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TMS320C8x Workstation Emulator

Installation Guide

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TRADEMARKS

Contents

1 Installing the Emulator and C Source Debugger 1-1

Lists the hardware and software you'll need to install the workstation emulator and C source debugger; provides installation instructions for SPARCstations running SunOS or Solaris.

1.1 What You'll Need 1-2
Hardware checklist 1-2
Software checklist 1-3
1.2 Step 1: Connecting the Emulator to Your Workstation 1-5
Locating a SCSI bus with an unused identifier 1-7
Setting the SCSI ID on your emulator 1-8
Adding the emulator onto the SCSI bus 1-9
Terminating the SCSI bus 1-10
1.3 Step 2: Setting Up Your Workstation to Recognize the Emulator 1-11
Modifying your workstation's configuration file 1-11
1.4 Step 3: Allowing the Debugger to Access the Emulator 1-15
1.5 Step 4: Connecting the Emulator to Your Target System 1-16
1.6 Step 5: Installing the Debugger Software 1-17
Mounting the CD-ROM 1-17
Copying the files 1-18
Unmounting the CD-ROM 1-18
1.7 Step 6: Making Sure the Emulator Supports the Debugger 1-19
1.8 Step 7: Describing Your Target System to the Debugger 1-20
1.9 Step 8: Setting Up the Debugger Environment 1-21
Modifying the PATH statement 1-21
Setting up the environment variables 1-21
Invoking the new or modified .cshrc file 1-23
1.10 Step 9: Verifying the Installation 1-24
1.11 Using the Debugger With the X Window System 1-25
Using the keyboard's special keys 1-25
Changing the debugger font 1-26
Color mappings on monochrome screens 1-26

2 Troubleshooting 2-1
Describes problems that you may encounter while installing and using the emulator on your workstation.

2.1 Problems When Booting Your Workstation 2-2
2.2 Problems When Resetting the Emulator 2-3
2.3 Problems When Invoking the Debugger 2-5
2.4 Additional Emulator and Debugger Problems 2-7

3 Interpreting the XDS510WS LEDs 3-1
Provides information about the eight LEDs on the workstation emulator.

3.1 XDS510WS LEDs 3-2
3.2 LED 1 3-2
3.3 LED 2 3-3
3.4 LED 3 3-3
3.5 LEDs 4, 5, and 6 3-4
3.6 LEDs 7 and 8 3-5
3.7 XDS510WS LED Interpretation 3-6

4 Release Notes 4-1
Describes release enhancements and miscellaneous changes for the current release.

4.1 Release Enhancements 4-2
Window Resizing on PCs 4-2
Window Resizing on All Platforms (–bl and –bw) 4-2
Multiple Watch Windows 4-2
Multiple Memory Windows 4-3
Improved Command Line Editing 4-3
New Command SAFEHALT 4-4
New Command LINE 4-4
New PC Debugger Option (–font) 4-4
4.2 Additional Features 4-5
C I/O support (–o option) 4-5
Global breakpoints 4-5
Little-endian support 4-5
Memory accesses less than a word 4-6
Memory access alignment 4-6
Viewing the data cache (CACHEVIEW command) 4-6
Disabling caching 4-7

Figures

1–1 Typical Setup of the Emulator on Your Workstation 1-5
1–2 Rear View of the XDS510WS Emulator 1-6
1–3 Front View of the XDS510WS Emulator 1-6
1–4 Front View of the XDS510WS Emulator 1-8
1–5 Connecting the Emulator to Your Workstation 1-9
1–6 Rear View of the XDS510WS Emulator 1-10
1–7 The External Terminator for SCSI Bus Termination 1-10
1–8 Connecting the Emulator to Your Target System 1-16
1–9 Command Setup for the Debugger 1-21
3–1 XDS510WS LEDs 3-2
3–2 Standard LED Sequences 3-6

Tables

1–1 Options for Use With D_OPTIONS 1-22

Examples

1–1 Locating the Name of Your Configuration File 1-11
1–2 Setting Up the EMULATOR Configuration File 1-13
1–3 Running Your Modified Configuration File 1-14

Chapter 1

Installing the Emulator and C Source Debugger

This chapter helps you to install the TMS320C8x emulator, the master processor (MP) and parallel processor (PP) C source debuggers, and the parallel debug manager (PDM) on a SPARCstation running OpenWindows under SunOS version 4.1.x or Solaris version 2.x. After completing the installation, turn to the *TMS320C80 (MVP) C Source Debugger User's Guide*.

Topic **Page**

1.1	What You'll Need	1-2
1.2	Step 1: Connecting the Emulator to Your Workstation	1-5
1.3	Step 2: Setting Up Your Workstation to Recognize the Emulator	1-11
1.4	Step 3: Allowing the Debugger to Access the Emulator	1-15
1.5	Step 4: Connecting the Emulator to Your Target System	1-16
1.6	Step 5: Installing the Debugger Software	1-17
1.7	Step 6: Making Sure the Emulator Supports the Debugger	1-19
1.8	Step 7: Describing Your Target System to the Debugger	1-20
1.9	Step 8: Setting Up the Debugger Environment	1-21
1.10	Step 9: Verifying the Installation	1-24
1.11	Using the Debugger With the X Window System	1-25

1.1 What You'll Need

The following checklists describe items that are shipped with your emulator and any additional items you'll need to use this tool.

Hardware checklist

☐	**host**	A SPARCstation or 100% compatible system.
☐	**display**	Monochrome or color (color recommended).
☐	**interface to host**	A SCSI bus controller with at least one free SCSI identifier (refer to page 1-7 for more information on locating a free SCSI ID).
☐	**power supply**	The external power supply for the emulator.
☐	**emulator**	An XDS510WS emulator.
☐	**SCSI cable**	A SCSI cable used for connecting the emulator to your SPARCstation.
☐	**SCSI terminator**	A SCSI bus terminator if your emulator is at the end of the SCSI chain. Refer to page 1-10 for more information on the SCSI terminator.
☐	**emulation cable**	A cable that connects the emulator to your target system.
☐	**target system**	A board with at least one 'C8x on the emulation scan path.
☐	**connector to target system**	A 14-pin connector (two rows of seven pins). Refer to the *TMS320C80 Data Sheet* for more information on the target system connector.
☐	**required hardware**	CD-ROM drive.
☐	**optional hardware**	A mouse.
☐	**root privileges**	You must have root privileges to configure your SPARCstation and to mount and unmount the CD-ROM.

Software checklist

☐	**operating system**	OpenWindows version 3.0 (or higher) running under SunOS version 4.1.3 (or higher) or Solaris version 2.0 (or higher). If you're using Solaris (also know as SunOS 5.x), you must have the Binary Compatibility Package (BCP) installed; if you don't, get your system administrator's help.
☐	**software tools**	TMS320C8x assembler, linker, and C compiler.
☐	**required files**	† *mpemu* and *ppemu* represent the debugger executable files for the MP and PP, respectively.
☐		† *mvp510ws.out* is the executable portion of the debugger that runs on the emulator.
☐		† *emurst* resets the emulator and downloads mvp510ws.out to the emulator.
☐		† *board.dat* describes your target board to your debugger in terms of what devices are on the emulation scan path.
☐	**optional files**	† *init.cmd* is a file that contains debugger commands and defines a memory map. If this file does not exist when you first invoke the debugger and you don't use the –t option, all memory is initially invalid. This memory map should be sufficient for your needs; however, you may want to define your own memory map later. For more information on defining your own memory map, refer to the *Defining a Memory Map* chapter in the *TMS320C80 (MVP) C Source Debugger User's Guide*.
☐		† The *composer* utility allows you to convert your text board configuration file (*board.cfg*) into a format the debugger can read (*board.dat*).
☐		† *board.cfg* is a text file used to describe your target board in terms of what devices are on the emulation scan path.
☐		† *init.clr* is a general-purpose screen configuration file. If this file isn't present when you invoke the debugger, the debugger uses a default screen configuration.

† Included as part of the debugger package

For more information about these files and about setting up your own screen configuration, refer to the *Customizing the Debugger Display* chapter in the *TMS320C80 (MVP) C Source Debugger User's Guide*.

WARNING

1) **To minimize the risk of electric shock and fire hazard, be sure that all major components that you interface with Texas Instruments devices are limited in energy and certified by one or more of the following agencies: UV, CSA, VDE, or TUV.**
2) **Turn the power off before you connect components and cables.**
3) **Never disconnect or reconnect any cables or other hardware devices while the emulator is turned on.**
4) **Be sure all devices on the SCSI bus, including your workstation, are turned off before you connect the emulator to your workstation.**

