TEXAS INSTRUMENTS

CDT370

Addendum to the TMS370 Family C Source Debugger User's Guide

Addendum

1993 Microprocessor Development Systems

[redacted]

Texas Instruments

Printed in U.S.A., October 1993; reprinted July 1995
2656911–9761 revision B

SPNU133

CDT370 Addendum to the TMS370 Family C Source Debugger User's Guide

SPRU133
July 1995

Printed on Recycled Paper

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.

Read This First

About This Manual

This book tells you how to install and use the CDT370 (Compact Development Tool) and explains the similarities and differences between the debugger used with the CDT370 and the debugger that is described in the *TMS370 Family C Source Debugger User's Guide*.

Information About Cautions

This book contains cautions.

> **This is an example of a caution statement.**
>
> **A caution statement describes a situation that could potentially damage your software or equipment.**

The information in a caution is provided for your protection. Please read each caution carefully.

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.

Trademarks

PC-DOS is a trademark of International Business Machines.

MS-DOS and Windows are trademarks of Microsoft Corporation.

Contents

Figures

Tables

Chapter 1

Introduction

The CDT370 (Compact Development Tool) offers a low-cost but highly efficient route to TMS370 family development. In addition, the CDT370 supports programming of the new Field Programmable Microcontroller (FPM) family members. Features such as a new interactive windowed CDT370 debugger, real-time emulation, and an integrated EPROM and EEPROM programmer all contribute to enhanced user productivity and, consequently, a shorter design cycle.

The CDT370 is composed of:

- ❑ CDT370 emulator board
- ❑ Interactive windowed CDT370 C-source debugger
- ❑ Assembler and linker
- ❑ Complete support documentation

The CDT370 debugger is a screen-oriented, interactive program that aids in the development of applications for TMS370 family microcontrollers. The debugger is used with a hardware unit called an emulator, which provides real-time, in-circuit emulation of the TMS370 microcontroller. The debugger runs under the MS-DOS operating system on an IBM or compatible and connects to the emulator through an add-on PC connection or RS-232 serial communications link.

Topic **Page**

1.1 About the CDT370 Board

Once the CDT370 is unpacked, you can begin code development immediately. Everything required to emulate or program TMS370 devices is provided. The CDT370 supports the following devices:

- TMS370Cx1x
- TMS370Cx2x
- TMS370Cx4x
- TMS370Cx5x

Use the *XDS22 Extended Development System* to develop code for TMS370Cx3x PACT devices.

The CDT370 emulator hardware is a single board that can be connected in two different ways:

- The CDT370 board is designed to plug into the expansion chassis of any IBM XT/AT or compatible
- The CDT370 can be connected to the PC through an RS-232 serial link

The CDT370 on-board hardware provides:

- Serial/parallel communication interface
- Real-time TMS370 emulation logic (up to 20 MHz)
- Real-time TMS370 data EEPROM emulation logic
- Real-time trace circular buffer (up to 2048 program steps)
- Real-time 24-bit cycle counter
- Integrated EPROM and EEPROM device programmer

1.2 About the Target Cable Set

Each emulator can have a target cable with a connector on one end that has the same pinout as the device being emulated. This connector plugs directly into the socket on the application system (also referred to as the *target system*) circuit board that would normally hold the TMS370 device. This allows direct, in-circuit emulation. Each target cable also has an easy-extract socket that allows you to program the devices.

In the supported TMS370 family, there are five different packages:

- ❑ 28DIL
- ❑ 28LCC
- ❑ 40DIL
- ❑ 44LCC
- ❑ 68LCC

There are seven different target cables to support these packages because the 40-pin DIL and the 44-pin LCC TMS370Cx2x devices have different pin-outs than the 40-pin DIL and 44-pin LCC TMS370Cx4x devices. As a result, the emulator target cables for the devices are different and not interchangeable. The seven target cable sets are listed below along with the devices they support:

- ❑ x1x devices in 28-pin DIL socket . . . . . 28-pin DIL target cable
- ❑ x1x devices in 28-pin LCC socket . . . . . 28-pin LCC target cable
- ❑ x2x devices in 40-pin DIL socket . . . . . 40-pin DIL target cable
- ❑ x2x devices in 44-pin LCC socket . . . . . 44-pin LCC target cable
- ❑ x4x devices in 40-pin DIL socket . . . . . 40-pin DIL target cable
- ❑ x4x devices in 44-pin LCC socket . . . . . 44-pin LCC target cable
- ❑ x5x devices in 68-pin LCC socket . . . . . 68-pin LCC target cable

Chapter 2

Getting Started

This chapter includes the proper procedures to set up the CDT370.

The following topics are covered:

2.1 System Hardware Requirements

☐	**Host**	An IBM PC XT/AT or 100% compatible PC with a hard-disk system, a serial port or a free full-length internal slot, and a 1.2-Mbyte 5-1/4" floppy-disk drive.
☐	**Memory**	A minimum of 640K bytes of main memory is needed, but extended (minimum 256K bytes) memory is also needed when you run the debugger under Windows.
☐	**Display**	A monochrome screen can be used, but a color screen (EGA or VGA) is recommended.
☐	**Cable**	A target cable is required to connect the CDT370 board to the target, but it is not needed when the emulator runs in stand-alone mode.
☐	**Options**	A Microsoft-compatible mouse. An EGA- or VGA-compatible graphics display card and a large 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, refer to Section 2.9, *Invoking the Debugger*.
☐	**Miscellaneous**	Blank, formatted disks.

Note: Firmware Version

Make sure you are using a CDT370 board with firmware version 3.0 or later.

2.2 System Software Requirements

- ☐ **Operating System** — MS-DOS or PC-DOS (version 3.0 or later)

  Optional: Microsoft Windows (version 3.0 or later)

- ☐ **Software Tools** — TMS370 C compiler, assembler (version 5.06 or later), and linker. If you have a program that you assembled with an earlier version of the assembler, be sure to update it.

- ☐ **Optional Files** † — init.cmd is a file that contains debugger commands. The version of this file that's shipped with the debugger defines a '370 memory map. If this file isn't present when you first invoke the debugger, then all memory is invalid at first. 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, refer to Section 7.2, *Memory Mapping* and *Defining a Memory Map*, in the *TMS370 Family C Source Debugger User's Guide*.

  In addition to init.cmd, there are several other .cmd files in the maps directory. These .cmd files define memory maps for standard '370 devices. If you want to emulate a specific device, copy the appropriate .cmd file into your init.cmd file.

- ☐ 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.

- ☐ The default configuration file (.clr extension) is for color monitors; another file (.mon extension) can be used with monochrome monitors. Several of each type of screen configuration file are included in your screens directory. When you first invoke 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, refer to *Customizing the Debugger Display*, in the *TMS370 Family C Source Debugger User's Guide*.

- ☐ Due to the 640K-byte memory limitation under DOS, it may not be possible to load and/or debug large applications with the DOS version of the debugger. The Windows version of the debugger will make use of any extended memory available on the PC.

† Included as part of the debugger package, these files are available on the C-source debugger product disk but have not been copied by the installation process.

2.3 Unpacking the CDT370 Board

Before you unpack the CDT370 board, decide if you want to plug the board into an expansion slot inside your PC or connect it to an RS-232 cable outside your PC. Placing the board inside your computer's case is preferable, but if you have no empty slots or if the internal mount makes it awkward to access the target system, the RS-232 link can be used.

Remove the CDT370 board from its antistatic protection sheath.

To avoid damage to the board, do not touch the board directly, except at a static-free workstation.

Do not connect any electric motors or fluorescent lights to the CDT370 power circuit. Noise and/or voltage spikes from these devices could affect operation.

Do not plug the CDT board into a slot next to an Ethernet card. The target cables are not shielded.

2.4 Add-On PC Connection

The CDT370 board can be plugged into any IBM PC XT/AT or compatible.

There are two different areas of jumpers on the board:

- ❑ CONF with two possible positions
- ❑ COM PORT with 4 possible positions

The shipping position is: Add-on PC link / Address 318h, IRQ4.

Figure 2–1. Configuration Switches

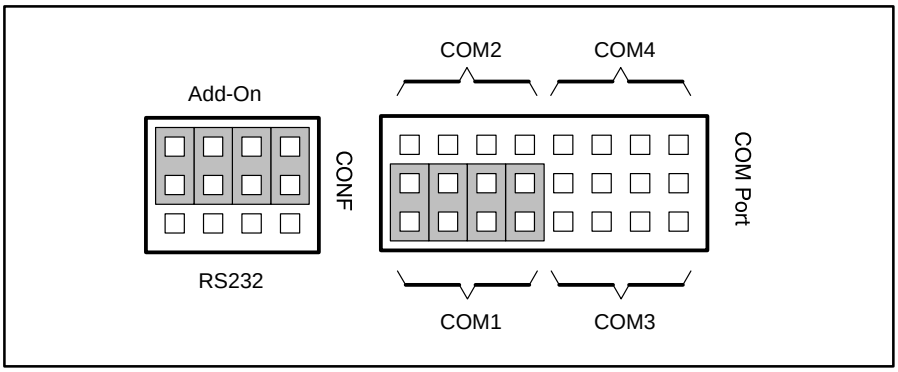


Table 2–1. On-Board Switches

CONF	COM Port	Comments
ADD-ON	COM1	Add-on PC link / 318h, IRQ4
ADD-ON	COM2	Add-on PC link / 358h, IRQ2
ADD-ON	COM3	Add-on PC link / 338h, IRQ3
ADD-ON	COM4	Add-on PC link / 398h, IRQ7
RS-232	X	RS-232 link / serial com port 1
RS-232	X	RS-232 link / serial com port 2

Step 1: The CONF jumper must be set to the ADD-ON position, and the com PORT jumper must be set to one of the four positions that are referred to as COM1 through com 4.

