Multiple Asynchronous Data Unit (MADU)

User Manual

555-401-702

Issue 1, September 1986

Multiple Asynchronous Data Unit

(MADU)

User Manual

Printed in U.S.A.

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The MADU is warranted against defects in materials and workmanship for 3 months from the date of purchase. If the product fails due to a manufacturing defect during the 3-month period, it will be repaired without charge, or replaced at our option. This warranty does not apply to damage due to accident, improper care, or negligence. Retain all documentation showing the date of sale to validate your warranty.

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You may order replacement parts by contacting your AT&T Sales Representative. You may also purchase additional MADUs, carriers, circuit packs, and related components through your AT&T Sales Representative. Components are listed in the Reference Material chapter of this manual.

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OVERVIEW

The Multiple Asynchronous Data Unit (MADU) provides asynchronous data access to host computers for a variety of data devices. The MADU may be attached to the System 75/85 switch, or to another Asynchronous Data Unit (MADU or Z3A ADU) directly over the building wiring. In either connection, the MADU can transmit signals through the building wiring for greater distances than standard RS-232C connections.

This guide contains the following information:

- A functional and feature description of the MADU, including switched-access and hard-wired applications
- A physical description of the MADU including mountings and circuit pack components
- Building wiring and host computer cabling options
- Installation procedures for stand-alone and multiple-mount housings
- Testing, busy-out, and troubleshooting procedures
- Reference material including technical specifications, pin assignments, component order numbers, administration, maintenance, acronyms, and references.

FUNCTIONAL DESCRIPTION

The primary application for the Multiple Asynchronous Data Unit (MADU) is to provide an RS-232C compatible, full duplex, asynchronous connection to host computers. The MADU may connect a host computer (or other RS-232C device) to System 75, System 85, another MADU, or a Z3A ADU. Some possible configurations appear in Figure 1. Different MADU applications are discussed in the following sections.

The MADU converts EIA (RS-232C) signals from the host computer to differential signals with lower voltages, enabling data to travel beyond the recommended RS-232C signal limit of 50 feet (15 meters). Signals from an MADU may be transmitted 2,000 to 40,000 feet (610 to 12,190 meters) over standard building wiring, depending on wire gauge and transmission speed. The maximum speed at which the MADU can operate is 19.2 kbps. The MADU imposes no other restrictions on the data transmission.

Each MADU circuit is functionally equivalent to one Z3A Asynchronous Data Unit (ADU). Therefore, one 8-port MADU circuit pack can replace eight Z3A ADUs either on the host computer or terminal side of a connection. Because the Z3A ADU uses a modular connector and the MADU uses 25-pair amphenol connectors, the cabling and cross-connect field requirements differ for these devices. See the Cabling Options chapter for MADU physical connections.

System 75/85 Switched-Access Applications

The MADU provides eight RS-232C compatible connections to System 75/85 port boards. Compatible switch port boards include:

- The 8-port TN726 Data Line board on System 75 (also called a Data Line Circuit or DLC board).
- The 4-port SN238 EIA port board on System 85. Two SN238 boards are required to connect all eight ports from one MADU board.

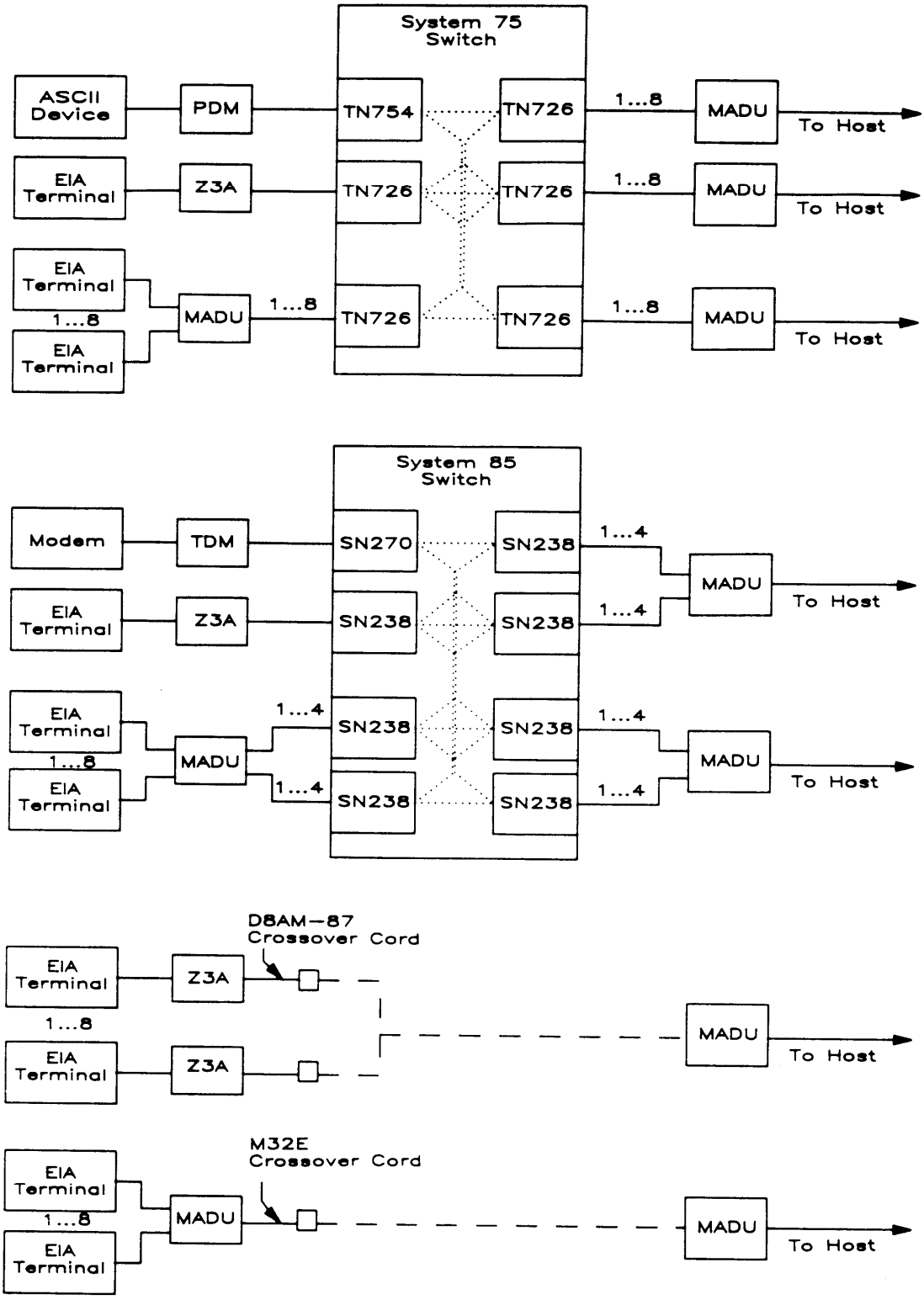


Figure 1. Multiple Asynchronous Data Unit (MADU) Sample Configurations

Each MADU circuit pack connect eight ports on a host or eight separate RS-232C compatible devices to switch. No crossover cords are needed for ADU devices attached to a compatible switch port board; these boards are set up to exchange data with ADU devices automatically. MADU switched-access applications are discussed in this section.

Host Computer Connection

The most common application for the MADU is to connect one or more host computers to the System 75/85 switch. The host computer may use RS-232C type ports or 8-pin modular ports (such as AT&T 3B2/300 computers). Adapters and cables for these connections are described in the Cabling Options chapter. The connections are functionally equivalent except that the modular connection does not support computer-generated busy-out of the host computer port.

The MADU passes information from the host computer to the System 75/85 port board, which converts the data to Digital Communications Protocol (DCP) Mode 2. The digital information is then transferred through the System 75/85 switch to another port board that accepts DCP data. The second port could be another TN726 Data Line board or a TN754 Digital Line circuit pack on System 75, or an SN238 EIA port board or a SN270 General Purpose Port (GPP) on System 85.

The port at the other end of the switch allows the MADU to access a variety of data devices. Devices include a Processor Data Module (PDM), Modular PDM (MPDM), digital terminal, computer, Z3A ADU, MADU, or a Trunk Data Module (TDM) or Modular TDM (MTDM) leading to a modem. See Figure 1 for examples.

Terminal Connection

Most terminals (or other RS-232C type devices) are attached individually to the switch using Z3A ADUs (one ADU per device or port). However, an MADU in a stand-alone housing could replace eight ADUs attached to terminals located in the same area (such as one office). Note that the MADU requires 25-pair cabling to the cross-connect field instead of the 4-pair cabling usually installed for individual terminal stations (see the Cabling Options chapter for wiring details).

If terminals are attached to an MADU, users would follow the same type of dialing procedures used for the Z3A ADU (except the MADU has no Originate/Disconnect button option). Some terminal dialing problems are covered in the Testing and Troubleshooting chapter. See the Z3A ADU user manual or user reference card listed in the "References" section for details on dialing procedures.

MADU Hard-Wired Applications

An RS-232C compatible terminal or device connected to an MADU or Z3A ADU may access a host computer through an MADU directly over the building wiring. This hard-wired connection bypasses the System 75/85 switch entirely, as shown in Figure 1.

> **NOTE:** Hard-wired applications require a crossover cord between the two ADU devices. The crossover cord connects the near-end receive wires to the far-end transmit wires and vice versa, allowing the ADUs or MADUs to exchange data. Without the crossover cord, data transfer could not take place.

Z3A ADU Connection

The Z3A ADU is functionally equivalent to one of the ports on the MADU board. It translates the signals from the MADU back to the RS-232C signals required by the terminal or other attached RS-232C device. Eight Z3As may be connected to one MADU circuit pack. A Z3A1, Z3A2, or Z3A4 ADU may be attached to the terminal or other RS-232C compatible device.

In a hard-wired connection, the Z3A ADU must have a D8AM-87 crossover cord attached to the standard 4-pair modular wall cord before it connects to the building wiring leading to the MADU. The Z3A ADU is described in the *Z3A Asynchronous Data Unit User Manual* (555-401-701).

MADU Connection

MADUs may be used back-to-back in a hard-wired connection. For example, an MADU in one office may connect eight terminals to a host computer in another office. A hard-wired MADU connection requires an M32E crossover cable to be connected to one of the MADUs. The crossover cable may then be attached to a longer 25-pair cable if needed. Cabling should be wired to a cross-connect field to access the building wiring leading to the other MADU.

FEATURES

The MADU provides the following features:

- The MADU may be connected to the System 75/85 switch, another MADU, or a Z3A ADU through its building wiring interface.
- Low-voltage signaling greatly increases the distance signals may travel over standard building wiring, from 2,000 feet (610 meters) at 19.2 kbps to 40,000 feet (12,192 meters) at 300 bps.
- The MADU provides eight full duplex, asynchronous, RS-232C compatible, Data Communications Equipment (DCE) interface ports for its host computer connection.
- The MADU may connect to a Data Terminal Equipment (DTE) or DCE device using the appropriate cables.
- Many cabling options for the host computer environment provide flexibility for installing the MADU. Options include connecting the MADU to one or more host computers that have either 25-pin RS-232C or 8-pin modular ports.
- A manual busy-out switch allows each MADU port attached to the switch to be busied out.
- A host-driven busy-out lead allows the host computer to send a busy-out signal to an MADU port. This option requires a 25-pin host computer port, RS-232C busy-out adapter, and correct option switch setup.
- An option switch on the circuit pack adapts the MADU for use with either System 75 or System 85.
- Three status lights for each MADU port indicate operating or error conditions.
- Circuit packs are self-powered through their own power transformers.
- Eight MADU circuit packs (8 ports per pack) may be mounted in one carrier for efficient use of computer room space (64 ports per carrier).
- Single-unit housings or multiple-mount carriers are available.

PHYSICAL DESCRIPTION

This chapter describes the physical components of the Multiple Asynchronous Data Unit (MADU). MADU single-unit and multiple-mount housings, power requirements, and circuit pack lights, switches, and connectors are discussed.

GENERAL INFORMATION

Each MADU circuit pack provides eight ports. The operating environment can range from 40 to 110°F (4 to 49°C) in temperature and from 5 to 95 percent noncondensing humidity. The MADU should be installed only in lightning-protected facilities. It is not designed to be used with central office cables or with "exposed" outside wiring (such as aerial cables).

This section covers MADU single-unit and multiple-mount housings and power requirements.

Single-Unit and Multiple-Mount Housings

One MADU circuit pack may be installed in a single-unit housing (see Figure 2). The metallic stand-alone housing measures 12 inches (30.5 cm) in length, 8.75 inches (22.2 cm) in width, 2.75 inches (7 cm) in height, and weighs 2.5 pounds (1.1 kg). Single-unit housings are stackable. In a stand-alone housing, the circuit pack is placed horizontally. A decal attached to the faceplate provides horizontal labeling.

Up to eight MADU circuit packs may be installed in a multiple-mount carrier (see Figure 3). Each MADU circuit pack has eight ports, so a completely filled multiple-mount carrier provides 64 ports. This considerably reduces the amount of space and the number of cabinets required to connect asynchronous devices to a host computer, compared to PDMs or similar devices.

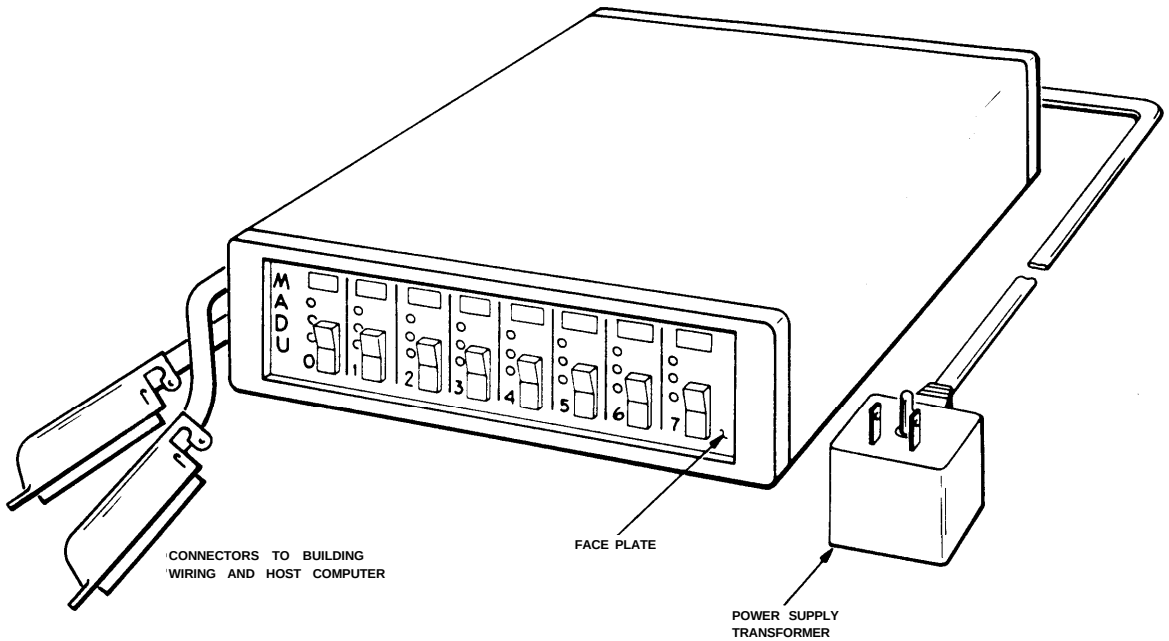


Figure 2. MADU Single-Unit Housing

The multiple-mount carrier measures 18.1 inches (46 cm) in length, 17.4 inches (44.2 cm) in width, and 8.7 inches (22.1 cm) in height. The carrier is shipped ready to be installed in a 23-inch (58-cm) rack, but it may be adapted through adjustable flanges to fit in a 19-inch (48-cm) or 25-inch (63-cm) rack. If the carrier or rack is to be placed in a cabinet, the cabinet must be at least 23 or 25 inches (58 or 63 cm) wide to allow room for the cabling.

