TEXAS INSTRUMENTS

TMS320C5x Emulator

Release 7.40

Getting Started Guide

1996 Digital Signal Processing Solutions

Texas Instruments

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TMS320C5x Emulator Getting Started Guide

Release 7.40

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Preface

Read This First

About This Manual

The *TMS320C5x Emulator Getting Started Guide* tells you how to install release 7.40 of the TMS320C5x emulator debugging tools on your system. It also does the following:

- Tells you how to set environment variables for parameters that you use often
- Gives helpful information for troubleshooting
- Gives information on new or changed features for this release of the emulator

How to Use This Manual

The goal of this book is to get you started using the emulator specifically designed for the TMS320C5x. Following are the topics covered in this getting started guide:

For information about …	**Refer to** …
Installing the debugger software, setting environment variables, and verifying the installation on DOS and Windows™ 3.x systems	Chapter 1
Installing the debugger software, setting environment variables, and verifying the installation on OS/2™ systems	Chapter 2
Installing the debugger software, setting environment variables, and verifying the installation on a SPARCstation™	Chapter 3
Installing the debugger software, setting environment variables, and verifying the installation on an HP system	Chapter 4
Enabling extended addressing	Chapter 5
Release enhancements	Chapter 6
Using extended addressing with the debugger	Chapter 7
Troubleshooting	Appendix A

Notational Conventions

- The TMS320C50, TMS320C51, TMS320C52, and TMS320C53 devices are referred to as ’C5x.
- Program listings, program examples, and interactive displays are shown in a `special typeface` similar to a typewriter’s. Examples use a **`bold version`** of the special typeface for emphasis; interactive displays use a **`bold version`** of the special typeface to distinguish commands that you enter from items that the system displays (such as prompts, command output, error messages, etc.).

  Here is an example of a command that you might enter:

  `cd /cdrom/hp`
- In syntax descriptions, the instruction, command, or directive is in a **bold typeface** font and parameters are in an *italic typeface*. Portions of a syntax that are in **bold** should be entered as shown; portions of a syntax that are in *italics* describe the type of information that should be entered. Here is an example of a command syntax:

  set PATH=C:*pathname1***;** *pathname2*

  set is the command. This command has one parameter, indicated by *pathname*.
- Square brackets ([and]) identify an optional parameter. If you use an optional parameter, you specify the information within the brackets; you don’t enter the brackets themselves. Here’s an example of a command that has optional parameters:

  emurst [*options*]

  This command allows you to specify one or more options.

Related Documentation From Texas Instruments

The following books describe the TMS320C5x devices and related support tools. To obtain a copy of any of these TI documents, call the Texas Instruments Literature Response Center at (800) 477–8924. When ordering, please identify the book by its title and literature number.

XDS51x Emulator Installation Guide (literature number SPNU070) describes the installation of the XDS510™, XDS510PP™, and XDS510WS™ emulator controllers. The installation of the XDS511™ emulator is also described.

TMS320C5x C Source Debugger User's Guide (literature number SPRU055) tells you how to invoke the 'C5x emulator, EVM, and simulator versions of the C source debugger interface. This book discusses various aspects of the debugger interface, including window management, command entry, code execution, data management, and breakpoints. It also includes a tutorial that introduces basic debugger functionality.

TMS320C1x/C2x/C2xx/C5x Assembly Language Tools User's Guide (literature number SPRU018) describes the assembly language tools (assembler, linker, and other tools used to develop assembly language code), assembler directives, macros, common object file format, and symbolic debugging directives for the 'C1x, 'C2x, 'C2xx, and 'C5x generations of devices.

TMS320C2x/C2xx/C5x Optimizing C Compiler User's Guide (literature number SPRU024) describes the 'C2x/C2xx/C5x C compiler. This C compiler accepts ANSI standard C source code and produces TMS320 assembly language source code for the 'C2x, 'C2xx, and 'C5x generations of devices.

TMS320C5x User's Guide (literature number SPRU056) describes the 'C5x 16-bit, fixed-point, general-purpose digital signal processors. Covered are its architecture, internal register structure, instruction set, pipeline, specifications, DMA, I/O ports, and on-chip peripherals.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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Notes: 1) The literature number for the book is required; see the center of the title page.

2) Please mention the full title of the book, the literature number from the lower-right corner of the back cover, and the publication date from the spine or front cover.

Contents

Chapter 1

Installing the Debugger With DOS or Windows 3.x

This chapter helps you install the C source debugger on a PC™ running DOS or Windows. When you complete the installation, see the *TMS320C5x C Source Debugger User's Guide* for instructions on using the debugger.

To install the XDS510 emulator controller, see the *XDS51x Emulator Installation Guide*.

Topic **Page**

1.1 System Requirements

To install and use the ’C5x emulator and C source debugger, you need the items listed in the following hardware and software checklists.

Hardware checklist

☐	**System**	80386-, 80486-, or Pentium™-based PC with a 100% compatible ISA/EISA card slot
☐	**Memory**	4–16 Mbytes of free memory is recommended to ensure optimum performance
☐	**Disk space**	10 Mbytes available disk space for executables and libraries
☐	**Display**	Monochrome or color monitor (color recommended)
☐	**Required hardware**	CD-ROM drive
☐	**Optional hardware**	Microsoft-compatible mouse
☐		EGA- or VGA-compatible graphics display card and a large (17 or 19 inch) monitor. The debugger has two options that allow you to change the overall size of the debugger display. To use a larger screen size, you must invoke the debugger with the appropriate option. For more information about options, see the invocation section in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User’s Guide*.
☐	**XDS510 emulator controller**	XDS510 or XDS510PP emulator controller

Note:

The speed at which your system operates depends on the amount of RAM available on your PC and the number of debuggers running simultaneously.

Software checklist

☐	**Operating system**	MS-DOS™ or PC-DOS™ (version 3.0 or later) Optional: Windows 3.x
☐	**Software tools**	TMS320C1x/C2x/C2xx/C5x DSP assembler and linker Optional: TMS320C2x/C2xx/C5x C compiler
☐	**Required files included with the debugger package**	The debugger executable file for your system: *emu5x.exe* is for DOS systems. *emu5xw.exe* is for Windows 3.x systems with one device. *emu5xwm.exe* is for Windows 3.x systems with multiple devices. You can use only one device at a time.
☐		*emurst* resets the emulator.
☐		*board.dat* describes your target system to the debugger in terms of what devices are on the emulation scan path. The board.dat file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.
☐	**Optional files included with the debugger package**	*emuinit.cmd* is a general-purpose batch file that contains debugger commands. The version of this file that's shipped with the debugger defines a 'C5x memory map. When you first start using the debugger, this memory map should be sufficient for your needs. Later, you may want to define your own memory map. For information about setting up your own memory map, see the *Defining a Memory Map* chapter in the *TMS320C5x C Source Debugger User's Guide*.
☐		*composer.exe* is the utility that translates the board.cfg file to a binary, conditioned format. For the emulator to initialize properly, you must create a new board.dat file with this release of the composer.
☐		*board.cfg* is a text file used to describe your target system in terms of what devices are on the emulation scan path. The board.cfg file included in the debugger package is for a target board with one TMS320C54x named *cpu_a*.
☐		*init.clr* is a general-purpose screen configuration file. If this file isn't present when you invoke the debugger, the debugger uses the default screen configuration.
☐		*init.25*, *init.43*, and *init.50* have been provided for basic 80×25, 80×43, and 80×50 screen sizes, respectively. The init.clr file brings up the debugger in 80×25 mode. To bring the debugger up in another mode, copy one of the init.xx files to the init.clr file.

- The default configuration is for color monitors; an additional file, *mono.clr*, can be used for monochrome monitors. When you first start to use the debugger, the default screen configuration should be sufficient for your needs. Later, you may want to define your own custom configuration.

  For information about these files and about setting up your own screen configuration, see the *Customizing the Debugger Display* chapter in the *TMS320C5x C Source Debugger User's Guide*.

1.2 Step 1: Installing the XDS510 Emulator Controller

Before installing the 'C5x debugger software, you must install an XDS510 emulator controller: the XDS510 or XDS510PP.

Follow the instructions in the *XDS51x Emulator Installation Guide* to install the XDS510 emulator controller.

1.3 Step 2: Installing the Debugger Software

This section explains the process of installing the debugger software on a hard-disk system for two different operating systems:

- ❑ DOS
- ❑ Windows 3.x

Installing the debugger on DOS systems

To install the debugger on a DOS system, follow these steps:

1) Insert the debugger CD-ROM into your CD-ROM drive.

2) Change to the CD-ROM drive (replace d with the letter of your CD-ROM drive):

   `d:` ↵

3) Enter the following command:

   `install` ↵

4) Follow the on-screen instructions.

Installing the debugger on Windows 3.x systems

To install the debugger on a Windows 3.x system, follow these steps:

1) Insert the debugger CD-ROM into your CD-ROM drive.

2) Start Windows 3.x.

3) From the File menu, select Run.

4) In the dialog box, enter the following command (replace d with the letter of your CD-ROM drive):

   `d:\setup.exe`

5) Click on OK.

6) Follow the on-screen instructions.

1.4 Step 3: Setting Up the Debugger Environment

You can define *environment variables* that set certain debugger parameters you normally use. An environment variable is a system symbol that you define and assign to a string. When you use environment variables, default values are set, making each individual invocation of the debugger simpler because these parameters are automatically specified.

The debugger uses environment variables for finding or obtaining certain types of information. By default, the installation program sets up these environment variables:

```
SET PATH=C:\c5xhll;%PATH%
SET D_DIR=C:\c5xhll
SET D_SRC=C:\c5xhll
SET D_OPTIONS=option1 option2...
```

D_OPTIONS is set to the options you enter when prompted. If you do not enter any options, then D_OPTIONS is not set.

If you choose not to have the environment variables set up automatically, you can modify your autoexec.bat file to include the SET commands above.

The remainder of this section describes these environment variables and other variables that you can define.

Identifying the directory that contains the executable files (PATH statement)

You must include the emulator directory in your PATH statement. This allows you to specify the debugger executable without specifying the name of the directory that contains the executable file.

- If you modify your autoexec.bat file to change the path information, add the following to the end of the PATH statement:

  ;C:\c5xhll

- If you are creating a batch file, use this format:

  SET PATH=C:\c5xhll;%PATH%

  (Be careful not to precede the equal sign with a space.)

