

B. WERNER

APL PLUS[®]

Time-Sharing

- * easier to program
 - * faster to enter
 - * faster to execute
 - * more powerful
 - * requires less storage
 - * easier to learn and use
- ... than any other time-sharing language

Scientific
Time Sharing
Corporation

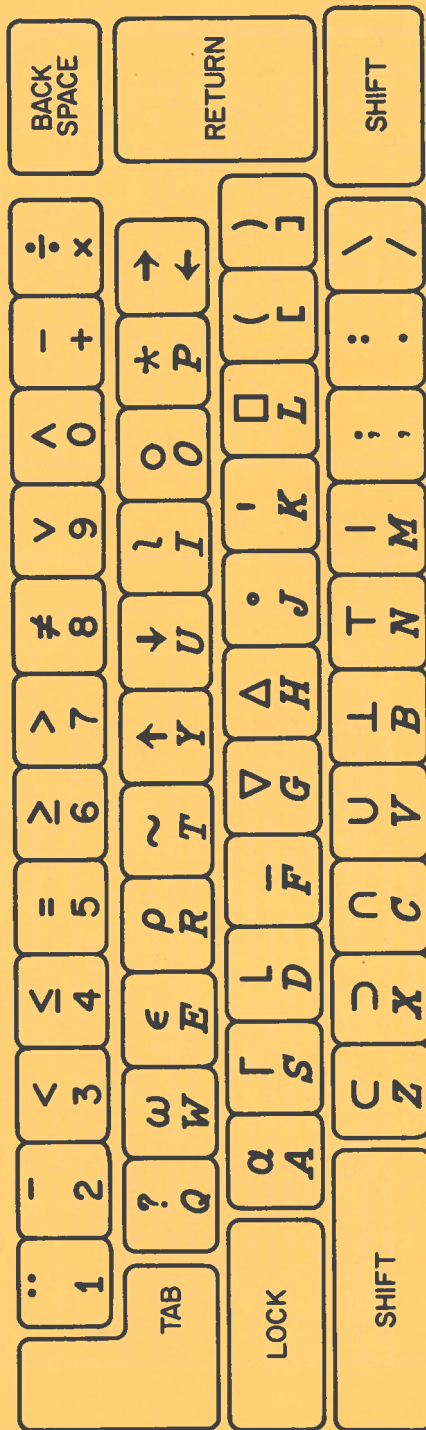
The national leader in APL time sharing

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APL KEYBOARD



PRIMITIVE MIXED FUNCTIONS

Name	Sign<1>	Definition or example<2>
Shape	ρA <i>f</i> $V_{\rho A}$	Dimension vector of A $\rho P \leftrightarrow 4$ $\rho E \leftrightarrow 3 \ 4$ $\rho S \leftrightarrow$ Empty vector $\rho 7 \leftrightarrow 10$ $\rho \rho A \leftrightarrow$ Rank of A $\rho \rho E \leftrightarrow 2$ $\rho \rho \rho A \leftrightarrow 1$
Reshape	$V_{\rho A}$	Reshape A to dimension V $7 \rho P \leftrightarrow 2 \ 3 \ 5 \ 7 \ 2 \ 3 \ 5$ $E \leftrightarrow 3 \ 4 \rho 12$ $0 \rho P \leftrightarrow 10$ $12 \rho E \leftrightarrow 12$ $(10) \rho P \leftrightarrow 2$ $2 \ 5 \rho E \leftrightarrow 1 \ 2 \ 3 \ 4 \ 5$ $6 \ 7 \ 8 \ 9 \ 10$
Ravel	$.A$	Make A into a vector $\leftrightarrow (*/\rho A)\rho A$ $P \leftrightarrow .P$ $.E \leftrightarrow 12$ $\rho, 7 \leftrightarrow 1$
Catenate <3 4>	A, B $A, [I]B$ <i>A, B</i>	Join two arrays along an existing coordinate. A and B conform if either $\rho A \leftrightarrow \rho B$ or $(I \neq 1 \rho A) / \rho A \leftrightarrow \rho B$ or $\rho A \leftrightarrow (I \neq 1 \rho B) / \rho B$ or if A or B is scalar. A scalar argument is extended (reshaped) to conform to the other argument. $'T', 'HIS' \leftrightarrow 'THIS'$ $2 \ 3 \ 5 \ 7, 1 \ 2 \leftrightarrow 2 \ 3 \ 5 \ 7 \ 1 \ 2$ $X, X \leftrightarrow$ $ABCDABCD$ $4,2,2,2$ $4,MM,[1] \ 5 \ 5 \ 5 \leftrightarrow 4 \ 3 \ 3 \ 3$ where $MM \leftrightarrow 2 \ 2 \ 2$ $4 \ 5 \ 5 \ 5$ $1 \ 1 \ 1$ $2 \ 2 \ 2$ $3 \ 3 \ 3$
