HP48G Entry Reference

Complete listing sorted by functionality
Edition 2.11, 30 May 2005

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Table of Contents

1 Introduction

This is a list of SystemRPL, User RPL and ML entries. The list groups the entries by task in many different chapters and sections. If you are looking for a particular entry go directly to the Index. There is also an address-sorted list, if you want to look up a particular address.

1.1 Disclaimer and Acknowledgments

The information provided in this document was compiled from a large variety of sources. The transformation of all the different formats to a single database was largely done with special purpose programs to reverse-engineer the different documents. This has worked very well in many cases, and less well in some other cases. If some of the information looks oddly formatted, the reason is probably the automatic extraction.

Many of the authors of the original documents will find literal bits and pieces of their text in this document. Thanks to all of them for their generosity in allowing me to use their documents and files freely.

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If you find any errors, let us know so that the database can up updated and fixed. Sent bug reports and other comments to Carsten Dominik. Reports about the ML chapter should be sent directly to Thomas Rast, but with a CC to Carsten Dominik.

Here is a list of sources which have been used.

Programming in System RPL by Eduardo Kalinowski
: This book has been a major source for the database. The entire book has been reverse-engineered using pdftotext and then a variety of Emacs and Perl programs to extract and format the reference part of the book.

CAS Documentation Draft by Bernard Parisse
: Bernard Parisse has kindly sent me a file with draft documentation about most CAS entries which is the basis of the CAS chapter. This covers both code derived from Erable (written by Bernard) and from ALG48 (by Mika Heiskanen and Claude-Nicolas Fiechter). The documentation is not complete, and not entirely up-to-date. However, the information given should be accurate.

entries.srt by Mika Heiskanen
: Mika's really useful collection of entry description has been used to double-check the information derived from Eduardo's book.

ML entry descriptions by Peter Geelhoed
: Peter Geelhoed created the initial version of the ML section for this document.

HP48/49 entry cross-reference by Joe Horn
: This document has been used to make a list of entries for the HP49 in the first place, and to add and double-check addresses for both calculators.

Various posts on `comp.sys.hp48`
: A number of post on `comp.sys.hp48` have documented a set of entry points, for example the Graphical Toolbox (Cyrille de Brebisson), the Editor related entries (myself) and other stuff.

Supported entry lists from HP
: HP has published lists of supported entries for all calculators in the database. The lists generally only contain names and addresses, no further description.

Further contributions
: Denis Martinez, Alberto Zamora Oyarce, Wolfgang Rautenberg, Michael de Coninck, Christoph Giesselink, Martin Lang, Piotr Kowalewski, Lilian Pigallio and in particular Jean-Yves Avenard have also contributed information about various entry points and/or have replied to my questions about different aspects related to entries.

1.2 Terminology

1.2.1 Abbreviations used in Stack Diagrams

Here is a list of the codes use to denote different objects in the stack diagrams.

`ob`	any object
`1...n`	n objects
`#`	binary integer (BINT)
`HXS`	hex string (User binary integer)
`CHR`	character
`$`	character string
`T`	TRUE
`F`	FALSE
`flag`	TRUE or FALSE
`%`	real number
`%%`	extended real number
`%C`	complex number
`%%C`	extended complex number
`z, Z ,ZINT`	infinite precision integer
`N`	positive infinite precision integer
`s, symb`	symbolic
`u, unit`	unit object
`{}`	list
`A, []`	Array
`V, []`	Vector
`M, [[]]`	Matrix
`P`	Polynom, a list of Qs
`Q`	ZINT or P
`meta, ob1..obn #n`	meta object
`grob`	graphical object
`menu`	list or program returning a list

UserRPL stack diagrams use some additional abbreviations

`x,y`	real, list, generic UserRPL object
`c, (,)`	complex number
`#`	hex string (User binary integer)
`greek theta`	angle (a real number)
`m,n`	integer (ZINT or real)
`date`	DD.MMYYYY or MM.DDYYYY
`name`	global name
`prog,prg`	program
`f,func`	function
`F`	integral of f

1.2.2 Unsupported Entry Points

A large number of entries in this database are not officially supported (i.e. their address is not guarantied by HP to be stable). However, many of these entries can still be used, provided that the entry address is (or has been) *stable* in all ROM versions.

On the HP49G, two address intervals have been pointed out by Jean-Yves Avenard to be stable, so entries found in these intervals will be added to this database.

On the HP48G, no new ROM versions are to be expected, and all entries can be considered *stable*.

The names of unsupported but stable entries will be *enclosed in single parenthesis*, like `(CURSOR@)`.

1.2.3 More Information

This database has been used to create the entries reference in the second edtion of *Programming in System RPL* by Eduardo M. Kalinowski and C. Dominik. In this book, the entry list is embedded into a lot more information about SystemRPL and the HP49G, so if you need additional information, check the book. The main reasons to make also the entry database available is that it is a more compact listing, contains information about ML entries as well and lists the addresses of the entry on many different calculators.

2 HP Objects

2.1 Binary Integers

2.1.1 Built-in BINTS 0-127

03FEF	BINT0	0d 0h aka: ZERO, any
03FF9	BINT1	1d 1h aka: ONE, real, MEMERR
04003	BINT2	2d 2h aka: TWO, cmp
0400D	BINT3	3d 3h aka: THREE, str
04017	BINT4	4d 4h aka: FOUR, arry
04021	BINT5	5d 5h aka: FIVE, list
0402B	BINT6	6d 6h aka: SIX, id, idnt
04035	BINT7	7d 7h aka: SEVEN, lam
0403F	BINT8	8d 8h aka: EIGHT, seco
04049	BINT9	9d 9h aka: NINE, symb
04053	BINT10	10d Ah aka: TEN, sym
0405D	BINT11	11d Bh aka: ELEVEN, hxs
04067	BINT12	12d Ch aka: TWELVE, grob
04071	BINT13	13d Dh aka: TAGGED, THIRTEEN
0407B	BINT14	14d Eh aka: EXT, FOURTEEN, unitob
04085	BINT15	15d Fh aka: FIFTEEN, rompointer

0408F	BINT16	16d 10h aka: REALOB, SIXTEEN
04099	BINT17	17d 11h aka: SEVENTEEN, 2REAL, REALREAL
040A3	BINT18	18d 12h aka: EIGHTEEN
040AD	BINT19	19d 13h aka: NINETEEN
040B7	BINT20	20d 14h aka: TWENTY
040C1	BINT21	21d 15h aka: TWENTYONE
040CB	BINT22	22d 16h aka: TWENTYTWO
040D5	BINT23	23d 17h aka: TWENTYTHREE
040DF	BINT24	24d 18h aka: TWENTYFOUR
040E9	BINT25	25d 19h aka: TWENTYFIVE
040F3	BINT26	26d 1Ah aka: REALSYM, TWENTYSIX
040FD	BINT27	27d 1Bh aka: TWENTYSEVEN
04107	BINT28	28d 1Ch aka: TWENTYEIGHT
04111	BINT29	29d 1Dh aka: TWENTYNINE
0411B	BINT30	30d 1Eh aka: REALEXT, THIRTY
04125	BINT31	31d 1Fh aka: THIRTYONE
0412F	BINT32	32d 20h aka: THIRTYTWO
04139	BINT33	33d 21h aka: THIRTYTHREE
04143	BINT34	34d 22h aka: THIRTYFOUR
0414D	BINT35	35d 23h aka: THIRTYFIVE

04157	BINT36	36d 24h aka: TTHIRTYSIX
04161	BINT37	37d 25h aka: THIRTYSEVEN
0416B	BINT38	38d 26h aka: THIRTYEIGHT
04175	BINT39	39d 27h aka: THIRTYNINE
0417F	BINT40	40d 28h aka: FORTY, FOURTY
04189	BINT41	41d 29h aka: FORTYONE
04193	BINT42	42d 2Ah aka: FORTYTWO
0419D	BINT43	43d 2Bh aka: FORTYTHREE
64B12	BINT44	44d 2Ch aka: FORTYFOUR
64B1C	BINT45	45d 2Dh aka: FORTYFIVE
64B26	BINT46	46d 2Eh aka: FORTYSIX
64B30	BINT47	47d 2Fh aka: FORTYSEVEN
64B3A	BINT48	48d 30h aka: FORTYEIGHT
64B44	BINT49	49d 31h aka: FORTYNINE
64B4E	BINT50	50d 32h aka: FIFTY
64B58	BINT51	51d 33h aka: FIFTYONE
64B62	BINT52	52d 34h aka: FIFTYTWO
64B6C	BINT53	53d 35h aka: FIFTYTHREE, STRLIST, THREEFIVE
64B76	BINT54	54d 36h aka: FIFTYFOUR
64B80	BINT55	55d 37h aka: FIFTYFIVE

64B8A	BINT56	56d 38h aka: FIFTYSIX
64B94	BINT57	57d 39h aka: FIFTYSEVEN
64B9E	BINT58	58d 3Ah aka: FIFTYEIGHT
64BA8	BINT59	59d 3Bh aka: FIFTYNINE
64BB2	BINT60	60d 3Ch aka: SIXTY
64BBC	BINT61	61d 3Dh aka: SIXTYONE
64BC6	BINT62	62d 3Eh aka: SIXTYTWO
64BD0	BINT63	63d 3Fh aka: SIXTYTHREE
64BDA	BINT64	64d 40h aka: BINT40h, SIXTYFOUR, YHI
64BE4	BINT65	65d 41h aka: ARRYREAL
64BEE	BINT66	66d 42h aka: FOURTWO
64BF8	BINT67	67d 43h aka: FOURTHREE
64C02	BINT68	68d 44h aka: SIXTYEIGHT
64C0C	BINT69	69d 45h aka: FOURFIVE
64C16	BINT70	70d 46h aka: SEVENTY
64C20	BINT74	74d 4Ah aka: SEVENTYFOUR
64C2A	BINT79	79d 4Fh aka: SEVENTYNINE
64C3A	BINT80	80d 50h aka: EIGHTY
64C3E	BINT81	81d 51h aka: EIGHTYONE, LISTREAL
64C48	BINT82	82d 52h aka: LISTCMP

64C52	BINT83	83d 53h aka: FIVETHREE
64C5C	BINT84	84d 54h aka: FIVEFOUR
64C66	BINT85	85d 55h aka: 2LIST
64C70	BINT86	86d 56h aka: FIVESIX
64C7A	BINT87	87d 57h aka: LISTLAM
64C84	BINT91	91d 5Bh aka: BINT_91d
64C8E	BINT96	96d 60h aka: BINT_96d
64C98	BINT97	97d 61h aka: IDREAL
64CA2	(BINT98)	98d 62h
64CAC	BINT100	100d 64h aka: ONEHUNDRED
64CB6	(BINT101)	101d 65h
64CC0	BINT111	111d 6Fh aka: char
64CCA	(BINT112)	112d 70h
64CD4	(BINT113)	113d 71h
64CDE	(BINT114)	114d 72h
64CE8	BINT115	115d 73h aka: BINT_115d
64CF2	BINT116	116d 74h aka: BINT_116d
64CFC	(BINT117)	117d 75h
64D06	BINT122	122d 7Ah aka: BINT_122d

2.1.2 Built-in BINTS 127-255

64D10	BINT128	128d 80h aka: BINT80h
64D1A	BINT130	130d 82h aka: BINT130d, BINT_130d, XHI-1
64D24	BINT131	131d 83h aka: BINT_131d, BINT131d, XHI

64D2E	(#8F)	143d	8Fh
64D38	SYMBREAL	145d	91h
64D42	(SYMBCMP)	146d	92h
64D4C	(SYMBSYM)	154d	9Ah
64D56	SYMBUNIT	158d	9Eh
64D60	(backup)	159d	9Fh
64D6A	SYMOB	160d	A0h
64D74	SYMREAL	161d	A1h
64D88	(SYMLIST)	165d	A5h
64D92	SYMID	166d	A6h
64D9C	SYMLAM	167d	A7h
64DA6	(SYMSYMB)	169d	A9h
64DB0	SYMSYM	170d	AAh
64DBA	SYMEXT	174d	AEh
1CD69	(BINT_AFh)	175d	AFh
64DC4	(HXSREAL)	177d	B1h
64DCE	(2HXS)	187d	BBh
64DD8	BINTC0h	192d	C0h
64DE2	2GROB	204d	CCh
64DEC	TAGGEDANY	208d	D0h
64DF6	EXTREAL	225d	E1h
64E00	EXTSYM	234d	EAh
64E0A	2EXT	238d	EEh
64E14	ROMPANY	240d	F0h
64E1E	BINT253	253d	FDh
64E28	BINT255d	255d	FFh

2.1.3 Built-in BINTS 256-

64E32	REALOBOB	256d	100h
64E3C	#_102	258d	102h
64E46	(#SyntaxErr)	262d	106h
64E50	(BINT_263d)	263d	107h
64E5A	(REALREALOB)	272d	110h
64E64	3REAL	273d	111h
15D6F	(BINT_117h)	279d	117h
64E6E	(Err#Kill)	291d	123h
64E78	(Err#NoLstStk)	292d	124h

64E82	(#NoRoomForSt)	305d 131h
64E8C	(#132)	306d 132h
64E96	(REALSTRSTR)	307d 133h
64EA0	(#134)	308d 134h
64EAA	(#135)	309d 135h
64EB4	(#136)	310d 136h
64EBE	(#137)	311d 137h
64EC8	(#138)	312d 138h
64ED2	(#139)	313d 139h
64EDC	(#13A)	314d 13Ah
64EE6	(#13B)	315d 13Bh
64EF0	(#13D)	317d 13Dh
64EFA	(Err#Cont)	318d 13Eh
64F04	INTEGER337	337d 151h
64F0E	(CMPOBOB)	512d 200h
64F18	(Err#NoLstArg)	517d 205h
64F22	STRREALREAL	785d 311h
64F2C	(ARRYREALREAL)	1041d 411h
64F36	(ARRYREALCMP)	1042d 412h
64F40	(3ARRY)	1092d 444h
64F4A	(ARRYLISTREAL)	1105d 451h
64F54	(ARRYLISTCMP)	1106d 452h
64F5E	(LISTREALOB)	1296d 510h
64F68	(LISTREALREAL)	1297d 511h
64F72	(LISTLISTOB)	1360d 550h
64F7C	(IDREALOB)	1552d 610h
64F86	(IDLISTOB)	1616d 650h
64F90	(FSTMACROROM#)	1792d 700h
64F9A	(PROGIDREAL)	2145d 861h
64FA4	(PROGIDCMP)	2146d 862h
64FAE	(PROGIDLIST)	2149d 865h
64FB8	(PROGIDEXT)	2158d 86Eh
34301	Attn#	2563d A03h
34301	ATTN#	2563d A03h
64FC2	ATTNERR	2563d A03h
64FCC	(SYMREALREAL)	2577d A11h
64FD6	(SYMREALCMP)	2578d A12h
64FE0	(SYMREALSYM)	2586d A1Ah

64FEA	(SYMCMPREAL)	2593d A21h
64FF4	(SYMCMPCMP)	2594d A22h
64FFE	(SYMCMPSYM)	2602d A2Ah
65008	(SYMIDREAL)	2657d A61h
65012	(SYMIDCMP)	2658d A62h
6501C	(SYMIDLIST)	2661d A65h
65026	(SYMIDEXT)	2670d A6Eh
65030	(SYMSYMREAL)	2721d AA1h
6503A	(SYMSYMCMP)	2722d AA2h
65044	(3SYM)	2730d AAAh
6504E	(XFERFAIL)	3078d C06h
65058	(PROTERR)	3079d C07h
65062	(InvalServCmd)	3080d C08h
6506C	Connecting	3082d C0Ah
65076	(Retry)	3083d C0Bh
65080	(#CAlarmErr)	3583d DFFh
6508A	EXTOBOB	3584d E00h
03F8B	TYPEREAL	10547d 2933h
03FDB	(TYPEEREL)	10581d 2955h
03FA9	TYPEIDNT	10568d 2948h
03F95	(TYPECMP)	10615d 2977h
03F9F	(TYPELIST)	10868d 2A74h
03FC7	(TYPERRP)	10902d 2A96h
03FBD	(TYPESYMB)	10936d 2AB8h
03FE5	(TYPEEXT)	10970d 2ADAh
03FB3	(TYPECOL)	11677d 2D9Dh
03FA9	TYPEIDNT	10568d 2948h
03FD1	(TYPELAM)	11885d 2E6Dh
65094	#EXITERR	458752d 70000h
6509E	MINUSONE	1048575d FFFFFh

2.1.4 Pushing Several BINTs

641FC	ZEROZERO	(→ #0 #0)
64209	#ZERO#ONE	(→ #0 #1)
6427A	#ZERO#SEVEN	(→ #0 #7)
63AC4	ONEONE	(→ #1 #1) aka: ONEDUP

6428A	#ONE#27	(→ #1 #27d)
6429D	#TWO#ONE	(→ #2 #1)
642AF	#TWO#TWO	(→ #2 #2)
642BF	#TWO#FOUR	(→ #2 #4)
642D1	#THREE#FOUR	(→ #3 #4)
642E3	#FIVE#FOUR	(→ #5 #4)
64309	ZEROZEROZERO	(→ #0 #0 #0)
6431D	ZEROZEROONE	(→ #0 #0 #1)
64331	ZEROZEROTWO	(→ #0 #0 #2)
62535	DROPZERO	(ob → #0)
64449	(3DROPZERO)	(ob ob ob → #0)
6254E	2DROP00	(ob ob → #0 #0)
62946	DROPONE	(ob → #1)
63A88	DUPZERO	(ob → ob ob #0)
63A9C	DUPONE	(ob → ob ob #1)
63AD8	DUPTWO	(ob → ob ob #2)
63AB0	SWAPONE	(ob ob' → ob' ob #1)
62E3A	ZEROSWAP	(ob → #0 ob)
63079	ZEROOVER	(ob → ob #0 ob)
6351F	ZEROFALSE	(→ #0 F)
62E67	ONESWAP	(ob → #1 ob)
63533	ONEFALSE	(→ #1 F)

2.1.5 Conversion

18CEA	COERCE	(% → #)
62CE1	COERCEDUP	(% → # #)
62E7B	COERCESWAP	(ob % → # ob)
194F7	COERCE2	(% %' → # #')
18CD7	%ABSCOERCE	(% → #)
193DA	(COERCE{}2)	({%} → {#})
4F408	C%>#	(C% → # #')
05A03	HXS>#	(hxs → #)
4F3D1	(2HXS>#)	(hxs hxs → # #)
51532	2HXSLIST?	({ hxs hxs' } → # #') Converts list of two hxs to two bints. Generates "Bad Argument Value" for invalid input.
05A51	CHR>#	(chr → #)

2.1.6 Arithmetic Functions

03DBC	#+	(# #' → #+#')
25B0B	(#+OVF)	(# #' → #+#') 0 ≤ result ≤ FFFFF
03DEF	#1+	(# → #+1)
03E2D	#2+	(# → #+2)
6256A	#3+	(# → #+3)
6257A	#4+	(# → #+4)
6258A	#5+	(# → #+5)
6259A	#6+	(# → #+6)
625AA	#7+	(# → #+7)
625BA	#8+	(# → #+8)
625CA	#9+	(# → #+9)
625DA	#10+	(# → #+10)
625EA	#12+	(# → #+12)
03DE0	#-	(# #' → #-#')
03E0E	#1-	(# → #-1)
03E4E	#2-	(# → #-2)
625FA	#3-	(# → #-3)
6260A	#4-	(# → #-4)
6261A	#5-	(# → #-5)
6262A	#6-	(# → #-6)
03EC2	#*	(# #' → #*#')
191B9	#*OVF	(# #' → #*#') 0 ≤ result ≤ FFFFF
03E6F	#2*	(# → #*2)
62691	#6*	(# → #*6)
62674	#8*	(# → #*8)
6264E	#10*	(# → #*10)
03EF7	#/	(# #' → #r #q)
03E8E	#2/	(# → #/2) Rounded down.
637CC	#1--	(# #' → #-#'+1) aka: #-+1
63808	#1-+	(# #' → #+#'-1) $1-+ is a typo in EXTABLE. aka: #+-1, $1-+
624FB	#-#2/	(# #' → (#-#')/2)
627D5	#+DUP	(# #' → #+#' #+#')

62DFE	#+SWAP	(ob # #’ → #+#’ ob)
63051	#+OVER	(ob # #’ → ob #+#’ ob)
627F8	#-DUP	(# #’ → #-#’ #-#’)
62E12	#-SWAP	(ob # #’ → #-#’ ob)
63065	#-OVER	(ob # #’ → ob #-#’ ob)
62809	#1+DUP	(# → #+1 #+1)
62E26	#1+SWAP	(ob # → #+1 ob)
1DABB	#1+ROT	(ob ob’ # → ob’ #+1 ob)
6281A	#1-DUP	(# → #-1 #-1)
5E4A9	#1-SWAP	(ob # → #-1 ob) aka: pull
62FD9	#1-ROT	(ob ob’ # → ob’ #-1 ob)
28558	#1-UNROT	(ob ob’ # → #-1 ob ob’)
62E4E	#1-1SWAP	(# → 1 #-1) Returns the bint ONE and the result.
628EB	DUP#1+	(# → # #+1)
626F7	DUP#2+	(# → # #+2)
6292F	DUP#1-	(# → # #-1)
63704	2DUP#+	(# #’ → # #’ #+#’) aka: DUP3PICK#+
637F4	DROP#1-	(# ob → #-1)
62794	SWAP#-	(# #’ → #’-#)
62904	SWAP#1+	(meta ob → meta&ob) aka: SWP1+
51843	SWAP#1+SWAP	(# ob → #+1 ob)
637E0	SWAP#1-	(# ob → ob #-1)
51857	SWAP#1-SWAP	(# ob → #-1 ob)
5EAF4	(SWAPDROP#1-)	(ob # → #-1)
637A4	SWAPOVER#-	(# #’ → #’ #-#’)
6372C	OVER#+	(# #’ → # #’+#)
6377C	OVER#-	(# #’ → # #’-#)
63718	ROT#+	(# ob #’ → ob #’+#)
63768	ROT#-	(# ob #’ → ob #’-#)
637B8	ROT#1+	(# ob ob’ → ob ob’ #+1)
5FB76	ROT#1+UNROT	(# ob ob’ → #+1 ob ob’)
62DCC	ROT#+SWAP	(# ob #’ → #’+# ob) aka: ROT+SWAP
63740	3PICK#+	(# ob #’ → # ob #’+#)
63754	4PICK#+	(# ob1 ob2 #’ → # ob1 ob2 #’+#)
62DE5	4PICK#+SWAP	(# ob1 ob2 #’ → # ob1 #’+# ob2) aka: 4PICK+SWAP

624BA	#MIN	(# #' → #'')
624C6	#MAX	(# #' → #'')
03EB1	#AND	(# #' → #'')
		Bitwise AND.

2.1.7 Tests

03D19	#=	(# #' → flag)
03D4E	#<>	(# #' → flag)
03CE4	#<	(# #' → flag)
03D83	#>	(# #' → flag)
03CC7	#0<>	(# → flag)
03CA6	#0=	(# → flag)
622B6	#1<>	(# → flag)
622A7	#1=	(# → flag)
636C8	#2<>	(# → flag)
6229A	#2=	(# → flag)
62289	#3=	(# → flag)
636B4	#5=	(# → flag)
63673	#<3	(# → flag)
636F0	#>1	(# → flag)
		aka: ONE#>
6289B	2DUP#<	(# #' → # #' flag)
628D1	2DUP#>	(# #' → # #' flag)
63385	ONE_EQ	(# → flag)
		Uses EQ test.
620EB	OVER#=	(# #' → # flag)
628B5	2DUP#=	(# #' → # #' flag)
6364B	OVER#0=	(# #' → # #' flag)
62266	DUP#0=	(# → # flag)
6365F	OVER#<	(# #' → # flag)
622C5	DUP#1=	(# → # flag)
636DC	OVER#>	(# #' → # flag)
622D4	DUP#0<>	(# → # flag)
63687	DUP#<7	(# → # flag)
		Returns TRUE if the argument is smaller than #7.
6362D	2#0=OR	(# # → flag)
		Returns TRUE if either argument is zero.

2.2 Real Numbers

2.2.1 Built-in Real Numbers

2A487	%-MAXREAL	-9.99E499
2A42E	%-9	-9
2A419	%-8	-8
2A404	%-7	-7
2A3EF	%-6	-6
2A3DA	%-5	-5
2A3C5	%-4	-4
2A3B0	%-3	-3
2A39B	%-2	-2
2A386	%-1	-1
2A4B1	%-MINREAL	-1E-499
2A2B4	%0	0
2A49C	%MINREAL	1E-499
494B4	%.1	.1
495AA	(%.15)	.15
650BD	%.5	.5
650D2	(%-.5)	-.5
2A2C9	%1	1
2A2DE	%2	2
650A8	%e	e
2A2F3	%3	3
2A443	%PI	π
2A308	%4	4
2A31D	%5	5
2A332	%6	6
514EB	(%2PI)	2π
2A347	%7	7
2A35C	%8	8
2A371	%9	9
650E7	%10	10
1CC03	%11	11
1CC1D	%12	12
1CC37	%13	13
1CC51	%14	14
1CC85	%15	15

1CD3A	%16	16
1CD54	%17	17
1CDF2	%18	18
1CE07	%19	19
1CC6B	%20	20
1CCA4	%21	21
1CCC3	%22	22
1CCE2	%23	23
1CD01	%24	24
1CD20	%25	25
1CD73	%26	26
1CD8D	%27	27
320B1	%80	80
415F1	%100	100
650FC	%180	180
65111	(%200)	200
6513B	(%400)	400
65126	%360	360
22352	(%1200)	1200
22367	(%2400)	2400
2237C	(%4800)	4800
22391	(%9600)	9600
0F02D	(%TICKSday)	707788800
2A472	%MAXREAL	9.99E499
514DC	1REV	(→ 6.28318530718) (→ 360.) (→ 400.) Returns the angle of a full circle, corresponding to the current angular mode.

2.2.2 Built-in Extended Real Numbers

2A4C6	%%0	0
2A562	%%.1	0.1
2B3DD	%%.4	0.4
2A57C	%%.5	0.5
10E68	cfF	0.555... %%5/9 for C↔F conversion.
2A4E0	%%1	1

10E82	cfC	1 For C↔K conversion.
2A4FA	%%2	2
2A514	%%3	3
2A458	(%%PI)	π
2A62C	PI/180	$\pi/180$
2A52E	%%4	4
2A548	%%5	5
0F688	%%2PI	2π
2B1FF	%%7	7
2A596	%%10	10
2B2DC	%%12	12
2B300	%%60	60
10E9C	(%%KZERO)	273.15
10EB6	(%%RZERO)	459.67

2.2.3 Stack Manipulation Combined with Reals

5198F	(DROP%0)	(ob → %0)
1CA0D	(DROP%1)	(ob → %1)
54B1E	(DROP%0ABND)	(ob → %0)
54A9C	(DROP%1ABND)	(ob → %1)
56AFB	(4DROP%0)	(1...4 → %0)
50A3B	(UNROT2DROP%0)	(1 2 3 → 3 %0)

2.2.4 Conversion

2A5C1	%>%%	(% → %%)
62E8F	%>%%SWAP	(ob % → %% ob)
2A5B0	%%>%	(%% → %)
2B45C	2%>%%	(% % → %% %%)
2B470	2%%>%	(%% %%' → % %')
18DBF	UNCOERCE	(# → %)
1950B	UNCOERCE2	(# # → % %)
63B96	UNCOERCE%%	(# → %%)
19529	(UNCOERCE{}2)	({#} → {%}) ({# #} → {% %})
5435D	HXS>%	(hxs → %)
05D2C	C%>%	(C% → %re %im)

2EC11	%IP># Does ABS too.	(% → #IP(ABS(%)))

2.2.5 Real Functions

2A974	%+	(% %' → %+%')
51BE4	%+SWAP	(ob % %' → %+%' ob)
50262	%1+	(% → %+1)
2A981	%-	(% %' → %-%')
50276	%1-	(% → %-1)
2A95B	%>%%-	(% %' → %%-%%')
2A9BC	%*	(% %' → %*%')
62BF1	%10*	(% → %*10)
2A9FE	%/	(% %' → %/%')
2AA70	%^	(% %' → %^%')
2A900	%ABS	(% → %')
2A920	%CHS	(% → -%)
2A8D7	%SGN	(% → -1/0/1)
2AAAF	%1/	(% → 1/%)
2AA9E	%>%%1/	(% → 1/%%)
2AB09	%SQRT	(% → $\sqrt{a}$%)
2AAF6	%>%%SQRT	(% → $\sqrt{a}$%%)
1B3F5	(CK%SQRT)	(% → $\sqrt{a}$%%)
1B47B	(%SQ)	(% → %')
2AB2F	%EXP	(% → e^%)
2AB42	%EXPM1	(% → e^%-1)
2AB6E	%LN	(% → LN%)
1B995	(CK%LN)	(% → LN%)
2ABA7	%LNP1	(% → LN(%+1))
2AB81	%LOG	(% → LOG%)
1BA0C	(CK%LOG)	(% → LOG%)
2ABBA	%ALOG	(% → 10^%)
2ABEF	%SIN	(% → SIN%)
2AC40	%COS	(% → COS%)
2AC91	%TAN	(% → TAN%)
2ACC1	%ASIN	(% → ASIN%)
1B6EA	(CK%ASIN)	(% → ASIN%)
2ACF1	%ACOS	(% → ACOS%)

1B775	(CK%ACOS)	(% → ACOS%)
2AD21	%ATAN	(% → ATAN%)
2ADAE	%SINH	(% → SINH%)
2ADDA	%COSH	(% → COSH%)
2ADED	%TANH	(% → TANH%)
2AE00	%ASINH	(% → ASINH%)
2AE13	%ACOSH	(% → ACOSH%)
1B86C	(CK%ACOSH)	(% → ACOSH%)
2AE26	%ATANH	(% → ATANH%)
1B8DE	(CK%ATANH)	(% → ATANH%)
2A930	%MANTISSA	(% → %mant)
2AE39	%EXPONENT	(% → %expn)
2AF4D	%FP	(% → %frac)
2AF60	%IP	(% → %int)
2AF86	%FLOOR	(% → %maxint <=%)
2AF73	%CEIL	(% → %minint >=%)
2ABDC	%MOD	(% %' → %rem)
2AFAC	(%INT)	(% %' → %rem)
1B30D	(%ARG)	(% %' → %rem)
2AD38	%ANGLE	(%x %y → %ang)
2AD5B	%>%%ANGLE	(%x %y → %%ang)
2B529	RNDXY	(% %places → %')
2B53D	TRCXY	(% %places → %')
2AE62	%COMB	(% %' → COMB(%,%'))
2AE75	%PERM	(% %' → PERM(%,%'))
2AE4C	%NFACT	(% → %!) Calculates factorial of number.
2B0C4	%FACT	(% → gamma(%+1)) Calculates gamma(x+1).
2AA81	%NROOT	(% %n → %') Calculates the %nth root of the real number. Equivalent to user function XROOT.
2A70E	%MIN	(% %' → %lesser)
2A6F5	%MAX	(% %' → %greater)
62D81	%MAXorder	(% %' → %max %min)
51AB7	(%MAXIMIZE)	(% %' → %max %min)
2AFC2	%RAN	(→ %random) Returns next random number.

2B044	%RANDOMIZE	(%seed →) System level RDZ: seeds the random number generator.
2B07B	DORANDOMIZE	(% →) Stores given number as random number seed.
2A9C9	%OF	(% %' → %'/% * 100)
2AA0B	%T	(% %' → %pctotal)
2AA30	%CH	(% %' → %pcchange)
2A622	%D>R	(%deg → %rad)
2A655	%R>D	(%rad → %deg)
2B48E	%REC>%POL	(%r %ang → %x %y)
2B4BB	%POL>%REC	(%x %y → %r %ang)
2B4F2	%SPH>%REC	(%r %ang %ph → %x %y %z)
51A71	(2%>%%SQR)	(%r %ang %ph → %x %y %z) Does <REF>2%>%% and then <REF>%%SQR

2.2.6 Extended Real Functions

2A943	%%+	(%% %%' → %%+%%')
2A94F	%%-	(%% %%' → %%-%%')
2A99A	%%*	(%% %%' → %%*%%')
62FED	%%*ROT	(ob ob' %% %%' → ob' %%+%%' ob)
62EA3	%%*SWAP	(ob %% %%' → %%+%%' ob)
63C18	%%*UNROT	(ob ob' %% %%' → %%+%%' ob ob')
2A9E8	%%/	(%% %%' → %%/%%')
63BBE	SWAP%%/	(%% %%' → %%'')
63B82	%%/>%	(%% %%' → %)
2AA5F	%%^	(%% %%' → %%^%%')
2AC27	%%SINRAD	(%% → %%')
2AD7C	%%ANGLERAD	(%% → %%')
51A94	(%%SQR)	(%% → %%')
520B2	(2DUP%%R)	
2A8F0	%%ABS	(%% → %%abs)
2AD08	%%ACOSRAD	(%% → %%rad)
2AD4F	%%ANGLE	(%%x %%y → %%ang)
2AD6C	%%ANGLEDEG	(%%x %%y → %%deg)
2ACD8	%%ASINRAD	(%% → %%rad)
2A910	%%CHS	(%% → -%%)
2AA92	%%1/	(%% → 1/%%)

2AC57	%%COS	(%% → %%cos)
2AC68	%%COSDEG	(%%deg → %%cos)
2ADC7	%%COSH	(%% → %%cosh)
2AC78	%%COSRAD	(%%rad → %%cos)
2AB1C	%%EXP	(%% → e^%%)
2AB5B	%%LN	(%% → ln %%)
2AF99	%%FLOOR	(%% → %%maxint) aka: %%INT
2AB94	%%LNP1	(%% → %%ln(%%+1))
2A6DC	%%MAX	(%% %%' → %%max)
2B498	%%R>P	(%%x %%y → %%radius %%angle)
2B4C5	%%P>R	(%%r %%ang → %%x %%y)
2AC06	%%SIN	(%% → %%sin)
2AC17	%%SINDEG	(%%deg → %%sin)
2AD95	%%SINH	(%% → %%sinh)
2AAEA	%%SQRT	(%% → $\sqrt{a}$%%)
2ACA8	%%TANRAD	(%%rad → %%tan)

2.2.7 Tests

2A8C1	%=	(% %' → flag)
2A8CC	%<>	(% %' → flag)
2A871	%<	(% %' → flag)
2A8B6	%<=	(% %' → flag)
2A88A	%>	(% %' → flag)
2A8A0	%>=	(% %' → flag)
2A76B	%0=	(% → flag)
63BAA	DUP%0=	(% → flag)
2A7CF	%0<>	(% → flag) Can be used to change a user flag into a system flag.
2A738	%0<	(% → flag)
2A799	%0>	(% → flag)
2A7F7	%0>=	(% → flag)
2A81F	%%<	(%% %%' → flag)
2A8AB	%%<=	(%% %%' → falg)
2A87F	%%>	(%% %%' → flag)
2A895	%%>=	(%% %%' → flag)
2A75A	%%0=	(%% → flag)

2A7BB	%%0<>	(%% → flag)
2A727	%%0<	(%% → flag)
2A80B	%%0<=	(%% → flag)
2A788	%%0>	(%% → flag)
2A7E3	%%0>=	(%% → flag)

2.3 Complex Numbers

2.3.1 Built-in Complex Numbers

524AF	C%0	(0,0)
524F7	C%1	(1,0)
5196A	C%-1	(-1,0)
5193B	C%%1	(%%1,%%0)
5267F	(C%i)	(0,1)
526AE	(C%-i)	(0,-1)

2.3.2 Conversion

519F8	C%%>C%	(C%% → C%)
05C27	%>C%	(%re %im → C%)
632A9	SWAP%>C%	(%im %re → C%)
51A37	Re>C%	(%re → C%)
519A3	C>Re%	(C% → %re)
519B7	C>Im%	(C% → %im)
51A07	%%>C%	(%%re %%im → C%)
519CB	C%>%%	(C% → %%re %%im)
519DF	C%>%%SWAP	(C% → %%im %%re)
51C6B	(SWAP2C%>%)	(C% C%' → %re %im %re' %im')
05DBC	C%%>%%	(C%% → %%re %%im)

2.3.3 Functions

51A4A	(C%*i)	(C% → C%')
51A5F	(C/i)	(C% → C%')
51C16	(C%C+C)	(C% C%' → C%'')
51CFC	(C%C-C)	(C% C%' → C%'')

1B48F	(C%C*C)	(C% → C%^2)
51EC8	(C%C/C)	(C% C%' → C%'')
51BD0	(C%C+R)	(C% % → C%')
51BF8	(C%R+C)	(% C% → C%')
51CE8	(C%C-R)	(C% % → C%')
51CD4	(C%R-C)	(% C% → C%')
51D4C	(C%C*R)	(C% % → C%')
51D60	(C%R*C)	(% C% → C%')
51E19	(C%R/C)	(% C% → C%')
51E64	(C%C/R)	(C% % → C%')
52374	C%C^C	(C% C%' → C%'')
52360	C%C^R	(C% % → C%')
52342	C%R^C	(% C% → C%')
52062	C%ABS	(C% → %)
51B70	C%CHS	(C% → -C%)
51EFA	C%1/	(C% → 1/C%)
52107	C%SQRT	(C% → $\sqrt{a}$C%)
1B48F	(C%C*C)	(C% → C%^2)
520CB	C%SGN	(C% → C%/C%ABS)
51BB2	C%CONJ	(C% → C%')
52099	C%ARG	(C% → %)
52193	C%EXP	(C% → e^C%)
521E3	C%LN	(C% → ln C%)
522BF	C%LOG	(C% → log C%)
52305	C%ALOG	(C% → 10^C%)
52530	C%SIN	(C% → sin C%)
52571	C%COS	(C% → cos C%)
525B7	C%TAN	(C% → tan C%)
52804	C%ASIN	(C% → asin C%)
52863	C%ACOS	(C% → acos C%)
52675	C%ATAN	(C% → atan C%)
5262F	C%SINH	(C% → sinh C%)
52648	C%COSH	(C% → cosh C%)
5265C	C%TANH	(C% → tanh C%)
5281D	C%ASINH	(C% → asinh C%)
52836	C%ACOSH	(C% → acosh C%)
527EB	C%ATANH	(C% → atanh C%)
05C72	(%%>C%%)	(%%re %%im → C%%)

51C84	(SWAP2C%%>%%)	(C%% C%%' → %%re %%im %%re' %%im')
51C3E	(C%%C+C)	(C%% C%%' → C%%'')
51D10	(C%%C-C)	(C%% C%%' → C%%'')
51DE2	(C%%C*C)	(C%% C%%' → C%%'')
51F13	(C%%C/C)	(C%% C%%' → C%%'')
51C9D	(C%%C+R)	(C%% %% → C%%')
51CB1	(C%%R+C)	(%% C%% → C%%')
51D24	(C%%R-C)	(%% C%% → C%%')
51D38	(C%%C-R)	(C%% %% → C%%')
51DAB	(C%%C*R)	(C%% %% → C%%')
51DBF	(C%%R*C)	(%% C%% → C%%')
51F3B	(C%%R/C)	(%% C%% → C%%')
51F7C	(C%%C/R)	(C%% %% → C%%')
52080	(C%%ABS)	(C%% → %%)
51B91	C%%CHS	(C%% → -C%%)
51BC1	C%%CONJ	(C%% → C%%')

2.3.4 Tests

51B43	C%0=	(C% → flag)
51B2A	C%%0=	(C%% → flag)

2.3.5 Real and Complex Number Functions

35B47	(SWITCHFLOATS)	(B% → ?) Dispatches action based on type. The order is %, C%, %%, C%%. For example, to change the sign of any float: :: SWITCHFLOATS %CHS C%CHS %%CHS C%%CHS ;
35B88	(SWITCH2FLOATS)	(L% L% → ?) Works similarly to the above function. The order is %% %%, C%% %%, %% C%%, C%% C%%.
37D19	(F%>L%)	(% → %%) (C% → C%%) Converts float to long float.
37BE9	(L%+)	(L% L% → L%) Adds long real or complex numbers.
37C0C	(L%-)	(L% L% → L%) Subtracts long real or complex numbers.
37C2F	(L%*)	(L% L% → L%) Multiplies long real or complex numbers.

37C52	(L%/)	(L% L% → L%) Divides long real or complex numbers.
37CD3	(B%NEG)	(B% → B%') Changes sign of any number.
37C75	(B%ABS)	(B% → B%') Absolute value of any number.
37DF6	(B%0=)	(B% → flag) Compares any number to zero.

2.4 Character Strings

2.4.1 Built-in Characters

6541E	CHR_00	'\00', CHR 0d 00h The NULL character.
6566A	CHR_Newline	'\0a', CHR 10d 0Ah
65425	CHR_...	'...', CHR 31d 1Fh
65686	CHR_Space	' ', CHR 32d 20h The space character.
6542C	CHR_DblQuote	'"', CHR 34d 22h
65433	CHR_#	'#', CHR 35d 23h
65663	CHR_LeftPar	'(', CHR 40d 28h
65678	CHR_RightPar	')', CHR 41d 29h
6543A	CHR_*	'*', CHR 42d 2Ah
65441	CHR_+	'+', CHR 43d 2Bh
65448	CHR_,	',', CHR 44d 2Ch
6544F	CHR_-	'-', CHR 45d 2Dh
65456	CHR_.	'.', CHR 46d 2Eh
6545D	CHR_/	'/', CHR 47d 2Fh
65464	CHR_0	'0', CHR 48d 30h
6546B	CHR_1	'1', CHR 49d 31h
65472	CHR_2	'2', CHR 50d 32h
65479	CHR_3	'3', CHR 51d 33h
65480	CHR_4	'4', CHR 52d 34h
65487	CHR_5	'5', CHR 53d 35h
6548E	CHR_6	'6', CHR 54d 36h
65495	CHR_7	'7', CHR 55d 37h
6549C	CHR_8	'8', CHR 56d 38h
654A3	CHR_9	'9', CHR 57d 39h
654AA	CHR_:	':', CHR 58d 3Ah

```
654B1     CHR_;               ';', CHR 59d 3Bh
654B8     CHR_<               '<', CHR 60d 3Ch
654BF     CHR_=               '=', CHR 61d 3Dh
654C6     CHR_>               '>', CHR 62d 3Eh
654CD     CHR_A               'A', CHR 65d 41h
654D4     CHR_B               'B', CHR 66d 42h
654DB     CHR_C               'C', CHR 67d 43h
654E2     CHR_D               'D', CHR 68d 44h
654E9     CHR_E               'E', CHR 69d 45h
654F0     CHR_F               'F', CHR 70d 46h
654F7     CHR_G               'G', CHR 71d 47h
654FE     CHR_H               'H', CHR 72d 48h
65505     CHR_I               'I', CHR 73d 49h
6550C     CHR_J               'J', CHR 74d 4Ah
65513     CHR_K               'K', CHR 75d 4Bh
6551A     CHR_L               'L', CHR 76d 4Ch
65521     CHR_M               'M', CHR 77d 4Dh
65528     CHR_N               'N', CHR 78d 4Eh
6552F     CHR_O               'O', CHR 79d 4Fh
65536     CHR_P               'P', CHR 80d 50h
6553D     CHR_Q               'Q', CHR 81d 51h
65544     CHR_R               'R', CHR 82d 52h
6554B     CHR_S               'S', CHR 83d 53h
65552     CHR_T               'T', CHR 84d 54h
65559     CHR_U               'U', CHR 85d 55h
65560     CHR_V               'V', CHR 86d 56h
65567     CHR_W               'W', CHR 87d 57h
6556E     CHR_X               'X', CHR 88d 58h
65575     CHR_Y               'Y', CHR 89d 59h
6557C     CHR_Z               'Z', CHR 90d 5Ah
65694     CHR_[               '[', CHR 91d 5Bh
6569B     CHR_]               ']', CHR 93d 5Dh
6568D     CHR_UndScore        '_', CHR 95d 5Fh
65583     CHR_a               'a', CHR 97d 61h
6558A     CHR_b               'b', CHR 98d 62h
65591     CHR_c               'c', CHR 99d 63h
65598     CHR_d               'd', CHR 100d 64h
6559F     CHR_e               'e', CHR 101d 65h
```

655A6	CHR_f	'f', CHR 102d 66h
655AD	CHR_g	'g', CHR 103d 67h
655B4	CHR_h	'h', CHR 104d 68h
655BB	CHR_i	'i', CHR 105d 69h
655C2	CHR_j	'j', CHR 106d 6Ah
655C9	CHR_k	'k', CHR 107d 6Bh
655D0	CHR_l	'l', CHR 108d 6Ch
655D7	CHR_m	'm', CHR 109d 5Dh
655DE	CHR_n	'n', CHR 110d 6Eh
655E5	CHR_o	'o', CHR 111d 6Fh
655EC	CHR_p	'p', CHR 112d 70h
655F3	CHR_q	'q', CHR 113d 71h
655FA	CHR_r	'r', CHR 114d 72h
65601	CHR_s	's', CHR 115d 73h
65608	CHR_t	't', CHR 116d 74h
6560F	CHR_u	'u', CHR 117d 75h
65616	CHR_v	'v', CHR 118d 76h
6561D	CHR_w	'w', CHR 119d 77h
65624	CHR_x	'x', CHR 120d 78h
6562B	CHR_y	'y', CHR 121d 79h
65632	CHR_z	'z', CHR 122d 7Ah
656A2	CHR_{	'{', CHR 123d 7Bh
656A9	CHR_}	'{', CHR 125d 7Dh
6564E	CHR_Angle	'∠', CHR 128d 80h
6565C	CHR_Integral	'∫', CHR 132d 84h
65655	CHR_Deriv	'∂', CHR 136d 88h
65639	CHR_->	'→', CHR 141d 8Dh
65640	CHR_<<	'≪', CHR 171d ABh
65647	CHR_>>	'≫', CHR 187d BBh
65671	CHR_Pi	'π', CHR 135d 87h
6567F	CHR_Sigma	'Σ', CHR 133d 85h
656B0	CHR_<=	'≤', CHR 137d 89h
656B7	CHR_>=	'≥', CHR 138d 8Ah
656BE	CHR_<>	'≠', CHR 139d 8Bh

2.4.2 Built-in Strings

055DF	NULL$	""
		Empty string.
65254	SPACE$	" "
		aka: tok_
65212	(14SPACES$)	" "
		String of 14 spaces.
65238	NEWLINE$	"\0a"
		Newline.
2E4F0	CRLF$	"\0d\0a"
		Carriage return and line feed.
652B4	(toklparen)	"("
652C0	(tokrparen)	")"
6516A	(tok[)	"["
65150	(tok])	"]"
65176	tok{	"{"
65182	(tok})	"}"
651D6	tok<<	"≪"
651CA	(tok>>)	"≫"
6573B	$_LRParens	"()"
65711	$_[]	"[]"
65703	$_{}	"{}"
656F5	$_<<>>	"≪≫"
6571F	$_''	"''"
		Two single quotes.
6572D	$_::	"::"
65749	$_2DQ	""""
		Two double quotes.
414BD	($_:)	":"
		": "
65290	tok,	","
65284	tok'	"'"
		One single quote.
652FC	tok-	"-"
6529C	tok.	"."
65308	tok=	"="
25446	tok->	"→"
0FA69	tok_g	"g"
0FA8E	tok_m	"m"
0FACE	tok_s	"s"
6534C	tok0	"0"
65358	tok1	"1"

65364	(tok2)	"2"
65370	(tok3)	"3"
6537C	(tok4)	"4"
65388	(tok5)	"5"
65394	(tok6)	"6"
653A0	(tok7)	"7"
652A8	(tok;)	";"
653AC	tok8	"8"
653B8	tok9	"9"
651BE	tokESC	"\1B" Escape character.
651E2	tokexponent	"E"
65278	tokquote	""" One double quote.
6518E	toksharp	"#"
651A6	(tok$)	"$"
651B2	(tok&)	"&"
652D8	(tok*)	"*"
652F0	(tok+)	"+"
652E4	(tok/)	"/"
651EE	(tokanglesign)	"∠"
65320	(tokDER)	"∂"
65244	($DER)	"der"
651FA	(tokSIGMA)	"Σ"
65314	(tokSQRT)	"$\sqrt{a}$"
6519A	(tokuscore)	"_"
65206	(tokWHERE)	"|"
652CC	(tok^)	"^"
65797	$_RAD	"RAD"
657A7	$_GRAD	"GRAD"
656E5	$_XYZ	"XYZ"
656D5	$_R<Z	"R∠Z" "R<angle>Z"
656C5	$_R<<	"R∠∠" "R<angle><angle>"
65769	$_EXIT	"EXIT"
65757	$_ECHO	"ECHO"
6577B	$_Undefined	"Undefined"
6532C	(tokCTGROB)	"GROB"

6533E	(tokCTSTR)	"C$"
65260	(tokUNKNOWN)	"UNKNOWN"

2.4.3 Built-in Strings with Stack Manipulation

62D59	NULL$SWAP	(ob → $ ob) NULL$, then SWAP.
04D3E	DROPNULL$	(ob → NULL$) DROP then NULL$.
04D57	(TWODROPNULL$)	(ob ob' → NULL$) 2DROP then NULL$.
1613F	NULL$TEMP	(→ $) Creates null string in temporary memory (NULL$, then <REF>TOTEMPOB).