1.2 Step 1: Connecting the Emulator to Your Workstation

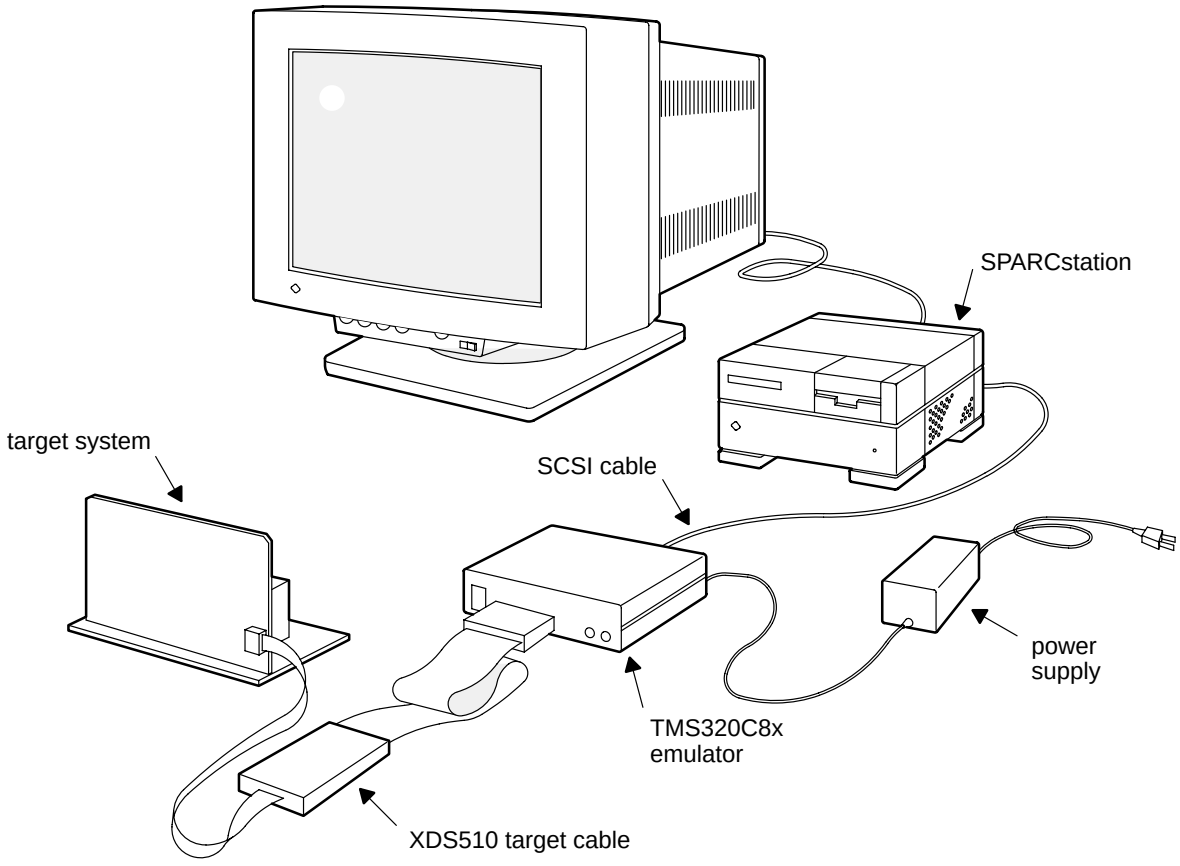
This section contains hardware installation information for the emulator. You *must* have root access to the host machine you intend to connect to the emulator. If you do not, contact your system administrator.

Figure 1–1 shows a typical setup using the emulator, target cable, and your workstation.

WARNING

Turn the power off before you connect components and cables.

Figure 1–1. Typical Setup of the Emulator on Your Workstation



Before you attach the emulator to your workstation, be sure the emulator is working properly. To do this, connect the power supply to your emulator and plug in the power supply (refer to Figure 1–2).

Turn on the emulator. When the first LED light from the left is lit, the emulator power is on. If this light does not come on, check your power connections and restart the emulator.

Refer to Figure 1–3 to locate the LED lights on the front of the emulator. Looking at your emulator, you should notice that the sixth LED from the left is on; this indicates that the emulator is running through a self test. Your emulator is ready and running properly, once the first, second, and fifth indicator lights from the left are on, and the sixth LED from the left is off.

If the first, second, and fifth indicator lights from the left do not come on, something is wrong with the emulator. Recheck your connections and turn the emulator off and on a second time. If the fifth indicator is still not on, shut off the emulator and contact the hotline.

Figure 1–2. Rear View of the XDS510WS Emulator

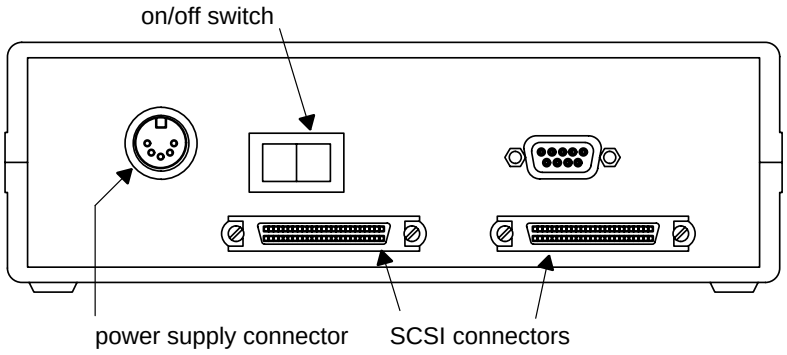
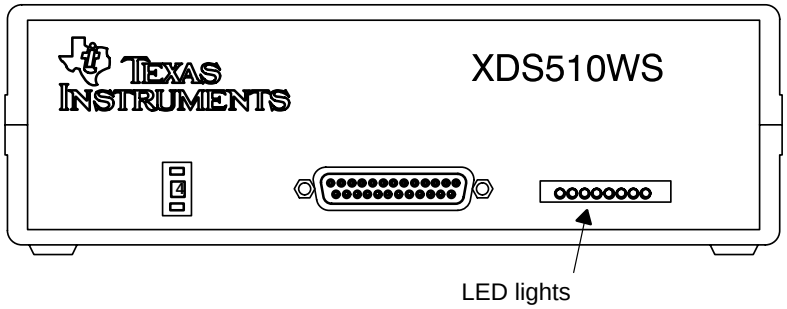


Figure 1–3. Front View of the XDS510WS Emulator



Locating a SCSI bus with an unused identifier

Each SCSI controller in your workstation has its own SCSI bus, and a workstation usually has only one SCSI controller (unless you have added additional controller cards). A single bus can support up to eight different devices, including the SPARCstation, each uniquely numbered 0 through 7, with the higher priority devices assigned to the larger SCSI ID numbers. Your SPARCstation is SCSI ID 7 by default. CD ROMs are ID 6 by default, and tape cartridges are usually ID 2. Your emulator uses SCSI ID 4 by default. If, however, SCSI ID 4 is already used, you must change the emulator's ID to one that is not used.

To get a list of the used SCSI IDs on your workstation, follow these steps:

Step 1: Enter the following command as *root* to get the PROM prompt:

```
halt ⏎
```

Step 2: If you receive the following message:

```
Program terminated
Type b(boot), c(continue), or n(new command mode)
>
```

Type **n** ⏎.

Step 3: After you receive the following message:

```
Type help for more information
ok
```

Type **probe–scsi** ⏎ (or, if you have multiple SCSI controllers, use **probe–scsi–all** ⏎).

You should see a list of used SCSI IDs scroll on your screen; it should look similar to the following message:

```
Target 3
   Unit 0 disk SEAGATE ST1480 SUN Copyright (c) 1992
   Seagate all rights reserved 0000
ok
```

The number following the word *Target* represents the currently used SCSI IDs. In the above message, SCSI ID number 3 is taken.

Note that the SPARC's SCSI ID is stored in the PROM environment variable *scsi_initiator_id* and can be viewed at this point when you type **printenv.**

Setting the SCSI ID on your emulator

If your SPARCstation is already using SCSI ID 4 (see the previous section on locating SCSI IDs), then you must change the SCSI ID on your emulator.

Before resetting the emulator's SCSI ID, be sure the emulator is not turned on.

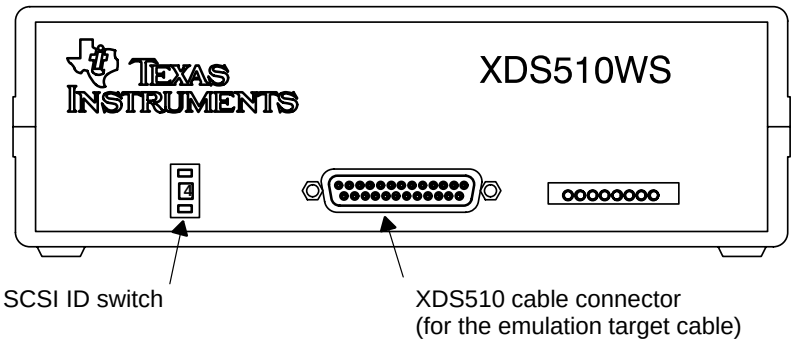
Never disconnect or reconnect any cables or other hardware devices while the emulator is turned on.

Your emulator's SCSI ID is controlled by a switch on the front panel of the emulator. Refer to Figure 1–4 for the location of this switch.

This switch can be in any one of ten positions, 0 through 9; however, do not use settings 8 and 9. (The emulator uses only the three least significant bits of the switch number; therefore, a setting of 8 would set the SCSI ID to 0, and a setting of 9 would set the SCSI ID to 1.)

When you've finished resetting the emulator's SCSI ID, you can connect the emulation target cable to the front of the emulator.

Figure 1–4. Front View of the XDS510WS Emulator



Adding the emulator onto the SCSI bus

The SCSI bus is a chain with two distinct ends; it is not a loop. Although there may be SCSI devices within your host, the visible chain begins at the host and ends at one of the external SCSI devices. You can connect the emulator into the SCSI bus anywhere along this chain; however, it's best to place the emulator where you can easily connect it to your target system. The emulator's indicator lights should be visible and the power switch readily accessible.

> **CAUTION**
>
> **Be sure all devices on the SCSI bus, including your workstation, are turned off before you connect the emulator to your workstation.**

Connect the SCSI cable to the back of your workstation (see Figure 1–5); you can use either one of the SCSI connectors. (Refer to Figure 1–6 for location of the SCSI connectors.)

