

They turn your complex, lengthy or repetitive calculations into a few simple steps anyone can do quickly.





Choose the Application Pacs you need from the constantly increasing Hewlett-Packard selection



To extend the versatility of the HP-65—so you can concentrate its capabilities in your field of interest—you can select from an ever-expanding selection of pre-recorded program cards, packaged in Application Pacs.

Each Pac contains up to 40 programs, a detailed manual on the Pac, plus a set of 20 Padded Interleave Cards.

These Pacs are already available in the following categories: Mathematics, Statistics, Surveying, Medical Technology, and Electrical Electronic Engineering.

Pacs in other categories and business disciplines will be introduced shortly.

As an example of the types of programs each Application Pac contains, the programs of Math Pac I are listed in detail...

Math Pac I

- 1. ALGEBRAIC FUNCTIONS.** This program computes the algebraic functions... add, subtract, multiply, divide, and cube.
- 2. FIRST ORDER DIFFERENTIAL EQUATION.** This program may be used to solve a wide variety of first-order differential equations numerically, using the third-order Runge-Kutta method.
- 3. SOLUTION OF AN ISOSCELES TRIANGLE.** Given a , b , c or a , b , C or a , B , C given the three sides, or two sides and their included angle, this program finds the remaining unknown side(s) and angle(s).
- 4. 3 X 3 MATRIX INVERSION.** This program, in conjunction with program 25, finds the inverse of a given 3×3 matrix.
- 5. FOUR DEGREE POLYNOMIAL EQUATION.** Finds one real root of a fourth degree polynomial equation with real coefficients, then reduces the equation to a fourth degree polynomial equation, which may be solved by program 13.
- 6. FACTORS OF AN INTEGER.** This program finds all prime factors of a positive integer and, therefore, determines if the number is a prime factor.
- 7. QUADRATIC EQUATION (BINARY) LAST EQUATION (BINARY).** Computes the greatest common divisor (GCD) and the least common multiple (LCM) for two given integers A and B . Also finds integer coefficients X and Y such that $GCD(A, B) = AX + BY$.
- 8. ARITHMETIC AND GEOMETRIC PROGRESSIONS.** Provides solutions to: (1) display the terms of an arithmetic progression; (2) find a particular term of an arithmetic progression; (3) find the sum of an arithmetic progression; (4) display the terms of a geometric progression.
- 9. GEOMETRIC PROGRESSION.** Can be used to: (1) display the terms of a geometric progression; (2) find the value of a particular term of a geometric progression; (3) find the sum of the first n terms of a geometric progression; (4) find the infinite sum of a geometric progression if the ratio of two successive terms has an absolute value less than one.
- 10. FUNCTIONS OF x AND y .** Can be used to find: (1) y related to the x given for any real x and y if y is negative, x must be an integer; (2) logarithms of y to base x if x is real and $y > 0$ (integer part of y is 0); (3) antilogarithms of y through base x at a time; (4) combinations of y things taken x at a time.
- 11. QUADRATIC EQUATION.** Finds the roots (real and/or imaginary) of a quadratic equation.
- 12. QUADRATIC EQUATION.** Finds a real root from the cubic equation, reducing it to a quadratic equation. (Other use program 11.)
- 13. FOURTH DEGREE POLYNOMIAL EQUATION.** Can be used in conjunction with programs 12 and 14 to find the roots (real and/or imaginary) of a fourth degree polynomial equation with real coefficients.
- 14. SIMULTANEOUS EQUATIONS IN TWO UNKNOWN.** Finds the solution for two simultaneous linear equations in two unknowns.
- 15. SIMULTANEOUS EQUATIONS IN THREE UNKNOWN.** Finds the solution for three simultaneous linear equations in three unknowns.
- 16. CYCLOTOMIC EQUATION.** Performs synthetic division on a polynomial of degree seven or less with real coefficients.
- 17. RECTANGULAR, SPHERICAL, CONVERSIONS.** Converts rectangular coordinates to spherical coordinates, and vice versa.
- 18. TRANSLATION AND/OR ROTATION OF COORDINATE AXES.** Finds the new coordinates for a point whose coordinates are known either from rotated, translated or both.

