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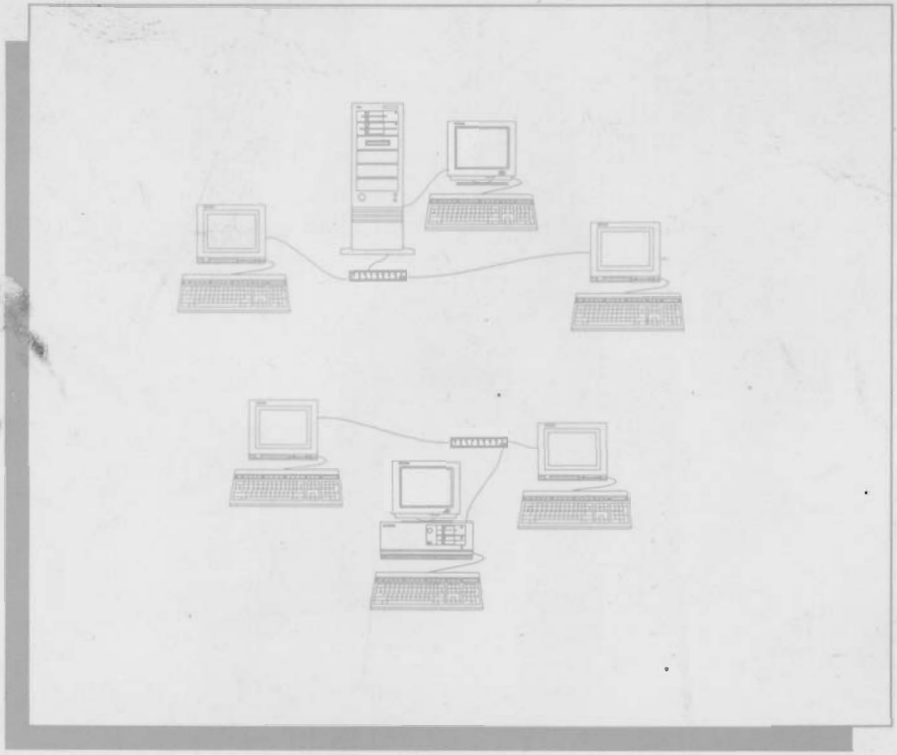

HP D2040A Terminal Multiplexor

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HP D2040A Terminal Multiplexor Installation and User's Manual

HP Part No. D2040-90001
Printed in USA October, 1989

E1089

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1

Introduction

The HP terminal multiplexor connects up to 32 terminals to a 386 computer using a single half-slot. This multiple microprocessor I/O subsystem offers high performance, slot savings, and low cost per user.

Terminal Multiplexor

The HP terminal multiplexor is a 32-port I/O subsystem with a unique design. Most I/O subsystems place all the intelligence on a single board. The HP terminal multiplexor uses a multiple processor distributed architecture, placing intelligence both on the host adaptor and the remote 8-channel terminal concentrator unit. Up to four terminal concentrators can be connected to the host adaptor, for a total of 32 channels. Connections between the host adaptor and the terminal concentrators are made through high-speed RS-422 links.

System Requirements

Note

This manual contains installation instructions for use with the Santa Cruz Operation (SCO) UNIX System V/386 operating system (refer to the *Software Installation* chapter). It also contains installation instructions for use with the SCO XENIX operating system (refer to the *SCO XENIX* appendix).

Prerequisites to HP terminal multiplexor installation:

- SCO UNIX System V/386 Basic O.S. + Link Kit
- PC/AT or approved compatible (386 based) that must:
  - Run standard SCO UNIX
  - Have one 16-bit slot for each host adaptor
  - Have IRQ10, IRQ11, IRQ12, or IRQ15 available
  - Be a non-cached computer or an approved cached computer

One of four "second connector" interrupts (IRQ10, IRQ11, IRQ12, or IRQ15) must be available for the host adaptor. 64K of memory space must be available between 640K and 1 MB, or the computer must have 10 MB or less installed. The computer must be either a non-cached computer or an approved cached computer. **All HP Vectra 386 computers are either non-cached computers or approved cached computers.**

There are no other hardware restrictions.

Generally, other third party drivers can be installed either before or after the D2040A software is installed. However, some third party drivers specify that they must be installed first or last. In that case, since HP's software can be installed at any time, follow the installation instructions for the third party driver.

Compatibility

The D2040A software is fully compatible with all SCO UNIX commands, applications, and third party device drivers.

Compatibility with add-in hardware is assured since no hardware I/O address space is used. The user can select one of four interrupts (IRQ10, IRQ11, IRQ12, or IRQ15) during software installation, thereby avoiding conflicts with other hardware products.

Installation Overview

An installation outline is listed below. For actual step-by-step procedures, refer to the detailed instructions in the chapters entitled *Hardware Installation* and *Software Installation.*

To install the terminal multiplexor:

1. Install SCO UNIX.
2. Install the SCO Link Kit.
3. Install third party I/O device drivers.

Note

You can install third party drivers before or after you install the D2040A software.

4. Install VP/ix if you have it.
5. Install the terminal multiplexor hardware.
6. Use the SCO UNIX **custom** utility to install the D2040A software.
7. Reboot and run.
8. Enable TTYs for login.

2

Product Description

The Terminal Multiplexor Basic Kit includes a host adaptor, one terminal concentrator, cables, and software. In addition to device drivers, the software includes extensive diagnostics and some performance measurement tools.

Host Adaptor

The host adaptor halfcard (which only requires a half-slot) contains four high speed links for attaching remote, self-contained 8-channel terminal concentrators. A system configured with a host adaptor can support up to four terminal concentrators, for a total of 32 lines. More than one host adaptor can be used to support 64 or more ports in a system. Other features include:

- 64K of dual-ported memory for data buffers and communication with the host processor.
- An 80188 processor to send and receive data packets between the host adaptor and four terminal concentrators, and to offload some of the character processing overhead from the base processor. Each terminal concentrator has a Z80 processor and 8K of memory to handle the lower level processing of terminal I/O. In its full 32-port configuration, five microprocessors share the serial I/O workload.

Terminal Concentrator

The terminal concentrator attaches to the host adaptor and provides intelligent I/O handling for eight serial lines. Its features include:

- 8 serial ports that support industry standard terminals
- A local microprocessor that performs low-level serial input/output functions, which increases overall system performance
- A 9600 baud, continuous, full-duplex data transfer that is guaranteed on all 8 ports
- Power provided through the host-to-concentrator cable when the concentrator is located up to ten feet from the host adaptor
- Two indicator lights (LEDs) per port that simplify the concentrator-to-terminal RS-232 connection procedure
- Easy to connect, modular, 8-pin RJ-45 jacks and cables
- An RS-422 connection to the host at 230.4K baud, over a single twisted pair
- Installation up to 1000 feet away from the host adaptor
- Baud rates individually set per port from 300 to 19.2K baud
- Intelligent transparent printing that allows each serial port to support a terminal and a remote printer with no interference with terminal usage

Using a simple, high performance communication link and controlled by an HC64180 microprocessor (CMOS Z80 family CPU), the terminal concentrator yields total throughput of over 150K (9600 x 2 x 8) baud. Individual ports can provide communication throughput up to 19.2K baud.

The serial lines (through the appropriate cables) can be connected to any serial interfaced device including terminals, modems, and printers.

Intelligent transparent printing is a feature that allows a serial interfaced printer to be connected to the auxiliary port of your terminal and operated as a normal system printer. A unique feature prevents printer data from appearing on your screen even if your terminal application does extensive cursor positioning. The serial interfaced output device attached to the terminal's auxiliary port need not be a printer. Any serial device can be used, but only output can be performed.

The terminal concentrator achieves continuous data transfer at a speed of 9600 baud even when all eight lines are maintaining active sessions. This performance is due to distributing the serial I/O processing between the base CPU, the host adaptor, and the 64180 processor in the terminal concentrator.

The terminal concentrator plugs into the host adaptor RS-422 concentrator port. Each terminal concentrator supports up to eight terminals.

The terminal concentrator concentrates eight serial data lines onto a single twisted-pair high-speed link back to the host. When the unit is placed within 10 feet of the computer, the cable acts as both a data and power connection, allowing the concentrator to be powered from the system voltage.

Each RS-232 port has two indicator LEDs. The green LED indicates data terminal ready and the yellow LED indicates whether the concentrator is receiving data from the terminal. The basic functioning of these LEDs is independent of the host connection and whether the ports are properly set up by the software. You can use them to facilitate the electrical connection of the terminals to the terminal concentrator.

3

Hardware Installation

The host adaptor can be installed in any unused 16-bit slot on the mother board, and one to four terminal concentrators can be attached to each host adaptor.

Installing the Host Adaptor

Note

Be sure to become the SCO UNIX superuser and type `haltsys` before powering off the computer.

To install the host adaptor, follow the steps below.

1. Power off the computer and unplug it from the AC power source.
2. Remove the computer's cover according to the instructions in the *Setting Up* manual for your computer.
3. Set the rotary switches on the host adaptor according to the instructions on the next page.
4. Carefully plug the host adaptor into a 16-bit slot and replace the computer's cover.

There are two small rotary switches on the host adaptor (H and L). These switches define which AT bus memory addresses are recognized by the adaptor.

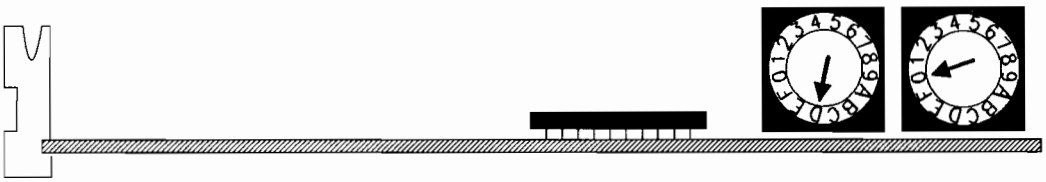

Figure 3-1. H (left) and L (right) Rotary Switches

It is critical that you set these switches properly so there is no conflict with system memory, the BIOS, or other devices in the system.