2.4.4 Conversion

167E4	#>$	(# → $) Creates string from the bint (decimal).
167D8	#:>$	(# → "#: ") Creates string from the bint and appends a colon and a space. Ex: "1: "
162B8	a%>$	(% → $) Converts real number into string using current display mode. aka: a%>$,
05BE9	ID>$	(id/lam → $) Converts identifier into string.
140F1	DOCHR	(% → $) Creates string of the character with the number specified.
540BB	hxs>$	(hxs → $) Uses current display mode and wordsize.
54061	HXS>$	(hxs → $) Does <REF>hxs>$ and then appends base character.

2.4.5 Management

05A75	#>CHR	(# → chr) Returns character with the specified ASCII code.
6475C	CHR>$	(chr → $* Strings) Converts a character into a string.
05636	LEN$	($ → #length) Returns length in bytes.

1CA26	(LEN$>%)	($ → %) LEN$ then UNCOERCE.
627BB	DUPLEN$	($ → $ #) DUP then LEN$.
05622	OVERLEN$	($ ob → $ ob #len) OVER then LEN$.
63191	NEWLINE$&$	($ → "$\0a") Appends newline character to string. aka: NEWLINE&$
2E4DC	APNDCRLF	($ → $') Appends carriage return and line feed to string.
1782E	(2LEN$#+)	($ $' → $ $' #) Returns sum of length of two strings.
127CA	(DROPDUPLEN$1+)	($ ob → $ #len+1) Does DROP, then DUP, then LEN$ and finally #1+.
050ED	CAR$	($ → chr) ($ → "") Returns first character of string as a string, or NULL$ for null string.
0516C	CDR$	($ → $') Returns string without first character, or NULL$ for null string.
645B1	POS$	($ $find start# → #pos) ($ $find start# → #0) Search for $find in $search, starting at position #start. Returns position of $find or 0 if not found. Same entry as POSCHR.
645B1	POSCHR	($search chr #start → #pos) ($search chr #start → #0) Same entry as <REF>POS$.
15EF6	(ONEPOS$)	($ $find/chr → #pos) ($ $find/chr → #0) <REF>POS$ with #start = 1.
1CAD7	(XEQPOS$)	($ $find/chr → %pos) ($ $find/chr → %0) <REF>POS$ with #start = 1 and followed by UNCOERCE.
645BD	POS$REV	($ $find #limit → #pos) ($ $find #limit → #0) Searches backwards from #limit to #1. Same entry as <REF>POSCHRREV.
645BD	POSCHRREV	($seach chr #start → #pos) ($seach chr #start → #0) Same entry as <REF>POS$REV.
12770	COERCE$22	($ → $') If the string is longer than 22 characters, truncates it to 21 characters and appends "...".

45676	Blank$	(#len → $) Creates a string with the specified number of spaces.
49709	PromptIdUtil	(id ob → $) Creates string of the form "id: ob".
127A7	SEP$NL	($ → $' $'') Separates string at the first newline. $" is the substring before the first newline; $' the substring after the first newline.
05733	SUB$	($ #start #end → $') Returns substring between specified positions.
1C8BB	(XEQSUB$)	($ % %' → $') Same as <REF>SUB$ but uses real numbers as arguments.
63245	#1-SUB$	($ #start #end+#1 → $') Does #1- and then SUB$.
63259	1_#1-SUB$	($ #end → $') Returns substring with the first #end characters. aka: 1_#1-SUB
6326D	LAST$	($ #start → $') Returns substring from the specified start position to the end (inclusive).
63281	#1+LAST$	($ #start-#1 → $') Returns substring from the specified start position to the end (exclusive).
62D6D	SUB$SWAP	(ob $ # #' → $' ob) SUB$ then SWAP.
30805	SUB$1#	($ #pos → #') Returns bint with ASCII code of character at the specified position.
61C1C	EXPAND	(hxs #nibs → hxs') Appends #nibs zero nibbles to the hxs.
05193	&$	($ $' → $+$') Concatenates two strings.
63F6A	&$SWAP	(ob $ $' → $+$' ob) &$ then SWAP.
62376	!append$	($ $' → $+$') Tries &$, if not enough memory does !!append$?.
622E5	!insert$	($ $' → $'+$) Does SWAP then <REF>!append$.
62F2F	!append$SWAP	(ob $ $' → $+$' ob) !append$ then SWAP.
62312	!!append$?	($ $' → $+$') Attempts append "in place" if target is in tempob.
623A0	!!append$	($ $' → $+$') Tries appending "in place".

62394	!!insert$	($ $' → $'+$) Tries inserting "in place".
0525B	>H$	($ chr → $') Prepends character to string
052EE	>T$	($ chr → $') Appends character to string.
62BB0	APPEND_SPACE	($ → $') Appends space to string.
622EF	SWAP&$	($ $' → $'+$) Concatenates two strings.
0D304	TIMESTR	(%dt %tm → "dy dt tm") Returns string representation of time, using current format. Example: "WED 06/24/98 10:00:45A"
188D2	(NOT$)	($1 $2 → $') Logical NOT.
18873	AND$	($1 $2 → $') Logical AND. Errors if strings are not the same length.
18887	OR$	($ $' → $'') Logical OR. Errors if strings are not the same length.
1889B	XOR$	($ $' → $'') Logical XOR. Errors if strings are not the same length.
18961	(!NOT$)	($ $' → $'' ???) Logical NOT "in place".
188E6	(!AND$)	($ $' → $'' ???) Logical AND. Does not check if strings are the same length.
188F5	(!OR$)	($ $' → $'' ???) Logical OR, does not check if strings are the same length.
18904	(!XOR$)	($ $' → $'' ???) Logical XOR. Does not check if strings are the same length.
1410F	(DONUM)	($ → CHR) Returns number of first character of string.

2.4.6 Parsing Strings

14137	DOSTR>	($ → ?) Internal version of <REF>STR→.

238A4	palparse	($ → ob T) ($ → $ #pos $' F) Tries parsing a string into an object. If successful, returns object and TRUE, otherwise returns position of error, the offending part of the string $', and FALSE. If the string contains several arguments, the resulting object is a secondary containing these objects.
0BC6F	!*trior	(F → <SKIP>)
		(T T → <COLA>)
0BCCF	!*triand	(T T →)
		(F T → F T <SEMI>)
0BD54	tok8cktrior	($1 $1 → :: $1 <Ob1> ;)
		($1 $2 → :: $1 <Ob2> <Rest> ;)
0BD60	tok8trior	(GNT data $1 $1 → :: GNT data GetNextToken ;)
		(GNT data $1 $2 → :: $1 <Ob1> <Rest> ;)
2534A	nultrior	(NULL$ → :: ;)
		($ → :: $ <Ob1> <Rest> ;)
26162	GetNextToken	(hxs-mask $ #start → hxs-mask $ #next $token)
25452	getmatchtok	(hxs-mask $ #loc $_tok → hxs-mask $ #next $match)
40AD9	Parse.1	
40B2E	ParseFail	(ob $parsed #pos $' →) Uses DispBadToken to re-edit the parsed string and displays "Syntax Error".
40B56	(DispBadToken)	(ob $parsed #pos $' →) Re-edits the parsed string, positions the cursor to the location of the error. Used by ParseFail.

2.4.7 Decompilation

1795A	!DcompWidth	(# →) Sets the width (in characters) of decompiled strings. This width is used to cut the resulting string (for stack display) or to break it into lines (mostly for editing). Note that most decompilation entries reset this value to the stack or editor width. Use stkdecomp$w and editdecomp$w to make sure the current width is used and not changed.
17980	DcompWidth@	(→ #) Recalls the width of decompiled strings (in characters).

159FA (setStdWid) (→)
Sets DcompWidth to the standard value for stack display, either 19 or 30 characters, depending on system flag 72 (stack minifont).
--
Flags: -72

159EB stkdecomp$w (ob → $)
Decompiles for stack display using the current DcompWidth to cut the string if it is too long.

15978 1stkdecomp$w (ob → $)
Calls setStdWid and decompiles for stack display (cutting the string if necessary).

41422 >Review$ (id → $)
Makes a string from the variable name and its contents (decompiled with <REF>Decomp1Line), for display with the review key. If the argument is a command, returns its name.

15B31 editdecomp$w (ob → $)
Decompiles entire object for editing. It only decompiles the UserRPL components. Some System RPL entries like <REF>TakeOver are simply skipped, others are written as "External". Breaks the resulting strings into lines using the current DcompWidth.

15A0E EDITDECOMP$ (ob → $)
Calls setStdEditWid and the decompiles for editing like <REF>editdecomp$w.

15B13 DECOMP$ (ob → $)
Calls <REF>setStdWid and decompiles entire object (UserRPL components only). Breaks the string into lines using DcompWidth as width.

14088 DO>STR ($ → $)
(ob → $)
Internal version of →STR.

62B5B palrompdcmp (romptr → $ T)
Decompiles a rompointer for the UserRPL stack. If it is a named rompointer, returns the name. Otherwise returns "XLIB n m".

2.4.8 String Tests

0556F NULL$? (ob → flag)

63209 DUPNULL$? (ob → ob flag)

142A6 ($<$?) ($ $' → flag)
String comparizon, alphabetically by character numbers.

1420A	($>$?)	($ $' → flag) String comparizon, alphabetically by character numbers.
142E2	($<=$?)	($ $' → flag) String comparizon, alphabetically by character numbers.
142BA	($>=$?)	($ $' → flag) String comparizon, alphabetically by character numbers.
42C3D	CkChr00	($ → $ flag) Returns FALSE if string contains any null characters.

2.5 HEX Strings

2.5.1 Conversion

059CC	#>HXS	(# → hxs) Length will be five.
543F9	%>#	(% → hxs) Converts real number into hxs. Should be called %>HXS.

2.5.2 General Functions

54039	WORDSIZE	(→ #) Returns the current wordsize as a bint.
53CAA	dostws	(# →) Sets the current wordsize.
055D5	NULLHXS	HXS 0 Puts a null hxs in the stack.
05566	(NULLHXS?)	(hxs → flag) Returns TRUE if the input is a null hxs.
5435D	#>%	(hxs → %)
0518A	&HXS	(hxs hxs' → hxs'') Appends hxs" to hxs'.
61C1C	EXPAND	(hxs #nibs → hxs') Appends #nibs zero nibbles to the hxs.
0EDE1	MAKEHXS	(#nibs → hxs) Makes blank hxs of specified size.
3742D	(!MAKEHXS)	(#nibs → hxs) Makes hxs filled with random data.
05616	LENHXS	(hxs → #nibs) Returns length in nibbles.
05815	SUBHXS	(hxs #m #n → hxs') Returns sub hxs string.

53EA0	bit+	(hxs hxs' → hxs'') Adds two hxs.
54330	bit%#+	(% hxs → hxs') Adds real to hxs, returns hxs.
54349	bit#%+	(hxs % → hxs') Adds real to hxs, returns hxs.
53EB0	bit-	(hxs hxs' → hxs'') Subtracts hxs2 from hxs1.
542FE	bit%#-	(% hxs → hxs') Subtracts hxs from real, returns hxs.
5431C	bit#%-	(hxs % → hxs') Subtracts real from hxs, returns hxs.
53ED3	bit*	(hxs hxs' → hxs'') Multiplies two hxs.
542D1	bit%#*	(% hxs → hxs') Multiplies real by hxs, returns hxs.
542EA	bit#%*	(hxs % → hxs') Multiplies hxs by real, returns hxs.
53F05	bit/	(hxs hxs' → hxs'') Divides hxs1 by hxs2.
5429F	bit%#/	(% hxs → hxs') Divides real by hxs, returns hxs.
542BD	bit#%/	(hxs % → hxs') Divides hxs by real, returns hxs.
53D04	bitAND	(hxs hxs' → hxs'') Bitwise AND.
53D15	bitOR	(hxs hxs' → hxs'') Bitwise OR.
53D26	bitXOR	(hxs hxs' → hxs'') Bitwise XOR.
53D4E	bitNOT	(hxs → hxs') Bitwise NOT.
53E65	bitASR	(hxs → hxs') Arithmetic shift one bit to the right. The most significant bit (the sign) does not change.
53E0C	bitRL	(hxs → hxs') Shifts circularly one bit to the left.
53E3B	bitRLB	(hxs → hxs') Shifts circularly one byte to the left
53DA4	bitRR	(hxs → hxs') Shifts circularly one bit to the right.
53DE1	bitRRB	(hxs → hxs') Shifts circularly one byte to the right.
53D5E	bitSL	(hxs → hxs') Shifts one bit to the left.
53D6E	bitSLB	(hxs → hxs') Shifts one byte to the left.

53D81	bitSR	(hxs → hxs') Shifts one bit to the right.
53D91	bitSRB	(hxs → hxs') Shifts one byte to the right.
53EC3	(bitNEG)	(hxs → hxs') Changes sign of hxs.

2.5.3 Tests

544D9	HXS==HXS	(hxs hxs' → %flag) == test
544EC	HXS#HXS	(hxs hxs' → %flag) ≠ test
54552	HXS<HXS	(hxs hxs' → %flag) < test
54500	HXS>HXS	(hxs hxs' → %flag) > test
5452C	HXS>=HXS	(hxs hxs' → %flag) ≥ test
5453F	HXS<=HXS	(hxs hxs' → %flag) ≤ test

2.6 Tagged Objects

05E81	>TAG	(ob $tag → tagged) Tags an object.
225F5	USER$>TAG	(ob $tag → tagged) Maximum of 255 characters in string.
22618	%>TAG	(ob % → tagged) Converts real to string using current display mode and tags object.
05F2E	ID>TAG	(ob id/lam → tagged) Tags object with identifier or lam.
05E9F	({}>TAG)	({ id ob } → tagged)
647BB	TAGOBS	(ob $tag → tagged) (ob.. { $.. } → tagged...) Tags one or more objects.
05EC9	(TAG>)	(tagged → ob $tag)
64775	STRIPTAGS	(tagged → ob) Strips all tags from the object.
647A2	STRIPTAGS12	(tagged ob' → ob ob') Strips all tags from the object in level two.

2.7 Arrays

2.7.1 General Functions

03562	ARSIZE	([] → #) Returns number of elements as a bint.
035A9	DIMLIMITS	([] → {#n #m}) Returns list of array dimensions.
0371D	GETATELN	(# [] → ob T) (# [] → F) Gets one element from array.
0C506	rGETATELN	Gets one element from array referenced by rompointer.
0C501	(GETEL)	(#i [] → ob T) (#i [] → F) Gets one element from array.
35D35	(MATIDN)	([F%] → [F%]') Creates identity matrix. Errors if input is not a square matrix.
3745E	SWAPROWS	(M % %' → M') SWAP two rows in matrix. Internal version of xRSWP.
37508	(SWAPCOLUMNS)	([] #m #n → []' #m #n)
9358F	(TYPEARRY@)	([] → #) Returns address of the prolog of the array element type.
03685	(ARRYEL?)	({#n #m} [] → # T) ({#n #m} [] → F) Returns TRUE if array element exists.
03685	(FINDELN)	({} A → # flag) Return index # of element {} in array.
1DBB0	(BANGARRY)	(el # M → M') Puts el at index # of matrix M.
35CAE	MATCON	([%] % → [%]') ([C%] C% → [C%]') Replace all elements of [F%] by F%.
37E0F	METREDIM	([F%] {#n #m} → [F%]') Redimensions matrix. Removes elements or adds zeros as necessary.
357A8	MDIMS	([1D] → #m F) ([2D] → #m #n T) If it is a vector, returns number of elements and FALSE. If it is an array (including arrays with only one line), returns dimensions and TRUE.
62F9D	MDIMSDROP	([2D] → #m #n) MDIMS followed by DROP.

63141	OVERARSIZE	([] ob → [] ob #elts) Does OVER then <REF>ARSIZE.
355B8	PULLREALEL	([%] # → [%] %) Gets real element.
355C8	PULLCMPEL	([C%] # → [C%] C%) Gets complex element.
3558E	(PULLEL)	([F%] #n → [F%] F%) Gets real or complex element.
35602	(PULLEREALEL)	([%] #n → [%] %%) Gets real element then converts to long real.
355D8	(PULLLONGEL)	([F%] #n → [F%] L%) Gets element then converts to long.
35628	PUTEL	([%] % # → [%]') ([C%] C% # → [C%]') Puts element at specified position. Converts to "short" before. Warning: no copy to tempob first.
3566F	PUTREALEL	([%] % # → [%]') Puts real element at specified position. Warning: no copy to tempob first.
356F3	PUTCMPEL	([C%] C% # → [C%]') Puts complex element at specified position. Warning: no copy to tempob first.
36115	(MAT+)	([F%] [F%]' → [F%]'') Adds two arrays.
36278	(MAT-)	([F%] [F%]' → [F%]'') Subtracts two arrays.
3644E	(MAT*)	([F%] [F%]' → [F%]'') Multiplies two arrays.
36AC3	(MAT/)	([F%] [F%]' → [F%]'') Divides two arrays.
362DC	(MATFLOAT*)	([F%] F% → [F%]') Multiplies matrix by float.
363DB	(MATFLOAT/)	([F%] F% → [F%]') Divides matrix by float.
36444	(MATSQ)	([F%] → [F%]') Squares matrix.
35F30	(MATCONJ)	([F%] → [F%]') If a complex array, does the conjugate of all elements. If a real array, does nothing.
35DEB	(MATNEG)	([F%] → [F%]') Changes sign of all elements of array.
36A99	(MATINV)	([F%] → [F%]') Reciprocal of all elements of array.
37E0F	MATREDIM	([F%] {#n #m} → [F%]')
3811F	MATTRN	([F%] → [F%]') Transposes matrix.

35FA3 (DUP%0CON) ([F%] → [F%] [0%])
DUP then creates a matrix of the same size filled with zeros.

36A48 (MATDET) ([F%] → F%)
Calculates determinant of matrix. Generates "Invalid Dimension" error for non-square matrices.

369E9 (MATABS) ([F%] → F%)
Returns the scalar magnitude of array.

36705 (MATDOT) ([F%] [F%]' → F%)
Returns the dot product of two vectors.

36791 (MATCROSS) ([F%] [F%]' → [F%]'')
Returns the cross product of two vectors. Generates a "Invalid Dimension" error if inputs are not vectors.

365BB (MATRSD) ([F%] [F%] [F%] → [F%])
Calculates residuals of solutions of a linear system.

368F4 (MATRNRM)
Row norm.

3690D (MATCNRM) ([F%] → F%)
Column norm.

36039 (MATR>C) ([%re] [%im] → [C%])
Creates complex matrix from real and imaginary parts.

360B6 (MATC>R) ([C%] → [%re] [%im])
Explodes complex matrix into real and imaginary parts.

35F8F (MATRE) ([F%] → [%re])
Returns (real) matrix with real part of complex numbers. Does nothing if the input is a real matrix.

35FEE (MATIM) ([F%] → [%im])
Returns (real) matrix with imaginary part of complex numbers. Returns an array of zeros if input is a real matrix.

35E2C (MATRND) ([F%] % → [F%]')
RND on all elements of matrix.

35EA9 (MATTRNC) ([F%] % → [F%]')
TRNC on all elements of matrix.

35C2C (DOARRYPRG1) (seco [F%] → [F%]')
Evaluates seco for each element in array, then builds array again. Argument for seco will be L%.

35C63 (DOARRYPRG2) (seco [F%] [F%] → [F%]')
Same as above, but seco has two arguments: one from array1 and another from array2. Arrays must be F%. Arguments for seco will be L%.

2.7.2 Conversion

03442	MAKEARRY	({#n #m} ob → []) Makes array with all elements initialized to ob.
19294	(>ARRY)	(F%..F% #n [%F] → [F%]') Copies floats into array.
1D054	XEQ>ARRAY	(F%..F% {#n #m} → [F%]) Makes array with specified dimensions and elements. Does checks first. aka: XEQ>ARRY
1D02C	(XEQ>VECTOR)	(F%..F% %n → [%F]) Creates a vector.
1D0AB	(DOARRY>)	([] → F%..F% {#n #m}) Explodes array. Only works for arrays of (normal) real and complex numbers.

2.7.3 Statistics

2C22F	STATCLST	(→) Clears ΣDAT.
2C270	(STATRCL)	(→ ob) Recalls ΣDAT.
2C1F3	(STATSTO)	(ob →) Stores ob into ΣDAT.
2C535	STATN	(→ N) Internal NΣ.
2C58A	STATSMIN	(→ %) Internal MINΣ.
2C558	STATSMAX	(→ %) Internal MAXΣ.
2C571	STATMEAN	(→ %) (→ []) Internal MEAN.
2C5A3	STATSTDEV	(→ %) (→ []) Internal SDEV.
2C5BC	STATTOT	(→ %) (→ []) Internal TOT.
2C5D5	STATVAR	(→ %) (→ []) Internal VAR.
2C675	(STATCOL)	(% %' →) Internal COLΣ.
2C6B6	(STATXCOL)	(n →) Internal XCOL.

2C6CF	(STATYCOL)	(n →) Internal YCOL.
2C6F2	(STATGETXCOL)	
2C706	(STATGETYCOL)	
2C8E6	(STATCOV)	(→ %) Internal COV.
2C940	(STATX)	(→ %) Internal ΣX.
2C959	(STATY)	(→ %) Internal ΣY.
2C972	(STATXX)	(→ %) Internal ΣX2.
2C99A	(STATYY)	(→ %) Internal ΣY2.
2C9C2	(STATXY)	(→ %) Internal ΣXY.
2CA0D	(STATLR)	
2CB4D	(STATPREDX)	(% → %') Internal PREDX.
2CADA	(STATPREDY)	(% → %') Internal PREDY.
2CCD3	(ColumnMIN)	
2CCBA	(ColumnMAX)	
2CCEE	(ColumnMEAN)	
2CD09	(ColumnTDEV)	
2CCDF	(ColumnTOT)	
2CCFD	(ColumnVAR)	
2C83C	(STATCORR)	(→ %) Internal CORR.

2.8 Unit Objects

2.8.1 Creating Units

10B5E	um*	* marker
10B68	um/	/ marker
10B72	um^	^ marker
10B7C	umP	Char prefix operator
10B86	umEND	Unit end operator
05481	EXTN	(ob1..obn #n → u) Builds a unit object.

2.8.2 General Functions

0FE44	U>NCQ	(u → n%% cf%% qhxs) Returns the number, conversion factor to base units and a vector in the form: [kg m A s K cd mol r sr ?] where each element represents the exponent of that unit. For example, 1_N U>NCQ would return: %%1 %%1 [1 1 0 -2 0 0 0 0 0 0] since it is equivalent to 1_kg*m/s^2
0F33A	UM>U	(% u → u') Replaces number part of unit.
0F371	UMCONV	(u1 u2 → u1') Change units of unit1 to units of unit2.
0F945	UMSI	(u → u') Equivalent to user word UBASE.
0F34E	UMU>	(u → % u') Returns number and normalized part of unit.
0F218	UNIT>$	(u → $) Converts unit to string.
197C8	(UMFACT)	(u1 u2 → u) Equivalent to user word UFACT.
10047	U>nbr	(u → %) Returns number part of unit.
10065	Unbr>U	(u % → u') Replaces number part of unit.
0F41B	TempConv	??? Used by UMCONV for the conversion of temperature units.
1553B	KeepUnit	(% ob ob' → % ob) (% ob u → u' ob) If the level one object is a unit object, replaces the numeric part of it with the number on level 3. If not, just DROP.

2.8.3 Arithmetic Functions

0F6A2	UM+	(u u' → u'')
0F774	UM-	(u u' → u'')
0F792	UM*	(u u' → u'')
0F823	UM/	(u u' → u'')
0FBAB	UM%	(u %percent → u')
0FC3C	UM%CH	(u u' → %)

0FCCD	UM%T	(u u' → %)
0FB8D	UMMIN	(u u' → u?)
0FB6F	UMMAX	(u u' → u?)
0F8FA	UMXROOT	(u u' → u'')
0F5FC	UMABS	(u → u')
0F615	UMCHS	(u → u')
0F841	(UMINV)	(u → u')
0F913	UMSQ	(u → u')
0F92C	UMSQRT	(u → u')
0FD4A	(UMOPER:)	(u → u') Evaluates next object with numeric unit part, then builds unit again. For example: :: UMOPER: %1/ ;
0FCE6	UMSIGN	(u → %)
0FCFA	UMIP	(u → u')
0FD0E	UMFP	(u → u')
0FD22	UMFLOOR	(u → u')
0FD36	UMCEIL	(u → u')
0FD68	UMRND	(u → u')
0FD8B	UMTRC	(u → u')
0F660	UMCOS	(u → u')
0F62E	UMSIN	(u → u')
0F674	UMTAN	(u → u')

2.8.4 Tests

0F584	UM=?	(u u' → %flag)
0F598	UM#?	(u u' → %flag)
0F5AC	UM<?	(u u' → %flag)
0F5C0	UM>?	(u u' → %flag)
0F5D4	UM<=?	(u u' → %flag)
0F5E8	UM>=?	(u u' → %flag)
0F3E4	puretemp?	([] []' → [] []' flag) Checks of the two arrays both denote pure temperature units, i.e. if both arrays are equal to [0. 0. 0. 0. 1. 0. 0. 0. 0. 0.]

2.9 Composites

2.9.1 General Operations

0521F	&COMP	(comp comp' → comp'') Concatenates two composites.
052FA	>TCOMP	(comp ob → comp+ob) Adds ob to tail (end) of composite.
052C6	>HCOMP	(comp ob → ob+comp) Adds ob to head (beginning) of composite.
1AC93	(SWAP>HCOMP)	(ob comp → ob+comp) Does SWAP then >HCOMP.
05089	CARCOMP	(comp → ob_head) (comp_null → comp_null) Returns first object of the composite, or a null composite if the argument is a null composite.
6317D	?CARCOMP	(comp T → ob) (comp F → comp) If the flag is TRUE, does CARCOMP.
05153	CDRCOMP	(comp → comp-ob_head) (comp_null → comp_null) Returns the composite minus its first object, or a null composite if the argument is a null composite.
0567B	LENCOMP	(comp → #n) Returns length of composite (number of objects).
63231	DUPLENCOMP	(comp → comp #n) Does DUP then <REF>LENCOMP.
1CA3A	(LENCOMP>%)	(comp → %n) Returns length of composite as a real number.
055B7	NULLCOMP?	(comp → flag) If the composite is empty, returns TRUE.
6321D	DUPNULLCOMP?	(comp → comp flag) Does DUP then <REF>NULLCOMP?.
056B6	NTHELCOMP	(comp #i → ob T) (comp #i → F) Returns specified element of composite and TRUE, or just FALSE if it could not be found.
62B9C	NTHCOMPDROP	(comp #i → ob) Does <REF>NTHELCOMP then DROP.
62D1D	NTHCOMDDUP	(comp #i → ob ob) Does <REF>NTHCOMPDROP then DUP.
71C3B	rNTHELCOMP	(romptr #i → ob T) (romptr #i → F) Returns specified element of composite referenced by the romptr, and TRUE, or just FALSE if it could not be found.

64426 POSCOMP
(comp ob pred → #i)
(comp ob pred → #0)
(eg: pred = ' %<)
Evaluates pred for all elements of composite and ob, and returns index of first object for which the pred is TRUE. If no one returned TRUE, returns #0. For example, the program below returns #4:

```
:: { %1 %2 %3 %-4 %-5 %6 %7 } %0
   ' %< POSCOMP ;
```

644A3 EQUALPOSCOMP
(comp ob → #pos)
(comp ob → #0)
POSCOMP with EQUAL as test.

644BC NTHOF
(ob comp → #i)
(ob comp → #0)
Does SWAP then <REF>EQUALPOSCOMP.

6448A #=POSCOMP
(comp # → #i)
(comp # → #0)
POSCOMP with #= as test.

05821 SUBCOMP
(comp #m #n → comp')
Returns a sub-composite. Makes all index checks first.

643EF matchob?
(ob comp → T)
(ob comp → ob F)
Returns TRUE if ob is EQUAL to any element of the composite.

64127 Embedded?
(ob1 ob2 → flag)
Returns TRUE if ob2 is embedded in, or is the same as, ob1. Otherwise returns FALSE.

644D0 Find1stTrue
(comp test → ob T)
(comp test → F)
Tests every element for test. The first one that returns TRUE is put into the stack along with TRUE. If no object returned TRUE, FALSE is put into the stack. For example, the program below returns %-4 and TRUE.

```
:: { %1 %2 %2 %-4 %-5 %6 } ' %0<
   Find1stTrue ;
```

644EE Find1stT.1
Recursive internal function for Find1stTrue.

6452F	Lookup	(ob test comp → nextob T) (ob test comp → ob F) Tests every odd element (1,3,...) in the composite. If a test returns TRUE, the object after the tested one is returned, along with TRUE. If no object tests TRUE, FALSE is returned. For example, the program below returns %6 and TRUE. :: %0 ' %< { %1 %2 %3 %-4 %-5 %6 } Lookup ;
64548	Lookup.1	(ob test → nextob T) (ob test → ob F) Return Stack: (comp →) Lookup with the composite already pushed (with >R) onto the runstream. Called by Lookup.
64593	EQLookup	(ob comp → nextob T) (ob comp → ob F) Lookup with EQ as test.
6480B	NEXTCOMPOB	(comp #ofs → comp #ofs' ob T) (comp #ofs → comp F) Returns object at specified nibble offset from start. If the object is SEMI (i.e., the end of the composite has been reached) returns FALSE. To get the first element, use FIVE as offset value (to skip the prolog). ZERO works as well.

2.9.2 Building

05331	COMPN	(obn..ob1 #n #prolog → comp)
05459	{}N	(obn..ob1 #n → { obn..ob1 })
05445	::N	(ob1..obn #n → :: ob1..obn ;)
0546D	SYMBN	(ob1..obn #n → sym)
54CEF	(SYMBN:)	(ob1..obn #n → symb) Does 'R, SWAP#1+ then SYMBN. Creates a symbolic from the meta in the stack and the next object in the runstream. This object is added to the end of the symbolic.
63F01	top&Cr	(meta1 meta2 → symb) Does top& then <REF>SYMBN: .
5E661	(ONESYMBN)	(ob1..obn #n → symb)
05481	EXTN	(ob1..obn #n → u) Builds a unit object.
5E0DA	P{}N	(ob1..obn #n → {}) Build list with possible garbage collection.

5E111	(P::N)	(ob1..obn #n → seco) Build seco with possible garbage collection.
5E0A3	(PSYMBN)	(ob1..obn #n → sym) Build symb with possible garbage collection.

2.9.3 Exploding

054AF	INNERCOMP	(comp → obn..ob1 #n)
631E1	DUPINCOMP	(comp → comp obn..ob1 #n)
631F5	SWAPINCOMP	(comp obj → obj obn..ob1 #n)
62B88	INCOMPDROP	(comp → obn..ob1)
62C41	INNERDUP	(comp → obn..ob1 #n #n)
4A95A	ICMPDRPRTDRP	(comp → obn...ob4 ob2 ob1) Does <REF>INCOMPDROP then ROTDROP.
1C973	(XEQLIST>)	(comp → obn..ob1 %n)
636A0	INNER#1=	(comp → obn..ob1 flag)
5E585	INNERtop&	(obn..ob1 #n comp → obm..ob1 #m) Explodes composite and adds to meta: INNERCOMP top& Adds composite objects to meta object.

2.9.4 Lists

055E9	NULL{}	(→ {}) Pushes a null list to the stack.
63A6F	DUPNULL{}?	({} → {} flag)
23EED	ONE{}N	(ob → { ob })
631B9	TWO{}N	(ob1 ob2 → { ob1 ob2 })
631CD	THREE{}N	(ob1 ob2 ob3 → { ob1 ob2 ob3 })
631A5	#1-{}N	(ob1..obn #n+1 → {})
1DC00	PUTLIST	(ob #i {} → {}') Replaces object at specified position. Assumes valid #i.
0E461	(INSERTN{})	({} ob #n → {}') Insert ob at #nth position. Assumes valid #n.
0E4DE	(REMOVEN{})	({} #n → {}') Removes nth ob. Assumes valid #n.
49CD6	(ROLL{})	({} → {}') Rolls list elements.
35491	apndvarlst	({} ob → {}') Appends ob to list if not already there.

152FF	EqList?	(ob →) Is ob a list of equations? Returns T if ob is a list of at least two elements, and the second element is not a list itself.

2.9.5 Secondaries

055FD	NULL::	(→ :: ;) Returns null secondary.
63FE7	Ob>Seco	(ob → :: ob ;) Does ONE then <REF>::N.
63FCE	?Ob>Seco	(ob → :: ob ;) If the object is not a secondary, does Ob>Seco.
63FFB	2Ob>Seco	(ob1 ob2 → :: ob1 ob2 ;) Does TWO then <REF>::N.
632D1	::NEVAL	(ob1..obn #n → ?) Does <REF>::N then <REF>EVAL.
5E8DE	(argum)	(seco → seco #args) Returns argument count for secondary. Checks first command, it it is different from CK0, CK1&Dispatch, etc. #5 is returned.
5E9A7	(infarg?)	(seco → seco flag) Is first command in secondary CKINFARGS?

2.10 Meta Objects

2.10.1 Stack Functions

5E35C	(dup)	(meta → meta meta)
0326E	NDROP	(1..n #n →)
63FA6	DROPNDROP	(1..n #n ob →)
62F75	#1+NDROP	(ob 1..n #n →) aka: N+1DROP
169A5	NDROPFALSE	(ob1..obn #n → F)
5EB1C	psh	(meta1 meta2 → meta2 meta1) Should be called swap.
5EB58	(rot)	(meta1 meta2 meta3 → meta2 meta3 meta1)
5EBDB	(unrot)	(meta1 meta2 meta3 → meta3 meta1 meta2)
5EBC6	(4roll)	(meta1 meta2 meta3 meta4 → meta2 meta3 meta4 meta1)
5EBEA	(4unroll)	(meta1 meta2 meta3 meta4 → meta4 meta1 meta2 meta3)
5ED45	(5roll)	(meta1..meta5 → meta2..meta5 meta1)

5ED5A	(5unroll)	(meta1..meta5 → meta5 meta1..meta4)
5EBFC	(N+1roll)	(META1..METAn+1 #n → META2..METAn+1 META1)
5ED6C	(N+1unroll)	(META1..METAn+1 #n → METAn+1 META1..METAn)
63911	SWAPUnNDROP	(meta1 meta2 → meta2) Should be called swapdrop.
638FD	SWAPUnDROP	(meta1 meta2 → meta2 ob1..obn) Swaps two metas and drops the count. Should be called swapDROP.
5E857	(rotswap)	(meta1 meta2 meta3 → meta2 meta1 meta3)
63F1A	metaROTDUP	(meta1 meta2 meta3 → meta2 meta3 meta1 meta1) Should be called rotdup.
5E870	(4rollunrot)	(meta1 meta2 meta3 meta4 → meta2 meta1 meta3 meta4)

2.10.2 Combining Functions

5E415	top&	(meta1 meta2 → meta1&meta2)
5E4D1	pshtop&	(meta1 meta2 → meta2&meta1)
63F2E	ROTUntop&	(meta1 meta2 meta3 → meta2 meta3&meta1)
63F42	roll2top&	(meta1 meta2 meta3 → meta3 meta1&meta2) aka: rolltwotop&
5E3C0	(over&)	(meta1 meta2 meta3 → meta1&meta2 meta3)
5E3AC	psh&	(meta1 meta2 meta3 → meta1&meta3 meta2)
5E843	(overev&)	(meta1 meta2 meta3 → meta2&meta1 meta3)
5E490	(2top&)	(meta1 meta2 meta3 → meta1&meta2&meta3)
5B861	(top&pshtop&)	(meta1 meta2 meta3 → meta2&meta3&meta1)

2.10.3 Meta and Object Operations

62904	SWAP#1+	(meta ob → meta&ob) aka: SWP1+
6119E	DUP#1+PICK	(n..1 #n → n..1 #n n)
5FC24	(pick1)	(ob meta → ob meta ob)
61305	get1	(ob meta → meta ob)
63105	OVER#2+UNROL	(meta ob → ob meta)
5E3E8	(pshm1)	(meta ob → ob #1 meta)
5E401	psh1top&	(meta ob → ob&meta)
5E4A9	pull	(meta&ob → meta ob) aka: #1-SWAP
5EAF4	(pulldrop)	(meta&ob → meta)

5E6BB	(pullpshm1)	(meta&ob → ob #1 meta)
5E4BD	pullrev	(ob&meta → meta ob)
5FA45	(pulldroppull)	(meta&ob1&ob2 → meta ob1)
5CC12	(2pull2DROP)	(meta&ob1&ob2 → meta)
5FA63	(revpulldrop)	(meta&ob1 ob2 → meta ob2)
548AA	(revpull&psh)	(meta&ob1 ob2 → ob1&ob2 meta)
5E706	psh1&	(meta1 meta2 ob → ob&meta1 meta2)
5E7A5	psh1&rev	(meta1 meta2 ob → ob&meta1 meta2)
57432	(addtpsh)	(meta1 meta2 ob → meta1&ob meta2)
10ADB	(UobROT)	(ob meta1 meta2 → meta1 meta2 ob)
10AF9	(unrot1)	(meta1 meta2 ob → ob meta1 meta2)
5E4EA	pullpsh1&	(meta1 meta2&ob → ob&meta1 meta2)
5E503	(pullrev1&)	(meta1 meta2&ob → meta1&ob meta2)
5D6FA	(pshpullpsh1&)	(meta1&ob meta2 → ob&meta2 meta1)
5E67A	pshzer	(meta → #0 meta)
25322	(4psh)	(meta1 ob1..ob4 → ob1&..ob4 meta1) meta2 = ob1&ob2&b3&ob4
554B3	(repl%1)	(meta&ob → meta&%1)
55607	(repl%-1)	(meta&ob → meta&%-1)
5483C	(COLAkeep1st)	(meta&ob → ob) Returns and (meta&ob ob)
5FC38	(%1pshm1)	(meta → %1 #1 meta)
5E51C	(addt:)	(meta → meta&ob) ob is next ob in runstream.
5E530	(addt2:)	(meta → meta&ob1&ob2) ob is next ob in runstream.
5E59E	(repl:)	(meta&ob → meta&ob') ob is next ob in runstream.
5E549	(psh1&rev:)	(meta1 meta2 → meta1&ob meta2) ob is next ob in runstream.
5E562	(psh1&rev2:)	(meta1 meta2 → meta1&ob1&ob2 meta2) ob is next ob in runstream.
5DD65	(2psh1&rev:)	(meta1 meta2 → meta1&ob meta2&ob) ob is next ob in runstream.
55477	(replfunc)	(meta&ob → meta&LAM1) Uses contents of LAM1.
560ED	xssgneral	(meta1 meta2 → meta1&meta2&LAM1) Uses contents of LAM1.
56101	xnsgeneral	(meta → LAM3&meta&LAM1) Uses contents of LAM1 and LAM3.
5611F	xsngeneral	(meta → meta&LAM3&LAM1) Uses contents of LAM1 and LAM3.
562BE	(dropaddoper)	(meta1 meta2 meta3 → meta1&meta2&LAM1) Uses contents of LAM1.

56309 (MetaUnCalc) (meta ob → LAM3 #1)
Uses contents of LAM1 LAM3.

2.10.4 Other Operations

64345 SubMetaOb (meta #start #end → meta')
Gets a sub-meta. Does range checks.

643BD SubMetaOb1 (ob1..obi..obn #n #i #n #i → ob1..obi #n #i)
This function can be used to take the first i objects of a meta, if you follow it with SWAPDROP. Example:
```
:: %1 %2 %3 %4 %5 BINT5
   BINT3 BINT5 BINT3
   SubMetaOb1 ;
```
results in:
```
%1 %2 %3 #5 #3
```

5F996 (tailpsh) (meta #n → meta1 meta2)
Pushes n-1 last objects in meta to meta1.

28296 metatail (ob1..obn-i..obn #i #n+1 → ob1..ob..obn-i #n-i obn-i+1..obn #i)
#n is the count of the objects in meta. Takes the last #i elements of meta and creates a new one. Example:
```
:: %1 %2 %3 %4 %5
   BINT2 BINT6 metatail ;
```
Results:
```
%1 %2 %3 #3 %4 %5 #2
```

584B2 (MEQU?) (meta1 meta2 → meta1 meta2 flag)
If the metas are equal (i.e., same count and equal objects) returns TRUE.

5768A (ObInMeta?) (meta ob → meta ob flag)
Returns TRUE if ob is equal to some ob in meta.

55314 (?addinver:) (meta&Nob → meta)
(meta → meta&1LAM)
If next object in the runstream is equal to first object of meta, drops that object. Otherwise, adds 1LAM to meta.

5540E (?addrever) (meta&1LAM → meta&1LAM)
(meta → meta&1LAM)
Adds 1LAM to meta, if not already there.

5613D (?addsimir) (meta meta → meta)

58715 (NoIdsInMeta?) (meta → meta flag)
If meta has any ids, lams or secondaries starting with CKO, returns FALSE.

5AD08 (dvars?) (meta → meta flag)
Returns TRUE if meta contains any LAM dvar.

5670F	(>dvars)	(meta1 meta2 → meta1&meta2') All ids in meta2 matching lam 'dvar contents are changed to LAM_'dvar. (meta1 can be #0).
5AC86	(dvars>)	(meta → meta') Lam 'dvars: are changed to 1LAM)
50F60	(dropDROPf)	(ob meta → F)
57419	(DROP2dropf)	(meta1 meta2 ob → F)
57405	(2DROP2dropf)	(meta1 meta2 ob1 ob2 → F)
5551C	(Repl0)	(meta → %0 #0)
55535	(Repl1)	(meta → %1 #1)
5554E	(Repl-1)	(meta → %-1 #1)
56183	(2Repl0)	(meta1 meta2 → %0 #1)
561D8	(2Repl-1)	(meta1 meta2 → %-1 #1)
5643A	(DropRepl0)	(meta ob → %0 #1)
5499F	(Repl0ABND)	(meta → %0)

2.11 Symbolics

2.11.1 General Operations

0546D	SYMBN	(ob1..obn #n → sym)
54CEF	(Cr)	ob1..obn #n -> symb Does 'R, SWAP#1+ then <REF>SYMBN . Creates a symbolic from the meta in the stack and the next object in the runstream. This object is added to the end of the symbolic.
055F3	(NULLSYMB)	(→ sym) Puts a null algebraic in the stack.
5E067	(SINNER)	(sym → meta) (ob → ob #1) If the argument is a symbolic, does INNERCOMP, otherwise ONE. Note that ob #1 is a meta object with only one object.
5E30C	(2SINNER)	(ob1 ob2 → meta1 meta2) SINNER for two objects.
5E2F8	(2SINNERtop&)	(ob1 ob2 → meta) Does <REF>2SINNER then <REF>top& .
5E32A	(SINNERMETA)	(meta → meta') Explodes each object in meta with SINNER and merges the result with top&.
5F2A3	(EXPLODE)	(ob → meta) Uses recursive calls to SINNER to explode object.

5F2EE	(IMPLODE)	(meta → ob) Builds symbolic obeying VUNS properties (UNSYM element), checking fcnapply, etc. Does not build symbolic if result is a single object valid in symbolics.
5E652	symcomp	(ob → ob') If ob is symbolic, does nothing, otherwise ONE SYMBN.
5A01D	SWAPcompSWAP	(ob ob' → ob'' ob') Does SWAP symcomp SWAP.
5E085	(CKSYMBN)	(meta → ob) If size is not one, does SYMBN, else DROPSYM.
5F384	(DROPSYM)	(ob1 ob2 → ob) Drops ob2, if ob1 if symf does nothing, else does ONESYMBN.
1CF2E	(SPLITEQ)	(sym → arg1 arg2) Internal version of EQ→.
1CFD0	(EXPR>)	(sym → arg1..argn %n ob) Internal version of OBJ→.
1578D	CRUNCH	(ob → %) Internal version of →NUM.
22F68	(SYMCRUNCH1)	(ob → %) If id does <REF>XEQRCL , then does <REF>CRUNCH for all object types.
22F86	(SYMCRUNCH2)	(ob1 ob2 → % ob2) <REF>SYMCRUNCH1 for the object in level two.
353AB	(FINDVAR)	(sym → {}) Returns a list of the variables of the equation, recursing into programs and functions in the equation.
5A036	uncrunch	(→) Clears numeric results flag (system flag 3) for the next command only. Example: SYMCOLCT = :: uncrunch colct ; -- Flags: -3
545A0	cknumdsptch1	(sym → symf) Used by one argument functions to evaluate a symbolic or numeric routine according to numeric results flag. Usage: :: cknumdsptch1 <sym> <num> ; If numeric mode, CRUNCH is applied to the level one object and COLA is applied to <num>. If symbolic mode, ckseval1: is called. Example: :: cknumdsptch1 MetaRE xRE ; -- Flags: -3

54DBC	(ckseval1:)	(symf' → symf') Binds next two objects in the runstream to LAMxSYMfcn and LAMxfnc. Explodes symf, then evaluates next on Meta, then builds ob with CKSYMBN. If symf is equation next is evaluated on both sides, then equation is rebuilt (ckevaleq1).
54E2A	(ckevaleq1)	(meta&= → sym) Evaluates 2LAM on both sides of equation, rebuilds symbolic and abandons temporary environment.
558DC	sscknum2	(sym sym → symf) Used by two argument functions to evaluate function according to current numeric mode. Usage: :: sscknum2 <sym> <num> ; In numeric mode both arguments are CRUNCHed and <num> is COLAd. Else, cksseval2: is called. Example: SYM+ = :: sncknum2 Meta+ x+ ;
558F5	sncknum2	(sym % → symf) Usage: :: sncknum2 <sym> <num> ; In symbolic mode uses cksneval2:. Example: SYM+0 = :: sncknum2 Meta+Con x+ ;
5590E	nscknum2	(% sym → symf) Usage: :: nscknum2 <sym> <num> ; In symbolic mode uses cknseval2:. Example: 0+SYM = :: nscknum2 Con+Meta x+ ;
55657	(cknum2:)	(symf symf → symf) Used by the three above functions to determine (and possibly to CRUNCH) the program to COLA.
557EC	(cksseval2:)	(sym sym → symf) Binds next two objects in the runstream to LAMxSYMfcn and LAMxfcn. Explodes the objects in the stack, and evaluates next object in the runstream. If either is an equation, ckevaleq2 is called. Rebuilds one symbolic.
5576F	(cksneval2:)	(sym % → symf) Binds % and next two objects in the runstream to LAMsc1, LAMxSYMfcn and LAMxfcn. Explodes sym, evaluates LAMxSYMfnc, rebuilds symbolic. If sym is equation, ckevaleq1 is called.
5575B	(cknseval:)	(% sym → symf) Does SWAP then <REF>cknseval2: .

