Applied
Microsystems
Corporation

ES Driver/PC
User's Manual

ES Driver/PC User's Manual

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PREFACE

APPLIED MICROSYSTEMS CORPORATION is proud of its role in the systems development industry and has made every effort to document this product accurately and completely. However, it assumes no liability for errors or any damages that result from use of this manual or the equipment it accompanies. Applied Microsystems reserves the right to make changes to this manual without notice at any time.

Before using this manual, you should be familiar with your PC and with the microprocessor you are using, including its characteristics as described in the manufacturer's data books.

SECTION 1
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INTRODUCTION

INTRODUCTION

This manual is your guide to using ES Driver with Applied Microsystems' ES 1800 Series 16-bit and 32-bit microprocessor emulators with either RS-232 or SCSI communications from your PC. ES Driver provides an easy-to-use interface between the PC and the emulator.

How to Use This Manual

The manual is organized into four sections and several appendices.

Section 1 introduces the concept and scope of ES Driver. If you are already familiar with ES 1800 emulators, you can begin with Section 2.

Section 2 provides ES Driver installation instructions for systems equipped with RS-232 communications. It also guides you through the initial use of ES Driver.

Section 2S provides ES Driver installation instructions for systems equipped with the SCSI Disk protocol communications option. It also guides you through the initial use of ES Driver.

Section 3 is a reference guide to each menu.

Section 4 describes how to use the advanced features of ES Driver.

Appendix A contains reference information on the required program files and machine compatibility.

Appendix B describes the object module formats that are available.

Appendix C provides a description of how to modify or translate the help file.

Appendix D provides a description of how to modify the keyboard.

Appendix E contains information on serial connections.

Appendix F contains information on installing the hardware required to use SCSI Disk protocol communications. It also explains host adapter installation and configuration, and connection of multiple devices to the SCSI bus.

System Concept

ES Driver software is part of a family of design and debugging tools for software and hardware design professionals who need to add microprocessor emulation capability to a DOS computer. ES Driver provides an interface between a PC and Applied Microsystems' family of ES 1800 emulators.

The program provides a convenient display of the emulation session and event monitor system information, as well as configuration control, directory control and file access.

Since ES 1800 emulators can accept binary files in a variety of formats, programs may be developed on the PC using many popular assemblers, compilers and linkers, then downloaded to the target system (or emulator RAM overlay) where they can be debugged and tested.

During emulation, all commands are passed directly to the ES 1800, where they are processed by ESL (the command language in the ES 1800 emulators). The full power of the ES 1800 is available for symbolic debugging and setting complex breakpoints. Both ES Driver and ESL have macro capability, so commonly used commands may be shortened to as few as one or two key strokes.

Access to on-line help for a specific situation is available anywhere in ES Driver by typing <F9> (except in transparent mode). When using ESL, type a question mark ? for help information.

ES Driver provides menu screens for the main functions. The menus are selected by using the function keys on the PC. The functions provided by the keys are displayed on the screen at all times.

Emulation as a Tool

Microprocessor emulation offers many benefits to system development. Without it, new product development can be a long and time-consuming process, especially in the integration phase when hardware and software are integrated into the final product.

Figure 1-1. The Development Cycle
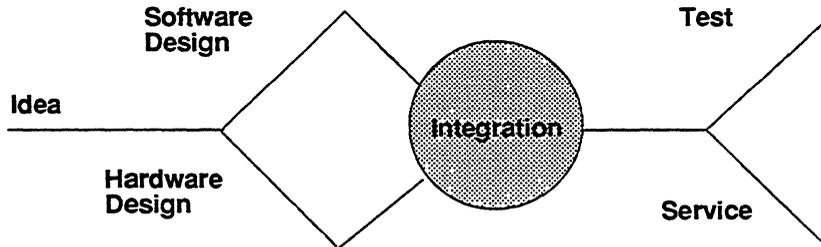
Emulation, in the context of microprocessors, is the concept of replacing the microprocessor itself with a device that provides the pin-equivalent functions of the microprocessor, while allowing user control and visibility of the functions.

Emulators do more than simply provide a microprocessor with a front panel. Applied Microsystems Corporation emulators have Random Access Memory (RAM) which can be used in place of allocated memory space in the target system during development of the software. This RAM can be configured to act like ROM so that ROM code can be checked and modified before programming the actual chips.

Other features include tracing run-time events of the target program and displaying the executed code in a convenient mnemonic format.

Emulators are also useful in production. The microprocessor socket is an excellent interface to most systems since it usually has access to most of the hardware. Emulators can be used to checksum ROM, test RAM memory, exercise I/O ports, etc., without the overhead of including the test program in the product.

Tests can be automated or run individually. They can be run from RAM overlay, from macros stored in ES Driver or from command files. When hardware problems are discovered, an emulator and an oscilloscope are often the best pair for troubleshooting, since the emulator can simulate the problem and the oscilloscope (or logic analyzer) can be used to analyze it.

SECTION 2

Contents

GETTING STARTED (PC/RS-232 ONLY)

GETTING STARTED (PC/RS-232 Only)

Introduction

This section explains installation of ES Driver in an ES 1800 system which is not equipped with a SCSI Controller board. If your system has a SCSI board, please use Section 2S, *Getting Started (PC/SCSI)*.

There are five steps to installing and using ES Driver:

1. Verify that you have all the equipment you need.
2. Connect the equipment.
3. Install ES Driver.
4. Start ES Driver.
5. Configure ES Driver.

This section explains each of these steps in detail and guides you through the initial use of ES Driver.

Equipment Needed

This ES Driver symbolic debugging and emulation controller software package requires the following components to run using RS-232 communications between the host computer and the emulator:

Host Computer

ES Driver must be used with an IBM-PC, PC-XT, PC-AT, or compatible with the following:

- Minimum 512KB RAM
- Serial port configured as COM1 or COM2
- Hard disk drive, or a high-density 5.25" or 3.50" diskette drive (720K, 1.2M, or 1.44M)
- MS-DOS or PC-DOS version 2.11 (or later)

Microprocessor Emulator

ES Driver is designed to work with Applied Microsystems ES 1800 16-bit and 32-bit microprocessor emulators for the following microprocessors:

8086/8088, 80C86/C88	68000/08
80186/80188, 80C186/80C188	68010
80286	68020
Z8001/2	68302

ES Driver Software

Distribution disks containing release 3.16.*x* or later software.

RS-232 Cables

PC/ES 1800 25-pin to 25-pin cable (Part # 600-10486-00) and 25-pin to 9-pin adapter (Part #600-00031-01).

Manual

The *ES Driver/PC User's Manual*.

Connecting the Equipment

To run ES Driver you must connect your ES 1800 emulator to your PC via the RS-232 cable and connect your target system to the emulator via the pod cable. This section provides step-by-step procedures for serial communication setup in an ES 1800 that is not equipped with a SCSI Controller board.

If you are coverting a SCSI-equipped system to RS-232-only, reverse the procedures in Appendix F, "Upgrading a Non-SCSI System to SCSI Disk Protocol." You must remove the Emulex adapter from your PC and the SCSI controller and SCSI/serial switching cable from the ES 1800, reposition the J1 jumper on the MCB, and insert the MCB in the top slot. See Figures F-9 and F-10.

Safety Precautions

The emulator contains a 3-wire cord with a 3-terminal polarized plug for connection to the power source and protective ground. The grounding terminal is connected to the metal chassis parts of the instrument. The emulator provides electrical shock protection only if the plug is plugged in to an outlet with a properly grounded protective ground contact.

Emulator/Target System Connection

1. Make sure the emulator is compatible with the microprocessor being emulated.
2. With the power off for both the emulator and the target system, remove the microprocessor from its socket, noting the location of Pin 1. Replace it with the emulator's probe tip. Make sure the bevel or Pin 1 indication on the emulator probe tip is aligned with Pin 1 on the microprocessor socket.

CAUTION

The pins in the probe tip are fragile. If they are banged against other objects, they may break. If they are broken, the emulator will not function properly. The probe tip or pins must be replaced if pins are broken or damaged.

Host Configuration

Before using ES Driver with your ES 1800, the PC's serial port must be configured to work with the emulator.

To use RS-232 communications with ES Driver, you must connect the emulator to the PC via an RS-232 cable. ES Driver is shipped with two cables: one 25-pin to 25-pin cable, and one short 25-pin to 9-pin adapter.

1. Use the cables required for your host computer, and connect your computer to the emulator TERMINAL port.

Host Computer	*Cables to Use[1]*
IBM PC XT or compatible	25-pin to 25-pin cable
IBM PC AT or compatible	25-pin to 25-pin cable and the 25-pin to 9-pin adapter cable
IBM PC[2] or compatible	25-pin to 25-pin cable

[1]If you want to make your own cables, the cable pin connections for most PC host computers are shown in Appendix E.

[2]If you are using a standard IBM-PC (not the XT or AT hard disk version), you must add a serial port with a male connector if you plan to use RS-232 communication.

2. Configure the serial port on your PC as either COM1: or COM2:. Port COM1: is assumed for the rest of this manual. If the PC has selection for RS-232 or current-loop, make sure that RS-232 voltage levels are selected. Usually, PCs are shipped with COM1:, RS-232 selected. Appendix E contains diagrams for configuring IBM serial ports.

3. ES Driver uses an interrupt-driven serial receive port. If your PC serial adapter has jumpers for the interrupt request line, they must be set also. If configured for COM1:, set the jumper for IRQ4. If using COM2:, set the jumper for IRQ3.

Emulator/PC Connection (SCSI Interface)

Using SCSI communications with ES Driver requires installing the SCSI Disk protocol controller board as described in Section 2S. If you have purchased the SCSI upgrade, follow the instructions in Appendix F and Section 2S, *Getting Started (PC/SCSI)*.

Installing ES Driver

The following procedure describes how to install ES Driver on your PC.

Installation on a hard disk is recommended, though ES Driver may be run from a high-density floppy disk. ES Driver is available on 5.25" and 3.50" diskettes.

Distribution Files

The following files are included on your distribution disks:

INSTALL.EXE	Automated installation routine
README	Release notes
EMX.EXE	Not used
ESD.CFG	Menu and macro configuration
ESD.EXE	Executable for ES Driver
ESD.HLP	Help file contains all help messages
ESDKEY.CFG	Keyboard configuration file
FILE.LIS	Descriptive list of current files

Installing on a Floppy Disk

You may run ES Driver from a single, high-density floppy disk. Use a 720K, or 1.44M 3.50" diskette, or a 1.2M 5.25" floppy disk. To create a single working disk, take the following steps:

1. Use the /s option with the DOS **FORMAT** command to copy the DOS system files onto a single high-density disk.

2. Copy the following ES Driver program and configuration files from the distribution disks onto your working disk.

   ESD.EXE
   ESD.CFG
   ESDKEY.CFG
   ESD.HLP

Once you have made a working copy, put the original disks away for safekeeping.

Installing on a Hard Disk

While ES Driver may be installed in any directory on your hard disk, we recommend that you create a directory called **AMCTOOLS** for ES Driver and other utilities you may obtain from Applied Microsystems. If you prefer you can simply use the DOS COPY command to copy all the files to your installation directory. Or you can use the installation program.

The installation program **INSTALL.EXE** simplifies hard disk installation. It prompts you for the following:

- the name of the drive to install the programs on
- the directory to install the files in
- the microprocessor you are emulating

To install ES Driver, insert the ES Driver disk 1 into floppy disk drive A. At the DOS prompt, type:

```
A:<return>
INSTALL <return>
```

Follow the instructions given by the **INSTALL** program.

<p align="center">NOTE</p>

> If you are running on a network you may want your system administrator perform these steps because you will need directory creation privileges to use **INSTALL.EXE**.

Setting the PATH

DOS uses the **PATH** environment variable to locate executable files outside of your current directory.

You will probably want to execute ES Driver from any directory. This allows you to keep your directories organized: one for each utility, such as ES Driver, and one for each project you are working on. For example, you may be working on a program called **MIFILE.ASM** in directory \WORK. You have an assembler stored in directory \ASMB, an editor in directory \UTIL, and ES Driver stored in directory \AMCTOOLS. Your DOS files are stored in the directory \DOS.

For this example, to have access to the assembler, the editor, and ES Driver from any directory, you enter the following path at the DOS prompt:

```
PATH=\DOS;\ASMB;\UTIL;\AMCTOOLS
```

Once set, this path string becomes part of the DOS environment. When you enter the name of a program, DOS first looks in the current directory for that program. If the program is not in the current directory, DOS looks in each directory specified in the path. For the example above, if you enter **ESD** to start the ES Driver program from the **\WORK** directory, DOS first looks in the **\WORK** directory for the program. Because the ES Driver program is not in the current directory **\WORK**, DOS looks for the program in the directory **\DOS**, then in **\ASMB**, then in **\UTIL**, and finally finds it in **\AMCTOOLS**.

NOTE

Your **PATH** will depend on the file organization on your PC.

To find what your current path is, type **PATH** at the DOS prompt. DOS will display the current path. If no path has been set, DOS displays the message:

```
NO PATH
```

The best place for the **PATH** command is in the **AUTOEXEC.BAT** file in the root directory. The **PATH** command will then execute each time you boot up your PC.

See your DOS manual for more information about **PATH** and **AUTOEXEC.BAT**.

Starting ES Driver

You are now ready to run ES Driver. At the DOS prompt, type **ESD**. The program takes a few seconds to load, and then the header page will appear on the screen.

The program name, version number and serial number appear in a box in the middle of the screen. The microprocessor that the program is configured for appears under the box.

At the bottom of the screen you'll see the prompt:

```
Press <Enter> to continue or <F6> to set configuration
```

If this is your first time using ES Driver, or if the microprocessor listed is not the one you are using, press <F6> to enter the Configuration Menu.

If you have already configured ES Driver, press <Enter> to go to the Main Menu.

Screen Colors

ES Driver can use with either a color or monochrome monitor. If you are using a color monitor, the colors represent the following fields:

Color	Field
yellow	fields that you can change
white	cursor
light green	highlighted fields
blue	information on your choices

Configuring ES Driver

This section is intended to help first-time ES Driver users get started quickly. For a more complete description of the Configuration menu, see Section 3 in this manual.

When you press <F6>, you'll see the Configuration menu, with four sets of prompts:

> Processor Type
> Communications Setup
> Object File Format
> System Processes

68000 family processors have two additional prompts:

> Download object length
> Address space

At this time, just set up the Processor Type and Communications Setup fields.

Use the following keys to change parameters:

<space> or <backspace>	to toggle between selections
↑ ↓ or <Enter>	to go to another parameter

(If the arrow keys don't work, make sure the <num-lock> key is off.)

You can request help at any time by pressing the <F9> function key.

Processor Type

ES Driver supports the following processors:

- 68020
- 8086/88/C86/C88
- 80186/188/C186/C188
- 80286
- 6800X/010/302
- Z800X

Use the <spacebar> to toggle through the choices.

RS-232 Communications Setup

To use the RS-232 serial interface, set the parameters up as follows:

    Communications Device Type: **RS-232**
    Serial Port (RS-232):   **COM1 or COM2**
    Baud Rate (RS-232):   **9600**

Press <F8> to save this configuration as your default setup. When ES Driver is in serial communication mode, you'll see the prompt:

```
Initialize and/or reconfigure the ES 1800 to match (Y/N)?
```

If you are using the ES 1800 emulator for the first time, or you are unsure of the emulator's current communications mode, follow the procedure below to initialize the emulator for serial communications.

You can initialize the ES 1800 emulator in several different ways. How you initialize the emulator depends on your particular setup. For example, if you use the emulator in a stand-alone environment (with a terminal, or terminal emulation program), you initialize the ES 1800 using the TERMINAL port. If you use the emulator in a hosted environment (with a PC, or with a PC and a terminal) and you plan to upload and download files, you first initialize the emulator using the TERMINAL port, and then reconfigure the ES 1800 to use the COMPUTER port. Additional factors include the following:

- the processor being emulated
- the current configuration of the ES 1800
- the desired configuration of the ES 1800
- the state of the target system (if connected)

The procedure below will help you establish communications using the factory default configuration. Any time you run into communications difficulties, you should first follow these steps to initialize the ES 1800 for serial communications.

Initializing the Emulator for Serial Communications

If you want to reinitialize communication with the ES 1800 from a known state, or if you are using the emulator for the first time, you should follow these steps. This procedure uses the TERMINAL port of the ES 1800 emulator and the factory default settings. (If you have already established communications with the emulator, and the you want to reinitialize the ES 1800 with a new baud rate, follow the procedure for auto-configuration, on page 2-13.)

1. Before applying power to the emulator and your target system, verify that you have correctly connected the ES 1800 emulator to your target system.

2. Connect the PC serial port cable to the TERMINAL port on the ES 1800 chassis.

3. Verify that the thumbwheel switch on the front of the ES 1800 MCB Controller board is set to "0." The thumbwheel switch is mounted on the left edge of the top circuit board. To set this switch, remove the front panel of the ES 1800.

   To remove molded front panels, first push upward on the left release tab (located on the bottom left side of the front panel), while pulling the bottom left side of the panel slightly outward. Then press on the right release tab (located on the bottom right side of the front panel) and pull outward until the bottom of the panel is completely unlatched. After unlatching the bottom of the panel, slide the panel downward to remove it.

   To remove aluminum front panels, loosen the two front panel release knobs and take off the panel.

4. Apply power to your target system.

5. Turn on power to the ES 1800.

Using the TERMINAL Port

After you have connected the PC to the TERMINAL port of the emulator and set the thumbwheel switch to "0," type Y (or y) at the prompt:

```
Initialize and/or reconfigure the ES 1800 to match (Y/N)?
```

ES 1800 emulators are shipped configured to use the TERMINAL port at 9600 baud. The thumbwheel switch on the ES controller card is set to "0." This setting loads the factory default parameters on power up (9600 baud, no parity, full duplex, 8-bit word length, one stop bit, XON and XOFF protocol). The default sets control of the emulator through the TERMINAL port of the ES 1800. Typing Y at the prompt to initialize the emulator will display the following message and prompt.

```
Attempting to establish communications with ES 1800,
please wait.
Communication established with ES 1800 at 9600 baud.
Connected to ES 1800 TERMINAL port.
You must be connected to the ES 1800 COMPUTER port to do
uploads and downloads. Do you desire to change to the
ES 1800 COMPUTER port (Y/N)?
```

If you respond N (or n) to the "change to the ES 1800 COMPUTER port (Y/N)?" prompt, you will see this display:

```
Sending factory default configuration to ES 1800.
Setting new baud rate to ES 1800. (If required.)
Saving new configuration.
Resetting the ES 1800. Please wait.........
```

You have established communication with the ES 1800 emulator. However, you will not be able to upload and download files to the emulator. If you plan to transfer files between the emulator and PC, you need to reconfigure the ES 1800 to use the COMPUTER port.

Using the COMPUTER Port

If you plan to upload or download files to the emulator, you need to establish communications through the COMPUTER port of the ES Driver. If this is the first time you have used the emulator, you should follow the procedure above and initialize the emulator through the TERMINAL port.

Once you have established communications with the ES 1800 using the TERMINAL port, the prompt asks you if you wish to change ports. Type Y (or y). ES Driver displays instructions for changing to the COMPUTER port.

```
SAVing current configuration. Please wait......ok
1. Turn off the ES 1800.
2. Locate the thumbwheel switch on the ES controller card
(You will have to remove the front panel of the ES 1800).
3. Set the thumbwheel switch to "3." (Remember to replace
the ES 1800 front panel.)
4. Change the RS 232 cable from the ES 1800 TERMINAL port
to the ES 1800 COMPUTER port (located on the back of the
ES 1800).
5. Turn on the ES 1800. When complete, press any key to
continue the initialization procedure.
```

Follow the instructions on the screen to reconfigure the ES 1800. After applying power, allow the emulator to come up to speed before you press any key; wait approximately 30 seconds.

By setting the thumbwheel switch to "3," you are switching control of the emulator to the COMPUTER port. A switch position of "3" also sets User "O" defined parameters. These parameters define the serial port settings (baud rates, parity, duplex, handshaking, and stop bits). On power-up, the switch position determines the parameters that autoload. For information on the 16-position thumbwheel switch and the default settings, check in your *ES 1800 Emulator User's Manual.*

Press any key to have ES Driver attempt to reestablish communication with the ES 1800 in the new configuration. You should see the following lines:

```
Attempting to establish communications with ES 1800...
Communications established with ES 1800 at 9600 baud.
Connected to ES 1800 COMPUTER port.
```

After the screen clears, you'll see the following display:

```
Sending factory default configuration to ES 1800.
Setting new baud rate to ES 1800. (If required.)
Saving new configuration.
Resetting the ES 1800. Please wait........
```

After saving the new configuration, ES Driver returns to the Main Menu. Control of the emulator now goes through the COMPUTER port, so files can be uploaded and downloaded. You may want to increase the baud rate to speed the transfer of files. The auto-configuration feature lets you adjust the baud rate "on the fly."

Using Auto-Configuration

Once you have established communication with the ES 1800 you can adjust the baud rate without having to reinitialize the emulator manually (using the ESL commands).

For example, if your PC is connected to the COMPUTER port of the ES 1800 and communication is established at 9600 baud, you can use the auto-configuration feature to speed the transfer of files.

To change the baud rate from 9600 to 19200, first press <F6> to return to the Configuration menu. Use the cursor keys to highlight 9600 baud. Toggle through the choices using the <space> bar and select 19200. Press <F8> to save the new configuration. Type Y (or y) to reinitialize the emulator after the prompt:

```
Initialize and/or reconfigure the ES 1800 to match (Y/N)?
```

If the auto-configuration is successful, you will see the message:

```
Attempting to establish communications with ES 1800...
Communications established with ES 1800 at 19200 baud.
Connected to ES 1800 COMPUTER port.
```

The screen clears, and ES Driver displays the following message:

```
Sending factory default configuration to ES 1800.
Setting new baud rate to ES 1800. (If required.)
Saving new configuration.
Resetting the ES 1800. Please wait........
```

After saving the new configuration, ES Driver returns to the Main Menu.

Troubleshooting the Communications Setup

If you are unable to establish communications between ES Driver and the emulator, the following section will help you initialize the ES 1800.

No Target Power or Clock Initialization

The most common problems encountered during initialization of the ES 1800 are the lack of power to the target system, or the lack of target clock. In this situation, ES Driver is able to initially establish communication with the ES 1800, but cannot establish full communication with the ES 1800 until the problem is resolved.

When this situation is encountered, ES Driver displays the ESL sign-on message and any diagnostic information from the emulator.

```
Attempting to establish communications with ES 1800......
Still trying to establish communications.
Communication established with ES 1800 at 9600 baud.
Attempting to get ESL prompt................timed out.
Sign-on message response:
COPYRIGHT 1986 APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR 80286 V3.10S
USER = 0, SW = 0
#256K AVAILABLE OVERLAY
NO TARGET POWER
SYSTEM RESET ERROR
Can't establish full communications with ES 1800.
Please consult your ES Driver manual for instructions on
how to configure the ES 1800 to communicate      .
with ES Driver.
```

The all-uppercase text is the sign-on message response from the ES 1800. In this particular case the "NO TARGET POWER" and "SYSTEM RESET ERROR" messages mean that the ES 1800 was not able to properly initialize itself. If this occurs, you can take several actions:

1. All 680x0 family processors require either a "Null target," a "Demonstrator target," or an active target system. Verify that the ES 1800 is properly connected to a target system that has power and an active clock signal. Then reset the ES 1800 <ctrl-z>.

2. For both Zilog Z800x family processor emulators and all Intel 808x, 8018x, 80C18x, and 80286 family processor emulators, initialization may result in displays similar to the one below for both power and clock errors:

```
Attempting to establish communications with ES 1800,
please wait.......
Still trying to establish communications.
```

```
Communication established with ES 1800 at 9600 baud.
Attempting to get ESL prompt................timed out.
Sign-on message response:
APPLIED MICROSYSTEMS COPORATION
SATELLITE EMULATOR XXXXX
USER = 0, SW = 0
#256K AVAILABLE OVERLAY
NO CLOCK - TYPE "Y" TO SELECT INTERNAL CLOCK
```

ES Driver may automatically attempt a "Y" response (Intel). If the system is successful or if you type Y (Zilog), one of two messages appears. If the host computer is connected serially to the TERMINAL port of the ES 1800, you will see the following:

```
Waiting for ESL prompt.ok
Connected to ES 1800 TERMINAL port.
You must be connected to the ES 1800 COMPUTER port to do
uploads and downloads. Do you desire to change to the
ES 1800 COMPUTER port (Y/N)?
```

If the host computer is connected serially to the COMPUTER port of the ES 1800. The display will appear as follows:

```
Waiting for ESL prompt.ok
Connected to ES 1800 COMPUTER port.
```

For all Zilog family processors either a "Null target," a "Demonstrator target," or your target system is recommended. Verify that the ES 1800 is properly connected to a target system that has power and has an active clock signal. Then reset the ES 1800 <ctrl-z>.

When successful with initialization, ES Driver returns to the Main menu.

Can't Establish Communication with the Host Computer

If ES Driver is unable to establish communications with the ES 1800, the following lines are displayed when you attempt to save <F8> the current configuration:

```
Attempting to establish communications with ES 1800....
Still trying to establish communications.......
Can't establish full communications with ES 1800.
Please consult your ES Driver manual for instructions on
how to configure the ES 1800 to communicate
with ES Driver.
```

Possible Solutions

1. The ES 1800 is configured to communicate using the TERMINAL port, but the serial cable of the host computer is connected to the COMPUTER port (or vice versa).

   Try the following:

   1. Power off the ES 1800.
   2. Set the thumbwheel switch on the ES 1800 MCB to "0."
   3. Connect the serial cable of the host computer to the TERMINAL port of the ES 1800.
   4. Power on the ES 1800.
   5. Retry the initialization sequence.

2. The serial cable is not connected to proper serial port on the host computer.

   Try the following:

   1. Connect the serial cable to other serial ports on the host computer.
   2. Verify that the IRQ is set up properly for the serial port you are using (see page 2-4

3. The serial cable is faulty or incorrectly wired.

   Try the following:

   1. Use a different serial cable.
   2. Check your serial cable wiring with the schematic given in Appendix E of this manual.

4. If you are still unable to establish communication with the ES 1800, you should do one of following:

   1. Attempt to establish communication with the ES 1800 with a terminal or terminal emulator program.
   2. Attempt to "manually" configure the ES 1800 according to the instructions given below.

Configuring the Emulator Manually

The instructions below are provided to allow you to manually configure the ES 1800. Make sure that the ES 1800 is powered off.

1. Connect the serial cable between the PC host and the ES 1800 TERMINAL port.

2. Set the thumbwheel switch on the ES 1800 MCB board to position 0.

3. Turn on the ES 1800.

4. Assuming that you have ES Driver running, go to the configuration menu by pressing <F6> if you *are not* in ES Driver's emulation window. If you *are* in the emulation window, you must first exit it by pressing <F7>.

5. Set the Communications Setup prompts as follows:

   Communications Device Type: **RS-232**
   Serial Port (RS-232):   **COM1 or COM2**
   Baud Rate (RS-232):   **9600**

6. Go back to the emulation window by pressing <F1> (or :t). You should see either an ESL sign-on message, or an ESL ">" prompt. If an "Emulator not responding" message appears, try pressing <ctrl-z> to re-initialize ES Driver and ESL. If this fails, check the following:

   A Your COM port configuration. See the section "Emulator/PC Connection (Serial Interface)."
   B The serial cable between the ES 1800 and the PC. If you are using a non-standard cable, a "null modem" is required. Check the cable for proper electrical connection. See Appendix E.
   C Try cycling power on the ES 1800.

If your emulator's processor probe tip is not plugged into a target system, then a power-up error message will occur. Pressing <ctrl-z> should cause the ESL sign-on message to be redisplayed, followed by the error message.

