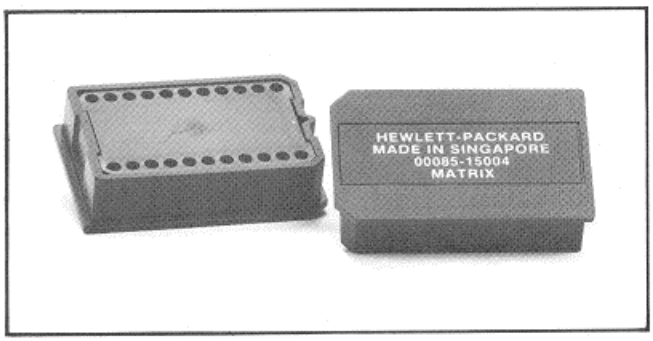
HEWLETT PACKARD

HP-85 Matrix ROM 00085-15004



The Matrix ROM provides a powerful set of statements and functions for working with arrays—both matrices (two-dimensional arrays) and vectors (one-dimensional arrays). These capabilities enable array calculations to be performed with more convenience, speed, and accuracy than if they were done using an HP-85 alone.

Features

Array Operation Statements. The Matrix ROM enables the HP-85, in only one statement, to:

- Perform matrix multiplication with two arrays, even if one of the arrays is a vector.
- Invert up to a 42 × 42 matrix (or, with an optional HP 82903A 16K Memory Module installed, a 61 × 61 matrix). A 20 × 20 matrix can be inverted in about 1 minute. Also, the inverse of a matrix can be post-multiplied by an array using just one statement.
- Solve the matrix equation AX = B for the unknown array X. The special statement provided can be used to quickly and accurately solve a system of up to 28 linear equations in 28 unknowns (or, with an optional HP 82903A 16K Memory Module installed, 42 linear equations in 42 unknowns). A system of 25 equations can be solved in less than 1 minute. Unlike many other implementations for solving matrix equations, the Matrix ROM does not restrict arrays X and B to be vectors or one-column matrices. Therefore, a single statement can be used to simultaneously solve two different systems of equations, provided that the coefficients in both systems of equations are identical.
- Transpose the elements of an array. Also, the transpose of an array can be pre- or post-multiplied by an array using just one statement.
- Multiply all elements of an array by a number or by the value of a numeric variable or expression. Also, two such operations can be performed, and the results added, in only one statement.
- Perform an arithmetic operation (addition, subtraction, multiplication, or division) between corresponding elements of two arrays.
- Calculate the sums of the elements in each row or in each column of an array.
- Calculate the cross product (vector product) of two 3-element vectors.

With each of the statements used to perform the operations above, the resulting values can be assigned to the elements of the array being operated upon, as well as to the elements of another array.

Array and Subarray Copy Statements. Not only can an array be copied into another, but values can also be copied from and/or into a subarray. Thus, matrices can be partitioned or augmented with ease. Values can be copied from a row or column of a matrix into a vector, or from a vector into a row or column of a matrix.

Array Display and Print Statements. The Matrix ROM can display and print values of array elements in various formats: several elements per line (spaced closely), two elements per line (spaced widely), or one element per line. Even more complete control of the displayed or printed format is possible using statements similar to the HP-85's DISP USING and PRINT USING statements.

Value Assignment Statements. The value of any numeric variable or expression can be assigned to all elements of an array with a single statement. Special statements assign the value 0 or 1 to all elements of an array, or create an identity matrix by assigning the value 1 to all diagonal elements and the value 0 to all other elements. Different values can be assigned to various elements of an array both from the keyboard and in a program; the statements used to do so are simply an extension of the HP-85's INPUT and READ statements.

Array Functions. Included among the Matrix ROM's 22 functions are ones that return:

- The determinant of the matrix specified or of the last matrix inverted.
- The Frobenius (Euclidean) norm.
- Row and column norms.
- The sum of the values or of the absolute values of an array's elements.
- The maximum and minimum element and the element with largest absolute value in an array, and the row and column numbers for these elements.
- The dot product of two vectors.