Figure 1–5. Connecting the Emulator to Your Workstation

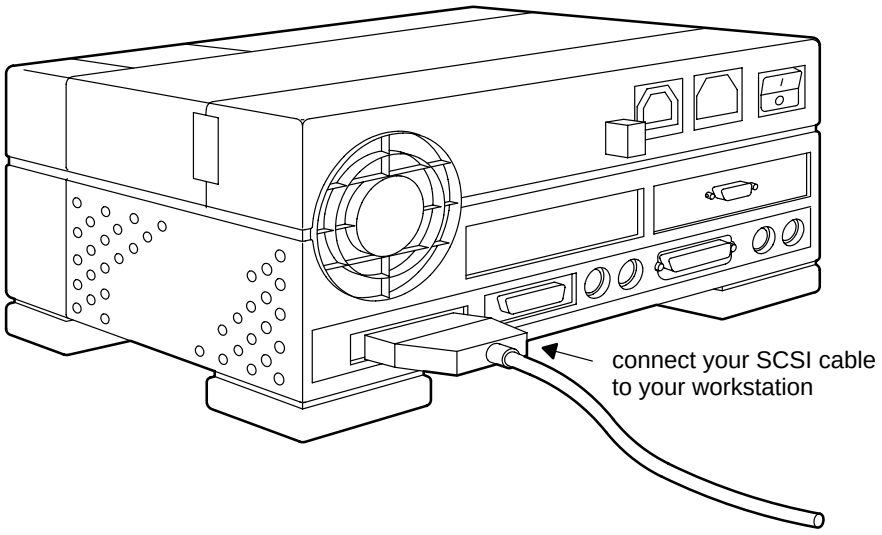
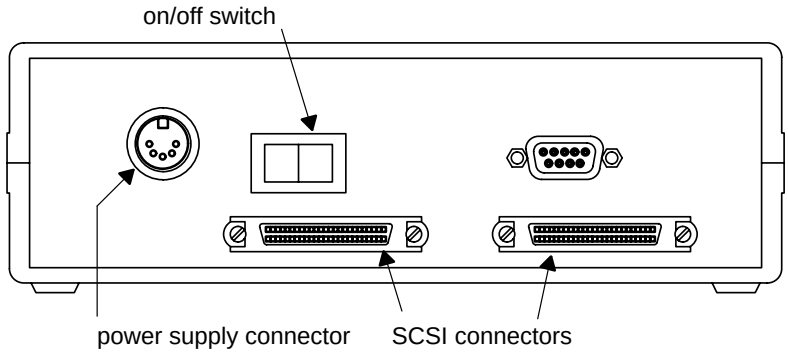


Figure 1–6. Rear View of the XDS510WS Emulator



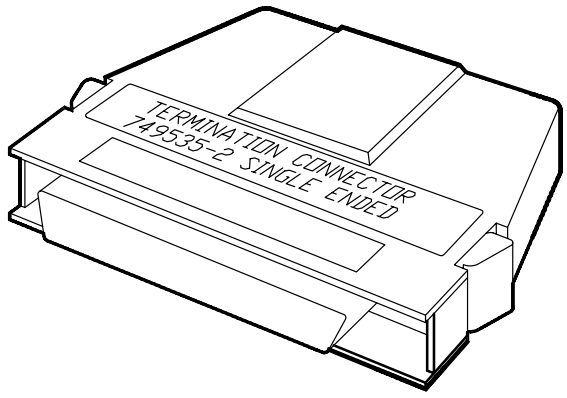
Terminating the SCSI bus

You *must* terminate the SCSI bus at each end of its chain to reduce signal noise. The device farthest on the chain from the host (your workstation) should be terminated; terminating intervening devices can cause intermittent errors in the SCSI bus.

If your emulator is at the end of a SCSI bus, you must terminate your emulator by connecting the external terminator (see Figure 1–7) to the unused SCSI connector on the back of your emulator.

Power up the external SCSI devices (including the emulator) before turning on your workstation.

Figure 1–7. The External Terminator for SCSI Bus Termination



1.3 Step 2: Setting Up Your Workstation to Recognize the Emulator

To continue this installation, you *must* have root access on your workstation; if you do not, contact your system administrator.

This step varies, depending on which version of the operating system you are using:

- **If you have Solaris 2.x**, as the root user, enter:

  `halt` ⏎

  With the XDS510WS properly connected and powered up, reboot your SPARCstation with the PROM command, *boot –r.* Once the system comes back up, execute the following command as the root user:

  `/usr/sbin/disks` ⏎

  Once you have entered these commands, you can skip to Section 1.4.

- **If you have SunOS 4.1.x**, you must complete the instructions in this section to set up your workstation.

Modifying your workstation's configuration file

Once you have set up your emulation hardware, you must modify your workstation's configuration file to allow the debugger to access the emulator. The name of the configuration file used by your workstation normally appears in parentheses following your SunOS version number when you boot or log in to your system. In Example 1–1, the configuration file is called GENERIC.

Example 1–1. Locating the Name of Your Configuration File

```
Last login: Mon Mar 15 09:40:13 on console
SunOS Release 4.1.1 (GENERIC)#1: Mon Feb 1 09:00:07 CST 1993
You have mail.
```

To change this configuration file, complete these ten steps:

1) Switch directories to find the configuration file. To do this, enter the following command:

   `cd /usr/kvm/sys/sun4/conf` ⏎

   If this command does not work, replace **sun4** with either **sun4c** or **sun4m**, depending on the type of workstation:

Machine type	Use directory name
SPARCstation 1, 1+, or 2	sun4c
SPARCstation 10 xxx–MP (i.e. 600 MP)	sun4m

Note:

If the specified directory does not exist or doesn't contain the specified configuration file, then your system was probably installed without modification privileges. Contact your system administrator for help.

2) Copy the current configuration file to a file called EMULATOR:

   cp *filename* **EMULATOR** ⏎

   Replace *filename* with the name of the current configuration file (see Example 1–1).

3) Edit the EMULATOR file. You can use any editor you are familiar with, but for the purpose of discussion, the vi editor is used; to use this editor, enter:

   vi EMULATOR ⏎

   Your EMULATOR file should look similar to Example 1–2. While in the vi editor, search for:

   - *ident* and replace the string following it with **"EMULATOR"**.
   - *options IPCSEMAPHORE* to be sure it exists in your configuration file and is not a comment; comments are preceded by the # symbol.
   - *options IPCSHMEM* to be sure it exists in your configuration file and is not a comment.
   - *options IPCMESSAGE* to be sure it exists in your configuration file and is not a comment.
   - *target # lun 0*, where # is the SCSI ID for the emulator (4 by default; refer to Section 1.2). Be sure the entry is set up as a disk; to do this, make sure *tape st4*, for example, is changed to *disk sd4*.

   Any other references to the driver that you have chosen (**sd4** is the default) should be turned into comments.

Note:

When you execute the debugger or emurst and you use the –p debugger option, you are referring to the sd# in the configuration file and to the associated rsd#a file. (This number is **not necessarily** the same as the SCSI ID number, but it can be.)

Example 1–2 shows a correctly modified EMULATOR file. Notice that modifications are highlighted and shown in bold face type. Lines preceded by # are comments and are ignored; you do not have to edit them. However, for consistency, these lines are modified.

Example 1–2. Setting Up the EMULATOR Configuration File

```
#
# @(#) GENERIC from master 1.28 90/09/21 SMI
#
# This config file describes an generic Sun–4c kernel, including all
# possible standard devices and software options.
#
# The following lines include support for all Sun–4c CPU types.
# There is little to be gained by removing support for particular
# CPUs, so you might as well leave them all in.
#
machine             ″sun4c″
cpu                 ″SUN4C_60″    # Sun–4/60
#
# Name this kernel EMULATOR.
#
ident         ″EMULATOR″
.
.
.
#
# The following options are for various System V IPC facilities.
# Most standard software does not need them, although they are
# used by SunGKS and some third–party software.
#
options IPCMESSAGE  # System V IPC message facility
options IPCSEMAPHORE# System V IPC semaphore facility
options IPCSHMEM    # System V IPC shared memory facility
.
.
.
scsibus0 at esp     # declare first scsi bus
  disk sd0 at scsibus0 target 3 lun 0   # first hard SCSI disk
  disk sd1 at scsibus0 target 1 lun 0   # second hard SCSI disk
  disk sd2 at scsibus0 target 2 lun 0   # third hard SCSI disk
  disk sd3 at scsibus0 target 0 lun 0   # fourth hard SCSI disk
  disk sd4 at scsibus0 target 4 lun 0   # XDS510WS emulator
  tape st1 at scsibus0 target 5 lun 0   # second SCSI tape
  disk sr0 at scsibus0 target 6 lun 0   # CD–ROM device

scsibus1 at esp     # declare second scsi bus
  #disk sd4 at scsibus1 target 3 lun 0  # fifth hard SCSI disk
  disk sd5 at scsibus1 target 1 lun 0   # sixth hard SCSI disk
  disk sd6 at scsibus1 target 2 lun 0   # seventh hard SCSI disk
  disk sd7 at scsibus1 target 0 lun 0   # eighth hard SCSI disk
  tape st2 at scsibus1 target 4 lun 0   # third SCSI tape
  tape st3 at scsibus1 target 5 lun 0   # fourth SCSI tape
  disk sr1 at scsibus1 target 6 lun 0   # 2nd CD–ROM device
```

4) When you have finished editing your EMULATOR file, save the file and exit the vi editor by pressing SHIFT Z Z.

5) Now, you must create the EMULATOR directory. To do this, enter:

   config EMULATOR ↵

6) Once you have created the EMULATOR directory, change your current directory to your newly created directory by entering:

   cd ../EMULATOR ↵

7) Now you must compile the new kernel described by your configuration file. To do this, enter:

   make ↵

8) Save the old kernel file (vmunix) so that you can easily revert to it; enter:

   mv /vmunix /vmunix.orig ↵

9) To move the new kernel file into use, enter:

   cp vmunix / ↵

10) You are now ready to reboot your workstation; enter:

    shutdown –r now ↵

When you log onto your workstation, you should notice the name EMULATOR appear in parentheses as shown in Example 1–3.

If EMULATOR does not appear in parentheses as you are rebooting your workstation, then your emulator may not be installed properly. Go back through these ten steps and be sure that you have followed each step correctly.

Example 1–3. Running Your Modified Configuration File

```
Last login: Mon Mar 15 09:40:13 on console
SunOS Release 4.1.1 (EMULATOR)#1: Mon Feb 1 09:00:07 CST 1993
You have mail.
```

1.4 Step 3: Allowing the Debugger to Access the Emulator

The debugger accesses the emulator by reading from and writing to the device driver you defined in the EMULATOR configuration file. As a result, to execute the debugger, you must have read and write permissions on the driver file.

This step varies, depending on which version of the operating system you are using:

- **If you have Solaris 2.x**, nothing further is required after taking the actions in the first bullet of Section 1.3. To confirm proper operation, execute the following command.

  `ls –l /dev/rsd*a` ↵

  If rsd#a is not listed, return to the first bullet in Section 1.3. If rsd#a is listed with permissions other than lrwxrwxrwx, change them as shown below for SunOS 4.1.x users.

