

TEXAS INSTRUMENTS

PROGRAMMABLE

TI-95

USER'S GUIDE



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INSTRUMENTS

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TEXAS INSTRUMENTS

TI-95

USER'S GUIDE

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Function Reference

Use this list if you know the function you want to perform but you need a reminder of the key sequence. The page reference tells where to find additional information about the function. This list includes scientific-calculator functions only; programming functions are discussed in the 71-95 *Programming Guide*.

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IMPORTANT

Record the serial number and date of purchase of the TI-95 in the space below. The serial number is identified by the abbreviation "NO." on the bottom case. Always refer to this information in any correspondence regarding your TI-95.

TI-95 Programmable
Model

Serial No.

Purchase Date

Key Reference Diagram

The following diagram shows page numbers you can reference for information about each calculator key discussed in this guide. The keys with no references are discussed in the *TI-95 Programming Guide*.

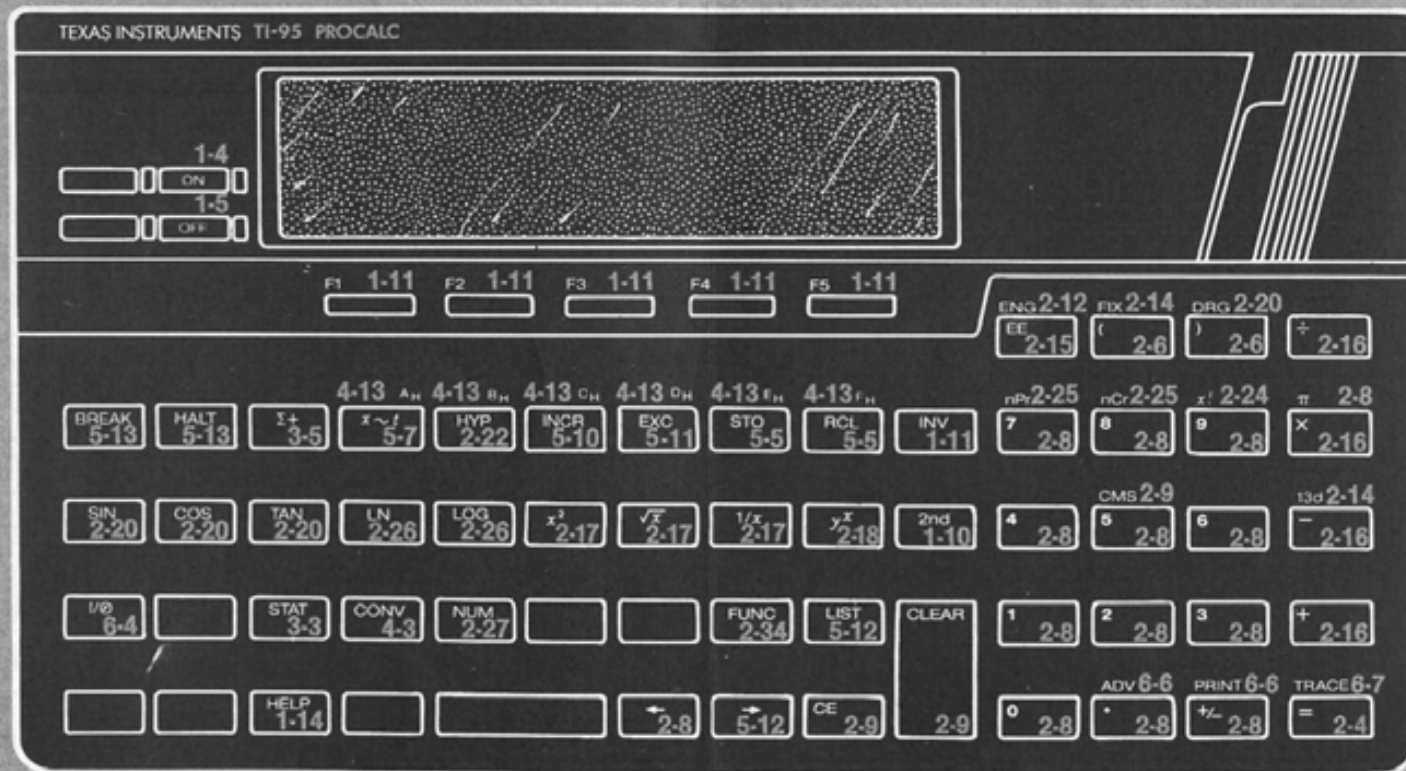


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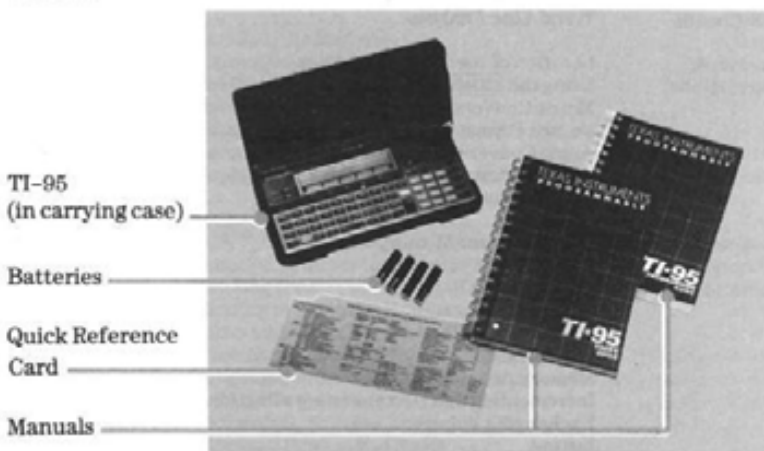
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Introduction

The TI-95 is an advanced programmable calculator that comes with two instructional manuals and a quick reference card.

