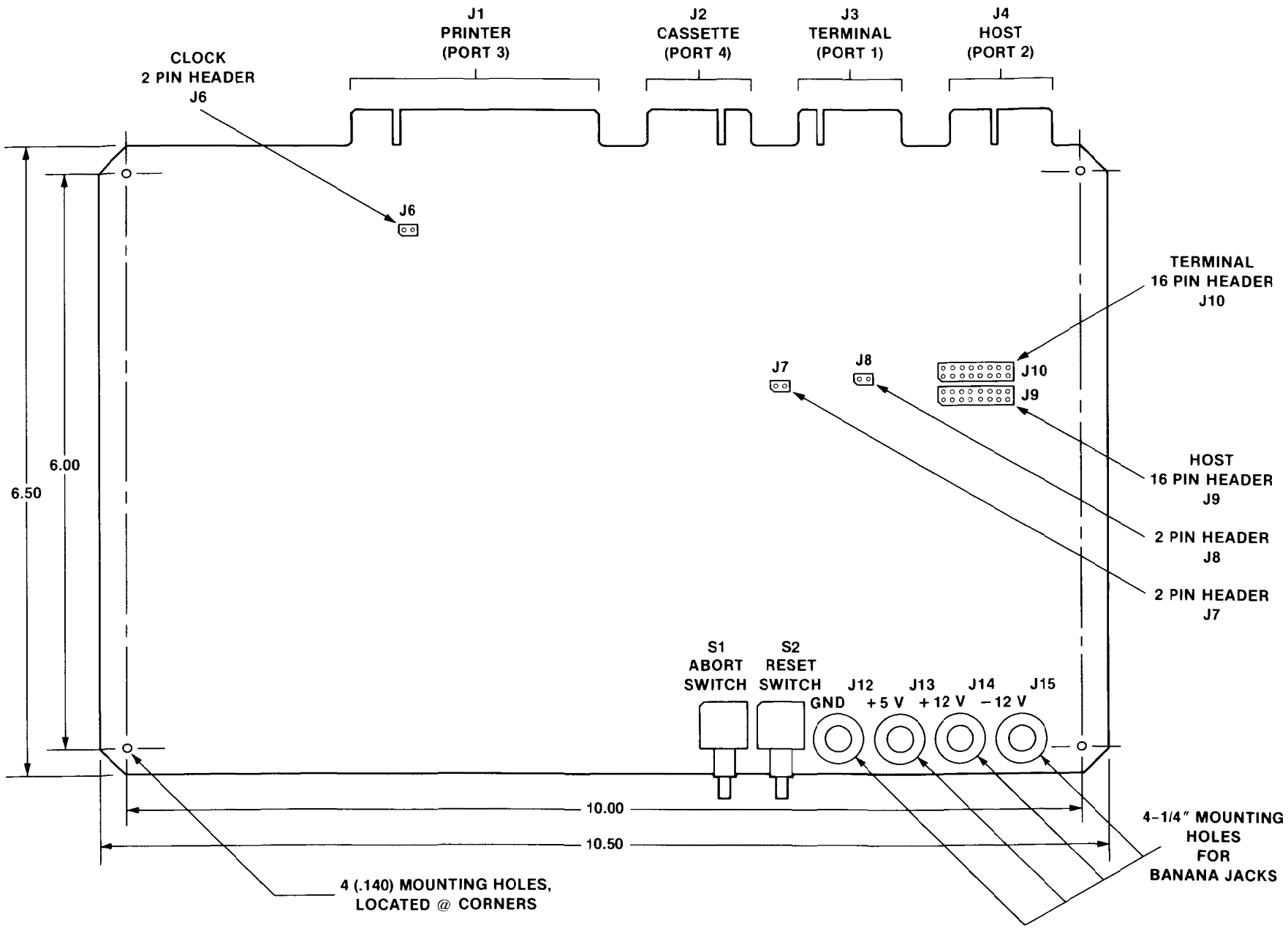


FIGURE 2-1. MEX68KECB Board Layout

## 2.2 PREPARING THE BOARD FOR USE

The MEX68KECB is intended primarily for training and educational use, including college-level courses and industrial in-plant training. In its most simple configuration, the board requires only an RS-232C compatible terminal (plus cable) and power supplies to function. The preparation instructions are intended to set up the board for this configuration. Use of optional features (audio cassette, host, or printer) requires additional preparation, which is covered in other sections of this chapter.

Figure 2-1 shows a layout of the MEX68KECB. Board preparation concerns the following items:

a. Because the board is intended for laboratory use, standoff legs can be used to allow the board to set on a bench.

b. Power connections must be made. Banana jacks can be used or wires can be soldered to the board.

c. Check that the system clock jumper (J6) is in place.

d. The terminal baud rate must be selected.

### 2.2.1 Attaching Standoff Legs

Four holes located at the corners of the board are used to mount the nylon standoffs. These are screwed to the back side (opposite of component side) of the card, as shown in Figure 2-2.

NOTE

The user may choose to mount the module on or in an enclosure via these holes. Dimensions are shown in Figure 2-1. The nylon standoffs can be used as spacers to provide clearance of 3/4 inch needed by the banana jacks.

### 2.2.2 Providing Power to the Board

2.2.2.1 Banana Jacks. Four banana jacks compatible with standard banana plugs are provided for power connectors (+12 Vdc, +5 Vdc, Ground, -12 Vdc). These are mounted in four 1/4-inch holes at a corner of the board, as shown in Figure 2-2.

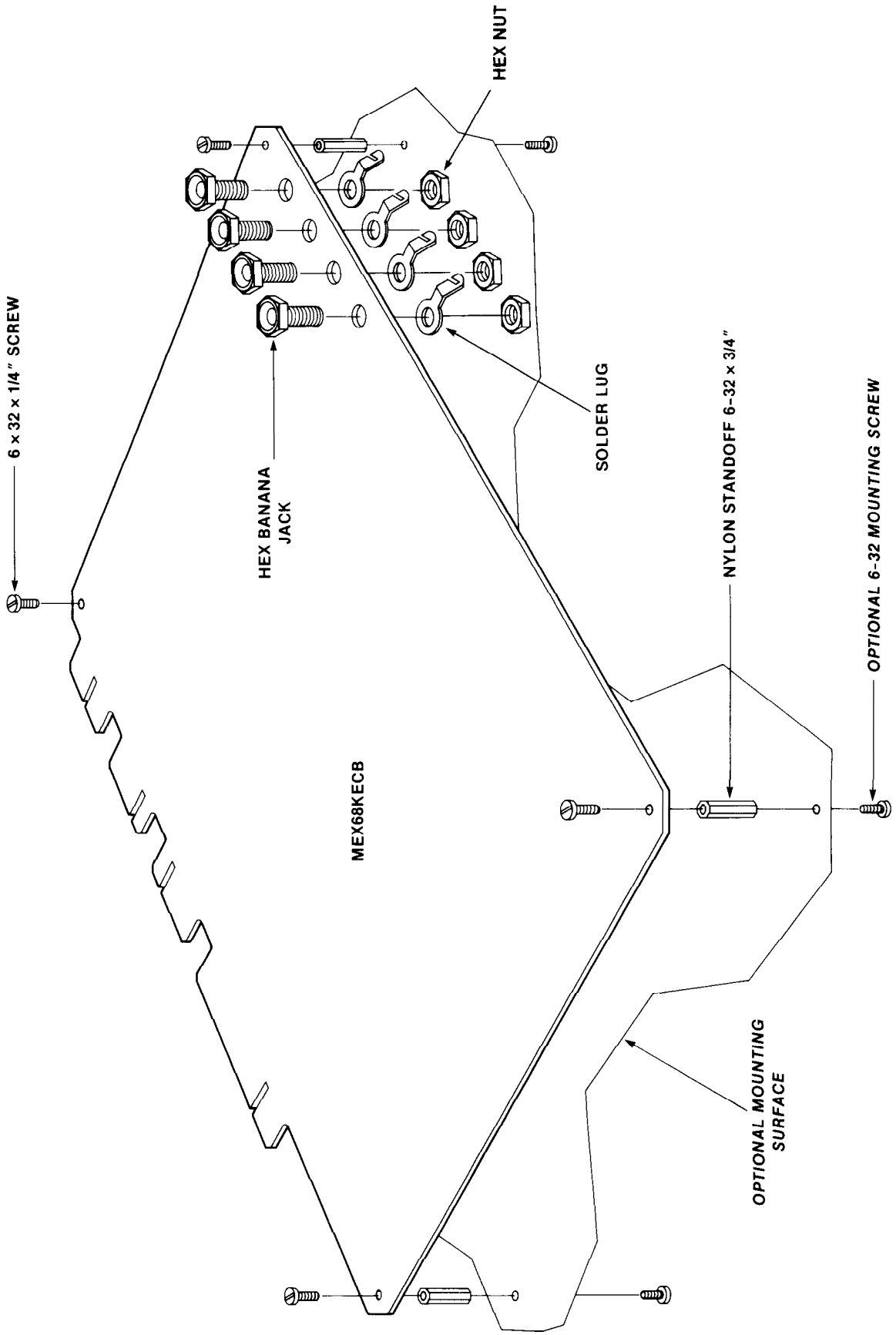


FIGURE 2-2. Hardware Mounting Detail

2.2.2.2 Alternate Method - Discrete Wires. If banana plugs are not desired, discrete wires can be used to supply power to the board. Wires can be soldered to the lugs supplied with the banana jacks (Figure 2-2) or four small holes are provided to solder discrete wires to the board. These holes (designated J12, J13, J14, J15) are shown in Figure 2-3, and interconnect supply voltages as follows:

