HP 12792B

8-CHANNEL ASYNCHRONOUS
MULTIPLEXER SUBSYSTEM

INSTALLATION AND REFERENCE MANUAL

Card Assembly: 5061-3415
Date Code: 2026

**HEWLETT
PACKARD**

PRINTING HISTORY

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual *will* contain new information, as *well* as updates.

To determine what manual edition is compatible with your current revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

First Edition..............January 1983

GENERAL - This product and relation documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS

⚠️ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

⚡ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

CAUTION

STATIC SENSITIVE DEVICES

When any two materials make contact, their surfaces are crushed on the atomic level and electrons pass back and forth between the objects. On separation, one surface comes away with excess electrons (negatively charged) while the other is electron deficient (positively charged). The level of charge that is developed depends upon the type of material. Insulators can easily build up static charges in excess of 20,000 volts. A person working at a bench or walking across a floor can build up a charge of many thousands of volts. The amount of static voltage developed depends on the rate of generation of the charge and the capacitance of the body holding the charge. If the discharge happens to go through a semiconductor device and the transient current pulse is not effectively diverted by protection circuitry, the resulting current flow through the device can raise the temperature of internal junctions to their melting points. MOS structures are also susceptible to dielectric damage due to high fields. *The resulting damage can range from complete destruction to latent degradation.* Small geometry semiconductor devices are especially susceptible to damage by static discharge.

The basic concept of static protection for electronic components is the prevention of static build-up where possible and the quick removal of already existing charges. The means by which these charges are removed depend on whether the charged object is a conductor or an insulator. If the charged object is a conductor such as a metal tray or a person's body, grounding it will dissipate the charge. However, if the item to be discharged is an insulator such as a plastic box/tray or a person's clothing, ionized air must be used.

Effective anti-static systems must offer start-to-finish protection for the products that are intended to be protected. This means protection during initial production, in-plant transfer, packaging, shipment, unpacking and *ultimate use.* Methods and materials are in use today that provide this type of protection. The following procedures are recommended:

1. All semiconductor devices should be kept in "antistatic" plastic carriers. Made of transparent plastics coated with a special "antistatic" material which might wear off with excessive use, these inexpensive carriers are designed for short term service and should be discarded after a period of usage. *They should be checked periodically to see if they hold a static charge greater than 500 volts in which case they are rejected or recoated.* A 3M Model 703 static meter or equivalent can be used to measure static voltage, and if needed, carriers (and other non-conductive surfaces) can be recoated with "Staticide" (from Analytical Chemical Laboratory of Elk Grove Village, Ill.) to make them "antistatic."

2. Antistatic carriers holding finished devices are stored in transparent static shielding bags made by *3M Company.* Made of a special three-layer material (nickle/polyester/polyethylene) that is "antistatic" inside and highly conductive outside, they provide a Faraday cage-like shielding which protects devices inside. "Antistatic" carriers which contain semiconductor devices should be kept in these shielding bags during storage or in transit.

Individual devices should only be handled in a static safeguarded work station.

3. A typical static safeguarded work station is shown below including grounded conductive table top, wrist strap, and floor mat to discharge conductors as well as ionized air blowers to remove charge from nonconductors (clothes). Chairs should be metallic or made of conductive materials with a grounding strap or conductive rollers.
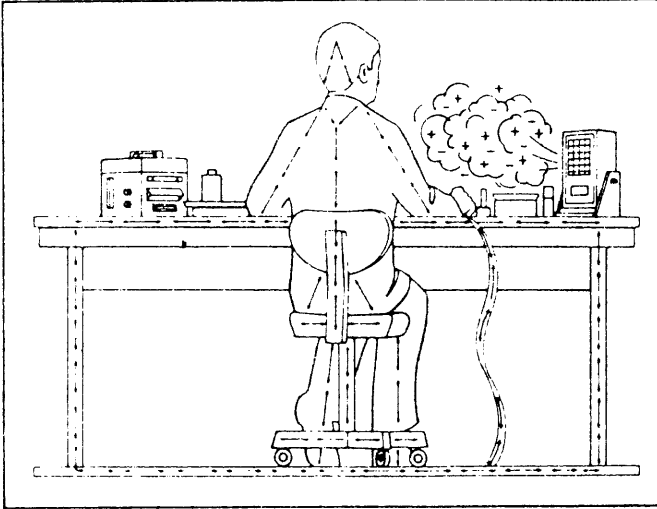
SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

WARNING

EYE HAZARD

Eye protection must be worn when removing or inserting integrated circuits held in place with retaining clips.

CONTENTS

Figure 1-1. HP12792B Multiplexer Interface

GENERAL INFORMATION

INTRODUCTION

Chapter One contains the following descriptions and specifications related to the HP 12792B Eight Channel Asynchronous Multiplexer (MUX) product:

*HP 12792B Product Overview

*Detailed Description of the MUX

*HP 12828A Multiplexer Panel and Custom Cabling

*Equipment and Documentation Supplied with the Standard Product

*MUX Product Identification

*MUX Subsystem Specifications

MULTIPLEXER SYSTEM OVERVIEW

Hewlett-Packard's 12792B 8-Channel Asynchronous Multiplexer Subsystem and its companion hardware, the HP 12828A RS-232-C Multiplexer Panel (part of the HP 12792B standard product), combine to provide a complete HP 1000 hardware/software package for multiplexed terminal/device applications. These applications include communications to and from all currently supported HP terminals (such as 262x, 264x, and 2675A) as well as line printer support for the 2631A, 2635A, and 7310A. Other HP or non-HP devices may be used in conjunction with the multiplexer subsystem; however, it may be necessary for the user to write simple device drivers to supply the necessary control for certain devices. Consult the HP 12792B Multiplexer User's Guide, part number 5955-8867, for detailed information regarding the user written device driver. This guide is supplied as part of the documentation for your operating system.

DETAILED DESCRIPTION

Hardware Operations

The HP 12792B 8-Channel Asynchronous Multiplexer Subsystem provides an efficient, high performance method for interfacing HP 1000 M/E/F-Series Computers to any RS-423 or RS-232-C compatible device connected in a hardwired or hardwire full-duplex modem point-to-point environment.

Device communication to and from the HP 1000 Computer is provided through a microprocessor-based interface which significantly off-loads the overhead normally associated with routine communication management, thus freeing the computer for application program execution or development tasks of HP 1000 terminal users. The on-board Z-80A microprocessor, in conjunction with EPROM, RAM, DMA, and SIO support, manages the asynchronous TTY-like protocol of connected devices. Each of the eight channels is separately buffered (input and output) and most communications to/from the interface memory to the host CPU backplane are accomplished under DMA, thus I/O processing time is significantly reduced. Up to 128 requests per second to the host from the interface are possible across the I/O backplane of the host.

Each interface provides two on-board programmable baud rate generators (BRGs) that control channel transmission speeds from 50 to 19.2K baud. The total aggregate throughput capability of the interface is processor and process dependent.

MUX Software Driver

The HP 12792B Multiplexer Subsystem (hardware and software) operates in HP 1000 M/E/F-Series Processors/Systems in conjunction with RTE-IVB, RTE-VI, or RTE-MIII Operating Systems. Program development and program execution are supported on RTE-IVB and RTE-VI. Application program execution is supported on RTE-MIII.

The software associated with the HP 12792B product consists of an interface driver and two standard device drivers. This software is supplied on the grandfather disc for your operating system. The interface driver manages the communications across the CPU backplane to and from the multiplexer interface printed circuit assembly (PCA). The device drivers perform the formatting of control and data strings, specifically the inclusion of control characters for device requirements. (For best performance and full implementation of multiplexer features, you should always use the latest revisions of the driver software. Refer to the driver documentation for your operating system to find the revision codes of the latest driver software.)

Additional flexibility is built into the RTE-compatible software in that I/O requests will be handled under DCPC control if a DCPC channel is currently available and deemed more efficient by the software driver. Otherwise, the request will be handled on a word-by-word basis. This dynamic allocation feature reduces the typical CPU overhead to approximately 3% per channel at 9600 baud for long block transfers on a continuous basis.

Flexibility is a key feature in the interface and device software area in that customers may write their own device drivers to interface to other devices such as terminals, plotters, and "black boxes" so long as the devices meet RS-423-A or RS232-C requirements.

MUX PANEL AND CUSTOM CABLING

Up to eight terminals or devices can be connected to a single multiplexer interface through the HP 12828A RS-232-C Multiplexer Panel, or through the use of custom cabling constructed by the user.

Virtually any number of interfaces will be supported in the operating system, up to the maximum number of available I/O slots. Future expansion can be built in at system generation time by allowing reserved slots for devices to be added as the need arises.

Since the interface supports the standard RS-423-A electrical interface specifications (also compatible with RS-232-C), the HP 12828A MUX Panel may be located at the CPU or up to 300 feet away from the main CPU (supported at channel speeds up to 9600 baud). Devices may then be connected to the panel through standard EIA 25-pin connectors on the panel. This remote locatability of the panel overcomes the typical 50-foot limitation imposed by RS-232-C specifications. Additionally, hardwired full-duplex modems may be employed on a channel-by-channel basis. No active modem controls to or from the MUX interface are provided. However, this limitation is easily overcome by the use of the HP 37214A Modem Card Cage. The HP 37214A is a rack-mountable card cage containing one microprocessor-based control card and seven I/O slots.

EQUIPMENT AND DOCUMENTATION SUPPLIED

The HP 12792B 8-Channel Asychronous Multiplexer Subsystem consists of the following:

Hardware

The standard HP 12792B product is suitable for connecting RS-232-C devices (terminals, printers, hardwired full duplex modems, and so on) to your computer. It contains the following hardware:

```
* 5061-3415   Multiplexer Interface PCA
* 5180-1970   Multiplexer Firmware (EPROM)
* 12828-60001 RS-232-C Connector Panel
* 12828-60002 3-meter Connector Cable
* 12828-60004 Connector Kit for Extension Cable
* 12828-00004 Mounting Bracket
```

Option #001 to the HP 12792B is suitable for upgrading an HP 12792A multiplexer to an HP 12792B. The only hardware contained in option 001 is:

```
* 5180-1970   Multiplexer Firmware (EPROM)
```

All other hardware items are deleted by option 001.

Option #002 to the HP 12792B product is suitable for connecting the multiplexer to an HP 37214A modem card cage. Option 002 contains the following hardware:

```
* 5061-3415   Multiplexer Interface PCA
* 5180-1970   Multiplexer Firmware (EPROM)
* 12828-60002 3-meter Connector Cable
```

All other hardware items are deleted by option 002.

Option #003 to the HP 12792B product is suitable for customers who want to build their own cables. Option 003 contains the following hardware:

```
* 5061-3415   Multiplexer Interface PCA
* 5180-1970   Multiplexer Firmware (EPROM)
* 5061-3467   80-pin Edge Connector Kit
```

Documentation

The following documentation is provided with the HP 12792B.

```
* 12792-90020  Multiplexer Installation & Reference Manual
```

Related Items

The items listed below are related to the HP 12792B multiplexer but are provided as part of other products.

The following driver software is provided on the grandfather disc for your operating system:

```
%PVM00 Multiplexer Predriver  (12792-16001)
%DVM00 Multiplexer Interface Driver  (12792-16002)
%DDV05 26XX Screen Device Driver  (12792-16003)
%DDV12 7310 Device Driver  (12792-16004)
%$DVTB Device Driver Address Table  (12792-16005)
```

The following diagnostic software for the HP 12792B multiplexer is part of the HP 91711B diagnostic product. These diagnostics are available on 264x mini-cartridge tapes, 800 BPI 9-track open reel tapes, and 1600 BPI 9-track open reel tapes.

```
%MUXST RTE-IVB On-line dowloadable diagnostic
!MUXST RTE-MIII Off-line downloadable diagnostic
```

The following manuals are part of the system documentation for your operating system:

```
* 5955-8867  Multiplexer User's Guide
* 5955-8868  Multiplexer Configuration Guide
```

IDENTIFICATION

Product

Five digits and a letter (12972B) are used to identify the Asynchronous Multiplexer Subsystem. As in most Hewlett-Packard products used with Hewlett-Packard Computers, these five digits are used to identify the product number, and the suffix letter represents the revision level of that product.

Interface

The interface supplied with the Subsystem is identified by an eight-digit part number (5061-3415) stamped in black ink on the PCA near the HP logo. You should not confuse this number with a similar number stamped in gold (5090-1608), also near the HP logo, which is the manufacturing assembly number used to identify the unloaded PCA (without components). It is of no use to the user.

PCA revisions are identified by a letter and a date code. (e.g., A-2026). This series of characters is stamped on the PCA near the Hewlett-Packard logo and under the part number. The letter (UPPER CASE ONLY) identifies the revision of the etched trace pattern on the unloaded PCA. The four digit date code refers to the electrical characteristics of the loaded (with components) PCA. An example of PCA identification is shown below:

```
        [hp]   5061-3415
               A-2118
        /        |    \         \
       /         |     \         \
      /          |      \         New Part Number or
     /           |       \        Exchange Part Number
Hewlett-Packard LOGO      \       (stamped in Gold)
(stamped in gold)          \
                            \
                             \
                              Date Code of
                              PCA Electrical
        Revision Artwork      Characteristics
        (stamped in Gold)     (stamped in ink)
```
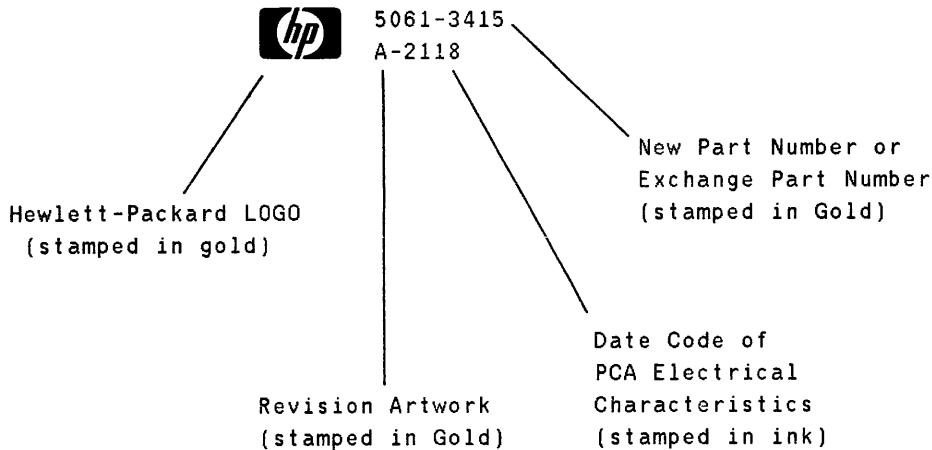
If the revision letter and date code stamped on your MUX interface do not agree with the revision and date code printed on the title page of this manual, there are differences between your interface and the interface described in this manual. If a discrepancy should occur, please contact your nearest Hewlett-Packard Sales and Service Office (listed at the back of this manual) for manual update information.

Documentation

All manuals supplied with the HP 12792B Multiplexer Subsystem are identified by their respective name, part numbers, and date codes. These identifiers are located on the front page of each manual along with the respective publication date. If a manual should change or be updated, a supplement that includes these changes is shipped with each manual. When the manual stock is depleted, all previous updates will be incorporated into a new printing of the manual and the print date will reflect the last supplement date. Consult the "Print History" on page ii of this manual for further details.

MUX SUBSYSTEM SPECIFICATION

Physical

The HP 12792B is a standard size M/E/F-Series I/O interface occupying one slot in the HP 1000 I/O backplane:

* SIZE: 19.70 by 22.10 by 1.27 centimeters, 7.75 by 8.70 by 0.50 inches

* BACKPLANE INTERCONNECTS: One 86-pin edge connector plugs into the M/E/F-Series I/O backplane.

* DEVICE INTERCONNECTS: One 80-pin edge connector on which a cable hood or connector may be placed for connection to any one or all of eight I/O devices.

Electrical

* TRANSMISSION MODE: Bit serial, asynchronous

* CAPACITY: Eight full-duplex (transmit and receive) communication channels with two 254-byte transmit buffers and two 254-byte receive buffers per channel.

* PROGRAMMABLE FEATURES: Echo on or off; break key detection; record termination processing (CR, DC2, RS, or control-D; end on count; host termination of record); buffer overflow detection; baud rates from 50 to 19.2K; on board editing (back space, line delete); block mode format; handshake via ENQ/ACK or XON/XOFF

* INTERFACE LEVEL: Conforms to EIA Standards (RS-423-A/RS-232-C or CCITT V.24).

* CHARACTER LENGTH: Programmable character length at 5, 6, 7, or 8 bits per character with programmable (1, 1-1/2, or 2) stop bits.

* DATA TRANSFER RATES: Two baud rate generators (BRGs) programmable from 50 to 19,200 baud. Each BRG can provide a single baud rate of 19.2K, 1800, 134.5, 110, or 50 baud; or it can provide multiple rates of 75 and 150, or 300 and 1200, or 2400, 4800, and 9600 baud simultaneously.

* AGGREGATE THROUGHPUT CAPACITY: Processor and process dependent.

* ERROR DETECTION: Parity (even/odd/none), overrun, and framing error detection.

* POWER REQURIEMENTS:

```
+ 5 VOLTS  2.0  AMPS
+12 VOLTS  0.3  AMPS
-12 VOLTS  0.04 AMPS
Total Power Dissipation = 14.1 WATTS
```

	SECTION
# INSTALLATION	**II**

INTRODUCTION

The following topics provide fundamental information which is necessary for successful installation of the HP 12792B Multiplexer Hardware.

* Unpacking and Inspection

* Calculation of Available Current vs Required Current

* Preparation Before Installation and Use

* Installation and Check-out of the Interface and Cable

* Reshipment for Repairs or Damage

UNPACKING AND INSPECTION

CAUTION

STATIC SENSITIVE DEVICES
Many components on the MUX interface are susceptible to damage by static discharge. The components can be identified readily as they are the ICs that are inserted into sockets. Refer to the safety considerations information at the front of this manual before handling, removing, or replacing these parts.

Upon receipt of your HP 12792B Multiplexer Subsystem, immediately inspect the shipping container for signs of any physical damage. If damage is detected, request that the carrier's agent be present when the equipment is unpacked. Inspect the hardware for damage (scratches, cracks, loose components, etc.) and ensure that all the contents of the MUX subsystem are present (refer to Section 1, specifically the paragraphs entitled "Equipment and Documentation Supplied"). If you find damaged, incorrect or missing parts, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Retain the shipping container and the packing material for the carrier's inspection.

The Hewlett-Packard Sales and Service Office will arrange for the repair or replacement of the damaged equipment without waiting for any claims against the carrier to be settled.

