Texas Instruments

Programmable Calculator News

Volume 2, Number 1

The TI-95 "ASM" Function

By Ash Osmani

The assemble function represented by the ASM key increases the program execution speed of the TI-95 PROCALC™ by converting label addresses used by the program into absolute addresses. This facilitates a faster execution of the assembled program since the calculator transfers control to the absolute address immediately instead of searching for a label before transferring control. In an assembled program, all the GTL, SBL, and DFN instructions are converted to GTO, SBR, and DFA instructions respectively (TI-95 Programming Guide, pages 4-25 & 4-29).

Pressing INV ASM disassembles the program, restoring references to labels in the program. Please note: If your program needs to be edited, it should first be disassembled to prevent the calculator from transferring control to an incorrect address generated by an increase or a decrease in the number of programming steps after editing.

The following program illustrates the use of the ASM function. The program increments the value in register A in each pass of the loop, stops when register A equals 150, and displays the "DONE" message. Program steps 0019 through 0849 are NOP's (No Operation, page 1-19). Absolute addresses generated by ASM are shown in parentheses. Do not enter these as part of the program.

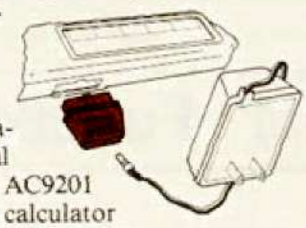
```
0000 LBL XX 0 STO A
0006 LBL XY 150 IF= A
0014 GTL XZ(GTO 0861) GTL ZZ(GTO 0853) NOP
0020 NOP NOP NOP NOP NOP
  .
  .
  .
0845 NOP NOP NOP NOP NOP
0850 LBL ZZ INC A
0855 GTL XY(GTO 0009)
0858 LBL XZ 'DONE' RTN
```

This program was first run without assembling (key sequence: RUN, PGM), and the execution time was approximately 15 seconds. The program was then assembled and run (key sequence: 2nd, ASM, RUN, PGM) with execution time reduced by more than half (6.5 seconds). In the unassembled program, the calculator had to scan through all NOP's before transferring control to the correct labels. In the assembled program, control is transferred directly to the absolute address.

The ASM function is very useful when its use in a program is valid. The value in any particular program depends on the extent to which the GTL, SBL, and DFN instructions are used. If your program is lengthy and uses these instructions extensively, the ASM speeds program execution considerably. The ASM function is more useful, too, in a program format where all subroutines follow the main program than in a program format where subroutines are within the main body of the program.

Letter From The Editor

Welcome to the second issue of Programmable Calculator News. Many of you have inquired about application cartridges for the TI-74 BASICALC™ and TI-95 PROCALC™. A complete listing of programs available within each cartridge begins on page 3. There's information on accessories, too. Our new PA-201 connector will allow you to use the AC9201 adapter with your TI-74 or TI-95 for operation from a standard electrical outlet. Using the PA-201 and AC9201 adapter, you can also change calculator batteries without losing memory contents.



An article beginning on page 2 illustrates menus and subroutines for the TI-74. TI-95 owners can become more familiar with the ASM key (page 1) and calculate logarithms quickly and easily (page 2).

We hope you enjoy this issue and welcome your comments. If you've written a program you'd like to share with our readers, write for submission details to:

Programmable Calculator News
P.O. Box 53
Lubbock, TX 79408

Logarithms On The TI-95

By Patrick Hicks

I was recently faced with a situation where I needed to find the exponent necessary to raise the number 4.4 to 83, or in technical terms, the log base 4.4 of 83. As you may recall, a log is the exponent necessary to raise a number to a power.

Here's a formula that uses the natural log, base e, to calculate the exponent necesary to raise any positive number to any positive power:

$$\log_B (X) = \log_e (X) / \log_e (B)$$

where X is the number and B is the base. For example, the log base 4.4 of 83 equals 2.982 or:

$$\log_{4.4} (83) = \log_e (83) / \log_e (4.4)$$

The following program incorporates this formula and also demonstrates use of the TI-95 ALPHA mode to display numbers along with alpha messages (pages 3-4 to 3-6 of the TI-95 Programming Guide). If you have a PC-324 printer, the program will print your results as well as display them.