- **If you have SunOS 4.1.x**, as the root user, enter the following command, replacing # with the device driver number of the emulator (4 by default):

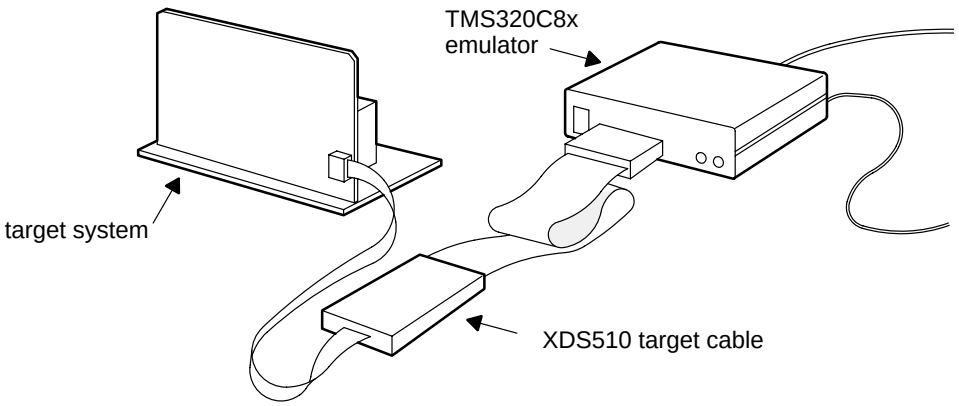
  `chmod a+rw /dev/rsd`#**`a`** ↵

  This enables the debugger to access the emulator *without* root privileges.

1.5 Step 4: Connecting the Emulator to Your Target System

In most cases, the target system is a board of your own design. It should have the appropriate emulation header, as described in the hardware requirements (refer to page 1-2). To correctly connect the target cable to your target board, make sure the key is aligned properly; then, slowly and firmly, attach the cable (see Figure 1–8).

Figure 1–8. Connecting the Emulator to Your Target System



1.6 Step 5: Installing the Debugger Software

This section explains the process of installing the software tools on your hard disk system. The software package is shipped on a CD-ROM. To install the software tools, you must mount the CD-ROM, copy the files, and unmount the CD-ROM.

Mounting the CD-ROM

The steps to mount the CD-ROM vary according to your operating-system version:

- ❏ If you have SunOS 4.1.x, as root, load the CD-ROM into the drive and enter the following from a command shell:

  ```
  mount –rt hsfs /dev/sr0 /cdrom ⏎
  exit ⏎
  cd /cdrom ⏎
  ```

- ❏ If you have Solaris 2.0 or 2.1, as root, load the CD-ROM into the drive and enter the following from a command shell:

  ```
  mount –rF hsfs /dev/sr0 /cdrom ⏎
  exit ⏎
  cd /cdrom/cdrom0 ⏎
  ```

- ❏ If you have Solaris 2.2 or higher:

  - If your CD-ROM drive is already attached, load the CD-ROM into the drive and enter the following from a command shell:

    ```
    cd /cdrom/cdrom0 ⏎
    ```

  - If you do not have a CD-ROM drive attached, you must shut down your system to the PROM level, attach the CD-ROM drive, and enter the following:

    ```
    boot –r ⏎
    ```

    After you log into your system, load the CD-ROM into the drive and enter the following from a command shell:

    ```
    cd /cdrom/cdrom0 ⏎
    ```

Copying the files

After you've mounted the CD-ROM, you must create the directory that will contain the software tools and copy the tools to that directory.

1) Create a directory named *c8xdebug* on your hard disk. To create this directory, enter:

   mkdir c8xdebug ↵

2) Make c8xdebug the current directory:

   cd c8xdebug ↵

3) Copy the files from the CD-ROM to your hard disk system:

   cp –r * c8xdebug ↵

Unmounting the CD-ROM

You must unmount the CD-ROM after copying the files.

- If you have SunOS 4.1.x or Solaris 2.0 or 2.1, as root, enter the following from a command shell:

  cd ↵
  umount /cdrom ↵
  eject /dev/sr0 ↵
  exit ↵

- If you have Solaris 2.2 or higher, enter the following from a command shell:

  cd ↵
  eject ↵

1.7 Step 6: Making Sure the Emulator Supports the Debugger

The ROM code for the emulator does not contain the information necessary to debug a processor; that code must be downloaded from the host. This makes it easier to upgrade the emulation software. The *emurst* program downloads the necessary code for proper emulation.

To run this program, enter the emurst command in the following format:

emurst [**–x**] [**–p** *number*] *pathname–filename*

The –x option tells the emurst utility to ignore any options specified with the D_OPTIONS environment variable.

Number represents the device driver number you defined in the EMULATOR configuration file (refer to Section 1.3), and *pathname–filename* is the location and name of the mvp510ws.out file.

You can omit the –p option if the default, *rsd4a*, is the device driver for the emulator.

Note:

When you execute the debugger or emurst and you use the –p debugger option, you are referring to the sd# in the configuration file and to the associated rsd#a file. (This number is **not necessarily** the same as the SCSI ID number, but it can be.)

You can be sure that emurst succeeded when only the first and second LEDs from the left are on.

1.8 Step 7: Describing Your Target System to the Debugger

In order for the debugger to understand how you have configured your target system, you must supply the target configuration information in a file for the debugger to read.

- ❑ If you're using an emulation scan path that contains only one 'C8x and no other devices, you can use the *board.dat* file that comes with the 'C8x emulator kit. This file describes to the debugger the single 'C8x in the scan path and gives the 'C8x the name MVP1. Since the debugger automatically looks for a file called board.dat in the current directory and in the directories specified with the D_DIR environment variable, you don't need to create your own board configuration file. Go to the next section.

- ❑ If you plan to use a different target system, you must follow these steps:

  Step 1: Create the board configuration file.

  Step 2: Translate the board configuration file to binary so that the debugger can read it.

  Step 3: Specify the configuration file when invoking the debugger.

  These steps are described in the *Describing Your Target System to the Debugger* appendix in the *TMS320C80 (MVP) C Source Debugger User's Guide*.

1.9 Step 8: Setting Up the Debugger Environment

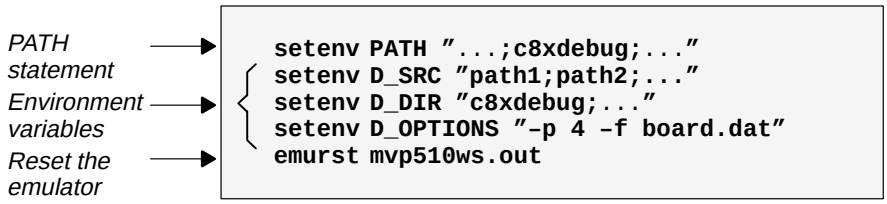
To ensure that your debugger works correctly, you must:

- ❑ Modify the PATH statement to identify the *c8xdebug* directory.
- ❑ Define environment variables so that the debugger can find the files it needs.
- ❑ Identify any nondefault device driver used by the emulator.
- ❑ Reset the emulator.

You can accomplish most of these tasks by entering individual commands, but it's simpler to put the commands in your .cshrc file.

Figure 1–9 shows an example of a .cshrc file that contains the suggested modifications (highlighted in bold type). The subsections following the figure explain these modifications.

Figure 1–9. Command Setup for the Debugger



Modifying the PATH statement

Define a path to the debugger directory. The general format for doing this is:

```
setenv PATH "...;c8xdebug;..."
```

This allows you to invoke the debugger without specifying the name of the directory that contains the debugger executable file.

Setting up the environment variables

An environment variable is a special system symbol that the debugger uses for finding or obtaining certain types of information. The debugger uses four environment variables named D_DIR, D_SRC, D_OPTIONS, and DISPLAY (X Window System only). The next four steps tell you how to set up these environment variables. The format for doing this is the same for either the .cshrc file or the command line.

- Set up the D_DIR environment variable to identify the emulator directory:

  ```
  setenv D_DIR "c8xdebug"
  ```

  This directory contains auxiliary files (init.cmd, init.clr, etc.) that the debugger needs.

- Set up the D_SRC environment variable to identify any directories that contain program source files that you'll want to look at while you're debugging source code. The general format for doing this is:

  ```
  setenv D_SRC "path1;path2;..."
  ```

  For example, if your programs were in a directory named *csource*, the D_SRC setup would be:

  ```
  setenv D_SRC "csource"
  ```

- You can use several options when you invoke the debugger. If you use the same options repeatedly, it's more convenient to specify them by using D_OPTIONS. The general format for doing this is:

  setenv D_OPTIONS [*object filename*] [*debugger options*]

  This tells the debugger to load the specified object file and use the selected options each time you invoke the debugger. Table 1–1 lists the options that you can identify with D_OPTIONS.

Table 1–1. Options for Use With D_OPTIONS

Option	Description
–b[b]	Select the screen size
–d *machinename*	Display debugger on different machine (X Windows only)
–f *filename*	Identify a new board configuration file
–i *pathname*	Identify additional directories
–n *processorname*	Identify the name of the processor
–o	Enable C I/O
–p *port address*	Identify the I/O address space
–s	Load the symbol table only
–t *filename*	Identify a new initialization file
–v	Load without the symbol table

Note that you can override D_OPTIONS by invoking the debugger or emurst with the –x option.

- If you are using the X Window System, you can use the DISPLAY environment variable to display the debugger on a different machine than the one the debugger is running on. The general format for doing this is:

  setenv DISPLAY "*machinename***"**

  For example, if you are running the debugger on a machine called opie and you want the 'C8x debugger display to appear on a machine called barney, the DISPLAY setup would be:

  ```
  setenv DISPLAY barney:0
  ```

  You can also display the debugger on a different machine by using the -d option when invoking the debugger.

  `mpemu –d barney:0` ↵

  For more information about using the debugger under the X Window System, refer to Section 1.11, *Using the Debugger With the X Window System*.

  For more information about options, refer to the *Overview of a Code Development and Debugging System* chapter in the *TMS320C80 (MVP) C Source Debugger User's Guide*.