PREPARATION FOR USE

Available Current vs. Required Current

The HP 12792B MUX interface obtains its operating voltage from the host computer power supply. The power supply feeds a crossover assembly located on top of the I/O and memory card cages of the host computer. This, in turn, distributes the various voltages to both I/O and memory backplanes. The MUX interface is designed to be inserted into the I/O card cage and backplane (rear of the computer) where it receives operating voltages and also becomes part of the I/O data and control bus structures. Since all items installed in the computer derive their operating power from the computer power supply, a calculation should be performed to determine whether the MUX interface, when installed in your present system, will cause a current overload.

> ### CAUTION

These calculations should be made before installing the MUX interface!

To accomplish this task, you must obtain and add all of the current requirements for each interface/product installed in the computer. The +5 volt CPU and +5 volt memory current drains (amps) are the most critical. The total current requirements should then be compared with the available current for each supplied voltage. The electrical specifications for each product are listed in the "specifications" section of the respective Operating & Reference or Installation & Service manuals. The current HP 1000 Hardware Data Book also contains this information for all computer-related products in a section entitled "Power Specifications and Applicability Summary". The MUX interface power/current requirements are as follows:

```
+ 5V @ 2.00 amps
+12V @  .30 amps
-12V @  .04 amps
```

If the additional Multiplexer current overloads the host computer power supply, it should not be installed until alternative arrangements have been made to offload the required current.

Proper Firmware (ROM) Installation

The firmware ROM is installed in a socket provided on the MUX interface as shown in figure 2-1.
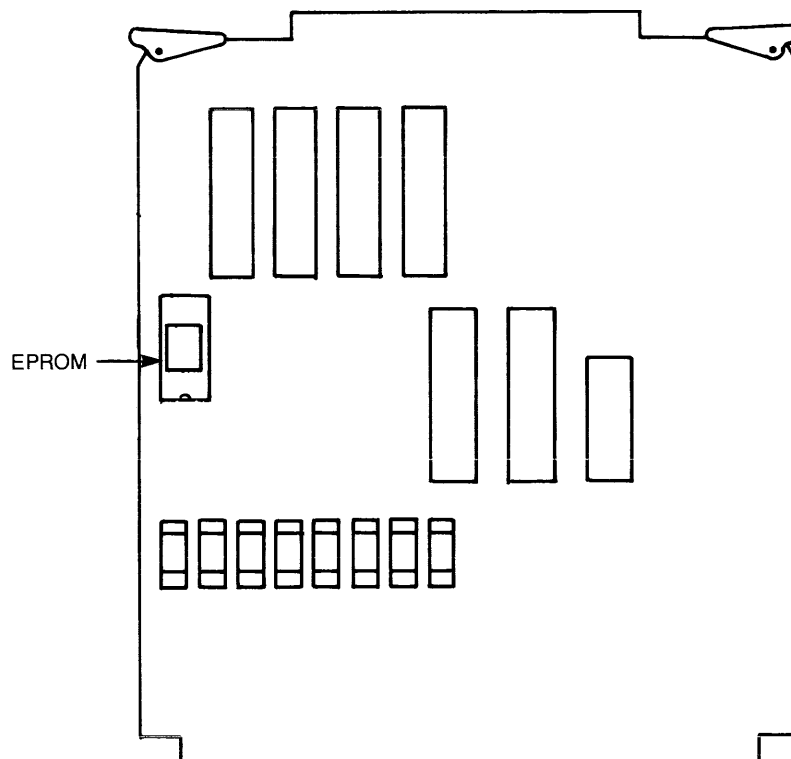
Figure 2-1. EPROM Socket Location

Ensure that the ROM is properly installed as shown above and that it has not been damaged or loosened from its socket during shipping.

Additionally, it is advisable to guard against bending or breaking pins during the process of installing or re-installing the ROM itself. These pins may also become folded between the ROM I/C and I/C socket resulting in intermittent operation of the MUX Subsystem. In most cases, a bent or damaged pin can be straightened with careful use of needle-nose pliers.

EPROM/ROM Jumper Configurations

As previously noted, the EPROM or ROM that resides on the MUX interface is referred to as "firmware". Inspect the MUX interface to ensure proper configuration and installation of the firmware jumpers. Figure 2-2 illustrates the location of this jumper block and shows the proper jumper configuration for the firmware on the MUX interface.
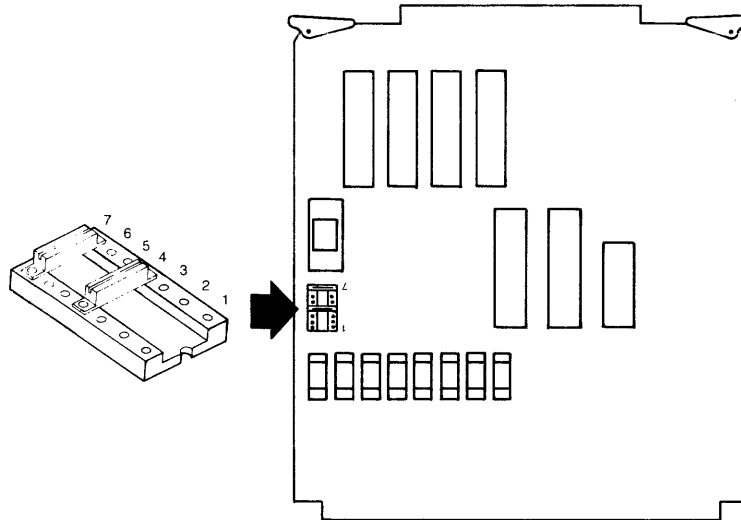
Figure 2-2. EPROM Jumper Location

Note that the positions on the block are labled 1 through 7. A combination of two or more jumpers is required to be installed in the block for proper operation. The versatility of the MUX interface design provides the capability to accept several types of EPROM or ROMS. The following table provides the jumper configurations for some common ROMs and EPROMs. This is not an exhaustive list by any means; however the scheduled availability of these parts may necessitate shipping the interface with different ROMs or EPROMs from time to time.

Manufacturer's Part Number	Install Jumpers	Sizes (bytes)
TI 4732, 2532	W2, W5	4K
MOT MCM68A332, MCM68764	W2, W5	4K
MK36000, AMI 54264	W3, W5	8K
MOT MCM68A364, MCM68764	W3, W5	8K
Intel 2732, 2332	W4, W7	4K
Intel 2364, 2764	W4, W7	8K
MK37000, MK2764	W4, W6	8K

Upgrading from HP 12792A to HP 12792B

If you have ordered option 001 to the HP 12792B product, for the purpose of upgrading an HP 12792A to an HP 12792B, you will have to remove the old EPROM and insert the new one. You may also have to change the jumper configuration. Take the following steps to change the EPROM.

> **CAUTION**
>
> STATIC SENSITIVE DEVICES
>
> Use anti-static procedures when handling
> the MUX card or the EPROM. Refer to
> page iii for more information.

1) Remove the old EPROM from its socket. Figure 2-1 shows the location of the EPROM.

2) Insert the new EPROM (HP part number 5180-1970) into the socket. Make sure that the notch on the EPROM faces the same way as the notch on the socket, and make sure that all pins are seated properly in the socket.

3) Check the jumper configuration (as described above) to make sure that is correct for the EPROM, and reconfigure if necessary.

CABLING

Connection to External Devices

The connection between the MUX card and external devices can be made in a variety of ways. The basic factors governing these connections are considered in the following paragraphs.

The HP 12792B MUX card adheres to the RS-423-A standard. This means that the cable connecting the MUX card to remote devices can be up to 300 feet (91 meters) long. That cable contains Send Data and Receive Data wire pairs for each of the eight multiplexed channels, as well as shield and power wires. The remote devices connected to the MUX card can be:

1) The HP 12828A RS-232-C panel. This panel provides RS-232-C connections for eight devices, typically terminals, printers, and hardwired full-duplex modems. Each cable connecting a device to the RS-232-C panel can be up to 50 feet (15 meters) long.

OR

2) The HP 37214A modem card cage. This card cage allows connection to RS-232-C devices (via terminal interface card), to modems (via modem interface card), and to telephone lines (via modem card). Up to seven devices can be connected through the modem card cage. The modem card cage is typically racked in the same cabinet as the host computer.

OR

3) Up to eight I/O devices, such as terminals and printers, that comply with the RS-423-A standard.

The HP 12792B comes standard with the RS-232-C panel, a 10 foot (3 meter) cable for connecting the RS-232-C panel to the MUX card, and a connector kit for fabricating an extension cable to extend the total cable length up to 300 feet (91 meters). As an option, the HP 12792B can be purchased without the RS-232-C panel and connector kit, but with the 10 foot (3 meter) cable for connecting to

an HP 37214A modem card cage. Another option deletes the RS-232-C panel and its connecting cables, and provides instead an 80-pin card edge connector kit for customers who want to fabricate their own cables for direct connection of devices to the MUX card.

Figure 2-3 shows typical cabling for the HP 12792B. (The terminals shown in the figure could actually be terminals, printers, or other appropriate devices. These devices will vary according to whether the connection is to an RS-232-C panel, to a modem card cage, or directly to the MUX card.)

Wiring diagrams for the cables mentioned above are contained in Section 4 of this manual.

Data Transmission Rate Wiring

The multiplexer interface uses two timers of a Z-80A CTC (Counter/Timer Circuit) to act as Baud Rate Generators (BRG0 and BRG1). Each port must be connected to either BRG0 or BRG1. This connection is made by wiring the MUX connector hood. (Details for this wiring are given in section 4 of this manual.) The standard HP 12792B comes wired from the factory with BRG0 connected to port 0 and BRG1 connected to ports 1 through 7. This distribution can be modified to suit the application.

The host's software interface driver allows the user to programmatically set the rate of each BRG. Driver interaction also allows the user to select from a group of baud rates in certain ranges. The procedure for programming multiplexer data rates is discussed in the HP 12792B Multiplexer User's Guide (part number 5955-8867). The following data rates can be programmed: 19.2K, 9600, 4800, 2400, 1800, 1200, 300, 150, 134.5, 110, 75, and 50 baud.

For a number of baud rates (19.2K, 1800, 134.5, 110, or 50 baud), only one baud rate at a time is available to the ports connected to a given BRG. The remainder of the baud rates are available in groups:

Group 1	Group 2	Group 3
75	300	2400
150	1200	4800
		9600

If a baud rate from one of these groups is selected, any rate in that group can be supplied to any port connected to that BRG. Thus, up to five different baud rates can be supplied to the ports at one time.

MUX
card

RS-232-C
panel

Connections to Terminals, or Other Devices

MUX
card

HP 37214A
modem card
cage

Connections to Terminals, to Modems, and to Telephone Lines

MUX
card

User-fabricated
connection to
RS-423-A devices
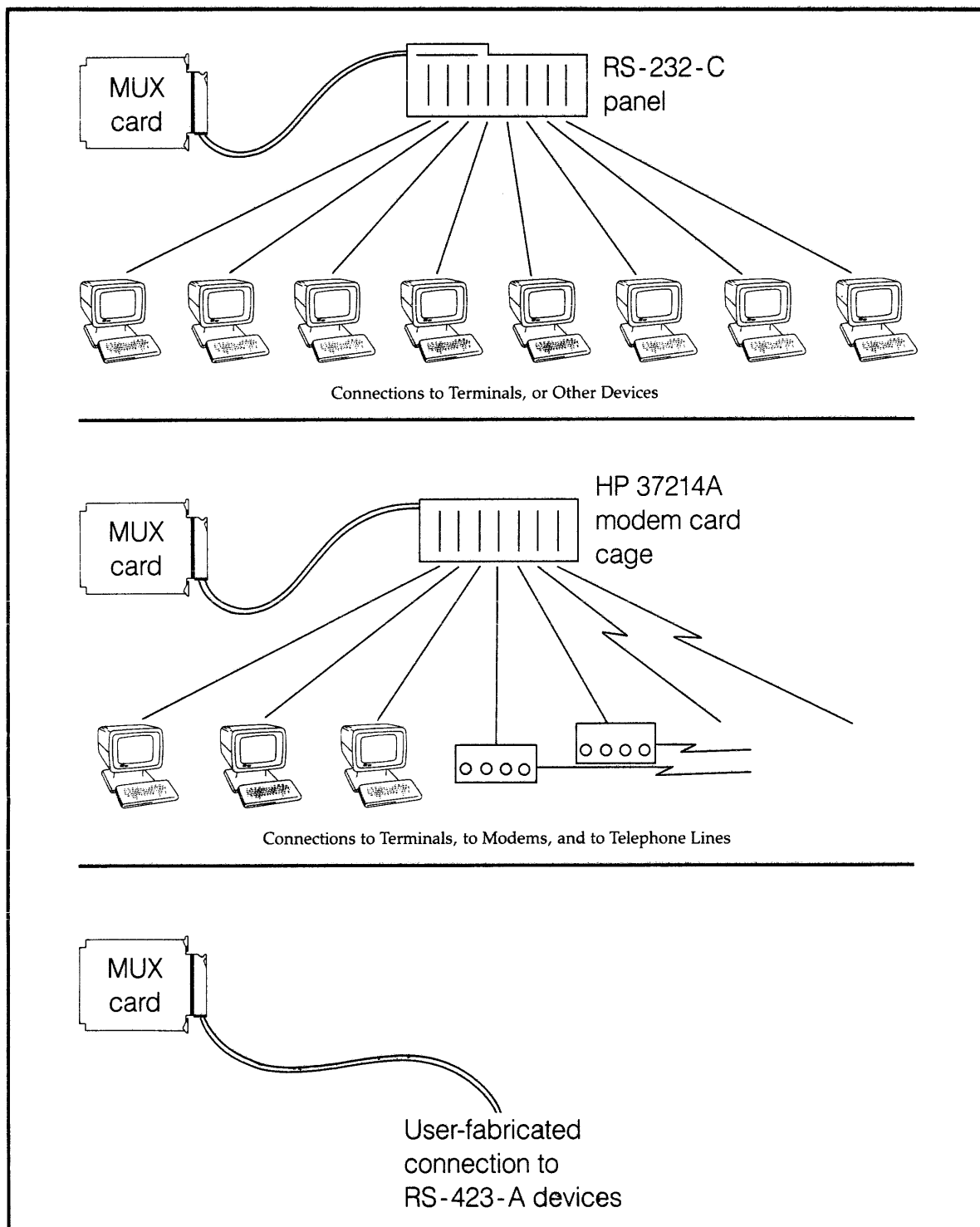
Figure 2-3. Connections to the HP 12792B MUX Card

The following examples show just two of the many possible baud rate combinations. Example 1 would be useful for a configuration with one printer (1200 baud) and seven terminals (9600 baud). Example 2 would be useful for a configuration with printers (300 and 1200 baud), modems and line drivers (1200, 2400, and 4800 baud), and terminals (9600 baud).

	Example 1		Example 2	
Port #	BRG	Data Rate	BRG	Data Rate
Port 0	0	1200	0	300
Port 1	1	9600	0	1200
Port 2	1	9600	0	1200
Port 3	1	9600	1	2400
Port 4	1	9600	1	2400
Port 5	1	9600	1	4800
Port 6	1	9600	1	9600
Port 7	1	9600	1	9600

CABLE AND INTERFACE INSTALLATION

Before continuing with the actual installation of the interface, make sure that you have reviewed and completed the preparation tasks that have been previously outlined in this chapter.

CAUTION

Always ensure that the power to the computer is off before inserting or removing the MUX interface and associated cabling. Failure to do so may result in damage to the inteface or the attached I/O device.

Gain access to the I/O card cage of the host computer and install the MUX interface into the desired backplane slot, ensuring that the component side of the interface is up. Press the interface firmly into place and note the number of this slot (select code number) as you will be required to reference this number when executing the MUX diagnostics and generating the MUX software into an operating system.

Next, connect the proper cable to the MUX interface. Ensure that 80-pin connector of the cable is properly attached to the interface such that the cable exits to the right of the backplane (toward the center of the host computer) as shown in figure 2-4.

ATTACH GROUND WIRE TO HOST FRAME USING AVAILABLE SCREWS AT REAR OF HOST
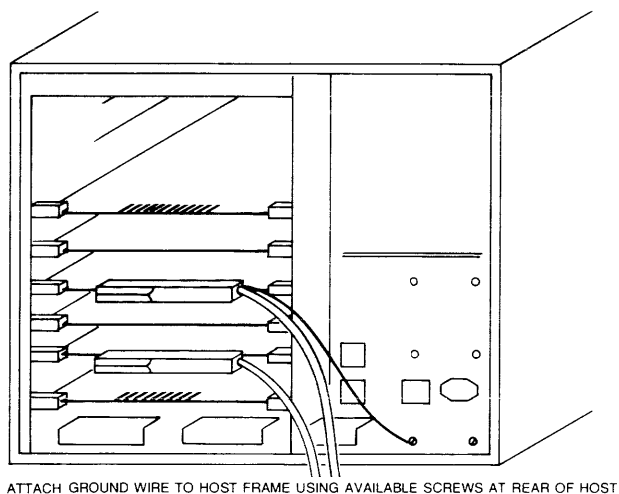
Figure 2-4. Connections to the MUX Card

After connecting the RS-232-C Multiplexer Panel or user-fabricated cabling to the desired I/O devices, you may restore power to the computer system.

For installation and configuration of the MUX Panel and customer cabling examples refer to Section 4 of this manual.

Multiplexer Check-out

Proper operation of the MUX interface and cabling can be assured by performing the tests and diagnostics described in Section 5 of this manual.

RESHIPMENT

If any part of the HP 12792B Multiplexer Subsystem is to be reshipped for any reason, the items should be packaged in the original factory (or similar) material. The proper identification needs to accompany the items on the inside of the shipping container as well as addressing on the outside. When the standard factory packaging is not used, wrap the items in Air Cap Th-240 cushioning (or equivalent) manufactured by Sealed Air Corporation, Hawthorn, N.J., and place in a corrugated carton (200 pound test material). Seal the shipping carton securely and mark it "FRAGILE" to assure careful handling.

PRINCIPLES OF OPERATION	SECTION
	III

INTRODUCTION

This section contains the following information relating to the Multiplexer interface:

* A description of the host computer I/O backplane interface

* A brief description of the Z-80A CPU and support chips

* Description of the principal command and status words

* A functional-level description of the interface operation

HARDWARE DESCRIPTION

The MUX interface, HP part number 5061-3415, includes the following major functional areas:

* HP 1000 M/E/F-Series Computer I/O backplane interface

* Z-80A Microprocessor family subsystem (CPU, SIO, DMA and CTC)

* Read-Only Memory (ROM)

* Random-Access Memory (RAM)

* Communication Line Interface

A block diagram illustrating the major functional areas of the MUX interface is presented in Figure 3-1.