Power Requirements

Each MADU circuit pack is powered from its own power transformer. The transformer is plugged into a 115-to-120 V 60-Hz ac power source, from which it draws 0.2 amperes. The transformer is attached to the MADU circuit pack by a 7-foot (2.1-meter) 2-pair modular cord, providing 20 V ac at 0.73 amps. Because a multiple-mount carrier houses eight MADU boards, the power cord leading to the distribution box in the carrier can draw up to 1.6 amps from the ac outlet or power strip (0.2 amps $\times$ 8 boards). The power distribution box contains a 6-amp circuit breaker.

The transformer for the stand-alone unit may be plugged directly into a 3-wire grounded 60-Hz ac wall outlet. However, no more than four transformers should be plugged directly into the same ac line due to the noise they generate. They should instead be plugged into a commercially available power strip with a radio frequency (RF) filter, which is then attached to the ac outlet. (The power distribution box in the multiple-mount carrier already contains a built-in RF filter.)

The MADU circuit pack requires +5 V and –5 V dc power which is converted from the ac source and regulated internally on the board. Each circuit pack requires no more than 3 watts of power.

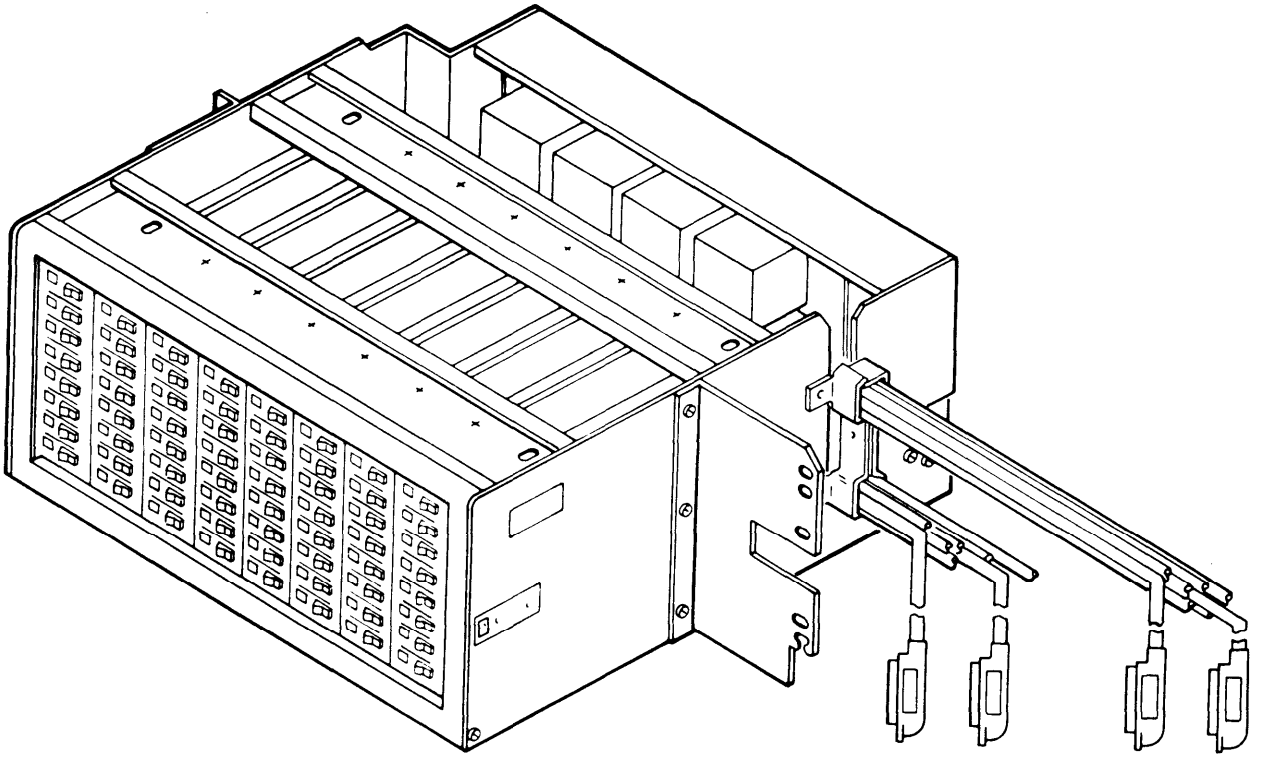


Figure 3. MADU Multiple-Mount Housing

CIRCUIT PACK DESCRIPTION

The MADU circuit pack measures 11.3 inches (28.7 cm) in length, 1.65 inches (4.2 cm) in width, and 7.67 inches (19.5 cm) in height. Each circuit pack weighs about 1 pound (0.5 kg) and has eight ports. All MADU circuit packs provide the features described in this section. The faceplate, decal (for a stand-alone housing), lights, switches, and connectors are described in turn.

Faceplate and Decal

The MADU faceplate is labeled to identify the ports, lights, and switches (see Figure 4). The text is readable when the circuit pack is in a vertical position in the multiple-mount carrier. A blank, erasable surface next to each port allows the port's location and identification to be written in pencil and changed if necessary.

A thin, plastic decal is attached to the front of the faceplate before the circuit pack is installed in a stand-lone housing. The adhesive decal rotates the text so it is readable in the horizontal position, as shown in Figure 2.

Busy Switch

Each port on the MADU circuit pack has its own MK BUSY (make-busy) rocker switch (see Figure 4). A total of eight busy switches are on each circuit pack. The MK BUSY switch allows the port to be busied-out manually until the rocker switch is returned to the normal position. Any device attached to the switch through an MADU may be busied out using the MK BUSY switch.

> **CAUTION:** *The busy signal works only with MADU ports attached to System 75/85. If MADU ports are attached to an MADU or Z3A ADU directly through the building wiring, the make-busy signal may only interfere with data transmission (the port is not busied out, as this is a switch function).*

Lights

Three light-emitting diodes (LEDs) on each port display the port's status. A total of 24 LEDs are on the circuit pack faceplate (see Figure 4). The LEDs display the following information:

- *Yellow – IN USE:* Indicates that a call is in progress (the port is connected to a remote device through the building wiring). The yellow LED lights when the Data Set Ready (DSR) lead is active and the Receive Data lead changes state (when data is transmitted). The light stays on until DSR is dropped.
- *Green – DTR:* Indicates the MADU is connected to a host computer or other RS-232C device, with the device driving the Data Terminal Ready (DTR) signal high.
- *Red – BUSY:* Indicates the MADU port is sending a "make-busy" signal to the far end. A busy signal may be generated in two ways:
  - — Toggling the MK BUSY rocker switch to the busy position. This works for any RS-232C device attached through an MADU to the switch.
  - — Having the computer send a make-busy signal through its RS-232C interface. This option works for host computers with 25-pin ports that are attached to an RS-232C busy-out adapter. The busy-out function must be activated as described in the "Option Switches" section.

More information on the LEDs and MK BUSY switch is in the Testing and Troubleshooting Procedures chapter. See the Reference Material chapter for more information on signals.

Connectors

The MADU circuit pack has three connectors at the rear of the board (see Figure 5). The connectors attach the MADU to the building wiring, power transformer, and host computer.

- *TO BUILDING WIRING:* This 25-pair connector attaches the MADU to the building wiring. A short centerfeed-to-endfeed cable is attached to this connector, and then to a longer cable that extends to the cross-connect field. The wiring may lead to a compatible port board on the switch, or to a hard-wired MADU or Z3A ADU. Table B in the Cabling Options chapter shows distance limitations for building wiring connections. Table F in the Reference Material chapter shows pin assignments for this connector.
- *POWER:* The central connector on the MADU circuit pack is a 4-pair modular jack used to attach the 7-foot (2.1-meter) modular cord on the power transformer. The connector is labeled "PWR" on the single-unit housing, but is not marked on the circuit pack itself. Although the power connector can accommodate a 4-pair cord, the 2-pair cord from the transformer also snaps into place, connecting the center pins. See Table H in the Reference Material chapter for pin assignments for this connector.

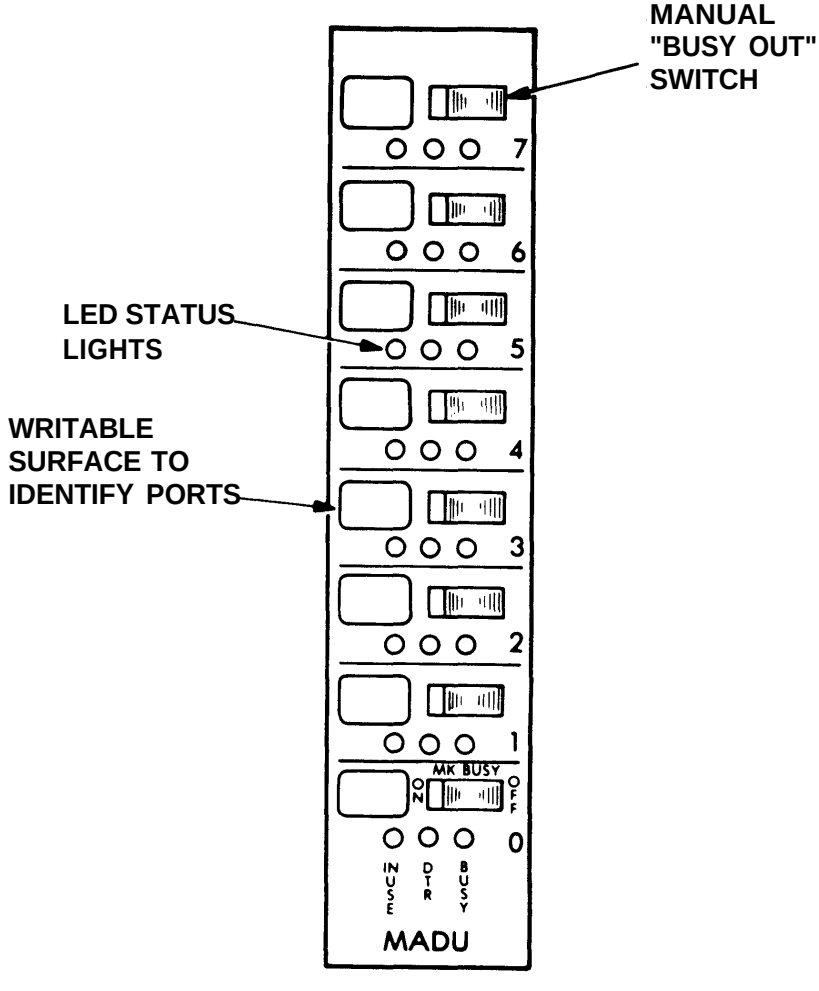


Figure 4. MADU Faceplate (Vertical Orientation)

- *TO HOST COMPUTER:* This 25-pair connector is primarily used to attach the MADU to an RS-232C compatible host computer. It may also connect other RS-232C devices as described in the Overview. The connector must be attached to a short centerfeed-to-endfeed cable, which in turn connects to an octopus cable. The octopus cable divides into eight RS-232C compatible connectors which connect to ports on the host computer (or other device). A number of cabling options and adapters for host computer connections are described in the Cabling Options chapter. Table G in the Reference Material chapter lists pin assignments for the "TO HOST COMPUTER" connector.

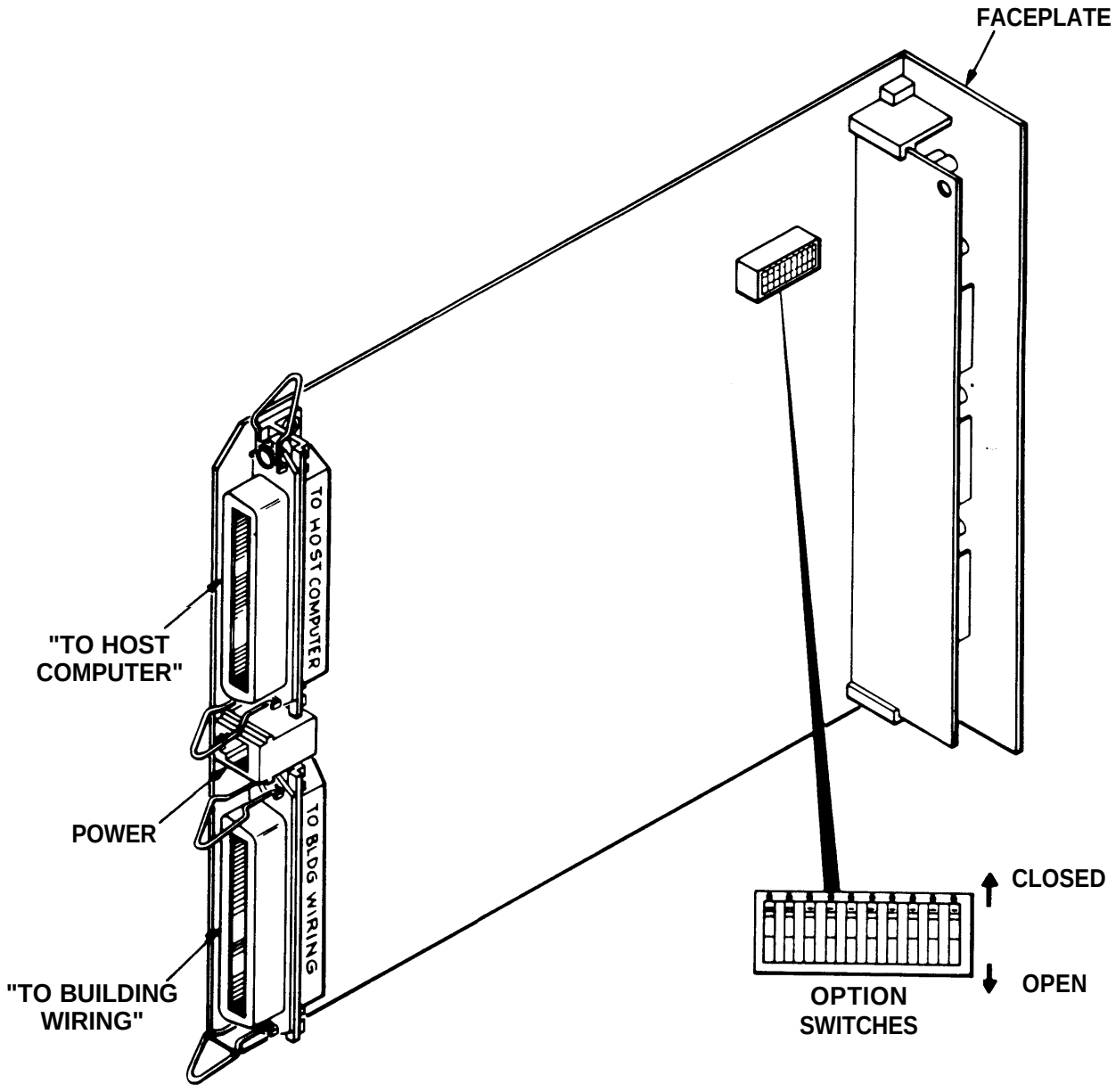


Figure 5. MADU Circuit Pack, Connectors, and Option Switches (Vertical Orientation)

Option Switches

The MADU circuit pack contains a 10-position dual in-line package (DIP) switch to activate or disable options (see Figures 5 and 6). Originally the option switches are set in the open or "down" position (the side of the option switch that faces downward when the circuit pack is placed vertically). Options are activated when the switch is closed (turned upwards towards the white dot or number).