What Your Package Includes

The following items are contained in the TI-95 package.



TI-95
(in carrying case)

Batteries

Quick Reference
Card

Manuals

TI-95 Calculator—An advanced programmable calculator with 8K bytes of built-in memory.

User's Guide—An instructional guide to using the TI-95 as a scientific calculator.

Programming Guide—An instructional guide to using the programming features of the calculator.

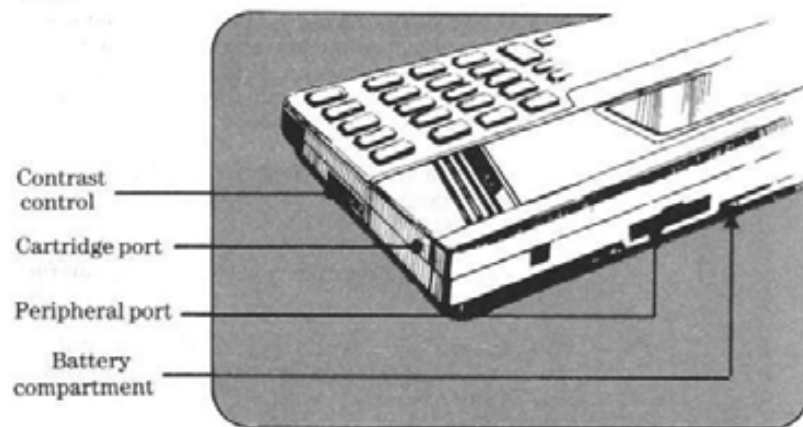
Quick Reference Card—A two-sided card, stored in the case lid, containing condensed information about the most often used features of the TI-95.

Batteries—Four AAA batteries that provide the calculator with at least 100 hours of operation.

Carrying Case—A sturdy case to provide protection for your calculator.

Parts of the TI-95

The parts of the TI-95 calculator are illustrated below.



Contrast
control

Cartridge port

Peripheral port

Battery
compartment

Rear View

Part	Description
Contrast control	Allows you to adjust the display for various lighting conditions.
Peripheral port	Provides a connection for your external peripherals.
Battery compartment	Holds batteries that provide power for the TI-95.
Cartridge port	Provides a connection for a software (ROM) or memory (RAM) cartridge.

Note: The TI-95 comes with a port protector, labeled "ROM/RAM," in the cartridge port. The port protector does not contain any memory or programs; it is installed to protect the port from dust. Keep the port protector or a cartridge in the port at all times.