  The addition of **;%PATH%** ensures that this PATH statement does not undo the PATH statements in any other batch files (including the autoexec.bat file).

Identifying alternate directories for the debugger (D_DIR)

The debugger uses the D_DIR environment variable to name alternative directories that contain auxiliary files (emurst, emuinit.cmd, etc.) that the debugger needs. The command for assigning the environment variable is as follows:

SET D_DIR=C:\c5xhll

(Be careful not to precede the equal sign with a space.)

Identifying directories that contain source files (D_SRC)

The debugger uses the D_SRC environment variable to name directories that contain program source files The command for assigning the environment variable is as follows:

SET D_SRC=*pathname1; pathname2 . . .*

(Be careful not to precede the equal sign with a space.)

The *pathnames* are directories that contain program source files. You can separate pathnames with a semicolon or with blanks.

Setting default debugger options (D_OPTIONS)

You might find it useful to set default debugger options using the D_OPTIONS environment variable. When you use the D_OPTIONS environment variable, the debugger uses the options and/or input filenames that you name with D_OPTIONS every time you run the debugger. The command for assigning the environment variable is a follows:

SET D_OPTIONS=[*object filename*] [*debugger options*]

(Be careful not to precede the equal sign with a space.)

This tells the debugger to load the specified object file and use the specified 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	Brief Description
–b[b]	Select the screen size
–f *filename*	Identify a new board configuration file
–i *pathname*	Identify additional directories
–n *processor name*	Identify processor for debugging
–p *port address*	Identify the port address
–profile	Enter profiling environment
–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 with the –x option.

For more information about options, see the invocation instructions in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User's Guide*.

1.5 Step 4: Resetting the Emulator

You must reset the emulator *before* invoking the debugger. Reset can occur only after you have powered up the target board. You can reset the emulator in one of these ways:

- Add the emurst command to the autoexec.bat file in the following format:

  emurst [**-x**] [**-p** *number*]

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

  The –p option *number* represents the device driver number.

If the following message appears after the emulator is reset, you have a hardware error:

```
CANNOT DETECT TARGET POWER
```

One of several problems may cause this error message to appear. Follow the suggestions listed below and restart your PC. Check:

- Is the emulator board installed snugly?
- Is the cable connecting your emulator and target system loose?
- Is the target power on?
- Is your target board getting the correct voltage?
- Is your emulator scan path uninterrupted?
- Is your port address set correctly?
  - Check to be sure the –p option of the D_OPTIONS environment variable matches the I/O address defined by your switch settings. For information about the switch settings, see the *XDS51x Emulator Installation Guide.*
  - Check to see if you have a conflict in address space with another bus setting. If you have a conflict, change the switches on your board to one of the alternate settings. Modify the –p option of the D_OPTIONS environment variable to reflect the change in your switch settings.

1.6 Step 5: Describing Your Target System to the Debugger

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

- ❑ If you're using an emulation scan path that contains only one 'C5x and no other devices, you can use the *board.dat* file that comes with the 'C5x emulator kit. This file describes to the debugger the single 'C5x in the scan path and gives the 'C5x the name cpu_a. 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 Section 1.7.

- ❑ If you want to use a different name for the target device, you must follow these steps:

  1) Create the board configuration file.

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

  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 *TMS320C5x C Source Debugger User's Guide*.

1.7 Step 6: Verifying the Installation

To ensure that you have correctly installed the emulator and debugger software, enter one of these commands:

- For DOS systems, enter this command from the DOS prompt:

  emu5x c:\c5xhll\sample ↵

- For Windows systems, choose one of these commands:

  - If you have one device in your scan path, enter this command from the system prompt:

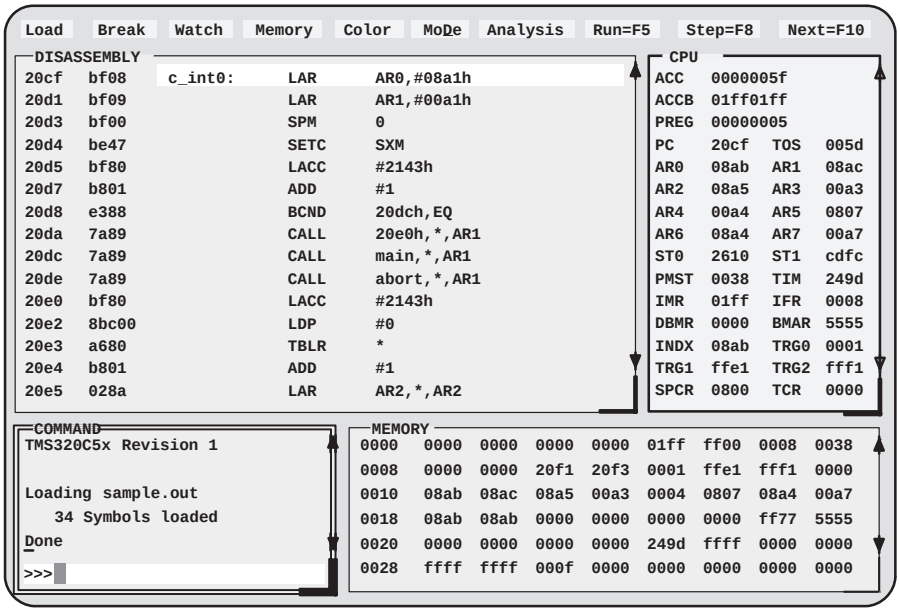
    emu5xw c:\c5xhll\sample ↵

  - If you have more than one device in your scan path, enter this command from the system prompt:

    emu5xwm c:\c5xhll\sample –n cpu_a ↵

    Note that while the emu5xwm executable supports more than one device on the target board, you can use only one device at a time.

You should see a display similar to this one:



- If you see a display similar to this one, you have correctly installed your emulator and debugger.
- If you see a display and the lines of code show ADD instructions, your emulator board may not be installed snugly. Check your board to see whether it is correctly installed, and reenter the command above.

- ❏ If you see a display and the lines of code say *Invalid address* or the fields in the MEMORY window are shown in red, the debugger may not be able to find the emuinit.cmd file. Check for the file in the directories specified by the D_SRC environment variable or ensure that the file is in the current directory. Reenter the command above.
- ❏ If you don't see a display, 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 reenter the command above.

Installation error messages

While invoking the debugger, you may see the following message:

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

One or several of the following conditions may be the cause:

- ❏ Is the target power on?
- ❏ Is the emulator board installed snugly?
- ❏ Is the device installed snugly?
- ❏ Is the cable connecting your emulator and target system loose?
- ❏ Is your target board getting the correct voltage?
- ❏ Is your emulator scan path interrupted? For DOS systems, only one device is allowed in the scan path. Check the connections; either they are not connected, or they are connected improperly.
- ❏ Did you use the –n option? Or was it used with an incorrect device name? You must supply a valid device name with the –n option.
- ❏ After you powered up the target board, did you execute the emurst.exe command? Check your autoexec.bat file. This command must be executed *after* you powered up the target board.

- ❑ Did you use the –p option? Is your port address set correctly?
  - ■ Check to be sure the –p option used with the D_OPTIONS environment variable matches the I/O address defined by your switch settings. For information about the switch settings, see the *XDS51x Emulator Installation Guide.*
  - ■ Check to see whether you have a conflict in address space with another bus setting. If you have a conflict, change the switches on your board to one of the alternate settings. Modify the –p option of the D_OPTIONS environment variable to reflect the change in your switch settings.
- ❑ Is the board.dat file in the current directory or in a directory specified by D_DIR?

After you have checked all of the above, repeat the verification instructions on page 1-11.

1.8 Using the Debugger With Windows 3.x

If you're using Windows 3.x, you can freely move or resize the debugger display on the screen. If the resized display is bigger than the debugger requires, the extra space is not used. If the resized display is smaller than required, the display is clipped. Note that when the display is clipped, it can't be scrolled.

You should run Windows 3.x in either the standard mode or the 386 enhanced mode to get the best results.

Chapter 2

Installing the Debugger With OS/2

This chapter helps you to install the C source debugger on a PC system running OS/2. When you complete the installation, see the *TMS320C5x C Source Debugger User's Guide* for instructions on using the debugger.

To install the XDS510 emulator controller, see the *XDS51x Emulator Installation Guide*.

Topic **Page**

2.1 System Requirements

To install and use the ’C5x emulator and C source debugger, you need the items listed in the following hardware and software checklists.

Hardware checklist

☐	**System**	80386-, 80486-, or Pentium-based PC with a 100% compatible ISA/ EISA card slot
☐	**Memory**	Minimum of 8 Mbytes
☐	**Disk space**	10 Mbytes available disk space for executables and libraries
☐	**Display**	Monochrome or color (color recommended)
☐	**Required hardware**	CD-ROM drive
☐	**Optional hardware**	Microsoft-compatible mouse
☐		EGA- or VGA-compatible graphics display card and a large monitor (17 or 19 inch). The debugger has two options that allow you to change the overall size of the debugger display. To use a larger screen size, you must invoke the debugger with the appropriate option. For more information about options, see the invocation section in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User’s Guide*.
☐	**XDS510 emulator controller**	XDS510 or XDS510PP emulator controller

Note:

The speed at which your system operates depends on the amount of RAM available on your PC and the number of debuggers running simultaneously.

Software checklist

☐	**Operating system**	OS/2 version 1.1 or later
☐	**Software tools**	TMS320C1x/C2x/C2xx/C5x DSP assembler and linker Optional: TMS320C2x/C2xx/C5x C compiler
☐	**Required files included with the debugger package**	*emu5xo.exe* is the debugger executable file.
☐		*emurst.exe* resets the emulator.
☐		*board.dat* describes your target board to the debugger in terms of what devices are on the emulation scan path. The board.dat file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.
☐	**Optional files**	*emuinit.cmd* is a general-purpose batch file that contains debugger commands. The version of this file that's shipped with the debugger defines a 'C5x memory map. When you first start using the debugger, this memory map should be sufficient for your needs. Later, you may want to define your own memory map. For information about setting up your own memory map, see the *Defining a Memory Map* chapter in the *TMS320C5x C Source Debugger User's Guide*.
☐		*composer.exe* is the utility that translates the board.cfg file to a binary, conditioned format. For the emulator to initialize properly, you must create a new board.dat file with this release of the composer.
☐		*board.cfg* is a text file used to describe your target system in terms of what devices are on the emulation scan path. The board.cfg file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.
☐		*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.
☐		*init.25*, *init.43*, and *init.50* have been provided for basic 80×25, 80×43, and 80×50 screen sizes, respectively. The init.clr file brings up the debugger in 80×25 mode. To bring the debugger up in another mode, copy one of the init.xx files to the init.clr file.