The option switches control the following features:

- *Host Computer Busy-Out Enabled/Disabled:* The first eight option switches are labeled "PORT 0" to "PORT 7." They are used to enable or disable computer-generated busy-out for the corresponding port on the MADU circuit pack. When the option switch for a port is in the closed (up) position, a make-busy signal can be transmitted on pin 18 or pin 25 from the host computer's 25-pin RS-232C connector to busy-out the computer port.

  > **NOTE:** The computer-generated busy-out option cannot be used on host computers with 8-pin modular ports. These ports do not have enough pins to transmit a busy signal to the MADU.

  In order for the busy signal to reach the MADU port, an RS-232C busy-out adapter must be placed between the host computer port and the octopus cable. The adapter connects pin 18 and pin 25 on the host computer's port to pin 22 on the octopus cable. Pin 22 then transmits the busy signal to the MADU port. Without the adapter in place, the MADU cannot detect a make-busy signal because no physical connection is present. Table K in the Reference Material chapter shows RS-232C busy-out adapter pin assignments.

  > **CAUTION:** *If the host computer uses pin* 22 *for another function and an RS-232C adapter is* **not** *attached, the MADU circuit pack could detect this activity and busy-out all its ports. To prevent this from happening, the "PORT 0" to "PORT 7" option switches are originally set in the open (down) position.*

- *Unlabeled:* The unmarked switch is not used.
- *Access to System 75 or System 85:* The last option switch controls whether all eight ports on the MADU circuit pack access System 75 or System 85.
  - — When the switch is set in the closed (up) position towards "SYS 75", all eight ports are set up to access a TN726 Data Line board on System 75.
  - — When the switch is set in the open (down) position towards "SYS 85", all eight ports are set up to access an SN238 EIA port board on System 85.

  Connections made directly through the building wiring to an MADU or Z3A ADU are not affected by this switch's position.

Figure 6 shows the labeling of the option switches as it appears on the MADU circuit pack. Table A summarizes the function of the different option switch positions.

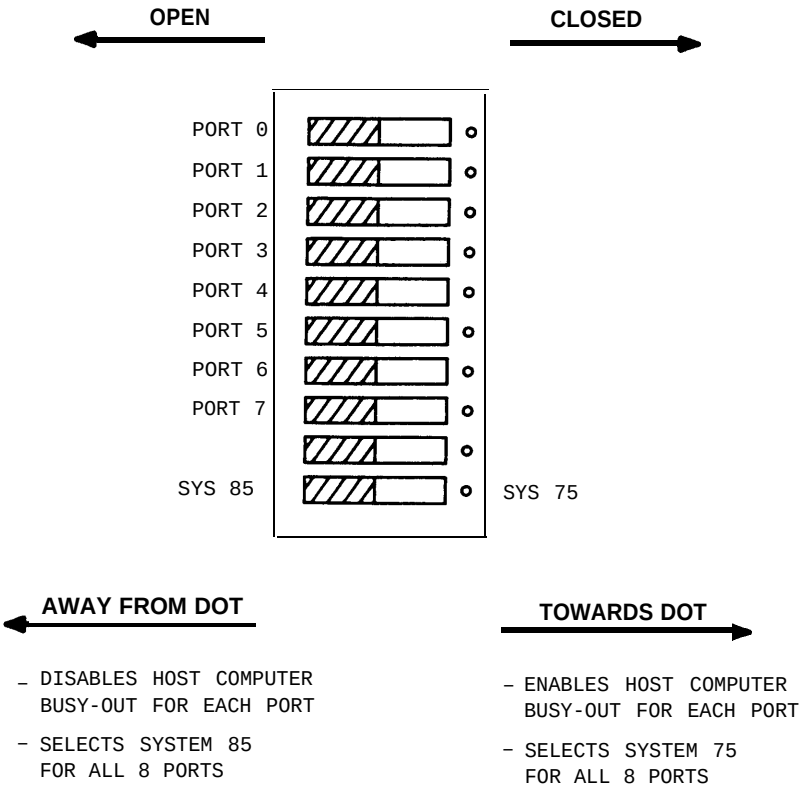


Figure 6. Option Switches and Functions

TABLE A. Option Switch Functions

Switch	Position (Note)	Function
PORT 0	CLOSED	Enables busy-out from host computer port for MADU port 0
	OPEN	Disables busy-out from host computer port for MADU port 0
PORT 1	CLOSED	Enables busy-out from host computer port for MADU port 1
	OPEN	Disables busy-out from host computer port for MADU port 1
PORT 2	CLOSED	Enables busy-out from host computer port for MADU port 2
	OPEN	Disables busy-out from host computer port for MADU port 2
PORT 3	CLOSED	Enables busy-out from host computer port for MADU port 3
	OPEN	Disables busy-out from host computer port for MADU port 3
PORT 4	CLOSED	Enables busy-out from host computer port for MADU port 4
	OPEN	Disables busy-out from host computer port for MADU port 4
PORT 5	CLOSED	Enables busy-out from host computer port for MADU port 5
	OPEN	Disables busy-out from host computer port for MADU port 5
PORT 6	CLOSED	Enables busy-out from host computer port for MADU port 6
	OPEN	Disables busy-out from host computer port for MADU port 6
PORT 7	CLOSED	Enables busy-out from host computer port for MADU port 7
	OPEN	Disables busy-out from host computer port for MADU port 7
Unlabeled	Either	Not used
SYS 75	CLOSED	Adapts all eight MADU ports for System 75
SYS 85	OPEN	Adapts all eight MADU ports for System 85

Note: "CLOSED" refers to the side of the option switch marked with dots or numbers. This side faces up when the circuit pack is in a vertical orientation.

"OPEN" refers to the side of the option switch that faces down (away from the dots or numbers) when the circuit pack is in a vertical orientation.

CABLING OPTIONS

The MADU provides flexible cabling in order to accommodate a wide variety of computer system and building wiring situations. Different building wiring and host computer cabling considerations are discussed in this chapter.

See your AT&T Account Executive to discuss options that may be applicable to your facility. Component order numbers for cables and adapters are listed in Table M in the Reference Material chapter.

BUILDING WIRING CONSIDERATIONS

The MADU's building wiring connection may terminate on a System 75 Data Line board, a System 85 EIA port board, or a Z3A ADU as shown in Figure 7. MADUs may also be connected back-to-back as shown in Figure 9. This section covers building wiring distance limitations and considerations for connecting the MADU to the System 75/85 switch, a Z3A ADU, or an MADU.

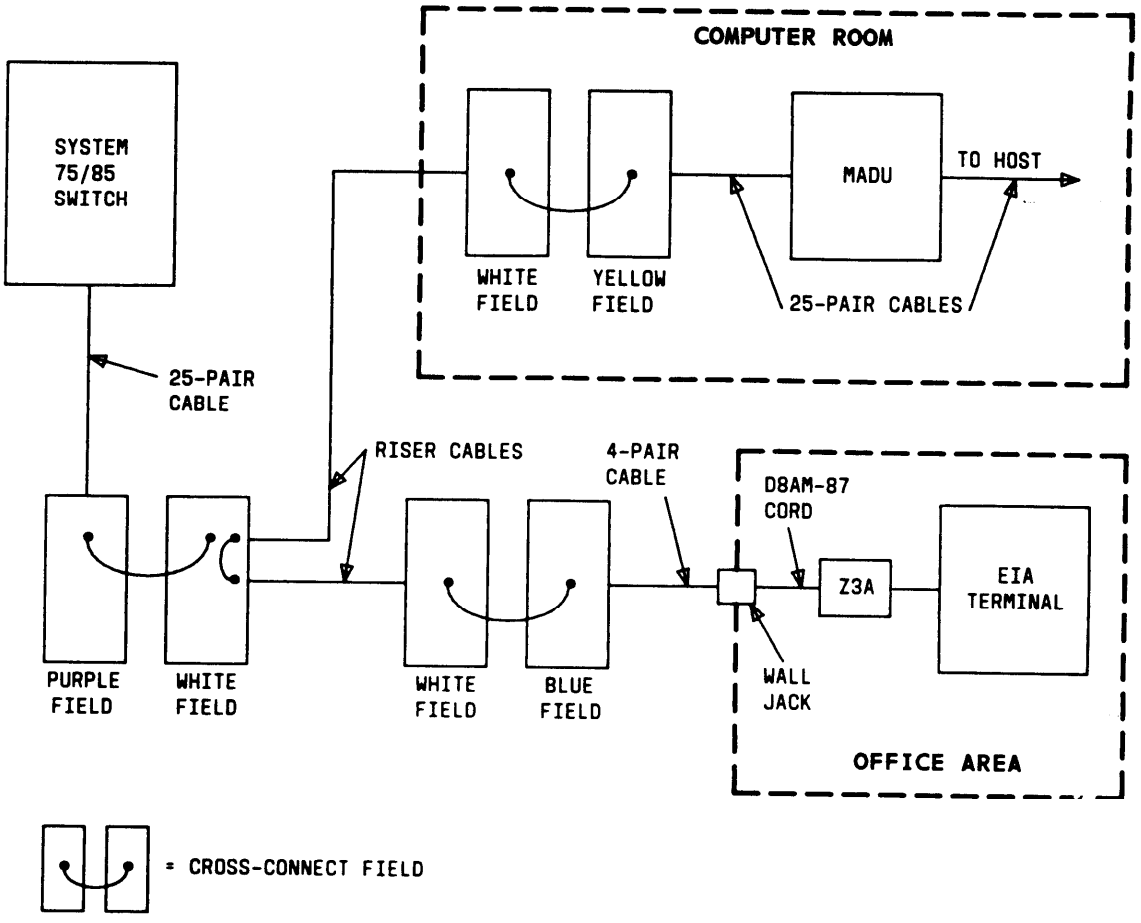


Figure 7. Building Wiring Connectivity and Cross-Connect Fields

Building Wiring Distance Limitations

Transmission speed and wire-gauge distance limitations from the MADU port to a System 75/85 port board, a Z3A ADU, or another MADU should be observed for all applications as listed in Table B. In the case of mixed wire sizes, use the specification for the smallest wire.

> **WARNING:** *The building wiring should not be run outside of the building. The MADU is not designed with outside lightning protection and other features that an outside wiring arrangement would require.*

TABLE B. Building Wiring Distance Limitations

Maximum Wiring Distance From MADU to Switch or ADU Device				
Transmission Speed	**24-Gauge (0.5-mm) Wire Maximum Distance**		**26-Gauge (0.4-mm) Wire Maximum Distance**	
19.2 kbps	2,000 feet	(610 meters)	2,000 feet	(610 meters)
9.6 kbps	5,000 feet	(1,524 meters)	4,500 feet	(1,372 meters)
4.8 kbps	7,000 feet	(2,134 meters)	6,000 feet	(1,829 meters)
2.4 kbps	12,000 feet	(3,658 meters)	10,000 feet	(3.048 meters)
1.2 kbps	20,000 feet	(6,096 meters)	16,000 feet	(4,877 meters)
300 bps	40,000 feet	(12,192 meters)	30,000 feet	(9,144 meters)

Building Wiring Options

The "TO BUILDING WIRING" connector on the MADU is always connected first to a short centerfeed-to-endfeed cable. This short cable is then attached to a longer cable leading to the cross-connect field. Considerations for connecting an MADU through the building wiring to a Z3A ADU, another MADU, or a System 75/85 port board are summarized in the following sections.

MADU Centerfeed-to-Endfeed Cables

- Required – Order Male or Female Endfeed Connectors.

Short centerfeed-to-endfeed cables are always required to provide electrostatic discharge protection and to ease cabling in the multiple-mount carrier. The centerfeed connector which attaches to the circuit pack is always a male connector. However. the cable may be ordered with a male or female end feed connector to conform to the standard building wiring cables used at your installation. Table M in the Reference Material chapter lists cable order codes.

Z3A ADU Hard-Wired Connections

- Required – D8AM-87 Crossover Cord.

An RS-232C device attached to a Z3A ADU may be connected to an MADU port directly through the building wiring (hard-wired). Because the MADU has eight ports, up to eight Z3A ADUs may be connected to a single MADU board. Figure 8 shows a sample Z3A ADU-to-MADU connection.

In the Z3A ADU application, a D8AM-87 modular crossover cord must be placed before the Z3A ADU at the terminal end of the connection. The crossover cord connects the receive pair of wires on the ADU to the transmit pair on the MADU and vice versa so data transfer may take place.

See the *Z3A Asynchronous Data Unit User Manual* (555-401-701) for details on Z3A ADU connections and component order codes.

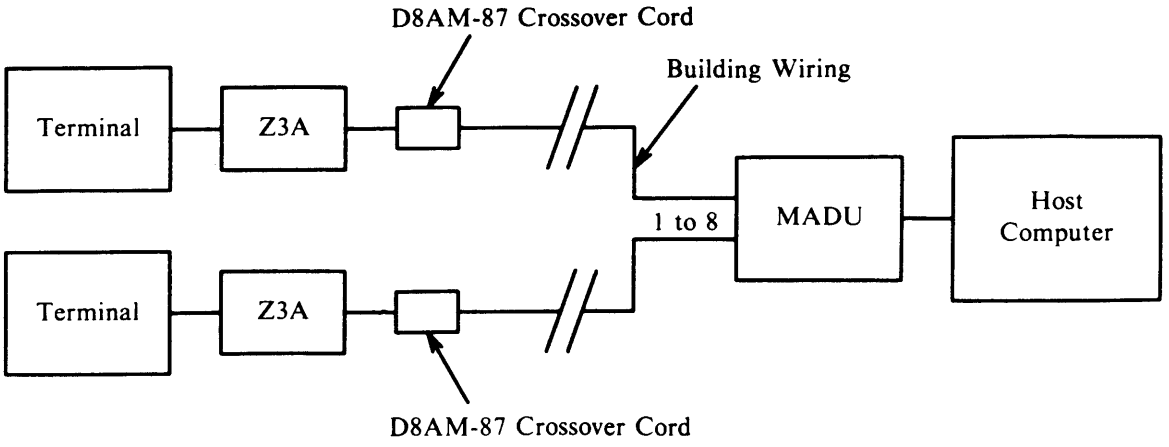


Figure 8. Sample Z3A ADU-to-MADU Connection

MADU Hard-Wired Connections

- Required – M32E Crossover Cable.

An MADU may be connected to another MADU directly through the building wiring (hard-wired). This allows eight RS-232C devices or eight ports on a computer to communicate directly with each other, bypassing the System 75/85 switch. Figure 9 shows a sample MADU back-to-back connection.

In an MADU hard-wired application, a M32E crossover cable must be attached to one of the MADUs. This 25-pair cable may then be attached to a standard 25-pair ("D"-type) cable for additional length if needed, or it may be connected directly to a cross-connect field leading to the building wiring. The crossover cable connects the receive wire pairs to the transmit pairs of the companion MADU so data transfer may take place.

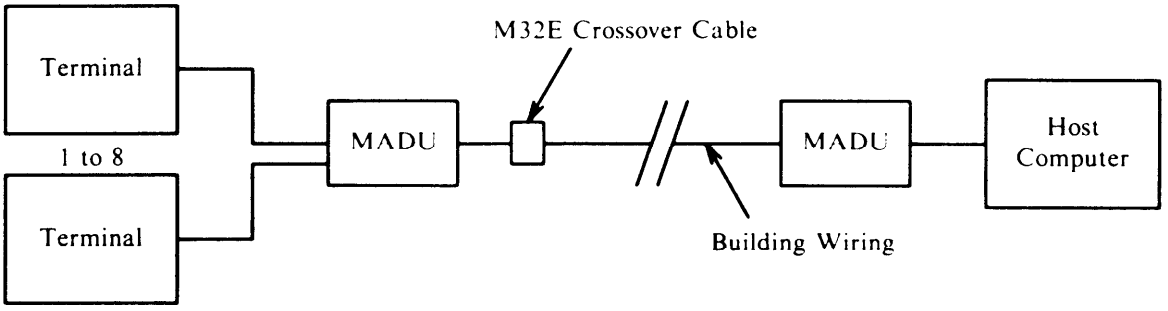


Figure 9. Sample MADU-to-MADU Connection

System 75/85 Connections

- Required – Correctly Translated Port Boards.