58CE4	(parameval)	(sym param → ?) Ensures sym is symbolic (using symcomp), then executes param on each element of symbolic. param is bound to 1LAM during the loop. param should return a flag. If TRUE, or if the object in level 1 is not an operator the loop continues, else possible COLCT property is executed. (Better return TRUE always).
58CEE	(eval)	(sym → ?) Like <REF>parameval, but without binding of a new param. Use this for recursive evaluation with the same parameter. (See SHOWLS and showparam for examples).
5918A	(evalTRUE)	(sym → ? T) Used for recursive parameval.

2.11.2 Mathematical Operations

55F2B	(SYM+O)
55F44	(O+SYM)
55F5D	(SYM+)
55F76	(SYM-O)
55F85	(O-SYM)
55F8F	(SYM-)
55FC1	(SYM*O)
55FDA	(O*SYM)
55FF3	(SYM*)
5600C	(SYM/O)
56025	(O/SYM)
5603E	(SYM/)
55EE0	(SYM^O)
55EF9	(O^SYM)
55F12	(SYM^)
56057	(SYM%MOD)
56070	(%SYMMOD)
56089	(SYMMOD)
55E95	(SYM%MIN)
55EAE	(%SYMMIN)
55EC7	(SYMMIN)
55E4A	(SYM%MAX)
55E63	(%SYMMAX)

```
55E7C      (SYMMAX)
55C3D      (SYM%%OF)
55C56      (%SYM%OF)
55C6F      (SYM%OF)
55C88      (SYM%%CH)
55CA1      (%SYM%CH)
55CBA      (SYM%CH)
55CD3      (SYM%%T)
55CEC      (%SYM%T)
55D05      (SYM%T)
55D1E      (SYM%COMB)
55D37      (%SYMCOMB)
55D50      (SYMCOMB)
55D69      (SYM%PERM)
55D82      (%SYMPERM)
55D9B      (SYMPERM)
55DB4      (SYM%RND)
55DCD      (SYMRND)
55DE6      (RNDSYM)
55DFF      (SYM%TRNC)
55E18      (TRCNYM)
55E31      (SYMTRCN)
560A2      (SYM%XROOT)
560BB      (%SYMXROOT)
560D4      (SYMXROOT)
54EEB      (SYMNEG)
54F04      (SYMABS)
54F68      (SYMSIGN)
54F36      (SYMINV)
5518E      (SYMIP)
551A7      (SYMFP)
551C0      (SYMFLOOR)
551D9      (SYMCEIL)
5520B      (SYMMANT)
551F2      (SYMEXPONENT)
54AE0      (SYMRE)
54EB9      (SYMIM)
54F1D      (SYMCONJ)
```

```
54ED2      (SYMNOT)
54F9A      (SYMSQ)
54F81      (SYMSQRT)
54FB3      (SYMSIN)
54FCC      (SYMCOS)
54FE5      (SYMTAN)
55049      (SYMASIN)
55062      (SYMACOS)
5507B      (SYMATAN)
54FFE      (SYMSINH)
55017      (SYMCOSH)
55030      (SYMTANH)
55094      (SYMASINH)
550AD      (SYMACOSH)
550C6      (SYMATANH)
550F8      (SYMLN)
55143      (SYMLNP1)
550DF      (SYMEXP)
5515C      (SYMEXPM)
55111      (SYMLOG)
5512A      (SYMALOG)
55175      (SYMFACT)
55224      (SYMD>R)
5523D      (SYMR>D)
54F4F      (SYMARG)
55256      (SYMUBASE)
5226F      (SYMUVAL)
5599A      (SYM%AND)
559B3      (%SYMAND)
559CC      (SYMAND)
559E5      (SYM%OR)
559FE      (%SYMOR)
55A17      (SYMOR)
55A30      (SYM%XOR)
55A49      (%SYMXOR)
55A62      (SYMXOR)
55A7B      (SYMFLOAT==)
55AAD      (SYM==)
```

```
55A94      (FLOATSYM==)
55AC6      (SYMFLOAT<>)
55ADF      (FLOATSYM<>)
55AF8      (SYM<>)
55B11      (SYM%<)
55B2A      (%SYM<)
55B43      (SYM<)
55B5C      (SYM%>)
55B75      (%SYM>)
55B8E      (SYM>)
55BA7      (SYM%<=)
55BC0      (%SYM<=)
55BD9      (SYM<=)
55BF2      (SYM%>=)
55C0B      (%SYM>=)
55C24      (SYM>=)
56331      (Con+Meta)
56543      (Meta+Con)
56160      (Meta+)
56566      (Meta-Con)
56359      (Con-Meta)
56174      (Meta-)
56589      (Meta*Con)
56390      (Con*Meta)
561BA      (Meta*)
565CF      (Meta/Con)
563DB      (Con/Meta)
56214      Meta/
5645D      (Meta^Con)
562FA      (Con^Meta)
5660B      (MetamodCon)
5642B      (ConmodMeta)
56250      (Metamod)
553D2      (MetaNEG)
555B2      (MetaABS)
553EB      (MetaINV)
5542C      (MetaRE)
55495      (MetaIM)
```

```
55567      (MetaCONJ)
555E9      (MetaSQ)
5533C      (MetaSIN)
55378      (MetaCOS)
553A5      (MetaTAN)
5529C      (MetaSINH)
552B0      (MetaCOSH)
552C4      (MetaTANH)
552D8      (MetaEXP)
55300      (MetaEXPM)
552EC      (MetaALOG)
```

2.11.3 Collection

57D90 SYMCOLCT (symf → symf)

```
:: uncrunch colct ;
```

57DA4 (colct) (symf → symf)

Basic collection function, does not check numeric results flag. Disassembly:

```
:: EXPLODE
   pshzer colfac
   pshzer colrev
   ATTNFLG@ #0<> case
     :: CKSYMBN CKONOLASTWD
        ?ATTNQUIT ;
   pshzer colunfac
   SYMN COLA coleval
;
--
```

Flags: -3

587AA (colfac) (meta1 meta2 → meta')

Appends objects in meta2 tail to meta1 tail replacing all -, /, NEG, INV and SQ with +, *, ^, and -1 as a possible factor. Example rules:

```
'SQ(A)'    'A^2'
'-A'       '-1*A'
'A-B'      'A+-1*b'
'A/B'      'A*B^-1'
```

57E08	(colrev)	(meta1 meta2 → meta') Appends objects in meta2 to tail of meta1 collecting numeric factors, ordering terms according to a comparison function, collecting numeric terms to front. Only + and * factors are checked. Sub-routines used by this function:
58511	(MetaLess?)	(meta1 meta2 → meta1 meta2 flag)
58525	(MetaMore?)	(meta1 meta2 → meta1 meta2 flag)
585A7	(BodyMore?)	(ob1 ob2 → flag)
58A20	(colunfac)	(meta1 meta2 → meta') Appends objects in meta2 to head of meta1 converting ^, + and * to / and - when suitable.
58CDA	(coleval)	(ob → ob') Passes FALSE as parameter to parameval. Thus eval uses ?COLCT to check special evaluation.

2.11.4 Expansion

57A0C	(SYMEXPAN)	(symf → symf) Expands symbolic or float
57A48	(expan)	(meta1 meta2 meta3 → meta) Expands meta3. Successful part is added to tail of meta2. Calls expan1 and larg until meta3 becomes empty.
57AA2	(expan1)	(meta → meta1 meta2) Expands meta. Meta1 is the unsuccessful part, meta2 the successful part (could be just and operator). Sub-expanders:
57B63	(?expan^)	If ^ then expands (returns if successful.)
57AB6	(expansq)	Expands SQ.
57B4C	(?expanneginv)	Prevents Meta->() from expanding [Expr INV NEG].
57B01	(?expanapp)	If <REF>xFCNAPPLY then tries calling <REF>?EXPAN .
57C71	(expansum^)	Expands (A+B)^2 or (A-B)^2
57CF8	(NXTPOT%)	(% → flag %' T) (% → % F) Returns next number when expanding ^. The flag indicates wheter %0>. Do not use for %0.

2.11.5 Integration

1F201	(XEQINTEGID)	(ob ob ob id/lam → symf)
1F27A	(XEQINTEG)	(ob ob ob QN → symf)
5AAC7	(SYMINTEG)	(symf symf symf QN → symf)
5662E	(NUMINTEG)	(symf QN symf_lo symf_hi → %)
52C36	(CALCINTEG)	(seco %precision %lo %hi → %integral %error) Low level numeric integration. If %low = %hi returns %0 %0. Checks that 1E-12 ≤ %accuracy ≤1 1. seco gets % as input and should return one value.
5ACC7	(intg)	(#0 #0 meta → meta_ok meta_fail) Integrates meta where variable of integration has been changed to LAMdvar. Meta objects should be merged by addition. Use colunfac to resume /, -, etc. from *, +.
5D0C2	(forceadd)	(meta → meta') Forces top level operators to be +, NEG when possible by changing from -, +, NEG. Attempts to arrange rightmost term to be second argument for top +. Example: 'A+(B+C)' 'A+B+-C'
5B659	(forcemul?aga)	(meta → meta') Recursive Meta<-D, MetaD-> and forcemul calling. If any operation was successful AGAIN is executed.
5B717	(forcemul)	(meta → meta') Forces top level operator to be + and NEG when possible by changing from / and INV. LAMdvar is ordered specially.
5AFAB	(intg1)	(M_ok M_fail M_temp meta → M_ok' M_fail' M_temp) Integrates meta, ok part is adds to meta1 (meta3 is the next part to integrate in the top level loop.)
5B0FA	(intg1ok)	(M1 M2 M3 M4 → M1' M2 M3 T) Adds M4 to M1. (Successful intg1).
5B09B	(intg1fail)	(M1 M2 M3 M4 → M1 M2' M4 T) Adds M4 to M2. (Unsuccessful intg1).
5B0CD	(intgconst)	(M_ok M_fail M_temp meta → M_ok' M_fail' M_temp) Integrates constant to meta. (dvars? gives FALSE).
5B131	(intglinear)	(M1 M2 M3 M4 → M1' M2 M3) Integrates linear term (M4).

5B140	(intgaddlin)	(meta #loc → meta') Adds 2^/2 to LAMdvar in meta at stack level #loc.
5AD80	(linear?)	(meta #level → meta' T) (meta #level → meta' #loc F) Is meta linear in LAMdvar? #level is first location of LAMdvar obtained from dvars? :: linear DUP IT SWAPDROP ;
5AD9E	(linear)	(meta #level → meta #loc flag) :: linear SWAPDROP ;
5AD6C	(linear!)	(meta #level → meta' flag)

2.11.6 Derivatives

7DBE2	D/D*	Derivative of multiplication.
7DBED	D/D+	Derivative of addition.
7DBF8	D/D-	Derivative of subtraction.
7DC03	D/D/	Derivative of division.
7DC72	D/D=	Derivative of equality.
7DC7D	D/DABS	Derivative of ABS.
7DCA1	D/DACOS	Derivative of ACOS.
7DCAC	D/DACOSH	Derivative of ACOSH.
7DCB7	D/DALOG	Derivative of ALOG.
7DE1C	D/DAPPLY	
7DCC2	D/DARG	Derivative of ARG.
7DCCD	D/DASIN	Derivative of ASIN.
7DCD8	D/DASINH	Derivative of ASINH.
7DCE3	D/DATAN	Derivative of ATAN.
7DCEE	D/DATANH	Derivative of ATANH.
7DCF9	D/DCHS	Derivative of CHS.
7DD17	D/DCONJ	Derivative of CONJ.

7DD35	D/DCOS	Derivative of COS.
7DD40	D/DCOSH	Derivative of COSH.
7DDF0	D/DDER	Derivative of derivative.
7DD4B	D/DEXP	Derivative of EXP.
7DD82	D/DIFTE	Derivative of IFTE.
7DE06	D/DINTEGRAL	Derivative of integral.
7DD56	D/DINV	Derivative of INV.
7DD61	D/DLN	Derivative of LN.
7DD6C	D/DLNP1	Derivative of LNP1.
7DD77	D/DLOG	Derivative of LOG.
7DD8D	D/DSIN	Derivative of SIN.
7DD98	D/DSINH	Derivative of SINH.
7DDA3	D/DSQ	Derivative of SQ.
7DDAE	D/DSQRT	Derivative of SQRT.
7DE11	D/DSUM	Derivative of SUM.
7DDB9	D/DTAN	Derivative of TAN.
7DDC4	D/DTANH	Derivative of TANH.
7DDFB	D/DWHERE	
7DDCF	D/D^	Derivative of power.
7DDDA	D/D^X	
7DDE5	D/D^Y	

2.11.7 Other Functions

1F38B	(SYMWHERE)	(symf {} → symf)
1F439	(XEQSYMWHERE)	(symf QN1 id1..QNn idn → symf)
1F43E	(CKWHEREARGS)	checks pairs of quoted names Checks pairs of quoted names/ids.

547B5	SYMBWHERE	(symf QN1 id1..QNn idn #2n+1 → symf)
547E2	(WHERE1)	(QN1 id1..QNn idn #n meta1 → symf) Used when meta size is 1.
54887	(WHEREN)	(QN1 id1..QNn idn #2 metan → symf)
58D75	SYMSHOW	(sym id/lam → symf)
20B00	XEQSHOWLS	(sym {} → symf)
5910B	(SHOWLS)	(sym {names} → symf) See this for a good example of recursive parameval.
1A4A3	(%IFTE)	(% ob1 ob2 → ?)
54564	(SYMIFTE)	(sym symf symf → symf) Uses cknumdsptch1 with:
54609	(MetaIFTE)	
54653	(NumIFTE)	
591AD	(SYMQUAD)	(sym id → symf) Avoids the obvious in solving a quadratic equation.
595DD	(SYMTAYLR)	(sym id % → symf) Calculates taylor polynomial.
57293	(SYMISOL)	(sym id → symb) Isolate a variable.
1F113	(XEQSYMDERCON)	(QN %/C%/u → symf)
1F0F5	(XEQSYMDERSTEP)	(QN sym → symf)
54977	(SYMDERSTEP)	(QN sym → symf) No CKSYMBTYPE check.
54954	(SYMDER)	(sym sym → symf)
56949	(SYMSUM)	(sym sym sym ob → symf)
56A06	(SYM%SUM)	(sym sym % ob → symf)
56A4C	(%SYMSUM)	(sym % sym ob → symf)
56AC9	(%%SUM)	(sym % % ob → symf)

2.11.8 Meta Symbolics Functions

5BC94	(addt+)	(meta → meta&+)
5BC67	(addt-)	(meta → meta&-)
5CD16	(addt*)	(meta → meta&*)
5CD2A	(addtNEG)	(meta → meta&NEG)
5CD3E	(addtINV)	(meta → meta&INV)
5BCC1	(repl/)	(meta&ob → meta&/)
5BCEE	(repl*)	(meta&ob → meta&*)
5ACD6	(M1st+?Drp)	(meta&+ → meta)

5BC5D	(meta+)	(meta&NEG → meta&-)
5BC8A	(meta-)	(meta&NEG → meta&+)
5BCB7	(meta*)	(meta&INV → meta&/)
5BCE4	(meta/)	(meta&INV → meta&*)
5BD3E	(drpmeta+)	(meta&NEG&ob → meta&-) (meta&ob → meta&+)
5BD57	(drpmeta-)	(meta&NEG&ob → meta&+) (meta&ob → meta&-)
5BD70	(drpmeta*)	(meta&INV&ob → meta&/) (meta&ob → meta&*)
5BD89	(drpmeta/)	(meta&INV&ob → meta&*) (meta&ob → meta&/)
5BBE5	(metaneg)	(meta&NEG → meta) (meta → meta&NEG)
5BC3F	(metainv)	(meta&INV → meta) (meta → meta&INV)
5BC03	(metaneglft)	(meta → meta') metaneg on left sub-expression.
5BC21	(metainvlft)	(meta → meta') metainv on left sub-expression.
5EA9F	pshzerpsharg	(meta → M_last M_rest) Pushes last sub-expression in meta. If meta is a valid expression M_rest will be empty.
63F92	pZpargSWAPUn	(meta → M_rest M_last) <REF>pshzerpsharg then <REF>psh .
63F56	plDRPpZparg	(meta&ob → M_last M_rest) Drops ob then calls <REF>pshzerpsharg .
5E68E	(pargop)	(meta → M_last&op M_rest) Pushes last sub-expression ignoring first object in meta. Thus op is +, -, etc. and M_last is their second argument.
5EAC2	(larg)	(meta → M_rest M_last) Splits last sub-expression from meta.
5E6F2	(parg&)	(meta1 meta2 → meta1&M_last M_rest)
5CCEE	(larg&)	(meta1 meta2 → meta1&M_rest M_last)
5CBF9	(drppargtop&)	(meta&ob → M_last&M_rest)
57F4B	(swappargunrot)	(meta1 meta2 → M_rest meta2 M_last)
1CF42	(drppargsym)	(meta&ob → 'M_rest''MetaLast') Buids objects with PSYMBN. Will give invalid expressions if ob is not a two-argument function.
5F926	(splitup)	(meta #n #m → meta #level) Calculates stack level of last object to be included when splitting last #m sub- expressions from meta starting from stack level n. (2 1 would give level of first object in the last sub-expression.)

5F96E	(splitdown)	(meta #n #m → meta #lowlevel #args+1) Seeks stack level n-1 downwards for extra operators for #m expressions. #lowlevel is the stack level of the extra operator. #args indicates how many expressions the lowlevel operator is still missing.
558BE	(?spliteq)	(meta1&meta2&= → meta2 meta1) If meta contains =, splits two sides, otherwise DUP.
58C02	(count+)	(meta → meta #0) (meta &+&+..&+ → meta #n)
58C0E	(count*)	(meta → meta #0) (meta &*&*..&* → meta #n) Same as count+ for *.
5BE56	(MetaMulInv)	Simplifiy combinations of INV and * (using /).
58A61	(colinv1)	([expr1 INV expr2 INV *] → [expr1 expr2 /])
58A93	(colinv2)	([expr INV *] → [expr /])
58AAC	(colinv3)	([expr1 INV expr2 *] → [expr1 expr2 /])
5971D	(MetaDNEG)	double negate Double negation.
5976B	(MetaDINV)	double invert Double inversion.
597B5	(Meta*1)	mult by one Multiply by one.
5983B	(Meta^1)	pow by one Raise to power of one.
59885	(Meta1/)	div by one Divide by one.
5990F	(Meta+1-1)	add 1 subtract 1 Add one and subtract one.
596D3	(MetaRCOLCT)	restricted collection Restricted collection.
5C6D9	(Meta<-T)	move nearest right term to left Move nearest right term to the left.
5C68D	(MetaT->)	move nearest left term to right Move nearest left term to the right.
5C623	(Meta(()))	parenthesise nearest term Put parentheses over nearest term.
5C589	(Meta(<-)	include left term Include left term.
5C5D6	(Meta->))	include right term Include right term.
5BE81	(Meta<-->)	commute terms Commute terms.
5BECE	(Meta<-A)	associate left term Associate left term.

5BF53	(MetaA->)	`associate right term` Associate right term.
5C137	(Meta->())	`remove prefix` Remove prefix.
5C0B9	(Meta<-D)	`delete left term` Delete left term (via expansion).
5C102	(Meta<-D!)	`delete left term` Delete left term (above - ^ expansion).
5BFD8	(MetaD->)	`delete right term` Delete right term (via expansion).
5C3C2	(Meta<-M)	`merge common factor on left` Merge common factor on left side.
5C4CF	(MetaM->)	`merge common factor on right` Merge common factor on right side.
5C261	(Meta-())	`double negate & remove prefix` Double negate, then remove prefix.
5C204	(Meta1/())	`double invert & remove prefix` Double inversion, then remove prefix.
5C348	(MetaL*)	`( LN(a^b) → b*LN(a) )` Transform LN(A^B) to LN(A)*B.
5C375	(MetaL())	`( b*LN(a) → LN(a^b) )` Transform LN(A)*B to LN(A^B).
5C2CE	(MetaE^)	`( EXP(a*b) → EXP(a)^b )` Transform EXP(A*B) to EXP(A)^B.
5C31B	(MetaE())	`( EXP(a)^b → EXP(a*b) )` Transform EXP(A)^B to EXP(A*B).
5C670	(Meta->TRG)	`change EXP to trig. fns.` Change EXP to trigonometric functions.
5C53C	(MetaAF)	`add fractions` Add fractions.
5C845	(Meta->DEF)	`define function` Define function (SIN, SINH, ASIN...)
5C91D	(MetaTRG*)	`expand trig fns. of a sum` Expand trigonometric function of a sum.
5C73D	(Meta->()C%)	`remove 1st RE,IM; CONJ` Remove first RE, IM or CONJ.
5CDF2	(Meta<-Dall)	
5CEF1	(MetaD->all)	
5CE15	(Meta<-Aall)	
5CE4C	(MetaA->all)	
5CFF5	(Meta<-Mall)	
5D009	(MetaM->all)	
5CF5A	(Meta<-Tall)	
5CF23	(MetaT->all)	

5CEBA	(Meta(<-all)	
5CE83	(Meta->)all)	
5CF91	(Meta->()all)	
5CFC3	(Meta->()C%all)	
5CD52	(evalcase:)	(meta → ?) Evaluates next object. If it drops current stream then continue, else SKIP next. Example: :: evalcase: Meta<-D Meta<-Daga ;
5CD7A	(revalcase:)	(meta → ?omeg) Evaluates next object for sub-expressions until current stream is not dropped by ob. Example: Meta<-Daga = :: revalcase: Meta<-D COLA RDROP ; COLA RDROP is there to mark successful operation.

2.12 Library and Backup Objects

2.12.1 Port Operations

0AAB2	PORTSTATUS	(#port → present? writeable? merged? #size #addr) Returns information for port.
0AB22	(PORTEND)	(#port → #addr) Gets end address of port.
0AB82	NEXTLIBBAK	(#addr → backup/library #nextaddr) Gets next library or backup.
0B409	(MERGE)	(#port →) Merges specified port. Only works for port one. Checks if wrong port number was entered.

2.12.2 Rompointers

07E50	#>ROMPTR	(#lib #cmd → ROMPTR) Creates rompointer.
08CCC	ROMPTR>#	(ROMPTR → #lib #cmd) Splits rompointer.
07E99	ROMPTR@	(ROMPTR → ob T) (ROMPTR → F) Recalls contents of rompointer.
62C19	DUPROMPTR@	(ROMPTR → ROMPTR ob T) (ROMPTR → ROMPTR F) Does DUP then ROMPTR@.

02FEF	(ROMSEC)	(ROMPTR → ?) Recalls contents of rompointer and EVAL. Generates "Undefined XLIB Error" if not found.
62A61	?>ROMPTR	(ob → ob') If ROM-WORD? and TYPECOL? then RPL@.
62A84	?ROMPTR>	(ob → ob') If <REF>TYPEROMP? and content exists <REF>INHARDROM? then return contents.
62BD8	RESOROMP	(→ ob) Recalls contents of next object in the runstream (which must be a rompointer).
07E76	(PTR>ROMPTR)	(ob → ROMPTR T) (ob → F) If the object is a library command, returns its rompointer and TRUE, if not just FALSE.
081FB	(ROMPTRDECOMP)	(ROMPTR → id T) (ROMPTR → F) If the library command exists and has a name, returns that name and TRUE, otherwise FALSE.
081E3	(PTR>ID)	(ob → id T) (ob → F) If the object is a library command and has a name, returns its name and TRUE, if not returns just FALSE.
07C18	(COMPILEID)	(id → id T) (id → ROMPTR T) (id → F) Searches id in current path, if found returns TRUE. Else searches attached libraries. If nothing was found, return FALSE.
61FB6	ROM-WORD?	(ob → flag)
61FA9	DUPROM-WORD?	(ob → ob flag)

2.12.3 Libraries

07709	TOSRRP	(# →) Attaches library to HOME directory. -- <REF>TEXT:Libraries
076AE	OFFSRRP	(# →) Detaches library from HOME directory. -- <REF>TEXT:Libraries
0778D	(ONSRRP?)	(# → flag) Returns TRUE if library is attached to HOME directory.

21C6F	XEQSETLIB	(% →) Internal ATTACH.
07638	SETHASH	(#libnum hxs →)
021DD	(ROMPOLL)	(→) Configures internal and external libraries. -- <REF>TEXT:Libraries
0210F	(DOROMPOLL)	({#libnum1 #libnum2..} →) Configures specified libraries. -- <REF>TEXT:Libraries
08199	(ROMPARTNAME)	(#libnum → id T) (#libnum → F) Returns title of library as an ID, and TRUE. If library is not found, returns just FALSE.
081DE	(LIB>#)	(lib → #libnum T) Returns number of library.
08081	(ROMPART>ADDR)	(#libnum → #addr T) (#libnum → F) Recalls library addres + 10 (prolog and length skipped).
080BF	(ROMPARTSIZE)	(#libnum → #nibbles-10 T) (#libnum → F) Returns size of library.
080DA	(NEXTROMPID)	(#libnum → #nextlibnum T) (#libnum → F) If specified library exists, #libnum is returned with TRUE.
08112	(GETHASH)	(#libnum → hxs_table T) (#libnum → F) Gets specified library's hash table.
08130	(GETMSG)	(#libnum → [] T) (#libnum → F) Gets specified library's message table. -- <REF>TEXT:Libraries
0764E	(SETMESG)	([$] #libnum →) Sets message table of specified library. -- <REF>TEXT:Libraries
0813C	(GETLINK)	(#libnum → hxs_table T) (#libnum → F) Gets specified library's link table.
08157	(GETCONFIG)	(#libnum → ob T) (#libnum → F)

07F86	(ROMPART)	(rrp → {#lib1..#libn} T) (ROMPTR → #libnum) Gets the list of libraries attached to the directory, along with TRUE. If the argument is a rom pointer, returns the library number of this pointer.

2.12.4 Backup Objects

081D9	BAKNAME	(bak → id T) Returns backup's name
0948E	BAK>OB	(bak → ob) Gets backup object.
21674	>BAK	(id ob → bak) Creates backup object with specified name and contents.

3 General SysRPL Entries

3.1 Stack Operations

03188	DUP	(ob → ob ob)
62CB9	DUPDUP	(ob → ob ob ob)
5E370	NDUPN	(ob #n → ob..ob #n)
		(ob #0 → #0)
62FB1	DUPROT	(1 2 → 2 2 1)
61380	DUPUNROT	(1 2 → 2 1 2)
		aka: SWAPOVER
630F1	DUPROLL	(1..n #n → 1 3..n #n 2)
61099	DUP4UNROLL	(1 2 3 → 3 1 2 3)
630DD	DUPPICK	(n..1 #n → n..1 #n n-1)
611F9	DUP3PICK	(1 2 → 1 2 2 1)
		aka: 2DUPSWAP
6119E	DUP#1+PICK	(n..1 #n → n..1 #n n)
5FC24	(DUP#2+PICK)	(n..1 #n → n..1 #n n+1)
031AC	2DUP	(1 2 → 1 2 1 2)
611F9	2DUPSWAP	(1 2 → 1 2 2 1)
		aka: DUP3PICK
63C40	2DUP5ROLL	(1 2 3 → 2 3 2 3 1)
031D9	NDUP	(1..n #n → 1..n 1..n)
03244	DROP	(1 →)
627A7	DROPDUP	(1 2 → 1 1)
63FA6	DROPNDROP	(1..n #n ob →)
6270C	DROPSWAP	(1 2 3 → 2 1)
62726	DROPSWAPDROP	(1 2 3 → 2)
		aka: ROT2DROP, XYZ>Y
62FC5	DROPROT	(1 2 3 4 → 2 3 1)
63029	DROPOVER	(1 2 3 → 1 2 1)
03258	2DROP	(1 2 →)
60F4B	3DROP	(1 2 3 →)
		aka: XYZ>
60F7E	4DROP	(1..4 →)
		aka: XYZW>
60F72	5DROP	(1..5 →)
60F66	6DROP	(1..6 →)
60F54	7DROP	(1..7 →)
0326E	NDROP	(1..n #n →)

62F75	#1+NDROP	(ob 1..n #n →)
		aka: N+1DROP
4B710	RESETDEPTH	(ob1..obn obn+1..obx #n → ob1..obn)
		Drops all but #n levels of the stack.
0314C	DEPTH	(1..n → 1..n #n)
6416D	UStackDepth	(→ #)
		The depth of the stack, similar to DEPTH.
5DE7D	reversym	(1..n #n → n..1 #n)
03223	SWAP	(1 2 → 2 1)
62747	SWAPDUP	(1 2 → 2 1 1)
6386C	SWAP2DUP	(1 2 → 2 1 2 1)
60F9B	SWAPDROP	(1 2 → 2)
		aka: XY>Y
62830	SWAPDROPDUP	(1 2 → 2 2)
6284B	SWAPDROPSWAP	(1 2 3 → 3 1)
		aka: UNROTDROP, XYZ>ZX
60F33	SWAPROT	(1 2 3 → 3 2 1)
		aka: UNROTSWAP, XYZ>ZYX
63C2C	SWAP4ROLL	(1 2 3 4 → 2 4 3 1)
		aka: XYZW>YWZX
61380	SWAPOVER	(1 2 → 2 1 2)
		aka: DUPUNROT
63C54	SWAP3PICK	(1 2 3 → 1 3 2 1)
62001	2SWAP	(1 2 3 4 → 3 4 1 2)
03295	ROT	(1 2 3 → 2 3 1)
62775	ROTDUP	(1 2 3 → 2 3 1 1)
62C7D	ROT2DUP	(1 2 3 → 2 3 1 3 1)
60F21	ROTDROP	(1 2 3 → 2 3)
		aka: XYZ>YZ
62726	ROT2DROP	(1 2 3 → 2)
		aka: DROPSWAPDROP, XYZ>Y
60F0E	ROTDROPSWAP	(1 2 3 → 3 2)
		aka: XYZ>ZY
60EE7	ROTSWAP	(1 2 3 → 2 1 3)
		aka: XYZ>YXZ
6112A	ROTROT2DROP	(1 2 3 → 3)
		aka: UNROT2DROP, XYZ>Z
62CA5	ROTOVER	(1 2 3 → 2 3 1 3)
60FBB	4ROLL	(1 2 3 4 → 2 3 4 1)
		aka: FOURROLL, XYZW>YZWX
62864	4ROLLDROP	(1 2 3 4 → 2 3 4)
62ECB	4ROLLSWAP	(1 2 3 4 → 2 3 1 4)
63001	4ROLLROT	(1 2 3 4 → 2 4 1 3)
		aka: FOURROLLROT

630A1	4ROLLOVER	(1 2 3 4 → 2 3 4 1 4)
60FD8	5ROLL	(1 2 3 4 5 → 2 3 4 5 1) aka: FIVEROLL
62880	5ROLLDROP	(1 2 3 4 5 → 2 3 4 5)
61002	6ROLL	(1..6 → 2..6 1) aka: SIXROLL
6106B	7ROLL	(1..7 → 2..7 1) aka: SEVENROLL
6103C	8ROLL	(1..8 → 2..8 1) aka: EIGHTROLL
03325	ROLL	(1..n #n → 2..n 1)
62F89	ROLLDROP	(1..n #n → 2..n)
62D45	ROLLSWAP	(1..n #n → 2..n-1 1 n)
612F3	#1+ROLL	(ob 1..n #n → 1..n ob)
61318	#2+ROLL	(a b 1..n #n → b 1..n a)
612DE	#+ROLL	(1..n+m #n #m → 2..n+m 1)
612CC	#-ROLL	(1..n-m #n #m → 2..n-m 1)
60FAC	UNROT	(1 2 3 → 3 1 2) aka: 3UNROLL, XYZ>ZXY
62CF5	UNROTDUP	(1 2 3 → 3 1 2 1)
6284B	UNROTDROP	(1 2 3 → 3 1) aka: SWAPDROPSWAP, XYZ>ZX
6112A	UNROT2DROP	(1 2 3 → 3) aka: ROTROT2DROP, XYZ>Z
60F33	UNROTSWAP	(1 2 3 → 3 2 1) aka: SWAPROT, XYZ>ZYX
60F0E	UNROTSWAPDROP	(1 2 3 → 3 2) aka: ROTDROPSWAP, XYZ>ZY
6308D	UNROTOVER	(1 2 3 → 3 1 2 1)
60FAC	3UNROLL	(1 2 3 → 3 1 2) aka: UNROT, XYZ>ZXY
6109E	4UNROLL	(1 2 3 4 → 4 1 2 3) aka: FOURUNROLL, XYZW>WXYZ
62D09	4UNROLLDUP	(1 2 3 4 → 4 1 2 3 3)
6113C	4UNROLL3DROP	(1 2 3 4 → 4) aka: XYZW>W
63015	4UNROLLROT	(1 2 3 4 → 4 3 2 1)
610C4	5UNROLL	(1 2 3 4 5 → 5 1 2 3 4) aka: FIVEUNROLL
610FA	6UNROLL	(1..6 → 6 1..5) aka: SIXUNROLL
62BC4	7UNROLL	(1..7 → 7 1..6)
63119	8UNROLL	(1..8 → 8 1..7)
6312D	10UNROLL	(1..10 → 10 1..9)

0339E	UNROLL	(1..n #n → n 1..n-1)
61353	#1+UNROLL	(ob 1..n #n → n ob 1..n-1)
61365	#2+UNROLL	(a b 1..n #n → n a b 1..n-1)
6133E	#+UNROLL	(1..n+m #n #m → n+m 1..n+m-1)
6132C	#-UNROLL	(1..n-m #n #m → n-m 1..n+m-1)
032C2	OVER	(1 2 → 1 2 1)
62CCD	OVERDUP	(1 2 → 1 2 1 1)
62D31	OVERSWAP	(1 2 → 1 1 2)
62D31	OVERUNROT	aka: OVERUNROT (1 2 → 1 1 2) aka: OVERSWAP
63105	OVER#2+UNROLL	(1..n #n ob → ob 1..n #n)
63C90	OVER5PICK	(1 2 3 4 → 1 2 3 4 3 1)
63FBA	2OVER	(1 2 3 4 → 1 2 3 4 1 2)
611FE	3PICK	(1 2 3 → 1 2 3 1)
62EDF	3PICKSWAP	(1 2 3 → 1 2 1 3)
630B5	3PICKOVER	(1 2 3 → 1 2 3 1 3)
63C68	3PICK3PICK	(1 2 3 → 1 2 3 1 2)
35D08	(DROP3PICK)	(1 2 3 4 → 1 2 3 1)
6121C	4PICK	(1 2 3 4 → 1 2 3 4 1)
62EF3	4PICKSWAP	(1 2 3 4 → 1 2 3 1 4)
63C7C	SWAP4PICK	(1 2 3 4 → 1 2 4 3 1)
630C9	4PICKOVER	(1 2 3 4 → 1 2 3 4 1 4)
6123A	5PICK	(1 2 3 4 5 → 1 2 3 4 5 1)
6125E	6PICK	(1..6 → 1..6 1)
61282	7PICK	(1..7 → 1..7 1)
612A9	8PICK	(1..8 → 1..8 1)
032E2	PICK	(1..n #n → 1..n 1)
611A3	#1+PICK	(1..n #n-1 → 1..n 1)
611BE	#2+PICK	(1..n #n-2 → 1..n 1)
611D2	#3+PICK	(1..n #n-3 → 1..n 1)
611E1	#4+PICK	(1..n #n-4 → 1..n 1)
61184	#+PICK	(1..n+m #n #m → 1..n+m 1)
61172	#-PICK	(1..n-m #n #m → 1..n-m 1)

3.2 Temporary Environments

3.2.1 Built-in IDs and LAMs

15777	NULLID	(→ id) Null (empty) identifier.
34D30	NULLLAM	(→ lam) Puts NULLLAM in the stack.
211B4	(ID_CST)	ID CST
225A4	(ID_S)	ID S
3FACF	(ID_SKEY)	ID SKEY ID SKEY
3FAE8	(LAM_SKEY)	LAM SKEY
4AB1C	ID_X	ID X
4744F	'IDX	(→ id) Puts ID X unevaluated on the stack.
4AB59	ID_Y	ID Y
41A39	('idUserKeys)	(→ id) Puts ID UserKeys unevaluated on the stack.
41A43	(ID_UserKeys)	ID UserKeys ID UserKeys
41A5F	('idUserKeys.)	(→ id) Puts ID UserKeys.CRC unevaluated on the stack.
41A69	(ID_UserKeys.)	ID UserKeys.CRC
1576C	(CUREQ)	ID EQ
2C1FD	(ID_SIGMADAT)	ID ΣDAT
549DB	(lam'dvar)	LAM 'dvar LAM 'dvar
5127E	('IDPAR)	(→ id) Puts ID PPAR unevaluated on the stack. -- <REF>TEXT:Reserved|PPAR

3.2.2 Conversion

05B15	$>ID	($ → ID)
63295	DUP$>ID	($ → $ ID)
05AED	(ID>LAM)	(id → lam)
05B01	(LAM>ID)	(lam → id)

3.2.3 Temporary Environments Words

074D0	BIND	(obn..ob1 {lamn..lam1} →) Binds n objects to n differently named lams.
074E4	DOBIND	(obn..ob1 lamn..lam1 #n →) Binds n objects to n differently named lams.

634CF	1LAMBIND	(ob →) Binds one object to a null named lam.
634CA	DUP1LAMBIND	(ob → ob) Does DUP then <REF>1LAMBIND.
0DB0B0	~nNullBind	(obn..ob1 #n →) Binds #n objects to null named lams. 1LAM has the count, 2LAM the first object. Decompiles to :: ' NULLLAM CACHE ;
63A29	dvarlsBIND	(ob →) Binds ob to LAM 'dvar.
07497	ABND	(→) Abandons topmost temporary environment.
61CE9	CACHE	(obn..ob1 #n lam →) Binds all objects under the same name. 1LAM has the count.
61EA7	DUMP	(NULLLAM → ob1..obn #n) Inverse of CACHE. Always does garbage collection.
61D41	SAVESTACK	(→) Caches stack to SAVELAM.
40CE9	CacheStack	(→) Caches the stack using SAVESTACK if UNDO is on and Suspend is OK. If there was a previous environment caching the stack, it is abandoned first.
61F8F	undo	(→) Dumps SAVELAM.
07943	@LAM	(lam → ob T) (lam → F) Tries recalling object from lam. If successful, returns object and TRUE, otherwise returns just FALSE.
07D1B	STOLAM	(ob lam →) Tries storing object in lam. Generates "Undefined Local Name" error if lam is not found.
02FD6	(DoLam)	(lam → ob) (lam → !error!) Tries recalling object from lam, generates "Undefined Local Name" error if not found.
078E9	(FIRST@LAM)	(lam → ob T) (lam → F) @LAM for first environment only.
078F5	(NTH@LAM)	(lam #n → ob T) (lam #n → F) @LAM for nth environment only.
075A5	GETLAM	(#n → ob) Gets contents of nth topmost lam.
613B6	1GETLAM	(→ ob)
613E7	2GETLAM	(→ ob)

6140E	3GETLAM	(→ ob)
61438	4GETLAM	(→ ob)
6145C	5GETLAM	(→ ob)
6146C	6GETLAM	(→ ob)
6147C	7GETLAM	(→ ob)
6148C	8GETLAM	(→ ob)
6149C	9GETLAM	(→ ob)
614AC	10GETLAM	(→ ob)
614BC	11GETLAM	(→ ob)
614CC	12GETLAM	(→ ob)
614DC	13GETLAM	(→ ob)
614EC	14GETLAM	(→ ob)
614FC	15GETLAM	(→ ob)
6150C	16GETLAM	(→ ob)
6151C	17GETLAM	(→ ob)
6152C	18GETLAM	(→ ob)
6153C	19GETLAM	(→ ob)
6154C	20GETLAM	(→ ob)
6155C	21GETLAM	(→ ob)
075E9	PUTLAM	(ob #n →)
		Stores new contents to nth topmost lam.
615E0	1PUTLAM	(ob →)
615F0	2PUTLAM	(ob →)
61600	3PUTLAM	(ob →)
61615	4PUTLAM	(ob →)
61625	5PUTLAM	(ob →)
61635	6PUTLAM	(ob →)
61645	7PUTLAM	(ob →)
61655	8PUTLAM	(ob →)
61665	9PUTLAM	(ob →)
61675	10PUTLAM	(ob →)
61685	11PUTLAM	(ob →)
61695	12PUTLAM	(ob →)
616A5	13PUTLAM	(ob →)
616B5	14PUTLAM	(ob →)
616C5	15PUTLAM	(ob →)
616D5	16PUTLAM	(ob →)
616E5	17PUTLAM	(ob →)

616F5	18PUTLAM	(ob →)
61705	19PUTLAM	(ob →)
61715	20PUTLAM	(ob →)
61725	21PUTLAM	(ob →)
61735	22PUTLAM	(ob →)
61610	DUP4PUTLAM	(ob → ob) Does DUP then <REF>4PUTLAM .
634B6	1GETABND	(→ 1lamob) Does <REF>1GETLAM then <REF>ABND .
62DB3	1ABNDSWAP	(ob → 1lamob ob) Does <REF>1GETABND then SWAP.
62F07	1GETSWAP	(ob → 1lamob ob) Does <REF>1GETLAM then SWAP.
55288	1GETLAMSWP1+	(# → 1lamob #+1) Does <REF>1GETLAM then SWAP#1+.
632E5	2GETEVAL	(→ ?) Does <REF>2GETLAM then <REF>EVAL .
617D8	GETLAMPAIR	(#n → #n ob lam F) (#n → #n T) Gets lam contents and name (10 = 1lam, 20 = 2lam, etc.)
61745	DUPTEMPEVN	(→) Duplicates topmost temporary environment (clears protection word).
61745	DUPTEMPENV	(→) Duplicates topmost tempenv (clears protection word).
34D2B	1NULLLAM{}	(→ {}) Puts a list with one NULLLAM in the stack.
37DB9	(2NULLLAM{})	(→ {}) Puts a list with two times NULLLAM in the stack.
37B17	(3NULLLAM{})	(→ {}) Puts a list with three times NULLLAM in the stack.
52D26	(4NULLLAM{})	(→ {}) Puts a list with four times NULLLAM in the stack.
3306C	(7NULLLAM{})	(→ {}) Puts a list with seven times NULLLAM in the stack.
10E36	(8NULLLAM{})	(→ {}) Puts a list with eight times NULLLAM in the stack.

3.3 Error Handling

3.3.1 General Words

141E5	ERRBEEP	(→)
		Beeps.
04CE6	ERROR@	(→ #)
		Returns current error number.
04D0E	ERRORSTO	(# →)
		Stores new error number.
6383A	ERROROUT	(# →)
		Stores new error number and calls ERRJMP.
04D33	ERRORCLR	(→)
		Stores zero as new error number.
04ED1	ERRJMP	(→)
		Invokes error handling sub-system.
04E07	GETEXITMSG	(→ $)
		Gets EXITMSG (user defined error message).
04E37	EXITMSGSTO	($ →)
		Stores $ as EXITMSG.
1502F	DO#EXIT	(# →)
		Stores new error number, does <REF>AtUserStack and then <REF>ERRJMP.
15007	DO%EXIT	(% →)
		Same as above, but takes real number as argument.
1501B	(DOHXSEXIT)	(hxs →)
		Same as above functions, but input is hxs.
15048	DO$EXIT	($ →)
		Stores string as EXITMSG, #70000 as error number, does <REF>AtUserStack and then <REF>ERRJMP .
04EA4	ABORT	(→)
		Does <REF>ERRORCLR and <REF>ERRJMP .
04E5E	ERRSET	(→)
		Sets new error trap.
04EB8	ERRTRAP	(→)
		Error trap marker. If no error happens, still removes all temporary environments created since ERRSET.
13FE5	(SAVEERRN)	(→)
		Saves error number to last error.
1400E	(ERR0)	(→)
		Clears last error.
14039	(ERRN)	(→ #)
		Returns last error number.
1404C	(ERRN>HXS)	(→ hxs)
		Returns last error number as hxs.
14065	(ERRM)	(→ $)
		Returns last error message.

04D87 JstGetTHEMESG
(# → $)
Fetches message from message table. To get a message from a library, use the formula:
libnum*#100+msgnum.
--
<REF>TEXT:Libraries aka: JstGETTHEMSG

04D64 GETTHEMESG
(# → $)
If #70000 then does <REF>GETEXITMSG, else does <REF>JstGetTHEMESG .
--
<REF>TEXT:Libraries

04DD7 (SPLITmsg)
(#msg → #error #libnum)
Splits message number into error and library numbers.
--
<REF>TEXT:Libraries

3.3.2 Error Generating Words

04FB6 SETMEMERR
Error 001h
Generates "Insufficient Memory" error.

04FC2 (SETDIRRECUR)
Error 002h
Generates "Directory Recursion" error.

04FCE (SETLAMERR)
Error 003h
Generates "Undefined Local Name" error.

05016 SETROMPERR
Error 004h
Generates "Undefined XLIB Name" error.

04FAA (SETLBERR)
Error 006h
Generates "Power Lost" error.

04FDA (SETCORPORT)
Error 008h
Generates "Invalid Card Data" error.

04FE6 (SETOBINUSE)
Error 009h
Generates "Object In Use" error.

04FF2 (SETPORTNOTAV)
Error 00Ah
Generates "Port Not Available" error.

04FFE (SETNOROOM)
Error 00Bh
Generates "No Room In Port" error.

0500A (SETXNONEXT)
Error 00Ch
Generates "Object Not In Port" error.

10F54 (NULLCHARERR)
Error 102h
Generates "Can't Edit Null Char" error.

10F64 (INVFUNCERR)
Error 103h
Generates "Invalid User Function" error.

10F74 (NOEQERR)
Error 104h
Generates "No Current Equation" error.

10F86 SYNTAXERR
Error 106h
Generates "Invalid Syntax" error.

10FE6	(LASTSTKERR)	Error 124h Generates "'Last Stack' Disabled" error.
10FF6	(LASTCMDERR)	Error 125h Generates "'Last Cmd' Disabled" error.
10FC6	NOHALTERR	Error 126h Generates "HALT Not Allowed" error.
11006	(ARGNUMERR)	Error 128h Generates "Wrong Argument Count" error.
11016	SETCIRCERR	Error 129h Generates "Circular Reference" error.
11026	(DIRARGERR)	Error 12Ah Generates "directory not allowed" error.
11036	(EMPTYDIRERR)	Error 12Bh Generates "Non-Empty Directory" error.
11046	(INVDEFERR)	Error 12Ch Generates "Invalid Definition" error.
11056	(MISLIBERR)	Error 12Dh Generates "Missing Library" error.
10F96	(SETINVPPAR)	Error 12Eh Generates "Invalid PPAR" error.
10FA6	(SETNONERAL)	Error 12Fh Generates "Non-real Result" error.
10FB6	(SETISOLERR)	Error 130h Generates "Unable To Isolate" error.
11066	(IDCONFERR)	Error 13Ch Generates "Name Conflict" error.
18CC2	SETSTACKERR	Error 201h Generates "Too Few Arguments" error.
18CB2	SETTYPEERR	Error 202h Generates "Bad Argument Type" error.
18CA2	SETSIZEERR	Error 203h Generates "Bad Argument Value" error.
18C92	SETNONEXTERR	Error 204h Generates "Undefined Name" error.
29DCC	(POSFLOWERR)	Error 301h Generates "Positive Underflow" error.
29DDC	(NEGFLOWERR)	Error 302h Generates "Negative Underflow" error.
29DEC	(OVERFLOWERR)	Error 303h Generates "Overflow" error.
29DFC	SETIVLERR	Error 304h Generates "Undefined Result" error.
29E0C	(INFRESERR)	Error 305h Generates "Infinite Result" error.
10EEA	(INVUNITERR)	Error B01h Generates "Invalid Unit" error.
10EFA	(CONSTUNITERR)	Error B02h Generates "Inconsistent Units" error.