| HOLE DESIGNATION | VOLTAGE |
|---|---|
| J12 | Ground |
| J13 | +5 Vdc |
| J14 | +12 Vdc |
| J15 | -12 Vdc |

NOTE

Use of the banana jack solder lugs is recommended because of greater mechanical strength and to prevent possible damage to the board.

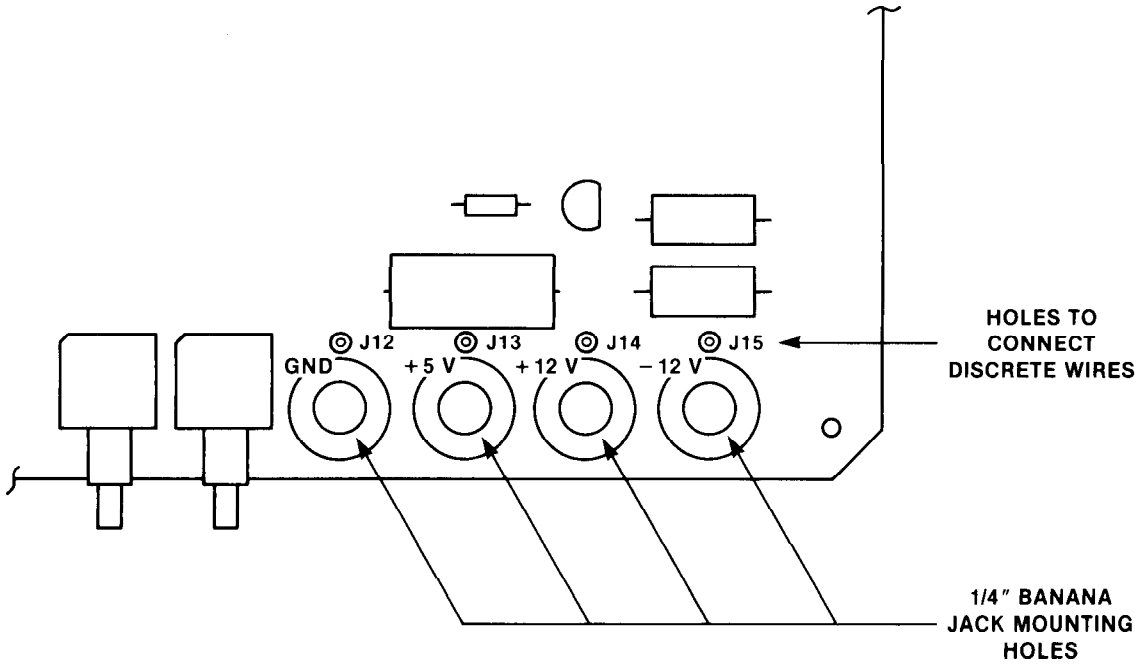


FIGURE 2-3. Detail Showing Location of Holes J12, J13, J14, J15 to Connect Discrete Power Wires

2.2.3 Checking System Clock Jumper

Referring to Figure 2-1, a 2-pin header designated J6 should have a plastic jumper cap in place on it (as shipped). If not, one of the jumpers supplied with the board should be put in place. This jumper connects the system clock source.

2.2.4 Selecting Terminal Baud Rate

2.2.4.1 Normal Operation - Transmitting and Receiving at the Same Baud Rate. Normally, the terminal transmits and receives at the same baud rate. Although the terminal Port 1 can be configured to transmit and receive at different rates, the board as supplied uses a single common baud rate for the port. The host interface Port 2 has similar attributes. The interconnection circuit is shown in Figure 2-4.

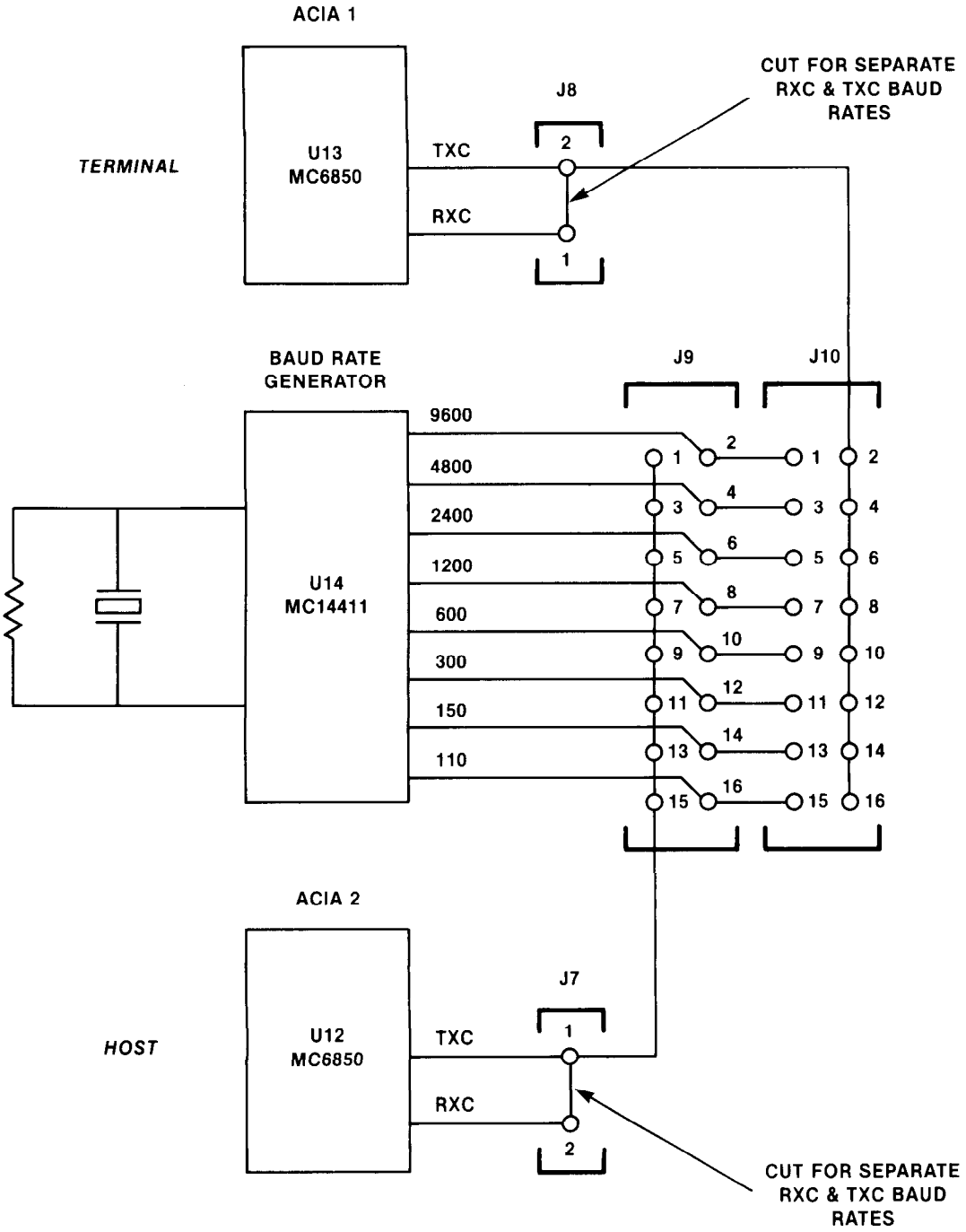


FIGURE 2-4. Interconnection Diagram for Baud Rate Selection

Referring again to Figure 2-1, two headers marked J9 and J10 are shown. Each header consists of a double row of eight pins (16 total), and is used to select the baud rate for a serial port. Header J10 is used to select the terminal baud rate (ACIA 1, serial Port 1).