(continued)

The TI-95 combines the features of a scientific calculator and a programmable calculator. In addition to the many built-in features, it provides the capability to add other optional accessories that will expand your calculator into a complete system.

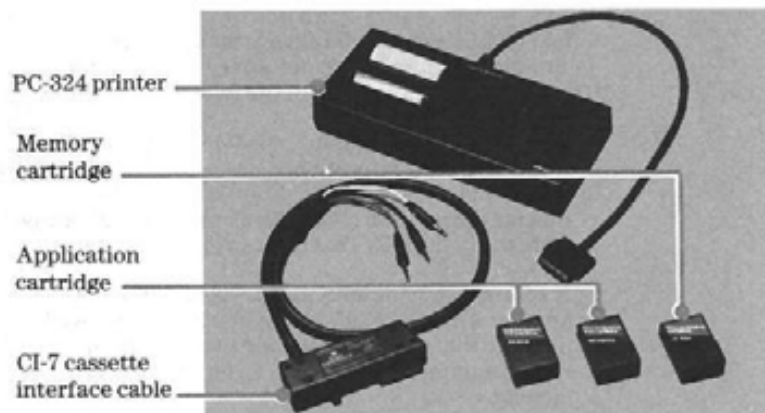
Features of the TI-95

The following features are built into the TI-95:

- ▶ The Algebraic Operating System (AOS™) feature directs the sequence of mathematical operations performed by the calculator. Most mathematical expressions can be entered into the calculator in a simple, straightforward sequence.
- ▶ The Constant Memory™ feature saves all information stored in memory even when the calculator is turned off.
- ▶ Memory file space enables you to save programs for future use.
- ▶ The alphanumeric display permits the display of prompts, program instructions, function-key labels, and descriptive error messages.
- ▶ Five redefinable function keys give you access to a variety of functions available on the calculator. The programs you write can also utilize this feature.
- ▶ Calculations can be in decimal, hexadecimal, or octal number base. You can also convert a number in one base to either of the other two.
- ▶ Special functions enable you to perform one- and two-variable statistics; metric, number base, polar/rectangular, and angle conversions; prime factors; common multiples and divisors; and cubic and quadratic equation roots.

Optional Accessories

The built-in features of your calculator enable you to perform most tasks. You can also obtain several optional accessories, shown below, from your dealer to expand it to a complete system with even greater capabilities. If you are unable to purchase these from your local dealer, you may order them from Texas Instruments. Please call Consumer Relations for information.



- ▶ 8K Constant Memory™ cartridge—Inserts into the cartridge port to expand the file space available to store your programs.
- ▶ PC-324 Printer—Enables you to obtain a paper copy of your programs, data, and results.
- ▶ CI-7 Cassette Interface Cable—Connects an optional cassette recorder to your calculator. Lets you store programs and data on tape.
- ▶ Application cartridge—Inserts into the cartridge port to provide additional capability for specific applications, such as statistics and mathematics, that are beyond the built-in capability of your calculator.

The TI-95 calculator generates and uses radio frequency energy. If not used properly, as described in this guide, the calculator may cause interference to radio and television reception.

The TI-95 has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Sub-part J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against radio/TV interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

If the TI-95 causes interference, which you can determine by turning it off and on, try to correct the interference by one or more of the following measures:

- ▶ Reorient the receiving antenna for the radio or TV that is receiving interference.
- ▶ Change the position of the calculator or move it away from the radio or TV that is receiving interference.
- ▶ If you are using the optional PC-324 printer and adapter with the TI-95, plug it into a different wall outlet so that the calculator and the equipment receiving interference are on different branch circuits.

If these measures do not eliminate the interference, please consult your dealer or an experienced radio/TV technician for additional suggestions. The FCC has prepared a helpful booklet, *How to Identify and Resolve Radio-TV Interference Problems*. Please specify Stock Number 004-000-00345-4 when ordering this booklet from:

The US Government Printing Office
Washington, D.C. 20402

This chapter introduces you to the TI-95 and gives you some basic information to help you use your calculator. It also helps you to interpret the parts of the display and to use the keyboard.