To calculate the base 4.4 log of 83, enter the program then press [RUN] and <PGM>. Next, press 4.4 and <BAS> followed by 83 and <NUM>. Finally, press <LOG> and your TI-95 will display the log, in this case 2.982. If you have more logs to determine, simply press <GO>.

```
0000 LBL ST 'BASE/LOG P'
0013 'ROG' PRT
0017 LBL AA DFN CLR
0022 DFN F1:BAS@BB
0029 DFN F2:NUM@CC
0036 DFN F3:LOG@DD HLT
0044 LBL BB STO A 'BASE'
0053 '=' COL 15 MRG A
0058 PRT GTL AA
0062 LBL CC STO B 'NUM='
0071 COL 15 MRG B PRT
0076 GTL AA
0079 LBL DD RCL B LN /
0086 RCL A LN = STO C
0092 'LOG=' COL 15 MRG C
0100 PRT ADV BRK CLR
0104 GTL ST
```

Correction

Lines 190 and 230 of "Can I Really Afford It?" in Volume 1, Number 1 should have read as follows:

```
190 PV=PMT*(1-(1+I)^(-N))/I
230 PMT=PV*1/(1-(1+I)^(-N))
```

Menus And Subprograms On The TI-74

By Stephen L. Reid and Rena Gillis

The TI-74 and its optional 8K RAM cartridge will each store one program, limited only by the space available. Program functionality can easily be expanded through the use of menus and subprograms, and programs stored in a cartridge can be interchanged with the program in the TI-74 RAM using the CALL PUT subprogram.

As an example, the program included with this article contains several unrelated subprograms and could be expanded further by adding conversions to/from metric, Degrees-Minutes-Seconds to Decimal Degrees, or other needed conversions. The additional routines would be added as subprograms to the end of the program, with the menu table being appropriately updated.

Scientific functions available in the TI-74 CALC (calculator) mode that are not provided in the BASIC mode may be programmed as add-on routines to the program described in this article. A listing of functions available in both CALC mode and BASIC mode appears in Appendix A of the TI-74 Programming Reference Guide.

The menu is the first portion of the program. It provides a listing of all routines available prefaced by a corresponding number. Lines 140-210 handle the display of the menu and obtain the menu selection from the user. All selections are in uppercase letters, so the keypress must be in uppercase. Line 230 handles routing the program to the appropriate subprogram based on the key pressed. Lines 240-260 pass control to the subprogram and then back to the menu routine upon subprogram completion.

To add other subroutines, you need only add the names of new menu items as DATA statements after line 310 and increase the number of menu items on line 280. Add the correct line number to the ON GOTO statement on line 230 and the CALL to the new subprogram after line 260. The actual subprogram may appear anywhere in the program after line 310.

You may want to use the RENUMBER feature (page 2.103 of the TI-74 Programming Reference Guide) to renumber lines. It will keep your program line numbers in an orderly sequence thus making the program easier to read.

Subroutines included in this program are: Fahrenheit to Celsius/Celsius to Fahrenheit conversions (460-550); Permutations (320-380); and Factorials (390-450). Please note that the Permutations and Factorials subprograms use a common subprogram, "SUB FACTORIAL" (570).

SUBBEND is the last statement of a subprogram. It instructs the calculator to return to the statement after the CALL statement. Parentheses following the CALL statement contain the argument list. These assigned values pass data to and from the subprogram. In the "FACTORIAL" subprogram, "B" is the value being passed to the subprogram and "F" is *the name of the* value being returned to the original routine. Another useful feature of subprograms is that variables named in one subprogram are not the same variable in another subprogram. This is why variable "F" in the "FACTORIAL" subprogram and variable "F" in the "PERM" subprogram are not the same variable, even though they have the same name.

For more information on subprograms, refer to the TI-74 Programming Reference Guide for SUB (page 2.120), SUBEND (page 2.124), SUBEXIT (page 2.125), and CALL (page 2.17) statement documentation.