The MADU ports may be connected to a compatible digital port board on the System 75/85 switch through the cross-connect field. Port boards which maybe used with the MADU are listed in Table C. The switch port boards must be correctly installed and translated before they can be used. See the "References" section in the Reference Material chapter for system administration manuals.

TABLE C. System 75/85 Port Boards Required for MADU

System	Port Board	Number of Ports	Number of Boards Needed
75	TN726 Data Line Board	8	1 for each MADU board
85	SN238 EIA Port Board	4	2 for each MADU board

HOST COMPUTER CABLING OPTIONS

A variety of cabling options exist to adapt the MADU to the computer room environment. Several options appear in Figure 10. Figure 11 shows a modular host computer connection.

The MADU requires a centerfeed-to-endfeed cable and an octopus cable for all "TO HOST COMPUTER" connections. However, these cables may be ordered with different options to fit a variety of situations as discussed in the next section. The "TO HOST COMPUTER" connector may be attached to other RS-232C devices as well as computers. See the Overview for different applications.

Extender cables or adapters may also be used if needed for additional length, the computer-generated busy-out option, or modular host computer ports. Table M in the Reference Material chapter lists order codes for required and optional cables and adapters.

> **NOTE:** The MADU's "TO HOST COMPUTER" connector produces RS-232C signals. The total length of cabling from the MADU to the host computer should normally be within the EIA recommended distance of 50 feet (15 meters). although local conditions dictate the actual length that should be used for any connection. In many configurations, the distance from the MADU port to the host computer port could safely extend up to 175 feet (53 meters).

Required Cables

The MADU's 25-pair "TO HOST COMPUTER" connector is attached first to a short centerfeed-to-endfeed cable. The short cable is then connected (directly or indirectly) to an octopus cable which breaks the 25-pair cable down into eight RS-232C compatible 25-pin connectors. Both of these cables are required, but may be ordered with different options as described.

MADU Centerfeed-to-Endfeed Cables

- Required – Order Male or Female Endfeed Connectors.

The 2-foot (61-cm) centerfeed-to-endfeed cables are always required to provide electrostatic discharge protection and to ease cabling in the multiple-mount carrier. The centerfeed connector which attaches to the circuit pack is always a male connector, but the cable may be ordered with a male or female endfeed connector as required by the cable it connects to. You may attach an octopus cable (with a male 25-pair connector) or a 50-pin extender cable (customer supplied) to the short cable, depending on the needs of your particular application.

MADU Octopus Cable

- Required – Order M48C for DTE Host Interface or M48G for DCE Host Interface.

A 7-foot (2.1-meter) octopus cable is always required to connect the MADU to the host computer (or other RS-232C device). However, the type of octopus cable required depends on the RS-232C interface presented by the host computer or other RS-232C device as described.

- *DTE Device – M48C Required:* The MADU is a Data Communications Equipment (DCE) device. As such, it can directly interface with a host computer that presents a Data Terminal Equipment DTE interface. If your host computer is a DTE device, the M48C octopus cable should be used. Table I in the Reference Material chapter shows pin assignments for the M48C octopus cable.
- *DCE Device – M48G Required:* If the host computer presents a DCE interface to the MADU (another DCE device), an M48G crossover octopus cable must be used. The crossover cable reverses some of the leads so the MADU appears as a DTE device, allowing it to exchange data with the DCE host. Table J in the Reference Material chapter shows pin assignments for the M48G octopus cable.

Figure 10 shows the required MADU "TO HOST COMPUTER" connections using different types of cables. The "TO HOST COMPUTER" connector may also be attached to other RS-232C compatible devices if required (see the applications sections in the Overview).

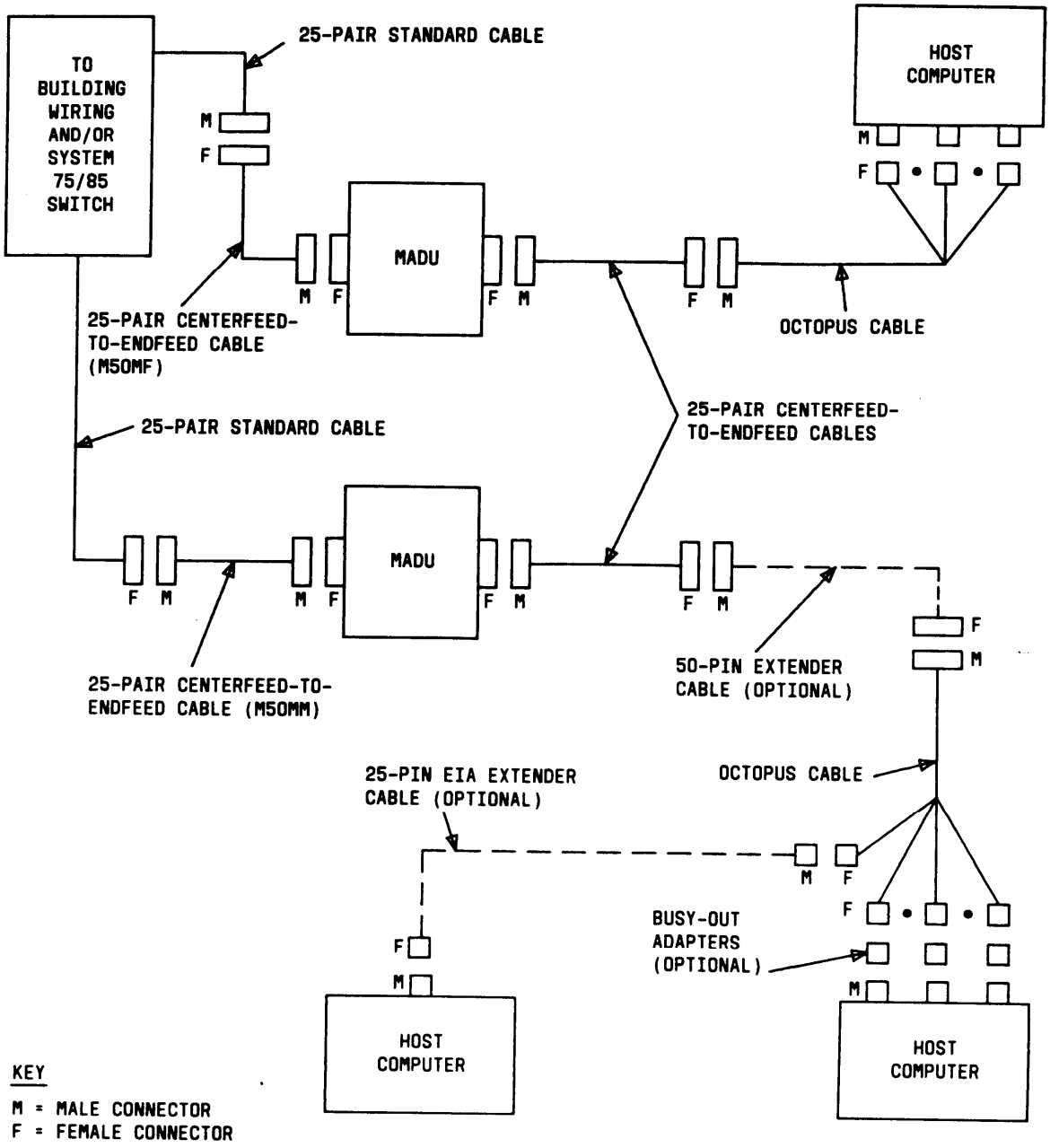


Figure 10. Host Computer Cabling Options

Optional Adapters and Cables

In addition to the required cables, you may attach extender cables for extra length as needed to allow the MADU to reach the desired computer(s). A busy-out adapter must be used if computer-generated busy-out is desired. Only host computers with 25-pin RS-232C type connectors support this option. Figure 10 shows the extended-length and busy-out options.

The MADU may also be attached to a host computer that uses 8-pin modular ports, such as an AT&T 3B2/300 computer. This connection requires a male modem connector to attached to the octopus cable, as shown in Figure 11. Each male modem connector is attached to the host port with an 8-pin modular cord.

This section describes busy-out adapters, extender cables, gender-changers, and modular host connections.

Busy-Out Adapters

- Optional – Order for Host Computer Busy-Out.

Before the host computer can busy-out a port, you must attach a 25-pin RS-232C busy-out adapter to the computer port. The busy-out adapter connects pins 18 and 25 on the host computer port to pin 22 in the octopus cable (or EIA extender cable, if attached), allowing the busy signal to be transmitted to the MADU port. Table K in the Reference Material chapter shows pin assignments for this adapter.

> **NOTE:** The computer-generated busy-out option cannot be used on host computers with 8-pin modular ports. These ports do not have enough pins to transmit a busy signal to the MADU.

The RS-232C adapter works for either the M48C or M48G octopus cables and may be ordered from a variety of vendors.

50-pin Extender Cables

- Optional – Order for Additional 25-Pair Cable Length.

The octopus cable is 7 feet (2.1 meters) long. If you need additional length from the MADU to reach the host computer, you may attach a 50-pin extender cable to the end of the centerfeed-to-endfeed cable before attaching it to the octopus cable.

The 50-pin extender cable should be a straight-through cable (no wire crossovers) with 25-pair amphenol connectors. It allows the signals from the MADU to be transmitted in a single cable until the host computer is near enough for an octopus cable to be attached. Suitable extender cables may be ordered from a variety of vendors.

EIA Extender Cables

- Optional – Order for Additional RS-232C Cable Length.

You may attach 25-pin EIA extender cables to the RS-232C connectors at the end of the octopus cable if extra length is needed at the host computer. For example, the host computer's ports may be too far apart, or one octopus cable must be connected to more than one host computer. The EIA extender cables should be straight-through cables (no wire crossovers). Suitable extender cables may be ordered from a variety of vendors.

Gender-Changer Adapter

- Optional – Order for Incompatible RS-232C Connectors.

An RS-232C connector on a computer, cable, or other device sometimes cannot attach directly to a required adapter or cable because both interfaces have the same gender (both have male or female connectors). To correct this problem, attach an appropriate 25-pin gender-changer to one of the connectors. Suitable adapters may be ordered from a variety of vendors.

Modular Host Computer Port Connection

- Optional – Order for Host Computer With 8-Pin Modular Ports.

The MADU may be attached to a host computer that uses 8-pin modular ports, such as an AT&T 3B2/300 computer. This connection requires a male modem connector and 8-pin modular cords to be attached to the octopus cable, as shown in Figure 11. Order numbers for these components are listed in Table M.

Due to the limited number of leads, this connection does not support computer-generated busy-out of the port. See the ***AT&T 3B2/300 Computer Extended Input/Output Capability Manual*** listed in the Reference Material chapter for pin assignments of the modular jack and the male modem connector.

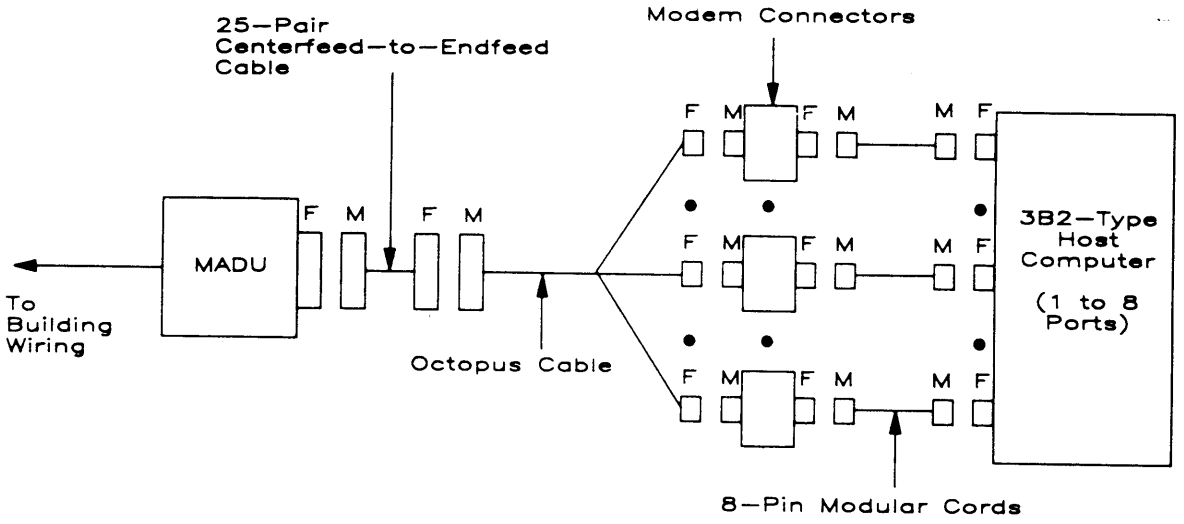


Figure 11. Modular Host Computer Port Connection

INSTALLATION PROCEDURES

This chapter describes installation of the Multiple Asynchronous Data Unit (MADU). The MADU may be installed in a stand-alone or multiple-mount setup. Not all required components are shipped with each MADU. Some parts are ordered separately to provide flexibility for installing the MADU. See your AT&T Account Executive to select cords and cables needed for your application.

> **NOTE:** This section covers the primary MADU application: host computer connections. Special applications (such as MADU connections to a terminal) are not discussed. See the Overview and Cabling Options chapters for details.

Before you begin:

- Obtain all required cables, adapters, and components as listed at the beginning of each section. Table M in the Reference Material chapter lists component order numbers.
- Review the Cabling Options chapter to be sure you understand the options and connections that are to be used at your installation.
- If you wish to access the System 75/85 switch, SN238 EIA port boards or TN726 Data Line boards must be installed and correctly translated.

> **WARNING:** *The MADU may not be used in Central Office (CO) applications or with exposed outside wiring.*

MADU STAND-ALONE MOUNTING INSTALLATION

A single MADU circuit pack may be installed in a stand-alone mounting, providing eight asynchronous data-port connections to a host computer or other RS-232C device. Correct wiring of the 25-pair cable through the building wiring or to the System 75/85 switch is assumed for this procedure. See the Reference Material chapter for cable and connector pin-assignment tables.

Component Checklist

The following components are required for a stand-alone mounting:

- MADU stand-alone unit (the 106A interface unit includes circuit pack. housing, decals, and power transformer with a 2-pair modular cord)
- Two centerfeed-to-endfeed cables (order with male or female endfeed connectors)
- 25-pair "D"-type connector cable to the building wiring (customer provided)
- Octopus cable (order an M48C for a DTE device or an M48G for a DCE device)
- *For More Than Four Units:* Power distribution box with an RF filter (customer provided)
- *Length Option:* 50-pin extender cable (customer provided)
- *Length Option:* 25-pin EIA extender cables (up to eight, one for each RS-232C octopus connector that is not to be directly connected to a host computer port) (customer provided)
- *Busy-out Option:* RS-232C busy-out adapter (one for each 25-pin host computer port) (customer provided)

- *Module Host Option:* Male modem connector and 8-pin modular cord (one set for each modular computer port) (customer provided).

Stand-Alone Mounting Installation Procedure

Use the following procedure to adjust the option switches if computer-generated busy-out is to be used or if the MADU ports are to be attached to System 75. If you do not need to adjust the option switches, go on to the next section.

> **WARNING:** *A grounding wrist strap must be worn when installing or removing circuit packs to protect them from damage caused by electrostatic discharge. The EMC wrist strap and cable assembly should be located in the System 75/85 module control cabinet.*

The following steps refer to Figure 12.