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Installing the Batteries

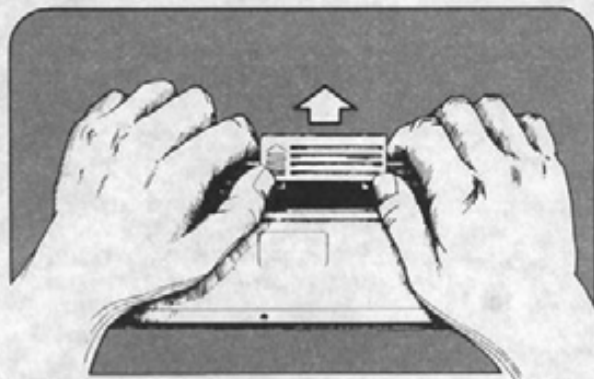
Four AAA batteries supply the power for your TI-95 calculator for about 100 hours of operation. The calculator cannot retain data if these batteries become discharged or are removed for several minutes.

Procedure

The following procedure is used to install the batteries in your TI-95 calculator.

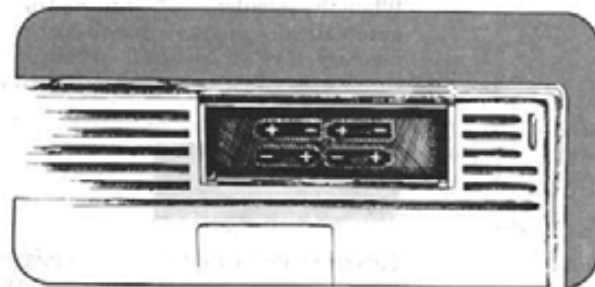
Note: To avoid loss of data in memory, save data in a cartridge or cassette before removing old batteries.

1. Press the **OFF** key.
2. Open the battery compartment by sliding the cover as shown.



Procedure (Continued)

3. Install the batteries as shown. Be sure each battery is positioned correctly. Installing a battery backwards can damage the calculator.



4. Replace the battery compartment cover by sliding it into the grooves until it clicks into place.

Each time you turn the TI-95 on, it performs a self-test to check for any changes in the contents of the memory since the last time it was turned off. The information displayed depends on the results of this test.

Initial Display at Power Up

Press the **[ON]** key to turn the calculator on. Adjust the display contrast control on the right side of the calculator as needed.

When the calculator is first turned on, a self-test is automatically performed to check the contents of the memory. If you have installed batteries just prior to turning the calculator on, the following message is displayed.



MEMORY CLEARED

This message means the self-test has detected a complete loss of memory. The memory has been cleared and all parameters have been reset to their default settings.

Refer to "System Parameter Settings" in Appendix A for a list of system parameters and the effects of pressing the **[RESET]** key or allowing the batteries to discharge.

If the memory has not been cleared, but the self-test detects a change in the memory contents, the message below is displayed. You should check any values stored in the calculator memories and verify any stored program instructions. This message is also displayed if you press the **[RESET]** key while the calculator is on.



MEM MAY BE LOST

If either of these messages is displayed, you can still perform any calculator operations.

Typical Display at Power Up

Generally, when you turn the calculator off and back on, the self-test detects no change in memory contents. When this is the case, the calculator shows the following display.



TI-95 PROCALC

This display indicates that any data or programs stored in the calculator are unchanged and only some parameters are reset to their default settings.

Default Settings

Some of the parameters that are reset to their default settings are:

- ▶ The display format (set to standard notation)
- ▶ The number base (set to decimal)
- ▶ The t-register (cleared)

Refer to "System Parameter Settings" in Appendix A for a complete list of the system parameters and the effects of turning the calculator off and back on.

Power Down

Although the TI-95 consumes very little power, you can extend the life of the batteries by turning the calculator off when you finish using it. If you forget to turn the calculator off, the Automatic Power Down (APD™) feature turns it off for you.

- ▶ Press the **[OFF]** key to turn the calculator off.
- ▶ The APD feature turns the calculator off if you do not press any keys for approximately 20 minutes. You can disable this feature by setting the appropriate system flag. Refer to Appendix C of the *TI-95 Programming Guide* for instructions on how to set this flag.