For Motorola (68000/08/10/20) emulators, if either message

```
NO TARGET POWER
or
NO TARGET CLOCK
```

appears, you must correct the target problem before continuing. Check your target system's power and/or clock. An Applied Microsystems "null target" or "demonstrator target" must be used if no other target is available.

For Intel (8086/88/186/188) emulators, if the message

```
NO TARGET POWER - TYPE "Y" TO USE INTERNAL CLOCK
```

appears, press **Y** (or y) to continue. An ESL prompt should then appear.

7. Once the ESL prompt is present, use the **SET** command to set the ES 1800 baud rate on the COMPUTER and TERMINAL ports to the desired values. For example, to set the baud rate to 19200, enter the following commands:

```
>SET #10,#15
>SET #20,#15
```

8. Use the ESL **sav** command to save the baud rate setting.

   >SAV

9. Wait for the ESL prompt to return. This may take as long as a minute. Exit ES Driver's emulation window by pressing <F7>.

10. Power down the ES 1800.

11. Change the thumbwheel switch on the ES 1800 MCB board to position 3.

12. Change the serial cable connection on the ES 1800 from the TERMINAL port to the ES 1800 COMPUTER port.

13. Leave the ES 1800 off for at least 30 seconds before powering it on again.

14. Go to ES Driver's configuration menu. This may be accomplished by pressing <F6> if you are not in ES Driver's emulation window. If you are in the emulation window, you must first exit it by pressing <F7>. Ignore the "emulator not responding" message that may occur.

15. Set the Communications Setup prompts as follows:

    Baud Rate (RS-232):   **19200**

    If you used the ESL SET command to select a baud rate other than 19200, then you must select the same baud rate in ES Driver's configuration menu.

16. Go back to the emulation window by pressing <F1>. You should see either an ESL sign-on message, or an ESL ">" prompt. If an "emulator not responding" message appears, try pressing <ctrl-z> to re-initialize ES Driver and ESL. If this fails try cycling power on the ES 1800.

17. Successful completion of this procedure means that the emulator, the serial link, and ES Driver are properly configured.

If you cannot establish communication between ES Driver and the emulator, please contact Customer Support at Applied Microsystems Corporation (1-800-ASK-4AMC).

NOTE

- On some PC systems, the cursor may remain on the screen even if the last page of the buffer is not displayed. Some interrupt-driven "background" tasks may have been installed that affect the cursor attributes of ES Driver.

- ES Driver uses <ctrl-s> and <ctrl-q> for the XON/XOFF protocol. These parameters are set in the ES 1800 at the factory. If you have changed these on your emulator, you should change them back so that ES Driver can communicate properly with the emulator. On most ES 1800 emulators, the command to restore the parameters is SET 3,$11,$13.

Using the Main Menu

The Main Menu shows the six sub-menus available. The Main Menu looks like this:

```
        Applied Microsystems Corporation     Type <F9> for Help

    1. Target Emulation              4. Upload to Host Computer
    2. Event Monitor System          5. Download to ES 1800
    3. Change Directory              6. Configuration
                                     7. Exit to Shell


    Enter Selection __

F1 Emulate F2 Bkpts F3 ChDir F4 Upload F5 Dnload F6 Configuration F7 Exit
```

You can choose a submenu by entering the number of the selection and pressing <Return> or pressing the function key listed on the bottom line (i.e., <F6> for Configuration).

For detailed information on each menu, see Section 3 of this manual.

Using the ES 1800 Emulator

To use the emulator, you enter target emulation mode by typing <F1> from anywhere in ES Driver. You should now have an ESL ">" prompt on the screen. If the prompt does not appear, press <Return>.

Commands typed on the keyboard must be in ESL (the command language in the ES 1800 emulator). For a full discussion of the command set, see "ES Language" in your *ES 1800 Reference Manual*. ES Driver provides you with a flexible, menu-driver interface to ESL. Responses from the emulator are displayed on the screen and are also stored in a screen buffer.

The up arrow and down arrow keys cause the display to scroll up and down one line. The <PgUp> and <PgDn> keys scroll the screen a page (16 lines) at a time. The <Home> key displays the first page (oldest saved page). The <End> displays the last (or current) page. The screen buffer holds up to 10K bytes of the most recently stored data.

If there is something already in the buffer, you may not see the ">" prompt or the cursor on the screen. As soon as you type any characters, the buffer automatically is scrolled to the end and the prompt and cursor will reappear.

ES Driver is not a replacement for ESL. While ES Driver provides features that enhance the usefulness and flexibility of ESL, you need to master the ESL command language to use your ES 1800 efficiently. See the *ES 1800 User's Manual* that came with your emulator for more information on using ESL and the ES 1800 emulator.

For detailed information on each of ES Driver's menus, see Section 3 of this manual.

SECTION 2S
Contents

GETTING STARTED (PC/SCSI)

GETTING STARTED (PC/SCSI)

The Small Computer Systems Interface (SCSI) Disk protocol option for the ES 1800 series of emulators provides a significant productivity enhancement. The SCSI Disk protocol interface enables the emulator to appear as a disk drive to the host. With SCSI Disk protocol, uploading and downloading can occur at sustained effective rates of up to 16 KBytes per second, eliminating data transfer bottlenecks. The actual speed depends on the host, the target microprocessor and the speed of the target microprocessor.

This section assumes you have completed hardware installation as described in Appendix F. It explains how to install ES Driver/PC and describes how to use both SCSI and RS-232 serial communications with your SCSI controller installed.

Hardware installation and multi-device bus configuration are explained in Appendix F.

CAUTION

You must complete hardware installation before going on with this section. Failure to follow the directions in Appendix F, especially those concerning the MCB controller board J1 jumper setting, will result in damage to the ES 1800. Even if you have a factory-installed SCSI controller, you must verify jumper position.

Equipment Needed

This ES Driver symbolic debugging and emulation controller package requires the following components:

Host Computer   ES Driver/PC must be used with an IBM-PC, PC-XT, PC-AT, or compatible with the following:

- Minimum 512KB RAM
- Serial port configured as COM1 or COM2
- Hard disk drive, or a high-density 5.25" (1.2M), or a 3.50" (720K) diskette drive
- MS-DOS or PC-DOS version 2.11 (or later)

Microprocessor Emulator   ES Driver is designed to work with Applied Microsystems ES 1800 16-bit and 32-bit microprocessor emulators for the following microprocessors:

8086/8088, 80C86/C88	68000/08
80186/80188, 80C186/80C188	68010
80286	68020
Z8001/2	68302

SCSI Controller   SCSI Disk protocol controller board for ES 1800 emulator.

Host SCSI Adapter   The SCSI/PC interface supports either an Emulex IB02 and any of the Future Domain TMC 800 line of host adapter cards. If you ordered one, an Future Domain is included with your system. Appendix F describes installation.

ES Driver Software   Distribution disks containing the release 3.16.*x* or later software.

Cables   RS-232:
                         PC/ES 1800 25-pin to 25-pin cable (P/N 600-10486-00),
                         Adapter 25-pin to 9-pin (P/N 600-00031-01).

                         SCSI:
                         PC/ES 1800 Emulex cable P/N 600-00041-*XX*
                         PC/ES 1800 Future Domain cable P/N 600-01000-*XX*

Manual   The *ES Driver/PC User's Manual.*

Installing Software

With the SCSI host adapter card installed in your PC, you are ready to load your software and configure for PC operation. The distribution disks included with your system or upgrade kit contain an installation program, ES Driver/PC, and an **ESDREAD.ME** file that describes changes too recent to be included in this guide. Be sure to read it before you start.

ES Driver/PC supports both SCSI and RS-232 communications. You must use the following release versions with the SCSI Disk protocol option:

> ES Driver/PC   Release 3.16.x or higher

If you are upgrading your equipment, your installation kit may include new software manuals, as well as new releases of the software you ordered.

Installation on a hard disk is recommended, though ES Driver may be run from a high-density floppy disk. ES Driver is available on 5.25" and 3.50" diskettes.

The files included on your distribution disks are described in **FILE.LIS**.

Installing on a Floppy Disk

You may run ES Driver from a single, floppy disk. Use a 720K 3.50" diskette, or a 1.2M 5.25" floppy disk. To create a single working disk, take the following steps:

1. Use the /s option with the DOS **FORMAT** command to copy the DOS system files onto a single high-density disk.
2. Copy the following ES Driver program and configuration files from the distribution disks onto your working disk.

   ```
   AMCSCSI.EXE
   EMX.EXE
   ESD.EXE
   ESD.CFG
   ESDKEY.CFG
   ESD.HLP
   ```

Once you have made a working copy, put the original disks away for safekeeping.

Installing on a Hard Disk

While the emulator control software may be installed in any directory on your hard disk, we recommend that you create a directory called **\AMCTOOLS** for ES Driver and other utilities you may obtain from Applied Microsystems. If you prefer you can simply use the DOS **COPY** command to copy all the files to your installation directory. Or you can use the installation program.

The installation program **INSTALL.EXE** simplifies hard disk installation. It will prompt you for the following:

- the name of the installation drive
- the directory to install the files in
- the microprocessor you are emulating

To install the files on your hard disk, insert the disk 1 into floppy disk drive A. At the DOS prompt, type:

```
A:<Return>
INSTALL <Return>
```

Follow the instructions given by the **INSTALL** program.

NOTE

If you are running on a network you may want your system administrator perform these steps because you will need directory creation privileges to use **INSTALL.EXE.**

Setting the PATH

DOS uses the **PATH** environment variable to locate executable files outside of your current directory.

You will probably want to execute ES Driver and other utilities from any directory. This allows you to keep your directories organized: one for each utility, such as ES Driver, and one for each project you are working on. For example, you may be working on a program called **MIFILE.ASM** in directory **\WORK**. You have an assembler stored in directory **\ASMB**, an editor in directory **\UTIL**, and ES Driver stored in directory **\AMCTOOLS**. Your DOS files are stored in the directory **\DOS**.

For this example, to have access to the assembler, the editor, and ES Driver from any directory, you enter the following path at the DOS prompt:

```
PATH=\DOS;\ASMB;\UTIL;\AMCTOOLS
```

Once set, this path string becomes part of the DOS environment. When you enter the name of a program, DOS first looks in the current directory for that program. If the program is not in the current directory, DOS looks in each directory specified in the path. For the example above, if you enter **ESD** to start the ES Driver program from the \WORK directory, DOS first looks in the \WORK directory for the program. Because the ES Driver program is not in the current directory \WORK, DOS looks for the program in the directory \DOS, then in \ASMB, then in \UTIL, and finally finds it in \AMCTOOLS.

NOTE

Your **PATH** will depend on the file organization on your PC.

To find what your current path is, type **PATH** at the DOS prompt. DOS will display the current path. If no path has been set, DOS displays the message:

```
NO PATH
```

The best place for the **PATH** command is in the AUTOEXEC.BAT file in the root directory. The **PATH** command will then execute each time you boot up your PC. Remember that your AUTOEXEC.BAT or emulator initialization batch file must include AMCSCSI and EMX, as described in Appendix F.

See your DOS manual for more information about **PATH** and **AUTOEXEC.BAT**.

Starting ES Driver

You are now ready to run ES Driver. At the DOS prompt, type **ESD**. The program takes a few seconds to load, and then the header page appears on the screen.

The program name, version number and serial number appear in a box in the middle of the screen. The microprocessor that the program is configured for appears under the box.

At the bottom of the screen you'll see the prompt:

```
Press <Enter> to continue or <F6> to set configuration
```

If this is your first time using ES Driver, or if the microprocessor listed is not the one you are using, press <F6> to enter the Configuration Menu.

If you have already configured ES Driver, press <Enter> to go to the Main Menu.

Screen Colors

ES Driver can be used with either a color or monochrome monitor. If you are using a color monitor, the colors represent the following fields:

Color	*Field*
yellow	fields that you can change
white	cursor
light green	highlighted fields
blue	information on your choices

Configuring ES Driver

This section is intended to help first-time ES Driver users get started quickly. For a more complete description of the Configuration menu, see Section 3 in this manual.

When you press <F6>, you'll see the Configuration menu, with four sets of prompts:

> Processor Type
> Communications Setup
> Object File Format
> System Processes

68000 family processors have two additional prompts:

> Download object length
> Address space

At this time, just set up the Processor Type and Communications Setup fields.

Use the following keys to change parameters:

<space> or <backspace>	to toggle between selections
↑ ↓ or <Enter>	to go to another parameter

(If the arrow keys don't work, make sure the <num-lock> key is off.)

You can request help at any time by pressing the <F9> function key.

Processor Type

ES Driver supports the following processors:

- 68020
- 8086/88/C86/C88
- 80186/188/C186/C188
- 80286
- 6800X/010/302
- Z800X

Use the <space> bar to toggle through the choices.

Communications Setup

With the SCSI Disk protocol option installed, you have communications flexibility. You can choose to operate completely in SCSI mode. Or you may want to use SCSI for its speed during uploading and downloading but switch to serial communication while using a software debugger. You can switch to RS-232 communications via the SCSI board or bypass the board completely to run continuously in RS-232.

The procedures for configuring ES Driver for SCSI communications are given below. This is recommended for initial operation. For information on setting up the ES1800 for RS-232 serial communications, and on switching between SCSI and serial communications, see "RS-232 Communications Setup" later in this section.

SCSI Communications Setup

If you are using a SCSI interface, set up the parameters as follows:

Communications Device Type:	SCSI
Device Number (SCSI):	0-7
Baud rate	**19200**

The Device Number field requires the SCSI ID you selected for the emulator during the configuration process in Appendix F. For example, if your SCSI configuration resulted in selection of SCSI ID 2 as the emulator's address on the SCSI bus, enter **2** in the Device Number field.

Press <F8> to save this configuration as your default setup. When you press <F8> you'll see two messages:

```
    Checking to see if the ES 1800 needs to be booted...
    Booting the ES 1800, please wait...
```

You should see the Main menu. Press <F1> to enter the transparent mode. When you see an ESL ">" prompt, you may map memory and begin downloading files using SCSI communication.

If you plan to use only SCSI communications, you can go on to "Using the Main Menu" or "Using the ES 1800 Emulator." If you want to enable and switch between serial and SCSI communication, see "RS-232 Communications Setup."

RS-232 Communications Setup

If you want to use ES Driver to communicate serially with your ES 1800, the host computer's serial port may be configured to work with the emulator. You must use the following procedures when you have a SCSI controller board installed. For RS-232 setup when no SCSI board is installed, see Section 2, "Getting Started (RS-232 Only)."

Emulator/PC Connection (Serial Interface)

To use RS-232 communications with ES Driver, you must connect the emulator to the PC via an RS-232 cable. ES Driver is shipped with two cables: one 25-pin to 25-pin cable, and one short 25-pin to 9-pin adapter. If you use non-standard cables, they must be null modem cables.

1. Use the cables required for your host computer, and connect your computer to the emulator COMPUTER port.

Host Computer	*Cables to Use*[1]
IBM PC XT or compatible	25-pin to 25-pin cable
IBM PC AT or compatible	25-pin to 25-pin cable and the 25-pin to 9-pin adapter cable
IBM PC[2] or compatible	25-pin to 25-pin cable

   [1]If you want to make your own cables, the cable pin connections for most PC host computers are shown in Appendix E.

   [2]If you are using a standard IBM-PC (not the XT or AT hard disk version), you must add a serial port with a male connector if you plan to use RS-232 communication.

2. Configure the serial port on your PC as either COM1: or COM2:. Port COM1: is assumed for the rest of this manual. If the PC has selection for RS-232 or current-loop, make sure that RS-232 voltage levels are selected. Usually, PCs are shipped with COM1:, RS-232 selected. Appendix E contains diagrams for configuring IBM serial ports.

3. ES Driver uses an interrupt-driven serial receive port. If your PC serial adapter has jumpers for the interrupt request line, they must be set also. If configured for COM1:, set the jumper for IRQ4. If using COM2:, set the jumper for IRQ3.

Using the Soft Switches

You can switch between serial and SCSI communication using soft switches. To enable this feature, you need to change only the ES 1800 port and the communication configuration in the ES Driver software. The ESL commands CCT and TCT change the ports. The ES Driver Configuration menu lets you reconfigure communication.

Changing Ports

The SCSI controller communicates with the MCB controller and, through it, to other boards in the emulator. It does so at a fixed baud rate of 19200 via the TERMINAL port at the *front* of the SCSI and MCB controller boards. The switching cable bypasses the SCSI board and connects the COMPUTER port on the back of the ES 1800 directly to the COMPUTER port on the front of the MCB. Serial up- and downloads are possible only via the COMPUTER port. Using ES Driver, you can switch control quickly to the COMPUTER port for RS-232 communications, or return to the TERMINAL port to reestablish SCSI communications.

The following instructions assume you have established SCSI communications, have ES Driver running, and want to switch to RS-232 communications. Your host/emulator serial cable should be connected to the COMPUTER port of the ES 1800.

To change to the COMPUTER port to prepare for RS-232 serial communication:

1. Press <F1> to go to the transparent mode.
2. At the ">" prompt, type in quick succession:

   CCT <Return> <F6>

   There will be a wait of up to 30 seconds.
3. When the Configuration menu appears, ignore the "Emulator Not Responding" prompt and the beep.
4. Reconfigure ES Driver for the RS-232 communication as described below.

Reconfiguring ES Driver

Changing the configuration is accomplished though ES Driver's Configuration menu.

1. To operate using RS-232 communication, toggle the communication device type to RS-232.
2. (Optional) Press <F8> to save this configuration as the default setup.
3. Press <F1> to enter transparent mode and verify proper operation. An ESL ">" prompt should display on your screen. ESL is the emulator command language. For a full discussion of the command set, see "ES Language" in your *ES 1800 User's Manual*.

Returning to SCSI Communication

To return to SCSI communications, you must switch control from the COMPUTER port to the TERMINAL port:

1. If you aren't at the ESL ">" prompt, press <F1>.
2. At the ">" prompt, type **TCT**, and press the following in quick succession:

   <Return> <F6>

   There will be a wait of up to 30 seconds.

3. When the Configuration menu appears, ignore the "Emulator Not Responding" prompt and the beep.
4. Reconfigure ES Driver for SCSI communication by changing the communications device type to SCSI.
5. Press <F8> to save this or <F1> to return to the transparent mode.

Typically, you should set the communications device type to SCSI for maximum speed when you are uploading files, downloading files, or using other ES Driver functions. You would set it to **RS-232** when you want to use a serial-only software debugger.

Port-Switching Macros

If you plan to switch frequently between SCSI and RS-232, you may want to create the following macros within ES Driver. They let you change quickly between SCSI and serial communications. The first macro tells ESL to use the COMPUTER port (the CCT command). The second macro instructs ESL to use the TERMINAL port (the TCT command). The final macro toggles the communication device type between RS-232 and SCSI.

These macros will work only inside ES Driver. Enter them at the ">" prompt of the transparent mode screen <F1>. Type only the boldface commands to enter the macros:

MACRO <F1>: USE THE COMPUTER PORT

<ctrl-F1>	"Loading macro F1" appears at the bottom of the screen.
<F7>	These two commands return the ES 1800 to a known state,
<F7>	the main menu.
< F1>	Enters transparent mode.
CCT <enter>	Changes to COMPUTER port. Continue immediately with the next entry.
<F6>	Go to configuration menu (wait for a beep before continuing).
<ctrl-F1>	Saves macro F1 (Configuration menu remains on screen).

Press <F6>, and change the communication type to RS-232. Then press <F1> to return to the transparent mode ">" prompt.

MACRO <F2 >: USE THE TERMINAL PORT

<ctrl-F2>	"Loading macro F2" appears at the bottom of the screen.
<F7>	These two commands return the ES 1800 to a known state,
<F7>	the main menu.
<F1>	Enters transparent mode.
TCT <enter>	Changes to TERMINAL port. Continue immediately with the next entry.
<F6>	Go to configuration menu (wait for a beep before continuing).
<ctrl-F2>	Saves macro F2 (Configuration menu remains on screen).

Change the communication type to SCSI. Then press <F1> to return to the transparent mode ">" prompt.

MACRO F3: SWITCH BETWEEN SCSI AND SERIAL

<ctrl-F3>	"Loading macro F3" appears at the bottom of the screen.
<enter>	Programs to advance to Communications Device Type field.
<space bar>	Programs to toggle communications type between **serial** and **SCSI** communication.
<F1>	Programs to enter transparent mode.
<ctrl-F3>	Saves macro F3.

These macros work only from the transparent mode ">" prompt or the Main menu screen.

SCSI to Serial

1. To shift from SCSI to serial communications, type SHIFT-F1 to execute macro F1. Wait for the beep caused by ESL's failure to return to the ">" prompt after switching to the new port.

2. Then press SHIFT-F3 to change to serial communications.

Serial to SCSI

1. To switch from serial to SCSI communications, type SHIFT-F2, wait for the beep caused by ESL's failure to return to the ">" prompt after switching to the new port.

2. Then type SHIFT-F3 to change from serial to SCSI communications.

Setting Serial Parameters

The configuration you define manually or using the macros remains active as long as you do not cycle power on the ES 1800. If you want to store serial parameters that can be invoked at any time, you can program the EEPROM once you have transferred control to the COMPUTER port and configured for serial communications.

1. At the ">" prompt, enter the following ESL commands:

>SET #1, #0	Choose user 0
>SET #20, #15	Set user 0 baud rate at 19200 for COMPUTER port
>SAV	Initiate load
>SET #1, #1	Choose User 1
>SET #20, #14	Set user 1 baud rate at 19200 for COMPUTER port
>SAV	Initiate load

2. Wait for the ESL prompt to return. This may take as long as a minute.

3. Change the thumbwheel switch on the MCB controller board to position 3 (user 0) or 4 (user 1). This manually switches control to the COMPUTER port and saves and restores the settings programmed with the SET command when you cycle power.

4. Make sure the serial cable is connected to the COMPUTER port.

5. Cycle power to the ES 1800.

6. If necessary, press <F6> and change the settings in ES Driver's Configuration menu to RS-232 at the baud rate you programmed with the SET command.

Table 2S-1. Baud Rates Using SET

SET Parameter	Baud Rate	SET Parameter	Baud Rate
#1	75	#9	2000
#2	110	#10	2400
#3	134.5	#11	3600
#4	150	#12	4800
#5	300	#13	7200
#6	600	#14	9600
#7	1200	#15	19200
#8	1800		

With the MCB switch set at 3 or 4, you can initialize the emulator for serial communication at any time at the values programmed into the EEPROM. The values will remain in the EEPROM until reprogrammed.

To return to SCSI communication, you need only to reset the MCB switch to "B" and cycle power.

Using Your Serial Software

Once you have transferred control to the COMPUTER port, you can exit ES Driver, and invoke and configure any other Applied Microsystems' software to communicate with the emulator in serial mode.

Be sure to set the baud rate to 19200.

To return to SCSI communications:

1. Exit your software.
2. Reinvoke ES Driver by typing **ESD**.
3. Press <F1> to enter the transparent mode.
4. Run the serial-to-SCSI switching macros (SHIFT -F2, SHIFT -F3) or follow the instructions in "Returning to SCSI Communications" above.

Initializing the Emulator without SCSI

If you need to initialize the ES 1800 in RS-232 and bypass the SCSI controller, follow the instructions in "Bypassing the SCSI Function," explained in the next section.

Troubleshooting the Communications Setup

If you are unable to establish communications between ES Driver and the emulator during normal operations, the following section will help you troubleshoot the problem.

No Target Power or Clock Initialization

The most common problems encountered during initialization of the ES 1800 are the lack of power to the target system, or the lack of target clock. In this situation, ES Driver is able to initially establish communication with the ES 1800, but cannot establish full communication with the ES 1800 until the problem is resolved.

The most common cause of these error messages is failure to connect the pod to a target with power or an Applied Microsystems null target or demonstrator target.

In this situation, ES Driver displays one of several messages, depending on the type of microprocessor you are using and the communications mode.

Serial Communications
In serial communications mode, the ES 1800 reports a target clock or power error as follows:

```
Attempting to establish communications with ES 1800......
Still trying to establish communications.
Communication established with ES 1800 at 9600 baud.
Attempting to get ESL prompt.................timed out.
Sign-on message response:
APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR XXXX
USER = 1, SW = 1
#256K AVAILABLE OVERLAY
NO TARGET POWER
SYSTEM RESET ERROR
Can't establish full communications with ES 1800.
Please consult your ES Driver manual for instructions on
how to configure the ES 1800 to communicate
with ES Driver.
```

The all-uppercase text is the sign-on message response from the ES 1800. In this particular case the "NO TARGET POWER" and "SYSTEM RESET ERROR" messages mean that the ES 1800 was not able to properly initialize itself. If this occurs, you can take several actions:

1. All 680x0 family processors require either a "Null target," a "Demonstrator target," or an active target system. Verify that the ES 1800 is properly connected to a target system that has power and an active clock signal. Then reset the ES 1800 <ctrl-z>.

2. For both Zilog Z800*x* family processor emulators and all Intel 808*x*, 8018*x*, 80C18*x*, and 80286 family processor emulators, initialization may result in displays similar to the one below for both power and clock errors:

```
Attempting to establish communications with ES 1800,
please wait.......
Still trying to establish communications.
Communication established with ES 1800 at 9600 baud.
Attempting to get ESL prompt...............timed out.
Sign-on message response:
APPLIED MICROSYSTEMS COPORATION
SATELLITE EMULATOR XXXXX
USER = 1, SW = 1
#256K AVAILABLE OVERLAY
NO CLOCK - TYPE "Y" TO SELECT INTERNAL CLOCK
```

ES Driver may automatically attempt a "Y" response (Intel). If the system is successful or if you type Y (Zilog), one of two messages appears. If the host computer is connected serially to the TERMINAL port of the ES 1800, you will see the following:

```
Waiting for ESL prompt.ok
Connected to ES 1800 TERMINAL port.
You must be connected to the ES 1800 COMPUTER port to do
uploads and downloads. Do you desire to change to the ES
1800 COMPUTER port (Y/N)?
```

If the host computer is connected serially to the COMPUTER port of the ES 1800. The display will appear as follows:

```
Waiting for ESL prompt.ok
Connected to ES 1800 COMPUTER port.
```

For all Zilog family processors either a "Null target," a "Demonstrator target," or your target system is recommended. Verify that the ES 1800 is properly connected to a target system that has power and has an active clock signal. Then reset the ES 1800 <ctrl-z>.

When successful with initialization, ES Driver returns to the Main menu.

SCSI Communications

If you are running SCSI communications, the ES 1800 reports target clock and power errors as follows:

1. For all 680x0 family processors either a "Null target," a "Demonstrator target," or your target system is required. If you see:

```
COPYRIGHT 19XX
APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR XXXXX
```

```
USER = 0, SW = B
#256K AVAILABLE OVERLAY
NO TARGET POWER
```

Verify that the ES 1800 is properly connected to a target system that has power and has an active clock signal.

Then press <ctrl-z> to reset the emulator. This should result in the sign-on message and an active ">" prompt:

```
COPYRIGHT 19XX
APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR XXXXX
USER = 0, SW = B
#256K AVAILABLE OVERLAY
>
```

2. For both Zilog Z800x family processor emulators and all Intel 808x, 8018x, 80C18x, and 80286 family processor emulators, initialization may result in displays similar to the one below for both power and clock errors:

```
COPYRIGHT 19XX
APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR XXXXX
NO CLOCK . . . TYPE "Y" TO SELECT INTERNAL CLOCK
```

This will be accompanied by an "Emulator Not Responding" prompt. First try resetting the ES 1800 <ctrl-z>.

ES Driver may automatically attempt a "Y" response (Intel). If the system is successful or if you type "Y" (Zilog), you will see the ">" prompt and can begin host-emulator transactions.

If this is unsuccessful, try recycling power on the ES 1800 and retrying the initialization sequence.