2EC34	SetIOPARerr	Error C12h Generates "Invalid IOPAR" error.
0CBAE	(NOALARMERR)	Error D04h Generates "nonexistent alarm" error.
64190	Sig?ErrJmp	(# →) Calls ERRJMP if the error number is any of {13E 123 DFF}.
15A40	ederr	(→) Error handler for applications which use savefmt1 to save the current display format. Calls <REF>rstfmt1 and then errors out.

3.4 Conditionals

3.4.1 Boolean Flags

5380E	COERCEFLAG	(T → %1) (F → %0) Converts system flag to user flag, drops current stream.
2A7CF	%0<>	(% → flag) Can be used to change a user flag into a system flag.
03A81	TRUE	(→ T)
0BBED	TrueTrue	(→ T T)
634F7	TrueFalse	(→ T F) aka: TRUEFALSE
03AC0	FALSE	(→ F)
6350B	FalseTrue	(→ F T) aka: FALSETRUE
2F934	FalseFalse	(→ F F)
0BC01	failed	(→ F T)
62103	DROPTRUE	(ob → T)
2F542	(2DROPTRUE)	(ob ob' → T)
5F657	(3DROPTRUE)	(ob1 ob2 ob3 → T)
10029	(4DROPTRUE)	(ob1..ob4 → T)
6210C	DROPFALSE	(ob → F)
62B0B	2DROPFALSE	(ob1 ob2 → F)
5F5E4	(4DROPFALSE)	(ob1..ob4 → F)
5F6B1	(5DROPFALSE)	(ob1..ob5 → F)
169A5	NDROPFALSE	(ob1..obn #n → F)
4F1D8	SWAPTRUE	(ob1 ob2 → ob2 ob1 T)
21660	SWAPDROPTRUE	(ob1 ob2 → ob2 T)

62EB7	XYZ>ZTRUE	(ob1 ob2 ob3 → ob3 T)
5DE41	(COLATRUE)	(→ T) Puts TRUE in the stack and drops rest of current stream.
5DE55	RDROPFALSE	(→ F) Puts FALSE in the stack and drops rest of current stream.
03AF2	NOT	(flag → flag') Returns FALSE if the input is TRUE, and vice-versa.
03B46	AND	(flag1 flag2 → flag) Returns TRUE if both flags are TRUE.
03B75	OR	(flag1 flag2 → flag) Returns TRUE if either flag is TRUE.
03ADA	XOR	(flag1 flag2 → flag) Returns TRUE if flags are different.
635B0	ORNOT	(flag1 flag2 → flag) Returns FALSE if either flag is TRUE.
62C55	NOTAND	(flag1 flag2 → flag) Returns TRUE if flag1 is TRUE and flag2 is FALSE.
62C91	ROTAND	(flag1 ob flag2 → ob flag) Returns TRUE if either flag is TRUE.

3.4.2 General Tests

03B2E	EQ	(ob1 ob2 → flag) Returns TRUE if both objects are the same, i.e., they occupy the same physical space in memory. Only the addresses of the objects are tested.
635D8	2DUPEQ	(ob1 ob2 → ob1 ob2 flag) Does 2DUP then EQ.
63605	EQOR	(flag ob1 ob2 → flag') Does EQ then OR.
6303D	EQOVER	(ob3 ob1 ob2 → ob3 flag ob3) Does EQ then OVER.
635F1	EQ:	(ob → flag) EQ with the next object in the current stream.
635EC	DUPEQ:	(ob → ob flag) Does DUP then EQ:.
03B97	EQUAL	(ob1 ob2 → flag) Returns TRUE if the objects are equal (but not necessarily the same), i.e., their prologs and contents are the same.
635C4	EQUALNOT	(ob1 ob2 → flag) Returns TRUE if the objects are different.
63619	EQUALOR	(flag ob1 ob2 → flag') Does EQUAL then OR.

3.4.3 True/False Tests

61A3B	?SEMI	(T → :: ;) (F → :: <ob1> <rest> ;)
61A2C	NOT?SEMI	(T → :: <ob1> <rest> ;) (F → :: ;)
638E4	?SEMIDROP	(ob T → :: ob ;) (ob F → :: <ob1> <rest> ;)
61B72	NOT?DROP	(ob T → :: ob <ob1> <rest> ;) (ob F → :: <ob1> <rest> ;)
62F1B	?SWAP	(ob1 ob2 T → :: ob2 ob1 <ob1> <rest> ;) (ob1 ob2 F → :: ob1 ob2 <ob1> <rest> ;)
62D9F	?SKIPSWAP	(ob1 ob2 T → :: ob1 ob2 <ob1> <rest> ;) (ob1 ob2 F → :: ob2 ob1 <ob1> <rest> ;)
62F5C	?SWAPDROP	(ob1 ob2 T → :: ob1 <ob1> <rest> ;) (ob1 ob2 F → :: ob2 <ob1> <rest> ;)
62F43	NOT?SWAPDROP	(ob1 ob2 T → :: ob2 <ob1> <rest> ;) (ob1 ob2 F → :: ob1 <ob1> <rest> ;)
070FD	RPIT	(T ob → :: ob <ob1> <rest> ;) (F ob → :: <ob1> <rest> ;) ob is actually executed, and not pushed in the stack.
070C3	RPITE	(T ob1 ob2 → :: ob1 <ob1> <rest> ;) (F ob1 ob2 → ob2 <ob1> <rest> ;) ob1 or ob2 is actually executed, and not pushed in the stack.
61A8E	COLARPITE	(T ob1 ob2 → :: ob1 ;) (F ob1 ob2 → :: ob2 ;) ob1 or ob2 is actually executed, and not pushed in the stack.
61AE9	2'RCOLARPITE	Return to composite and ITE there.
619BC	IT	(T → :: <ob1> <rest> ;) (F → :: <ob2> <rest> ;)
0712A	?SKIP	(T → :: <ob2> <rest> ;) (F → :: <ob1> <rest> ;) aka: NOT_IT
61AD8	ITE	(T → :: <ob1> <ob3> <rest> ;) (F → :: <ob2> <rest> ;)
6381C	COLAITE	(T → :: <ob1> ;) (F → :: <ob2> ;)
61A58	ITE_DROP	(ob T → :: <ob2> <rest> ;) (ob F → :: ob <ob1> <rest> ;)
63E61	ANDITE	(f1 f2 → :: <ob1> <ob3> <rest> ;) (f1 f2 → :: <ob2> <rest> ;)
61993	case	(T → :: <ob1> ;) (F → :: <ob2> <rest> ;)

619AD	NOTcase	(T → :: <ob2> <rest> ;) (F → :: <ob1> ;)
63CEA	ANDcase	(f1 f2 → :: <ob1> ;) (f1 f2 → :: <ob2> <rest> ;)
63DDF	ANDNOTcase	(f1 f2 → :: <ob1> ;) (f1 f2 → :: <ob2> <rest> ;)
629BC	ORcase	(f1 f2 → :: <ob1> ;) (f1 f2 → :: <ob2> <rest> ;)
618F7	casedrop	(ob T → :: <ob1> ;) (ob F → :: ob <ob2> <rest> ;)
618E8	NOTcasedrop	(ob T → :: ob <ob2> <rest> ;) (ob F → :: <ob1> ;)
6191F	case2drop	(ob1 ob2 T → :: <ob1> ;) (ob1 ob2 F → :: ob1 ob2 <ob2> <rest> ;)
61910	NOTcase2drop	(ob1 ob2 T → :: ob1 ob2 <ob2> <rest> ;) (ob1 ob2 F → :: <ob1> ;)
6194B	caseDROP	(ob T → :: ;) (ob F → :: ob <ob1> <rest> ;)
61960	NOTcaseDROP	(ob T → :: ob <ob1> <rest> ;) (ob F → :: ;)
638B2	casedrptru	(ob T → T) (ob F → :: ob <ob1> <rest> ;) Note: should be called caseDRPTRU.
6356A	casedrpfls	(ob T → F) (ob F → :: ob <ob1> <rest> ;) Note: should be called caseDRPFLS.
63AEC	NOTcsdrpfls	(ob T → :: ob <ob1> <rest> ;) (ob F → F) Note: should be called NOTcaseDRPFLS.
61970	case2DROP	(ob1 ob2 T → :: ;) (ob1 ob2 F → :: ob1 ob2 <ob1> <rest> ;)
61984	NOTcase2DROP	(ob1 ob2 T → :: ob1 ob2 <ob1> <rest> ;) (ob1 ob2 F → :: ;)
63583	case2drpfls	(ob1 ob2 T → F) (ob1 ob2 F → :: ob1 ob2 <ob1> <rest> ;) Note: should be called case2DRPFLS.
634E3	caseTRUE	(T → T) (F → :: <ob1> <rest> ;)
638CB	NOTcaseTRUE	(T → :: <ob1> <rest> ;) (F → T)
6359C	caseFALSE	(T → F) (F → :: <ob1> <rest> ;)
5FB49	NOTcaseFALSE	(T → :: <ob1> <rest> ;) (F → F)

62986	COLAcase	(T → :: <ob1> ;) (F → :: <ob2> <rest> ;) Drops the rest of current stream and executes case in the stream above.
629A1	COLANOTcase	(T → :: <ob2> <rest> ;) (F → :: <ob1> ;) Drops the rest of current stream and executes NOTcase in the stream above.

3.4.4 Binary Integer Tests

6336C	#=?SKIP	(#m #n → :: <ob2> <rest> ;) (#m #n → :: <ob1> <rest> ;)
63399	#>?SKIP	(#m #n → :: <ob1> <rest> ;) (#m #n → :: <ob2> <rest> ;)
62C2D	#=ITE	(#m #n → :: <ob1> <ob3> <rest> ;) (#m #n → :: <ob2> <rest> ;)
63E9D	#<ITE	(#m #n → :: <ob1> <ob3> <rest> ;) (#m #n → :: <ob2> <rest> ;)
63EB1	#>ITE	(#m #n → :: <ob2> <rest> ;) (#m #n → :: <ob1> <ob3> <rest> ;)
6186C	#=case	(#m #n → :: <ob1> ;) (#m #n → :: <ob2> <rest> ;)
6187C	OVER#=case	(#m #n → :: #m <ob1> ;) (#m #n → :: #m <ob2> <rest> ;)
618D3	#=casedrop	(#m #n → :: <ob1> ;) (#m #n → :: #m <ob2> <rest> ;) Note: should be called OVER#=casedrop.
63547	#=casedrpfls	(#m #n → F) (#m #n → :: #m <ob1> <rest> ;) Note: should be called OVER#=caseDRPFLS.
63D3A	#<>case	(#m #n → :: <ob2> <rest> ;) (#m #n → :: <ob1> ;)
63D12	#<case	(#m #n → :: <ob1> ;) (#m #n → :: <ob2> <rest> ;)
63D67	#>case	(#m #n → :: <ob2> <rest> ;) (#m #n → :: <ob1> ;)
61A18	#0=?SEMI	(#0 → :: ;) (# → :: <ob1> <rest> ;)
6333A	#0=?SKIP	(#0 → :: <ob2> <rest> ;) (# → :: <ob1> <rest> ;)
63E89	#0=ITE	(#0 → :: <ob1> <ob3> <rest> ;) (# → :: <ob2> <rest>)
63E48	DUP#0=IT	(#0 → :: #0 <ob1> <rest> ;) (# → :: # <ob2> <rest> ;)

63EC5	DUP#0=ITE	(#0 → :: #0 <ob1> <ob3> <rest> ;) (# → :: # <ob2> <rest> ;)
61896	#0=case	(#0 → :: <ob1> ;) (# → :: <ob2> <rest> ;)
61891	DUP#0=case	(#0 → :: #0 <ob1> ;) (# → :: # <ob2> <rest> ;)
618A8	DUP#0=csedrp	(#0 → :: <ob1> ;) (# → :: # <ob2> <rest> ;)
63CBD	DUP#0=csDROP	(#0 → :: ;) (# → :: # <ob1> <rest> ;)
63D26	#1=case	(#1 → :: <ob1> ;) (# → :: <ob2> <rest> ;)
63353	#1=?SKIP	(#1 → :: <ob2> <rest> ;) (# → :: <ob1> <rest> ;)
63D4E	#>2case	(#0/#1/#2 → :: <ob2> <rest> ;) (# → :: <ob1> ;)
3FF1B	?CaseKeyDef	(# #' → :: ' ob1 T ;) (# #' → :: <ob2> <rest> ;) Compares two bints. If equal, quotes the next object from the runsream and returns it along with TRUE.
3FF48	?CaseRomptr@	(# #' → ob T) (# #' → F) (# #' → :: <ob2> <rest> ;) Compares two bints. If equal, tries to resolve the rompointer which must be the next object in the runstream. The ROMPTR@ pushes TRUE when successful, so this entry can be used directly for key handlers.

3.4.5 Real and Complex Number Tests

5F127	%0=case	(%0 → :: %0 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
63D7B	j%0=case	(%0 → :: <ob1> ;) (ob → :: <ob2> <rest> ;)
5F13B	C%0=case	(C%0 → :: C%0 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5F0FA	num0=case	(0 → :: 0 <ob1> ;) (ob → :: ob <ob2> <rest> ;) Both a real and a complex zero are TRUE conditions for this test.
5F181	%1=case	(%1 → :: %1 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5F19F	C%1=case	(C%1 → :: C%1 <ob1> ;) (ob → :: ob <ob2> <rest> ;)

5F154	num1=case	(1 → :: 1 <ob1> ;) (ob → :: ob <ob2> <rest> ;) Both a real and a complex one are TRUE conditions for this test.
5F1EA	%2=case	(%2 → :: %2 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5F208	C%2=case	(C%2 → :: C%2 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5F1BD	num2=case	(2 → :: 2 <ob1> ;) (ob → :: ob <ob2> <rest> ;) Both a real and a complex two are TRUE conditions for this test.
5F267	%-1=case	(%-1 → :: %-1 <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5F285	C%-1=case	(C%-1 → :: C%-1 <ob1> ;) (ob → ob <ob2> <rest> ;)
5F23A	num-1=case	(-1 → :: -1 <ob1> ;) (ob → :: ob <ob2> <rest> ;) Both a real and a complex -1 are TRUE conditions for this test.
5EEDB	(REALNEGcase)	(%<0 → :: % <ob1> ;) (ob → :: ob <ob2> <rest> ;)
5FBE6	(pick1#0=case)	(#0 M → COLA) (ob M → SKIP)

3.4.6 Meta Object Tests

5EFD9	MEQ1stcase	(meta&ob1 ob2 → ob1=ob2 ? case) Meta&ob1 ob2 ob1=ob2 ? case
5EF15	AEQ1stcase	(meta&ob → ob=nob ? case) Meta&ob ob=nob ? case
5EFF9	MEQopscase	(meta1&ob1 meta2&ob2 ob3 →) Meta1&ob1 Meta2&ob2 ob3
5F048	AEQopscase	meta1&ob1 meta2&ob2 Meta1&ob1 Meta2&ob2
5F061	Mid1stcase	(meta&ob → ob is id) lam ? case Meta&ob ob is id or lam ? case
549EC	(MetaConcase)	(meta → meta) (Meta Meta) COLA if meta contains no ids, lams, symbs or romptrs. Else SKIP.
5EF2E	(M1st+case)	Meta&+ ? case Meta&+ ? case
5EF41	(M1st-case)	Meta&- ? case Meta&- ? case
5EF54	(M1st*case)	Meta&* ? case Meta&* ? case

5EF67	(M1st/case)	Meta&/ ? case Meta&/ ? case
5EFA0	(M1stˆcase)	Meta&ˆ ? case Meta&ˆ ? case
58ADE	(M-1potcase)	Meta&-1&ˆ ? case Meta&-1&ˆ ? case
5EFB3	(M1stSQcase)	Meta&SQ ? case Meta&SQ ? case
5EF7A	(M1stNEGcase)	Meta&NEG ? case Meta&NEG ? case
5EF8D	(M1stINVcase)	Meta&INV ? case Meta&INV ? case
5EFC6	(M1stFNCcase)	Meta&FNCAPPLY ? case Meta&FCNAPPLY ? case
5EE10	M-1stcasechs	(Meta&NEG → Meta COLA) (Meta → Meta SKIP) (Meta&(%<0) → Meta&ABS(%) COLA) Meta&NEG Meta COLA ; Meta Meta SKIP Meta&(%<0) Meta&ABS(%) COLA

3.4.7 General Object Tests

63E2F	EQIT	(ob1 ob1 → :: <ob1> <rest> ;) (ob1 ob2 → :: <ob2> <rest> ;)
63E75	EQITE	(ob1 ob1 → :: <ob1> <ob3> <rest> ;) (ob1 ob2 → :: <ob2> <rest> ;)
63CD6	jEQcase	(ob1 ob1 → :: <ob1> ;) (ob1 ob2 → :: <ob2> <rest> ;)
61933	EQcase	(ob1 ob1 → :: ob1 <ob1> ;) (ob1 ob2 → :: ob1 <ob2> <rest> ;) Note: Should be called OVEREQcase.
629D0	REQcase	(ob → :: ob <ob2> ;) (ob → :: ob <ob3> <rest> ;) EQcase with the next object in the runstream.
618BA	EQcasedrop	(ob1 ob1 → :: <ob1> ;) (ob1 ob2 → :: ob1 <ob2> <rest> ;) Note: should be called OVEREQcasedrop.
629E9	REQcasedrop	(ob → <ob2> ;) (ob → <ob3> <rest> ;) EQcasedrop with the next object in the runstream.
63CFE	EQUALcase	(ob1 ob1 → :: <ob1> ;) (ob1 ob2 → :: <ob2> <rest> ;)
63DF3	EQUALNOTcase	(ob1 ob1 → :: <ob2> <rest> ;) (ob1 ob2 → :: <ob1> ;)
63CA4	EQUALcasedrp	(ob ob1 ob2 → :: <ob1> ;) (ob ob1 ob2 → :: ob <ob2> <rest> ;)

517FE	EQUALcasedro	(ob1 ob2 → :: <ob1> ;) (ob1 ob2 → :: ob1 <ob2> <rest> ;) Note: should be called OVEREQUALcasedrp.
517F3	EQUALcasedrop	(ob1 ob2 → :: <ob1> ;) (ob1 ob2 → :: ob1 <ob2> <rest> ;)
2856C	tok=casedrop	($ $' → :: <ob1> ;) ($ $' → :: $ <ob2> <rest> ;) Note: should be called OVERtok=casedrop.
5E984	nonopcase	(seco → :: seco <ob2> <rest> ;) (ob → :: ob <ob1> ;)
5F0AA	idntcase	(id → :: id <ob1> ;) (ob → :: ob <ob2> <rest> ;)
63E07	dIDNTNcase	(id → :: id <ob2> <rest> ;) (ob → :: ob <ob1> ;)
5F0CD	idntlamcase	(id/lam → :: id <ob1> ;) (ob → :: ob <ob2> <rest> ;)
63D8F	REALcase	(% → :: <ob1> ;) (ob → :: <ob2> <rest> ;)
63E1B	dREALNcase	(% → :: % <ob2> <rest> ;) (ob → :: ob <ob1> ;)
63DA3	dARRYcase	([] → :: [] <ob1> ;) (ob → :: ob <ob2> <rest> ;)
63DB7	dLISTcase	({} → :: {} ob1 ;) (ob → :: ob <ob2> <rest> ;)
27244	NOTLISTcase	({} → :: {} <ob2> <rest> ;) (ob → :: ob <ob1> ;)
18E45	(DNOTSYMB?SEMI)	(symb → :: symb <ob1> <rest> ;) (ob → :: ob ;)
27254	NOTSECOcase	(seco → :: seco <ob2> <rest> ;) (ob → :: ob <ob1> ;)
27264	NOTROMPcase	(romp → :: romp <ob2> <rest> ;) (ob → :: ob <ob1> ;)
27224	(DNOTBAKcase)	(bak → :: bak <ob2> <rest> ;) (ob → :: ob <ob1> ;)
27234	(DNOTLIBcase)	(lib → :: lib <ob2> <rest> ;) (ob → :: ob <ob1> ;)
5EDFC	numb1stcase	(%/C%/[]/[L] → :: <ob1> ;) (ob → :: ob2 <rest> ;) If %, C%, [ ] or [L] then <REF>COLA, else <REF>SKIP .

3.4.8 Miscellaneous

63ED9	UserITE	(#set → :: <ob1> <ob3> <rest> ;) (#clr → :: <ob2> <rest> ;)

63EED	SysITE	(#set → :: <ob1> <ob3> <rest> ;) (#clr → :: <ob2> <rest> ;)
63BEB	caseDoBadKey	(T → :: DoBadKey ;) (F → :: <ob1> <rest> ;) aka: caseDEADKEY
63BD2	caseDrpBadKy	(ob T → :: DoBadKey ;) (ob F → :: ob <ob1> <rest> ;)
63169	caseERRJMP	(T → :: ERRJMP ;) (F → :: <ob> <rest> ;)
63B05	caseSIZEERR	(T → :: SIZEERR ;) (F → :: <ob> <rest> ;)
63B19	NcaseSIZEERR	(T → :: <ob> <rest> ;) (F → :: SIZEERR ;)
63B46	NcaseTYPEERR	(T → :: <ob1> <rest> ;) (F → :: TYPEERR ;)
40D93	NoEdit?case	(→ :: <ob1> <rest> ;) (→ :: <rest> ;) Tests if there is no edit line active.
63DCB	EditExstCase	(→ :: <ob1> <rest> ;) (→ :: <rest> ;) Tests if there is an edit line active.

3.5 Runstream Control

06E8E	NOP	(→) Does nothing.
1ACDD	xNEGNEG	(→) Does nothing, decompiles to :: CK1&Dispatch BINT0 NOP ; There like NOP, but requires an argument.
06EEB	'R	(→ ob) Pushes next object in return stack (i.e., the first object in the composite above this one) to the stack (skipping it). If top return stack is empty (contains SEMI), a null secondary is pushed and the pointer is not advanced.
06F66	'REVAL	(→ ?) Does <REF>'R then <REF>EVAL.
639DE	'R'R	(→ ob1 ob2) Does <REF>'R twice.
61B89	ticR	(→ ob T) (→ F) Pushes next object in return stack to stack and TRUE, of just FALSE if the top return stack body is empty. In this case, it is dropped.

639FC	'RRDROP	(→ ob) Does <REF>'R , then <REF>RDROP.
06F9F	>R	(:: →) Pushes :: to top of return stack (skips prolog, i.e., the composite will be executed automatically).
0701F	R>	(→ ::) Creates and pops a secondary from top return stack body to stack.
07012	R@	(→ ::) Like <REF>R>, but the return stack is not popped.
0716B	IDUP	(→) Pushes interpreter pointer into the return stack.
06F8E	EVAL	(ob →) Evaluates object.
18EBA	COMPEVAL	(comp →) EVAL just pushes a list back, this one executes it.
61B45	2@REVAL	(→) EVAL first object in the stream above the previous one.
61B55	3@REVAL	(→) EVAL first object in the stream above the stream above the previous one.
619CB	GOTO	(→) Jumps to next address in stream. Address is a five-nibble address, not a system binary. Can only be used to jump to the middle of programs, cannot jump to a program prolog.
619E0	?GOTO	(flag →) If TRUE, jumps, else skips five nibbles.
619F3	NOT?GOTO	(flag →) If FALSE jumps, else skips five nibbles.
14EA5	RDUP	(→) Duplicates top return stack level.
06FB7	RDROP	(→) Pops the return stack.
6114E	2RDROP	(→) Pops two return stack levels.
61160	3RDROP	(→) Pops three return stack levels.
632F9	DROPRDROP	(ob →) Does DROP then <REF>RDROP .
62958	RDROPCOLA	(→) Does <REF>RDROP then <REF>COLA .
54C4F	(RDROPCOLATRUE)	(→ T) Does <REF>RDROP then <REF>COLATRUE .

60EBD RSWAP (→)
Swap in the return stack.

14F2A (RROLL) (#n →)
Rolls nth return stack level to top of return stack.

63880 RSKIP (→)
Skips first object in the return stack (i.e., the first object in the composite above this one).

0312B SEMI (→)
DROP the rest of the current stream.

3.5.1 Quoting Objects

06E97 ' (→ nob (nextob))
Pushes next object in the stream to the stack (skipping it).

2349C xSILENT' (→ nextob)
Put the next ob in the runstream on the stack. Quoter used in UserRPL.

63925 DUP' (ob → ob nob)
Does DUP then '.

6394D DROP' (ob → nob)
Does DROP then '.

63939 SWAP' (ob1 ob2 → ob2 ob1 nob)
Does SWAP then '.

63961 OVER' (ob1 ob2 → ob1 ob2 ob1 nob)
Does OVER then '.

63975 STO' (ob id/lam → nob)
Does STO then '.

63989 TRUE' (→ T nob)
Pushes TRUE and the next object to the stack.

639B6 FALSE' (→ F nob)
Pushes FALSE and the next object to the stack.

6399D ONEFALSE' (→ #1 F nob)
Pushes ONE, FALSE and the next object to the stack.

639CA #1+' (# → #+1 nob)
Does #1+ then '.

632BD 'NOP (→ NOP)
Pushes NOP to the stack.

63155 'ERRJMP (→ ERRJMP)
Pushes ERRJMP to the stack.

3A9B8 'DROPFALSE (→ DROPFALSE)
Pushes DROPFALSE to the stack.

3FDFE 'DoBadKey (→ DoBadKey)
Pushes DoBadKey to the stack.

3FE12 'DoBadKeyT (→ DoBadKey T)
Pushes <REF>DoBadKey and TRUE to the stack.

4D11E	DROPDEADTRUE	(ob → DoBadKey T) Makes the user drop dead, then pushes TRUE.
63B5A	'x*	(→ x*) Pushes <REF>x* (User word *) to the stack.
63B6E	'xDER	(→ xDER) Pushes xDER (User word ∂) to the stack.
5129C	'IDFUNCTION	(→ xFUNCTION) Pushes xFUNCTION (User word FUNCTION) to the stack.
512C4	'IDPOLAR	(→ xPOLAR) Pushes xPOLAR (User word POLAR) to the stack.
512B0	('IDCONIC)	(→ xCONIC) Pushes xCONIC (User word CONIC) to the stack.
512D8	'IDPARAMETER	(→ xPARAMETRIC) Pushes xPARAMETRIC (user word PARAMETRIC) to the stack.
512EC	('IDTRUTH)	(→ xTRUTH) Pushes xTRUTH (user word TRUTH) to the stack.
51300	('IDSCATTER)	(→ xSCATTER) Pushes xSCATTER (user word SCATTER) to the stack.
51314	('IDHISTOGRAM)	(→ xHISTOGRAM) Pushes xHISTOGRAM (user word HISTROGRAM) to the stack.
51328	('IDBAR)	(→ xBAR) Pushes xBAR (user word BAR) to the stack.
2520A	'Rapndit	(meta ob1...ob4 → meta&ob ob1...ob4) Takes ob from runstream and appends it to the meta starting in level 5.
63A56	'xDEREQ	(ob → flag) Is ob eq to user command xDER?

3.5.2 Skipping Objects

06FD1	COLA	Evals next obj and drops rest of this stream.
63A15	ONECOLA	Does ONE, then COLA.
63312	SWAPCOLA	Does SWAP, then COLA.
63326	XYZ>ZCOLA	Does UNROT2DROP, then COLA.
61A6D	COLA_EVAL	Returns and evals first obj in previous stream.
6296D	COLACOLA	Drops rest of current stream does COLA in the above one.
0714D	SKIP	Skips 1 obj in the runstream.
0715C	(2SKIP)	Skips 2 objs in the runstream.

283D8	(3SKIP)	Skips 3 objs in the runstream.
21C47	(MEMSKIP)	(ob → #nextaddress)
626EE	skipcola	Does SKIP, then COLA.
626E5	2skipcola	Does 2SKIP, then COLA.
626DC	3skipcola	Does 3SKIP, then COLA.
626AE	5skipcola	Skips 5 objects, then does COLA.
633B2	COLASKIP	Drops rest of current stream and skips one obj in above stream.
283C4	(COLAskipcola)	Drops rest of current stream, skipcola in the above.

3.6 Loops

3.6.1 Indefinite Loops

0716B	IDUP	(→) Pushes interpreter pointer into the return stack.
071A2	BEGIN	(→) Pushes interpreter pointer into the return stack.
071AB	AGAIN	(→) Sets the interpreter pointer to the topmost value in the return stack, without popping it.
071E5	REPEAT	(→) Sets the interpreter pointer to the topmost value in the return stack, without popping it.
071C8	UNTIL	(flag →) If FALSE then <REF>AGAIN, otherwise <REF>RDROP .
633C6	NOT_UNTIL	(flag →) NOT then <REF>UNTIL .
62B6F	#0=UNTIL	(# → #) Actually, should be called DUP#0=UNTIL.
071EE	WHILE	(flag →) If TRUE does nothing, otherwise <REF>RDROP then <REF>2SKIP .
633DF	NOT_WHILE	(flag →) NOT then <REF>WHILE .
633F8	DUP#0<>WHILE	(# →) Try to guess what it does.

3.6.2 Definite Loops

073F7	DO	(#stop #start →)

073C3	ZERO_DO	(#stop →)
6347F	DUP#0_DO	(#stop → #stop)
073CE	ONE_DO	(#stop →)
073DB	#1+_ONE_DO	(#stop →)
63498	toLEN_DO	({} → {}) From ONE to #elements.
37BCB	(ONE_DO_ARRY)	([] → []) From ONE to #elements.
07334	LOOP	(→)
073A5	+LOOP	(# →) Increments index by specified number.
63466	DROPLOOP	(ob →)
6344D	SWAPLOOP	(ob1 ob2 → ob2 ob1)
54CB3	(SWAPDROPLOOP)	(ob1 ob2 → ob2)
07321	(STOPLOOP)	(→) Destroys topmost loop environment.
61A47	SEMILOOP	(→)
07221	INDEX@	(→ #) Recalls topmost loop counter value.
63411	DUPINDEX@	(ob → ob #)
63425	SWAPINDEX@	(ob1 ob2 → ob2 ob1 #)
63439	OVERINDEX@	(ob1 ob2 → ob1 ob2 ob1 #)
63790	INDEX@#-	(# → #')
63790	INDEX@-	(# → #')
07270	INDEXSTO	(# →) Stores new topmost loop counter value.
07249	ISTOP@	(→ #) Recalls topmost loop stop value.
07295	ISTOPSTO	(# →) Stores new topmost loop stop value.
5182F	ISTOP-INDEX	(→ #)
07258	JINDEX@	(→ #) Recalls second topmost loop counter value.
072AD	JINDEXSTO	(# →) Stores new second topmost loop counter value.
07264	JSTOP@	(→ #) Recalls second topmost loop stop value.
072C2	JSTOPSTO	(# →) Stores new second topmost loop stop value.
6400F	ExitAtLOOP	(→) Does not exit loop immediately. Just stores zero as the stop value, so all objects until the next LOOP will be evaluated. aka: ZEROISTOPSTO

3F78C	(DUPExitAtLOOP)	(ob → ob ob)
3F7EB	(ExitAtLOOPDUP)	(ob → ob ob)
4334F	(DRPExitAtLOOP)	(ob →)

3.7 Memory Operations

3.7.1 Recalling, Storing and Purging

0797B	@	(id/lam → ob T) (id/lam → F) Basic recalling function.
62C05	DUP@	(id/lam → id/lam ob T) (id/lam → id/lam F) Does DUP then <REF>@.
62A34	SAFE@	(id/lam → ob T) (id/lam → F) For lams does <REF>@. For ids does <REF>?ROMPTR> to the ob found.
5E5EE	(SAFE@NOT)	(id → ob F) (id → T) Does <REF>SAFE@ then NOT.
62A2F	DUPSAFE@	(id/lam → id/lam ob T) (id/lam → id/lam F) Does DUP then <REF>SAFE@.
1853B	SAFE@_HERE	(id → ob F) (id → T) Same as <REF>SAFE@, but works only in the current directory.
2EA6A	Sys@	(ID → ob T) (ID → F) Switches temporarily to the HOME directory and executes @ there.
20B81	XEQRCL	(id → ob) Same as <REF>SAFE@, but errors if variable is not found. Also works for lams, but you get the wrong error.
20B9A	LISTRCL	({path id} → ob) Recalls from specified path.
5E602	(@LAMNOT)	(lam → ob F) (lam → lam T) Recalls lam contents if possible.
5E616	(ROMPTR@NOT)	(ROMPTR → ob F) (ROMPTR → ROMPTR T) Recalls contents of ROMPTR if possible.

5E5B7	(@OBNOT)	(ob → ob' F) (ob → ob T) Recalls contents if input is id, lam or ROMPTR. For other types returns TRUE.
07D27	STO	(ob id/lam →) For ids this assumes ob is not pco. If replacing some object, that object is copied to TEMPOB and pointers are updated. For lams: Errors if lam is unbound.
62A02	SAFESTO	(ob id/lam →) For ids, does <REF>?>ROMPTR to the object before storing.
2E9E6	SysSTO	(ob ID →) Switches temporarily to the HOME directory and executes <REF>STO there.
18513	XEQSTOID	(ob id/lam →) Same as <REF>SAFESTO, but will only store in the current directory and will not overwrite a directory. aka: ?STO_HERE
40F22	XEQStoKey	(ob ID →)
085D3	REPLACE	(newob oldob → newob) Replaces oldob (in memory) with newob.
08C27	PURGE	(id →) Purges variable. Does no type check first.
1854F	?PURGE_HERE	(id →) Like <REF>PURGE, but only works in current directory.
7DF7C	MOVEVAR	Move the variable to a different directory. Stack diagram unknown - level 1 must be rrp, but level two??
08696	CREATE	(ob id →) Creates a variable in the current directory. Errors if id is or contains current directory. Assumes id is not a pco.
185C7	DoHere:	(→) Next object in the runstream is evaluated for the current directory only.
63A3D	'LAMLNAMESTO	(ob →) STO to LAM LAMLNAME.

3.7.2 Directories

077E4	(MAKERRP)	(#libnum → rrp) Creates an empty directory.

08DF2	(CREATERRP)	(id →) Creates an empty directory. Does not check if the name is already used. :: # 7FF CRDIR# SWAP CREATE ;
184E1	CREATEDIR	(id →) Creates an empty directory. Calls <REF>?PURGE_HERE first to delete the original.
08326	LASTRAM-WORD	(rrp → ob T) (rrp → F) Recalls first object in directory.
18621	LastNonNull	(rrp → ob T) (rrp → F) Recalls first object in directory (not null named).
08376	PREVRAM-WORD	(ob → ob' T) (ob → F) Recalls next object in directory.
1863A	PrevNonNull	(ob → ob' T) (ob → F) Recalls next object in directory (not null named).
18653	(CkNonNull)	(ob → ob T) (ob → F) Checks that the variable (ob) has a name.
082E3	RAM-WORDNAME	(ob → id) Recalls name of object in current directory.
18595	XEQPGDIR	(id →) Purges a directory. Checks references, etc. first.
20FF2	XEQORDER	({id1 id2..} →) Orders the variables in the directory by moving the given variables to the beginning of the directory.
18779	DOVARS	(→ {id1 id2..}) Returns list of variables from current directory.
186E8	DOTVARS%	(% → {}) Returns a list of variables in the current directory with user type given by the number. Internal TVARS if a single number was given.
1867F	(DODIRPRG)	(ob :: → {}) Executes seco (can be single object) on all directory variables. At execution: ob :: id_contents { } id To be returned: ob :: id_contents { } ob flag If flag is TRUE, ob is added with >TCOMP to list, else it is dropped.
1848C	PATHDIR	(→ {HOME dir1 dir2..}) Returns current path.
1A16F	UPDIR	(→) Goes to parent directory.

08309	(MYRAMROMPAIR)	(rrp → rrp' T) (rrp → F) Gets parent directory. Returns FALSE if parent directory is HOME.
08DD4	SYSRRP?	(rrp → flag) Is rrp HOME?
08D5A	CONTEXT@	(→ rrp) Recalls current directory.
08D08	CONTEXT!	(rrp →) Sets new current directory.
08DD4	SYSRRP?	(rrp → flag) Is rrp HOME?
08D82	(STOPSIGN@)	(→ rrp) Recalls last directory.
08D4A	(STOPSIGN!)	(rrp →) Stores new last directory.
08D92	HOMEDIR	(→) Sets HOME as current directory. aka: SYSCONTEXT
08DC4	(SYSSTOPSIGN)	(→) Sets HOME as last directory.
640A0	SaveVarRes	(→) Binds current and last directories to two nullnamed lams.
640FA	RestVarRes	(→) First sets HOME as both the current and last directories (in case an error happens). Then, restores the current and last directories from 1LAM and 2LAM.

3.7.3 The Hidden Directory

640BE	SetHiddenRes	(→) Sets the hidden directory as the current and last directories.
64037	WithHidden	(→ ?) Executes next command in hidden directory.
64023	RclHiddenVar	(id → ob T) (id → F) Recalls variable in hidden directory. Same as :: WithHidden @ ;
64078	StoHiddenVar	(ob id →) Stores variable in hidden directory. Same as :: WithHidden STO ;
6408C	PuHiddenVar	(id →) Purges variable in hidden directory. Same as :: WithHidden PURGE ;

3.7.4 Temporary Memory

06657	TOTEMPOB	(ob → ob') Copies object to TEMPOB and returns pointer to the new copy.
62C69	TOTEMPSWAP	(ob1 ob2 → ob2' ob1) Does TOTEMPOB then SWAP.
37B44	CKREF	(ob → ob') If object is in TEMPOB, is not embedded in a composite and not referenced, does nothing. Else copies it to TEMPOB and returns the copy.
63F7E	SWAPCKREF	(ob1 ob2 → ob2 ob1') Does SWAP then <REF>CKREF.
06B4E	INTEMNOTREF?	(ob → ob flag) If the object is in TEMPOB area, is not embedded in a composite and is not referenced, returns the object and TRUE, otherwise returns the object and FALSE.
06B3E	(FREEINTEMP?)	(ob → ob flag) Tests if object is in TEMPOB area and not in a composite.
01E0E8	~INTEMPOB?	(ob → ob flag)
065D9	(PTRREFD?)	(ob → ob flag) Tests if object is referenced.
065E5	(REFERENCED?)	(ob → ob flag) Tests if object is referenced or in composite.
06BC2	(NOTREF?)	(ob → ob flag) Tests if object is not referenced or in composite. (:: REFERENCED? NOT ;)
06DDE	(>TOPTEMP)	(ob → ob') Moves object to top ob TEMPOB area. Does not garbage collection.
064BD	(TOTEMPOBADJ)	(ob → ob ob') Makes a standalone copy by moving references to a new copy.
064D6	(DOADJ1)	(ob1 ob2 → ob1 ob') Moves references from ob2 to ob1 (ob1 in TEMPOB area).
064E2	(DOADJ)	(ob1 ob2 → ob1 ob') Moves references from ob2 to ob1 (ob1 in TEMPOB area). References to body of ob2 are moved too.

3.8 Time and Alarms

40EE7	SLOW	(→) 15 millisecond delay.
40F02	VERYSLOW	(→) 300 millisecond delay.
48FF9	SORTASLOW	(→) 1.2 second delay (4 x VERYSLOW).
40F12	VERYVERYSLOW	(→) 3 second delay.
1A7ED	(wait)	(hxs →) Wait specified number of ticks (there are 8192 ticks in a second).
1A7C9	dowait	(%secs →) Waits specified number of seconds.
1A7B5	(dowait/quit?)	(%secs →) Waits specified number of seconds, exits program if ⟨CANCEL⟩ is pressed.
2A673	%>HMS	(% → %hms) Converts from decimal to H.MMSS format.
2AF27	%%H>HMS	(%% → %%hms) Same as %>HMS, but for long reals.
2A68C	%HMS>	(%hms → %) Converts from H.MMSS format to decimal.
2A6A0	%HMS+	(%hms1 %hms2 → %hms) Adds time in hms format.
2A6C8	%HMS-	(%hms1 %hms2 → %hms) Subtracts time in hms format.
0CBFA	TOD	(→ %time) Returns current time.
0CD53	(>TIME)	(%time →) Sets time.
0CD3F	(CLKADJ)	(%time →) Also sets time.
0E66A	VerifyTOD	(%time → %time) Checks for validaty of time. Errors if not valid.
0CC0E	DATE	(→ %date) Returns current date.
0CD2B	(>DATE)	(%date →) Sets date, errors if % is not a valid date.
0CC5B	DATE+DAYS	(%date %days → %date') Adds specified number of days to date.
0CC39	DDAYS	(%date1 %date2 → %days) Returns number of days between two dates.
0EB81	CLKTICKS	(→ hxs) Returns tick count. aka: SysTime

0D304	TIMESTR	(%dt %tm → "dy dt tm") Returns string representation of time, using current format. Example: "WED 06/24/98 10:00:45A"
0CFD9	Date>d$	(%date → $) Returns string representation of date, using current format.
0D2F0	(Date>wd$)	(%date → $weekday) Returns weekday: "SUN", "MON", etc.
0CF5B	(Ticks>wd$)	(hxs → $weekday) Same function but using clock ticks.
0D06A	TOD>t$	(%time → $) Returns string represent the time, using current format.
0EE50	Date>hxs13	(%date → hxs) Converts date to ticks.
0D156	(Ticks>Date)	(hxs → %date) Returns date from hxs of internal alarm list format.
0EE83	(TOD>Ticks)	(%time → hxs) Converts time to ticks.
0D143	(Ticks>TOD)	(hxs → %time) Returns time from hxs of internal alarm list format.
0D169	(Ticks>Rpt)	(hxs → %rpt) Converts hxs in internal alarm list format to repetition interval.
0EE26	(Date+Time)	(hxs_d hxs_t → hxs) Takes two hxs representing the date and the time, and joins them into only one hxs.

3.8.1 Alarms

0E235	ALARMS@	(→ {}) Returns internal alarms list.
0E6ED	STOALM	(%date %time acti %rep → %) Stores an alarm. %repeat is the number of ticks between every repetition. Since there are 8192 ticks in a second, 60 seconds in a minute, and 60 minutes in an hour, to make an alarm that repeats every hour, %repetition would be 8192*60*60 = 29491200. Returns real number representing the position of the alarm in the list.

0E54D	(STOALARMLS)	({} → %) Stores an alarm. List contents: { %date %time action %repeats } You may omit %repeats and action. In this case, the alarm has no repetition and no message is displayed. Returns real number representing the position of the alarm in the list.
0E510	(STOALARM%)	(%time → %) Store an alarm at specified time today, with no message and no repetition. Returns real number representing the position of the alarm in the list.
0E724	(PURGALARM%)	(% →) Internal <REF>xDELALARM.
0EF45	(>ALRMLS)	($ %date %time %rpt → {}) Generates list (of the internal type) representing the alarm.
0E1D8	(ALRMLS>)	({} → {}') Converts list of internal format to list in the format of STOALARMLS.
0E402	(RCLALM)	(#n → {} T) (#n → F) Recalls nth alarm. List is in the internal format.
0E3DF	(RCLALARM%)	(%n → {}) Recalls nth alarm. List is in the format of STOALARMLS.
0EAD7	(FINDALARM%)	(%date → %) Returns position in the internal alarm list of the first alarm of that day (or in any following day).
0EB31	(FINDALARMLS)	({} → %) Takes a list of the format: { %date %time } Returns real represent the position of the specified alarm in the alarm list, or 0 if not found.
0E724	(DELALARM)	(%n →) Deletes nth alarm.
422A1	ALARM?	(→ flag) Returns TRUE if an alarm is due.
0DDC1	(ACKALM)	(→ flag) Tries acknowledging first alarm due. Returns TRUE if no due alarm was found, or FALSE if a due alarm has been found and acknowledged.
0DDA8	(ACKALLALMS)	(→) Acknowledges all due alarms.
0EB31	(FNDALARM{})	
0EBD5	FindNext	

3.9 System Functions

3.9.1 User and System Flags

53731	SetSysFlag	(# →) Sets the system flag with number #. <REF>TEXT:Flags
53761	ClrSysFlag	(# →) Clears the system flag with number #. <REF>TEXT:Flags
53784	TestSysFlag	(# → flag) Returns TRUE if system flag is set. <REF>TEXT:Flags
1C4EC	(TestSysClr)	(# → flag) Clears flag after testing. <REF>TEXT:Flags
3EDA2	(TogSysFlag)	(# →) Toggles system flag. <REF>TEXT:Flags
53725	SetUserFlag	(# →) Set the user flag with number #. <REF>TEXT:Flags
53755	ClrUserFlag	(# →) Clear the user flag with number #. <REF>TEXT:Flags
53778	TestUserFlag	(# → flag) Returns TRUE if user flag is set. <REF>TEXT:Flags
1C4CE	(TestUserClr)	(# → flag) Clears flag after testing. <REF>TEXT:Flags
1C637	RCLSYSF	(→ hxs) Recalls system flags from 1 to 64. <REF>TEXT:Flags
1C731	(STOSYSF)	(hxs →) Stores system flags from 1 to 64. <REF>TEXT:Flags
1C6E3	DOSTOSYSF	(hxs →) Stores system flags from 1 to 64, checking for changes in LASTARG flag.
1C64E	RCLUSERF	(→ hxs) Recalls user flags from 1 to 64.
1C6F7	(STOUSERF)	(hxs →) Stores user flags from 1 to 64.
1C6CF	(STOALLFcont)	(hxs_usr hxs_sys →) Stores user and system flags from 1 to 64. First is user flags, second is system flags.

1C6A2	DOSTOALLF0	({} →) Stores user and system flags from 1 to 64. Expects a list of two hxs, first is user flags, second is system flags.
53C96	(XEQSTWS)	(% →)
53CF0	(XEQRCWS)	(→ %)
53C37	DOHEX	(→) Switch stack display format of HEX strings to hexadecimal. <REF>TEXT:Flags
53C5B	DODEC	(→) Switch stack display format of HEX strings to decimal. <REF>TEXT:Flags
53C43	DOBIN	(→) Switch stack display format of HEX strings to binary.
53C4F	DOOCT	(→) Switch stack display of HEX strings to octal.
54050	BASE	(→ #) Returns #10h, #10d, #10b or #10o. In decimal terms, 16 for hexadecimal base, 10 for decimal base, 8 for octal base or 2 for binary base.
5407A	(BASECHAR)	(→ char) Returns "h", "d", "b" or "o".
16707	DOSTD	(→) Internal version of user word STD.
166E3	DOFIX	(# →) Internal version of user word FIX.
166EF	DOSCI	(# →) Internal version of user word SCI.
166FB	DOENG	(# →) Internal version of user word ENG.
15A8B	savefmt1	(→) Saves the current number format, and changes to STD mode.
15A60	rstfmt1	(→) Restores the number format saved by savefmt1. Only one set of flags can be saved, there is no nesting of these entries.
53B61	(NumbMode)	(→ #) Returns 0 for STD mode, 1 for FIX mode, 2 for SCI mode or 3 for ENG mode.
2A5F0	SETRAD	(→) Set angular mode to RAD.
53BDD	RAD?	(→ flag) Is angular mode RAD?
2A5D2	SETDEG	(→) Set angular mode DEG.

