TEXAS INSTRUMENTS

PROGRAMMABLE

TI-95

USER'S GUIDE

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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 *TI-95 Programming Guide*.

General Functions	Key Sequence	Page
Set calculator defaults	HELP ⟨YES⟩	1-14
Clear calculator	CLEAR	2-9
Clear entry	CE	2-9
Change sign	+/–	2-8
Clear function labels	2nd [F:CLR]	2-9
List registers	LIST n ⟨REG⟩	5-12
List status	LIST ⟨ST⟩	5-13
Math Functions		
Equals	=	2-3
Parentheses	(and)	2-6
Addition	x + y	2-16
Subtraction	x – y	2-16
Multiplication	x × y	2-16
Division	x ÷ y	2-16
Reciprocal	x 1/x	2-17
Square	x x^2	2-17
Square root	x $\sqrt{x}$	2-17
Power	y y^x x	2-18
Root	y INV y^x x	2-19
Factorial	x 2nd [x!]	2-24
Permutations	n x⇌t r 2nd [nPr]	2-25
Combinations	n x⇌t r 2nd [nCr]	2-25
Logarithm (natural)	x LN	2-26
Logarithm (common)	x LOG	2-26
e^x Antilogarithm (natural)	x INV LN	2-26
10^x Antilogarithm (common)	x INV LOG	2-26
Quadratic roots	FUNC ⟨QAD⟩	2-35
Cubic roots	FUNC ⟨CUB⟩	2-37
Trigonometric Functions		
Pi	2nd [π]	2-8
Select angle units	2nd [DRG]	2-20
Sine	x SIN	2-20
Cosine	x COS	2-20
Tangent	x TAN	2-20
Arcsine	x INV SIN	2-20
Arccosine	x INV COS	2-20
Arctangent	x INV TAN	2-20

(continued)

Hyperbolic Functions	Key Sequence	Page
Hyperbolic sine	x [HYP] [SIN]	2-22
Hyperbolic cosine	x [HYP] [COS]	2-22
Hyperbolic tangent	x [HYP] [TAN]	2-22
Inverse hyperbolic sine	x [INV] [HYP] [SIN]	2-22
Inverse hyperbolic cosine	x [INV] [HYP] [COS]	2-22
Inverse hyperbolic tangent	x [INV] [HYP] [TAN]	2-22
Number Functions		
Integer portion	[NUM] x ⟨INT⟩	2-28
Fractional portion	[NUM] x ⟨FRC⟩	2-28
Initialize random seed	[NUM] x [INV] ⟨R#⟩	2-33
Random number	[NUM] ⟨R#⟩	2-33
Round number	[NUM] x ⟨RND⟩	2-29
Signum function	[NUM] x ⟨SGN⟩	2-32
Least common multiple	[NUM] x1 [x⇄t] x2 ⟨LCM⟩	2-31
Greatest common divisor	[NUM] x1 [x⇄t] x2 ⟨LCM⟩ [x⇄t]	2-31
Prime factors	[NUM] x ⟨PF⟩ [x⇄t] ⟨PF⟩ [x⇄t] ...	2-30
Absolute value	[NUM] x ⟨ABS⟩	2-32
Statistics Functions		
Clear and begin 1-variable entry	[STAT] ⟨CLR⟩ ⟨CS1⟩	3-4
Enter a 1-variable value	x [Σ+]	3-5
Remove a 1-variable value	x [INV] [Σ+]	3-5
Enter multiple 1-variable values	[STAT] n ⟨FRQ⟩ x [Σ+]	3-5
Remove multiple 1-variable values	[STAT] n ⟨FRQ⟩ x [INV] [Σ+]	3-5
Clear and begin 2-variable entry	[STAT] ⟨CLR⟩ ⟨CS2⟩	3-4
Enter a 2-variable value	x [x⇄t] y [Σ+]	3-10
Remove a 2-variable value	x [x⇄t] y [INV] [Σ+]	3-10
Enter multiple 2-variable values	[STAT] n ⟨FRQ⟩ x [x⇄t] y [Σ+]	3-10
Remove multiple 2-variable values	[STAT] n ⟨FRQ⟩ x [x⇄t] y [INV] [Σ+]	3-10
Display Formats		
Scientific notation	[EE]	2-12
Cancel scientific notation	[INV] [EE]	2-12
Engineering notation	[2nd] [ENG]	2-12
Cancel engineering notation	[INV] [2nd] [ENG]	2-12
Fix decimal	[2nd] [FIX] n	2-14
Show 13 digits	[2nd] [13d]	2-14

Conversion Functions	Key Sequence	Page
Metric conversions	CONV ⟨MET⟩	4–4
DMS to decimal degrees	CONV D.MMSSssssss ⟨DMS⟩	4–6
Decimal degrees to DMS	CONV D.ddddddddd INV ⟨DMS⟩	4–6
Polar to rectangular	CONV r x⇌t θ ⟨P-R⟩ x⇌t	4–10
Rectangular to polar	CONV x x⇌t y INV ⟨P-R⟩ x⇌t	4–10
Angle conversions	CONV ⟨ANG⟩	4–8
Decimal mode	CONV ⟨BAS⟩ ⟨DEC⟩	4–13
Hexadecimal mode	CONV ⟨BAS⟩ ⟨HEX⟩	4–13
Octal mode	CONV ⟨BAS⟩ ⟨OCT⟩	4–13
Two's complement mode	CONV ⟨BAS⟩ ⟨2sC⟩	4–14
Signed mode	CONV ⟨BAS⟩ INV ⟨2sC⟩	4–14
Memory Functions		
Clear memories	2nd [CMS]	5–4
Store number	x STO nnn or X	5–5
Recall number	x RCL nnn or X	5–5
Exchange number	x EXC nnn or X	5–11
Register addition	x STO + nnn or X	5–8
Register subtraction	x STO − nnn or X	5–8
Register multiplication	x STO × nnn or X	5–8
Register division	x STO ÷ nnn or X	5–8
Increment	INCR nnn or X	5–10
Decrement	INV INCR nnn or X	5–10
Swap t-register	x⇌t	5–7
Printer Operations		
Print display	2nd [PRINT]	6–6
Advance paper	2nd [ADV]	6–6
Set device number	I/O ⟨PRT⟩ ⟨DEV⟩ nnn	6–4
Set line width	I/O ⟨PRT⟩ ⟨WID⟩ nn	6–5
Set word break on	I/O ⟨PRT⟩ ⟨WB⟩	6–5
Set word break off	I/O ⟨PRT⟩ INV ⟨WB⟩	6–5
Set trace mode on	2nd [TRACE]	6–7
Set trace mode off	INV 2nd [TRACE]	6–7

DATAMATH CALCULATOR MUSEUM

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*.

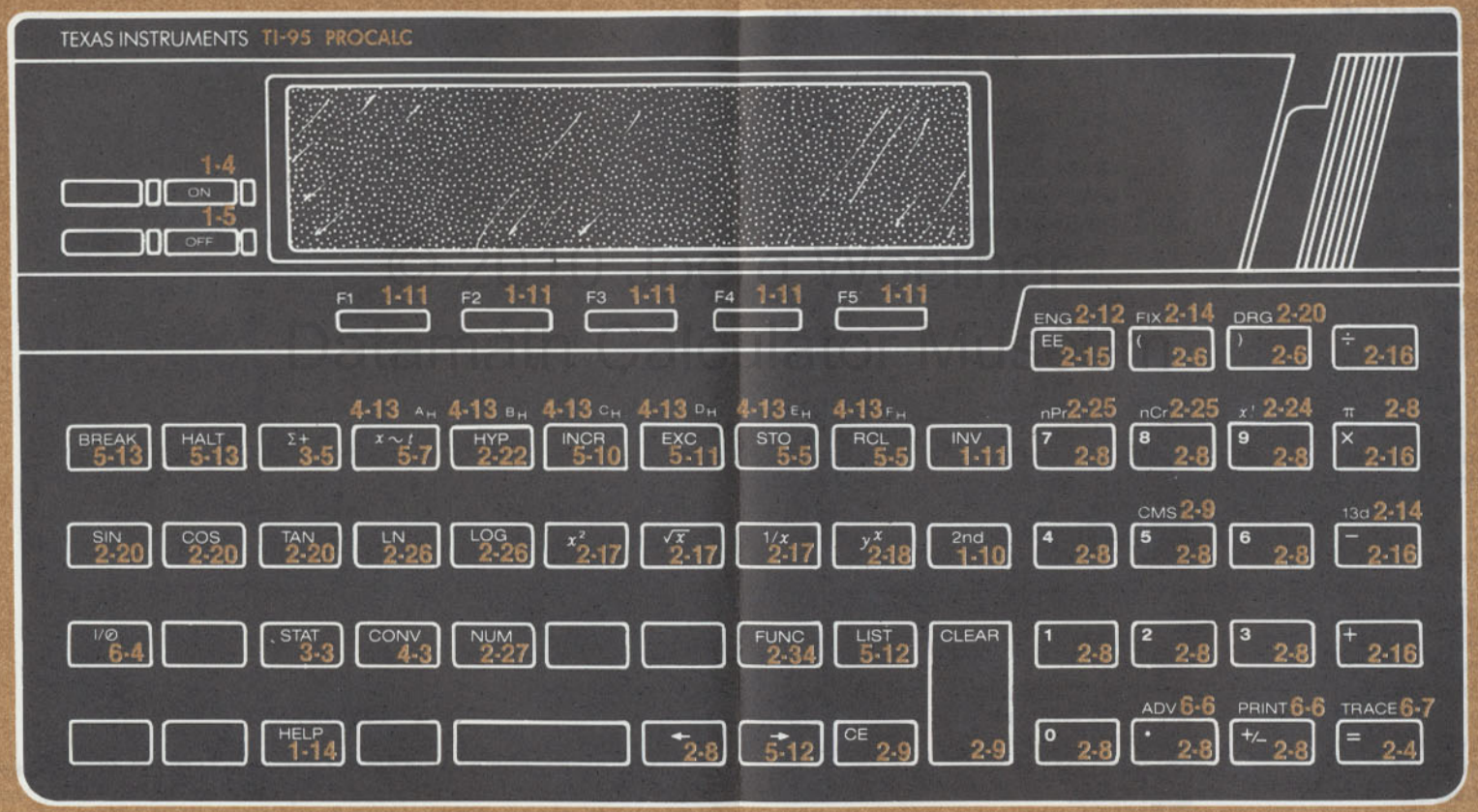


Table of Contents

This guide contains information to help you use the scientific calculator functions of the TI-95. Programming functions of the calculator are described in the *TI-95 Programming Guide.*

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 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.

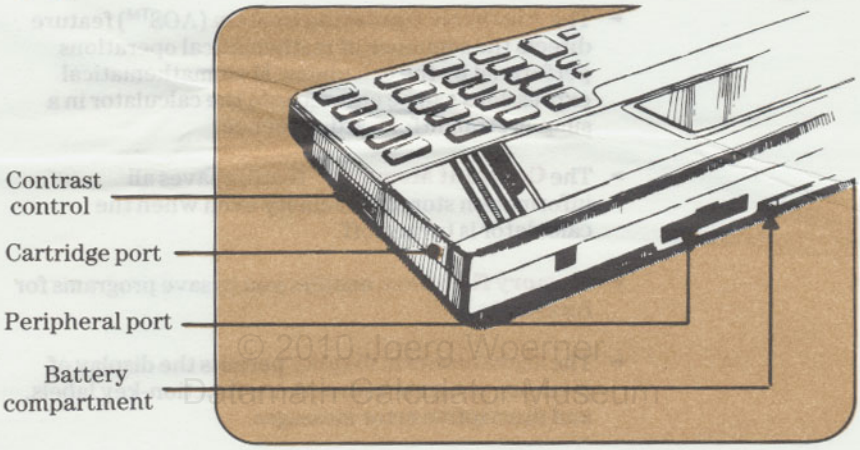
Quick Reference Card—A two-sided card, stored in the case lid, containing condensed information about the most often used features of the TI-95.

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.



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.

FCC Information Concerning Radio Frequency Interference

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

Chapter 1: Getting Started

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.

Table of Contents

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.

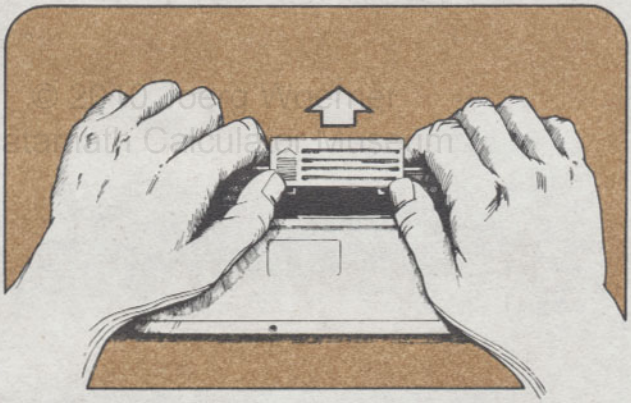
Procedure

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.

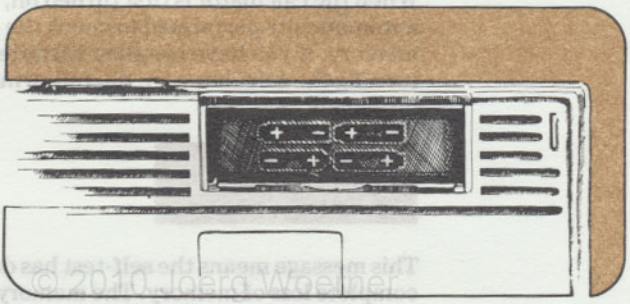
1. Press the OFF key.

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

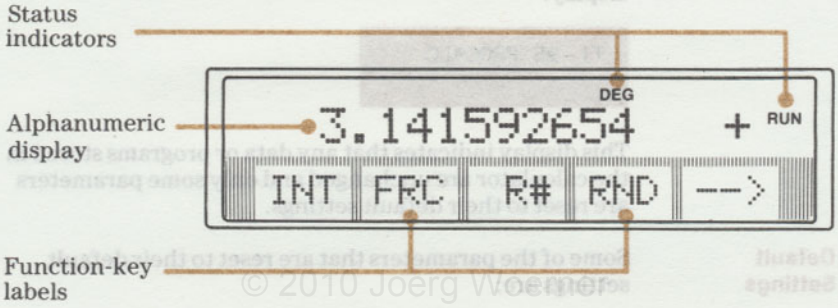
Although the TI-95 consumes very little power, you can extend the life of the batteries by turning the calculator off when you finish using it. If you forget to turn the calculator off, the Automatic Power Down (APD™) feature turns it off for you.

- 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 TI-95 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.



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 [+], [−], [×], or [÷]), 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.

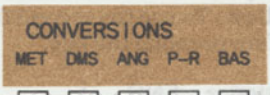
Temporary messages also appear in the left or right side of the display and usually show the entry you just made. For example, if you press **45** [SIN], the message **SIN** appears in the right side of the display momentarily, until the calculation is complete.

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.



[F1] [F2] [F3] [F4] [F5]

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] [F:CLR].

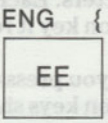
Generally, when a menu is displayed, you can:

- 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 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

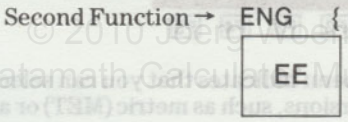
The primary function of each key is printed on the key.



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.



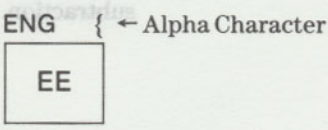
In this guide, second functions are enclosed in brackets and preceded by the [2nd] key symbol. Example: [2nd] [ENG].

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.

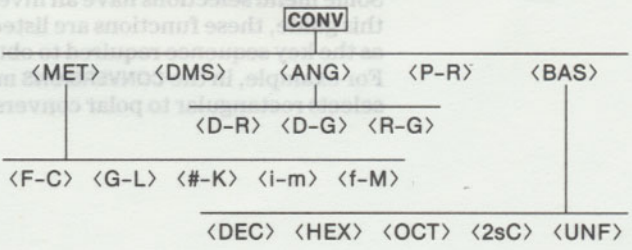
Definable Function Keys

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

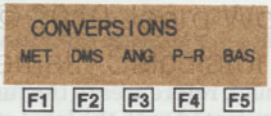
Although there are only five function keys, some menus may have more than five selections. When more selections are available, the rightmost function key (F5) is labeled as an arrow (-->). When you make this selection, the function keys are redefined to present the additional selections.