Emulator Not Responding

This is a common system message that usually occurs when one or more of the parameters in the Configuration menu are set incorrectly or when you have failed to power up or connect the emulator. If you are using SCSI communication, try the following:

1. Press <ctrl-z> to reset the emulator.

2. Review the parameters in the Configuration menu. If you have been using serial communication, you may have used soft switches to transfer control to the TERMINAL port but not changed the Configuration menu to SCSI communication. Be sure the baud rate is set to 19200 and that the SCSI device number is correct.

3. Turn off power. Then restore power in the following order: target, emulator, PC.

If you are running with RS-232 communication, see "Can't Establish Communication with the Host Computer."

Can't Establish Communication with the Host Computer

If ES Driver is unable to establish serial communications with the ES 1800, the following lines are displayed when you attempt to save <F8> the current configuration:

```
Attempting to establish communications with ES
1800.......
Still trying to establish communications.......
Can't establish full communications with ES 1800.
Please consult your ES Driver manual for instructions on
how to configure the ES 1800 to communicate
with ES Driver.
```

Possible Solutions

1. The ES 1800 is configured to communicate serially using the COMPUTER port, but the serial cable of the host computer is connected to the TERMINAL port. (Or vice versa.)

    Try the following:

    1. Move the cable to the COMPUTER port.
    2. Press <F1>.
    3. When you see the ">" prompt, you can begin operations.

2. The serial cable is not connected to proper serial port on the host computer.

    Try the following:

    1. Connect the serial cable to other serial ports on the host computer. The default is COM1:.
    2. Press <F1>.

3. The serial cable is faulty or incorrectly wired.

    Try the following:

    1. Use a different serial cable. Non-standard cables must be null modem cables.
    2. Check your serial cable wiring with the schematic given in Appendix E of this manual.

4. You have used soft switches to transfer control to the COMPUTER port but have not changed the Configuration menu to RS-232.

5. If you are still unable to establish communication with the ES 1800, try using a terminal or terminal emulator program as described in "Bypassing the SCSI Function."

Can't Access Named SCSI Device

This most often occurs when you have changed your thumbwheel settings.

1. Check that the left thumbwheel is set to 1 (PC defaults; parity disabled), 3 (PC defaults; parity enabled), or 0 (user-defined configuration).

2. Check that the right thumbwheel setting matches the SCSI ID you selected when you configured the AMCSCSI TSR.

3. Make sure **ESDKEY.CFG** is loaded into your installation directory.

Using the Main Menu

The Main menu shows the six sub-menus available. The Main menu on a PC looks like this:

```
          Applied Microsystems Corporation     Type <F9> for Help

     1. Target Emulation              4. Upload to Host Computer
     2. Event Monitor System          5. Download to ES 1800
     3. Change Directory              6. Configuration
                                      7. Exit to Shell


     Enter Selection __
```

F1 Emulate F2 Bkpts F3 ChDir F4 Upload F5 Dnload F6 Configuration F7 Exit

You can choose a submenu by entering the number of the selection and pressing <Enter> or pressing the function key corresponding to the number of your selection (e.g., <F6> for 6, Configuration).

Using the ES 1800 Emulator

To use the emulator, you enter target emulation mode by typing <F1> from anywhere in ES Driver. You should now have an ESL ">" prompt on the screen. If the prompt does not appear, press <Return>.

Commands typed on the keyboard must be in ESL (the command language in the ES 1800 emulator). For a full discussion of the command set, see "ES Language" in your *ES 1800 User's Manual*. ES Driver provides you with a flexible, menu-driver interface to ESL. Responses from the emulator are displayed on the screen and are also stored in a screen buffer.

The up arrow and down arrow keys cause the display to scroll up and down one line. The <PgUp> and <PgDn> keys scroll the screen a page (16 lines) at a time. The <Home> key displays the first page (oldest saved page). The <End> displays the last (or current) page. The screen buffer holds up to 10K bytes of the most recently stored data.

If there is something already in the buffer, you may not see the ">" prompt or the cursor on the screen. As soon as you type any characters, the buffer automatically is scrolled to the end and the prompt and cursor will reappear.

ES Driver is not a replacement for ESL. While ES Driver provides features that enhance the usefulness and flexibility of ESL, you need to master the ESL command language to use your ES 1800 efficiently. See the *ES 1800 User's Manual* for more information on using ESL and the ES 1800 emulator.

For detailed information on each of ES Driver's menus, see Section 3 of this manual.

SECTION 3

Contents

OPERATION

Contents

OPERATION

Introduction

This section details the basic features of ES Driver. It describes all of the menus and how to use the on-line help.

ES Driver has eight menus, including a setup menu and a main menu. The Setup Menu displays the version number and target processor. The Main Menu displays the names of six operational menus and an Exit-to-DOS function.

Each menu has its own display screen. To choose a menu from the main menu, type the corresponding function key.

The names of the six operational menus, the Exit-to-DOS selection, and their corresponding functions are listed below:

1. **Target Emulation**. Provides access to the ES 1800 emulator. A large screen buffer maintains a transcript of the emulation session. The buffer may be viewed by scrolling.

2. **Event Monitor System**. For 16-bit microprocessors, this selection displays the event-monitor system setup. For the 32-bit 68020, this selection provides a menu which allows you to set up and display the event-monitor system.

3. **Change Directory**. Displays the current directory, allows you to change the current directory, or list a subset of the files within a directory.

4. **Upload** to host computer. Displays the names of files in the current directory and allows you to open a file for saving a program, symbols or the session history to the PC.

5. **Download** to ES 1800. Displays the names of files in the current directory and allows you to send a program, symbols, or commands file from the host computer to the emulator.

6. **Configuration**. Allows control of parameters for configuring ES Driver for specific applications.

7. **Exit to Shell**. This selection terminates ES Driver and returns to DOS.

The Main Menu

The Main menu shows the six sub-menus available. The Main menu on a PC looks like this:

```
        Applied Microsystems Corporation    Type <F9> for Help

    1. Target Emulation            4. Upload to Host Computer
    2. Event Monitor System        5. Download to ES 1800
    3. Change Directory            6. Configuration
                                   7. Exit to Shell


    Enter Selection __

F1 Emulate F2 Bkpts F3 ChDir F4 Upload F5 Dnload F6 Configuration F7 Exit
```

When the Main Menu is displayed, the currently selected menu is highlighted.

There are several ways to select a menu.

1. The arrow keys or <spacebar> may be used to change selections.

2. The numeric keys 1 through 7 can be used to make a selection.

3. Press the function key <F1> through <F7> that matches the menu you want to select. The function keys select and display the new menu screen immediately. (You don't need to highlight the function first, or press <Return>.)

You do not need to go to the Main Menu to select a new menu. The function keys <F1> through <F7> always select and display the new menu, regardless of the menu currently being displayed.

You can change the function key mapping by editing the ESDKEY.CGF file. The changes you make in this file will show up on the appropriate menus. See Appendix D.

Getting On-Line Help

The ES Driver program includes an on-line help feature. Help is available when you need assistance with a menu or function and can be accessed almost anywhere in the program by typing <F9>.

When you request help, a window is opened on the screen and a help message is displayed. If there is more help information than can be displayed in single screen, help displays the message "Hit SPACE for MORE." Press the <spacebar> to view the next screen. You can also use <PgUp> and <PgDn> keys to move forward and backward one screen at a time, or you can use the <↓> and <↑> cursor keys to move one line at a time. Press any other key to exit help.

Help is also available for error messages. There are two sources of errors:

ES Driver   ES Driver may generate error messages. Type<F9> for an
                                       explanation of the error message.

ESL   When you are in the Target Emulation screen, ESL may
                                       generate its own error messages in response to a command
                                       or target system conditions. Type a question mark (?) for an
                                       explanation of the error message.

The ES Driver help messages come from the file **ESD.HLP**. This file should be in the
directory specified in the **PATH** environment variable **$ESDDIR**. Take care to ensure that
ESD.EXE and **ESD.HLP** are kept in the same directory.

If you would like to modify the help file, or to translate it to a different language, see the
instructions in Appendix C.

Target Emulation <F1>

Pressing <F1> from anywhere in ES Driver displays the Target Emulation screen. On this screen, you have transparent access to the ES 1800 emulator.

The ">" prompt is the ESL prompt from the emulator. From this prompt, you can use any ESL commands. See Sections 4 through 7 of your *ES 1800 User's Manual* for information on using ESL.

The screen is implemented as a full-duplex ASCII terminal. Commands you type are sent to the emulator, and data received from the emulator is displayed on the screen.

Buffer Control

The screen is actually displayed from a buffer. The buffer can contain several pages of data, which is saved as characters are received from the emulator and placed on the screen character by character. This allows scrolling back through the emulation session to review past events.

When you enter the Target Emulation screen, the last page of the buffer is displayed on the screen. This page contains the last data received from the emulator. The cursor is placed on the screen at the position where the next character will appear.

The ↑ and ↓ keys cause the display to scroll up and down one line. The <PgUp> and <PgDn> keys scroll the screen a page (16 lines) at a time.

The <Home> key displays the first page (oldest saved data). The <End> key displays the last (or current) page. The buffer holds up to 10K bytes of the most recently saved data.

NOTE

- On some PC systems the cursor may remain on the screen even if the last page is not displayed. Some interrupt-driven background tasks may have been installed that affect the cursor attributes set by ES Driver.

- ES Driver uses <ctrl-s> and <ctrl-q> for the XON/XOFF protocol. These parameters are set in the ES 1800 at the factory. If you have changed these on your emulator, you should change them back so that ES Driver can communicate properly with the emulator. On most ES 1800 emulators, the command to restore the parameters is
SET 3, $11, $13.

If you do not see the > prompt, please check Section 2 of this manual to make sure you have installed ES Driver and configured the emulator correctly.

Event Monitor System <F2> (16-bit Microprocessors)

The <F2> menu is different for 16-bit and 32-bit microprocessors.

For 16-bit microprocessors, choosing <F2> displays all the Event Monitor System breakpoints you have set. Breakpoints are set up using ESL and the Event Monitor System when you are in the Target Emulation screen (<F1>).

Only those groups that have "WHEN-THEN" clauses set up are displayed. This display is in the same format as shown with the ESL DES command. For each group it shows the WHEN-THEN clauses, followed by a list of the comparators.

After displaying the Event Monitor System, you are left in the Target Emulation screen.

For 32-bit microprocessors, the <F2> menu, which is described next, allows you to both set up and display the Event Monitor System.

Event Monitor System Menu <F2>
(68020 Microprocessor)

The Event Monitor System menu for the 68020 microprocessor allows you to set up the Event Monitor System of the emulator. Note that this is different than ES Driver for 16-bit microprocessors, which only displays the setup.

ES Driver, versions 3.10 and above, fully supports the 68020 event-monitor system. All meaningful combinations of address, data, status, and LSA comparators are allowed. There are restrictions on what is meaningful, however, because of the design of the 68020 event-monitor system. For example, in trace mode 2, the following "WHEN-THEN" clause is meaningful:

> WHEN a and g   THEN brk

However, ES Driver accepts the "a and g" WHEN clause, but not the "a or g" clause:

> WHEN a or g   THEN brk

And the following combination of clauses will not work:

> WHEN a   THEN brk
> WHEN g   THEN brk

The reason is that in trace mode 2, all 32 bits of the 68020's address are traced. The bottom 24 bits are compared with either address comparator AC1 or AC2. The top 8 bits are compared with bits 7 through 14 of either status comparator S1 or S2. (See Fig. 3-1, "Bits Traced in Each Trace Mode.") In trace mode 2, ES Driver's "a" address comparator is actually all of the ES 1800's AC1 comparator and part of the ES 1800's S1 comparator. The "g" status comparator is the rest of the ES 1800's S1 comparator. Because "a" and "g" share the same physical comparator, only "a and g" is meaningful. The WHEN clause "a or g" can not be implemented.

You can still use the Event Monitor System directly from Target Emulation mode if you prefer. However, the <F2> Event Monitor System menu makes it easier to set up and view your breakpoints and also protects you from making mistakes; when you begin emulation, all the entries in the Event Monitor System setup are verified, and comprehensive on-line help guides you through correct usage. In addition, the expression analyzer lets you use expressions anywhere that a value is expected.

This section describes how to use the <F2> menu to set up the Event Monitor System:

> - Choosing which bits to trace: Trace modes

> - Setting up breakpoints:

- Defining when to break: Comparators

- Defining what to do after breaking: Actions

- Quadrupling the number of breakpoints: Groups

You may want to refer to Section 8 of your *ES 1800 Emulator User's Manual* for more detail on the Event Monitor System.

Choosing Which Bits to Trace: Trace Modes

The Event Monitor System is based on a 16-bit environment. For the 32-bit 68020, selective tracing was added to permit access to all 32 bits of information. You can pick the bits you need to trace. There are four trace modes:

MODE	ADDRESS	DATA	STATUS	TIMER	LSA
0	24	16	19	24	16
1	24	32	19	24	0
2	32	32	11	24	0
3	32	16	21	24	6

To program the Event Monitor System, a detailed description of the signals traced and their location in the event comparators is needed. The chart on page 3-9 shows the signals and their locations for the four trace modes.

Choose the mode that traces the bits you are interested in by typing each trace mode. This lets you set up different breakpoints in each trace mode, and switch between them with a few keystrokes.

NOTE

When you change trace modes, make sure to reconfigure the emulator hardware. See Section 8 in your *ES 1800 Emulator User's Manual*. Modes 1-3 require a 40-conductor cable from the pod to the Logic State Probe connector on the ES 1800 front panel.

Setting Up Breakpoints

The Event Monitor System provides extremely flexible system and breakpoint control, so you can isolate or break on any predefined series of events and then perform various actions. You control and monitor the target by entering commands that define events as logical combinations of address, data, status, count limit and optional logic state probe inputs. The section on "Comparators" describes how to set these up.

When an event is detected, the ES 1800 can break emulation, trace specific sequences, count events, execute user-supplied target routines, and trigger a TTL output.

Setting up breakpoints on logical combinations of comparators and defining the actions is described in the section on "WHEN-THEN Clauses."

Comparators

The top half of the screen allows you to set up the comparators A through H. Error checking is done to make sure you enter valid addresses and values.

If you are familiar with using the Event Monitor System directly from the ES 1800 and ESL, the following chart explains the connection between what you see on the screen and the comparators:

	Mode 0	*Mode 1*	*Mode 2*	*Mode 3*
A	AC1	AC1	AC1+S1	AC1+LSA[b]
B	DC1	DC1+LSA[a]	DC1+LSA[a]	DC1
C	CL	CL	CL	CL
D	AC2	AC2	AC2+S2	AC2+LSA[b]
E	DC2	DC2+LSA[a]	DC2+LSA[a]	DC2
F	LSA	_[c]	_[c]	LSA (partial)
G	S1	S1	S1 (partial)	S1
H	S2	S2	S2 (partial)	S2

Notes:

[a] in trace mode 1 and 2, you can't set up B and E with the bottom 16 bits different

[b] in trace mode 3, you can't set up A and D with the top 16 bits different

[c] in trace modes 1 and 2, the LSA bits are not available

Figure 3-1. Bits Traced in Each Trace Mode

					101 BITS																
	ACX BITS	DCX BITS	TIMER BITS	STATUS BITS	SX BITS																LSA BITS
BIT NO.	A23 ← A0	D15 · D0	T23 · T0	OCS, DSACK, OSACK, SIZ1, SIZ0	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	
MODE 0	A23 ← A0	D31 · D16	T23 · T0	OCS, DSACK, OSACK, SIZ1, SIZ0	0	IP	AV	BRK	IPL2	IPL1	IPL0	BER	MAV/ MWV	FC2	FC1	FC0	0	TGT/ OVL	R/W	B/W	See
MODE 1	A23 · A0	D31 · D16	T23 · T0	OCS, DSACK, OSACK, SIZ1, SIZ0	0	IP	AV	BRK	IPL2	IPL1	IPL0	BER	MAV/ MWV	FC2	FC1	FC0	0	TGT/ OVL	R/W	B/W	Below
MODE 2	A23 ← A0	D31 · D16	T23 · T0	OCS, DSACK, OSACK, SIZ1, SIZ0	0	A31	A30	A29	A28	A27	A26	A25	A24	FC2	FC1	FC0	0	TGT/ OVL	R/W	B/W	
MODE 3	A23 · A0	D31 · D16	T23 · T0	OCS, DSACK, OSACK, SIZ1, SIZ0	0	IP	AV	BRK	IPL2	IPL1	IPL0	BER	MAV/ MWV	FC2	FC1	FC0	0	TGT/ OVL	R/W	B/W	

LSA BITS															
LS15	LS14	LS13	LS12	LS11	LS10	LS9	LS8	LS7	LS6	LS5	LS4	LS3	LS2	LS1	LS0
LS15	LS14	LS13	LS12	LS11	LS10	LS9	LS8	LS7	LS6	LS5	LS4	LS3	LS2	LS1	LS0
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
A31	A30	A29	A28	A27	A26	A25	A24	RMC	CDS	L5	L4	L3	L2	L1	L0

The <F2> menu prompts for the values to use to set the comparator registers. When the cursor appears to the RIGHT of the value displayed, a hexadecimal value is expected. The Address, Data, Count, LSA, and Status Value prompts expect hexadecimal values.

When the cursor appears to the left of the value displayed, a choice selection is expected. Choice selection is made by using the space bar. The BYT/WRD, RD/WR, Function Code, IPL (Interrupt Priority Level), BER (Bus Error), and AV (Auto Vector) prompts expect a choice selection.

Note that the choices of comparators on the menu are different depending on the trace mode selected.

Comparator Groups

There are four independent event monitor comparator groups, providing four times as many breakpoints. All four groups may be enabled simultaneously.

Group 1 is the default. Use <Alt-F1> through <Alt-F4> to select groups 1 through 4. The current group being edited is displayed near the top right of the menu.

WHEN-THEN Clauses

The real power of the event monitor system is its capability of setting up complex breakpoint configurations. Pressing <Alt-F7> puts you directly onto the comparator entry line for group 1. You may begin entering WHEN-THEN statements. To conserve screen space, comparators are referenced by the letter preceding each comparator's label on the screen. For example, the first address comparator is referenced by the letters "A" or "a," and the second status bit comparator is referenced by the letters "H" or "h."

A list of allowed actions is displayed below the comparator prompts. These actions are combined with references to the comparators to produce clauses. A CLAUSE statement is formed when a valid WHEN clause is followed by a valid THEN (or action) clause.

For example, you enter the following statements (in trace mode 0):

    WHEN a and b   THEN brk
    WHEN d and e   THEN brk

Target processor execution will be halted when an address in the address range of the first address comparator (AC1) and data specified by the first data comparator (DC1) are simultaneously encountered, OR when an address in the address range of the second address comparator (AC2) and data specified by the second data comparator (DC2) are encountered simultaneously.

The combination of clause statements behaves like WHEN (a and b) or (d and e) THEN brk. Logical AND of comparator results is specified by placing **AND** between the comparator references. Logical OR of comparator results is specified by placing **OR** between references.

> If
> WHEN a and b   THEN cnt
> WHEN d and e   THEN cnt
> WHEN c   THEN brk

are entered as clauses, then target processor execution will be halted only when the condition (a and b) or (d and e) is encountered N times. N is the value of the count comparator.

Because of the configuration of the 68020 emulator, some combinations of comparator references are not allowed. (See "Event Monitor System")

The only action that requires user input is the FSI (forced special interrupt) action. This prompts you for a hexadecimal special interrupt address.

Using Expressions

You can use expressions anywhere that a value is expected. The expression analyzer accepts numeric data and math operators.

To use the expression analyzer, press (') or (.) when the event monitor system expects a value, for example, when you specify an address.

When you are in the Target Emulation menu, use the features of ESL. The expression analyzer can only be used in the Event Monitor System menu for 68020 microprocessors.

Expression Analyzer

Invoke the expression analyzer by pressing (') or (.). A prompt appears at the bottom of the screen and asks you to enter an expression. The expression may contain numbers and math operators. Numeric values are assumed to be hexadecimal and must begin with a number. Place a zero in front of hexadecimal numbers that begin with a letter (e.g., 0ff). The expression analyzer follows ESL conventions for entering numeric values (however, it is not necessary to enter a $ symbol for hexadecimal values). To specify values other than hexadecimal, place one of these symbols in front of the number.

#	(decimal)
\	(octal)
%	(binary)

The following is the list of allowable operators, shown here in order of precedence (from highest to lowest):

( )
/ *
+ -
& l

The following is an example of a valid expression:

18*(5 + #44)

In this example, the value is the sum of 5 (hex) plus 44 (decimal) multiplied by 18 (hex).

After you enter an expression, press <Return> to evaluate the expression and return the result to the menu prompt.

To designate the unary minus (-) operator, use parenthesis. For example, enter -3 as (-3). The expression analyzer also supports the bitwise AND (&) and the bitwise inclusive OR (l) operators.

Saving the Event Monitor System Configuration

The Event Monitor System configuration is automatically saved in the **ESD.CFG** file when you exit ES Driver. The Event Monitor System menu does not replace ESL. If you set up the EMS using ESL and then use ES Driver's Event Monitor System menu, the events you set up with ESL will be overwritten—whether or not you make any changes to the menu. Use the Event Monitor System menu instead of ESL; the Event Monitor System menu provides all the functions of ESL, in addition to other features.

NOTE

To exit the Event Monitor System menu all four comparator groups must have valid WHEN clauses. If you are unable to exit even after clearing all clauses in the current group, check the other comparator groups for invalid clauses.

Clearing the Event Monitor System Configuration

To clear the entire event monitor configuration, first press <Alt-F8>. A prompt then asks for confirmation. Enter <Y> or <y> to clear the configuration. The default is N(o); press <Return> to remove the prompt without clearing the event monitor configuration.

Clearing the event monitor configuration removes all clauses for the current group. All comparators are reset to zero. The trace mode setting is not changed.

This does not affect the clauses for the three other groups; clear each group separately.

THERE IS NO UNDO FUNCTION to restore a cleared configuration. If a particular configuration has future uses, be sure to save it as the default configuration before clearing it.

Change Directory <F3>

This menu can be used to change directories or to display a subset of the files in the current directory. Pressing <F3> displays the current directory name, lists the files, and prompts for a new directory name and/or filename. ES Driver supports full DOS directory path syntax.

The command syntax is

   [d:] [path] [filename]

(the brackets indicate optional parameters)

Drive Specifier

If you specify a drive in the directory path ([d:]), the letter you use must designate a valid drive and must be followed by a colon (for example, A:).

Directory Path String

The directory path string uses standard DOS directory path syntax.

If the first character in the path is a backslash, then the path is assumed to start from the root directory. If the string does not start with a backslash, then the path is assumed to start from the current directory. You can use the standard directory abbreviations:

..	the parent of the current directory
.	the current directory.

All directory names must be separated by a backslash (\).

Using Wildcards in Filenames

If wildcards are used in the filename, only files that match the pattern are displayed. This is useful if you are only interested in files with a certain name or extension.

The * and ? wildcards are valid. The * wildcard matches any character or string of characters. The ? wildcard matches any one character.

EXAMPLES:

A:\   Changes the current directory to the root directory on drive A and displays the directory.

*.EXE   Displays only filenames in the current directory that have a
                                    tag (extension) of **EXE**.

When ES Driver is terminated, the original directory is restored.

Upload to Host Computer <F4>

The <F4> key is used to save a program, the symbol table or the debug history to disk. When you call up the menu, there are three options:

1. Upload Program Memory

2. Save Symbol Table

3. Save Session Record

To select one of these options, type the number and <Return>. DO NOT press a function key, as this will display another menu instead.

The number of lines transferred is displayed on the left side of the screen. If you need to interrupt the upload, press <ctrl><break>.

ES Driver's serial input is interrupt driven. You may encounter difficulties when you upload large files from the emulator if you have memory resident programs installed. If a memory resident program keeps interrupts disabled too long, ES Driver can miss characters. If this occurs, either select a slower baud rate or disable the memory resident program.

Upload Program Memory

When you select the "Upload Program Memory" item by typing 1<Return>, you'll see a new menu. It shows you the default object file format and asks you to supply the following:

- the starting address
- the ending address
- the file name

Check that the default object file format is what you want. If it is not, type <F6> to go to the Configuration menu, and change the file format. Press <F4> to return to the Upload menu.

Enter the addresses of the start and end of the program you want to save. Then enter the name of a file to save the program in.

If you make an error, use the backspace or delete key to backspace. If you would prefer another key, you can change the keyboard configuration file: see Appendix D.

The formatted files are assigned an extension based on the file format:

.ETH	Extended Tek Hex
.OMF	Intel OMF-86
.MOT	Motorola S-Records
.ABS	Microtec
.HEX	Intel Hex

If the file exists, you'll see a prompt to (O)verwrite, (A)ppend, or (N)o (don't save file). If the file doesn't exist, you'll see the prompt:

```
Create file *.xxx (Y/N)? CR=Y.
```

File Names

Filenames must conform to PC filename syntax. A filename must be 1 to 8 characters in

length and can be followed by a 1-character to 3-character filename extension. If no filename extension is specified, a default extension will be added based on the default object file format:

.ETH	Extended Tek Hex
.OMF	Intel OMF-86
.MOT	Motorola S-Records
.ABS	Microtec
.HEX	Intel Hex

The filename may include a drive specifier and/or directory path. Wildcard characters cannot be used in the filename. The entire string must be 12 characters or less.

Saving the Symbol Table

When you save a program, the symbol table is not automatically saved. You must specify selection 2 to save the symbol table.

A prompt is displayed asking you to supply the file name for the saved symbol table. The extension .SYM is automatically added to the file name if an extension is not specified.

If the file exists, you'll see a prompt to (O)verwrite, (A)ppend, or (N)o (don't save file). If the file doesn't exist, you'll see the prompt:

```
Create file xxx.SYM (Y/N)? CR=Y
```

The symbol table is saved in ESL command line format, for example:

'symbol_name = symbol_value.

See "Download Target Program" for more details.

Saving a Session Record

You can save a transcript of anything you do in the Target Emulation screen, including everything transmitted from the emulator. You can save sections of your session into different files. This is useful for creating hard copies of trace memory, memory maps or event-monitor system breakpoint setups.

When you choose selection 3, a prompt asks for the session history file name for the save. If no extension is specified, the extension .REC is automatically added to the file name.

If the file exists, you'll see a prompt to (O)verwrite, (A)ppend, or (N)o (don't save file). If the file doesn't exist, you'll see the prompt:

```
Create file xxxx.REC (Y/N)? CR=Y
```

As soon as you press <Return>, you are automatically put into the Target Emulation mode. While the session record is open, every time you enter Target Emulation mode, a prompt appears at the bottom of the screen to remind you that the file is being written.

```
SAVE:file.REC <F8>=close
```

Download to ES 1800 <F5>

This menu is used to transfer a program, symbol table or a command file to the emulator or to target system memory. It is primarily used for downloading formatted binary target programs.

When you call up the menu, there are three options:

1. Download Target Program
2. Download Symbol Table
3. Send Commands File

To select one of these options, type the number (1, 2, or 3) and press <Return>. DO NOT press a function key, as this will display another menu instead.

If there is an error in a downloaded file, you will see the error message from the ES 1800 describing the problem with the file.

The number of lines transferred is displayed on the left side of the screen. If you need to interrupt the download, press <ctrl><break>.

Download Target Program

When you select "Download Target Program" by typing 1<Return>, you'll see a new menu, which tells you the default object-file format, and prompts for the file name.

Check that the default object-file format is what you want. If it is not, type <F6> to go to the Configuration menu, and change the file format. Then return to this menu by typing <F5>.

Enter the file name.

The formatted file name extensions default to one of the following, based on the file format:

.ETH	Extended Tek Hex
.OMF	Intel OMF-86
.MOT	Motorola S-Records
.ABS	Microtec
.HEX	Intel Hex

While the file is being transferred, ES Driver displays a byte count (for SCSI option), or a character count (for RS-232 option) of the data as it is sent. If an error is encountered, the download process is aborted.