The Display

The TI-85 display is a liquid-crystal display composed of three areas. Each of these areas displays different kinds of information as discussed on the next few pages.

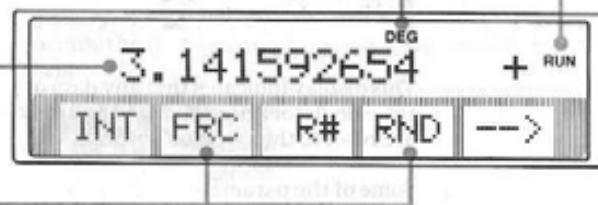
Types of Information Displayed

The three types of information displayed are illustrated below. Each type of information is explained in the following pages.

Status indicators

Alphanumeric display

Function-key labels



The **status indicators** show you the current operating status of the calculator.

The **alphanumeric display** shows numeric values, audit trail symbols, and alphanumeric messages.

The **function-key labels** correspond to the function keys (F1 through F5). These display system menu selections for many of the calculator's functions. These are also used with programs available on software cartridges or programs you develop.

Status Indicators

The status indicators and their meanings are listed below.

Indicator	Meaning
LOW	The calculator batteries are low.
2nd	The 2nd key has been pressed.
LC	The alpha keyboard is locked into lower case.
ERROR	An error condition has occurred.
DEG	Angle units are set to degrees.
RAD	Angle units are set to radians.
GRAD	Angle units are set to grads.
ALPHA	The alpha mode has been selected.
HEX	Hexadecimal number base has been selected.
OCT	Octal number base has been selected.
SYS	The system registers are unprotected.
RUN	A program is running.
INS	Insert mode is in effect (in the alpha or learn mode).
I/O	Information is being exchanged with an external device.
INV	The inverse key has been pressed.
P	The PC-324 printer batteries are low.
◀	More information is available to the left.

(continued)

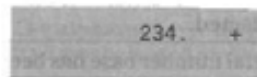
Alphanumeric Display

The alphanumeric display consists of 16 character positions. It displays the entries you make, an audit trail of operations performed, calculation results, and messages you receive from the calculator.

The entries you make first appear on the right side of the display. Then, when you press an operation key (such as $+$, $-$, \times , or \div), the number moves toward the center of the display.

An audit trail of your calculations is created when the symbol representing the operation you select appears at the right side of the display.

For example, as you enter the number 234, it appears at the right of the display. If you then press the $+$ key, the numbers move toward the center of the display and the audit trail symbol appears at the right as shown below.



The results of numeric calculations also appear in the alphanumeric display. You can choose from a variety of formats for the display of such results.

Messages that are shown in this area of the display include error and status messages.

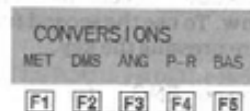
Temporary messages also appear in the left or right side of the display and usually show the entry you just made. For example, if you press 45 SIN , the message SIN appears in the right side of the display momentarily, until the calculation is complete.

Function-key Labels

The function-key labels are grouped in five sets of three characters. Each label is located directly above the function key it represents.

When you press certain keys, the labels above the function keys show a system menu of available selections.

For example, if you press the CONV key, the **CONVERSIONS** menu is displayed.



This menu indicates that you can select types of conversions, such as metric (MET) or angle (ANG).

When labels are visible above the function keys, the functions indicated by those labels are available. You are not required to select a menu item merely because a menu is displayed. If you want to remove the menu labels, however, you can do so by pressing 2nd IF:CLR .

Generally, when a menu is displayed, you can:

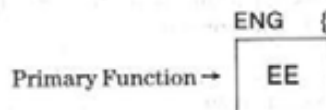
- Select one of the menu items.
- Press a key (such as NUM) that displays another menu.
- Perform other calculations, such as division or subtraction.

The Keyboard

The TI-95 has 65 keys, each with a primary function. In addition, many keys have alternate functions. The five definable function keys provide additional selections. Some functions use "fields" as labels or addresses for the function to be performed.

Primary Functions

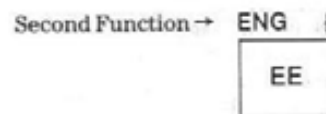
The primary function of each key is printed on the key.