- The default configuration is for color monitors; an additional file, *mono.clr,* can be used with monochrome monitors. When you first start to use the debugger, the default screen configuration should be sufficient for your needs. Later, you may want to define your own custom configuration.

  For information about these files and about setting up your own screen configuration, see the *Customizing the Debugger Display* chapter in the *TMS320C5x C Source Debugger User's Guide*.

2.2 Step 1: Installing the XDS510 Emulator Controller

Before installing the 'C5x debugger software, you must install an XDS510 emulator controller: the XDS510 or XDS510PP.

Follow the instructions in the *XDS51x Emulator Installation Guide* to install the XDS510 emulator controller.

2.3 Step 2: Installing the Debugger Software

To install the debugger on an OS/2 system, follow these steps:

1) Insert the debugger CD-ROM into your CD-ROM drive.

2) Start a DOS-Windows session.

3) Change to the CD-ROM drive (replace d with the letter of your CD-ROM drive):

   `d:` ↵

4) Enter the following command:

   `install` ↵

5) Follow the on-screen instructions.

2.4 Step 3: Setting Up the Debugger Environment

You can define *environment variables* that set certain debugger parameters you normally use. An environment variable is a system symbol that you define and assign to a string. When you use environment variables, default values are set, making each individual invocation of the debugger simpler because these parameters are automatically specified.

The debugger uses environment variables for finding or obtaining certain types of information. By default, the installation program sets up these environment variables:

```
SET PATH=C:\c5xhll;%PATH%
SET D_DIR=C:\c5xhll
SET D_SRC=C:\c5xhll
SET D_OPTIONS=option1 option2 ...
```

D_OPTIONS is set to the options you enter when prompted. If you do not enter any options, then D_OPTIONS is not set.

If you choose not to have the environment variables set up automatically, you can modify your config.sys file to include the SET commands above.

The remainder of this section describes these environment variables and other variables that you can define.

Identifying the directory that contains the executable files (PATH statement)

You must include the emulator directory in your PATH statement. This allows you to specify the debugger executable without specifying the name of the directory that contains the executable file.

- If you modify your config.sys file to change the path information, add the following to the end of the PATH statement:

  ;C:\c5xhll

- If you are creating a batch file, use this format:

  SET PATH=C:\c5xhll;%PATH%

  (Be careful not to precede the equal sign with a space.)

  The addition of **;%PATH%** ensures that this PATH statement does not undo the PATH statements in any other batch files (including the config.sys file).

Identifying alternate directories for the debugger (D_DIR)

The debugger uses the D_DIR environment variable to name alternative directories that contain auxiliary files (emurst, emuinit.cmd, etc.) that the debugger needs. The command for assigning the environment variable is as follows:

SET D_DIR=C:\c5xhll

(Be careful not to precede the equal sign with a space.)

Identifying directories that contain source files (D_SRC)

The debugger uses the D_SRC environment variable to name directories that contain program source files The command for assigning the environment variable is as follows:

SET D_SRC=*pathname1; pathname2 . . .*

(Be careful not to precede the equal sign with a space.)

The *pathnames* are directories that contain program source files. You can separate pathnames with a semicolon or with blanks.

Setting default debugger options (D_OPTIONS)

You might find it useful to set default debugger options using the D_OPTIONS environment variable. When you use the D_OPTIONS environment variable, the debugger uses the options and/or input filenames that you name with D_OPTIONS every time you run the debugger. The command for assigning the environment variable is a follows:

SET D_OPTIONS=[*object filename*] [*debugger options*]

(Be careful not to precede the equal sign with a space.)

This tells the debugger to load the specified object file and use the specified options each time you invoke the debugger. Table 2–1 lists the options that you can identify with D_OPTIONS.

Table 2–1. Options for Use With D_OPTIONS

Option	Brief Description
–b[b]	Select the screen size
–f *filename*	Identify a new board configuration file
–i *pathname*	Identify additional directories
–n *processor name*	Identify processor for debugging
–p *port address*	Identify the port address
–profile	Enter profiling environment
–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 with the –x option.

For more information about options, see the invocation instructions in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User's Guide*.

Setting the IOPL option

You must override the default IOPL setting. IOPL is an OS/2-specific option that prevents you from accessing your emulator. To override the default setting, set IOPL to YES by adding the following line to your config.sys file:

```
IOPL=YES
```

Note:

You must set the IOPL option in the config.sys file; you cannot access it in any other way.

2.5 Step 4: Resetting the Emulator

You must reset the emulator *before* invoking the debugger. Reset can occur only after you have powered up the target board. You can reset the emulator in one of these ways:

- Add the following line to the end of your config.sys file:

  RUN = C:\C5XHLL\EMURST.EXE

> **Note:**
>
> If you reset the emulator using the RUN command in your config.sys file, emurst will *not* display an error message when trying to reset the emulator while a debugger is running. In addition, executing emurst in this manner will not produce any standard messages.

- Create or modify a file called C:\startup.cmd that contains the emurst command in the following format:

  emurst [**-x**] [**-p** *number*]

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

  The –p option *number* represents the device driver number.

> **Note:**
>
> If a debugger is running, emurst will not reset the emulator. The debugger displays the message, “RESET DISALLOWED : DEBUGGER RUNNING”.

If the following message appears after the emulator is reset, you have a hardware error:

```
CANNOT DETECT TARGET POWER
```

One of several problems may cause this error message to appear. Follow the suggestions listed below and restart your PC. Check:

- Is the emulator board installed snugly?
- Is the cable connecting your emulator and target system loose?
- Is the target power on?
- Is your target board getting the correct voltage?
- Is your emulator scan path uninterrupted?

- ❑ Is your port address set correctly?
  - ■ Check to be sure the –p option of the D_OPTIONS environment variable matches the I/O address defined by your switch settings. For information about the switch settings, see the XDS510 installation instructions in the *XDS51x Emulator Installation Guide.*
  - ■ Check to see if you have a conflict in address space with another bus setting. If you have a conflict, change the switches on your board to one of the alternate settings. Modify the –p option of the D_OPTIONS environment variable to reflect the change in your switch settings.

2.6 Step 5: Describing Your Target System to the Debugger

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

- ❑ If you're using an emulation scan path that contains only one 'C5x and no other devices, you can use the *board.dat* file that comes with the 'C5x emulator kit. This file describes to the debugger the single 'C5x in the scan path and gives the 'C5x the name cpu_a. 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 Section 2.7.
- ❑ If you plan to use a different target system, you must follow these steps:
  1) Create the board configuration file.
  2) Translate the board configuration file to binary so that the debugger can read it.
  3) Specify the configuration file when invoking the debugger.

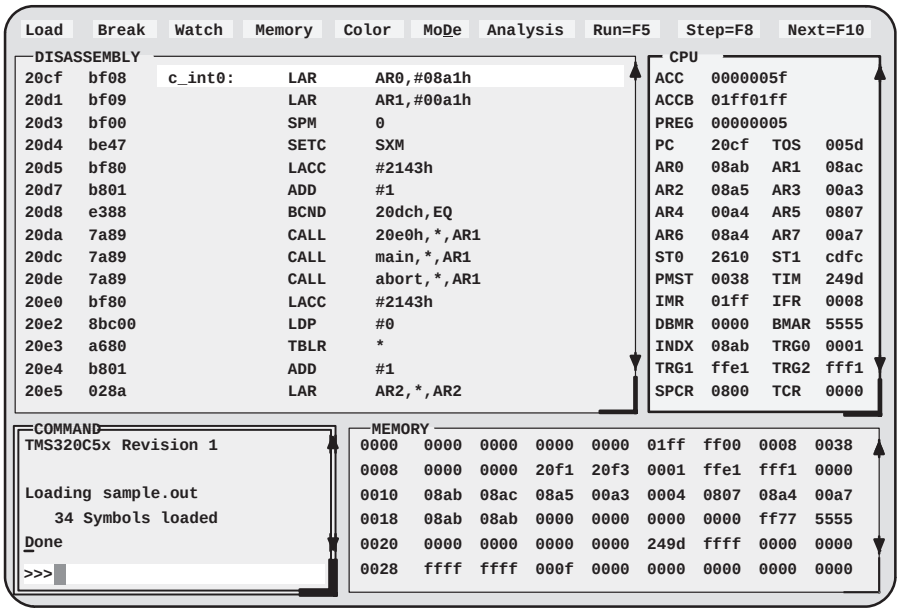
  These steps are described in the *Describing Your Target System to the Debugger* appendix in the *TMS320C5x C Source Debugger User's Guide*.

2.7 Step 6: Verifying the Installation

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

emu5xo c:\C5xhll\sample –n cpu_a ↵

You should see a display similar to this one:



- ❑ If you see a display similar to this one, you have correctly installed your emulator and debugger.
- ❑ If you see a display and the lines of code show ADD instructions, your emulator board may not be installed snugly. Check your board to see whether it is correctly installed, and reenter the command above.
- ❑ If you see a display and the lines of code say *Invalid address* or the fields in the MEMORY window are shown in red, the debugger may not be able to find the emuinit.cmd file. Check for the file in the directories specified by the D_SRC environment variable or ensure that the file is in the current directory. Reenter the command above.
- ❑ 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 reenter the command above.

Installation error messages

While invoking the debugger, you may see the following message:

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

One of several of the following conditions may be the cause; check:

- ❑ Is the target power on?
- ❑ Is the emulator board installed snugly?
- ❑ Is the device installed snugly?
- ❑ Is the cable connecting your emulator and target system loose?
- ❑ Is your target board getting the correct voltage?
- ❑ Is your emulator scan path interrupted? One or more devices on the emulator scan path may have been removed. Check the connections; either they are not connected, or they are connected improperly.
- ❑ Did you use the –n option? Or was it used with an incorrect device name? You must supply a valid device name with the –n option.
- ❑ After you powered up the target board, did you execute the emurst.exe command? Check your startup.cmd file or config.sys file. This command must be executed *after* you powered up the target board.
- ❑ Did you use the –p option? Is your port address set correctly?
  - ■ Check to be sure the –p option of the D_OPTIONS environment variable matches the I/O address defined by your switch settings. For information about the switch settings, see the *XDS51x Emulator Installation Guide.*
  - ■ Check to see whether you have a conflict in address space with another bus setting. If you have a conflict, change the switches on your board to one of the alternate settings. Modify the –p option of the D_OPTIONS environment variable to reflect the change in your switch settings.
- ❑ Is the board.dat file in the current directory or in a directory specified by D_DIR?