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.

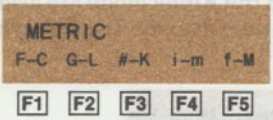


<MET>	Selects metric conversions
<DMS>	Selects degrees/minutes/seconds format conversions
<ANG>	Selects angle conversions
<P-R>	Selects polar to rectangular coordinate conversions
<BAS>	Selects number base conversions

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.



⟨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.

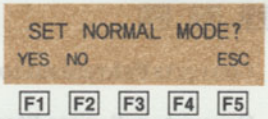
You can continue to make conversions using the **METRIC** menu as long as the function key labels remain in the display. You do not need to reselect the menu.

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.



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 UNFORMAT?	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.

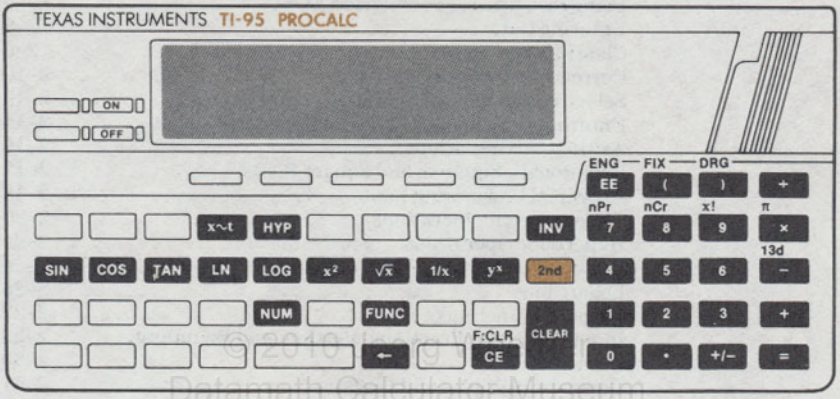
Chapter 2: Math Operations

The TI-95 mathematics capabilities include a variety of functions that exceeds that of most scientific calculators.

Table of Contents

Location of the Math Keys

The keys used to perform math operations are shown in the figure below. You should familiarize yourself with these keys and their location on the keyboard.



AOS™ Algebraic Operating System

The AOS™ Algebraic Operating System enables you to enter numbers and combined operations into the calculator in a straightforward sequence. To ensure your calculations are performed in the correct order, the AOS uses algebraic rules to assign priorities to the mathematics operations.

Purpose

Without a fixed set of algebraic rules, a problem such as $16 - 8 \div 2 + 6$ may have several possible answers, depending on the order in which the operations are completed. However, the Algebraic Operating System solves this problem by completing the division first $(8 \div 2)$ and then completing the subtraction and addition. Therefore, $16 - 8 \div 2 + 6 = 18$.

Pending Operations

In a problem such as $4 \times 5 = 20$, simply entering 4 [×] 5 does not produce the answer. The operation must be completed by pressing an appropriate key such as [=]. (Note that multiplication can be completed by any operation that has equal or lower priority in the algebraic hierarchy.) Until completed, 4×5 creates a pending operation.

The TI-95 can perform calculations containing a maximum of eight pending operations.

Note: Immediate functions, such as x^2, complete themselves and do not need to be completed by pressing another key.

(continued)

Algebraic Hierarchy

The AOS algebraic hierarchy completes all operations according to their relative priorities, which are listed below in descending priority.

1. Immediate functions—[SIN], [COS], [TAN] [INV] [SIN], [INV] [COS], [INV] [TAN] [HYP] [SIN], [HYP] [COS], [HYP] [TAN] [INV] [HYP] [SIN], [INV] [HYP] [COS], [INV] [HYP] [TAN] [2nd] [nPr], [2nd] [nCr], [2nd] [x!] [LOG], [INV] [LOG], [LN], [INV] [LN] [CONV] functions, [NUM] functions [x^2], [$\sqrt{x}$], [1/x]
2. Universal powers and roots—[y^x], [INV] [y^x]
3. Multiplication and division—[×], [÷]
4. Addition and subtraction—[+], [−]
5. Equals—[=]

With the AOS hierarchy, lower-priority operations are delayed until higher-priority operations are complete.

- Operations in priority 1 are immediate functions. These functions are performed as soon as you press the keys.
- Operations in priorities 2, 3, and 4 are completed by any operation with the same or a lower priority. For example, multiplication and division are completed by another [×] or [÷] operation or by [+], [−], or [=].
- The [=] key completes all operations. If you finish a calculation with the [=], there is no need to clear the calculator prior to performing another calculation.

Example The following calculation illustrates the algebraic hierarchy and pending operations.

Calculate $4+8\div2^5-2$.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter addition	4 +	4. +
Enter pending division (addition is also pending)	8 +	8. /
Enter pending power (addition and division are also pending)	2 y^x	2. y^x
Complete pending operations and set up pending subtraction	5 −	4.25 −
Complete calculation	2 =	2.25

Because subtraction is lower than division and equal to addition in the AOS hierarchy, both of these operations are completed.

Using Parentheses to Override AOS

At times, you may want an expression evaluated differently from the normal order of evaluation. Using parentheses lets you control the order of evaluation. You should use parentheses if you have any doubts about the way the calculator will evaluate an expression.

Effect of Parentheses

Using parentheses enables you to give priority to operations within an expression. When you enclose a portion of an expression within parentheses, that portion is evaluated separately.

Although some mathematics expressions often use parentheses to imply multiplication, the TI-95 requires that you include the [×] key in the calculation. For example, you must enter $7(3+5)$ as $7\times(3+5)$.

Example

Calculate $7\times(3+5)$.

Procedure	Press	Display
Clear display	CLEAR	0.
Begin pending multiplication	7 ×	7.
Enter and evaluate parenthetical expression	(3 + 5)	8.
Complete pending operation	=	56.

If this expression were entered without parentheses, the AOS feature would complete the multiplication (7×3) before the addition ($+5$), producing an incorrect result of 26.

Levels of Parentheses

You can use up to 15 levels of parentheses. This gives you the capability to enter more complex expressions.

Example

Calculate $2\times(2\times(2\times(2\times(2+3)+2)+2)))$.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter pending multiplications	2 × (2 × (2 × (2 × (2 ×	2.
Enter (2+3)	(2 + 3)	5.
Evaluate (2×5+2)	+ 2)	12.
Evaluate (2×12+2)	+ 2)	26.
Evaluate (2×26)	)	52.
Evaluate (2×52)	)	104.
Evaluate 2×104	=	208.

It is not necessary to press) when it is at the end of a calculation. Pressing = automatically closes all open parentheses, evaluates the expression in the proper order, and displays the end result. However, if you want to see the intermediate result of a parenthetical expression, you must use the) key.

Entering Data

The data entry keys enable you to enter the numerical data needed to perform calculations. You can enter numbers in either standard or scientific notation.

Entering Digits

The digit keys enter numbers into the display. In standard notation, you can enter up to 13 digits and a decimal point. In scientific notation, you can enter 13 digits, a decimal point, and two exponent digits.

Entering the Decimal Point

The [.] key enters a decimal point. Only one decimal point can be entered. The exponent of scientific notation cannot include a decimal point.

Changing the Sign

The [+/−] key changes the sign of the number in the display. This enables you to enter negative numbers and negative exponents. To enter a negative number, press the [+/−] key before, during, or after entering the number. To enter a negative exponent, press the [+/−] key after entering the exponent.

Correcting Entries

The [←] key enables you to backspace the number in the display to replace a digit. After you replace the digit, you can continue entering data.

Entering Scientific Notation

The [EE] key enables you to enter numbers in scientific notation. You can enter numbers as small as $\pm 1 \times 10^{-99}$ or as large as $\pm 9.999999999999 \times 10^{99}$.

Note: If the result of a calculation is outside the range −9999999999 to −.000000001, zero, or .000000001 to 9999999999, the calculator displays the number in scientific notation even though you have not pressed [EE].

Entering Pi

The [2nd] [π] key sequence enters the value of pi to 13 significant digits, with a value of 3.141592653590. The display shows the value of pi rounded to ten digits, 3.141592654, unless you have selected a format other than the standard, 10-digit display.

The calculator contains several keys used for clearing. When you use one of the clear keys on the calculator, you should be sure that you will not affect areas you do not want to clear.

The CLEAR Key

When you press the CLEAR key, the alphanumeric area of the display is cleared. The standard display format is returned. Also, any fields in progress and any pending operations in the AOS stack are cleared.

The CE Key

When you press the CE key, the entry you just made is cleared if no other function key has been pressed. The AOS stack is not affected. This enables you to continue with a calculation without starting over.

The 2nd [CMS] Key Sequence

When you press 2nd [CMS], the data registers, as defined by the current partition, are cleared.

The 2nd [CP] Key Sequence

When you press 2nd [CP] in the learn mode, programs you have stored in program memory are cleared.

The 2nd [F:CLR] Key Sequence

When you press 2nd [F:CLR], the function-key label area of the display is cleared.

The RESET Button

You should only press the RESET button as a "last resort" to restart the calculator when a problem occurs that prevents you from entering from the keyboard. The button is flush with the case of the calculator so that you cannot press it accidentally. When you press the RESET button, the display is cleared and replaced with the message **MEM MAY BE LOST**. The following conditions are changed. For other effects, refer to "System Parameter Settings" in Appendix A.

- The display format is changed to standard notation.
- The decimal point is changed to floating decimal.
- The number base is changed to decimal.
- The temporary register is cleared.

Correcting Entry Errors

You may occasionally enter an incorrect number or press an incorrect function key. You can use the [CLEAR] key to remove these errors, but this also clears the display, cancels all operations, and clears scientific notation. In many instances, you can correct an error without these unwanted effects.

Correcting Numeric Entries

You can correct mistaken numeric entries using the [←] or the [CE] key, provided you have not yet pressed an operation key such as [+] or [=].

- When you use the [←] key, the display is backspaced one character at a time to enable you to replace any digit or decimal point in the mantissa. You can also use this key to correct the exponent if you are entering in scientific notation.

- When you use the [CE] key, the entire number entry is cleared but pending operations are not.

If you make an error while entering the mantissa of a number in scientific notation, you must correct the error before pressing the [EE] key. After you have pressed the [EE] key, you can make corrections to the exponent using the [←] key or by entering new numbers over the incorrect numbers. The [CE] key cannot be used to correct only the exponent.

Correcting Pending Operations

You may be able to correct another type of mistaken entry, depending on whether the entry completes a pending operation.

- If the incorrect entry has an equal or higher priority than the intended entry, you can immediately press the correct key and continue. The calculator will obtain the correct result.

- If the incorrect entry has a lower priority than the intended entry, it may complete a pending operation. Even if you replace the incorrect entry, the calculator will obtain an incorrect result.

The examples on the next page illustrate when you can correct mistaken entries involving a pending operation.

Equal Priority Example

Calculate $10.6 + 12.7 \times 5$.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter addition	10.6 +	10.6 +
Incorrect ÷ does not complete pending +	12.7 +	12.7 /
Correct × replaces ÷, yields correct answer	× 5 =	74.1

Lower Priority Example

Calculate $10.6 + 12.7 \times 5$.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter addition	10.6 +	10.6 +
Incorrect minus completes pending +	12.7 −	23.3 −
Correct × yields incorrect answer	× 5 =	116.5

Selecting the Format of Displayed Values

Although all numeric values are stored in the calculator with a 13-digit mantissa, you can choose the format in which the calculator displays these values. Three formats are available. You can also fix the number of decimal places or display the entire 13 digits.

Standard

The calculator is in standard notation when you turn it on until you select another notation. In this format, a number is displayed with a maximum of ten digits and a decimal. A sign is also displayed if the number is negative. The following list shows the ranges of values that can be displayed in standard notation.

$-9999999999.$ to -0.000000001
zero
0.000000001 to $9999999999.$

Values outside these ranges are automatically converted to scientific notation. When values are once again in range, they are displayed in standard notation.

Scientific Notation

To convert to the scientific notation format, press [EE]. Numbers are displayed as a 7-digit mantissa with a 2-digit exponent. Because pressing [EE] puts the calculator in the live entry mode, the mantissa may have more than 7 digits when you first press [EE]. The internal value is displayed until you make your first entry. All numbers are displayed in this notation until you select a different format.

Press [INV] [EE] to return the calculator to standard notation. If you have selected a fixed number of decimal positions, this is not changed.

Engineering Notation

To convert to the engineering notation format, press [2nd] [ENG]. This is a form of scientific notation with an exponent that is a multiple of three. This enables the display of engineering-related results, such as 10^{6} for megohms or 10^{-12} for picofarads.

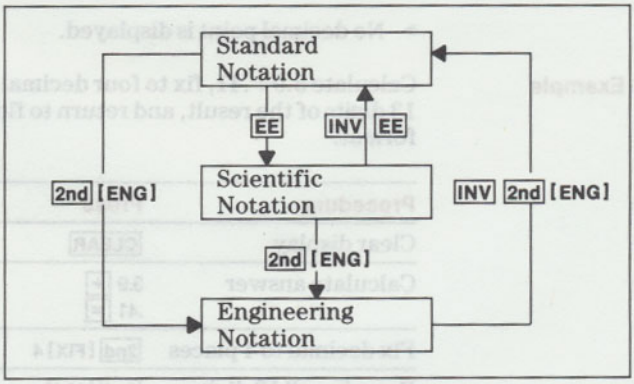
All numbers are displayed in this notation until you select standard notation. (You cannot convert directly from engineering to scientific notation.)

Press [INV] [2nd] [ENG] to return the calculator to standard notation. If you have selected a fixed number of decimal positions, this is not changed.

Example The following example illustrates the conversion of numbers from one notation to another.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter number in standard notation	740772592.9 +/–	– 740772592.9
Convert to scientific notation	EE =	– 7.407726 08
Convert to standard notation	INV EE	– 740772592.9
Convert to engineering notation	2nd [ENG]	– 740.7726 06
Convert to standard notation	INV 2nd [ENG]	– 740772592.9

Summary of Notation Conversions The key sequences required to convert between display notations are summarized in the illustration below.



(continued)

In addition to selecting the notation of the displayed value (standard, scientific, or engineering), you can set the number of decimal places to be displayed. You can also display the entire 13 digits in a number, regardless of the format selected.

Fixing the Number of Decimal Places

The calculator normally displays numbers with a floating decimal point. You can, however, display results with a fixed number of decimal places.

The key sequence [2nd] [FIX], followed by any number from 0 to 8, fixes the number of decimal places. Displayed numbers are rounded as necessary to the number of decimal places you select. Only the display is affected. The number is not changed internally.

[2nd] [FIX] 9 restores the floating decimal point.

Displaying All 13 Digits

The [2nd] [13d] key sequence lets you examine the digits not normally shown in the display due to rounding.

When you use this function, all 13 digits in the numeric display register are displayed.

- They are preceded by the sign of the number.
- No exponent is displayed, regardless of notation.
- The 13-digit display is temporary.
- No decimal point is displayed.

Example

Calculate 3.9 ÷ .41, fix to four decimal places, display all 13 digits of the result, and return to floating-decimal format.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Calculate answer	3.9 [÷] .41 [=]	9.512195122
Fix decimal to 4 places	[2nd] [FIX] 4	9.5122
Examine all 13 digits	[2nd] [13d]	+9512195121951
Clear fixed decimal	[2nd] [FIX] 9	9.512195122

Entering Numbers in Scientific Notation

You can enter numbers in scientific notation regardless of which display format you have selected.

Procedure

To enter numbers in scientific notation:

1. Enter the mantissa, including [+/–] if negative.
2. Press [EE].
3. Enter the exponent, including [+/–] if negative.

When you press an operation key, the display and resulting notation depend on prior conditions.

- If you have previously selected standard or scientific notation, the number is displayed in the scientific format and the calculator remains in scientific notation until changed.
- If you have previously selected engineering notation, the number is normalized to the engineering format and the calculator remains in engineering notation until changed.