Redimensioning. The Matrix ROM enables arrays to be redimensioned after they are first declared.

Statements and Functions

ABSUM ...
Sum of absolute values of elements in array.

AMAX ...
Value of largest element in array.

AMAXCOL
Column number of largest element in array most recently specified in AMAX function.

AMAXROW
Row number of largest element in array most recently specified in AMAX function.

AMIN ...
Value of smallest element in array.

AMINCOL
Column number of smallest element in array most recently specified in AMIN function.

AMINROW
Row number of smallest element in array most recently specified in AMIN function.

CNORM ...
Largest sum of absolute values of elements in each column of array (*column norm*).

CNORMCOL
Column number with largest sum of absolute values in array most recently specified in CNORM function.

DET ...
Determinant of matrix.

DETL
Determinant of last matrix inverted in MAT ... INV statement or specified as first argument in MAT ... SYS statement.

DOT ...
Sum of products of corresponding elements of vectors (*dot product* or *scalar product*).

ERROM
Number designating last plug-in ROM to generate error message.

FNORM ...
Square root of sum of squares of elements in array (*Frobenius norm* or *Euclidean norm*).

LBND ...
Lower bound of array subscript.

MAT ... = ...
Assigns value of numeric expression or values of all elements of operand array to elements of result array. Alternatively, assigns specified elements of operand array to specified elements of result array.

MAT ... (+, −, ·, /, or *) ...
Performs specified arithmetic operation between array and scalar (number, numeric variable, or numeric expression) or between two arrays. Alternatively, performs matrix multiplication.

MAT ... = ... * ... + ... * ...
Adds two products of a scalar and an array.

MAT ... CON
Assigns value 1 to all elements of array.

MAT ... CROSS ...
Finds cross product (vector product) of two 3-element vectors.

MAT ... CSUM ...
Adds values of elements in each column of array.

MAT ... IDN
Assigns value 1 to all diagonal elements of matrix, and assigns value 0 to all other elements.

MAT ... INV ...
Finds inverse of matrix.

MAT ... INV ... * ...
Multiplies inverse of matrix by another array.

MAT ... RSUM ...
Adds values of elements in each row of array.

MAT ... SYS ...
Solves matrix equation AX = B for unknown array X, given any square matrix A and any other array B.

MAT ... ZER
Assigns value 0 to all elements of array.

MAT ... TRN ...
Finds transpose of array.

MAT ... TRN ... * ...
Multiplies transpose of array by another array.

MAT ... = ... * TRN ...
Multiplies array by transpose of another array.

MAT DISP ...
Displays elements of array(s).

MAT DISP USING ...
Displays elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.

MAT INPUT ...
Assigns values input from keyboard to elements of array(s).

MAT PRINT ...
Prints elements of array(s).

MAT PRINT USING ...
Prints elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.

MAT READ ...
Assigns values listed in DATA statement(s) to elements of array(s).

MAXAB ...
Largest absolute value of any element in array.

MAXABCOL
Column number of element with largest absolute value in array most recently specified in MAXAB function.

MAXABROW
Row number of element with largest absolute value in array most recently specified in MAXAB function.

REDIM ...
Changes working size of array(s) to size specified.

RNORM ...
Largest sum of absolute values of elements in each row of array (*row norm*).

RNORMROW
Row number with largest sum of absolute values in array most recently specified in RNORM function.

SUM ...
Sum of elements in array.

UBND ...
Upper bound of array subscript.

Ordering Information

00085-15004 HP-85 Matrix ROM
(Requires HP 82936A ROM Drawer)

Warranty and Service

Hewlett-Packard offers a 90-day warranty on the HP-85 Matrix ROM. A copy of the complete warranty statement is available upon request.

Service for the HP-85 and its peripherals is available at service centers in the United States and many countries around the world. Contact your local dealer or sales representative for more information and service center locations.

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