- 19. ANGULAR CONVERSIONS.** Converts an angle in one angular unit to another angular unit. Angles can be expressed in-degrees, radians, grads or mils.
- 20. SECONDARY VALUES OF SIN, COS, TAN.** Computes secondary values of sine, cosine, and tangent and arc tangent. Angles can be in degrees, radians or grads.
- 21. TRIGONOMETRIC IDENTITIES.** Provides options to compute the values of trigonometric, secant or cosecant, and their inverses.
- 22. INVERSE HYPERBOLIC FUNCTIONS.** Computes the inverse of $\sinh, \cosh, \tanh, \coth, \sinh^{-1}$ and \cosh^{-1} .
- 23. SOLUTION OF A TRIANGLE (Given a , b , C or a , b , C).** Given either one side, the opposite angle and an adjacent angle, or vice versa one side and two adjacent angles, this program finds the remaining angle(s) and side(s) of an oblique triangle.
- 24. SOLUTION OF A TRIANGLE (Given a , b , C).** Given one angle, and opposite side, and an adjacent side, this program finds the remaining side and angles of an oblique triangle.
- 25. SPHERICAL TRIANGLE SOLUTION.** Given either two sides and their included angle, or three sides, this program finds the remaining unknowns.
- 26. AREA OF A TRIANGLE.** Finds the area of a triangle, given either (1) three sides, (2) two sides and their included angle, (3) one side and its adjacent angle, or (4) the coordinates of the vertices.
- 27. AREA OF A POLYGON.** Finds the area of a polygon (concave or convex), given the coordinates of the vertices.
- 28. CIRCLE DETERMINED BY THREE POINTS.** Finds the radius and center point of a circle drawn through three distinct points.
- 29. SQUARE OF A CIRCLE.** Given the radius, the center point and the central angle, this program finds the coordinates of naturally spaced points on a circle in a given positive number.
- 30. POLYGON INSCRIBED IN AND CIRCUMSCRIBED A CIRCLE.** Given the number of sides of a regular polygon (inscribed or circumscribed) and the radius of a circle, this program finds the lengths of the sides and the area of the polygon.
- 31. UNIT CONVERSIONS.** $1 \rightarrow 10, 10 \rightarrow 100, 100 \rightarrow 1000$ Performs unit conversions between: (1) Fahrenheit and Centigrade; (2) feet, inches and centimeters; and (3) pounds and kilograms.
- 32. UNIT CONVERSIONS.** $1 \rightarrow 10, 10 \rightarrow 100, 100 \rightarrow 1000$ Performs unit conversions between: (1) miles and kilometers; (2) gallons and liters; (3) pounds and kilograms; and (4) acres and square feet.
- 33. POLYNOMIAL INTERPOLATION (RAT).** Evaluates polynomials with real coefficients. The degree of the polynomial must be equal to or less than eight.
- 34. LAGRANGE AND LAGRANGE INTERPOLATION.** (Linear or Lagrangian interpolation formula is used for data points in the region of tabulated data).
- 35. POINT DIFFERENCE INTERPOLATION.** Interpolates for data points in the region of tabulated data for continuous space intervals, with a specified spacing. The equation used is the backward interpolation formula of Gauss, which uses pairs of data points and sets up the value equation for interpolation.
- 36. RUNGE-KUTTA INTEGRATION (Fourth Order).** Approximates definite integrals by the Runge-Kutta rule, or by Simpson's Rule. The values of the function at tabulated points are all tabulated by hand.
- 37. RUNGE-KUTTA FOR NUMERICAL INTEGRATION.** Approximates definite integrals by Runge-Kutta's Rule.
- 38. ROOTS OF A POLYNOMIAL IN AN INTERVAL.** Finds the intervals of interval-bisecting to find real roots of an equation in a closed interval. The equation may be algebraic, rational or transcendental.
- 39. DETERMINANT AND CHARACTERISTIC EQUATION OF A 3 X 3 MATRIX.** Finds the determinant and coefficients of the characteristic equation of a 3×3 matrix.
- 40. 3 X 3 MATRIX OPERATIONS.** Performs addition, subtraction and multiplication of 3×3 matrices.



Medical Pac I

Allows for the rapid calculation of more than three dozen common problems, such as:

1. **BUILT-IN VITAL CAPACITY.** This program accepts the height and age of a male subject along with measured pulmonary function values and calculates the percent of the predicted values for the person. The input values are: (1) vital capacity, (2) forced expiratory volume at 1 sec., and (3) mean expiratory flow rate over 100 to 1500 cc expired volume. Other programs in the Pac calculate other pulmonary functions.

2. **BODYSURF BODY SURFACE AREA.** This program calculates the body surface area in square meters from the patient's height and weight using the DuBois formula. Additionally, gives the random subject, the random index is calculated.

3. **BVE CURVE GRAPHIC OUTPUT.** This program allows calculation of cardiac output from dye-densitometry methods.

4. **OXYGEN SATURATION AND CONTENT (Soyler-Silverman).** This program utilizes the arterial oxygen tension and calculates the percentage saturation from the hemoglobin dissociation curve, and gives the hemoglobin content, calculates the oxygen content of the blood. This can be defined as arterial or venous (which stores in an internal register) for later use by other programs.