Host Computer I/O Backplane Interface

The MUX interface communicates with the HP 1000 host computer through the computer I/O backplane. The backplane interface circuitry on the MUX interface can be logically divided into two major sections: the I/O data latches and the control circuitry section.

The I/O data latches consist of two 8-bit input latches and two 8-bit output latches. The input latches hold 16-bit data or command words that are output from the host computer until the MUX interface is ready to process them. Likewise, the output latches on the MUX interface hold 16-bit status or data words which are to be input to the computer.
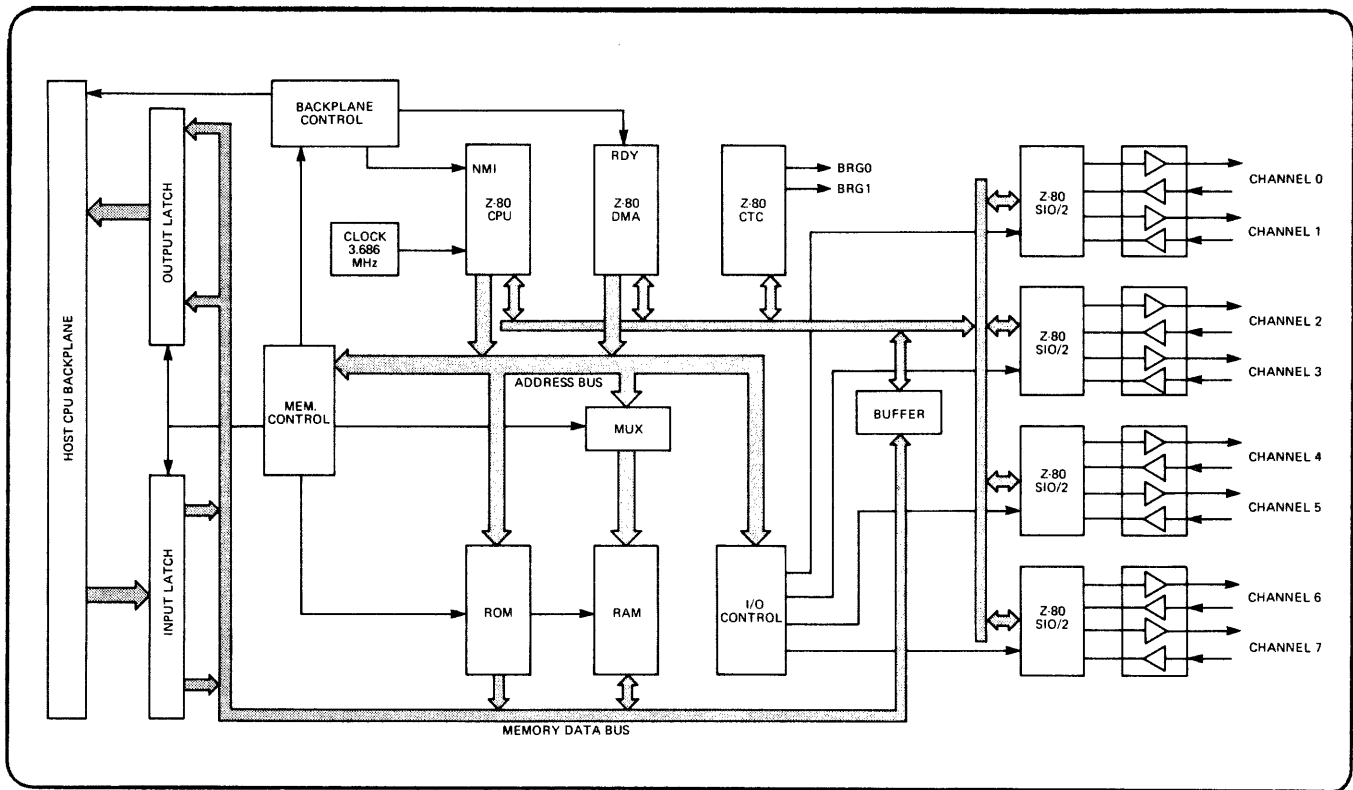
Figure 3-1. Multiplexer Interface Functional Block Diagram

The control circuitry is made up of seven flip-flops (Flag, Flag Buffer, Control, LIA Instruction, Backplane Ready, DMA Ready, and Reset) and various other support logic elements. The primary function of this circuitry is to handle the control signals to and from the I/O backplane. These signals are used to generate and acknowledge interrupts, to handshake data between the host and the interface, and to conform to the standard HP 1000 computer I/O backplane signal conventions. For a more detailed discussion of the HP 1000 backplane signals, refer to the HP 1000 I/O Interface Guide, HP part number 02109-90006.

Z-80A Microprocessor Subsystem

CENTRAL PROCESSING UNIT (CPU)

The heart of the interface is the Z-80A CPU (Central Processing Unit). The CPU's location on the interface and its relationship to buses and other devices on the card are shown below.
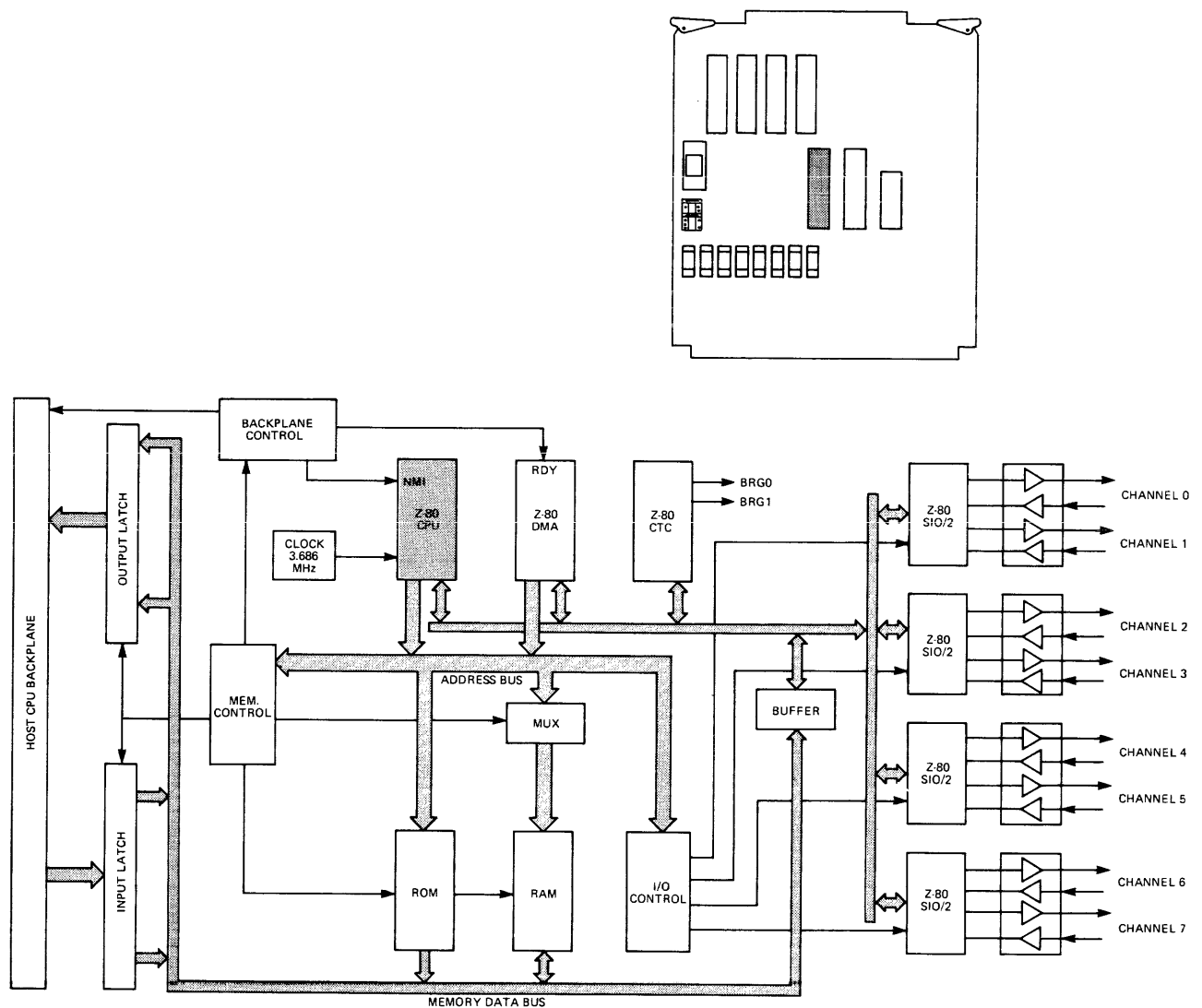
Figure 3-2. Central Processing Unit

This metal oxide semiconductor large scale integration microprocessor (MOS LSI) operates from a single +5 volt supply, uses a single-phase clock and has a typical instruction execution time of 1.0 microsecond. The Z-80A employs a data bus width of eight bits and an address bus width of 16 bits. All Z-80A CPU inputs and outputs are TTL compatible.

The Z-80A CPU employs a register-based architecture that includes two sets of six general-purpose registers which can be used as 8-bit registers or 16-bit register pairs. Additional 8-bit registers include two sets of accumulator and flag registers, and the interrupt vector and memory refresh registers. Aditional 16-bit registers include the stack pointer, program counter and two index registers. The Z-80A CPU provides the intelligence for the MUX interface to function as a preprocessor to relieve the host computer of a majority of the protocol processing.

An important input function on the Z-80A as far as the MUX interface is concerned is the NMI (Non-Maskable Interrupt) input pin. By pulling this input low with an STC instruction, the host computer can "get the attention of" the Z-80A. An NMI is the highest priority interrupt to the Z-80A and forces it to start fetching and executing instructions from a predetermined location in the firmware. The MUX interface software driver (DVM00) executed out of the host uses this feature to inform the interface that it requires service.

Various support chips are used in conjunction with the Z-80A CPU to facilitate interface operation as an intelligent communication multiplexer interface. These chips are discussed in the paragraphs that follow.

TWO-CHANNEL SERIAL INPUT/OUTPUT (SIO/2)

Four Z-80A SIO/2 chips are used on the interface to provide eight serial data communications channels as shown below.
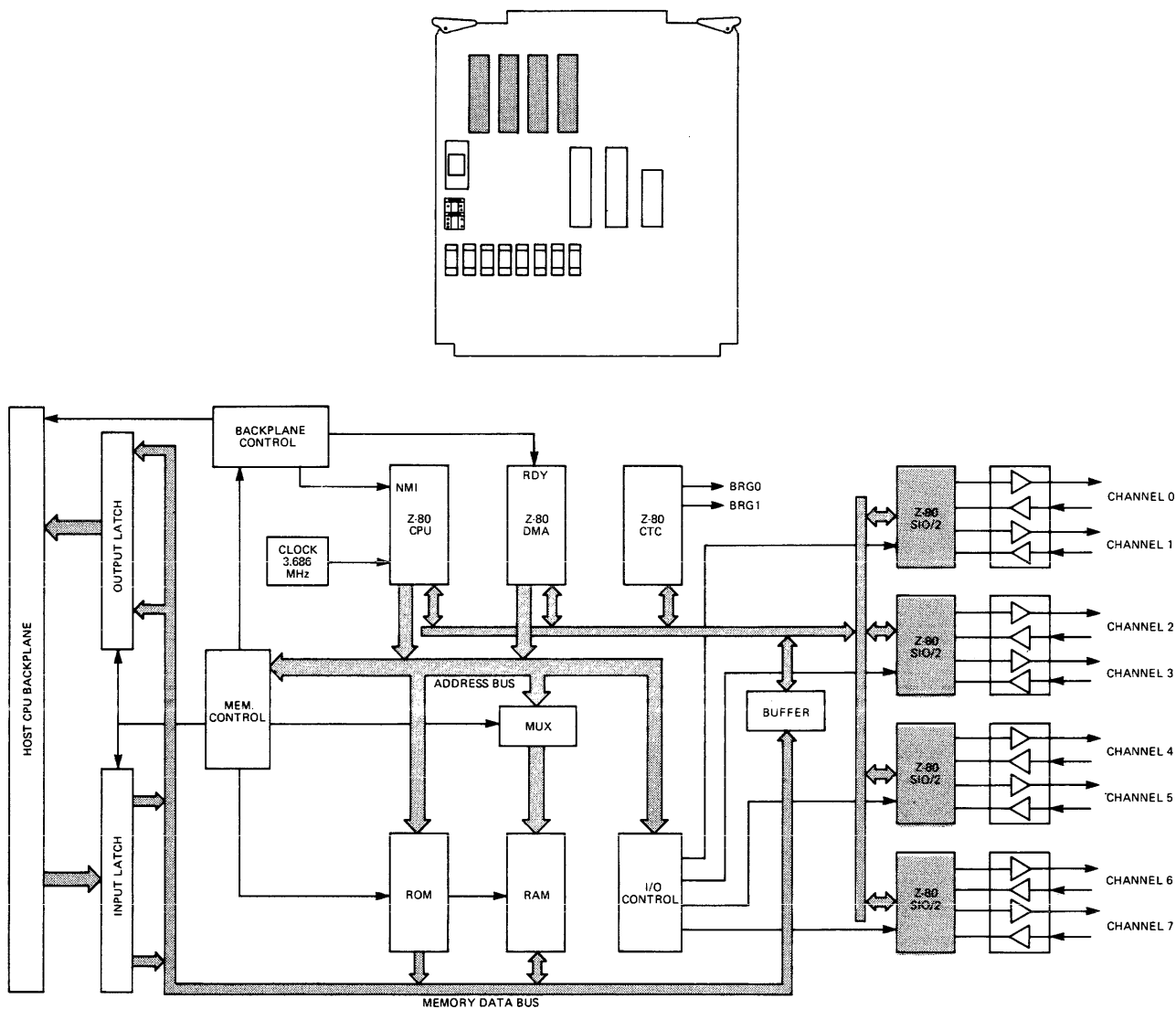
Figure 3-3. Serial I/O

Each SIO/2 chip contains two Universal Synchronous-Asynchronous Receiver Transmitters (USART). The major functions performed by the SIO/2 chips are serial-to-parallel conversion of input data and parallel-to-serial conversion of output data. In addition, break, parity, overrun and framing error detection are also provided by the SIO/2 chip.

As shown in the illustration, the SIO/2 chips share the Z-80A data with other Z-80A devices. The data bus allows the Z-80A CPU to transfer data to and from the SIO/2 chips. In addition, the CPU can read status from the SIO/2 status registers and configure the SIO/2 chips for a particular operation by writing to their control registers using the data bus.

The SIO/2 chip interrupts the Z-80A CPU on an interrupt-per-character basis when transferring data to and from the communication line. In the transmit mode, the SIO/2 interrupts the CPU for the next character to be transmitted after the proceeding character has been sent. In the receive mode, the CPU is interrupted each time the SIO/2 converts serial data into an 8-bit parallel data character and is ready to send it to a RAM buffer. Three 1-byte buffer registers are implemented on the SIO/2 chip to prevent the CPU from missing data characters when it responds to interrupts by the SIO/2 in the receive mode.

DIRECT MEMORY ACCESS (DMA)

The MUX interface uses a Z-80A DMA chip, which is an LSI Direct Memory Access controller. The sole task of the DMA logic is to transfer data directly between the MUX interface memory and the host computer via the data latches of the backplane interface circuitry. The DMA logic accomplishes this task by creating signal sequences that enable data transfers to and from the host. The Z-80A CPU is free to execute other code while the data transfer is taking place. This increases the throughput rate of the interface.
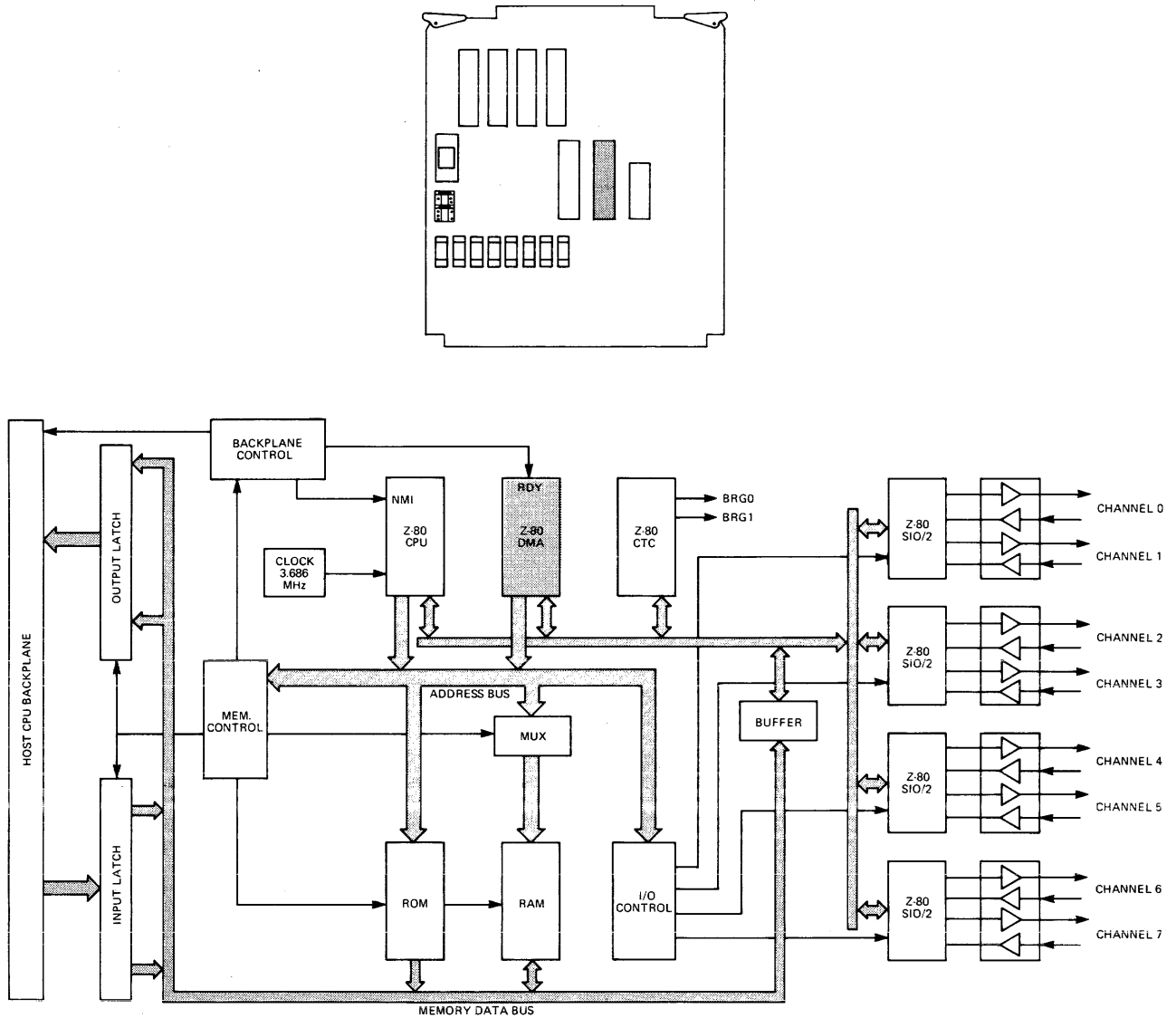
Figure 3-4. Direct Memory Access

As is shown in the illustration, the DMA chip is capable of taking control of the data and address buses to accomplish its data transfer tasks. Since the Z-80A CPU and the DMA cannot take control of the buses at the same time, the CPU is locked out (from using either bus) during DMA data transfers. The DMA chip is prevented from taking control of the buses for extended periods of time by a counter called a DMA pacer so that the CPU has a chance to monitor all events taking place on the interface. In this manner, data is not lost on the interface while a DMA transfer is in progress.