If the object file includes symbols, you will see the prompt:

```
(D) Download symbols (S) Save symbols (Q) Quit (D?S?Q)?
```

Press **D** or **d** to download symbols to the ES 1800.

Press **S** or **s** to save the symbols to a file. A prompt will request the filename you want to use. All symbols in the original download file are included in the symbol file in ESL command line format, for example:

'symbol_name_one =$hex_value_one
'symbol_name_two =$hex_value_two
'symbol_name_three =$hex_value_three
'symbol_name_four =$hex_value_four etc...

If you use the "S" option to save the symbols to a file, they are not downloaded to the emulator. The symbol file may be downloaded to the emulator using the "Download Symbol Table" option on the Download menu (see the next section). You can edit the symbol file to reduce the number of downloaded symbols, which is useful when using a symbol file containing more symbols than your symbolic debugger can handle.

Symbol table files use the default extension **.SYM.**

Press **Q** or **q** to discard all the symbolic information read from the original download file.

Downloading the Symbol Table

When you choose **2,** "Download Symbol Table," you will see a prompt for the file name where you have previously saved the symbol table. The symbol table file must be in ESL command line format as discussed above.

Even though the symbol table is downloaded in ESL command line format, it is much more efficient to download the symbol file using the Download Symbol Table menu selection rather than the Send Command File option. The Download Symbol Table command concatenates several symbols together on each line and queues multiple lines.

To download symbols to the emulator, you must have the "SYMBUG" option installed into your ES 1800 emulator. If SYMBUG is installed in your ES 1800, then an "S" is appended to the version number that is displayed in the sign-on message. You can see the sign-on message from the Target Emulation window by pressing <ctrl-z>.

For example, in the sign-on message below, the "S" appended to "V2.5" indicates that SYMBUG is installed.

```
COPYRIGHT 1985
APPLIED MICROSYSTEMS CORPORATION
```

```
SATELLITE EMULATOR 68010 V2.5S
```

When SYMBUG is not installed, the sign-on message appears without the "S" appended to the version number.

```
COPYRIGHT 1985
APPLIED MICROSYSTEMS CORPORATION
SATELLITE EMULATOR 68010 V2.5
```

Typically SYMBUG can hold 2000 to 4000 symbols, depending on the length of the symbol names.

ES Driver (version 3.10, and higher) checks for the existence of SYMBUG, and checks if SYMBUG's symbol table is full.

Sending Commands

The download feature can also be used to send ESL commands to the emulator. A command file can be prepared using an editor and then used to enter memory maps or to automate repeated command sequences. For 16-bit processors, complex event-monitor system setups can be loaded via command files. (For the 32-bit 68020, the <F2> menu should be used for setting up the event-monitor system.)

Command files have the default extension .CMD.

For example, you could put the following event monitor configuration commands into the file **TRACE.CMD**.

```
AC1='Sub_start
AC2='Sub_end
WHEN AC1 THEN TOT
WHEN AC2 THEN BRK
RBK
```

Another use of command files is to map overlay memory and prefill some of it:

```
map 0 to $ffff:rw
fill 0 len 100,0
fill 100 len 100,55
fill 200 len 200,$aa
purge
ces
```

When a command file is loaded, the commands and any responses are not echoed to the screen. Since ES Driver waits until an ESL prompt is returned after each command, do not use commands that expect additional input (such as the single line assembler).

Configuration <F6>

The Configuration menu is provided so that ES Driver may be conveniently tailored to a specific application. The Configuration menu is accessed by typing <F6>. This section describes how to set the parameters in this menu.

The following paragraphs describe the settings for the four categories of parameters:

- Processor Type
- Communications Setup
- File Format
- System Processes

To select a parameter, use the ↑ and ↓ cursor keys, or press <Return>. Use the <spacebar>, or the → and ← cursor keys, to toggle through the parameter settings.

Processor Type

ES Driver supports the following processors:

- 68020
- 8086/88/C86/C88
- 80186/188/C186/C188
- 80286
- 6800X/010/302
- Z800X

Use the <spacebar> to toggle through the choices and select your target.

Communications Setup

The first communications parameter is "Communications Device Type." Set this to either RS-232 or SCSI, depending on the interface you are using.

Using an RS-232 Interface

If you choose RS-232, you need to set-up the Serial Port and Baud Rate parameters.

Serial Port

The Serial Port refers to the serial port on the host computer that is used to communicate to the ES 1800 emulator. ES Driver supports either COM1 or COM2. Appendix E contains information on how to configure the IBM serial interface physical hardware for either COM1 or COM2.

When communication is first attempted to the ES 1800 emulator, the chosen serial port will be initialized, and an interrupt-driven handler will be assigned to it. If the port does not exist, an error will be displayed.

Baud Rate

The Baud Rate selection specifies the speed of asynchronous serial communications channel in bits per second, and refers to both the send and receive data speed.

Use the <spacebar> or the → and ← cursor keys to select the baud rate that matches the host or terminal that you are planning to use.

We recommend using the highest baud rate possible for the best performance. The slower baud rates are provided for special cases where modems must be used. Also, slower baud rates may be required if other interrupt-driven handlers are used. For example, using PC/NFS with ES Driver limits upload baud rates to 9600 baud. Using a baud rate of 19200 with PC/NFS installed results in dropped characters.

Using a SCSI Interface

If you choose the SCSI interface, you need to set up the Device Number parameter.

Device Number

The Device Number specifies the address of the emulator on the SCSI bus. Each device on the bus must have a unique device number.

The Configuration device number should be set to the device number selected by the right thumbwheel switch on the SCSI controller board. If you need to change device numbers, please consult Section 2S, "Getting Started (SCSI)."

File Format Parameters

You have a choice of saving files in Extended TEKHEX, OMF-86, Microtec, Motorola S-record or Intel Hex formats.

The decision of which file format to use is based on which object-file format your compiler, assembler, and linker produce.

For more information on file formats, see Appendix B.

Up/Download Setup Parameters

You can set up four upload and download parameters. Toggle through the selections for each prompt:

Download object length   For the 68000 family of emulators (6800x, 68010, 68020, 68302) you can select the data object size:

BYTE allows byte-wide data reads and writes (default).
WORD allows word-wide (2 byte) data reads and writes.
LONG allows long-wide (4 byte) data reads and writes.

Selection of WORD or LONG guarantees that data is read and written on even word or longword boundaries. Non-aligned data writes are handled by first reading in aligned data, modifying the selected portion, and then writing out the modified aligned data.

Address space: 68000 family of emulators:

0 (RESERVED)
1 (USER DATA)
2 (USER PROGRAM)
3 (USER DEFINED)
4 (RESERVED)
5 (SUPERVISORY DATA)
6 (SUPERVISORY PROGRAM)
7 (CPU)

For the 68000 family of emulators, you may specify the address space code for memory accesses.

For up/downloads to and from target RAM, the selected address space must match the desired address space implemented in the target system. (See you Motorola processor manual for descriptions of the address space codes.)

For up/downloads to and from overlay RAM, overlay must be enabled for the selected address space (See your ES 1800 manual for a description of the ESL OVE command.)

Verify Download: If you're using SCSI to communicate with the ES 1800, you
                                        can increase download speed by disabling read after write
                                        verification. Selecting "NO" disables read after write
                                        verification. Selecting "YES" enables read after write
                                        verification.

                                        This option has no effect if you are using RS-232 to
                                        communicate with the ES 1800. Set this option to "NO" only
                                        if downloads to your target work reliably.

Exclude Symbols During Download:

                                        If you are downloading only data to the ES 1800, you can
                                        increase download speed by telling ES Driver's format
                                        converters to exclude processing of symbol records.

                                        If you are using the SYMBUG feature of the ES 1800, then
                                        you do need to download symbolic information to the ES
                                        1800.

System Process Parameters

You can map four commands to <Alt-1>, <Alt-2>, <Alt-3>, and <Alt-4>. This allows you to
run other commands at any time (even in Target Emulation mode) without leaving ES Driver.

Once you have mapped a command, you can use <Alt-1>-<Alt-4> to execute the command
from anywhere in ES Driver. See Section 4 for examples and more information.

Saving Your Configuration

When you finish entering your configuration, type <F8> to save the configuration. Each time
you start ES Driver, this configuration will be used. The configuration is stored in **ESD.CFG**.

When you type <F8>, you'll see the prompt (with RS-232 communication only):

```
Initialize and/or reconfigure the ES 1800 to match (Y/N)?
```

You need to initialize the ES 1800 in the following cases:

1. This is your first time using the emulator or ES Driver.
2. You changed any Communications Setup or Processor Type parameters.

If you have difficulties with this sequence, refer to the manual initialization instructions in
Section 2. Complete instructions for running the initialization procedure are in Section 2. You
can also save multiple configuration setups in different directories. See Section 4.

Exit to Shell <F7>

When you are done using ES Driver and wish to return to DOS, type <F7>. This returns you to the Main Menu. Pressing <F7> again selects the "Exit to DOS" function. Press <Return> to confirm that you want to exit to DOS.

When the program terminates, the original directory is restored. If you have set up any macros, they are saved in file **ESD.CFG**. They will be reloaded the next time ES Driver is run.

If you want to exit without saving your macros and configuration, type <ctrl-c> two times. Note that <ctrl-c><ctrl-c> works from everywhere in ES Driver *except* the Target Emulation screen.

SECTION 4

Contents

ADVANCED FEATURES

ADVANCED FEATURES

This section covers four advanced features of ES Driver:

1. Using macros to reduce typing and automate repetitive command sequences.

2. Using ES Driver in multiple directories to organize configurations and files for different projects.

3. Executing DOS commands within ES Driver to enable quick switching between tasks such as compiling, assembling, editing and emulating.

4. Customizing your ES 1800 setup by modifying the **ESD.CFG** file.

The Macro Feature

You can create up to ten macros to reduce the amount of typing and remembering needed for commonly used command sequences. Macros may be created at any time, and from any menu.

These 10 macros are saved in the **ESD.CFG** file when you leave ES Driver (by pressing <F7>) from the Main Menu. When you restart the program, they are automatically reloaded.

Please note the difference between ES Driver macros and ESL macros. ES Driver does not currently save ESL macros; The <F7> key saves ES Driver macros, which *may reference ESL commands and ESL macros*. The ESL command, MAC, only displays ESL macros.

If you terminate ES Driver by pressing <ctrl-c>, your new macros are not saved, and the previous ones are still intact in the **ESD.CFG** file.

Loading a Macro Buffer

The macro strings are entered by holding down the <ctrl> key and simultaneously pressing one of the function keys, <ctrl-F1> through <ctrl-F9>.

To enter macro 1, type:

    <ctrl-F1> (simultaneously)

From this point on, all your keystrokes will be saved in macro 1. A maximum of 255 keystrokes may be saved in any one macro.

To end the loading of macro 1, use the same key combination you used in starting the macro. In the above example, typing <ctrl-F1> again terminates the loading of the macro buffer 1.

ES Driver macros may not contain calls to other ES Driver macros; however, ES Driver macros may contain calls to ESL macros. Only one ES Driver macro may be loaded at a time.

Executing a Macro

You can use a macro at any time within ES Driver. To execute a macro sequence, type <shift-F1> to <shift-F9>.

Suggestions for Using Macros

1. Most macros are designed for use from within a certain menu. Since a macro may be started anywhere within ES Driver, it is good practice to begin a macro definition with a function key in order to guarantee that the macro will begin execution from the same menu every time.

For example, suppose you define macro 1 while you are in the download menu (<F5>) which downloads a particular program file. If the same macro were executed from the Target Emulation menu, it would have an entirely different and unwanted effect.

2. One handy use of macros is to save several breakpoint setups and then load them when needed. You simply open a macro for loading at the time you enter each breakpoint setup. Later, these may be recalled from the macro buffer. "Canned" target system tests can also be saved as macros and executed when needed.

3. Macros may not work as you expect when you use them in time-dependent functions. For example, suppose you set up a macro from the Target Emulation menu that includes run to breakpoint on the emulator followed by other keystrokes.

   When you enter the macro, you would wait until the emulator reaches the breakpoint before continuing to enter commands. However, when you execute the macro, the macro processor does not wait for the emulator operation to terminate, and sends the next keystrokes immediately. In this example, emulation would probably stop prematurely.

Clearing Macros

To clear a macro, open and close it without typing any commands.

For example, to clear macro 1, you would first open macro 1 by typing <ctrl-F1>. By opening the macro you have erased any existing information. Instead of supplying any commands, simply close the macro by typing <ctrl-F1> again. The macro is now cleared.

These same steps can be repeated to clear any of the macros.

Using ES Driver In Multiple Directories

ES Driver is designed so that it can be used for several projects on one computer. As explained in Section 2, ES Driver should be installed in its own directory and included in the search path.

When you start ES Driver, setup information is read from the two configuration files: **ESD.CFG** and **ESDKEY.CFG**. The **ESD.CFG** file is a binary format file that contains the current menu configuration, saved macros, and system commands. The **ESDKEY.CFG** file is an ASCII file that contains communication configuration information and key sequence map definitions. More information on both of these files is provided in Appendix A and Appendix D.

You can customize either of these files (see the appropriate appendix). ES Driver will first search for and use customized versions of these files if they exist in your current directory. If not, ES Driver will search the directory that contains **ESD.EXE**.

If you create a directory for each project, you can maintain separate configuration files in each directory. An easy way to do this is to copy the existing configuration files to each new directory, and then modify each for its special purpose.

The only way to modify the **ESD.CFG** file is by using the Configuration menu within ES Driver to modify the system configuration (with the <F6> function key) and then saving the modified configuration.

NOTE

If you start ES Driver using a command that includes a path under DOS 3.00 —for example, from your current directory \WORK, you enter the command C:\AMCTOOLS\ESD—ES Driver may not know how to find its companion files ESD.HLP, ESDKEY.CFG, and ESD.CFG. Instead, you should make sure the DOS PATH includes the directory (in this case, AMCTOOLS) that contains ESD.EXE and its companion files. You can then start ES Driver from any directory by typing ESD.

Executing DOS Commands within ES Driver

ES Driver includes a DOS "Shell Escape" feature that allows you to run DOS commands or other utilities without having to terminate ES Driver. This allows you to "escape" to DOS to run your compiler, assembler or editor in the middle of an emulation session.

Setting Up the DOS Commands

Near the bottom of ES Driver's Configuration Setup menu, there is space for four "System Processes" entries. These entries define MS-DOS commands or utilities that you can execute without exiting ES Driver.

Press <F6> to get the Configuration menu on the screen, and use the arrow keys to move the cursor to the System Processes entries.

Some examples of entries are the following:

```
Alt-1:   command.com
Alt-2:   editor.exe
Alt-3:   make.exe
Alt-4:
```

The four key sequences <Alt-1>, <Alt-2>, <Alt-3>, and <Alt-4> can be mapped to any MS-DOS command by typing the command in after the appropriate key sequence prompt.

To add System Processes, move the cursor to the <Alt> key combination you want to use and enter a command. For example, if you use a MAKEFILE you might want to use a utility similar to the UNIX "Touch," to force a complete rebuild of a program. To add "TOUCH *.C" as the <Alt-4> system process, move the cursor to the "Alt-4:" prompt and enter the command:

```
Alt-4: TOUCH *.C
```

System process entries become effective "as they are typed." (This command updates the source files with the current date; now, because the .c files are more recent than the object files, when you run the MAKE command your program will be recompiled.) You can edit a system process command—try it—and continue editing if you desire. You should not map these key sequences to commands such as DIR, as the output will flash on the screen too quickly for you to read (instead, use COMMAND.COM to start a new DOS shell).

Save system process entries by pressing <F8> while in the Configuration menu. The next time you run ES Driver, the saved system processes will be restored.

Executing the Commands

Once you have entered a command as a system process, you can execute it from anywhere in ES Driver (including the transparent emulation window) by pressing the corresponding <Alt> key sequence. For example, to change the date on your source files you can execute "TOUCH *.C" anywhere in ES Driver by pressing <Alt-4>. When you press <Alt-4>, ES Driver is "escaped," and the utility TOUCH.EXE changes the time and date on all of your files with the extension ".C" to the current time and date. The program TOUCH behaves as if it were the only program executing on your PC. When TOUCH is finished, control is automatically returned to ES Driver. ES Driver continues execution exactly where it left off when you pressed the <Alt-4> key sequence.

NOTE

This example will work only under the following conditions:

1. Alt-4: TOUCH *.C is set up.

2. The files with the extension ".C" exist in the current default directory.

3. You have a DOS version of the UNIX utility TOUCH.EXE somewhere along the search path defined by the DOS PATH environment variable.

In most circumstances, your command will execute correctly; however, if a command won't execute, it is probably due to one of the following reasons:

- Your path may not include the path to the commands you have specified.
- There is not enough memory left to load the program.
- The command path may not include a drive specifier, and the program is on another disk.
- The version of DOS was determined to be 2.00 or earlier. This feature works only on DOS version 2.1 or later.

There are possible side effects when you use the shell escape feature. For example, when you return to ES Driver, it restores the screen from memory, and may not show that directories or files have changed.

You can execute a new DOS command shell by calling the COMMAND.COM process. This loads a new copy of DOS into RAM in the PC. The copy inherits its own environment from the parent DOS.

ES Driver is still resident in memory, but is inactive. ES Driver has saved its screen and its status in memory.

To return to ES Driver, type EXIT. This terminates COMMAND.COM. ES Driver will restore its screen and continue where it left off.

Failing to exit the new COMMAND.COM will tie up memory in the PC.

CAUTION

Loading programs that remain resident (such as device drivers) may cause memory allocation errors because they will probably be loaded above ES Driver. These errors may not surface until ES Driver is terminated and another process is attempted.

Customizing ES 1800 Setup

When the emulator is initialized by ES Driver, setup information is read from four places:

1. The setup information stored in the EEPROM of the ES 1800
2. The file ESD.CFG in the program directory (where ESD.EXE resides)
3. The file ESD.CFG in the current directory
4. An optional, user-created setup file, ES_SETUP.CFG in either the program or current directory

Changes made to the ESD.CFG file in the *program* directory (where ESD.EXE resides), will be loaded any time you use ES Driver, while changes made to ESD.CFG in your current directory will only be loaded when you are working in the current directory.

You can use ES_SETUP.CFG file to configure for any ESL commands that require no additional user input while executing.

Creating ES_SETUP.CFG

This is an optional file you can create using a line editor (edlin, for example) or your word processor. It can contain ESL commands you want sent to the emulator as part of the initialization sequence. These can include:

- SET commands
- MAP commands
- FIL commands
- ESL macro definitions
- ON/OFF switches
- SAV variables to EEPROM
- LD system variables
- Others that require no additional user input

You cannot pre-configure for interactive ESL commands such as ASM or DNL.

To create ES_SETUP.CFG:

1. Start your line editor or word processor and create a file named ES_SETUP.CFG.
2. Enter separate lines for each ESL command.

For example, to set the TERMINAL port baud rate to 19200:

```
SET #1, #0
SET #20, #15
SAV
```

To map overlay:

```
CLM
MAP $1F000000 TO $1F0007FF :RW
MAP $1F100000 TO $1F101FFF :ILG
MAP $1F200000 TO $1F2007FF :RO
```

See your *ES 1800 User's Manual* for more about ESL commands.

3. Save the file to the program directory if you want the configuration to affect every initialization of the ES 1800. Save the file to the current directory if you want the configuration to affect only initializations using that directory's copy of ES Driver.

   If you use a word processor, be sure to save the file as non-formatted ASCII text.

ES_SETUP.CFG should contain only ESL commands that are to be sent to the ES 1800 as part of the emulator initialization sequence. When you respond "Y" to the "Do you want to initialize the ES 1800?" prompt, the ES_SETUP.CFG file contents are read as the last part of the initialization sequence.

Saving and Restoring System Variables

You may choose to save and restore a variety of system variables to the EEPROM on the MCB controller board. These variables are maintained even if you cycle power and are restored automatically if you use settings 1 (user 0, TERMINAL port) or 2(user 1, TERMINAL port) or 3 (user 0, COMPUTER port) or 4 (user 1, COMPUTER port) of the MCB thumbwheel switch. Categories of variables that can be saved and restored include:

    0   SET menu
    1   Contents of ES 1800 registers
    2   Event Monitor System WHEN/THEN statements
    3   Overlay Map
    4   Software switch settings
    5   Macros

You must have initialized the system as described in either Section 2 or Section 2S. There is room in the EEPROM to SAV the system variables for two different users. You use the SET command to initiate the SAV by telling ESL which user is active:

```
SET #1#0                        User 0 active
SET #1,#1                       User 1 active
```

From the transparent mode prompt ">" while in pause mode, use the following syntax to SAV all or selected categories of variables:

SAV	Copies all system variables from ES 1800 in the MCB EEPROM
SAV<*category number*>	Copies one of the six categories of variables.

A SAV operation may take several minutes. Do not interrupt the process.

For procedures specific to your emulator, see the SAV, SET, and LD commands in your *ES 1800 User's Manual*.

SAV and SCSI Disk Protocol

On SCSI Disk protocol equipped emulators, the MCB thumbwheel switch normally remains at B, which initializes the TERMINAL port at 19,200 baud. However, you may use settings 1 (user 0) and 2 (user 1) to save and restore additional system variables in EEPROM, as long as the baud rate remains 19,200 and you bring the system up on a TERMINAL port setting (switch settings 1 or 2).

If you choose this option,

1. You must initialize the emulator the first time with the MCB switch at B to establish SCSI communication.

2. Then start ES Driver or other SCSI Disk-compatible Applied Microsystems software.

3. At the ESL prompt, enter the following command to set the TERMINAL port explicitly for 19,200 baud:

   SET #10,#15

4. Enter additional variables as described in the *ES 1800 User's Manual*.

5. Enter the SAV command:

   SAV <return>

6. Exit ES Driver or other software when you have finished entering and saving commands.

7. Change the MCB thumbwheel to 1 or 2, and cycle power to the emulator.

As long as the switch remains at 1 or 2, the variables stored for user 0 or 1 will be applied each time you cycle power.

Factory Default ES 1800 Configuration

The factory default is:

SET #1,0	set the user number to 0
SET #2,$1A	set the ES 1800 reset character to <Ctrl-z>
SET #3,$11,$13	set X-on and X-off to <Ctrl-q>, <Ctrl-s>
SET #13,23	set number of lines on screen to 23
SET #21,1	set 1 stop bit
SET #22,0	set no parity
SET #23,$1B,$1B	set Target Emulation mode escape sequences to <Esc>l<Esc>
SET #24,$0D,0,0	set command terminator sequence to <Return> null null
SET #26,2	set upload/download type to Motorola S Record
SET #27,6	set acknowledge character to $06

NOTE

You should not change setup parameter #26 even if you are using other file formats. ES Driver converts whatever format you choose to Motorola S Records when you download a file.

To change the default settings, you need to either:

1. Change the values in the ES 1800 EEPROM, by going to the Target Emulation screen and using SET to change the parameters, then SAV to save them.

2. Make a commands file and load it each time you start ES Driver. Sample commands files can be found in Section 3, in the section on the Download Menu <F5>.

APPENDIX A

Contents

PROGRAM FILES AND MACHINE COMPATIBILITY

PROGRAM FILES AND
MACHINE COMPATIBILITY

This appendix describes the ES Driver files. It also provides information on possible PC compatibility issues.

Program File: ESD.EXE

ESD.EXE loads two configuration files: ESD.CFG and ESDKEY.CFG.

ESD.EXE needs to access the PC screen, keyboard, disks and serial ports in order to be usable. DOS function calls and standard BIOS interrupts are used in most cases to preserve portability between most DOS machines. However, in some cases this was not desirable for performance reasons.

ES Driver has been used on most PC clones with no problems. The technical information in this section is provided for those users who may experience problems using non-IBM versions of the PC.

Direct Screen Access

The directory, and trace displays access the screen memory directly and do not call BIOS. Certain save and restore utilities also access the screen directly. ES Driver senses which monitor is currently active by accessing the BIOS equipment flag directly, then uses the appropriate screen buffer.

Interrupt Driven Serial Interface

ESD.EXE also uses an interrupt-driven serial interface. Since this is not supported by the system BIOS, it is contained in ESD.EXE. The IBM Asynchronous Communication Adapter or compatible device is assumed to be located at port address 3F8h through 3FEh for COM1:, and 2F8h through 2FEh for COM2:. On the PC-AT, ESD.EXE assumes that the (standard) AT-Serial/Parallel adapter is installed. ES Driver uses IRQ4 for COM1: and IRQ3 for COM2:. Compatible hardware should also work with ES Driver, provided it has the same software interface and pinout.

Help File: ESD.HLP

This file is opened when the user requests help while running ES Driver. The help page(s) for the particular situation are displayed.

ESD.HLP should be in the same directory as ESD.EXE. If you would like to modify the help file or translate it to another language, please see Appendix D.

Configuration File: ESD.CFG

The ESD.CFG configuration file is a binary file that contains any user-defined macros and configuration setups. The configuration file is loaded each time ESD.EXE is executed. It is updated when the user saves a configuration and also when ESD.EXE terminates normally. Breakpoints set up with the <F2> menu are also saved (68020 only).

If the configuration file is missing, or cannot be found by ES Driver, it is created in the current directory with factory default settings.

The configuration file is loaded each time ESD.EXE is executed. It controls how ES Driver accesses the serial ports and SCSI devices. You should not modify this file.

Keyboard Configuration File: ESDKEY.CFG

The configuration file, ESDKEY.CFG is loaded each time ESD.EXE is executed. It controls the information displayed in the menu bar. Information on modifying the keyboard configuration can be found in Appendix D. This file also governs the SCSI device number assignment. Procedures for modifying this part of the file are explained in "Getting Started (SCSI)."

Adapter Configuration Program: EMX.EXE

The EMX.EXE program allows you configure the Emulex IB02 SCSI host adapter's device table to match the emulator to your host system. EMX.EXE must be run each time you initialize (boot) your PC and before you start or configure ES Driver. It may be included in the AUTOEXEC.BAT file for automatic configuration each time you boot your PC.

Procedures for using this utility are explained in "Getting Started (SCSI)."

Installation Program: INSTALL.EXE

The program INSTALL.EXE is used to install ES Driver on your hard disk.

APPENDIX B

Contents

FILE FORMATS FOR TARGET OBJECT FILES

FILE FORMATS FOR TARGET OBJECT FILES

Program File Up/Download Format

ES Driver currently supports Motorola S Record, Extended Tekhex, Microtec, OMF-86 and Intel Hex loader formats.

Motorola EXORciser Format (S Records)

Motorola data files may begin with a sign-on record, initiated by the code S0. Valid data records start with an eight-character prefix and end with a two- character suffix.

Figure B-1 demonstrates a series of valid Motorola data records. S-record output format follows.

- Each data record begins with the start characters, Sx (where x = {1,2,3,...}); the emulator will ignore all earlier characters.
- The third and fourth characters represent the byte count, expressing the number of data, address, and checksum bytes in the record.
- The address of the first data byte in the record is expressed by the last four to eight characters of the prefix.
- Data bytes follow, each represented by two hexadecimal characters. The number of data bytes occurring must be three less than the byte count.
- The suffix is a two-character checksum.

See the Microtec Format section for more examples of Motorola format. Motorola format does not include symbol or module records

Figure B-1. Specifications for Motorola EXORciser 16-Bit Data Files

NOTE

S2, S3, S7 and S8 records are also accepted. S2 and S8 records have 24-bit addresses (six address characters) rather than the 16-bit addresses (four address characters) shown in the figure above. S3 and S7 records have 32-bit addresses (eight address characters).