If you have multiple boards installed in your system, it is also important that these boards be set to different memory locations. The following settings are recommended:

Table 3-1. Rotary Switch Settings

Switches		Memory Address	Notes
H	L	Range	
D	0	D00000-D0FFFF	Factory Setting
D	X	DX0000-DXFFFF	Recommended w/multiple host adaptors
E	X	EX0000-EXFFFF	Alternate high memory settings
0	A	0A0000-0AFFFF	Try if > 10 MB of memory installed*
0	B	0B0000-0BFFFF	Try if > 10 MB of memory installed**
0	C	0C0000-0CFFFF	Try if > 10 MB of memory installed
0	D	0D0000-0DFFFF	Try if > 10 MB of memory installed
0	E	0E0000-0EFFFF	Try if > 10 MB of memory installed

* only if Hercules, CGA, or no video adapter installed

** only if no video adapter installed

The particular settings used are not important so long as no conflict exists with other system memory, and multiple host adaptors are set to different addresses. The host adaptor software will find all installed host adaptors with distinct, allowable settings upon start up. Independent of the actual addresses used, the user interface software will refer to the lowest addressed adaptor found as "D2040A board 1", the next lowest addressed board as "D2040A board 2", and so on.

If 10 MB or less of system memory is installed, the settings from D0 to DF are recommended. With a full 16 MB of memory, these addresses will be in conflict with RAM, and therefore will not work properly. In that case, the area between 640 KB and 1 MB must be used instead. The settings 0A, 0B, 0C, 0D, and 0E are in that range. The "safest" settings among these are 0C and 0D; however, your specific computer and the add-in boards installed will determine the potential conflicts for your system.

There are no other settings—all other board parameters (such as the interrupt line used) are programmed during driver installation.

The host adaptor has four high-speed terminal concentrator ports. During software installation, a mapping is made between the concentrator ports and the tty device names. The naming convention assigns the topmost port as the first, the next port down as the second, the next port down as the third, and so on. The letter "a" is the default name for the first port.

Connecting the Terminal Concentrator

Each host adaptor can have from one to four terminal concentrators attached to it. Each terminal concentrator supports up to eight serial lines.

The connection between the host adaptor and the concentrator is made using the small 8-pin mini-DIN connector on the host adaptor and an identical connector on the terminal concentrator which is labeled HOST. A 10-foot cable is supplied with the terminal concentrator which conveys both the data and power.

To connect the terminal concentrator:

1. Power off the computer.
2. Plug one end of the supplied 8-pin cable into the host adaptor and the other end into the terminal concentrator.
3. Power on the computer. After a self-test sequence, the HOST LED on the terminal concentrator should be blinking. This signifies that the unit has passed self-test, has power, and is not yet being accessed by the host adaptor.

RS-232 serial devices (such as terminals, modems, or printers) can be connected to the eight ports on the terminal concentrator. One terminal/printer cable is supplied with each terminal concentrator. Additional cables can be purchased from your HP dealer or directly from Hewlett Packard. For detailed pin-out and cable information, refer to the chapter entitled *Hardware Specification* or the appendix entitled *Cables.*

In order to put the terminal concentrator more than 10 feet away from the computer, an optional Extension Adaptor Kit and Power Supply are required. If you use the kit, the power supply, and an RS-422 twisted pair cable, you can put the concentrator up to 1000 feet from the computer. (To order the kit and power supply, refer to the appendix entitled *Third Party Hardware*).

After the hardware installation, proceed to the software installation. It is not necessary to connect all terminals and terminal concentrators before proceeding with the software installation.

Host-to-Concentrator Connection

The host adaptor connects to the terminal concentrator through an 8-pin mini-DIN connector. The clock signal is encoded with the data, and a single differential pair is used for both transmit and receive data.

Since the data is sent as a differential RS-422 signal, the distance between the host adaptor and the concentrator can be extended up to 1000 feet. In addition to the signals, terminal concentrator power (+5 volts and ground) is also sent through this cable for distances up to ten feet. For cables longer than ten feet, terminal concentrator power must be provided by an external power supply. These longer cables must not connect to the host adaptor +5 volt supply pin since the drop in voltage would not allow the proper operation of the terminal concentrator. An Extension Adaptor kit and an external power supply **must** provide the 5 volts the concentrator requires. For additional information on the kit and the external power supply, refer to appendix entitled *Third Party Hardware.*

Concentrator-to-Device Connection

The terminal concentrator connects to devices (terminals, printers, etc.) through 8-pin RJ-45 connectors. Refer to the *Hardware Specification* chapter for pin-out diagrams and other connection details.

Terminal Concentrator Back Panel

Eight RS-232 ports, the HOST connection, and the connection for an optional external power supply are on the back of the terminal concentrator.

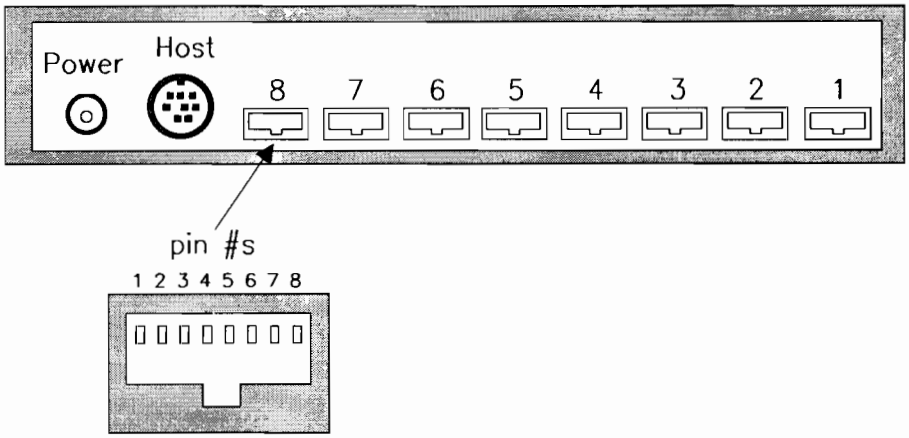

Figure 3-2. Terminal Concentrator Back Panel

Terminal Concentrator Front Panel

The front of the concentrator has seventeen LEDs in total.

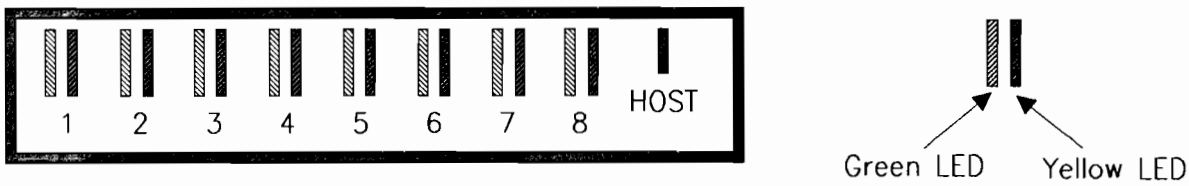

Figure 3-3. Terminal Concentrator Front Panel

A single green LED labeled HOST will be on and blinking if the unit has power but is not being polled from the host. This will occur when the D2040A

software is not running; for instance, in System Maintenance mode and when diagnostics are running.

When the HOST LED is solid, communication packets are being exchanged between the host adaptor and the terminal concentrator. This exchange goes on even if there is no actual data traffic.

Concentrator Indicator Lights

To assist with the connection of peripherals, each channel has two LEDs associated with it. The LEDs can provide information about the ports even when the D2040A software is not running.

If DSR and DCD are both asserted for a particular channel, the terminal concentrator blinks that channel's green LED. In addition, if the operating system has the line open, the green LED will be steady rather than blinking.

The yellow LEDs will blink when Received Data is seen, if DSR is also asserted. This indication is independent of system software, and whether the baud rates are properly set.

Connecting Serial Printers

Printers, as well as terminals and other RS-232 interfaced serial devices, can be connected to the eight ports on the concentrator. This includes printers that require a "hardware handshake". The concentrator supports additional modem control signals required to operate such printers.

As an alternative to directly connecting a serial printer to a terminal concentrator port, a serial printer may be connected to the auxiliary port of a terminal. This method uses the intelligent transparent printing feature that is described in the *Support Software* chapter of this manual. Additional information about adding printers is contained in the *Software Installation* chapter.

4

Software Installation

This chapter provides step-by-step instructions on how to install the D2040A software with SCO UNIX. Installation and removal of the D2040A software is facilitated by the SCO UNIX **custom** utility. Advanced users may want to refer to the *Software Technical Reference* chapter for a detailed description of the installation procedures.

Installing the D2040A Software

To install the D2040A software, follow the steps below.

1. Install SCO UNIX. Follow the directions given in SCO's Installation Guide. You must install the Run Time System (RTS) and the Basic extended utility set (BASE).
2. Install the Link Kit (LINK) if you haven't already installed it.
3. Install any third party or optional device drivers. Generally, you can install any third party drivers before or after you install the terminal multiplexor software. However, some third party drivers must be installed last.
4. Install VP/ix if you have it.
5. Make sure the system is in System Maintenance Mode.
6. Type `custom` and then press Enter. The **Custom** main menu is displayed with the **Install** option highlighted.
7. Press Enter to bring up the **Install** menu.
8. Press Enter to select **A New Product.**

9. Press (Enter) to select the **Entire Product.** The following message is displayed:

```
Insert the requested volume and press <Return> to continue the
installation
```

10. Insert the D2040A Software disk into the primary flexible disk drive and press (Enter). After installing custom data files, the following message is displayed:

```
Insert the requested volume and press <Return> to continue the
installation
```

11. Press (Enter). After extracting files, the following message is displayed:

```
Enter an interrupt line to use [10, 11, 12 or 15]:
```

Note

For a complete list of interrupt lines (both in use and available), refer to the appendix entitled *Interrupt Lines.*

---

12. Type an interrupt that is not already in use and press (Enter). Also, if you're using any other UNIX third party board, make sure an interrupt conflict doesn't exist. After you type an interrupt, the following message is displayed:

```
Enter maximum number of D2040A boards to be supported
[1 (32 lines), 2 (64), 3 (96), or 4 (128)]:
```

13. Type 1, 2, 3, or 4 and press (Enter). The appropriate number depends on the number of terminal concentrators you intend to use. If you enter a number larger than you need, kernel data space will be used up unnecessarily but will cause no problems. If you later add more terminal concentrators, re-run the **custom** program and indicate the number of host adaptor boards you will be using. After you enter the maximum number of host adaptor boards, the following message is displayed:

```
Beginning terminal concentrator letter [a-w, default a]:
```

14. Type a letter "a" through "w" and press (Enter). The serial lines are referenced by a letter that corresponds to the four terminal concentrator

ports on the host adaptor (see the *Hardware Installation* chapter for an illustration) and a number that identifies the line on the terminal concentrator. Letters used for the serial line reference four consecutive letters. The initial letter defaults to the letter "a". For each terminal concentrator port, the system will automatically assign the next corresponding letter in the alphabet. The terminal concentrators lines are numbered from 1 to 8. For example, line 3 on the second terminal concentrator is normally known as "/dev/ttyb3". This scheme may generate a name that conflicts with another device. To avoid such a conflict, you may need to select a beginning letter other than "a".