Step 2: Switch off your IBM PC XT/AT or compatible and remove the cover. Then, carefully plug the properly configured CDT370 board into an empty slot.

Step 3: To use the CDT370 to perform in-circuit emulation on your target device or device programming, plug the target cable dedicated to the TMS370 family member you are working with into the CDT370 board before closing the cover.

For target cable connection, refer to Chapter 8, *Target Connectors*.

Step 4: Close the cover of your PC and turn the power on.

2.5 Serial RS-232 Connection

This section discusses connecting the debugger's host machine to the CDT370 board with a serial RS-232 communication link.

In addition to what is supplied with the CDT370 board, you must supply a 5-volt regulated power supply (Icdt max = 1.8 A. Standard 5-V, 3-A power supply recommended) and an RS-232 serial cable type DB-9.

Do not connect the system to a power source at this time. Wait until all installation checks are complete.

Check to make sure that there are no metal objects beneath the CDT370 board that might short the V_{CC}, ground, or other signals.

Step 1: The CONF jumper must be set to the position RS232.

When the CONF jumper is set to RS232, the com PORT area's jumper is not relevant, and any position is allowed.

Step 2: Connect the external regulated power supply to the CDT370 board through the dedicated connector. Make sure that the polarity is set correctly.

Step 3: Connect the RS-232 cable of the host to the DB-9 pin connector of the CDT370 according to the cable description (Table 2–2).

Step 4: If you want to perform in-circuit emulation or device programming with the CDT370, install the target cable dedicated to the TMS370 family member you are working with.

For target cable connections, refer to Chapter 8, *Target Connectors*.

Step 5: Turn the CDT370 board on before you turn on the application hardware.

The CDT370 uses 8 of the 9 signals on a DB9 connector to communicate with the host. The pin and signal assignments for the emulator and host computer are listed in Table 2–2.

Table 2–2. RS-232 Pin and Signal Assignments

Function	CDT370 Female DB-9			HOST DB-25	HOST DB-9
	Pin	Signal		Signal	Pin/XT	Pin/AT
Connect Established	1	DCD	←	DCD	8	1
Data to Host	2	TX	→	RX	3	2
Data to Emulator	3	RX	←	TX	2	3
Terminal Ready	4	DTR	←	DTR	20	4
Signal Ground	5	GND	—	GND	7	5
Emulator Ready	6	DSR	→	DSR	6	6
Attention to Emulator	7	CTS	←	RTS	4	7
Attention to Host	8	RTS	→	CTS	5	8
Not used	9	RI	—	RI	22	9

2.6 Software Installation

This section explains the process of installing the debugger software on a hard-disk system:

1) Make a backup copy of each product disk. Refer to a DOS manual, if necessary, to complete this step.

2) On your hard disk or system disk, create a directory named 370TOOLS. This directory will contain the debugger software.

   `md c:\370TOOLS` ↵

3) Insert a product disk into drive A. Copy the debugger software onto the hard disk or system disk.

   `copy a:\*.* c:\370TOOLS\*.* /v` ↵

   Repeat this step for each product diskette.

4) If you don't plan to use both the DOS and the Windows versions of the debugger, you may want to delete the one you're not using.

   To delete the DOS executable file, enter:

   `del cdt370.exe` ↵

   To delete the Windows executable file, enter:

   `del cdt370w.exe` ↵

Modifying your config.sys file

When using the debugger, you can have only twenty files open or active at the same time. To tell the system not to allow more than twenty active files, you must add the following line to your config.sys file:

FILES = 20

Once you have edited your config.sys file and added the line, invoke the file by turning off the PC's power and turning it on again.

Setting up the debugger environment

To ensure that your debugger works correctly, you must:

- ❑ Modify the PATH statement to identify the 370TOOLS directory.
- ❑ Define environment variables so that the debugger can find the files it needs.

Not only must you do these things before you invoke the debugger for the first time, *you must do them any time you power up or reboot the system*.

You can accomplish these tasks by entering individual DOS commands, but it's simpler to put the commands in a batch file.

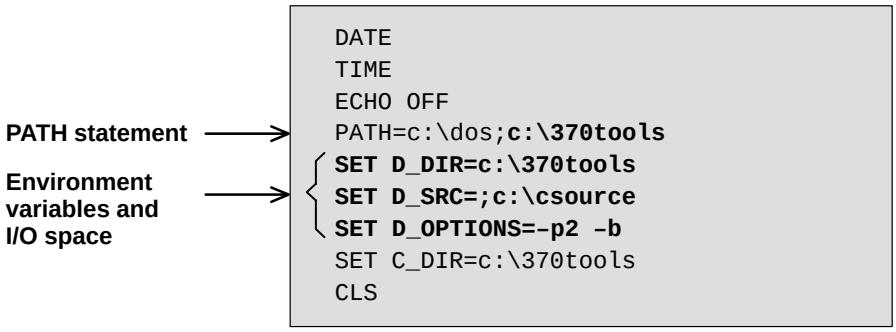
You can edit your system's autoexec.bat file; however, in some cases, modifying the autoexec.bat file may interfere with other applications running on your PC. So, if you prefer, you can create a separate batch file that performs these tasks.

Figure 2–2 (a) shows an example of an autoexec.bat file that contains the suggested modifications (highlighted in bold type).

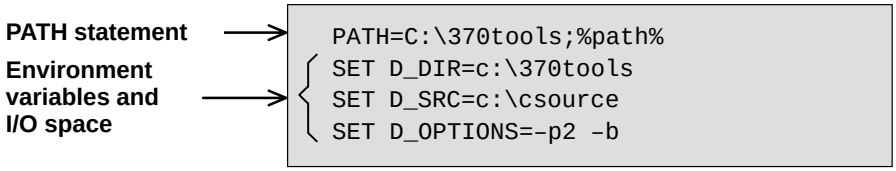
Figure 2–2 (b) shows a sample batch file that you could create instead of editing the autoexec.bat file. (For the purpose of discussion, assume that this sample file is named initdb.bat). The subsections following the figure explain these modifications.

Figure 2–2. DOS Command Setup for the Debugger

(a) Sample autoexec.bat file



(b) Sample initdb.bat file



Invoking the new or modified batch file

❑ If you modify the autoexec.bat file, be sure to invoke it before invoking the debugger for the first time. To invoke this file, enter:

autoexec ↵

- If you create an initdb.bat file, you must invoke it before invoking the debugger for the first time. If you are using Microsoft Windows, invoke initdb.bat *before* entering the Windows environment. After that, you'll need to invoke initdb.bat any time that you power up or reboot your PC. To do so, enter:

  initdb ↵

Modifying the path statement

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

PATH = C:\370TOOLS;*pathname2***;***pathname3***;...**

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

- If you are modifying your autoexec.bat file and it already contains a PATH statement, simply include ;C:\370TOOLS at the end of the statement, as shown in Figure 2–2 (a).

- If you are creating an initdb.bat file, use a different format for the PATH statement:

  PATH=C:\370TOOLS;%path%

  The addition of **;%path%** ensures that this PATH statement won't undo the PATH statements in other batch files (including the autoexec.bat file).

Setting up the environment variables

An environment variable is a special system symbol that the debugger uses for finding or obtaining certain types of information. The debugger uses three environment variables named **D_DIR**, **D_SRC**, and **D_OPTIONS**. The next three steps tell you how to set up these environment variables. The format for doing this is the same for both the autoexec.bat and initdb.bat files.

- Set up the D_DIR environment variable to identify the 370TOOLS directory:

  SET D_DIR=C:\370TOOLS;*pathname2***;...**

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

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

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

  SET D_SRC=*pathname1*;*pathname2*;...

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

  For example, if your '370 programs reside in a directory named CSOURCES, the D_SRC setup would be:

  SET D_SRC=C:\CSOURCES

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

  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 selected options each time you invoke the debugger.

  These are the options that you can identify with **D_OPTIONS**:

–b	**–bb**	**–i** *pathname*	**–p** *serial port*
–a *add-on address*		**–profile**	**–s**
–t *filename*		**–v**	

  Note that the –p and –a options cannot be used at the same time. Also, you can override D_OPTIONS by invoking the debugger with the –x option.

  For more information about options, refer to Section 2.9, *Invoking the Debugger*.