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Microtec Format

The format of absolute object modules is described below. Absolute object modules consist of symbol table information, data specifications for loading memory, and a terminator record.

```
$$ [module name]
symbol records
$$ [module_name]
symbol records
$$ [module_name]
$$
header record
data records
record count record
terminator record
```

Module Record

Each object file contains one module record for each module that is a component of it. A sample record follows:

```
$$ MODNAME
```

Symbol Record

As many symbol records as needed may be contained in the object module. Up to 4 symbols per line may be used, but it is not mandatory that each line contain 4 symbols. A module may contain only symbol records. A sample record is shown below.

```
APPLE 00000H LABEL1 ODOG3H MEM 0FFFFH ZEEK 01947H
```

The module name associated with the symbols may be specified on the $$ record preceding the symbol records. For example: $$MAIN. Until another module is specified with another $$ record, all symbols specified are assumed to be in the module named on the preceding $$ record.

Symbols defined by the linker's PUBLIC command appear following the first module record, which indicates the name of the output object module specified by the linker's NAME command.

Header Record

Each object module has exactly one header record with the following format:

    S00600004844521B

Description:

S0	identifies the record as a header record
06	is the number of bytes following this one
0000	is the address field, which is ignored
484452	is HDR in ASCII
1B	is the checksum

Data Record

A Data Record specifies data bytes that are to be loaded into memory.

```
1 2    3 4   5 6 7 8 9 10  11 ... 41 42   43 44
S I    byte    load        data .. data   check
  D    count   address       1        n     sum
```

where:

Column 1 contains "S", which indicates the start of a record in Motorola S-Record format.

Column 2 contains a digit identifying the record type. For Data Records, this digit is 1 (for 16 bit addresses), 2 (for 24 bit addresses) or 3 (for 32 bit addresses).

Columns 3 and 4 contain the count of the number of bytes following this one within the record. The count includes the checksum and the load address bytes, but not the byte count itself.

Columns 5 through 10 (for S3 records: 5 through 12) contain the load address. The first data byte is to be loaded into this address, subsequent bytes into the next sequential addresses. Columns 5 and 6 contain the high-order address byte, columns 9 and 10 (for S3 records, it is columns 11 and 12) contain the low-order address byte.

Columns 11 through 42 (for S3 records, columns 13 through 42) (or less, if not 16 data bytes) contain the specifications for up to 16 bytes of data.

The last two columns in the data record contain a checksum for the record. To calculate this, the sum of the values of all bytes from the byte count up to the last data byte, inclusive, is taken modulo 256, and this result subtracted from 255.

Record Count Record

This record contains the number of data records preceding, for a check. Its format is the same as that of a Data Record with the ID (Column 2) set to 5, the byte count (columns 3 and 4) set to 03, no address field, and two data bytes which are set to the number of data records in this file. (The high-order byte is in columns 5 and 6.) The checksum is calculated in the usual manner.

Terminator Record

A Terminator Record has the same format as a Data Record with the ID (Column 2) set to 8 normally or 9 for CHIP 68020, the byte count (columns 3 and 4) set to 04 and the load address field (columns 5 through 10 or 5 through 12) either set to zero or to the starting address specified in the END directive (there are no data bytes).

Figure B-2. Sample Microtec Data Record

```
S00600004844521B
S113E0008E00FF7F10048683B71039CE10001C04E5
S113E010011C04021C04041C040886FF0C69046926
S113E020046904690469046904690469046904690469044AA3
S113E03026EA8D46CE0000CC0108DD0218CE000091
S113E040CC0100DD048607B710048FD3028F2402AD
S113E09003B710268640B710243936373C0ACEE041
S113E0A0BA1AA300270B0808088CE0D225F30B202A
S113E0B005A602B7102B3833323925803012C03010
S113E0C009603004B030025830012C300096300022
S113E0D04B307F102C860CB7102D860BB710097FA0
S113E0E0005CCC0061DD5DDD5F7F00067F0007CC56
S10DFFF6E25BE25BE000E000E000E3
S9030000FC
```

Symbol Table File Format

ES Driver can create or load the symbol table from a disk in Microtec format. The Microtec symbol format is the same as the symbol record in the Microtec object format. See the preceding pages in this appendix for details.

Extended Tekhex Format

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Extended Tekhex uses three types of message blocks:

1. The data block contains the object code.
2. The symbol block that contains information about a program section and the symbols associated with it. This information is only needed for symbolic debug.
3. The termination block contains the transfer address and marks the end of the load module.

NOTE

Extended Tekhex has no specially defined abort block. To abort a formatted transfer, use a Standard Tekhex abort block.

Each block begins with a six-character header field and ends with an end-of-line character sequence. A block can be up to 255 characters long, not counting the end-of-line character. The header field has the format shown in the following table.

Extended Tekhex Format		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
%	1	A percent sign specifies that the block is in ExtendedTekhex format.
Block	2	The number of characters in the block: Lengtha two-digit hex number. This count does not include the leading % or the end-of-line.
Block	1	6 = data block Type 3 = symbol block 8 = termination block
Checksum	2	A two-digit hex number representing the sum, mod 256, of the values of all the characters in the block, except the leading %, the checksum digits and the end-of-line. The following table gives the values for all characters that may appear in Extended Tekhex message blocks.

Character Values for Checksum Computation	
Characters	*Values (Decimal)*
0..9	0..9
A..Z	10..35
$	36
%	37
&. (period)	38
_ (underscore)	39
a..z	40-65

Variable-Length Fields

In Extended Tekhex, certain fields may vary in length from 2 to 17 characters. This practice enables you to compress your data by eliminating leading zeros from numbers and trailing spaces from symbols. The first character of a variable-length field is a hexadecimal digit that indicates the length of the rest of the field. The digit 0 indicates a length of 16 characters.

For example, the symbols START, LOOP, and KLUDGESTARTSHERE are represented as 5START, 4LOOP, and 0KLUDGESTARTSHERE. The values 0, 100H, and FF0000H are represented as 10, 3100, and 6FF0000.

Data and Termination Blocks

If you do not intend to transfer program symbols with your object code, you do not need symbol blocks. Your load module can consist of one or more data blocks followed by a termination block. The following tables show the format for a data block and a termination block.

Extended Tekhex Data Block Format		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
Header	6	Standard header field Block type = 6
Load Address	2 to 17	Address where the object code is to be loaded: a variable length number.
Object	2*n*	*n* bytes, each represented as two hex digits

Extended Tekhex Termination Block Format		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
Header	6	Standard header field Block type=8
Transfer Address	2 to 17	Address where program execution is to begin: a variable-length number

Symbol Blocks

A symbol used in symbolic debug has the following attributes:

1. The symbol itself: 1 to 16 letters, digits, dollar signs, periods, a percent sign, or symbolize a section name. Lower case letters are converted to upper case when they are placed in the symbol table.

2. A value: up to 64 bits (16 hexadecimal digits).

3. A type: address or scalar. (A scalar is any number that is not on address.) An address may be further classified as a code address (the address of an instruction) or a data address (the address of a data item). As symbolic debug does not currently use the code/data distinction, the address/scalar distinction is sufficient for standard applications of Extended Tekhex.

4. A global/local designation. This designation is of limited use in a load module, and is provided for future development. If the global/local distinction is not important for your purposes, simply call all your symbols global.

5. Section membership. A section may be thought of as a named area of memory. Each address in your program belongs to exactly one section. A scalar belongs to no section.

The symbols in your program are conveyed in symbol blocks. Each symbol block contains the name of a section and a list of the symbols that belong to that section. (You may include scalars with any section you like.) More than one block may contain symbols for the same section. For each section, exactly one symbol block should contain a section definition field, which defines the starting address and length of the section.

If your object code has been generated by an assembler or compiler that does not deal with sections, simply define one section called, for example, MEMORY, with a starting address of 0 and a length greater than the highest address used by your program; and put all your symbols in that section.

The following table gives the format of a symbol block. Tables that follow give the formats for section definition field and symbol definition fields, which are parts of a symbol block.

Extended Tekhex Symbol Block Format		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
Header	6	Standard header field Block type=3
Section Name	2 to 17	The name of the section that contains the symbols defined in this block: a variable-length symbol.
Section	5 to 35	This field must be present in exactly one definition symbol block for each section. This field may be preceded or followed by any number of symbol definition fields. The table on the next page gives the format for this field.
Symbol	5 to 35	Zero or more symbol definition fields as described in the next table.

Extended Tekhex Symbol Block Format: Section Definition Field		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
0	1	A zero signals a section definition field.
Base	2 to 17	The starting address of the Address section: a variable-length number.
Length	2 to 17	The length of the section: a variable-length number computed as: 1 + (high address1-base address).

Extended Tekhex Symbol Block Format: Symbol Definition Field		
ITEM	CHARACTERS NUMBER OF ASCII	DESCRIPTION
Type	1	A hex digit that indicates the global/local designation of the symbol, and the type of value the symbol represents: 1 = global address 2 = global scalar 3 = global code address 4 = global data address 5 = local address 6 = local scalar 7 = local code address 8 = local data address
Symbol	2 to 17	A variable-length symbol.
Value	2 to 17	The value associated with the symbol: a variable-length number.

The following figures show how the preceding tables of information might be encoded in Extended Tekhex. The information for the Extended Tekhex Symbol Block illustration (see Figure B-5) could be encoded in a single 96-character block. It is divided into two blocks for purposes of illustration.

Figure B-3. Extended Tekhex Data Block

Block length: 15H = 21

Checksum: 1CH = 28 = 1+5+6+3+1+0+0+0+2+0+2+...

Object Code: 6 bytes

%1561C31000202020202 0202

Load address: 100H

Block type: 6

Header character
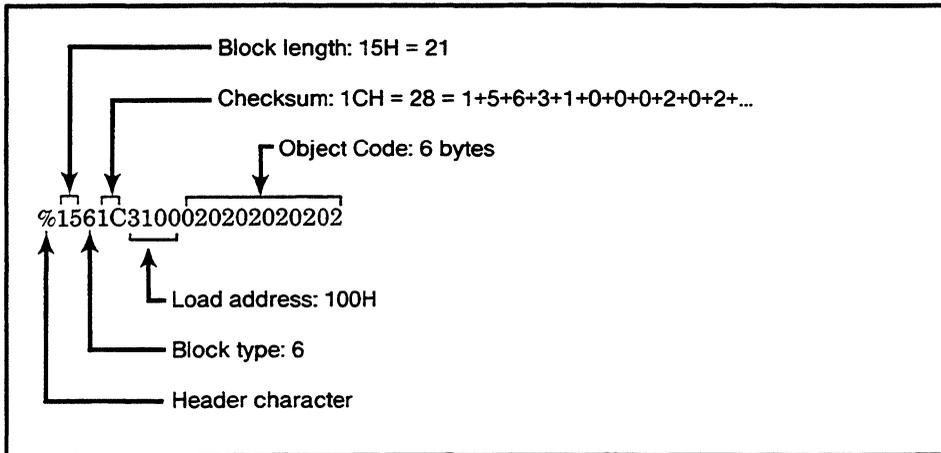
Figure B-4. Extended Tekhex Termination Block

Block length: 8

Checksum: 1AH = 26 = 0+8+8+2+8+0

%0881A280

Transfer address: 80H

Block type: 8

Header character
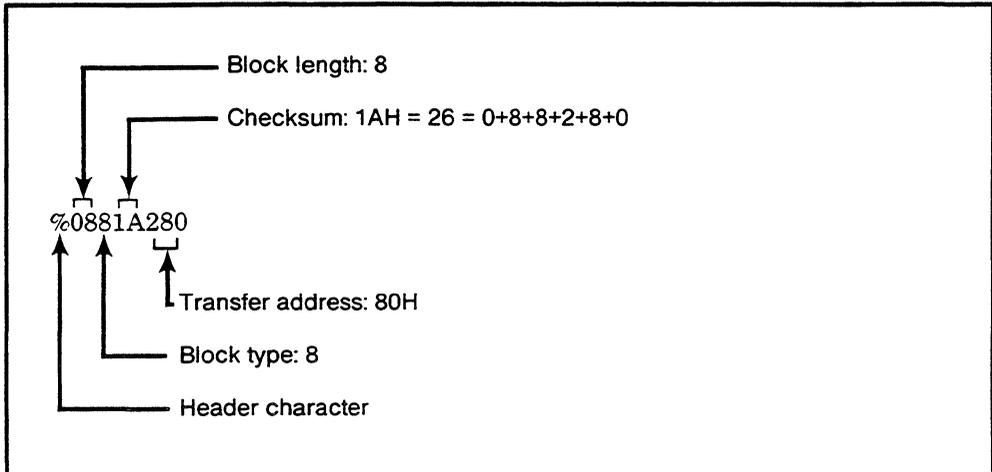
Figure B-5. Extended Tekhex Symbol Block
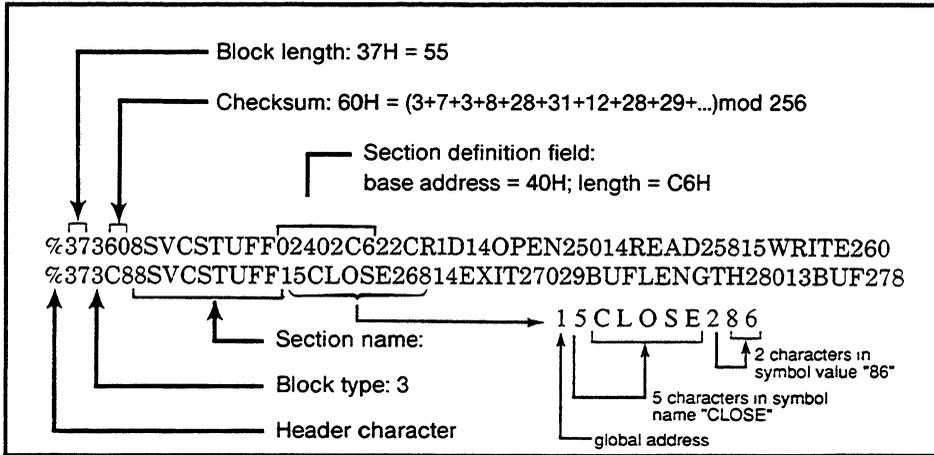
OMF-86 Format

OMF-86 is a binary format. For information on OMF-86, please consult the following Intel technical specification:

8086 Relocatable Object Module Formats, 1981
Order Number: 121748-001
Intel Corporation
3065 Bowers Ave.
Santa Clara, CA 95051

Intel Hex Format

There are four types of records which can be used in an Intel hex object file:

1. Extended address record
2. Start address record
3. Data record
4. End of file record

Records begin with a colon (ASCII 3AH) and end with a checksum field. The checksum is the ASCII value of the two's complement of the eight-bit sum of the eight-bit bytes resulting from converting each pair of ASCII hex digits to 1 byte of binary. The checksum uses the values beginning with the byte count and ending with the last byte of the data field. The binary sum of all the ASCII pairs in a record (including the checksum and excluding the leading:) is zero.

Extended Address Record

Record mark	Byte count	Zeros	Record type	Upper segment base address	Check sum
:	02	0000	02	xxxx	ss

Data Record

Record mark	Byte count	Load address	Record type	Data	Check sum
:	cc	aaaa	00	dd..dd	ss

Start Address Record

Record mark	Byte count	Zeros	Record type	CS	IP	Check sum
:	04	0000	03	xxxx	yyyy	ss

End of File Record

Record mark	Byte count	Zeros	Record type	Check sum
:	02	0000	02	ss

APPENDIX C

Contents

MODIFYING THE HELP FILE

MODIFYING THE HELP FILE

Procedures

ES Driver obtains all of its help information from the file **ESD.HLP**. This file may be modified to provide additional help or to provide help in a language other than English, without changing ES Driver.

There are strict syntax rules when modifying this file. Errors in the help file will cause the useful portion of the file to be truncated by the initialization routine. All characters are ASCII-coded characters and digits. The file may be edited by most popular editors or word processors as long as it is saved in a plain ASCII file.

1. The first character in the file is a tilde (~). This is the help delimiter character (7Eh), and precedes each "set" of help pages.

2. The next 4 numbers define the window where the help text is to appear. Each number is represented in ASCII as a base 10 number, and separated by commas. The top left-hand corner of the screen is at coordinates 0, 0. The order is as follows:

   > Top Row,
   > Left Column,
   > Bottom Row,
   > Right Column,

3. Comments may follow. Anything following up to the next "new-line" character(s) is ignored when the file is loaded.

4. The next two characters are an ASCII carriage return, and line feed or "new-line."

5. The help text follows. This is the text as it will actually appear on the screen. All ASCII printable characters are valid except the tilde "~" (7Eh).

If more lines are included than there is room for in the specified window, they will be shown in "pages," and a prompt indicating that more is available will be included in the perimeter of the window.

CAUTION

The help ( ) function draws a box within the window opened by the coordinates specified. Text is actually inserted beginning at row 1, column 1 within the window (window corner is 0, 0). Text must be organized to fit within this smaller window. The actual "text" window can be calculated as follows:

> Max rows of text = Bottom Row - Top Row -1

Max columns each line = Right Col - Left Col -1

Text looks the best when a blank column is left at both left and right sides of the text.

EXAMPLE:

~3, 45, 6, 79, /* Sample help page */

This text will appear centered in a 3 line box.

~0, 0, 4, 79, /* Here are 3 pages of 3 lines each */

One solo line near the top of the screen.

This is the second page of help. The solo line and the 2 blank lines were shown on the first page, and these 3 lines are shown on the second.

This line starts the third page of help.

~0, 0, 24, 79, /* a full screen of help */

There is only one line of text on the screen.

6. Make sure not to insert any extra tilde characters (~) in the file as they will be assumed to be the start of another "set" of the help pages. The help pages are keyed to operator prompting within ES Driver, and their sequence is important.

7. Applied Microsystems Corporation has provided this information as a convenience to its customers, and reserves the right to modify the above protocol without notice.

APPENDIX D

Contents

MODIFYING THE KEY CONFIGURATION FILE

MODIFYING THE KEY CONFIGURATION FILE

ES Driver obtains keyboard mapping information from the keyboard-configuration file **ESDKEY.CFG** including the characters you type for functions such as macros, changing menus and shell escapes, and the corresponding information displayed on each menu. You may modify the keyboard-configuration file so that you can run ES Driver with your favorite key combinations. Modifying the keyboard-configuration file will not change the ES Driver program.

The **ESDKEY.CFG** file is the default configuration file. You may rename this file as long as you supply the file name as an argument in the command that starts **ESD.EXE**. For example, you could enter the following commands:

  ESD   (uses **ESDKEY.CFG** as the configuration file)
  ESD *file*   (uses *file* as the configuration file)

When modifying the keyboard configuration file, you must follow strict syntax rules. Errors in the file will cause ES Driver to function incorrectly. To avoid problems, be sure to keep a backup copy of the original file.

All characters in the keyboard configuration file are ASCII coded characters and digits. The file may be edited by most popular editors or word processors as long as it is saved in a plain ASCII file.

There are two sections in the file:

- Communications control for ES Driver
- ES Driver key translation

This appendix deals only with the key translation section, which contains the following eight types of keys:

- Cursor motion keys
- Line editing keys
- Control keys
- Menu selection keys
- Shell escape selection keys
- Load macro keys
- Execute macro keys
- Tunneling keys (used in the 68020 Break Event menu)

Procedures

You can examine the existing key sequences in the configuration file itself. Within each key category, there are three fields for each key:

KEY_PURPOSE:*"primary sequence" KEY:"secondary sequence" (optional) ID:"key_id_string"*

For example

```
PAGE_DOWN KEY:"0x151" ID:"PgDn"}
```

maps the page down function to the "0x151" key code. This is the key code produced when the <PgDn> function key on the PC keyboard is pressed. The string **PgDn** is an identifier that appears on the screen when references to the page down function are made. The line

```
TRANSPARENT KEY:": T" KEY:": t" KEY:"0x13b" ID:"F1"
```

maps activation of the Target Emulation mode with either the **:T, :t,** or **0x13b key codes.** The last sequence is the default key code produced when the <F1> function key on the PC keyboard is pressed. The string **F1** is an identifier that appears on the screen when references to the target emulation function are made.

The **:T** and **:t** key sequences will also activate Target Emulation mode. If you plan to do major modifications to the **ESDKEY.CFG** file, study the entire file before making changes.

The **KEY_PURPOSE** fields are mandatory. They may be in a different order, but all of them MUST be present.

For each **KEY_PURPOSE** field, there must be at least one and as many as ten **KEY:***key sequence* fields.

For each **KEY_PURPOSE** field, there must be one and only one **ID:***key_id_string* field.

All of the **KEY:***key sequence* and **ID:***key_id_string* fields must be on the same line as the corresponding **KEY_PURPOSE** field. For long entries, the line continuation character "\" (backslash) may be used. If you use the "\" character, do not break up any single **KEY:***key sequence* or the **ID:***key_id_string* fields.

For example

```
TRANSPARENT KEY:": T" KEY:": t" KEY:"0x13b" \
   ID:"F1"
```

is acceptable, but

```
TRANSPARENT KEY:": T" KEY:": t" KEY: \
"0x13b" ID:"F1"
```

is not.

The KEY: "key sequence" field may contain a variety of ASCII character identifiers. Each identifier must be separated by a space. Valid identifiers are

1. ASCII character names

Character Name	Character Value (hexadecimal)
NUL	0x00
SOH	0x01
STX	0x02
ETX	0x03
EOT	0x04
ENQ	0x05
ACK	0x06
BEL	0x07
BS	0x08
HT	0x09
LF	0x0A
VT	0x0B
FF	0x0C
CR	0x0D
SO	0x0E
SI	0x0F
DLE	0x10
DC1	0x11
DC2	0x12
DC3	0x13
DC4	0x14
NAK	0x15
SYN	0x16
ETB	0x17
CAN	0x18
EM	0x19
SUB	0x1A
ESC	0x1B
FS	0x1C
GS	0x1D
RS	0x1E
US	0x1F
SP	0x20
DEL	0x7F

2. Hexadecimal numbers. Any valid hexadecimal number that is preceded by 0x is allowed. Accepted hexadecimal digit values are 0-9, a-f, and A-F. Examples are

  0x3e   0xff   0x00   0x82

3. Decimal numbers that are two or three digits long. Examples are

62	255	130	22

4. Single printable ASCII characters, except the space, tab, and double quote characters. Examples are

3	a	X	z

For example, the sequence

```
"ESC [ 2 2 5 z"
```

is interpreted as

character identifier	hexadecimal value
ESC	0x1B
[	0x5D
2	0x32
2	0x32
5	0x35
z	0x7A

and could be replaced by

```
"0x1B 0x5D 0x32 0x32 0x35 0x7A"
```

ES Driver will abort during program initialization if it encounters a syntax error in the **ESDKEY.CFG** file. ES Driver attempts to identify the nature of the first syntax error that it encounters, but does not report a line number.

APPENDIX E
Contents

SERIAL INTERFACE

SERIAL INTERFACE

Serial Interface for the PC-AT

IBM-PC-AT Serial/Parallel Adapter

Serial Interface for the PC-XT

IBM-PC-XT Asynchronous Interface Adapter

Port Selection

COM 1:   COM 2:

13   25

1   14

Voltage
Interface

ES Series Emulator		PC XT Asynchronous Communications Adapter (RS-232)
3	2	TX
2	3	RX
5	4	RTS
4	5	CTS
	6	DSR
7	7	GND
	8	CD
	20	DTR

DB-25P   DB-25S
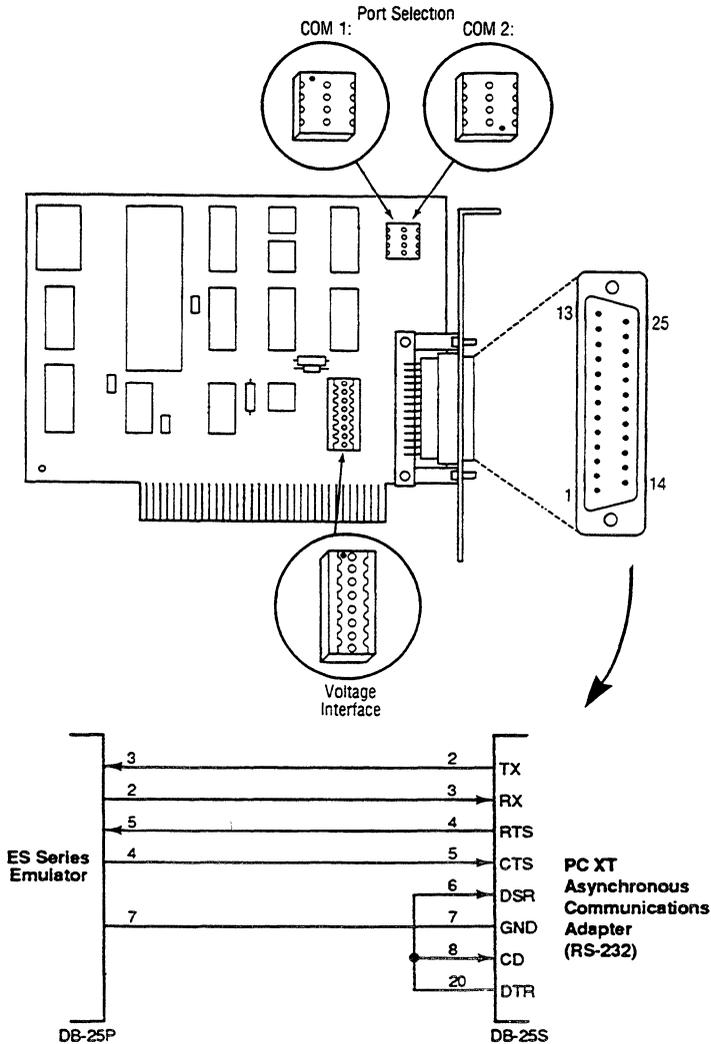
ES 1800 Series Emulator Serial Interface

PIN	NAME	DESCRIPTION
1	Protective Ground	Connected in the emulator to the logic ground.
2	Serial Data Out	This signal is driven to nominal +/- 12-volt levels by an RS232-compatible driver.
3	Serial Data In	Data is accepted on this pin if the voltage levels are as specified by RS-232 specifications.

NOTE

You should be familiar with the pin configuration of your own PC. Some systems receive on pin 2 and some on pin 3. It may be necessary for you to rewire the cable connecting the units.

4	Request to Send	This signal is driven to Output)nominal +/- 12-volt levels by an RS232-compatible driver; it signals other equipment that the emulator is ready to accept data on this port.
5	Clear to Send	This input to the emulator Input)indicates that other equipment in the system is ready to accept data. This signal is terminated such that the emulator will operate with it disconnected.
6	Not Used	
7	Signal Ground	This pin is connected to the emulator system logic ground. Note that this ground is also to the emulator probe ground pin. When the emulator is connected to the target system, the target system logic ground, the emulator logic ground, and the PC logic ground are all tied together.
8 to 25	Not Used.	

APPENDIX F

Contents

SCSI DISK PROTOCOL OPTION

Contents

SCSI DISK PROTOCOL OPTION

This appendix contains instructions for installing SCSI Disk protocol hardware in an ES 1800. Follow the instructions in this section if you plan to use ES Driver or another software application that can be configured for SCSI communications.

The Small Computer Systems Interface (SCSI) Disk protocol option for the ES 1800 series of emulators provides a significant productivity enhancement. The SCSI Disk protocol interface enables the emulator to appear as a disk drive to the host. SCSI Disk protocol eliminates data transfer bottlenecks for uploading and downloading and provides significant speed improvements over serial communications. The actual speed depends on the host, the target microprocessor and the speed of the target microprocessor.

Installation of the SCSI Disk protocol hardware varies depending on whether you have a new ES 1800 system or are updating one you purchased earlier. You should complete this hardware installation before installing your application software.

This appendix covers the following procedures:

- How to install SCSI Disk protocol hardware in an ES 1800
- How to install a host adapter in your PC
- How to make the physical connections on the SCSI bus
- How to configure your host computer to recognize the emulator as a SCSI device
- How to troubleshoot problem installations
- How to connect multiple devices to the SCSI bus

CAUTION

Failure to follow the directions in this manual, especially those concerning the J1 jumper setting on the MCB controller board, will result in damage to the ES 1800. Even if you have a factory-installed SCSI controller, you must verify the J1 jumper position.