15. When asked if you want to create a new kernel, type **y** and press Enter.
16. When asked if you want the kernel to boot by default, type **y** and press Enter.
17. When asked if you want the kernel environment rebuilt, type **y** and press Enter.
18. When **Press any key to continue** is displayed, press Enter.
19. To quit **custom,** type **q** and press Enter.
20. Remove the D2040A Software disk, type **reboot** to reboot the default system, and then press Enter.
21. After the boot prompt is displayed (:), press Enter.
22. After the system reboots, press Ctrl D to bring the system up in normal multiuser mode.
23. When prompted for the System Time, press Enter.

Enabling Terminals

Before SCO UNIX can recognize the terminals that are connected to a terminal concentrator, you must enable them. To enable terminals, follow the steps below.

1. At the root prompt, type **sysadmsh** and press Enter.
2. Type **a** to select **Accounts**.
3. Type **t** to select **Terminal**.
4. Type **c** (create) to display the **Terminal Database Entry** menu.
5. Create an entry in the table for each terminal you plan to connect to the terminal concentrator. In the **terminal device** field, type **ttyxn** where **x** is the terminal concentrator (a-w) and **n** is the line number (1-8).
6. When finished, continue to press Esc until you return to the **Sysadmsh** main menu.
7. Type **q** and press Enter to leave the utility.
8. At the root prompt, enable each terminal by typing **enable ttyxn** for each terminal, where **x** is the terminal concentrator (a-w) and **n** is the line number (1-8).

After you enable all ttys that require logins, the software installation for the concentrators is complete. Access to the serial ports on the terminal concentrator is via devices in the **/dev** directory. During the installation of the software, device names are created for these **tty** lines.

The standard name assignment is "tty" followed by the letter and line number (1-8) selected. The second set of names is the same except lower case. An upper case letter indicates use of modem control; a lower case letter indicates no modem control and is generally used to interface to printers. For example, the device **/dev/ttya1** is the same as the device **/dev/ttyA1** except that the upper case version requires the port's Data Set Ready (DSR) signal to be valid to open the device, while the lower case version will allow the device to be opened independent of the state of the DSR signal.

When you press Ctrl D to bring the system up in normal multiuser mode, the host adaptor will automatically be initialized and put in service.

The installation is now complete and the system is ready to use. Appendix A contains demo software instructions.

Configuring Serial Printers

Printers, as well as terminals and other RS-232 interfaced serial devices, can be connected to the eight ports on the concentrator. If a printer is connected directly to a terminal concentrator, a few things should be noted.

The SCO UNIX **sysadmsh** utility provides a very easy way to configure a printer into your system. When this utility prompts you for the **device name,** type `/dev/ttyxn` where `x` is the terminal concentrator (a-w) and `n` is the line number (1-8). For additional information on the **sysadmsh** utility, refer to the *SCO UNIX System Administrator's Guide.*

Transparent Printing

This capability allows printers to be attached to the auxiliary RS-232 ports of terminals and be used as general purpose system printers, independent of work being done on the associated terminal. HP has implemented this capability in a manner that is easy to use and that offers improved reliability over alternate approaches used by some intelligent multiplexors.

The device name for the auxiliary port is the name of the non-modem version of the line (lowercase letter) with the letter "p" appended. For example, a printer attached to a terminal on line 2 of the first host adaptor port has the name `/dev/ttya2p`.

The file `/etc/ttyprinter` controls the operation of transparent printing. It is used to indicate the character string to switch to a printer, the character string to switch back to the terminal, and the average printing rate supported. It can also specify the terminal type. The terminal type field provides information needed to avoid sending characters to the printer port in the middle of multi-character control sequences being sent to the terminal. A typical entry in this file might be:

```
ttya1p escdef ansi rate 120 enter \e[5i exit \e[4i
```

The **ttya1p** in this example is the transparent printer port (p) of the terminal on line 1 of the first terminal concentrator (for example, "a"). The rate is the number of characters per second that are sent to the printer. If this number is set higher than the actual average number of characters per second throughput of the printer, the printer may send an X-OFF command to the terminal that would stop the terminal's use until the printer could accept more characters.

An important related point is that the communication between the terminal and the printer must be set up at the terminal. The terminal should have setup modes that allow auxiliary port baud rates, etc., to be determined. The printer must provide the flow control as required by the terminal, which is usually XON/XOFF. Most serial printers have the option of being placed in this mode.

The **enter** string is the control sequence that causes the terminal to enter its "transparent copy" mode (i.e., after this sequence is received, the terminal writes every character it receives to the auxiliary port and not the screen). The **exit** string is the control sequence that causes the terminal to exit the "transparent copy" mode.

These strings are best determined from the terminal manufacturer's documentation. The mode desired is one in which incoming data is set to the auxiliary port and not to the screen.

The terminal type is called **escdef**, which means "escape definition". This feature is used to guarantee that no characters intended for the printer end up on the terminal's screen incorrectly. By specifying an appropriate **escdef** for your terminal, the driver software will correctly determine the allowable times to switch between the terminal data traffic and the printer data traffic. This feature prevents multi-character cursor positioning or other control sequences from being interrupted by a command to switch output to the printer port.

The **escdef** feature is only used for this purpose of determining when it is permissible to switch to the auxiliary port.

Escape sequences for some terminals are subsets of those of more powerful terminals. In this case, the **escdef** setting for the more powerful terminal can be used for both terminals. For example, the **escdef wy60** handles both the Wyse 60 and Wyse 50 terminals.

The escape definition **dumb** is correct for a wide range of ASCII terminals based on the ADM-3 escape sequences. If your terminal is not specifically supported at this time, use **dumb** (for most ASCII terminals) or **ansi** (for ANSI or VT100 terminals).

ESCDEF Types

- **ansi** is a generic definition for terminals whose control sequences are of the form specified in ANSI 3.64, including the DEC VT100 and VT220, the Wyse 75, and many others. Due to the consistent form of 3.64 control sequences, this escape definition should be "complete" (i.e., recognize all possible control sequences) for ANSI style terminals. One way to determine if a terminal is "ansi" is to check the escape sequence for cursor movement—ansi terminals use an escape sequence of the form: "<ESC>[<row>;<col>H".
- **dumb** is a generic definition for most other ASCII terminals whose control sequences are similar to the LSI ADM-3 or "dumb" terminal. Due to the wide variance in extensions made to the original "dumb" sequences, this is not a very complete definition, but it is complete enough that this definition should work fine for applications that use termcap. Applications "tuned" for a particular terminal that don't use termcap may require a more specific terminal definition such as the ones below. The cursor movement sequence used by "dumb" terminals is either "<ESC>=<r><c>" or "<ESC>Y<r><c>" where <r> and <c> are single characters that denote the destination row and column.
- **wy60** is a complete definition of escape sequences for the Wyse 60 terminal. Use this escdef for Wyse 50 terminals as well—the Wyse 50 escape sequences are a subset of the Wyse 60.
- **qvt101** is a complete definition of escape sequences for the ITT/Qume model 101 terminal.

See the **/etc/ttyprinter** file and the **/etc/8x4/README** file for the currently supported terminals.

Typical Sprinter Entries

If your terminal does not appear on this list, it is probably supported by either the "ansi" or "dumb" escape definition. Use the "transparent copy" or "transparent print" on and off sequences from the terminal's *User's Guide* for the "enter" and "exit" parameters, respectively.

Table 4-1. Typical Sprinter Entries

Terminal	Emulation	Escdef	Enter	Exit
HP700/22	VT220	ansi	\e[5i	\e[4i
	VT100	ansi	\e[5i	\e[4i
	VT52	dumb	\e[5i	\e[4i
HP700/41	WY30	wy60	\030^X	\024^T
	TVI 905	dumb	\e‘	\ea
	TVI 910+	dumb	\e‘	\ea
	TVI 925E	dumb	\e‘	\ea
	ADDS	dumb	\e3	\e4
	ADM 3A	dumb	\016^N	\016^O
	ADM 5	dumb	\016^N	\016^O
	QVT-101	qvt101	\022^R	^T
	Hazeltine 1500	N/A	N/A	N/A
HP700/43	WY-50	wy60	\030^X	\024^T
	ADM31	dumb	\eA1	\eA0
	TV 950	N/A	N/A	N/A
HP700/44	HP-PC	ansi	\e[5i	\e[4i
	VT220	ansi	\e[5i	\e[4i
	VT100	ansi	\e[5i	\e[4i
	VT52	dumb	\e[5i	\e[4i

Table 4-1. Typical Sprinter Entries (continued)

Terminal	Emulation	Escdef	Enter	Exit
HP700/92	HP	N/A	N/A	N/A
	VT220	N/A	N/A	N/A
	VT100	N/A	N/A	N/A
	VT52	N/A	N/A	N/A
HP700/94	HP	N/A	N/A	N/A
	VT220	N/A	N/A	N/A
	VT100	N/A	N/A	N/A
	VT52	N/A	N/A	N/A
Wyse 50*	N/A	wy60	\ed\#	^T
Wyse 60*	N/A	wy60	\ed\#	^T
Qume/ITT 101**	N/A	qvt101	^R	^T
Televideo***	N/A	dumb	\e‘	\ea

* There are two ways to enter transparent print mode on Wyse terminals—either a single `^X` or the sequence `^d#`. The first can be used only if the terminal is not in "Enhance" mode; the second is recommended. Note that the pound sign character (#) is used to set off comments in the `/etc/ttyprinter` file; therefore, it must be escaped with a backslash. For example, an appropriate ttyprinter entry for a Wyse 50 or 60 could be:

```
ttya1p escdef wy60 rate 120 enter \ed\# exit ^T # comment.
```

** The enter sequence is "escape back-quote" and not "escape single-quote" or "escape-backslash".

*** TV 910, 920, 924, 925, and 950

At system boot time, the file **/etc/ttyprinter** is used to set transparent printing parameters. The utility **sprinter** can also be used at any time, much like the standard UNIX utility **stty**. For example:

```
sprinter rate 300
```

changes the characters per second rate on the auxiliary port of the terminal it was typed on to 300 cps. Typing:

```
sprinter
```

causes the escdef, enter, exit, and rate parameter values to be printed.