5. **CRISTO-DEMETRIC CONVERSIONS.** This program allows conversion between the most commonly used metric and English units of length, weight, and temperature. The metric units used are centimeters, kilograms, and degrees centigrade. The English units to which these can be converted are: feet, inches, pounds (male) and degrees Fahrenheit.

Other programs are:

6. **INDUCT CONVERSIONS.** (Three magnetic cards)
7. **LENCH CONVERSIONS.** (Two magnetic cards)
8. **FOURIER CONVERSIONS.** (Three magnetic cards)
9. **WET-BLASH SETUP (Soyler).**
10. **WET-BLASH SETUP CORRECTIONS.**
11. **P₅₀, NORMALIZATION.**
12. **SOYLER BODY SURFACE AREA.**
13. **TYTHER, P₅₀.**
14. **BLOOD ACID-BASE STATUS.**
15. **DEAD SPACE FRACTION.**
16. **p-H₂O DIFFERENCE.**
17. **PHYSLIOGRAPH, SHUNT AND PVR.**
18. **NAIVE AREA.**
19. **PICK CARDIAC OUTPUT.**
20. **MALE HWT, P₅₀, V_E, V_C, AND V_{IR}.**
21. **MALE FORCED EXPIRATORY FLOW.**
22. **FEMALE VITAL CAPACITY.**
23. **FEMALE HWT, P₅₀, V_E, V_C, AND V_{IR}.**
24. **FEMALE FORCED EXPIRATORY FLOW.**
25. **PATIENT IDENTIFICATION.**
26. **LONG DIFFUSION.**
27. **SATURATED WATER VAPOR PRESSURE.**
28. **RESPIRATORY GAS CONVERSIONS.**
29. **ANTAGONIC SHUNT.**
30. **TYTHER WORK.**
31. **AMBIENT P_{O2} AND pH CHANGE.**
32. **AMBIENT P_{O2} CHANGE.**
33. **CONTRACTILEITY.**



EE Pac I

This Pac provides a variety of functions for use in electronic and electrical engineering projects.

1. **WOLFRUM'S (SART).** This program determines the mixing value in the relation

$$I = \frac{1}{\frac{1}{I_1} + \frac{1}{I_2} + \frac{1}{I_3}}$$

given any two of the three variables.

2. **IMPEDANCE OF LADDER NETWORK.** This program computes the input impedance of an arbitrarily long ladder network containing series or shunt R, L, and C.

3. **TRANSMISSION LINE DIFFERENCE TRANSFORMER.**

This program computes the input impedance of a length of transmission line of characteristic impedance Z₀ terminated in Z_L.

This problem is commonly solved graphically on a Smith Chart.

4. **2 TO 1 PARAMETER CONVERSION.** (Two magnetic cards.) This program converts complex two-port parameters to y-parameters and vice-versa.

5. **FOURIER SERIES.** This program computes the Fourier coefficients given a large enough number of samples of a periodic function.

Other programs are:

6. **SERIES RESONANT CIRCUIT.**
7. **PARALLEL RESONANT CIRCUIT.**
8. **ATTENUATION.**
9. **P₁ ATTENUATION.**
10. **TWO PORTS OR SEVEN-PORT TRANSFORMATION.** (Two magnetic cards)
11. **IMPEDANCE LINES AND NETWORKS.**
12. **P₁ NETWORK (SUTLAND) NETWORKS.**
13. **BAND PASS FILTER.** (Two magnetic cards)
14. **ACTIVE FILTER—LOW PASS.**
15. **ACTIVE FILTER—HIGH PASS.**
16. **BUTTERWORTH'S FILTER DESIGN.**
17. **CHEBYSHEV FILTER DESIGN.** (Two magnetic cards)
18. **CAPACITANCE OF PARALLEL PLATES.**
19. **SELF INDUCTANCE OF STRAIGHT ROUND WIRE.**
20. **IMPEDANCE OF A SINGLE-LAYER COILS—PIPING COIL.**
21. **SKIN EFFECT AND DCL C.**
22. **TRANSFORMER (SUT).**
23. **WIRE RELAY DESIGN.** (Two magnetic cards)
24. **IMPEDANCE OF TRANSMISSION LINE.**
25. **MICROWAVE TRANSMISSION LINE.**
26. **POWER SUPPLY REGULATOR CIRCUITS.**
27. **CONTROLLED RECTIFIER CIRCUITS.**
28. **INTEGRATED CIRCUIT CURRENT SOURCE.**
29. **TRANSMISSION LOSS.**
30. **SET BACK AND TRANSDUCIMANCE.**
31. **PHASE LOCK LOOP.**
32. **SIGNAL CONVERSION.**
33. **FILTER TO GAIN.**
34. **WIRE TURNS AT 60 HERTZ IS CO.**
35. **WIRE TURNS.**

Each Application Pac contains up to 40 pre-recorded program cards, to save you hundreds of hours of calculating time!