Example

Enter the number -74.07×10^4 when the calculator is in the standard display format.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Enter the mantissa	74.07 [+/–]	–74.07
Enter the exponent	[EE] 4	–74.07 04
Convert to scientific notation	[=]	–7.407 05
Return to standard notation	[INV] [EE]	–740700.

Arithmetic Operations

The four basic arithmetic operations—addition, subtraction, multiplication, and division—are the mathematical functions you will use most often when solving problems with your calculator.

Basic Arithmetic Keys

The [+], [−], [×], and [÷] keys perform the four basic arithmetic functions. When you use a combination of these functions in an expression, the AOS™ system keeps track of the priorities and causes the functions to be performed in the correct order.

The [=] key completes all pending operations and displays the result of a calculation.

Example

Calculate $15+(6\div3)\times4$.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter addition	15 [+]	15. +
Enter division (pending addition not completed)	6 [÷] 3	3
Complete division (6 ÷ 3)	[×]	2. *
Calculate $15+(2\times4)$	4 [=]	23.

Reciprocals, Squares, and Square Roots

The reciprocal (x^{-1}), square (x^2), and square root ($x^{.5}$) can be considered mathematically as raising a number to a predetermined power. Your calculator performs these functions in one keystroke. The functions are performed immediately and do not affect any pending operations.

Reciprocals Use the [1/x] key to calculate the reciprocal of any nonzero number in the display.

Squares Use the [x²] key to calculate the square of a number in the display if the result is within the range of the calculator.

Square Roots Use the [√x] key to determine the square root of a positive number in the display.

Example This example illustrates the operation of the [1/x], [x²], and [√x] functions.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Enter a negative number	8 [+/−]	−8
Calculate the reciprocal of the number	[1/x]	−0.125
Calculate the square of the displayed number	[x²]	0.015625
Calculate the square root of the displayed number	[√x]	0.125
Change displayed number to a negative value	[+/−]	−0.125
Display indicates a negative number has no real square root	[√x]	INVALID ARGUMENT
Clear error condition	[CLEAR]	0.

Universal Powers and Roots

The universal power and universal root functions calculate any power or root value of a positive number. They will also calculate integer powers of negative numbers. Both functions are pending operations that must be completed by entering an operation key.

Universal Powers

You can use the universal power key [y^x] to raise a positive number to any power. You can also raise a negative number to an integer power. The power can be either negative or positive.

To use the universal power function:

1. Enter the number (the y value) you want raised to a power.
2. Press [y^x].
3. Enter the power (the x value).
4. Press any operation key to complete the calculation.

Example

Calculate $3.1^{4.7}$ and -3.1^4

Procedure	Press	Display
Clear display	CLEAR	0.
Enter positive y value	3.1 y^x	3.1 y^x
Enter x value	4.7	4.7
Complete the pending operation	=	203.8918944
Enter negative y value	3.1 +/− y^x	−3.1 y^x
Enter integer x value	4	4
Complete the pending operation	=	92.3521

Universal Roots

You can use the universal root function [INV] [y^x] to determine any root (positive or negative) of a positive number. You can also determine a root of a negative number if the reciprocal of the root is an integer.

To use the universal root function:

1. Enter the number (the y value) and press [INV] [y^x].
2. Enter the root (the x value) and press an operation key.

Example Calculate $^{-3.8}\sqrt{21}$ and $^{.5}\sqrt{21}$.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Enter positive y value	21 [INV] [y^x]	21. $x\sqrt{y}$
Enter negative x value	3.8 [+/–]	–3.8
Complete the operation	[=]	0.448794529
Enter negative y value	21 [+/–] [INV] [y^x]	–21. $x\sqrt{y}$
Enter x value	0.5	.5
Complete the operation	[=]	441.

Trigonometric Operations

You can use the calculator to perform operations involving the most commonly used trigonometric functions and set it to display the results in either degrees, radians, or grads.

Selecting the Angle Units

When you turn the calculator on, you can enter angles in the angle units last selected. The results of any angle calculations are also displayed in these angle units.

The key sequence [2nd] [DRG] changes the angle units. Each time you press this key sequence, the calculator rotates to the next unit. The rotation sequence is degrees, radians, grads, and then degrees again. You can press [INV] [2nd] [DRG] at any time and return to degree units. A status indicator in the display shows the units you have selected.

Changing the angle units does not convert a number in the display. You can use angle conversions, described on page 4-8, to convert a number in the display without changing angle modes.

Available Trigonometric Functions

The following table lists the trigonometric functions available on the calculator and the keys you must press to obtain them. All are immediate functions.

Trigonometric Function	Keys
Sine	[SIN]
Cosine	[COS]
Tangent	[TAN]
Arcsine	[INV] [SIN]
Arccosine	[INV] [COS]
Arctangent	[INV] [TAN]

Example In the following example, calculate the cosine of 35° and the arccosine of the result to illustrate the operation of the trigonometric functions.

Procedure	Press	Display
Clear display	CLEAR	0.
Select degree mode	INV 2nd [DRG]	DEG MODE
Enter the number	35	35
Calculate the cosine	COS	.8191520443
Calculate the arccosine	INV COS	35.

Hyperbolic Operations

Hyperbolic operations have properties that are very similar to the trigonometric operations described previously. However, the angle units setting does not affect the results of a hyperbolic function because these functions are not based on angles.

The Hyperbolic Key

The [HYP] key enables you to use the trigonometric keys on your calculator to perform hyperbolic functions. The [INV] key enables you to perform the inverse hyperbolic functions.

The following table lists the hyperbolic functions available on your calculator and the key sequences you use to obtain them. Note that the [INV] and [HYP] keys may be pressed in either order when calculating the inverse hyperbolic functions.

Hyperbolic Function	Keys
Hyperbolic sine	[HYP] [SIN]
Inverse hyperbolic sine	[INV] [HYP] [SIN] or [HYP] [INV] [SIN]
Hyperbolic cosine	[HYP] [COS]
Inverse hyperbolic cosine	[INV] [HYP] [COS] or [HYP] [INV] [COS]
Hyperbolic tangent	[HYP] [TAN]
Inverse hyperbolic tangent	[INV] [HYP] [TAN] or [HYP] [INV] [TAN]

Example. The following example illustrates the operation of the hyperbolic functions.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter a number	3	3
Calculate the hyperbolic sine	HYP SIN	10.01787493
Enter a number	.5	.5
Calculate the inverse hyperbolic tangent	INV HYP TAN	.5493061443

Factorials, Permutations, and Combinations

In probability calculations, you often need to multiply a series of consecutive numbers (factorials) or find the number of possible arrangements of items (permutations or combinations). The functions discussed in this section provide you with these capabilities.

Factorial

The factorial function enables you to calculate the factorial of negative or positive numbers.

The range of negative numbers is from −70.5 to 0. Only half-integer numbers are valid. For example, −8.5 and −9.5 are valid inputs, but −9 is not.

The factorial of any number less than −70.5 results in an answer of 0., indicating an underflow, due to the limit of 13 digits in the mantissa.

The valid range of positive numbers is from 0 to 69.5. Both half- and whole-integer numbers are valid. For example, 8.5, 9, and 9.5 are all valid inputs.

The factorial function operates on the internal value, not the displayed value. Use the 2nd [13d] key sequence to ensure a displayed number is a valid input.

Example

The following example illustrates the operation of the factorial function.

Procedure	Press	Display
Clear display	CLEAR	0.
Calculate −49.5 factorial	49.5 +/− 2nd [x!]	x! = −3.624523 −62
Calculate −49 factorial	49 +/− 2nd [x!]	INVALID ENTRY
Calculate 49 factorial	CLEAR 49 2nd [x!]	x! = 6.082819 62
Calculate 9.999999999 divided by 2	9.999999999 ÷ 2 =	5.
Calculate the factorial	2nd [x!]	INVALID ENTRY
Clear display	CLEAR	0.

Permutations This function enables you to calculate the number of permutations of n items taken r at a time. The range is limited only by the range of the calculator as long as n is a positive number equal to or greater than r. If your calculation exceeds the range of the calculator, an **OVERFLOW** message appears.

Example Calculate the number of possible arrangements of six appliances of the same width on a kitchen wall with only room for three.

Procedure	Press		Display
Clear display	CLEAR		0.
Calculate the permutations	6 x⇄t 3 2nd [nPr]	nPr =	120.

Combinations This function enables you to calculate the number of combinations of n items taken r at a time. The range is limited only by the range of the calculator as long as n is a positive number equal to or greater than r. If your calculation exceeds the range of the calculator, an **OVERFLOW** message appears.

Example Calculate the number of hands you might draw from a deck of 52 cards if you draw 5 cards each time.

Procedure	Press		Display
Clear display	CLEAR		0.
Calculate the combinations	52 x⇄t 5 2nd [nCr]	nCr =	2598960.

Logarithms

The TI-95 can perform calculations involving common and natural logarithms and their inverses (antilogarithms).

Logarithms

The [LN] key calculates the natural (base e) logarithm of a number in the display. The [LOG] key calculates the common (base 10) logarithm of a number in the display. These functions require a positive input value.

Antilogarithms

The key sequence [INV] [LN] calculates the natural antilogarithm of a number in the display. The natural antilogarithm function can be thought of as e^x.

The key sequence [INV] [LOG] calculates the common antilogarithm of a number in the display. The common antilogarithm function can be thought of as 10^x.

Example

The following example illustrates the operation of the logarithm and antilogarithm functions.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Enter a number	83	83
Calculate the common logarithm	[LOG]	1.919078092
Calculate the common antilogarithm	[INV] [LOG]	83.
Calculate the natural logarithm	[LN]	4.418840608
Calculate the natural antilogarithm	[INV] [LN]	83.

Eight numeric functions are available as selections on the NUMBER FUNCTIONS menu. You access the menu when you select the numeric (NUM) function.

The Number Functions Menu

When you press the NUM key, a menu appears. Each of the menu selections is explained in the following pages.

```
NUMBER FUNCTIONS
INT FRC R#  RND -->
```

⟨INT⟩	Discards the fraction and keeps the integer
⟨FRC⟩	Discards the integer and keeps the fraction
⟨R#⟩	Generates a random number
INV ⟨R#⟩	Enables you to enter a seed number to generate a predictable random number sequence
⟨RND⟩	Rounds a number internally to the display format (scientific, engineering, standard, or fixed)
⟨-->⟩	Displays the selections shown below

```
NUMBER FUNCTIONS
SGN LCM PF  ABS -->
```

⟨SGN⟩	Calculates the signum (sign) of a number
⟨LCM⟩	Calculates the least common multiple and greatest common divisor of a number
⟨PF⟩	Determines the lowest prime factor of a number
⟨ABS⟩	Changes a number to its absolute value
⟨-->⟩	Displays the selections shown above

Integer Portion, Fractional Portion, and Rounding

You can choose to discard a portion of a number that you consider insignificant or unimportant to the problem you are solving. You can do this using the integer portion, fractional portion, or rounding functions. These functions operate on the internal value, not the displayed value.

Integer Portion

Selecting ⟨INT⟩ from the **NUMBER FUNCTIONS** menu discards the fractional portion of the internal value and retains only the integer portion.

If the displayed value is the same as the internal value, the integer portion remains the same and the fractional portion is discarded. Because this function operates on the internal value, if the two values are not the same, selecting the INT function may produce an unexpected result as shown in the example below. You can use the 2nd [13d] key sequence to check the internal value before using the INT function.

Fractional Portion

Selecting ⟨FRC⟩ from the **NUMBER FUNCTIONS** menu discards the integer portion of the internal value and retains only the fractional portion.

If the displayed value is the same as the internal value, the fractional portion remains the same and the integer portion is discarded. Because this function operates on the internal value, if the two values are not the same, selecting the FRC function may produce an unexpected result as shown in the example below. You can use the 2nd [13d] key sequence to check the internal value before using the FRC function.

Example

The example below illustrates the operation of the INT and FRC functions.

Internal Value	Displayed Value	Integer Portion	Fractional Portion
−65.231	−65.231	−65.	−0.231
.9999999999991	1.	0.	1.
1.999999999998	2.	1.	1.

Rounding

Selecting ⟨RND⟩ from the **NUMBER FUNCTIONS** menu changes the internal value to match the value that is displayed.

You can use the RND function with standard, scientific, or engineering notation. You can also use it with fixed decimal.

Example

The example below illustrates the operation of the RND function.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter π	2nd [π]	3.141592654
Check internal value	2nd [13d]	+3141592653590
Round internal value	NUM ⟨RND⟩	3.141592654
Check internal value	2nd [13d]	+3141592654000
Calculate 2 times .9999999999991 99	.9999999999991 EE 99 × 2 =	2. 99
Check internal value	2nd [13d]	+1999999999998
Round and verify internal value	⟨RND⟩ 2nd [13d]	+2000000000000

The value is changed internally to the same value as that in the display.

Prime Factors

You can use the calculator to determine the prime factors of a whole number.

Calculating Prime Factors

Selecting ⟨PF⟩ from the **NUMBER FUNCTIONS** menu finds the lowest prime factor of the displayed value. To use the PF function:

1. Enter the number.
2. Press [NUM] and select ⟨-->⟩.
3. Select ⟨PF⟩. The least prime factor is displayed and the remaining value is stored in the t-register (temporary register).
4. Press [x~t]. The remaining value is displayed.
5. Repeat steps 3 and 4 until the result is 1.

Note: If the first displayed factor of a number is 1, the number is prime.

Example

Find the prime factors of 102.

Procedure	Press		Display
Clear display	[CLEAR]		0.
Enter a number	102		102
Calculate least prime factor	[NUM] ⟨-->⟩ ⟨PF⟩	f=	2.
Display remaining value	[x~t]		51.
Calculate next factor	⟨PF⟩	f=	3.
Display remaining value	[x~t]		17.
Calculate next factor	⟨PF⟩	f=	1.

The prime factors are 2, 3, and 17.

Common Multiples and Common Divisors

One of the selections on the NUMBER FUNCTIONS menu lets you calculate least common multiples and greatest common divisors.

The LCM Function

Selecting ⟨LCM⟩ from the **NUMBER FUNCTIONS** menu calculates both the least common multiple and the greatest common divisor of two numbers.

Because this function requires two numbers for the comparison and calculates two results, a separate storage area is required. You must store one number in the t-register and place the other number in the display. The function places the least common multiple in the display and stores the greatest common divisor in the t-register.

To use the LCM function:

1. Enter one of the numbers and press [x⇄t] to store the number in the t-register.
2. Enter the other number and press [NUM] ⟨-->⟩ ⟨LCM⟩ to perform the calculation and display the least common multiple.
3. Press [x⇄t] to display the greatest common divisor.

Example

Determine the least common multiple and greatest common divisor of the numbers 36 and 48.

Procedure	Press		Display
Clear display	[CLEAR]		0.
Enter the two numbers	36 [x⇄t] 48		48
Display LCM (GCD stored in t-register)	[NUM] ⟨-->⟩ ⟨LCM⟩	LCM =	144.
Display GCD	[x⇄t]		12.

Absolute and Signum Functions

You can use the calculator to determine the absolute value and signum function of a number.

Absolute Values

Selecting ⟨ABS⟩ from the **NUMBER FUNCTIONS** menu changes the number in the display to its absolute value.

Example

Calculate $|3 \div 10 - 2| \times 11$.

Procedure	Press	Display
Clear display	CLEAR	0.
Perform the calculation	(3 ÷ 10 − 2)	−1.7
Calculate the absolute value	NUM ⟨-->⟩ ⟨ABS⟩	1.7
Multiply the absolute value by 11	× 11 =	18.7

Signum Function

Selecting ⟨SGN⟩ from the **NUMBER FUNCTIONS** menu determines the sign of the number in the display and results in either a 1 or −1, depending on the sign.

Value in Display	Signum
0 or greater	1
Less than 0	−1

For example, if the display contains −0.941863 and you press NUM ⟨-->⟩ ⟨SGN⟩, the calculator displays −1.

You can use the calculator to produce random numbers. Entering a seed value allows you to reproduce a random sequence.

Generating Random Numbers

You can use the R# function to generate a sequence of uniformly distributed, random decimal numbers between 0 and 1. To use the R# function, press NUM ⟨R#⟩.