Note:

If the debugger suddenly quits or behaves erratically during the debugging process, the board.dat file may contain incorrect information in the correct format. See Section 2.6, *Step 5: Describing Your Target System to the Debugger*, page 2-10 for more information.

After you have checked all of the above, repeat the verification instructions on page 2-11.

Chapter 3

Installing the Debugger on a SPARCstation

This chapter helps you to install the TMS320C5x C source debugger on a SPARCstation running OpenWindows™ under SunOS™ version 4.1.1 (or higher). After completing the installation, see the *TMS320C5x C Source Debugger User's Guide* for instructions on using the debugger.

To install the XDS510WS emulator controller, see the *XDS51x Emulator Installation Guide.*

Topic **Page**

3.1 System Requirements

To install and use the ’C5x emulator and C source debugger, you need the items listed in the following hardware and software checklists.

Hardware checklist

☐	**System**	SPARCstation or 100% compatible system
☐	**Display**	Monochrome or color (color recommended)
☐	**CD-ROM drive**	CD-ROM drive
☐	**XDS510 emulator controller**	XDS510WS emulator controller

Software checklist

☐	**Operating system**	SunOS version 4.1.3 (or higher) or SunOS version 5.x (also known as Solaris 2.x) using an X Window System-based window manager, such as OpenWindows version 3.0 (or higher).
☐	**Root privileges**	If you are running SunOS 4.1.x, 5.0, or 5.1, you *must* have root privileges to mount and unmount the CD-ROM. If you don’t, get help from your system administrator.
☐	**Software tools**	TMS320C1x/C2x/C2xx/C5x DSP assembler and linker Optional: TMS320C2x/C5x DSP C compiler
☐	**Required files included with debugger package**	*emu5x* is the debugger executable file.
☐		*c5x510ws.out* is the executable portion of the debugger that runs on the emulator.
☐		*emurst* resets the emulator and downloads c5x510ws.out to the emulator.
☐		*board.dat* describes your target board to your debugger in terms of what devices are in the emulation scan path. The board.dat file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.

Optional files included with debugger package

- *emuinit.cmd* is a general-purpose batch file that contains debugger commands. The version of this file that's shipped with the debugger defines a 'C5x memory map. When you first start using the debugger, this memory map should be sufficient for your needs. Later, you may want to define your own memory map. For information about setting up your own memory map, see the *Defining a Memory Map* chapter in the *TMS320C5x C Source Debugger User's Guide*.

- *composer* is the utility that translates the board.cfg file to a binary, conditioned format. For the emulator to initialize properly, you must create a new board.dat file with this release of the composer.

- *board.cfg* is a text file used to describe your target system in terms of what devices are on the emulation scan path. The board.cfg file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.

- *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.

- *init.25*, *init.43*, and *init.50* have been provided for basic 80×25, 80×43, and 80×50 screen sizes, respectively. The init.clr file brings up the debugger in 80×25 mode. To bring the debugger up in another mode, copy one of the init.xx files to the init.clr file.

- The default configuration is for color monitors; an additional file, *mono.clr,* can be used with monochrome monitors. When you first start to use the debugger, the default screen configuration should be sufficient for your needs. Later, you may want to define your own custom configuration.

  For information about these files and about setting up your own screen configuration, see the *Customizing the Debugger Display* chapter in the *TMS320C5x C Source Debugger User's Guide*.

3.2 Step 1: Installing the XDS510WS Emulator Controller

Before installing the 'C5x debugger software, you must install an XDS510WS emulator controller.

Follow the instructions in the *XDS51x Emulator Installation Guide* to install the XDS510WS emulator controller.

3.3 Step 2: Installing the Debugger Software

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

Note:

If you are running SunOS 4.1x, 5.0, or 5.1, you *must* have root privileges to mount or unmount the CD-ROM. If you don't, get help from your system administrator.

Mounting the CD-ROM

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

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

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

- ❏ If you have SunOS 5.0 or 5.1, load the CD-ROM into the drive. As root, enter the following from a command shell:

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

- ❏ If you have SunOS 5.2 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/sparc ⏎
    ```

- 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/sparc ↵

Copying the files

After you mount the CD_ROM, you must create the directory that will contain the debugger software and copy the software to that directory.

1) Create a directory named *c5xhll* on your hard disk. To create this directory, enter:

   mkdir /*your_pathname*/c5xhll

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

   cp -r * /*your_pathname*/c5xhll

Unmounting the CD-ROM

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

- If you have a SunOS 4.1.x, 5.0, or 5.1, as root, enter the following from a command shell:

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

- If you have SunOS 5.2 or higher, enter the following from a command shell:

  cd ↵
  eject ↵

3.4 Step 3: Ensuring That 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 debugger 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.

The –p option *number* represents the device driver number you defined in the EMULATOR configuration file (see the *XDS51x Emulator Installation Guide*), and *pathname–filename* is the location and name of the c5x510ws.out file. Specify the number in hexadecimal.

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

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.

3.5 Step 4: 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 'C5x and no other devices, you can use the *board.dat* file that comes with the 'C5x emulator kit. This file describes to the debugger the single 'C5x in the scan path and gives the 'C5x the name *cpu_a*. 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 Section 3.6.

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

  1) Create the board configuration file.

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

  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 *TMS320C5x C Source Debugger User's Guide*.

3.6 Step 5: Setting Up the Debugger Environment

To ensure that your debugger works correctly, you must:

- ❑ Modify the path shell variable to identify the c5xhll directory
- ❑ Set up the environment variables that you want to use
- ❑ Reinitialize your shell

Modifying the path statement

You must include the debugger directory in your shell path. To do this, you need to modify your shell configuration file in your home directory (for example, the .cshrc file for a C shell). Include the pathname to your c5xhll directory in your path. The following statement is an example of what a typical path-variable definition looks like:

```
set path = (. /bin /usr/ucb /usr/contrib/bin /usr/bin \
/usr/openwin/bin)
```

The following is an example of a modified path variable. The part of the path that is boldface is an example of a pathname that identifies the c5xhll directory:

```
set path = (. /bin /usr/ucb /usr/contrib/bin /usr/bin \
/usr/openwin/bin /user/fred/c5xhll)
```

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. You can set up the environment variables in your shell configuration file. The debugger uses four environment variables, named D_DIR, D_SRC, D_OPTIONS, and DISPLAY:

- ❑ Set up the D_DIR environment variable to identify the c5xhll directory. The general format for doing this is:

  `setenv D_DIR "/user/fred/c5xhll"`

  (Be sure to enclose the directory name within quotes.)

  This directory contains auxiliary files (such as emuinit.cmd) 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 access from the debugger. The general format for doing this is:

  setenv D_SRC "*pathname1; pathname2...***"**

  (Be sure to enclose the path names within one set of quotes.)

  For example, if your programs were in a directory named */user/fred/c5xcode*, the D_SRC setup would be:

  `setenv D_SRC "/user/fred/c5xcode"`

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

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

  (Be sure to enclose the options and filenames within one set of quotes.)

  This tells the debugger to load the specified object file and use the specified options each time you invoke the debugger. These are the options that you can identify with D_OPTIONS:

Option	Brief Description
–b[b]	Select the screen size
–d *machine name*	Display debugger on different machine
–f *filename*	Identify a new board configuration file
–i *pathname*	Identify additional directories
–n *processor name*	Identify processor for debugging
–p *port address*	Identify the port address
–profile	Enter profiling environment
–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.

  For more information about options, see the invocation section in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User's Guide*.

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

  setenv DISPLAY "*machine name***"**

  For example, if you are running the debugger on a machine called opie and you want the 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.

  `emu5x –d barney:0` ⏎

  For more information about using the debugger under the X Window system, see Section 3.8, *Using the Debugger With the X Window System*, page 3-12.

Invoking the new or modified .cshrc file

When you modify your shell configuration file, you must ensure that the changes are made to your current session. For example, if you are using a C shell, use this command to reread the .cshrc file:

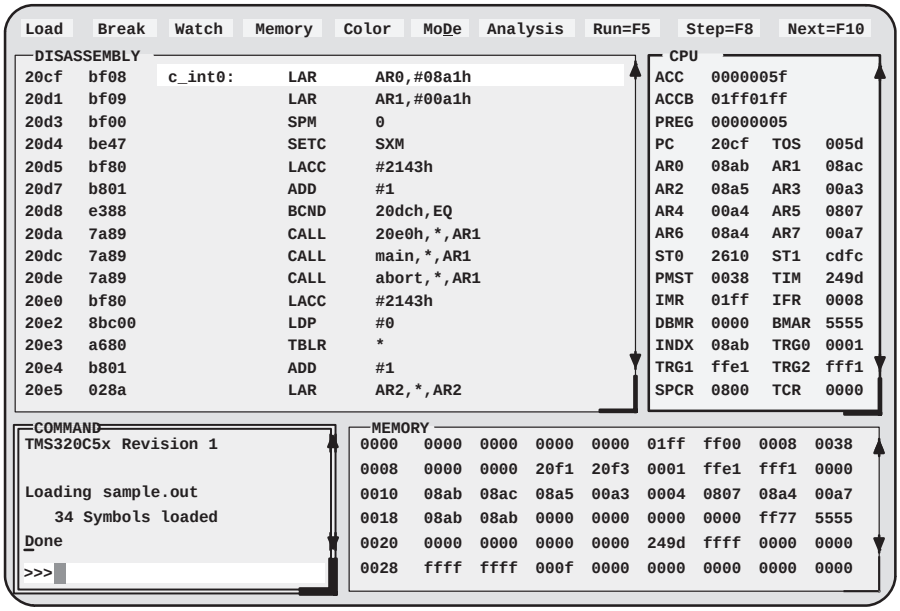
`source ~/.cshrc` ⏎

3.7 Step 6: Verifying the Installation

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

emu5x sample –n cpu_a ↵

You should see a display similar to this one:



- ❑ 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 reenter the command above.
- ❑ If you continue to experience problems, see Appendix A, *Troubleshooting*.