Laminate <3 4>	$A, [I]B$ S, S	Join two arrays along a new coordinate. Two scalars laminate to a length-2 vector. Two non-scalar arguments must have identical shapes. If one argument is scalar, it is extended to match the shape of the non-scalar argument. I is non-integral and shows what existing coordinate(s) the new coordinate lies next to. $'O', 'K' \leftrightarrow 'OK'$ $100, 5 \leftrightarrow 100 \ 5$ $C, [1.5]D \leftrightarrow ABC$ DEF $C, [1.5]D \leftrightarrow BE$ CF $C, [0.5] ' * ' \leftrightarrow ABC$ where $C \leftrightarrow 'ABC'$ $***$ $D \leftrightarrow 'DEF'$
Index <4 6>	$V[A]$ $N[A;A]$ $A[A;...;A]$	$P[2] \leftrightarrow 3$ $E[1;] \leftrightarrow 1 \ 5 \ 9$ $E[1;] \leftrightarrow 1 \ 2 \ 3 \ 4$ $P[4 \ 3 \ 2 \ 1 \ 1 \ 3] \leftrightarrow 7 \ 5 \ 3 \ 2 \ 2 \ 5$ $E[1 \ 3; 3 \ 2 \ 1] \leftrightarrow 3 \ 2 \ 1$ $11 \ 10 \ 9$ $'ABCDEFGHIJKL'[E] \leftrightarrow EFGH$ $IJKL$
Index <3> generator Index of <3>	$1S$ $V1A$	First S integers $15 \leftrightarrow 1 \ 2 \ 3 \ 4 \ 5$ $10 \leftrightarrow$ An empty vector First occurrence of A in V , or $1+\rho V$ if no occurrence $P13 \leftrightarrow 2$ $5 \ 6 \ 5 \ 15 \leftrightarrow 1$ $P[P15 \ 2] \leftrightarrow 5 \ 2$ $5 \ 1 \ 2 \ 5$ $3 \ 5 \ 4 \ 5 \leftrightarrow P1E$ $5 \ 5 \ 5 \ 5$
Take Drop	$V+A$ $V-A$	Take or drop the ($ V[I] $ first (if $V[I] \geq 0$) or last (if $V[I] < 0$) elements along coordinate I of A $2+P \leftrightarrow 5 \ 7$ $2+'THIS' \leftrightarrow 'IS'$ $6+'THIS' \leftrightarrow$ Empty vector $6+P \leftrightarrow 0 \ 0 \ 2 \ 3 \ 5 \ 7$ $2 \ 3+X \leftrightarrow$ ABC EFG
Grade up <3> Grade down	$4V$ $4V$	The permutation which would order V (ascending -- 4 ; or descending -- 4) $43.7 \ 10 \ 3.7 \ 1.2 \leftrightarrow 4 \ 1 \ 3 \ 2$ $43.7 \ 10 \ 3.7 \ 1.2 \leftrightarrow 2 \ 1 \ 3 \ 4$ $V[4V]$ gives ascending sort
Compress <5> Expand	V/A $V \setminus A$	$1 \ 0 \ 1 \ 0/P \leftrightarrow 2 \ 5$ $1 \ 0 \ 1 \ 0/E \leftrightarrow 5 \ 7$ $1 \ 0 \ 1 \setminus 12 \leftrightarrow 1 \ 0 \ 2$ $9 \ 11$ $1 \ 2 \ 3 \ 4 \leftrightarrow 1 \ 0 \ 1/[1]E \leftrightarrow 1 \ 0 \ 1/E$ $9 \ 10 \ 11 \ 12$ $1 \ 0 \ 1 \ 1 \setminus X \leftrightarrow E \ FGH$ $I \ JKL$