The random number generator begins at a random point and generates a unique sequence. Each time the calculator is turned off and back on, a new random sequence can be generated.

You can also "seed" the generator to produce the same sequence of numbers each time you enter the same seed. To seed the generator:

1. Enter a seed number (0 or any number between 1 and 100, not including 100). If you enter numbers outside this range, they duplicate the action of other seed numbers.
2. Press INV ⟨R#⟩.

Example

Generate a predictable sequence of random numbers, and then verify the seed will regenerate the same sequence.

Procedure	Press	Display
Clear display	CLEAR	0.
Enter seed value	8.2 NUM INV ⟨R#⟩	8.2
Display random number	⟨R#⟩	.5333248654
Display random number	⟨R#⟩	.4256753429
Display random number	⟨R#⟩	.9490727541
Reenter seed value	8.2 INV ⟨R#⟩	8.2
Display random number	⟨R#⟩	.5333248654

The extended functions consist of three selections that enable you to find roots of quadratic and cubic equations and to access the contents of the system registers.

The Extended Functions Menu

When you press the FUNC key, the following menu appears.

```
EXTENDED FUNC
QAD CUB SYS
```

⟨QAD⟩	Selects quadratic equation roots
⟨CUB⟩	Selects cubic equation roots
⟨SYS⟩	Selects system functions

Note: The ⟨SYS⟩ selection provides access to system register contents. You should use this selection only if you have sufficient knowledge of the internal operations of the calculator. Refer to the *TI-95 Programming Guide* for information concerning the ⟨SYS⟩ selection.

The ⟨QAD⟩ selection requires you to enter the coefficients of your equation. An equation in quadratic form has coefficients a, b, and c:

$ax^2 + bx + c = 0$

Finding Quadratic Roots

Select ⟨QAD⟩ from the **EXTENDED FUNC** menu to display the **QUADRATIC EQN** menu.

1. Enter the value of the a coefficient and select ⟨a⟩.
2. Enter the value of the b coefficient and select ⟨b⟩.
3. Enter the value of the c coefficient and select ⟨c⟩.
4. Select ⟨XEQ⟩. One of the menus below is displayed.

5. If the roots are real, display the two roots by selecting:

   ⟨R1⟩ The first real root

   ⟨R2⟩ The second real root

6. If the roots are complex, display the real and imaginary parts by selecting:

   ⟨Re⟩ The real part

   ⟨Im⟩ The imaginary part

   The two roots are Re + (Im)i and Re – (Im)i.

(continued)

Finding Quadratic Roots (Continued)

Data registers 000, 001, and 002 are used to store both the inputs and the results. As the values for a, b, and c are entered, they are stored in registers 000, 001, and 002, respectively. After the two roots are determined, they are stored in registers 000 and 001. Register 002 contains a 0 if the roots are real and a 1 if the roots are complex. Therefore, the original inputs are no longer available in the registers.

Quadratic Example

Find the roots of the equation $4.2x^2 + .22x + 8 = 0$.

Procedure	Press		Display
Clear display	CLEAR		0.
Select quadratic roots	FUNC ⟨QAD⟩	QUADRATIC EQN	
Enter value for a	4.2 ⟨a⟩	a =	4.2
Enter value for b	.22 ⟨b⟩	b =	0.22
Enter value for c	8 ⟨c⟩	c =	8.
Determine roots	⟨XEQ⟩	COMPLEX ROOTS	
Display real part	⟨Re⟩	Re =	−.0261904762
Display imaginary part	⟨Im⟩	Im =	1.379882591

The two roots are:

$-.0261904762 + (1.379882591)i$
$-.0261904762 - (1.379882591)i$

The ⟨CUB⟩ selection requires you to enter the coefficients of your equation. An equation in cubic form has coefficients a, b, c, and d:

$$ax^3 + bx^2 + cx + d = 0$$

Finding Cubic Roots

Select ⟨CUB⟩ from the **EXTENDED FUNC** menu to display the **CUBIC EQN** menu.

1. Enter the value of the a coefficient and select ⟨a⟩.
2. Enter the value of the b coefficient and select ⟨b⟩.
3. Enter the value of the c coefficient and select ⟨c⟩.
4. Enter the value of the d coefficient and select ⟨d⟩.
5. Select ⟨XEQ⟩. Depending on the results, one of the following menus is displayed.

The results are obtained using the procedure on the next page.

Finding Cubic Roots (Continued)

6. If the roots are real, display the three roots by selecting:

⟨R1⟩	The first real root
⟨R2⟩	The second real root
⟨R3⟩	The third real root

7. If there are two complex roots and one real root, display the results by selecting:

⟨Re⟩	The real part of the complex roots
⟨Im⟩	The imaginary part of the complex roots
⟨R3⟩	The real root

The complex roots are Re + (Im)i and Re – (Im)i.

Data registers 000, 001, 002, and 003 are used to store both the inputs and the results. As the values for a, b, c, and d are entered, they are stored in registers 000, 001, 002, and 003, respectively. After the three roots are determined, they are stored in registers 000, 001, and 002. Register 003 contains a 0 if all roots are real and a 1 if two of the roots are complex. Therefore, the original inputs are no longer available in the registers.

Cubic Example Find the roots of the equation $3x^3 + 9x^2 - 9x + 3 = 0$.

Procedure	Press		Display
Clear display	CLEAR		0.
Select cubic roots	FUNC ⟨CUB⟩	CUBIC EQN	
Enter value for a	3 ⟨a⟩	a=	3.
Enter value for b	9 ⟨b⟩	b=	9.
Enter value for c	9 +/− ⟨c⟩	c=	−9.
Enter value for d	3 ⟨d⟩	d=	3.
Determine roots	⟨XEQ⟩	2 COMPLEX, 1 REAL	
Display real part	⟨Re⟩	Re=	.4236610509
Display imaginary part	⟨Im⟩	Im=	0.283606001
Display real root	⟨R3⟩	R3=	−3.847322102

The three roots are:

−3.847322102
.4236610509 + (0.283606001)i
.4236610509 − (0.283606001)i

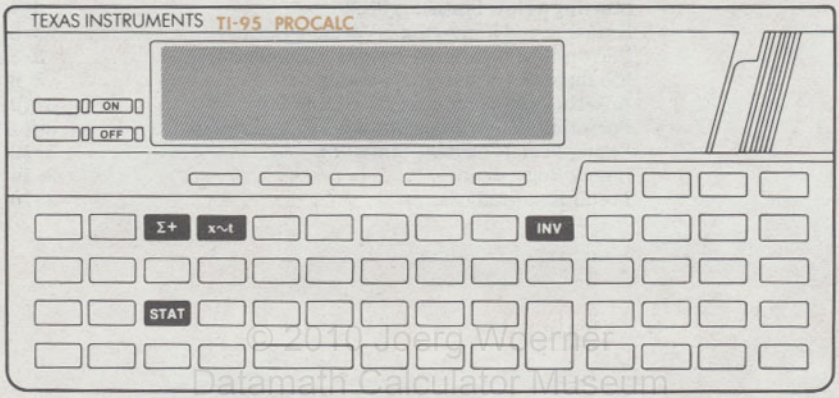
Chapter 3: Statistics Operations

This chapter describes the calculator's built-in statistics functions. You can enter 1- or 2-variable data and then analyze the data by performing any of several statistics calculations.

Table of Contents

Location of the Statistics Keys

The keys used to perform statistics functions are shown in the figure below. Familiarize yourself with these keys and their location on the keyboard.



You can enter data into the statistics registers by using the [Σ+] key. Before you can analyze the data, however, you must press the [STAT] key to display the STAT FUNCTIONS menu. Pressing [STAT] redefines the function keys and enables you to select the operation you want to perform.

The Statistics Menu

When you press [STAT], the **STAT FUNCTIONS** menu is displayed. You can then use the function keys to select from the statistics functions shown below.

```
STAT FUNCTIONS
CLR  FRQ  MN   s    -->
```

⟨CLR⟩	Clears the statistics registers and enables you to select 1- or 2-variable statistics
⟨FRQ⟩	Enters number of occurrences of identical data values; entered as data when you press [Σ+], or removed when you press [INV] [Σ+]
⟨MN⟩	Calculates the mean
⟨s⟩	Calculates sample standard deviation
[INV] ⟨s⟩	Calculates population standard deviation
⟨-->⟩	Displays the menu selections shown below


```
STAT FUNCTIONS
m-b  r    y'   SHW  -->
```

⟨m-b⟩	Calculates slope/intercept (linear regression)
⟨r⟩	Calculates correlation coefficient (linear regression)
⟨y'⟩	Predicts a y value (linear regression)
[INV] ⟨y'⟩	Predicts an x value (linear regression)
⟨SHW⟩	Displays sums calculated during data entry
⟨-->⟩	Displays the previous selections shown above

Starting a New Statistics Problem

When you start a new statistics problem that does not use any previously entered data values, begin by clearing the statistics registers and selecting 1- or 2-variable statistics. Clearing the statistics registers does not affect any values stored in the calculator's data register memories. However, the t-register is cleared.

The Number of Variables

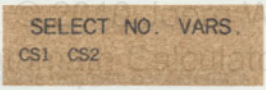
In 1-variable statistics, a data value is represented as x_n, where n = 1, 2, ..., N. (N is the total number of data values.)

In 2-variable statistics, a data value is represented as (x_n, y_n). The x value is the independent variable, and the y value is the dependent variable.

Clearing the Registers

To clear the statistics registers and select 1- or 2-variable statistics, use the following procedure.

1. Press [STAT] to display the **STAT FUNCTIONS** menu.
2. Press ⟨CLR⟩. The following menu is then displayed.



⟨CS1⟩ 1-variable statistics

⟨CS2⟩ 2-variable statistics

3. Select either 1- or 2-variable statistics.

   After you press ⟨CS1⟩ or ⟨CS2⟩, the **STAT FUNCTIONS** menu is displayed.

Entering and Removing 1-Variable Data

Before performing a statistics calculation, you must enter all the data values into the statistics registers. You can enter the data values individually or enter several identical data values at one time. You can also remove any data values that are entered incorrectly. (An example of entering and removing 1-variable data begins on page 3-8.)

Entering 1-Variable Data Values

The [Σ+] key enables you to enter data values and display the number of data values accumulated.

To enter a single data value:

1. Enter the value.
2. Press [Σ+].

To enter several identical data values at one time:

1. Press [STAT], enter the number of data values, and press ⟨FRQ⟩.
2. Enter the data value and press [Σ+].

Removing 1-Variable Data Values

The [INV] [Σ+] key sequence enables you to remove previously entered data values and display the number of data values that remain.

To remove a value just after you entered it, press [INV] [Σ+].

To remove a data value after pressing any key other than [2nd] or [INV]:

1. Reenter the value.
2. Press [INV] [Σ+].

To remove several identical data values at one time after pressing any key other than [2nd] or [INV]:

1. Press [STAT], reenter the number of data values, and press ⟨FRQ⟩.
2. Reenter the data value and press [INV] [Σ+].

Note: If you remove more values than you intend, the resulting sum can be negative. To correct this, either reenter the points removed in error or begin again.

After entering data into the statistics registers, you can calculate the mean and standard deviation of the data values. You can also calculate intermediate sums or check the data in the registers. (An example of these calculations begins on page 3-8.)

Calculating the Mean

The [STAT] ⟨MN⟩ key sequence calculates the mean (average) of the data values according to the following equation.

$$MN = \frac{\Sigma x}{n}$$

Calculating the Standard Deviation

The [STAT] ⟨s⟩ key sequence calculates the sample (n – 1 weighted) standard deviation according to the following equation.

$$s_{n-1} = \sqrt{\frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)}}$$

The [STAT] [INV] ⟨s⟩ key sequence calculates the population (n weighted) standard deviation according to the following equation.

$$s_n = \sqrt{\frac{n\Sigma x^2 - (\Sigma x)^2}{n^2}}$$

The Show Selection

The [STAT] <--> <SHW> key sequence displays a menu that enables you to display intermediate sums or to check the data in the registers.

<n>	Displays number of data values
<Sx>	Displays sum of data values
<Sxx>	Displays sum of the squares
<Lfr>	Displays last entered frequency
<Lx>	Displays last entered value

Example of 1-Variable Statistics

The following example shows you how to apply the information given in the previous three sections concerning 1-variable data. The example is divided into two parts. Part 1 shows you how to enter and remove the data. Part 2 shows you how to perform calculations and review the data.

Example (Part 1)

Enter the data values listed below. (Be sure to remove any values that are entered incorrectly.)

75 86 93 93 93 93 98 100

Procedure	Press		Display
Clear display	[CLEAR]		0.
Clear registers and select 1-variable	[STAT] ⟨CLR⟩ ⟨CS1⟩	STAT FUNCTIONS	
Begin data entry	75 [Σ+]	n =	1.
Enter incorrect value for later removal	85 [Σ+]	n =	2.
Enter correct value	86 [Σ+]	n =	3.
Enter incorrect repeated values	4 ⟨FRQ⟩ 94 [Σ+]	n =	7.
Remove values	[INV] [Σ+]	n =	3.
Enter repeated values correctly	4 ⟨FRQ⟩ 93 [Σ+]	n =	7.
Enter remaining data	98 [Σ+]	n =	8.
	100 [Σ+]	n =	9.
Remove earlier incorrect value	85 [INV] [Σ+]	n =	8.

Example (Part 2)

Calculate the mean, population standard deviation, sum, and sum of the squares of the data entered in Part 1. Then check the data to find the total number of data values, the last data value entered, and the frequency of the last data value entered.

Procedure	Press		Display
Mean	⟨MN⟩	MNx =	91.375
Population standard deviation	INV ⟨s⟩	sx =	7.296189074
Select show option	⟨--->⟩ ⟨SHW⟩	SHOW STAT REGS	
Sum	⟨Sx⟩	Sx =	731.
Sum of squares	⟨Sxx⟩	Sxx =	67221.
Number of data values	⟨n⟩	n =	8.
Last entered value	⟨Lx⟩	Lx =	100.
Last entered frequency	⟨Lfr⟩	Lfr =	1.

Entering and Removing 2-Variable Data

You enter 2-variable data in much the same way as previously described for 1-variable data. With two variables, however, you must use the [x⇌t] key to store the x value. Before starting a new problem, be sure to select the number of variables and clear the statistics registers as described on page 3-4.

Entering 2-Variable Data Values

Each time you enter a data pair, the calculator displays the number of pairs accumulated.

To enter a single data pair:

1. Enter the x value and press [x⇌t].
2. Enter the y value and press [Σ+].

To enter several identical data pairs at one time:

1. Press [STAT], enter the number of pairs, and press ⟨FRQ⟩.
2. Enter the x value and press [x⇌t], and then enter the y value and press [Σ+].

Removing 2-Variable Data Values

To remove a pair just after you enter it, press [INV] [Σ+]. All pairs determined by the last frequency are removed, and the number of pairs remaining is displayed.

To remove a pair after pressing a key other than [2nd] or [INV]:

1. Reenter the x value and press [x⇌t].
2. Reenter the y value and press [INV] [Σ+].

To remove several identical data pairs at one time after pressing any key other than [2nd] or [INV]:

1. Press [STAT], reenter the number of pairs, and press ⟨FRQ⟩.
2. Reenter the x value and press [x⇌t].
3. Reenter the y value and press [INV] [Σ+].

Note: If you remove more values than you intend, the resulting sum can be negative. To correct this, either reenter the points removed in error or begin again.

After entering the statistics data values, you can analyze the data in the statistics registers by performing any of the calculations shown below. (An example of these calculations is given on page 3-13.)

Calculating the Mean

To calculate the mean (average) of the data values, press [STAT] ⟨MN⟩.

- The mean of the y values appears in the display.
- The mean of the x values is stored in the t-register. Press [x⇌t] to display the number.

Calculating the Standard Deviation

To calculate the sample (n – 1 weighted) standard deviation, press [STAT] ⟨s⟩.

- The sample standard deviation of the y values appears in the display.
- The sample standard deviation of the x values is stored in the t-register. Press [x⇌t] to display the number.

To calculate the population (n weighted) standard deviation, press [STAT] [INV] ⟨s⟩.

- The population standard deviation of the y values appears in the display.
- The population standard deviation of the x values is stored in the t-register. Press [x⇌t] to display the number.