3.8 Using the Debugger With the X Window System

If you're using the X Window System to run the 'C5x debugger, you need to know about the keyboard's special keys, the debugger fonts, and using the debugger on a monochrome monitor.

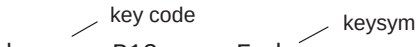
Using the keyboard's special keys

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

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.

Debugger Key Needed	Keysym for That Function
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 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 map a Sun Type 4 keyboard to 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 'C5x debugger fonts to Courier, add the following line to the .Xdefaults file:

```
emu5x*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, , you can use a monochrome monitor. 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 4

Installing the Debugger on an HP Workstation

This chapter helps you to install the TMS320C5x C source debugger on an HP 9000 Series 700™ PA-RISC™ computer with HP-UX™ 9.0x. After completing the installation, see the *TMS320C5x C Source Debugger User's Guide* for instructions on using the debugger.

To install the XDS510WS emulator controller, see the *XDS51x Emulator Installation Guide.*

Topic **Page**

4.1 System Requirements

To install and use the ’C5x emulator and C source debugger, you need the items listed in the following hardware and software checklists.

Hardware checklist

☐	**System**	HP 9000 Series 700 PA-RISC computer
☐	**Display**	Monochrome or color (color recommended)
☐	**CD-ROM drive**	CD-ROM drive
☐	**XDS51x emulator kit**	XDS510WS emulator

Software checklist

☐	**Operating system**	HP-UX version 9.0x or higher
☐	**Root privileges**	You *must* have root privileges to mount and unmount the CD-ROM. If you don’t, get help from your system administrator.
☐	**Software tools**	TMS320C1x/C2x/C2xx/C5x DSP assembler and linker Optional: TMS320C2x/C2xx/C5x C compiler
☐	**Required files included with debugger package**	*emu5x* is the debugger executable file.
☐		*c5x510ws.out* is the executable portion of the debugger that runs on the emulator.
☐		*emurst* resets the emulator and downloads c5x510ws.out to the emulator.
☐		*board.dat* describes your target board to your debugger in terms of what devices are on the emulation scan path. The board.dat file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.

Optional files included with debugger package

- *emuinit.cmd* is a general-purpose batch file that contains debugger commands. The version of this file that's shipped with the debugger defines a 'C5x memory map. When you first start using the debugger, this memory map should be sufficient for your needs. Later, you may want to define your own memory map. For information about setting up your own memory map, see the *Defining a Memory Map* chapter in the *TMS320C5x C Source Debugger User's Guide*.

- *composer* is the utility that translates the board.cfg file to a binary, conditioned format. For the emulator to initialize properly, you must create a new board.dat file with this release of the composer.

- *board.cfg* is a text file used to describe your target system in terms of what devices are on the emulation scan path. The board.cfg file included in the debugger package is for a target board with one TMS320C5x named *cpu_a*.

- *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.

- *init.25*, *init.43*, and *init.50* have been provided for basic 80×25, 80×43, and 80×50 screen sizes, respectively. The init.clr file brings up the debugger in 80×25 mode. To bring the debugger up in another mode, copy one of the init.xx files to the init.clr file.

- The default configuration is for color monitors; an additional file, *mono.clr*, can be used for monochrome monitors. When you first start to use the debugger, the default screen configuration should be sufficient for your needs. Later, you may want to define your own custom configuration.

  For information about these files and about setting up your own screen configuration, see the *Customizing the Debugger Display* chapter in the *TMS320C5x C Source Debugger User's Guide*.

4.2 Step 1: Installing the XDS510WS Emulator Controller

Before installing the 'C5x debugger software, you must install an XDS510WS emulator controller.

Follow the instructions in the *XDS51x Emulator Installation Guide* to install the XDS510WS emulator controller.

4.3 Step 2: Installing the Debugger Software

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

Note:

You *must* have root privileges to mount or unmount the CD-ROM. If you don't, get help from your system administrator.

Mounting the CD-ROM

As root, you can mount the CD-ROM using the UNIX mount command or the SAM (system administration manager):

- To use the UNIX mount command, enter:

  mount –rt cdfs /dev/dsk/*your_cdrom_device* /cdrom ↵
  exit ↵

  Make the hp directory on the CD-ROM the current directory. For example, if the CD-ROM is mounted at /cdrom, enter:

  cd /cdrom/hp ↵

- To use SAM to mount the CD-ROM, see *System Administration Tasks*, the HP documentation about SAM, for instructions.

Copying the files

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

1) Create a directory named *c5xhll* on your hard disk. To create this directory, enter:

   mkdir /*your_pathname*/c5xhll ↵

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

   cp –r * /*your_pathname*/c5xhll ↵

Unmounting the CD-ROM

You must unmount the CD-ROM after copying the files. As root, enter:

```
cd ↵
umount /cdrom ↵
exit ↵
```

4.4 Step 3: Ensuring That 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 debugger 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.

The –p option *number* represents the SCSI controller number concatenated to the SCSI ID number of the XDS510WS (for example, the default would be 2014), and *pathname–filename* is the location and name of the c5x510ws.out file.

If the default, *4*, is the SCSI ID for the emulator and if the emulator is on the default SCSI bus, you can omit the –p option.

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

4.5 Step 4: 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 'C5x and no other devices, you can use the *board.dat* file that comes with the 'C5x emulator kit. This file describes to the debugger the single 'C5x in the scan path and gives the 'C5x the name cpu_a. 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 Section 4.6.

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

  1) Create the board configuration file.

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

  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 *TMS320C5x C Source Debugger User's Guide*.

4.6 Step 5: Setting Up the Debugger Environment

To ensure that your debugger works correctly, you must:

- ❑ Modify the path shell variable to identify the c5xhll directory
- ❑ Set up the environment variables that you want to use
- ❑ Reinitialize your shell

Modifying the path statement

You must include the debugger directory in your shell path. To do this, you need to modify your shell configuration file in your home directory (for example, the .cshrc file for a C shell). Include the pathname to your c5xhll directory in your path. The following statement is an example of what a typical path-variable definition looks like:

```
set path = (. /bin /usr/ucb /usr/contrib/bin /usr/bin \
/usr/openwin/bin)
```

The following is an example of a modified path variable. The part of the path that is boldface is an example of a pathname that identifies the c5xhll directory:

```
set path (. /bin /usr/ucb /usr/contrib/bin /usr/bin \
/usr/openwin/bin /user/fred/c5xhll)
```

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. You can set up the environment variables in your shell configuration file. The debugger uses four environment variables, named D_DIR, D_SRC, D_OPTIONS, and DISPLAY:

- ❑ Set up the D_DIR environment variable to identify the c5xhll directory. The general format for doing this is:

  setenv D_DIR ”/user/fred/c5xhll”

  (Be sure to enclose the directory name within quotes.)

  This directory contains auxiliary files (such as emuinit.cmd) 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 ”*pathname1;pathname2;...***”**

  (Be sure to enclose the path names within one set of quotes.)

  For example, if your programs were in a directory named */user/fred/c5xcode*, the D_SRC setup would be:

  setenv D_SRC ”/user/fred/c5xcode”

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

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

  (Be sure to enclose the options and filenames within one set of quotes.)

  This tells the debugger to load the specified object file and use the specified options each time you invoke the debugger. These are the options that you can identify with D_OPTIONS:

Option	Brief Description
–b[b]	Select the screen size
–c	Clear the .bss section
–f *filename*	Identify a new board configuration file
–i *pathname*	Identify additional directories
–me	Select little-endian format
–min	Select the minimal debugging mode
–n *processor name*	Identify processor for debugging
–p *port address*	Identify the port address
–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.

  For more information about options, see the invocation instructions in the *Overview of a Code Development and Debugging System* chapter in the *TMS320C5x C Source Debugger User's Guide*.

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

  setenv DISPLAY "*machine name***"**

  For example, if you are running the debugger on a machine called opie and you want the 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.

  ```
  emu5x –d barney:0
  ```

  For more information about using the debugger under the X Window system, see Section 4.8, *Using the Debugger With the X Window System*.

Invoking the new or modified .cshrc file

When you modify your shell configuration file, you must ensure that the changes are made to your current session. For example, if you are using a C shell, use this command to reread the .cshrc file:

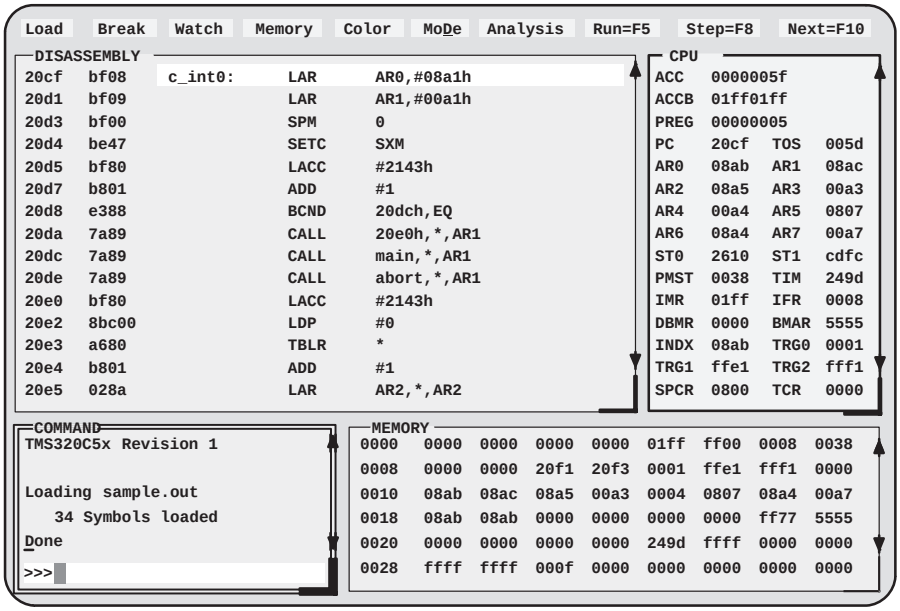
```
source ~/.cshrc
```

4.7 Step 6: Verifying the Installation

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

emu5x sample –n cpu_a ↵

You should see a display similar to this one:



- ❑ 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 reenter the command above.
- ❑ If you continue to experience problems, see Appendix A, *Troubleshooting*.

4.8 Using the Debugger With the X Window System

If you're using the X Window System to run the 'C5x debugger, you need to know about the keyboard's special keys, the debugger fonts, and using the debugger on a monochrome monitor.

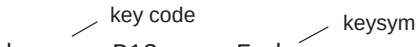
Using the keyboard's special keys

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

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.

Debugger Key Needed	Keysym for That Function
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 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 map a Sun Type 4 keyboard to 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 'C5x debugger fonts to Courier, add the following line to the .Xdefaults file:

```
emu5x*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, , you can use a monochrome monitor. 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 5

Enabling Extended Addressing

The TMS320C5x is limited to 64K bytes of address space in program, data, and I/O space. Some applications require access to memory beyond the 64K limit for program and data space. By adding memory and additional logic to your target system, you can extend the memory of your system. The emulator version of the debugger includes an extended addressing feature that enables the ’C5x to access this extended memory when you debug your system.

