

# ***TMS320C54x Evaluation Module Installation Guide***

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# Installing the Evaluation Module and the C Source Debugger

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This guide helps you install the TMS320C54x evaluation module (EVM) board and the C source debugger on a PC running MS-DOS™ or PC-DOS™. You can also use the debugger with MS-Windows™. When you complete the installation, refer to the *TMS320C5xx C Source Debugger User's Guide*.

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## 1. What You'll Need

In addition to the materials that are shipped with the 'C54x EVM and C source debugger, you'll need the following hardware and software.

### **Hardware checklist**

- |                          |                                     |  |
|--------------------------|-------------------------------------|--|
| <input type="checkbox"/> | <b>host</b>                         | An IBM PC/AT or 100% compatible ISA/EISA-based PC with a hard-disk system and a 1.44-megabyte, 3.5-inch floppy-disk drive  |
| <input type="checkbox"/> | <b>memory</b>                       | Minimum of 640K bytes. In addition, if you are running the tools under MS-Windows, you will need at least 256K bytes of extended memory.   |
| <input type="checkbox"/> | <b>display</b>                      | Monochrome or color (color recommended)  |
| <input type="checkbox"/> | <b>expansion slot</b>               | One 16-bit slot  |
| <input type="checkbox"/> | <b>EVM board power requirements</b> | 1.5 amperes at 5 volts<br>0.1 amperes at -5 volts<br>0.5 amperes at 12 volts<br>0.1 amperes at -12 volts   |
| <input type="checkbox"/> | <b>optional hardware</b>            | A Microsoft-compatible mouse   |
| <input type="checkbox"/> |                                     | 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. If you have an EGA- or VGA-compatible graphics card, you can take advantage of some of these larger screen sizes. These larger screen sizes are most effective when used with a large (17" or 19") monitor. (To use a larger screen size, you must invoke the debugger with an appropriate option. For more information about options, refer to the invocation section in the <i>Overview of a Code Development and Debugging System</i> chapter of the <i>TMS320C5xx C Source Debugger User's Guide</i> .) |
| <input type="checkbox"/> | <b>miscellaneous materials</b>      | Blank, formatted disks   |

**Software checklist**

- |                          |                         |  |
|--------------------------|-------------------------|--|
| <input type="checkbox"/> | <b>operating system</b> | MS-DOS or PC-DOS (version 3.0 or later)<br>Optional: MS-Windows (version 3.0 or later)   |
| <input type="checkbox"/> | <b>software tools</b>   | TMS320C54x assembler and linker<br>Optional: TMS320C54x C compiler   |
| <input type="checkbox"/> | <b>optional files</b> † | <i>evmrst.exe</i> resets the EVM   |
| <input type="checkbox"/> | †                       | <i>evminit.cmd</i> is a batch file that contains debugger commands. The version of this file that's shipped with the debugger defines a 'C54x 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 the <i>Defining a Memory Map</i> chapter of the <i>TMS320C5xx C Source Debugger User's Guide</i> . |
| <input type="checkbox"/> | †                       | <i>init.clr</i> 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.   |
| <input type="checkbox"/> | †                       | <i>init.25</i> and <i>init.50</i> have been provided for basic 80x25 and 80x50 screen sizes, respectively. The <i>init.clr</i> file brings up the debugger in 80x25 mode. To bring the debugger up in another mode, copy one of the <i>init.xx</i> files to the <i>init.clr</i> file.  |
| <input type="checkbox"/> | †                       | The default configuration is for color monitors; an additional file, <i>mono.clr</i> , 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.<br><br>For information about these files and about setting up your own screen configuration, refer to the <i>Customizing the Debugger Display</i> chapter of the <i>TMS320C5xx C Source Debugger User's Guide</i> .   |