Hardware Installation

The procedures for installing, modifying, or verifying ES 1800 SCSI Disk protocol hardware vary according to whether your ES 1800 is a new or existing system. Choose one of the situations listed below. Complete only the procedures that match your situation.

> *If you have a new, SCSI-equipped ES 1800 system,* remove the front panel as described below. Perform the steps described under "Removing the Front Panel" on page F-2 in this appendix. Then go on to "Host Adapter Installation."

> *If you are upgrading your existing system to SCSI for the first time,* remove the front panel as described below. Perform the procedures described under "Upgrading a Non-SCSI System To SCSI Disk Protocol" on page F-6 in this appendix. Then go on to "Host Adapter Installation."

<div align="center">

CAUTION

</div>

> *Failure to position the MCB J1 jumper correctly will result in severe damage to your ES 1800. All users must verify the jumper position before powering up the ES 1800.*

Removing the Front Panel

Follow these steps to open the ES 1800 chassis:

1. Turn off the emulator.

2. Disconnect it from the power source.

3. Remove the front panel. Depending on the version of your emulator, you have one of two types of front panel.

   If you have the molded-plastic front panel, the release tabs are located at the bottom left and right corners. Press the left release tab, while pulling the left side of the panel slightly outward. Then press the right release tab, and pull outward until the bottom of the panel is completely free. Slide the panel down to remove it.

   If you have the metal front panel, disconnect the cables from the front of the emulator (if applicable). Then loosen the thumbscrews in the upper corners of the front panel and remove it.

4. Remove board retainer (if applicable).

   To remove the retainer, lift up on the top panel of the emulator just enough to free the retainer bar.

Checking a New System

If you purchased a new ES 1800 equipped with the SCSI Disk protocol option, you need only verify the proper position of the J1 jumper on the MCB controller board (MCB). Figure F-1 shows the board locations. You need to remove the MCB controller board.

Figure F-1. The ES 1800 Emulator Equipped with SCSI Disk Protocol Option
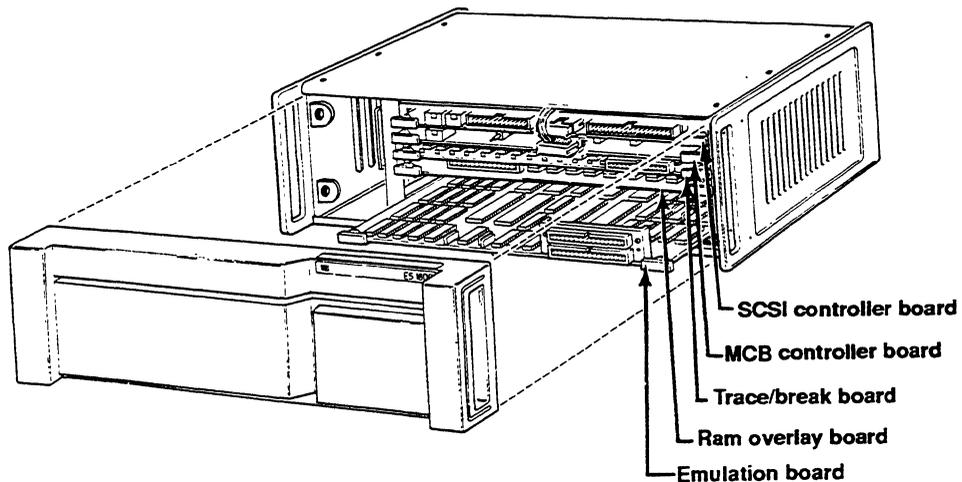
           └ **SCSI controller board**
          └ **MCB controller board**
          └ **Trace/break board**
          └ **Ram overlay board**
          └ **Emulation board**

CAUTION

When performing any of the procedures described in this step, use appropriate anti-static protection measures, including static-free bench pads and a grounded wrist strap.

1. To remove the MCB controller, first disconnect the Y-cable that connects the top and second boards. Note the connections for later replacement.

2. Grasp the two ejector levers on the MCB, and pull outward.

3. Place the board on a static-free surface.

Verifying Jumper Position

Orient the MCB controller board as shown in Figure F-2. Locate J1 which is near the edge connector P1 at the back of the board. Inspect the jumper block which is installed on J1. For SCSI operations, it should engage only the upper row of pins on J1, as shown in Figure F-3. If it is incorrectly positioned, remove it, flip it over, and install it as shown in the figure.

<div align="center">

CAUTION

Failure to install the J1 jumper correctly will result in damage to the system.

</div>

Figure F-2. MCB Controller Board (showing J1 location)
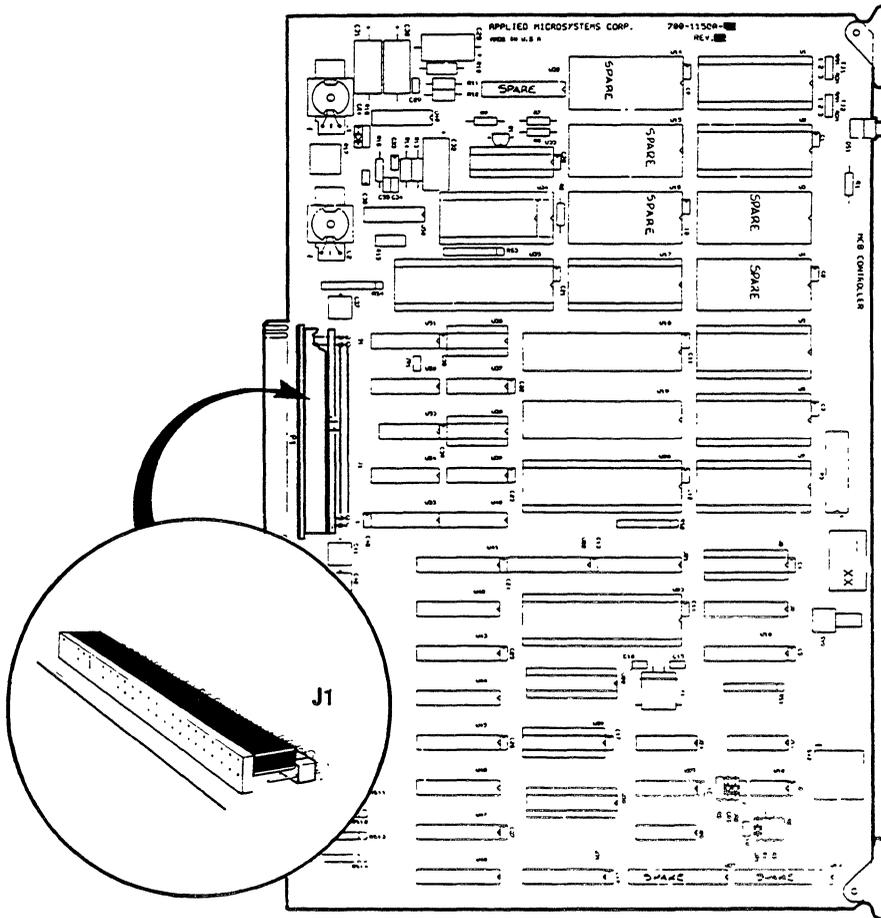
Figure F-3. J1 Jumper Block Positions
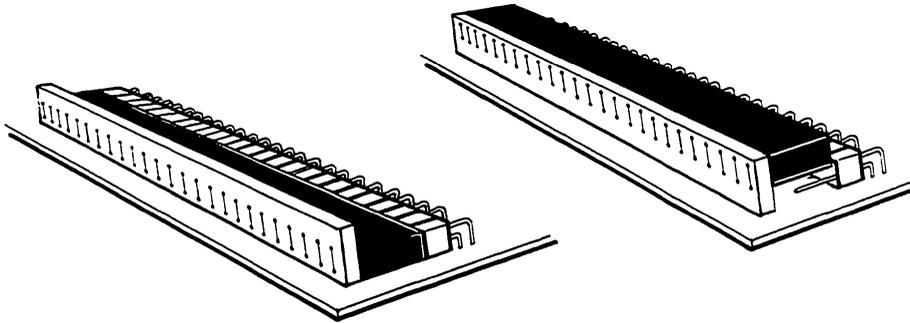
Correct position
when no SCSI board
is installed
(MCB in first slot)

Correct position
with an installed SCSI board
(MCB in second slot)

Once you have verified the J1 position, you can reinstall the MCB and reconnect the cable. Be sure the board seats firmly in the backplane and that the cable connections are correct. Replace the board retainer.

Verify that the toggle switch just to the right of the thumbwheel switch is in the center position.

Leave the front panel off because you need access to the boards during later procedures. You should now go to "Host Adapter Installation."

Upgrading a Non-SCSI System To SCSI Disk Protocol

If you are installing the SCSI Disk protocol option in an ES 1800 that does not currently run SCSI communication, you must modify the MCB controller board. You will also need to install the SCSI controller board and the SCSI/Serial Switching Cable supplied with your kit.

Removing the Top Cover

In addition to removing the front panel, as described at the beginning of this section, you must remove the top of the chassis. Figure F-4 illustrates the position of the cover screws and identifies the location of the boards in your system. Remove the eight phillips screws from the top of the ES 1800 and take off the top cover.

Figure F-4. ES 1800 Emulator Without SCSI Controller

MCB controller board
Trace/break board
Ram overlay board
Emulation board
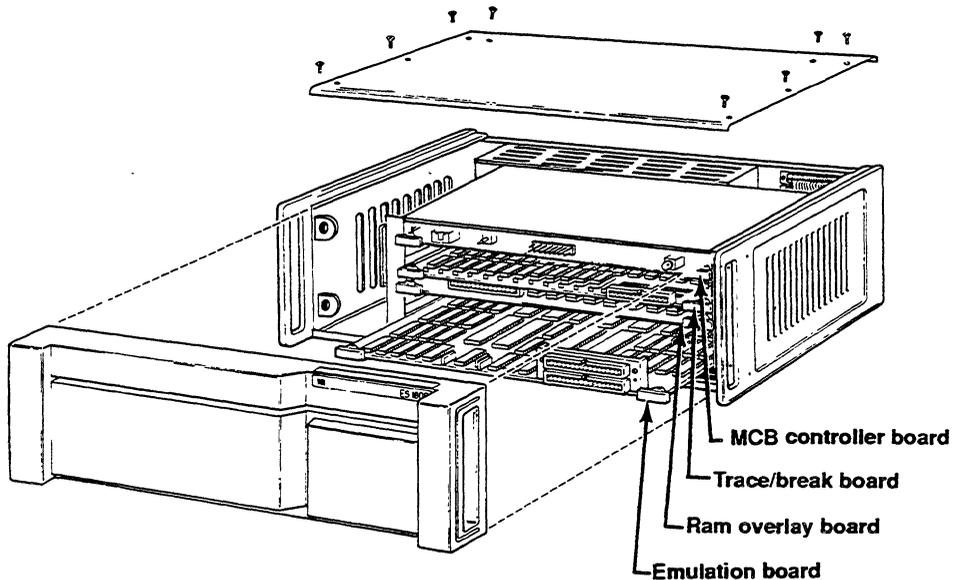
CAUTION

When performing any of the procedures described here, use appropriate anti-static protection measures, including static-free bench pads and a grounded wrist strap.

Modifying the MCB

To prepare for SCSI operations, you must remove the MCB controller, change the jumper setting, and install Symbug (if ordered).

1. Remove the topmost board in the chassis (the MCB controller board) by gently grasping the two ejector levers and pulling outward.

2. Place the board on a static-free surface.

Changing the Position of Jumper Block J1 on the MCB

Orient the MCB controller board as shown in Figure F-5. Locate J1 which is near the edge connector P1 at the back of the board. Remove the jumper block which is installed on J1, flip it over, and install it as shown in Figure F-6 so that it engages *only* the *upper* row of pins on J1.

<div align="center">

CAUTION

</div>

Failure to install the J1 jumper correctly will result in damage to the system.

Figure F-5. MCB *Controller Board (showing J1 position and U1, U2 and U8 locations)*
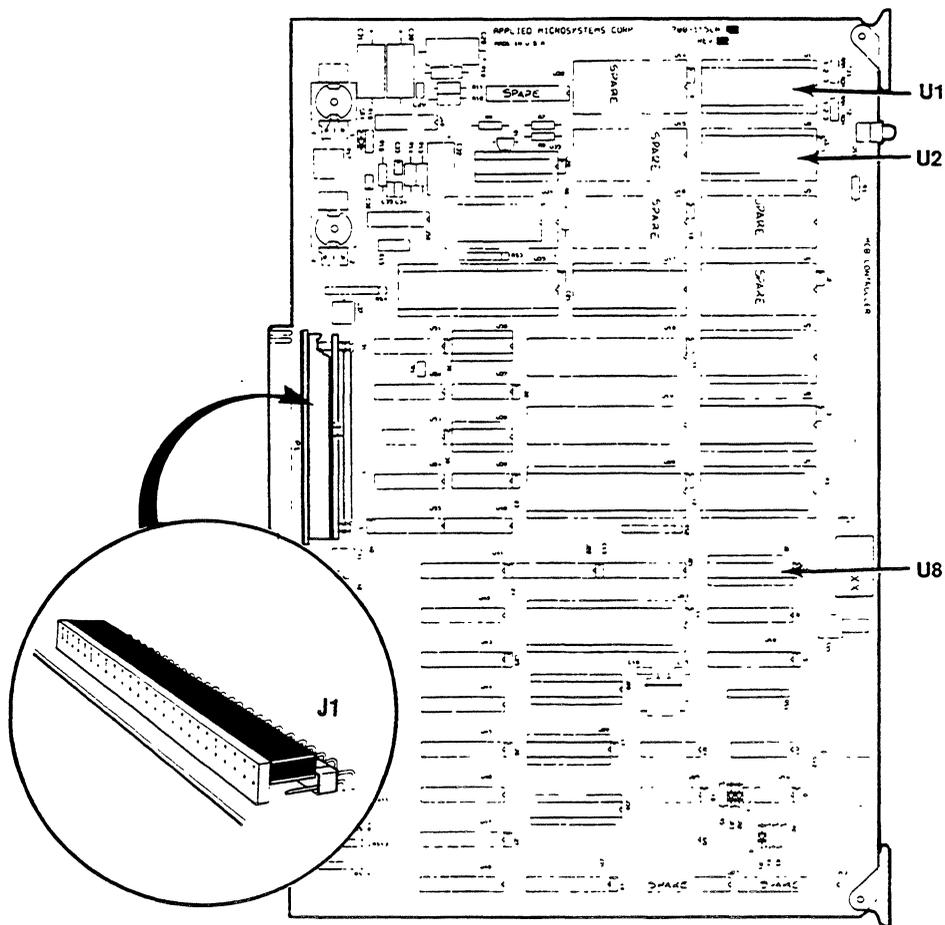
Figure F-6. J1 Jumper Block Positions

Correct position
when no SCSI board
is installed
(MCB in first slot)

Correct position
with an installed SCSI board
(MCB in second slot)
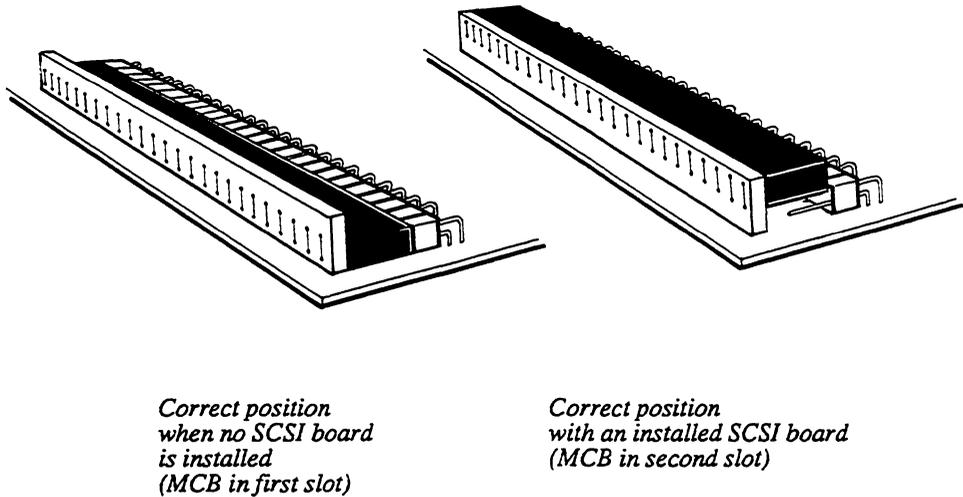
Installing Symbug (if ordered)

If you want the ability to download symbols, you must install the Symbug option. Many MCBs already have this option installed.

1. Check locations U1 and U2 on the MCB controller board. (see Figure F-5). If there are IC's installed in these locations, the Symbug option has already been installed. If there are no IC's installed, continue with step 2.

2. Remove the part installed in location U8. Under static-controlled conditions, install the following parts included in the Symbug option in the locations listed in Table F-1. Be sure that pin 1 (notched end) is installed at the notched end of the socket.

Table F-1. Symbug Parts Installation

Location	Part Number	Description
U8	341-00142-00	PLA,MCB,SYMRAM
U1, U2	335-11258-00	IC,SRAM,32Kx8

Installing the MCB and the SCSI Controller Boards

Install the MCB controller board in the *second* slot from the top, and the supplied SCSI controller board in the *top* slot. Make sure both boards seat firmly in the backplane.

Verify that the toggle switch just to the right of the thumbwheel switch on the MCB board is in the center position.

CAUTION

Reversing the location of the MCB and SCSI controller boards will result in severe damage to your system. The SCSI board must be installed in the TOP slot.

Installing the SCSI/Serial Switching Cable

The Y-cable supplied with your upgrade kit enables communication between the MCB and the SCSI boards. It also allows rapid switching from serial to SCSI communication between the host and the ES 1800 emulator. Switching procedures are described in Section 2S of your *ES Driver/PC User's Manual.* For now, just install the cable as described below.

1. Inside the back of the ES 1800 chassis are the TERMINAL port and the COMPUTER port connections to the backplane. (The TERMINAL port is above the COMPUTER port.) Check these connections so you are familiar with their orientation (for reconnection), and then pull them loose from the backplane connectors.

   If your unit has a shield installed over the backplane, you will need a pair of needle-nosed pliers to reach the connections and gently disconnect them.

2. The SCSI/serial switching cable has two closely spaced connectors on one end. Make sure you orient the connectors correctly! The connector with both cable strands connects to the MCB. The 12" long cable extension should be on the left side of the MCB connector as you face the front of the emulator (see Figure F-7). Plug the second connector into the SCSI board. Make sure all connections are firmly seated.

3. Run the cable extension over the top of the chassis towards the COMPUTER port connection on the backplane. Make sure the cable lies flat and will not interfere with the replacement of the top and front ES 1800 covers.

4. Match pin 1 on the extension connector with pin 1 of the COMPUTER port ribbon connector. Both connectors have notched arrows to indicate pin 1. Seat the connector firmly, but without forcing it. See Figure F-8.

CAUTION

Make sure that the connector is not improperly placed up one row or offset left or right.

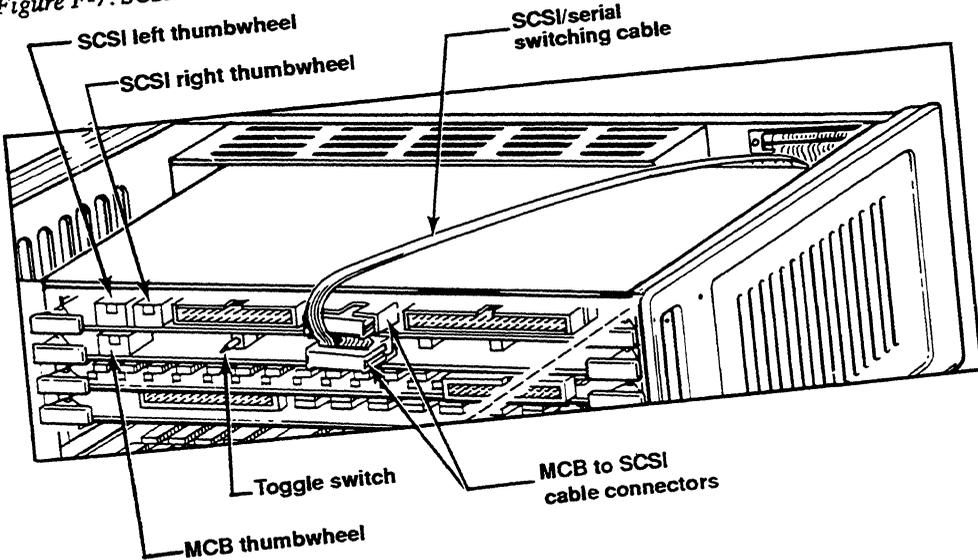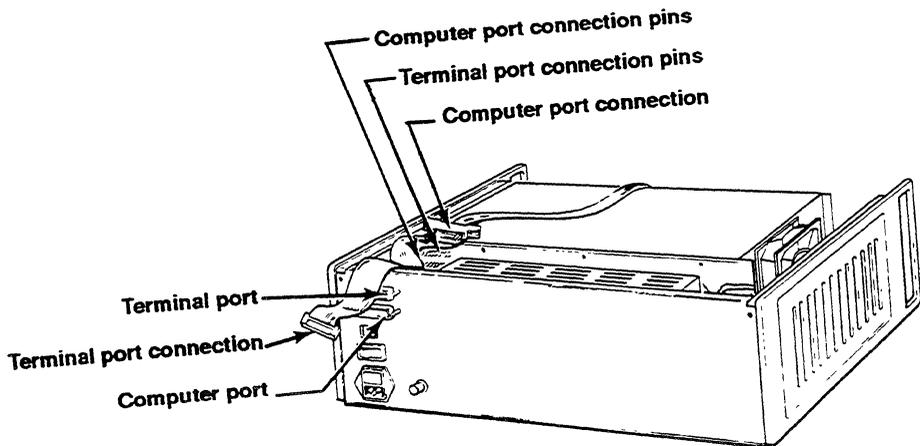*Figure F-7. SCSI/Serial Switching Cable Connection (Front)*

SCSI left thumbwheel

SCSI/serial
switching cable

SCSI right thumbwheel

Toggle switch

MCB to SCSI
cable connectors

MCB thumbwheel

Figure F-8. SCSI/Serial Switching Cable Connection (Rear)

Computer port connection pins

Terminal port connection pins

Computer port connection

Terminal port

Terminal port connection

Computer port

F-11

SCSI Disk Protocol Option

5. Reconnect the TERMINAL port connection to the backplane as before. Ensure that both rows of pins seat firmly.

6. Your SCSI/Serial switching cable is now connected. Pack the remaining length of the cable down behind the backplane near the TERMINAL and COMPUTER port connections. The cable should run neatly across the top of the ES 1800 chassis, without extra slack.

7. Replace the top and tighten the phillips screws.

8. Go to "Host Adapter Installation."

Host Adapter Installation

Your SCSI-equipped ES 1800 communicates with a PC host through a SCSI host adapter. The Applied Microsystems' interface works with many available SCSI adapters and specifically supports the Future Domain TMC 800 line and Emulex IB02. If you ordered one, a Future Domain host adapter is included with your system. Other SCSI adapters may work, including Adaptec AH-1520, Western Digital WD-7000-ASC FASST2, and Software Architect Formater Three.

Installing the Future Domain TMC

If you choose to use a Future Domain SCSI host adapter, you must install it in your PC and connect your system components before beginning your software setup.

Installation is a two-step process:

- setting the jumpers on the Future Domain card (if necessary)
- installing the card in the PC

Future Domain adapter installation is straightforward, provided there are no conflicts with other adapters you may have in your PC. The types of adapters likely to conflict are ones that use the hardware interrupts or contain a BIOS ROM. A VGA adapter may also cause memory conflicts. If you don't have adapter cards that may conflict, you may leave the jumpers on your Future Domain card as shipped from the factory.

If there are conflicts or you need technical data about the Future Domain card, see the Future Domain manual shipped with the adapter card. It includes detailed information about changing memory addresses, interrupts, and jumper settings. You may also need to refer to the manuals for your other adapters.

NOTE

When performing any of the procedures described in this step, use appropriate anti-static protection measures, including static-free bench pads and a grounded wrist strap.

Inserting the Future Domain Card in Your PC

Once you have the jumpers set correctly, you are ready to install the Future Domain TMC in your PC system.

1. Power down your PC, and remove its cover.
2. Locate an unused I/O expansion slot, and remove the screw that secures the system expansion slot cover to the card support. This screw is located at the top of the panel for the slot.

3. Plug the Future Domain TMC card into the I/O expansion slot.

4. Align the hole in the angle bracket with the hole in the expansion card support of the PC. Use the screw from step 2 to secure the card in place.

5. Boot the PC to make sure it works with the Future Domain card installed. If you see your normal sign-on and prompt, the card is installed correctly.

   If not, there is probably a conflict between the card and another adapter. Check the DMA, interrupt, and BIOS addresses against the settings of your other adapters. See Future Domain's *User's Guide* and the manuals for your other adapters to resolve conflicts.

6. Replace the cover on the PC.

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Connecting the Equipment

You may connect your ES 1800 emulator to your host computer via either the SCSI cable, the RS-232 cable, or both. You must also connect your target system to the emulator via the pod cable. This section provides step-by-step procedures for connecting the emulator to the target system and to the SCSI bus. RS-232 serial communications via the SCSI controller board are discussed in section 2S of the *ES Driver User's Manual.* If you are running VALIDATE/XEL, you cannot switch communications type on the fly; so you must configure for SCSI if you have a SCSI controller installed in the ES 1800.

Safety Precautions

The emulator contains a 3-wire cord with a 3-terminal polarized plug for connection to the power source and protective ground. The grounding terminal is connected to the metal chassis parts of the instrument. The emulator provides electrical shock protection only if the plug is plugged in to an outlet with a properly grounded protective ground contact.

Emulator/Target System Connection

Your *ES 1800 User's Manual* provides complete information about pod types and connections. In general, you must connect the emulator to your target or an Applied Microsystems null target before initializing the emulator.

1. Make sure the pod type (68000, for example) is the same as the microprocessor being emulated.
2. With the power off for both the emulator and the target system, remove the microprocessor from the target socket noting the location of Pin 1. Replace it with the emulator's probe tip. Make sure the bevel or Pin 1 indication on the emulator probe tip is aligned with Pin 1 on the microprocessor socket.

<div align="center">CAUTION</div>

> *The pins in the probe tip are fragile. If they are banged against other objects, they may break. If they are broken, the emulator will not function properly. The probe tip and/or pins must be replaced if pins are broken or damaged.*

Host/Emulator SCSI Connections

New systems and some upgrade kits include a cable and a terminator resistor network. Use these or equivalent components to connect the ES 1800 and the PC.

The SCSI standard specifies that the cabling should be installed as a "bus" topology, rather than a "star" or "tree" network, and that one terminator resistor set should be installed at each end of the bus.

A terminator resistor network has connectors on both sides and resistors in the middle. The terminator resistor is plugged in to the end device and to the cable.

*Figure F-11. Terminator Resistor*
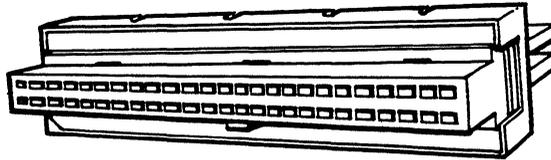
The Future Domain and Emulex host adapter cards have built-in terminator resistors. If you are attempting to use SCSI host adapter other than these, it must have either an external or an internal terminator resistor if the PC forms one end of the bus. The Future Domain resistor set may be removed, if necessary, to suit your particular configuration. For example, it may be easier to remove the adapter's terminator resistors and install the PC in the center of the bus than to remove the terminator resistors from external drives that terminate the bus. Note that devices that do not terminate the bus should not have terminator resistors.