Programming Problems or Questions?
Contact our technical staff at (806) 741-2663.

```
100 !Menu-Subprogram Functions
110 READ N:N=N-1
120 !Menu section
130 PVAL=ASC("A"):RESTORE 290
140 DISPLAY ERASE ALL AT(1),"Press:( ) for";
150 READ SUBJECT$:DISPLAY AT(8)SIZE(1),CHR$(PVAL);
160 DISPLAY AT(15),SUBJECT$;
170 PAUSE .5:CALL KEY(KVAL,KST):IF KVAL<>255 THEN 190
180 PVAL=PVAL+1:IF PVAL-ASC("A")>N THEN 130 ELSE 150
190 IF KVAL>=ASC("A")AND KVAL<=ASC("Z")THEN 200
    ELSE 180
200 IF KVAL-ASC("A")>N THEN 180
210 KVAL=KVAL-ASC("A")+1
220 !Routine selection/execution
230 ON KVAL GOTO 240,250,260
240 CALL FACT:GOTO 130
250 CALL PERM:GOTO 130
260 CALL TEMP:GOTO 130
270 !Menu table
280 DATA 3
290 DATA Factorials
300 DATA Permutations
310 DATA Temperature Conv.
320 !Permutations Subprogram
330 SUB PERM:PRINT:INPUT "Total number=";N
340 INPUT "Number of groups=";R:IF N<R THEN
    NPR=0:GOTO 380
350 B=N:CALL FACTORIAL(B,F):NF=F
360 B=N-R:CALL FACTORIAL(B,F):NRF=F
370 NPR=NF/NRF
380 PRINT NPR;"=total permuations":PAUSE:SUBEND
390 !Factorials Subprogram
400 SUB FACT:PRINT:PRINT "X=   X!=";
410 ACCEPT AT(3)SIZE(2)VALIDATE(DIGIT),X;:IF X>84
    THEN 440
420 CALL FACTORIAL(X,F):DISPLAY AT(9),F;
430 PAUSE:SUBEXIT
440 DISPLAY AT(9),"Value out of range";
450 PAUSE:SUBEND
460 !Temperature Conversions
470 SUB TEMP:D$=CHR$(223)
480 PRINT:PRINT "            "&D$&"F =
    "&D$&"C";
490 ACCEPT AT(2)SIZE(8)VALIDATE(NUMERIC),F$
500 IF F$=""THEN ACCEPT AT(16)SIZE(8)VALIDATE
    (NUMERIC),C$ ELSE 520
510 IF C$=""THEN 480 ELSE 530
520 F=VAL(F$):C=(F-32)/1.8:GOTO 540
530 C=VAL(C$):F=(C*1.8)+32
540 DISPLAY AT(2)SIZE(8),F;:DISPLAY AT(16)SIZE(8),C;
550 PAUSE:SUBEND
560 !Common factorial subprogram
570 SUB FACTORIAL(B,F):F=1:FOR I=2 TO
    B:F=F*1:NEXT:SUBEND
```

Moving?

Please send the label from this issue along with your new address to:

Programmable Calculator News
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Lubbock, TX 79408

TI-95 Application Cartridge Library

Application software cartridges can provide powerful programs for a specific application without the need for user programming. These cartridges contain 32K bytes of ROM and include programs which are generated through hundreds of hours of research, consultation and programming by TI staff members or experts in the field. Although no programming skill is required, an understanding of the application is needed to fully utilize the software. Chemical Engineering, Math and Statistics cartridges are presently available for the TI-95, with others being developed.