(continued)

The Show Selection

The [STAT] ⟨-->⟩ ⟨SHW⟩ key sequence displays a menu that enables you to display intermediate sums or to check the data in the registers.

```
SHOW STAT REGS
n   Sy  Syy Ly  -->
```

```
SHOW STAT REGS
Sxy Sx  Sxx Lfr -->
```

⟨n⟩	Displays total number of data pairs
⟨Sy⟩	Displays sum of the y values
⟨Syy⟩	Displays sum of the squares of the y values
⟨Ly⟩	Displays last entered y value and places last entered x value in t-register
⟨Sxy⟩	Displays sum of the products of x and y
⟨Sx⟩	Displays sum of the x values
⟨Sxx⟩	Displays sum of the squares of the x values
⟨Lfr⟩	Displays last entered frequency

Example of 2-Variable Statistics

The following example shows you how to apply the information given in the previous sections concerning 2-variable data.

Example Enter the following data pairs, and then calculate the mean and sample standard deviation.

(101.3, 609) (103.7, 626) (98.6, 586)
(99.9, 594) (97.2, 579) (100.1, 605)

Procedure	Press		Display
Clear display	CLEAR		0.
Clear registers and select 2-variable	STAT 〈CLR〉 〈CS2〉	STAT FUNCTIONS	
Begin data entry	101.3 x~t 609 Σ+	n =	1.
	103.7 x~t 626 Σ+	n =	2.
	98.6 x~t 586 Σ+	n =	3.
	99.9 x~t 594 Σ+	n =	4.
	97.2 x~t 579 Σ+	n =	5.
	100.1 x~t 605 Σ+	n =	6.
Mean of y values	〈MN〉	MNy =	599.8333333
Mean of x values	x~t		100.1333333
Sample standard deviation of y values	〈s〉	sy =	17.05774506
Sample standard deviation of x values	x~t		2.240238083

Linear Regression

Linear regression analysis calculates a straight line that best represents the relationship between two variables for which measurements are made in ordered pairs.

Calculating Slope and Intercept

To calculate the slope (m) and the y-intercept (b) of the representative line, press [STAT] ⟨m-b⟩.

- The slope appears in the display.
- The y-intercept is stored in the t-register. Press [x⇌t] to display the number.

The representative line is:

$$y = mx + b$$

Calculating the Correlation Coefficient

To calculate the correlation coefficient, press [STAT] ⟨r⟩. The correlation coefficient is a measure of how well the representative line fits the two sets of data values.

When the |r| is close to 1, most of the data is on or very near the line, in which case the line is highly representative of the data. However, the validity of the line diminishes as |r| decreases.

Calculating a Predicted Value

If |r| is close to 1, you can use the equation of the line to make valid predictions about additional data.

- To predict a y value, enter an x value and press ⟨y'⟩.
- To predict an x value, enter a y value and press [INV] ⟨y'⟩.

Example

A life insurance company has found that the volume of sales varies according to the number of salespeople employed, as shown below.

Number of salespeople (x)	7	12	4	5	11	9
Sales in thousands/mo. (y)	99	152	81	98	145	112

(continued)

Example (Continued)

Perform a linear regression analysis and predict the number of salespeople needed to produce $115,000 in monthly sales. Then estimate the amount of sales that should be generated by 10 salespeople.

Procedure	Press		Display
Clear display	CLEAR		0.
Clear registers and select 2-variable	STAT 〈CLR〉 〈CS2〉	STAT FUNCTIONS	
Begin data entry	7 x~t 99 Σ+	n =	1.
	12 x~t 152 Σ+	n =	2.
	4 x~t 81 Σ+	n =	3.
	5 x~t 98 Σ+	n =	4.
	11 x~t 145 Σ+	n =	5.
	9 x~t 112 Σ+	n =	6.
Slope (m)	〈--〉 〈m-b〉	m =	8.423076923
y-intercept (b)	x~t		47.11538462
Correlation coeff.	〈r〉	r =	.9630910446
Projected sales for 10 people	10 〈y'〉	y' =	131.3461538
Number of people needed for $115,000	115 INV 〈y'〉	x' =	8.059360731

The equation 8.42x + 47.12 describes the representative line, with a correlation coefficient of 0.96.

Trend-line Analysis

In a trend-line analysis, you are performing a linear regression calculation on data that is collected at regular, sequential intervals. Each new x value is one greater than the previous x value. The calculator automatically increments the initial value of x so that you do not have to enter subsequent x values.

Entering the Data

To enter data for a trend-line analysis:

1. Enter the first data value as described in "Entering and Removing 2-Variable Data."
   - Enter x and press [x⇌t].
   - Enter y and press [Σ+].
2. Enter only the y value for the remaining data values. The calculator automatically enters the corresponding x.

Note: If any of the remaining data values are not sequential, be sure to reenter the new x value.

A trend line applies only to single occurrence data, so the ⟨FRQ⟩ key is not part of trend line data entry.

Removing Data

To remove a data pair just after it is entered, press [INV] [Σ+]. The calculator removes the last x and y values and automatically decrements the contents of the t-register in preparation for the next entry.

To remove an entry at a later time, use the procedure described in "Entering and Removing 2-Variable Data."

Example

A company has the following annual profits:

Year (x)	Profit in Millions (y)
1971	−2.1
1972	−0.3
1973	0.8
1974—80	inactive
1981	2.9
1982	2.8
1983	3.6
1984	4.0
1985	4.7

(continued)

Example (Continued)

Use the data on the previous page to perform a trend-line analysis. How much profit can the company expect to make in 1986, and when will it break the $6 million mark?

Procedure	Press		Display
Clear display	[CLEAR]		0.
Clear registers and select 2-variable	[STAT] ⟨CLR⟩ ⟨CS2⟩	STAT FUNCTIONS	
Initial value of x (1971)	1971 [x⇌t] 2.1 [+/−] [Σ+]	n =	1.
1972 profit	.3 [+/−] [Σ+]	n =	2.
1973 profit	.8 [Σ+]	n =	3.
Skip to 1981	1981 [x⇌t] 2.9 [Σ+]	n =	4.
1982 profit	2.8 [Σ+]	n =	5.
Incorrect 1983 profit	3.4 [Σ+]	n =	6.
Remove last entry	[INV] [Σ+]	n =	5.
1983 profit	3.6 [Σ+]	n =	6.
1984 profit	4 [Σ+]	n =	7.
1985 profit	4.7 [Σ+]	n =	8.
Correlation	⟨--->⟩ ⟨r⟩	r =	.9652421505
1986 prediction	1986 ⟨y'⟩	y' =	4.82244898
Year of $6 million profits	6 [INV] ⟨y'⟩	x' =	1989.026224

Chapter 4: Conversions

This chapter shows you how to use the calculator's built-in conversion functions. You can perform metric, degree format, angle, polar/rectangular, and base number conversions. By changing the base number mode, you can also perform calculations with octal or hexadecimal numbers.

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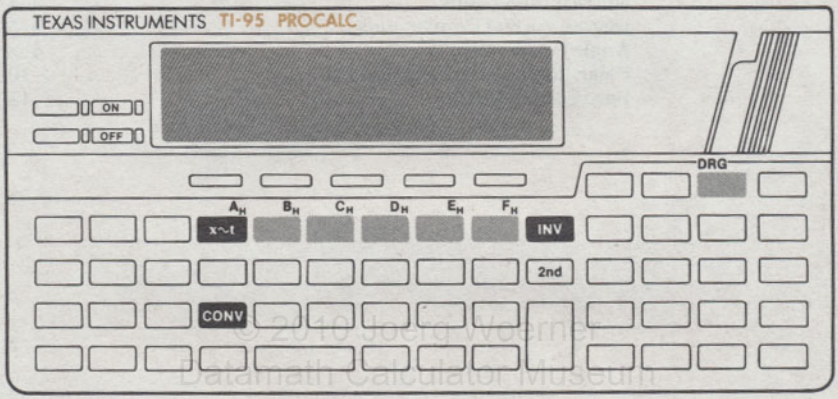
Location of the Conversion Keys

The keys used to perform conversions are shown in the figure below. Familiarize yourself with these keys and their location on the keyboard.



To perform the conversions described in this chapter, you must begin by pressing the CONV key to display the CONVERSIONS menu. Pressing CONV redefines the function keys and enables you to select from a variety of conversions.

The Conversions Menu

When you press CONV, the **CONVERSIONS** menu is displayed.

```
CONVERSIONS
MET  DMS  ANG  P-R  BAS
```

⟨MET⟩	Metric conversions
⟨DMS⟩	Degrees/minutes/seconds to decimal degrees conversions
INV ⟨DMS⟩	Decimal degrees to degrees/minutes/seconds conversions
⟨ANG⟩	Angle conversions
⟨P-R⟩	Polar to rectangular conversions
INV ⟨P-R⟩	Rectangular to polar conversions
⟨BAS⟩	Base conversions

Selecting ⟨MET⟩ from the CONVERSIONS menu displays another menu that enables you to select the type of metric conversion you want to perform. You can convert from English to metric units or (by using the INV key) from metric to English units.

Using Metric Conversions

To perform metric conversions:

1. Press CONV to display the **CONVERSIONS** menu.
2. Press ⟨MET⟩ to display the menu for metric conversions.

3. Enter the number you want to convert.
4. Press the appropriate key sequence listed below. The converted value then appears in the display.

⟨F-C⟩	Fahrenheit to Celsius
INV ⟨F-C⟩	Celsius to Fahrenheit
⟨G-L⟩	Gallons to liters
INV ⟨G-L⟩	Liters to gallons
⟨#-K⟩	Pounds to kilograms
INV ⟨#-K⟩	Kilograms to pounds
⟨i-m⟩	Inches to millimeters
INV ⟨i-m⟩	Millimeters to inches
⟨f-M⟩	Feet to meters
INV ⟨f-M⟩	Meters to feet

Example Convert 212° Fahrenheit to Celsius, 284 pounds to kilograms, and 1000 meters to feet.

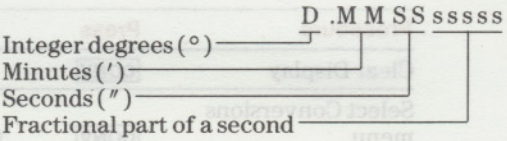
Procedure	Press		Display
Clear Display	CONV		0.
Select Conversions menu	CONV	CONVERSIONS	
Select Metric menu	⟨MET⟩	METRIC	
Celsius equivalent of 212° F	212 ⟨F-C⟩	C=	100.
Number of kilograms in 284 pounds	284 ⟨#-K⟩	K=	128.8202331
Number of feet in 1000 meters	1000 INV ⟨f-M⟩	ft=	3280.839895

Degree Format Conversions

Selecting ⟨DMS⟩ from the CONVERSIONS menu converts the degree format of the angle in the display to decimal degrees. When angles are measured in degrees/minutes/seconds, you must convert the angles to decimal degrees before you can add them or use them in trigonometric calculations. (This also applies to hours/minutes/seconds versus decimal hours.)

DMS Format

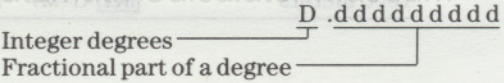
In the degrees/minutes/seconds (DMS) format, an angle is expressed as D.MMSSssssss.



When you enter minutes and seconds, remember to include zeros where needed to place the digits in the proper positions. You do not need to enter trailing zeros. For example, the angle 9° 7′ 5″ is entered as 9.0705.

Decimal Degrees Format

In the decimal degrees format, an angle is expressed as D.ddddddddd.



You do not need to enter trailing zeros.

Converting Between the Formats

To perform degree format conversions, follow these steps. (Although these angles are expressed in degrees, the calculator does not have to be in the degree mode when you perform the conversions.)

1. Press [CONV] to display the **CONVERSIONS** menu.
2. Enter the angle you want to convert.
3. Press the appropriate key sequence listed below. The converted value then appears in the display.

Conversion	Key Sequence
DMS to decimal degrees	⟨DMS⟩
Decimal degrees to DMS	[INV] ⟨DMS⟩

Example 1 Calculate the sum of the angles 42° 6′ 59.5″ and 101° 54′ 0.8″. Before adding the angles, convert them to decimal degrees. Convert the result back to DMS format.

Procedure	Press		Display
Clear display	CLEAR		0.
Select Conversions menu	CONV	CONVERSIONS	
Enter angle and convert to decimal	42.06595 ⟨DMS⟩	D.d =	42.11652778
Add other angle after converting to decimal	+ 101.54008 ⟨DMS⟩	D.d =	101.9002222
Calculate result	=		144.01675
Display result in DMS	INV ⟨DMS⟩	DMS =	144.01003

The result is 144° 1′ 0.3″.

Example 2 Calculate cos 27° 50′ 16.2″. Because you are using a trigonometric function, the calculator must be in the degree mode.

Procedure	Press		Display
Clear display	CLEAR		0.
Select Conversions menu	CONV	CONVERSIONS	
Select degree mode	INV 2nd [DRG]	DEG MODE	
Enter angle and convert to decimal	27.50162 ⟨DMS⟩	D.d =	27.83783333
Calculate cosine	COS		.8842728197

Angle Conversions

Selecting ⟨ANG⟩ from the CONVERSIONS menu displays another menu that enables you to select the type of angle conversion you want to perform. You can convert an angle in degrees, radians, or grads to its equivalent angle in any of the other units. Unlike [2nd] [DRG], these conversions do not affect the current setting of the calculator's angle mode.

Using Angle Conversions

To perform angle conversions:

1. Press [CONV] to display the **CONVERSIONS** menu.
2. Press ⟨ANG⟩ to display the menu for angle conversions.

3. Enter the angle you want to convert.
4. Press the appropriate key sequence listed below. The converted value then appears in the display.

⟨D–R⟩	Degrees to radians
[INV] ⟨D–R⟩	Radians to degrees
⟨D–G⟩	Degrees to grads
[INV] ⟨D–G⟩	Grads to degrees
⟨R–G⟩	Radians to grads
[INV] ⟨R–G⟩	Grads to radians

Example Convert 90° to radians, grads, and then back to degrees.

Procedure	Press		Display
Clear display	CLEAR		0.
Select Conversions menu	CONV	CONVERSIONS	
Select angle conversions	⟨ANG⟩	ANGULAR	
Degrees to radians	90 ⟨D–R⟩	Rad =	1.570796327
Radians to grads	⟨R–G⟩	Grd =	100.
Grads to degrees	INV ⟨D–G⟩	Deg =	90.

Polar/Rectangular Conversions

Selecting 〈P-R〉 from the CONVERSIONS menu performs polar/rectangular conversions. You can convert a pair of coordinates from the polar coordinate system to the rectangular coordinate system or vice versa. The t-register is used to store one of the two coordinates required for the conversion.

Polar to Rectangular Conversions

To convert from polar (r,θ) to rectangular (x,y) coordinates:

1. Press [CONV] to display the **CONVERSIONS** menu.
2. Use [2nd] [DRG] to select the correct angle mode (degree, radian, or grad).
3. Enter the r-coordinate and press [x⇄t] to store it in the t-register.
4. Enter the θ-coordinate.
5. Press 〈P-R〉 to display the y-coordinate.
6. Press [x⇄t] to display the x-coordinate.

Until you enter another number into the display, pressing [x⇄t] alternates between the x- and y- coordinates.

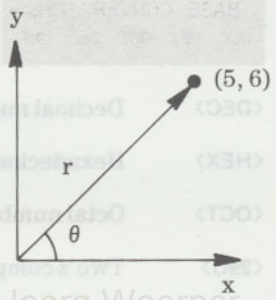
Rectangular to Polar Conversions

To convert from rectangular (x,y) to polar (r,θ) coordinates:

1. Press [CONV] to display the **CONVERSIONS** menu.
2. Use [2nd] [DRG] to select the correct angle mode (degree, radian, or grad).
3. Enter the x-coordinate and press [x⇄t] to store it in the t-register.
4. Enter the y-coordinate.
5. Press [INV] 〈P-R〉 to display the θ-coordinate.
6. Press [x⇄t] to display the r- coordinate.

Until you enter another number into the display, pressing [x⇄t] alternates between the r- and θ-coordinates.

Example Convert the rectangular coordinates (x = 5, y = 6) to polar coordinates.