The pins are jumpered together using a plastic jumper cap (one of seven provided with the board). The cap should be positioned on header J10, as shown in Figure 2-5, to select the desired baud rate. Table 2-1 lists which pins must be jumpered for a given baud rate.

TABLE 2-1. Headers J9 and J10 Jumpers to Select Serial Port Baud Rates

| JUMPER PINS | SELECTED BAUD RATE |
|---|---|
| 1-2 | 9600 |
| 3-4 | 4800 |
| 5-6 | 2400 |
| 7-8 | 1200 |
| 9-10 | 600 |
| 11-12 | 300 |
| 13-14 | 150 |
| 15-16 | 110 |

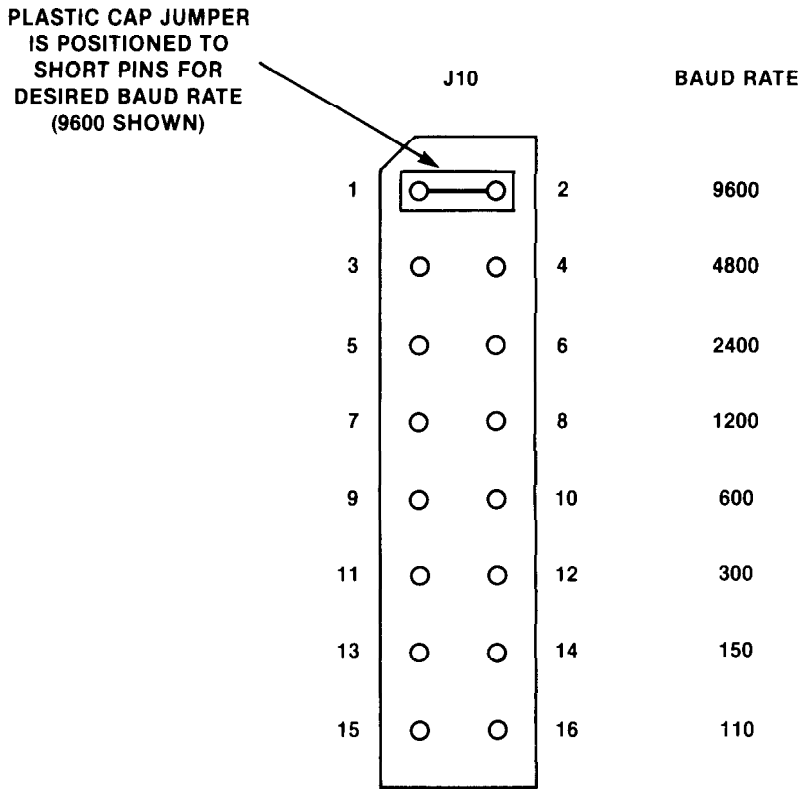


FIGURE 2-5. Terminal Baud Rate Select Jumper (J10)

Figure 6-4 is a functional schematic diagram of the serial communication ports. The RS-232C signal lines required at each port are shown.

Port 1 must receive an active level on DTR (data terminal ready), or data will not be transmitted. The terminal connected to Port 1 must drive DTR. CTS (clear to send), DSR (data set ready), and DCD (data carrier detect) are each asserted when DTR is asserted. Refer to Appendix C for further information.

2.2.4.2 Special Operation - Transmitting and Receiving at Different Baud Rates. The MEX68KECB is wired with the transmit clock (TXC) and Receive clock (RXC) of each ACIA (refer to Figure 2-4) tied together and then jumpered to the selected baud rate. To provide different baud rates, the connection between TXC and RXC must be cut and individual baud rates connected to each. Perform the following steps to select separate transmit and receive baud rates for the terminal:

a. Cut the signal trace located between Pin 1 and Pin 2 of header J8 on the back side of the printed circuit board. BE CAREFUL -- be sure to cut the correct trace; it is approximately 1/8 inch long.

b. The transmit baud rate (TXC) is selected by using the plastic jumper cap on header J10 in accordance with Table 2-1.

c. The receiver baud rate (RXC) is selected by wire-wrapping Pin 1 of header J8 to the desired odd numbered pin of header J10. Again, use Table 2-1 to determine the correct pin.

NOTE

The MEX68KECB as now configured is ready to be connected to a terminal and power supplies. If the user wants to utilize options of the printer, tape recorder, and/or host computer (serial Port 2), additional preparation is required. See the appropriate section in this chapter on each option.

## 2.3 SYSTEM HOOKUP INSTRUCTIONS

As previously stated, the most simple configuration requires only the MEX68KECB, a terminal, and power supplies (Figure 2-6.) This section describes the required interconnections to hook up this configuration.