Reverse <5> Rotate	ϕA $B\phi A$	Reflect A $\phi 4 \leftrightarrow 4 \ 3 \ 2 \ 1$ $\phi X \leftrightarrow$ Circulate A left B places $DCBA$ $HCFE$ $LKJI$ $eX \leftrightarrow \phi[1]X \leftrightarrow$ $EFGH$ $ABCD$ $1 \ 0 \ 1 \setminus \phi X \leftrightarrow EFGH$ $LIJK$
Transpose <6>	VQA QA	Coordinate I of A becomes coordinate $V[I]$ of result $2 \ 1\phi X \leftrightarrow \phi X \leftrightarrow$ Transpose last two coordinates AEI BFJ CGK DHL $1 \ 6 \ 11 \leftrightarrow 1 \ 1\phi E$
Membership	$A \in A$ $A \notin A$	$\rho W \in Y \leftrightarrow \rho W$ $P \in 13 \leftrightarrow 1 \ 1 \ 0 \ 0$ $E \in P \leftrightarrow 0 \ 1 \ 1 \ 0$ $0 \ 0 \ 0 \ 0$
Deal <3>	$S \rho S$ ρS	$WY \leftrightarrow$ Random selection of W elements from Y without replacement $(16)e276 \leftrightarrow$ vector with exactly two 1's $52752 \leftrightarrow$ card deck shuffle
Decode, Base value	$B1A$	Polynomial evaluation $1011 \ 7 \ 7 \ 6 \leftrightarrow 1776$ $1614 \ 0 \ 10 \leftrightarrow 1034$ $X1C \leftrightarrow$ Value of polynomial with coefficients C (for several values of X if X is a matrix)
Encode, Representation	$B1A$	Radix conversion of A to base B $10 \ 10 \ 10 \ 10 \leftrightarrow 1776 \leftrightarrow 1 \ 7 \ 7 \ 6$ $16 \ 16 \ 16 \ 16 \leftrightarrow 1034 \leftrightarrow 0 \ 4 \ 0 \ 10$ $0 \ 1 \ 13.141592 \leftrightarrow 3 \ 0.141592$ (Split integer and fraction)
Matrix divide	BA BBA	Generalized inverse of A B has $(\rho \rho B) \leq 1 \ 2$ and $1+\rho B \leftrightarrow 1+\rho A$ $105 \ 97 \ 114$ $7 \ 10 \ 2$ A has $(\rho \rho A) = 2$ and $\geq \rho A$ $4 \ 8 \ 5$ $3 \ 9 \ 2 \leftrightarrow 2 \ 9 \ 5$ \square minimizes Euclidean norm of error term $\sqrt{\square}(\rho V) \cdot 0 \ 1 \ 2 \leftrightarrow$ Quadratic least-squares fit of V