If you use extended addressing, the debugger supports access to instructions and data stored in extended memory.

This chapter defines extended addressing and describes what you need to do to your target system, your source files, and your debugger to enable extended addressing for the TMS320C5x.

Topic **Page**

5.1 Understanding the Use of Extended Addressing

With the extended addressing feature, you have the ability to add additional memory to your target system for use by the ’C5x.

About extended addressing

Once you modify your target system to include extended memory, you can use the debugger to access the extended memory. To determine which memory location you want to access, the debugger must have a unique address.

In an extended memory system, you logically split the 16-bit ’C5x address space into two pieces. The low-ordered addresses are common or *unmapped* memory. The high-ordered addresses are extended or *mapped* memory. The address that defines the boundary between unmapped and mapped memory, the *mapped start address*, is defined based on the external registers and memory that you add to your target system.

You can add and define multiple banks of physical memory that overlay each other in a single, mapped address range. The use of extended pages of memory extends the native 16-bit address space. Because the 16-bit address space is extended, the debugger uses addresses that are 32 bits wide. The 32-bit address is composed of the following:

- The 16 most significant bits (MSBs) represent the extended page number. In your source code, you store this number in one of the following registers:
  - The program mapper register (PMR) stores the extended page number for extended program-memory pages. The value that you use in the PMR is the same extended-page number that you use in the linker command file.
  - The data mapper register (DMR) stores the extended page number for extended data-memory pages. The value that you use in the DMR is the same extended-page number that you use in the linker command file.

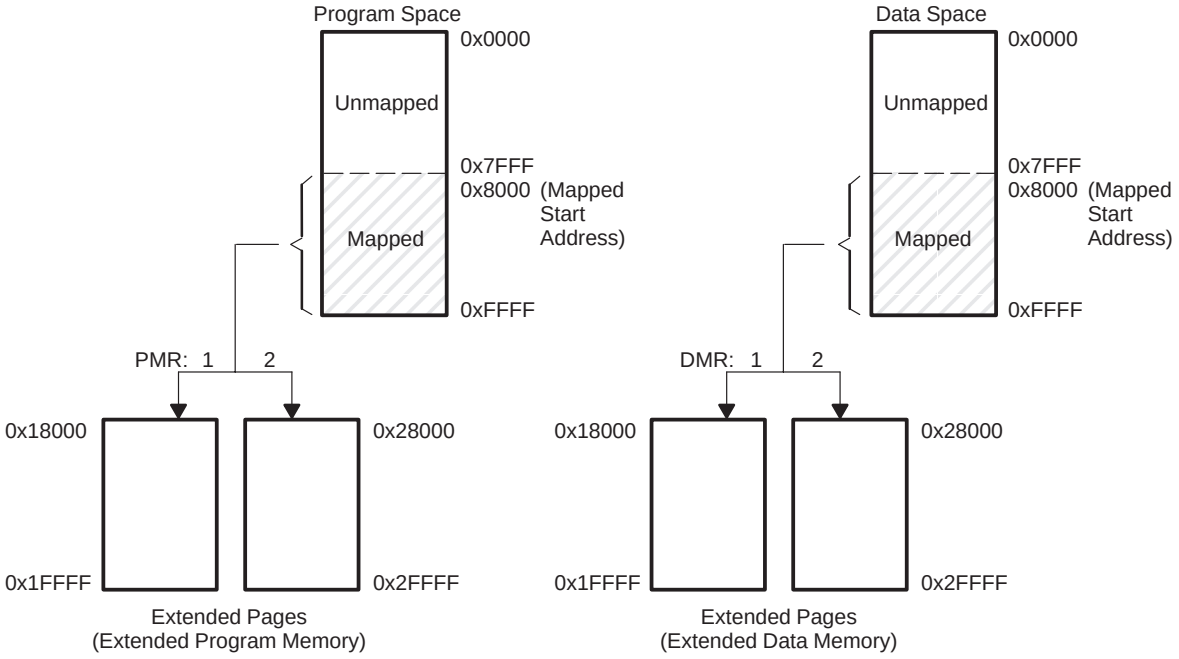
  You create the PMR or DMR when you build your extended memory system.
- The 16 least significant bits (LSBs) represent the native 16-bit address for the symbol.

Sample extended memory system

Figure 5–1 illustrates a sample extended memory system. In this example, the program and data space are allocated in the same manner:

- The unmapped memory region is from 0x0000 to 0x7FFF.
- The mapped memory region is from 0x8000 to 0xFFFF.
- Two extended pages extend the mapped address space.
- The mapper register (PMR or DMR) qualifies the mapped address, creating a unique address for each location in each extended page.

Figure 5–1. Sample Extended Memory System



5.2 Building an Extended Memory System

To use the emulator with extended addressing, you must do the following:

Step	Action	See Page
1	Add memory and its associated logic to your target system.	5-4
2	Create registers on your target system.	5-5
3	Update or create source files that take advantage of extended memory.	5-5
4	Update or create a linker command file that takes advantage of extended memory.	5-6
5	Describe and enable extended addressing in the debugger.	7-4

Adding memory and logic

When you build your target system, add memory and the logic for the memory as you normally would. The following rules apply when adding extended memory:

- ❑ The amount of memory you can add is limited by the number of high-order addresses (up to 16 bits) and the size of the mapped memory region (some amount you determine, but less than 64K).
- ❑ Memory is divided into extended pages.
- ❑ You must supply memory decode logic that expands the 16-bit address into a 32-bit address.
- ❑ The decode logic determines the mapped start address.
- ❑ You assign a number to each extended page. You load this number into a register, which becomes the high-order portion of a 32-bit address used to access an extended address (see the *Creating registers* subsection, page 5-5, for information about these registers).
- ❑ The maximum size for an extended page is the size of the mapped memory region of the ’C5x address space.

  For example, in Figure 5–1 the maximum size of an extended page can be 0x8000 bytes since that is the size of the mapped address space.
- ❑ You cannot define all of your ’C5x address space as mapped, and you can only have one mapped area per program or data memory space.
- ❑ Memory addresses cannot be more than 32 bits. The high-order portion is up to 16 bits, and the low-order portion is 16 bits.

Creating registers

When you build your target system, add one or two external registers. Add the registers as you would normally add a register. You add one or both of the following registers:

- Program mapper register (PMR). The PMR is used to extend program memory.
- The data mapper register (DMR). The DMR is used to extend data memory.

The following rules apply when building the registers:

- They must be in the mapped memory region of the ’C5x address space.
- They must be mapped into an unmapped data space or an I/O space.
- They must be read and write enabled.
- They can be up to 16 bits wide.
- The size of a register determines the number of extended pages since each extended page must have a number associated with it. For example, if your register is 8 bits wide, you can have 256 extended pages since an 8-bit register can contain addresses 0x00 to 0xFF.

Updating or creating source files

To read and write to extended memory in your source code, you must do the following:

1) Load the extended page number for the memory you want to access into a mapper register (PMR or DMR). This is the 16 MSBs of the extended address.
2) Use the normal 16-bit I/O instructions with the 16 LSBs of the extended address. This identifies the memory that you want to access in the extended page.

The linker and assembler automatically concatenate the extended page number and the 16-bit address together to obtain the 32-bit address needed to access extended memory.

Updating or creating a linker command file

You must define your extended memory system to the linker by using the linker MEMORY directive in a linker command file. This section describes how to define extended memory addresses in a linker command file. For more details about linker command files, see the *TMS320C1x/C2x/C2xx/C5x Assembly Language Tools User's Guide*.

The only difference between specifying a normal address and an extended address is to add an extended page number to a 16-bit address in the MEMORY directive. All other conventions for a linker command file are the same.

Example 5–1 shows a sample linker command file for use with an extended memory system.

- Base defines the unmapped region of the 'C5x program space. The region starts at 0x1000 and has a length of 0x2000.
- Ext0 defines the mapped memory region of the 'C5x program space. The region starts at 0xC000 and has a length of 0x4000. The PMR must be set to 0 to access this memory.
- Ext1, Ext2, Ext3, and Ext4 define extended pages for program space. When accessed, these pages overlay the mapped memory region defined by Ext0. Each extended page starts at 0xC000 and has a length of 0x4000, although they do not have to take up the entire mapped memory region.

  The number preceding each starting address is the extended page number. You load this number into a mapper register to identify the section of extended memory you want to access. This entire number is used as the extended memory address.

  Ext1 has a starting address of 0x0001 C000, Ext2 has a starting address of 0x0002 C000, and so on. The number you assign to the extended page is arbitrary, but it cannot be larger than the mapper register you load it into.
- No extended memory is defined for the 'C5x data space.
- All other aspects of the linker command file are the same as defined in the *TMS320C1x/C2x/C2xx/C5x Assembly Language Tools User's Guide*.