Verifying the installation

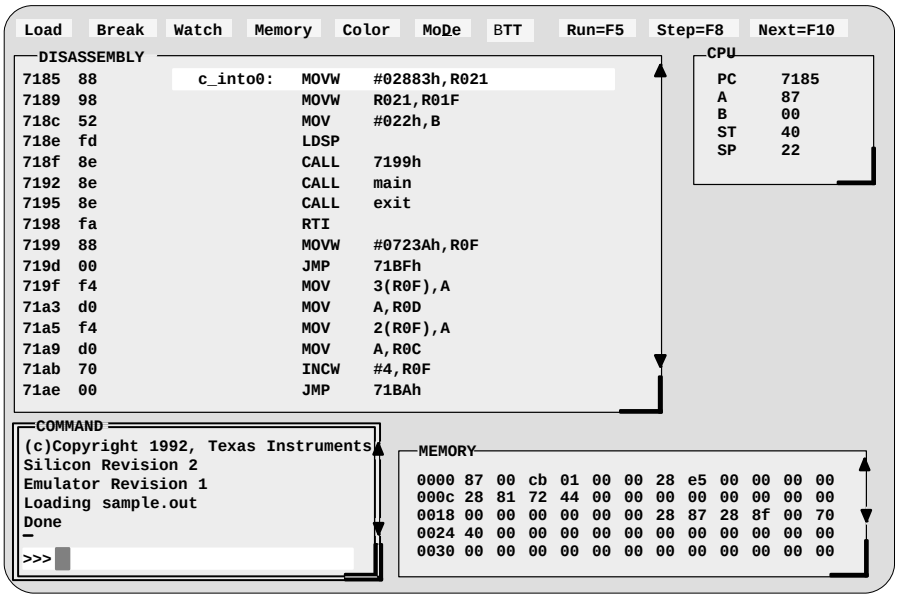
To ensure that you have correctly installed the emulator and debugger software, enter this command at the system prompt:

CDT370 C:\370TOOLS\sample –p*serial port*

or

CDT370 C:\370TOOLS\sample –a *add_on address*

If you are using Microsoft Windows, use **cdt370w** to invoke the debugger. Please refer to Section 2.7 for information on running under Microsoft Windows. After invoking the debugger, you should see a display similar to this:



- ❑ 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 cables 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.

Installation error messages

If the following message appears on your screen:

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

One of several conditions may be the cause.

Check these items:

- ❑ If the target cable is installed on the target board, is the target board powered?

- ❑ If the target cable is not installed on the target, is it isolated from any conductive surfaces, including conductive foam or bags?
- ❑ Is the emulator board installed properly and powered?
- ❑ Are you using the correct host communication port?
- ❑ If an RS-232 link is used, is the cable properly connected and wired?
- ❑ Is your serial port or add-on address set correctly?

2.7 Using the Debugger With Microsoft Windows

When using the debugger under Windows, you must configure a communication port:

- **Serial Connection:** The debugger will communicate with Windows through Windows com port 1 if you have connected the CDT370 to com port 1, and Windows com port 2 if you have connected the CDT370 to com port 2. The standard communication settings (baud rate, data bits, parity, stop bits, and flow control) are configured directly by the debugger software without your intervention and can therefore be ignored.

  The advanced settings should be configured by your Windows program to correspond to your hardware setup. You can verify this by checking the advanced communications settings of the com port you are using; open the Control Panel window, select the Ports icon, and compare the advanced settings for the port you are using (COM1 or COM2) against your hardware manual.

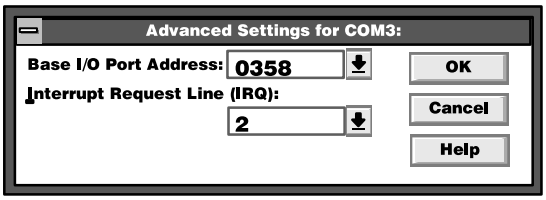
- **Add-On PC Connection:** Regardless of how you set the com port jumper on the CDT370 board, the debugger software will always communicate with Windows through Windows com port 3. The standard communication settings (baud rate, data bits, parity, stop bits, and flow control) are configured directly by the debugger software without your intervention and can therefore be ignored. You must set the advanced settings, however (base I/O port address and interrupt request line (IRQ)).

  To configure the port, open the Control Panel window and choose the Ports icon. The Ports dialog box appears, showing icons for the four possible serial ports. Double-click on the COM3: icon. The Settings dialog box appears. Choose the Advanced button. The Advanced Settings dialog box appears. Type the correct value into the Base I/O Port Address; then open the Interrupt Request Line list and select the proper IRQ number. These values are determined by the way you have positioned the com port jumper on the CDT370 board and are shown in Table 2–1 on page 2-5.

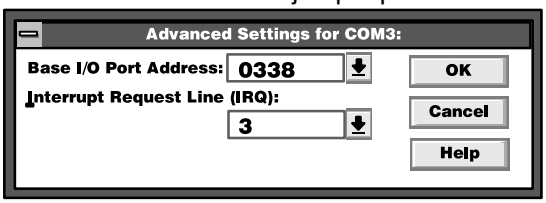
  Choose the OK button and restart Windows by choosing the Restart Now button.

Example 2–1. Examples of Windows COM Port Configuration for Add-on Connections

1) Add-on connection with jumper position COM2



2) Add-on connection with jumper position COM3



Invoking the debugger with Microsoft Windows

You may want to create an icon to make it easier to invoke the debugger from within the Microsoft Windows environment. To install the debugger software in Microsoft Windows, create a new program item. (Please refer to your Microsoft Windows manual for details.) While creating a new program item, type **cdt370w.exe** at the command line and include any additional parameters you want. If you plan on using the profiler, be sure to include the *–profile* option.

If you prefer, you can also execute the DOS version from Windows by entering **cdt370.exe** at the command line. If you are going to be switching frequently between the basic debugger and the profiler, it might be more convenient for you to create separate program items for each.

Using Microsoft Windows, 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.

When running Microsoft Windows, you should run it in either the standard mode or the 386 enhanced mode to get the best results.

2.8 Power-Up Procedure

If a target system is used, replace the TMS370 microprocessor in the target system with the target connector of the CDT370. See Section 8.4, *Connecting the Target Cable to the Target System*. Make sure that the pin orientation is correct.

Note: Pin 1 is marked with an open dot (○).

Always ensure that the power of the CDT370 is off before connecting or disconnecting the target connectors.

2.9 Invoking the Debugger

Before invoking the debugger, check that the emulator is properly configured and that the cable from the emulator to the PC host (if used) is properly connected. The debugger will not operate unless the emulator is correctly connected and turned on.

Here's the basic format for the commands that invoke the debugger:

cdt370 [*filename*] [*–options*]

cdt370 is the command that invokes the debugger. If you are using Microsoft Windows, use **cdt370w** to invoke the debugger.

filename is an optional parameter that names an object file that the debugger will load into memory during invocation. The debugger looks for the file in the current directory; if the file isn't in the current directory, you must supply the entire pathname. If you don't supply an extension for the filename, the debugger assumes that the extension is .out.

–options supply the debugger with additional information (Table 2–3 summarizes the available options).

You can also specify filename and option information with the D_OPTIONS environment variable (see *Setting up the environment variables* on page 2-11). Table 2–3 lists the debugger options; the subsections following the table describe the options.

Table 2–3. Summary of the Debugger Options

Option	Brief description
–b[**b**]	Selects the screen size
–i *pathname*	Identify additional directories
–a *address*	Identify the add-on address
–p *serial port*	Identify the serial port
–profile	Enter the profile environment (Windows version only)
–s	Load the symbol table only
–t *filename*	Identify a new initialization file
–v	Load without the symbol table
–x	Ignore D_OPTIONS

Selecting the screen size (–b option)

By default, the debugger uses an 80-character-by-25-line screen. You can use one of the options in Table 2–4 to specify a different screen size.

Table 2–4. Screen Size Options (for Use With the –b Option)

Option	Description	Notes
none	80 characters by 25 lines	Default display
–b	80 characters by 43 lines	Any EGA or VGA display
–bb	80 characters by 50 lines	VGA only

Note:

Using the –b options overrides the *init.clr* file.

Identifying additional directories (–i option)

The **–i** option identifies additional directories that contain your source files. Replace *pathname* with an appropriate directory name. You can specify several pathnames; use the **–i** option as many times as necessary. For example:

CDT370 –i*path1* **–i***path2* **–i** *path3...*

Using **–i** is similar to using the **D_SRC** environment variable.

(See *Setting up the environment variables* in 2.4.3)

If you name directories with both **–i** and **D_SRC**, the debugger first searches through directories named with **–i**. The debugger can track a cumulative total of 20 paths (including paths specified with **–i**,**D_SRC**, and the debugger **USE** command).