Invoking the new or modified .cshrc file

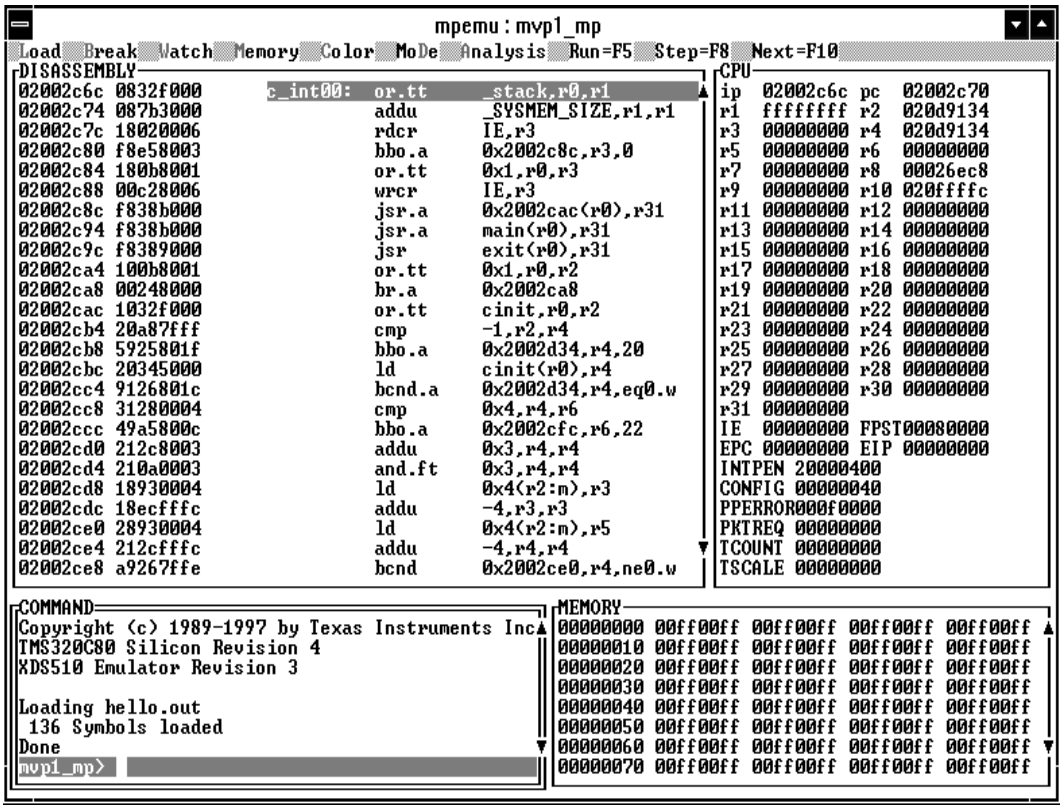
If you create or modify your .cshrc file, you must invoke that file before invoking the debugger for the first time. To do so, enter:

`source .cshrc` ↵

1.10 Step 9: Verifying the Installation

To ensure that you have correctly installed the emulator and debugger software, enter this command at the system prompt:

mpemu hello -n mvp1_mp ↵



- ❑ If you see a display similar to this one, you have correctly installed your emulator and debugger.
- ❑ If you don't see a display, then your debugger or board may not be installed properly. Go back through the installation instructions and be sure that you have followed each step correctly; then re-enter the command above.

1.11 Using the Debugger With the X Window System

If you're using the X Window System to run the MP or PP debugger, you need to know about the keyboard's special keys, the debugger fonts, and using the debugger on a monochrome monitor.

Using the keyboard's special keys

The debugger uses some special keys that you can map differently from your particular keyboard. Some keyboards, such as the Sun Type 5 keyboard, may have these special symbols on separate keys. Other keyboards, such as the Sun Type 4 keyboard, do not have the special keys.

The special keys that the debugger uses are shown in the following table with their corresponding keysym. A **keysym** is a label that interprets a keystroke; it allows you to modify the action of a key on the keyboard.

Key	Keysym
F1 to F10	F1 to F10
PAGE UP	Prior
PAGE DOWN	Next
HOME	Home
END	End
INSERT	Insert
→	Right
←	Left
↑	Up
↓	Down

Use the X utility xev to check the keysyms that are associated with your keyboard. If you need to change the keysym definitions, use the xmodmap utility. For example, you could create a file that contains the following commands and use that file with xmodmap to change a Sun Type 4 keyboard to match the keys listed above:

```
keysym R13    = End
keysym Down   = Down
keysym F35    = Next
keysym Left   = Left
keysym Right  = Right
keysym F27    = Home
keysym Up     = Up
keysym F29    = Prior
keysym Insert = Insert
```

Refer to your X Window System documentation for more information about using xev and xmodmap.

Changing the debugger font

You can change the font of the debugger screen by using the xrdb utility and modifying the .Xdefaults file in your root directory. For example, to change the fonts of the MP and PP debuggers to Courier, add the following line to the .Xdefaults file:

```
mpemu*font:courier
ppemu*font:courier
```

For more information about using xrdb to change the font, refer to your X Window System documentation.

Color mappings on monochrome screens

Although a color monitor is recommended (and necessary for the graphic display features), the following table shows the color mappings for monochrome screens:

Color	Appearance on Monochrome Screen
black	black
blue	black
green	white
cyan	white
red	black
magenta	black
yellow	white
white	white

Chapter 2

Troubleshooting

This chapter describes some common problems you may encounter while using your emulator or debugger on your workstation. You should be familiar with the procedures described in Chapter 1 before trying to troubleshoot problems with the XDS510WS and its software.

Topic **Page**

2.1	**Problems When Booting Your Workstation**	**2-2**
2.2	**Problems When Resetting the Emulator**	**2-3**
2.3	**Problems When Invoking the Debugger**	**2-5**
2.4	**Additional Emulator and Debugger Problems**	**2-7**

2.1 Problems When Booting Your Workstation

After installing your emulator, problems may occur when you attempt to boot your workstation. The following suggestions resolve many of these problems:

- ❑ Your workstation will not boot when connected to your emulator, even if your emulator is not turned on.

  1) Be sure all of your SCSI cables are connected securely and the SCSI bus is terminated properly (see *Terminating the SCSI bus* on page 1-10).

  2) Remove any unnecessary SCSI devices from the bus.

  3) Make sure the total length of the SCSI bus is less than six meters, including the section of the bus within the SPARC chassis.

- ❑ Your workstation will boot when the emulator is turned off but will not boot when the emulator is turned on.

  Your emulator's SCSI ID conflicts with the SCSI ID of another device on the SCSI bus. Go back through the instructions on page 1-7.

2.2 Problems When Resetting the Emulator

After you power up the emulator and the workstation, if you have the following problems attempting to reset the emulator, implement the applicable solutions:

- When you execute the emurst command, you receive this message:

  ```
  emurst file [.out]:
  ```

  You forgot to specify the *pathname–filename* of the mvp510ws.out file. You can specify it at this prompt or re-execute emurst with *pathname–filename* specified on the command line.

- When executing the emurst command, you receive this message:

  ```
  >> can't initialize the target system
  ```

  1) You haven't set the IPCSEMAPHORE option to allow the debugger to access the emulator. Be sure that the configuration file, EMULATOR, has the options line set correctly, without comments. Then, use the corrected configuration file to build the currently executing kernel (see Section 1.3, *Step 2: Setting Up Your Workstation to Recognize the Emulator,* on page 1-11).

  2) There are too many current semaphores on the system. Clean up the unused semaphores by using the **ipcs –st** and **ipcrm** utilities, and try to execute emurst again.

  3) You may not have permission to access the driver file you specified with the –p debugger option. Normally, you specify the –p debugger option on the command line or in the D_OPTIONS environment variable. Remember, if you haven't specifically reset the driver file number to another number, the default is 4. Have the root user execute the following command and try to execute emurst again.

     chmod a+rw /dev/rsd#a ↵

  4) The driver file you specified with the –p debugger option is not correctly associated with your emulator in your configuration file. Make sure your configuration file contains a line similar to this:

     ```
     disk sd# at scsibus<m> target <s> lun 0
     ```

     where # is the device driver number, <s> is the SCSI ID of the XDS510WS you set with the switch at the front of the XDS510WS. The <m> is zero(0), unless the XDS510WS is connected to a second SCSI bus that you added to your SPARC, which will cause <m> to change. Use the corrected configuration file to build the currently executing kernel (see Section 1.3, *Step 2: Setting Up Your Workstation to Recognize the Emulator,* on page 1-11).

5) You haven't turned on the XDS510WS, or it hasn't completed its self tests. Turn on the XDS510WS and wait for the self test to complete successfully before executing emurst. The self test has completed, once the sixth LED from the left is off and the first, second, and fifth LEDs from the left are on.

- When executing the emurst command, you receive this message:

  ```
  >> error loading file
  ```

  1) The emurst utility can't find the mvp510ws.out file as specified. If you didn't specify the *pathname–filename* with an extension as part of the name, the emurst utility appends the default extension *.out* to the name.

  2) If you didn't provide path information (just the filename), emurst searches first in the current directory and then in all of the directories specified in the D_DIR environment variable before returning this error. Make sure the correct file is somewhere emurst can find it.

  3) The file that you specified to emurst isn't appropriate for this use. Use the mvp510ws.out file that is included with the debugger software.

2.3 Problems When Invoking the Debugger

If you encounter these problems when you invoke the debugger, the suggested solutions may resolve the problems:

- ❑ You receive the following message when executing the mpemu or ppemu command:

```
CANNOT INITIALIZE THE TARGET !!
– Check I/O configuration
– Check cabling and target power
```

  1) The emurst command didn't successfully execute before you tried to invoke the debugger. Execute emurst (see Section 1.7, *Step 6: Making Sure the Emulator Supports the Debugger,* on page 1-19). The emurst has completed successfully if you see your command prompt after this message:

     `EMURST for XDS510WS loading <pathname-filename> at #`

     where <pathname-filename> is the location of the mvp510ws.out file, and # refers to the file /dev/rsd#a, which is associated with the emulator in the configuration file, EMULATOR. Also, you can be sure that emurst succeeded when only the first and second LEDs from the left are on.