Like **stty**, **sprinter** can also be used to change the parameters for any terminal by redirecting standard input. For example, typing the following on any terminal:

```
sprinter rate 200 </dev/ttya2p
```

sets the printer rate for **ttya2** to 200 characters per second.

In order to change the characteristics of several terminals' printer ports, the best method is to edit the **/etc/ttyprinter** file. It will be re-evaluated on the next system boot, or type:

```
sprinter -f
```

to have that file re-evaluated while the system is still up.

Removing the Software

You can boot the previous kernel at any time by specifying **/unix.old** at the boot prompt. To remove all or part of the software, use SCO's **custom** utility.

1. Login as root and type:

   ```
   custom
   ```

2. Type **r**. The **Remove** menu is displayed.
3. Use the arrow keys to highlight **Hewlett Packard D2040A Software** and then press Enter.
4. Press Enter to select **ALL**.
5. When asked if you want to continue, press Enter.
6. When asked if you want to create a new kernel, type **y** and press Enter.
7. When asked if you want the kernel to boot by default, type **y** and press Enter.
8. When asked if you want the kernel environment rebuilt, type **y** and press Enter.
9. When **Press any key to continue** is displayed, press Enter.
10. To quit **custom**, type **q** and press Enter.

5

Support Software

This chapter describes utility programs provided to control the host adaptor.

Diagnostic

The host adaptor diagnostic **mxd** is a modular diagnostic consisting of over 30 tests. It is executed as a SCO UNIX utility. See the `Diagnostic` chapter for details on the use of the diagnostic.

Sprinter

The **sprinter** utility can be used much like the standard UNIX **stty** utility. It is used to set the parameters for reliable transparent printing through the auxiliary port of a terminal. This utility controls four parameters:

- average printing rate
- string to enable printing
- string to disable printing
- an "escape definition" for the terminal being used that prevents print data from erroneously appearing on the screen

Usage:

```
sprinter escdef <term> rate <cps> enter <str> exit <str>

sprinter <-f filename>

sprinter
```

term A terminal type. Supported terminal types include none, dumb, qvt, and ansi. See the **/etc/ttyprinter** file and the **/etc/8x4/README** file for other currently supported terminal types. If no escape definition is specified, printing will still operate but certain terminal operations may inadvertently cause printer data to appear on the screen.

cps The average characters per second sent to the attached printer. If set higher than the actual printer average data printing rate, the printer will signal XOFF to the terminal, which will signal XOFF to the computer. This will stop all output to both the terminal and the printer until the printer can accept more data.

str A character string to be sent to the terminal that causes the terminal to enter or exit its "transparent copy" mode. Refer to your terminal manual to determine the correct sequence to enter and exit pass through printing mode. **Specifying a terminal type with the escdef parameter does not specify an enter or exit string. They must be specified with the enter and exit parameters.**

Special characters can be specified in the enter and exit strings as follows:

* control characters (caret symbol ^ followed by a letter)
* escape (\E or \e—backslash then character)
* newline (\n)
* carriage return (\r)
* backslash (\\)
* any character (\ooo where ooo is the 1, 2, or 3 digit octal representation of the character)

-f With this option, a file is used to set the parameters for one or more terminals. If no filename is specified, **/etc/ttyprinter** is used.

Examples

The following example:

```
sprinter escdef wy60 rate 120 enter ^X exit ^T
```

sets the transparent print parameters for the terminal to an escape definition of wy60, a printing rate of 120 cps, an enter string set to control-T and an exit string set to control-X. Although the enter and exit strings are single characters, multiple character strings are also supported.

As another example:

```
sprinter rate 50
```

changes the characters per second rate on the auxiliary port of the terminal to 50 cps. This changes only the printing rate, no other parameters are changed.

Typing:

```
sprinter
```

causes the escdef, rate, enter, and exit parameter values to be printed.

To change the characteristics of several terminals' printer ports, the best method is to edit the **/etc/ttyprinter** file. It will then be re-evaluated on the next system boot. Or, type:

```
sprinter -f
```

to have the file re-evaluated while the system is still up.

See the *Software Installation* chapter for additional information on setting up terminals and printers.

MXSTTY

The **mxstty** utility provides mechanisms for overriding some of the standard SCO UNIX default processing for serial ("tty") lines and their associated transparent print devices. This is sometimes useful with some third party software packages or add-on devices. Note that these features are only available with lines on the HP terminal concentrators—**mxstty** does not work with other vendors' boards.

One use of **mxstty** is to make XON/XOFF hand shaking permanently enabled, regardless of the state of the "IXON" tty control bit. This may be needed when using a device that requires XON/XOFF hand shaking with an application that either never sets the IXON bit or that changes the IXON bit during operation (e.g., FoxBase). Note that with XON/XOFF locked on, the XON (^Q) and XOFF (^S) characters are intercepted by the driver and are never passed to the application being used.

Another use of **mxstty** is to change the parameters that are given to a line when it is first opened. This is needed when using an application that opens a line directly (e.g., for printing) and does not set the line parameters. The SCO UNIX default parameters for a line are 9600 baud, XON/XOFF disabled, newline to CR/LF mapping disabled. Most devices need either XON/XOFF or newline to CR/LF processing, so if the application doesn't override the defaults, they won't work properly. Finally, **mxstty** can be used to report information about a line.

mxstty reports whether XON/XOFF is locked on, what parameters are given to the line when it is opened, and where a given line is located (which host adaptor, concentrator, and port the line is on).

For example, the following command:

```
mxstty
```

reports the mxstty settings for the line opened as "standard input" (i.e., the terminal on which the command is run). To get the status of another line, redirect standard input. For example:

```
mxstty </dev/ttya1
```

reports the mxstty settings for /dev/ttya1.

The following example:

```
mxstty <stty-parameters>
```

sets the parameters used when the line associated with "standard input" is opened. As above, standard input can be redirected to any concentrator line. <stty-parameters> can be any parameters that can be set with the **stty** command (see the SCO UNIX manual for further information). For example:

```
mxstty 19200 ixon onlcr < /dev/ttya2
```

sets up /dev/ttya2 so that when it is opened, it is set to 19200 baud with XON/XOFF control enabled and newlines on output converted to carriage return/line feed sequences. Note that these parameters are in effect only when the line being opened is completely closed (i.e., not opened by any other process on the system). Changing the defaults doesn't change the tty modes when the line is reopened by forking another process (causing a process to split in two with each half heading down a separate side of the fork).

```
mxstty reset
```

This resets the parameters used on open to the standard SCO UNIX defaults for the line opened as "standard input".

```
mxstty lockixon
mxstty -lockixon
```

These commands turn XON/XOFF locking on and off for the line associated with "standard input". After **mxstty lockixon** is executed, XON/XOFF flow control on output will always be in effect; after **mxstty -lockixon**, XON/XOFF flow control is determined by the "ixon" stty mode. The lockixon and -lockixon parameters can be mixed with the "stty" parameters above. For example:

```
mxstty lockixon 19200 < /dev/ttya3
```

forces XON/XOFF for output on **/dev/ttya3** and when **/dev/ttya3** is opened, its baud rate is set to 19200.

```
mxstty -f
```

This command causes the file named **/etc/ttydefault** to be read to set the mxstty parameters for a number of lines. This command is automatically invoked when the system goes to multi-user mode, so that making an entry in **/etc/ttydefault** is a convenient way of causing a line's settings to be changed whenever the system is booted. Each entry in **/etc/ttydefault** consists of a single line containing the simple tty name of the line to be set (e.g., **ttya4**) followed by the default line parameters desired ("lockixon" and/or any "stty" modes). Lines starting with a "#" in **/etc/ttydefault** are comments. See the **/etc/ttydefault** file for further examples.

Note that mxstty can be used with "pass-thru" print devices (e.g., **/dev/ttya1p**) to set default parameters as well. Please note, though, that since the interface parameters such as speed and flow control are controlled by the terminal to which a local printer is attached, setting the baud and flow control parameters for a pass-thru print device will have no effect—you must use the terminal's setup mode to set these interface parameters. You can, however, change the default SCO UNIX output processing parameters for a pass-thru print device (e.g., onlcr to do newline to CR/LF processing or tab3 to expand tabs).

Note also that specifying "lockixon" for a pass-thru print device has no effect (since the flow control is done by the terminal to which the printer is attached). If characters are being lost on a pass-thru print device because the pass-thru "rate" is greater than the device can handle, then specifying "lockixon" for the terminal to which the printer is attached may help. In general, though, it is best to set the pass-thru rate to what the printer can normally sustain without needing flow control.

MXL

This utility program is the host adaptor kernel loader. **This program is automatically executed at system startup and is not generally invoked by users.** You must be logged on as root to execute this utility.

The usage is as follows:

```
/etc/8x4/mxl <-a>

/etc/8x4/mxl <-l>

/etc/8x4/mxl <-b n> <-e> <mxkernel>

/etc/8x4/mxl <-b n> <-d>
```

-a	Specify all host adaptors found.
-l	Load the firmware on the host adaptors specified.
-b n	Specify the host adaptor board number n. The default is 1 if -b isn't specified.
-e	Enable this host adaptor and terminal concentrators attached for use.
mxkernel	The name of the host adaptor executive file to load. Usually, `/etc/8x4/mxkernel` is the host adaptor executive.
-d	Disable this host adaptor and terminal concentrators attached (if connected). Signal SIGHUP (hangup) is sent to any processes associated with a tty line on an attached terminal concentrator.