1. Pull down on the hinged front cover to reveal the faceplate and striker plates. (The front cover is held shut by magnets that adhere to the striker plates.)
2. Remove the screw from each of the two striker plates. Remove the striker plates.
3. Slide the circuit pack out of the stand-alone housing far enough to reveal the option switches.
4. Move the appropriate option switches towards the white dot or number (the closed position) to either:

   — Use the MADU with System 75, or

   — Enable busy-out from the host computer.

   The computer-generated busy-out option cannot be used if the host computer has modular (8-pin) ports. See the "Option Switches" section in the Physical Description chapter for details.
5. When the adjustments have been made, slide the circuit pack back into the housing.
6. Position the striker plates over the faceplate to serve as retainer brackets. Reinsert and tighten the two screws in the lower screw-hole on each side to hold the circuit pack securely in the housing.
7. Place the assembled unit in a horizontal position on a level surface.

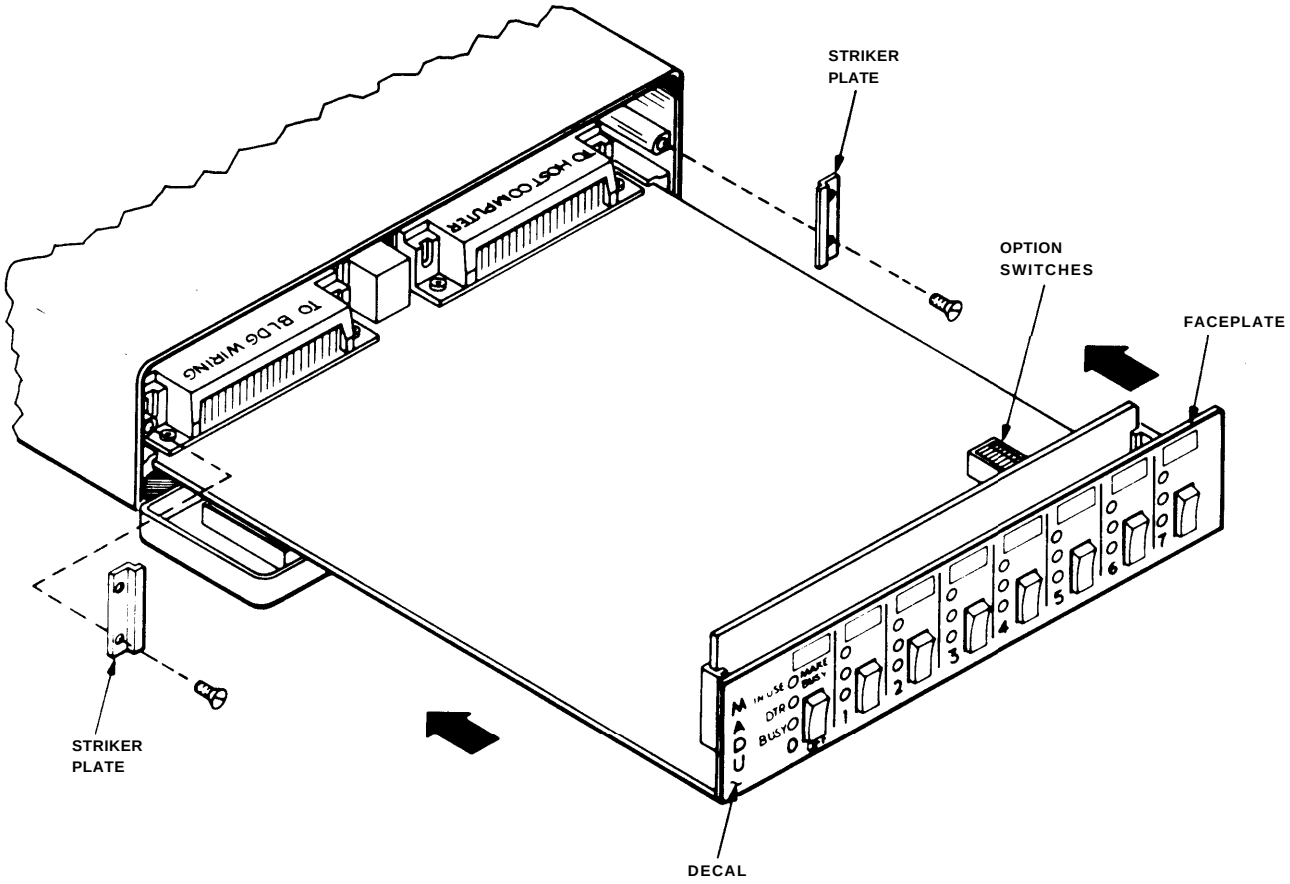


Figure 12. MADU Stand-Alone Mounting Assembly (Front View)

The following steps refer to Figure 13.

8. Attach the centerfeed connector on one of the short centerfeed-to-endfeed cables to the "TO BUILDING WIRING" connector at the rear of the unit. Snap the bail clips over the ends of the connector for strain relief.

9. Attach the endfeed end of the centerfeed-to-endfeed cable to a 25-pair cable that extends to the cross-connect field. (The wiring may connect to a Z3A ADU or MADU in a hard-wired connection, or it may connect to a System 85 EIA port board or System 75 Data Line board in a switched connection). Identify the port on the endfeed connector's label.

   NOTE: The centerfeed-to-endfeed cables are available with male or female endfeed connectors to attach to the standard cables used at your facility.

10. Attach the centerfeed connector on a short centerfeed-to-endfeed cable to the "TO HOST COMPUTER" connector at the rear of the unit. Snap the bail clips over the ends of the connector for strain relief. Use the label on the endfeed connector to identify the port.

11. *If more length is needed to reach the computer:* Attach a 50-pin extender cable to the short cable's endfeed connector.

12. Attach the 25-pair connector on the octopus cable to the endfeed end of the centerfeed-to-endfeed cable (or to the 50-pin extender cable if used).

    — *If the host computer has a DTE interface:* Use an M48C octopus cable.

    — *If the host computer has a DCE interface:* Use an M48G octopus cable.

13. The octopus cable terminates in eight RS-232C compatible 25-pin connectors. The connectors may be attached to the host computer system in two ways:

    — Attach the RS-232C connectors directly to the ports on the host computer.

    — Attach 25-pin EIA extender cables to the connectors on the octopus cable. This allows you to increase the distance from the MADU to the host computer, or to attach different connectors on the octopus cable to more than one host computer.

14. *To enable computer-generated busy-out:* For each port, attach an RS-232C busy-out adapter to the host computer's 25-pin port. The option switches on the MADU circuit pack must be set as described in the "Options Switches" section (if not already adjusted).

15. *To connect a modular host computer (not shown):* For each port, attach a male modem connector to the end of the octopus cable (or extender cable if used). Plug an 8-pin modular cord into the connector and then into the host computer port.

16. Attach the 2-pair modular power cord on the power transformer to the central "PWR" connector at the rear of the unit. Plug the power transformer into a 3-wire grounded 115-to-120 V 60-Hz ac wall outlet.

17. *To connect more than four power transformers to a single ac line:* Plug the transformers into a power distribution box with an RF filter. Plug the cord from the power distribution box into the ac wall outlet.

18. The MADU is now installed. See the Testing and Troubleshooting Procedures chapter to test the ports.

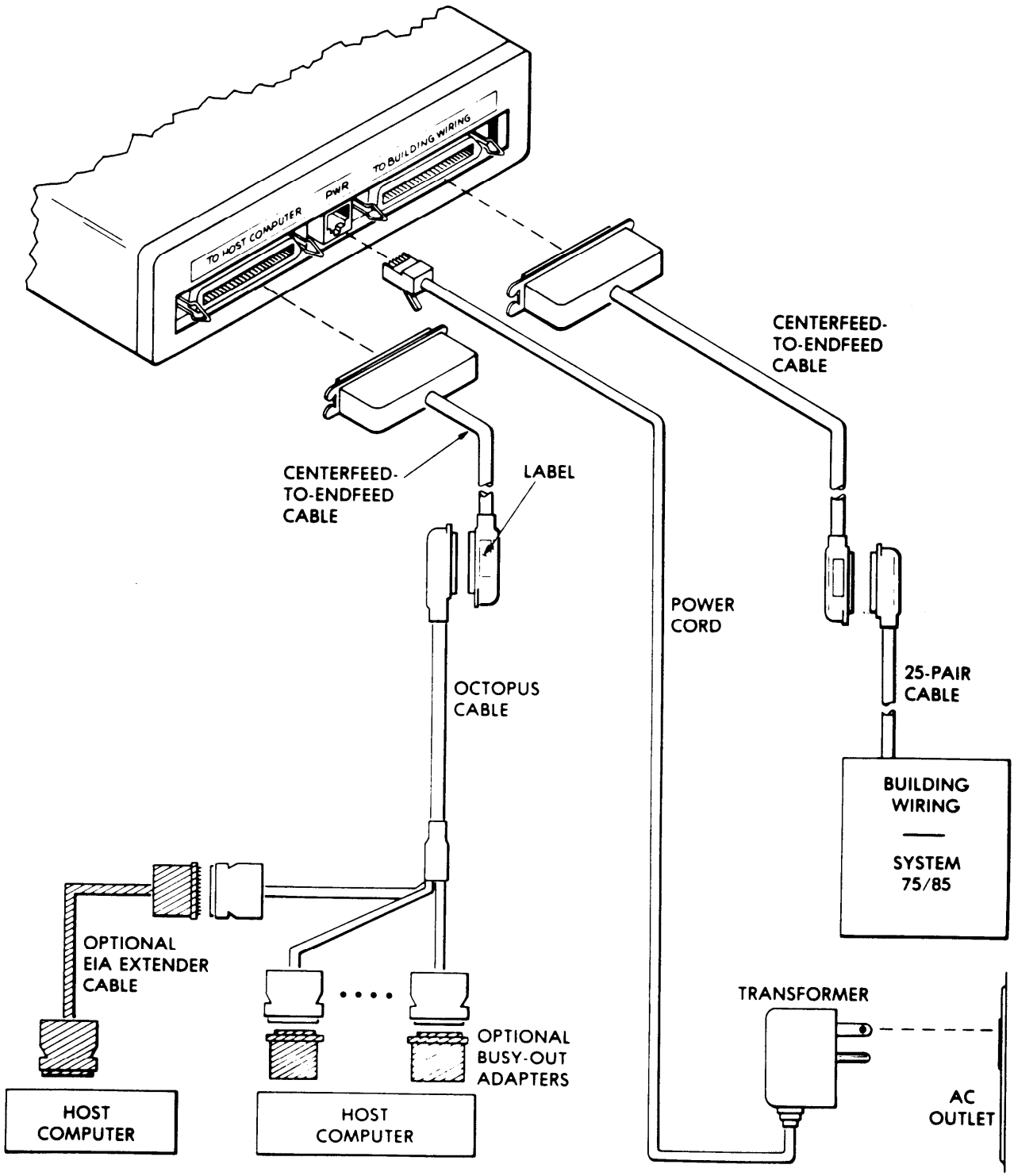


Figure 13. MADU Stand-Alone Mounting Installation (Rear view)

MADU MULTIPLE-MOUNTING INSTALLATION

Up to eight circuit packs may be inserted in one MADU multiple-mount carrier. The carrier may be placed in any cabinet or rack that measures 23 or 25 inches (58 or 63 cm) in width. Correct wiring of the MADU's 25-pair cable to the building wiring or switch is assumed for this procedure. See the Reference Material chapter for cable and connector pin-assignment tables.

Component Checklist

The following components are required to install the MADU in a multiple-mount carrier:

- MADU carrier (72A data mounting includes carrier, flanges, and side bracket)
- MADU BPP2 circuit packs (one to eight per carrier) (one power transformer with a 2-pair modular cord is provided with each circuit pack)
- Centerfeed-to-endfeed cables (two for each circuit pack) (order with male or female endfeed connectors)
- 25-pair "D"-type connector cables to the building wiring (one for each circuit pack) (customer provided)
- Octopus cables (one for each circuit pack) (order M48C cables for a DTE device or M48G cables for a DCE device)
- *Length Option:* 50-pin extender cables (one for each circuit pack) (customer provided)
- *Length Option:* 25-pin EIA extender cables (up to 64, one for each RS-232C octopus connector that is not to be directly connected to a host computer port) (customer provided)
- *Busy-Out Option:* RS-232C busy-out adapter (one for each 25-pin host computer port) (customer provided)
- *Modular Host Option:* Male modem connector and 8-pin modular cord (one set for each modular computer port) (customer provided)
- *Mounting Option:* 19-inch (48-cm), 23-inch (58-cm), or 25-inch (63-cm) rack or cabinet (customer provided).

Multiple-Mounting Installation Procedure

Use the following procedure to install the MADU multiple-mount carrier.

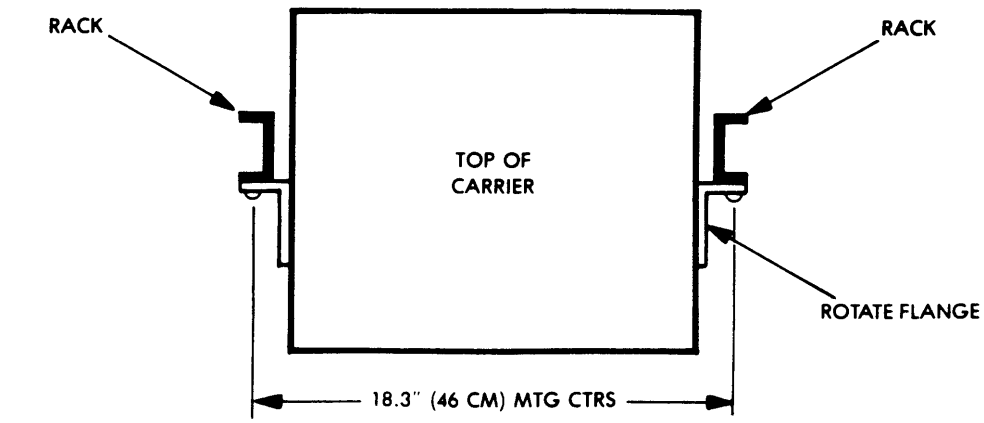
The following steps refer to Figure 14.

1. The carrier is shipped ready to be mounted in a 23-inch (58-cm) rack. If the rack or carrier is to be placed in a cabinet, the cabinet must be 23 inches (58 cm) or 25 inches (63 cm) wide to allow room for the cables.

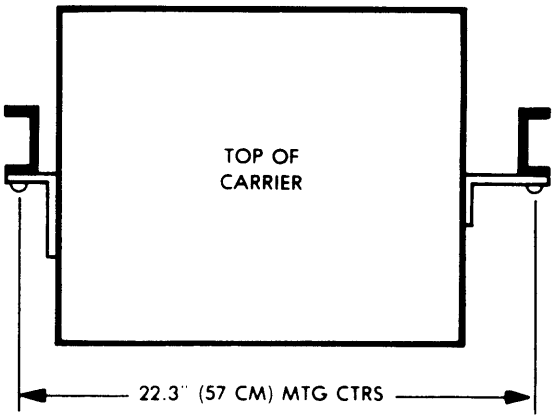
   For a 19-inch (48-cm) rack (no cabinet): Remove the flange on the right side of the carrier (as you face the front), and turn it so the long edge of the flange lies against the side of the carrier (the short side should stick out). Bolt the flange in place.

   For a 25-inch (63-cm) rack or cabinet): Remove the flange on the left side of the carrier (as you face the front), and turn it so the short edge of the flange lies against the side of the carrier (the longer side should stick out. notched side down). Bolt the flange in place.