The backplane control logic monitors the state of the host backplane and controls the operation and transfer rate of DMA transfers through manipulation of the Ready (RDY) input of the Z-80A DMA chip.

COUNTER-TIMER CIRCUIT (CTC)

The MUX interface uses one Z-80A Timer Circuit which provides four independent counter/timers. Two of the counter/timers are used as serial baud rate generators (BRG0 and BRG1). Another is used to maximize the effective throughput of the interface by controlling the frequency of DMA cycle stealing (this is called a DMA pacer) and the fourth counter/timer is used as a system timer to control the processing of certain events within the Z-80A subsystem.
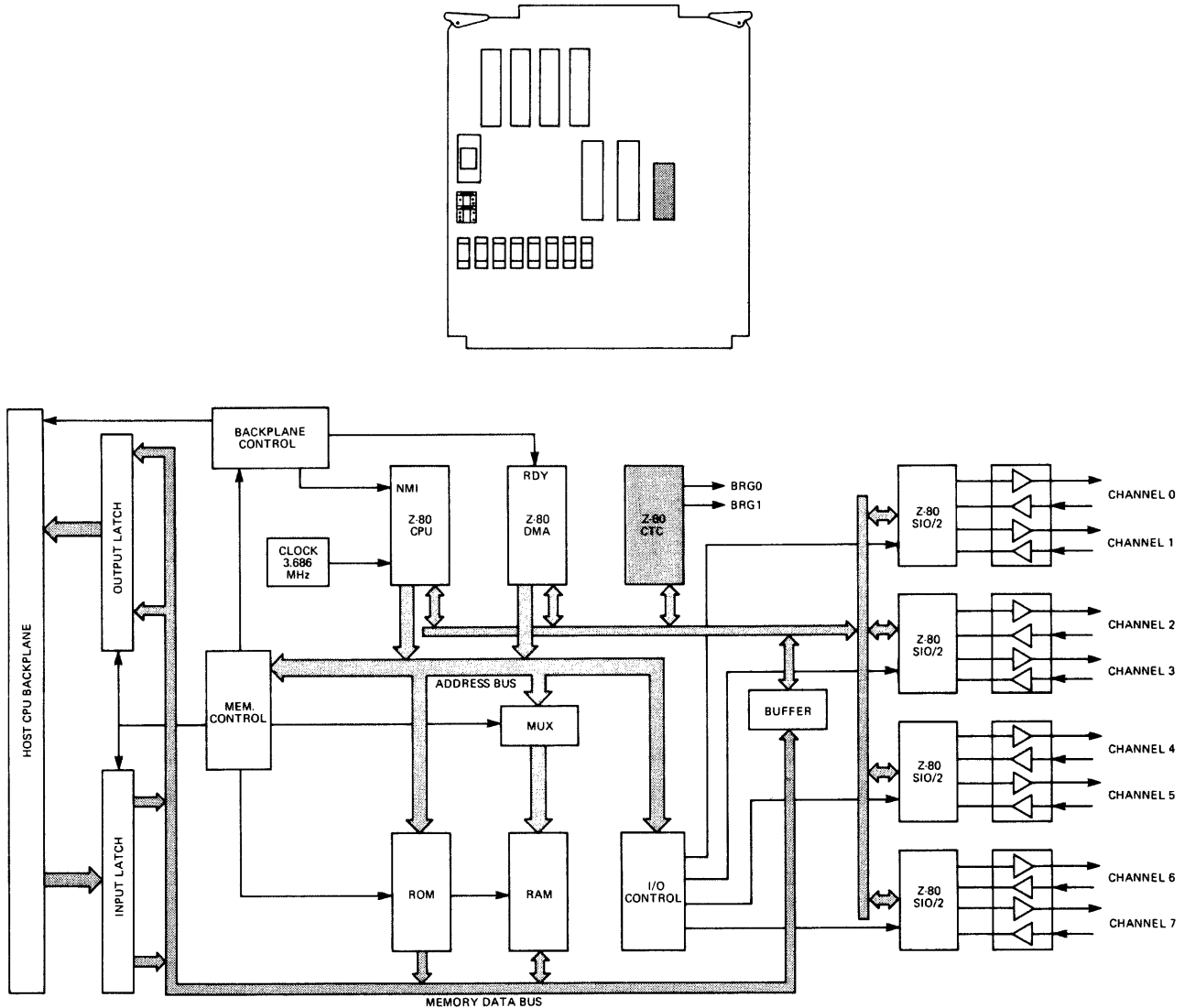
Figure 3-5. Counter-Timer Circuit

The CTC interfaces to the Z-80A data bus to allow the CPU to send configuration control words to the CTC and to read the status of four counter/timers when the need arises.

Two channels of the CTC, designated as Baud Rate Generators, provide data clocks to the 8 ports of the MUX. These ports can be arbitrarily divided into two groups, each connected to a BRG. Twelve baud rates have been defined from 50 baud to 19.2 kilobaud. This is accomplished

through the issuance of a particular command word to the interface by the host software driver. Ports connected to the same BRG must be initialized to the same baud rate with the following exceptions:

An additional parameter to the command word mentioned above, selects a prescaler within the SIO chip that acts upon the signal received from the BRG. Prescalers redefine the baud rate such that either BRG can simultaneously supply the data rates in one of the columns listed below:

SIO PRESCALER		GROUP 1	GROUP 2	GROUP 3
X16	=	75	300	2400
X32	=	150		4800
X64	=		1200	9600

READ-ONLY MEMORY (ROM)

The MUX interface employs 8K bytes of ROM on one chip. All of the Z-80A software required to implement the backplane control and interaction functions for eight serial data communications channels is contained in this ROM and is referred to as firmware. The power fail recovery and initialization routines are also contained in ROM.
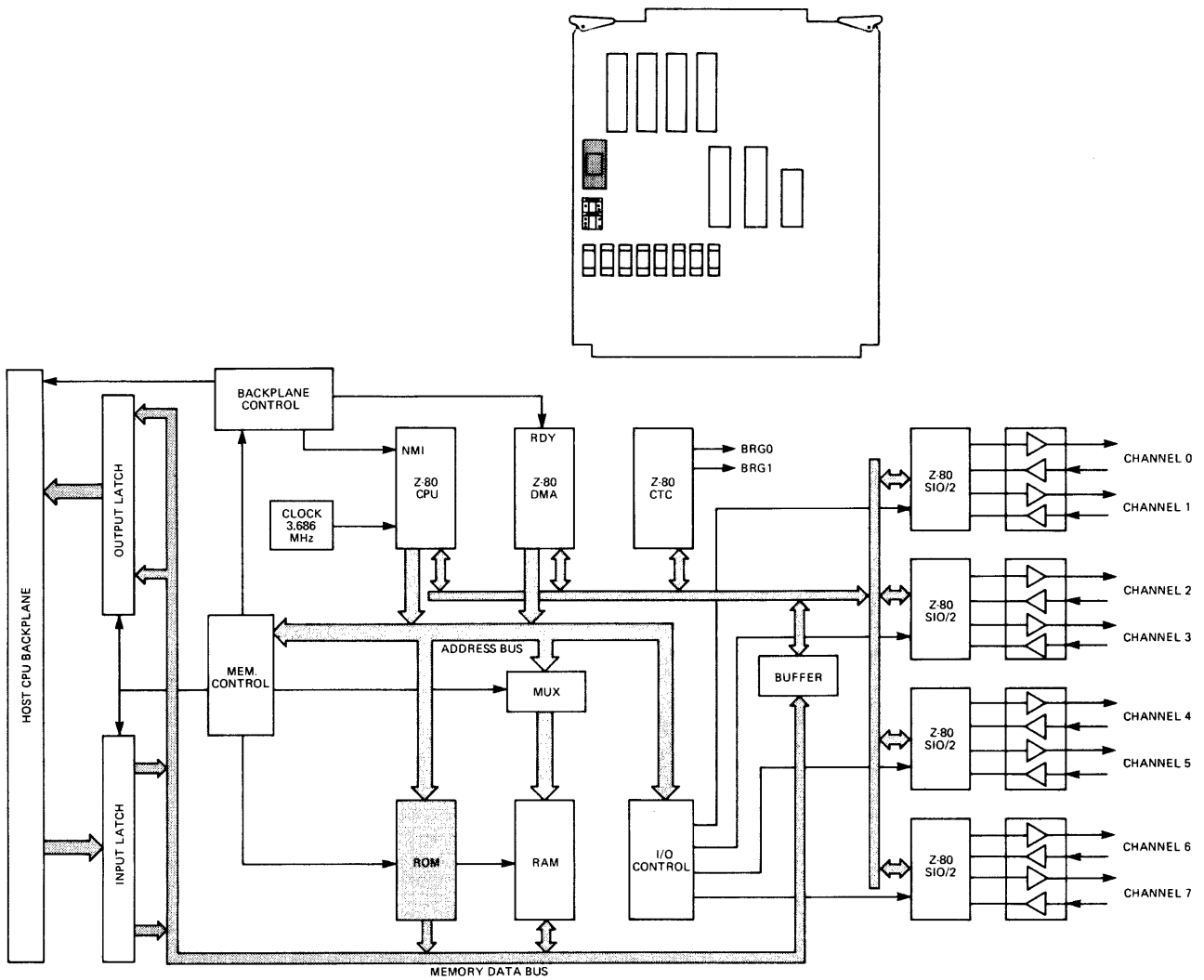
Figure 3-6. Read-Only Memory

A set of removeable jumpers on the MUX interface is provided to allow the use of different ROM devices. Refer to Section 2, "Installation", for the proper ROM jumper configuration. The HP 12792B product is shipped from the factory with the ROM jumpers properly configured for the type of ROM chip installed.

RANDOM-ACCESS MEMORY (RAM)

The MUX interface employs 16K bytes of dynamic RAM in the location illustrated below.
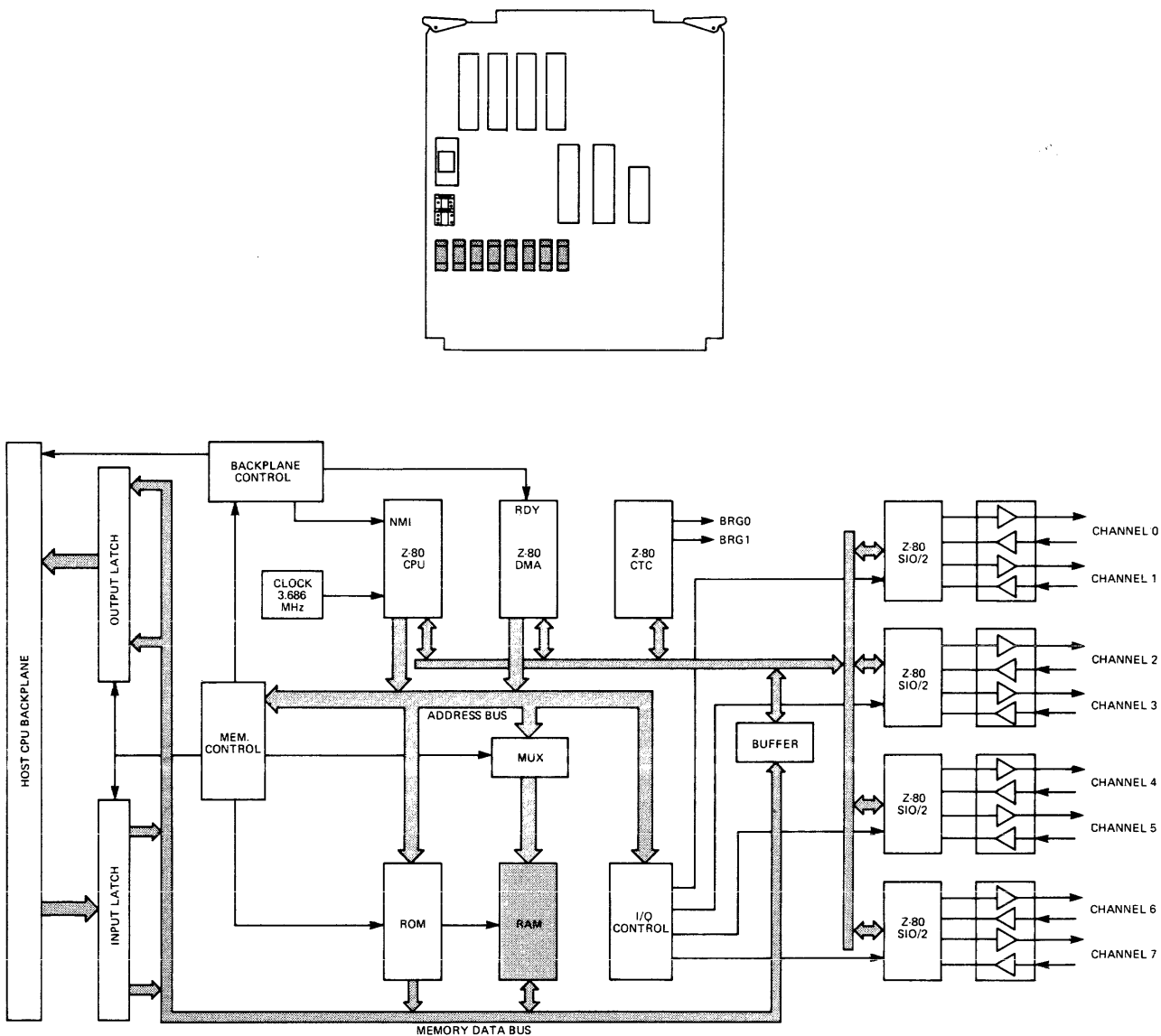
Figure 3-7. Random-Access Memory

This memory is used for data buffers (two 254-byte buffers for transmit and two 254-byte buffers for receive per channel) and the storage of firmware variables. The appropriate refresh signals are provided to the dynamic RAM devices by a combination of the refresh capability of the Z-80A CPU and a Field Programmable Logic Array (FPLA) on the MUX interface. The FPLA operates as a state machine and also invokes WAIT states in reads from ROM and in interrupt cycles, among others.

Additional technical information concerning the Z-80A CPU and support chips is available in the following technical manuals provided by the Zilog Corporation:

* Z-80A CPU Technical Manual (Zilog part number 03-0029-01)

* Z-80A SIO Technical Manual (Zilog part number 03-3033-01)

* Zilog Data Book (Zilog part number 03-8032-01)

Communication Line Interface

The communication line circuitry refers to the receivers and drivers on the MUX interface that accept and send data to and from a terminal or user device over the communication line. The MUX interface communication line circuitry is capable of supporting the EIA RS-232-C, CCITT V.24 and EIA RS-423-A serial I/O standards. For the purposes of this discussion, the various communications circuits are referred to by their RS-449 names. The correspondence between RS-232-C, V.24, and RS-449 circuit nomenclature is given in Section 6 of this manual.

Section 4 of this manual addresses the subject of serial interface standards and their relationship to various cabling options for the HP 12792B Multiplexer interface and subsystem.

COMMAND AND STATUS WORDS

In addition to data words, command and status words are also exchanged between the host computer and the MUX interface. These additional words are transferred across the data bus and the data latches to aid in the process of communication between the host and the interface. Command words are issued by the host to the interface and status words are sent by the interface to the host.

A brief description of the principal command and status words will prove helpful in understanding the functional level description given later in this section.

Command Words

Command words are initiated by the host driver. Some examples of command words are as follows:

SET KEY - Intializes certain parameters for a particular channel such as baud rate, parity, number of stop bits, and the number of bits per character.

RESET - Causes a branch to the power-up routine within the interface firmware.

ENABLE UNSOLICITED INPUTS - Enables the MUX interface to send status inputs to the host without the host asking for them. This command must be issued to enable the MUX interface to interrupt the host.

DISABLE UNSOLICITED INPUTS - Disables status inputs from the MUX interface so that the host can initiate a transfer.

ACKNOWLEDGE - Host acknowledges an unsolicited status input from the MUX interface and requests any further information regarding the status input.

CANCEL ALL - Cancel all active receive buffers on an individual channel.

REQUEST WRITE - The host wishes to send data to a particular channel and requires information concerning the availability of transmit buffer space.

WRITE - The host is ready to send data to an individual channel.

SET CHARACTER COUNT - The host specifies that a line of text will be terminated on a predetermined character count as opposed to an end-of-text (EOT) character.

SET READ CONFIGURATION - The host sets the read configuration parameters such as echo, edit (backspace) and record terminators (CR, RS, DC2, control-D or character count).

READ - The host is ready to receive data from an individual channel.

Status Words

Status words are generated by the MUX interface to inform the host of events that have occurred or are occurring on the interface or communications line. Examples of these status words are as follows:

BREAK RECEIVED - The break key has been pressed on this particular channel.

BUFFER AVAILABLE - A transmit buffer is available for transmitting data to the terminal.

TEXT AVAILABLE - the MUX interface has received a line of text from an individual channel.

The MUX interface can send status inputs to the host only after the host has enabled unsolicited inputs. The host can, of course, ask for status from the card. This constitutes a solicited status input.

FUNCTIONAL-LEVEL DESCRIPTION

The description that follows typifies the transmit and receive operations of the MUX interface. The command and status words used in the description below were explained in the previous paragraphs and the various data paths and hardware groups referenced below are presented in the block diagram in Figure 3-1.

Initially, the HP 1000 has been powered up and the communications line is not yet operational. The process of powering up the host resets the logic on the MUX interface.

Before either a transmit or receive operation can take place between the host and the MUX interface, certain setup parameters for each channel are sent to the interface via a command word from the host. These parameters include baud rate, parity type, number of stop bits, number of bits per character and ENQ-ACK handshake enable/disable. Once these parameters are set for each operational channel, the transmit and receive operations may proceed.