<1> Restrictions on argument ranks are indicated by: S for scalar, V for vector, M for matrix, A or B for any. Except as the first argument of $S:A$ or $S:A$, a scalar may be used instead of a vector. A one-element array may replace any scalar.

<2> Arrays used in examples: $P \leftrightarrow 2 \ 3 \ 5 \ 7$
 $E \leftrightarrow 5 \ 6 \ 7 \ 8$
 $9 \ 10 \ 11 \ 12$
 $ABCD$
 $X \leftrightarrow EFGH$
 $IJKL$

<3> Function result depends on index origin.

<4> Elision of any index selects all along that coordinate.

<5> The function is applied along the last coordinate; the symbols ρ , \setminus , and ϕ are equivalent to $/$, \setminus , and ϕ , respectively, except that the function is applied along the first coordinate. If $[S]$ appears after any of the symbols, the relevant coordinate is determined by the scalar S .

<6> Index origin affects left argument of ϕ and index list of $[A;...;A]$.

APL PLUS SYSTEM COMMANDS

ws ↔ workspace	wsid ↔ library number and workspace name or workspace name alone
<p>)nnnnnnn Sign on with user number nnnnnnn and start APL PLUS work session. Use)nnnnnnn:lockword if user number is locked.)OFF Sign off (end work session). Use)OFF:newlock to change user number lockword to newlock.)OFF HOLD Sign off and hold telephone dialup connection. Use)OFF HOLD:newlock to change user number lockword to newlock.)CONTINUE Sign off and save active ws as CONTINUE in library. Use)CONTINUE:newlock to change user number lockword.)CONTINUE HOLD Sign off, save active ws as CONTINUE and hold dialup connection. Use)CONTINUE HOLD:newlock for new lockword. </p>	
<p>)CLEAR Discard contents of active workspace; load a clear workspace.)LOAD wsid Load a copy of wsid from library into active workspace. Use)LOAD wsid:lockword if wsid is locked.)COPY wsid name(s) Copy into active ws named global objects from wsid. Use)COPY wsid:lockword name(s) if wsid is locked.)COPY wsid Copy into active workspace all global objects from wsid. Use)COPY wsid:lockword if wsid is locked.)PCOPY wsid name(s) Same as COPY except protect (do not replace) objects already in active ws (even tho the objects were named).)PCOPY wsid Same as COPY except protect (do not replace) objects already in active ws (even tho the objects were in wsid).)SAVE Store a copy of the active workspace.)SAVE wsid Store a copy of active workspace using wsid. Use)SAVE wsid:newlock to change workspace lockword to newlock.)DROP wsid Delete the workspace wsid from user's library. No change made to active workspace.)WSID Show wsid of active workspace.)WSID newwsid Change wsid of active workspace to newwsid. No change made in library.)LIB List names of workspaces in user's library.)LIB nnn List names of workspaces in public library nnn. 1 ≤ nnn ≤ 999)BL0T Obfuscation (deliberate smudge) to cover next input line. It can be used to keep lockwords secret. </p>	
<p>)FWS List alphabetically names of defined functions in active workspace. Use)FWS letter to start list at letter.)VARS List alphabetically names of variables in active workspace. Use)VARS letter to start list at letter.)GRPS List alphabetically names of groups in active workspace. Use)GRPS letter to start list at letter.)GROUP groupname name(s) Gather named objects (functions variables groups) into a group named groupname.)GRP groupname List names of objects in group groupname.)ERASE name(s) Delete named global objects (functions variables groups) from active workspace. No change made to library.)SEAL Unify a program package; lock and inhibit dispersal of functions in a workspace. </p>	
<p>)DIGITS nn Set maximum for significant digits in output. 1 ≤ nn ≤ 16)WIDTH nnn Set maximum width for output line. 30 ≤ nnn ≤ 130 In a clear workspace, 30 ≤ nnn ≤ 254)TABS nnn Set tab interval for automatic tabbing for input and output. nnn must correspond to manual tabs. 0 ≤ nnn ≤ 254)SYMBOLS nnnn In a clear workspace, set the minimum size of the symbol table. 26 ≤ nnnn ≤ 4241)ORIGIN n Set index origin (where n=1 or n=0) for array operations including mixed functions [...]; 1 4 7 ? 8)SI List halted functions (workspace state indicator))SIV List halted functions and associated local variables (augmented state indicator). </p>	
<p>)MSG port message Send message to specified port and lock keyboard to await reply.)MSGN port message Send message to specified port and unlock keyboard.)OPR message Send message to operator and lock keyboard to await reply.)OPRN message Send message to operator and unlock keyboard. </p>	<p>Names of commands may be abbreviated to the first four letters.</p>

DETERMINING AND CHANGING TERMINAL INPUT MODE

APL Typed:	Input Mode	APL Expects:	Escape by Typing:
6 space indent	Immediate Execution	Any Input	- - -
0:	Evaluated Input	Any APL expression	+ or)CLEAR or)LOAD wsid
Keyboard unlocked at left margin	□ Input Unmatched quote mark	1 line of characters Any characters	# OBSUBST BS=backspace ' (quote mark)
[n]	Function Definition	Line of function or editing command	∇ or)CLEAR or)LOAD wsid
[n] line of function indent to some position	Line-edit Phase 1	/, 0-9, A-Z	RETURN
[n] line of function no carrier return	Line-edit Phase 2	Line modification by "visual fidelity"	∇ as rightmost character

SPECIAL SYMBOLS

A+D	Request evaluated input. Assign value to A.
'X7*'	Quote marks delimit character data constants.
A+D	Request character data input; assign it to A.
□+A	Print value in A and pass it to left.
⌘	Lamp symbol; first character of comment statement.
T&F+V	Set trace vector of statement numbers for function F.
S&F+V	Set stop vector of statement numbers for function F.
+X	Branch to X; X may be a label or statement number. If X is a vector, +X[1]. If X is empty vector, there is no branch; the next line is taken. If X is not a statement number in the function, terminate execution of the function.
+	Terminate entire execution sequence of functions.
:	Separates label from statement in functions.
;	Separates character and numeric data in same output statement.
Ⓜ39	
Overstruck symbols: ABCDEFGHIJKLMOQRSTUVWXYZa-z*+@#%&'()*~!:";?<=>[]{} _`~	