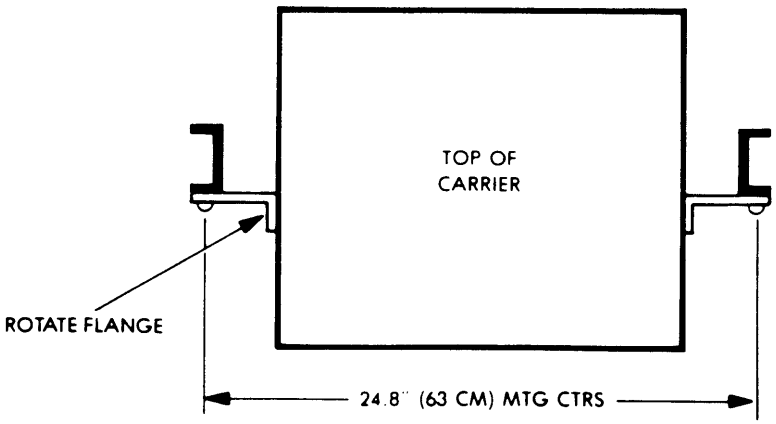
2. Insert two screws in the rack or cabinet as mounting bolts. Hang the carrier on the bolts and secure it with two more screws in each flange.



19-INCH MOUNTING: USE SHORT SIDES OF FLANGES



23-INCH MOUNTING: USE ONE LONG AND ONE SHORT FLANGE (AS SHIPPED)



25-INCH MOUNTING: USE LONG SIDES OF FLANGES

Figure 14. MADU Carrier Rack-Mount Variations

The following steps refer to Figure 15.

Use the following procedure to install MADU circuit packs.

> **WARNING:** *A grounding wrist strap must be worn when installing or removing circuit packs to protect them from damage caused by electrostatic discharge. The EMC wrist strap and cable assembly should be located in the System 75/85 control cabinet.*

3. Pull down on the top edge of the front gate to open the hinged front cover.
4. For each circuit pack, move the appropriate option switches towards the white dot or number (the closed position) to either:

   — Use the MADU with System 75, or

   — Enable busy-out from the host computer.

   The computer-generated busy-out option cannot be used if the host computer has modular (8-pin) ports. See the "Option Switches" section in the Physical Description chapter for details.
5. Place the first circuit pack to be installed in a vertical position so the text on the front panel reads correctly.
6. Align the circuit pack with the guide rails in the rightmost position of the MADU carrier (position number 1).

   > **NOTE:** Circuit packs should be installed from right to left to facilitate cable installation.

7. Slide the circuit pack into the carrier until the faceplate is stopped by the carrier.
8. Repeat this procedure to install the second circuit pack in the next position and so on, until all circuit packs for the carrier have been installed.
9. Close the front cover by swinging up the front gate until the mechanical latches engage.

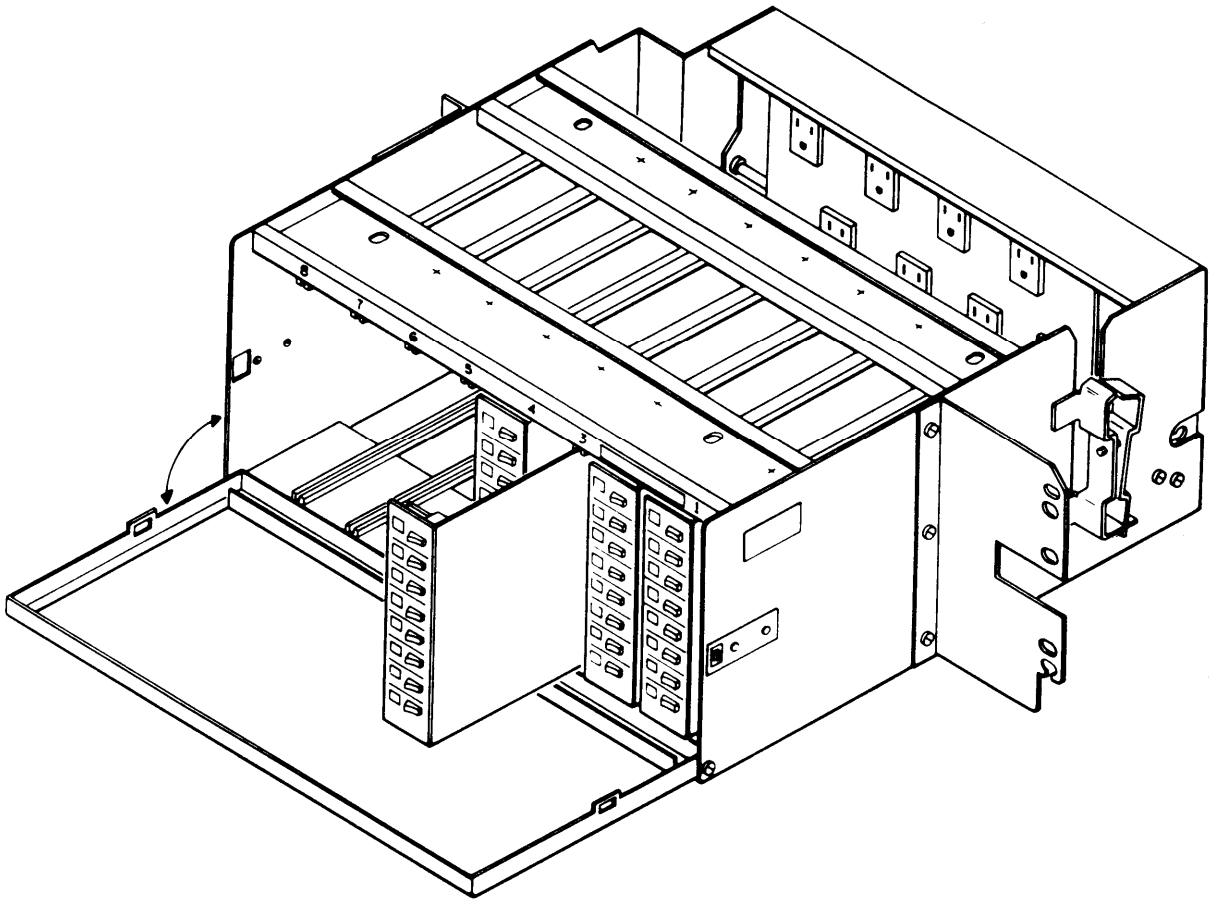


Figure 15. MADU Multiple-Mount Circuit Pack Installation (Front View)

The following steps refer to Figure 16.

Use the following procedure to attach cables and cords to the circuit packs.

10. Open the rear panel of the carrier by turning the pawl latch counterclockwise. Lower the hinged rear panel.

    CAUTION: *The power distribution box assembly makes the rear panel heavy.*

11. Unthread the screw that holds the reversible side bracket closed. Prop the bracket open on the "T" lock base.

12. *For four or fewer circuit packs:* Turn the reversible bracket sideways and remove it from the "T" lock. Reverse the bracket so the "1 TO 4 CABLES" side faces outward, and replace the bracket in the "T" lock. See the blow-ups of side bracket positions in Figure 16.

13. Attach the centerfeed connectors on the centerfeed-to-endfeed cables to the "TO BUILDING WIRING" connectors in the lower position of each circuit pack. Snap the bail clips over each end of the connectors for strain relief.

    NOTE: The centerfeed-to-endfeed cables are available with male or female endfeed connectors to attach to the standard cables used at your facility.

14. Feed the cables through the notch at the left side of the carrier (looking from the rear) and through the lower half of the open side bracket. Label the cables as you go so you can tell which cable goes to which MADU circuit pack (use the label on the endfeed connector).

15. When all the "TO BUILDING WIRING" cables are installed, reinsert the screw in the side bracket and partially tighten it, leaving an opening for cables to be inserted in the top half of the bracket.

16. Plug a power transformer into each outlet in the power distribution box, located on the rear panel of the carrier. Outlets are numbered to correspond to each circuit pack.

17. Plug the 2-pair modular cord attached to each transformer to the central modular connector on the corresponding circuit pack.

18. Attach the centerfeed connectors on the centerfeed-to-endfeed cables to the "TO HOST COMPUTER" connectors in the upper position of each circuit pack. Snap the bail clips over each end of the connectors to provide strain relief.

19. Feed the cables through the notch at the left side of the carrier and through the upper half of the open side bracket. Label the cables as you go so you can tell which cable goes to which MADU circuit pack (use the label on the endfeed connector).

20. When all the cables for the circuit packs are installed, tighten the screw in the side bracket. This holds the cables securely in two bundles and provides strain relief.

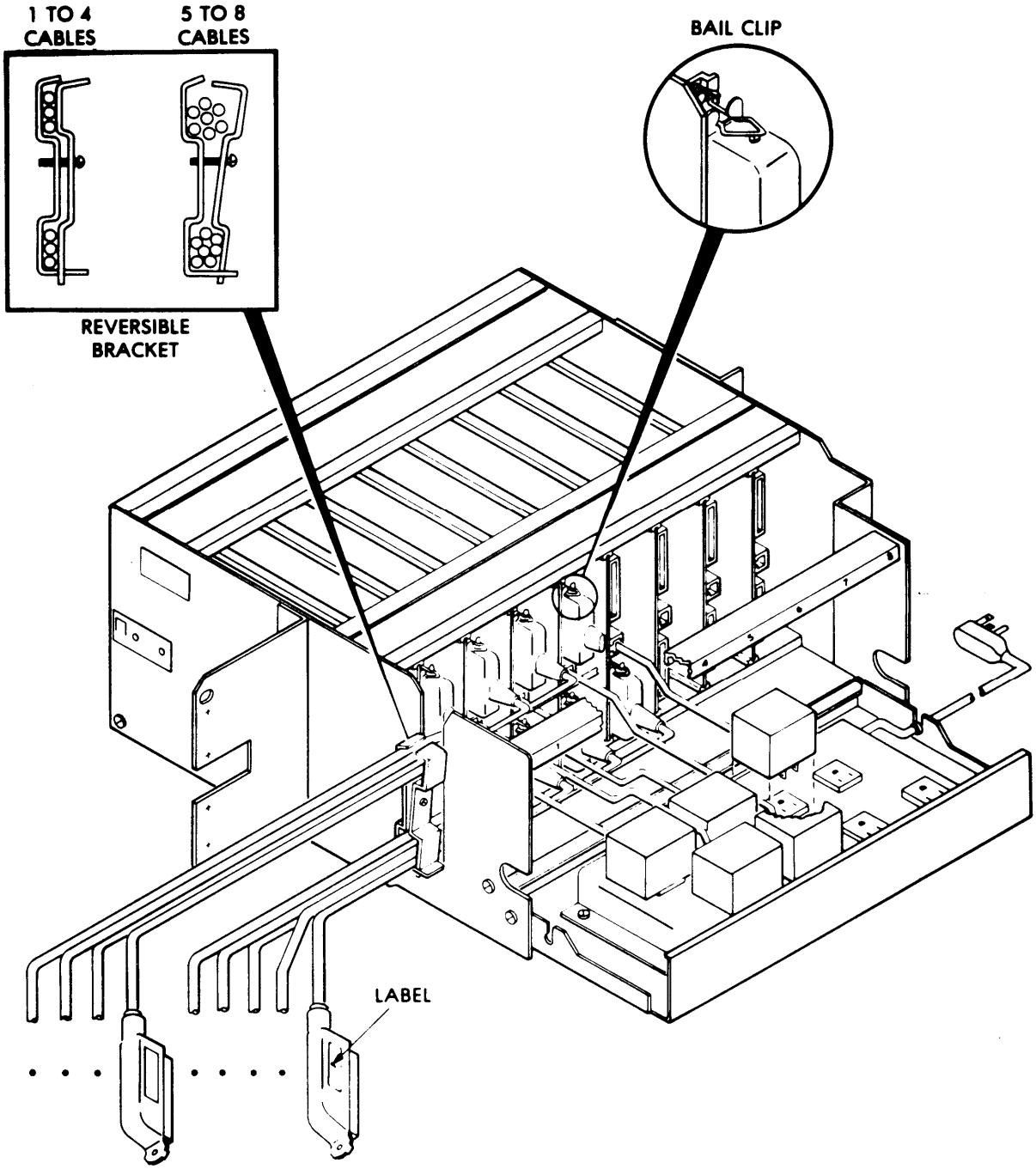


Figure 16. MADU Multiple-Mount Circuit Pack Installation (Rear View)

The following steps refer to Figure 17.

Use the following steps to run cables from the carrier to the building wiring and host computer.

> **NOTE:** The cables coming out of the side of the carrier are arranged in two bundles by the reversible side bracket The upper bundle contains labeled cables for the host computer, and the lower bundle contains labeled cables for the building wiring.

21. Attach 25-pair "D"-type connector cables to the end of each of the building wiring cables in the lower bundle outside of the carrier.

    > **NOTE:** The other end of the 25-pair cables should be attached to the cross-connect field. The wiring may connect to a Z3A ADU or MADU in a hard-wired connection, or it may connect to a System 85 EIA port board or System 75 Data Line board in a switched connection.

22. *If more length* is *needed to reach the host computer:* Attach 50-pin extender cables to the endfeed end of the centerfeed-to-endfeed cables in the upper bundle outside of the carrier.

23. Attach the 25-pair connectors on the octopus cables to the endfeed end of each of the centerfeed-to-endfeed cables in the upper bundle outside of the carrier (or to the 50-pin extender cables if used).

    — *If the host computer has a DTE interface:* Use an M48C octopus cable.

    — *If the host computer has a DCE interface:* Use an M48G octopus cable.

24. The octopus cables terminate in eight RS-232C compatible 25-pin connectors. The connectors may be attached to the host computer system in two ways:

    — Attach the RS-232C connectors directly to the ports on the host computer.

    — Attach 25-pin EIA extender cables to the connectors on the octopus cable. This allows you to increase the distance from the MADU to the host computer, or to attach different connectors on the octopus cable to more than one host computer.

25. *To enable computer-generated busy-out:* For each port, attach an RS-232C busy-out adapter to the host computer's 25-pin port. The option switches on the MADU circuit pack must be set as described in the "Options Switches" section (if not already adjusted).

26. *To connect a modular host computer (not shown):* For each port, attach a male modem connector to the end of the octopus cable (or extender cable if used). Plug an 8-pin modular cord into the connector and then into the host computer port.

27. Plug the power cord attached to the power distribution box into a 3-wire grounded 115-to-120 V 60-Hz ac outlet in the cabinet's power strip.

28. To test the MADU ports, see the Testing and Troubleshooting Procedures chapter.

29. When the installation and testing is complete, close the rear panel of the carrier and turn the knob until it latches.