Identifying the serial port (–p option)or the add-on address (–a option)

The **–p** or **–a** option identifies the serial port or the add-on address that the debugger uses for communicating with the emulator. The default value, **–a1**, corresponds to the CDT370 board shipping position (Add-on PC link, Address 318h, IRQ4). Depending on your configuration, use one of these values:

Table 2–5. Serial Port and Add-On Address Options

Option	CONF	COM PORT	Comments
–a1	ADD-ON	COM1	Add-on PC link 318h IRQ4
–a2	ADD-ON	COM2	Add-on PC link 358h IRQ2
–a3	ADD-ON	COM3	Add-on PC link 338h IRQ3
–a4	ADD-ON	COM4	Add-on PC link 398h IRQ7
–p1	RS-232	X	RS232 link serial com port 1
–p2	RS-232	X	RS232 link serial com port 2

Note: You Cannot Use the –a and –p Options at the Same Time

the –a and –p options are mutually exclusive; only one can be used (according to your hardware configuration).

If you used a wrong setting, you'll see this error message when you try to invoke the debugger:

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

Entering the profiling environment (–profile option)

The **–profile** option allows you to bring up the debugger in a profiling environment so that you can collect statistics about code execution. Note that only a subset of the base debugger features is available in the profiling environment.

Loading the symbol table only (–s option)

If you supply a filename when you invoke the debugger, you can use the **–s** option to tell the debugger to load only the file's symbol table (without the file's object code). This is similar to the debugger's **SLOAD** command.

Identifying a new initialization file (–t option)

The **–t** option allows you to specify an initialization command file that will be used instead of init.cmd. If **–t** is present on the command line, the file specified by filename will be invoked as the command file instead of init.cmd.

Loading without the symbol table (–v option)

The **–v** option prevents the debugger from loading the entire symbol table when you load an object file. The debugger loads only the global symbols and later loads local symbols as it needs them. This speeds up the loading time and consumes less memory space.

The **–v** option affects all loads, including those performed when you invoke the debugger and those performed with the **LOAD** command within the debugger environment.

Ignoring D_OPTIONS (–x option)

The –x option tells the debugger to ignore any information supplied with the D_OPTIONS. For more information about D_OPTIONS, please refer to *Setting up the environment variables* in Section 2.6.

2.10 Exiting the Debugger

To exit any version of the debugger and return to the operating system, enter this command:

`quit` ↵

You don't need to worry about where the cursor is or which window is active—just type. If a program is running, press ESC to halt program execution before you quit the debugger.

If you are running the debugger under Microsoft Windows, you can also exit the debugger by selecting the exit option from the Microsoft Windows menu bar.

Chapter 3

Trace

This chapter explains how to use the circular trace buffer that exists on the CDT370 board. With the trace buffer and the trace and timing commands, you can monitor and collect statistics on the CPU as it runs. This chapter also covers the differences between the CDT370 trace functions and the breakpoint/trace/timing (BTT) board described in the *TMS370 Family C Source Debugger User's Guide.*

Topic **Page**

3.1 Trace and Timing

There is a 2K x 16-bit trace circular buffer on the CDT370 board. The TMS370 internal address bus is stored each time an opcode fetch is detected. When you want to display the contents of this buffer, the debugger reconstitutes all the opcodes executed by the TMS370.

This trace feature is fully real time because the CPU is not halted. The sample capture begins when you start the CPU and ends when you halt it, either with a breakpoint or halt command.

A 24-bit-wide on-board counter is incremented by the CPU's clock, so the total number of cycles can be measured between two defined instructions (referenced by two breakpoints).

The capacity of this counter is up to 16 777 216 cycles; at 20 MHz, that means a total time of 3.35 seconds.

Trace Feature

The trace feature is used to display trace samples that have been collected, as well as the value of the timer.

When you select Trace from the menu bar, a pull-down menu is opened, where you can open the Inspect window, position the frame to display within the Inspect window, or save the trace buffer to a file.

Most of the inspect window consists of space for the trace samples. In the bottom corner, the value of the on-board timer is displayed. You can move and scroll through trace samples in the same way as with other windows.

Trace Samples

Trace samples are snapshots of bus cycle activity that are collected and stored by the on-board trace logic when the CDT370 is running.

The trace buffer is a circular buffer that can hold 2048 samples. If more samples than this are collected, the buffer wraps around, and new samples overwrite the old ones. Each sample is 16 bits wide and contains the value of the address bus of the CPU when an opcode fetch is detected.

Each trace sample is referred to by its index in the trace buffer, starting from 0. Trace samples with lower indices are chronologically older than samples with higher indices. Thus, if the buffer is full, sample 2046 is always the most recent sample taken.

When trace samples are displayed on the screen, they include the information shown in Table 3.1 identified by a heading displayed on top of the screen.

Table 3–1. Displayed Trace Samples

Field	Description
SAMPLE	Index in trace buffer
ADDRESS	16-bit value of address bus
REVERSE ASM	Disassembled code

Note: The first trace sample is never taken, but the runtime value is accurate. After target reset, trace buffer content are irrelevant.

Timer Value

On the bottom of the screen, the value of the on-board counter is displayed. This counter is incremented by the CPU's clock in run mode. When you enter the RUN command (F5 key), this timer is automatically reset before the CPU runs, and automatically disabled when the CPU is halted (manually or by a breakpoint). As a result, you can measure the number of cycles spent during the whole run mode. The major purpose of this counter is to measure the number of cycles spent between defined addresses. You simply need to define breakpoints before executing the RUN command; Each time a breakpoint is reached, the number of cycles spent since the last breakpoint is displayed.

This counter is 24 bits wide, so it overflows at 16 777 216 cycles.

A time information can be obtained by applying the following formula :

$$\text{TIME\_SPENT } (\mu s) = \frac{4 \times \text{COUNTER\_VALUE}}{\text{FREQUENCY\_USED (MHz)}}$$

$$\text{ACCURACY } (\mu s) = \frac{4}{\text{FREQUENCY\_USED (MHz)}}$$

For example, if the frequency is 16 MHz, and the counter value is 42 400, the time spent and accuracy are:

$$\text{TIME\_SPENT } (\mu s) = \frac{4 \times 42400}{16 \text{ MHz}} = 10600 \ \mu s = 10.6 \text{ ms}$$

$$\text{ACCURACY } (\mu s) = \frac{4}{16 \text{ MHz}} = \frac{4}{16} = 0.25 \ \mu s = 250 \text{ ns}$$

At the maximum allowed frequency of 20 MHz, the maximum time measurable is about 3. 355 433 seconds with an accuracy of 200 ns.

Benchmarking

Code benchmarking, as explained in the *TMS370 Family C Source Debugger User's Guide*, is also available in the CDT370. The value of the pseudoregister CLK is valid after a RUN or a RUNB command that is terminated by a software breakpoint.

3.2 Trace Commands

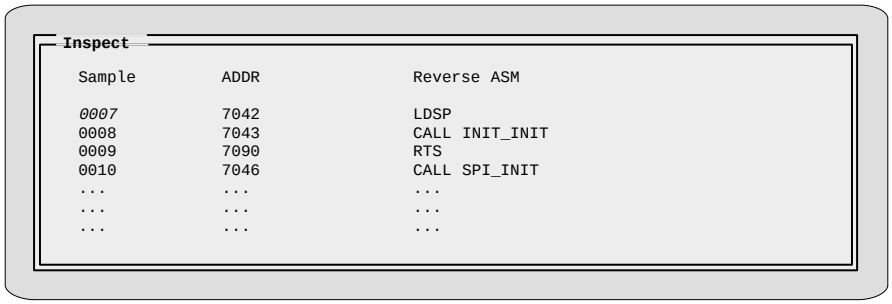
To access the Trace , simply hit ALT T, or click Trace from the menu bar. This opens a trace pull-down menu in which you can select or click the following commands:

- **I**nspect
- **P**osition
- **S**ave

Inspect frames (the I command)

When Inspect is selected, the debugger checks the emulator to determine how many trace samples have been collected. If the emulator has no trace samples, a blank window appears on the screen. Otherwise, the debugger reads a screenful of the most recent trace samples and displays them. The Inspect window looks as follows.

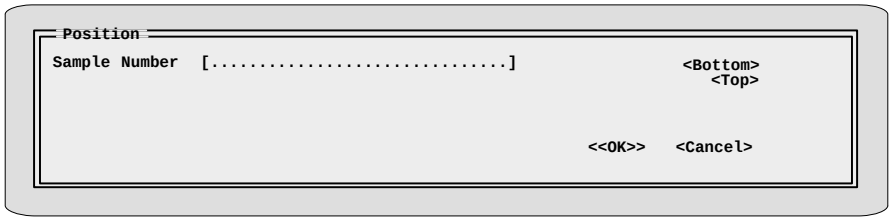
(This is given as an example only and assumes that the trace has collected something)



Sample is the frame number within the trace buffer, ADDR is the program counter of the traced instruction, and Reverse ASM is the recreated mnemonic of the instruction.

Position at an index (the P command)

When Position is selected by pressing ALT P or by clicking the P with the mouse, the following dialog box is opened.