Example 5–1. Sample Linker Command File

```
*/ Input filenames    */
callall.obj
ext0.obj
ext1.obj
ext4.obj

*/ Options            */
–o callall.out
–m callall.map
–c
–l rts50.lib
–stack 30
MEMORY
{
/* Program memory     */
   PAGE 0 :
      Base:  origin =  1000h  ,  length =  2000h
      Ext0:  origin =  0c000h ,  length =  4000h
      Ext1:  origin =  1c000h ,  length =  4000h
      Ext2:  origin =  2c000h ,  length =  4000h
      Ext3:  origin =  3c000h ,  length =  4000h
      Ext4:  origin =  4c000h ,  length =  4000h
/* Data memory        */
   PAGE 1 :
      Scratch_RAM  : origin  =  3000h  , length  =  1000h
}
/* SECTIONS directive */
SECTIONS
{
   .text  :       > Base         PAGE = 0
   .text0 :     { ext0.obj(.text) } > Ext0 PAGE 0
   .text1 :     { ext1.obj(.text) } > Ext1 PAGE 0
   .text4 :     { ext4.obj(.text) } > Ext4 PAGE 0
}
```

Once you set up your extended address system, you are ready to use it. To use it with the ’C5x debugger, you must describe your memory system to the debugger and enable extended addressing. You accomplish these tasks by using the EXT_ADDR_DEF and EXT_ADDR debugger commands.

Additionally, some of the debugger displays are altered when using extended addressing. For information about using the debugger with extended addressing, see Chapter 7, *Using the Debugger With Extended Addressing*.

Chapter 6

Release Notes

Release 7.40 of the TMS320C5x debugger contains general enhancements as well as enhancements specific to the 'C5x emulator. The following sections list these enhancements.

COFF version 2

This release supports an expanded object file format called COFF2. The debugger is capable of handling COFF object files developed with assembly language tools using the COFF0, COFF1, or COFF2 formats.

Multiple MEMORY windows

You can now open more than four MEMORY windows. The MEM command has a new optional *window name* parameter. When you open an additional MEMORY window, the debugger appends the *window name* to the MEMORY window label. You can create as many MEMORY windows as you need. The basic syntax for the MEM command is:

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

You can use the MEM command to display a different memory range in a window. The *window name* parameter is optional if you are displaying a different memory range in the default MEMORY window. Use the *window name* parameter when you want to display a new memory range in one of the additional MEMORY windows.

Multiple WATCH windows

You can now access multiple WATCH windows. Use the *window name* parameter as described for each WATCH window command.

- The WA command has a new optional *window name* parameter. When you open an additional WATCH window, the debugger appends the *window name* to the WATCH window label. You can create as many WATCH windows as you need. The basic syntax for the WA command is:

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

  If you omit the *window name* parameter, the debugger displays the expression in the default WATCH window (labeled WATCH).

- The WD command deletes a specific item from the WATCH window. The WD command's *index number* parameter must correspond to one of the watch indexes listed in the WATCH window. The optional *window name* parameter is used to specify a particular WATCH window. The basic syntax for the WD command is:

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

- The WR command deletes all items from a WATCH window and closes the window.

  - To close the default WATCH window, enter:

    wr

  - To close one of the additional WATCH windows, use this syntax:

    wr *windowname*

  - To close all WATCH windows, enter:

    wr *

New debugger commands

The debugger supports the following new commands on all platforms.

cd, chdir — *Change Directory*

Syntax

cd [*directory name*]
chdir [*directory name*]

Menu selection

none

Environments

☑ basic debugger ☐ PDM ☑ profiling

Description

The CD or CHDIR command changes the current working directory from within the debugger. You can use relative pathnames as part of the *directory name*. If you don't use a *directory name*, the CD command displays the name of the current directory. Note that this command can affect any other command whose parameter is a filename, such as the FILE, LOAD, and TAKE commands, when used with the USE command. You can also use the CD command to change the current drive. For example:

```
cd c:
cd d:\csource
cd c:\c5xhll
```

dir — *List Directory Contents*

Syntax

dir [*directory name*]

Menu selection

none

Environments

☑ basic debugger ☐ PDM ☑ profiling

Description

The DIR command displays a directory listing in the display area of the COMMAND window. If you use the optional *directory name* parameter, the debugger displays a list of the specified directory's contents. If you don't use the a *directory name*, the debugger lists the contents of the current directory.

You can list only files that match a specific format within a directory by using the asterisk (*) wildcard character. If the *directory name* ends in a partial filename with an asterisk, the debugger lists only the files which match the wildcard string. For example, to list every file in the home directory that has a .cmd extension, you would enter:

```
DIR /home/*.cmd
```

Extended addressing

The ’C5x debugger supports mapped extended memory. You can define a segmented memory architecture that goes beyond the 64K byte limit imposed by the 16-bit address bus. You can use extended addressing with program address space or data address space.

See Chapter 5, *Enabling Extended Addressing*, for information on setting up and enabling extended addressing. See Chapter 7, *Using Extended Addressing With the Debugger*, for more information on implementing extended addressing with the ’C5x debugger.

Chapter 7

Using the Debugger With Extended Addressing

The TMS320C5x is limited to 64K bytes of address space in program, data, and I/O space. Some applications require access to memory beyond the 64K limit for program and data space. By adding memory and additional logic to your target system, you can *extend* the memory of your system. The emulator version of the debugger includes an extended addressing feature that enables the ’C5x to access this extended memory when you debug your system.

This chapter defines extended addressing and describes what you need to do in your debugger to enable extended addressing for the TMS320C5x.

Topic **Page**

7.1 Understanding the Use of Extended Addressing

With the extended addressing feature, you have the ability to add additional memory to your target system for use by the ’C5x.

About extended addressing

Once you modify your target system to include extended memory, you can use the debugger to access the extended memory. To determine which memory location you want to access, the debugger must have a unique address.

In an extended memory system, you logically split the 16-bit ’C5x address space into two pieces. The low-ordered addresses are common or *unmapped* memory. The high-ordered addresses are extended or *mapped* memory. The address that defines the boundary between unmapped and mapped memory, the *mapped start address*, is defined based on the external registers and memory that you add to your target system.

You can add and define multiple banks of physical memory that overlay each other in a single, mapped address range. The use of extended pages of memory extends the native 16-bit address space. Because the 16-bit address space is extended, the debugger uses addresses that are 32 bits wide. The 32-bit address is composed of the following:

- The 16 most significant bits (MSBs) represent the extended page number. In your source code, you store this number in one of the following registers:
  - The program mapper register (PMR) stores the extended page number for extended program-memory pages. The value that you use in the PMR is the same extended-page number that you use in the linker command file.
  - The data mapper register (DMR) stores the extended page number for extended data-memory pages. The value that you use in the DMR is the same extended-page number that you use in the linker command file.

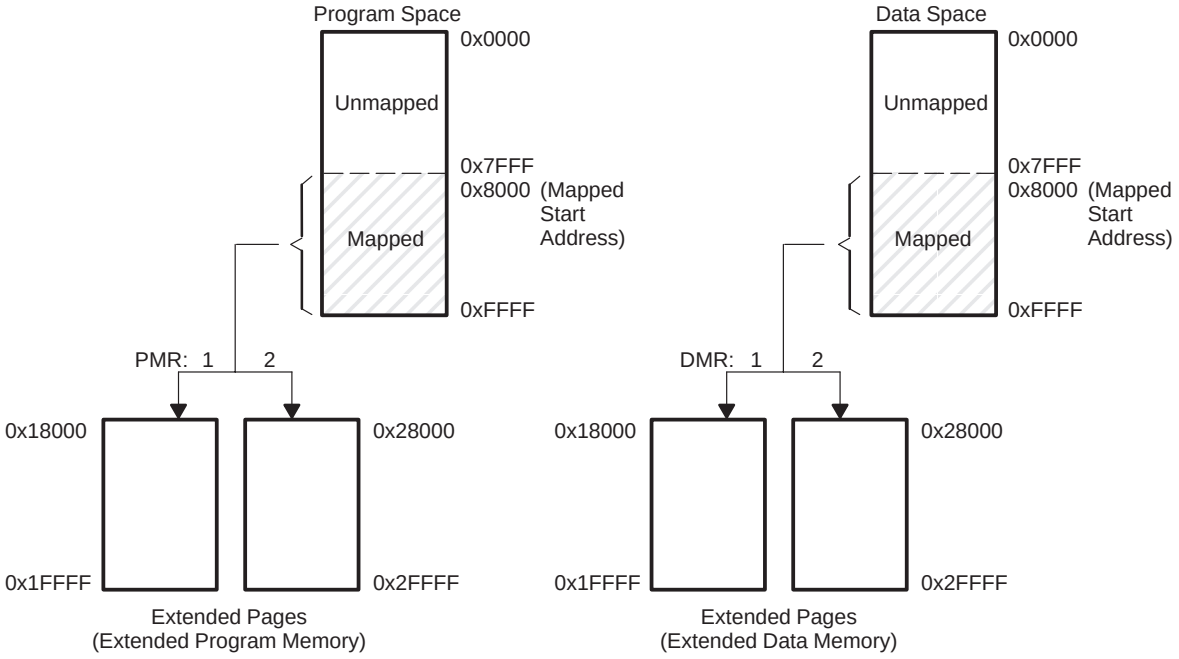
  You create the PMR or DMR when you build your extended memory system.
- The 16 least significant bits (LSBs) represent the native 16-bit address for the symbol.

Sample extended memory system

Figure 7–1 illustrates a sample extended memory system. In this example, the program and data space are allocated in the same manner:

- The unmapped memory region is from 0x0000 to 0x7FFF.
- The mapped memory region is from 0x8000 to 0xFFFF.
- Two extended pages extend the mapped address space.
- The mapper register (PMR or DMR) qualifies the mapped address, creating a unique address for each location in each extended page.

Figure 7–1. Sample Extended Memory System



7.2 Setting Up Extended Addressing

Before you can use extended memory, you must build a target system that includes extended memory, including hardware that assigns an extended page to an extended memory region. Chapter 5, *Enabling Extended Addressing*, describes how to set up your target system with extended memory.

Once you have built your extended memory system, you must set up the debugger to use extended addressing by doing the following:

- ❏ Describe your extended memory configuration to the debugger
- ❏ Enable extended addressing

This section describes how to perform these tasks.

Describing your extended memory configuration to the debugger

You must describe to the debugger your extended memory configuration and where to look for the PMR or DMR register. To do so, use the EXT_ADDR_DEF command. The syntax for this command is:

ext_addr_def *map start* [{**@prog** | **@data**}], *reg addr* [{**@prog** | **@data** | **@io**}], *mask*

- ❏ The *map start* parameter defines the beginning of the mapped memory range. By default, the *map start* parameter is treated as a program-memory address. However, you can follow it with **@prog** to identify program memory or with **@data** to identify data memory.
- ❏ The *reg addr* parameter defines the location of the mapper register (PMR or DMR).
  - ■ If you are defining program memory, use the address for the PMR.
  - ■ If you are defining data memory, use the address for the DMR.