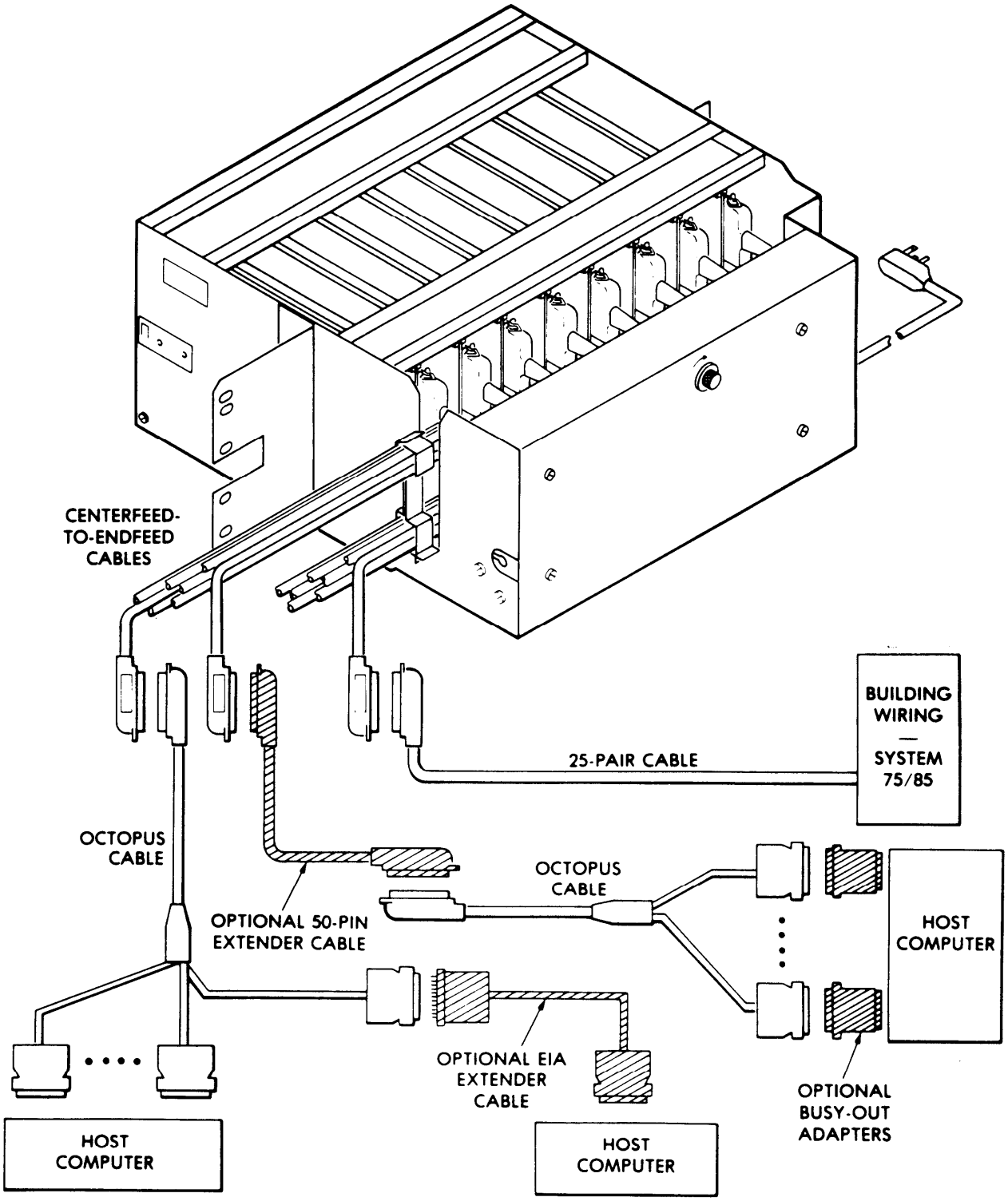


Figure 17. MADU Multiple-Mount Cable Installation (Rear View)

TESTING AND TROUBLESHOOTING PROCEDURES

This chapter describes the procedures used to test the Multiple Asynchronous Data Unit (MADU) after it has been installed. Busy-out procedures may be used to take ports attached to the System 75/85 switch out of service during testing. Troubleshooting procedures, option switch considerations, LED status lights, and signal levels are also discussed. If needed, contact your AT&T Service Representative for replacement parts or assistance.

TESTING AND BUSY-OUT PROCEDURES

To ensure your equipment is operating correctly, tests may be run to check the health of the equipment and to identify and isolate problems that may occur. You can take a port out of service to conduct tests, or leave a faulty port busied-out until it can be repaired. These procedures are described in this section.

Port Busy-Out Procedures

The "make-busy" signal takes a port attached to the System 75/85 switch out of service, making it inaccessible to remote devices. A port may be busied out in order to perform testing on the host computer or MADU. A faulty computer port may be busied out until it can be repaired.

To busy-out a port, use one of the following methods:

1. *Manual:* Press the MK BUSY (make-busy) rocker switch on the front of the circuit pack. This busies out any RS-232C device attached through an MADU to the switch.
2. *Computer-Generated:* Drive pin 18 or pin 25 (busy) of the host computer's RS-232C port high.

For the *computer-generated busy-out* option to work, the following conditions must be met:

1. The make-busy option switches on the MADU circuit pack must be set to the closed position (towards the white dot or number). See the "Option Switch Settings" section in this chapter for details.
2. An RS-232C busy-out adapter must be attached to the 25-pin computer port to transmit the busy signal to the MADU.

> **NOTE:** A modular host computer port does not support the computer-generated busy-out option, because all eight pins are needed for other signals.

The red LED (BUSY) lights to show that the port is busied out. On System 75, an MADU port is busied out by dropping the Data Terminal Ready (DTR) line. On System 85, a port is busied out by sending a constant space.

> **CAUTION:** *The port busy-out procedure works only for MADU ports attached to System 75/85. If MADU ports are attached to a Z3A ADU or MADU directly through the building wiring, the busy signal may only interfere with data transmission (the port is not busied out, as this is a switch function).*

Building Wiring Test

After the MADU is installed, the connections through the switch and/or building wiring should be checked by making a call to each MADU port. Procedures for testing switch-connected or hard-wired MADUs are in this section.

Switch Connection Test

The connections from an MADU through the building wiring and switch can be checked using the following steps. A telephone or RS-232C terminal may be used for this test.

1. Busy-out all ports on the MADU except the one you intend to test. Use the MK BUSY switches on the circuit pack.
2. *On a telephone:* Dial the computer port connected to the MADU. When you hear the carrier tone, the building wiring connection is verified.

   On a terminal: Dial the computer port connected to the MADU. When the computer answers the call, the building wiring connection is verified. You may check for correct data transmission and reception at this time by beginning a computer session.
3. When a good connection is verified, end the call by hanging up the telephone or disconnecting the terminal call.
4. Busy-out the MADU port you just tested. Take the next port you wish to test out of the busy state and repeat the testing procedure.

Hard-Wired Connection Test

The MADU may be hard-wired to another MADU or several Z3A ADUs directly through the building wiring. The MADU ports are dedicated in this connection and must be tested individually.

1. *Z3A ADU:* To test each Z3A ADU connection to an MADU, you need a terminal connected to a Z3A ADU. The ADU must be connected with a D8AM-87 crossover cord to a wall jack leading to the building wiring.

   MADU: To test a back-to-back MADU connection, you need an ASCII terminal. Attach the terminal to an arm of the octopus cable at one of the MADUs.
2. Enter the command needed to access the remote device attached to the MADU port on the far end (press BREAK, RETURN, etc.).
3. When the remote device returns a prompt or message, the building wiring connection is verified. You may check for correct data transmission and reception at this time by beginning a computer session.
4. When a good connection is verified, end the call. Disconnect the terminal if needed to test another port.
5. Test the next Z3A ADU port (it may be in another room) or hook up the next arm on the octopus cable to the terminal until all ports on the remote MADU have been tested.

If you cannot establish a good connection through an MADU, either the MADU port, computer port, System 75/85 port board, or building wiring may be faulty. See the "Troubleshooting Procedures" section to isolate the cause of the problem.

TROUBLESHOOTING PROCEDURES

If you have a problem making or maintaining a connection through an MADU, use the following procedures to help isolate the problem. Option switch problems, signal levels, and problems indicated by the LED status lights are listed in the following sections.

Hardware Problems

Use the following list to help identify problems with ports, circuit packs, cables, or wiring.

1. *Check the MADU board:*

   To determine if the MADU board is causing a problem, check the signal levels of the circuit pack to see if they are correct (see the "Signal Levels" section in this chapter). You may also exchange the MADU board with a known good MADU board and see if the problem is corrected. If the problem persists with a known good board, there may be a problem in the building wiring or host computer connection.

2. *Check the building wiring:*

   If a known good MADU board does not work, the building wiring is probably faulty. If the nonworking board is in a multiple-mount carrier, exchange cables with a working board in the same carrier, then test the good board. If the second (good) board now fails to work, suspect the building wiring. Check the cross-connect field(s). See Table F in the Reference Material chapter for connector pin assignments.

3. *Check the System 75/85 port board:*

   If the MADU is attached to an EIA port board or Data Line board on the System 75/85 switch, check the port board wiring and make sure the board is installed in the correct slot. You may also exchange the port board with a known good board to see whether the port board or the wiring is the problem.

4. *Check the host computer port:*

   Exchange the nonworking RS-232C connector at the end of the octopus cable with a working connector on another arm. If the second (good) octopus connector fails to work, suspect a problem with the host computer port.

5. *The MADU does not exchange data with a host computer port:*

   Check the RS-232C interfaces. If the host computer (or other RS-232C device) presents a DCE interface, an M48G octopus cable must be used. If the host is a DTE device, an M48C octopus cable should be used. Tables I and J in the Reference Material chapter show pin assignments for these cables.

6. *A hard-wired MADU does not exchange data with another MADU:*

   Check if an M32E crossover cord is connected to an MADU at one end of the connection. Without a crossover cord, data transmission between hard-wired MADUs cannot take place.

7. *A hard-wired MADU does not exchange data with a Z3A ADU:*

   Check if a D8AM-87 crossover cord is connected at the Z3A ADU end of the connection. Without a crossover cord, data transmission between an MADU and ADU cannot take place. See the *Z3A Asynchronous Data Unit User Manual* (555-401-701) for details.

Dialing Problems

The following list covers dialing and disconnect problems that may occur when terminals access the switch through an MADU. See the Z3A user manual and user reference card listed in the "References" section for dialing procedures.

- *Occasional character errors appear on the screen:*

  Parity may be incompatible with the System 75/85 port board. Disable parity on your terminal.

- *You do not get a "DIAL:" prompt after pressing BREAK to begin a call:*

  Autobaud may be enabled on the port board. Press BREAK, then press the carriage return within 2 seconds. A "DIAL:" prompt should appear.

  NOTE: If the "DIAL:" prompt is modified, the wrong parity was selected. Keep pressing the return key until you receive a clean "DIAL:" message.

- *A garbled message (or nothing) appears on the screen when you try to dial:*

  1. The wrong baud rate may be selected. Check your terminal options to make sure your terminal is set to a compatible baud rate (300, 1200, 2400, 4800, 9600, or 19,200 bps).
  2. If the terminal's baud rate is compatible, you may be out of synchronization with the port board. Press BREAK to disconnect the call. Wait 5 seconds, then press BREAK followed by a carriage return within 2 seconds. A clean "DIAL:" message should appear.
  3. If you still cannot make a connection, autobaud on the EIA port board may not be enabled. Set your terminal to each of the compatible baud rates in turn and redial.
  4. If the fixed baud rate test does not work. the port board or the MADU may be faulty. See the other testing procedures in this chapter.

- *The call does not disconnect:*

  You may be using the wrong disconnect option. Try the following:

  1. *Long Break (System 75 and System 85):* If your terminal can produce a long break signal, hold the BREAK key down at least 2 seconds.
  2. *Short Break on System 75:* Press BREAK twice within 1 second. You can set the short break option through the user options menu. To access the menu, press BREAK (or BREAK and return) to get a new "DIAL:" prompt, then press BACKSPACE or CTRL-H.
  3. *Short Break on System 85:* Press BREAK three times within 2 seconds.
  4. *Drop DTR:* Turn the terminal off.

- *The message "ANSWERED" is followed by no response.*

  The connection was made at a different baud rate. Change the baud rate to match that of the System 75/85 port board or endpoint.

- *The message "ANSWERED" is followed by "DISCONNECTED":*

  The called device was a nondata endpoint.

- *The message "CHECK OPTIONS" or "INCOMPATIBLE FAR END" appears:*

  The endpoint's options are incompatible with the port or terminal options. Check the remote device's requirements and reset your options before redialing.

- *The message "DENIED" appears:*

  You dialed an invalid extension or waited too long to dial. Check that you dialed the correct number. Whenever you dial a number, you must enter each character within 10 seconds of the previous one or the switch times out.

Option Switch Settings

If you experience problems with the MADU after installation, check that the option switches are set correctly for your system. A few option-switch related problems appear in the following list. See the "Option Switches" section in the Physical Description chapter for more information.

- *Busy-out from the host computer does not work:*

  1. Check that the "PORT 0" to "PORT 7" option switches are set in the closed (up) position (towards the white dot or number). These switches are originally set in the open position to disable host computer busy-out.
  2. If the option switches are in the correct position, make sure an RS-232C busy-out adapter is attached between the 25-pin host computer port and the octopus cable connector to provide the physical connection.

- *All the MADU ports are busied out when the circuit pack is first powered on:*

  The host computer may be driving pin 22 high. Without an RS-232C busy-out adapter, this sends a signal that the MADU interprets as a busy signal. Make sure the "PORT 0" to "PORT 7" option switches are set in the closed (down) position.

- *The MADU ports do not interact correctly with the System 75/85 switch:*

  Check that the end option switch is set to "SYS 85" if the MADU is to access a System 85 EIA port board, or set to "SYS 75" if the MADU is to access a System 75 Data Line board.

LED Status Lights

The status of each MADU port is displayed by the LEDs associated with that port. For all ports, red indicates a BUSY signal is being sent, green indicates a Data Terminal Ready (DTR) signal is present, and yellow indicates a call is in progress (IN USE). Different combinations of these lights may indicate a problem with the MADU. The port status and possible error conditions indicated by the LED lights are listed in Table D.

TABLE D. LED Status Lights for MADU Ports

LEDs	Condition	Status
All OFF	FAULT if powered on	The port is not in use or busied out. If the circuit pack is powered on, the lack of a green DTR light indicates a fault condition with the host computer port (or other RS-232C device).
Red (BUSY) ON (Green off) (Yellow off)	FAULT on System 85 BUSY on System 75	The port is busied out, preventing remote devices from accessing the faulty port through the System 75/85 switch. The lack of a green DTR light on System 85 indicates a fault condition with the host computer port.
Red (BUSY) ON Green (DTR) ON (Yellow off)	BUSY on System 85	The port has been busied out, either manually with the MK BUSY switch or through the host computer on pin 18 or 25. The green DTR light indicates the host computer is also driving DTR high (possible on System 85 only).
Green (DTR) ON (Red off) (Yellow off)	NORMAL	The port is not in use or busied out. The port is ready for use because the green LED indicates the host is driving DTR high.
Green (DTR) ON Yellow (IN USE) ON (Red off)	NORMAL	The port is currently in use and the host computer is driving DTR high. This is the normal condition for a call in progress.

Signal Levels

If a circuit pack appears to be malfunctioning, you may check the signal levels to try to determine if the problem is in the MADU board. RS-232C signals may be checked on the circuit pack's "TO HOST COMPUTER" connector using a volt meter. See Table G in the Reference Material chapter for the pins to check.

RS-232C signals may also be checked at the 25-pin octopus cable connectors using a commercially available RS-232C break-out box. Table E shows correct signal levels for an M48C octopus cable.

TABLE E. MADU Power and Signal Levels (M48C Octopus Cable)

Pin No.	Signal	Level	Function
1, 7	GND	Ground	Protective and Signal Ground
2	TD	Active High/Low	Transmit Data
3	RD	Active High/Low	Receive Data
20	DTR	Active High	Data Terminal Ready
22	BUS	Active High (if busy) or Low	Make Busy

NOTE: Signals for an M48G octopus cable are slightly different (DTR is on pins 5, 6, and 8). See Table J in the Reference Material chapter for M48G cable pin assignments.

REFERENCE MATERIAL

This chapter contains additional information about the Multiple Asynchronous Data Unit (MADU). Technical specifications, pin-assignment tables, component order numbers, administration and maintenance procedures, acronyms, and additional references are included.

TECHNICAL SPECIFICATIONS

Technical specifications about the MADU circuit board, housings, and power requirements are provided below for quick reference.