53BC9	(DEG?)	(→ flag) Is angular mode DEG?
2A604	SETGRAD	(→) Set angular mode GRAD.
167BF	DPRADIX?	(→ flag) Returns TRUE if current radix is ".".
53C23	(PRSOL?)	(→ flag) Returns TRUE if general solutions flag (1) is set.
53C0A	(NOTCONST?)	(→ flag) Returns TRUE if symbolic constants flag (2) is cleared.
53B9C	(SETNUM)	(→) Sets numeric results flag (3).
53B88	(CLRNUM)	(→) Clears numeric results flag (3).
53BB0	(NOTNUM?)	(→ flag) Returns TRUE if numeric results flag (3) is cleared.
538DC	UNDO_OFF	(→) Turns saving of the last stack for UNDO off.
538CE	UNDO_ON	(→) Turns saving of the last stack for UNDO on.
538C0	UNDO_ON?	(→ flag) Tests if last stack saving for UNDO is on.
3AA0A	1A/LockA	(→) Equivalent to pressing the ALPHA key, turns on ALPHA mode for either 1 keypress or until the next ALPHA keypress, depending on system flag 60. -- Flags: -60

3.9.2 General Functions

1415A	DOBEEP	(%freq %dur →) Beeps. Analog to user function BEEP.
141B2	setbeep	(#ms #Hz →) Also beeps.
041A7	TurnOff	(→) Internal OFF.
041DA	(!TurnOff)	(→) Internal OFF. Does not do alarm check, etc.
041ED	DEEPSLEEP	(→ flag) Puts HP into deepsleep mode. Returns TRUE if "Invalid Card Data" message.
325AA	ChkLowBat	

0426A	ShowInvRomp	(→) Flashes "Invalid Card Data" message.
386D8	?FlashAlert	(→) Displays system warnings.
04544	(AlertStatus)	(→ #) Gets last system warning: #0h = OK #1h = Alarm #2h = LowBat (S) #4h = LowBat (P1) #8h = LowBat (P2)
04575	(Alert$)	(# → $) Recalls system warning message.
0D2A3	(WSLOG)	(→ $4 $3 $2 $1) Recalls warm start log messages.
0D18A	(WSLOGN)	(#n → $) Recalls specified warm start log message.
21B4E	(DOAPWL)	(→) Forces a warm start but does not log a warmstart event.
04912	(LiteSlp)	(→) Enters light sleep mode.
05F42	GARBAGE	(→) Forces garbage collection.
05F61	MEM	(→ #) Returns amount of free memory in nibbles. Does not do garbage collection. (The user word does.)
05902	OSIZE	(ob → #) Returns object size in nibbles. Forces garbage collection.
05944	OCRC	(ob → #nib hxs) Returns size in nibbles and checksum as hxs.
1A1FC	OCRC%	(ob → hxs %bytes) Returns checksum and size in bytes.
1A265	VARSIZE	(id → hxs %bytes) Returns checksum and size in bytes of specified variable.
1A2DA	INHARDROM?	(ob → ob flag) Is object address < #80000h?
19350	(NOTINHARDROM?)	(ob → ob flag) Is object address #80000h?
05AB3	CHANGETYPE	(ob #prolog → ob') Changes prolog of object, does TOTEMPOB.
05ACC	(!CHANGETYPE)	(ob #prolog → ob') Changes prolog of object.

6595A	getnibs	(hxs hxs → hxs') Peek. First hxs is data, second is address. The data is overwritten for its length (maximum 16) with nibbles starting from specified address.
6594E	putnibs	(hxs hxs →) Poke. First hxs is data, second is address. See <REF>getnibs.
538F8	NOBLINK	(→) Clears the BLINKFLAG, SysNib5.
13D28	cursorblink+	
13D55	cursorblink-	
42078	?BlinkCursor	(→) Makes the cursor Blink if in App-mode or Editline.

3.10 Kermit

2D396	MAXRETRY	Maximum number of retries = 10.
2D3A0	LAMPKNO	Contains packet number.
2D3B1	LAMPACKET	
2D3C6	LAMRETRY	Contains #retry.
2D3D9	(LAMERRMSG)	
2D3EE	LAMKP	
2D3FB	LAMLNAME	
2D40E	LAMOBJ	
2D41D	LAMOPOS	
2D42E	(LAMEXCHP)	
2D45A	LAMKLIST	
2D46D	LAMKMODE	
2D480	(LAMKPTRN)	
2D493	LAMKRM	
2D4A2	(LAMMaxR)	
2F211	LAMKML	
2D441	'LamKPSto	
2D816	(DORECN)	($/id/lam →) Internal RECN.
2D9F5	(DOSERVER)	Internal SERVER.
2E6EB	SENDLIST	({} →) Internal SEND.

2E5AB	(SENDNAME)	(id/lam →)
		Internal SEND.
2E7EF	GETNAME	($/id/lam →)
		Internal KGET.
2E876	DOFINISH	(→)
		Internal FINISH.
2E8D1	DOPKT	($ $' →)
		Internal PKT.
2EC84	DOBAUD	(% →)
		Internal BAUD.
2ECCA	DOPARITY	(% →)
		Internal PARITY.
2ED10	DOTRANSIO	(% →)
		Internal TRANSIO.
2ED4C	(DOCKSM)	
		Internal CKSM.
2EDA6	DOKERRM	(→ $)
		Internal KERRM.
2EDE1	DOBUFLEN	(→ % 0/1)
		Internal BUFLEN.
2EDF5	(DOSTIME)	
		Internal STIME.
2EE18	DOSBRK	(→)
		Internal SBRK.
2EE6F	(DOXMIT)	($ →)
		Internal XMIT.
2EE97	DOSRECV	(% →)
		Internal SRECV.
315C6	CLOSEUART	(→)
		Internal CLOSEIO.
31868	DOCR	(→)
		Internal CR.
31FFD	DODELAY	(% →)
		Internal DELAY.
2D730	KDispRow2	
2D74E	KDispStatus2	
2D517	EXCHINITPK	
2D58C	SENDEOT	
2E0A9	SENDNAK	
2E0C7	SENDERROR	
2E0F4	SENDPKT	
2E6BE	InitIOEnv	
2EAE2	KERMOPEN	
2EB37	DOOPENIO	
2EB62	OpenIO	
3187C	OpenIOPrt	

2E4DC	APNDCRLF	($ → $’) Appends carriage return and line feed to string.
31854	docr	
2EC25	IOCheckReal	
2E99E	StdIOPAR	(→ {}) Default IOPAR: { 9600 0 0 0 3 1 }.
2EA4F	GetIOPAR	(→ %baud % % % % %) Recalls IOPAR and explodes it into the stack.
2E9CB	StoIOPAR	({} →) STO the list of IO parameters in the HOME directory in the variable IOPAR.
2EC34	SetIOPARerr	Error C12h Generates "Invalid IOPAR" error.
31F4A	StdPRTPAR	
31F7D	StoPRTPAR	
3205C	GetChkPRTPAR	
30ED2	OUTUART	
31289	POPUART	
3161E	OpenUartClr	
315F9	CloseUart	
31608	(OpenUart?Clr)	
32161	PRINT	
32387	PRINTxNLF	
323F9	REMAP	
3252B	SetEcma94	
324A6	AllowPrlcdCl	
32B74	PrintGrob	
2D9A1	SetServMode	
2D9B2	ClrServMode	
2EEC4	SendSetup	
2EFD7	TRPACKETFAIL	
2F383	IncrLAMPKNO Increases packet number.	
2F39C	GetKermPkt#	
2F989	RecvNextPkt	

2FEC9	KVISLF	($ → $') String translation for transfer from HP to PC. Inserts <cr> (character 12) in front of every newline (character 10), and translates characters >127 to the corresponding backslash escape. Which translations are being made depends upon the current translation mode (the last number in the IOPAR variable, can be set with DOTRANSIO). 0: No translation 1: CRLF translation 2: CRLF and characters 128-159 (80h-9Fh) 3: CRLF and characters 128-255 (80h-FFh)
2FEDD	KVIS	($ → $') Like <REF>KVISLF, but never translates newlines.
3016B	KINVISLF	($ → $' $'') String translation for transfer from PC to HP. Translates digraphs in the string to characters and removes <cr> (character 12) in front of newline characters. Which translations are actually made depends upon the current translation mode, see KVISLF. $" contains any incomplete trailing backslash sequence in the original string.
307E2	GETKP	
2FEA1	SENDACK	
2FEB5	SENDNULLACK	
30914	ACK_INIT	
30B1D	(CHOOSE_INIT)	
30BBE	ENCODE1PKT	
30BD7	ENCODE	
30D31	DECODE	
3133B	UARTBUFLEN	
3136C	FLUSHRSBUF	
31444	PUTSERIAL	
314E5	GETSERIAL	
30794	VERSTRING	(→ $) Returns version string.
3037A	(VERSTRING?)	($ → $ flag) Checks if $ starts with VERSTRING.
42249	UART?	
42145	UARTxcp	
2D5E1	SEND_PACKET	
21B5A	XEQIOBACKUP	

```
00C10       kermpktmsg
00C0E       kermrecvmsg
00C0D       kermsendmsg
```

4 Input and Output

4.1 Checking for Arguments

4.1.1 Number and Type of Arguments

18A1E	CK0	(→) Saves current command to LASTCKCMD. Marks stack below level 1 to STACKMARK.
18AA5	CK1	(ob → ob) Saves current command to LASTCKCMD. Verifies that there is at least one object in the stack, if not generates a "Too Few Arguments" error. Saves stack mark to STACKMARK. If Last Arg is enabled then saves the argument.
18A80	CK2	(ob1 ob2 → ob1 ob2) Like <REF>CK1, but checks for at least two arguments.
18A5B	CK3	(ob1...ob3 → ob1...ob3) Like <REF>CK1, but checks for at least three arguments.
18B92	CK4	(ob1...ob5 → ob1...ob5) Like <REF>CK1, but checks for at least four arguments.
18B6D	CK5	(ob1...ob5 → ob1...ob5) Like <REF>CK1, but checks for at least five arguments.
18C34	CKN	(ob1...obn %n → ob1..obn #n) Checks for a real in level one. Then checks for that number of arguments. Finally, converts the real to a bint.
18A15	CK0NOLASTWD	(→) Like <REF>CK0, but does not save current command.
18AB2	CK1NOLASTWD	(ob → ob) Like <REF>CK1, but does not save current command.
18A8D	CK2NOLASTWD	(ob1 ob2 → ob1 ob2) Like <REF>CK2, but does not save current command.
18A68	CK3NOLASTWD	(ob1...ob3 → ob1...ob3) Like <REF>CK3, but does not save current command.
18B9F	CK4NOLASTWD	(ob1...ob4 → ob1...ob4) Like <REF>CK4, but does not save current command.

18B7A	CK5NOLASTWD	(ob1...ob5 → ob1...ob5) Like <REF>CK5, but does not save current command.
18C4A	CKNNOLASTWD	(ob1...obn %n → ob1..obn #n) Like <REF>CKN, but does not save current command.
18F9D	CK&DISPATCH0	(→) Dispatches on stack argument. Does not convert ZINTs to REAL. -- <REF>CK&DISPATCH1 <REF>CK&DISPATCH2 <REF>TEXT:Dispatch_Types
18FB2	CK&DISPATCH1	(→) Dispatches on stack arguments, stripping tags and converting ZINTS to REALS (HP49 only) if necessary. -- <REF>CK&DISPATCH0 <REF>CK&DISPATCH2 <REF>TEXT:Dispatch_Types
18FA9	CK&DISPATCH2	(→) Equivalent to <REF>CK&DISPATCH1. -- <REF>CK&DISPATCH0 <REF>TEXT:Dispatch_Types
18ECE	CK1&Dispatch	(→) Combines <REF>CK1 with <REF>CK&DISPATCH1. -- <REF>TEXT:Dispatch_Types
18EDF	CK2&Dispatch	(→) Combines <REF>CK2 with <REF>CK&DISPATCH1. -- <REF>TEXT:Dispatch_Types
18EF0	CK3&Dispatch	(→) Combines <REF>CK3 with <REF>CK&DISPATCH1. -- <REF>TEXT:Dispatch_Types
18F01	CK4&Dispatch	(→) Combines <REF>CK4 with <REF>CK&DISPATCH1. -- <REF>TEXT:Dispatch_Types

18F12	CK5&Dispatch	(→) Combines <REF>CK5 with <REF>CK&DISPATCH1. -- <REF>TEXT:Dispatch_Types
5EA09	CKINFARGS	(→) Gets meta as argument and checks its length (using DEPTH), and errors if it is too short. Collects the arguments to a list, does CK1NOLASTWD, and explodes the meta again.
1884D	0LASTOWDOB!	(→) Clears command save by last CK<n> command. <REF>CK0 aka: 0LASTOWDOB!, 0LastRomWrd!
40BC9	AtUserStack	(→) :: CKONOLASTWD 0LASTOWDOB! ;
1592D	CK1NoBlame	(→) :: 0LASTOWDOB! CK1NOLASTWD ;
62474	'RSAVEWORD	(→) Stores first object in the composite above the actual to LASTCKCMD. aka: 'RSaveRomWrd
18F23	EvalNoCK	(comp → ?) Evaluates composite without saving as current command. If first command is CK<n>&Dispatch it is replaced by CK&DISPATCH1. If first command is CK<n> it is skipped. Any other first command is also skipped!
18F6A	(EvalNoCK:)	Run Stream: (ob →) <REF>EvalNoCK with the next object in the runstream as argument.
18F6A	('EvalNoCK:_sup)	Run Stream: (ob →) <REF>EvalNoCK with the next object in the runstream as argument. aka: EvalNoCK:

4.1.2 Type Checking

63B2D	CKREAL	(% → %) (Z → %) Checks for real. If a ZINT, convert to real. Else SETTYPEERR.
54C63	nmetasyms	(meta → meta) Checks for meta containing %, C%, unit, id, lam or symb.

19207	(CKNFLOATS)	(→) Checks for #n floats (F%) zero = C%0 if at least one float was complex, otherwise it is %0.
03C64	TYPE	(ob → #prolog) Returns address of prolog of object.
1CB90	XEQTYPE	(ob → ob %type) System version of user word TYPE, but this keeps the object.
6216E	TYPEREAL?	(ob → flag)
62169	DUPTYPEREAL?	(ob → ob flag) aka: DTYPEREAL?
62183	TYPECMP?	(ob → flag)
6217E	DUPTYPECMP?	(ob → ob flag)
62159	TYPECSTR?	(ob → flag)
62154	DUPTYPECSTR?	(ob → ob flag) aka: DTYPECSTR?
62198	TYPEARRAY?	(ob → flag)
62193	DUPTYPEARRY?	(ob → ob flag) aka: DTYPEARRY?
62198	TYPEARRY?	(ob → flag ???)
6223B	TYPERARRY?	(ob → flag)
62256	TYPECARRY?	(ob → flag)
62216	TYPELIST?	(ob → flag)
62211	DUPTYPELIST?	(ob → ob flag) aka: DTYPELIST?
6203A	TYPEIDNT?	(ob → flag)
62035	DUPTYPEIDNT?	(ob → ob flag)
6211A	TYPELAM?	(ob → flag)
62115	DUPTYPELAM?	(ob → ob flag)
621D7	TYPESYMB?	(ob → flag)
621D2	DUPTYPESYMB?	(ob → ob flag)
62144	TYPEHSTR?	(ob → flag)
6213F	DUPTYPEHSTR?	(ob → ob flag)
62201	TYPEGROB?	(ob → flag)
621FC	DUPTYPEGROB?	(ob → ob flag)
6222B	TYPETAGGED?	(ob → flag)
62226	DUPTYPETAG?	(ob → ob flag)
6204F	TYPEEXT?	(ob → flag) Is ob a unit object?
6204A	DUPTYPEEXT?	(ob → ob flag) Is ob a unit object?
621AD	TYPEROMP?	(ob → flag)

621A8	DUPTYPEROMP?	(ob → ob flag) Is on a secondary?
6212F	TYPEBINT?	(ob → flag)
6212A	DUPTYPEBINT?	(ob → ob flag)
621C2	TYPERRP?	(ob → flag)
621BD	DUPTYPERRP?	(ob → ob flag)
62025	TYPECHAR?	(ob → flag)
62020	DUPTYPECHAR?	(ob → ob flag)
621EC	TYPECOL?	(ob → flag)
621E7	DUPTYPECOL?	(ob → ob flag) Is ob a secondary? aka: DTYPECOL?
26A2D	?OKINALG	(ob → ob flag) Is object allowed in algebraics?

4.2 Keyboard Control

4.2.1 Converting Keycodes

41CA2	Ck&DecKeyLoc	(%rc.p → #kc #p) Converts from user key representation format to system. Does handle shift-hold keys.
41D92	CodePl>%rc.p	(#kc #p → %rc.p) Converts from system key representation format to user. Does handle shift-hold keys.
3FE44	H/W>KeyCode	(# → #') Converts the keycode offset for shift keys to the keycode of the shift key, i.e. 80h->32d, 40h->37d, C0h->42d
3FE26	H/WKey>KeyOb	
3FE7B	ModifierKey?	(#kc #pl → flag) Is the key any of the three modifiers right-shift, left-shift, or alpha?
40A82	KeyOb@	(→ id/romptr) Returns the object assigned the the key which caused the current program to be executed, or whatever has been stored with KeyOb!
40A6F	KeyOb!	(ob →) Store ob as the KeyOb.
40A95	KeyOb0	(→) Clear the KeyOb.

4.2.2 Waiting for Keys

00D71 FLUSHKEYS
(→)
Flushes the key buffer. aka: FLUSH

04708 CHECKKEY
(→ #kc T)
(→ F)
Returns next key in the key buffer (if there is one), but does not pop it. Does handle shift-hold keys.
--
<REF>TEXT:Keycodes

04714 GETTOUCH
(→ #kc T)
(→ F)
Pops next key from key buffer (if there is one). Does handle shift-hold keys.
--
<REF>TEXT:Keycodes

42159 GETKEY
(→ #kc flag)
Get a single keypress from the keybuffer, waits if necessary. The key is returned along with TRUE. If an exception happens, returns FALSE. The exception is not handled. Does handle shift-hold keys.
--
<REF>TEXT:Keycodes

420A0 GETKEY*
(→ #kc T)
(→ F F)
(→ {Alrmlist} T F)
Get a single keypress from the keybuffer, waits if necessary. The key is returned along with TRUE. If an exception happens (error or alarm), the exceptions is handled and the entry returns FALSE. Does handle shift-hold keys.
--
<REF>TEXT:Keycodes

4203C GetKeyOb
(→ ob)
Wait for a single key and return the object associated with this key. Does handle shift-hold keys.
--
<REF>TEXT:Keycodes

40454 DoKeyOb
(ob →)
Execute ob as if it had been assigned to a key and the key had been pressed.

047C7 REPKEY?
(#kc → flag)
Returns TRUE if the key is being pressed.
--
<REF>TEXT:Keycodes

40E88 REPEATER
(→)
Takes two objects from the runstream, a BINT and a program. The BINT must represent a keycode. The program is evaluated at least once, and then again and again as long as the specified key is being pressed.
--
<REF>TEXT:Keycodes

51735 REPEATERCH
(→)
Same as REPEATER, but slower, so more appropriate for scrolling and cursor motions.
--
<REF>TEXT:Keycodes

42402 KEYINBUFFER?
(→ flag)
Returns TRUE if there is at least a key in the key buffer.

41F65 WaitForKey
(→ #kc #flag)
Returns next full key press. Does *not* handle shift-hold keys.
--
<REF>TEXT:Keycodes

1A738 Wait/GetKey
(% → ?)
Internal WAIT command. Does *not* handle shift-hold keys.
--
<REF>TEXT:Keycodes

4.2.3 The ATTN Flag

42262 ATTN?
(→ flag)
Returns TRUE if ⟨CANCEL⟩ has been pressed.

4243E ?ATTNQUIT
(→)
If ⟨CANCEL⟩ has been pressed, ABORTs program.
aka: ?ATTN_QUIT

23768 CKOATTNABORT
(→)
Executed by the UserRPL program delimiters x<< and x>> and by xUNTIL. Mainly just ?ATTNQUIT.

4245C NoAttn?Semi
(→)
If ⟨CANCEL⟩ has been not pressed, drops the rest of the stream.

05040 ATTNFLG@
(→ #)
Recalls ⟨CANCEL⟩ key counter.

05068 ATTNFLGCLR
(→)
Clears ⟨CANCEL⟩ key counter. Does not affect the key buffer.

4.2.4 Bad Keys

3FDD1	DoBadKey	(→) Beeps.
3FDC7	DropBadKey	(ob →) Beeps.
3FDBD	2DropBadKey	(ob ob' →) Beeps.

4.2.5 User Keys

41A8D	UserKeys?	(→ flag) Does BINT62 TestSysFlag.
41F3F	GetUserKeys	(→ {}) Returns user keys list (internal format). -- <REF>TEXT:Reserved|UserKeys
41C02	(XEQRclKeys)	(→ {}) Recalls all key assignments (in user format) plus status of non defined keys. -- <REF>TEXT:Reserved|UserKeys
41B28	(XEQAsnKey)	(ob %rc.p →) Assigns an object to a key, specified in user format.
41E78	(StoUserKeypatch)	(ob #kc #p →) Assigns an object to a key, specified in system format. If ob is NULL{}, then this actually deletes a key assignment. -- <REF>TEXT:Reserved|UserKeys
41F2C	(UserKeys!)	({} →) Stores user keys (list is in internal format). -- <REF>TEXT:Reserved|UserKeys
41E32	(StoUserKeys)	({} →) Like <REF>UserKeys!, but also recalculates CRC. -- <REF>TEXT:Reserved|UserKeys
41AA1	(Ck&AsnUKeys)	({} →) Stores user keys (list in user format), recalculates CRC.
41B8C	(DelKey)	(#kc #plane →) Deletes that key assignment, recalculates CRC.

41B3C (XEQDelKeys) ({} →)
Deletes specified keys (in user format).

41B69 (Ck&ClrUKey) (0 →)
(%rc.p →)
System version of user word DELKEYS: if 0, deletes all keys, otherwise deletes specified key.

41F52 (PgUserKeys) (→)
Deletes all user keys.

41F13 (ClrUserKeys) (→)
Deletes all user keys and recalculates CRC.
--
<REF>TEXT:Reserved|UserKeys

3FF75 (NonUsrKeyOK?) (→ flag)
Returns TRUE if the keys not defined do their normal actions.

3FF86 (SetNUsrKeyOK) (→)
Keys not defined do their normal actions.

3FF97 (ClrNUsrKeyOK) (→)
Keys not defined just beep when pressed.

3FB1A Key>StdKeyOb (#kc #pl → ob)
Recalls the standard assignment of the key. This is the assignment which is active when USER mode is of.

3FA57 Key>U/SKeyOb (#kc #pl → ob)
If user mode is on, recalls the user object assigned to a key. If user mode is off, recalls the standard assignment instead.

3FA7A ?Key>UKeyOb

3FF75 (NonUsrKeyOK?) (→ flag)
Returns TRUE if the keys not defined do their normal actions.

4.3 The Menu

4.3.1 Menu Properties

04A41 GETDF (#menukey → ob)
Gets the definition of a menu key from THOUCHTAB. #menukey = #1..#6

04A0B GETPROC (#menukey → ob)
Gets the definition of a menu key from THOUCHTAB. #menukey = #1..#6. With #7, get the executor.

418F4 `LabelDef!` `( ob → )`
Store a program which displays a menu label. Prg has the stack diagram
`( #col ob → )`
For example, the `LIBS` command uses the following program to make all menu label look like directories:

```
:: DUPNULL$? ITE
   MakeStdLabel MakeDirLabel
   Grob>Menu ;
```

During execution, `INDEX@` will contain the menu key number.

419E4 `LastMenuDef!` `( menu → )`
Sets the definition of the last menu. menu is a MenuList or a program, or a Rompointer.

419F4 `LastMenuDef@` `( → menu )`
Recalls the definition of the last menu. menu is a MenuList or a program, or a Rompointer.

4139B `SaveLastMenu` `( → )`
Stores row and definition of current menu as the last menu.

4186E `LastMenuRow!` `( #n → )`
Sets the row of the last menu. #n is not the row, but the index of the first menu key in that row, i.e. 1,7,13,...

41881 `LastMenuRow@` `( → #n )`
Recalls the index to the first menu key in the current row of the last menu. Returns 1 for the first page, 7 for the second page, 13 for the third and so on.

418A4 `MenuDef@` `( → menu )`
Recalls the current menu definition. menu is a MenuList or a program, or a Rompointer.

419C4 `MenuExitAct!` `( ob → )`
Store ob as exit action.

3EC85 `NoExitAction` `( → )`
Sets `NOP` as ExitAction. Mostly used to avoid that the menu is saved as the previous menu when a new Menu gets installed.

41848 `MenuRow!` `( #n → )`
Sets the menu row. #n is not the row, but the index of the first menu key in that row, i.e. 1,7,13,...

4185B `MenuRow@` `( → #n )`
Recalls the index of the first menu key in the current menu page. Returns 1 for the first page, 7 for the second page, 13 for the third and so on.

41944 MenuKeyLS! (ob → ob)
Set the action for left-shifted menu keys. The program receives the action part of the menu item as an argument, i.e. {ob-NS ob-LS ob-RS}.

401D4 StdMenuKeyLS ({ob-NS ob-LS ob-RS} → ?)
The content of MenuKeyLS for standard menus.

41914 MenuKeyNS! (og → ob)
Set the action for unshifted menu keys. The program receives the action part of the menu item as an argument, i.e. ob-NS or {ob-NS ob-LS ob-RS}.

41924 MenuKeyNS@ (→ ob)
Recall the action for unshifted menu keys.

3FCAF SetKeysNS (ob →)
Sets ob as MenuKeysNS, DoBadKey to LS & RS.

4019D StdMenuKeyNS (ob-NS → ?)
({ob-NS ob-LS ob-RS} → ?)
The content of MenuKeyNS for standard menus.

41964 MenuKeyRS! (ob → ob)
Set the action for right-shifted menu keys. The program receives the action part of the menu item as an argument, i.e. {ob-NS ob-LS ob-RS}.

417F3 SetRebuild (→)
Sets the flag that the menu needs to be rebuild.

41984 ReviewKey! (ob →)
Store a program which is called with the review key (RS DOWN). The program has the stack diagram (→)

418D4 MenuRowAct! (ob →)
Stores ob as the RowAct menu property.

41741 InitTrack: (→)
Execute the program which is next in the runstream if the directory changes. Used by the VAR menu to set first menurow when diretory changes, or by the CST menu to rebuild it.

4.3.2 Building Menus

40788 TakeOver (→)
Override the default menu key executer. If this is the first entry in a program, the program can be used in edit mode. When the first in a program in the label slot of a menu key, the program is evaluated to get the label object (most likely a grob).

3EC71 NullMenuKey
(→)
A placeholder for an empty menu key when defining menu lists.

4085A Modifier
(→)
:: TakeOver ;

407FB MenuMaker
(→ ob)
Quotes next object, and also provides TakeOver. The disassembly is
:: TakeOver 'R ;
Normally this is used like this:
:: MenuMaker menu InitMenu ;

40F86 InitMenu
(menu →)
menu is {} or :: settings {} ; Settings override the default settings installed by InitMenu.

40DC0 DoMenuKey
(menu →)
:: SetDA12NoCh InitMenu ;

41679 InitMenu%
(%mnu.pg →)
(%0 →)

415C9 GetMenu%
(→ %)

41008 StartMenu
(menu #n →)
#n is the index of the first menu key on the page, use 1 for the first page, 7 for the second etc. StartMenu does ExitAction (Previous menu!), sets the default menu properties and page. Then it evaluates menu, stores result to MenuKeys and executes SetThisRow.

410C6 SetThisRow
(→)
Builds a new TOUCHTAB, SetBadMenu.

41175 LoadTouchTbl
(MenuKey1 .. MenuKeyN #n →)
Builds new TOUCHTAB from menukeys.

4.3.3 Menu Display

3866F SysMenuCheck
(→)
Checks menu validity. If DA3NoCh? then nothing. If Track? then ?DoTrackAct@. If Rebuild? then SetThisRow.

3A1CA ?DispMenu
(→)
Redisplays the menu now if no key is waiting in the buffer. Even better is this:
:: DA3OK?NOTIT ?DispMenu ;

3A1FC DispMenu.1
(→)
Displays menu now.

3A1E8 DispMenu
(→)
:: DispMenu.1 SetDAsValid ;

4.3.4 Displaying Menu Labels

3A297	Grob>Menu	(#col grob →) Displays grob as menu label.
3A2B5	Str>Menu	(#col $ →) Displays string as menu label.
3A2DD	Id>Menu	(#col id →) Displays id as menu label.
3A2C9	Seco>Menu	(#col :: →) Does EVAL then DoLabel.
41904	DoLabel	(#col ob →) If ob is of one of the supported types, displays a menu label. If not, generates a "Bad Argument Type" error.
3A260	(>MENU)	(#col grob →) (#col $ →) (#col id →) (#col :: →) Works by dispatching the object type.
3A4AB	MakeLabel	($ #w #x grob → grob') Inserts $ into grob using CENTER$3x5 with y=5.

4.3.5 General Entries

41111	CheckMenuRow	(# → # #')
3A9E7	SetSomeRow	(#n →) with Mod(n,FFFFFh)= 0.
41934	DoMenuKeyNS	(#n →)
40828	MenuKey	(→) Takes NOB from Runstream.
51125	CLEARMENU	(→)
4E266	CHECKMENU	(→)
211B4	(ID_CST)	ID CST
7DEE2	nCustomMenu	(→) Installs the CST menu.
151A6	SolvMenuInit	(→) Sets MenuKeyNS/LS/RS, ReviewKey and LabelDef properties needed by the Solver menu.
3BE54	DoSolvrMenu	(→) Installs the solver menu which is also available via 75 MENU.
40350	DoNameKeyLRS	
40337	DoNameKeyRS	

3B211	DoFirstRow	(→) Sets the first row of the current menu.
3A71C	DoNextRow	
3A735	DoPrevRow	

4.4 InputLine and Inputforms

4.4.1 Inputline

42F44	InputLine	(args → $ T) (args → $ ob1..obn T) (args → ob1..obn T) (args → F) args = $pr $line #pos #I/R #I/A #alph menu #row attn #parse
43200	InputLAttn	
43179	InputLEnter	

4.4.2 Inputform

199EB	DoInputForm	(l1..ln f1..fm #n #m msg $ → ob1..obn T)
		(l1..ln f1..fm #n #m msg $ → F)
		
		l = $ #x #y
		f = msg #x #y #w #h #type legal
		dec $hlp ChDat ChDec res init
		Starts an input form using the old engine.

0050B0	~IFMenuRow1	(→ {}) Returns the menu for the first menu row of an InputForm.
0060B0	~IFMenuRow2	(→ {}) Returns the menu for the second menu row of an InputForm.

4.5 The Browser Engines

4.5.1 The HP48 Browser Engine

0000B3 ~Choose
(::Appl $Title ::Convert {} offset → {}' T)
(::Appl $Title ::Convert {} offset → ob T)
(::Appl $Title ::Convert {} offset → F)
The return value is a list if checkfields are enabled, otherwise it is just the selected object. Only FALSE is returned when the user presses ⟨CANCEL⟩.
--
<REF>TEXT:Browser48

0050B3 ~ChooseMenu0
(→ {})
Menus with "OK".
--
<REF>TEXT:Browser48

0060B3 ~ChooseMenu1
(→ {})
Menus with "CANCL", "OK".
--
<REF>TEXT:Browser48

0070B3 ~ChooseMenu2
(→ {})
Menus with "CHK", "CANCL", "OK".
--
<REF>TEXT:Browser48

0660B3 ~ChooseSimple
($title {items} → ob T)
($title {items} → F)
Simple interface to the HP48 choose engine. On the HP49G, calls ^RunChooseSimple.
--
<REF>TEXT:Browser48

0150B3 (~BBMoveTo)
(# →)
Moves selection to line and updates display.
--
<REF>TEXT:Browser48

0190B3 (~BBRecalOff&Disp)
(flag →)
Recalculates offset of selected item in page, and redraws lines if the flag is TRUE.
--
<REF>TEXT:Browser48

0220B3 (~BBRunEntryProc)
(→)
Sends message 85 to ::Appl, thus running the user-defined start-up procedure.
--
<REF>TEXT:Browser48

0230B3 (~BBReReadPageSize)
(→)
Re-reads the size of the page (message 57).
--
<REF>TEXT:Browser48

0240B3 (~BBReReadHeight)
(→)
Re-reads the height of the browser line (message 58).
--
<REF>TEXT:Browser48

`0250B3` `(~BBReReadCoords)` `( → )`
Re-reads the coordinates of the browser box (message 63).
--
<REF>TEXT:Browser48

`0260B3` `(~BBReReadWidth)` `( → )`
Re-reads the width of the browser line (message 59).
--
<REF>TEXT:Browser48

`0280B3` `(~BBRunENTERAction)` `( → )`
Sends message 96 to ::Appl, thus running the OK action. It does not check the value returned and never exits.
--
<REF>TEXT:Browser48

`0290B3` `(~BBRunCanclAction)` `( → )`
Sends message 91 to ::Appl, thus running the ⟨CANCEL⟩ action. It does not check the value returned and never exits.
--
<REF>TEXT:Browser48

`02F0B3` `(~BBReDrawBackgr)` `( → )`
Redraws the background.
--
<REF>TEXT:Browser48

`0370B3` `(~BBGetNGrob)` `( #n → grob )`
Returns nth element as a grob.
--
<REF>TEXT:Browser48

`0380B3` `(~BBGetNStr)` `( #n → $ )`
Returns nth element as a string.
--
<REF>TEXT:Browser48

`03B0B3` `(~BBRereadChkEnbl)` `( → )`
Re-reads whether checkmarks are enabled. (Message 61).
--
<REF>TEXT:Browser48

`03C0B3` `(~BBRereadFullScr)` `( → )`
Re-reads whether to use full-screen mode. (Message 60).
--
<REF>TEXT:Browser48

`03D0B3` `(~BReReadMenus)` `( → )`
Re-reads the menu. (Message 83).
--
<REF>TEXT:Browser48

```
03E0B3    (~BBReReadNElems)     ( → )
                                Re-reads the number of elements. (Message 62).
                                --
                                <REF>TEXT:Browser48
03F0B3    (~BBGetN)             ( #n → ob )
                                Returns nth element.
                                --
                                <REF>TEXT:Browser48
04B0B3    (~BBIsChecked?)       ( #n → flag )
                                Returns whether the given element is checked.
                                --
                                <REF>TEXT:Browser48
0520B3    (~BBUpArrow)          ( → grob )
                                Returns up arrow as grob
                                --
                                <REF>TEXT:Browser48
0530B3    (~BBDownArrow)        ( → grob )
                                Returns down arrow as grob
                                --
                                <REF>TEXT:Browser48
0540B3    (~BBSpace)            ( → grob )
                                Returns a space as grob.
                                --
                                <REF>TEXT:Browser48
0590B3    (~BBPgDown)           ( → )
                                Go down one page.
                                --
                                <REF>TEXT:Browser48
05A0B3    (~BBPgUp)             ( → )
                                Go up one page.
                                --
                                <REF>TEXT:Browser48
05B0B3    (~BBEmpty?)           ( → flag )
                                Returns TRUE if the browser has no elements.
                                --
                                <REF>TEXT:Browser48
05C0B3    (~BBGetDefltHeight)   ( → # )
                                Returns height of lines based on the font that will be
                                used. This value is the default height of the browser.
                                Equivalent to FPTR 2 64.
                                --
                                <REF>TEXT:Browser48
0100E0    ~BRbrowse
0120E0    ~BRoutput
0180E0    ~BRRclC1              ( → )
                                :: LAM 'BR5 ;
0170E0    ~BRRclCurRow
                                :: LAM 'BR3 ;
```

```
0030E0    ~BRStoC1
                                  :: ' LAM 'BR5 STO ;
```

4.5.2 The HP49 Browser Engine

4.6 The Parametrized Outer Loop (POL)

38985	ParOuterLoop	(Disp Keys NonAppKeys? DoStdKeys? menu #row suspendOK? ExitCond AppErr →)
389BC	POLSaveUI	(Disp Keys NonAppKeys? DoStdKeys? menu #row suspendOK? ExitCond AppErr →) Saves current UI to LAMSavedUI.
38A64	POLSetUI	<see>ParOuterLoop Sets new UI, same arguments as to ParOuterLoop.
38AEB	POLKeyUI	(→) Displays, reads and evaluates keys according to set UI.
38B09	(1POLKeyUI)	(→) Executes UI once, doesn't check exit condition.
38B45	(POLKeyErr)	(→) Handles error caused by a key press.
38994	(POLSet&KeyUI)	<see>ParOuterLoop :: POLSetUI POLKeyUI ;
38B90	POLRestoreUI	(→) Restores saved UI from LAMSavedUI.
38B77	POLResUI&Err	(→) Restores saved UI and executes ERRJMP.
389CB	(RclUI)	Recalls current ParOuterLoop UI
38A11	(RclHPUI)	Recalls system UI.
38BD6	(NormAppFlags)	Sets default application flags.
38A3E	(SavedUILS)	{ LAMSavedUI }
38A3E	(LAMSavedUI)	
38C08	AppDisplay!	(ob →)
38C18	AppDisplay@	(→)
38C28	(NoAppDisplay!)	
38C38	AppKeys!	(ob →)
38C58	AppKeys0	???
38C48	(AppKeys@)	
38C58	(NoAppKeys!)	

38C68	AppExitCond!	(ob →)
38C78	AppExitCond@	(→ ob)
38C88	(NoAppExitCnd!)	
38C98	AppError!	(ob →)
38CAB	AppError@	(→ ob)
38CBE	(NoAppError!)	(→)
38CD1	(AppError?)	(→ flag)
38CDF	(SetAppError)	(→)
38CED	(ClrAppError)	(→)
38CFB	AppMode?	(→ flag) Is currently a POL active?
38D09	SetAppMode	(→)
38D17	ClrAppMode	(→)
38D25	(NAppKeyOK?)	(→ flag)
38D33	SetNAppKeyOK	(→)
38D41	(ClrNAppKeyOK)	(→)
38D4F	(DoStdKeys?)	(→ flag)
38D5D	SetDoStdKeys	(→)
38D6B	(ClrDoStdKeys)	(→)
1446F	SuspendOK?	(→ flag) Does the current user interface allow suspension?
14483	nohalt	(→ ob) :: LAM 'nohalt ;
38D79	(AppSuspOK?)	(→)
38D8A	SetAppSuspOK	(→)
38D9B	ClrAppSuspOK	(→)
38BD6	(InitPOLVars)	

4.7 Editor Commands

4.7.1 Status

53A4A	EditLExists?	(→ flag) Does an EditLine exist?
4488A	NoEditLine?	(→ flag) Does no EditLine exist?
44683	EDITLINE$	(→ $) Returns a copy of the current command line to the stack. Same as RCL_CMD.
13EF1	(CURSOR@)	(→ #) Recalls the current cursor position.

444A5 CURSOR_END? (→ flag)
Checks if the cursor is at the end of a line or at the end of the file. Works by checking the current character against newline and CHR_00.

4.7.2 Display Window

11432 (FIRSTC@) (→ #)
Column of the left display window edge.

11462 (FIRSTC+) (→)
Increases the position of the left window ege by one.

11442 (SETFIRSTC_0) (→)
Sets the position of the left display window edge to zero.

13E85 CURSOR_OFF (→ #)
Cursor column relative to left edge of display window.

13ED2 (CURSOR_OFF+) (→)
Increases the CURSOR offset by one.

13EBC (CURSOR_OFF0) (→)
Sets the cursor offset to zero.

4.7.3 Inserting Text

42CFB (InsertEcho) ($ →)
Inserts string at current cursor position in EditLine.

42BD4 Echo$Key ($/chr →)
Same as CMD_PLUS.

42AE4 EchoChrKey ($/chr →)
Same as CMD_PLUS, but first ?TogU/LCase.

42BB6 Echo$NoChr00 ($ →)
Inserts string at current cursor position in EditLine.

40DD4 DoDelim (→)
Takes a character or string from the runstream and inserts it.

40DF7 DoDelims (→)
Takes a character or a string from the runstream, inserts it and moves the cursor back by one character.

53A2E INSERT_MODE (→)
Turns insert mode on. In insert mode, new characters do not overwrite old ones.

448C1	?TogU/LCase	(chr → chr') Toggle upper/lowercase of character if some condition is fulfilled.
53A3C	INSERT?	(→ flag) Returns TRUE if insert mode is active.

4.7.4 Moving the Cursor

4325A	SetCursor	(# →) ({# #'} →) Sets the cursor to the given position. For the list argument, the numbers are row and column.
13F29	(SETCURSOR)	

4.7.5 Starting the Editor

42D46	ViewLevel1	(ob → ob') Edits the object in level 1.
444EE	Char>Edit	
42D82	CharEdit	
53A90	ClrNewEditL	
42D32	EditLevel1	(ob → ob')
42DC8	ObEdit	(ob → ob' T) (ob → F) Edits object. When the user cancels, only FALSE is returned. Otherwise the changed object along with TRUE is returned.

443CB EditString ($ →)
Starts editing the string in the command line when the current program exits. This is the entry to use if a program should exit with the command line. Use InitEdLine before this entry to clear the command line (if desired) - if not, the string is inserted into the existing command line. All code after this entry will be executed *before* control is handed to the editor application. For example:

```
::
  "SOME STRING"
  DUPLEN$ SWAP   (get length)
  InitEdLine     (clear the editline)
  EditString     (string to editline)
  STO_CURS_POS2  (cursor at end)
  "Starting editor..."
  FlashMsg       (display *before* edit)
;
```

Note that when you press ENTER after editing, the command line will be parsed normally.

42E86 Rcl&Do: (id →)
Executes the program which is next in the runstream on the contents of the variable. The program typically is an edit command, with the stack diagrams
(ob → ob' T)
(ob → F)
If the flag is TRUE, ob' is stored back into the original variable.

42E27 Roll&Do: (# →)
Does ROLL and then executes the program which is next on the runsteam. So the program is applied to the object on level #. Typically, this is an edit command, with the stack diagram
(ob → ob)
After the program exits, UNROLL is used to put the object back to the right stack position. This entry is probably used in the interactive stack.

4.7.6 Miscellaneous

3BDFA EditMenu (→ {})
Returns the Editor menu.

3E3E1 <DelKey (→ {})
Returns the ⟨←DEL⟩ menu key.

3E4CA >DelKey (→ {})
Returns the ⟨DEL→⟩ menu key.

3E2DD	<SkipKey	(→ {}) Returns the ⟨←SKIP⟩ menu key.
3E35F	>SkipKey	(→ {}) Returns the ⟨SKIP→⟩ menu key.
44277	InitEd&Modes	(→) :: InitEdLine InitEdModes ;
4428B	InitEdLine	(→) :: DEL_CMD ;
44394	InitEdModes	(→)
40C76	SaveLastEdit	($ →) Calls CMD_STO if history is on.
40C94	CMDSTO	($ →) Adds string to the list of the last 4 commands, accessible with the ⟨CMD⟩ key.

4.8 Entries Related to the Matrix Editor and Matrix Operations

44C31	DoNewMatrix	(→ []/[[]]) Start matrix editor to enter a new matrix.
44FE7	DoOldMatrix	([] → []) Edit an existing matrix.

4.9 The Display

4.9.1 Display Organization

1314D	TOADISP	(→) Sets the text display as the active.
13135	TOGDISP	(→) Sets the graphic display as the active.
13167	(GDISPON?)	(→ flag) Returns a flag indicating whether the graphic display is active.
12655	ABUFF	(→ textgrob) Returns the text grob to the stack.
12665	GBUFF	(→ graphgrob) Returns the graphic grob to the stack. The HP49 extable address for ExitAction! is the same, but this must be a bug.
12635	HARDBUFF	(→ dispgrob) Returns the current grob to the stack.

12645	HARDBUFF2	(→ menugrob) Returns the menu grob to the stack.
0E128	HBUF_X_Y	(→ HBgrob #x #y)
12B6C	HARDHEIGHT	(→ #height) Returns the height of HARDBUFF.
12B58	(HBUFFDIMw)	(→ #width)
5187F	GBUFFGROBDIM	(→ #height #width) Returns dimensions of graphic grob.

4.9.2 Preparing the Display

130AC	RECLAIMDISP	(→) Activates the text grob, clears it and sets the default size.
39531	ClrDA1IsStat	(→) Suspends clock display.
4E360	MENUOFF?	(→ flag) Returns TRUE if the menu grob is off.
4E2CF	TURNMENUOFF	(→) Turns off menu display, enlarges ABUFF to fill screen.
4E347	TURNMENUON	(→) Turns menu grob on.
4E2AC	MENUOFF	(→)
130CA	(RSZVDISP)	(→) Sets standard size for currently displayed grob.
1297D	(BROADENHBUFF)	(#cols →) Broadens currently displayed grob.
12964	(HEIGHTENHBUFF)	(#rows →) Heightens currently displayed grob.
12BB7	(BROADENGROB)	(grob #cols →) Broadens graph or text grob.
12DD1	HEIGHTENGROB	(grob #rows →) Heightens graph or text grob.
13043	(KILLADISP)	(→) Clears text display.
13061	KILLGDISP	(→) Clears graph display by setting it to NULLGROB. See DOERASE.
4B60C	DOERASE	(→) Erases the graphics display grob without changing its size.

4.9.3 Immediate Refresh

`386A1` `SysDisplay` (→)
Redisplays all required areas. Does it immediately, without waiting for the current command to finish.

`3A00D` `DispEditLine` (→)
Just calls `DispCommandLine`.

`3A1CA` `?DispMenu` (→)
Redisplays the menu now if no key is waiting in the buffer. Even better is this:
`:: DA3OK?NOTIT ?DispMenu ;`

`3A1FC` `DispMenu.1` (→)
Displays menu now.

`3A1E8` `DispMenu` (→)
:: `DispMenu.1 SetDAsValid` ;

`39B85` `?DispStack` (→)
Redisplays the stack now if necessary.

`3959C` `?DispStatus` (→)
Redisplays the status area now if necessary.

`395BA` `DispStatus` (→)
Displays the status area now.

`39B0A` `DispStsBound` (→)
Displays a horizontal line at y=14, normally the separation between header and stack.

`39515` `(DispTime?)`

`39AF1` `DispTimeReq?` (→ `flag`)
Is time display required? Checks system flag 40 and something else.

`398F4` `DispDir?Tim1`

`39958` `DispDir?Tim2`

`3988B` `DispDir?Time`

`430CF` `DispILPrompt` (→)
Redisplays the InputLine prompt, i.e. refreshes the region between the command line and the header during `InputLine`. Requires a string (the prompt) in 4LAM.