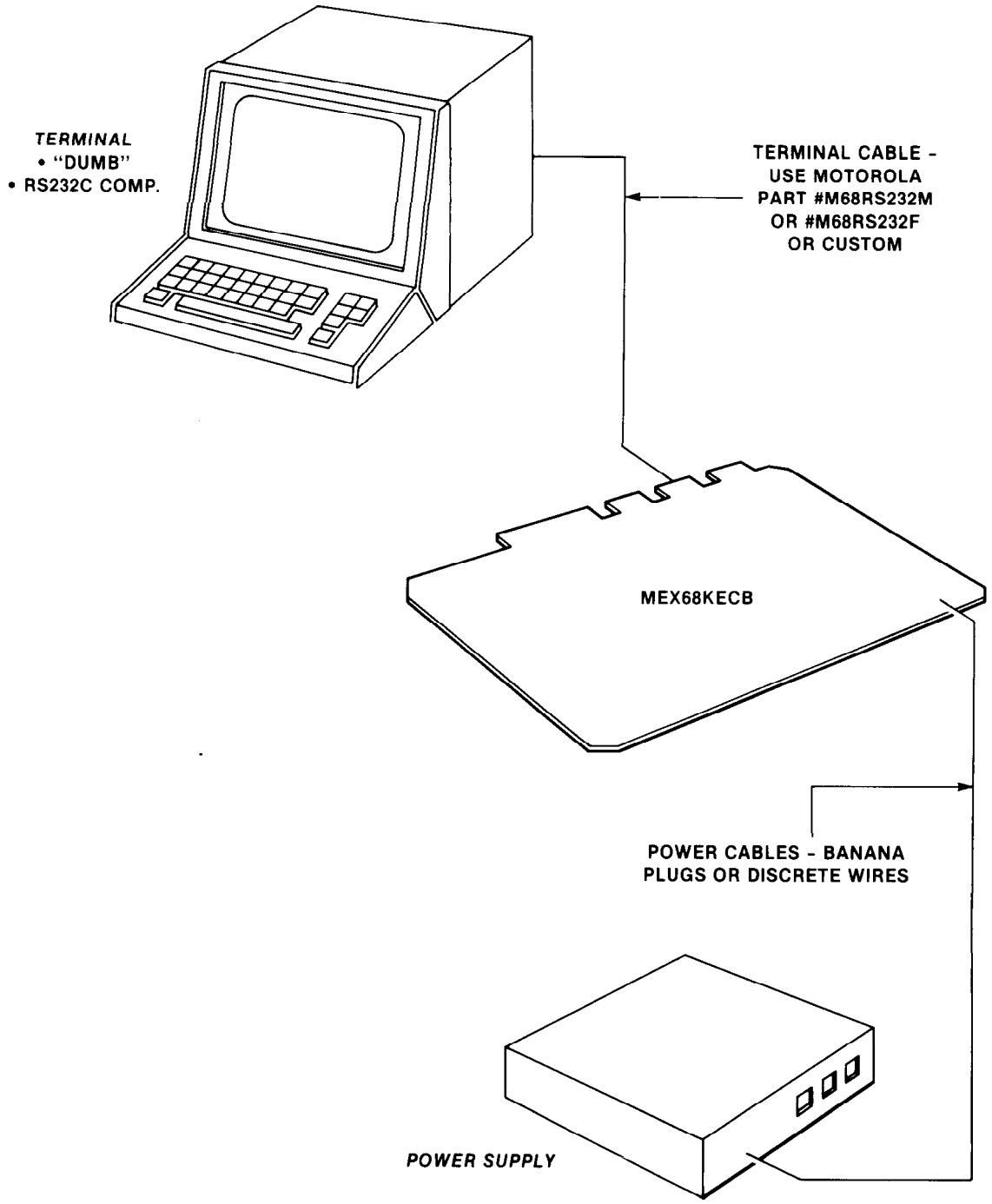


FIGURE 2-6. Minimum System Configuration

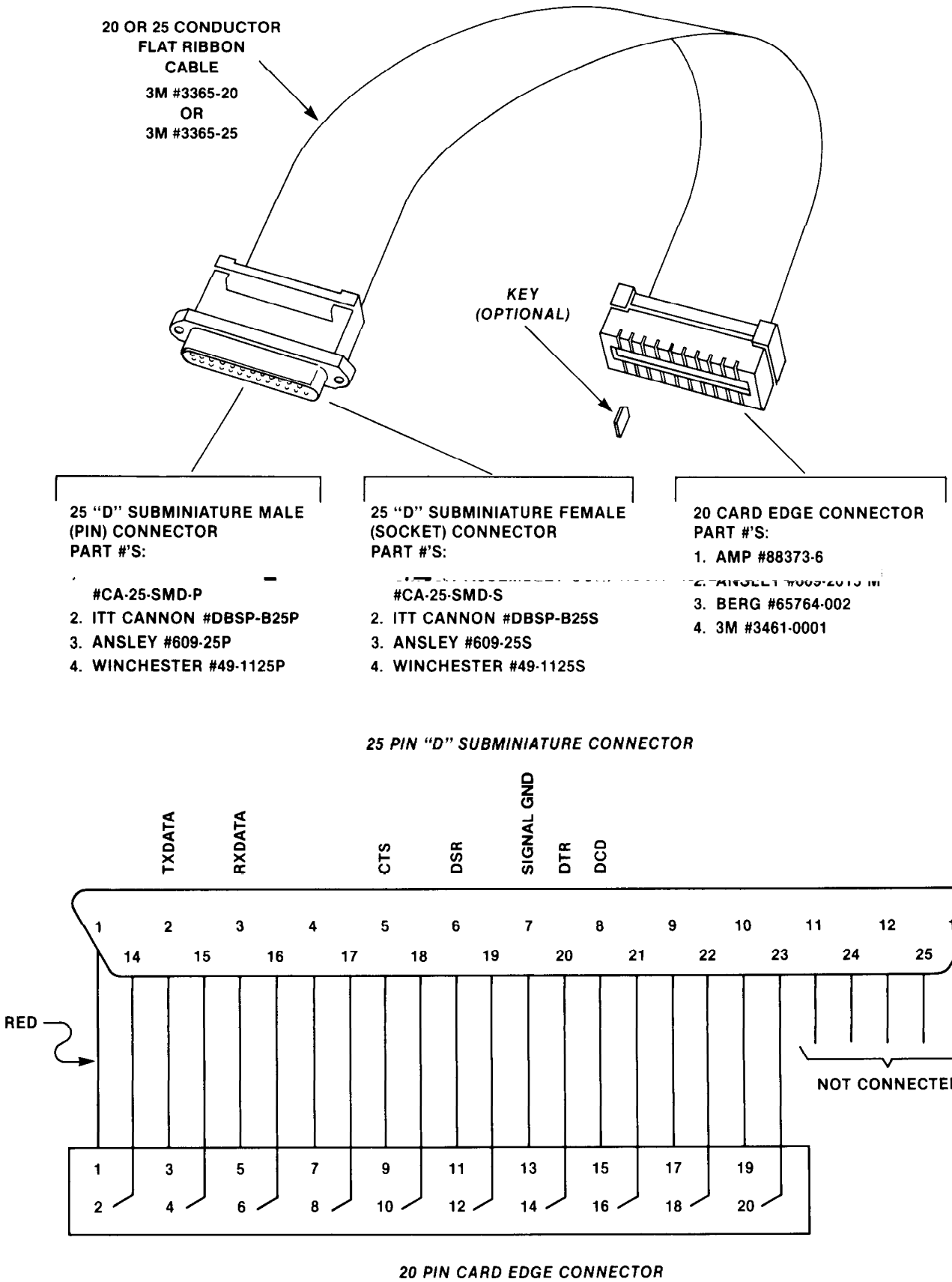


FIGURE 2-7. Terminal Cable Detail and Signal Line Connections

2.3.1 Connecting the Terminal

The terminal is connected to the MEX68KECB with a cable (normally flat ribbon) requiring a 20-contact card edge connector on the MEX68KECB end and a 25-contact "D" subminiature connector on the terminal end. The "D" subminiature connector can be either pin (male) or socket (female), as required by the user terminal. Both of these cable types are available from Motorola:

| PART NUMBER | DESCRIPTION |
|---|---|
| M68RS232M | RS232 CABLE - Card edge connector/Male DB25 connector |
| M68RS232F | RS232 CABLE - Card edge connector/Female DB25 connector |

As an alternative, the user can manufacture his own cable. Figure 2-7 shows a detail of the cable, lists several suitable vendor part numbers (any equivalent part can be used), and shows the conductor line designations. The cable requires a 25-conductor flat ribbon; connectors should be installed according to manufacturer's directions. Also, the card edge connector can be keyed to prevent incorrect cable connection.

The suitable cable is connected to Port 1 (connector J3), as shown in Figure 2-8, with the other end going to the terminal.

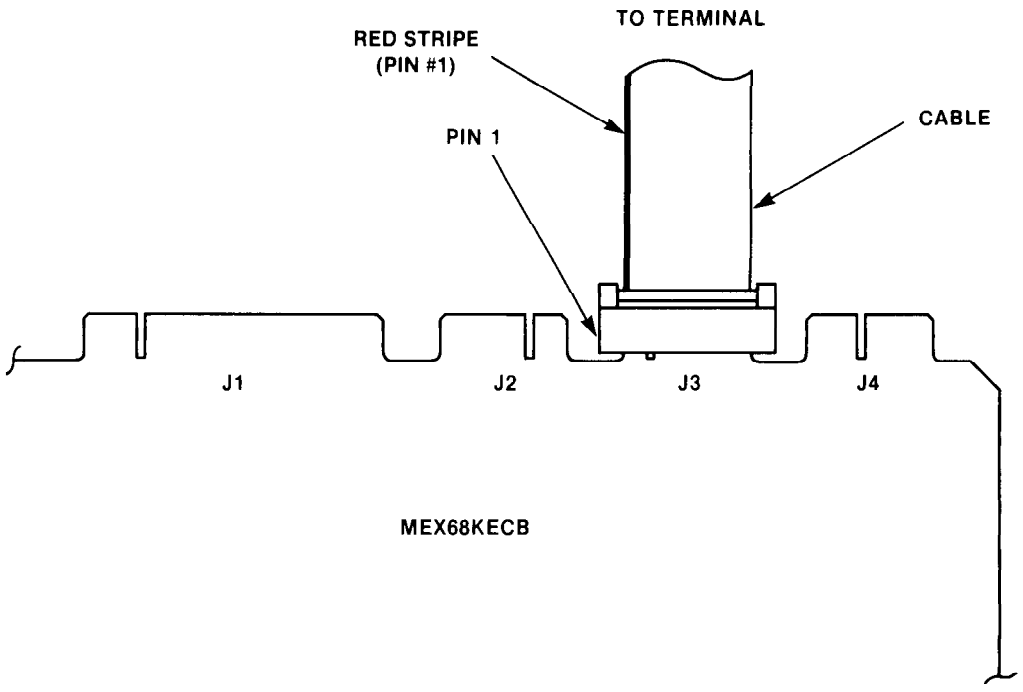


FIGURE 2-8. Terminal Cable Connection to MEX68KECB

### 2.3.2 Connecting the Power Supplies

Three supply voltages are required for the board -- that is, +5.0 Vdc ± 5%, +12.0 Vdc ± 10%, and -12.0 Vdc ± 10%. If the banana jacks are used, cables with standard banana plugs are required to connect the power supplies. With discrete wires, the wires are connected directly to the suitable voltages.

All supply voltages must be referenced to ground, and these connections should be made before turning on power. The voltage turn-on must be done in proper sequence to prevent damage to the RAM devices. Follow system turn-on instructions in the following section.

## 2.4 SYSTEM TURN-ON AND INITIAL OPERATION

CAUTION

POWER SUPPLY VOLTAGES MUST BE TURNED ON IN PROPER SEQUENCE TO AVOID DAMAGE TO THE DYNAMIC RAM DEVICES. FOLLOW THE TURN-ON INSTRUCTIONS TO PREVENT PROBLEMS.