Procedure	Press		Display
Clear display	CLEAR		0.
Select Conversions menu	CONV	CONVERSIONS	
Select degree mode	INV 2nd [DRG]	DEG MODE	
Enter x and y	5 x~t 6		6
Display θ-coordinate	INV ⟨P-R⟩	Ang =	50.19442891
Display r-coordinate	x~t		7.810249676

The rectangular coordinates (5, 6) convert to the polar coordinates (7.810249676, 50.19442891°).

Selecting ⟨BAS⟩ from the CONVERSIONS menu displays another menu that enables you to change the number base used for display. Like the other conversions, ⟨BAS⟩ lets you convert the number in the display. However, after you select one of the base number modes, the calculator displays all results in the selected base.

Using Base Conversions

When you select ⟨BAS⟩ from the **CONVERSIONS** menu, the following selections are displayed.

```
BASE CONVERSIONS
DEC HEX OCT 2sC UNF
```

⟨DEC⟩	Decimal number base
⟨HEX⟩	Hexadecimal number base
⟨OCT⟩	Octal number base
⟨2sC⟩	Two's complement notation
INV ⟨2sC⟩	Signed notation
⟨UNF⟩	Unformatted mode

These selections are described on the following pages.

Decimal (Base 10)

Pressing ⟨DEC⟩ converts the displayed number to its decimal equivalent and places the calculator in the decimal mode. (The calculator is in the decimal mode when you first turn it on. You only need to press ⟨DEC⟩ if you have previously pressed ⟨HEX⟩, ⟨OCT⟩, or ⟨UNF⟩.)

The digits 0–9 may be entered in the decimal mode.

Hexadecimal (Base 16)

Pressing ⟨HEX⟩ converts the displayed number to its hexadecimal equivalent, places the calculator in the hexadecimal mode, and lights the **HEX** status indicator in the display.

The digits 0–9 and the letters A–F may be entered in the hexadecimal mode. In hexadecimal mode, special second functions, labeled A_H–F_H, are used instead of the alpha characters A–F for number entries.

Octal (Base 8)

Pressing ⟨OCT⟩ converts the displayed number to its octal equivalent, places the calculator in the octal mode, and lights the **OCT** status indicator in the display.

The digits 0–7 may be entered in the octal mode.

Hexadecimal and Octal Accuracy

The following rules apply to the calculation accuracy of number conversions.

- The conversion to hexadecimal or octal is made on the rounded integer value of the number entered in decimal mode. This rounding does not affect internal accuracy.
- A value you enter in the hexadecimal or octal mode must be an integer and not exceed 10 digits.
- Hexadecimal and octal numbers that are out of range of the display format appear as **********.
- Hexadecimal and octal results are maintained to 13 decimal digits internally.

(continued)

Two's Complement and Signed Notation

In the hexadecimal and octal modes, you can select how negative numbers are displayed and entered.

- Pressing ⟨2sC⟩ causes numbers to be displayed in two's complement notation. In this notation, the most significant bit is the sign bit, so the range of numbers that can be displayed in hexadecimal or octal mode is smaller. Negative numbers are displayed without a minus sign, but they can be entered as negative numbers using either of two methods. You can set the most significant bit for a negative number or press the [+/−] key. If you use the [+/−] key, it must be pressed after you complete the number entry. When you press the [+/−] key after pressing ⟨2sC⟩, the number in the display is immediately converted to its two's complement hexadecimal or octal equivalent (depending on which has been selected).

- Pressing [INV] ⟨2sC⟩ causes negative numbers to be displayed as the positive form preceded by a minus sign. (The calculator is in signed notation when you first turn it on. You only need to select this notation if you have previously selected two's complement.) With signed notation, you must use a minus sign when entering negative numbers. Pressing [+/−] in signed notation displays (or removes) the minus sign.

Unformatted Mode

Pressing ⟨UNF⟩ converts the calculator to the unformatted mode, allowing you to display and enter data-register contents in internal hexadecimal form.

This mode is not convenient for numeric applications. It is useful mainly to programmers because it simplifies the entry of hexadecimal values, such as those used during I/O (input/output) operations involving certain external devices.

For information on using the unformatted mode, refer to Appendix A of the *TI-95 Programming Guide*.

Example 1

Convert the decimal number 4095.6 to its octal and hexadecimal equivalents and then back to decimal.

Procedure	Press	Display
Clear display	CLEAR	0.
Select Conversions menu	CONV	CONVERSIONS
Select base menu	⟨BAS⟩	BASE CONVERSIONS
Convert rounded integer portion to octal	4095.6 ⟨OCT⟩	10000.
Convert to hexadecimal	⟨HEX⟩	1000.
Return to decimal mode	⟨DEC⟩	4095.6

Example 2

Convert the decimal number 10 to hexadecimal. Next, add FF to the number and convert the result to its two's complement. Then convert the result to its decimal equivalent.

Procedure	Press	Display
Clear display	CLEAR	0.
Select Conversions menu	CONV	CONVERSIONS
Select base menu	⟨BAS⟩	BASE CONVERSIONS
Convert to hexadecimal	10 ⟨HEX⟩	A.
Add FF	+ 2nd [F_H] 2nd [F_H] =	109.
Two's complement	⟨2sC⟩ +/−	FFFFFFFEF7.
Decimal equivalent	⟨DEC⟩	−265.

Chapter 5: Memory Operations

By using the data registers of the calculator, you can store, recall, and perform other operations on large amounts of numeric data. Data that you store in data registers is not lost when you turn the calculator off.

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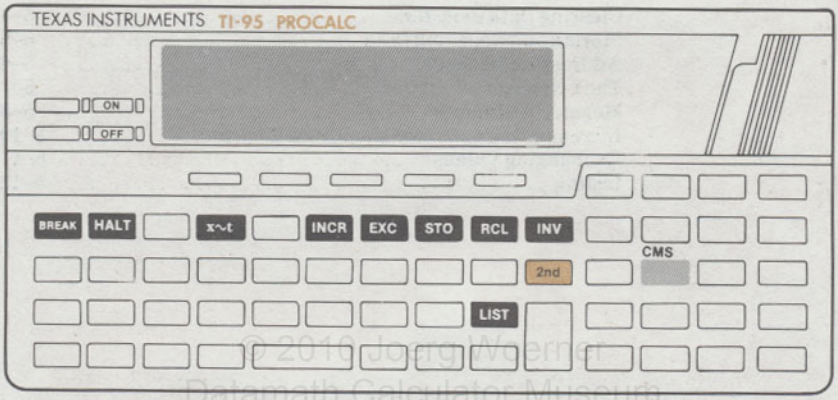
Location of the Memory Keys

The keys used to perform memory operations are shown in the figure below. Familiarize yourself with these keys and their location on the keyboard.



You can use a segment of the TI-95 memory to hold numeric values while you perform calculations with other values. You can also perform some math operations on values stored in memory.

Types of Memory

The TI-95 memory is divided into data registers, program memory, and file space. Data registers are discussed in this chapter. Program memory and file space are discussed in the *TI-95 Programming Guide*. Although you can specify the amount of memory allocated to each of the three types of memory, the default allocations are adequate for most needs.

Data Registers

The first time you turn the calculator on, 125 data registers (numbered 000 through 124) are available for storage.

Each data register can hold a numeric value or alphanumeric characters. This chapter discusses only storing, recalling, and manipulating numeric data. Operations involving alphanumeric characters are discussed in the *TI-95 Programming Guide*.

Clearing Data Registers

Before beginning a task in which you will use data registers, you should consider clearing (setting to zero) the contents of the registers you will use. You can clear all data registers or a single data register.

Clearing All Registers

The key sequence [2nd] [CMS] enables you to set to zero all memory currently allocated to data registers. Because this function clears the contents of **all** data registers, you should ensure there is no vital data stored in any registers before using it.

Clearing a Single Register

By storing a 0 in a data register, you can clear that register without affecting the contents of other registers.

Storing and recalling numbers are two of the most often-used memory functions.

Storing Data

The [STO] key followed by the data register address stores the currently displayed value in the register.

Because storing a value does not complete any pending operations, you can store a value you are entering into an expression or an intermediate result.

Example

Calculate 3×4.5^2 and store the intermediate result of 4.5^2 in data register 004.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Begin expression	3 [×]	3. *
Evaluate 4.5^2	4.5 [x^2]	20.25
Store 20.25 in register 004	[STO] 004	20.25
Display result	[=]	60.75

Recalling Data

The [RCL] key displays the value stored in a specified register. (You can use the recall function to enter a stored value into an expression.)

Example

Multiply by 6 the value previously stored in data register 004.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Begin expression	6 [×]	6. *
Recall stored value	[RCL] 004	20.25
Display result	[=]	121.5

Addressing Methods

Because there are many data registers, each memory function requires you to specify which register you wish to use. You can use several methods to address a particular data register. If you make a mistake while entering the address or any other field, press [HELP], [CLEAR], or [OFF] / [ON] to cancel the entry, and then reenter the field correctly.

Long-Form Addressing

In the examples on the previous page, a three-character field is used to address a particular data register (004). When you use such long-form addressing, you must include all three characters, including leading zeros for addresses less than 100.

Short-Form Addressing

When referring to a data register whose address is less than 100, you can reduce keystrokes by omitting any leading zeros in the field. The calculator supplies the leading zeros when you press any key other than [HELP], [CLEAR], [OFF] / [ON], or a number (digit) key.

For example, to use short-form addressing to recall the contents of data register 004 and add 12.3, press [RCL] 4 [+] 12.3 [=]. (When you press [+], the 4 is accepted as the entire field for data register 004.)

Alphabetic Addressing

You may find it easier to remember an alphabetic letter than a number. You can use the letters A through Z to refer to the first 26 data registers (000 through 025). When you use such alphabetic addressing, the memory operation is completed as soon as you enter the letter.

For example, to recall the contents of data register D (register address 003), press [RCL] D.

Indirect Addressing

An addressing method used primarily in programming is indirect addressing. This method lets you refer to a particular data register by storing its register address in a second data register.

Indirect addressing is discussed in detail in the *TI-95 Programming Guide*.

Although the t-register (temporary register) is used primarily in statistics and polar/rectangular conversions, you can use it for temporary storage of a numeric value. When using the t-register for temporary storage, you should be aware of some characteristics that make this register different from a data register.

Using the t-Register

The [x⇌t] key enables you to quickly exchange (swap) the displayed value with the value in the t-register. Because this operation requires only one keystroke to store or recall a value, you may occasionally find it more convenient than using a data register.

Example

Using the t-register, calculate $2.77^{3.55-2.77}+3.55$.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Begin calculation	2.77 [y^x]	2.77 y^x
Store 2.77 in t-register and continue problem	[x⇌t] [(] 3.55 [−]	3.55 −
Store 3.55, restore 2.77 to display	[x⇌t]	2.77
Perform subtraction, then exponentiation	[)] [+]	2.213778778 +
Restore 3.55 to display	[x⇌t]	3.55
Display result	[=]	5.763778778

Limitations

The operation of the t-register is different from that of a data register. Remember the following limitations.

- You lose any value stored in the t-register if you turn off the calculator or perform any functions that use the t-register, such as statistics functions or polar/rectangular conversions.
- You cannot perform memory arithmetic, increment, or decrement operations using the t-register.

Memory arithmetic can reduce keystrokes by letting you both perform a calculation and store its result using a single operation. Because memory arithmetic does not disturb the original displayed value and does not complete any pending operations, you can use it while entering an expression without affecting the way the expression is evaluated.

Data Register Addition

The key sequence STO + followed by the address of a data register adds the displayed value to the contents of the specified register.

For example, if the display contains the value 1000 and data register 000 contains the value 234, the key sequence STO + 000 leaves the sum 1234 in data register 000.

Data Register Subtraction

The key sequence STO − followed by the address of a data register subtracts the displayed value from the contents of the specified register.

For example, if the display contains the value 1000 and data register 000 contains the value 1234, the key sequence STO − 000 leaves the difference 234 in data register 000.

Data Register Multiplication

The key sequence STO × followed by the address of a data register multiplies the contents of the specified register by the displayed value and stores the product in the register.

For example, if the display contains the value 1000 and data register 000 contains the value 234, the key sequence STO × 000 leaves the product 234000 in data register 000.

Data Register Division

The key sequence STO ÷ followed by the address of a data register divides the contents of the specified register by the displayed value and stores the quotient in the register.

For example, if the display contains the value 1000 and data register 000 contains the value 234000, the key sequence STO ÷ 000 leaves the quotient 234 in data register 000.

Example The following example demonstrates each of the four memory arithmetic functions.

Procedure	Press	Display
Clear display	CLEAR	0.
Store 25 in register 000	25 STO 000	25.
Add 215 to register 000 (register 000 now contains 240)	215 STO + 000	215.
Subtract 200 from register 000 (register 000 now contains 40)	200 STO − 000	200.
Multiply register 000 by 2 (register 000 now contains 80)	2 STO × 000	2.
Divide register 000 by 4 (register 000 now contains 20)	4 STO ÷ 000	4.
Verify contents of register 000	RCL 000	20.

Incrementing and Decrementing a Register

You can add one to or subtract one from the contents of a register using the INCR function.

Increment and Decrement

The TI-95 includes specialized forms of data-register addition and subtraction. The [INCR] key increments the contents of a register by one and the key sequence [INV] [INCR] decrements the contents of a register by one.

Example

The following example demonstrates the use of the INCR function.

Procedure	Press	Display
Clear display	[CLEAR]	0.
Store 1234 in register 000	1234 [STO] 000	1234.
Increment register 000 by two using short-form addressing	[INCR] 0 [INCR] 0	INC _ 0 INC _ 0
Recall register 000 contents	[RCL] 000	1236.
Decrement register 000 by one using short-form addressing	[INV] [INCR] 0	INV INC _ 0
Recall register 000 contents	[RCL] 000	1235.

Exchanging Values

In addition to storing, recalling, and performing memory arithmetic, you can exchange the displayed value with a stored value.

Exchanging

The EXC key followed by the address of a data register exchanges the displayed value with the value stored in the specified register.

Exchanging values can eliminate the need to perform separate store and recall operations.

Example

Evaluate $x^2 + 4xy + 2y^2$ where $x = .25$ and $y = 1.2$. (This example uses alphabetic addressing.)

Procedure	Press	Display	
Clear display	CLEAR	0.	
Store x	.25 STO A	0.25	
Evaluate x^2	x^2 +	0.0625	+
Enter y	1.2 ×	1.2	*
Store y, recall x	EXC A	0.25	
Evaluate $x^2 + 4xy$	× 4 +	1.2625	+
Recall y	2 × RCL A	1.2	
Evaluate y^2	x^2	1.44	
Display result	=	4.1425	

You may want to know the contents of a series of data registers or the status of the calculator. The LIST function provides you with this capability. You can also list programs and labels as explained in *The TI-95 Programming Guide*. If you have a PC-324 printer, you can print the listing. For more information, refer to Chapter 6, "Using an Optional Printer."

Listing Data Registers

To list the contents of a series of data registers:

1. Press [LIST]. The display shows the list options.

2. Enter the address of the first register to list. If you do not enter an address, the list begins at register 000 each time you press the [LIST] key.

3. Select ‹REG›.

Beginning with the specified register, the calculator lists the addresses and contents at a one-second rate.

If you do not have a printer connected, you can use the [→] key to control the speed of the displayed listing.

- To pause the listing indefinitely, hold down the [→] key.
- To advance through the listing without the one-second pause, repeatedly press and release the [→] key.

Listing the Calculator Status

Press [LIST] ⟨ST⟩ to list the current calculator status.

The calculator lists the current partition settings and each parameter that is not currently set to its default setting. (Parameters that are currently set to their default settings are not listed.)

The list is displayed at a one-second rate. You can use the [→] key to control the speed of the listing.

If you have a PC–324 printer attached, the listing is also printed. For more information, refer to Chapter 6, "Using an Optional Printer."

The list below shows all possible statuses.

Partition (memory)
Angle mode (degrees, radians, or grads)
Hexadecimal mode (with or without two's complement)
Octal mode (with or without two's complement)
Flags set (flag numbers)
Fixed decimal (places)
Module (installed)
Word break mode (if turned on)
Print device (number)
Print width (number)
System mode (if selected)
Last error (since [LIST] ⟨ST⟩ function last used)

Stopping the Listing

To stop a listing before all register contents or status messages have been displayed, hold down the [BREAK] or [HALT] key until the word **LIST:** is displayed.