For example, type:

```
mxl -b 2 -e mxkernel
```

to enable board number 2.

MXRC

`/etc/8x4/mxrc` is a shell script executed by `/etc/rc`. **This is automatically executed at system start up and is not generally invoked by users.** This script uses `mxl` to determine the number of host adaptors installed, loads them with host adaptor executives, and enables them. It is automatically invoked upon boot up of the system into multiuser mode, and is not normally invoked otherwise.

MXKERNEL

This is the host adaptor executive program. It is automatically loaded on each host adaptor by the `mxl` program during system boot and startup. This is **not** an SCO UNIX executable file.

6

Hardware Specifications

This chapter provides connector pinouts, AT-bus address locations, and other hardware specifications.

Hardware Overview

The host adaptor contains an 80188 microprocessor, two 8530 two-channel serial communications controllers (SCC), an 8237 four-channel direct memory access (DMA) controller, and 64K of SRAM.

The SCC, DMA, and SRAM controllers all have dual-ported access and can be accessed by both the base CPU and the host adaptor 80188 CPUs. I/O addresses are memory mapped for access by the base CPU. None of the AT bus I/O address space is used.

Each host adaptor processor can interrupt on IRQ10, IRQ11, IRQ12, or IRQ15 (software programmable) and multiple adaptors will share a single interrupt.

RS-232 Connections

The terminal concentrator provides "full modem control" RS-232 operation. Using an 8-pin RJ-45 modular jack, the pin-out of the ports on the terminal concentrator are:

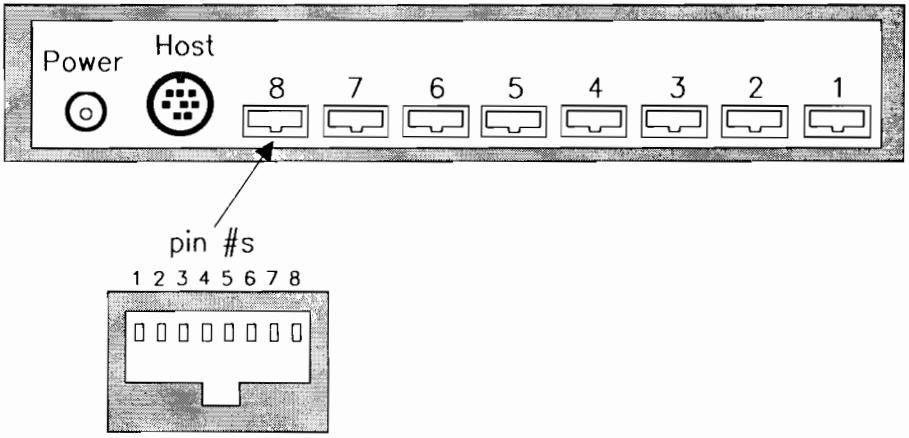

Figure 6-1. Terminal Concentrator Back Panel

Table 6-1. Terminal Concentrator Port Pinouts

Pin No.	Signal	Direction
1	Ground	
2	Request to Send (RTS)	Output to terminal concentrator
3	Data Terminal Ready (DTR)	Output to terminal concentrator
4	Transmit Data (TXD)	Output to terminal concentrator
5	Received Data (RXD)	Input to terminal concentrator
6	Carrier Detect (DCD)	Input to terminal concentrator
7	Clear to Send (CTS)	Input to terminal concentrator
8	Data Set Ready (DSR)	Input to terminal concentrator

Host-to-Concentrator Connection

The host adaptor connects to the terminal concentrator through an 8-pin mini-DIN connector. Below is the pinout of that connector and the cable wiring provided in the ten foot host cable. The clock signal is encoded with the data, and a single differential pair is used for both transmit and receive.

Table 6-2. Host-to-Concentrator Connections

Host Adaptor End	Concentrator End	Signal Name
1	1	Data+
2	2	Data-
3	3	+5V
4	4	GND
5	5	GND
6	6	+5V
7	7	+5V
8	8	GND

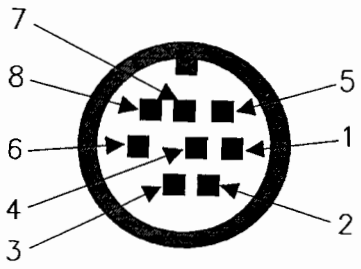

Figure 6-2. Mini-DIN Connector

Since the data signals are a differential RS-422, the distance between the host and the concentrator can be extended to 1000 feet. **Any cable over 10 feet must not connect the +5 volts and ground signals.** The drop in voltage would not allow proper operation of the concentrator. An external power supply **must** be used to provide the 5 volts that the concentrator requires.

The chassis ground of the PC is connected to the shield of the cable, but is isolated from the chassis on the terminal concentrator end. Therefore, if power is supplied through an external 5 volt supply, there is a DC ground isolation between the terminal concentrator and the host computer. This ground isolation prevents ground shift problems from interfering with communications between the host and the terminal concentrator beyond ten feet.

In order to extend the distance between the host and the concentrator, Corollary, Inc. provides an Extension Adaptor Kit and an external +5 volt Power Supply. The kit consists of two short cables that have 8-pin mini-DIN connectors on one end and DB25 connectors on the other end. This makes it easier to attach a long (up to 1000 feet) twisted-pair cable in the field. For additional information on the kit and the power supply, refer to the appendix entitled *Third Party Hardware.*

RS-422 Cable Specifications

If you run RS-422 cable to connect terminal concentrators to host adaptors, the following cable specifications are recommended:

- Conductors: 22AWG stranded, 17 ohm per 300 meters
- Shield: 85% coverage braid
- Impedance: 78 ohm
- Capacitance: 68 pF per meter

External Power Source

The connector on the back of the concentrator labeled "Power" may be attached to an external regulated 5 volt source. It uses a standard connector with a 2 millimeter center pin. The pinout is:

- Center Pin: +5V regulated at 0.5 A
- Outside Contact: Ground

Specifications

The specifications for the components of the terminal multiplexor are listed below.

Host Adaptor

Processor

Type	80188
Memory Size	64 Kbytes, dual-ported RAM

Terminal Concentrator Ports

Interface	RS-422
Connector Type	8-pin mini-DIN
Protocol	Polled master/slave
Data Rate	230.4 KHz
Power Output	+5 VDC up to 10 feet (fused at 1.5 A)

PC/AT Hardware Interface

Data Bus Size	16 bits
Memory Address	Between 640 KB and 1 MB, or above 10 MB
I/O Address	Does not use I/O space
Interrupt Lines	IRQ10, 11, 12, 15, software selectable
Power	+5 VDC, 1A max (plus 300 mA per terminal concentrator powered from host adaptor)

Terminal Concentrator

Processor

Type	CMOS HC64180
Speed	6.144 MHz

Host Connection Port

Interface	RS-422
Connector	8-pin mini-DIN
Protocol	Point-to-point polled
Data Rate	230.4 KHz
Isolation	Data is transformer-coupled to eliminate DC ground shift problems
Power	Only for operation within 10 feet

RS-232 Port Interface

Number of Ports	8
Port Type	RS-232 Serial
Connector Type	8-pin RJ-45
Protocol	Async
Line Speed	300 to 19.2K baud
Bandwidth	Sustained 9600 baud rate on all 8 channels, transmit and receive
Flow Control	Software (XON/XOFF), Hardware (CTS/RTS)
Control Signals	DSR, DTR, DCD, CTR, RTS

Physical

Concentrator Size	8.2" x 7.3" x 1.6"
Host Adaptor Size	AT Halfcard

Environmental Considerations

Operating Altitude	0-4600 meters (15,000 feet)
Non-Operating Altitude	0-15,300 meters (50,000 feet)
Operating Humidity	15-80% relative humidity @ 40C (non-condensing)
Non-Operating Humidity	90% relative humidity @ 65C (non-condensing)
Operating Temperature	5C to 40C
Non-Operating Temperature	-40C to 70C

Safety Approvals

- UL Listed
- Complies with IEC 950

RFI

- FCC Class A verified
- FTZ 1046/84 (Manufacturer's Declaration)
- VCCI Registered (Class 1)

7

Software Technical Reference

Note

This section is intended to supply additional information to the experienced UNIX user. This section is not necessary for installation or normal system operation.

Installation Scripts

Several shell scripts are executed under SCO's **custom** program to install or remove the D2040A software. Installation is non-destructive; original versions of files modified or replaced are renamed with a .ORIG extension. The only exception to this is `/unix`. Its original is saved as `/unix.old`.

If versions of files are already present with a .ORIG extension, the existing .ORIG is left in place and a "-" extension is used instead. Therefore, if multiple installations and removals were performed, the .ORIG files would be the versions as they were just before the first installation, and the "-" versions would be the versions just before the last installation.

Device Nodes

The following device nodes are created:

/dev/amx[1-4]

These nodes allow access to the host adaptor processor memory and other special functions required by the system. Four character device nodes are created: /dev/amx1, /dev/amx2, /dev/amx3, and /dev/amx4. The devices /dev/amx1 through /dev/amx4 correspond to the host adaptor boards 1 through 4.

The major device number is allocated dynamically at installation time.

/dev/tty[a-wA-W][1-8]

These nodes allow access to the serial ports on the terminal concentrators. The letter in the name identifies an terminal concentrator; the number designates the port on the concentrator.

Both modem control and non-modem control tty device nodes are created for each line attached through a host adaptor. The modem control device name uses a capital letter, such as ttyA1, and the non-modem device name uses the corresponding lower case letter, such as ttya1.

Not all letters in the range a-w are used. One letter is assigned to each terminal concentrator, starting with whatever letter is specified at installation time. For example, a system with one host adaptor and 4 terminal concentrators with "a" as the starting letter will have modem control devices /dev/tty [A-D][1-8] and non-modem control devices /dev/tty[a-d][1-8] created.

A maximum host adaptor configuration consists of four host adaptors, each attached to four terminal concentrators for a total of 16 terminal concentrators. Since each terminal concentrator can support up to eight terminal lines, a maximum of 128 lines are supported, and since both modem control and non-modem control devices are created, a maximum configuration would have 256 device nodes.