In this guide, primary key functions are illustrated by a box around the function. Example: **EE**.

Second Functions

Some of the keys have a second function labeled above the key in yellow. To use the second function of a key, press **2nd** before pressing the key.



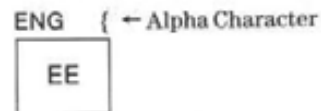
In this guide, second functions are enclosed in brackets and preceded by the **2nd** key symbol. Example: **2nd** [ENG].

Fields

Many functions must be followed by identifying data, called fields, to complete the function. For example, to store a number in data register 4, you must enter **STO** 004. The register address 004 is the field.

Alpha Mode Characters

Some keys have an alphabetic or punctuation character labeled above the key. These symbols can be accessed only through the alpha mode or when entering alpha fields, such as file names or labels. The alpha mode is discussed in the *TI-95 Programming Guide*.



In this guide and the programming guide, references to alpha characters are boldfaced without brackets.

Inverse Functions

Some keys have an inverse function that generally produces the opposite effect of the primary function. To use the inverse function of a key, press **INV** before pressing the key. For example, **INV** **SIN** is the arcsine function.

A few functions are implemented by using **INV** with the second function of a key. For example, the key sequence **INV** **2nd** [ENG] returns the calculator from engineering notation to standard notation. When using these functions, the **INV** and **2nd** keys may be pressed in either order.

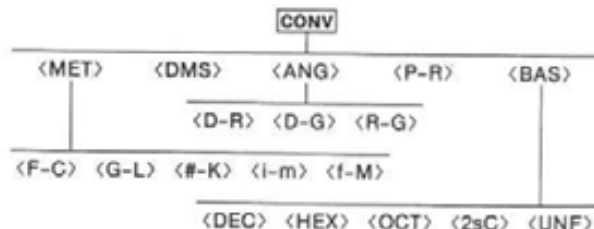
Definable Function Keys

The functions of the **F1** through **F5** keys are defined by certain other keys. Labels appear in the display directly above the keys to indicate their functions.

In this manual, references to the functions of definable keys are illustrated with the label enclosed in brackets. Example: <F-C>.

When you press certain keys (such as **CONV** or **NUM**), the labels above the function keys offer you a system menu of available selections. You can continue using the menu as long as it remains in the display.

For example, when you press the **CONV** (conversions) key, a menu appears. You then select the type of conversion you want from the menu. Some of the conversions you select offer other menus as shown below.



The system menus increase the number of available functions. Although the operation of a particular menu may vary slightly from others, the general operation of menus is the same. "System Menus" in Appendix A contains a complete list of function key menus.

Operation of System Menus

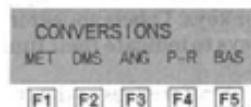
Although there are only five function keys, some menus may have more than five selections. When more selections are available, the rightmost function key (F5) is labeled as an arrow (→). When you make this selection, the function keys are redefined to present the additional selections.

Example of a System Menu

The following example demonstrates the operation of a system menu using the **CONVERSIONS** menu.

1. Press the **CONV** (conversions) key.

The following labels appear over the function keys.



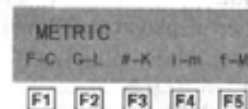
```
CONVERSIONS
MET DMS ANG P-R BAS
[F1] [F2] [F3] [F4] [F5]
```

- <MET> Selects metric conversions
- <DMS> Selects degrees/minutes/seconds format conversions
- <ANG> Selects angle conversions
- <P-R> Selects polar to rectangular coordinate conversions
- <BAS> Selects number base conversions

Some menu selections have an inverse function. In this guide, these functions are listed below the menus as the key sequence required to obtain the function. For example, in the **CONVERSIONS** menu, **INV** <P-R> selects rectangular to polar conversions.

Example (Continued)

2. Select <MET> for metric conversions. The function keys are redefined and the following labels appear above the function keys.



```
METRIC
F-C G-L #-K I-m f-M
[F1] [F2] [F3] [F4] [F5]
```

- <F-C> Converts Fahrenheit to Celsius
- <G-L> Converts gallons to liters
- <#-K> Converts pounds to kilograms
- <I-m> Converts inches to millimeters
- <f-M> Converts feet to meters

3. Place a value you wish to convert in the display.
4. Select the appropriate function key for the conversion you want. The converted value appears in the display.