Chemical Engineering Library

- Properties table program
- Properties estimation programs, including:
  - Gas properties
    - A. Gas viscosity estimation of polar and nonpolar gases according to high and low pressure models. Hydrogen-bonding and non-hydrogen-bonding polar gases are treated separately.
    - B. Gas thermal conductivity estimation of pure gases according to high and low pressure models.
  - Liquid properties
    - A. Liquid viscosity estimation for hydrocarbons and nonhydrocarbons according to high and low temperature models, as well as binary mixtures at moderate temperatures.
    - B. Liquid thermal conductivity of pure liquids using the Robbins-Kingrea method and of mixtures using the Power Law rule.
    - C. Liquid density for pure liquids and mixtures.
  - Other chemical properties
    - A. Vapor pressure using the Frost-Kalkwarf-Thodos method and/or Raoult's Law K-Value.
    - B. Critical properties estimation for critical temperature, pressure and volume using Lydersen's method instead of the built-in table of compounds.
    - C. Latent heat of vaporization estimated using the Riedel-Plank-Miller method.
- Pipe design for liquid flow to evaluate the pressure drop for flowing liquids in a pipe when the liquid flow rate, physical properties and a definition of the pipe geometry are given. Also calculates the liquid flow rate, given pressure drops.
- Thermodynamics
  - Soave-Redlich-Kwong method to calculate the compressibility factor and saturated vapor density for a pure component or mixture.
  - Peng-Robinson method for calculating the compressibility factor, vapor density, vapor enthalpy and the fugacity coefficient of each component of a mixture which does not contain hydrogen.
  - Specific heat estimation of the ideal heat capacity for hydrocarbons and nonhydrocarbons in the gas and liquid phases.
- Absorber design using the Edmister method to solve heat and material balances for multicomponent, multistage absorption.
- Distillation design to calculate the minimum number of ideal trays, the minimum reflux ratio and the actual number of ideal trays for a multicomponent distillation column using the Fenske-Underwood-Gilliland short-cut distillation method.
- Heat exchanger design using a modified Kern method to design shell and tube heat exchangers. Options include log mean dt, geometry, and pressure drop.
- Heat transfer coefficient estimation to estimate heat transfer coefficients for four different geometries: internal fluid-to-wall coefficients in turbulent flow; external fluid-to-wall coefficients in a heat exchanger bundle; external condensing coefficients on vertical tubes; and external condensing coefficients on horizontal tubes.
- Other chemical engineering solutions:
  - Equilibrium flash taking a feed stream at a given composition, pressure and temperature, to perform a single-stage, equilibrium flash calculation.
  - Activity coefficient estimates liquid-phase activity coefficients for mixtures using the Wilson equation.

Mathematics Library

- Complex functions consisting of four categories:
  - Arithmetic
  - Power, root and log
  - Trigonometric
  - Hyperbolic functions
- Cubic splines for use with:
  - Known data points ("new" data)
  - Known second derivatives ("old" data)
- Exact polynomials for use with:
  - Known data points
  - Known coefficients
- Gamma function calculation as well as the natural log of gamma for a given number.
- Gauss Quadrature for computing the definite integral of a function defined in program memory.
- Matrix Algebra consisting of four programs:
  - Matrix product for multiplying two matrices.
  - Inversion/linear systems to perform matrix inversion, solve a system of simultaneous equations or calculate the determinant of a matrix.
  - Tridiagonal systems to solve simultaneous equations whose coefficients form a tridiagonal matrix.
  - Eigenvalues and eigenvectors determined for a symmetric matrix.
- Polynomial multiplication of two polynomials where the result is less than 95th order.
- Finding roots consisting of Q-D, Bairstow, Bisection and Newton's methods.

- Differential equations/Runge-Kutta to solve a system of differential equations. Higher-order equations must be broken down into first-order equations.
- Number theory selections including:
  - Totient function
  - Divisor function
  - Congruences
  - Rational approximation
- Coordinate transforms of three-dimensional coordinates between rectangular, cylindrical and spherical coordinate systems.
- Analytic geometry programs, including:
  - Conic sections to analyze the six coefficients of the general second-degree equation to identify the type of conic section.
  - Quadric surfaces to analyze the ten coefficients of the general second-degree equation, identifying the type of quadric surface.
  - Nonlinear systems approximating the roots of a system of up to eight simultaneous equations using Newton's method. The solution is a point that occurs at the intersection of all the entered functions.

