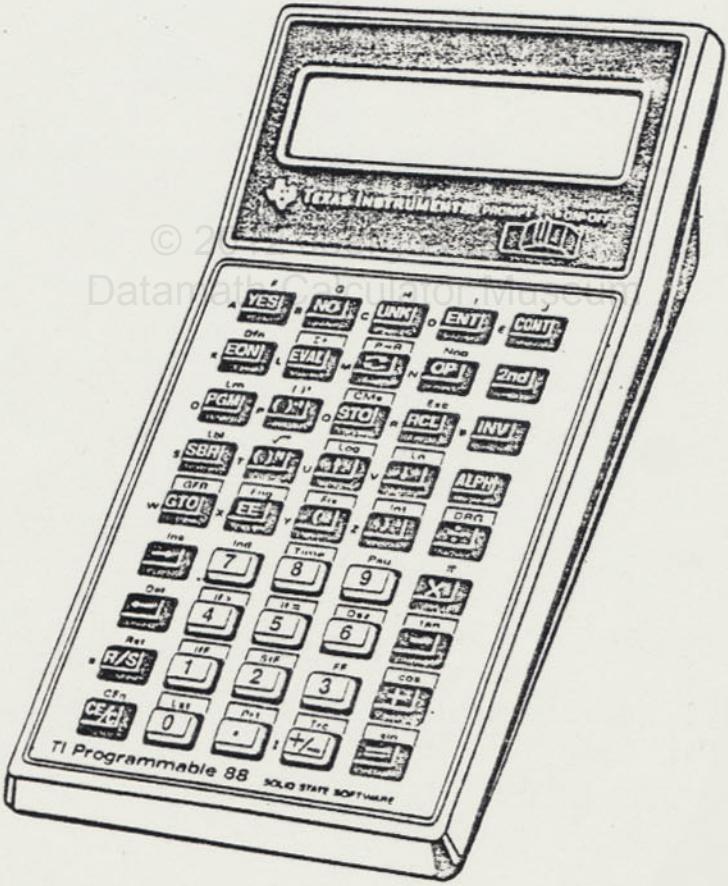
TEXAS INSTRUMENTS PROGRAMMABLE 88
USER'S REFERENCE GUIDE

A Complete Owner's Manual
for the TI Programmable 88.



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Key Index

This indexed keyboard provides a quick page reference to the description of each key. First function page references appear below the key symbols. Second function page references appear above the key symbols. Inverse function page references appear to the left of the keys. Page references for the Alpha Mode functions [Σ] and [!] appear below the key. Refer to page 4-14 for information on the user-defined labels [A] through [2nd][Σ]. Refer to "Appendix H" for a list of OP code page references.

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IMPORTANT

Record the serial number from the bottom of the unit and purchase date in the space below. The serial number is identified by the words "SERIAL NO." on the bottom case. Always reference this information in any correspondence with TI.