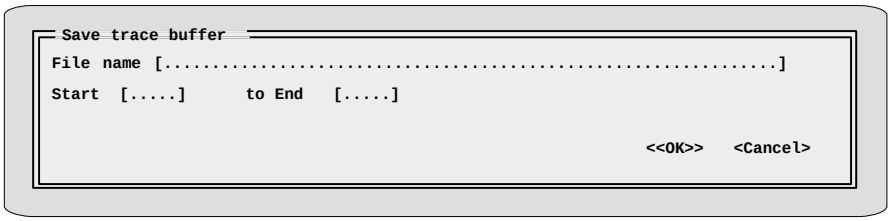
To select the frame to display within the Inspect window, enter an adequate frame number, select the Bottom frame (with the ALT B keys or by clicking it with the mouse), or select the Top frame (with the ALT T keys or by clicking it with the mouse). Once the choice is made, simply quit the Position window with the ALT O (for OK) or ALT A (for Cancel). The Trace Window will then be updated accordingly.

T (Top Samples) positions the screen at the top of the trace buffer. The oldest samples in the buffer are displayed, starting with index 0.

B (Bottom Samples) positions the screen at the bottom of the trace buffer. The most recent samples in the buffer are displayed. If the buffer is full, the highest index is 2046. Otherwise, the highest index is one less than the total.

Saving trace information (the S command)

When the Save Command is invoked, the following dialog box is opened:



The Save command saves trace samples to a disk file for later inspection. Any number of samples can be saved, up to the number that were recorded. Just type in the filename of the file where you want to store the trace information and hit the enter key or click the **O** (for O. K.) with the mouse.

Enter the indices of the first and last samples if you want specific frames to be saved.

The default start index is 0, and the default end index is the last sample taken; using both defaults causes the whole trace buffer to be saved. The specified trace samples are read from the emulator, formatted just as they would be for display on the screen, and written to the file. If many samples are saved, this process can be somewhat lengthy. For example, saving a full trace buffer of 2048 samples may take approximately 30 seconds.

Execute from the trace screen

You can execute code while you are viewing the trace screen. You use the **F8** or **F10** command from the trace menu. After the code executes, the debugger will update the trace screen by reading the new trace samples from the emulator and displaying the most recent ones.

3.3 Differences Between XDS/22 BTT and CDT370 Trace

The **BTT** command, which is specific to the XDS/22 BTT, is not available with the CDT370.

The *TMS370 Family C Source Debugger User's Guide* includes two chapters that are not applicable to the CDT370 debugger: *Tutorial: Using BTT Features* and *Using Hardware Breakpoint, Trace, and Timing Features*.

The following commands are available:

- **INSP** Open INSPECT Window
- **TSAVE** Store and Save the Trace Buffer
- **RUNF** Run Free
- **RRUNF** Reset and Run Free
- **WRUNF** Wait and Run Free
- **HALT** Halt Target System

Please refer to the *Summary of Commands and Special Keys* in the *TMS370 Family C Source Debugger User's Guide* for a description of these commands. Since the CDT370 does not have a BTT, you remain in control of the command line; that is, you do not have to press ESC to regain control after entering a RUNF, RRUNF, or WRUNF command.

Chapter 4

Programming

With the debugger, it is possible to:

- ❑ Program an EPROM device (FPM)
- ❑ Program data EEPROM
- ❑ Blank Check a device
- ❑ Verify a device
- ❑ Upload the contents of a device to RAM

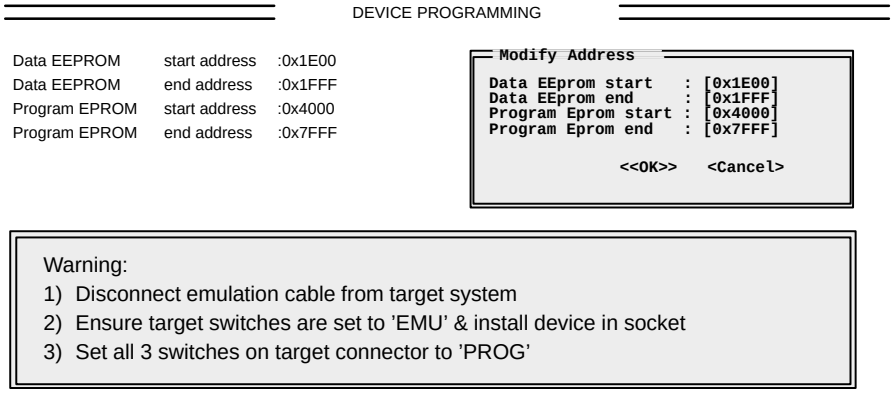
These features use the emulator's memory. First, you must configure the emulator memory map to match the device you are emulating. Second, you must load your code into the emulator's memory in the same locations where the code will ultimately reside on the device. For information on memory mapping, please refer to Section 7.2, *Memory Mapping*, and to *Defining a Memory Map* in the *TMS370 Family C Source Debugger User's Guide.*

Topic **Page**

4.1 Programming a Device (the P Command)

The **P** (programming) command is used to program the device that you will plug into the target connector's easy-extract socket. When you type ALT P, or click the P on the menu bar with the mouse, the Device Programming window is displayed and a dialog box is opened as shown in Figure 4–1.

Figure 4–1. Modify Address Dialog Box



A warning at the bottom of the window reminds you that you must disconnect the emulation cable from the target system, ensure that target switches are set to EMUL, install the device to be programmed into the socket, and finally set all 3 switches on target connector to PROG.

If you want to modify the start and end address of each memory block, click with the mouse, or position the cursor (with the keyboard cursor keys) on the address to modify, then enter the proper value for each memory type.

Remember to load your object code in the emulator RAM at these address ranges before entering the Programming mode if you intend to program or verify your device.

When the values are right for your application, click on OK with the mouse or activate it with the ALT O keys. The debugger will then load progv3.obj, the device programming utility (DPU), and open the Select Action dialog box.

Note: Effects of Loading the DPU

Loading the Device Programming Utility erases the current debugger symbol table.

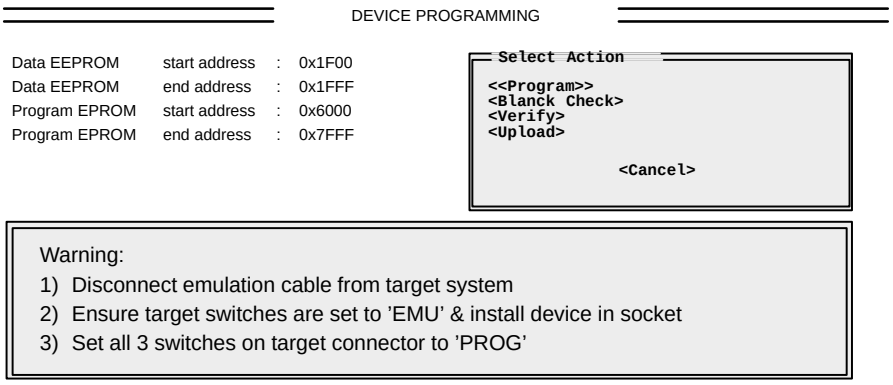
To go back, or to cancel the **P** Command, simply click the **A** with the mouse or use the ALT A keys to activate the cancel command. When you specify this commmand, the debugger will return to the menu bar.

Press the ESC to return to the previous window.

4.2 Action Selection

Once the address ranges convenient for the application are selected, the Select Action dialog box is opened as shown in Figure 4–2.

Figure 4–2. Select Action Dialog Box



You can select **one** of following actions:

- **Program** to program the device
- **Blank Check** to check that the device has no program
- **Verify** to check the contents of the device against the CDT's content
- **Upload** to upload the contents of the device into the CDT's memory

Program is the default selection. The action selected will be applied to the memory address ranges selected previously.

Program

This action programs the contents of the CDT370 RAM into the device (byte per byte copy, at the same addresses). The program is automatically verified.

Blank Check

This action checks whether a device has already been programmed or not. Each EPROM or EEPROM memory location is compared to FFh.

Verify

This action verifies that the contents of the device memory perfectly match the contents of the CDT370 RAM.

Upload

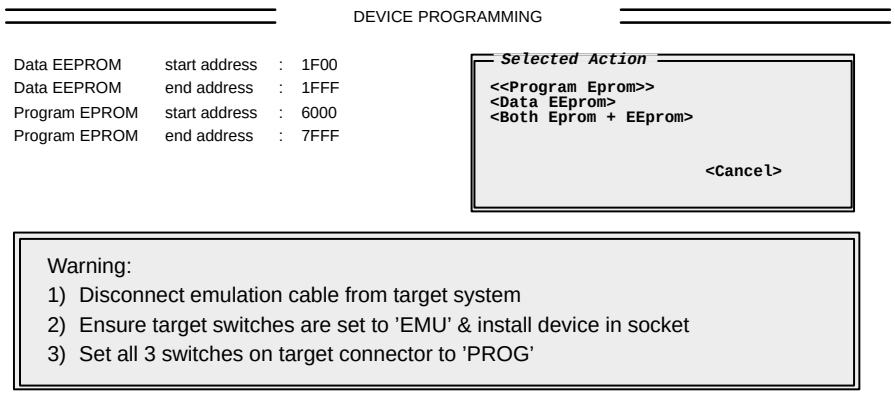
This action loads the contents of the device memory into the CDT370 RAM.