After the cables are in place, the final step to system turn-on is applying power. The dynamic RAM devices (MCM4116's) require that the negative voltage -12 Vdc be applied first. This is especially important when individual power supplies (such as laboratory supplies) are used. The power-up sequence should be:

a. Ground must be connected common to all power supplies.

b. Turn on -12.0 Vdc.

c. Turn on +12.0 Vdc.

d. Turn on +5.0 Vdc.

If a single multivoltage power supply is used, it is not possible to turn voltages on independently. However, with most power supplies the -12 Vdc and +12 Vdc come up before the +5 Vdc because these are lightly loaded and do not have to charge heavy internal filter capacitance. The user should test the multivoltage supply, simulating typical loading from Table 1-1, to determine if the -12 Vdc comes up first. When powering up with a single multivoltage supply:

a. Be sure all voltages are connected prior to power up.

b. Turn power ON to the board.

CAUTION

THE POWER DOWN SEQUENCE IS THE REVERSE OF THE ABOVE POWER UP SEQUENCE AND IS EQUALLY IMPORTANT.

After power on, the system should initialize itself and print on the terminal:

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TUTOR 1.X >
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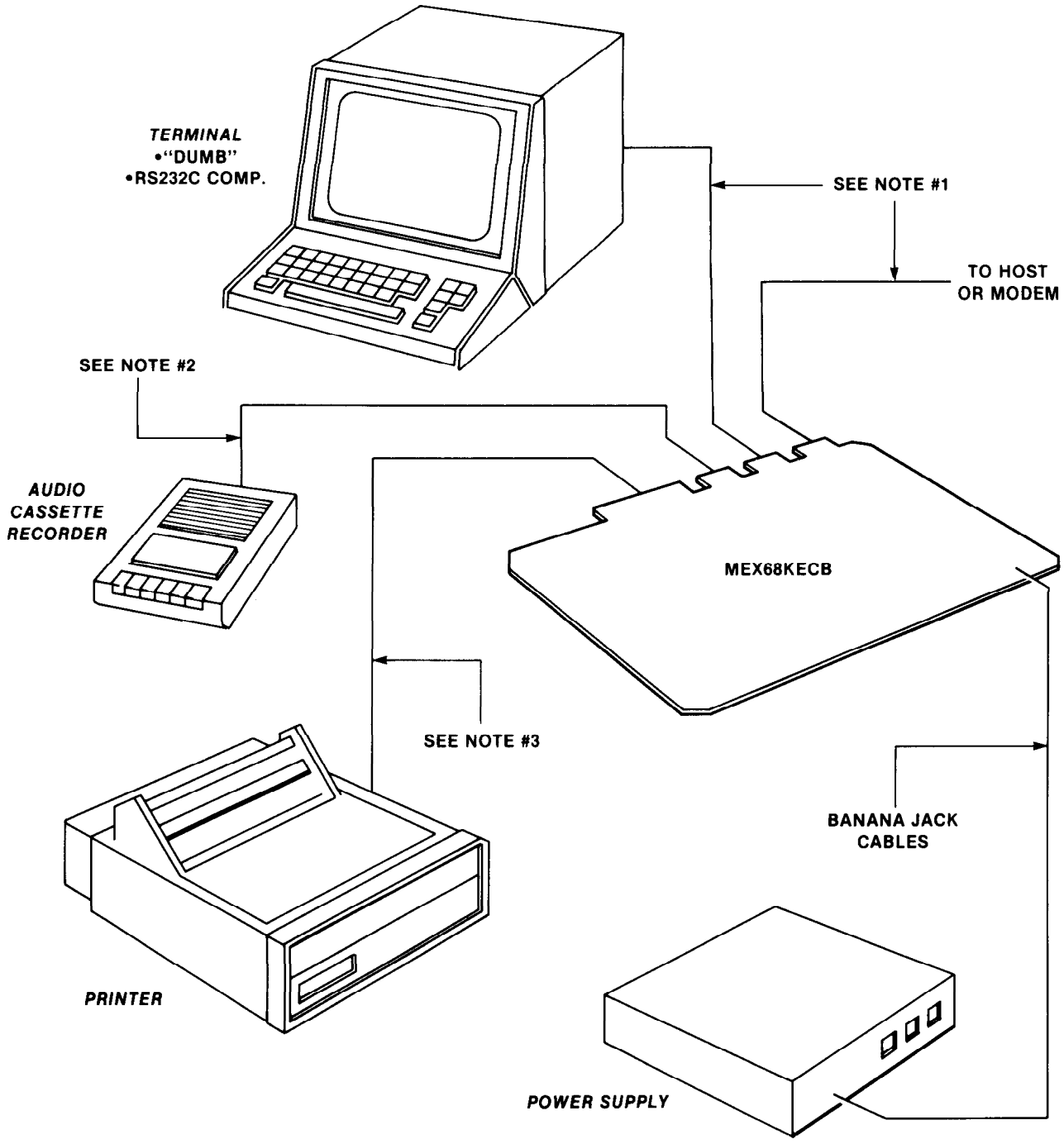



NOTES: 1. USE MOTOROLA CABLE M68RS232M OR M68RS232F OR MAKE CUSTOM.
2. MAKE CUSTOM CABLE.
3. USE MOTOROLA CABLE MEX68PIC OR MAKE CUSTOM.

FIGURE 2-9. Expanded System Configuration with Options

It is now ready for operation under control of the firmware as described in Chapters 3 and 4. If this response does not appear on the terminal, perform the following system checks:

a. Press the black reset button to guarantee that the board has been initialized properly.

b. Check that the terminal and board are set for the same baud rates.

c. If the baud rates are set properly and the terminal is still not reacting properly, the terminal may require special null characters and formatting from the educational computer. The Port Format (PF) command can be used to set the required ACIA format (see Paragraph 3.5.21 and Appendix B).

## 2.5 PREPARATION FOR USE OF SYSTEM OPTIONS

The MC68000 Educational Computer Board can use options of a Centronics-compatible printer, audio cassette storage, and a link to a host computer. Figure 2-9 shows the expanded system configuration with these options. The following paragraphs describe preparation for use of each option.

### 2.5.1 Printer Option

The board is properly buffered to directly drive a Centronics-compatible printer. The Port 3 edge connector J1 must be connected via cable to the user-supplied printer. This cable is available from Motorola, Part Number MEX68PIC.

The user may desire to manufacture this cable, although it is a more complex assembly than just flat ribbon cable and connectors. Resistors are used on the cable to help protect unbuffered inputs from damage due to static discharge. Figure 2-10 shows the interconnection diagram of the cable and lists suitable connector part numbers. Note that the cable can be keyed on the card edge connector to prevent incorrect cable connection.