Here's how easy it is to load a pre-recorded program card into the HP-65



Simply insert the card into the HP-65 magnetic card reader, and in less than two seconds . . .



. . . the card's entire program is duplicated in the HP-65's program memory. Then the card exits for further use whenever you need it again.



Although each card is less than one-half inch by three inches in size, it contains a complete program (up to 180 steps long) directing the HP-65 to perform a predetermined routine, to solve a specific problem or series of problems. The HP-65 incorporates a magnetic card reader to duplicate the program on the magnetic card into the HP-65's program memory.

All you need to do is run a pre-recorded program card through the HP-65 (a two-second operation), then key in your known data and run the program as described by the instructions furnished for the program. In seconds, your complex problems are solved, with extreme accuracy. And each card can be used thousands of times.

A particular program can be a relatively simple or intricate sequence of steps. Because the program card has all of the steps pre-recorded, you only have to feed in the known data—the HP-65 will do the work!

Each Application Pac contains up to 40 pre-recorded program cards. In addition, each Pac includes a manual which gives program descriptions, user instructions and program listings. Also included are a set of 20 two-sided Pocket Instruction Cards, each of which holds two program cards and space for listing their program instructions.



The HP-65
Fully Programmable
Pocket Calculator comes
complete with the

Standard Pac

This Pac not only demonstrates the versatility of the HP-65 pocket "computer," but provides two cards for displaying various functions, and a card for clearing the next program load (when necessary). The Standard Pac consists of the following cards:

1. **PERSONAL INFORMATION.** Used to forecast long- or short-term personal financial investment, monthly deposits, withdrawal and interest for specified time periods.
2. **MEAN, STANDARD DEVIATION, STANDARD ERROR.** Computes the mean, standard deviation and standard error when given a set of data.
3. **GRANT CHOICE INVESTMENT.** When given the coordinates of two points on the globe, calculates the grant's circle distance between them and the initial heading.
4. **INTEGER BASE CONVERSION.** Converts an integer of one base to an equivalent integer of a second base. (Both bases must be integers in the range 2 to 36.)
5. **BODY BODY SURFACE AREA.** Calculates the body surface area when given a person's height and weight. With additional data of cardiac output, area calculates the cardiac index (rate of blood pumped per unit of body surface area).
6. **PI NETWORK IMPEDANCE MATCHING.** Computes element values for a lossless PI network given desired input and output impedances Z_1 and Z_2 , operating frequency f , and quality factor Q .
7. **SLIP SLOPE REDUCTION (GRADE & ELEVATION).** Reduces slope distance to horizontal distance at the instrument point elevation, after considering the earth's curvature.
8. **TEMPERATURE CONVERSION.** This program converts temperatures between Celsius, degrees Fahrenheit, degrees Rankine, and degrees Reaumur.
9. **WEIGHT-MASS CONVERSION.** This program converts interchangeably between grams, kilograms, pounds, ounces and slugs.
10. **LENGTH CONVERSIONS.** This program converts interchangeably between U.S. gallons, imperial gallons, cubic inches, cubic centimeters and liters.
11. **FORMULA INVERTER.** Given three of the following four—interest, number of periods, present value or future value—the program computes the fourth.
12. **LOAN REPAYMENT.** Given the interest rate and the number of payment periods, the program calculates the present value given a payment, or a payment given a present value.
13. **INTEREST CHECKING ACCOUNT.** This program can be used as an aid in balancing a checking account against a bank statement.
14. **ITERATIVE SOLUTION OF $f(x)=0$.** This program finds the roots for equations of the form $f(x)=0$ by choosing better and better approximations.
15. **QUADRATIC EQUATION.** This program finds either real or complex roots of quadratic equations.
16. **AREA AND SOLUTIONS OF RIGHT TRIANGLE.** The areas of circles, ellipses, rectangles, and triangles and combinations of these geometric shapes can be calculated. The third side of a right triangle, given the other two sides, can also be found.
17. **WING.** A game of logic which the user can play against the HP-65.
18. **DIAGNOSTIC I.** Used to check the condition of various HP-65 functions—flags, relational operators, decrement and skip on zero, subtractive carry and repeat. Signals you if functions are operating improperly.
19. **DIAGNOSTIC II.** Similar to above, but displays the four arithmetic functions, the "L1" (inverse f') and "L2" functions or f'' and f''' and decimal point, registers 6 and 8, the Change Sign and Enter Register functions, and the Back/Stop control.
20. **HEAD-CLEANING CARD.** An display (not incorporated) card designed to clean the read-program head. (Used infrequently.)
21. **Blank magnetic cards are also included.**

HEWLETT  PACKARD

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