4.3 Memory Type Selection

Once you have selected an action, select the type of memory you want to access.

The dialog box looks like:

Figure 4–3. Select Memory Type Dialog Box



You can apply the selected action (Program, Blank Check, Verify or Upload) to:

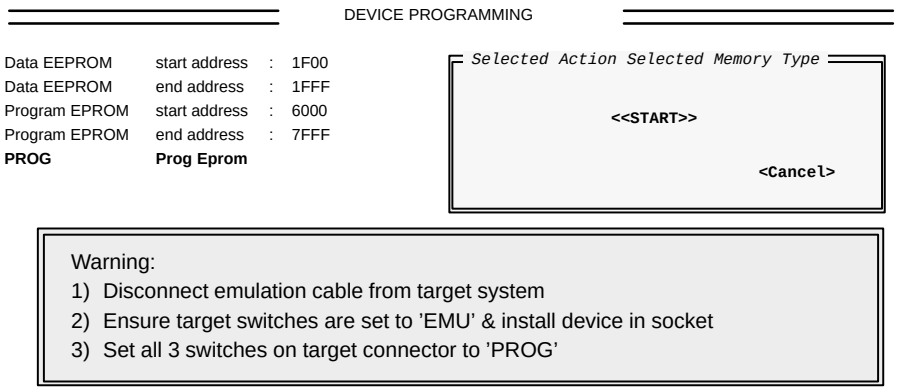
- the Program EPROM only,
- the Data EEPROM only,
- or Both EPROM and EEPROM.

Program EPROM is the default selection.

4.4 Validation Dialog Box

After selecting the memory type, the Validation dialog box allows you to start or cancel the operation.

Figure 4–4. Validation Dialog Box



Make sure that all three target connector switches are set to PROG before starting the operation. To abort the process once it has been started, press ESC.

Once the operation has completed, a warning message at the bottom of the window reminds you that, to avoid damage to the device, you must return all 3 target switches to EMUL before removing the device from the programming socket; a completion message is displayed in the command window. You can then repeat the same operation to the same device or a different one, or cancel and go back to Action Selection.

4.5 Messages

Depending on the action selected, the following messages can be displayed:

Action	Message
Program	Device programmed and checked Programmation failed Verification failed
Blank Check	Device is blank Device is not blank
Verify	Device programmed and checked Verification failed
Upload	Device upload completed
All	Fault condition ... Operation failed

Chapter 5

Autotest

The Autotest command, from the Load pull-down menu, provides a quick technical check of the CDT370 board functionality. When you select this function, the debugger loads the Autotest and a TMS370C756 memory map required to perform the test. When started, the Autotest software displays the message:

`AUTOTEST IN PROGRESS.`

At the end of the Autotest (a few seconds), the completion message is displayed as:

`AUTOTEST SUCCESSFUL` or **`AUTOTEST FAILED.`**

and the original memory map is restored. The autotest program can be run from the command line of the Command window or in a batch file.

> The Autotest software must be run with
>
> **No connection** to a target system and
>
> **No device** in the easy extract socket of the target cable.
>
> The Autotest software is not exhaustive.

See Chapter 9, *Repair Guide*, for information about what to do if the Autotest fails.

> **Note: Autotest Restores the Memory Map, but not Memory**
>
> Running the Autotest command erases the symbol table and the CDT370 memory contents.

Chapter 6

Clock Source

You can select an alternate clock setting through the Configuration dialog box in the Load menu. Please refer to *Setting Up The Clock* in the *TMS370 Family C Source Debugger User's Guide*. The crystal option is not available on the CDT370.

The choices are:

- **OSCILLATOR:** If you select OSCILLATOR from the menu, the debugger will reset the TMS370 device with Osc 2 as the clock. If there is not a usable clock signal at Osc 2, the device will use Osc 1. The CDT370 20 MHz oscillator (location Osc 1) is used to generate the default clock. You can also plug in another oscillator at Osc 2, to work at any allowed frequency. Osc 2 is the highest priority device.

- **TARGET:** If you select TARGET, the CPU expects the clock input from the target system. A clock buffer circuitry is found in the target cable head, so the external clock can be a crystal.

As a result, the target clock source can be:

1) A crystal connected between low and high input lead on the target connector (the crystal driver of the target connector will generate the clock for the CDT370 board).

2) An oscillator driving low input lead on the target connector.

If you change the clock source, the debugger tries to reset the TMS370 device with the new clock source. If the emulator detects that the device is not operating properly, it rejects the new clock source and resets the chip again, restoring the old clock.

When this occurs, an error message is displayed:

source **not available for clock**

source is the clock source you tried to select.

Chapter 7

Defining a Memory Map

Before you begin using the debugger, you must supply the debugger with a memory map. The memory map tells the debugger which areas of memory it can access and how those areas are accessed.

Topic **Page**

7.1 Memory Mapping Introduction

The memory mapping capability of the TMS370 debugger allows you to specify exactly how the CPU is allowed to access various memory ranges. The TMS370 device provides significant flexibility in the memory map, with its various configurations of internal memory and external addressing capability. In addition, the emulator has 64K bytes of high-speed emulation RAM, which can be used to functionally emulate target system memory. The debugger memory mapping system allows you to take advantage of the hardware's flexibility.

Specifying the memory map is accomplished by dividing the 64K address space into ranges. Each range starts and ends on a 16-byte boundary and has a type that determines how addresses in the range are accessed. The type determines:

- what class of memory the range falls into, such as RAM, program ROM, EEPROM, etc... (the type for a given range is determined by the architecture of the particular TMS370 device being emulated),
- whether the memory is to be accessed internally on the chip, from external target memory, or from emulator RAM, and
- the protection that allows you to prevent the CPU from reading and/or writing to the given address range.

Please refer to *Defining a Memory Map* in the *TMS370 Family C source Debugger User's Guide* for more information.

Any address that is not covered by a specified range in the debugger memory map is considered to be "unconfigured". All unconfigured memory is protected against both read and write operations so that if the CPU tries to access an unconfigured location, an access violation occurs, and the CPU halts.

7.2 Memory Mapping

The emulator board contains 64K bytes of RAM reserved for emulation. Memory references from the TMS370 can be satisfied in one of three ways:

- Internally from the TMS370 device,
- Externally from target system memory, or
- Externally from emulator RAM.

The 64K-byte address range of the microcontroller is divided into 16-byte areas called frames. The memory mapping scheme of the debugger and emulator allows you to specify, for each 16-byte frame of the address space, where memory references to that frame are to be satisfied. References to the register file (addresses 000h to 0FFh) are always satisfied internally. Sixteen-byte frames in the peripheral register file (addresses 1000h to 10FFh) can be mapped either internally or to an optional user-supplied peripheral expansion board on the emulator.

In addition to mapping various parts of the address space to different parts of the physical memory, you can protect areas of memory from certain types of access. Protection can be on read cycles, write cycles, both, or none. If the CPU tries to execute a memory cycle on an address that is protected for that cycle, a trap occurs, and the CPU is halted. Thus, you can use memory as ROM by write protecting it, and you can treat it as nonexistent by both read and write protecting it. Any memory that you don't explicitly map is fully protected in this way so that any attempt to access an address outside configured memory causes a trap and halts the CPU.

The CDT370 emulates ROM by write-protecting the ROM area of emulator memory.

The CDT370 emulates data EEPROM with on-board hardware that allows the use of every feature of the data EEPROM module:

- Control frame access
- Write-protect registers
- Write-protect override
- Write ones, write zeros
- Array programming
- Programming time of 10 ms (20 ms for array programming)

You access emulated data EEPROM on the CDT370 in the same way as you would access EEPROM on a TMS370 chip.

For more information, refer to *Data EEPROM Modules* in the *TMS370 Family Data Manual*.

Register File Memory

Description Locations are part of the TMS370 on-chip register file.

Mapping Attributes It should be mapped as IRAM for location 0x00 to 0x7F or 0xFF, depending on the device to emulate.

Peripheral Frame Memory

Description This type is used for 16-byte ranges in the peripheral register file.

Program ROM/EPROM Memory

Description This memory type is used for addresses that fall in the range of the on-chip mask ROM. Program ROM and program EPROM are emulated using the high-speed RAM in the emulator.

Mapping Attributes Program ROM should be mapped as emulator ROM, and program EPROM should always be mapped as PEPROM. This means that whenever internal memory is enabled on the device, memory accesses in this range are satisfied by the emulator (just as if the memory were actually on the chip).

You **must not** define any EPROM control frame (EPCTL) when you define PEPROM. You can define only one PEPROM.

Protection Attributes Program ROM is, by default, write protected. Write cycles to addresses in a range of this type cause an access violation trap to occur. Writes to external target memory cause a trap, but the write operation cannot be prevented.

Note: Unsupported EPROMS

Data EPROM (DEPROM) and Custom EPROM (CEPROM) are not supported.

