

MATX	Matrix					
g-shift			EIGVEC	EIGVAL	M.LU	M.QR
f-shift	$\ x\ _p$	UNITV	$[M]^T$	$\tilde{x}, \tilde{y}$	dot	cross
unshifted	$[M]^{-1}$	MSQRT	RSUM	CSUM	$ M $	VECTOR
Page 2	F1	F2	F3	F4	F5	F6

- Prev menu

https://47calc.com/doc/R47/Menus/R47v0_Menu_MATX_page_1.pdf
- Next menu

https://47calc.com/doc/R47/Menus/R47v0_Menu_MATX_page_3.pdf
- Ref 1

https://47calc.com/doc/Application%20Notes/AN0020_C47_R47_Matrix_and_Vector.pdf

Level	Label	Type	FullName	Extended description	Category	Flag	Catalog	Default
Menu p2	MATX	MENU	Matrix	Matrix functions ; a matrix is displayed in X and shown in other stack registers as [m×n Matrix] or [m×n C Matrix] when containing complex element(s) ; Ref : https://47calc.com/doc/Application%20Notes/AN0020_C47_R47_Matrix_and_Vector.pdf ; Info : monadic functions work per matrix element (except 1/x, which is a shortcut for [M] ⁻¹ , use -1 y* instead ; and $\sqrt{x}$, which is a shortcut for MSQRT, use 0.5 y* instead) ; in edit mode, all functions work per element ; use registers to input calculation results	Matrix operations		MATX	
F1	[M] ⁻¹	Function (monadic)	Invert matrix	Invert matrix in X (exists only when M ≠ 0) ; Shortcut : [1/x] ; Info : Error 22 -- Singular matrix -- is raised when M = 0	Matrix operations		[M] ⁻¹	
F2	MSQRT	Function (monadic)	Square root of matrix	Square root of matrix in X : if M = MSQRT(X), M × M = X, where × denotes matrix multiplication ; Shortcut : [$\sqrt{x}$] ; Info : Error 20 -- No root found or Error 21 -- Matrix mismatch may be raised (the latter when the matrix is not square)	Matrix operations		M.SQRT	
F3	RSUM	Command	Row sum	Row sum of vector or matrix in X : RSUM = $\sum a_{ij}$	Matrix operations		RSUM	
F4	CSUM	Command	Column sum	Column sum of vector or matrix in X : CSUM = $\sum a_{ij}$	Matrix operations		CSUM	
F5	M	Function (monadic)	Determinant	Determinant of matrix in X (matrix must be square)	Matrix operations		M	
F6	VECTOR	MENU	Vector menu	Vector functions ; Ref : https://47calc.com/doc/R47/Reference/R47v0_Vector_display.pdf ; Info : Vectors are stored internally as rectangular and calculation results are presented in rectangular format ; to edit a vector, first put it in rectangular format ; vector TI's are shown for values in X only and a small font may be used ; vector TI's are minimised if the stack changes or [EXIT] is pressed (only ijk or rθφ is shown, without subscripts or brackets)	Vector operations		VECTOR	
ff1	$\ x\ _p$	Function (monadic)	Norm	Norm of vector or matrix in X with parameter p (trailing input) = 0, 1, 2, ..., 9, ∞ : 0 : Number of non-zeros of vector or matrix in X : $\ x\ _0 = \sum_i I(a_i \neq 0)$, where I is the indicator function, 1 if true, 0 if false ; 1 : Maximum column sum of absolute element values of a matrix in X : $\ x\ _1 = \max_j \sum_i a_{ij} $; 2 : Euclidean magnitude of a vector in X or Frobenius norm of a matrix in X : $\ x\ _2 = \sqrt{\sum_i \sum_j a_{ij} ^2}$; 3 : $\ x\ _3 = \sqrt[3]{\sum_i \sum_j a_{ij} ^3}$; ... ; 9 : $\ x\ _9 = \sqrt[9]{\sum_i \sum_j a_{ij} ^9}$; ∞ : Maximum row sum of absolute element values of a matrix in X : $\ x\ _\infty = \max_i \sum_j a_{ij} $; TAM : $\ x\ _p$ _ TamNorm menu ; Info : parameter 0, 1, 2, ..., 9, ∞ (use [TamNorm.1] F2 to enter ∞)	Matrix operations		$\ x\ _p$	
ff2	UNITV	Command	Unit vector or matrix	Unit vector or matrix for Real or Complex matrix or vector ; the result will have Euclidean magnitude 1 ; Info : UNITV also applies to Complex numbers	Complex numbers		UNITV	
ff3	[M] ^T	Function (monadic)	Transpose matrix	Transpose matrix in X	Matrix operations		[M] ^T	
ff4	$\angle \vec{x}, \vec{y}$	Function (dyadic)	Vector angle	Angle between the 2D or 3D vectors in X and Y	Matrix operations	3Dxyz	$\angle \vec{x}, \vec{y}$	
ff5	dot	Function (dyadic)	Dot product (·)	Dot product of vectors in X and Y	Complex numbers		DOT	
ff6	cross	Function (dyadic)	Cross product (×)	Cross product of vectors in X and Y	Complex numbers		CROSS	
gF1								
gF2								
gF3	EIGVEC	Function (monadic)	Eigenvector	Eigenvector of matrix in X ; tolerance set by SDIGS (use value of 10 ⁻¹⁶ for better performance or higher for better accuracy) ; Info : Displays : i/m Tol: current/target Iter: n, where i/m is count of eigenvalues, n is iteration counter ; shown if flag MONIT is SET ; for new models and simulator, extended internal eigenvalue precision with 159-digit type integration was added, achieving 39-digit accuracy for 2x2 and 3x3 solvers, but this is not applicable to DM42 hardware	Matrix operations	MONIT	EIGVEC	

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gF4	EIGVAL	Function (monadic)	Eigenvalues	Eigenvalues as a 1xn vector (returned in X) and as the diagonal elements of an nxn matrix (returned in Y) ; tolerance set by SDIGS (use value of 10-16 for better performance or higher for better accuracy) ; Info : Displays : i/m Tol: current/target Iter: n, where i/m is count of eigenvalues, n is iteration counter ; shown if flag MONIT is SET ; for new models and simulator, extended internal eigenvalue precision with 159-digit type integration was added, achieving 39-digit accuracy for 2x2 and 3x3 solvers, but this is not applicable to DM42 hardware	Matrix operations	MONIT	EIGVAL	
gF5	M.LU	Function (monadic)	LU decomposition	Decompose matrix in X into lower (L) in Y and upper (U or R) matrix in X ; pivot matrix in Z ; Info : LU (LR) factorisation, underlies inversion and linear solving	Matrix operations		M.LU	
gF6	M.QR	Function (monadic)	QR decomposition	Decompose matrix in X into unitary (Q) in Y and upper (R) matrix in X ; Info : QR factorisation, underlies eigenvalue computation	Matrix operations		M.QR	

p2	MATX	Link
F1	$[M]^{-1}$	
F2	MSQRT	
F3	RSUM	
F4	CSUM	
F5	$ M $	
F6	VECTOR	https://47calc.com/doc/R47/Menus/R47v0_Menu_VECTOR_page_1.pdf
fF1	$\ x\ _p$	
fF2	UNITV	
fF3	$[M]^T$	
fF4	$\angle \vec{x}, \vec{y}$	
fF5	dot	
fF6	cross	
gF1		
gF2		
gF3	EIGVEC	
gF4	EIGVAL	
gF5	M.LU	
gF6	M.QR	