Transactions initiated by the host driver begin with a DISABLE UNSOLICITED INPUTS command followed by a series of other commands which vary from task to task. This command sequence is terminated by an ENABLE UNSOLICITED INPUTS command. The MUX interface initiates transactions by sending an unsolicited status input to the host. The host driver takes over at this point and sends an ACKNOWLEDGE and a series of commands. These transactions are terminated by the host sending an ENABLE UNSOLICITED INPUTS command.

The host sends a command to the MUX interface by writing data to the select code of the interface and executing an STC instruction. The STC instruction causes a Z-80A Non-Maskable Interrupt which then informs the interface to treat the data in its input latch as a command instead of data.

Receive Mode

The steps involved in a "receive transfer" (e.g., a transfer from a terminal to the host computer) are as follows:

1. The host computer issues DISABLE UNSOLICITED INPUTS, SET KEY, and SET CHARACTER COUNT commands (if need be) to configure a particular channel for the request.

2. The host computer issues an ENABLE UNSOLICITED INPUTS command to the MUX interface.

3. Characters are transmitted one at a time from the terminal to the RAM buffer on the MUX interface allocated to this particular channel. The SIO/2 chip converts the serial data characters it receives from the communications line to parallel data for processing on the MUX interface and the host computer.

4. The transfer of data from the RAM buffer to the host backplane can occur in one of three ways:

   a) Special Character Termination. The terminal sends a specified end-of-text character to the MUX. When the MUX recognizes this character, it writes a TEXT AVAILABLE status input message to the data latches and interrupts the host by setting the Flag flip-flop. (The status message also contains end-of-text information for the host.) The host returns a READ command and the line of text is transferred from the RAM buffer to to the data latches.

   b) Character Count Termination. The terminal sends a predetermined number of characters to the MUX. As in the above case, when the MUX recognizes the end of the text, it alerts the host. The host issues a READ command and the line of text is transferred to the data latches.

   c) Host Record Termination. The host controls the data transfer by issuing a READ command to transfer whatever characters have accumulated in the RAM buffer. If the buffer is empty, the READ remains pending until the terminal sends a character to the buffer; that character is passed to the host and the READ is satisfied.

   The method of data transfer is set up through instructions to the driver. For details, refer to the Multiplexer User's Guide, part number 5955-8867.

It should be noted that the Z-80A CPU is controlling all of the processing on the MUX interface by executing instructions that it fetches from ROM. This allows the host computer to communicate with eight separate devices in a multiplexed fashion.

Transmit Mode

The steps involved in a "transmit transfer" (e.g., a transfer from the host computer to a terminal) are as follows:

1. The host software driver issues a REQUEST WRITE comand to the MUX interface to find out if buffer space is available for the transmission of data.

2. When a transmit buffer becomes available, the MUX interface sends a BUFFER AVAILABLE status word to the host.

3. The host sends a WRITE command to the MUX interface.

4. The text block is transferred from the host to a RAM buffer on the MUX interface allocated to this particular channel via the DMA chip on the interface. The interface firmware appends carriage-return/line-feed characters to the text (if enabled to do so).

5. The transmit buffer on the MUX interface is transferred to the terminal, one character at a time, after all previous data transmissions to that terminal have completed. The transfer of the text to the terminal involves the RAM and the SIO/2 chips on the interface. The SIO/2 chip requests each character by interrupting the Z-80A CPU.

CABLE FABRICATION

INTRODUCTION

This section provides information to aid you in purchasing and fabricating cables for use with the HP 12792B Mulitplexer Interface. The information provided in this chapter is as follows:

* A brief description of the RS-232-C and RS-423 serial interface standards.
* Cabling information for all MUX connections.
* Data transmission rate wiring.

SERIAL INTERFACE STANDARDS

The most widely used standard for interfacing data communications equipment to data terminal equipment is the RS-232-C standard issued in its original form by the Electronic Industries Association in 1969. This standard defines a single-ended, bipolar (+/- 25 volts, maximum), un-terminated circuit for serial data transmission rates of up to 20 kilobaud with a maximum line length of 15 meters (50 ft). Only one signal line is required per circuit. However, the simplicity of the RS-232-C interface has its drawbacks. The line length and bandwidth restrictions result from the fact that considerable crosstalk and radiated emissions are generated by this interface.

The EIA issued the RS-423 standard in 1976 to allow higher data signalling rates and longer line lengths than the RS-232-C standard. This interface standard is single-ended, bipolar (+/- 6 volts, maximum) and unterminated for backward compatibility with RS-232-C. Signalling rates vary from 3 kilobaud at a 1219 meter (4000 feet) line length to 300 kilobaud at 12 meters (40 feet). RS-423 differs from RS-232-C in that a balanced receiver is used which references the driver's ground, thus permitting a ground potential difference between the local environments in which the driver and the receiver reside. In addition, the Signal Ground, Send Common and Receive Common circuits of the RS-423 equipment are connected to the AB circuit of the RS-232-C equipment. The end result of these measures is a reduction in noise interference.

Satisfactory operation and backward compatibility of RS-232-C circuits with the RS-423 circuits is possible if certain electrical, functional, and mechanical provisions are made. These provisions include the following:

* The RS-423 receivers must withstand the maximum RS-232-C driver voltages of +/- 25 volts.

* The RS-423 driver waveshape must be compatible with the RS-232 risetime.

* The RS-423 load resistance should be equal to or greater than 3K ohms.

* All common returns should be connected together.

* Other differences between RS-232-C and RS-423 include: Three RS-232-C circuits that do not have equivalents in RS-423 and eight RS-423 circuits that do not have RS-232-C equivalents.

* RS-232-C devices typically use a 25-pin connector; RS-423 devices use a 37-pin connector.

Figure 4-1 illustrates the RS-423-to-RS-232-C conversion. The balanced receiver for each channel on the MUX interface is fed from a twisted pair containing a data transmission line, Receive Data (RD-), and a Receive Data common (RD+). The fact that the RD- line carries the actual data signal may be confusing, however the MUX interface design inverts this signal as it enters the interface for use with the Z-80A SIO subsystem. The non-differential signal drivers, Send Data (SD-) and a respective Send Data Common line (SD+) make up the transmit data twisted pair.

Since the MUX interface is designed to meet RS-423 standards, the aforementioned electrical and functional considerations are provided. The mechanical provisions such as connector compatibility and circuit wiring are your responsibility. This Section provides the information necessary to build or purchase custom cables (if need be) for proper MUX interface operation with either RS-232-C or RS-423 devices.

CABLING

Any one of the following three connections can be made to the HP 12792B MUX card:

1) Connection to one HP 12828 RS-232-C panel. Up to eight RS-232-C devices (terminals, printers, and hard-wired full duplex modems) can be connected to an RS-232-C panel.

2) Connection to one HP 37214 modem card cage. The modem card cage allows up to seven connections to terminals, to modems, or directly to telephone lines.

3) Direct connection to RS-423-A devices. Up to eight such devices (terminals, printers, modems, "black boxes", and so on) can be connected to a single HP 12792B MUX card.

These connections will be described in the following paragraphs.

Connection to RS-232-C Panel

The standard HP 12792B product is designed for connection to user-supplied devices through the HP 12828 RS-232-C panel. It includes the following parts:

Description	HP Part No.
8-channel MUX card	5061-3415
8K EPROM	5180-1970
RS-232-C connector panel	12828-60001
Connecting cable (3 meters)	12828-60002
Connector kit for extension cable	12828-60004
Mounting bracket	12828-00004
This manual	12792-90020
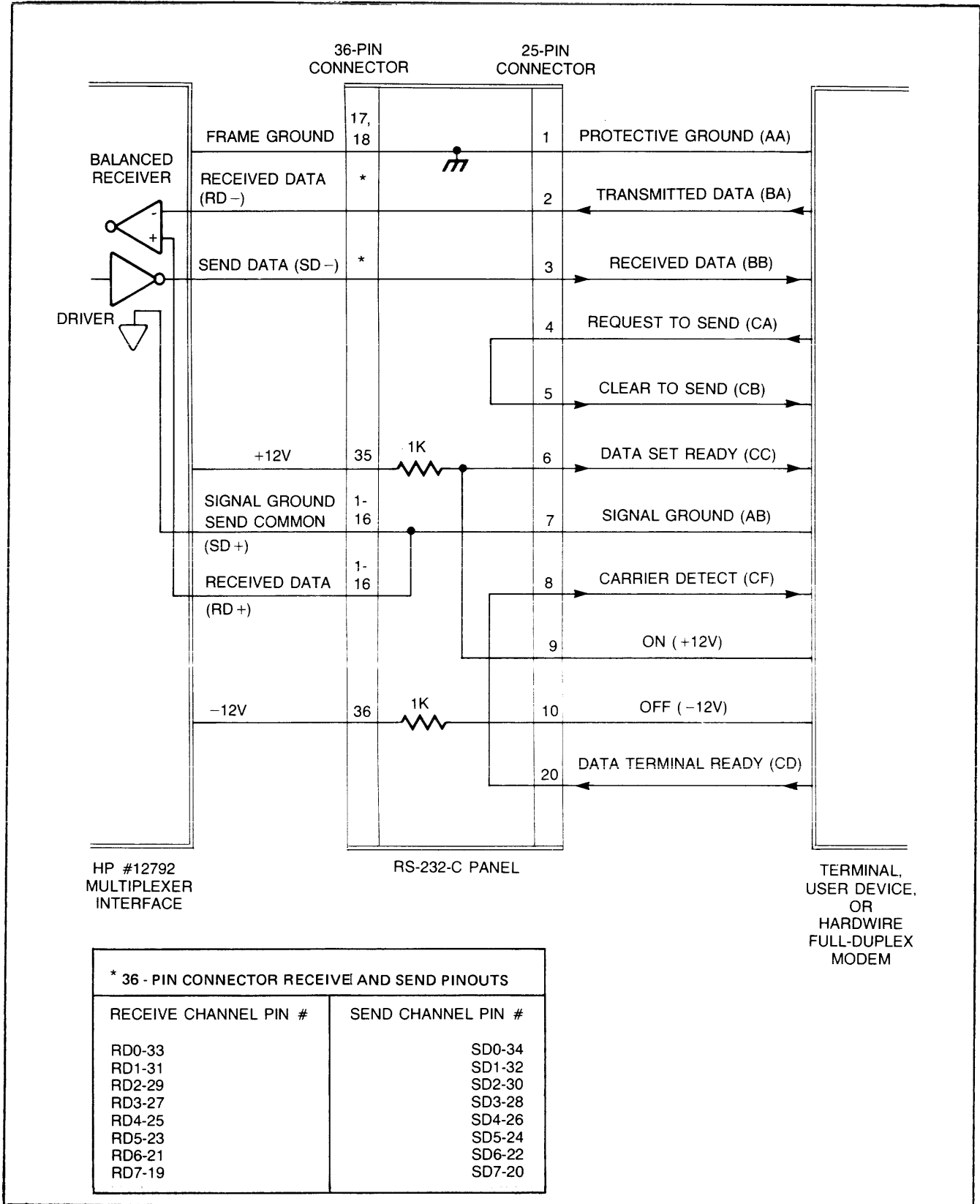
Figure 4-1. MUX Interface to MUX Panel to Device Wiring

Connect the MUX card to the RS-232-C panel with the 3-meter connecting cable. (When you connect the hooded connector to the MUX card, the cable should exit the connector on the right side. The connector will face the same way as all other connectors in the card cage.)

If 3 meters (10 feet) of cable isn't enough for your application, you can build an extension cable using the connector kit supplied. This extension cable goes between the 3-meter cable and the RS-232-C panel, and can be up to 88 meters (290 feet) long. The total cable length must not exceed 91 meters (300 feet).

The extension connector kit includes male and female connectors for the extension cable, as well as an insertion tool to aid in connecting the wires to the connector pins. The cable used for the extension is not supplied as part of the HP 12792B. You should use a shielded cable that contains 17 or more twisted pairs of 24 AWG wire. Belden cable number 9519 (19 pairs, 24 AWG, shielded), or its functional equivalent, is appropriate.

Connect the wires as shown in figure 4-2. Make sure that the shield is connected to pins 17 and 18 on each end of the cable. Then connect pin 1 of the male connector to pin 1 of the female connector, pin 2 to pin 2, and so on. If you have extra pairs left over, tie them off and cover them with a short length of heat-shrink tubing to prevent them from making contact with any of the other wires in the cable.

The above cables take care of connections between the MUX card and the RS-232-C panel. The

LESS THAN 88 METRES
(290 FT.) TOTAL

-12V	36	1	RD7 +
+12V	35	2	GND
SD0	34	3	RD6 +
RD0 -	33	4	GND
SD1	32	5	RD5 +
RD1 -	31	6	GND
SD2	30	7	RD4 +
RD2 -	29	8	GND
SD3	28	9	RD3 +
RD3 -	27	10	GND
SD4	26	11	RD2 +
RD4 -	25	12	GND
SD5	24	13	RD1 +
RD5 -	23	14	GND
SD6	22	15	RD0 +
RD6 -	21	16	GND
SD7	20	17	(SHIELD)
RD7 -	19	18	(SHIELD)

(3 METRE (10 FT.) CABLE END)
FEMALE CONNECTOR

RD7 +	1	36	-12V
GND	2	35	+12V
RD6 +	3	34	SD0
GND	4	33	RD0 -
RD5 +	5	32	SD1
GND	6	31	RD1 -
RD4 +	7	30	SD2
GND	8	29	RD2 -
RD3 +	9	28	SD3
GND	10	27	RD3 -
RD2 +	11	26	SD4
GND	12	25	RD4 -
RD1 +	13	24	SD5
GND	14	23	RD5 -
RD0 +	15	22	SD6
GND	16	21	RD6 -
(SHIELD)	17	20	SD7
(SHIELD)	18	19	RD7 -

(RS-232-C PANEL END)
MALE CONNECTOR

Figure 4-2. Extension Cable Wiring

RS-232-C panel itself is designed to convert the RS-423 standard, which originates at the MUX interface, to the RS-232-C standard, thus providing the backward compatibility needed for existing terminals and user I/O devices. Figure 4-1 illustrates the Panel-to-RS-232-C device connections. The Panel provides the necessary EIA RS-232-C Modem signal simulation (CA, CB, CC, CD, and CF) to be used if your terminals or devices require it. A device not requiring the extra protocol lines can operate sufficiently using the Transmitted Data (BA) and Received Data (BB) lines.

There are several ready-made cables available from Hewlett-Packard for connecting RS-232-C devices to the RS-232-C panel. Among these cables are:

Cable	Length	Remarks
13222N	5 m (17 ft)	Connects an HP 262x terminal to the RS-232-C panel.
13232A	4.5 m (15 ft)	Connects an HP 264x terminal to the RS-232-C panel.
30062B	7.6 m (25 ft)	Connects a hard-wired full duplex modem to the RS-232-C panel.
30062B, opt. 001	15.2 m (50 ft)	Longer version of 30062B.
30062C	7.6 m (25 ft)	Extension cable for any of the above cables.

If you need to make your own cables for connection to the RS-232-C panel, the wiring information in figure 4-3 will be useful. Figure 4-3 illustrates the RS-232-C Panel device connector pin assignments that are representative of each port, J0 through J7. Note that in keeping with EIA RS-232-C standards when referring to the terminal or I/O device, Received Data (BB) and Transmitted Data (BA) should be referenced with respect to the terminal or device. In other words the Transmitted Data (BA) at the device end is actually the Receive Data (RD-) at the MUX interface. By the same convention, Received Data (BB) at the device is actually Send Data (SD-) at the MUX interface. A standard 25-pin male connector (shown in Figure 4-3) must be attached to the RS-232-C Panel end of the cable and your device compatible connector at the other. It is recommended that such a cable not exceed 15 meters (50 ft) in length by the RS-232-C standard. Figure 4-3 gives the pin-to-signal relationships for the 25-pin connector at the RS-232-C Panel end of the fabricated cable.

A +12 volt line is provided on pin 9 of each RS-232-C Panel connector as well as a -12 volt line on pin 10. These lines are intended for use in providing static control levels to hardwired full-duplex modems. These voltages can be used in situations where a device handshake or control line needs to be permanently tied high or low. The current available at each connector is +/- 0.05 amps. This current is sufficient to drive three control lines.

The figure shows wiring details including:

Direction, NAME, PIN columns (DEVICE side):

NAME	PIN
CD	20
-12	10
+12	9
CF	8
AB	7
CC	6
CB	5
CA	4
BB	3
BA	2
AA	1

25-PIN MALE CONNECTOR

+12V AND -12V AVAILABLE FOR STATIC CONTROL OF HARDWIRED FULL-DUPLEX MODEMS.

-12V — 10
+12V — 9
DATA CARRIER DETECT(CF) — 8
SIGNAL GROUND (AB) — 7
DATA SET READY(CC) — 6   20 — DATA TERMINAL READY (CD)
CLEAR TO SEND (CB) — 5
REQUEST TO SEND(CA) — 4
*RECEIVED DATA(BB) — 3
*TRANSMITTED DATA (BA) — 2
PROTECTIVE GROUND(AA) — 1

*WITH RESPECT TO TERMINAL OR DEVICE.

DEVICE-DEPENDENT CONNECTOR   MULTIPLEXER PANEL CONNECTOR

Figure 4-3. RS-232-C Panel to Device Wiring

Connection to Modem Card Cage

Option #002 of the HP 12792B is designed for connection to the HP 37214 modem card cage. The HP 12792B with option 002 includes the following parts:

Description	HP Part No.
8-channel MUX card	5061-3415
8K EPROM	5180-1970
Connecting cable (3 meters)	12828-60002
This manual	12792-90020

The modem card cage can be located no more than 4.5 meters (15 feet) from the MUX card. The 3-meter cable supplied should be of ample length, as the modem card cage is usually racked in the same cabinet as the host computer. Connecting the modem card cage to the MUX card is similar to connecting the RS-232-C panel. (Indeed, the same connecting cable is used.)

Connect the MUX card to the modem card cage using the 3-meter connecting cable. (When you connect the hooded connector to the MUX card, the cable should exit the connector on the right side. The connector will face the same way as all other connectors in the card cage.)

Connection to RS-423-A Devices

Option #003 of the HP 12792B is appropriate for direct connection to RS-423-A devices. The HP 12792B with option 003 includes the following:

Description	HP Part No.
8-channel MUX card	5061-3415
8K EPROM	5180-1970
80-pin edge connector kit	5061-3467
This manual	12792-90020

Two possible types of connections are suggested: a direct connection from your device to the MUX interface or a connection that would involve a central distribution panel of your own design. You might consider a panel that does not impose the RS-232-C restriction but would implement and pass the RS-423 circuit standards, which are originally observed on the interface, to your I/O devices.