COMPOSITE FUNCTIONS

0/A	Reduction across last coordinate of A.
0/[S]A	Reduction across coordinate S of A.
A0.B	Generalized Inner Product of A and B.
A.0B	Generalized Outer Product of A and B.
where 0 can be any of +-x+*0[:]0<≤2>=V^W^ E.G. +/V sums all elements of vector V. A+.xB is ordinary matrix product of A and B.	

0/A
 0/[S]A

PRIMITIVE SCALAR DYADIC FUNCTIONS $A \circ B$				\odot	PRIMITIVE SCALAR MONADIC FUNCTIONS $\odot B$					
Definition or Example		Name		Name	Definition or Example					
1.5 ↔ $-2+3.5$	5.5 ↔ $2+3.5$	$-1.5 \leftrightarrow 2+^{-}3.5$	Add	+	No Change	$0+B \leftrightarrow +B$	$3.5 \leftrightarrow +3.5$	$-3.5 \leftrightarrow +^{-}3.5$		
$-1.5 \leftrightarrow 2-3.5$	$1.5 \leftrightarrow 3.5-2$	$5.5 \leftrightarrow 2-^{-}3.5$	Subtract	-	Change Sign	$0-B \leftrightarrow -B$	$-3.5 \leftrightarrow -3.5$	$3.5 \leftrightarrow -^{-}3.5$		
$5 \leftrightarrow 4 \times 1.25$	$^{-}3 \leftrightarrow 6 \times^{-}1.5$	$0 \leftrightarrow 0 \times^{-}.09$	Multiply	×	Signum	Sign of B: $1 \leftrightarrow \times 7.2$	$0 \leftrightarrow \times 0$	$-1 \leftrightarrow \times^{-}3$		
$1.75 \leftrightarrow 3.5 \div 2$	$^{-}5 \leftrightarrow 10 \div^{-}2$	$4 \leftrightarrow 12 \div 3$	Divide	÷	Reciprocal	$1+B \leftrightarrow \div B$	$.5 \leftrightarrow \div 2$	$-2 \leftrightarrow \div^{-}.5$		
$8 \leftrightarrow 2^*3$	A raised to the power B ↔ A^*B $2 \leftrightarrow 4^*.5$ $3 \leftrightarrow^{-}27^*(1+3)$		Power	*	Exponential	$(2.71828\dots)^*B$	$2.71828\dots \leftrightarrow *1$	$4 \leftrightarrow *1.386294361\dots$	$20.0855\dots \leftrightarrow *3$	
$(\odot B) \div \odot A \leftrightarrow$ logarithm of B for base A ↔ $A \odot B$	$1.87506\dots \leftrightarrow 10 \odot 75$	$3 \leftrightarrow 2 \odot 8$	Logarithm	⊙	Natural Logarithm	$(2.71828\dots) \odot B$	$N \leftrightarrow * \odot N \leftrightarrow \odot * N$	$1.386294361\dots \leftrightarrow \odot 4$	$^{-}0.693147\dots \leftrightarrow \odot .5$	
$7 \leftrightarrow 3 \lceil 7$	Larger of A and B ↔ $A \lceil B$ $6.01 \leftrightarrow 6.01 \lceil 6.01$ $^{-}3 \leftrightarrow^{-}3 \lceil^{-}7$		Maximum	⌈	Ceiling	Smallest integer ≥ B ↔ $\lceil B$	$4 \leftrightarrow \lceil 3.141$	$^{-}3 \leftrightarrow \lceil^{-}3.141$	$101 \leftrightarrow \lceil 101$	
$3 \leftrightarrow 3 \lfloor 7$	Smaller of A and B ↔ $A \lfloor B$ $6.01 \leftrightarrow 6.01 \lfloor 6.01$ $^{-}7 \leftrightarrow^{-}3 \lfloor^{-}7$		Minimum	⌊	Floor	Largest integer ≤ B ↔ $\lfloor B$	$3 \leftrightarrow \lfloor 3.141$	$^{-}4 \leftrightarrow \lfloor^{-}3.141$	$101 \leftrightarrow \lfloor 101$	