  2) The –p debugger option that you entered on the command line or in the D_OPTIONS environment variable specifies a different driver file than the one used by emurst. Remember, if you haven't specifically reset the driver file number to another number, the default is 4. Use the same –p option that you used when you executed emurst. (Refer to Section 1.7 on page 1-19 for more information on the –p option).

  3) The –f debugger option you specified on the command line or in the D_OPTIONS environment variable (where the default file specified by the –f option is board.dat) specifies a file that the debugger can't find.

     - If you didn't provide *any* path information with the filename, the debugger couldn't find the file in the current directory or in any of the directories listed in the D_DIR environment variable.
     - If you didn't provide the *correct* path information, re-execute the debugger, specifying the correct pathname and filename for the board configuration file.

  4) One of these two problems could exist:

     - You didn't specify **–n** *processor name* debugger option.
     - The debugger couldn't find the *processor name* that you specified with the **–n** option in your board configuration file.

     Re-execute the debugger with the –n debugger option, specifying the name of a *processor name* from the board configuration file.

5) You may not have described your target system correctly in the board configuration file that you specified with the –f debugger option on the command line or in the D_OPTIONS environment variable. Review your board configuration file and correctly describe the target system.

6) Make sure your emulation cable is firmly attached both to the XDS510WS and to your target system.

7) Make sure your target system is receiving sufficient power at the required voltage to allow all devices on the board to work properly.

❑ You receive one of the following messages at the operating-system command line when trying to execute the mpemu or ppemu command:

```
mpemu: display :0.0 doesn't know font 7x14
```

or

```
ppemu: display :0.0 doesn't know font 7x14
```

The default font file that the debugger uses (7x14.ff) couldn't be found by OpenWindows. OpenWindows searches for these font files in the directories specified in the FONTPATH environment variable. To correct the problem, do one of the following:

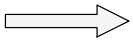
- Add the font file 7x14.ff to a directory defined in the FONTPATH environment variable.
- Add to the .Xdefaults file in your home directory the line "mpemu*font: *GoodFontName*", where *GoodFontName* is the name of a font that OpenWindows can find.
- Copy a valid font file onto 7x14.ff.

Note:

The operating-system window provides operating-system messages. These messages differ from the error messages that you may see in the COMMAND window of the debugger.

2.4 Additional Emulator and Debugger Problems

The operating-system window displays operating-system messages. These messages differ from the error messages that you may see in the COMMAND window of the debugger. If you receive one of these operating-system messages while executing the emurst or the debugger, refer to the following explanations.



Note:

For each of the following four bulleted items (❑), note that the messages are *status messages, **not** error messages*.

❑ In your operating-system window, you receive the following message while executing mpemu, ppemu, or emurst under SunOS 4.1.x:

```
<date> <time> <hostname> vmunix: sd<n>: disk not
responding to selection
```

or under Solaris 2.x:

```
WARNING: /sbus@1,f8000000/esp@0,800000/sd@<n>,0(sd<n>):
      disk not responding to selection
```

The XDS510WS didn't respond to the SPARC in a certain amount of time. This can be caused by several different things:

- The XDS510WS isn't powered
- The XDS510WS is executing its self test
- The XDS510WS is executing a lengthy debugger command such as a large memory-fill

❑ In your operating-system window, you receive the following message while executing mpemu, ppemu, or emurst under SunOS 4.1.x:

```
<date> <time> <hostname> vmunix: sd<n>: offline
```

or under Solaris 2.x:

```
WARNING /sbus@1,f8000000/esp@0,800000/sd@<n>,0(sd<n>):
      offline
```

The SPARCstation is unable to select the XDS510WS after several attempts and therefore considers the emulator offline. This message can be generated during large memory-fill instructions and should **not** be considered an error by itself or in combination with the preceding message. The debugger automatically corrects for this situation, unless a major error has taken place, in which case, the debugger eventually returns an error message in the COMMAND window of the debugger.

- In your operating-system window, you receive the following message while executing mpemu, ppemu, or emurst under SunOS 4.1.x:

  ```
  <date> <time> <hostname> vmunix: sd<n>: disk okay
  ```

  or under Solaris 2.x:

  ```
  WARNING: /sbus@1,f8000000/esp@0,800000/sd@<n>,0(sd<n>):
        disk okay
  ```

  The SPARCstation has reconnected with the XDS510WS after the XDS510WS didn't respond to the selection. When the debugger recovers from the *offline* condition (described in the previous bulleted item), one of the two messages shown above is written to the operating-system window.

- In your operating-system window, you receive the following message while executing mpemu, ppemu, or emurst under SunOS4.1.x:

  ```
  sd<n> at esp0 target <p> lun 0
  sd<n>: Vendor 'TI–ASP', product 'XDS510–WS_Rev.*', 130
  512 byte blocks
  <date> <time> <hostname> vmunix: sd<n>: corrupt label –
  wrong magic number
  ```

  If the emulator has been inactive on the bus since the SPARCstation's last attempt to access it, the XDS510WS returns to an active status on the bus. The above message informs you of this *new* SCSI device.

Note:

Since the SPARCstation interprets the emulator as a SCSI disk, the SPARCstation expects it to be formatted. When the SPARCstation first finds that the new device isn't formatted, it produces the corrupt label message.

Chapter 3

Interpreting the XDS510WS LEDs

The TMS320C8x XDS510WS emulator provides status information about the operation of the emulator through eight light-emitting diodes (LEDs) on the front panel of the emulator chassis.

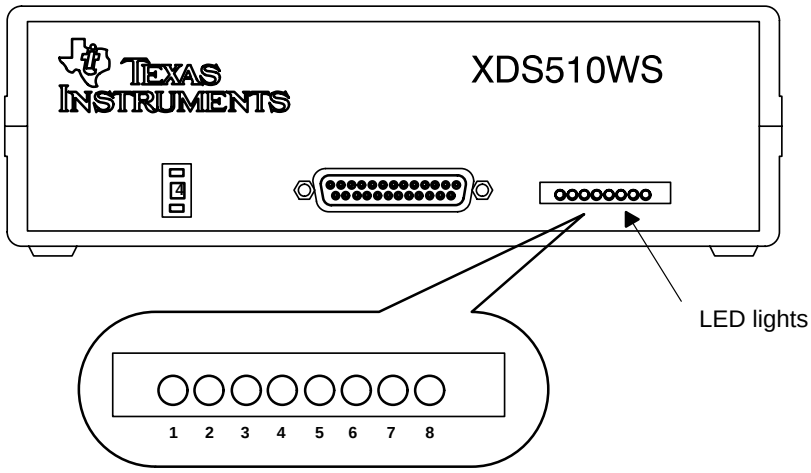
Topic **Page**

3.1	XDS510WS LEDs	3-2
3.2	LED 1	3-2
3.3	LED 2	3-3
3.4	LED 3	3-3
3.5	LEDs 4, 5, and 6	3-4
3.6	LEDs 7 and 8	3-5
3.7	XDS510WS LED Interpretation	3-6

3.1 XDS510WS LEDs

On the front of the XDS510WS is a small panel of LEDs that provide status information during the operation of the emulator (refer to Figure 3–1).

Figure 3–1. XDS510WS LEDs



The LEDs are numbered from left to right, starting with LED 1 through LED 8. The three LED conditions are:

Meaning		LED Symbol
Off	=	○
On	=	●
Intermittent†	=	◐

† Intermittently on and off; no steady state

3.2 LED 1

LED 1 is on whenever the system is plugged in and switched on. If LED 1 doesn't come on, you should:

1) Ensure that the power supply is firmly plugged into a proper outlet.

2) Check to see that the power supply cable is firmly plugged into the XDS510WS.

3) Check to see that the XDS510WS is switched on.

3.3 LED 2

When LED 2 is on, the XDS510WS has detected a power loss on the target system.

Note:

After you apply power to the target, this LED remains on until you invoke a debugger.

When you invoke the debugger, if LED 2 fails to go off and the debugger fails to start, you should ensure that the emulation cable is firmly and correctly attached to both the XDS510WS and the target. Also, check to see that the target is turned on and powered sufficiently. Additionally, check to see whether the target was designed to provide V_{CC} to the emulation header pin, PD.

Once LED 2 has gone off, if it comes on during your debugging session, the target system has lost power.

3.4 LED 3

LED 3 is on whenever the XDS510WS is executing an emulation instruction. Normally, you shouldn't notice the sporadic on state of this LED.

Occasionally, when you're performing a time-consuming emulation command such as a large FILL, LED 3 and LED 1 will be the only LEDs on. If LED 3 stays on for too long (greater than five minutes), there is a problem. To continue working, exit the debugger, cycle the power on the XDS510WS, and begin again.

3.5 LEDs 4, 5, and 6

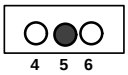
LEDs 4, 5, and 6 indicate error messages and signify the state of the emulator.

When you first power up the XDS510WS and immediately after you execute an emurst command, the emulator performs a self-test. LEDs 4 and 5 will be off, and LED 6 will be on to indicate that the self-test is being performed:

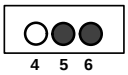
Note:

The self-test should take only a few seconds; moreover, if these three LEDs show this pattern for more than a minute, something is wrong:

If the self-test completes successfully, LEDs 4 and 6 will be off, and LED 5 will be on:



If these three LEDs show this pattern:



there has been a communications error. These errors are generally not serious, but if you can't continue without intervention, cycle the power on the XDS510WS, re-execute emurst, and restart the debugger.