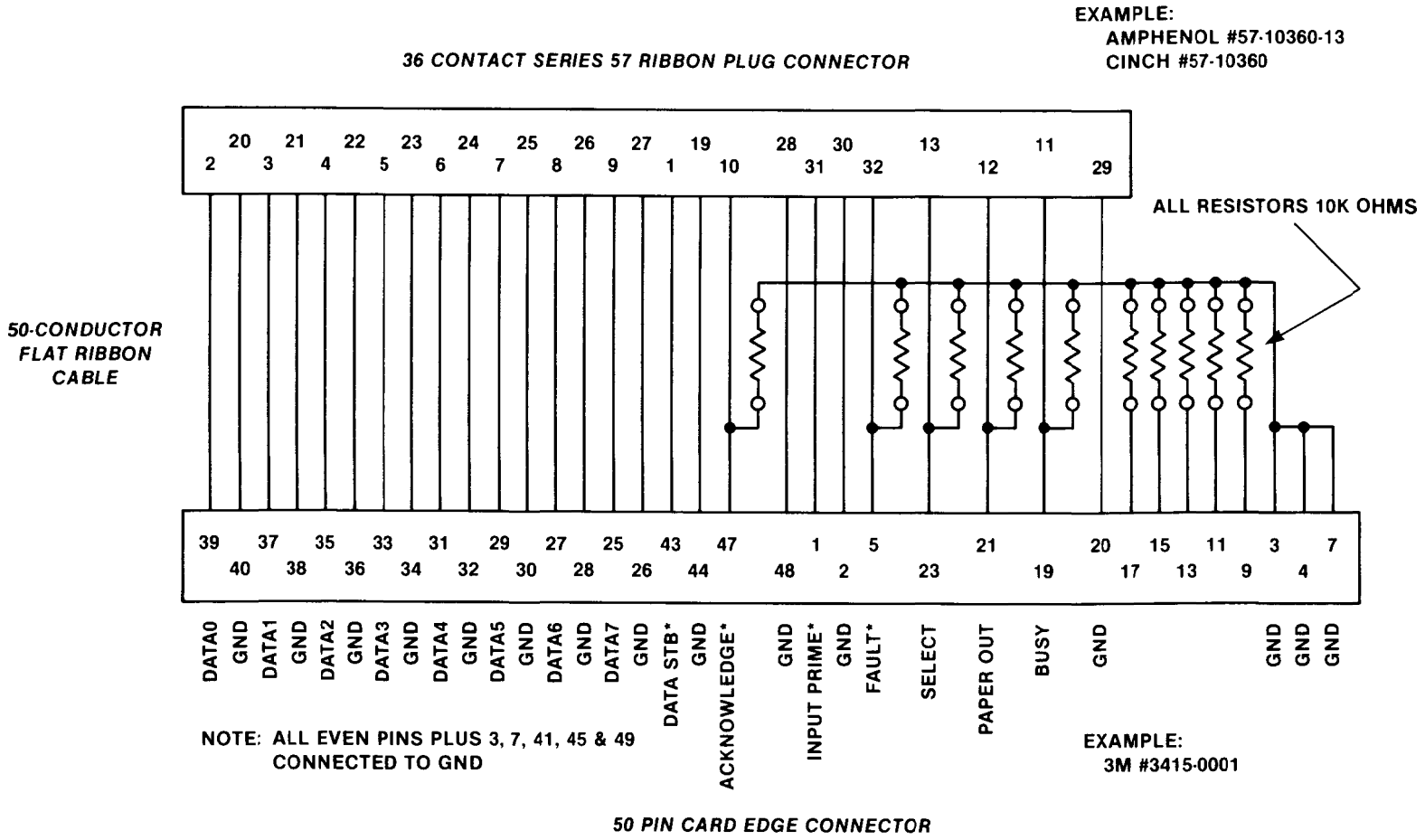



FIGURE 2-10. Printer Cable Interconnection Diagram

The cable is connected to Port 3 (connector J1), as shown in Figure 2-11, with the other end going to the printer.

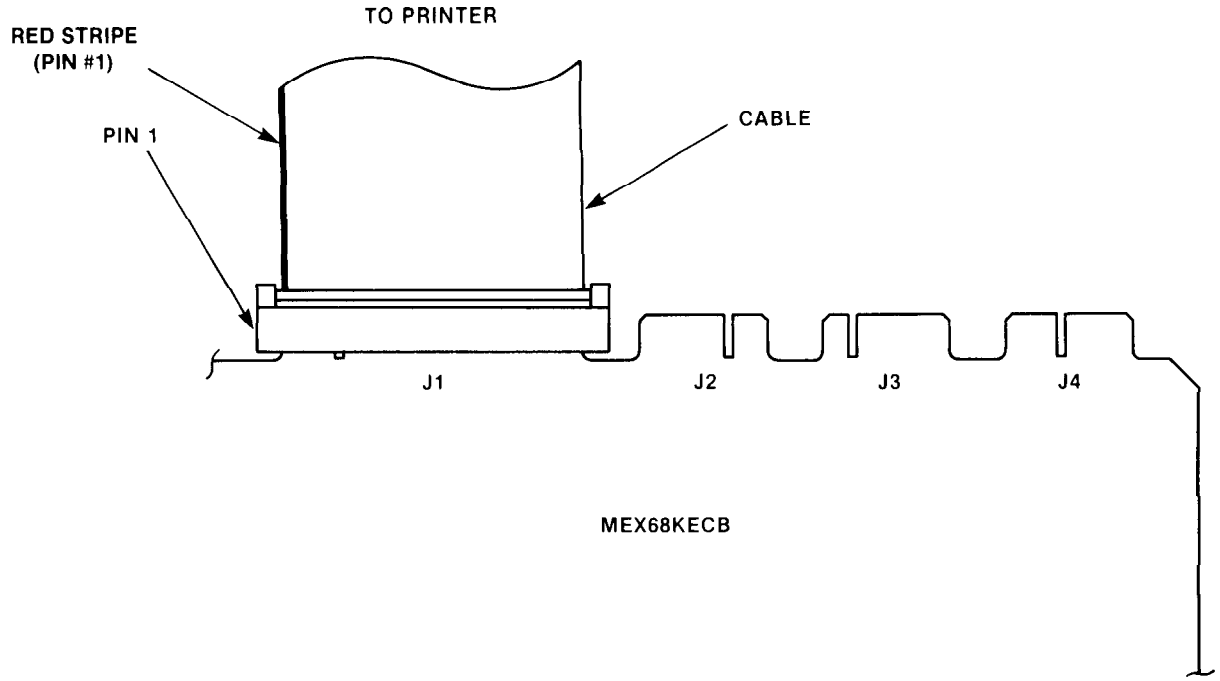



FIGURE 2-11. Printer Cable Connection to MEX68KECB

2.5.2 Host Computer (Modem) Option

A second serial RS-232 port, Port 2 connector J4, is provided to interconnect into a host computer directly or by modem. Preparation similar to serial Port 1 is required — that is, program the baud rate and prepare a cable.

Again referring to Figure 6-4, the modem or host connected to Port 2 must assert CTS (clear to send) before information can be transmitted via Port 2. RTS is asserted by the ECB when power is applied to the board. DTR is asserted as part of the ECB power-up/reset firmware.

2.5.2.1 Selecting Host Baud Rate. As with the terminal baud rate, the host serial port is wired to transmit and receive at the same baud rate. The desired baud rate is selected via a plastic cap jumper positioned on header J9, as shown in Figure 2-12. Also reference Figure 2-4 for the interconnection diagram and Table 2-1 for the selected baud rate.

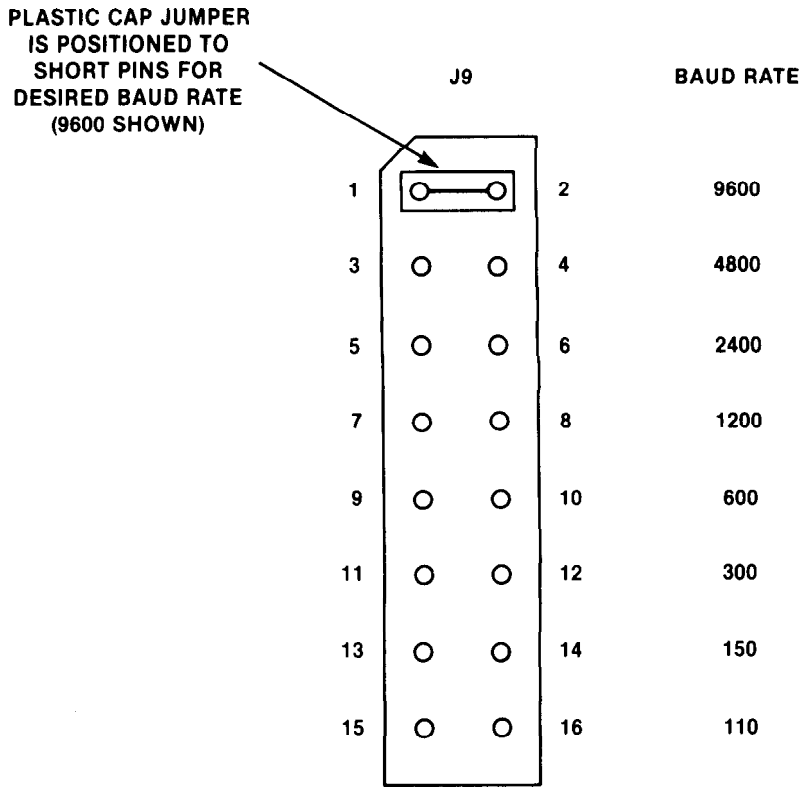



FIGURE 2-12. Host Baud Rate Select Jumper (J9)

Again similar to the terminal port, to provide different baud rates, the connection between TXC and RXC for ACIA2 must be cut (reference Figure 2-4) and individual baud rates connected to each. Perform the following steps to select separate transmit and receive baud rates for the host port:

a. Cut the signal trace located between Pin 1 and Pin 2 of header J7 on the back side of the printed circuit board. BE CAREFUL -- be sure to cut the correct trace; it is approximately 1/8 inch long.

b. The transmit baud rate (TXC) is selected by using the plastic jumper cap on header J9 in accordance with Table 2-1.

c. The receiver baud rate (RXC) is selected by wire-wrapping Pin 2 of header J7 to the desired even numbered pin of header J9. Again, use Table 2-1 to determine the correct pin.