$3 \leftrightarrow 5 \lfloor 13$	B - (A) × B + A ↔ $A \lfloor B$ For A=0 $5 \leftrightarrow 0 \lfloor 5$ B ↔ $A \lfloor B$ For A=0, B ≥ 0 Domain Error ↔ $A \lfloor B$ For A=0, B < 0 $.14 \leftrightarrow 1 \lfloor 3.14$ $4 \leftrightarrow 5 \lfloor^{-}11$ D.E. ↔ $0 \lfloor^{-}4$		Residue		Magnitude	Absolute value of B ↔ $ B $	$9.5 \leftrightarrow 9.5$	$9.5 \leftrightarrow ^{-}9.5$	$0 \leftrightarrow 0$	
$6 \leftrightarrow 2 \uparrow 4$	$(!B) + (!A) \times !B - A \leftrightarrow A \uparrow B$ For $A \leq B$ $0 \leftrightarrow 9 \uparrow 3$ $1 \leftrightarrow 5 \uparrow 5$ $0 \leftrightarrow A \uparrow B$ For $A > B$ Complete Beta Function for A and B $^{-}10 \leftrightarrow 3 \uparrow^{-}3$ $4.9346\dots \leftrightarrow 1.1 \uparrow 4.5$		Combinations or Binomial Coefficient or Beta	!	Factorial or Gamma	$B \times !B - 1 \leftrightarrow !B$ For $B \geq 1$, B an integer; $1 \leftrightarrow !0$ Gamma(B+1) ↔ $!B$ for non-integer B $6 \leftrightarrow !3$ $39916800 \leftrightarrow !11$ $2.68344\dots \leftrightarrow !2.3$ $3.3283\dots \leftrightarrow !^{-}2.3$ D.E. ↔ $!^{-}2$				
See Table of Mixed Functions				?	Roll	Random choice from $!B \leftrightarrow ?B$ (Origin dependent) Random integer from 1 2 3 4 5 6 7 8 ↔ ?8				
See Table at right			Circular	∘	Pi times	$B \times 3.14159\dots \leftrightarrow \circ B$	$6.283185\dots \leftrightarrow \circ 2$			
A	B	$A \wedge B$	AVB	A^*B	$\sim(A \wedge B)$	$A^* \sim B$	$\sim(A \vee B)$			
0	0	0	0	1	1	1	1	And		
0	1	0	1	1	1	0	0	Or		
1	0	0	1	1	1	0	0	Nand		
1	1	1	1	0	0	0	0	Nor		
Relational Tests:			$1 \leftrightarrow 3 < 4$	$0 \leftrightarrow 4 < 3$	Less	<				
Result is 1 if the relation is true; result is 0 if the relation is false.			$1 \leftrightarrow 4 \leq 4$	$0 \leftrightarrow 6 \leq 4$	Not Greater	≤				
			$1 \leftrightarrow 9 = 9$	$0 \leftrightarrow 2 = 9$	Equal	=				
			$1 \leftrightarrow 7 \geq 7$	$0 \leftrightarrow 3 \geq 8$	Not Less	≥				
			$1 \leftrightarrow 7 > 0$	$0 \leftrightarrow 2 > 8$	Greater	>				
			$1 \leftrightarrow 3 \neq 6$	$0 \leftrightarrow 9 \neq 9$	Not Equal	≠				
				\sim	Not	Logical Negation			$0 \leftrightarrow \sim 1$	$1 \leftrightarrow \sim 0$
				\wedge	Table of Dyadic ∘ Functions					
				\vee	$(1-B*2)^*.5 \leftrightarrow 0 \circ B$					$(1-B*2)^*.5 \leftrightarrow 0 \circ B$
				∇	Arcsin B ↔ $(-1) \circ B$					Sine B ↔ $1 \circ B$
				∇	Arccos B ↔ $(-2) \circ B$					Cosine B ↔ $2 \circ B$
				∇	Arctan B ↔ $(-3) \circ B$					Tangent B ↔ $3 \circ B$
				∇	$(^{-}1+B*2)^*.5 \leftrightarrow (-4) \circ B$					$(1+B*2)^*.5 \leftrightarrow 4 \circ B$
				∇	Arcsinh B ↔ $(-5) \circ B$					Sinh B ↔ $5 \circ B$
				∇	Arccosh B ↔ $(-6) \circ B$					Cosh B ↔ $6 \circ B$
				∇	Arctanh B ↔ $(-7) \circ B$					Tanh B ↔ $7 \circ B$
				∇	B in radians					