The major device numbers are allocated dynamically at installation time.

/dev/tty[a-w][1-8]p

These nodes allow access to the auxiliary ports of terminals connected to serial ports on the terminal concentrators and correspond to the ttys described above.

Since whatever terminal is chosen implements any aux port modem control functions independently of the host or the host adaptor, no modem control device name is used.

8

Troubleshooting

Troubleshooting any sophisticated system involves breaking down the problem to isolate the component causing the problem. The components of the terminal multiplexor I/O system are:

- Computer
- D2040A Software
- Host Adaptor
- Terminal Concentrator
- Host Cable
- Cable to Device

Unlisted components are the version of UNIX installed, the cable connecting the terminal concentrator to a device (terminal, modem, etc.), and the device, itself.

Computer

Is the computer supported by the operating system vendor? Did it operate reliably without the terminal multiplexor installed? What other boards are installed and might there be a conflict with the interrupt line selected when the D2040A Software was installed?

Software (other than D2040A)

Are gettys (logins) enabled on lines as desired? Without this setup, no login message will appear on the terminal. Are the baud rates set the same as the terminal's baud rate?

UNIX requires lines to be "conditioned". That is, if you **cat** data to a port, there is no specification of the baud rate or other line attributes. The two most common ways these attributes are set up is by the **getty** program, which puts up the login message, or by a print spooler.

D2040A Software

Does an HP copyright notice appear when the machine is first booted? If not, the software may not be installed in the **/unix** kernel. Do the names of the tty ports appear in the **/dev** directory? If not, a proper installation has not be accomplished.

Host Adaptor

Although a half-card, it must be installed in an AT slot. That is, a slot that has both the XT connector and the second AT specific connector. After taking the system multiuser after bootup, a message should appear on the console indicating that each host adaptor installed is responding. It should look like:

```
Mux Host Adaptor: 1 board found using IRQ10
```

It indicates the number of host adaptors detected and the interrupt line they share.

If the board's presence is not recognized, it may be due to problems with the rotary switch settings.

If you suspect a defective host adaptor, run the **mxd** diagnostic. See the *Diagnostic* chapter for additional information.

Terminal Concentrator

Each terminal concentrator properly detected will cause a line on the console like:

```
Mux Host Adaptor: terminal concentrator A on-line
```

Is the concentrator receiving power? If so, the HOST LED should be either flashing or on solidly. Upon power-up, the concentrator goes through a self-test. All LEDs go on, then they go off in turn from left to right, leaving the HOST LED flashing if no communication is possible between the host adaptor and the concentrator, or on solidly if communication has been established.

If you suspect a problem with a particular port, try connecting the same device (and the same cable) to an alternate port. Of course, you must also change the software to use the alternate port.

Host Cable

Little is likely to go wrong with the supplied ten foot cable used to connect the host adaptor to a terminal concentrator. This cable has two functions. It supplies both power and data to the concentrator. When a concentrator is connected to a host adaptor that is in a powered-up system, the green HOST LED should be on (or flashing on and off). If not, the fuse for that particular channel has burnt out. Each of the four connectors on the host adaptor has a separate fuse.

If the concentrator is placed further from the computer than the ten foot host cable allows, the cable can only be used to carry data. Power for the terminal concentrator must be provided by a separate 5 volt supply plugged into the POWER connector on the rear of the concentrator. This connector requires regulated 5 volts DC.

Warning

DO NOT use wall-mounted power units (typically 9 volts DC or 12 volts AC) found at electronic retail outlets. They are likely to destroy the concentrator.

One way to isolate problems with a remote concentrator is to try the same unit locally connected. If it operates with the standard ten foot cable, but remotely only has a blinking HOST LED, the remote data connection is probably not correct. The HOST LED will stay on solidly when data packets are being received by the concentrator (the host adaptor, once initialized by the D2040A software, continually polls the concentrator even if no actual data is being transferred).

9

Diagnostic

The host adaptor processor diagnostic **mxd** is a modular diagnostic consisting of 34 tests. It is executed as a UNIX utility. The diagnostic must be run while in System Maintenance mode.

Since the diagnostic uses the host adaptor device driver, the drivers must be installed when running for the diagnostic to function.

To run all standard tests on board #1, type:

```
/etc/8x4/mxd
```

To run the diagnostic on board #2, type:

```
/etc/8x4/mxd -b 2
```

See the next section for details on running selected tests, non-standard tests, and options for looping and modifying the output of the test.

Usage

Standard command line syntax for **mxd** is:

```
/etc/8x4/mxd -b n
/etc/8x4/mxd -T
/etc/8x4/mxd[-b n][-QqLl][-a x-y]
/etc/8x4/mxd[-b n][-QqLl][-a x-y] test ...
/etc/8x4/mxd[-b n][-QqLl][-a x-y] test-test
```

-T	Prints a table of tests and usage. This option overrides all other options and does not run any tests.
-b n	Specifies the host adaptor board number n (1-4). The default is 1 if -b is not specified.
-Q	Runs the tests very quietly. The diagnostic will not generate any status or error messages. Note the lower case -q option below.
-q	Runs the tests quietly. The diagnostic will generate only error messages. Note the -Q option above.
-L	Runs an infinite loop on tests. The diagnostic automatically repeats the sequence of tests specified. This is the preferred loop mode for normal use.
-l	Runs an infinite loop on tests. This is a "technician" loop that repeats the "inner loop" of a single test.
-a x-y	Specifies the address range limits for tests that test memory (tests 5 through 8). Limits are specified in hexadecimal. The lower memory limit is x and the upper memory limit is y. The default is all 64K if the -a option is not specified. See example on next page.
test	Lists the individual test numbers to run. If no test numbers are specified, than all standard tests are run. Standard tests are those listed with "std" in the right column when a test table (-T) is run.
test-test	Lists the range (or ranges) of test numbers to run.

Example

```
/etc/8x4/mxd -b 2 -a 0-ff 1-4 7
```

This example selects board #2 for the tests, sets the address range of any memory test to 0-ff, runs tests 1, 2, 3, 4, and 7, and then stops. Tests 1 through 4 are run to initialize the board.

Test Descriptions

The following list contains a basic description of each of the mxd tests:

Table 9-1. Test Descriptions

Test #	Test Name	Test Description
Test 0	Tech Tests	The diagnostic enters a mode that accepts interactive commands to peek and poke into the host adaptor I/O and memory address space. A detailed description of the test tech commands follows this section.
Test 1	Board Reset	Reset 80188, 8530s, 8237, and all board functions.
Test 2	Blink LED	Blink green LED for 1 to 2 seconds.
Test 3	DMA Req I/O	Test 8237 register access from base CPU using rotating ones and rotating zeros patterns.
Test 4	DMA Reset	Reset 8237.
Test 5	Memory Fill Ones	Fill specified memory addresses (-a option) with all ones and verify.
Test 6	Memory Fill Zeros	Fill specified memory addresses (-a option) with all zeros and verify.
Test 7	Memory Walking Ones	Test memory over the specified range (-a option) using a walking ones pattern. This test takes a long time to run if the address range is large. This test is non-standard and runs only if specified on the command line.
Test 8	Memory Walking Zeros	Test memory over the specified range (-a option) using a walking zeros pattern. This test takes a long time to run if the address range is large. This test is non-standard and runs only if specified on the command line.
Test 9	SCC A Reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.

Table 9-1. Test Descriptions (continued)

Test #	Test Name	Test Description
Test 10	SCC B Reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros pattern.
Test 11	SCC C Reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
Test 12	SCC D Reg I/O	Test 8530 register access from base CPU using rotating ones and rotating zeros patterns.
Test 13	Async Internal Loopback A	Test async serial data transfer on 8530 channel A using programmed I/O and internal loopback modes.
Test 14	Async Internal Loopback B	Test async serial data transfer on 8530 channel B using programmed I/O and internal loopback modes.
Test 15	Async Internal Loopback C	Test async serial data transfer on 8530 channel C using programmed I/O and internal loopback modes.
Test 16	Async Internal Loopback D	Test async serial data transfer on 8530 channel D using programmed I/O and internal loopback modes.
Test 17	DMA Async Internal Loopback A	Test async serial data transfer on 8530 channel A using DMA I/O and internal loopback modes.
Test 18	DMA Async Internal Loopback B	Test async serial data transfer on 8530 channel B using DMA I/O and internal loopback modes.
Test 19	DMA Async Internal Loopback C	Test async serial data transfer on 8530 channel C using DMA I/O and internal loopback modes.

Table 9-1. Test Descriptions (continued)

Test #	Test Name	Test Description
Test 20	DMA Async Internal Loopback D	Test async serial data transfer on 8530 channel D using DMA I/O and internal loopback modes.
Test 21	DMA Async Output A	Generate async data output on 8530 channel A using DMA I/O.
Test 22	DMA Async Output B	Generate async data output on 8530 channel B using DMA I/O.
Test 23	DMA Async Output C	Generate async data output on 8530 channel C using DMA I/O.
Test 24	DMA Async Output D	Generate async data output on 8530 channel D using DMA I/O.
Test 25	External Loopback A<->C	Sends characters between terminal concentrator ports A and C, using DMA I/O and async mode at 19.2K baud. A standard D2040A host adaptor-to-terminal concentrator cable must connect port A and port C in order to run this test. Also, you must run test 4 before you run this test.
Test 26	External Loopback B<->D	Sends characters between terminal concentrator ports B and D, using DMA I/O and async mode at 19.2K baud. A standard host adaptor-to-terminal concentrator cable must connect port C and port D in order to run this test. Also, you must run test 4 before you run this test.

Table 9-1. Test Descriptions (continued)

Test #	Test Name	Test Description
Test 27	Host Interrupt Self	Test the ability of the D2040A processor to interrupt the base CPU.
Test 28	Start Loop	Start execution of the 80188 in a very small loop at the start up vector.
Test 29	Nop Loop	Start execution of the 80188 in a nop loop.
Test 30	Read/Write Loop	Start execution of the 80188 in a memory read/write loop. The base CPU verifies the operation.
Test 31	DMA I/O Loop	Start execution of the 80188 in an I/O loop referencing the 8237. The base CPU verifies the operation.
Test 32	SCC I/O Loop	Start execution of the 80188 in an I/O loop referencing the 8530. The base CPU verifies the operation.
Test 33	Interrupt	Test the ability of the base CPU to interrupt the 80188 processor.
Test 34	Bus Lock	Verify the proper operation of test and set memory operations.