† Included as part of the debugger package

## 2. Step 1: Installing the EVM Board in Your PC

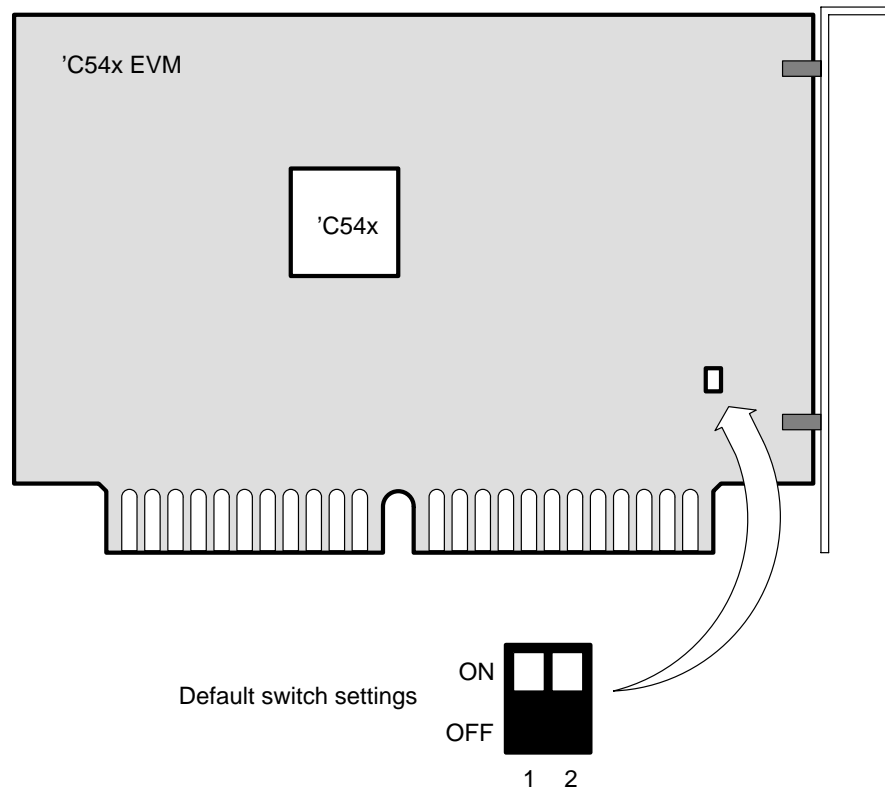
This section contains hardware installation information for the EVM.

### *Preparing the EVM board for installation*

Before you install the EVM board, you must be sure that the board's switches are set to correctly identify the I/O space that the board can use. The EVM board has two switches that identify your system's I/O address space. You can change the switch settings to identify the I/O address space that the EVM uses in your system.

Figure 1 shows the location of these switches on the EVM board and identifies the switch numbers.

Figure 1. EVM Board I/O Switches




In most cases, you can leave the switch settings in the default position. However, you must ensure that the EVM I/O address space does not conflict with other system hardware. For example, if you have installed a bus mouse in your system, you may not be able to use the default switch settings for the I/O address space. The mouse might use this space. Refer to your PC technical reference manual and your other hardware board manuals to circumvent any I/O space conflicts. If you find a conflict, use one of the settings in Table 1.

Table 1. EVM Board Switch Settings

	Address Range	Switch #	
		1	2
default	0x0240–0x025F	on	on
	0x0280–0x029F	on	off
	0x0320–0x033F	off	on
	0x0340–0x035F	off	off

Some of the other installation steps require you to know which switch settings you used. If you reset the I/O switches, note the modified settings in Table 2 below for later reference.

Table 2. Your Switch Settings

	Address Range	Switch #	
		1	2
			



### Setting the EVM board into your PC

After you have prepared the EVM board for installation, follow these steps:

**Step 1:** Turn off the power to the PC, and unplug the power cord.

**Step 2:** Remove the cover of the PC.

**Step 3:** Remove the mounting bracket from an unused 16-bit slot.

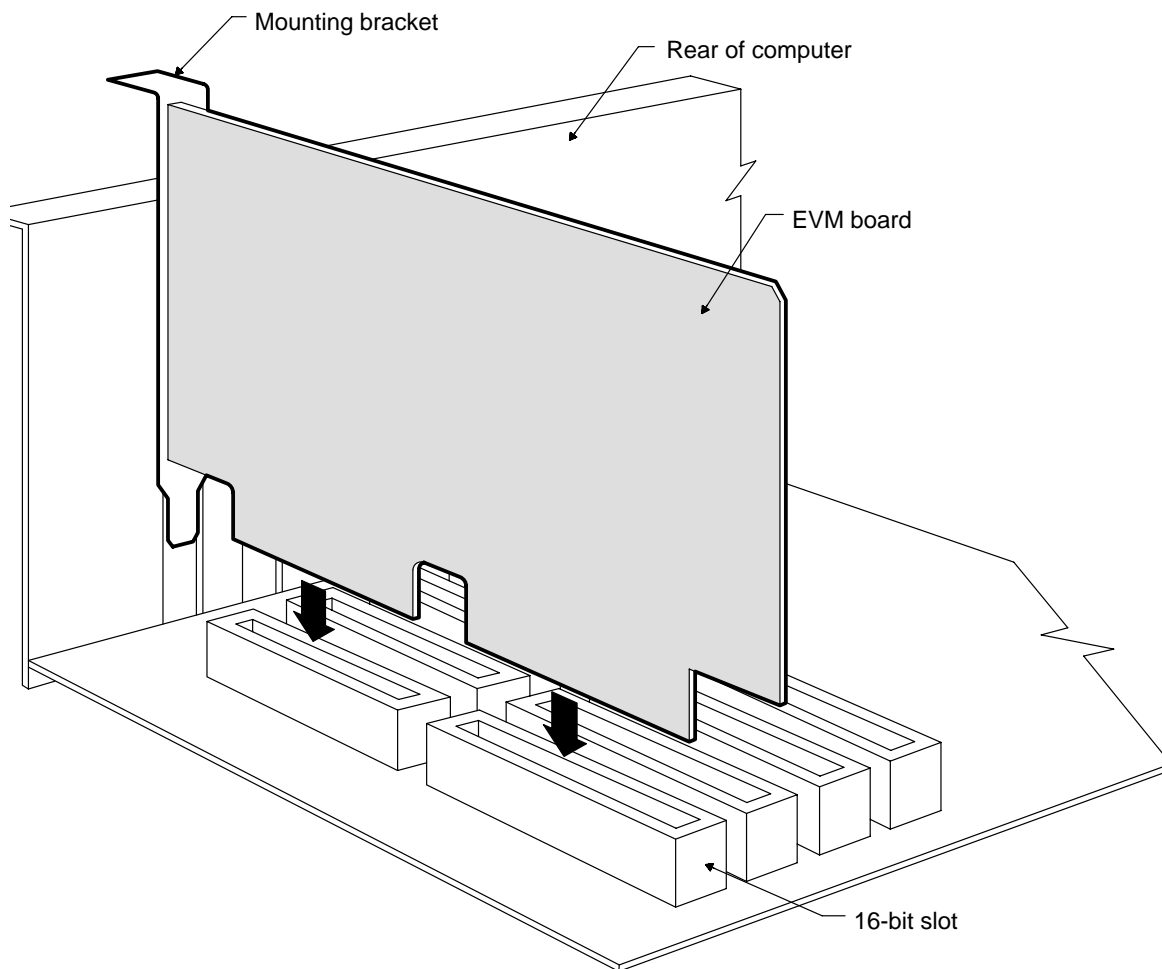
**Step 4:** Install the EVM board in a 16-bit slot (see Figure 2).

**Step 5:** Tighten the mounting bracket.

**Step 6:** Replace the PC cover.

**Step 7:** Plug in the power cord, and turn on the power to the PC.

Figure 2. EVM Board Installation



### 3. Step 2: Installing the Debugger Software

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

- 1) Make a backup copy of the DOS and/or MS-Windows debugger product disk. (If necessary, refer to the DOS manual that came with your computer.)
- 2) On your hard disk or system disk, create a directory named *c5xxhll*. This directory will contain the 'C54x C source debugger software. To create this directory, enter:

```
MKDIR C:\C5xxHLL
```

- 3) Insert either the DOS or MS-Windows debugger product disk into drive A. Copy the contents of the disk:

```
COPY A:\*.* C:\C5xxHLL\*.* /V
```

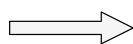
Repeat this step for the other product disk if you want to be able to run both the DOS and MS-Windows versions of the debugger.

The DOS version of the debugger executable is called *evm5xx.exe*, and the MS-Windows version of the debugger executable is called *evm5xxw.exe*. Throughout this document, the executable for the debugger is referred to as simply *evm5xx*.

#### 4. Step 3: Setting Up the Debugger Environment

To ensure that your debugger works correctly, you must:

- Modify the PATH statement to include the C5xxhll directory.
- Define environment variables so that the debugger can locate all required files.
- Identify any nondefault I/O space used by the EVM.