Data EEPROM Memory

Description The data EEPROM type is used for addresses that fall in the range of the chip data EEPROM. Some devices have no memory of this type in the memory map. Data EEPROM is emulated using the RAM in the emulator and a special interface logic that allows you to use all the data EEPROM module features found in any TMS370 devices:

- ❑ Control frame access
- ❑ Write protection registers
- ❑ Write protect override mode
- ❑ Array programming
- ❑ Minimum programming time criteria

When a programming operation is started, it must be finished; the EXE bit must be reset at least 10 or 20 ms (depending on the operation) after its rising edge. Otherwise, the CPU is halted and an the following error message is displayed:

EEPROM VIOL

Since the data EEPROM memory is emulated through a simple RAM, all written data are retained as long as the CDT370 is powered; they are lost when it is switched-off.

In all other respects, the CDT370 behaves exactly as if you were programming actual data EEPROM with a TMS370 device. Refer to *Programming the Data EEPROM* in the *TMS370 Family Data Manual* for complete instructions.

Mapping Attributes Data EEPROM memory must always be mapped as DEEPROM; you can define only one DEEPROM. You **must not** define any EPROM control frame (EPCTL) when you define a DEEPROM. An EPCTL is automatically created (address 0x1010, length 0x10); any frame that may have existed at this address must be deleted first. The EPCTL is automatically deleted when the DEEPROM is deleted.

Note: Unsupported EEPROMS

Program EEPROM (PEEPROM) and Custom EEPROM (CEEPROM) are not supported.

7.3 Copying Data Within the On-Board RAM

You can use the MEMCOPY command to copy data from one location in the on-board RAM to another. The syntax for the command is:

memcopy *source, destination, length*

- The *source* parameter identifies the starting address of the range that you want to copy. This parameter can be an absolute address, a C expression, the name of a C function, or an assembly language label.
- The *destination* parameter identifies the location in RAM where you want the data to go. This parameter can be an absolute address, a C expression, the name of a C function, or an assembly language label.
- The *length* parameter defines the length of the range. This parameter can be any C expression.

If you select Memcopy from the Memory menu, or if you enter MEMCOPY without any parameters, the debugger displays a dialog box for you to enter the source, destination, and length.

Chapter 8

Target Cables

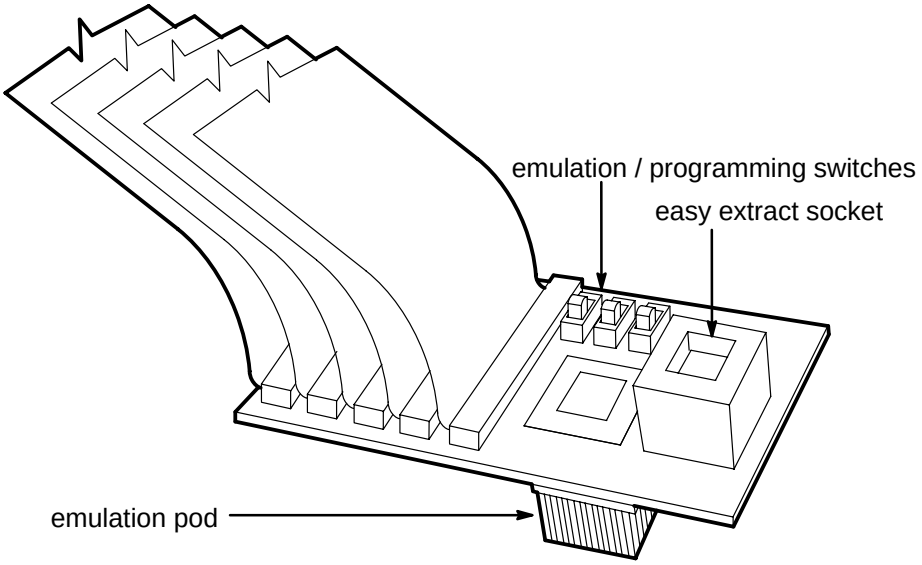
Target cables allow you to emulate and program TMS370 devices. This chapter describes the target cables and their installation.

The following sections are included:

8.1 Target Cables Description

All the CDT370 target cables are built in the same way and allow you to emulate any of the TMS370 devices or program any TMS370 Field Programmable Device.

Figure 8–1. PLCC Target Cable Termination



These items are at the end of a target cable:

- ❑ an emulation pod (for real time in-circuit emulation)
- ❑ a crystal driver HC4061 (allowing the use of a target crystal)
- ❑ an easy to extract socket (for field programmable device programming)
- ❑ a set of three switches (emulation/programming selection)

Depending on the type of device to emulate (or to program), 3, 4 or 5 flat ribbon cables are found. They are used to connect the target cable to the CDT370 board. They are terminated by 34-pin 2-row female connectors.

Five different emulation pods may be found, one for each package of the TMS370 microcontrollers family supported by the CDT370.

Table 8.1 shows the target cables available for the CDT370.

Table 8–1. Available Target Cables

Reference	Emulated Device
EDSTRG28DIL	28-pin DIL
EDSTRG28PLCC	28-pin PLCC
EDSTRG2XDIL	40-pin DIL (x2x)
EDSTRG2XPLCC	44-pin PLCC (x2x)
EDSTRG40DIL	40-pin DIL (x4x)
EDSTRG44PLCC	44-pin PLCC (x4x)
EDSTRG68PLCC	68-pin PLCC

8.2 Switches Description

Figure 8–2 shows the position of the target cable switches for both the emulation and the programming configuration.

Figure 8–2. Switch Positions

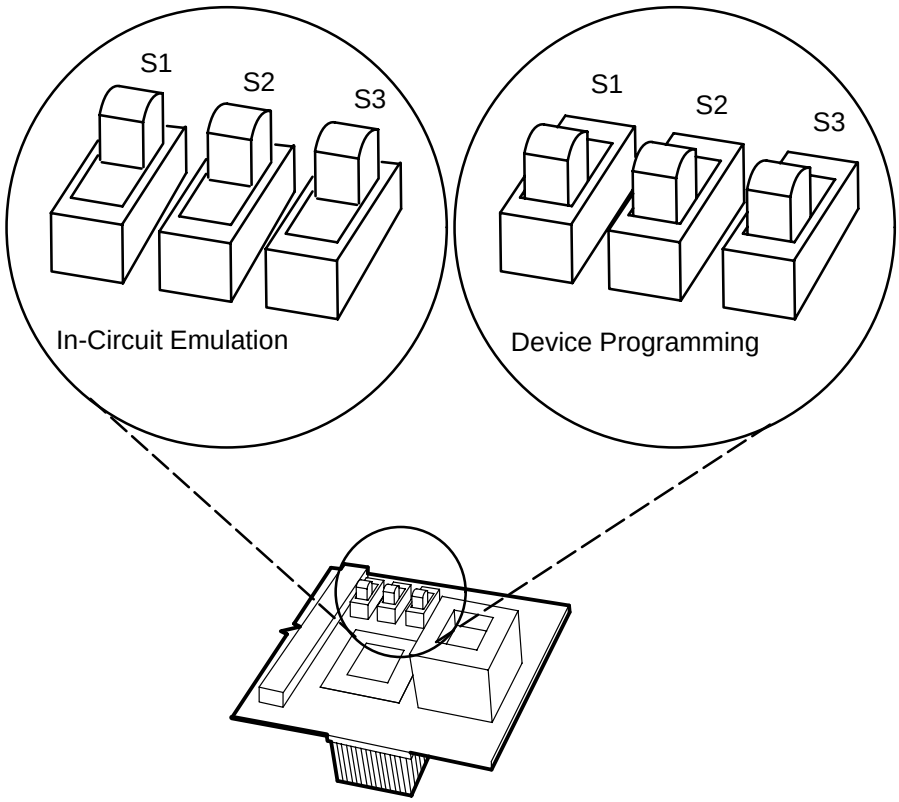


Table 8–2 shows the signals that are controlled by these three switches.

Table 8–2. Switch Signals

Switch	EMUL position	PROG position
S1	V_{CC} disable on socket	V_{CC} enable on socket
S2	V_{PP} disable on socket	V_{PP} enable on socket
S3	HC4061 enable	HC4061 disable

8.3 Installing the Target Cable in the Emulator

To install a target cable in the emulator or change from one cable to another one, you must remove the CDT370 board from the PC when it is connected in add-on PC mode.