TI PROGRAMMABLE 88

Model No. _____ Serial No. _____ Purchase Date _____

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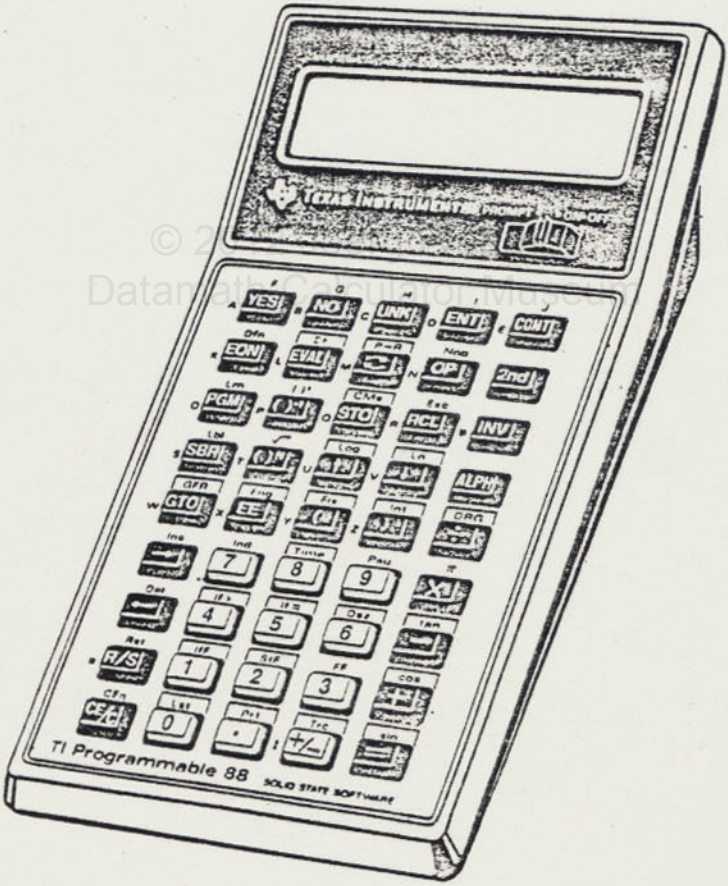

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TEXAS INSTRUMENTS PROGRAMMABLE 88

USER'S REFERENCE GUIDE

A Complete Owner's Manual

For the TI Programmable 88.

First Edition March 2012

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INTRODUCTION

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Introduction
FEATURES

CHAPTER 1

Texas Instruments, inventor of the integrated circuit and one of the largest manufacturers of programmable calculators in the world, welcomes you to a new world of hand-held computing. Whether engineer, scientist, businessman, educator, or student, you can solve problems faster and easier using the TI Programmable 88 with its alphanumeric display capability and broad selection of preprogrammed *Solid State Software*™ library modules.

If you are new to programming, we are confident that you will quickly learn to use and appreciate the "user-friendly" features of this product. If you are already familiar with programmable calculators, you will find the new features of the TI-88 greatly enhance the power, usefulness, and convenience of owning a portable, programmable computing system.

FEATURES

- **Alphanumeric Display** capability permits prompts, program titles, operating instructions, labels, program mnemonics, and system messages to be displayed in readable English.
- **Constant Memory**™ feature saves all information stored in memory even when the calculator is turned off.
- **Memory Expansion** feature allows increase of available memory by installation of one or two **Constant Memory**™ modules. **Constant Memory** modules may be installed in either or both module ports and increase memory capacity by 1184 program steps or 148 data memories per module. The battery in each **Constant Memory** module maintains all information stored in the module for an estimated lifetime of five years and allows the module to be removed from the calculator without altering its contents.
- **Module "Numbering"** feature permits creation of your own program modules which retain their contents when removed from the calculator and are fully compatible with other TI-88 calculators.
- **Master Library** module provided with the calculator contains 12 general purpose application programs. Additional *Solid State Software* libraries in a wide range of professional and academic fields are available for use with the calculator.

CHAPTER 1

Introduction

FEATURES

- **Main Prompting Sequence** guides you in setting the calculator's time, date, and alarm and in running *Solid State Software* programs.
- **Special Equation Mode™** for solving repetitive problems containing variables. Equations of up to 88 instructions can be keyed into memory, using variables similar to those in the original problem. Each time the [EVAL] key is pressed, the calculator evaluates the equation and displays the result. If equation variables have been "defined" during their entry, the calculator prompts for the input of current variable values during the evaluation process.
- **Time and Date** features allow the calculator to keep accurate 12 or 24 hour time and maintain the date and day of the week even when turned off. The time and date settings can be used in programs for testing, calculations, and timing applications.
- **Tone** feature allows the calculator to sound a tone at a specified time or when directed from the keyboard or in a program. Keyboard tone, tone-on-error, and tone-on-cue options allow audible identification of key presses, errors, or cue states.
- **Algebraic Operating System (AOS™)** allows most problems and equations to be entered into the calculator just as they are written. Answers are obtained simply and directly—no awkward transpositions, intermediate calculations, or misleading key sequences are required.
- **Memory Partitioning** permits calculator memory (including any unnumbered memory expansion modules installed) to be divided into whatever proportion of data and program memory suits your needs.
- **Descriptive Error Messages** permit easy identification and correction of error conditions.
- **Hierarchy Instructions** permit user access to the calculator's internal registers and allow operations to be performed on the digit and bit level.
- **Optional Printer** accessory allows printing of calculations, program input and output, program listings, and Trace Mode audit trail symbols.
- **Optional Cassette Interface** accessory allows recording of programs or data on audio cassette tape, providing virtually unlimited storage capabilities.