The HP 12792B Multiplexer may be directly connected to terminals, printers, hardwired full-duplex modems or user-supplied termination panels, thereby removing the need for the RS-232-C Panel. The backward-compatible nature of the RS-423 drivers and receivers with RS-232-C devices makes this possible. The direct connection involves the fabrication of a cable not longer than 91 meters (300 ft) with the 80-pin card connector (supplied with the HP 12792B Option 003 product) at one end and up to eight device-dependent connectors or a termination panel at the other.

Figure 4-4 details the actual fabrication of the cable. Terminals require connection of the Send Data (SD-) signal for data reception, the Receive Data (RD-) signal for data transmission and a signal ground. The Send Data (SD-) and ground signals (SD+) are all that are needed to connect a line printer. Remember that these signal names are referenced with respect to the MUX and not the terminal, printer, or I/O device.

Physically, this cable is an 18 or 19 twisted-pair conductor, 24 AWG cable (Belden cable number 9519 or equivalent), not more than 91 meters (300 ft) in length. The MUX interface connector is an eighty-pin hooded connector (supplied with 12792B Option 003). This connector contains a different pin numbering scheme than the MUX interface it connects to. The even-numbered (component) side of the MUX interface corresponds with the side labeled "B" of the connector. The odd-numbered (solder) side of the MUX interface corresponds with the side of the connector labeled "A".

The device connectors will depend upon the devices being interfaced. Hewlett-Packard terminals require a 30-pin hooded card connector (HP 264x series and 2675A), a 50-pin connector (HP 262x series), or a standard 25-pin connector (HP 2635A). Hewlett-Packard printers require a 25-pin connector (HP 2631A, 2635A and HP 7310A).
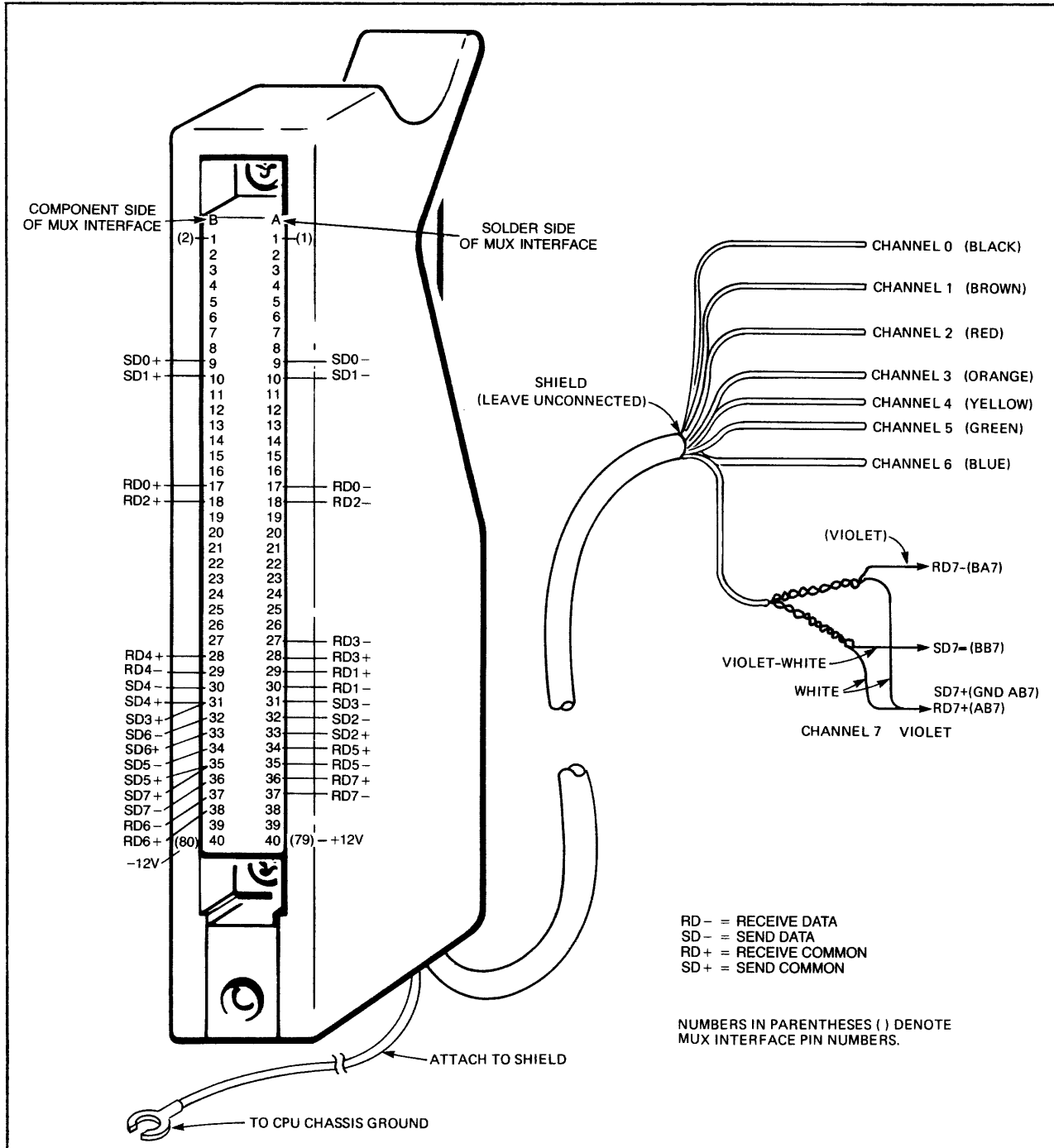
Figure 4-4. MUX Connector Wiring

Figure 4-5 illustrates the fabrication of the hooded card connector end of the custom cable.

According to the RS-423 standard, the MUX interface Send Data common signals are simply ground connection pins on the edge connector. For instance, the channel 0 Send Data common (SD0+) signal is actually a ground pin on the MUX interface edge connector. This pin is numbered 18 on the in-
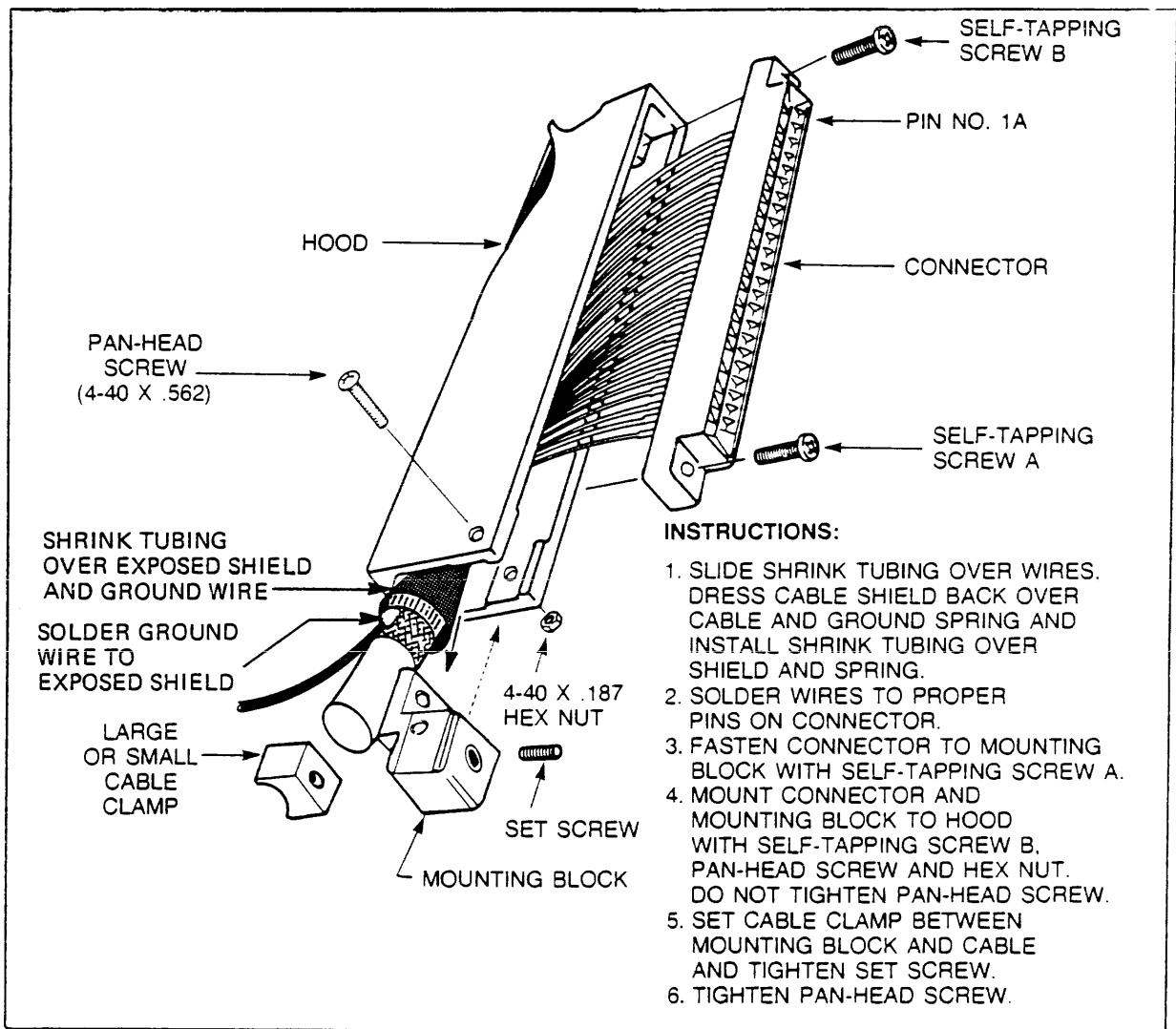
Figure 4-5. 80-Pin Card Connector

terface and 9A on the connector. Note that there are two cases in which one ground pin serves as the Send Data common line for two channels. Pin 31B (62 on the MUX interface) is the Send Data common for channels 3 and 4; and pin 35B (70 on the MUX interface) is the Send Data common for channels 5 and 7.

In making the RS-423-to-RS-232-C conversion for your terminal or device, the two common lines, Send Data common and Receive Data common (the white wire in each of the twisted pairs), can be tied together at the terminal or device end.

Static control-level lines for hardwired full-duplex modems are provided. In this case, the +12 volt line is on pin 40A (pin 79 of the MUX interface) and the -12 volt line is on pin 40B (pin 80 of the MUX interface). Because of the length of this cable, the available current at the end of each of the static control lines may be as small as +/- 0.04 amps.

Custom Panel

If the RS-423 (subset of RS-449) standards are followed you can design and construct an RS-423 distribution panel. The RS-423 panel would have to implement the use of twisted pair for both send and receive lines between the panel and the device as well as from the MUX interface to the panel. The common (white) wires for each function would not be permitted to be tied together at the panel but instead passed through to the device, thus providing the needed differential operation between the host and the device. Good shielding and grounding practices should also be followed.

Data Transmission Rate Wiring

There are two hardware baud rate generators (BRGs) on the MUX card. Each MUX channel is connected to one (and only one) of the BRGs. These connections are hard-wired through the use of jumpers in the MUX card connector. You can rearrange the jumpers at any time (as long as the MUX card is not in use) to suit your needs.

The host software interface driver allows you to programatically set the baud rate of each MUX channel. This, in turn, sets the baud rates of the BRGs. The combination of the software-selectable baud rate and the hard-wired distribution of the BRG outputs gives you great flexibility. By using the "grouped" baud rates (described in Section 2) you can distribute up to five different baud rates to the eight MUX channels.

For example, consider a typical system configuration in which seven terminals and one line printer are used with the MUX. The terminals assigned to channels 1 through 7 are connected to one BRG, and the printer, assigned to channel 0, is connected to the other BRG. This connection is physically brought about by connecting wire jumpers on the MUX card connector, as illustrated by wiring option 1 in figure 4-6. (The MUX card connector is wired at the factory in this configuration.) The actual baud rates of 9600 (for the terminals) and 1200 (for the printer) are set by the user through the software interface driver. Refer to the Driver Reference Manual for your system for full details on setting baud rates.

Wiring option 2 illustrates the wiring of the connector for connecting two devices to one BRG and the remaining six devices to the other BRG. Wiring option 3 connects three devices to one BRG and five devices to the other BRG. Wiring option 4 connects four devices to each BRG.

The figure shows a rear view of the MUX interface connector with pin assignments in columns A and B (numbered 1–40), a jumper pattern table, and several wiring options.

Labels on the connector diagram:

REAR VIEW OF
MUX INTERFACE
CONNECTOR

JUMPERS NEEDED
FOR TIMING INTERNAL
TO THE MUX INTERFACE

BRG0
BRG1

CHANNEL 7 TIMING
CHANNEL 5 TIMING
CHANNEL 4 TIMING
CHANNEL 6 TIMING
CHANNEL 3 TIMING
CHANNEL 1 TIMING
CHANNEL 2 TIMING
CHANNEL 0 TIMING

CABLE ENTRY
WIRE VIEW

WIRING OPTION 1

JUMPER PATTERN	BRG0	BRG1
1	0	1-7
2	0-1	2-7
3	0-2	3-7
4	0-3	4-7

WIRING OPTION 2   WIRING OPTION 3   WIRING OPTION 4

Figure 4-6. Data Transmission Rate Wiring

INTRODUCTION

This chapter should be consulted for reference regarding the following topics:

* Maintenance Procedures

* Testing/Diagnostic Procedures

* Basic Troubleshooting Techniques

PREVENTIVE MAINTENANCE

There is no preventive maintenance (PM) required for the HP 12792B Multiplexer Subsystem other than a routine inspection of interface, cables, etc. This should be performed as part of the entire HP 1000 System PM. At that time, the interface and cables should be visually inspected for loose or broken components, or the presence of foreign objects. The following MUX interface Tests/Diagnostics should only be performed when a failure is suspected in the MUX hardware.

Two methods exist to verify proper operation of the Multiplexer hardware subsystem:

* The Echoplex Verification Test

* The Off/On-line Functional Diagnostics

More information regarding these tests is provided in the following paragraphs.

ECHOPLEX VERIFICATION TEST

The purpose of the Echoplex Verification Test is to confirm the basic integrity of the MUX interface. When performing power-up or PRESET, the MUX interface enters an echoplex mode. This enables the Z-80 subsystem, resident on the interface, to accept typed characters from terminals connected to any of its eight ports. The interface then processes the character(s) and echoes the character(s) back to the initiating terminal. As a result of this echo feature, any cables, panels, or terminals attached to the MUX interface are also tested as they provide the essential path by which the echo is accomplished.

This test is capable of testing the Z-80A CPU and subsystem (ROM, RAM, SIO, and CTC and all associated support circuitry), however, it is not capable of confirming the integrity of the communication path between the host computer and the MUX interface, i.e., the input and output data/control/status latches and the DMA circuitry.

The term "test" refers to a Go/No Go test that, when executed, provides 75% assurance or confidence that the hardware operates correctly as specified. This percentage figure is only an approximation and relates to the amount, as well as the importance, of the circuitry that is tested. The Echoplex test, though providing limited confidence, is quick and easy to perform and requires a minimal amount of additional equipment and set-up effort. It should be performed only as an initial check for the interface and associated hardware.

Preparation and Required Hardware

Before the test can be performed, one to eight terminals (HP 2645's 2621's, etc.) must be connected to the MUX interface with a cable of your own design or the HP 12828A RS-232-C MUX Panel/cable and the appropriate RS-232-C compatible terminal cable(s). Consult chapter four of this manual if detailed cabling or baud rate configuration information is needed.

Reviewing chapter three, recall that two programmable baud rate generators (BRGs), resident on the MUX interface, are responsible for controlling the data transmission speed of all eight channels (ports). The physical connection between the BRGs and each of the eight ports is made in the cable connector (at the MUX interface end of the cable).

Both BRGs are initialized upon powering-up or after pressing PRESET. That is, BRG0 (baud rate generator number 0) will default to 2400 baud and BRG1 will default to 9600 baud. Thus, depending upon the BRG connections made inside the connector, each of the eight ports can be configured for either 2400 or 9600 baud. Note that the cable and connector supplied with the HP 12828A MUX Panel is wired so that channel 0 is connected to BRG0 while channels 1 through 7 are wired to BRG1. As previously stated, you can simply rewire this connector to obtain the desired baud rate/channel distribution.

Ensure that each terminal's baud rate setting is the same as that of the MUX interface port it is connected to. Also, the terminal(s) must be in the REMOTE mode.

Execution

After the desired number of terminals have been connected to the interface to be tested, you must either press PRESET or cycle the AC power on the host computer. This will initialize the echo mode as previously discussed. The following default conditions exist on the MUX interface as a function of power-up or PRESET:

```
* All ports are initialized to  - Edit and Echo modes
                                 - 8 bits/character
                                 - 1 stop bit/character
                                 - No parity

* Baud rate generators default  - BRG0 = 2400 baud
                                 - BRG1 = 9600 baud
```

The rest is up to you! As you type on any of the terminal keyboards, characters are sent to the MUX interface, processed by the Z-80 subsystem, then immediately sent back to the initiating terminal for your inspection. Characters should appear exactly as they are typed. You may wish to type in several ASCII combinations as well as perform the edit features (line delete and backspace) available in this mode.

Troubleshooting

Note that if the terminal is configured for LOCAL mode it may appear to pass this test, however this does not test the MUX interface and supporting hardware in this configuration.

If characters are not echoed back properly, a quick check of the following items may save troubleshooting time:

* Are MUX interface and supporting hardware correctly installed?

   Is the interface inserted all the way into the backplane of the host?

   Are the cabling connections (BRG-to-ports and input/ output data lines) wired correctly for the ports you are using?

   Is there power supplied to the interface from the host CPU?

   Did you initialize the echo test by pressing PRESET or by cycling the host computer power?

* Is the terminal correctly connected and configured?

   Is the cable properly connected to the terminal?

   Is the terminal set to the REMOTE mode and the baud rate correctly configured?

   Is there cause to suspect a failure in the terminal? Does the terminal operate correctly in other applications including connection to an HP 1000 Computer under RTE?

MUX Status After Testing

The MUX interface will remain in the initialized state (uninitialized from an operating system point of view) after power-up or PRESET until the driver software or system "welcome" commands are executed as a function of the RTE operating system. Thus the MUX hardware/ firmware subsystem will not respond to operating software unless the proper control requests are first sent to the interface from the driver or from an assembly language program. Consult the Multiplexer User's Guide for further details regarding MUX interface initialization from a driver.