After you stop a listing, you can perform other operations or you can list the registers again by selecting ⟨REG⟩. The list begins at the number in the display, register. If an alpha message is in the display, you can press [CE] to see the number.

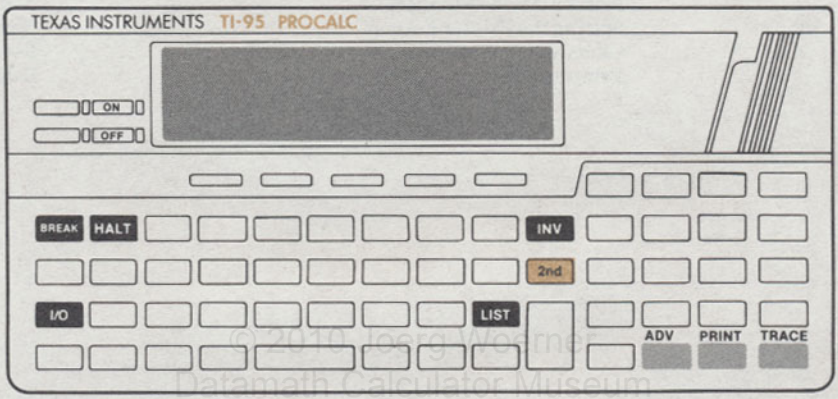
Chapter 6: Using an Optional Printer

This chapter describes how to use the printing functions of the TI-95 after you have connected an optional PC-324 printer, or another suitable printer, to your calculator.

Table of Contents

Location of the Printer Operation Keys

The keys used with the printer are shown in the figure below. Familiarize yourself with these keys and their location on the keyboard.



Two of the printer operation keys ([I/O] and [LIST]) present menus that allow you to perform some of the printer operations.

The I/O Menu

The [I/O] key displays an **INPUT/OUTPUT** menu. One of the selections on this menu lets you set certain calculator parameters used in printing. If you are using a PC-324 printer, this function is not necessary. The calculator defaults to the parameters for that printer.

```
 INPUT / OUTPUT
TAP  PRT  CIO  KW
```

⟨TAP⟩	Cassette tape operations (discussed in the *TI-95 Programming Guide*)
⟨PRT⟩	Selects **PRINTER SETUP** menu
⟨CIO⟩	Call I/O (discussed in the *TI-95 Programming Guide*)
⟨KW⟩	Key wait function (discussed in the *TI-95 Programming Guide*)

The LIST Menu

The [LIST] key lets you print lists of items such as data registers and program labels.

```
 LIST:
REG  PGM  LBL  ST
```

⟨REG⟩	List data registers
⟨PGM⟩	List program
⟨LBL⟩	List program labels
⟨ST⟩	List calculator status

Printer Device Numbers

Because the calculator can connect to different devices through a single peripheral port, each device has a unique device number to identify it. The calculator assumes a particular device number for all printer operations unless you change the number.

Default Device Number

The first time you turn the calculator on, the printer device number defaults to 012, the device number for the PC-324 printer. If you have a PC-324 printer attached, you can use all the printing functions of the calculator without changing the default device number.

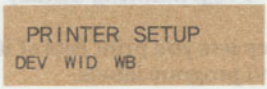
If you do not have a PC-324 printer attached, you can change the device number. The new number is saved even if you turn the calculator off and back on.

Changing the Device Number

If you have a different printer attached, you must use the **INPUT/OUTPUT** menu to change the calculator's printer device number before using your printer.

To change the device number:

1. Determine the device number of your printer.
2. Press [I/O] ⟨PRT⟩ to select the **PRINTER SETUP** menu.



3. Select ⟨DEV⟩ and enter the device number of your printer.

When you enter the last digit, the new device number becomes active and the **PRINTER SETUP** menu returns. You can now use the printing functions of the calculator.

In addition to setting the printer device number, you can use the PRINTER SETUP menu to control the format of printed data. You can specify the maximum number of characters to be printed on each line, and you can specify whether to break after a word at the end of a line if there is not enough room to print all of the next word on that same line.

Setting Line Width

When you first turn the calculator on, the default line width is 24 characters per line, the PC-324 printer setting. If your printer prints more or less than 24 characters on a line, you may want to change the calculator's line-width setting to match your printer. If you change the line width, the new line width is saved, even if you turn the calculator off and back on.

To change the line-width setting:

1. Press [I/O] ⟨PRT⟩ ⟨WID⟩ to select the width option on the **PRINTER SETUP** menu.

2. Enter a two-digit number for the new line width. (The number you enter must be between 01 and 80.)

   When you enter the second digit, the new line width becomes active and the display returns to the **PRINTER SETUP** menu.

Setting Word Break

When you first turn the calculator on, the word break feature is off. If you turn word break on, it is saved, even though you turn the calculator off and back on.

```
These two examples illus
trate the effect of usin
g word break.
```

Word break off (default)

```
These two examples
illustrate the effect of
using word break.
```

Word break on

If you are printing text, such as long alphanumeric messages, you may want to turn word break on to prevent the words from being broken.

To turn word break on, press [I/O] ⟨PRT⟩ ⟨WB⟩.

To turn word break off, press [I/O] ⟨PRT⟩ [INV] ⟨WB⟩.

You can use the calculator keyboard to control the printer. In addition to advancing the paper and printing the current contents of the display, you can print an audit trail of calculator operations and their results.

Advancing the Paper

The 2nd [ADV] key sequence lets you advance the paper in the printer by one line without printing anything. This lets you use the advance function in a program.

Printing the Display Contents

The 2nd [PRINT] key sequence lets you print the contents of the display. When you use the print function:

- An alphanumeric message is printed in its entirety, even though only a portion of the message may be visible in the 16-character display.
- Status indicators and function-key labels are not printed.
- Some special characters may be displayed but not printed.

Printing Codes

In addition to numbers, letters, and punctuation symbols, your printer may also respond to other codes.

- Control codes may cause your printer to perform some action, such as setting double line spacing. The PC-324 printer responds to the following codes.

  Code 13 produces a carriage return and line feed.
  Code 17 activates single spacing.
  Code 18 activates double spacing.

- Special character codes enable you to produce special symbols, such as boxes on certain printers. Other printers may not have this capability.

To use the print function to send any of these codes to a printer, you must first generate the code using the CHR function of the TI-95 alpha mode. Because the alpha mode is used primarily in programming, it is described in the *TI-95 Programming Guide*.

Using the Trace Mode

The 2nd [TRACE] key sequence lets you turn the calculator's trace mode on or off.

Trace mode is useful when you need a "printing calculator." When trace mode is on, the calculator automatically prints each display as it appears, eliminating the need for you to press 2nd [PRINT] with each new display. This also produces a hard copy of the inputs and outputs of each function executed.

The trace mode can also be useful in isolating errors in a program. Use of the trace mode for this purpose is discussed in the *TI-95 Programming Guide*.

To turn trace mode on, press 2nd [TRACE].

To turn trace mode off, press INV 2nd [TRACE].

Using Printer Power for the Calculator

If you have a PC-324 printer connected to the calculator, the printer provides power for the calculator from either the AC adapter or the batteries.

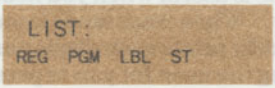
When you see a **P** in the status indicator area of the display, this indicates the PC-324 printer batteries are low and should be replaced.

If you have a PC-324 or another suitable printer attached and properly set up when you use the LIST function, the list is printed as well as displayed. You can print lists of data register contents, status settings of the calculator, stored program keystrokes, and program labels. If you wish, you can stop a listing before it has finished.

Printing Data Registers

To print a list of the contents of a series of data registers:

1. Press [LIST]. The display shows the list options.



2. Enter the address of the first register you want to print. If you do not enter an address, the listing begins at register 000 each time you press the [LIST] key.
3. Select ‹REG›.

Beginning with the specified register, the address and contents of each register are displayed and printed as shown in the following sample.

000	4.
001	0.
002	1.234
003	0.
004	−7.89333333

Printing the Calculator Status

To print the current status of the calculator, press LIST <ST>.

The calculator prints the current partition settings and each parameter that is not currently set to its default setting. (Parameters that are currently set to their default settings are not printed.)

For example, if you are using the default partitioning and have selected the radians angle mode, the printed result is similar to the following.

```
P1000,R125,F5200
ANGLE MODE = RAD
FLAGS SET = NONE
MODULE = NONE
LAST ERROR=NONE
```

Refer to Chapter 5, "Listing the Calculator Status," for a complete list of the available statuses.

(continued)

Before you can list a program or its labels, you must first load the program into program memory (using the procedures described in the *TI-95 Programming Guide*). Because programs supplied in software cartridges cannot be loaded into program memory, you cannot list those programs or their labels.

Printing a Program

To print a listing of the program currently stored in program memory:

1. Press LIST ⟨PGM⟩.

   The display shows:

2. To start the listing at the first program step, select ⟨1st⟩. To start the listing at the current program step (described in the *TI-95 Programming Guide*), select ⟨PC⟩.

   Beginning with the specified step, the calculator prints a program listing. Each line of the listing begins with the program address of the first instruction in the line, as shown in the following sample.

```
0000 LBL XX CLR 20
0006 STO 020
0009 LBL YY INC 020 39
0017 IF< 020 GTL ZZ CLR
0024 STO IND 020 GTL YY
0031 LBL ZZ CLR STO 020
0038 HLT
```

The format of your printed copy may be slightly different, depending on the current setting of line width.

Printing Program Labels

To print the labels of the program currently stored in program memory:

1. Press [LIST] ⟨LBL⟩.

   The display shows:

   ```
   START LISTING AT
   1st PC
   ```

2. To start the listing at the first program label, select ⟨1st⟩. To start the listing at a particular program label (described in the *TI-95 Programming Guide*), select ⟨PC⟩.

   Beginning with the specified program step, the calculator prints a list of program labels. The address and name of each program label are printed, as shown in the following sample.

   ```
   0023 LBL BB
   0041 LBL AZ
   0058 LBL AA
   0109 LBL P
   ```

Stopping a Listing

Normally, the printing of a list continues until all items have been printed.

To stop a listing before it has finished, hold down the [BREAK] or [HALT] key until the word **LIST:** reappears in the alphanumeric display.

After stopping a listing, you can perform other calculator operations or restart the listing.

Appendix A: Reference Information

This appendix contains reference information that you may need as you become more experienced in using your calculator.

Table of Contents

System Parameter Settings

The calculator has several parameters which can be set and reset to different conditions. These parameters are affected when you change batteries, reset the calculator, turn the calculator off and on, clear the calculator, or use the HELP function. The information in this table lists the effects of these actions on each parameter.

Parameter	Effect of New Batteries* (Default Condition)	Effect of RESET or OFF ON	Effect of CLEAR	Effect of HELP ⟨YES⟩
Display	cleared	cleared	cleared	cleared
Display format	standard	standard	removes EE	standard
Decimal point	floating	floating	no effect	floating
Number base	decimal	decimal	no effect	decimal
Memory partition	125 data registers, 1000 program steps, and 5200 file bytes	no effect	no effect	**
Data registers	cleared	no effect	no effect	no effect
Program registers	cleared	no effect	no effect	no effect
File space	cleared	no effect	no effect	no effect
Statistics registers	cleared	no effect	no effect	no effect
Temporary register	cleared	cleared	no effect	cleared
AOS™ stack	cleared	cleared	cleared	cleared
User subroutine stack	cleared	cleared	no effect	no effect

* You can use a PC-324 printer (if available) to power the calculator while you change batteries to avoid these effects.

** Memory not used as file space is equally divided into program steps and data registers.

Parameter	Effect of New Batteries* (Default Condition)	Effect of RESET or OFF ON	Effect of CLEAR	Effect of HELP ⟨YES⟩
Angle mode	degrees	no effect	no effect	degrees
Alpha mode	reset	reset	no effect	reset
Alpha registers	TI-95 PROCALC	TI-95 PROCALC	no effect	no effect
Uppercase/ lowercase lock	uppercase	uppercase	no effect	no effect
Learn mode	reset	reset	no effect	no effect
Printer device number	set to 12	* usually no effect	no effect	no effect
Print width	set to 24	** usually no effect	no effect	no effect
Word break	off	no effect	no effect	no effect
Trace	off	off	no effect	no effect
User flags	reset	reset	no effect	resets flag 15 (Halt On Error) only
System memory	protected	protected	no effect	protected
Halt on error	off	off	no effect	off

* Set to 12 if PC-324 printer is attached

** Set to 24 if original device was not 12, but PC-324 is attached now

The following lists show the functions assigned to the F1-F5 keys when certain other keys are pressed. Many of these redefined keys also have inverse functions. Although they do not appear in the menu, they are shown here. Detailed information on how to use these system menus is contained in sections of this manual and in the *TI-95 Programming Guide*.

- ALPHA
  - DEL: delete alpha character
  - INS: insert alpha characters
  - COL: move cursor to column
  - MRG: merge with alpha register
  - RCA: recall to alpha register
  - STA: store from alpha register
  - CHR: enter a character code
  - LC: set/reset lowercase lock
- CONV conversions
  - MET: metric conversions
    - F-C: Fahrenheit to Celsius
    - INV F-C: Celsius to Fahrenheit
    - G-L: gallons to liters
    - INV G-L: liters to gallons
    - #-K: pounds to kilograms
    - INV #-K: kilograms to pounds
    - i-m: inches to millimeters
    - INV i-m: millimeters to inches
    - f-M: feet to meters
    - INV f-M: meters to feet
  - DMS: degrees/minutes/seconds to decimal degrees
  - INV DMS: decimal degrees to degrees/minutes/seconds
  - ANG: degrees/radians/grads
    - D-R: degrees to radians
    - INV D-R: radians to degrees
    - D-G: degrees to grads
    - INV D-G: grads to degrees
    - R-G: radians to grads
    - INV R-G: grads to radians
  - P-R: polar to rectangular
  - INV P-R: rectangular to polar
  - BAS: number base
    - DEC: decimal mode
    - HEX: hexadecimal mode
    - OCT: octal mode
    - 2sC: two's complement mode
    - INV 2sC: signed mode
    - UNF: unformatted mode

STAT statistics

- CLR: clear statistics registers
- FRQ: frequency for entry
- MN: mean
- s: sample standard deviation
- INV s: population standard deviation
- m-b: slope-intercept
- r: correlation coefficient
- y': predicted y value
- INV y': predicted x value
- SHW: show statistics values
  - CS1: 1-variable statistics
  - CS2: 2-variable statistics

(1-VARIABLE)
n: number of points
Sx: sum of x's
Sxx: sum of x^2's
Lfr: last frequency
Lx: last x entered

(2-VARIABLE)
n: number of points
Sy: sum of y's
Syy: sum of y^2's
Ly: last y entered
Sxy: sum of xy's
Sx: sum of x's
Sxx: sum of x^2's
Lfr: last frequency