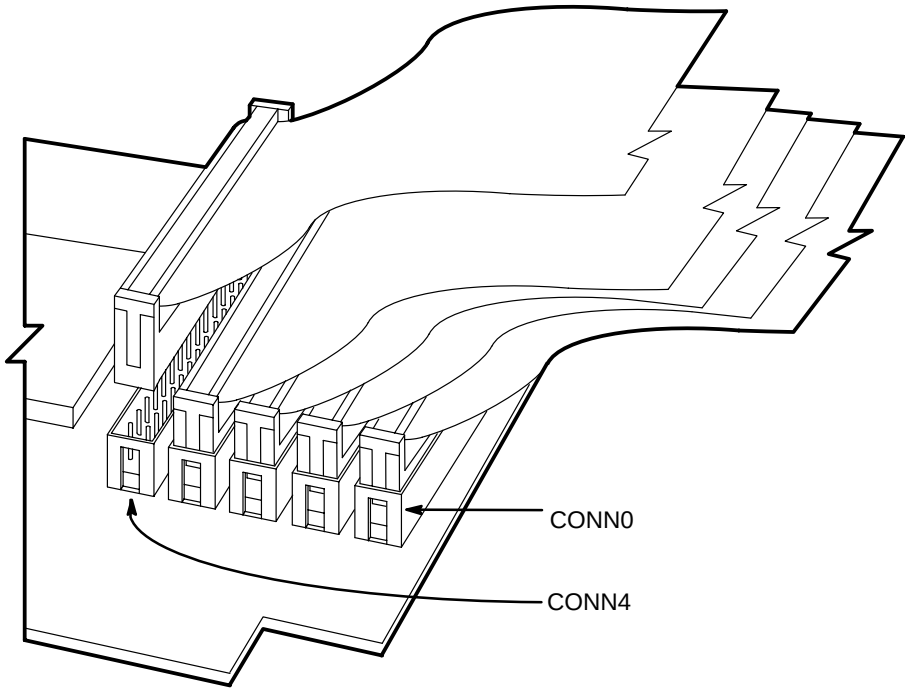
Follow the CDT370 board installation procedure detailed in Chapter 2, *Getting Started*.

1) Carefully remove the currently installed target cable by grasping the connectors of the target cable and pulling them gently upward while holding the CDT370 emulator board down on the table. Do not grasp, pull, or twist the cable at any time.

2) Align the connectors of the new target cable with the CDT370 board according to Figure 8–3. Move the target cable slightly from side to side until all the pins have slipped into the connectors.

3) Gently push the target cable down onto the emulator card until the cable is firmly attached. Check that no pins are bent.

Figure 8–3. Connecting the Target Cable to the CDT370 Board



On the CDT370 Board, there are five 2-row headers referenced CONN0 to CONN4. Table 8–3 describes the connection of each target cable.

Table 8–3. Connections for CDT370/Target Cables

Target Cable	# of Connectors	CONN0	CONN1	CONN2	CONN3	CONN4
EDSTRG28DIL	3	X	X	X		
EDSTRG28PLCC	3	X	X	X		
EDSTRG40DIL	4	X	X	X	X	
EDSTRG44PLCC	4	X	X	X	X	
EDSTRG2XDIL	5	X	X	X	X	X
EDSTRG2XPLCC	5	X	X	X	X	X
EDSTRG68 PLCC	5	X	X	X	X	X

8.4 Connecting the Target Cable to the Target System

Handle the target connector with extreme care at all times because it can be easily damaged.

When removing a PLCC from its socket, use a sharp instrument to pry the assembly from its target; do not pull it out by the attached cable.

Protect against electrostatic discharge into the target connector, especially in extremely dry air conditions. An electrostatic discharge would damage the internal circuits of the CDT370 board.

Check the Target Cable Before Installing

When installing the target connector into the target system, make sure that the lead orientation is correct.

Make sure that no device is plugged into the easy extract socket

A ground connection is made between the CDT370 and the target system through the V_{SS} pin of the emulation pod. For normal applications, plug the target connector into the target system in place of the microprocessor. The target system can be any circuit that incorporates one or several processors. The target connector pinout for the TMS370 microprocessor and the signal characteristics are provided in the specification of the appropriate TMS370 family device.

8.5 How to Use the Target Cable

- Emulation mode

  When you use the CDT370 as a real time in-circuit emulator, all three switches (S1,S2,S3) **must** be in the EMUL position.

- Programming mode

  In this mode, the CDT power **must** be on and the board **must** be under the control of the debugger software. For example, you have finished an emulation session and you want to program some TMS370 Field Programmable Microcontroller samples. Follow this procedure:

  1) Make sure all switches are in the EMUL position.
  2) Carefully insert the device you wish to program into the easy extract socket.
  3) Set all the switches to the PROG position.
  4) Run the programming command.
  5) When the command has executed, move all the switches back to the EMUL position.
  6) Remove the device from the easy extract socket.

Note:

You can execute steps 2 and 3 either before entering the programming screen or when the programming screen is already displayed, but you must complete both steps **before** starting a command (Program, Verify, Upload or Blank check).

Do Not Use Program Mode While Connected to the Target System

When using target cables in programming mode, disconnect the emulation pod from the target system. You may damage your system if you do not.

If you need to program many devices:

1) Configure all switches in the EMUL position.
2) Extract the programmed device from the easy extract socket and insert a new device.
3) Set all the switches to the PROG position.
4) Run the programming command.
5) When finished, go back to step 1.

Chapter 9

CDT370 Repair Guide

This chapter contains a brief system repair guide for both the add-on PC connection and the serial link.

The following topics are included in this chapter.

9.1 The Debugger Menu Doesn't Display

If the CDT370 board is connected inside the PC, refer to this page. If the CDT370 board is connected through an RS-232 link, refer to page 9-3.

Add-on PC connection

1) If the screen displays nothing, follow normal troubleshooting procedures and/or local repair procedures for the computer.

2) If the screen displays an error message when you invoke the debugger, push the CDT370 reset button and try again.

3) Be sure there is no chip in the easy extract socket of the target connector.

4) If you are using a target system, disconnect the target connector from the target system and try again. If it works with the target connector disconnected, see Section 9.3.

5) If the problem remains, be sure you invoke the proper communication port and interrupt request line. Be sure also that the I/O address/IRQ used by the CDT is not used by another card inside the PC.

6) Switch off your PC, remove the cover, and check that the CDT370's configuration jumpers are correctly set and all components are firmly plugged in their respective sockets.

7) If the CDT370 board seems to be well configured and you are using a target system, disconnect the target connector from the CDT 370 board and try again. If the CDT370 works, the problem is linked to the target connector itself; see Section 9.3.

8) If all is OK and the debugger menu doesn't display, please contact your local Texas Instruments Distributor.

RS-232 serial link

1) If the screen displays nothing, follow normal troubleshooting procedures and/or local repair procedures for the computer.

2) If the screen displays an error message when you invoke the debugger, push the CDT370 reset button and try again.

3) Verify that the CDT370 board is powered up and that the external power supply matches CDT370 board requirements (5 V, 3 A).

4) Verify that the connections from the RS-232 cable between the PC and CDT370 board are correct and tight.

5) Check that the CDT370's configuration jumpers are properly set.

6) Verify that all components are firmly plugged into their respective sockets.

7) Ensure that there are no metal objects beneath the CDT370 board that might short V_{CC}, ground, or other signals.

8) Be sure there is no chip in the easy extract socket of the target connector.

9) If you are using a target system, disconnect the target connector from the target system and try again. If it works with the target connector disconnected, see Section 9.3, *Target System Doesn't Respond*.

10) If the CDT370 board seems to be well configured and you are using a target system, disconnect the target connector from the CDT 370 board and try again. If the CDT370 works, the problem is linked to the target connector itself; see Section 9.3.

11) Disconnect the RS-232 cable and check its wiring against Table 2–2 on page 2-8.

12) If the problem remains, be sure you invoke the proper serial communication port.

13) If all is OK and the debugger screen doesn't display, contact your local Texas Instruments Distributor.

9.2 The CDT370 Does Not Function

If the debugger screen displays but the CDT370 does not function, you can run the Autotest Software by typing the A (Autotest) Command in the Load menu.

This Autotest Software must be run with no link to a target system (Target Connectors must be disconnected from the target system) and no chip resident in the easy extract socket.

This Autotest software is a “go-no-go” software that tells you if the CDT370 board is definitively functional or not. This autotest is not exhaustive but checks almost all board functionalities, including EEPROM emulation logic. See Chapter 5, *Autotest*.

If the debugger screen displays but the Autotest software fails each time, contact your local Texas Instruments Distributor.

9.3 The Target System Doesn't Respond

If the PC and CDT370 board work but the target system doesn't respond, or if a problem linked to the target connector causes the emulator to hang, follow this procedure:

1) Check the target system power (must be on when you invoke the debugger).

2) If OK, power off the target system, remove the target connector from target system, and check for broken or bent pins.

3) If the problem remains, power off the target system and the CDT370. If an add-on PC connection is used, power off the PC and remove the cover. Then check that the target system cable is properly connected to the CDT370 board. Refer to the Chapter 8.

4) Check that there is no short circuit or broken wire on the target connector.

5) Check the application hardware (look for short-circuit and supply problems).

6) If the problem remains, contact your local Texas Instruments Distributor.

Chapter 10

Additional Notes

Like the other debugging tools available to the 370 family, the CDT370 debugger defines a symbol that you can use in batch files (See *Entering Commands From a Batch File* in the *TMS370 Family Debugger User's Guide*).

Table 10–1. Predefined Constants for Use With Conditional Commands

Constant	Debugger Tool
$$XDS22$$	XDS/22 emulator
$$ABD$$	application board
$$CDT370$$	CDT370 emulator

Index

E

H

I

M

O

P

Q

R

S

T

U

V

W

X

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.