2.5.2.2 Cable Connection. The same cables referenced in paragraph 2.3.1 can be used with the host serial port. As before, the cable can be either purchased or manufactured with the components referenced in Figure 2-7. The card edge connector can also be keyed. Figure 2-13 shows the host computer serial port cable signal line connection.

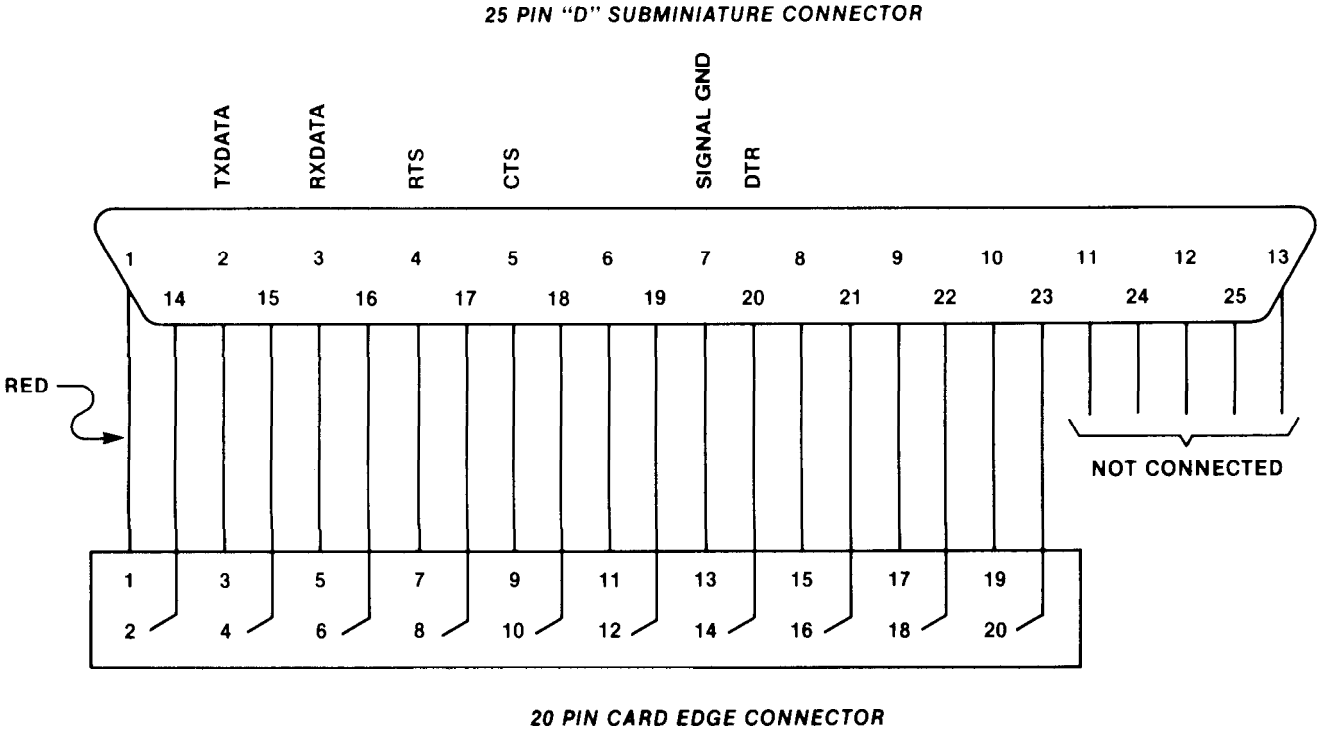



FIGURE 2-13. Host Cable Signal Line Connections

The suitable cable is connected to Port 2 (connector J4), as shown in Figure 2-14, with the other end going to the host computer or modem.

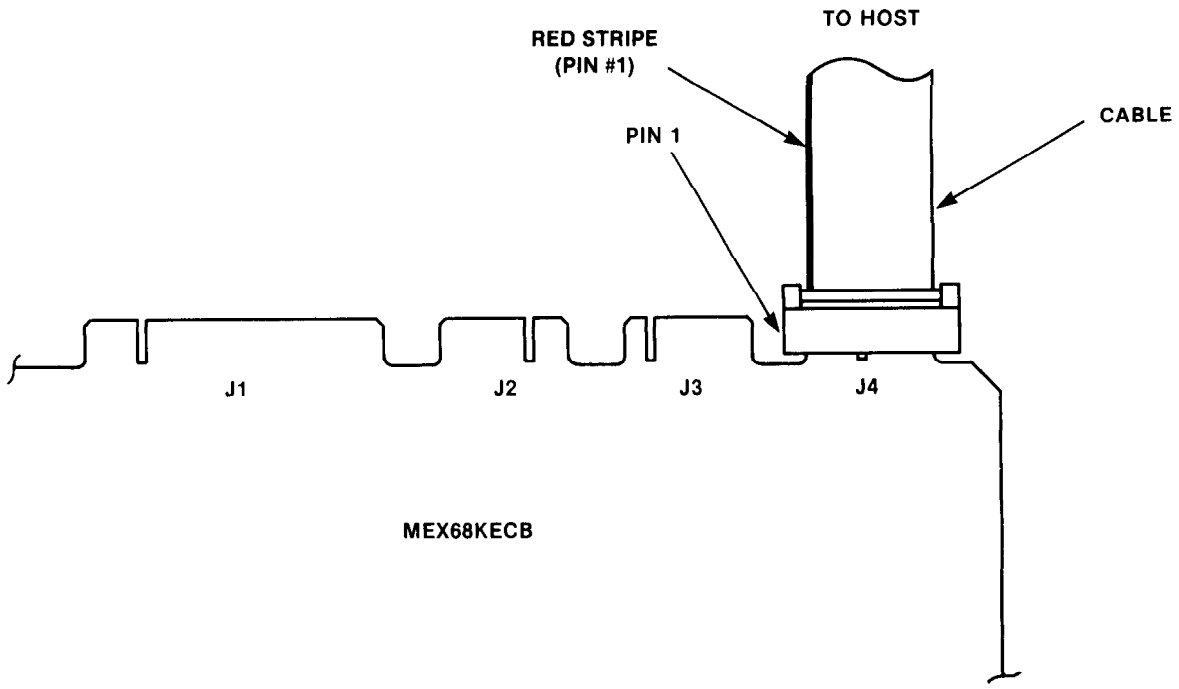
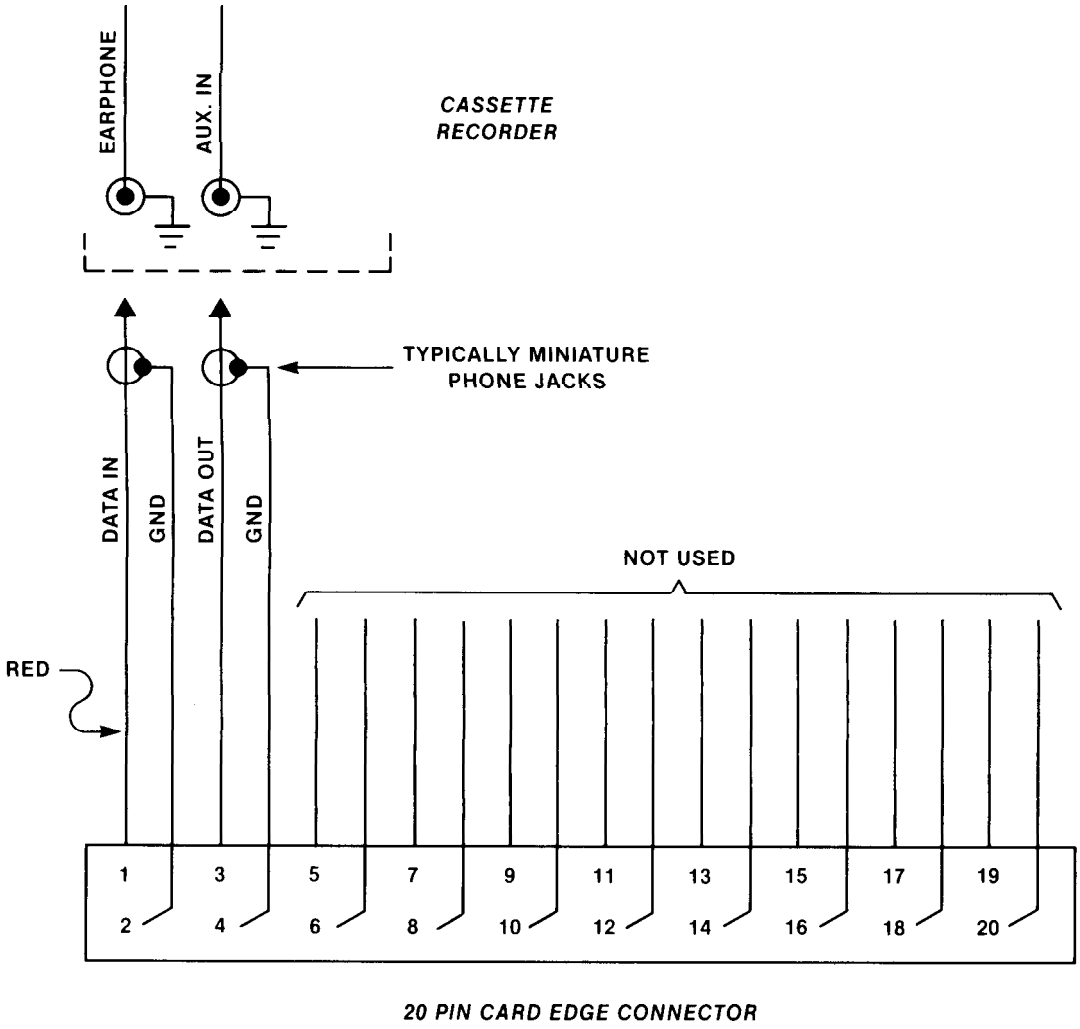