  By default, the *reg addr* parameter is treated as a data-memory address. However, you can follow it with **@prog** to identify program memory, with **@data** to identify data memory, or with **@io** to identify I/O space.
- ❏ The *mask* parameter is a bit mask that represents the size of the PMR or DMR.

For example, if you designed an extended memory system that begins mapping at address 0x8000 in program memory, with the 8-bit PMR located at 0x0100 in I/O space, you would enter:

```
ext_addr_def 0x8000@prog, 0x0100@io, 0xff
```

To avoid entering the EXT_ADDR_DEF command each time you invoke the debugger, you can modify your emuinit.cmd file to include the command. The debugger reads and executes the commands in the emuinit.cmd file each time you invoke the debugger.

Enabling extended addressing

Before you load your target code, you must enable extended addressing. To do so, use the EXT_ADDR ON command. The syntax for this command is:

ext_addr {**on** | **off**}

You cannot use this command before you define your extended memory configuration with the EXT_ADDR_DEF command.

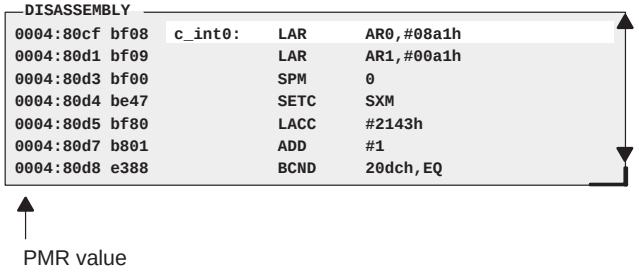
To avoid entering the EXT_ADDR command each time you invoke the debugger, you can modify your emuinit.cmd file to include the command.

7.3 Debugging With Extended Addressing

Once you have set up the debugger for extended addressing (as described in Section 7.2, *Setting Up Extended Memory*, on page 7-4), you can use the debugger to access data or code stored in the extended memory of your system.

When the debugger loader loads a section of code that contains extended addresses, the loader places the addresses in the proper overlays automatically. The debugger also changes the display of the DISASSEMBLY or MEMORY window to show extended addresses. It uses the PMR or DMR value (which contains the extended page number) as a prefix to the address. The DISASSEMBLY window in Figure 7–2 shows addresses that have been accessed from extended memory. The debugger used the PMR value (4) as a prefix to the addresses in extended memory.

Figure 7–2. The DISASSEMBLY Window With Extended Addressing In Use



Note:

The extended-page number that is shown in the DISASSEMBLY or MEMORY window does not always represent the value currently stored in the PMR or DMR. However, while stepping through the code, the PMR and the extended-page number are the same.

Registers associated with extended addressing: PMR, DMR, and EPC

When you turn extended addressing on (using the EXT_ADDR ON command), the debugger adds the following registers to the CPU window:

- One of the following mapper registers:
  - The program mapper register (PMR) displays the current value of the external PMR that you created in your target system.
  - The data mapper register (DMR) displays the current value of the external DMR that you created in your target system.
- The extended program counter (EPC). The EPC is 32 bits wide and represents the PMR or DMR value concatenated with the PC value.

You can use these registers in expressions. For example, this command sets the PMR to 4 and the program counter (PC) to 0x8000:

```
? EPC= 0x48000
```

This DASM command causes the DISASSEMBLY window to display the current extended PC location:

```
DASM EPC
```

When you turn extended addressing off (using the EXT_ADDR OFF command), the CPU window no longer displays the PMR, DMR, and EPC registers, and you cannot use these registers in expressions.

New expression syntax

When you enter one of the commands listed in Table 7–1, you can use an address as one of the command parameters. You can append a suffix to the address to specify whether the address is in program memory (@prog), data memory (@data), or I/O space (@io). When extended addressing is enabled, you can use two new suffixes with the commands in Table 7–1:

- The @prog16 suffix identifies an address in extended program memory. The debugger uses the current value in the PMR to qualify the address that you enter.
- The @data16 suffix identifies an address in extended data memory. The debugger uses the current value in the DMR to qualify the address that you enter.

Table 7–1. Commands That Use the @prog16 and @data16 Suffixes

Command	Command
? (evaluate expression)	EVAL
ADDR	MEM
DASM	WA
DISP	

How extended addressing affects symbols

When you use the debugger with symbol names, the debugger uses the entire extended address associated with the symbol.

When you use a pointer in an expression, the debugger uses the current PMR or DMR value to determine the pointer value. Likewise, if you use the contents of a register as an address, the debugger uses the current PMR or DMR value to determine the correct address. For example, if the PC=0x8000 and the PMR=2 and you enter:

```
? *PC
```

The debugger returns the value at location 0x28000.

Table 7–2 shows typical commands that you could use with the debugger and how the results of the commands are affected by extended addressing.

Table 7–2. Sample Commands and Results Using Extended Addressing

If you enter this...	The result is...
`dasm 0x8000`	Disassembly starting at 0:8000, regardless of the PMR value
`dasm 0x8000@prog16`	Disassembly starting at *x*:8000, where *x* represents the current PMR value
`dasm label0`	Where label0 is a label located at 0x8000, the result is disassembly starting at 0:8000, regardless of the PMR value
`dasm label4`	Where label4 is a label located at 0x48000, the result is disassembly starting at 4:8000, regardless of the PMR value
`dasm pc`	Where PC=0x8000, the result is disassembly starting at *x*:8000, where *x* represents the current PMR value
`dasm ptr`	Where ptr is a VOID* pointing to 0x8000, the result is disassembly starting at *x*:8000, where *x* represents the current PMR value
`dasm (ptr+1)`	Where ptr is a VOID* pointing to 0x8000, the result is disassembly starting at *x*:8001, where *x* represents the current PMR value

Note:

In the DISASSEMBLY window, addresses associated with symbols are shown as 16-bit addresses. Moreover, if a symbol represents an extended address, you cannot see the entire 32-bit address in the DISASSEMBLY window. However, when you use the symbol name in an expression, the debugger accesses the correct address.

Using 16-bit expressions with 32-bit extended addressing

Extended addressing allows you to use 32-bit addresses to reference locations in extended memory. When you use the debugger and specify a 16-bit expression, the debugger uses the following algorithm to determine which memory location to access:

1) If you use the @prog16 suffix, the debugger uses the current PMR value as a prefix to the address that you entered. Likewise, if you use the @data16 suffix, the debugger uses the current DMR value as a prefix to the address that you entered.

2) If you use a pointer in an expression, the debugger uses the current PMR or DMR value as a prefix to the pointer value, as applicable.

3) If you use the contents of a register as an address, the debugger uses the PMR or DMR value as a prefix to the address, as applicable.

4) If none of the above is true, the debugger uses 0 as a prefix to the address. This applies to constants and program labels.

Hardware breakpoints and extended addressing

Do not use extended addressing when you are using hardware breakpoints. A hardware breakpoint set at a particular address causes the debugger to stop at that address not only for the native ’C5x memory but for every extended page defined by your extended memory. This might confuse the emulator and can cause unexpected results.

Appendix A

Troubleshooting

This chapter describes some common problems you may encounter while using your emulator or debugger on your workstation.

Topic **Page**

A.1 Problems When Booting Your Workstation

After installing your emulator, problems may occur when you attempt to boot your workstation. The following are typical problems and suggestions to help resolve these problems:

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

  1) Be sure that all of your SCSI cables are connected securely and that the SCSI bus is terminated properly.
  2) Remove any unnecessary SCSI devices from the bus.
  3) Make sure that the total length of the SCSI bus is less than six meters, including the section of the bus within the SPARCstation 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.

  For more information, see the *XDS51x Emulator Installation Guide.*

A.2 Problems With Multiple Emulators on SunOS

When you have multiple emulators running constantly, they may consume most of the CPU time. To overcome this situation, run the emulators at a lower priority using the UNIX nice command. See the man page entry on nice for more information.

A.3 Problems When Resetting the Emulator

After you power up the emulator and the workstation, if you have the following problems while 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 c5x510ws.out file. You can specify it at this prompt or you can reexecute 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 the XDS510WS installation instructions in the *XDS51x Emulator Installation Guide* for more information).

  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 to 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 SPARCstation, which causes <m> to change. Use the corrected configuration file to build the currently executing kernel (see the XDS510WS installation instructions in the *XDS51x Emulator Installation Guide* for more information).

5) You haven't turned on the XDS510WS, or it hasn't completed its self test. 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 c5x510ws.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 located where emurst can find it.

3) The file that you specified to emurst isn't appropriate for this use. Use the c5x510ws.out file that is included with the debugger software.

A.4 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 emu5x 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 3.4, *Step 3: Ensuring That the Emulator Supports the Debugger,* on page 3-6 for SPARCstations and Section 4.4, *Step 3: Ensuring That the Emulator Supports the Debugger,* on page 4-6, for HP workstations). 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 c5x510ws.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 from 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. (For more information on the –p option, see Section 3.4, *Step 3: Ensuring That the Emulator Supports the Debugger,* on page 3-6, for SPARCstations and Section 4.4, *Step 3: Ensuring That the Emulator Supports the Debugger,* on page 4-6, for HP workstations.)

  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, reexecute 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** *cpu_name* debugger option.
   - The debugger couldn't find the *cpu_name* that you specified with the **–n** option in your board configuration file.

   Reexecute the debugger with the –n debugger option, specifying the name of a 'C5x device 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 that your emulation cable is firmly attached both to the XDS510WS and to your target system.

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

❑ You receive the following message at the operating-system command line when trying to execute the emu5x command:

```
emu5x: 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 "emu5x*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.

A.5 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 emu5x or emurst under SunOS 4.1.x, refer to the following explanations.

These messages are status messages, not error messages.

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

  or under SunOS 5.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 SPARCstation in a certain amount of time. This can be caused by one of these conditions:

  - 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.

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

  or under SunOS 5.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 to be 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.

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

  or under SunOS 5.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.

- ```
  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.
  ```

*This template is for the "*See*" and "*See also*" references in your index. Since these entries do not have a page number associated with them, it's extremely difficult to locate one if you need to modify or delete it and you don't remember which chapter it's in. By using this template, you can alphabetize your entries according to the first letter of the first level entry.*

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

Index

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

X