4.9.4 Controlling Display Refresh

`390CC` `ClrDA1OK` (→)

`390E5` `ClrDA2aOK` (→)

`390FE` `ClrDA2bOK` (→)

`39117` `ClrDA2OK` (→)

3912B	ClrDA3OK	(→)
39144	ClrDAsOK	(→)
38DAC	DA1OK?	(→ flag)
38DFC	(DA2aOK?)	(→ flag)
38E4C	(DA2bOK?)	(→ flag)
38E9C	(DA2OK?)	(→ flag)
38EB5	DA3OK?	(→ flag)
38F05	(DAsOK?)	(→ flag)
38FB9	DA2aLess1OK?	(→ flag)
38F28	DA1OK?NOTIT	(→) Does DA1OK?, NOT then IT.
38F41	DA2aOK?NOTIT	(→) DA2aOK?, NOT then IT.
38F5A	DA2bOK?NOTIT	(→) DA2bOK?, NOT then IT.
38F73	DA3OK?NOTIT	(→) Does DA3OK?, NOT then IT.
3902C	SetDA1Temp	(→)
39045	SetDA2aTemp	(→)
39059	SetDA2bTemp	(→)
3938D	(ClrDA2bTemp)	(→)
39207	SetDA2OKTemp	(→)
39072	SetDA3Temp	(→)
3921B	SetDA12Temp	(→)
3922F	SetDAsTemp	(→)
3932B	(SetDA1TempF)	(→)
39339	(ClrDA1TempF)	(→)
3931D	(DA1TempF)	(→)
39355	(SetDA2aTempF)	(→)
39363	(ClrDA2aTempF)	(→)
39347	(DA2aTempF?)	(→ flag)
3937F	(SetDA2bTempF)	(→)
3938D	(ClrDA2bTempF)	(→)
39371	(DA2bTempF?)	(→ flag)
393A9	(SetDA3TempF)	(→)
393B7	(ClrDA3TempF)	(→)
3939B	(DA3TempF?)	(→ flag)
38FD2	SetDA1Valid	(→)
38FEB	SetDA2aValid	(→)

38FFF	SetDA2bValid	(→)
3915D	SetDA2Valid	(→)
39018	SetDA3Valid	(→)
39171	(SetDAsValid)	(→)
39283	(SetDA1ValidF)	(→)
39291	(ClrDA1ValidF)	(→)
39275	(DA1ValidF?)	(→ flag)
392AD	(SetDA2aValidF)	(→)
392BB	(ClrDA2aValidF)	(→)
3929F	(DA2aValidF?)	(→ flag)
392D7	(SetDA2bValidF)	(→)
392E5	(ClrDA2bValidF)	(→)
392C9	(DA2bValidF?)	(→ flag)
39301	SetDA3ValidF	(→)
3930F	(ClrDA3ValidF)	(→)
392F3	(DA3ValidF?)	(→ flag)
39248	(DAsBad?)	(→ flag) Is any DA "Bad"?
3947B	SetDA1Bad	(→)
38DE8	(SetDA1BadT)	(→ T) (SetDA1Bad TRUE)
39489	ClrDA1Bad	(→)
3946D	(DA1Bad?)	(→ flag)
394A5	SetDA2aBad	(→)
38E38	(SetDA2aBadT)	(→ T) (SetDA2aBad TRUE)
394B3	ClrDA2aBad	(→)
39497	DA2aBad?	(→ flag)
394CF	SetDA2bBad	(→)
38E88	(SetDA2bBadT)	(→ T) (SetDA2bBad TRUE)
394DD	ClrDA2bBad	(→)
394C1	(DA2bBad?)	(→ flag)
394F9	SetDA3Bad	(→)
38EF1	(SetDA3BadT)	(→ T) (SetDA3Bad TRUE)
39507	ClrDA3Bad	(→)
394EB	(DA3Bad?)	(→ flag)
393D3	SetDA1NoCh	(→)

393E1	(ClrDA1NoCh)	(→)
393C5	(DA1NoCh?)	(→ flag)
393FD	SetDA2aNoCh	(→)
3940B	(ClrDA2NoCh)	(→)
393EF	(DA2aNoCh?)	(→ flag)
39427	SetDA2bNoCh	(→)
39435	(ClrDA2bNoCh)	(→)
39419	DA2bNoCh?	(→ flag)
3918A	SetDA2NoCh	(→)
3919E	SetDA12NoCh	(→)
39451	SetDA3NoCh	(→)
3945F	(ClrDA3NoCh)	(→)
39443	(DA3NoCh?)	(→ flag)
391C6	SetDA13NoCh	(→)
391B2	SetDA23NoCh	(→)
391DA	(SetDA12a3NCh)	(→) aka: SetDA12a3NoCh
391EE	SetDA123NoCh	(→)
391EE	(SetDAsNoCh)	(→)
39086	SetDA2Echo	(→)
39086	SetDA2aEcho	(→)
39523	SetDA1IsStat	(→)
3957A	SetNoRollDA2	(→)
3958B	ClrNoRollDA2	(→)
39569	(NoRollDA2?)	(→ flag)
39086	(?SetEditRoll)	:: EditExst?NOT ITE SetDA2RollF SetDA2aNoCh ;
39515	(DA1IsStat?)	(→ flag)
39515	(DA1IsStatus?)	(→ flag)
3954D	(SetDA2bIsEdL)	(→)
3953F	(DA2bIsEdL?)	(→ flag)
3955B	(ClrDA2bIsEdL)	(→)
3954D	(SetDA2bEdit)	(→)
3955B	(ClrDA2bEdit)	(→)
3953F	(DA2bEdit?)	(→ flag)
390A4	MENoP&FixDA1	
390B3	MENP&FixDA12	
38F8C	(InitDispModes)	(→)

`142FB` `Ck&Freeze` `( % → )`
Internal FREEZE.

4.9.5 Clearing the Display

`126DF` `BLANKIT` `( #startrow #rows → )`
Clears #rows from `HARDBUFF`, starting at #startrow.

`134AE` `CLEARVDISP` `( → )`
Clears `HARDBUFF`.

`0E083` `Clr8` `( → )`
Clears top eight rows (first status line).

`0E097` `Clr8-15` `( → )`
Clears 2nd status line.

`0E06F` `Clr16` `( → )`
Clears top 16 rows.

`3A546` `BlankDA1` `( → )`
Clears status area from `HARDBUFF`.

`3A591` `BlankDA2a` `( → )`
Clears display area DA2a.

`3A55F` `BlankDA2` `( → )`
Clears display areas DA2a and DA2b.

`3A578` `BlankDA12` `( → )`
Clears display areas DA1 and DA2

`01F6D` `CLCD10` `( → )`
Clears status and stack areas.

`01FA7` `CLEARLCD` `( → )`
Clears whole display.

`5046A` `DOCLLCD` `( → )`
Like user word <REF>CLLCD.

4.9.6 Annunciator and Modes Control

`11361` `SetLeftAnn` `( → )`
Sets left-shift annunciator.

`1136E` `ClrLeftAnn` `( → )`
Clears left-shift annunciator.

`11347` `SetRightAnn` `( → )`
Sets right-shift annunciator.

`11354` `ClrRightAnn` `( → )`
Clears right-shift annunciator.

`1132D` `SetAlphaAnn` `( → )`
Sets alpha annunciator.

`1133A` `ClrAlphaAnn` `( → )`
Clears alpha annunciator.

11543	(SetLock)	(→) Sets alpha mode.
1156C	(ClrLock)	(→) Clears alpha mode.
40D25	LockAlpha	(→) Sets alpha mode, annunciators, etc.
40D39	UnLockAlpha	(→) Clears alpha mode, annunciators, etc.
11501	(Lock?)	(→ flag) Is alpha mode set?
11320	(ClrBusyAnn)	(→) Clears the busy annunciator.
11533	SetPrgmEntry	(→) Sets program-entry mode.
1155C	(ClrPrgmEntry)	(→) Clears program-entry mode.
11511	PrgmEntry?	(→ flag) Is program-entry mode set?
3EDF2	(Do1st/1st+:)	(→ :: ob1 ; (PRG mode)) (→ :: ob1 <rest> (no PRG mode)) If in program mode, executes only the next object after it. If not, execution continues normally.
3EE1A	Do1st/2nd+:	(→ :: <ob1> ; (PRG mode)) (→ :: <ob2> <rest> ; (no PRG mode)) If in program mode, executes the next object after it. If not in program mode, executes the rest of the stream starting at the second object after it.
53976	SetAlgEntry	(→) Sets algebraic-entry mode.
53984	ClrAlgEntry	(→) Clears algebraic-entry mode.
53968	AlgEntry?	(→ flag) Is algebraic-entry mode set?
408AA	ImmedEntry?	(→ flag) Returns TRUE if immediate-entry mode (program and algebraic-entry modes cleared).
40E3D	?ClrAlg	(→) Clears AlgEntry mode if set.
40E5B	?ClrAlgSetPr	(→) Clears AlgEntry mode if set and sets ProgramEntry mode.

4.9.7 Window Coordinates

0E0D3	TOP8	(→ HBgrob #x1 #y #x1+131 #y1+8) Returns coordinates of first status line.
0E0FB	Rows8-15	(→ HBgrob #x1 #y1+8 #x1+131 #y1+16) Returns coordinates of second status line.
0E0AB	TOP16	(→ HBgrob #x1 #y1 #x1+131 #y1+16) Returns coordinates of status area.
137B6	WINDOWCORNER	(→ #y #x) Gets coordinates of corner of window. Note the order of #x and #y.
0E128	HBUFF_X_Y	(→ HBgrob #x #y) Returns current grob and window coordinates.
515FA	LEFTCOL	(→ #x) Gets x-coordinate of left column.
5160E	RIGHTCOL	(→ #x) Gets x-coordinate of right column.
515A0	TOPROW	(→ #y) Gets y-coordinate of top row.
515B4	BOTROW	(→ #y) Gets y-coordinate of bottom row.
13679	WINDOWXY	(#y #x →) Sets corner coordinates. The name really should be WINDOWYX
13695	(REDISPHBUFF)	(→) Sets #0 and #0 as window corner coordinates.

4.9.8 Scrolling the Display

131C8	WINDOWUP	(→) Moves display one pixel up.
13220	WINDOWDOWN	(→) Moves display one pixel down.
134E4	WINDOWLEFT	(→) Moves display one pixel left.
1357F	WINDOWRIGHT	(→) Moves display one pixel right.
4D132	SCROLLUP	(→) Moves display one pixel up, checks for corresponding key being pressed.
4D16E	SCROLLDOWN	(→) Moves display one pixel down, checks for corresponding key being pressed.
4D150	SCROLLLEFT	(→) Moves display one pixel left, checks for corresponding key being pressed.

4D18C	SCROLLRIGHT	(→) Moves display one pixel right, checks for corresponding key being pressed.
51690	JUMPTOP	(→) Jumps to top of display.
516AE	JUMPBOT	(→) Jumps to bottom of display.
516E5	JUMPLEFT	(→) Jumps to left of display.
51703	JUMPRIGHT	(→) Jumps to right of display.
5162C	WINDOWTOP?	(→ flag) Is window at the top?
51645	WINDOWBOT?	(→ flag) Is window at the bottom?
5165E	WINDOWLEFT?	(→ flag) Is window at the left?
51677	WINDOWRIGHT?	(→ flag) Is window at the right?
12996	(ScreenUpN)	((#n →) moves stk displ up #n lines) (#n) Moves stack display up #n lines.
12A4A	(ScreenDnN)	((#n →) moves stk displ down #n lines) (#n) Moves stack display down #n lines.
12A0D	(ScreenUp)	moves stk displ up 1 line Moves stack display up one line.
12AF6	(ScreenDn)	moves stk displ down 1 line Moves stack display down one line.

4.9.9 Displaying Objects

14C17	sstDISP	(ob →) Displays ob in status line. Used for single stepping during debugging.
4F052	WINDOW#	(#x #y →) Internal PVIEW, displays PICT starting at the given coordinates.

4.9.10 Displaying Text

140AB	DODISP	(ob %row →) Displays any object in specified row.
1245B	DISPROW1	($ →) aka: DISP@01, BIGDISPROW1
12725	DISPROW1*	($ →) Displays relative to window corner.

0E029	DISPROW1*!	($ →) Does Clr8 then DISPROW1*.
1246B	DISPROW2	($ →) aka: DISP@09, BIGDISPROW2
12748	DISPROW2*	($ →) Displays relative to window corner.
1247B	DISPROW3	($ →) aka: DISP@17, BIGDISPROW3
1248B	DISPROW4	($ →) aka: DISP@25, BIGDISPROW4
1249B	DISPROW5	($ →)
124AB	DISPROW6	($ →)
124BB	DISPROW7	($ →)
124CB	DISPROW8	($ →) May not be possible depending on the size of the font and whether the menu is on or off.
12429	DISPN	($ #row →) aka: BIGDISPN
3A4CE	Disp5x7	($ #start #max →) Displays string on multiple lines, starting at #start and no using more than #max rows. New lines must be manually specified. Segments longer than 22 characters are truncated and appended with "...".
39632	Blank&GROB!	($ #x #x1 #x2 →) Clears HARDBUFF between (#x1, 0) and (#x2, 6). Converts string to grob with small characters and displays it at (#x, 0).
0E047	(Save16)	(→ grob) Returns top 16 rows.
0E05B	(Restore16)	(grob →) Restores top 16 rows.
1270C	DISPSTATUS2	($ →) Displays message in status area using two lines.
4E6EF	DispCoord1	($ →) Displays $ in menu grob using minifont.
4A055	DISPCOORD2	($ →) Displays $ in menu grob using minifont and waits for a key. Then refreshes menu display.

4.9.11 Messages and Boxes

12B85	FlashMsg	($ →) Displays message in status area, then restores it to normal.

38926	FlashWarning	($ →) Displays message in a message box and beeps. Waits for OK to be pressed.
38908	DoWarning	($ →) Displays message, beeps and freezes status area.
0000B1	~DoMsgBox	($ #x #y grob menu → T) Displays a message box with a grob in the upper left corner and the specified menu. If no grob is desired, use MINUSONE. The meaning of #x and #y is unclear - it seems that any BINT will do.
0020B1	~MsgBoxMenu	(→ {}) The messsage box menu, with just the OK key.

4.10 Graphics

4.10.1 Built-in Grobs

505B2	(NULLPAINT)	(→ grob) 0x0 Null grob
13D8C	CURSOR1	(→ grob) 6x10 Insert cursor (arrow)
13DB4	CURSOR2	(→ grob) 6x10 Replace cursor (solid box)
66EF1	SmallCursor	(→ grob)
66ECD	MediumCursor	(→ grob)
66EA5	BigCursor	(→ grob)
5053C	CROSSGROB	(→ grob) 5x5 Cross cursor ("+")
5055A	MARKGROB	(→ grob) 5x5 Mark symbol ("x")
39B2D	(LineGrob)	131x2 line 131x2 Line (status area divider)
3A337	(NullMenuLbl)	21x8 normal menu key
3A399	(BoxLabelGrob)	21x8 menu key with box
3A3FB	(DirLabelGrob)	21x8 directory menu key
3A45D	(InvLabelGrob)	21x8 inverse menu key
0850B0	~grobAlertIcon	9x9 Alert grob
0860B0	~grobCheckKey	21x8 Check Key menu grob A tickmark and "CHK" in a menu grob.

4.10.2 Dimensions

50578	GROBDIM	(grob → #height #width)
5179E	DUPGROBDIM	(grob → grob #height #width)
63C04	GROBDIMw	(grob → #width)
4F7E6	CKGROBFITS	(g1 g2 #n #m → g1 g2' #n #m) Shrinks g2 if it does not fit in g1.
511E3	CHECKHEIGHT	(grob #height →) Forces grob (ABUFF/GBUFF) to be at least 64 rows high.

4.10.3 Grob Handling

11679	GROB!	(grob1 grob2 #x #y →) Stores grob1 into grob2. Bang type.
4F78C	GROB+#	(flag grob1 grob2 #x #y → grob') Inserts grob2 into the specified position of grob1, using OR (if flag is TRUE) or XOR (if flag is FALSE). Does all necessary checks first.
11A6D	GROB!ZERO	(grob #x1 #y1 #x2 #y2 → grob') Blanks a rectangular region of the grob. Bang type.
6389E	GROB!ZERODRP	(grob #x1 #y1 #x2 #y2 →) Blanks a rectangular region of the grob. Probably only useful if grob is the text or graphics grob (see section on display-organization). Bang type.
1192F	SUBGROB	(grob #x1 #y1 #x2 #y2 → grob') Returns specified portion of grob.
128B0	XYGROBDISP	(#x #y grob →) Stores grob in HARDBUFF with upper left corner at (#x,#y). HARDBUFF is expanded if necessary.
12F94	GROB>GDISP	(grob →) Stores new graph grob.
1158F	MAKEGROB	(#height #width → grob) Creates a blank grob.
4B323	MAKEPICT#	(#w #h →) Creates blank graph grob. Minimum size is 131x64. Smaller grobs will be automatically resized.
122FF	INVGROB	(grob → grob') Inverts grob data bits. Bang type.
1384A	PIXON	(#x #y →) Sets pixel in text grob.
1383B	PIXOFF	(#x #y →) Clears pixel in text grob.
13992	PIXON?	(#x #y → flag) Is pixel in text grob on?

13825	PIXON3	(#x #y →) Sets pixel in graph grob.
1380F	PIXOFF3	(#x #y →) Clears pixel in graph grob.
13986	PIXON?3	(#x #y → flag) Is pixel in graph grob on?
51893	ORDERXY#	(#x1 #y1 #x2 #y2 → #x1' #y1' #x2' #y2') Orders the bints to be appropriate for defining a rectangle in a grob. Swaps #x1 and #x2 if #x2<#x1. Swaps #y1 and #y2 if #y2<#y1.
518CA	ORDERXY%	(%x1 %y1 %x2 %y2 → %x1' %y1' %x2' %y2') ORDERXY# with real numbers.
50B17	LINEON	(#x1 #y1 #x2 #y2 →) Draws a line in text grob.
50B08	LINEOFF	(#x1 #y1 #x2 #y2 →) Clears a line in text grob.
50AF9	TOGLINE	(#x1 #y1 #x2 #y2 →) Toggles a line in text grob.
50AEA	LINEON3	(#x1 #y1 #x2 #y2 →) Draws a line in graph grob.
50758	DRAWLINE#3	(#x1 #y1 #x2 #y2 →) Draws a line in graph grob. x1<x2 is not required.
50ACC	LINEOFF3	(#x1 #y1 #x2 #y2 →) Clears a line in graph grob.
50ADB	TOGLINE3	(#x1 #y1 #x2 #y2 →) Toggles a line in graph grob.
5072B	TOGGLELINE#3	(#x1 #y1 #x2 #y2 →) Toggles line in graph grob. x1<x2 is not required.
4E582	DRAWBOX#	(#x1 #y1 #x2 #y2 →) Draws rectangle in graph grob.
503D4	DOLCD>	(→ grob) Returns current display.
50438	DO>LCD	(grob →) Grob to display.
659DE	Symb>HBuff	(symb →) Displays symbolic in HARDBUFF in Equation Writer form. Enlarges HARDBUFF if necessary, so use RECLAIMDISP after.

4.10.4 Creating Menu Label Grobs

3A328	MakeStdLabel	($ → grob) Makes standard menu label.
3A38A	MakeBoxLabel	($ → grob) Makes label with a box.

3A3EC	MakeDirLabel	($ → grob) Makes directory label.
3ED6B	(DirLabel:)	(→ grob) Makes directory label with next string in the stream. Usage: :: DirLabel: $;
3A44E	MakeInvLabel	($ → grob) Makes inverse label.
3EC99	Box/StdLabel	($ flag → grob) If TRUE makes box label, otherwise makes standard label.
3ED0C	Std/BoxLabel	($ flag → grob) If TRUE makes standard label, otherwise makes box label.
3ECB2	Box/StdLbl:	(→ grob) Does Box/StdLabel with the next two objects from the stream. Usage: :: Box/StdLbl: $ <test> ;
3ECEE	(FBox/StdLbl:)	(→ grob) Takes a string and a bint from the runstream. Tests the system flag specified, does Box/StdLabel. Usage: :: FBox/StdLbl: $ #flag ;
3ED25	(BBox/StdLbl:)	(→ grob) Takes a string and a bint from the runstream. Does BASE then EQ, and finally Box/StdLabel. Usage: :: BBox/StdLabel: $ #base ;
3ED48	(MBox/StdLbl:)	(→ grob) Takes a string and a bint from the runstream. Does NumbMode and EQ, then Box/StdLabel. Usage: :: MBox/StdLbl: $ #mode ;
3ECD0	(FStd/BoxLbl:)	(→ grob) Takes a string an a bint from the runstream. Tests the system flag specified, does Std/BoxLabel. Usage: :: FStd/BoxLbl: $ #flag ;
3A297	Grob>Menu	(#col grob →) Displays grob as menu label.
3A2B5	Str>Menu	(#col $ →) Displays string as menu label.
3A2DD	Id>Menu	(#col id →) Displays id as menu label.
3A2C9	Seco>Menu	(#col :: →) Does EVAL then DoLabel.
41904	DoLabel	(#col ob →) If ob is of one of the supported types, displays a menu label. If not, generates a "Bad Argument Type" error.

3A260	(StdLabelDef)	(#col grob →) (#col $ →) (#col id →) (#col :: →) Works by dispatching the object type.

4.10.5 Converting Strings to Grobs

11CF3	$>BIGGROB	($ → grob) Makes grob of the string using the large font (5x9).
11D00	$>GROB	($ → grob) Makes grob of the string using the system font. Linefeed does *not* make new line.
11F80	$>grob	($ → grob) Makes grob of the string using the minifont. Linefeed does *not* make new line.
05F0B3	(~$>grobOrGROB)	($ → grob) Converts string to a grob using either the current font or the minifont, depending on system flag 90.
1200C	RIGHT$3x6	($ #n → flag grob) Transforms string into grob (using the minifont), then takes all characters starting after column #n. flag is FALSE if #n is greater than the width of the grob. In this case, the whole grob is returned.
1215E	CENTER$3x5	(grob #x #y $ #w → grob') Creates grob from string (using the minifont) and embeds it at specified position (#x, #y). The grob is centered around #x and the to is put at #y. #w represents the maximum width of the grob created. If the text is wider, it is truncated. Bangtype.
3A4AB	MakeLabel	($ #w #x grob → grob') Inserts $ into grob using CENTER$3x5 with y=5.

4.11 Plotting

5127E	('IDPAR)	(→ id) Puts ID PPAR unevaluated on the stack. -- <REF>TEXT:Reserved|PPAR
51166	CHECKPICT	(→) Checks size of GBUFF. If it is smaller than 131x64 sets GBUFF back to its default size (131x64).
51148	CKPICT	(xPICT →) Checks for user word xPICT on level 1. Errors (SETTYPEERR) if there is another object.

20CAD	PICTRCL	(xPICT → grob) Does CKPICT, then recalls GBUFF and does TOTEMPOB.
4AAEA	MAKEPVARS	(→ {}) Creates the default PPAR variable in the current directory and returns its value. -- <REF>TEXT:Reserved|PPAR
4A9AF	CHECKPVARS	(→ {}) Recalls contents of PPAR in current path to stack. Creates PPAR in current directory if non-existent. Errors "Invalid PPAR" if existing PPAR is invalid. -- <REF>TEXT:Reserved|PPAR
4B364	GETPARAM	(# → ob) Extracts the #th item from PPAR. No error checking! -- <REF>TEXT:Reserved|PPAR
4B10C	GETXMIN	(→ %) Recalls XMIN from the PPAR list if existent. If not, the default PPAR is created in the current directory. -- <REF>TEXT:Reserved|PPAR
4B166	PUTXMIN	(% →) Sets a new value for XMIN. PPAR is created if necessary. -- <REF>TEXT:Reserved|PPAR
4B139	GETXMAX	(→ %) Recalls XMAX from the PPAR list if existent. If not, the default PPAR is created in the current directory. -- <REF>TEXT:Reserved|PPAR
4B1AC	PUTXMAX	(% →) Sets a new value for XMAX. PPAR is created if necessary. -- <REF>TEXT:Reserved|PPAR
4B120	GETYMIN	(→ %) Recalls YMIN from the PPAR list if existent. If not, the default PPAR is created in the current directory. -- <REF>TEXT:Reserved|PPAR

4B189 PUTYMIN
(% →)
Sets a new value for YMIN. PPAR is created if necessary.
--
<REF>TEXT:Reserved|PPAR

4B14D GETYMAX
(→ %)
Recalls YMAX from the PPAR list if existent. If not, the default PPAR is created in the current directory.
--
<REF>TEXT:Reserved|PPAR

4B1CF PUTYMAX
(% →)
Sets a new value for YMAX. PPAR is created if necessary.
--
<REF>TEXT:Reserved|PPAR

4B0DA GETPMIN&MAX
(→ C% C%)
--
Returns PMIN and PMAX.
--
<REF>TEXT:Reserved|PPAR

4AF77 PUTINDEP
(ID →)
Internal xINDEP if the arg is an ID.

4AF8B PUTINDEPLIST
({} →)
Internal xINDEP if the arg is a list.

510AD INDEPVAR
(→ id)
Recalls the independent variable. If a list, extract first element.
:: GETINDEP DUPTYPELIST? ?CARCOMP ;

4AF63 GETINDEP
(→ id)
(→ {})
Recalls the independent variable field in PPAR.
--
<REF>TEXT:Reserved|PPAR

4B062 GETPTYPE
(→ name)
Recalls the plot type using GETPARAM.
--
<REF>TEXT:Reserved|PPAR

4B076 PUTPTYPE
(name →)
Sets a new plot type. PPAR is created if necessary.
--
<REF>TEXT:Reserved|PPAR

4AFDB GETRES
(→ %)
Recalls the plot resolution using GETPARAM.
--
<REF>TEXT:Reserved|PPAR

4B012	PUTRES	(% →) Set new plot resolution. PPAR is created if necessary. -- <REF>TEXT:Reserved|PPAR
4ADB0	GETSCALE	(→ % %') Recalls the plot scale parameters. -- <REF>TEXT:Reserved|PPAR
4AE3C	PUTSCALE	(% %' →) Set new plot scale. PPAR is created if necessary. -- <REF>TEXT:Reserved|PPAR
491D5	AUTOSCALE	(→) Internal AUTO.
4CE6F	DOGRAPHIC	(→) Sets the scroll mode of PICTURE and is essentially the same as { } PVIEW.
505C6	GETXPOS	
505E4	getxpos	
5068D	GETYPOS	
506AB	getypos	
15744	EQUATION	(→ ob T) (→ F) Recall the current equation, stored in the 'EQ' variable, and TRUE. If there is no 'EQ' variable on the path, just returns FALSE.
4A0AA	GetEqN	(#n → ob T) (#n → NULL$ F) Get the #nth equation, if EQ is a list of equations.
1572B	DORCLE	(→ ob) Recalls the contents of the EQ variable, errors if it does not exist.
15717	DOSTOE	(ob →) Stores ob into the variable EQ.
20F8A	XEQPURGEPICT	(xPICT →) If object in level one is xPICT, erases the graphic display. Otherwise, errors.
00113	CRER	
4ECAD	CROSSMARKON	
4DA0D	CROSS_HAIRS	
4DA76	CROSS_OFF	
4CF05	GDISPCENTER	(→) Moves to center of graphics display
4B7D8	GetRes	

4B5AD	HSCALE	
4B553	VSCALE	
4B6D9	PLOTERR	
50DA5	PlotOneMore?	
4B765	PLOTPREP	
4F0AC	DOPX>C	({ hxs hxs' } → C%) Converts a list of two hex strings into a complex number. Used for plotting coordinates. Inverse operation is DOC>PX.
4F179	DOC>PX	(C% → { hxs hxs' }) Converts a complex coordinate point into list of two HXS numbers. Inverse operation is DOPX>C.

5 The HP49G CAS

5.1 Matrix Operations

5.1.1 Other Matrix Operations

6 UserRPL Commands

6.1 A-F

1AA1F xABS (x → x')
Absolute Value Function
--
Returns the absolute value of its argument.
x → |x|
(x,y) → sqrt(x^2+y^2)
x_unit → |x|_unit
[array] → || array ||
'sym' → 'ABS(sym)'
--
Flags: -3
--
Related: NEG,SIGN

1987E xACK (→)
Acknowledge Alarm cmd
--
Acknowledges the oldest past due alarm.
--
Flags: -43 -44
Repeat Alarms Not Rescheduled -43
Acknowledge Alarms Saved -44
--
Clears alert annunciator if
1. There are no other past-due alarms and
2. There are no other active alert sources - ie low batt.

Has no effect on control alarms Control alarms that come due are automatically acknowledged AND saved in the sys alarm list.
--
Related: ACKALL

19863 xACKALL
(→)
Acknowledge All Alarms cmd
--
Acknowledges all past due alarms.
--
Flags: -43 -44
Repeat Alarms Not Rescheduled -43
Acknowledge Alarms Saved -44
--
Clears alert annunciator if there are no other active alert sources, ie low batt. Has no effect on control alarms Control alarms that come due are automatically acknowledged AND saved in the sys alarm list.
--
Related: ACK

1B72F xACOS
(x → x')
Arc cos fn
--
Returns angle with given cos.
--
z → arc cos z
'sym' → 'ACOS(sym)'
--
Related: ASIN,ATAN,COS,ISOL,ACOSH

1B830 xACOSH
(x → x')
Arc hyp cos fn
--
Returns val with given hyp cos.
--
z → arc hyp cos z
'sym' → 'ACOSH(sym)'
--
Related: ASINH,ATANH,COSH,ISOL

1BA3D xALOG
(x → x')
Common antilog fn
--
ALOG x = 10^x
--
Flags: -3
numeric result
--
z → 10^z
'sym' → 'ALOG(sym)'
--
Related: EXP,LN,LOG

1E783 xAND

(x1 x2 → x3)
And fn
--
Logical AND of 2 args.
--

```
#n1    #n1    → #n3
"str1" "str2" → "str3"
T/F1   T/F2   → 0/1
T/F    'sym'  → 'T/F AND sym'
'sym'  T/F    → 'sym AND T/F'
'sym1' 'sym2' → 'sym1 AND sym2'
```

--
Flags: -3 -5

```
Numeric res      -3
Bin int wordsize -5 → -10
```

--
Related: NOT,OR,XOR

1F5C5 xAPPLY

({symb1 .. symbn} f → f(symb1...symbn))
Apply to args fn
--
Creates expr for specified fn name & args
--
Related: QUOTE,|

1E5D2 xARC

(c r θ1 θ2 →)
({#x #y} #r θ1 θ2 →)
Draw arc fn
--
Draws arc in PICT anticlockwise from θ1 to θ2 centred on coord specified on lev4 with radius on lev3
--
Flags: -17 -18

```
angle mode (-17 & -18)
```

--
Related: BOX,LINE,TLINE

2125A xARCHIVE
(:port:name →)
(:IO:name →)
Archive HOME cmd
--
Creates backup of HOME in RAM (including user key assignments & alarm catalog)
--
if :IO: is used backup transmitted through IO port via Kermit to filename 'name'
--
Flags: -33 -39
I/O Device -33
I/O Messages -39 if :IO:name
--
Related: RESTORE

1B2DB xARG
(c → θ)
Argument fn
--
Returns angle of a complex number
--
(x,y) → θ
'sym' → 'ARG(sym)'
--
Flags: -17 -18
Ang Mode -17,-18

1D092 xARRY>
([] → x1...xn {n})
([[]] → x11...xnm {n m})
Array to stack cmd
--
Return elems of array to stack. OBJ→ includes this functionality.
--
Related: →ARRY,DTAG,EQ→,LIST→, OBJ→,STR→ UserRPL: xARRY→

1D009 x>ARRY
(x1..xn n → [])
(x11...xnm {n m} → [[]])
Stack to Array Cmd
--
Returns a vector of n real or complex elements or a matrix of n m real or complex solutions.
--
Related: ARRY→,LIST→,→LIST, OBJ→,STR→,→TAG,→UNIT UserRPL: x→ARRY

1B6A4	xASIN	(x → x') Arc sin fn -- Gives angle whose sin is given -- z → arc sin z 'sym' → 'ASIN(sym)' -- Flags: -1 -3 -17 -18 Principal soln -1 Numerical res -3 Angle mode -17,-18 -- Related: ACOS,ATAN,ISOL,SIN
1B7EB	xASINH	(x → x') Arc hyp sin fn -- Gives Val whose hyp sin is given -- z → arc hyp sin z 'sym' → 'ASINH(sym)' -- Flags: -1 -3 Principal soln -1 Numerical res -3 -- Related: ACOSH,ATANH,ISOL,SINH

224F4 xASN

(obj key →)
('SKEY' →)
Assign cmd
--
Defines single key on user kbd by assigning the given obj to the key x_key
--
Flags: -61 -62
User mode lock -61
User mode -62
--
The arg x_key is a real number rc.p where r=row,c=col,p=plane as follows:
0,1 - unshifted
2 - left shifted
3 - right shifted
4 - shifted
5 - left shifted
6 - right shifted
Add 0.01 if the modifier is to be held pressed down.
--
After ASN, pressing the assigned in User or 1-User mode exeutes the assigned obj instead. Remains in effect until altered by ASN or STOKEYS or DELKEYS. If 'SKEY' is passed instead, the specified key is restored to std.
--
Related: DELKEYS,RCLKEYS,STOKEYS <REF>TEXT:Keycodes

1957B xASR

(# → #')
Arithmetic shift right cmd
--
Shifts a bint 1 bit to the right except for the most significant bit which stays.
--
Flags: -5 -6 -7 -8 -9 -10 -11 -12
bint wordsize -5 -> -10
bint base -11, -12
--
Related: SL,SLB,SR,SRB

1B79C xATAN
(x → x')
Arc tan fn
--
Returns the angle having the tan
--
z → arc tan z
'sym' → 'ATAN(sym)'
--
Flags: -1 -3 -17 -18
Principle soln -1
Numeric results -3
Angle mode -17,-18
--
Related: ACOS,ASIN,ISOL,TAN

1B8A2 xATANH
(x → x')
Arc hyp tan fn
--
Returns the value with given hyp tan.
--
z → arc hyp tan z
'sym' → 'ATANH(sym)'
--
Flags: -1 -3 -22
Principle soln -1
Numeric results -3
Infinite result exception -22
--
Related: ACOSH,ASINH,ISOL,TANH

21448 xATTACH
(n →)
(:nport:n →)
Attach library cmd
--
Attaches lib with given num to current directory.
--
Related: DETACH,LIBS

1E1AB xAUTO

(→)
Calculates a y-axis display range or an x- & y-axis display range.
--
Action depends on plot type:

FUNCTION	sets range to max & min of y vals sampled at 40 equi-spaced x vals (excluding)
CONIC	sets y-axis scale = to x-axis scale
POLAR	same as FUNCTION
;	
PARAMETRIC	same as POLAR
;	
TRUTH	no action
;	
BAR	sets x-axis range from 0 to # of elems in ΣDAT +1. sets y-range to min & max of the elts x-axis is always included.
HISTOGRAM	sets x-axis range to min & max of the elems in ΣDAT. sets y-range from 0 to # of rows in ΣDAT.
SCATTER	x-range is min & max of XCOL. y-range is min & max of YCOL

--
Related: DRAW,SCALEH,SCALE,SCLΣ, SCALEW,XRNG,YRNG

1E0BE xAXES

(c →)
({c tick $x $y } →)
Axes cmd
--
Specifies intersection coords of x- & y- axes, tick mark annotatn and x- & y- axes labels. stored in PPAR.
--
<REF>TEXT:Reserved|PPAR
--
Related: ATICK,DRAW,DRAX,LABEL

1E741 xBAR (→)

Bar plot type cmd

--

Sets plot type to BAR When plot type is BAR, the DRAW Cmd plots a bar chart using data from 1 col of the stat matrix (ΣDAT). The col to be plotted is specified by the XCOL cmd & is stored in 1st param of ΣPAR. Plot params are specified in PPAR of ff form:

```
{ (xmin,ymin) (xmax,ymax) indep
  res axes ptype depend }
```

For BAR they are used as follows:

--

(xmin,ymin) specifies lower left cnr of PICT (default: (-6.5,-3.1))

--

(xmax,ymax) specifies upper right cnr of PICT (default: (6.5,3.2))

--

indep name - specifies horiz axis label or list - { name x1 x2 } smaller of x1 & x2 is horiz location of 1st bar (default: X)

--

res real - bar width in user units or bint - bar width in pixels (default: 0 - 1 in user units)

--

axes list containing one or more of the ff in order: (x1,y1) - user unit origin pos a list specifying tick mark annotatn & 2 strings specifying horiz & vert axes labels (default: (0,0))

--

ptype plot type - BAR in this case

--

depend label for vert axis. (default: Y)

--

<REF>TEXT:Reserved|PPAR

--

Related: CONIC,DIFFEQ,FUNCTION,GRIDMAP, HISTOGRAM,PARAMETRIC,PARSURFACE,PCONTOUR, SCATTER,SLOPEFIELD,TRUTH,YSLICE

20133 xBARPLOT
(→)
Draw bar plot cmd
--
Draws bar chart of specified col of stat matrix (ΣDAT) Col to be plotted is specified by XCOL & is stored as first param in ΣPAR. Default col is 1. data can be +ve or -ve giving bars above or below the axis. y-axis is autoscaled & plot type is BAR. When executed from a program, plot doesn't persist unless PICTURE,PVIEW (with empty list) or FREEZE is subsequently executed
--
Related: FREEZE,HISTPLOT,PICTURE, PVIEW,SCATRPLOT,XCOL

2200C xBAUD
(n →)
Baud rate cmd
--
Specify bit transfer rate.
--
Related: CKSM,PARITY,TRANSIO

1A5C4 xBEEP
(freq dur →)
Beep cmd
--
Sounds a tone of n Hz for x secs.
--
Flags: -56
Error Beep -56
Max Freq = 4400 Hz
Max Duration = 1048.575 secs.
--
Related: HALT,INPUT,PROMPT,WAIT

2025E xBESTFIT
(→)
Best fit model cmd
--
Executes LR with each of the 4 curve fitting models and selects the model giving the largest correlation coefficient.
--
Selected model stored in 5th param of ΣPAR & regression coeffs intercept & slope are stored in 3rd & 4th params.
--
Related: EXPFIT,LINFIT,LOGFIT,LR,PWRFIT

1C559 xBIN
(→)
Binary mode cmd
--
Selects binary base for bint ops. (Default base is 10)
--
Flags: -5 -6 -7 -8 -9 -10 -11 -12
Bint wordsize -5 → -10
Bint base -11, -12
Bints require prefix #. Bints entered & returned in binary show the b suffix. If current base not binary, enter binary nums by using b suffix. The current base doesn't affect the internal representation of bints as unsigned bints.
--
Related: DEC,HEX,OCT,STWS,RCWS

2010E xBINS
(min width n → [[]] [])
Sort Into Frequency Bins Cmd
--
Sorts the elements of the indep. col (XCOL) of the stat matrix (ΣDAT) into (nbins + 2) bins, where the left edge for bin 1 starts at value xmin and each bin has width xwidth.
--
xmin xwidth nbins →
[[nbin1...nbinn]]
[nbinL nbinR]
--
Related: BARPLOT,XCOL

1E416 xBLANK
(#width #height → grob)
Blank Graphics Obj Cmd
--
Creates a blank graphics obj of the specified width and height.
--
Related: →GROB,LCD→

1E3EC xBOX
({#n1 #m1} {#n2 #m2} →)
(c1 c2 →)
Box Cmd
--
Draws in PICT a box whose opposite corners are defined by the specified pixel or user-unit coords.
--
Related: ARC,LINE,TLINE

22087 xBUFLEN
(→ nchars 0/1)
Buffer Length Cmd
--
Returns the number of characters in the HP 48's serial input buffer and a single digit indicating whether an error occurred during data reception.
--
Related: CLOSEIO,OPENIO,SBRK,SRECV, STIME,XMIT

1A1D9 xBYTES
(obj → chksum size)
Bytes Size Cmd
--
Returns the number of bytes & the checksum for the given obj.
--
Related: MEM

196BB xB>R
(# → R)
Binary to Real Cmd
--
Converts a binary integer to its floating-point equivalent.
--
Related: R→B UserRPL: xB→R

2378D xCASE
(→)
CASE Conditional Structure Cmd
--
Starts CASE ... END conditional structure.
--
```
CASE  →
THEN T/F →
END  →
END  →
```
--
Related: END,IF,IFERR,THEN

1BC0F xCEIL
(x → n)
Ceiling Func
--
Returns the smallest integer greater than or equal to the argument.
--
```
x     → n
x_u   → n_u
'sym' → 'CEIL(sym)'
```
--
Flags: -3
--
Related: FLOOR,IP,RND,TRNC

1E0E8 xCENTR

((x,y) →)
(x →)
Centre Cmd
--
Adjusts the first two parameters in the reserved variable PPAR, (xmin, ymin) and (xmax,ymax), so that the point represented by the argument (x,y) is the plot centre.
--
<REF>TEXT:Reserved|PPAR
--
Related: SCALE

1C2D5 xCF

(n →)
Clear Flag Cmd
--
Clears the specified user or system flag.
--
Related: FC?,FC?C,FS?,FS?C,SF

1CB66 xCHR

(n → $)
Character Cmd
--
Returns a string representing the HP 48 character corresponding to the character code n.
--
Related: NUM,POS,REPL,SIZE,SUB

1C149 x%CH

(x1 x2 → x3)
Percent Change Func
--
Returns the percent change from x (level 2) to y (level 1) as a percentage of x.
--

```
x       y       → 100(y-x)/x
x       'sym'   → '%CH(x,sym)'
'sym'   x       → '%CH(sym,x)'
'sym1'  'sym2'  → '%CH(sym1,sym2)'
x_u     y_u     → 100(y_u-x_u)/x_u
x_u     'sym'   → '%CH(x_u,sym)'
'sym'   x_u     → '%CH(sym,x_u)'
```

--
Flags: -3
--
Related: %,%T

21FEC xCKSM
(n_type →)
Checksum Cmd
--
Specifies the error-detection scheme.
--
Related: BAUD,PARITY,TRANSIO ;

1FCEB xCLEAR
(ob1 .. obn →)
Clear Cmd
--
Removes all objects from the stack.
--
Related: CLVAR,PURGE

1FD2B xCLSIGMA
(→)
Clear Sigma Cmd
--
Purges the current statistics matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: RCLΣ,STOΣ,Σ+,Σ- UserRPL: xCLΣ

198DE xCLKADJ
(ticks →)
Adjust System Clock Cmd
--
Adjusts the system time by x clock ticks, where 8192 clock ticks equal 1 second.
--
Related: →TIME

1A858 xCLLCD
(→)
Clear LCD Cmd
--
Clears (blanks) the stack display
--
Related: DISP,FREEZE

21ED5 xCLOSEIO
(→)
Close I/O Port Cmd
--
Closes the serial port and the IR port, and clears the input buffer and any error messages for KERMIT.
--
Related: BUFLEN,OPENIO

210FC xCLUSR
(→)
Clear Variables Cmd
--
Purges all variables and empty subdirectories in the current directory.
--
Related: CLUSR,PGDIR,PURGE UserRPL: xCLVAR

1BFBE xCNRM
([] → col_norm)
Column Norm Cmd
--
Returns the column norm (onenorm) of the array argument.
--
Related: CROSS,DET,DOT,RNRM

20A15 xCOLCT
(symb → symb')
Collect Like Terms Cmd
--
Simplifies an algebraic expression or equation by "collecting" like terms. Does not modify numbers.
--
Related: EXPAN,ISOL,QUAD,SHOW

2009A xSIGMACOL
(x_col y_col →)
Sigma Columns Cmd
--
Specifies the independent variable and dependent-variable columns of the current stat matrix (the reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BARPLOT,BESTFIT,CORR,COV, EXPFIT,HISTPLOT,LINFIT,LOGFIT, LR,PREDX,PREDY,PWRFIT,SCATRPLOT,XCOL,YCOL UserRPL: xCOLΣ

1C1F6 xCOMB
(n k → Cn,k)
Combinations Func
--
Returns the number of possible combinations ofn items taken m at a time.
--
```
n      m      → Cn:m
'symn' m      → 'COMB(symn,m)'
n      'symm' → 'COMB(n,symm)'
'symn' 'symm' → 'COMB(symn,symm)'
```
--
Related: PERM,!