Statistics Library

- Means and Moments to determine the means, central moments, skewness and kurtosis for a set of sample data.
- Theoretical Distributions, including:
  - Normal—calculate Q(z), the right-tailed area and f(z), height under curve.
  - Inverse Normal—calculate z, the number of standard deviations a value is away from the mean.
  - Student's t-distribution—calculates the alpha risks for hypothesis testing.
  - F-distribution—calculates Q(f), the area under the curve to the right of the F-statistic.
  - Chi-square—calculates Q(x), the right-tailed area under the Chi-square distribution.
  - Weibull—If you know (w) of a sample, this solves for P(w).
  - Inverse Weibull—If you know P(w), this will solve for (w).
  - Binomial—determines the probability that an event will occur a certain number of times in a given number of trials.
  - Poisson—determines the probability that an event will occur a certain number of times if the event is Poisson-distributed.
  - Hypergeometric—determines the probability of obtaining a certain number of successes in a given sample, when the sample is taken from a population containing a specific number of successes.
- Analysis of variance offering three programs:
  - One-Way ANOVA
  - Two-Way ANOVA
  - Two-Way ANOVA with replication
- Regression analysis to perform multiple linear calculations and Bivariate Data Transforms.
- Hypothesis testing containing Unpaired t-Test and Paired t-Test programs.
- Histogram program allowing users to construct or enter a histogram and perform Goodness-of-Fit tests for distributions, including:
  - Normal
  - Uniform
  - Weibull
  - Poisson
  - Binomial
  - Exponential
- Nonparametric programs, including:
  - Friedman test—similar to the Two-Way Analysis of variance but does not assume population normality.
  - Wald-Wolfowitz runs test—used to check for randomness by testing the hypothesis that all outcomes are equally likely.
  - Kruskal-Wallis test—similar to the One-Way Analysis of Variance except it does not require the assumption of population normality.
  - RxC Contingency table—enables the user to test the hypothesis that row-column occurrences of an event are independent of one another.
  - Tolerance limits—determines one- or two-sided tolerance limits.
  - Kendall's Tau—used to test the hypothesis that the observations are mutually independent.
  - Rank function—determines the rank order of the elements.
  - Mann-Whitney test—used to test the hypothesis that the means of two populations are equal when population normality is not assumed.

TI-74 Application Cartridge Library

Available for the TI-74 are five application cartridges: Chemical Engineering, Mathematics, Statistics, Finance and Learn Pascal. The Chemical Engineering, Mathematics, Statistics and Finance modules are all written in BASIC.

Chemical Engineering Library

- Properties estimation programs, including:
  - Gas properties
    - A. Gas viscosity estimation of pure gases and gas mixtures, polar and nonpolar, according to high and low pressure models. Hydrogen-bonding and non-hydrogen-bonding polar gases are treated separately.
    - B. Gas thermal conductivity estimation of pure gases according to high and low pressure models.
  - Liquid properties
    - A. Liquid viscosity estimation for hydrocarbons and nonhydrocarbons at various temperatures, as well as binary mixtures at moderate temperatures.

TI-74 Application Cartridge Library

B. Liquid density for pure liquids and mixtures.
C. Liquid thermal conductivity of pure liquids using the Robbins-Kingrea method and of mixtures using the Power Law rule.