FIGURE 2-14. Host Computer Cable Connection to MEX68KECB

### 2.5.3 Audio Cassette Option

An audio cassette player can be used for data storage with MEX68KECB. Two signal lines plus ground must be connected to the cassette player from Port 4, connector J2. The user must make a custom cable suitable for the tape player used. Figure 2-15 shows a typical configuration. The educational board requires a 20-pin card edge connector, and a cassette recorder typically uses miniature phone plugs. The "DATA OUT" signal line from the board is connected to the AUXILIARY input to the cassette recorder (or the microphone input if no auxiliary input is available; see Chapter 6 for more details). The "DATA IN" signal line from the board is connected to the EARPHONE output of the recorder. The optional key is located between positions 13 and 15.




NOTE: All even pins are ground.

FIGURE 2-15A. Cassette Recorder Cable Signal Line Connection

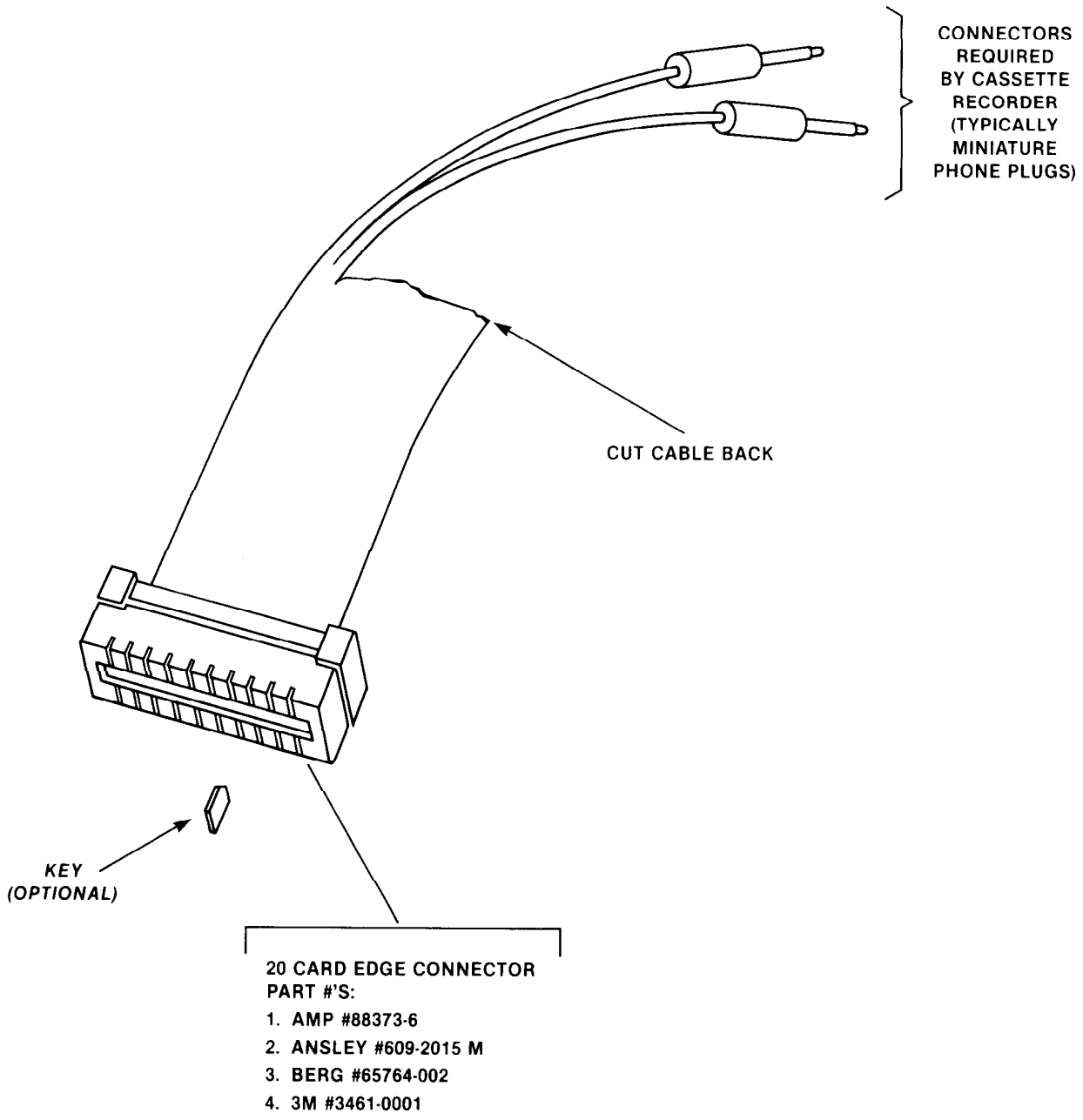



FIGURE 2-15B. Cassette Recorder Cable Detail

The cable is then connected to Port 4 (connector J2), as shown in Figure 2-16, with the other end going to the recorder.

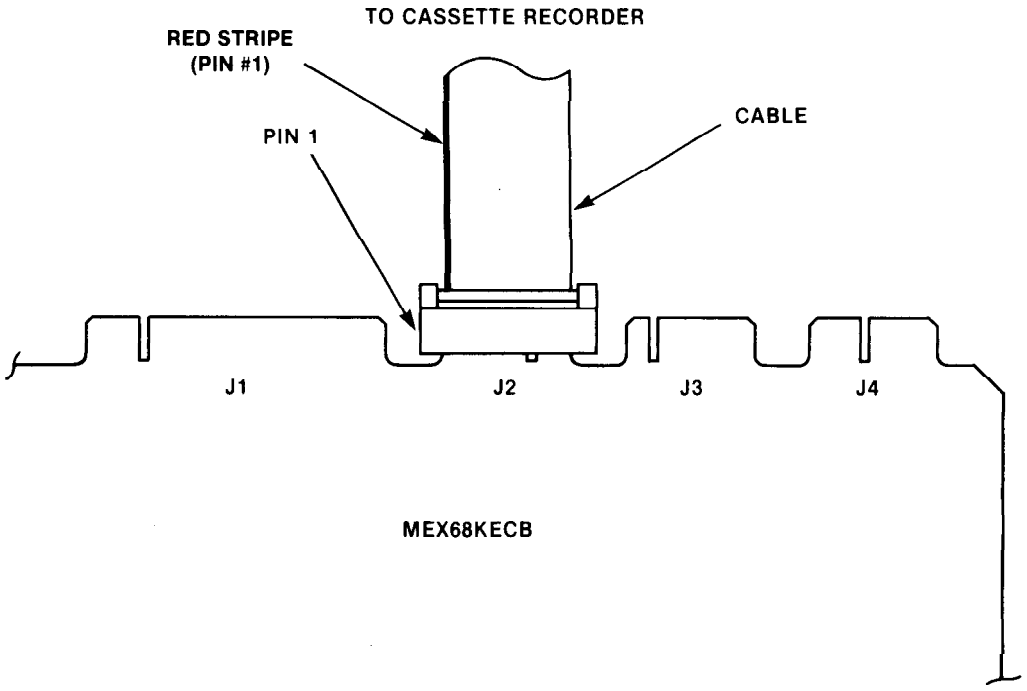



FIGURE 2-16. Cassette Recorder Cable Connection to MEX68KECB