FUNCTIONS

- **Display Versatility:**
  Standard 10-digit display format
  Scientific notation format with automatic entry when results exceed limits of standard display
  Engineering notation format
  Fixed-decimal format to control the number of decimal places shown in the display
  Rounding function to control level of accuracy
  Show digits function to allow viewing of internal "guard" digits
  Special unformatted display mode allows examination and entry of numbers and program instructions in the calculator's internal storage format.
- **Mathematical Functions:**
  Arithmetic operations
  Up to 17 levels of "nested" parentheses
  Universal roots and powers function (allows powers or roots to be "nested")
  Reciprocal, factorial, and integer powers functions
  Absolute value and signum functions
  Square root, integer, and fraction functions
  Logarithmic functions (both common and natural)
  Trigonometric functions (angles may be entered or computed in degrees, radians, or grads)
  Pi (π) accurate to 13 digits
  Degrees/radians/grads, degrees-minutes-seconds/decimal degrees, polar/rectangular, and hexadecimal/decimal conversion functions
  Time addition and subtraction functions
  Implied multiplication option
  Accuracy ensured by computation to 16 digits and storage internally to 13 digits

Introduction

FUNCTIONS

- **Data memory functions:**
  - Store and recall from any data memory
  - Display/Memory exchange with any data memory
  - Perform arithmetic operations directly into any data memory
  - Define variable function for prompted entry of values into data memories
  - List the contents of data memory beginning with any memory
- **Statistical Functions:**
  - Entry of single- or paired-variable data
  - Computation of mean and standard deviation (both N and N-1 weighting)
  - Linear regression analysis with computation of Y-intercept and slope, correlation coefficient, Y-estimate, and X-estimate
  - Trend-line analysis
  - Full data editing capability
- **Alphanumeric functions:**
  - Keyboard and program entry of 128 alpha characters, including upper and lower case letters, punctuation marks and symbols, numeric superscipts, and common Greek letters
  - Display or printing of 16-character single- or multiple-line messages and instructions
  - Special four-characters-or-fewer labeling of display or printer output
  - Right and left circular shift functions
  - Recall alpha function
  - Full alpha editing capability
  - Special "block" function for combining alpha messages and numeric data

- **Program functions:**
  - Alphanumeric program mnemonics
  - Complete program editing capability
  - 10 user-definable keys
  - 10 subroutine levels
  - 26 alpha labels and 100 numeric labels
  - Transfer instructions (3 different types, including relative transfers)
  - Decision-making instructions (3 different types)
  - Concatenation of decision-making instructions
  - 24 user-defined flags (in two sets) and 4 system flags
  - Program access to and control of time, date, tone, and other general options
  - Full indirect capabilities (40 instructions)
  - Program step/display operations
  - Special hierarchy instructions (including direct and indirect hierarchy register control, digit, and bit instructions)
- **Program Prompting functions** to permit:
  - Selective program branching based upon the prompting response keys: [YES], [NO], [UNK], [ENT], and [CONT].
- **Module Control:**
  - Two built-in module ports which may be used for *Solid State Software* or **Constant Memory** modules
  - Capability to call *Solid State Software* or numbered **Constant Memory** module programs as subroutines of your programs
  - Capability to download *Solid State Software* or numbered **Constant Memory** module programs into the calculator's memory for study or incorporation in your programs
  - Capability to "trace" *Solid State Software* programs
  - "Numbering" of **Constant Memory** modules to create your own program libraries
  - Reading and writing of programs to "numbered" modules
  - Capability to erase and copy "numbered" modules
  - Module status function to determine number of programs stored in a numbered **Constant Memory** module and amount of unused memory remaining
  - Protect module function to safeguard proprietary software