FUNCTIONAL DIAGNOSTIC (MUXST)

If you require more than a minimum of functional assurance for MUX interface operation, a high level interface diagnostic may be performed as a function of the on-line RTE-IVB or RTE-VI operating system or the off-line RTE-MIII system. This diagnostic (%MUXST or !MUXST, for on-line or off-line use, respectively) is part of the HP 91711B diagnostic package. Refer to the appropriate HP 91711B manual for loading and execution instructions for these diagnostics.

INTRODUCTION

This Chapter contains the following information tables and servicing diagrams:

* M/E/F-Series MUX interface backplane connections (P1 connector)

* MUX interface device communication lines connections (J1 connector)

* RS-232-C MUX Panel 36-pin (J8) and 25-pin connections (J0 through J7)

* Serial I/O Circuits and Equivalents

* MUX interface Parts Location Diagram

* MUX interface Schematic Diagrams

* RS-232-C MUX Panel Schematic Diagram

Table 6-1 - Host Backplane (MUX I/F connector P1) Pin Assignments

PIN NO.	SIGNAL MNEMONIC	SIGNAL NAME
1	GND	Ground
2	GND	Ground
3	PRL	Priority Low
4	FLAGL	Flag Signal, Lower Select Code
5	SFC	Skip if Flag is Clear
6	IRQL	Interrupt Request, Lower Select Code
7	CLF	Clear Flag
8	IEN	Interrupt Enable
9	STF	Set Flag
10	IAK	Interrupt Acknowledge
11	T3	I/O Time Period 3
12	SKF	Skip on Flag
13	CRS	Control Reset
14	LSCM	Select Code Most Significant Digit (Lower Address)
15	IOG	I/O Group
16	LSCL	Select Code Least Significant Digit (Lower Address)
17	POPIO	Power On Preset to I/O
18	BIOS	"Not" Block I/O Strobe (E-Series Only)
19	SRQ	Service Request
20	IOO	I/O Data Output Signal
21	CLC	Clear Control
22	STC	Set Control
23	PRH	Priority High
24	IOI	I/O Data Input Signal
25	SFS	Skip if Flag is Set
26	IOBI 0	I/O Bus Input, bit 0
27	IOBI 8	I/O Bus Input, bit 8
28	IOBI 9	I/O Bus Input, bit 9
29	IOBI 1	I/O Bus Input, bit 1
30	IOBI 2	I/O Bus Input, bit 2
31	IOBI 10	I/O Bus Input, bit 10
32	SIR	Set Interrupt Request
33	IRQH	Interrupt Request (Higher Select Code)
34	HSCL	Select Code Least Significant Digit (Higher Address)
35	IOBO 0	I/O Bus Output, bit 0
36	+28 Volts	
37	HSCM	Select Code Most Significant Digit (Higher Address)
38	IOBO 1	I/O Output Bus, bit 1
39	+5V	

40	+5V	
41	IOBO 2	I/O Bus Output, bit 2
42	IOBO 4	I/O Bus Output, bit 4
43	+12V	
44	+12V	
45	IOBO 3	I/O Bus Output, bit 3
46	ENF	Enable Flag
47	-2V	
48	-2V	
49	FLGH	Interrupt Flag Signal (Higher Select Code)
50	RUN	Run
51	IOBO	I/O Bus Output, bit 5
52	IOBO 7	I/O Bus Output, bit 7
53	IOBO 6	I/O Bus Output, bit 6
54	IOBO 8	I/O Bus Output, bit 8
55	IOBO 11	I/O Bus Output, bit 11
56	IOBO 9	I/O Bus Output, bit 9
57	IOBO 12	I/O Bus Output, bit 12
58	IOBO 10	I/O Bus Output, bit 10
59	NOT USED	
60	IOBI 11	I/O Bus Input, bit 11
61	IOBO 13	I/O Bus Output, bit 13
62	EDT	End Data Transfer (DCPC)
63	NOT USED	
64	IOBI 3	I/O Bus Input, bit 3
65	IOBO 14	I/O Bus Output, bit 14
66	PON	Power On Normal
67	BIOO	"Not" Block I/O Output (E-Series Only)
68	NOT USED	
69	-12V	
70	-12V	
71	NOT USED	
72	NOT USED	
73	BIOI	"Not" Block I/O Input (E-Series Only)
74	IOBO 15	I/O Bus Output, bit 15
75	NOT USED	
76	NOT USED	
77	IOBI 4	I/O Bus Input, bit 4
78	IOBI 12	I/O Bus Input, bit 12
79	IOBI 13	I/O Bus Input, bit 13
80	IOBI 5	I/O Bus Input, bit 5
81	IOBI 6	I/O Bus Input, bit 6
82	IOBI 14	I/O Bus Input, bit 14
83	IOBI 15	I/O Bus Input, bit 15
84	IOBI 7	I/O Bus Input, bit 7
85	GND	Ground
86	GND	Ground

Table 6-2. MUX interface device communication lines connector (J1)

LEGEND: > = OUTPUT FROM MUX INTERFACE
< = INPUT TO MUX INTERFACE
( ) = MUX INTERFACE CABLE CONNECTOR PIN NUMBER
EIA = DENOTES EIA RS-423 SIGNAL

* MUX Interface and cable connector pinouts both given.

* TTL is implied when no logic level is given.

MUX INTERFACE CIRCUIT SIDE				MUX INTERFACE COMPONENT SIDE			
PIN		LABEL	NOTE	PIN		LABEL	NOTE
1	(1A)	+5V		2	(1B)	GND	
3	(2A)	+5V		4	(2B)	SCLK	1.843 MHz >
5	(3A)	+5V		6	(3B)	FCLK	7.373 MHz >
7	(4A)	+5V		8	(4B)	PNLIN	TTL <
9	(5A)			10	(5B)	PNLIN	GND
11	(6A)	PNLOUT	TTL >	12	(6B)	PNLOUT	GND
13	(7A)	CLK'	3.686MHz >	14	(7B)	CLK'	GND
15	(8A)	ENABL	LED DRIVER >	16	(8B)	ENABL	GND
17	(9A)	SD0-	EIA >	18	(9B)	SD0+	GND
19	(10A)	SD1-	EIA >	20	(10B)	SD1+	GND
21	(11A)			22	(11B)	GND	GND
23	(12A)	TIMSTRB	TTL <	24	(12B)	TIMSTRB	GND
25	(13A)	CLK1	CTC1 IN <	26	(13B)	CLK1	GND
27	(14A)	BRG0	CTC0 OUT >	28	(14B)	BRG0	GND
29	(15A)	BRG1	CTC1 OUT >	30	(15B)	BRG1	GND
31	(16A)	CLK0	CTC0 IN <	32	(16B)	CLK0	GND
33	(17A)	RD0-	EIA <	34	(17B)	RD0+	EIA <
35	(18A)	RD2-	EIA <	36	(18B)	RD2+	EIA <
37	(19A)	T7	TTL <	38	(19B)	T7	GND
39	(20A)	T5	TTL <	40	(20B)	T5	GND
41	(21A)	T4	TTL <	42	(21B)	T4	GND
43	(22A)	T6	TTL <	44	(22B)	T6	GND
45	(23A)	T3	TTL <	46	(23B)	T3	GND
47	(24A)	T1	TTL <	48	(24B)	T1	GND
49	(25A)	T2	TTL <	50	(25B)	T2	GND
51	(26A)	T0	TTL <	52	(26B)	T0	GND
53	(27A)	RD3-	EIA <	54	(27B)	GND	GND
55	(28A)	RD3+	EIA <	56	(28B)	RD4+	EIA <
57	(29A)	RD1+	EIA <	58	(29B)	RD4-	EIA <
59	(30A)	RD1-	EIA <	60	(30B)	SD4-	EIA >
61	(31A)	SD3-	EIA >	62	(31B)	SD3+,4+	GND
63	(32A)	SD2-	EIA >	64	(32B)	SD6-	EIA >
65	(33A)	SD2+	GND	66	(33B)	SD6+	GND

Table 6-2. MUX Interface Connector (continued)

PIN		LABEL	NOTE		PIN		LABEL	NOTE	
MUX INTERFACE CIRCUIT SIDE					**MUX INTERFACE COMPONENT SIDE**				
67	(34A)	RD5+	EIA	<	68	(34B)	SD5-	EIA	>
69	(35A)	RD5-	EIA	<	70	(35B)	SD5+,7+	GND	
71	(36A)	RD7+	EIA	<	72	(36B)	SD7-	EIA	>
73	(37A)	RD7-	EIA	<	74	(37B)	RD6-	EIA	<
75	(38A)				76	(38B)	RD6+	EIA	<
77	(39A)	+12V			78	(39B)	BLANK		
79	(40A)	+12V			80	(40B)	-12V		

Table 6-3. RS-232-C MUX Panel Connector Pinouts

36-PIN J8 CONNECTOR	SIGNAL MNEMONIC	SIGNAL FUNCTION
(MUX interface port)	(with respect to MUX interface)	
PIN NUMBER		
1	RD7+	RECEIVE DATA COMMON
2	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
3	RD6+	RECEIVE DATA COMMON
4	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
5	RD5+	RECEIVE DATA COMMON
6	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
7	RD4+	RECEIVE DATA COMMON
8	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
9	RD3+	RECEIVE DATA COMMON
10	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
11	RD2+	RECEIVE DATA COMMON
12	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
13	RD1+	RECEIVE DATA COMMON
14	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
15	RD0+	RECEIVE DATA COMMON
16	GND (SD+)	SIGNAL GROUND (SEND DATA COMMON)
17	GND	FRAME GROUND (CABLE SHIELD)
18	GND	FRAME GROUND (CABLE SHIELD)
19	RD7-	RECEIVE DATA
20	SD7-	SEND DATA

Table 6-3. RS-232-C MUX Panel Connector Pinouts (continued)

36-PIN J8 CONNECTOR	SIGNAL MNEMONIC	SIGNAL FUNCTION
(MUX interface port)	(with respect to MUX interface)	
PIN NUMBER		
21	RD6-	RECEIVE DATA
22	SD6-	SEND DATA
23	RD5-	RECEIVE DATA
24	SD5-	SEND DATA
25	RD4-	RECEIVE DATA
26	SD4-	SEND DATA
27	RD3-	RECEIVE DATA
28	SD3-	SEND DATA
29	RD2-	RECEIVE DATA
30	SD2-	SEND DATA
31	RD1-	RECEIVE DATA
32	SD1-	SEND DATA
33	RD0-	RECEIVE DATA
34	SD0-	SEND DATA
35	+12V	STATIC CONTROL VOLTAGE
36	-12V	STATIC CONTROL VOLTAGE

25-PIN CONNECTOR	SIGNAL MNEMONIC	SIGNAL FUNCTION
(Device ports J0-J7) PIN NUMBER	(with respect to Terminal or I/O Device)	
1	AA	PROTECTIVE GROUND
2	BA	TRANSMITTED DATA
3	BB	RECEIVED DATA
4	CA	REQUEST TO SEND
5	CB	CLEAR TO SEND
6	CC	DATA SET READY
7	AB	SIGNAL GROUND
8	CF	DATA CARRIER DETECT
9	ON	+12V STATIC LEVEL CONTROL
10	OFF	-12V STATIC LEVEL CONTROL

Table 6-3. RS-232-C MUX Panel Connector Pinouts (continued)

25-PIN CONNECTOR	SIGNAL MNEMONIC	SIGNAL FUNCTION
(Device ports J0-J7)	(with respect to Terminal or I/O Device)	
PIN NUMBER		
11	NC	NO CONNECTION
12	NC	NO CONNECTION
13	NC	NO CONNECTION
14	NC	NO CONNECTION
15	NC	NO CONNECTION
16	NC	NO CONNECTION
17	NC	NO CONNECTION
18	NC	NO CONNECTION
19	NC	NO CONNECTION
20	CD	DATA TERMINAL READY
21	NC	NO CONNECTION
22	NC	NO CONNECTION
23	NC	NO CONNECTION
24	NC	NO CONNECTION
25	NC	NO CONNECTION

Table 6-4. Serial I/O Circuits

SIGNAL RS-232-C	CCITT V.24	FUNCTION	SIGNAL RS-449	FUNCTION	DIRECTION WITH RESPECT TO TERMINAL
AA	101	PROTECTIVE GROUND	--		
AB	102	SIGNAL GROUND	SG	SIGNAL GROUND	
--	---		SC	SEND COMMON	
--	---		RC	RECEIVE COMMON	
BA	103	TRANSMITTED DATA	*SD	SEND DATA	OUT
BB	104	RECEIVED DATA	*RD	RECEIVE DATA	IN
CA	105	REQUEST TO SEND	RS	REQUEST TO SEND	OUT
CB	106	CLEAR TO SEND	CS	CLEAR TO SEND	IN
CC	107	DATA SET READY	DM	DATA MODE	IN
CD	108.2	DATA TERMINAL READY	TR	TERMINAL READY	OUT
CF	109	CARRIER DETECT	RR	RECEIVER READY	IN

*SD (terminal) = RD- (MUX interface)

*RD (terminal) = SD- (MUX interface)
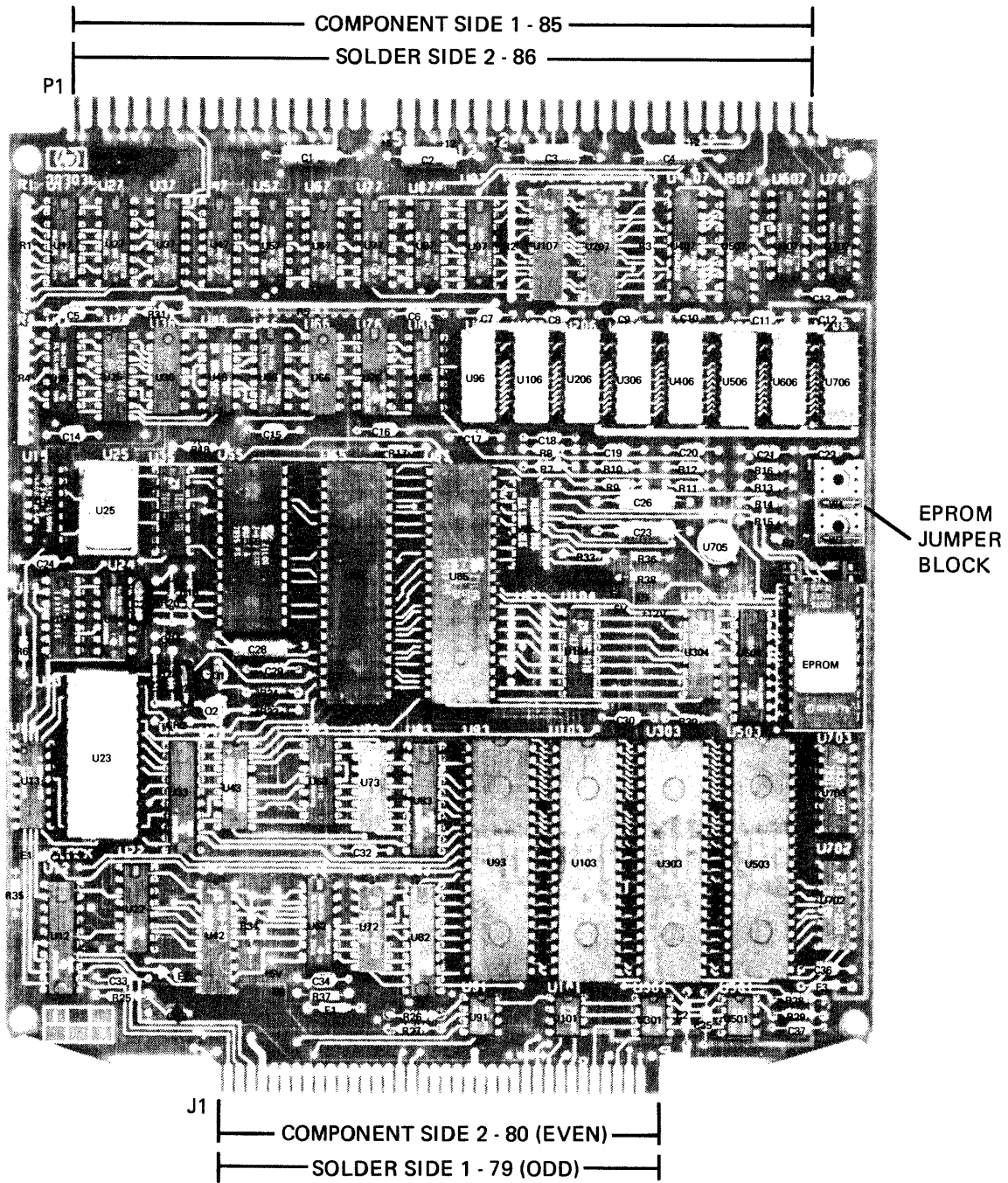
Figure 6-1. MUX Interface Parts Location Diagram
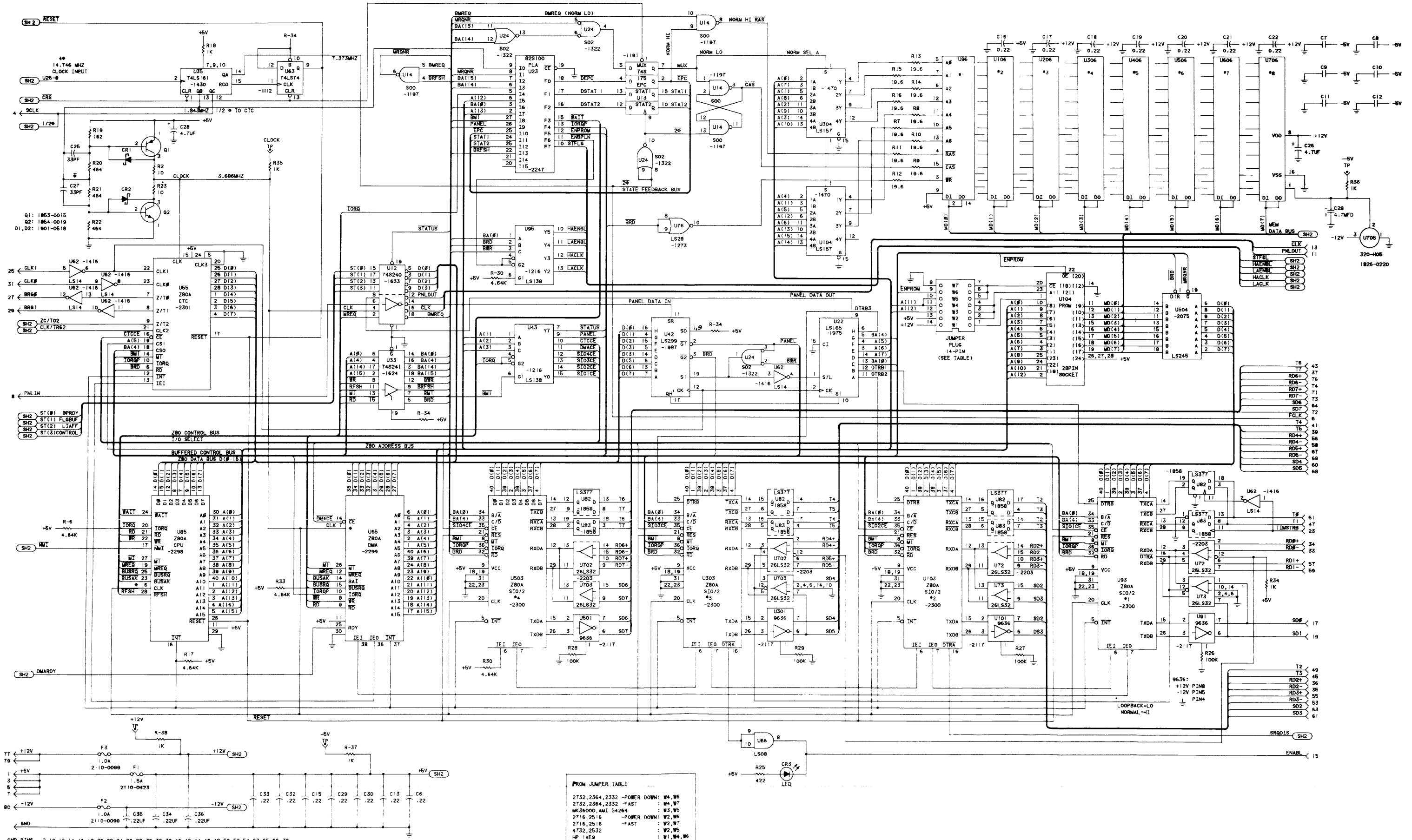
Figure 6-2. HP 12792B MUX Interface
Schematic Diagrams (Sheet 1 of 2)
6-9/6-10
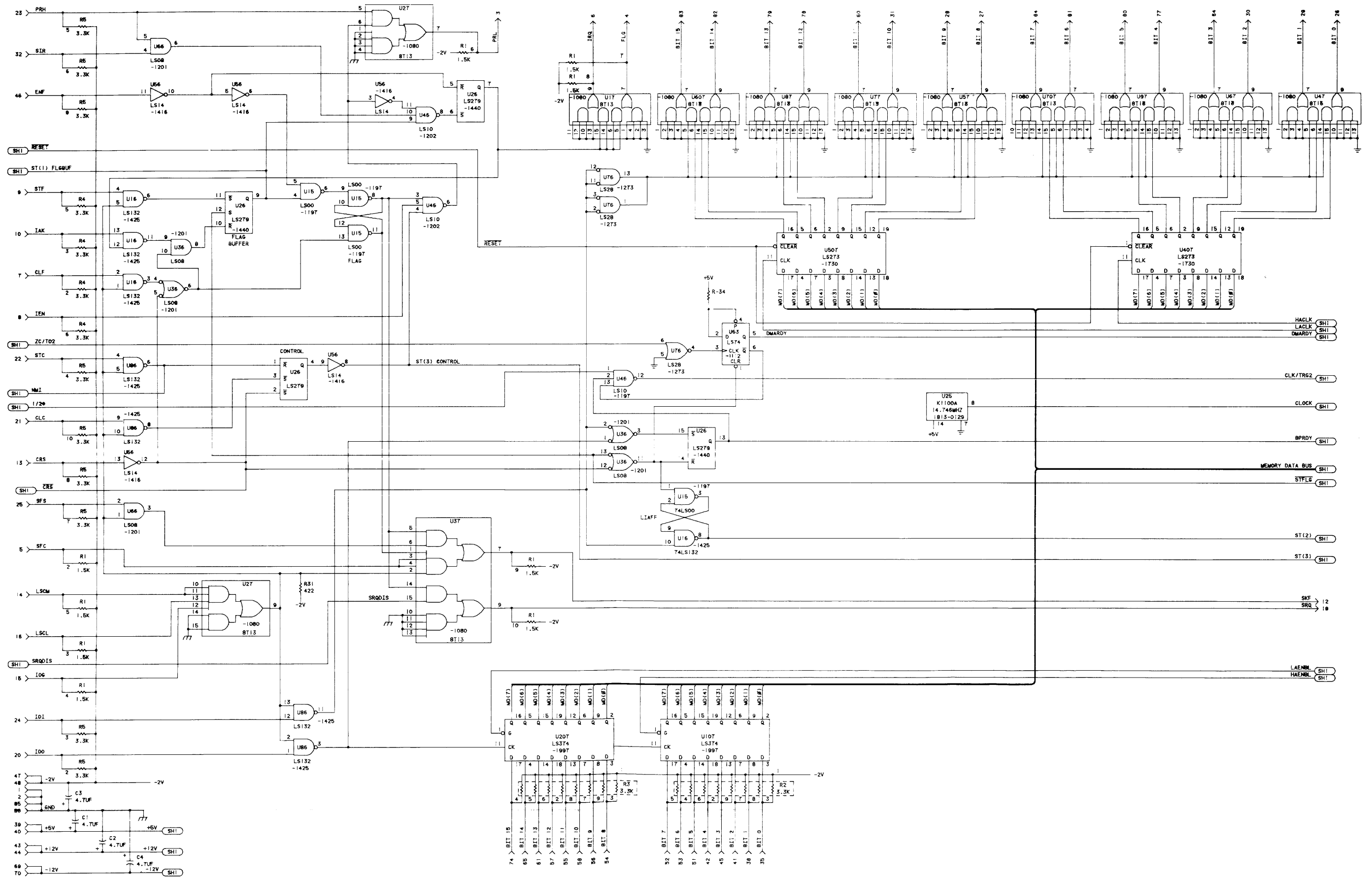
Figure 6-2. HP 12792B MUX Interface
Schematic Diagrams (Sheet 2 of 2)
6-11/6-12