1D186 xCON

({ n } x → [])
({ n k } x → [[]])
([] x → []')
Constant Array Cmd
--
Returns a constant array, defined as an array whose elements all have the same value.
--
{ncols} zcnst → [[veccnst]]
{nrows mrows} zcnst → [[matcnst]]
[R-arr] xcnst → [R-arrcnst]
[C-arr] xcnst → [C-arrcnst]
'name' zcnst →
--
Related: IDN

1E681 xCONIC

(→)
Conic Plot Type Cmd
--
Sets the plot type to CONIC.
--
Related: BAR,DIFFEQ,FUNCTION,GRIDMAP, HISTOGRAM,PARAMETRIC,PARSURFACE,PCONTOUR, POLAR,SCATTER,SLOPEFIELD,TRUTH,WIREFRAME,YSLICE

1AA6E xCONJ

(x → x')
Conjugate Analytic Func
--
Conjugates a complex number or a complex array.
--
x → x
(x,y) → (x,-y)
[R-arr] → [R-arr]
[C-arr]1 → [C-arr]2
'sym' → 'CONJ(sym)'
--
Flags: -3
--
Related: ABS,IM,RE,SCONJ,SIGN

1A8BB xCONT

(→)
Continue Program Execution Cmd
--
Resumes execution of a halted program.
--
Related: HALT,KILL,PROMPT

196DB xCONVERT
(x1_u1 x2_u2 → x3_u2)
Convert Units Cmd
--
Converts a source unit object to the dimensions of a target object
--
Related: UBASE,UFACT,→UNIT,UVAL

1FDC1 xCORR
(→ x_correlation)
Correlation Cmd
--
Returns the correlation coefficient of the independent and dependent data columns in the current statistics matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: COLΣ,COV,PREDX,PREDY,XCOL,YCOL

1B505 xCOS
(x → x')
Cos Func
--
Returns the cos of the argument.
--
```
z          → cos z
'sym'      → 'COS(sym)'
x_uangular → cos(x_uangular)
```
--
Flags: -3 -17 -18
--
Related: ACOS,SIN,TAN

1B606 xCOSH
(x → x')
Hyp Cos Func
--
Returns the hyp cos of the argument.
--
```
z     → cosh z
'sym' → 'COSH(sym)'
```
--
Flags: -3
--
Related: ACOSH,SINH,TANH

1FDDC	xCOV	(→ x_covariance) Covariance Cmd -- Returns the sample covariance of the independent and dependent data columns in the current stat matrix (reserved variable ΣDAT). -- <REF>TEXT:Reserved|ΣDAT -- Related: COLΣ,CORR,PCOV,PREDX,PREDY, XCOL,YCOL
1EEA4	xCR	(→) Carriage Right Cmd -- Prints the contents, if any, of the printer buffer. -- Flags: -37 -34 -33 -- Related: DELAY,OLDPRT,PRLCD,PRST,PRSTC, PRVAR,PR1
1A105	xCRDIR	(name →) Create Directory Cmd -- Creates an empty subdirectory with the specified name within the current directory. -- Related: HOME,PATH,PGDIR,UPDIR
1C01E	xCROSS	([1] [2] → [3]) Cross Product Cmd -- CROSS returns the cross product [3] = [1] x [2] of vectors [1] and [2]. -- Related: CNRM,DET,DOT,RNRM
1E29A	xC>PX	((x,y) → {#n #m}) Complex to Pixel Cmd -- Converts the specifiec user-unit coordiates to pixel coordiates. -- (x,y) → { #n #m } -- Related: PX→C UserRPL: xC→PX

1C98E	xC>R	((x,y) → x y) ([C] → [R] [I]) Complex to Real Cmd -- Separates the real and imaginary parts of a complex number or complex array. -- Related: R→C,RE,IM UserRPL: xC→R
19812	xDATE	(→ date) Returns the system date. -- Related: DATE+,DDAYS,TIME,TSTR
1989E	xSETDATE	(date →) Set Date Cmd -- Sets the system date to date. -- Related: →TIME UserRPL: x→DATE
199D2	xDATE+	(date ndays → date') Date Addition Cmd -- Returns a past or future date, given a date in level 2 and a nmber of days in level 1. -- Flags: -42 -- Related: DATE,DDAYS
199B2	xDDAYS	(date1 date2 → days) Delta Days Cmd -- Returns the number of days between two dates. -- Related: DATE,DATE+
1C574	xDEC	(→) Decimal Mode Cmd -- Selects decimal base for binary integer operations. (The default base is decimal.) -- Related: BIN,HEX,OCT,RCWS,STWS

209AA	xDECR	(name → x_new) Decrement Cmd -- Takes a variable on level 1, subtracts 1, stores the new value back into the original variable, and returns the new value to level 1. -- Related: INCR,STO+,STO-
20D65	xDEFINE	('name=expr' →) ('name(name1...)=expr(name1...) →) Define Variable or Func Cmd -- Stores the expression on the right side of the = in the variable specified on the left side, or creates a user-defined function -- Related: STO
1C399	xDEG	(→) Degrees Cmd -- Sets Degrees angle mode. -- Related: GRAD,RAD
19972	xDELALARM	(n →) Delete Alarm Cmd -- Deletes the alarm specified in level 1. -- Related: FINDALARM,RCLALARM,STOALARM
1EF43	xDELAY	(x_delay →) Delay Cmd -- Specifies how many seconds the HP 48 waits between sending lines of information to the printer. -- Related: CR,OLDPRT,PRLCD,PRST,PRSTC,PRVAR,PR1
22548	xDELKEYS	(rc.p →) ({ rc.p ... n } →) Delete Key Assignments Cmd -- Clears user-defined key assignments. -- Related: ASB,RCLKEYS,STOKEYS

1E22B	xDEPND	(name →) ({name} →) ({name y1 y2} →) ({y1 y2} →) (y1 y2 →) Dependent Variable Cmd -- Species the dependent variable (and its plotting range for TRUTH plots). -- Related: INDEP
1FC44	xDEPTH	(→ n) Depth Cmd -- Returns a real number representing the number of objects present on the stack (before DEPTH was executed).
1BFDE	xDET	([[]] → x) Determinant Func -- Returns the determinant of a square matrix. -- Related: CNRM,CROSS,DOT,RNRM
2147C	xDETACH	(n →) (:port:n →) Detach Library Cmd -- Detaches the library with the specified number from the current directory. Each library has a unique number. If a port number is specified, it is ignored. -- Related: ATTACH,LIBS,PURGE
23813	xDIR	
1A584	xDISP	(obj n_line →) Display Cmd -- Displays obj in the nth display line. -- Related: FREEZE,HALT,INPUT,PROMPT

230C3 xDO
(→)
DO Indefinite Loop Structure Cmd
--
Starts DO ... UNTIL ... END indefinite loop structure.
--
DO →
UNTIL →
END T/F →
--
Related: END,UNTIL,WHILE

1A339 xDOERR
(n →)
(#n →)
($ →)
(0 →)
Do Error Cmd
--
Executes a "user-specified" error, causing a program to behave exactly as if a normal error had occurred during program execution.
--
Related: ERRM,ERRN,ERR0

1BFFE xDOT
([1] [2] → x)
Dot Product Cmd
--
Returns the dot product AoB of two arrays A and B, calculated as the sum of the products of the corresponding elements of the two arrays.
--
Related: CNRM,CROSS,DET,RNRM

1E190 xDRAW
(→)
Draw Plot Cmd
--
Plots the mathematical data in the reserved variable EQ or the statistical data in the reserved variable ΣDAT, using the specified x- and y-axis display ranges.
--
<REF>TEXT:Reserved|EQ
--
Related: AUTO,AXES,DRAX,ERASE,FREEZE, PICTURE,LABEL,PVIEW

1E1C6	xDRAX	(→) Draw Axes Cmd -- Draws axes in PICT. -- Related: AXES,DRAW,LABEL
1FBD8	xDROP	(ob →) Drop Object Cmd -- Removes the level 1 object from the stack. -- Related: CLEAR,DROPN,DROP2
1FBF3	xDROP2	(ob1 ob2 →) Drop 2 Objects Cmd -- Removes the first two objects from the stack. -- Related: CLEAR,DROP,DROPN
1FC64	xDROPN	(ob1...obn n →) Drop n Objects Cmd -- Removes the first n + 1 objects from the stack (the first n objects excluding the integer n itself). -- Related: CLEAR,DROP,DROP2
22633	xDTAG	(tag:obj → obj) Delete Tag Cmd -- DTAG removes all tags (labels) from an object. -- Related: LIST→,→TAG
1FB87	xDUP	(ob → ob ob) Duplicate Object Cmd -- DUP returns a copy to level 1 of the object in level 1. -- Related: DUPN,DUP2,PICK
1FBA2	xDUP2	(1 2 → 1 2 1 2) Duplicate 2 Objects Cmd -- DUP2 returns copies of the objects in levels 1 and 2 of the stack. -- Related: DUP,DUPN,PICK

1FC7F xDUPN
(1...n n → 1...n 1...n)
Duplicate n Objects Cmd
--
Takes an integer n from level 1 of the stack, and returns copies of the objects in stack levels 2n through n + 1.
--
Related: DUP,DUP2,PICK

1BEC8 xD>R
(x → (π/180)x)
Degrees to Radians Func
--
Converts a real number representing an angle in degrees to its equivalent in radians.
--
x → (π/180) x
'sym' → 'D→R(sym)'
--
Related: R→D UserRPL: xD→R

1AB23 xCONSTANTe
(→ e)
e Func
--
Returns the symbolic constant e or its numerical representation, 2.71828182846.
--
Related: EXP,EXPM,i,LN,LNP1,MAXR,MINR,π UserRPL: xe

22FB5 xELSE
(→)
ELSE Cmd
--
Starts false clause in conditional or error-trapping structure. See the IF and IFERR keyword entries for syntax information.
--
Related: IF,CASE,DO,ELSE,IFERR,REPEAT, THEN,UNTIL,WHILE

236B9 xENDDO
(1/0 →)
END Cmd
--
Ends conditional, error-trapping, and indefinite loop structures. ; See the IF, CASE, IFERR, DO, and WHILE keyword entries for syntax information.
--
Related: IF,CASE,DO,ELSE,IFERR,REPEAT, THEN,UNTIL,WHILE UserRPL: xEND

22FD5 xIFEND

END Cmd
--
Ends conditional, error-trapping, and indefinite loop structures.
--
See the IF, CASE, IFERR, DO, and WHILE keyword entries for syntax information.
--
Related: IF,CASE,DO,ELSE,IFERR,REPEAT, THEN,UNTIL,WHILE UserRPL: xEND

23694 xWHILEEND

END Cmd
--
Ends conditional, error-trapping, and indefinite loop structures.
--
See the IF, CASE, IFERR, DO, and WHILE keyword entries for syntax information.
--
Related: IF,CASE,DO,ELSE,IFERR,REPEAT, THEN,UNTIL,WHILE UserRPL: xEND

1C452 xENG

(n →)
Engineering Mode Cmd
--
Sets the number display format to Engineering mode, which displays one to three digits to the left of the fraction mark (decimal point) and an exponent that is a multiple of three. The total number of significant digits displayed is n + 1.
--
Related: FIX,SCI,STD

1CEE3 xEQ>

('l=r' → l r)
Equation to Stack Cmd
--
Separates an equation into its left and right sides.
--

```
'sym1=sym2' → 'sym1' 'sym2'
z           → z      0
'name'      → 'name' 0
x_u         → x_u    0
'sym'       → 'sym'  0
```

--
Related: ARRY→,DTAG,LIST→,OBJ→,STR→ UserRPL: xEQ→

1E25F	xERASE	(→) Erase PICT Cmd -- Erases PICT, leaving a blank PICT of the same dimensions. -- Related: DRAW
1A36D	xERR0	(→) Clear Last Error Number Cmd -- Clears the last error number so that a subsequent execution of ERRN returns # 0h, and clears the last error message. -- Related: DOERR,ERRM,ERRN
1A3A3	xERRM	(→ $msg) Error Message Cmd -- Returns a string containing the error message of the most recent calculator error. -- Related: DOERR,ERRN,ERR0
1A388	xERRN	(→ $nerr) Error Number Cmd -- Returns the error number of the most recent calculator error. -- Related: DOERR,ERRM,ERR0

1A3BE xEVAL

(ob → ?)
Evaluate Object Cmd
--
Evaluates the object.
--
obj → (see below)
Obj. Type Effects of Evaluation Local Name Recalls the contents of the variable. Global Name Calls the contents of the variable: ; A name is evaluated. A program is evaluated. A directory becomes the current directory. Other objects are put on the stack. If no variable exists for a given name, evaluating the name returns the name to the stack. Program. Enters each object in the program: Names are evaluated (unless quoted). ed). Cmds are evaluated. Other objects are put on the stack. List Enters each object in the list: Names are evaluated. Cmds are evaluated. Programs are evaluated. Other objects are put on the stack. Tagged If the tag specifies a port, recalls and evaluates the specified object. Otherwise, puts the untagged object on the stack. Algebraic Enters each object in the algebraic expression: Names are evaluated. Cmds are evaluated. Other objects are put on the stack. Cmd, Func, XLIB Name Evaluates the specified object. Other Objects Puts the object on the stack.
--
Related: →NUM,SYSEVAL

1B905 xEXP

(x → x')
Exponential Analytic Func
--
Returns the exponential, or natural antilogarithm, of the argument; that is, e raised to the given power.
--
z → ez
'sym' → 'EXP(sym)'
--
Related: ALOG,EXPM,LN,LOG

20A49 xEXPAN

(symb1 → symb2)
Expand Products Cmd
--
Rewrites an algebraic expression or equation by expanding products and powers.
--
Related: COLCT,EXPAND,ISOL,QUAD,SHOW

201FB xEXPFIT
(→)
Exponential Curve Fit Cmd
--
Stores EXPFIT as the fifth parameter in the reserved variable ΣPAR, indicating that subsequent executions of LR are to use the exponential curve futting model.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: BESTFIT,LR,LINFIT,LOGFIT,PWRFIT

1BAC2 xEXPM
(x → x')
Exponential Minus 1 Analytic Func
--
Returns e^x - 1.
--
x → e^x - 1
'sym' → 'EXPM(sym)'
--
Related: EXP,LNP1

1C360 xFC?
(n → 0/1)
Flag Clear? Cmd
--
Tests whether the system or user flag specified by nflag number is clear, and returns a corresponding test result: 1 (true) if the flag is clear or 0 (false) if the flag is set.
--
Related: CF,FC?C,FS?,FS?C,SF

1C520 xFC?C
(n → 0/1)
Flag Clear? Clear Cmd
--
Tests whether the system or user flag specified by nflag number is clear, and returns a corresponding test result: 1 (true) if the flag is clear or 0 (false) if the flag is set. After testing, clears the flag.
--
Related: CF,FC?,FS?,FS?C,SF

19948 xFINDALARM
(date → n)
({date time} → n)
(0 → n)
Find Alarm Cmd
--
Returns the alarm index nindex of the first alarm due after the specified time.
--
Related: DELALARM,RCLALARM,STOALARM

21FB6 xFINISH
(→)
Finish Server Mode Cmd
--
Terminates Kermit Server mode in a device connected to an HP 48.
--
Related: BAUD,CKSM,KGET,PARITY,PKT, RECN,RECV,SEND,SERVER

1C3EA xFIX
(n →)
Fix Mode Cmd
--
Sets the number display format to Fix mode, which rounds the display to n display places.
--
Related: SCI,STD,ENG

1BBD9 xFLOOR
(x → n)
Floor Func
--
Returns the greatest integer that is less than or equal to the argument.
--
x → n
x_u → n_u
'sym' → 'FLOOR(sym)'
--
Related: CEIL,IP,RND,TRNC

231A0 xSTARTVAR
(start finish →)
FOR Definite Loop Structure Cmd
--
Starts
FOR ... NEXT and
FOR ... STEP
definite loop structures.
--
```
FOR  xstart xfinish        →
           NEXT            →
FOR  xstart xfinish        →
    STEP   xincrement      →
    STEP   'symincrement'  →
```
--
Related: NEXT,START,STEP UserRPL: xFOR

1BBA3 xFP
(x → x')
Fractional part Func
--
Returns the fractional part of an argument.
--
```
x      → y
x_u    → y_u
'sym'  → 'FP(sym)'
```
--
Related: IP

213D1 xFREE
Not useful on the 49G. Free RAM Card Cmd
--
Frees (makes independent) the previously merged RAM in port 1. FREE is provided for compatibility with the HP 48SX, which could merge RAM in port 2 as well. See FREE1.
--
```
{ }                       nport →
{ namebackup ... nlib }   nport →
namebackup                nport →
nlib                      nport →
```

1A5A4 xFREEZE
(n →)
Freeze Display Cmd
--
Freezes the part of the display specified by ndisplay area, so that it is not updated until a key is pressed.
--
Related: CLLCD,DISP,HALT

1C4A1 xFS?C
(n → 0/1)
Flag Set? Clear Cmd
--
Tests whether the system or user flag specified by nflag number is clear, and returns a corresponding test result: 1 (true) if the flag is set or 0 (false) if the flag is clear. After testing, clears the flag
--
Related: CF,FC?,FC?C,FS?C,SF

1C313 xFS?
(n → 0/1)
Flag Set Cmd
--
Tests whether the system or user flag specified by nflag number is set, and returns a corresponding test result: 1 (true) if the flag is set or 0 (false) if the flag is clear.
--
Related: CF,FC?,FC?C,FS?,SF

1E661 xFUNCTION
(→)
Function Plot Type Cmd
--
Sets the plot type to FUNCTION.
--
Related: BAR,CONIC,DIFFEQ,FASTEQ,FAST3D, GRIDMAP,HISTOGRAM,PARAMETRIC,PARSURFACE, PCONTOUR,POLAR,SCATTER,SLOPEFIELD,TRUTH, WIREFRAME,YSLICE

6.2 G-M

1D7C6 xGET

(ob n → elm)
ob = [] or [[]] or {} or name
pos = n or {n} or {n m}
Get Element Command
--
Returns from the level 2 array or list (or named array or list) the real or complex number zget or object objget whose position is specified in level 1.
--

```
[[ mat ]]    nposition     → zget
[[ mat ]]    { nrow mcol } → zget
'namematrix' nposition     → zget
'namematrix' { nrow mcol } → zget
[ vector ]   nposition     → zget
[ vector ]   { nposition  }→ zget
'namevector' nposition     → zget
'namevector' { nposition } → zget
{ list }     nposition   → objget
{ list }     {nposition} → objget
'namelist'   nposition   → objget
'namelist'   {nposition} → objget
```

--
Related: GETI,PUT,PUTI

1D8C7 xGETI

(ob pos → ob' pos' elm)
ob = [] or [[]] or {} or name
pos = n or {n} or {n m}
Get and Increment Index Command
--
Returns from the level 2 array or list (or named array or list) the real or complex number zget or object objget whose position is specified in level 1, along with the level 2 argument and the next position in that argument.
--
[[mat]] npos1
→ [[mat]] npos2 zget
[[mat]] { nr mc }1
→ [[mat]] { nr mc }2 zget
'namemat' npos1
→ 'namemat' npos2 zget
'namemat' { nr mc }1
→ 'namemat' { nr mc }2 zget
[vec] npos1
→ [vec] npos2 zget
[vec] { npos1 }
→ [vec] { npos2 } zget
'namevec' npos1
→ 'namevec' npos2 zget
'namevec' { npos1 }
→ 'namevec' { npos2 } zget
{ list } npos1
→ { list } npos2 objget
{ list } { npos1 }
→ { list } { npos2 } objget
'namelist' npos1
→ 'namelist' npos2 objget
'namelist' { npos1 }
→ 'namelist' { npos2 } objget
--
Related: GET,PUT,PUTI

1E456 xGOR

(g_targ {#n #m} grob → g_targ')
(g_targ (x,y) grob → g_targ')
(PICT ... ... →)
Graphics OR Cmd
--
Superimposes grob1 onto grobtgt or PICT, with the upper left corner of grob1 positioned at the specified coordinate in grobtgt or PICT.
--
grobtgt {#n #m} grob1 → grob'
grobtgt (x,y) grob1 → grob'
PICT {#n #m} grob1 →
PICT (x,y) grob1 →
--
Related: GXOR,REPL,SUB

1C3CF xGRAD

(→)
Grads Mode Cmd
--
Sets Grads angle mode.
--
Related: GRAD,RAD

23813 xGROB

1E5AD x>GROB

(ob n_chrsize → grob)
Stack to Graphics Object Cmd
--
Creates a graphics object representing the level 2 object, where the argument nchar size specifies the character size of the representation.
--
Related: →LCD,LCD→ UserRPL: x→GROB

1E4E4 xGXOR

(g_targ {#n #m} g_src → g_targ')
(g_targ (x,y) g_src → g_targ')
(PICT ... ... →)
Graphics Exclusive OR Cmd
--
Superimposes grob1 onto grobtgt or PICT, with the upper left corner of grob1 positioned at the specified coordinate in grobtgt or PICT.
--
grobtgt {#n #m} grob1→ grobresult
grobtgt (x,y) grob1→ grobresult
PICT {#n #m} grob1→
PICT (x,y) grob1→
--
Related: GOR,REPL,SUB

23472 xHALT
(→)
Halt Program Cmd
--
Halts program execution.
--
Related: CONT,KILL

1C58F xHEX
(→)
Hexadecimal Mode Cmd
--
Selects hexadecimal base for binary integer operations. (The default base is decimal.)
--
Related: BIN,OCT,DEC,RCWS,STWS

1E721 xHISTOGRAM
(→)
Histogram Plot Type Cmd
--
Sets the plot type to HISTOGRAM.
--
Related: BAR,CONIC,DIFFEQ,FUNCTION, GRIDMAP,PARAMETRIC,PARSURFACE,PCONTOUR, POLAR,SCATTER,SLOPEFIELD,TRUTH,WIREFRAME,YSLICE

20167 xHISTPLOT
(→)
Draw Histogram Plot Cmd
--
Plots a frequency histogram of the specified column in the current stat matrix (reserved matrix ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BARPLOT,BINS,FREESE,PICTURE, PVIEW,RES,SCATRPLOT,XCOL

1BF7E xHMS-
(hms1 hms2 → hms3)
Hours-Minutes-Seconds Minus Cmd
--
Returns the difference of two real number, where the arguments and the result are interpreted in hours-minutes-seconds format.
--
Related: HMS→,→HMS,HMS+

1BF5E xHMS+
(hms1 hms2 → hms3)
Hours-Minutes-Seconds Plus Cmd
--
Returns the sum of two real number, where the arguments and the result are interpreted in hours-minutes-seconds format.
--
Related: HMS→,→HMS,HMS-

1BF1E x>HMS
(x → x')
Decimal to Hours-Minutes-Seconds Cmd
--
Converts a real number representing hours or degrees with a decimal fraction to hours-minutes-seconds format.
--
Related: HMS→,HMS+,HMS- UserRPL: x→HMS

1BF3E xHMS>
(x → x')
Hours-Min-Sec to Decimal Cmd
--
Converts a real number in hours -minutes-seconds format to its decimal form (hours or degrees with a decimal fraction.
--
Related: →HMS,HMS+,HMS- UserRPL: xHMS→

1A140 xHOME
(→)
HOME Directory Cmd
--
Makes the HOME directory the current directory.
--
Related: CRDIR,PATH,PGDIR,UPDIR

1AB45 xi
(→ i)

1D2DC xIDN
(n → [[]])
([[]] → [[]]')
(name → [[]])
Identity Matrix Cmd
--
Returns an identity matrix; that is, a square matrix with its diagonal elements equal to 1 and its off-diagonal elements equal to 0.
--
Related: CON

22EC3 xIF
(→)
IF Conditional Structure Cmd
--
Starts IF ... THEN ... END and IF ... THEN ... ELSE ... END conditional structures.
--
IF →
THEN T/F →
END →
→
IF →
THEN T/F →
ELSE →
END →
--
Related: CASE,ELSE,END,IFERR,THEN

233DF xIFERR
(→)
If Error Conditional Struct Cmd
--
Starts IFERR ... THEN ... END and IFERR ... THEN ... ELSE ... END error trapping structures.
--
Related: CASE,ELSE,END,IF,THEN

1A4CD xIFT
(0/1 obj → ?)
IF-THEN Cmd
--
Executes obj if T/F is nonzero. Discards obj if T/F is zero.
--
Related: IFTE

1A3FE xIFTE
(0/1 objT objF → ?)
IF-THEN-ELSE Cmd
--
Executes objT if T/F is nonzero. Discards objF if T/F is zero.
--
Related: IFT

1AB45 xi
(→ i)

1C819 xIM
((x,y) → y)
([] → []')
Imaginary Part Func
--
Returns the imaginary part of its (complex) argument.
--
x → 0
(x,y) → y
[R-arr] → [R-arr]
[C-arr] → [R-arr]
'sym' → 'IM(sym)'
--
Related: C→R,RE,R→C

208F4 xINCR
(name → x)
Increment Cmd
--
Takes a variable on level 1, adds 1, stores the new value back into the original variable, and returns the new value to level 1.
--
Related: DECR

1E04A xINDEP
(name →)
({name} →)
Independent Variable Cmd
--
Specifies the independent variable and its plotting range.
--
Related: DEPND

224CA xINPUT
($prompt $ → $')
($prompt {specs} → $')
Input Cmd
--
Prompts for data input to the command line and prevents the user access to stack operations.
--
Related: PROMPT,STR→

1B278 xINV
(x → 1/x)
([[]] → [[]]')
Inverse (1/x) Analytic Func
--
Returns the reciprocal or the matrix inverse.
--
Related: SINV,/

1BB6D xIP
(x → n)
Integer Part Func
--
Returns the integer part of the argument.
--
x → n
x_u → n_u
'sym' → 'IP(sym)'
--
Related: FP

20A93 xISOL
(symb var → symb')
Isolate Variable Cmd
--
Returns an algebraic symb' that rearranges symb to "isolate" the first occurrence of variable var.
--
Related: COLCT,EXPAN,QUAD,SHOW,SOLVE

1FAEB xFORMUNIT
UserRPL: x_

23654 x'

23679 xENDTIC
UserRPL: x'

2361E x<<
UserRPL: x≪

23639 x>>
UserRPL: x≫

235FE x>>ABND
UserRPL: x≫

2206C xKERRM
(→ msg)
Kermit Error Message Cmd
--
Returns the text of the most recent Kermit error packet.
--
Related: FINISH,KGET,PKT,RECN,RECV, SEND,SERVER

1A873 xKEY
(→ rc 1)
(→ 0)
Key Cmd
--
Returns to level 1 a test result, and if a key is pressed, returns to level 2 the row-column location xn m of that key.
--
Related: WAIT,KEYEVAL

21F24 xKGET
(name →)
("name" →)
({names} →)
({{old new}...} →)
Kermit Get Cmd
--
Used by a local Kermit to get a Kermit server to transmit the named object(s).
--
Related: BAUD,CKSM,FINISH,PARITY,RECN, RECV,SEND,SERVER,TRANSIO

1A303 xKILL
(→)
Cancel Halted Programs Cmd
--
Cancels all currently halted programs. (Halted programs are typically canceled by pressing PRG NXT RUN KILL.) If KILL is executed within a program, that program is also canceled.
--
Related: CONT,DOERR,HALT,PROMPT

1E2D5 xLABEL
(→)
Label Axes Cmd
--
Labels axes in PICT with x- and y-axis variable names and with the minimum and maximum values of the display ranges.
--
Related: LABEL,DRAW,DRAX

1A604 xLAST
(→ ob1 .. obn)
Last Arguments Cmd
--
Returns copies of the arguments of the most recently executed command. UserRPL: xLASTARG

1E58D x>LCD
(grob →)
Graphics Object to LCD Cmd
--
Displays the graphics object from level 1, with its upper left pixel in the upper left corner of the display.
--
Related: LCD→,BLANK,→GROB UserRPL: x→LCD

1E572 xLCD>
(→ grob)
LCD to Graphics Object Cmd
--
Returns the current stack and menu display as a 131x64 graphics object.
--
Related: →LCD,→GROB UserRPL: xLCD→

2142D xLIBS
(→ {title nlib nport ...})
Libraries Cmd
--
Lists the title, number, and port of each library attached to the current directory.
--
Related: ATTACH,DETACH

1E398 xLINE
((x1,y1) (x2,y2) →)
({#n1 #m1} {#n2 #m2} →)
Draw Line Cmd
--
Draws a line in PICT between the coordinates in levels 1 and 2.
--
Related: ARC,BOX,TLINE

200F3 xSIGMALINE
(→ symb)
Regression Model Formula Cmd
--
Returns an expression representing the best fit line according to the current statistical model, using X as the independent variable name, and explicit values of the slope and intercept taken from the reserved variable ΣPAR.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: BESTFIT,COLΣ,CORR,COV, EXPFIT,LINFIT,LOGFIT,LR,PREDX, PREDY,PWRFIT,XCOL,YCOL UserRPL: xΣLINE

201B1 xLINFIT
(→)
Linear Curve Fit Cmd
--
Stores LINFIT as the fifth parameter in the reserved variable ΣPAR, indicating that subsequent executions of LR are to use the linear curve fitting model.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: BESTFIT,EXPFIT,LOGFIT,LR, PWRFIT

1C95A xLIST>
({} → ob1...obn n)
List to Stack Cmd
--
Takes a list of n objects and returns them in separate levels, and returns the total number of objects to level 1.
--
Related: ARRY→,DTAG,EQ→,→LIST, OBJ→,STR→ UserRPL: xLIST→

1C783 x>LIST
(ob1 .. obn n → {})
Stack to List Cmd
--
Takes n objects from level n+1 through level 2 and returns a list of those n objects.
--
Related: →ARRY,LIST→,→STR, →TAG,→UNIT UserRPL: x→LIST

1B94F xLN
(x → x')
Natural Logarithm Analytic Func
--
Returns the natural (base e) logarithm of the argument.
--
z → ln z
'sym' → 'LN(sym)'
--
Related: ALOG,EXP,ISOL,LNP1,LOG

1BA8C xLNP1
(x → x')
Natural Log of x+1 Analytic Func
--
Returns ln (x + 1).
--
x → ln(x+1)
'sym' → 'LNP1(sym)'
--
Related: EXPM,LN

1B9C6 xLOG
(x → x')
Common Logarithm Analytic Func
--
Returns the common logarithm (base 10) of the argument.
--
z → log z
'sym' → 'LOG(sym)'
--
Related: ALOG,EXP,ISOL,LN

201D6 xLOGFIT
(→)
Logarithmic Curve Fit Cmd
--
Stores LOGFIT as the fifth parameter in the reserved variable ΣPAR, indicating that subsequent executions of LR are to use the logarithmic curve-fitting model.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: BESTFIT,EXPFIT,LINFIT,LR,PWRFIT

1FF20 xLR
(→ Intercept Slope)
Linear Regression Cmd
--
Uses the currently selected statistical model to calculate the linear regression coefficients (intercept and slope) for the selected dependent and independent variables in the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BESTFIT,COLΣ,CORR,COV,EXPFIT, ΣLINE,LINFIT,LOGFIT,PREDX,PREDY, PWRFIT,XCOL,YCOL

1BE9C xMANT
(x → x')
Mantissa Func
--
Returns the mantissa of the argument.
--
x → ymant
'sym' → 'MANT(sym)'
--
Related: SIGN,XPON

1FA8D xMATCHDN
(symb {spat srepl} → symb' 0/1)
(symb {spat srepl scond} → symb' 0/1)
Match Pattern Down Cmd
--
Rewrites an expression.
--
Related: X↑MATCH UserRPL: x↓MATCH

1FA59 xMATCHUP

(symb {spat srepl} → symb' 0/1)
(symb {spat srepl scond} → symb' 0/1)
Bottom-Up Match and Replace Cmd
--
Rewrites an expression.
--
Related: X∇MATCH UserRPL: x↑MATCH

1BC71 xMAX

(x y → x')
Maximum Func
--
Returns the greater (more positive) of the arguments.
--

```
x       y       → max(x, y)
x       'sym'   → 'MAX(x, sym)'
'sym'   x       → 'MAX(sym, x)'
'sym1'  'sym2'  → 'MAX(sym1, sym2)'
x_u1    y_u2    → max(x_u1, y_u2)
```

--
Related: MIN

1AADF xMAXR

(→ MAXR)
Maximum Real Func
--
Returns the symbolic constant 'MAXR' or its numerical representation, 9.99999999999E499.
--

```
→ 'MAXR'
→ 9.99999999999E499
```

--
Related: Ee,i,MINR,π

1FE7E xMAXSIGMA

(→ xmax)
(→ [x1...xn])
Maximum Sigma Cmd
--
Finds the maximum coordinate value in each of the m columns of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BINS,MEAN,MINΣ,SDEV,TOT,VAR UserRPL: xMAXΣ

1FE99 xMEAN

(→ xmean)
(→ [x1...xn])
Mean Cmd
--
Returns the mean of each of the m columns of coordinate values in the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BINS,MAXΣ,MINΣ,SDEV,TOT,VAR

20FAA xMEM

(→ x)
Memory Available Cmd
--
Returns the number of bytes of available RAM.
--
Related: BYTES

21196 xMENU

(% →)
Display Menu Cmd
--
Displays a built-in menu or a library menu, or displays a custom menu.
--
namemenu →
{ listdefinition } →
'namedefinition' →
obj →
--
Related: RCLMENU,TMENU

2137F xMERGE

(1 →)
Merge RAM Card Cmd Only useful on the 48.
--
Merges the RAM from the card in port 1 with the rest of main user memory. Merged memory is no longer independent.
--
Related: FREE,FREE1

1BCE3 xMIN
(x y → x')
Minumum Func
--
Returns the lesser (more negative) of its two arguments.
--

```
x       y       → min(x, y)
x       'sym'   → 'MIN(x, sym)'
'sym'   x       → 'MIN(sym, x)'
'sym1' 'sym2'   → 'MIN(sym1, sym2)'
x_u1    y_u2    → min(x_u1, y_u2)
```

--
Related: MAX

1AB01 xMINR
(→ MINR)
Minimum Real Func
--
Returns the symbolic constant 'MINR' or its numerical representation, 1.00000000000E-499.
--

```
→ 'MAXR'
→ 1.00000000000E-499
```

--
Related: e,i,MAXR,π

1FEB4 xMINSIGMA
(→ xmin)
(→ [x1...xn])
Minimum Sigma Cmd
--
Finds the minimum coordinate value in each of the m current statistics matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BINS,MAXΣ,MEAN,SDEV,TOT,VAR UserRPL: xMINΣ

1BE4D xMOD
(x y → x')
Modulo Func
--
Returns a remainder defined by: x mod y = x - y floor (x/y)
--

```
x       y       → x mod y
x       'sym'   → 'MOD(x, sym)'
'sym'   x       → 'MOD(sym, x)'
'sym1' 'sym2'   → 'MOD(sym1, sym2)'
```

--
Related: FLOOR,/

6.3 N-S

1A995 xNEG
(x → x')
Negate Analytic Func
--
Changes the sign or negates an object.
--
z → -z
#n1 → #n2
[arr] → [-arr]
'sym' → '-(sym)'
x_u → -x_u
grob1 → grob2
PICT1 → PICT2
--
Related: ABS,CONJ,NOT,SIGN

1A2BC xNEWOB
(ob → ob)
New Object Cmd
--
Creates a new copy of the specifiedfied object.
--
Related: MEM,PURGE

2324C xNEXT
(→)
NEXT Cmd
--
Ends definite loop structures. See the FOR and START command entries for syntax information.
--
Related: FOR,START,STEP

1E88F xNOT
(x → x')
NOT Cmd
--
Returns the one's complement or the logical inverse of the argument.
--
#n1 → #n2
T/F → 0/1
"str1" → "str2"
'sym' → 'NOT sym'
--
Related: AND,OR,XOR

1FDA6 xNSIGMA
(→ nrows)
Number of Rows Cmd
--
Returns the number of rows in the current statistical matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: ΣX,ΣXY,ΣX2,ΣY,ΣY2 UserRPL: xNΣ

1CB46 xNUM
($ → n)
Character Number Cmd
--
Returns the character code n for the first character in the string.
--
Related: CHR,POS,REPL,SIZE,SUB

1A5E4 x>NUM
(x → x')
Evaluate to Number Cmd
--
Evaluates a symbolic argument object and returns the numerical result.
--
objsym → z
--
Related: →Q,→Qpi UserRPL: x→NUM

1CF7B xOBJ>
(ob → ?)
Object to Stack Cmd
--
Separates an object into its components onto the stack. For some object types, the number of composites is returned to level 1.
--

```
(x,y)             →  x y
{obj1 ... objn}   → obj1 objn n
[x1 ... xn]       → x1 xn {n}
[[x11 ... xm n]] → x11 xm n {m n}
"obj"             → evaluated-obj
'sym'             → obj1 ... objn n func
x_u               → x 1_u
:tag:obj          → obj "tag"
```

--
Related: ARRY→,C→R,DTAG,EQ→, R→C,STR→,→TAG UserRPL: xOBJ→

1C5AA xOCT
(→)
Octal Mode Cmd
--
Selects octal base for binary integer operations. (The default base is decimal.)
--
Related: BIN,DEC,HEX,RCWS,STWS

1A31E xOFF
(→)
Off Cmd
--
Turns off the calculator.
--
Related: CONT,HALT,KILL

1EE38 xOLDPRT
Old Printer Cmd
--
Modifies the remapping string in the reserved variable PRTPAR so that the extended character set of the HP 48 matches that of the HP 82240A Infrared Printer. Not useful on the 49G.

21EB5 xOPENIO
(→)
Open I/O Port Cmd
--
Opens the serial port or the IR port using the I/O parameters in the reserved variable IOPAR.
--
<REF>TEXT:Reserved|IOPAR
--
Related: BUFLEN,CLOSEIO,SBRK,SRECV, STIME,XMIT

1E809 xOR
(x y → x')
OR Func
--
Returns the logical OR of two arguments.
--

```
#n1    #n2    → #n3
"str1" "str2" → "str3"
T/F1   T/F2   → 0/1
T/F    'sym'  → 'T/F OR sym'
'sym'  T/F    → 'sym OR T/F'
'sym1' 'sym2' → 'sym1 OR sym2'
```

--
Related: AND,NOT,XOR

20FD9 xORDER
({names} →)
Order Variables Cmd
--
Reorders the variables in the current directory (shown in the VAR menu) to the order specified.
--
Related: VARS

1FC29 xOVER
(1 2 → 1 2 1)
Over Cmd
--
Returns a copy to stack level 1 of the object in level 2.
--
Related: PICK,ROLL,ROLLD,ROT,SWAP

1E6C1 xPARAMETRIC
(→)
Parametric Plot Type Cmd
--
Sets the plot type to PARAMETRIC.
--
Related: BAR,CONTOUR,DIFFEQ,FUNCTION, GRIDMAP,HISTOGRAM,PARSURFACE,PCONTOUR, POLAR,SCATTER,SLOPEFIELD,TRUTH, WIREFRAME,YSLICE

2202C xPARITY
(n →)
Parity Cmd
--
Sets the parity value in the reserved variable IOPAR.
--
<REF>TEXT:Reserved|IOPAR
--
Related: BAUD,CKSM,TRANSIO

1A125 xPATH
(→ {HOME dir1 .. dirn})
Current Path Cmd
--
Returns a list specifying the path to the current directory.
--
Related: CRDIR,HOME,PGDIR,UPDIR

1E201 xPDIM
((xmin,ymin) (xmax,ymax) →)
(#width #height →)
PICT Dimension Cmd
--
Replaces PICT with a blank PICT of the specified dimensions.
--
Related: PMAX,PMIN

1C236 xPERM
(n k → n')
Permutations Func
--
Returns the number of possible permutations of n items taken m at a time.
--

```
n      m       → Pn,m
'symn' m       → 'PERM(symn,m)'
n      'symm'  → 'PERM(n,symm)'
'symn' 'symm'  → 'PERM(symn,symm)'
```

--
Related: COMB,!

2123A xPGDIR
(name →)
Purge Directory Cmd
--
Purges the named directory (whether empty or not).
--
Related: CLVAR,CRDIR,HOME,PATH,PURGE, UPDIR

1FC9A xPICK
(1...n n → 1..n 1)
Pick Object Cmd
--
Copies the contents of a specified level to level 1.
--
Related: DUP,DUPN,DUP2,OVER,ROLL,ROLLD, ROT,SWAP

1E436 xPICT
(→ PICT)
PICT Cmd
--
Puts the name PICT on the stack.
--
Related: GOR,GCOR,NEG,PICTURE,PVIEW, RCL,REPL,SIZE,STO,SUB

1E2BA xGRAPH
(→)
Picture Environment Cmd
--
Selects the Picture environment (selects the graphics display and activates the graphics cursor and Picture menu).
--
Related: PVIEW,TEXT,PIC UserRPL: xPICTURE

1E36E xPIX?
((x,y) → 1/0)
({#n #m} → 1/0)
Pixel On? Cmd
--
Tests whether the specified pixel in PICT is on; returns 1 (true) if the pixel is on, and 0 (false) if the pixel is off.
--
Related: PIXON,PIXOFF

1E344 xPIXOFF
((x,y) →)
({#n #m} →)
Pixel Off Cmd
--
Turns off the pixel at the specified coordinate in PICT.
--
Related: PIX?,PIXON

1E31A xPIXON
((x,y) →)
({#n #m} →)
Pixel On Cmd
--
Turns on the pixel at the specified coordinate in PICT.
--
Related: PIX?,PIXOFF

220DD xPKT
($data $type → $response)
Packet Cmd
--
Used to send command "packets" (and receive requested data) to a Kermit server.
--
Related: CLOSEIO,KERRM,SERVER

1E09E xPMAX
((x,y) →)
PICT Maximum Cmd
--
Specifies (x,y) as the coordinates at the upper right corner of the display.
--
Related: PDIM,PMIN,XRNG,YRNG

1E07E xPMIN
((x,y) →)
PICT Minimum Cmd
--
Specifies (x,y) as the coordinates at the lower left corner of the display.
--
Related: PDIM,PMAX,XRNG,YRNG

1CAB4 xPOS
(str substring → n/0)
({} ob → n/0)
Position Cmd
--
Returns the position of a substring within a string or the position of an object within a list.
--
Related: CHR,NUM,REPL,SIZE,SUB

1EE53 xPR1
(ob → ob)
Print Level 1 Cmd
--
Prints an object in multiline printer format.
--
Related: CR,DELAY,OLDPRT,PRTLCD,PRST, PRSTC,PRVAR

1FF7A xPREDV
(x → y)
Predicted y-Value Cmd
--
Returns the predicted dependent variable value ydepend, based on the independent-variable value xindep, the currently selected stat model, and the current regression coefficients in the reserved variable ΣPAR.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: PREDX

1FFBA xPREDX
(y → x)
Predicted x-Value Cmd
--
Returns the predicted dependent variable value xindepend, based on the independent-variable value ydepend, the currently selected stat model, and the current regression coefficients in the reserved variable ΣPAR.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: COLΣ,CORR,COV,EXPFIT, ΣLINE,LINFIT,LOGFIT,LR, PREDY,PWRFIT,XCOL,YCOL

1FF9A xPREDY
(x → y)
Predicted y-Value Cmd
--
Returns the predicted dependent variable value ydepend, based on the independent-variable value xindepend, the currently selected stat model, and the current regression coefficients in the reserved variable ΣPAR.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: COLΣ,CORR,COV,EXPFIT, ΣLINE,LINFIT,LOGFIT,LR, PREDX,PWRFIT,XCOL,YCOL

1EF63 xPRLCD
(→)
Print LCD Cmd
--
Prints a pixel-by-pixel image of the current display (excluding the annunciators)
--
Related: CR,DELAY,OLDPRT,PRST,PRSTC, PRVAR,PR1

23824 xPROMPT
($ →)
Prompt Cmd
--
Displays the contents of "prompt" in the status area, and halts program execution.
--
Related: CONT,DISP,FREEZE,HALT,INFORM, INPUT,MSGBOX

1EE89 xPRST
(→)
Print Stack Cmd
--
Prints all objects in the stack, starting with the object in the highest level.
--
Related: CR,DELAY,OLDPRT,PRLCD,PRSTC, PRVAR,PR1

1EE6E xPRSTC
Print Stack (Compact) Cmd
--
Prints in compact form all objects in the stack, starting with the object in the highest level.
--
Related: PR,DELAY,OLDPRT,PRLCD,PRST, PRVAR,PR1

1EEBF xPRVAR
(name →)
({names} →)
(:port:name →)
Print Variable Cmd
--
Searches the current directory path or port for the specified variables and prints the name and contents of each variable.
--
Related: CP,DELAY,OLDPRT,PR1,PRLCD, PRST,PRSTC

20EFE xPURGE
(name →)
({names} →)
(PICT →)
Purge Cmd
--
Purges the named variables or empty subdirectories from the current directory.
--
Related: CLEAR,CLVAR,NEWOB,PGDIR

1D407 xPUT
(ob pos obj → ob')
ob = [] or [[]] or {} or name
pos = n or {n} or {n m}
Put Element Cmd
--
In the level 3 array or list, PUT replaces with zput or objput the object whose position is specified in level 2; if the array or list is unnamed, returns the new array or list.
--
Related: GET,GETI,PUTI

1D5DF xPUTI
(ob pos obj → [] pos')
ob = [] or [[]] or {} or name
pos = n or {n} or {n m}
Put and Increment Index Cmd
--
In the level 3 array or list, replaces with zput or objput the object whose position is specified in level 2, returning the new array or list and the next position in that array or list.
--
Related: GET,GETI,PUT

211FC xPVARS
(nport → {} mem)
Port-Variables Cmd
--
Returns a list of the backup objects (:nport:name) and the lib- rary objects (:nport:nlibrary) in the specified port. Also returns the available memory size (if RAM) or the memory type.
--
Related: VARS

1E2F0 xPVIEW
((x,y) →)
({#n #m} →)
PICT View Cmd
--
Displays PICT with the specified coordinate at the upper left corner of the graphics display.
--
Related: FREEZE,PICTURE,PICT,TEXT

20220 xPWRFIT
Power Curve Fit Cmd
--
Stores PWRFIT as the fifth parameter in the reserved variable ΣPAR, indicating that subsequent executions of LR are to use the power curve fitting model.
--
<REF>TEXT:Reserved|ΣPAR
--
Related: BESTFIT,EXPFIT,LINFIT, LOGFIT,LR

1E27A xPX>C
({#m #n} → (x,y))
Pixel to Complex Cmd
--
Converts the specified pixel coordinates to user-unit coordinates.
--
Related: C→PX UserRPL: xPX→C

1F9C4 x->Q
(x → a/b)
To Quotient Cmd
--
Returns a rational form of the argument.
--
```
x       → 'a/b'
(x,y)   → 'a/b+c/d*i
'sym1'  → 'sym2'
```
--
Related: →Qπ,/ UserRPL: x→Q

1F9E9 x->QPI
(x → symb)
To Quotient Times π Cmd
--
Returns a rational form of the argument, or a rational form of the argument with π factored out, whichever yields the smaller denominator.
--
x → 'a/b*π'
x → 'a/b'
'sym1' → 'symb2'
(x,y) → 'a/b*π+c/d*π*i
(x,y) → 'a/b+c/d*i
--
Related: →Q,/,π UserRPL: x→Qπ

20AB3 xQUAD
(symb var → symb')
Solve Quadratic Equation Cmd
--
Solves an algebraic object symb for the variable var, and returns an expression symb' representing the solution.
--
Related: COLCT,EXPAN,ISOL,SHOW,SOLVE

1F500 xQUOTE
(ob → 'ob)
Quote Argument Func
--
Returns its argument unevaluated.
--
'sym' → 'sym'
obj → obj
--
Related: APPLY,|

1C3B4 xRAD
(→)
Radians Mode Cmd
--
Sets Radians angle mode.
--
Related: DEG,RAD

1C1B9 xRAND
(→ x)
Random Number Cmd
--
Returns a pseudo-random number generated using a seed value, and updates the seed value.
--
Related: COMB,PERM,RDZ,!

1FB5D xPREDIV

(x y → x/y)
Prefix Divide Func
--
Prefix form of / (divide) generated by the Equation Writer Application.
--

```
z1      z2       → z1/z2
[arr]   [[mat]]  → [[arrmat^-1]]
[arr]   z        → [arr/z]
z       'sym'    → 'z/sym'
'sym'   z        → 'sym/z'
'sym1'  'sym2'   → 'sym1/sym2'
#n1     n2       → #n3
n1      #n2      → #n3
#n1     #n2      → #n3
x_u1    y_u2     → (x/y)_u1/u2
x       y_u      → (x/y)_1/u
x_u     y        → (x/y)_u
'sym'   x_u      → 'sym/x_u'
x_u     'sym'    → 'x_u/sym'
```

--
Related: / UserRPL: xRATIO

1F133 xRCEQ

(→ EQ)
Recall from EQ Cmd
--
Returns the unevaluated contents of the reserved variable EQ from the current directory.
--
<REF>TEXT:Reserved|EQ
--
Related: STEQ

20B40 xRCL

(var → x)
(:port:nlib → lib)
(:port:name → ob)
(:port:{path} → ob)
Recall Cmd
--
Returns the unevaluated contents of a specified variable or plug -in object.
--
Related: STO

19928 xRCLALARM

(n → {date time action rep})
Recall Alarm Cmd
--
Recalls a specified alarm.
--
Related: DELALARM,FINDALARM,STOALARM

1C619	xRCLF	(→ {#s1 #u1 #s2 #u2}) Recall Flags Cmd -- Returns a list containing four 64 bit binary integers representing the states of the 64 system and user flags, respectively. -- Related: STOF
22586	xRCLKEYS	(→ {ob ... key ...}) (→ {S ob ... key ...}) Recall Key Assignments Cmd -- Returns the current user key assignments. This includes an S if the standard key definitions are active (not suppressed) for those keys without user key assignments. -- Related: ASN,DELKEYS,STOKEYS
211E1	xRCLMENU	(→ x) Recall Menu Number Cmd -- Returns the menu number of the currently displayed menu. -- Related: MENU,TMENU
1FD46	xRCLSIGMA	(→ [[]]) Recall Sigma Cmd -- Returns the current stat matrix (the contents of reserved var ΣDAT) from the current directory. -- <REF>TEXT:Reserved|ΣDAT -- Related: CLΣ,STOΣ,Σ+,Σ- UserRPL: xRCLΣ
1C5FE	xRCWS	(→ n) Recall Wordsize Cmd -- Returns the current wordsize in bits (1 through 64). -- Related: BIN,DEC,HEX,OCT,STWS

1D0DF xRDM

(ob size → ob')
(name size →)
ob= [] or [[]]
size = {n} or {n m}
Redimension Array Cmd
--
Rearranges the elements of the argument according to the specified dimensions.
--
Related: TRN

1C1D4 xRDZ

(x →)
Randomize Cmd
--
Uses a real number xseed as a seed for the RAND command.
--
Related: COMB,PERM,RAND,!

1C7CA xRE

((x,y) → x)
([] → []')
Real Part Func
--
Returns the real part of the argument.
--
x → x
x_u → x
(x,y) → x
[R-arr] → [R-arr]
[C-arr] → [R-arr]
'sym' → 'RE(sym)'
--
Related: C→R,IM,R→C

21F62 xRECN

(name →)
($name →)
Receive Renamed Object Cmd
--
Prepares the HP 48 to receive a file from another Kermit device, and to store the file in a specified variable.
--
Related: BAUD,CKSM,CLOSEIO,FINISH, KERRM,KGET,PARITY,RECV,SEND, SERVER,TRANSIO

21F96	xRECV	(→) Receive Object Cmd -- Instructs the HP 48 to look for a named file from another Kermit device. The received file is stored in a variable named by the sender. -- Related: BAUD,CKSM,FINISH,KGET,PARITY, RECN,SEND,SERVER,TRANSIO
2305D	xREPEAT	(1/0 →) REPEAT Cmd -- Starts loop clause in WHILE ... REPEAT ... END indefinite loop structure. -- Related: END,WHILE
1C8EA	xREPL	(ob pos new → ob') ob= [[]] or [] or {} or $ or PICT pos= N or {n m} or (n,m) Replace Cmd -- Replaces a portion of the level 3 target object with the level 1 object, beginning at a position specified in level 2. -- Related: CHR,GOR,GXOR,NUM,POS,SIZE,SUB
1E126	xRES	(n_int →) (#n_int →) Resolution Cmd -- Specifies the resolution of mathematical and statistical plots, where the resolution is the interval between values of the independent variable used to generate the plots. -- Related: BAR,CONIC,DIFFEQ,FUNCTION, GRIDMAP,HISTOGRAM,PARAMETRIC,PARSURFACE, PCONTOUR,POLAR,SCATTER,SLOPEFIELD, TRUTH,WIREFRAME,YSLICE

2133C xRESTORE
(:port:name →)
(ob →)
Restore HOME Cmd
--
Replaces the current HOME directory with the specified backup copy.
--
```
:nport:namebackup → obj
backup            →
```
--
Related: ARCHIVE

1959B xRL
(# → #')
Rotate Left Cmd
--
Rotates a binary integer one bit to the left.
--
Related: RLB,RR,RRB

195BB xRLB
(# → #')
Rotate Left Byte Cmd
--
Rotates a binary integer one byte to the left.
--
Related: RL,RR,RRB

1BD55 xRND
(x n → x')
Round Func
--
Rounds an object to a specified number of decimal places or significant digits, or to fit the current display format.
--
```
z1     nrnd     → z2
z      'symrnd' → 'RND(z,symrnd)'
'sym'  nrnd     → 'RND(symb,nrnd)'
'sym1' 'symrnd' → 'RND(sym1,symrnd)'
[arr1] nrnd     → [arr2]
x_u    nrnd     → y_u
x_u    'symrnd' → 'RND(x_u,symrnd)'
```
--
Related: TRNC

1BF9E xRNRM
([] → x)
Row Norm Cmd
--
Returns the row norm (infinity norm) of its argument array.
--
Related: CNRM,CROSS,DET,DOT

1FCB5 xROLL
(1...n n → 2...n 1)
Roll Objects Cmd
--
Moves the contents of a specified level to level 1, and rolls upwards the portion of the stack beneath the specified level.
--
Related: OVER,PICK,ROLLD,ROT,SWAP

1FCD0 xROLLD
(n ... 1 n → 1 n...2)
Roll Down Cmd
--
Moves the contents of level 1 to a specified level, and rolls downwards the portion of the stack beneath the specified level
--
Related: OVER,PICK,ROLL,ROT,SWAP

1F16E xROOT
(prog/s var guess → x)
(prog/s var {guesses} → x)
Root-Finder Cmd
--
Returns a real number xroot that is a value of the specified variable var for which the specified program or algebraic object most nearly evaluates to zero or a local extremum.