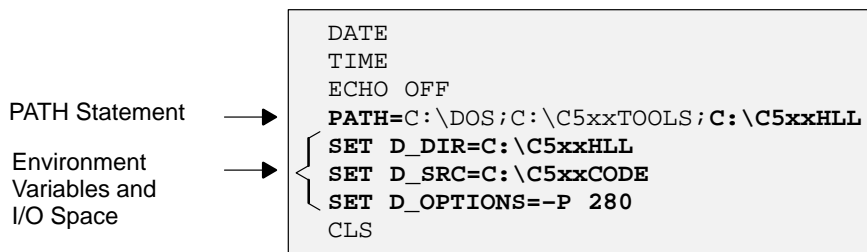
Not only must you do these things before you invoke the debugger for the first time, *you must do them any time you power up or reboot your PC.*

You can accomplish tasks by entering individual DOS commands, but you may find it simpler to put the commands in a batch file. You can edit the system's autoexec.bat file, but in some cases, modifying it may interfere with other applications running on your PC. So, you may prefer to create a separate batch file that performs these tasks.

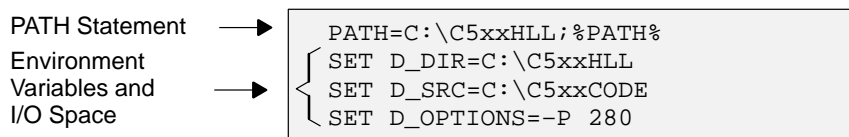
Example 1 (a) shows an autoexec.bat file that contains the suggested modifications highlighted in bold type. Example 1 (b) shows a sample batch file that you could create instead of editing autoexec.bat. For the purpose of this discussion, assume that this sample file is named initdb.bat. The subsections following the example explain these modifications.

##### Example 1. DOS-Command Setup for the Debugger

(a) Sample autoexec.bat file to use with the debugger and EVM



(b) Sample initdb.bat file to use with the debugger and EVM



### **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 MS-Windows, invoke initdb.bat *before* entering MS-Windows. You'll need to invoke initdb.bat any time that you power up or reboot your PC. To invoke this file, enter:

```
INITDB @
```

### **Modifying the PATH statement**

To invoke the debugger without specifying the name of the directory that contains the debugger executable file, define a path to the debugger directory. The general format is:

```
PATH=C:\C5XXHLL
```

- If you are modifying an autoexec.bat file that already contains a PATH statement, simply include **;C:\c5xxhll** at the end of the statement, as shown in Example 1 (a).
- If you are creating an initdb.bat file, use a different format for the PATH statement, as shown in Example 1 (b):

```
PATH=C:\C5XXHLL;%PATH%
```

The addition of **;%path%** ensures that this PATH statement won't undo 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 and obtaining certain types of information. The debugger uses three environment variables named `D_DIR`, `D_SRC`, and `D_OPTIONS`. This section tells you how to set up these environment variables. For both the `autoexec.bat` and `initdb.bat` files, the format is the same.

- ❑ Set up the `D_DIR` environment variable to identify the `c5xxhll` directory:

```
SET D_DIR=C:\C5XXHLL
```

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

This directory contains auxiliary files (`evmrst`, `evminit.cmd`, etc.) that the debugger needs.

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

```
SET D_SRC=pathname1;pathname2...
```

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

For example, if your 'C54x programs were in a directory named `c5xxsrc` on drive C, the `D_SRC` setup would be:

```
SET D_SRC=C:\C5XXSRC
```

- ❑ 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 specified options each time you invoke the debugger. These are the options that you can identify with `D_OPTIONS`:

<code>-b[b]</code>	<code>-i pathname</code>	<code>-p port address</code>
<code>-s</code>	<code>-t filename</code>	<code>-v</code>

Note that you can override `D_OPTIONS` by invoking the debugger with the `-x` option.

For more information about options, refer to the invocation section in the *Overview of a Code Development and Debugging System* chapter of the *TMS320C5xx C Source Debugger User's Guide*.

### Identifying the correct I/O switches

Refer to your entries in Table 2 (page 5). If you didn't modify the I/O switches, skip this step.

If you modified the I/O switch settings, you must use the debugger's `-p` option to identify the I/O space that the emulator is using. You can do this each time you invoke the debugger, or you can specify this information by using the `D_OPTIONS` environment variable. Table 3 lists the nondefault I/O switch setting and the appropriate line that you can add to the `autoexec.bat` or `initdb.bat` file.