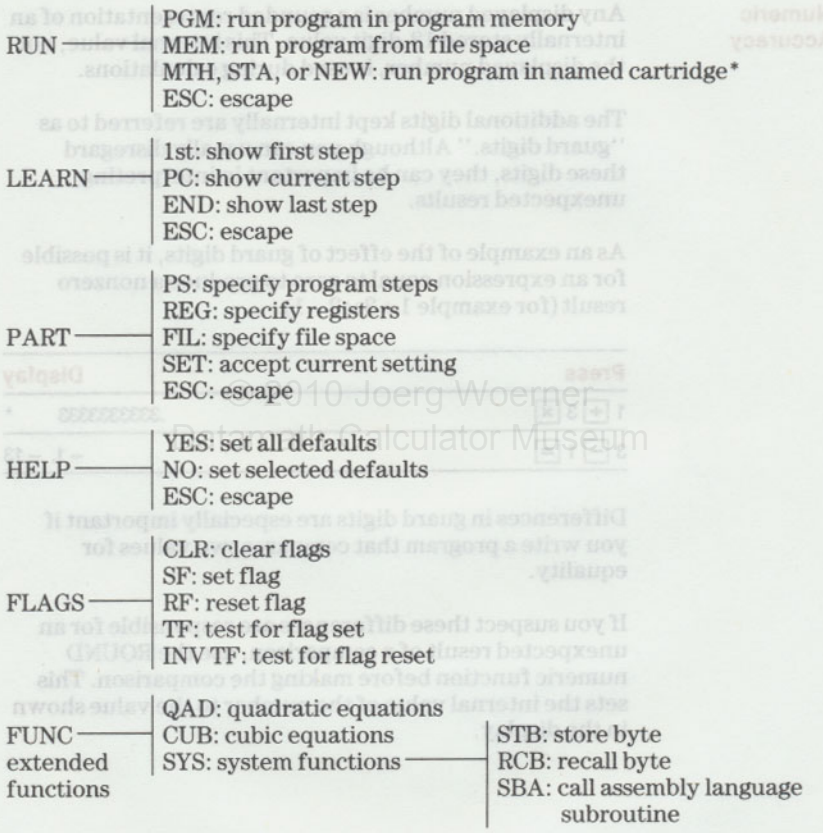
NUM numeric functions

- INT: integer
- FRC: fraction
- R#: random number
- INV R#: random number generator seed
- RND: round internal value
- SGN: signum
- LCM: least common multiple/greatest common divisor
- PF: prime factors
- ABS: absolute value

- REG: list registers
- LIST PGM: list program
  - 1st: start at first step
  - PC: start at current step
- LBL: list program labels
- ST: list calculator status
  - 1st: start search at first step
  - PC: start search at current step

(continued)

- FILES
  - GET: load program or data from files
  - INV GET: load program or data from RAM cartridge (program only)
  - PUT: save program or data in files
  - INV PUT: save program or data in RAM cartridge (program only)
  - DF: delete specified file
  - INV DF: delete specified file in RAM cartridge (program only)
  - CAT: show catalog of directory
  - INV CAT: show catalog of RAM cartridge (program only)
  - CD: clear all files in directory
  - INV CD: clear all files in RAM cartridge (program only)
  - NAM: rename a RAM cartridge
- I/O
  - TAP: tape storage functions
    - RD: read from tape
    - WRT: write to tape
    - VFY: verify tape
  - PRT: printer setup
    - DEV: set printer device #
    - WID: set print width
    - WB: word break on
    - INV WB: word break off
  - CIO: call I/O subroutine
  - KW: key wait
- TESTS conditional tests
  - IF>: if greater than
  - INV IF>: if less than or equal
  - IF<: if less than
  - INV IF<: if greater than or equal
  - IF = : if equal
  - INV IF = : if not equal
  - DSZ: decrement and skip if zero
  - INV DSZ: decrement and skip if not zero
  - Y/N: yes/no input test



* The name may be the name of a library cartridge or a name assigned to a Constant Memory™ cartridge.

Accuracy Information

The calculator maintains values internally to greater accuracy than the values it displays. Occasionally, the difference between a displayed number and its internal value can produce unexpected results.

Numeric Accuracy

Any displayed number is a rounded representation of an internally stored 13-digit value. This internal value, not the displayed number, is used during calculations.

The additional digits kept internally are referred to as "guard digits." Although you can usually disregard these digits, they can be important in interpreting unexpected results.

As an example of the effect of guard digits, it is possible for an expression equal to zero to produce a nonzero result (for example $1 \div 3 \times 3 - 1$).

Press	Display
1 ÷ 3 ×	.3333333333 *
3 − 1 =	−1. −13

Differences in guard digits are especially important if you write a program that compares two values for equality.

If you suspect these differences are responsible for an unexpected result of a comparison, use the ROUND numeric function before making the comparison. This sets the internal value of the number to the value shown in the display.

Internal Values

The 13 digits of the mantissa are displayed when you use the [2nd] [13d] key sequence.

All the digits of the internal value are shown in the unformatted mode (a selection of [CONV] ⟨BAS⟩). An unformatted number has three parts:

- The left 13 digits are the base 10 mantissa with the decimal implied after the first digit.
- The 14th digit conveys the sign of both the mantissa and the exponent. (Because the signs are indicated by a digit, the [+/−] key has no effect in this mode.)

Mantissa Sign	Exponent Sign	Sign Digit
+	+	0
−	+	4
+	−	8
−	−	C

- The last two digits are the exponent of scientific notation.

The main use of the unformatted mode is the entry of hexadecimal values for CIO (call I/O) instead of numeric calculations.

Number Limits

The range of numbers that can be displayed depends on the display format in use. This table lists the allowable range of numbers for each format.

Display Format	Allowable Range
Standard notation	-9999999999 to -0.000000001 zero 0.000000001 to 9999999999
Scientific or engineering notation	-9.999999×10^{99} to -1×10^{-99} zero 1×10^{-99} to 9.999999×10^{99}
Hexadecimal	$-$FFFFFFFFF to FFFFFFFFF
Octal	-7777777777 to 7777777777

Use this list of items to find a topic of reference. Also see the Key Index inside the front cover.

Appendix B: In Case of Difficulty

This appendix contains information you will find useful if you encounter problems using your calculator.

Table of Contents

The information in this section may be useful if your calculator does not function properly. If the suggested solution does not correct the problem, refer to "Service Information" on page B-10.

Difficulty	Suggested Solution
An error message appears in the display.	Refer to the list of error messages beginning on page B-4. If a solution is not found: a. Use the HELP function. See "Using the HELP Function" in Chapter 1. b. Press CLEAR to clear the calculator. See "Clearing the Calculator" in Chapter 2. c. Turn the calculator off and back on. See "Turning the Calculator On and Off" in Chapter 1.
The entire display is blank when you turn the calculator on.	a. Adjust the contrast control. b. Check for correct installation of batteries. c. Check battery condition.
Information in the display disappears.	a. Press ON. The Automatic Power Down feature may have turned the calculator off. b. Check battery condition.
Information is displayed, but calculator does not respond to keystrokes.	Check RUN indicator. (Program may be in progress.) Press BREAK or HALT.
Calculator will not go into learn mode.	a. Cancel alpha mode, if active. b. Check for program size of zero.
Calculations produce unexpected results.	a. Check for display rounding caused by the current decimal fix setting. b. Check for HEX or OCT mode (using the HELP key). c. Refer to "Accuracy Information" on page A-8.

Difficulty	Suggested Solution
Printer does not print.	a. Make sure printer is properly connected. b. Make sure printer device number matches that of printer (using [I/O] ⟨PRT⟩ ⟨DEV⟩). The PC-324 device number is 12.
Printer does not use full page width when printing.	Set page width to match printer (using [I/O] ⟨PRT⟩ ⟨WID⟩). The PC-324 page width has a default width of 24 characters.
Printer does not stop printing.	a. Press [BREAK] or [HALT]. (Program may be running.) b. Make sure trace mode is turned off (using [INV] [2nd] [TRACE]).
Any other difficulty that does not display an error message	a. Use the HELP function. See "Using the HELP Function" in Chapter 1 for instructions. b. List the calculator status. See "Listing" in Chapter 5 for instructions. c. Clear the calculator. See "Clearing the Calculator" in Chapter 2 for instructions. d. Turn the calculator off and back on. See "Turning the Calculator On and Off" in Chapter 1 for instructions. e. Reset the calculator. See "Turning the Calculator On and Off" in Chapter 1 for instructions.

When an error condition occurs, the ERROR status indicator shows in the display, accompanied by an error message. This table lists messages, alphabetically, that you may encounter when using the TI-95. The error number is included, although it is not displayed, to help you identify error numbers you might see when you use the LIST ⟨ST⟩ (status) function.

Error Message	Possible Cause
AOS STACK FULL (3)	a. Exceeded the limit of eight pending math operations b. Exceeded the limit of 15 levels of parentheses
CASSETTE ERROR (17)	a. No files on the tape b. Invalid file header on the tape c. No cassette recorder or cassette interface attached
DID NOT VERIFY (18)	File on tape does not match the data in memory
ERROR IN DATA (19)	Both copies of data on the tape are bad
FILES IN USE (14)	Attempted to partition already occupied file space as program memory or data registers

Error Message	Possible Cause
ILLEGAL FIELD (7)	a. Most significant digit of the SBA field is zero or greater than six
	b. Register specified for indirect addressing contains a value with an exponent greater than three (STB, RCB, SF, RF, TF, WID, COL, CHR, FIX, DEV, SBA, or SHW)
	c. Exceeded 99 for the SF, RF, or TF field
	d. Exceeded 80 or entered 0 for the COL or WID field
	e. Exceeded 255 for the CHR field
	f. Exceeded 9 for the FIX field
	g. Exceeded 255 or entered 0 for the DEV field
	h. Exceeded 8 for the SHW field
	i. Entered a non-ASCII field for NAM, PUT, GET, DF, DFN, DFA, SBL, RD, WRT, VFY, or GTL
INADEQUATE SPACE (20)	a. Attempted the PUT function when not enough room is in the directory
	b. Attempted the GET or RD function when not enough room is in the partition
	c. Requested too many program steps or registers in the partition

(continued)

Error Message	Possible Cause
INVALID ADDRESS (8)	a. Addressed a program step larger than the current partitioning b. Attempted to direct program execution past the end of program memory c. Main memory or file address is specified with HEX digits
INVALID ARGUMENT (2)	a. Attempted to take the common or natural logarithm of a number less than or equal to zero b. Attempted to take the square root of a negative number c. Attempted to raise a negative number to a power other than positive or negative integers d. Attempted to determine the root of a negative number e. Attempted to take the arcsine or arccosine of a number greater than 1 or less than -1 f. Attempted to take the sine, cosine, or tangent of an angle greater than $\pi/2 \times 10^{10}$ radians g. Attempted to take the hyperbolic arccosine of a value less than 1 h. Attempted to take the hyperbolic arctangent of a value greater than 1, less than -1, or equal to ± 1

Error Message	Possible Cause
INVALID DIR/FILE (12)	a. Failed to find specified file (RUN, SBA, GET, F1–F5, RTN, etc.)
	b. Failed to find specified directory (RUN, SBA, etc.)
	c. Directory PGM or library cartridge name was specified in the alpha register and used for SBA 6xx
	d. Attempted to rename a module with no RAM cartridge in the port
	e. No program files in chosen directory for RUN function
	f. No directory present for file functions (PUT, GET, CD, NAM, CAT, or DF)
	g. Used "+" as the first character in a program file name
INVALID ENTRY (13)	a. Attempted an illegal factorial operation (factorials operate only on positive whole integers, zero, and positive and negative half integers)
	b. Attempted to store a number greater than 255 with the STB function
	c. Requested more than 6200 file bytes when partitioning
	d. Specified a negative value or zero for PUT or WRT register file
	e. Attempted to use the nPr, nCr, LCM, or PF functions for input other than positive integers

(continued)

Error Message	Possible Cause
INVALID REGISTER (9)	a. Attempted to address a data memory outside the current partitioning b. Attempted to PUT or WRT a data file larger than the current data memory partitioning c. Most significant digit of a four-digit register address is not 0, 2, 3, or 6 d. Attempted to access a system register outside the range 0–139 e. Specified the last user register or system registers 0–16 for CIO f. Attempted STA or RCA within the last nine user registers or within the first 16 or last nine system registers
INVALID SEQUENCE (6)	a. Attempted SBA 5— outside a library cartridge b. Attempted RCB with an address in the system ROM c. Attempted to use a flag greater than 15 outside a program or system mode
I/O ERROR nnn (4)	Return status from CIO is not 0. Actual status returned is nnn.
LABEL NOT FOUND (11)	Addressed a label that does not exist in current program (can be file or program memory)
MORE DATA IN PGM (21)	File on tape verified correctly, but there was more data in program memory after verified amount
NO DATA FOUND (5)	Attempted to store an empty program file to directory or tape

Error Message	Possible Cause
NO SOLUTION (15)	a. Attempted to compute mean when there are zero or fewer points b. Attempted to compute standard deviation, r, m–b, x', or y' when there are one or fewer points c. Attempted to compute x' when slope is zero d. Computed the correlation coefficient of a data set with a zero or infinite slope
OVERFLOW (1)	a. Calculated a result that exceeds the numeric range of the calculator b. Divided by zero c. Raised zero to a power less than zero d. Attempted to calculate the tangent of 90° or 270°, $\pi/2$ or $3\pi/2$ radians, 100 or 300 grads, or their rotational multiples, such as 450° e. Attempted to take the factorial of a number larger than 69.5
SBR STACK FULL (10)	Exceeded the limit of eight nested subroutines
WRONG FILE FOUND (16)	Found a file on the tape other than the one specified
**********	Although not an error message, this indicates you tried to convert a number from decimal to octal or hexadecimal which is too large to be displayed

If the solutions suggested by "General Difficulties" and "Error Messages" do not correct a problem you may have with your calculator, please call or write Consumer Relations to discuss the problem.

For Service and General Information

If you have questions about service or the general use of your calculator, please call Consumer Relations at:

1-806-747-1882.

Please note that this is a toll call, and collect calls are not accepted.

You may also write to the following address:

Texas Instruments Incorporated
Consumer Relations
P.O. Box 53
Lubbock, Texas 79408

Please contact Consumer Relations:

- Before returning the calculator for service.
- For general information about using the calculator.

For Technical Information

If you have technical questions about the operation of the product or programming applications, call 1-806-741-2663. We regret that we cannot accept collect calls at this number. As an alternative, you can write Consumer Relations at the address given above.

Express Service

Texas Instruments offers an express service option for fast return delivery. Please call Consumer Relations for information.

Calculator Accessories

If you are unable to purchase calculator accessories (such as carrying cases or adapters) from your local dealer, you may order them from Texas Instruments. Please call Consumer Relations for information.

Returning Your Calculator for Service

A defective calculator will be either repaired or replaced with the same or comparable reconditioned model (at TI's option) when it is returned, postage prepaid, to a Texas Instruments Service Facility.

Texas Instruments cannot assume responsibility for loss or damage during incoming shipment. For your protection, carefully package the calculator for shipment and insure it with the carrier. Be sure to enclose the following items in the package:

- Your full return address
- Any accessories related to the problem
- A note describing the problem you experienced
- A copy of your sales receipt or other proof of purchase to determine warranty status

Please ship the calculator postage prepaid; C.O.D shipments cannot be accepted.

In-Warranty Service

For a calculator covered under the warranty period, no charge is made for service.

Out-of-Warranty Service

A flat-rate charge by model is made for out-of-warranty service. To obtain the service charge for a particular model, call Consumer Relations **before** returning the product for service. (We cannot hold products in the Service Facility while providing charge information.)

Texas Instruments Service Facilities

U.S. Residents (U.S. Postal Service)
Texas Instruments
P.O. Box 2500
Lubbock, Texas 79408

U.S. Residents (other carriers)
Texas Instruments
2305 N. University
Lubbock, Texas 79415

Canadian Residents Only
Texas Instruments
41 Shelley Road
Richmond Hill, Ontario L4C 5G4

One-Year Limited Warranty

This Texas Instruments electronic calculator warranty extends to the original consumer purchaser of the product.

Warranty Duration

This calculator is warranted to the original consumer purchaser for a period of one (1) year from the original purchase date.

Warranty Coverage

This calculator is warranted against defective materials or workmanship. **This warranty is void if the product has been damaged by accident, unreasonable use, neglect, improper service, or other causes not arising out of defects in material or workmanship.**

Warranty Disclaimers

Any implied warranties arising out of this sale, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are limited in duration to the above one-year period. Texas Instruments shall not be liable for loss of use of the calculator or other incidental or consequential costs, expenses, or damages incurred by the consumer or any other user.

Some states do not allow the exclusion or limitations of implied warranties or consequential damages, so the above limitations or exclusions may not apply to you.

Legal Remedies

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Warranty Performance

During the above one-year warranty period, your defective calculator will either be repaired or replaced with a reconditioned comparable model (at TI's option) when the product is returned, postage prepaid, to a Texas Instruments Service Facility.

The repaired or replacement calculator will be in warranty for the remainder of the original warranty period or for six months, whichever is longer. Other than the postage requirement, no charge will be made for such repair or replacement.

Texas Instruments strongly recommends that you insure the product for value prior to mailing.

C. C.

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