- Properties at the phase boundary
  - Vapor pressure using the Frost-Kalkwarf-Thodos method and/or Raoult's Law K-Value.
  - Latent heat of vaporization estimated using the Riedel-Plank-Miller method.
  - Critical properties estimation for critical temperature, pressure and volume using Lydersen's method.
- Thermodynamics
  - Specific heat for estimating the ideal heat capacity for hydrocarbons and nonhydrocarbons in the gas and liquid phases.
  - Soave-Redlich-Kwong method for calculating the compressibility factor and saturated vapor density for a pure component or mixture.
  - Peng-Robinson Thermodynamics for calculating the compressibility factor, vapor density, vapor enthalpy and the fugacity coefficient of each component of a mixture that does not contain hydrogen.
- Liquids in interaction
  - Activity coefficient estimating liquid-phase activity coefficients for mixtures using the Wilson equation.
  - Reaction order program using the chemical-reaction kinetics data of concentration or partial pressure versus time to determine the order of the reaction. As an alternative procedure, after the program selects an appropriate reaction mechanism, it computes the reaction rate constants.
- Equipment analysis
  - Heat transfer coefficient estimation to estimate heat transfer coefficients for four different geometries: internal fluid-to-wall coefficients in turbulent flow; external fluid-to-wall coefficients in a heat exchanger bundle; external condensing coefficients on vertical tubes; and external condensing coefficients on horizontal tubes.
  - Equilibrium flash taking a feed stream at a given composition, pressure and temperature, and performing a single-stage, equilibrium flash calculation.
  - Pipe analysis for liquid flow to evaluate the pressure drop for flowing liquids in a pipe when the liquid flow rate, physical properties and a definition of the pipe geometry are given. Also calculates the liquid flow rate, given pressure drops.
  - Absorber analysis using the Edmister method to solve heat and material balances for multicomponent, multistage absorption.
- Equipment design
  - Distillation design for calculating the minimum number of ideal trays, the minimum reflux ratio and the actual number of ideal trays for a multicomponent distillation column using the Fenske-Underwood-Gilliland short-cut distillation method.
  - Heat exchanger design using a modified Kern method to design shell and tube heat exchangers. Options include log mean dt, geometry, and pressure drop.

Mathematics Library

- Complex functions including 19 mathematical operations and functions on complex numbers. This program will calculate REAL(Z), IMAG(Z), R and THETA, dependent upon which function or operation is in use.
- Gamma functions to compute the value of the gamma functions for positive integers and positive and negative non-integers; also in(gamma(x)).
- Polynomial multiplication to perform multiplication of two polynomials.
- Prime factors to factor an integer into prime numbers.
- Cubic splines fitting a sequence of cubic polynomials to m input data points (a maximum of 100 data points using cubic spline interpolation).
- Relative minimums for finding a value at which a function is minimum within an interval. The minimum of the interval is not necessarily the absolute minimum.
- Root finder-bisection to approximate the roots of a function.
- Root finder-Newton to converge on the roots of a function.
- Convolution, given the impulse response for a linear system, using the convolution integral to find the output for a specified input waveform. The program uses the trapezoidal rule to generate outputs at intervals of delta t.
- Differential equations/Runge-Kutta using a fifth-order Runge-Kutta method to solve a system of differential equations of the type $y' = f(x,y)$.
- Gauss quadrature to approximate the integral of a specified function over an interval, a to b.
- Complex system to solve a system of n by n simultaneous equations with complex coefficients. Rows and columns are assigned in a traditional matrix.
- Matrices allowing five different operations using: matrix addition, matrix multiplication, matrix inversion, solution of linear simultaneous equations and evaluation of the determinant of a matrix.
- Tridiagonal matrix for use when a matrix in tridiagonal form has non-zero elements only along the main diagonal and the diagonals on either side.

Statistics Library

- Histograms to determine the number of counts per cell, means and moments.
- Means and Moments for a given set of input data with associated frequencies. Calculates the means, moments, skewness and kurtosis of a sample distribution.
- t-Test: Paired Observations to evaluate the t-statistic with $n - 1$ degrees of freedom to test the hypothesis

that two normally distributed populations of paired data with the same unknown variance have the same mean.