<u>syntax</u>	<u>use</u>	<u>codes</u> access <u>FE</u>
expression <i>FAPPEND</i> fn	place new component on file	8 7
'lib name amt' <i>FCREATE</i> fn	create and tie new file	- 1
<i>FDROP</i> fn,n	delete component from file	32 13
'lib name' <i>FERASE</i> fn	erase file	4 5
<i>FHOLD</i> fn,fn,...	request temporary exclusive use of files	64 14
result + <i>FLIB</i> n	names of files in library n	- 9
result + <i>FLIM</i> fn	gives component numbering	1 10
result + <i>FNAMES</i>	names of tied files	- 19
result + <i>FNUMS</i>	numbers of tied files	- 18
result + <i>FRDAC</i> fn	gives access matrix	256 16
result + <i>FRDCI</i> fn,cn	gives component information (space,who,when)	512 11
result + <i>FREAD</i> fn,cn	reads component from file	1 6
'lib name amt' <i>FRENAME</i> fn	change lib, name, or space	128 15
expression <i>FREPLACE</i> fn,cn	replace component in a file	16 8
result + <i>FSIZE</i> fn	gives component numbering, space used, space reserved	1 10
expression <i>FSTAC</i> fn	defines accesses for users	256 17
'lib name' <i>FSTIE</i> fn	opens file for shared use	any 4
'lib name' <i>FTIE</i> fn	opens file for exclusive use	2 2
<i>FUNTIE</i> fn,fn,...	unties files	- 3

Notes: fn is file number; cn is component number

Access Matrix Columns +	1	2	3
	account number	permission code	lock
	(0 for everyone)	(sum of access codes)	(0 for none)

Reference: APL PLUS FILE SUBSYSTEM INSTRUCTION MANUAL

ΔFMT Workspace 1 PLOTFORMAT

'fp,fp,...,fp' ΔFMT (expr;expr;...;expr)

expr scalar, vector, or matrix

fp format phrase:

maw	character data
maw.d	floating-point
mqfw.d	fixed-point
mqiw	Integer
mXw	skip
m□text□	literal text

m repetition factor (optional)

w field width

d number of decimal positions

q qualifiers (optional):

B	blank if zero
C	comma insertion
L	left justify
Z	leading zeroes
M□text□	left of negative result
N□text□	right of negative result
P□text□	left of zero or positive result
Q□text□	right of zero or positive result
R□text□	background for result

SYSTEM DEPENDENT FUNCTIONS

X Definition of rX

- | | |
|----|--|
| 19 | Accumulated keying time (time during which the keyboard has been unlocked awaiting entries) during this session. |
| 20 | The time of day. |
| 21 | The central computer time used in this session. |
| 22 | The amount of available space (in bytes). |
| 23 | The number of terminals currently connected. |
| 24 | The time at the beginning of this session. |
| 25 | The date. |
| 26 | The first element of the vector r27. |
| 27 | The vector of statement numbers in the state indicator. |
| 28 | A code indicating the terminal device being used. |
| 29 | User sign-on number. |

NOTES

- All times in 1:60 seconds
- Date is represented by a 6-digit integer; successive digit pairs represent month, day, and year.
- r27 yields a vector; all other results are scalars.

FUNCTION EDITING

FORM	RESULT
[]	LIST ENTIRE FUNCTION.
[]	LIST BEGINNING WITH LINE N.
[N]	INSERT OR REPLACE LINE N; TO DELETE, FOLLOW WITH INTERRUPT AND CARRIAGE RETURN.
[N□]	LIST LINE N AND INSERT REPLACE OR DELETE.
[N□M]	LIST LINE N AND PLACE TYPE BALL UNDER COLUMN M FOR EDITING.

WHEN EDITING A LINE OF A FUNCTION, SPACES TO BE REMOVED ARE INDICATED BY '/', SPACES TO BE ADDED BY SINGLE DIGITS OR LETTERS; THE SPACES ARE INSERTED BEFORE THE INDICATED SPOT; WHEN LETTERS ARE USED, THE NUMBER OF SPACES INSERTED IS EQUAL TO 5×'ABCDEFGHI...'\ LETTER.