Introduction

FUNCTIONS

- **Printer Capabilities**—Attachment of an optional printer accessory allows:
  - Printing of the contents of the display (including all alpha characters)
  - Listing of the contents of program memory, data memory, program labels, and hierarchy registers
  - Listing of OP code and flag definitions, calculator settings, and alpha entry positions
  - Tracing of calculation or program sequences in which the function and result of the function is printed
  - Paper advancement
  - Plotting using program 12 of the Master Library module
- **Cassette Interface Capability**—Attachment of an optional cassette interface accessory and a standard cassette recorder permits program or keyboard:
  - Reading and recording of data memory files
  - Reading and recording of program files
  - Reading and recording of main memory files
  - Reading and recording of "numbered" module files
  - Chaining of program files to permit execution of programs of virtually unlimited length

WHERE TO LOOK

Designed to serve both experienced and inexperienced calculator owners, this book is one of four manuals provided with the TI Programmable 88. Also included is an *Applications Workbook*, a *Master Library* manual, and a *Quick Reference Guide*. A brief summary of each manual follows:

The *Applications Workbook* is designed to provide supplementary information for the beginning programmer. Each chapter is broken into lessons illustrating specific calculator functions. Following a discussion of the functions are examples and problems to be solved by the reader. If you are new to programming, this manual will help you master the basics of programming the TI-88.

The *Master Library* manual provides instructions for using the Master Library module. Included in the manual is a description of the formulas or algorithms used by each program, a sample problem, and full details on the data memories, flags, subroutine levels, and other information needed to use the programs as a subroutines in your own programs.

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The *Quick Reference Guide* can be easily carried with the calculator and contains in condensed format basic reference information on the operation of the calculator. Use this guide to refresh your memory when you do not have your reference manual handy.

The *User's Reference Guide* provides a description of all TI Programmable 88 functions. To obtain the most benefit from this manual, please read the book in the order written. A summary of each chapter is listed below.

> Chapter 1 contains a quick overview of the features and functions of the TI-88 and a summary of the contents of the documentation.
>
> Chapter 2 briefly illustrates keyboard calculations, the Equation Mode, the Alpha Mode, running *Solid State Software* library programs, and writing programs. Also covered is setting the calculator's time, date, and alarm functions. This chapter gives a general idea of what the calculator can do. For specific information on using calculator functions, refer to the remaining chapters of the book.

Introduction

WHERE TO LOOK

Chapter 3 begins the formal definition of the calculator. The numeric functions are defined and illustrated with example problems in this chapter. Please read this material carefully; a basic understanding of the numeric functions is assumed in later chapters.

Chapter 4 is split into two parts: "General Programming" and "Advanced Programming." "General Programming" should be read first and defines the majority of the programming functions. The "Advanced Programming" section provides instructions on the more sophisticated programming options of the calculator.

Chapter 5 covers the module control functions and provides instructions on removing and replacing modules. The information in this chapter will allow you to use the memory expansion and module control capabilities of the calculator to maximum benefit.

Chapter 6 discusses printer control functions that become useful when the optional printer accessory is connected to the calculator.

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Chapter 7 defines the functions which permit data and programs to be recorded on standard audio cassette tape. To use these operations you must have the optional cassette interface accessory.

The final pages of this manual contain appendices, a glossary, and a reference index. The appendices supply reference information in easily accessable, compact form. The glossary defines terms used in this manual and the index provides page references for topics covered by the book.