MADU Circuit Pack

Length: 11.3 inches (28.7 cm)
Width: 1.65 inches (4.2 cm)
Height: 7.67 inches (19.5 cm)
Weight: 1 pound (0.5 kg)

Multiple-Mount Carrier

Length: 18.1 inches (46 cm)
Width: 17.4 inches (44.2 cm)
Height: 8.7 inches (22.1 cm)
Weight: 19 pounds (8.7 kg)
(includes power distribution box)

Single-Unit Housing

Length: 12 inches (30.5 cm)
Width: 8.75 inches (22.2 cm)
Height: 2.75 inches (7 cm)
Weight: 2.5 pounds (1.1 kg) (board included)

Environment

Temperature: 40 to 110°F (4 to 49°C)
Humidity: 5 to 95 percent (noncondensing)

Power

Each MADU circuit pack is powered from an individual transformer which is plugged into an ac power source. The transformer may be plugged directly into a wall outlet for four or fewer units. For more than four MADU packs, transformers should be plugged into a multiple-mount carrier's power distribution box or a commercially available power strip with an RF filter.

Power Distribution Box Contains:	Built-in RF filter and 6-ampere circuit breaker
Power Distribution Box Cord:	6.5-foot (2-meter) power cord with IEC connector
A Multiple-Mount Requires:	Up to 1.6 amps (0.2 amps × 8 boards)
One Circuit Pack Requires:	+5 V and –5 V dc power (no more than 3 watts)
One Transformer Requires:	0.2 amps from a 115-to-120 V 60-Hz ac power source
One Transformer Provides:	20 V ac at 0.73 amps to each circuit pack
One Transformer Weighs:	0.8 pounds (0.3 kg)
Transformer Cord:	7-foot (2.1-meter) modular cord

PIN ASSIGNMENT TABLES

This section contains tables listing the pin assignments for MADU circuit pack connectors, octopus cables, busy-out adapter, and crossover cables. Table M at the end of this section lists component order numbers for the MADU.

TABLE F. MADU "TO BUILDING WIRING" Connector Pin Assignments

Pin No. (Note 1)	Pair No. (Note 2)	Signal	MADU Port	Function (Note 3)
26, 1	1	–		N/C
27, 2	2	R1, R2	0	Receive Pair
28, 3	3	S1, S2	0	Transmit Pair
29, 4	4	–		N/C
30, 5	5	R1, R2	1	Receive Pair
31,6	6	S1, S2	1	Transmit Pair
32, 7	7	–		N/C
33, 8	8	R1, R2	2	Receive Pair
34, 9	9	S1, S2	2	Transmit Pair
35, 10	10	–		N/C
36,11	11	R1, R2	3	Receive Pair
37, 12	12	S1, S2	3	Transmit Pair
38, 13	13	–		N/C
39, 14	14	R1, R2	4	Receive Pair
40, 15	15	S1, S2	4	Transmit Pair
41, 16	16	–		N/C
42, 17	17	R1, R2	5	Receive Pair
43.18	18	S1, S2	5	Transmit Pair
44, 19	19	–		N/C
45, 20	20	R1, R2	6	Receive Pair
46,21	21	S1, S2	6	Transmit Pair
47, 22	22	–		N/C
48, 23	23	R1, R2	7	Receive Pair
49, 24	24	S1, S2	7	Transmit Pair
50, 25	25	–		N/C

Notes:

1. These pins carry the signals from the MADU to the cross-connect field. NOTE: The first pair in each set (e.g., pins 26 and 1) is not connected (N/C).
2. Pins correspond to these pairs at the cross-connect field.
3. Signals are referenced to the MADU circuit pack (transmitted by or received to the MADU). Signals R1 and R2 are the receive pair, and S1 and S2 are the send (transmit) pair.

TABLE G. MADU "TO HOST COMPUTER" Connector Pin Assignments

Pin No.	Signal (Note 1)	Port	Cord Arm (Note 2)	Pin No.	Signal (Note 1)	Port	Cord Arm (Note 2)
1	GND	0	1	13	GND	4	5
2	CTS/DSR/CD	0	1	14	CTS/DSR/CD	4	5
3	TD	0	1	15	TD	4	5
26	RD	0	1	38	RD	4	5
27	BUS	0	1	39	BUS	4	5
28	DTR	0	1	40	DTR	4	5
4	GND	1	2	16	GND	5	6
5	CTS/DSR/CD	1	2	17	CTS/DSR/CD	5	6
6	TD	1	2	18	TD	5	6
29	RD	1	2	41	RD	5	6
30	BUS	1	2	42	BUS	5	6
31	DTR	1	2	43	DTR	5	6
7	GND	2	3	19	GND	6	7
8	CTS/DSR/CD	2	3	20	CTS/DSR/CD	6	7
9	TD	2	3	21	TD	6	7
32	RD	2	3	44	RD	6	7
33	BUS	2	3	45	BUS	6	7
34	DTR	2	3	46	DTR	6	7
10	GND	3	4	22	GND	7	8
11	CTS/DSR/CD	3	4	23	CTS/DSR/CD	7	8
12	TD	3	4	24	TD	7	8
35	RD	3	4	47	RD	7	8
36	BUS	3	4	48	BUS	7	8
37	DTR	3	4	49	DTR	7	8

Notes:

1. Signals are referenced to the MADU board and have the following levels:

   DTR (Data Terminal Ready) = Active High
   CTS (Clear to Send), DSR (Data Set Ready), CD (Carrier Detect) = Active High
   GND (Protective and Signal Ground) = Ground
   RD (Received Data enters on (his pin) = High/Low bipolar signal
   TD (Transmitted Data leaves on this pin) = High/Low bipolar signal
   BUS (Make-Busy signal from host computer) = Active High if busy

2. This column refers to the arm of the octopus cable whose pins correspond to the MADU port at the 25-pair end of the cable. Note the M48G octopus cable crosses some of these leads (see Tables I and J for octopus cable pin assignments).

TABLE H. MADU Modular Power Connector Pin Assignments

Pin No.	Signal	Function
1, 2	–	Not used
3	AC	Power source
4	AC	Power source
5	GND	Ground
6	GW	Green-wire ground (not connected)
7, 8	–	Not used

TABLE I. M48C Octopus Cable RS-232C Interface Pin Assignments (to DTE Device)

Pin No.	RS-232C Signal	Connected Pins	Function
1	PG	1, 7	Protective Ground (Note 1)
2	TD	–	Transmitted Data
3	RD	–	Received Data
5	CTS	5, 6, 8	Clear To Send (Note 2)
6	DSR	5, 6, 8	Data Set Ready (Note 2)
7	SG	1, 7	Signal Ground (Note 1)
8	CD	5, 6, 8	Carrier Detect (Note 2)
20	DTR	–	Data Terminal Ready
22	BUS	–	Used for Busy signal (Note 3)

Notes:

1. Pins 1 and 7 are tied together on one lead (protective and signal ground).
2. Pins 5 (CTS), 6 (DSR), and 8 (CD) are driven by one lead and are connected together inside the RS-232C connector shroud.
3. Pin 22 (BUS) on the octopus cable must be connected to a 25-pin host computer port with a busy-out adapter to transmit a busy signal.
4. All other pins are not connected.

TABLE J. M48G Octopus Cable RS-232C Interface Pin Assignments (to DCE Device)

Pin No.	RS-232C Signal	Connected Pins	Function
1	PG	1, 7	Protective Ground (Note 1)
2	RD	–	Received Data
3	TD	–	Transmitted Data
5	DTR	5, 6, 8	Data Terminal Ready (Note 2)
6	DTR	5, 6, 8	Data Terminal Ready (Note 2)
7	SG	1, 7	Signal Ground (Note 1)
8	DTR	5, 6, 8	Data Terminal Ready (Note 2)
20	CTS, DSR, CD	–	Clear To Send, Data Set Ready, and Carrier Detect
22	BUS	–	Used for Busy signal (Note 3)

Notes:

1. Pins 1 and 7 are tied together on one lead (protective and signal ground).
2. Pins 5, 6, and 8 (DTR) are driven by one lead and are connected together inside the RS-232C connector shroud.
3. Pin 22 (BUS) on the octopus cable must be connected to a 25-pin host computer port with a busy-out adapter to transmit a busy signal.
4. All other pins are not connected.

TABLE K. RS-232C Busy-Out Adapter Pin Assignments

Octopus Pin	connects to	Computer Pin
1	———	1
2	———	2
3	———	3
5	———	5
6	———	6
7	———	7
8	———	8
20	———	20
22	———	18
22	———	25

TABLE L. M32E Crossover Cable Pin Assignments

NOTE: This cable reverses the transmit and receive wires in a 25-pair cable and is only used in an MADU hard-wired application. See Table F for MADU signals.

Pin No. (Note 1)	Pair No. (Note 2)	Signal	MADU Port	Function (Note 3)
26, 1	1	–		N/C
27, 2	2	S1, S2	0	Transmit Pair
28, 3	3	R1, R2	0	Receive Pair
29, 4	4	–		N/C
30, 5	5	S1, S2	1	Transmit Pair
31, 6	6	R1, R2	1	Receive Pair
32, 7	7	–		N/C
33, 8	8	S1, S2	2	Transmit Pair
34, 9	9	R1, R2	2	Receive Pair
35, 10	10	–		N/C
36, 11	11	S1, S2	3	Transmit Pair
37, 12	12	R1, R2	3	Receive Pair
38, 13	13	–		N/C
39, 14	14	S1, S2	4	Transmit Pair
40, 15	15	R1, R2	4	Receive Pair
41, 16	16	–		N/C
42, 17	17	S1, S2	5	Transmit Pair
43, 18	18	R1, R2	5	Receive Pair
44, 19	19	–		N/C
45, 20	20	S1, S2	6	Transmit Pair
46, 21	21	R1, R2	6	Receive Pair
47, 22	22	–		N/C
48, 23	23	S1, S2	7	Transmit Pair
49, 24	24	R1, R2	7	Receive Pair
50, 25	25	–		N/C

Notes:

1. These pins carry the signals from the MADU to the cross-connect field. NOTE: The first pair in each set (e.g., pins 26 and 1) is not connected (N/C).
2. Pins correspond to these pairs at the cross-connect field.
3. Signals are referenced to the MADU circuit pack (transmitted by or received to the MADU). Signals R1 and R2 are the receive pair, and S1 and S2 are the send (transmit) pair.

TABLE M. MADU Component Order List

Item	Comcode	Price Element Code (PEC)	Description
Single Unit Assembly (106A Interface Unit)	103 981 809	2169-005	Stand-alone mounting, circuit pack, decal, transformer, manual
Multiple-Mount Carrier (72A Data Mounting)	103 973 608	2169-006	Carrier for eight circuit packs with side bracket, flanges, power distribution box and cord, manual
MADU Circuit Pack (BPP2)	103 969 705	21694	Circuit pack with eight ports (for multiple-mount carrier)
Power Transformer (338-1058-T01)	403 957 038	21695	Attaches each circuit pack to ac source; includes 7-foot cord
M48C Octopus Cable	104 109 285	2724-29G	7-foot cord with eight 6-inch arms for DTE host interface
M48G Octopus Cable	104 319 025	2724-98G	7-foot cord with eight 6-inch arms for DCE host interface
Centerfeed-to-endfeed Cable (M50MF-87)	105 225 007	2724-78B	2-foot cable with male centerfeed and female endfeed connector
Centerfeed-to-endfeed Cable (M50MM-87)	105 224 984	2724-79B	2-foot cable with male centerfeed and male endfeed connector
25-Pair Cable ("D"-type)	A25D cable or equivalent	Varies (section 2720)	25-pair cable to System 75/85 and/or building wiring
50-Pin Extender Cable (Optional)	A25D cable or equivalent	Varies (section 2720)	50-pin cable for extending length to octopus cable
EIA Extender Cable (Optional)	–	customer-supplied	25-pin RS-232C cable to add length from octopus cable to host ports
M32E Crossover Cable (Optional)	105 073 811	2720-07P	15-foot 25-pair cable for hard-wired MADU connections
RS-232C Adapter	–	customer-supplied	RS-232C busy-out adapter to enable host computer busy-out
Male Modem Connector (#232 21 25 005)	403 417 538	2750-C10	Connects 8-pin modular cords to 25-pin RS-232C connectors
8-Pin Modular Cord	403 600 968	2725-16G	7-foot 8-wire cord with male plugs
EMC Wrist Strap	900 698 226	–	Includes cable

ADMINISTRATION PROCEDURES

The MADU requires no special administration procedures. However, the SN238 EIA port boards or TN726 Data Line boards that attach the MADU to the System 75/85 switch must be administered. Use standard administration techniques (the boards must be correctly translated before the MADU can be used). See the "References" section for system administration manuals.

An MADU attached to a Z3A Asynchronous Data Unit (ADU) or another MADU directly over the building wiring does not connect to the System 75/85 switch and cannot affect it. No switch administration procedures are needed for this application.

MAINTENANCE PROCEDURES

The MADU is designed to be transparent to System 75/85. Therefore, no special maintenance procedures have been developed for the MADU. Troubleshooting is performed through the System 75/85 interface using standard maintenance procedures and troubleshooting techniques. See the "References" section for system maintenance manuals.

The LEDs on the faceplate may indicate a problem with the MADU circuit pack. See the Testing and Troubleshooting Procedures chapter for an LED status chart and testing procedures.

The MADU does not require routine maintenance or adjustments. If trouble is traced to a MADU port, replace the entire circuit pack. If the MADU is attached to System 75/85, a faulty port may be busied out until it can be repaired or replaced (see the Testing and Troubleshooting Procedures chapter for busy-out and troubleshooting procedures).

ACRONYMS

The following acronyms are defined below for your convenience.

bps	bits per second
D8AM-87	Crossover cord used with a hard-wired Z3A ADU
DCE	Data Communications Equipment (RS-232C device)
DCP	Digital Communications Protocol (used by switch)
DTE	Data Terminal Equipment (RS-232C device)
M32E	25-pair crossover cable for hard-wired MADUs
M48C	Octopus cable used with DTE device
M48G	Octopus cable used with DCE device
MADU	Multiple Asynchronous Data Unit
MPDM	Modular Processor Data Module
MTDM	Modular Trunk Data Module
PDM	Processor Data Module
RS-232C	EIA protocol translated by MADU
SN238	System 85 ADU/MADU-compatible port board
SN270	System 85 digital port board
TDM	Trunk Data Module
TN726	System 75 ADU/MADU-compatible port board
TN754	System 75 digital port board
Z3A ADU	Z3A Asynchronous Data Unit (models Z3A1, Z3A2, and Z3A4 are compatible with MADU and TN726 or SN238 port boards)

REFERENCES

The following documents may be useful in understanding and effectively using the MADU. These documents should be available in the library received with your System 75/85 or from your AT&T Account Executive.

- AT&T System 75 Administration Manual (555-200-500)
- AT&T System 75 Implementation Manual (999-700-277 IS for R1V1) (555-200-651 for R1V2)
- AT&T System Reference Manual System Description (555-200-200)
- AT&T System Service Manual System Maintenance (555-200-105)
- AT&T System Wiring Guide (555-200-111)

- AT&T System 85 Data Management Reference Manual (999-700-420 IS)
- AT&T System 85 Feature Translations Service Manual (555-101-107)
- AT&T System 85 Installation Service Manual (555-101-104)
- AT&T System 85 Maintenance Service Manual (555-101-108)
- AT&T System 85 System Description Reference Manual (999-700-006 IS)
- AT&T System 85 Uniform Wiring Guide (999-700-011 IS)

- AT&T 3B2/300 Computer Expanded Input/Output Capability Manual (Select Code 305-452)
- AT&T Information Systems Network (ISN) System Design Guide (999-740-201 IS)
- User Reference Card/Dialing Procedures for EIA Port Board or Data Line Board with an ADU (555-400-701)
- Z3A Asynchronous Data Unit User Manual (555-401-701).

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