Tech Test Commands

Diagnostic test 0 enters a mode that provides interactive commands that allow "peeking and poking" into host adaptor I/O and memory address space:

```
/etc/8x4/mxd -b n 0
```

n is host adaptor processor 1-4. An "*" prompt is output indicating tech test mode. All addresses specified are in hexadecimal and are relative to the particular board indicated. The following commands are supported:

Table 9-2. Tech Test Commands

q		Quit the tech test mode
ib	ioaddr	Input byte from ioaddr and print
ob	ioaddr byte	Output byte to ioaddr
rb	maddr	Read byte from maddr and print
wb	maddr byte	Write byte to maddr
rw	maddr	Read word (16 bits) from maddr and print
ww	maddr byte	Write word (16 bits) to maddr
d	maddr1 maddr2	Display (print) from maddr1 to maddr2
f	maddr1 maddr2 byte	Fill from maddr1 to maddr2 with byte
L		Loop on the next tech test command

Where:

ioaddr is a host adaptor logical I/O address (0 through 1F)

maddr is a host adaptor memory address (0 through FFFF)

byte is 8 bits (2 hex characters)

word is 16 bits of data (4 hex characters)

For example, to output the byte "A" to the host adaptor Control Register 1 (I/O location 15) on board #3, type:

```
/etc/8x4/mxd -b 3 0
```

When you see the tech test prompt (*), type:

```
ob 10 0
```

As an example of looping, to continually read the byte of data from memory address A5, type the following at the tech test prompt:

```
L
rb a5
```

To exit this loop mode, press the interrupt character(s) for UNIX (usually Delete or Ctrl C).

A

Demonstration Software

This appendix describes the demonstration software provided on the D2040A Software disk.

If DEMO or ALL is selected at installation time, the demonstration software is loaded in a directory called **/mxdemo**. If you need disk space, you can delete the entire contents of this directory by using **custom** to remove the package called "DEMO".

tty Output Speed Benchmark

These scripts show the performance of the terminal concentrator and character I/O system.

At least one terminal (or serial device connected to a port) is required to run this demo. The more terminals the better.

Any terminals that don't have a login enabled should be set to 9600 baud, 8-bit, no parity.

If a different baud rate test is desired, you can indicate that on the command line. For example:

```
starttys -1200 a1 -19200 a2
```

uses 1200 baud for ttya1 and 19.2K baud for output to ttya2.

The shell script **starttys** starts background processes that continuously output to each terminal. A special program is used to generate infinite output while timing and counting output characters.

The shell script **stopttys** stops all output and prints a summary of the output performance.

Recommended Procedure

Make sure the system is in multiuser mode. Then login the console and `CD` to `/mxdemo`. Finally, type:

```
./starttys pn
```

where `p` is a port number and `n` is a terminal number. For example, if there are terminals connected to lines 1 through 4 of the terminal concentrator, which is connected to port a of host adaptor 1, then the ttys are ttya1, ttya2, ttya3, and ttya4. The command line would be **`startttys a1 a2 a3 a4`**.

The terminals listed should start displaying text as the test program is being run.

Allow the terminals to run for a while (at least 30 seconds). The longer the terminals run, the more accurate the results. Note that all terminals should output at full speed, concurrently, and with no hesitation.

After at least 30 seconds, type:

```
stopttys
```

After several seconds, the program will stop sending data to the terminal and a summary of the results will be displayed. The number of characters per second should be nearly the maximum possible for the baud rate of the terminal. For example, a terminal at 9600 baud should be able to output 960 characters/second.

B

Interrupt Lines

Table B-1. Interrupt Lines

Interrupt	Description
IRQ0	Timer 0
IRQ1	Keyboard
IRQ2	Slave IPC 8259A Interrupt Controller
IRQ3	Serial Port 2
IRQ4	Serial Port 1
IRQ5	Parallel Port 2
IRQ6	Flexible Disk Controller
IRQ7	Parallel Port 1
IRQ8	Real-Time Clock
IRQ9	Master IPC 8259A Interrupt Controller
IRQ10	Serial Port 3
IRQ11	Serial Port 4
IRQ12	HP-HIL Default
IRQ13	Coprocessor
IRQ14	Hard Disk Controller
IRQ15	Reserved

C

Cables

This appendix contains information about the following cables:

- Host Cable (D2040-60003)
- Terminal/Printer Cable (D2042-60001)
- Modem Cable (D2043-60001)
- Vectra Cable (D2044-60001)
- Third Party Cables

D2040-60003

Cable Length: 10 feet

Uses: Host cable—to connect a terminal concentrator to a host adaptor. There are 8-pin mini-DIN connectors on both ends of the cable.

Table C-1. Host Cable Pinouts

Mux Pin #	Signal	TC Pin #
1	Data+	1
2	Data-	2
3	+5 VDC	3
4	Ground	4
5	Ground	5
6	+5 VDC	6
7	+5 VDC	7
8	Ground	8

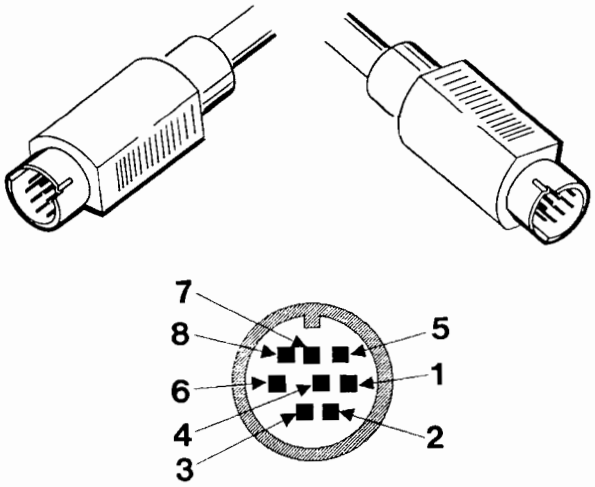

Figure C-1. Host Cable

D2042-60001

Cable Length: 10 feet

Uses: To connect an HP 700/41, 700/43, 700/44, or 700/45 terminal, or a printer to a terminal concentrator. To connect a 700/44 terminal to a terminal concentrator, you also need a DB25 female-to-female gender changer. There is an 8-pin RJ-45 male connector on one end of the cable and a DB25 male connector on the other end of the cable.

Table C-2. Terminal/Printer Cable Pinouts

RJ-45 Pin #	Signal	DB25 Pin #
1	Ground 0 Volts	7
2	Request to Send	8
3	Data Terminal Ready	5 & 6
4	Transmit Data	3
5	Receive Data	2
6	Data Carrier Detect	4
7 & 8	Clear to Send	20
8 & 7	Data Set Ready	20

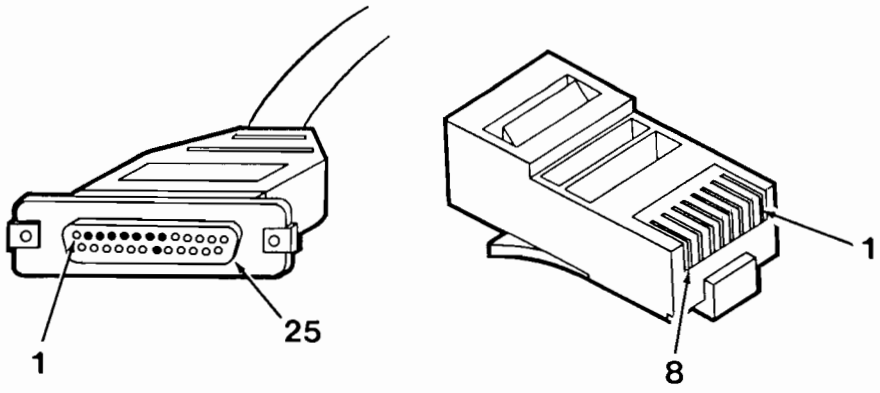

Figure C-2. Terminal/Printer Cable

D2043-60001

Cable Length: 10 feet

Uses: To connect a U.S. or European modem to a terminal concentrator. There is an 8-pin RJ-45 male connector on one end of the cable and a DB25 male connector on the other end.

Table C-3. Modem Cable Pinouts

RJ-45 Pin #	Signal	DB25 Pin #
1	Ground 0 Volts	7
2	Request to Send	4
3	Data Terminal Ready	20
4	Transmit Data	2
5	Receive Data	3
6	Data Carrier Detect	8
7	Clear to Send	5
8	Data Set Ready	6
-	Cable Shield	1

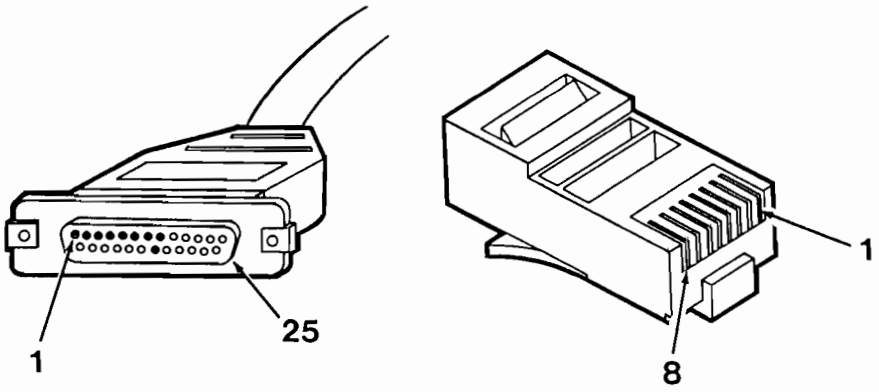

Figure C-3. Modem Cable

D2044-60001

Cable Length: 10 feet

Uses: To connect an HP Vectra computer (serial port) to a terminal concentrator. There is an 8-pin RJ-45 connector on one end of the cable and a DB9 female connector on the other end.