3.6 LEDs 7 and 8

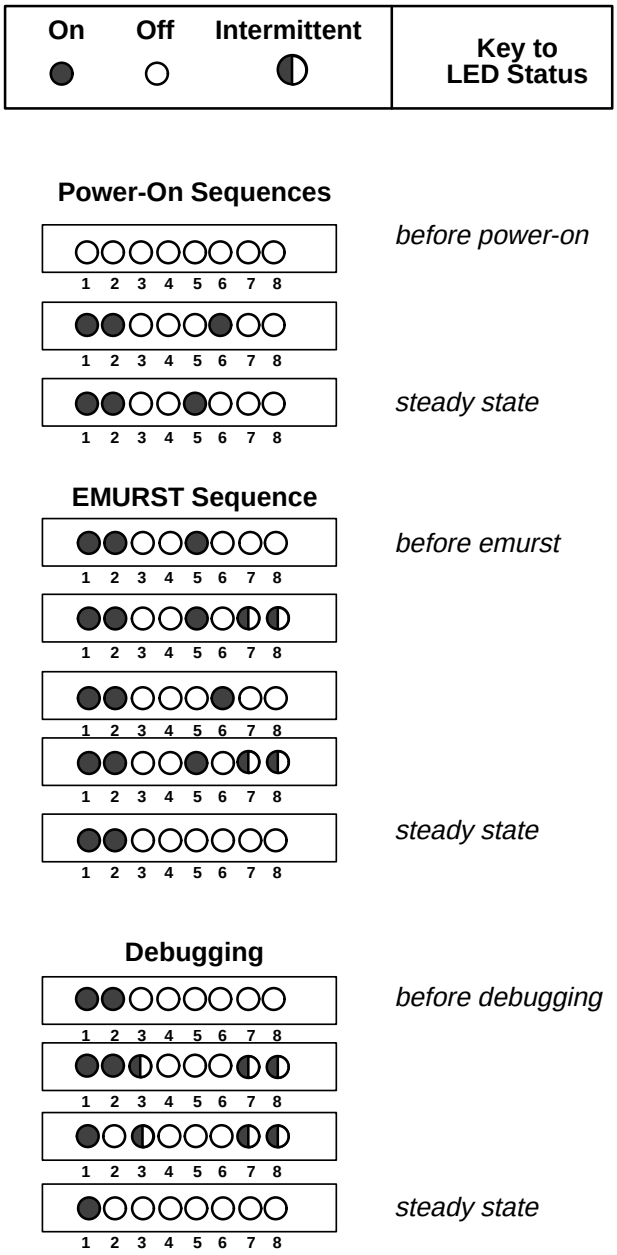
LEDs 7 and 8 indicate that a SCSI transfer is in progress with the emulator. If the debugger seems to hang and the LEDs become fixed (not flashing) in any pattern other than 7 and 8 off as shown below:

there is probably a problem. You can cycle the power on the XDS510WS, re-execute emurst, and restart the debugger.

3.7 XDS510WS LED Interpretation

Figure 3–2 shows the standard LED sequences. These patterns allow you to understand quickly the operational status of the emulator and its functions.

Figure 3–2. Standard LED Sequences



Chapter 4

Release Notes

This chapter contains documentation of features that are new or have been changed since the last release. This is not an exhaustive list of all code changes since the last release, but it is a list of all of the changes that may require modifications to your debugger batch or initialization files, or makefiles, so please take time to read this chapter completely.

Topic **Page**

4.1 Release Enhancements 4-2

4.2 Additional Features 4-5

4.1 Release Enhancements

Window Resizing on PCs

The maxium window width has been increased from 80 characters to 132.

Window Resizing on All Platforms (–bl and –bw)

The command line options –bl and –bw have been added to allow the debugger window to be initialized to any length or width.

Syntax:

`–bl#`

where # specifies the length (in lines). The default length is 25 lines and the maximum is 60. Do not enter a space between –bl and #.

`–bw#`

where # is the width (in characters). The default width is 80 characters and the maximum is 132. Do not enter a space between –bw and #.

Multiple Watch Windows

An optional fourth parameter (*window name*) has been added to the WA (Watch Add) command to allow you to watch your expression in an alternative watch window. You can create as many watch windows as you desire. A new watch window will appear each time a unique window name is specified.

Syntax:

`wa` *expression*`[,[`*label*`][,[`*display format*`][,`*window name*`]]]`

Example:

```
wa i,,,New_Watch_Window
```

To remove an expression from an alternative watch window, you must specify the window name.

Syntax:

`wd` *index number* `[,`*window name*`]`

Example:

```
wd 1,New_Watch_Window
```

To remove an alternative watch window, specify the *window name* or * if you want to remove all watch windows.

Syntax:

`wr [`*window name* `| *]`

Example:

```
wr New_Watch_Window
```

Multiple Memory Windows

An optional third paramter (*window name*) has been added to the MEM command. It allows you to create as many memory windows as you desire. A new memory window will appear each time a unique window name is specified.

Syntax:

`mem` *expression*`[,[`*display format*`][,`*window name*`]]`

Example:

```
mem 0x02000000,,New_Mem_Window
```

Improved Command Line Editing

Editing in the command window and dialog windows has changed slightly. The following keystrokes have new or different meanings.

Backspace	Backspace will delete characters to the left of the cursor, and move characters to the right of the cursor to the left by one space. It leaves the cursor in the position previously held by the character just deleted.
Left Arrow	Moves the cursor to the left. From there, characters can be overwritten, deleted, or inserted. Before this change, the left arrow and backspace had the same function.
Carriage Return	The entire command string, as it appears in the command window, is passed to the debugger. This is regardless of where the cursor is located at the time.
CNTRL–K	All characters to the right of the cursor are deleted.

New Command SAFEHALT

The SAFEHALT command prevents mouse clicks from halting the target while it is running. When the debugger is placed in SAFEHALT mode, only the <ESC> key or breakpoints will halt the target while running. The default is off.

Syntax:

```
SAFEHALT ON | OFF
```

New Command LINE

The LINE command causes the FILE window to display the specified line number. If the line number is already displayed in the FILE window, the command has no effect. If the line number is not currently displayed, the contents of the FILE window are repositioned so that the line number appears in the middle of the FILE window.

Syntax:

`LINE` *num*

New PC Debugger Option (–font)

The –font option is only available on PCs. It will search through your PC's terminal fonts and use a font which is closest to *num* points high by 2/3 *num* points wide. This option is useful to view multiple debuggers that are running at the same time.

Syntax:

`–font` *num*

The recommended value for *num* is 8.

4.2 Additional Features

The features described in this section are not new to this release. They are listed here because they are not documented in the current revision of the *TMS320C80 (MVP) C Source Debugger User's Guide.*

C I/O support (–o option)

You must use the –o debugger option when invoking either the MP or PP debugger if the program that you will be debugging will use the standard C I/O facilities. The debuggers set up a special environment with the host machine for performing I/O functions. This environment will not be set up if you don't use the –o option.

This option prevents more than one debugger from attempting to set up the special C I/O environment when multiple TMS320C8x debuggers are running. Since only one debugger (or processor) can be using the C I/O facilities at a time, the –o debugger option allows you to explicitly identify which debugger will set up the environment.

This change may require you to modify PDM initialization files or script files that you use to invoke the debuggers.

Global breakpoints

You can use global breakpoints, through the use of the EMU0/1 pins (when connected as shown in the *JTAG/MPSD Emulation Technical Reference*), to halt multiple processors across multiple 'C8x devices. The EMU0 pin is used also as a carry out for the RUNB counter. See the *Using the Analysis Interface* chapter in the *TMS320C80 (MVP) C Source Debugger User's Guide* for details on global breakpoints.

A Breakpoints Disable selection has been added to the **Analysis break events** dialog box, allowing you to disable the bus breakpoints without disabling the **EMU0/1 driven low** breakpoint.

Little-endian support

Both MP and PP debuggers now support little-endian 'C8x operation. Before invoking a debugger (MP or PP), you must reset to the 'C8x (through the $\overline{\text{RESET}}$ pin) to set the 'C8x's endian order. To change the endian order of the 'C8x, you must quit all debuggers that are active, reset the 'C8x, then restart the debuggers. See the *TMS320C80 Data Sheet* for information on the $\overline{\text{RESET}}$ pin.

When the ’C8x is configured for big-endian operation, the address of values in the MEMORY window are referenced from the MSB. If the ’C8x is configured for little-endian operation, the address of values in the MEMORY window are referenced from the LSB.

Memory accesses less than a word

In previous revisions of the ’C8x, all memory accesses were performed on word or doubleword address boundaries. If an access was performed that required less than a word (byte or halfword):

- For a read operation, the emulator performed a word read and then extracted the required data.
- For a write operation, the emulator performed a word read, modified the data, and then performed a word write.

This version of the emulator accesses only the addresses requested. If a byte or halfword is requested, the emulator performs the appropriate memory operation to access only the requested data. For example:

```
?*(char *)0x02000000 = 0x12
```

For this example, previous revisions performed a word read from memory, modified the word with the byte data, and then performed a word write. The current revision simply performs a byte write of the data.

Memory access alignment

The emulator now automatically aligns accesses to the ’C8x’s natural address boundaries. If you request a short data type on an odd-byte address boundary, the emulator performs two byte accesses. If you request an int (integer) data type on an odd-byte address, the emulator performs a byte access, a halfword access, followed by a byte access.

Viewing the data cache (CACHEVIEW command)

Previous revisions of the MP debugger accessed memory from the data caches first, then from external memory. This feature restricted access to external memory when data was found within the MP’s data cache.

The CACHEVIEW command toggles the view of all memory accesses generated by the debugger between the data cache view and the external memory view. When the data cache view is enabled (default), memory writes are performed to both the cache and the external memory location (cache write through). When the external memory view is enabled, memory writes are performed only to the external memory location.

Disabling caching

When the emulator is performing memory operations, it caches memory accesses. If you request a byte, the emulator may read up to eight full words to service its internal cache, and then extract the byte from that data. To disable caching for memory locations that you want to access individually (such as a memory mapped I/O port), use the MA command to map the address as an I/O port. See the *Defining a Memory Map* chapter in the *TMS32080 (MVP) C Source Debugger User's Guide* for more information on I/O port mapping.