Table 3. Identifying Nondefault I/O Address Space

Address Range	switch #		Add this line to the batch file
	1	2	
0x0280–0x029F	on	off	SET D_OPTIONS=-p 280
0x0320–0x033F	off	on	SET D_OPTIONS=-p 320
0x0340–0x035F	off	off	SET D_OPTIONS=-p 340

#### Notes:

- 1) The 'C54x EVM uses 96 bytes of the PC I/O space.
- 2) If you didn't note the I/O switch settings, you may use a trial-and-error approach to find the correct `-p` setting. If you use the wrong setting, you will encounter an error message when you try to invoke the debugger:

```
CANNOT INITIALIZE THE EVM !!
- Check I/O Configuration
```

When you use the EVM, you must first load a valid object file into the EVM. To do this, invoke the debugger and load the object file:


```
evm5xx [object filename]
```

Once you have entered the debugging environment and loaded the object file, exit the debugger:

```
quit
```

## Resetting the EVM

At the DOS prompt, reset the EVM by entering the `evmrst` command:

`evmrst` 

If you decide to change your I/O switch settings, you can specify a different I/O space by entering the `-p` option following `evmrst`. You can identify the I/O space by modifying the `D_OPTIONS` environment variable in your `autoexec.bat` or `initdb.bat` file and invoking `evmrst`. You can override `D_OPTIONS` by entering `evmrst` followed by the `-x` option.

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### Notes:

- 1) Never reset the 'C54x EVM with `evmrst` unless you have first loaded a valid object file to the EVM.
  - 2) If you plan to use the debugger with the EVM, you don't need to reset the EVM with `evmrst` before invoking the debugger.
-

## 5. Step 4: Verifying the Installation

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

```
evm5xx c:\c5xxh11\sample
```

You should see a display similar to this one:

The screenshot shows a debugger window with several panes:

- DISASSEMBLY:** Shows assembly instructions for the function `c_int00`. The instructions include `STM #0011dh, SP`, `ADDM #003ffh, *(00018h)`, `ANDM #0fffeh, *(00018h)`, `SSEX SXM`, `SSEX CPL`, `LD #00173h, 0, A`, `ADD #00001h, 0, A, B`, `BC 0013ch, BEQ`, `B 00136h`, `READA *(00012h)`, `ADD #00001h, 0, A, A`, `RPT *(00011h)`, `READA *AR2+`, `ADD *(00011h), A`, and `ADD #00001h, 0, A, A`.
- CPU:** Shows the state of various registers: `AG 00 AHL 00000000`, `BG 00 BHL 00000000`, `PC 0119 SP 0000`, `AR0 08ab AR1 08ac`, `AR2 08a5 AR3 00a3`, `AR4 00a4 AR5 0807`, `AR6 08a4 AR7 00a7`, `BK 2610 BRC cdfe`, `RSA 0038 REA 249d`, `IMR 0000 IFRR 5555`, `T 08ab TRN 0001`, and `PMST ffe1`.
- COMMAND:** Shows the command history: `TMS320C5xx Revision 1`, `load sample`, `Loading sample.out`, `35 Symbols loaded`, `Done`, and the prompt `>>>`.
- MEMORY:** Shows a memory dump starting at address 0000: `0000 0000 0000 0000 0000 01ff ff00 0008`, `0008 0000 0000 20f1 20f3 0001 ffe1 fff1`, `0010 08ab 08ac 08a5 00a3 0004 0807 08a4`, `0018 08ab 08ab 0000 0000 0000 0000 ff77`, `0020 0000 0000 0000 0000 249d ffff 0000`, and `0028 ffff ffff 000f 0000 0000 0000 0000`.

- If you see a display similar to this one, you have correctly installed your EVM and debugger.
- If you see a display and the lines of code show ADD instructions or *Invalid address*, your EVM board may not be installed snugly. Check your board to see if it is seated correctly and reenter the command above.
- If you do not 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 encounter the following error message.

```
CANNOT INITIALIZE THE EVM !!  
- Check I/O configuration
```

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

- Is the EVM board installed snugly?
- 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 (refer to Table 2 on page 5, and Table 3 on page 11).
  - 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 in Table 3. Modify the `-p` option of the `D_OPTIONS` environment variable to reflect the change in your switch settings.

After you have checked all of the above, repeat the verification instructions in Section 5.

## **6. Using the Debugger With MS-Windows**

You may want to create an icon to make it easier to invoke the debugger from within the MS-Windows environment. Refer to your MS-Windows user's manual for details.

In the MS-Windows environment, 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.