Table C-4. Vectra Cable Pinouts

RJ-45 Pin #	Signal	DB9 Pin #
1	Ground 0 Volts	5
2	Request to Send	1
3	Data Terminal Ready	8 & 6
4	Transmit Data	2
5	Receive Data	3
6	Data Carrier Detect	7
7 & 8	Clear to Send	4
8 & 7	Data Set Ready	4

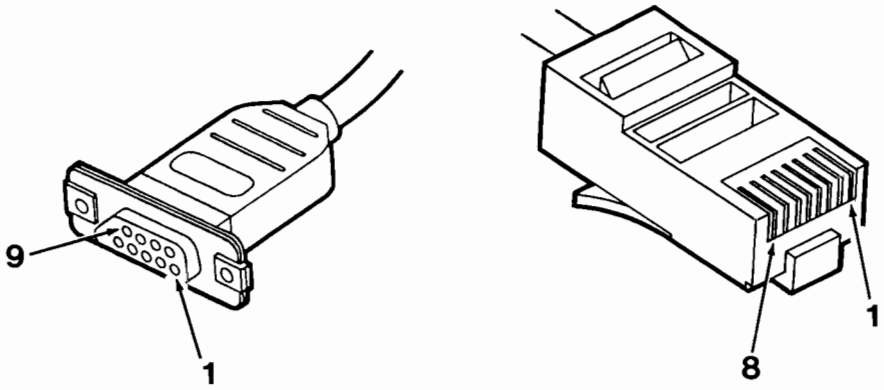

Figure C-4. Vectra Cable

Third Party Cables

You can make your own cables for use with the HP D2040A Terminal Multiplexor. To do this, you need to use third party cable parts. These parts are listed in the table below.

Part Number	Description	Supplier
231652-1	RJ-45 Crimping Tool	AMP
554739-1	RJ-45 8-Pin Connectors	AMP
8168	DATALENE Insulated Multi-Pair Individual and Overall Shielded Cable (8 conductor cable for RS-422 transmission)	Belden
8310	S-R PVC Multi-Pair Individual Overall Shielded Cable (10 conductor cable for terminals and printers)	Belden
	Male DB25 Connectors	AMP
	Female DB25 Connectors	AMP

D

Replaceable Parts

This appendix provides part numbers for replaceable parts.

Table D-1. Replaceable Parts

Part Number	Description	Supplier
D2040-13001	D2040A Software (3.5-inch media)	DMK
D2040-15001	D2040A Software (5.25-inch media)	DMK
D2040-67001	Terminal Concentrator	SMO
D2040-67002	Host Adaptor	SMO
D2040-60003	Host Cable	SMO
D2042-60001	Terminal/Printer Cable	SMO
D2043-60001	Modem Cable	SMO
D2044-60001	Vectra Cable	SMO
1252-3504	Female-to-Female Gender Changer	SMO

E

Third Party Hardware

In order to extend the distance between the host and the concentrator beyond ten feet, Corollary, Inc. provides an Extension Adaptor kit and an external +5 volt Power Supply. The kit consists of two short cables that have 8-pin mini-DIN connectors on one end and DB25 connectors on the other end. This makes it easier to attach a long (up to 1000 feet) twisted-pair cable in the field. The Extension Adaptor Kit cable pin-out is shown below.

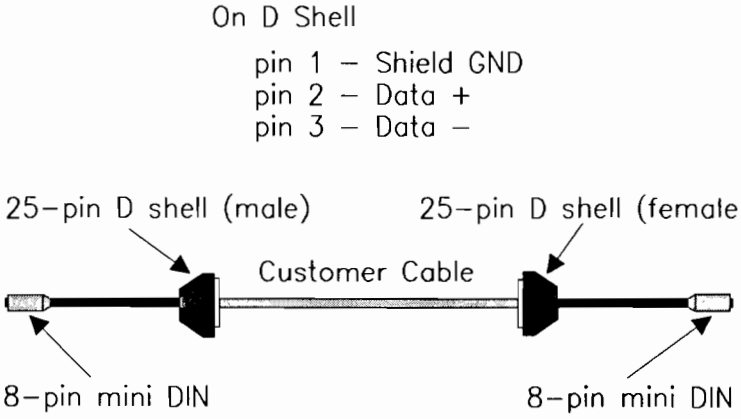

Figure E-1. Extension Adaptor Kit Cables

The external power supply specifications are shown below.

Table E-1. External Power Supply Specifications

Usage (optional)	If more than 10 feet from host adaptor system
Input Voltage	105-129 VAC, 60 Hz, 0.15 A
Output Voltage	5 VDC, 0.50 A
Connector Type	2.0 mm center pin positive

To order the kit and the power supply, contact:

Corollary, Inc.
17881 Cartwright Road
Irvine, CA
(714) 250-4040

Warning

DO NOT use wall-mounted power units (typically 9 volts DC or 12 volts AC) found at electronic retail outlets. They are likely to destroy the terminal concentrator.

F

SCO XENIX

This appendix provides step-by-step instructions on how to install the D2040A software using the SCO XENIX operating system. Installation and removal of the D2040A software is facilitated by the SCO **custom** utility.

Installing the D2040A Software

To install the D2040A software, follow the steps below.

1. Install SCO XENIX 386. Follow the directions given in SCO's Installation Guide. You must install the Run Time System (RTS) and the Basic extended utility set (BASE).
2. Install the Link Kit (LINK) if you haven't already installed it.
3. Install any third party or optional device drivers. Generally, you can install any third party drivers before or after you install the terminal multiplexor software. However, some third party drivers must be installed last.
4. Make sure the system is in System Maintenance mode.
5. Type `custom` and then press Enter. The **Custom** main menu appears.
6. Select `Add a Supported Product` and press Enter. The following message is displayed:

   ```
   Insert distribution volume 1
   and press <RETURN> or enter q to quit:
   ```

7. Insert the D2040A software disk into the primary flexible disk drive and then press Enter.

8. Select **Install one or more Packages** and press Enter. You'll see a menu that lists the installable D2040A software packages.

   ALL installs all of the software below.

   DRV installs the D2040A software and creates appropriate device nodes.

   DEMO installs a subdirectory called **/mxdemo** that contains demo software.

9. Select **ALL** to load all packages and press Enter. The following message is displayed:

```
Insert Hewlett Packard D2040A Software volume I
and press <RETURN> or enter q to return to the menu:
```

10. Press Enter. The following message is displayed:

```
Enter an interrupt line to use [10, 11, 12 or 15]:
```

Note

For a complete list of interrupt lines (both in use and available), refer to the appendix entitled *Interrupt Lines*. Also, if you're using any other XENIX third party board, make sure an interrupt conflict doesn't exist.

---

11. Type an interrupt that is not already in use and press Enter. After you type an interrupt, the following message is displayed:

```
Enter maximum number of D2040A boards to be supported
[1 (32 lines), 2 (64), 3 (96), or 4 (128)]:
```

12. Type 1, 2, 3, or 4 and press Enter. The appropriate number depends on the number of terminal concentrators you intend to use. If you enter a number larger than you need, kernel data space will be used up unnecessarily but will cause no problems. If you later add more terminal concentrators, re-run the **custom** program, select DRV, and indicate the number of host adaptor boards you will be using. After you enter the maximum number of host boards, the following message is displayed:

```
Beginning terminal concentrator letter [a-w, default a]:
```

13. Type a letter a through w and press Enter. The serial lines are referenced by a letter than corresponds to the four high-speed terminal concentrator ports on the host adaptor (see the *Hardware Installation* chapter for an illustration) and a number that identifies the line on the terminal concentrator. Letters used for the serial line reference four consecutive letters. The initial letter defaults to the letter "a". For each high-speed terminal concentrator port, the system will automatically assign the next corresponding letter in the alphabet. The terminal concentrators' lines are numbered from 1 to 8. For example, line 3 on the second terminal concentrator is normally known as "/dev/ttyb3". This scheme may generate a name that conflicts with another device. To avoid such a conflict, you may need to select a beginning letter other than "a".
14. When asked if you want to create a new kernel, type **y** and press Enter.
15. When asked if you want the kernel to boot by default, type **y** and press Enter.
16. Type **q** to quit **custom** and press Enter.
17. Remove the D2040A Software disk and type `reboot` to reboot the system.
18. After the boot prompt is displayed (:), press Enter.
19. After the system reboots, press Ctrl D to bring the system up in normal multiuser mode.
20. When prompted for the System Time, press Enter.

Enabling Terminals

Before SCO XENIX can recognize terminals that are connected to a terminal concentrator, you must enable them. To enable a terminal, type `enable ttyxn` where **x** is the terminal concentrator (a-w) and **n** is the line number (1-8).

Using Serial Printers

Printers, as well as terminals and other RS-232 interfaced serial devices, can be connected to the eight ports on the concentrator. If a printer is connected directly to a terminal concentrator, a few things should be noted.

The SCO XENIX program **lpinit** provides a very easy way to configure a printer into your system. When prompted for the device name, type **ttya1** for example. This example uses the lower case "a" instead of the upper case "A" to cause the driver software to ignore the Data Set Ready signal for that port. This is important because most printers will drop CTS or DTR when taken offline, when out of paper, etc. If the driver does not ignore DSR, it will abort the line printer spooler when DSR is no longer asserted.

The XENIX spooler makes use of "interface" programs that drive the output to printers. There are some things to note about the standard interface programs provided by SCO.

You should use the "serial device requiring<nl> to <cr><if> mapping" interface for most "dumb" printers, but there is an oversight in that SCO 2.3 interface script. After configuring a serial device with that interface, edit the interface file (**/usr/spool/lp/interface/<printername>**) and change the line:

```
stty onlcr 0<&1
```

to:

```
stty ixon onlcr 0<&1
```

This turns on XON/XOFF hand shaking to the device (the default script leaves it off). The HP LaserJet interface script does not have this problem.

It is a good idea to modify all interface scripts to add the command:

```
stty ixon 0<&1
```

just before the **exit 0** command at the bottom of the script. This forces all pending output to be flushed to the printer device before returning control to the line printer spooler, which avoids a timing problem with the spooler that can cause some characters at the end of the listing to be dropped or garbled.

See your operating system documentation for more information regarding setting up system printers and the spooling program provided by your operating system.

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