Before hooking up the SCSI cable, you need to determine where to attach the other terminator resistor network. Its placement depends on the configuration you choose. What follows describes the basic host-emulator configuration. If you plan to attach multiple SCSI devices (drives, additional emulators, etc.) to the bus, follow the instructions in "Complex Bus Configuration" later in this appendix. Then complete the remainder of steps in this section.

In a basic host-to-emulator configuration, plug in the terminator resistor network between the SCSI cable and the 50-pin SCSI connector on the front of the SCSI controller of your ES 1800. Be sure that pin 1 matches from cable end to terminator to SCSI board. Plug the other end of the cable into the SCSI connector of your PC's host adapter.

Figure F-12. Host and Emulator are Only Devices on SCSI Bus
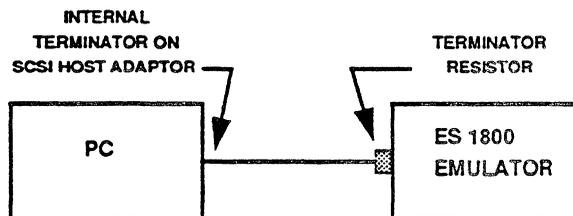
Installing the SCSI Disk Support Software

This section explains how to install the support software included with your system and to configure the ES 1800 as a disk device on the SCSI bus. The section is organized as follows:

- General overview of the support software
- Future Domain and Emulex autoconfiguration
- Generic adapter autoconfiguration
- Troubleshooting

Each of the two autoconfiguration sections provides a quick-start which should work in most situations.The troubleshooting section covers typical problems and diagnostics for the type of adapter in use.

Complete technical specifications for the SCSI Disk protocol support software is included in the **SCSIREAD.ME** file on your SCSI Support Software distribution disk. You may print or view this file, using DOS commands or your text editor.

Description

The SCSI Disk protocol support software provides a BIOS level, disk compatible interface for PC host communication with Applied Microsystems' SCSI Disk protocol emulators. It consists of two executable modules, AMCSCSI.EXE and EMX.EXE. AMCSCSI.EXE is a Terminate and Stay Resident (TSR) program that serves as a device driver for Future Domain, Emulex, and many other SCSI host adapters. The second module, EMX.EXE, is a configuration utility program that configures the TSR and enables software diagnostics.

Only functions that are required by application software are included in the TSR. EMX.EXE provides the remaining initialization, configuration, and diagnostic functions not required by an application program while it is running. Dividing the support software into two parts minimizes resident memory use to less than 17 K.

Used together, the two modules allow the ease of automated standard configuration or the flexibility of a command-line driven interface for custom configurations. Included are

- Support for the TMC-800 line of Future Domain interface adapters (845, 850, 860, 870, 875, 885). This includes systems which use a Future Domain controller with an existing SCSI hard disk.
- Support for the Emulex IB02 interface adapter.
- Support for other interface host adapters via a generic SCSI disk mode. Adapters currently known to work in the generic mode are the Adaptec AHA-1520, Western Digital WD-7000-ASC FASST2, and Software Architect Formatter Three.

- Seamless integration into the BIOS disk interface scheme via the PC BIOS `int13h`.
- Autotest for TSR installation.
- Verification of proper connection and low-level SCSI communication with the SCSI disk emulator.
- Automatic detection of the SCSI interface adapter type and correct interface with it. You may override any automatic configuration selection using the command line interface.
- Selective configuration of the host interface adapter to recognize SCSI disk emulators with any SCSI device ID and LUN. (Supported only with Future Domain and Emulex interface adapters.)
- Diagnostic information about the TSR initialization and configuration process. (Supported only with Future Domain and Emulex interface adapters.)
- Trace file capability and different levels of diagnostic trace information.
- Hotkeys to enable/disable tracing via `int9h`.

Features and Operation

The resident (TSR) device driver AMCSCSI.EXE and the non-resident initialization/ configuration program EMX.EXE work together to manage the SCSI bus so that emulators set to a selected SCSI ID are recognized by the host adapter and communication occurs. Figure F-13 illustrates how the two fit into SCSI Disk protocol software configuration.

How EMX.EXE Works

The non-resident configuration program, EMX.EXE, communicates with the device driver via the `int13h` interface. All requests to initialize and configure the device driver are made via `int13h` requests. EMX.EXE knows about the extended `int13h` function codes supported by the device driver and uses them to initialize and configure the device driver.

What AMCSCSI.EXE Does

The device driver portion AMCSCSI.EXE is chained into the BIOS `int13h` hard disk handler and intercepts all `int13h` requests. It processes any requests that are intended for itself and passes on all other requests to the original `int13h` interrupt request handler. The device driver maintains a local configuration table that keeps track of all SCSI and non-SCSI disk devices recognized by the BIOS level interface.

Figure F-13. Roles of the Support Software Modules
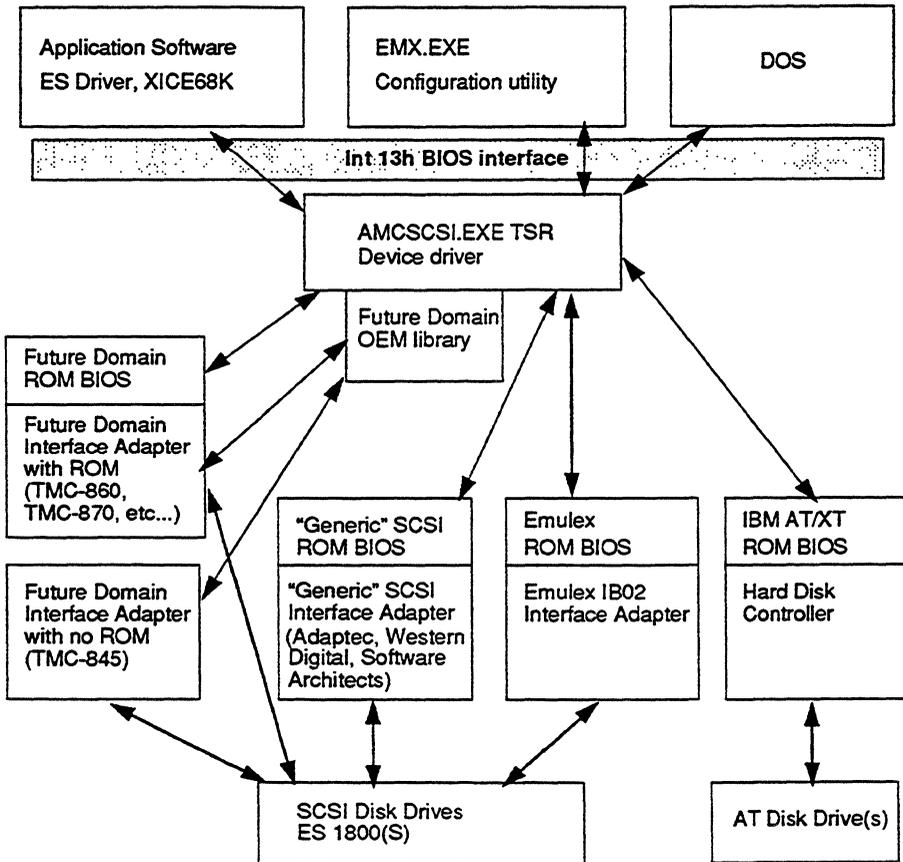
The device driver's local configuration table is initialized the first time that the EMX.EXE program is run. Until this occurs, the device driver is inactive, and passes on all int13h function codes except those specific to the device driver. At initialization time, EMX.EXE polls the BIOS for a list of currently supported disk devices. The results are then used to configure the AMCSCSI TSR.

Logging and Diagnostics

Since the AMCSCSI TSR device driver processes all requests to and from the SCSI Disk protocol emulator, it is possible for it to log all requests to a log file. A bit mask is provided to filter the type of information logged. Because the TSR cannot access the internals of the

ROM BIOS of generic adapters, much of the SCSI specific information that can be logged when using either the Future Domain or Emulex adapter is not available when using a generic adapter.

The device driver supports hotkeys for enabling and disabling logging by intercepting the keyboard hardware interrupt int 9h. Hotkeys allow logging to be enabled or disabled while an application is running, minimizing the amount of information logged to that directly related to the event of interest.

ES 1800 Hardware Settings

During the configuration process, you must select a SCSI ID for each emulator, program the TSR, and set the emulator's selection switches to match. Once you have selected the SCSI ID for the ES 1800 and programmed the TSR, you use the two thumbwheels located on the SCSI controller and one thumbwheel on the MCB controller to set up the ES 1800. Figure F-14 shows thumbwheel locations.

Figure F-14. Thumbwheel Locations on MCB and SCSI Controllers
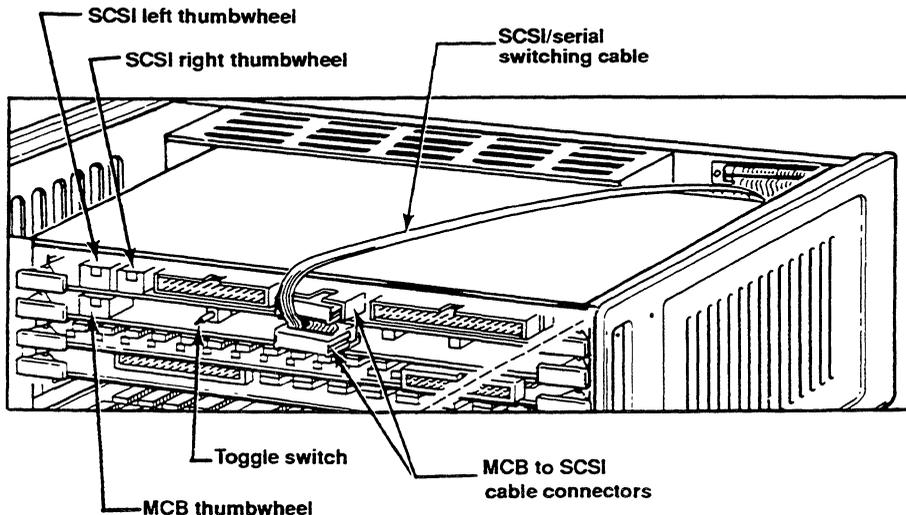
1. Turn the thumbwheel switch on the MCB controller board to "B." This sets the baud rate between the SCSI controller board and the MCB controller board to 19,200. This switch normally remains at "B."

NOTE

You may choose to save and restore system variables from the MCB EEPROM automatically at power-up. In such cases you may use settings 1 (user 0) or 2 (user 1). The variables you may save and the procedures for using them are described in the Advanced Features section of your *ES Driver User's Manual* and under the SAV command in your *ES 1800 User's Manual*.

2. On the SCSI controller board, locate the two thumbwheel switches to the left of the SCSI/serial switching cable.

3. Set the left switch. Setting 1 is recommended for most PCs. Setting the switch to 1 selects the PC defaults, no parity. Set it to 3 to select PC defaults with parity enabled. You should only enable parity if your host system requires it. Most hosts ignore parity; some will fail if parity is enabled. Use of the software parity generation scheme (switch position 3 or parity setting in the menu for user-defined setup) may affect performance slightly.

4. The right switch assigns a SCSI ID to the emulator. You select this number during host adapter configuration. Turn the thumbwheel to the appropriate number.

The following tables identify the values for each setting of the SCSI controller thumbwheels.

Figure F-15. SCSI Board Right Switch Values

Switch (ID)	Description
0-7	SCSI IDs 0-7
8-F	SCSI IDs 0-7 with diagnostics enabled (see "Troubleshooting SCSI Hardware")

Figure F-16. SCSI Board Left Switch Settings

Switch position	Host
0	User-defined setup, found in battery backed RAM
1	Configure for PC defaults; parity disabled.
2	Configure for Sun defaults; parity disabled
3	Configure for PC defaults; parity enabled
4	Configure for Sun defaults; parity enabled.
E	Transparent Mode Pass data from MCB to TERMINAL port (no SCSI function) (Must set terminal or PC baud rate to 9600)
F	Battery backed RAM setup menus

Autoconfiguring Future Domain and Emulex IB02 Adapters

The procedures that follow assume you have completed the hardware installation steps explained earlier in this guide. Your ES 1800 must be connected via the SCSI cable to a Future Domain or Emulex IB02 adapter.

Quick Start

If you are using any Future Domain SCSI host adapter or the Emulex IB02, the support software has an autoconfiguration mode. The following procedures should establish communication if the emulator is properly connected. If you encounter any problems, see "Troubleshooting SCSI Configuration" that follows for additional details.

1. Insert the SCSI Support Software disk in your floppy drive, and copy the EMX.EXE and AMCSCSI.EXE files to the installation directory on your hard disk:

   COPY A:*.EXE <return>

2. From within the installation directory, invoke the AMCSCSI TSR:

   AMCSCSI <return>

   You should see the following:

   ```
   amcscsi.exe - SCSI Disk Protocol Emulator Driver
   Version 2.x, Copyright 1990, Applied Microsystems Corporation
   ```

3. With the ES 1800 power off, invoke EMX.EXE from within the installation directory, using the following switches:

   EMX -A -V <return>

   The next to last line of the response, should be similar to the example below. Available IDs will vary depending on the number of SCSI devices on your system's SCSI bus:

   ```
   Autoconfiguration SCSI ID's available for emulator:1 2 3 4 5 6 7
   ```

   If you see instead a message containing the following line, you probably have not connected the host adapter and emulator correctly:

   ```
   Generic SCSI host adapter cannot be autoconfigured
   ```

   Check that Pin 1 carries through from the SCSI cable, to the terminator, to the ES 1800 SCSI controller. Then repeat this step.

4. Select one of the available SCSI IDs shown, and set the right thumbwheel of the SCSI controller board to it. See Figure F-14 if you need help locating the proper switch.

   Note this number. You will use it later in the Device Number field of ES Driver's Configuration menu or the Communications section, device number field (DEVICE:*n*), of the XICE68K configuration file.

5. Set the left thumbwheel to 1 (standard PC setting)

6. Set the MCB thumbwheel to "B."

7. Turn on power to the ES 1800.

8. Re-invoke EMX.EXE:

   EMX -A -V <return>

   You should see the following:

   ```
   emx - SCSI Disk Protocol Configuration Program

   Version 2.0.0 Copyright 1990, Applied Microsystems Corporation

   Autoconfiguration SCSI ID's available for emulator: 1 2 3 4 5 6 7

   Responding emulator(s) with SCSI ID's: 2
   ```

   The number on the last line should match the right thumbwheel switch setting. If you receive this message, your emulator is connected correctly to the host and communicating via the SCSI interface. If you are unsuccessful, see "Troubleshooting Future Domain and Emulex IB02 Configuration" later in this appendix.

9. Modify your AUTOEXEC.BAT or emulator initialization batch file. See "Continuous Operation."

10. You may now install your emulator control software. See your *ES Driver/PC User's Manual* or the *VALIDATE/XEL Installation and Learning Guide* for procedures.

Continuous Operation

As with any TSR device driver, when you power down or reboot the PC, the device driver is lost. AMCSCSI.EXE and EMX.EXE must be run each time you initialize (boot) your PC and before you start or configure either ES Driver/PC or XICE68K. To allow proper configuration of the device table when you boot the PC, the ES 1800 emulator must be connected to the PC, powered up, and responding.

To avoid manually reloading the device driver each time you boot your PC, you can invoke AMCSCSI.EXE and EMX.EXE in your AUTOEXEC.BAT file or emulator initialization batch file.

Once you have used EMX.EXE to verify initial configuration, you can add the following lines to your batch file:

```
AMCSCSI
EMX   -a   -v
```

You must also include the location of these files in your PATH statement.

You must run EMX.EXE and configure for SCSI communication (even if you plan to switch to RS-232 communication) as long as you have a host adapter in your PC and a SCSI controller installed in the ES 1800.

Autoconfiguring Other SCSI Host Adapters

The procedures explained in this section apply to SCSI host adapters other than the Future Domain or Emulex IB02. They assume you have completed the hardware installation steps explained earlier in this guide. Your ES 1800 emulator must be connected to the PC, powered up, and responding to begin configuration of the local device table.

Quick Start

If you are not using either the Future Domain SCSI host adapters or the Emulex IB02, EMX.EXE cannot interpret and make changes to the adapter's ROM BIOS. You must provide additional information as you proceed with installation. You should know what SCSI ID your adapter card uses and the SCSI ID of any other installed SCSI drive and devices. See your adapter and device manuals for information.

The following procedures should establish communication if the emulator is properly connected, powered on, properly configured, and responding when you boot your PC. If you encounter any problems, see the "Diagnostics" section that follows for additional details.

1. Set the right thumbwheel switch of your SCSI controller board to any number between 0 and 7 that isn't used by your host adapter or another SCSI drive. This number represents the SCSI ID used by the emulator. Typically the adapter uses 0 and sometimes requires that disk drives use sequentially higher numbers.

   If you need help locating the proper switch, see Figure F-14.

2. Set the left thumbwheel to 1 (default PC setting).

3. Set the MCB thumbwheel to "B."

4. Insert the SCSI Support Software Disk in your floppy drive, and copy the EMX.EXE and AMCSCSI.EXE files to the installation directory on your hard disk:

   COPY A:*.EXE <return>

5. Cycle power to the ES 1800; then re-boot your PC.

6. From within the installation directory, invoke the AMCSCSI TSR:

   AMCSCSI <return>

   You should see the following:

   ```
   amcscsi.exe - SCSI Disk Protocol Emulator Driver

   Version 2.x, Copyright 1990, Applied Microsystems Corporation
   ```

7. With the ES 1800 power on, invoke EMX.EXE from within the installation directory:

   EMX <return>

   The response should be similar to the following:

   ```
   emx - SCSI Disk Protocol Configuration Program

   Version 2.0.0 Copyright 1990, Applied Microsystems Corporation
   ```

```
SCSI disk emulator(s) recognized as drive(s): 81 with unknown SCSI ID
```

If you receive a similar message, your emulator is connected correctly to the host and communicating via the SCSI interface.

8. Subtract 80 from the number shown on the last line. Use this number in the Device Number field of ES Driver's Configuration Menu or as the Communications section in the XICE68K configuration file.

   For example, if the number returned by EMX is 86, use 6 in ES Driver's Device Number field or in the Communications section, SCSI device number field (DEVICE:6), of XICE.CFG.

9. Modify your AUTOEXEC.BAT file or emulator initialization batch file. See "Continuous Operation."

10. You may now install your emulator control software. See your *ES Driver/PC User's Manual* or the *VALIDATE/XEL Installation and Learning Guide* for procedures.

Continuous Operation

As with any TSR device driver, when you power down or reboot the PC, the device driver is lost. AMCSCSI.EXE and EMX.EXE must be run each time you initialize (boot) your PC and before you start or configure either ES Driver/PC or XICE68K. To allow proper configuration of the device table when you boot the PC, the ES 1800 emulator must be connected to the PC, powered up, and responding.

To avoid manually reloading the device driver each time you boot your PC, you can invoke AMCSCSI.EXE and EMX.EXE in your AUTOEXEC.BAT file or emulator initialization batch file.

Once you have used EMX.EXE to verify initial configuration, you can add the following lines to your batch file:

```
AMCSCSI
EMX
```

You must also include the location of these files in your PATH statement.

You must run EMX.EXE and configure for SCSI communication (even if you plan to switch to RS-232 communication) as long as you have a host adapter in your PC and a SCSI controller installed in the ES 1800.

Troubleshooting SCSI Configuration

Problems in installation and configuration of your SCSI Disk protocol system can occur at a hardware or software level. This section explains several features of the SCSI support software that are useful in diagnosing and correcting problems at the software level. The section that follows, "Troubleshooting SCSI Hardware," covers SCSI hardware diagnosis.

Troubleshooting Future Domain and Emulex Configuration

If you have installed either a Future Domain TMC or the Emulex IB02 host adapters, you may add additional devices to those initially recognized by the adapter. Once the TSR device driver knows about the non-SCSI and SCSI disk devices attached to your system, it can be configured to add SCSI Disk protocol emulator devices to its local configuration table.

In autoconfiguration mode (-a), EMX.EXE and the AMCSCSI.EXE TSR interpret and modify the adapters' configuration tables to automatically configure remaining free entries as SCSI Disk protocol emulators. In most cases, the autoconfiguration mode results in proper communication. Problems typically occur in a complex installation. For example, it is possible to have both Emulex and Future Domain adapters installed in the PC at the same time. By default, the Emulex controller is used. If your emulator is connected to the Future Domain card, it cannot communicate with the host PC.

In such a case, it is possible to override the autoconfiguration process. You use the EME.EXE command line interface to force use of the Future Domain adapter for communication with the emulator. In the process of configuring the device driver, EMX can also be instructed to perform BIOS level read requests to verify the presence of a properly functioning emulator. The command line would be as follows:

```
EMX -F -V
```

See the -f and -v argument in the "Configuration Command Line Arguments" section. Similar arguments are available for the Emulex and generic host adapters. If these are unsuccessful, see the "Diagnostics" section to log TSR activity for analysis.

Troubleshooting Other Host Adapter Configurations

Since virtually all SCSI host adapters configure themselves as part of the PC's boot initialization process, SCSI devices must be present and responding at boot time in order to be recognized by an adapter. Because the EMX.EXE configuration program and the AMCSCSI.EXE TSR do not have low-level access to the generic adapter's ROM BIOS to support additional devices upon demand, the disk devices reported by the BIOS are the *only* ones available to them. The configuration process requires the following:

- The ES 1800 must be properly connected, powered-up, and responding when the host PC is booted.
- AMCSCSI and EMX configuration occur after the ES 1800 is recognized by DOS.

Though not explicitly supported, the following SCSI host adapters are known to accept the ES 1800 SCSI Disk protocol and recognize the emulator as a SCSI drive:

- Adaptec AHA-1520
- Western Digital WD-7000-ASC FASST2
- Software Architect Formatter Three

In addition, some host adapters have restrictions on the number of SCSI devices they will support. For example, Adaptec's AHA-1520 supports up to two hard disk drives under DOS without a software driver. Typically such drives must be ordered with consecutive SCSI device ID numbers. In a typical host system with one SCSI drive with ID 0, the emulator should be configured to have a SCSI ID 1.

The emulator does not support parity. If there is a parity jumper on the adapter, it should be set to disable parity. If there is no jumper to disable parity, then the adapter may not be able to support the SCSI Disk protocol emulator. The Seagate ST01 and ST02 host adapters require parity, so cannot be used with SCSI Disk protocol emulators.

You may also need to consider that the SCSI controller board in the ES 1800 imitates a Micropolis 1355 disk drive and uses SCSI Logical Unit Number 0 (LUN 0).

Using the Command Line Interface

The same command line interface you used for autoconfiguration can be used for manual configuration in problem situations. It provides two type of arguments: those that force a specific configuration and those that enable logging to record activity of the device driver. This section explains how to use the command line to resolve installation problems. The AMCSCSI TSR must be loaded into memory before you use the EMX command line.

Configuration Command Line Arguments

To view the available command line arguments online, invoke EMX.EXE with a non-existent switch argument such as "emx --. Use the following command line arguments singly or in combination to configure your system.

The first time EMX.EXE runs, it fixes the adapter type. If you use a command that changes the adapter type, you must first reboot and re-install the AMCSCSI TSR. If you find that you must use a special configuration command line to assure proper installation, be sure to modify your AUTOEXEC.BAT or emulator initialization batch file to include the new EMX command line.

-a   Specifies autoconfiguration of the TSR's local configuration table. After reading in all current DOS drive number assignment, the TSR assigns any remaining free entries as SCSI Disk protocol emulators.

-v   Verifies that the selected SCSI Disk protocol emulator is
          active. Used with either the -s or -a argument, this forces
          EMX.EXE to attempt to communicate with the selected
          device. If the device fails to respond, a warning message is
          displayed. Use of this option does not affect the success of
          configuration table modifications.

-f   Forces use of the Future Domain host adapter for SCSI Disk
          protocol emulators. This is useful in situations where more
          than one adapter is installed in the host or when you want to
          assure that configuration uses the Future Domain mode.

          EMX -F -V -A

-e   Forces use of the Emulex IB02 host adapter for SCSI Disk
          protocol emulators. This is useful in situations where more
          than one adapter is installed in the host or when you want to
          assure that configuration uses the Emulex mode.

          EMX -E -V -A

-g   Forces use of the generic mode for SCSI Disk protocol
          emulators. This is useful for manual configuration of non-
          supported adapters and in situations where more than one
          adapter is installed in the host. The Future Domain adapter
          can communicate in generic mode, but the Emulex IB02
          cannot. You cannot use -a with in the generic mode.

          EMX -G -V

-sx   Emulex and Future Domain only. Adds and installs an entry
          with SCSI ID x (0-7). This is useful to assure that the proper
          device is installed at the selected SCSI ID during problem
          installations. To install the ES 1800 at SCSI ID 1, use

          EMX -S1 -F -V

          This command creates the table entry, assigns the SCSI ID
          number, forces use of a Future Domain card, and verifies
          communication.

          You may use either the -f, -e, or -g argument in combination
          with the -s argument to tell the TSR which type of adapter is
          installed.

-d   Emulex and Future Domain only. Deletes device entry from
                                  the TSR configuration. This argument must be preceded by
                                  the -s argument indicating the ID to delete:

                                  `EMX -S1 -D`

-c*nnnn*   For Applied Microsystems use only. Specifies the number of
                                  cylinders for the virtual disk. The default is 1536. The
                                  default must be used for proper SCSI communication with
                                  the emulator.

-h*nn*   For Applied Microsystems use only. Specifies the number of
                                  heads for the virtual disk. Default is 10. The default must be
                                  used for proper SCSI communication with the emulator.

-t*nn*   For Applied Microsystems use only. Specifies the number of
                                  sectors and tracks. Default is 18. The default must be used
                                  for proper SCSI communication with the emulator.

Logging and Diagnostics

Because the AMCSCSI TSR device driver processes all requests to and from the SCSI Disk
protocol emulator, it is possible for it to log all requests to a log file. This section explains
how to use the command line interface to capture information for debugging problem
installations. It covers the methods for logging the output of both AMCSCSI and EMX,
including

- Redirecting to log files
- Using masks to limit captured output
- Using hotkeys to control when output is captured

NOTE

In most cases, you will use these procedures only if requested by your Applied
Microsystems representative. If you understand SCSI specifications and wish
to interpret the output yourself, the SCSIREAD.ME included on the SCSI
Support Software disk contains additional technical information.

Logging AMCSCSI Installation

AMCSCSI.EXE uses a very simple command-line interface. Only one optional command
line argument is recognized.

      `AMCSCSI -P`

The -p option enables diagnostic messages which report whether the TSR is or has been
installed properly. If the TSR has been previously installed, its version number is verified. If
a valid version of the TSR is already installed, then an additional copy is not installed.

To redirect the output to a log file, use the syntax that follows:

```
AMCSCSI -P >filename
```

where filename is replaced by the name of the file you wish to create.

Using EMX.EXE Diagnostic Arguments

The EMX.EXE command-line interface provides a number of arguments specifically suited to tracing the requests passed to and handled by AMCSCSI. These enable and disable logging, specify the file to redirect output to, create masks to filter output, and define hotkeys to invoke and disable logging manually.

Diagnostic Command Line Arguments

-l*filename*

Redirects output of diagnostic information to a log file specified by *filename*. The file logs information from the AMCSCSI TSR only. If no *filename* is specified, then the default operation is to attempt to close an open log file.

For example,

```
EMX -LTEST.LOG
```

opens a log file named *test.log*. Logging is enabled as soon as the log file is opened. Logging is disabled the next time EMX is run.

On the other hand,

```
EMX -L
```

closes the log file, if open.