- t-Test: Unpaired Observations to provide the capabilities of the t-Test: paired observations program; the two samples do not need to contain the same number of data points.
- Contingency Table Analysis to evaluate two-way contingency tables.
- MANN-WHITNEY RANK SUM TEST to compare the mean of two populations having the same distribution. This program will test that the mean of populations are equal, or that the mean of the populations differ by an unknown constant.
- One-way Analysis of Variance (ANOVA) to compare the mean of various sets of data with different variances and test the hypothesis that a number of populations have the same mean. One-way ANOVA is used to analyze several sample populations where only one factor varies.
- Two-way ANOVA for use in situations which involve two or more varying factors and a possible influence of one factor upon another.
- Binomial distribution for use when variables comply with the following conditions: the experiment consists of a fixed number of statistically independent trials; each trial results in either success or failure; and, each has a constant probability of success and failure.
- Chi-squared distribution of variance for a normally distributed random variable. Often used to establish confidence intervals for the standard deviation of a population since its distribution depends on the deviation of a sample.
- F-distribution, the statistical ratio of two variances, may be used to compare the variances of two normal populations.
- Normal distribution for use with normally distributed data with populations of at least 100 elements and a sample size greater than 30.
- Poisson distribution for use when the probability of a specific event occurring is very small.
- Student's t-distribution, similar to normal distribution, allows for small samples. The t-curve is most commonly used when the sample size is less than 30.

Finance Library

The TI-74 Finance Library allows users to perform financial calculations quickly and easily. Programs include:

- Finance—performs time-value-of-money, rate conversion, bond, depreciation, cash-flow and date calculations.
- Data Forecasting—to estimate and revise forecasting model coefficients and forecast future data.
- Learning Curve—computes the learning factor, number of units, cost of first unit, cost of Nth unit, and average unit cost of production processes that vary in close relation to the learning curve.
- Rent or Buy—compares the cost of buying or renting a residence.
- True Cost of Insurance—calculates the cost per $1000 of whole life insurance or comparison with term life insurance.

Learn Pascal

The TI-74 Learn Pascal Solid State Software™ cartridge is both a learning aid and a tool for writing programs. Pascal is characterized by a highly disciplined, formal syntax and structure. In addition to the memory module, the TI-74 Learn Pascal software package includes user and reference guides, a keyboard overlay and a quick reference card.

Suggested retail price for all TI-95 and TI-74 Application Cartridges is $50.00. Texas Instruments reserves the right to make changes in materials, specifications and prices of any product without notice.

Calculator Club

The TI Programmable Calculator Club is a group of hand-held programmable calculator and computer users. The club's newsletter, TI PPC Notes, supports several calculators including the TI-59, TI-74, and TI-95.

While the Club emphasizes support of devices manufactured by Texas Instruments, it is not sanctioned by or financially supported in any way by Texas Instruments. For information contact:

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TI-95/74 Accessories

■ 8K Constant Memory™ Solid State Software™ modules maintain their contents when removed from the calculator. An asset for storing programs, the modules contain an internal battery providing a typical service life of more than five years. Suggested retail price: $50.00.

■ The PC-324 dot matrix thermal printer prints up to 24 characters per line at a speed of 48 lines per minute. The PC-324 will print the contents of each calculator's display under keyboard or program control and can provide a printed record of calculations at any time. Paper can be advanced at any time. Four AA batteries and two rolls of thermal paper are packaged with the unit. Suggested retail price: $115.00.

■ Accessories for the PC-324 printer:
- The AC9201 adapter provides power for both the printer and the calculator. Suggested retail price: $18.95.
- TP-324 thermal paper is available in three-roll packages. Suggested retail price: $5.95.

■ The CI-7 Cassette Interface cable connects the TI-95 or TI-74 to any standard cassette recorder, allowing users to store and retrieve information on cassette tape. Tape operations can be performed directly from the keyboard or from within a program. Suggested retail price: $35.00.

■ The PA-201 connector can be used with the AC9201 adapter to operate the TI-95 or TI-74 from a standard electrical outlet. It is also possible, using the PA-201 and AC9201 adapter, to change calculator batteries without losing memory contents. Suggested retail price: $7.95.

■ Documentation
- The TI-95 and TI-74 are packaged with user and programming guides. In addition, a Learn BASIC Guidebook is available for the TI-74. Suggested retail price for the Learn BASIC Guidebook: $9.99.
- The TI-74 Technical Data Manual documents the hardware design and software system. It is available from TI for $10.00. Call 1-800-TI CARES.

As always, we ask that you purchase Texas Instruments products and accessories at a retailer in your area. If you are unable to locate a specific item, phone 1-800-TI CARES.

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