You can continue to make conversions using the **METRIC** menu as long as the function key labels remain in the display. You do not need to reselect the menu.

The number you wish to convert can be entered either before or after selecting the menu.

The HELP function enables you to determine current parameter settings and reset any parameters that are not currently set to their normal settings. When all parameters are set to their normal settings, the calculator is in the "normal" mode.

The HELP Menu When you press the **HELP** key, the calculator clears the t-register and any calculation in progress. All error conditions are cleared. Scientific notation display format and the Alpha mode are also cancelled. The calculator then displays the following menu.

```

SET NORMAL MODE?
YES NO          ESC
F1  F2  F3  F4  F5
    
```

Setting the Normal Mode If you select <ESC>, you escape from the HELP function and clear the display. No other settings are changed. If you select <YES>, the HELP function sets all system parameters except those related to printer setup (printer device number, print width, and trace) to their normal settings and displays the message **NORMAL MODE SET**.

If you want to set the printer-related parameters or selectively set any of the others, proceed to "Resetting Selected Modes" on the next page.

The list of parameters that are changed when you select <YES> is provided below.

- ▶ The SYS mode is reset.
- ▶ The number base is set to decimal.
- ▶ The display format is set to standard notation with floating decimal.
- ▶ The angle units are set to degrees.
- ▶ The Halt On Error flag (flag 15) is reset.
- ▶ User memory (other than files) is partitioned to half data registers and half program memory.

Resetting Selected Modes

If you select <NO> in response to the **SET NORMAL MODE?** prompt, the status may be displayed in one of two ways.

- ▶ If all parameters are at their normal settings, the message **FUNCTION DONE** is displayed.
- ▶ If any parameters are not at their normal settings, the calculator displays a series of prompts for only these parameters that lets you reset them to their normal setting. The list below shows all possible prompts that you might see.

Prompt	Function Keys				
	F1	F2	F3	F4	F5
CLR SYSTEM MODE?	YES	NO			
RESET HEX MODE?	YES	NO			
or RESET OCT MODE?	YES	NO			
or RESET UNIFORMAT?	YES	NO			
CLR FIX = x MODE? *	YES	NO			
RESET ENG MODE?	YES	NO			
RESET GRAD MODE?	YES	NO			
or RESET RAD MODE?	YES	NO			
CLR HALT ON ERR?	YES	NO			
RESET PRT DEV #?	YES	NO			
RESET PRT WIDTH?	YES	NO			
RESET TRACE?	YES	NO			
RESET PARTITION?	YES	NO			

* x represents the fix number in effect.

If you respond to any prompt by selecting <YES>, that parameter is reset to its normal setting.

If you respond to a prompt by selecting <NO>, that parameter remains at the current setting.

Most of these parameters are also affected when you change batteries, reset the calculator, or turn the calculator off and on. Refer to "System Parameter Settings" in Appendix A for information concerning the effects of these actions on each parameter.

Displayed Values versus Internal Storage

The accuracy of a calculating device is determined by the number of digits used for computations. To provide the precision required by a professional calculator, the TI-95 stores all values internally to 13 digits.

The Numeric Display Register

Numbers that you see in the calculator's display are also stored internally in a special memory location called the *numeric display register*. As you use the numeric functions of the calculator, be aware that what you see in the display and what is stored internally can differ. The number of digits shown in the display depends upon the display format that you have selected.

The numeric functions of the calculator, whether executed from the keyboard or in a program, always use the value stored in the numeric display register. In most cases, the difference between a displayed value and the value stored internally is not important, because the internally stored value is used for subsequent calculations.

The possibility of different values can be important when numbers are compared in a program for decision-making purposes. For details on comparison tests, refer to Chapter 5 of the *TI-95 Programming Guide*.

If you want to see the 13 digits stored internally in the numeric display register, use the **[2nd] [13d]** key sequence described on page 2-14 of this guide. If you want to force the calculator to store the same value internally that is displayed, use the **[NUM] <RND>** key sequence described on page 2-29.