Figure 6-3. HP 12828A RS-232-C MUX Panel Schematic Diagram

REPLACEMENT PARTS
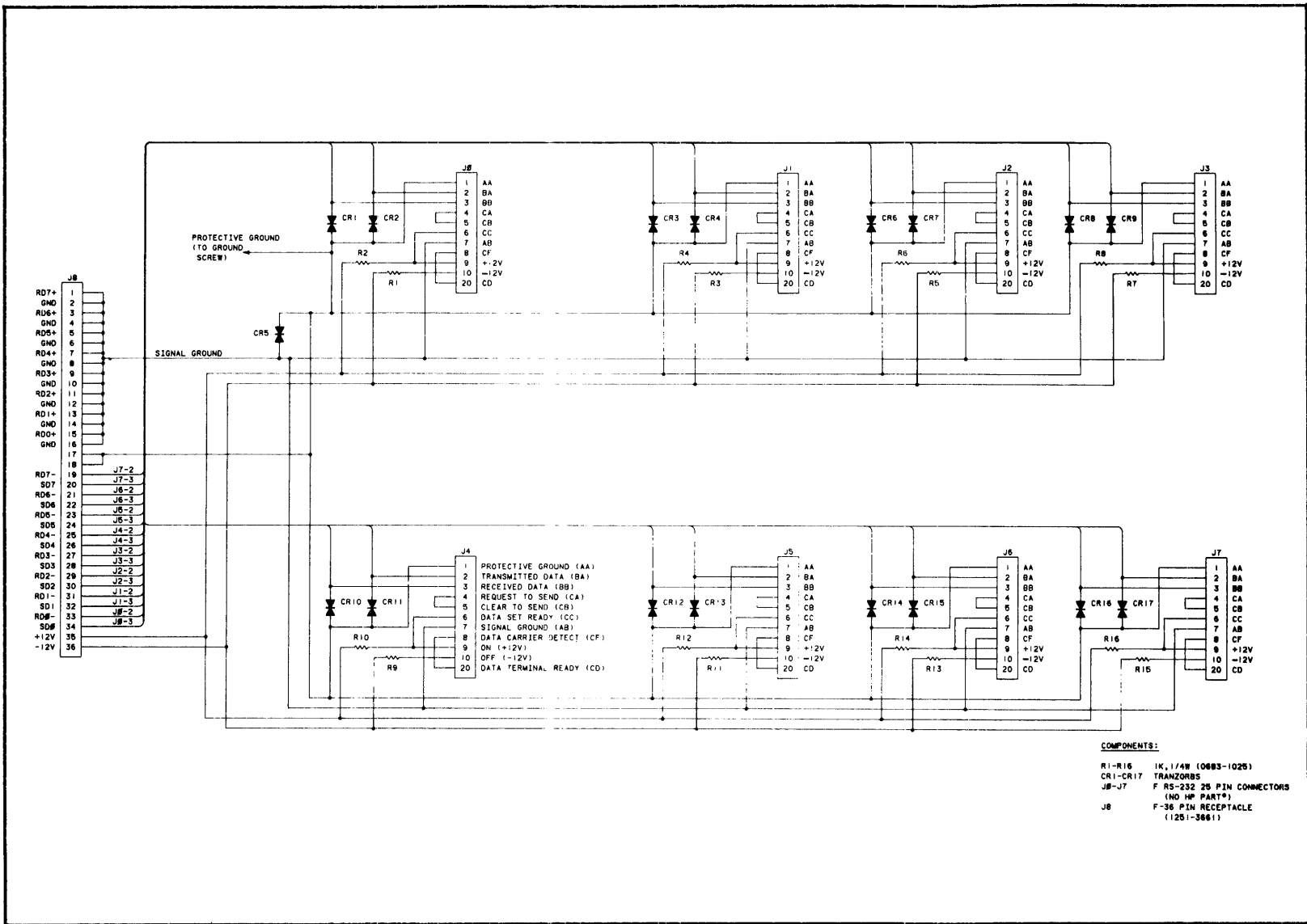
INTRODUCTION

This Chapter contains the following information that will aid you when ordering replaceable parts for the HP 12792B MUX Interface:

* How to order listed and non-listed parts for the MUX

* Replaceable Parts tables and information for the MUX

* Code List of Manufacturers for the replaceable parts

REPLACEABLE PARTS

Table 7-1 gives you a list of the replaceable parts in alphanumeric order of the reference designations used on the MUX Interface Parts Location Diagram (Figure 6-1) and the MUX Interface Schematic Diagrams (Figure 6-2) in Section Six. The following information is listed for each part:

1. Reference designation of the part.

2. The Hewlett-Packard part number.

3. Part number check digit (CD).

4. Total quantity (QTY) of each part used in the interface.

5. Description of the part.

6. A five-digit code number that corresponds to the manufacturer of the part.

7. The manufacturer's part number.

ORDERING INFORMATION

To order replacement parts or to obtain information on the parts used in the MUX interface, address the order or inquiry to your local Hewlett-Packard Sales and Service Office (Sales and Service Office are listed in the back of this manual).

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with the check digit), and indicate the quantity you require. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, specify the following information:

1. Identification of the MUX interface or part.

2. Description and function of the part.

3. Quantity required.

Table 7-1. MUX Interface Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	5061-3415	2	1	21 MX MULTIPLEXER	28480	5061-3415
C1	0180-0100	3	7	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C2	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C3	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C4	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C5	0160-4842	6	27	CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C6	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C7	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C8	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C9	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C10	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C11	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C12	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C13	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C14	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C15	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C16	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C17	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C18	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C19	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C20	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C21	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C22	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C23	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C24	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C25	0160-2150	5	2	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
C26	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C27	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
C28	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
C29	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C30	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C32	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C33	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C34	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C35	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C36	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
C37	0160-4842	6		CAPACITOR-FXD .22UF +80-20% 50VDC CER	28480	0160-4842
CR1	1901-0518	8	2	DIODE-SCHOTTKY	28480	1901-0518
CR2	1901-0518	8		DIODE-SCHOTTKY	28480	1901-0518
CR3	1990-0486	6	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
F1	2110-0423	8	1	FUSE 1.5A 125V .281X.093	28480	2110-0423
F2	2110-0099	4	2	FUSE 1A 125V .281X.093	28480	2110-0099
F3	2110-0099	4		FUSE 1A 125V .281X.093	28480	2110-0099
Q1	1853-0015	7	1	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
Q2	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
R1	1810-0276	2	1	NETWORK-RES 10-SIP1.5K OHM X 9	01121	210A152
R2	1810-0278	5	8	NETWORK-RES 10-SIP3.3K OHM X 9	01121	210A332
R3	1810-0278	4		NETWORK-RES 10-SIP3.3K OHM X 9	01121	210A332
R4	1810-0278	4		NETWORK-RES 10-SIP3.3K OHM X 9	01121	210A332
R5	1810-0278	4		NETWORK-RES 10-SIP3.3K OHM X 9	01121	210A332
R6	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
R7	0698-3429	2	10	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R8	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R9	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R10	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R11	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R12	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R13	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R14	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R15	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R16	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R17	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
R18	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
R19	0757-0405	4	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162M-F
R20	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
R21	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
R22	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
R23	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
R24	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
R25	0698-3447	8	2	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422K-F
R26	0757-0465	6	4	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
R27	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
R28	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
R29	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
R30	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F

Table 7-1. MUX Interface Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R31	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-TO-422R-F
R33	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4641-F
R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
U12	1820-1633	8	1	IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U13	1820-1191	3	1	IC FF TTL S D-TYPE POS-EDGE-TRIG COM	01295	SN74S175N
U14	1820-0681	4	1	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U15	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
U16	1820-1425	6	2	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
U17	1820-1080	9	11	IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U22	1820-1975	1	1	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165N
U23	1820-2544	2	1	IC GATE TTL	28480	1820-2544
U24	1820-1322	2	1	IC GATE TTL S NOR QUAD 2-INP	01295	SN74S02N
U25	1813-0129	0	1	IC OSC HYBRID	34344	K1100A
U26	1820-1440	5	1	IC LCH TTL LS QUAD	01295	SN74LS279N
U27	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U33	1820-1624	7	1	IC BFR TTL S OCTL 1-INP	01295	SN74S241N
U35	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U36	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
U37	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U42	1820-1987	5	1	IC SHF-RGTR TTL LS COM CLEAR STOR 8-BIT	01295	SN74LS299N
U43	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
U46	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
U47	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U55	1820-2301	9	1		28480	1820-2301
U56	1820-1416	5	2	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
U57	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U62	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
U63	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U65	1820-2299	4	1		28480	1820-2299
U66	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
U67	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U72	1820-2203	0	4	IC RCVR TTL LS LINE RCVR QUAD	34335	AM26LS32PC
U73	1820-2203	0		IC RCVR TTL LS LINE RCVR QUAD	34335	AM26LS32PC
U76	1820-1273	2	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN74LS28N
U77	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U82	1820-1858	9	2	IC FF TTL LS D-TYPE OCTL	01295	SN74LS377N
U83	1820-1858	9		IC FF TTL LS D-TYPE OCTL	01295	SN74LS377N
U85	1820-2298	3	1		28480	1820-2298
U86	1820-1425	6		IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
U87	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U91	1820-2117	5	4	IC DRVR TTL LINE DRVR DUAL	07263	9636ATC
U93	1820-2300	8	4		28480	1820-2300
U95	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
U96	1818-1396	5	8	IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U97	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U101	1820-2117	5		IC DRVR TTL LINE DRVR DUAL	07263	9636ATC
U103	1820-2300	8			28480	1820-2300
U104	1820-1470	1	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
U106	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U107	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
U206	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U207	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
U301	1820-2117	5		IC DRVR TTL LINE DRVR DUAL	07263	9636ATC
U303	1820-2300	8			28480	1820-2300
U304	1820-1470	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
U306	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U406	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U407	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U501	1820-2117	5		IC DRVR TTL LINE DRVR DUAL	07263	9636ATC
U503	1820-2300	8			28480	1820-2300
U504	1820-2075	4	1	IC MISC TTL LS	01295	SN74LS245N
U506	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U507	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U606	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U607	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N
U702	1820-2203	0		IC RCVR TTL LS LINE RCVR QUAD	34335	AM26LS32PC
U703	1820-2203	0		IC RCVR TTL LS LINE RCVR QUAD	34335	AM26LS32PC
U705	1826-0220	9	1	IC V RGLTR TO-39	27014	LM320H-05
U706	1818-1396	5		IC NMOS 16384-BIT RAM DYN 200-NS 3-S	0003J	1818-1396
U707	1820-1080	9		IC DRVR TTL LINE DRVR DUAL 4-INP	18324	N8T13N

Table 7-1. MUX Interface Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
XW1	1258-0124	7	2	PIN-PROGRAMING JUMPER .30 CONTACT	91506	8136-475G1
				MISCELLANEOUS PARTS		
	1200-0483	0	2	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0483
	1200-0567	1	3	SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
	1200-0607	0	8	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
	1200-0654	7	4	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654

Table 7-2. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers
Cataloging Handbooks H4-1 and H4-2, and their supplements.

CODE NO.	MANUFACTURER ADDRESS	CODE NO.	MANUFACTURER ADDRESS
0003J	Nippon Electric Co.	27014	Natl. Semicond. Corp. . . . . . . Santa Clara, CA 95051
01121	Allen-Bradley Co. . . . . Milwaukee, WI 53204	28480	Hewlett-Packard Co.
01295	Texas Instr Inc.		Corporate Hq. . . . . Palo Alto, CA 94304
	Semicond. Compnt. Div. . . . . . . Dallas, TX 75222	34335	Advanced Micro
03888	KDI Pyrofilm Corp. . . . . Whippany, NJ 07981		Devices Inc. . . . . Sunnyvale, CA 94086
07263	Fairchild Semicond. Div. . . . . . . Mt. View, CA 94042	34344	Motorola Inc. . . . . Franklin Park, IL 60131
18324	Signetics Corp. . . . . Sunnyvale, CA 94086	56289	Sprague Electric Co. . . . . . North Adams, MA 01247
24546	Corning Glass Works	91506	Augat Inc. . . . . Attleboro, MA 02703
	(Bradford) . . . . Bradford, PA 16701		

READER COMMENT SHEET

HP 12792B
8-Channel Asynchrouous
Multiplexer Subsystem
Installation and Reference Manual
Manual Part NO. 12792-90020
January 1983
Update No. _____ **.**
                    (If Applicable)

We welcome your evaluation of this manual. Your comments and suggestions help us improve our publications. Please use additional pages if necessary.

FROM:

Name _____

Address _____

Company_____

          _____

          _____

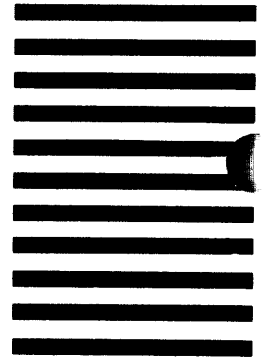FOLD   FOLD

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