-k*xxyy*

Defines the hotkey to enable TSR logging to a log file. If no enable hotkey switch is specified, then logging is enabled when the log file is opened. The -l switch with a *filename* must be specified for this switch to take effect. If the -k switch is specified with no hotkey code, then the default enable hotkey, <Alt-Q> is used to enable logging.

The format of the optional hotkey specifier is *xxyy* where *xx* is the shift status and *yy* is the scan code. Both *xx* and *yy* are in hex. See "Changing Hotkeys" for more information.

For example,

```
EMX -LTEST.LOG -K -O
```

opens the log file *test.log* and enables the default hotkeys <Alt-Q> to enable logging and <Alt-S> to disable logging. Logging begins when <Alt-Q> is pressed.

-m*nnnn*	Specifies the log file message selection mask. The default mask is hex 7f5 (log all transactions except block data). The mask value must not be preceded by 0x. The *-lfilename* switch must be specified for this switch to take effect. Bit assignments (in hex) are as follows:

0001 - log read sector requests
0002 - log read sector data
0004 - log write sector requests
0008 - log write sector data
0010 - log get parameter requests/data
0020 - log adapter type specification requests
0040 - log BIOS drive number requests
0080 - log AMC TSR ID requests
0100 - log AMC configuration table pointer requests
0200 - log all errors
0400 - log all SCSI commands
0800 - log all SCSI data except R/W sectors
1000 - log all SCSI R/W sector data
2000 - reserved
4000 - reserved
8000 - reserved

For example,

```
EMX -LTEST.LOG -K -O -M0800
```

creates the file *test.log*, specifies the default hotkeys will be used, and limits output to any SCSI data except Read/Write sectors.

-o*xxyy*	Specifies hotkey to disable TSR logging to log file. If no disable hotkey is specified, then logging is disabled when the log file is closed. The *-lfilename* switch must be specified for this switch to take effect. If the -o switch is specified with no disable hotkey code, then the default disable hotkey <Alt-S> is used to disable logging. The format of the disable hotkey specifier is the same as for the enable hotkey switch. See the "-k" switch option above and "Changing Hotkeys" for more information. Logging stops when <Alt-S> is pressed.
-p*n*	Specifies the nature of diagnostic messages from the non-resident initialization program EMX.EXE only. This switch does not affect the log file operation of *-lfilename*. Code values are as follows:

0 - no diagnostic messages except errors
1 - autoconfiguration status messages
2 - local configuration table modification messages
3 - basic operation debugging messages
4 - detailed debugging messages

If no -p switch is specified, the default is 0. If -p is specified by itself, then the default is 2.

To redirect the output of this operation, put this argument anywhere in the command, and follow the command with a redirection symbol and filename:

EMX −A −V −P3 −LTEST.LOG −K −O >EMX.LOG

This command line creates two log files. TEST.LOG monitors the TSR requests and activity. EMX.LOG monitors the EMX.EXE configuration and initialization activity.

-x*nnnn*   Performs a timing test the specified number of repetitions. The test repeatedly reads block 0 of the SCSI emulator disk. The *nnnn* determines the number of reads to do (default=1000).

Using this switch requires that the -sx and -v switches also be used. This switch is invalid if either the -a or -d switches are used

-s*x*   Emulex and Future Domain only. Adds and installs an entry with SCSI ID *x* (0-7). To install the ES 1800 at ID 1, use

EMX −S1

This command creates the table entry, assigns the SCSI ID number, and programs the default values for SCSI disk protocol.

You may use either the -f, -e, or -g argument in combination with the -s argument to tell the TSR which type of adapter is installed.

-v   Verifies that the selected SCSI Disk protocol emulator is active. Used with either the -s or -a argument, this argument forces EMX.EXE to attempt to communicate with the selected device. If the device fails to respond, then a warning message is displayed. Use of this option does not affect the success of configuration table modifications.

Changing Hotkeys

You may change the default hotkeys that enable (Alt-Q) and disable (Alt-S) logging of AMCSCSI activities. Either hotkey command line switch can be followed by a combined scan code and shift status value. The format of the value is *xxyy* where *xx* is the shift status and *yy* is the scan code. Both values must be in hex.

For example, to change the enable hotkey to <Ctrl-Alt-E> and the disable hotkey to <Ctrl-Alt-D>, use the command:

```
EMX -K0C12 -O0C20 -Lfilename
```

In both cases, the first two hex digits "0C" form the logical OR of the <Ctrl> shift status (04) and the <Alt> shift status (08). The last two hex digits, "12" and "20," are the scan key codes for the "E" key and the "D" key respectively. See Figure F-17 for valid scan code and shift masks.

Hotkey switches take effect only when the -*lfilename* switch is used.

Figure F-17. Scan Key Codes and Shift Key Status Masks

Key	Scan Code	Key	Scan Code	Shift Key	Status Masks
1	02	F	21	Right Shift	01
2	03	G	22	Left Shift	02
3	04	H	23	Control	04
4	05	J	24	Alt	08
5	06	K	25		
6	07	L	26		
7	08	Z	2C		
8	09	X	2D		
9	0A	C	2E		
0	0B	V	2F		
Q	10	B	30		
W	11	N	31		
E	12	M	32		
R	13	F1	3B		
T	14	F2	3C		
Y	15	F3	3D		
U	16	F4	3E		
I	17	F5	3F		
O	18	F6	40		
P	19	F7	41		
A	1E	F8	42		
S	1F	F9	43		
D	20	F10	44		

Troubleshooting SCSI Hardware

The ES 1800's SCSI controller firmware provides some useful diagnostic capabilities if you encounter trouble getting your SCSI-equipped system operating. If you connect a PC or dumb terminal to the ES 1800, various information about the SCSI hardware and its interaction with the system may be routed to the ES 1800's TERMINAL port.

Connecting to the Terminal Port

1. Connect one of the following to the TERMINAL port:
   - Dumb terminal
   - PC running ES Driver, Procomm, terminal emulator program, etc.
2. Configure the dumb terminal or the software for RS-232 communications at 9600 baud.
3. Cycle power to the emulator.

Start-Up Self-Test

The SCSI-equipped ES 1800 performs a variety of tests at power-up:

1. When the control software is initiated at power-up, it performs a RAM test of the first 256K, a CRC test of the two SCSI EEPROMS, and some limited testing of other hardware on the SCSI controller board.

   If it encounters any failure, it causes the SELECT LED (left of the thumbwheel switches on the SCSI board) to flash at a 1 Hz rate. Initialization will not progress past this point until the failure is corrected.

2. Following initial testing (3-4 seconds), the control software issues a sign-on message via the TERMINAL port. This shows:
   - Copyright notice and SCSI firmware revision level
   - Thumbwheel settings
   - Board function and SCSI ID number
   - Level of debugging information compiled into the firmware.

   At the same time it reads the thumbwheel settings, it saves them to RAM for later use. Check that the values you selected have been activated.

3. Finally it reads the ESL sign-on to extract the CPU type and reports it in the last line of the message.
   ```
   Applied Microsystems ES1800 SCSI/DISK firmware V1.X
   self test in progress: test complete. no errors
      SCSI board switches = 1/1
      Board function = 1; SCSI address = 1
      Debugging information disabled:
   emulator type = 10 = 8086
   ```

Though you will not get a ">" prompt or be able to perform any operations, the information displayed can be useful for checking the switch settings without removing the front cover. Check that they are set correctly and that the system is reading them correctly.

NOTE

The ES 1800 reads the switches only on power up. So if you have changed a switch setting but haven't cycled power, the new setting will not appear in the diagnostic message.

SELECT LED Flashing

If the system hangs up during power-up, remove the front panel and locate the SELECT LED (left of the thumbwheel switches) on the SCSI controller board. If it flashes at a 1 Hz rate when the system hangs up, there may be faulty connections or a problem with the board components.

1. Turn off emulator power.
2. Reseat both the SCSI and MCB controller boards in the backplane.
3. Check the pin alignment and seating of the SCSI-MCB cable connections.
4. Check the pin alignment and connections for the switching cable and COMPUTER and TERMINAL ports. (Proper installation is explained earlier in this appendix.)
5. Check the thumbwheel settings on the MCB and SCSI controller boards.
6. Turn on emulator power.

Bypassing the SCSI function

If you would like to connect directly to the ES 1800 to verify that the system is working correctly, you may use the Diagnostic Transparent Mode via the TERMINAL port.

To test the function of the emulator alone and bypass SCSI functions:

1. Connect to the TERMINAL port as described "Connecting to the TERMINAL Port." Be sure to set ES Driver or the terminal to 9600 baud.
2. Set the left SCSI thumbwheel to "E," and verify the MCB thumbwheel is on "B."
3. Cycle power to the emulator.
4. You should see:

```
Applied Microsystems ES 1800 SCSI/DISK firmware V1.X
   SCSI board switches = e/1
   Board function = 14; SCSI address = 1
   Debugging information disabled:
COPYRIGHT 19XX
APPLIED MICROSYSTEM CORPORATION
```

```
SATELITE EMULATOR XXXXX
USER = 0, SW = B
#256K AVAILABLE OVERLAY
>
```

5. When the ESL ">" prompt appears, you should be able to begin host-emulator transactions.

If you can perform transactions in Diagnostic transparent mode but not in SCSI mode, you should check the following:

1. SCSI cable connections

2. SCSI device assignments

3. Host operating system configuration

4. Host software configuration

Advanced Diagnostics

Using the **right** thumbwheel switch on the SCSI board, you can route certain debugging information to the TERMINAL port at any time during normal operation. If you call Customer Support, you may be asked to run these diagnostics and report the results.

1. Connect an additional PC or dumb terminal to the TERMINAL port as described in "Connecting to the TERMINAL Port."

2. Set the **right** switch on the SCSI board to a value that equals the SCSI ID number plus 8 hex. Typically this is the value of the right switch plus 8 (hex).

SCSI ID	*Normal* *Switch Position*	*Diagnostic* *Switch Position*
1	1	9
2	2	A
3	3	B
4	4	C
5	5	D
6	6	E
7	7	F

3. Be sure the left switch is positioned at 1 (PC defaults; parity disabled), 3 (PC defaults, parity enabled) or 0 (user-defined parameters).

4. Cycle power on the emulator.

5. The standard sign-on banner is expanded to include:

- Host defaults: If you have selected 1 on the left thumbwheel, it reports standard DOS default selection. If you have created a user-defined configuration (left switch 0), it displays the virtual disk parameters stored in the SCSI board's battery-backed RAM.
- The start of normal operation.
- Virtual disk parameters

```
Applied Microsystems ES1800 SCSI/DISK firmware V2.XX
AMC EPROM Part numbers(even=340-00134-XX)(odd=340-142-XX)
    SCSI board switches = 1/1  CMCB switch=B
    Board function = 1; SCSI address = 1
    Debugging information enabled: STAT DETAIL CMDS PARAM
      ERRS
emulator type = 10 = 8086
Resetting configuration to DOS defaults
beginning normal operation
10 heads, 10 sectors, 1536 cylinders, 512 sector size
276480 blocks of 512 bytes
SCSI DISK ACTIVE
```

Though you do not have an active ">" prompt, error and status information will display during ES 1800 operation. On most emulator drivers, one line of status information appears for every peek and poke operation requested by the host. The status line shows how many bytes are peeked and poked, the starting address, and other related information.

The display of status information out the TERMINAL port does not affect normal operation of the SCSI controller while using SCSI I/O. For example, if ES Driver is used to communicate with the ES 1800, all emulator functions (transparent mode, uploads, downloads, etc.) will work normally. The only difference from normal operation is that during uploads and downloads, a status line displays out the TERMINAL port for each data block transmitted.

NOTE

Do not leave diagnostic transparent mode enabled at all times. If the terminal stops the serial data using the hardware handshake lines or XOFF, the serial buffer in the SCSI firmware can overflow, causing the firmware to lock. This diagnostic mode also significantly slows down operation.

Complex Bus Configurations (Optional)

This section describes the procedures needed to connect additional devices to your host using the SCSI bus. These can include additional ES 1800 emulators, as well as SCSI disk and tape drives. The following instructions assume that you have completed hardware installation and are ready to configure your SCSI bus.

Before you begin, you will need to acquire one or more additional cables, or you can build your own. Guidelines for constructing cables are given in "Building Additional Cables" at the end of this section. Cables 1, 2, and 3, identified in each of the configurations discussed here, match the characteristics described in "Building Additional Cables." Cable 1 is always the host adapter-to-SCSI controller cable supplied with your system or upgrade kit.

The configurations described in this section are recommended because:

- They don't require removal or alteration of the terminator in the devices you are installing.
- You can disconnect any additional emulators without disrupting the operations of your host or other emulators.

Requirements

Three important factors apply whether you're incorporating a disk/tape drive in your PC-ES 1800 configuration or adding multiple emulators:

- A terminator resistor should exist at both ends of the bus.
- Your software configuration must properly identify the SCSI ID numbers.
- You must have the correct SCSI cable:

        Emulex IB02   P/N 600-00041-00 or higher
        Future Domain   P/N 600-01000-00 or higher

Including Disk or Tape Drives

If you are connecting your PC to a single ES 1800 and including a SCSI disk/tape drive on the SCSI bus, your configuration can take two forms. If the tape/disk drive contains a terminator, use the bottom configuration in Figure F-18. If your tape/disk drive has no terminator, use the top configuration.

Figure F-18. Bus Configuration for Added SCSI Disk/tape:

PC with SCSI Host Adapter	SCSI disk/tape	ES 1800
(internal terminator)	(no terminator)	(use supplied terminator)

PC with SCSI Host Adapter	ES 1800	SCSI disk/tape
(internal terminator)	(no terminator)	(internal terminator)
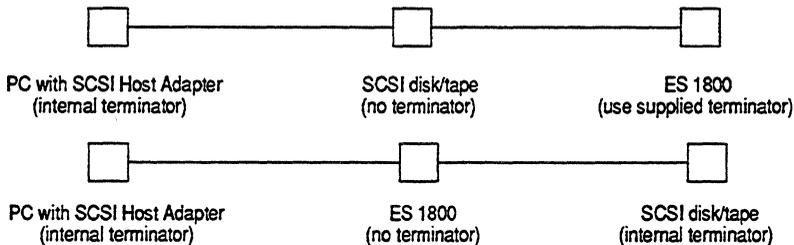
If you have installed a host adapter that has no internal terminator, you must install an external terminator.

Cabling

Figure F-19 shows recommended cabling. Most SCSI disk and tape units have a male 50-pin flat ribbon cable header connector that actually connects to the disk or tape unit. The ES 1800 SCSI controller board also has a male 50-pin flat ribbon cable header connector. For these use a combination of Cable 1 and Cable 2, as described at the beginning of this section.

Some disk/tape combinations have a female DB 50 connector. For these use a combination of Cable 1 and Cable 3.

Figure F-19. Recommended Cabling

CABLE 1*   CABLE 2 or 3

PC with SCSI Host Adapter	ES 1800	SCSI disk/tape
(internal terminator)	(no terminator)	(internal terminator)
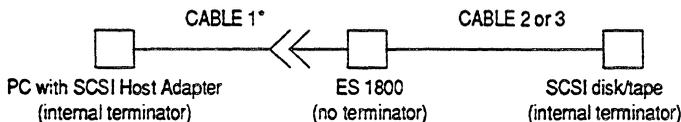
*Be sure your Cable 1 matches the part number given for your console. See page F-39

NOTE

Make sure that pin 1 on all of the connectors is connected to the same conductor in the cable. Actual placement of the female 50-pin flat ribbon cable header for t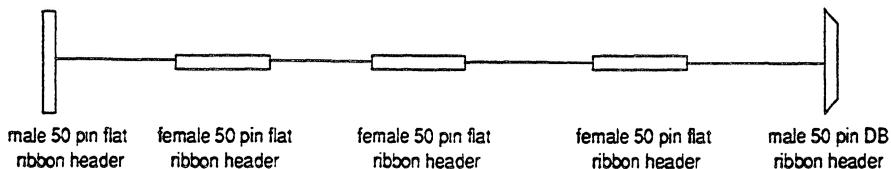he ES 1800 may be customized for the particular installation, but total length of all SCSI cables must be less than 6 meters.

Assigning SCSI Device IDs

Your SCSI disk or tape drive unit can be assigned to any device number from 0 through 7, as long as no two devices have the same device number. If you are using the Future Domain TMC or the Emulex IB02 host adapter, the PC host is assigned SCSI ID 7. The ES 1800 and SCSI disk/tape device can be assigned any other unused number. Return to the "Installing SCSI Support Software" section earlier in this appendix.

For more information on complex configurations, consult the ANSI SCSI specifications, "X3T9.2".

Running Multiple Emulators

You can connect up to seven ES 1800s to your host PC via the SCSI bus. ES Driver/PC will communicate with several different emulators one at a time. VALIDATE/XEL can communicate with only one. The instructions that follow assume that you have already installed a host adapter in your PC host.

SCSI Bus Connections

Figure F-20 shows the recommended connections for three emulators and a SCSI disk/tape. Your choice of Cable 2 or Cable 3 will depend on whether the disk/tape drive uses a male 50-pin flat ribbon header or female 50-pin DB ribbon connector. As long as you include a terminator at both ends of the bus, you may configure your systems as you like.

Figure F-20. Recommended Configuration for Multiple Emulators on the SCSI Bus
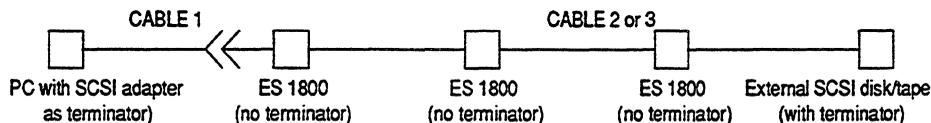
NOTE

Make sure that pin 1 on all of the connectors is connected to the same conductor in the cable. Actual placement of the female 50 pin flat ribbon cable headers for ES 1800s may be customized for the particular installation. Total length of the SCSI cables should not exceed 6 meters. Note that the device furthest from the host must have a terminator installed.

Assigning SCSI Device IDs

SCSI devices can be assigned any SCSI ID from 0 through 7, as long as no two devices have the same device number. You may use the autoconfiguration process described in "Installing the SCSI Support Software" to configure a multi-emulator system. If you are using a non-supported adapter, you will need to determine the SCSI IDs of all the non-emulator SCSI devices on the bus before you begin configuration.

Communicating with Multiple Emulators

This section describes how to talk to multiple ES 1800s with a single PC.

ES Driver/PC

To select one of several ES 1800 emulators connected to the SCSI bus, go to the Configuration menu <F6> and change the SCSI device ID to match the device table line number of the desired ES 1800. Then toggle the communications type from SCSI to RS-232 and then back to SCSI. This tells ES Driver to connect to the new SCSI device.

Spontaneous data returned from a deselected emulator will be lost. When communication is established with a "new" emulator, all communications buffers are flushed.

You can avoid having data flushed by using the shell escape feature of ES Driver to invoke a second copy of ES Driver. When you invoke the second copy, the first copy's communication buffers remain intact. Furthermore, if the second copy of ES Driver does not attempt to communicate with the ES 1800 used by the first copy, all spontaneously returned data will be buffered in the ES 1800. When you exit the second copy of ES Driver, control returns to the first copy, and the buffered data will be properly processed.

Due to memory limitations, no more than two copies of ES Driver can be RAM-resident at the same time.

For XICE68K

Only one copy of XICE68K (VX680x0.EXE) may be run at a time on a PC.

Building Additional Cables

The configurations described in this section use one or more of the three cables described below. You can build these with the components listed for each. The number of ribbon headers will vary according to the number of devices you link together.

1. Cable 1 is the AMC SCSI cable supplied with your system or upgrade kit. Be sure its part number is appropriate to your host adapter:

   Emulex IB02   P/N 600-00041-00 or higher
   Future Domain P/N 600-01000-00 or higher

2. Cable 2 (male-female flat header) can be built using:

   2 or more female 50-pin flat ribbon cable header connectors
   1 male 50-pin ribbon cable header connector
   6 ft. to 12 ft. of 50-conductor ribbon cable
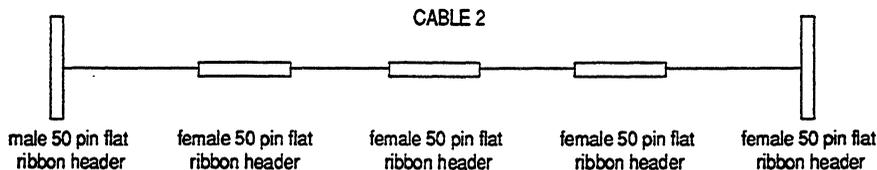
CABLE 2

| male 50 pin flat ribbon header | female 50 pin flat ribbon header | female 50 pin flat ribbon header | female 50 pin flat ribbon header | female 50 pin flat ribbon header |

Make sure that pin 1 on all of the connectors is connected to the same conductor in the cable. Total length of the cables should not exceed 6 meters. Actual placement of the female 50 pin flat ribbon cable headers for ES 1800s may be customized for the particular installation.

3. Cable 3 (male flat header-male DB header) can be built using:

   1 male 50-pin flat ribbon cable header
   2 or more female 50-pin flat ribbon cable header connectors
   1 male 50-pin DB ribbon cable header connectors
   6 ft. to 12 ft. of 50-conductor ribbon cable

| male 50 pin flat ribbon header | female 50 pin flat ribbon header | female 50 pin flat ribbon header | female 50 pin flat ribbon header | male 50 pin DB ribbon header |

Make sure that pin 1 on all of the connectors is connected to the same conductor in the cable. Total length of the cables should not exceed 6 meters. Actual placement of the female 50 pin flat ribbon cable headers may be customized for the particular installation.

SCSI Bus Specifications

The SCSI Bus has the single-ended interface for short (less than 6 meters) bus applications.

For further information about the SCSI Bus, refer to the ANSI standard X3T9.2.

Electrical Specifications

Single-Ended Version (standard)

TTL level signals with 48 mA drive on all outputs

Terminator power (TERMPWR) supported

One set of terminator resistors provided

Parity supported

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Universal PC Communications Cable Kit

This kit contains cables for all possible PC-hosted EL 1600 systems and upgrades of ES 1800 systems to EL 1600. You will have parts left over when you finish installation. The following is a list of the PC cables provided in this kit:

Component	Part number	Component	Part number
HSP/SCSI extension cable	600-01610	25-pin male/male adapter	600-00503
HSP/SCSI TMC-850 cable	600-01972	25-to-9-pin RS-232 cable	600-00078
RJ-11 diagnostic cable	600-12500	HSP/SCSI TMC-850 host adapter	336-00021
RJ-11 to 25-pin adapter	210-12502	HSP/SCSI TMC cable	600-01001
9-to-25-pin adapter cable	600-00031	25-pin RS-232 cable	600-10486

The figures on the next page illustrate typical cable connections.

Please use the information in the table below to verify that you have the documentation appropriate for your application.

Instruction Title	Part Number	Use when . . .
EL 1600 Emulator Hardware Setup and Reference Guide	922-17350 (68000/HC000/ EC000/302)	Installing a new EL 1600 system or Moving ES 1800 components to EL 1600 chassis.
	922-17340 (80C18x)	
ES 1800 to EL 1600 Upgrade Instructions	922-17300	Use with 922-17340 or 17350 when moving ES 1800 components to EL 1600 chassis.
EL 1600 Emulator Hardware Setup and Reference Guide with Upgrade Instructions	922-17298 (68000/HC000/ EC000/302)	Upgrading an ES 1800 chassis to EL 1600 functionality. Replaces 922-17340 or 17350.
	922-17301 (80C18x)	

PC to EL 1600 Chassis

HSP/SCSI host adapter
336-00021

HSP/SCSI TMC Cable
600-01972

25-to-9-pin RS-232 cable
600-00078

RJ-11 diagnostic cable
600-12500

TMC-850
SCSI
Adapter

386/486 PC

9-pin
Port

M

F

M

F

M

M

EL 1600

Rear

Front

9-to-25-pin
RS-232 cable
600-00031

25-pin male/male adapter
600-00503

Legend
F=Female M=Male
·············· =Alternate
          connections

PC or Dumb Terminal

25-pin
or 9-pin
RS-232
Port

M M

F

M

F

9-to-25-pin
RS-232 adapter cable
600-00031

RJ-11 to 25-pin adapter
210-12502

PC to Upgraded ES 1800 Chassis

HSP/SCSI host adapter
336-00021-00

HSP/SCSI TMC cable
600-01001

HSP/SCSI extension cable
600-01610

RJ-11 diagnostic cable
600-12500

TMC-850
SCSI
Adapter

386/486 PC

9-pin
Port

M

F

M

F

M

ES 1800

Rear

Front

25-pin RS-232 cable
600-10486

9-to-25-pin
RS-232 cable
600-00031

25-pin male/male adapter
600-00503

PC or Dumb Terminal

25-pin
or 9-pin
RS-232
Port

M M

F

M

F

9-to-25-pin
RS-232 adapter cable
600-00031

RJ-11 to 25-pin adapter
210-12502

Legend
F=Female M=Male
·············· =Alternate connections

The following diagrams illustrate the pin assignments of the ports and cables for serial communications and diagnostics. If you choose to create your own extension cables, please use these diagrams to determine pin assignment requirements.

EL 1600 Chassis - serial

EL 1600 Chassis - diagnostics

Upgraded ES 1800 Chassis - serial

ES-EL 1600   600-10486   600-00031   PC

TX 2
RX 3
RTS 4
CTS 5
DSR 6
GND 7
DTR 20

2 RX
3 TX
4 DTR
5 GND
6 DSR
7 RTS
8 CTS

DB-25F   DB-25M   DB-25F   DB-25M   DB-9F   DB-9M
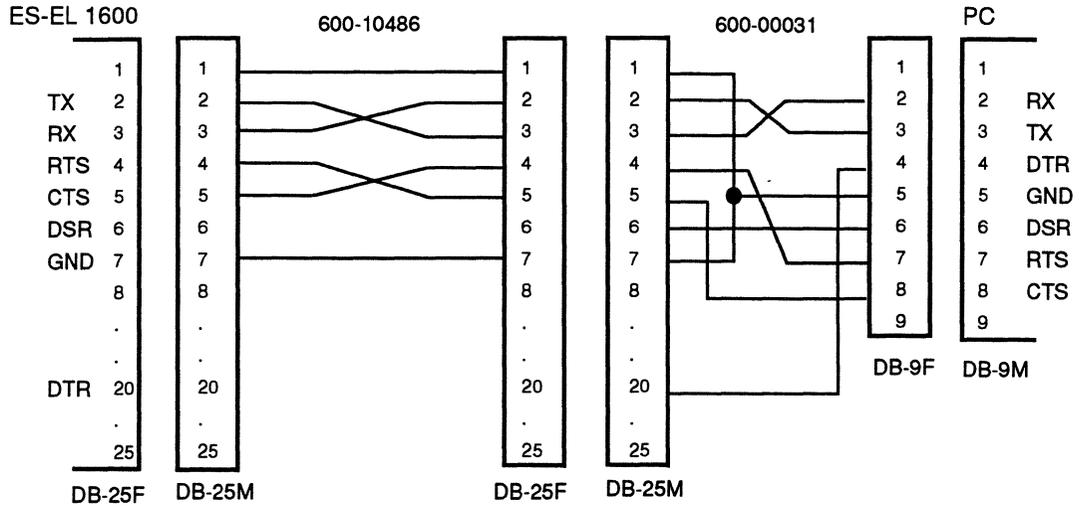
Upgraded ES 1800 Chassis - diagnostics

ES-EL 1600
RJ-11 to 25 pin adapter   600-00503   Dumb Terminal or 25-pin PC   600-00031   PC

GND 1
RX 2
TX 3
CTS 4
RTS 5
GND 7

2 TX
3 RX
4 RTS
5 CTS
6 DSR
7 GND
20 DTR

OR

2 RX
3 TX
4 DTR
5 GND
6 DSR
7 RTS
8 CTS

DB-25F DB-25M   DB-25M DB-25F   DB-25M   DB-9F DB-9M