Index

A

arrow keys 1-25
assembler 1-3

B

–b debugger option
  with D_OPTIONS environment variable 1-22
batch files
  board.cfg 1-3
  board.dat 1-3
  .cshrc 1-21 to 1-23
    sample 1-21
  emurst 1-3
  init.clr 1-3
  init.cmd 1-3
  initialization
    init.cmd 1-3
  invoking
    .cshrc 1-23
–bl debugger option 4-2
board.cfg file 1-3
board.dat file 1-3, 1-20
booting problems 2-2
building the kernel 1-14
–bw debugger option 4-2

C

C I/O support 4-5
cable requirements 1-2
CACHEVIEW command 4-6
CD-ROM
  mounting 1-17
  retrieving files from 1-18
  unmounting 1-18
cd unix command 1-11, 1-14
changing directories 1-11, 1-14
changing the debugger display (font) 1-26
chmod unix command 1-15, 2-3
colors
  mapping with the X Window System 1-26
command line editing 4-3
compiler 1-3
composer utility 1-3
config unix command 1-14
configuration file
  board.cfg 1-3
  board.dat 1-3, 1-20
  confirming 1-15
  example 1-13
  locating the name 1-11
  modifying 1-11 to 1-14
  renaming 1-11 to 1-14
copying files 1-14
  unix command 1-12
cp unix command 1-12, 1-14
.cshrc file 1-21
  invoking 1-23
  sample 1-21
customizing the display
  changing the font 1-26
  init.clr file 1-3

D

–d debugger option
  with D_OPTIONS environment variable 1-22
D_DIR environment variable 1-22
D_OPTIONS environment variable 1-22
  troubleshooting 2-6
D_SRC environment variable 1-22

data cache
  disabling 4-7
  viewing 4-6
debugger
  access to emulator 1-15
  changing font size 4-4
  changing the displayed font 1-26
  communicating with your target system 1-3, 1-20
  displaying on a different machine 1-23
  environment setup 1-21 to 1-23
  installation 1-1 to 1-26
    troubleshooting 2-5 to 2-6
    verifying 1-24
  resizing windows 4-2
  troubleshooting 2-5 to 2-6, 2-7 to 2-8
  using the X Window System 1-25 to 1-26
  watch windows 4-2
default
  memory map 1-3
  screen configuration file
    color displays 1-3
  SCSI ID 1-7
directories
  for auxiliary files 1-22
  for debugger software 1-18, 1-21
  identifying additional source directories 1-22
  mvphll directory 1-18, 1-22
DISPLAY environment variable 1-23
display requirements 1-2
downloading code 1-19
driver file
  troubleshooting 2-3, 2-5

E

editing the command line 4-3
emulation cable 1-8
emulator 1-2
  adding to the SCSI bus 1-9 to 1-10
  additional tools 1-3
  assigning a SCSI ID 1-7
  booting problems 2-2
  communicating with your workstation 1-11
  connecting to workstation 1-9 to 1-10
  connecting to your target system 1-16
  debugger environment 1-21 to 1-23
emulator (*continued*)
  debugger installation 1-1 to 1-26
    verifying 1-24
  default SCSI ID 1-7
  driver file access 2-3
  front view 1-6, 1-8
  host system 1-2
  installation 1-5 to 1-10
    debugger software 1-17
    verifying 1-24
  LED lights 1-6
  locating the SCSI ID 1-7
  memory
    default map 1-3
  operating system 1-3
  rear view 1-6, 1-10
  requirements
    cable 1-2
    display 1-2
    hardware 1-2
    mouse 1-2
    power 1-2
    software 1-3 to 1-4
  resetting 1-3
    problems 2-3 to 2-4, 2-7 to 2-8
  screen configuration files 1-3
  self test 1-6
  setting the SCSI ID 1-8
  state
    LED lights 3-4
  target system 1-2
  terminating the SCSI bus 1-10
  troubleshooting 2-1 to 2-8
  typical setup 1-5
EMULATOR file 1-11 to 1-14
  creating a new kernel 1-14
  creating the EMULATOR directory 1-14
  example 1-13
  modifying 1-12
  running the new kernel 1-14
  troubleshooting 2-3
emurst command 1-3, 1-19
  specifying parameters 2-3
  troubleshooting 2-3 to 2-4, 2-7 to 2-8
  when invoking the debugger 2-5
end key 1-25
enhancements 4-2 to 4-4

environment variables
D_DIR 1-22
D_OPTIONS 1-22
D_SRC 1-22
DISPLAY 1-23
displaying the debugger on a different machine 1-23
for debugger options 1-22
identifying auxiliary directories 1-22
identifying source directories 1-22
PATH 1-21
error messages
LED lights 3-4
exiting your workstation 1-7

F

–f debugger option
troubleshooting 2-5
with D_OPTIONS environment variable 1-22
function keys (F1-F10)
mapping 1-25
font
changing the debugger display 1-26
troubleshooting 2-6
–font debugger option 4-4

G

GENERIC file 1-11 to 1-14
renaming 1-12
global breakpoints 4-5

H

halt unix command 1-7
hardware
checklist 1-2
installation 1-5 to 1-10
home key 1-25
host system 1-2

I

–i debugger option
with D_OPTIONS environment variable 1-22
ident 1-12
identifier
locating a SCSI ID 1-7
init.clr file 1-3
init.cmd file 1-3
initialization batch files
init.cmd 1-3
insert key 1-25
installation
debugger software 1-17
emulator 1-5 to 1-10
troubleshooting 2-1 to 2-8
verifying 1-24
invoking
.cshrc file 1-23
debugger 1-24
troubleshooting 2-5 to 2-6
IPCMESSAGE option 1-12
ipcrm unix command 2-3
ipcs unix command 2-3
IPCSEMAPHORE option 1-12, 2-3
IPCSHMEM option 1-12

K

kernel
building 1-14
confirming 1-15
modifying 1-11 to 1-14
running 1-14
keyboard
mapping keys 1-25
keys
special keys with the X Window System 1-25
keystrokes redefined 4-3
keysym label 1-25

L

labels
keysym 1-25
LED lights 1-6, 3-1 to 3-6
after emurst 1-19
LED 1-LED 8 3-2 to 3-5
location 3-2
overview 3-6
standard sequences 3-6
states 3-2
lights on the front of the emulator 1-6

LINE command 4-4
linker 1-3
little-endian support 4-5
locating the SCSI ID 1-7
ls unix command 1-15

M

make unix command 1-14
mapping keys for use with the X Window System 1-25
memory
  default map 1-3
  mapping
    init.cmd file 1-3
memory access
  alignment 4-6
  less than a word 4-6
memory windows
  creating multiple 4-3
monochrome monitors
  color mapping with the X Window System 1-26
mouse requirements 1-2
mpemu command 1-3
  options
    D_OPTIONS environment variable 1-22
  troubleshooting 2-5 to 2-6, 2-7 to 2-8
  verifying the installation 1-24
mv unix command 1-14
mvp510ws.out file 1-3, 1-19
mvphll directory 1-18, 1-22

N

–n debugger option
  troubleshooting 2-5
  with D_OPTIONS environment variable 1-22

O

–o debugger option
  with C I/O support 4-5
  with D_OPTIONS environment variable 1-22
OpenWindows
  finding the font file 2-6
operating system 1-3
optional files 1-3
options
  IPCMESSAGE 1-12
  IPCSEMAPHORE 1-12, 2-3
  IPCSHMEM 1-12

P

–p debugger option
  selecting the driver file
    troubleshooting 2-3, 2-5
  using with emurst 1-19
  with D_OPTIONS environment variable 1-22
page-up/page-down keys 1-25
PATH statement 1-21
permissions
  changing 1-15
  root access 1-2
power loss
  detecting 3-3
power supply 1-6
  requirements 1-2
ppemu command 1-3
  D_OPTIONS environment variable 1-22
  troubleshooting 2-5 to 2-6, 2-7 to 2-8
printenv unix command 1-7
probe–scsi unix command 1-7

R

rebooting your workstation 1-7, 1-14
release notes 4-1 to 4-8
renaming files 1-12
required files 1-3
required tools 1-3
resetting
  emurst command 1-3
  troubleshooting 2-3 to 2-4, 2-7 to 2-8
resizing debugger windows 4-2
retrieving files from CD-ROM 1-18
root privileges 1-2

S

–s debugger option
  with D_OPTIONS environment variable 1-22
SAFEHALT command 4-4

SCSI bus
adding devices 1-9 to 1-10
terminating the chain 1-10
SCSI ID
assigning 1-7
locating 1-7
setting on the emulator 1-8
self test 1-6
shutdown unix command 1-14
software checklist 1-3 to 1-4
SPARC
display requirements 1-2
hardware requirements 1-2
host system 1-2
mouse requirements 1-2
operating system 1-3
power requirements 1-2
setting up debugger environment 1-21 to 1-23
software requirements 1-3 to 1-4
SPARCstations 1-11
target system 1-2
special keys
X Window System 1-25
sun4 1-11
sun4c 1-11
sun4m 1-11
switching directories 1-11

T

–t debugger option
with D_OPTIONS environment variable 1-22
target # 1-12
target system 1-2
connection to emulator 1-16
describing to the debugger 1-3, 1-20
termination
external terminator for the SCSI chain 1-10
terminator
SCSI bus 1-2
troubleshooting 2-1 to 2-8
when booting workstation 2-2
when invoking the debugger 2-5 to 2-6
when resetting emulator 2-3 to 2-4, 2-7 to 2-8
when using the debugger 2-7 to 2-8

U

utilities
xev 1-25
xmodmap 1-25
xrdb 1-26

V

–v debugger option
with D_OPTIONS environment variable 1-22
verifying
installation 1-24
troubleshooting 2-5
vi editor 1-12
exiting 1-14

W

WA command 4-2
watch windows
creating multiple 4-2
removing 4-3
removing an expression from 4-2
window resizing 4-2
workstation
configuring 1-11
connecting emulator 1-9 to 1-10
modifying your configuration file 1-11 to 1-14
modifying your kernel 1-11 to 1-14
problems when booting 2-2
rebooting 1-14
typical setup 1-5

X

–x debugger option 1-22
using with emurst 1-19
X Window System
changing the displayed font 1-26
color mapping 1-26
displaying debugger on a different machine 1-23
special keys 1-25
using with the debugger 1-25 to 1-26
xev utility 1-25
xmodmap utility 1-25

.Xdefaults file
    changing the displayed debugger font 1-26
XDS510WS 1-2
xev utility 1-25
xmodmap utility 1-25

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