1FC0E xROT
(1 2 3 → 2 3 1)
Rotate Objects Cmd
--
Rotates the first three objects on the stack, moving the object in level 3 to level 1.
--
Related: OVER,PICK,ROLL,ROLLD,SWAP,UNROT

195DB xRR
(# → x')
Rotate Right Cmd
--
Rotates a binary integer one bit to the right.
--
Related: RL,RLB,RRB

195FB xRRB
(# → x')
Rotate Right Byte Cmd
--
Rotates a binary integer one byte to the right.
--
Related: RL,RLB,RR

1C03E xRSD
([B] [[A]] [Z] → []')
([[B]] [[A]] [[Z]] → [[]]')
Residual Cmd
--
Computes the residual B - AZ of the arrays B, A, and Z.

20A7D xRULES

1969B xR>B
(x → #)
Real to Binary Cmd
--
Converts a positive real integer to its binary integer equivalent.
--
Related: B→R UserRPL: xR→B

1C79E xR>C
(x y → (x,y))
([X] [Y] → [(x,y)])
Real to Complex Cmd
--
Combines two real numbers or real arrays into a single complex number or array.
--
Related: C→R,IM,RE UserRPL: xR→C

1BEF4 xR>D
(x → (180/π)x)
Radians to Degrees Func
--
Converts a real number expressed in radians to its equivalent in degrees.
--
x → (180/π)x
'sym' → 'R→D(sym)'
--
Related: D→R UserRPL: xR→D

1E761 xSAME
(ob1 ob2 → 1/0)
Display information about the makers of the calculator. Same Object Cmd
--
Compares two objects, and returns a true result (1) if they are identical, and a false result (0) if they are not.
--
Related: TYPE,==

220C2 xSBRK
(→)
Serial Break Cmd
--
Interrupts serial transmission or reception.
--
Related: BUFLEN,SRECV,STIME,XMIT

1E1E1 xSCALE
(xs ys →)
Scale Plot Cmd
--
Adjusts the first two parameters in PPAR, (xmin, ymin) and (xmax, ymax), so that xscale and yscale are the new plot horizontal and vertical scales, and the center point doesn't change.
--
<REF>TEXT:Reserved|PPAR
--
Related: AUTO,CENTR,SCALEH,SCALEW

1E150 x*H
(xf →)
Multiply Height Cmd
--
Multiplies the vertical plot scale by xfactor.
--
Related: AUTO,SCALEW,YRING UserRPL: xSCALEH

1E170 x*W
(yf →)
Multiply Width Cmd
--
Multiplies a plot's horizontal scale by xfactor.
--
Related: AUTO,SCALEH,YRING UserRPL: xSCALEW

2018C xSCATRPLOT
(→)
Draw Scatter Plot Cmd
--
Draws a scatter plot of (x, y) data points from the specified columns of the current statistics matrix (reserved variable ΣDAT).
--
Related: BARPLOT,PICTURE,HISTPLOT, PVIEW,SCLΣ,XCOL,YCOL

1E701 xSCATTER
Scatter Plot Type Cmd
--
Sets the plot type to SCATTER.
--
Related: BAR,CONIC,DIFFEQ,FUNCTION, GRIDMAP,HISTOGRAM,PARAMETRIC,PARSURFACE, PCONTOUR,POLAR,SLOPEFIELD,TRUTH, WIRE-FRAME,YSLICE

1C41E xSCI
(n →)
Scientific Mode Cmd
--
Sets the number display format to Scientific mode, which displays one digit to the left of the fraction mark and n significant digits to the right.
--
Related: ENG,FIX,STD

200C4 xSCLSIGMA
(→)
Scale Sigma Cmd
--
Adjusts (xmin,ymin) and (xmax, ymax) in PPAR so that a subsequent scatter plot exactly fills PICT.
--
<REF>TEXT:Reserved|PPAR
--
Related: AUTO,SCATRPLOT UserRPL: xSCLΣ

203CC xSCONJ
(name →)
Store Conjugate Cmd
--
Conjugates the contents of a named object.
--
Related: CONJ,SINV,SNEG

1FECF xSDEV
(→ xsdev)
(→ [x1...xn])
Standard Deviation Cmd
--
Calculates the sample standard deviation of each of the m columns of coordinate values in the current stat matrix (reserved var ΣDAT).
--
Related: MAXΣ,MEAN,MINΣ,PSDEV, PVAR,TOT,VAR

21EF0 xSEND
(name →)
({names} →)
({{old new}...} →)
Send Object Cmd
--
Sends a copy of the named object to a Kermit device.
--
Related: BAUD,CLOSEIO,CKSM,FINISH, KERRM,KGET,PARITY,RECN, RECV,SERVER,TRANSIO

21FD1 xSERVER
(→)
Server Mode Cmd
--
Selects Kermit Server mode.
--
Related: BAUD,CKSM,FINISH,KERRM, KGET,PARITY,PKT,RECN,RECV, SEND,TRANSIO

1C274 xSF
(n →)
Set Flag Cmd
--
Sets a specified user or system flag.
--
Related: CF,FC?,FC?C,FS?,FS?C

20AD3 xSHOW
(symb name → symb')
(symb {names} → symb')
Show Variable Cmd
--
Returns symb' which is equivalent to symb except that all implicit references to a variable name are made explicit.
--
Related: COLCT,EXPAN,ISOL,QUAD

1B32A xSIGN
(x → x')
Sign Func
--
Returns the sign of a real number argument, the sign of the numerical part of a unit object argument, or the unit vector in the direction of a complex number argument.
--
Related: ABS,MANT,XPON

1B4AC xSIN
(x → x')
Sine Analytic Func
--
```
z          → sin z
'sym'      → 'SIN(sym)'
x_uangular → sin(x_uangular)
```
--
Related: ASIN,COS,TAN

1B5B7 xSINH
(x → x')
Hyperbolic Sine Analytic Func
--
Returns the hyperbolic sine of the argument.
--
z → sinh z
'sym' → 'SINH(sym)'
--
Related: ANUSH,COSH,TANH

202CE xSINV
(name →)
Store Inverse Cmd
--
Replaces the contents of the named variable with its inverse.
--
Related: INV,SCONJ,SNEG

1C9B8 xSIZE
(ob → n)
(ob → {N m})
(ob → #nw #nh)
Size Cmd
--
Returns the number of characters in a string, the number of elements in a list, the dimensions of an array, the number of objects in a unit object or algebraic object, or the dimensions of a graphics object.
--
"str" → n
{ list } → n
[vector] → { n }
[[mat]] → { n m }
'sym' → n
grob → #nwidth #mheight
PICT → #nwidth #mheight
x_u → n
--
Related: CHR,NUM,POS,REPL,SUB

1961B xSL
(# → #')
Shift Left Cmd
--
Shifts a binary integer one bit to the left.
--
Related: ASR,SLB,SR,SRB

1963B xSLB
(# → #')
Shift Left Byte Cmd
--
Shifts a binary integer one byte to the left.
--
Related: ASR,SL,SR,SRB

2034D xSNEG
(name →)
Store Negate Cmd
--
Replaces the contents of a variable with its negative.
--
Related: NEG,SCONJ,SINV

1B426 xSQ
(x → x')
Square Analytic Func
--
Returns the square of the argument.
--
z → z2
x_u → x2_u2
[[mat]] → [[mat mat]]
'sym' → 'SQ(sym)'
--
Related: $\sqrt{a}$,^

1965B xSR
(# → #')
Shift Right Cmd
--
Shifts a binary integer one bit to the right.
--
Related: ASR,SL,SLB,SRB

1967B xSRB
(# → #')
Shift Right Byte Cmd
--
Shifts a binary integer one byte to the right.
--
Related: ASR,SL,SLB,SR

21E95 xSRECV
(n → $ 0/1)
Serial Receive Cmd
--
Reads up to n characters from the serial input buffer and returns them as a string, along with a digit indicating whether errors occurred.
--
Related: BUFFLEN,CLOSEIO,OPENIO, SBRK,STIME,XMIT

23103 xSTART
(start finish →)
START Definite Loop Structure Cmd
--
START xstart xfinish →
NEXT xstart xfinish →
STEP xincrement →
STEP 'symbincrement' →
--
Related: FOR,NEXT,STEP

1C486 xSTD
(→)
Standard Mode Cmd
--
Sets the number display format to Standard mode.
--
Related: ENG,FIX,SCI

23380 xSTEP
(n →)
(symb →)
STEP Cmd
--
Defines the increment (step) value, and ends definite loop struct See the FOR and START command entries for syntax information.
--
Related: FOR,BEXT,START

1F14E xSTEQ
(ob →)
Store in EQ Cmd
--
Stores an object into the reserved variable EQ in the current directory.
--
<REF>TEXT:Reserved|EQ
--
Related: RCEQ

220A2 xSTIME
(x/0 →)
Serial Time-Out Cmd
--
Specifies the period that SRECV (serial reception) and XMIT (serial transmission) wait before timing out.
--
Related: BUFLEN,CLOSEIO,SBRK,SRECV,XMIT

20CCD xSTO
(ob name →)
(ob :port:name →)
(lib port →)
(bup port →)
(ob 'name(i)' →)
Store Cmd
--
Stores an object into a specified variable or object.
--
Related: DEFINE,RCL,→

20538 xSTO-
(ob name →)
(name ob →)
Store Minus Cmd
--
Calculates the difference between a number (or other object) and the contents of a specified variable, and stores the new value to the specified variable.
--
Related: STO+,STO*,STO/,-

20753 xSTO*
(ob name →)
(name ob →)
Store Times Cmd
--
Multiplies the contents of a specified variable by a number or other object.
--
Related: STO+,STO-,STO/,*

2060C xSTO/
(ob name →)
(name ob →)
Store Divide Cmd
--
Calculates the quotient of a number (or other object) and the contents of a specified variable, and stores the new value to the specified variable.
--
Related: STO+,STO-,STO*,/

2044B xSTO+
(ob name →)
(name ob →)
Store Plus Cmd
--
Adds a number or other object to the contents of a specified variable.
--
Related: STO-,STO*,STO/,+

198FE xSTOALARM
(time → n)
({date time act rep} → n)
Store Alarm Cmd
--
Stores an alarm in the system alarm list and returns its alarm index number. act and rep arguments are optional.
--
Related: DELALARM,FINDALARM,RCLALARM

1C67F xSTOF
({#s1 #u1 #s2 #u2} →)
Store Flags Cmd
--
Sets the states of the system flags or the system and user flags.
--
Related: RCLF,STWS,RCWS

22514 xSTOKEYS
({ob key ...} →)
({'S' ob key ...} →)
('S' →)
Store Key Assignments Cmd
--
Defines multiple keys on the user keyboard by assigning objects to specified keys.
--
Related: ASN,DELKEYS,RCLKEYS

1FD0B xSTOSIGMA
(ob →)
Store Sigma Cmd
--
Stores obj in the reserved variable ΣDAT.
--
Related: CLΣ,RCLΣ,Σ+,Σ- UserRPL: xSTOΣ

1CB26 xSTR>
($ → ob)
Evaluate String Cmd
--
Evaluates the text of a string as if the text were entered from the command line.
--
Related: ARRY→,DTAG,EQ→,LIST→, OBJ→,→STR UserRPL: xSTR→

1CB0B x>STR
(ob → $)
Object to String Cmd
--
Converts any object to string form.
--
Related: →ARRY,→LIST,STR→, →TAG,→UNIT UserRPL: x→STR

1C5C5 xSTWS

(n →)
(#n →)
Set Wordsize Cmd
--
Sets the current binary integer wordsize to n bits, where n is a value from 1 through 64 (the default is 64).
--
Related: BIN,DEC,HEX,OCT,RCWS

1C85C xSUB

(ob start end → ob')
ob= [[]], $, {}, grob, PICT
start,end = n, {n m}, (n,m)
Subset Cmd
--
Returns the portion of a string or list defined by specified positions, or returns the rectangular portion of a graphics object or PICT defined by two corner pixel coordinates.
--
Related: CHR,GOR,GXOR,NUM,POS,REPL,SIZE

1FBBD xSWAP

(ob1 ob2 → ob2 ob1)
Swap Objects Cmd
--
Interchanges the first two objects on the stack.
--
Related:
DUP,DUPN,DUP2,OVER,PICK,ROLL,ROLLD,ROT

1A52E xSYSEVAL

(# → ?)
Evaluate System Object Cmd
--
Evaluates unnamed operating system objects specified by their memory addresses.
--
Related: EVAL,LIBEVAL,FLASHEVAL

6.4 T-Z

1C0D7 x%T

(x y → 100y/x)
Percent of Total Function
--
Returns the percent of the level 2 argument that is represented by the level 1 argument.
--

```
x       y       → 100y/x
x       'sym'   → '%T(x,sym)'
'sym'   x       → '%T(sym,x)'
'sym1'  'sym2'  → '%T(sym1,sym2)'
x_u1    y_u2    → 100y_u2/x_u1
x_u     'sym'   → '%T(x_u,sym)'
'sym'   x_u     → '%T(sym,x_u)'
```

--
Related: %,%ch

225BE x->TAG

(ob tag → :tag:ob)
Stack to Tag Cmd
--
Combines objects in levels 1 and 2 to created tagged (labeled) object. Tag may be any object. It will eb converted to a string.
--
Related: →ARRY,DTAG,→LIST,OBJ→, →STR,→UNIT UserRPL: x→TAG

1B55E xTAN

(x → x')
Tangent Analytic Func
--
Returns the tangent of the argument.
--

```
z          → tan z
'sym'      → 'TAN(symb)'
x_unitang  → tan(x_unitang)
```

-
Related: ATAN,COS,SIN

1B655 xTANH

(x → x')
Hyperbolic Tangent Analytic Func
--
Returns the hyperbolic tangent of the argument.
--

```
z      → tanh z
'sym'  → 'TANH(sym)'
```

-
Related: ATANH,COSH,SINH

20B20 xTAYLR
(symb var n → symb')
Taylor's Polynomial Cmd
--
Calculates the nth order Taylor's polynomial of 'symb' in the variable var.
--
Related: ∂,$\int$,Σ

1E606 xTEXT
(→)
Show Stack Display Cmd
--
Displays the stack display.
--
Related: PICTURE,PVIEW

22EFA xTHEN
(0/1 →)
THEN Cmd
--
Starts the true-clause in conditional or error-trapping structure
--
Related: CASE,ELSE,END,IFERR

237A8 xTHENCASE
THEN in a CASE statement.
--
Related: CASE,ELSE,END,IFERR UserRPL: xTHEN

2371F xERRTHEN
THEN in an ON ERROR construct.
--
Related: CASE,ELSE,END,IFERR UserRPL: xTHEN

1982D xTICKS
(→ #)
Ticks Cmd
--
Returns the system time as a binary integer, in units of 1/8192 second.
--
Related: TIME

197F7 xTIME
(→ time)
Time Cmd
--
Returns the system time in the form HH.MMSSs.
--
Related: DATE,TICKS,TSTR

198BE xSETTIME
(time →)
Set System Time Cmd
--
Sets the system time.
--
Related: CLKADJ,→DATE UserRPL: x→TIME

1E3C2 xTLINE
((x1,y1) (x2,y2) →)
({#n1 #m1} {#n2 #m2} →)
Toggle Line Cmd
--
For each pixel along the line in PICT defined by the specified coordinates, TLINE turns off every pixel that is on, and turns on every pixel that is off.
--
Related: ARC,BOX,LINE

2115D xTMENU
(% → [InitMenu%])
({} →)
(name →)
(Ob → [@LIST InitMenu])
Temporary Menu Cmd
--
Displays a built-in menu, libary menu, or a user-defined menu.
--
Related: MENU,RCLMENU

1FEEA xTOT
(→ xsum)
(→ {x1...xn})
Total Cmd
--
Computes the sum of each of the m columns of coordinate values in the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: MAXΣ,MINΣ,MEANMPSDEV, PVAR,SDEV,VAR

2204C xTRANSIO
(n →)
I/O Translation Cmd
--
Specifies the character translation option. These translations affect only ASCII Kermit transfer and files printed to the serial port.
--
Related: BAUD,CKSM,PARITY

1D392 xTRN
([[]] → [[]]')
(name →)
Transpose Matrix Cmd
--
Returns the (conjugate) transpose of a matrix.
--
Related: CONJ

1BDD1 xTRNC
(x n →)
Truncate Func
--
Truncates an object to a specified number of decimal places or significant digits, or to fit the current display format.
--
```
z1       ntrnc     → z2
z1       'symtrnc' →
'TRNC(z1,symtrnc)'
'sym1'   ntrnc     →
'TRNC(sym1,ntrnc)'
'sym1'   'symtrnc' →
'TRNC(sym1,symtrnc)'
[ arr ]1 ntrnc     → [ arr ]2
x_u      ntrnc     → y_u
x_u      'symtrnc' →
'TRNC(x_u,symtrnc)'
```
--
Related: RND

1E6E1 xTRUTH
(→)
Truth Plot Type Cmd
--
Sets the plot type to TRUTH.
--
Related: BAR,CONIC,DIFFEQ,FUNCTION, GRIDMAP,HISTOGRAM,PARAMETRIC,PARSURFACE, PCONTOUR,POLAR,SCATTER,SLOPEFIELD,WIREFRAME,YSLIC

19992 xTSTR
(date time → $)
Date and Time String Cmd
--
Returns a string derived from the date and time.
--
Related: DATE,TICKS,TIME

`1A1AF` `xTVARS`

`( ntype → {} )`
`( {n...} → {} )`
Typed Variables Cmd
--
Lists all global variables in the current directory that contain objects of the specified types.
--
Related: PVARS,`TYPE`,VARS

1CB86 xTYPE (ob → %type)

Type Cmd

--

Returns the type number of an object.

--

User Objects:

--

Object	Type	Number
Real	number	0
Complex	number	1
Character	string	2
Real	Array	3
Complex	Array	4
List		5
Global	name	6
Local	name	7
Program		8
Algebraic	Object	9
Binary	Integer	10
Graphics	object	11
Tagged	object	12
Unit	object	13
XLIB	name	14
Directory		15
Library		16
Backup	object	17

--

Built-in Cmds:

--

Object	Type	Number
Built-in	function	18
Built-in	command	19

--

System Objects:

--

Object	Type	Number
System	binary	20
Extended	real	21
Extended	complex	22
Linked	array	23
Character		24
Code	object	25
Library	data	26
External	object	26-31

--

Related: SAME,TVARS,VTYPE

19771 xUBASE
(u → u')
Convert to SI Base Units Func
--
Converts a unit object to SI base units.
--
x_u → y_base-units
'sym' → 'UBASE(symb)'
--
Related: CONVERT,UFACT,→UNIT,UVAL

197A5 xUFACT
(u1 u2 → u3)
Factor Unit Cmd
--
Factors the level 1 unit from the unit expression of the level 2 unit object.
--
Related: CONVERT,UBASE,→UNIT,UVAL

1974F x>UNIT
(x u → u')
Stack to Unit Object Cmd
--
Creates a unit object from a real number and the unit part of a unit object.
--
Related: →ARRY,→LIST,→STR,→TAG UserRPL: x→UNIT

230ED xUNTIL
(→)
UNTIL Cmd
--
Starts test-clause in
DO ... UNTIL ... END
indefinite loop structure.
--
See the DO entry for syntax info.
--
Related: DO,END

1A15B xUPDIR
(→)
Up Directory Cmd
--
Makes the parent of the current directory the new current directory.
--
Related: CRDIR,HOME,PATH,PGDIR

2001A xUTPC
(n x → x')
Upper Chi-Square Distribution Cmd
--
Returns the probability utpc(n,x) that a chi-square random variable is greater than x, where n is the number of degrees of freedom of the distribution.
--
Related: UTPF,UTPN,UTPT

2005A xUTPF
(n1 n2 x → x')
Upper Snedecor's F Distrib. Cmd
--
Returns the probability utpf(n1,n2,x) that a Snedecor's F random variable is greater than x, where n1 and n2 are the numerator and denominator degrees of freedom of the F distribution.
--
Related: UTPC,UTPN,UTPT

2003A xUTPN
(n v x → x')
Upper Normal Distribution Cmd
--
Returns the probability utpn(m,v,x) that a normal random variable is greater than x, where m and v are the mean and variance, respectively, of the normal distribution.
--
Related: UTPC,UTPF,UTPT

2007A xUTPT
(n x → x')
Upper Student's t Distrib. Cmd
--
Returns the probability utpt(n,x) that a Student's t random variable is greater than x, where n is the number of degrees of freedom of the distribution.
--
Related: UTPC,UTPF,UTPN

1971B xUVAL
(u → x)
Unit Value Func
--
Returns the numerical part of a unit object.
--
x_u → x
'sym' → 'UVAL(sym)'
--
Related: CONVERT,UBASE,UFACT,→UNIT

1DD06 xV>

([]/() → x y)
([]/() → x y z)
(in current co-system)
Vector/Complex Num to Stack Cmd
--
[x y] → x y
[xr ANGyθ] → xr yθ
[x1 x2 x3] → x1 x2 x3
[x1 ANGxθ xz] → x1 xθ xz
[x1 ANGxθ ANGx] → x1 xθ x
[x1 x2 ... xn] → x1 ... xn
(x,y) → x y
(xr ANGyθ) → xr yθ
--
Related: →V2,→V3 UserRPL: xV→

1DE66 x>V2

(x y → [])
(x y → ())
Stack to Vector/Complex Num Cmd
--
Converts two numbers from the stack into a 2-element vector or complex number.
--
Related: V→,→V3 UserRPL: x→V2

1DEC2 x>V3

(x y z → [])
Stack to 3-Element Vector Cmd
--
Converts three numbers into a 3-element vector.
--
Related: V→,→V2 UserRPL: x→V3

1FF05 xVAR

(→ x)
(→ [x1...xn])
Variance Cmd
--
Calculates the sample variance of the coordinate values in each of the m columns in the current stat matrix (ΣDAT).
--
Related: MAXΣ,MEAN,MINΣ,PSDEV,PVAR, SDEV,TOT

1A194 xVARS

(→ {})
Variables Cmd
--
Returns a list of all variables' names in the VAR menu (the current directory).
--
Related: ORDER,PVARS,TVARS

1CE28 xVTYPE
(name → n)
Variable Type Cmd
--
Returns the type number of the object contained in the named variable.
--
'name' → ntype
:nport:namebackup → ntype
:nport:nlibrary → ntype
--
Related: TYPE

1A71F xWAIT
(sec →)
(0 → rc.p)
Wait Cmd
--
Suspends program execution for specified time, or until a key is pressed.
--
Related: KEY

23033 xWHILE
(→)
WHILE Indefinite Loop Struct Cmd
--
Starts the
WHILE ... REPEAT ... END
indefinite loop structure.
--
Related: DO,END,REPEAT

19848 xWSLOG
(→ $ $ $ $)
Warmstart Log Cmd
--
Returns four strings recording the date, time, and cause of the four most recent warmstart events

1FE2D xSUMX2
(→ xsum)
Sum of Squares of x-Values Cmd
--
Sums the squares of the values in the independent-variable column of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: NΣ,XCOL,ΣX,ΣXY,ΣX2,ΣY,ΣY2 UserRPL: xΣX2

1FFDA xXCOL
(n →)
Independent Column Cmd
--
Specifies the independent variable column of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT

21E75 xXMIT
($ → 1)
($ → $rest 0)
Serial Transmit Cmd
--
Sends a string serially without using Kermit protocol, and returns a single digit that indicates whether the transmission was successful.
--
Related: BUFLEN,SBRK,SRECV,STIME

1E8F6 xXOR
(# #' → #'')
($ $' → $'')
(1/0 1/0 → 1/0)
Exclusive OR Cmd
--
Returns the logical exclusive OR of two arguments.

```
#n1    #n2    → #n3
"str1" "str2" → "str3"
T/F1   T/F2   → 0/1
T/F    'sym'  → 'T/F XOR sym'
'sym'  T/F    → 'sym XOR T/F'
'sym1' 'sym2' → 'sym1 XOR sym2'
```

--
Related: AND,OR,NOT

1BC45 xXPON
(% → n)
Exponent Func
--
Returns the exponent of the arg.
--
Related: MANT,SIGN

1E621 xXRNG
(x1 x2 →)
x-Axis Display Range Cmd
--
Specifies the x-axis display range.
--
Related: AUTO,PDIM,PMAX,PMIN,YRNG

1B1CA xXROOT
(y x → Y')
xth Root of y Cmd
--
Computes the xth root of a real number.

```
y      x      → x ROOT y
'sym1' 'sym2' → 'XROOT(sym2,sym1)'
'sym'  x      → 'XROOT(x,sym)'
y      'sym'  → 'XROOT(sym,y)'
y_u    x      → x ROOT y_u1/x
y_u    'sym'  → 'XROOT(sym,y_u)'
```

1FE63 xSUMXY
(→ xsum)
Sum of x Times Y Cmd
--
Sums the products of the corresponding values in the independent and dependent variable columns of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: NΣ,XCOL,ΣX,ΣX2,ΣY,ΣY2 UserRPL: xΣXY

1FE12 xSUMY
(→ xsum)
Sum of y-Values Cmd
--
Sums the values in the dependent variable column of the current stat matrix (reserved var ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: NΣ,XCOL,ΣX,ΣXY,ΣX2,ΣY2 UserRPL: xΣY

1FE48 xSUMY2
(→ xsum)
Sum of Squares of y-Values Cmd
--
Sums the squares of the values in the dependent-variable column of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: NΣ,XCOL,ΣX,ΣXY,ΣX2,ΣY UserRPL: xΣY2

1FFFA xYCOL

(n →)
Dependent Column Cmd
--
Specifies the dependent-variable column of the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: BARPLOT,BESTFIT,COLΣ,CORR, COV,EXPFIT,HISTPLOT,LINFIT,LOGFIT, LR,PREDX,PREFY,PWRFIT,SCATRPLOT,XCOL

1E641 xYRNG

(y1 y2 →)
y-Axis Display Range Cmd
--
Specifies the y-axis display range.
--
Related: AUTO,PDIM,PMAX,PMIN,XRNG

6.5 Non A-Z

1B02D x^

(y x → y^x)
Power Analytic Func
--
Returns the value of the level 2 object raised to the power of the level 1 object.

```
w      z      → w^z
z      'sym'  → 'z^sym'
'sym'  z      → '(sym)^z'
'sym1' 'sym2' → 'sym1^(sym2)'
x_u    y      → xy_uy
x_u    'sym'  → '(x_u)^(sym)'
```

--
Flags: -1 -3

```
Principal soln  -1
Numeric results -3
```

--
Related: EXP,ISOL,LN,XROOT

1B374 xSQRT
(x → x')
Square Root Analytic Func
--
Returns the (+ve) square root of the argument.
--
z → $\sqrt{a}$z
x_u → $\sqrt{a}$(x)_u
'sym' → 'SQRT(sym)'
--
Flags: -1 -3
--
Related: SQ,^,ISOL UserRPL: x$\sqrt{a}$

1FD61 xSIGMA+
(x →)
(x1...xn →)
([]/[[]] →)
Sigma Plus Cmd
--
Adds one or more data points to the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: CLΣ,RCLΣ,STOΣ,Σ- UserRPL: xΣ+

1FD8B xSIGMA-
(→ x)
(→ [])
Sigma Minus Cmd
--
Returns a vector of m real numbers (or one number x if m = 1) corresponding to the coordinate values of the last data point entered by Σ+ into the current stat matrix (reserved variable ΣDAT).
--
<REF>TEXT:Reserved|ΣDAT
--
Related: CLΣ,RCLΣ,STOΣ,Σ+ UserRPL: xΣ-

1AABD xPI
(→ π)
PI Func
--
Returns the symbolic constant 'π' or its numerical representation, 3.14159265359.
→ 'π'
→ 3.14159265359
--
Flags: -2 -3
--
Related: e,i,MAXR,MINR,→Qπ UserRPL: xπ

1ECFC x<=?

(x y → 1)
(x y → 0)
Less Than or Equal Func
--
Tests whether one object is less than or equal to another object.
--

x	y	→ 0/1
#n1	#n2	→ 0/1
"str1"	"str2"	→ 0/1
x	'sym'	→ 'x<=sym'
'sym'	z	→ 'sym<=z'
'sym1'	'sym2'	→ 'sym1<=sym2'
x_u1	y_u2	→ 0/1
x_u	'sym'	→ 'x_unit<=sym'
'sym'	x_u	→ 'sym<=x_unit'

--
Flags: -3
--
Related: <,>,≥,==,≠ UserRPL: x≤

1ED9B x>=?

(x y → 1)
(x y → 0)
Greater Than or Equal Func
--

x	y	→ 0/1
#n1	#n2	→ 0/1
"str1"	"str2"	→ 0/1
x	'sym'	→ 'x≥sym'
'sym'	z	→ 'sym≥z'
'sym1'	'sym2'	→ 'sym1≥sym2'
x_u1	y_u2	→ 0/1
x_u	'sym'	→ 'x_u≥sym'
'sym'	x_u	→ 'sym≥x_u'

--
Flags: -3
--
Related: <,≤,>,==,≠ UserRPL: x≥

1EA9D x#?

(x y → 1)
(x y → 0)
Not Equal Func
--
Tests if two objects are equal.

```
obj1   obj2   → 0/1
(x,0)  x      → 0/1
x      (x,0)  → 0/1
z      'sym'  → 'z≠sym'
'sym'  z      → 'sym≠z'
'sym1' 'sym2' → 'sym1≠sym2'
```

--
Flags: -3
--
Related: SAME,TYPE,<,≤,>,≥, == UserRPL: x≠

234C1 xRPN->

(ob1 .. obn →)
Create Local Variables Cmd
--
Creates local variables.

```
obj1 ... objn →
```

--
Syntax:

```
→ name1 name2 ... nameN ≪ prog ≫
→ name1 name2 ... nameN 'Expr'
```

--
Related: DEFINE,STO UserRPL: x→

22FEB xALG->

Create local variable comand. <REF>xRPN-> UserRPL: x→

1BB02 xFACT

(x → x')
Factorial (Gamma) Func
--
Returns the factorial n! of a positive integer argument n, or the gamma function (x+1) of a non-integer argument x.

```
n      → n!
x      → (x+1)
'sym'  → '(sym!)'
```

--
Flags: -3 -20 -21

```
Numerical Results   -3
Underflow exception -20
Overflow exception  -21
```

--
Related: COMB,PERM UserRPL: x!

1C060 x%

(x y → xy/100)
Percent Func
--
Returns x (level 2) percent of y (level 1).

```
x       y       → xy/100
x       'sym'   → '%(x,sym)'
'sym'   x       → '%(sym,x)'
'sym1' 'sym2'  → '%(sym1,sym2)'
x       y_unit  → (xy/100)_unit
x_unit y        → (xy/100)_unit
'sym'   x_unit  → '%(sym,x_unit)'
x_unit 'sym'   → '%(x_unit,sym)'
```

--
Flags:
Numerical Results -3
--
Related: %CH,%T

1ADEE x*

(x y → x*y)
Multiply Analytic Func
--
Returns the product of the args.

```
z1          z2        → z1z2
[[ mat ]] [ arr ] → [[ matarr ]]
z           [ arr ] → [ z  array ]
[ arr ]    z         → [ arr  z ]
z           'sym'     → 'z * sym'
'sym'      z         → 'sym * z'
'sym1'     'sym2'    → 'sym1 * sym2'
#n1        n2        → #n'
n1          #n2       → #n'
#n1        #n2       → #n'
x_u        y_u       → xy_ux  unity
x           y_u       → xy_u
x_u        y         → xy_u
'sym'      x_u       → 'sym * x_u'
x_u        'sym'     → 'x_u * sym'
```

--
Flags: -3 -5 -6 -7 -8 -9 -10
Numeric results -3
bint wordsize -5 → -10
--
Related: +,-,/,=

1AB67 x+

(x y → x+y)
Add Analytic Func
--
Returns the sum of the arguments. Addition. If one arg is list, insert element in list or concatenate lists.
<REF>xADD

```
z1       z2       → z1+z2
[ arr ]1 [ arr ]2 → [ arr ]1+2
z        'sym'    → 'z+(sym)'
'symb'   z        → 'sym+z'
'sym1'   'sym2'   → 'sym1 + sym2'
{ lst1 } { lst2 } → { lst1 lst2 }
obj      { o... } → { obj o... }
{ o... } o        → { o... obj }
"str1"   "str2"   → "str1str2"
obj      "str"    → "obj str"
"str"    obj      → "str obj"
#n1      n2       → #n'
n1       #n2      → #n'
#n1      #n2      → #n'
x1_u1    y_u2     → (x2+y)_u2
'sym'    x_u      → 'sym+x_u'
x_u      'sym'    → 'x_u+sym'
grob1    grob2    → grob'
```

--
Flags: -3 -4 -5 -6 -7 -8 -9 -10

```
Numeric results -3
Bint wordsize   -5 → -10
```

--
Related: -,*,/,=

1AD09 x-

(x y → x-y)
Subtract Analytic Func
--
Returns the difference of the arguments: the object in level 1 is subtracted from the object in level 2.

```
z1       z2       → z1-z2
[ arr ]1 [ arr ]2 → [ arr ]1_2
z        'sym'    → 'z-sym'
'sym'    z        → 'sym-z'
'sym1'   'sym2'   → 'sym1 - sym2'
#n1      n2       → #n'
n1       #n2      → #n'
#n1      #n2      → #n'
x1_u1    y_u2     → (x2-y)_u2
'sym'    x_u      → 'sym-x_u'
x_u      'sym'    → 'x_u-sym'
```

--
Flags: -3
Numeric results -3
--
Related: +,*,/,=

1AF05 x/

(x y → x/y)
Divide Analytic Func
--
Returns the quotient of the arguments: the level 2 object divided by the level 1 object. (Abbrev. _u = _unit)

```
z1      z2        → z1 / z2
[ arr ] [[ mat ]] → [[mat^-1arr]]
[ arr ] z         → [ arr / z ]
z       'sym'     → 'z / sym'
'sym'   z         → 'sym / z'
'sym1'  'sym2'    → 'sym1 / sym2'
#n1     n2        → #n'
n1      #n2       → #n'
#n1     #n2       → #n'
x_u1    y_u2      → (x/y)_u1/u2
x       y_u       → (x/y)_1/u
x_u     y         → (x/y)_u
'sym'   x_u       → 'sym/x_u'
x_u     'sym'     → 'x_u/sym'
```

--
Related: +,-,*,=,RATIO

1EBBE x<

(x y → 1)
(x y → 0)
Less Than Func
--
Tests whether one object is less than another object.

```
x       y       → 0/1
#n1     #n2     → 0/1
"str1" "str2" → 0/1
x       'sym'   → 'x<sym'
'sym'   x       → 'sym<z'
'sym1' 'sym2' → 'sym1<sym2'
x_u1    y_u2    → 0/1
x_u     'sym'   → 'x_u<sym'
'sym'   x_u     → 'sym<x_u'
```

--
Flags: -3
Numeric results -3

1A8D8 x=

(x y → x=y)
Makes equation out of two expressions. Equals Analytic Func
--
Returns an equation formed from the two arguments.

```
z1      z2      → 'z1=z2'
z       'sym'   → 'z=sym'
'sym'   z       → 'sym=z'
'sym1' 'sym2' → 'sym1=sym2'
y       x_u     → 'y=x_u'
y_u     x       → 'y_u=x'
y_u     x_u     → 'y_u=x_u'
'sym'   x_u     → 'sym=x_u'
x_u     'sym'   → 'x_u=sym'
```

--
Flags: -3
Numeric results -3
--
Related: DEFINE,EVAL,-

1E972 x==

(x y → 1)
(x y → 0)
Logical Equality Func
--
Tests if two objects are equal.

```
obj1    obj2    → 0/1
(x,0)   x       → 0/1
x       (x,0)   → 0/1
z       'sym'   → 'z==sym'
'sym'   z       → 'sym==z'
'sym1' 'sym2'  → 'sym1==sym2'
```

--
Flags: -3
Numeric results -3
--
Related: SAME,TYPE,<,≤,>,≥,≠

1EC5D x>

(x y → 1)
(x y → 0)
Greater Than Func
--
Tests whether one object is greater than another object.

```
x       y       → 0/1
#n1     #n2     → 0/1
"str1" "str2"  → 0/1
x       'sym'   → 'x>sym'
'sym'   z       → 'sym>z'
'sym1' 'sym2'  → 'sym1>sym2'
x_u1    y_u2    → 0/1
x_u     'sym'   → 'x_u>sym'
'sym'   x_u     → 'sym>x_u'
```

--
Flags: -3
Numeric results -3
--
Related: <,≤,≥,==,≠ ;

7 ML Entry Points

7.1 General Purpose

0679B	SAVPTR	D0 to RPLTOP D1 to DSKTOP B to RETTOP D to FREETOP Clear carry
067D2	GETPTR	<see>SAVPTR in reverse Clears Carry.
05143	GETPTRLOOP	<see>GETPTR , Loop to RPL
6384E	D0=DSKTOP	Get new D0 from DSKTOP, uses A
6385D	D1=DSKTOP	Get new D1 from DSKTOP, uses C
010E5	AllowIntr	Allow interrupts.
01115	DisableIntr	Disable interrupts.
0115A	AINRTN	A=IN see also <see>CINRTN For hardware reasons (bug) A=IN must be at even addr
01160	CINRTN	C=IN see also <see>AINRTN For hardware reasons (bug) C=IN must be at even addr

7.2 Errors

7.2.1 Generating Errors

04FBB	DOMEMERR	Insufficient Memory error
18CA7	DOSIZEERR	Bad Argument Value error
05023	Errjmp	Error exit A.A = error number
10F80	ErrjmpC	A=C.A <see>Errjmp
10F40	GPErrjmpC	A=C.A <see>GETPTR <see>Errjmp
065AA	GPMEMERR	<see>GETPTR <see>DOMEMERR

7.2.2 Error Number Constants

00202	argtypeerr	"Bad Argument Type"
00203	argvalerr	"Bad Argument Value"

00B02	constuniterr	"Inconsistent Units"
00305	infreserr	"Infinite Result"
00A03	intrptderr	"Interrupted"
00C14	lowbaterr	"Low Battery"
00302	negunferr	"Negative Underflow"
00303	ofloerr	"Overflow"
0000A	portnotaverr	"Port Not Avaliable"
00301	posunferr	"Positive Underflow"
00C13	prtparerr	"Invalid PRTPAR"
00C02	timeouterr	"Timeout"
00C06	xferfailerr	"Transfer Failed"

7.3 Hexadecimal Math

0D62F	DCHXW	Converts BCD in C.W to hex in A.W B.W C.W. See <see>HXDCW Uses P CRY
06A8E	DIV5	C.A = C.A/5 Uses A.10 C.10 D.10 P
0DB91	HXDCW	Converts hex in A.W to BCD in A.W B.W C.W. See <see>DCHXW Uses P CRY Note that HXDCW wants the input in A but DCHXW wants it in C
03F24	IntDiv	A.A/C.A -> A.A=remainder, C.A=quotient, uses D.A P SB
53EE4	MPY	Multiply A.W and C.W (-> A.W=C.W) Uses D.W, SB. Returns carry clear
03991	MUL#	B.A = A.A*C.A

7.4 Long Reals

7.4.1 Storage Handling

2BE61	STAB0	A.W -> R0 B.W -> R1
2BE6F	STAB2	A.W -> R2 B.W -> R3
2BE7D	STCD0	C.W -> R0 B.W -> R1
2BE8B	STCD2	C.W -> R2 B.W -> R3

2BEB5	RCAB0	R0 -> A.W R1 -> B.W
2BEC0	RCAB2	R2 -> A.W R3 -> B.W
2BECB	RCCD0	R0 -> C.W R1 -> D.W
2BED6	RCCD2	R2 -> C.W R3 -> D.W
2BE99	EXAB0	A.W <-> R0 B.W <-> R1
2BEA7	EXAB2	A.W <-> R2 B.W <-> R3
2BE53	XYEX	A:B <-> C:D

7.4.2 Calculating

2B977	DIVF	x=x/y
2B91E	MULTF	x=x*y
2B7B0	RADD1	x=x+1 see <see>RADDF
2B7CA	RADDF	x=x+y
2B7A7	RSUB1	x=x-1 see <see>RADDF

7.4.3 Conversion

29E46	PACK	(x -> A) <see>PACKSB without rounding
29E21	PACKSB	(x -> A) Converts %% to %.If SB is clear uses roundup, if set uses lowest nibble in % field to determine rounding direction. Obeys and sets flow flags/indicators
2BC4A	SPLITA	(A -> x) Convert % to %%
2BCA0	SPLTAC	(A,C -> x, y) Convert 2 reals to long reals

7.5 Memory Handling

7.5.1 General Memory Handling Routines

069F7	ADJMEM	D= @FREETOP=<see>ROOM / 5 Uses A.10 B.10 C.10 D.10 <see>DIV5

```
0554C     DOGARBAGE          If ST=1 10 then <see>GPMEMERR
                             else <see>GARBAGECOL
                             and <see>GETPTR
0613E     GARBAGECOL         Garbage collection
                             does not use R1..R4
06806     ROOM               -> C.A = @DSKTOP-@RETTOP
                             Uses A.A D0
03019     SKIPOB             Skip object in D0, clears ST1,
                             clears carry, P=0
                             --> D0 = addr past object
                             Uses: A.A C.A P ST1 RSTK2
```

7.5.2 Moving and Swapping Memory Areas

```
0670C     MOVEDOWN           Copy downwards C.A nibbles from
                             D0 to D1, D0 and D1 will point
                             to the next locations
                             Used: A.W C.A P
                             Use this to move upwards
06992     MOVERSD            Delete a block below RSK
                             A.A=end C.A=nibbles
                             Adjusts all refs, then <see>ADJMEM
                             Uses A.W B.A C.W D.10 D0 D1 P
06A53     MOVERSU            Open a block below RSK
                             A.A=start C.A=nibbles
                             Adjusts all refs, then <see>ADJMEM
                             Uses A.W B.A C.10 D.10 D0 D1 P
06A1D     MOVEDSD            Open a block above stack
                             A.A=end C.A=nibbles
                             Adjusts all refs, then <see>ADJMEM
                             Uses A.W B.A C.10 D.10 D0 D1 P
069C5     MOVEDSU            Delete a block above stack
                             A.A=start C.A=nibbles
                             Adjusts all refs, then <see>ADJMEM
                             Uses A.W B.A C.10 D.10 D0 D1 P
066B9     MOVEUP             Copy upwards C.A nibbles from
                             D0 to D1
                             D0 D1 will point to start of
                             area
                             Used: A.W C.A P
                             Use this to move downwards
```

7.5.3 Allocating Memory in TEMPOB

06AD8	CREATETEMP	Allocates C.A nibbles carry if not enough memory -> D0=bottom, D1=top of area -> B.A = C.A = @D1 = offset to previous tempob = #nibbles+6
039BE	GETTEMP	<see>CREATETEMP with <see>GARBAGECOL if necessary <see>GPMEMERR if not enough memory
05B79	MAKE$	Creates character string in tempob area Does SETHEX, C=C+C.A and then <see>MAKE$N
05B7D	MAKE$N	Creates character string in tempob area If not enough mem even after GC then memerr C.A = nibbles -> A=nibbles+5, B=nibbles+16 C=D1=addr of stack D0 = addr of body of $ R0 = addr of $ Not used: R1-R4

7.5.4 Resizing TEMPOB Areas

16683	(Clean$)	Shrink strobj in top of TEMPOB R1=addr of length field A.A=new end address Uses A.W B.A C.W D.A D0 D1
16677	(Clean$R0)	R1=R0+5 <see>Clean$
16671	Shrink$	Shrinks a strobj R0.A=->$ D0=end of $ Uses A.W B.A C.W D.10 D0 D1

7.5.5 CRC Routines

05981	DoCRC	Calculates the CRC of A.A nibs at D0. Returns CRC in A.A Uses C.W P
0597E	DoCRCc	Turns interrupts off and on D0=C <see>DoCRC
0A00E	CKLBCRC	Check CRC of library at D0 CC: Ok CS: CRC is wrong Uses A.A C.W D0 P Disables and re-enables interrupts

7.5.6 Working with Memory

```
0675C     WIPEOUT          Zeroes C.A nibbles at D1
                           Uses A.W C.A P
```

7.5.7 Other Routines

```
083D1     (GETRRP)         Returns the RRP in which the
                           object at A.A lies. If ob is
                           SysRRP, returns CS and leaves
                           A.A unchanged; else CC and
                           A.A->RRP B.A->RAM-WORD
                           Uses A.A B.A C.A D.A D0
```
An RRP is a directory, the returned address points to the last-object-offset inside the directory. The SysRRP is the same as HOME.

7.6 Memory Addresses

```
0010C     (ANNCTRL2)       Annunciator control
                           [AON XTRA LA6 LA5]
                           (on extra io busy)
0010B     ANNCTRL          Annunciator control
                           [LA4 LA3 LA2 LA1]
                           (alarm alpha -> <-)
00101     (CONTRAST)       5 bit value for contrast.
                           [CON3 CON2 CON1 CON0]
00104     CRC              4 nibbles for CRC.
                           Every memory fetch updates CRC.
00120     (DISPADDR)       Display start address
                           write-only
00100     (DISPIO)         Display bit offset for
                           scrolling and DON (display on)
00102     (DISPTEST)       High bit of contrast and
                           display test bits.
00125     (LINEOFFS)       3 nibble offset for display
                           write-only
00128     (LINECOUNT)      Display line counter
                           [LC3 LC2 LC1 LC0]
                           and miscellaneous
                           [DA19 M32 LC5 LC4]
00130     (MENUADDR)       Menu display start addr
                           write-only
```

00108	(POWERSTATUS)	Low power registers
00109	(POWERCTRL)	Low power detection
00137	TIMER1	1 nibble timer decremented 16 times/s
00138	TIMER2	8 nibble timer decremented 8192 times/s
0012E	(TIMER1CTRL)	TIMER1 control [SRQ WKE INT XTRA]
0012F	(TIMER2CTRL)	TIMER2 control [SRQ WKE INT TRUN]

7.7 Display

11D8F	$5x7	(D.A B.A C.A D0 D1 -->) Displays string body at D1 in grob at D0 C.A = chars B.A = xlocation D.A = row length in nibbles -> D1 = addr after $ D0 = location of next char D.A = row length
01C31	D0->Row1	(--> D0) Gets addr of current display
01C58	D0->Sft1	(--> D0) Gets address of menu grob
01B8F	DispOn	Turns display on <see>Dispoff
01BBD	DispOff	Turns display off <see>Dispon
116B5	(grob!)	R0,R1 = (row,col), D0 = grob1, D1 = grob2 --> Stores grob1 into grob2
115B3	makegrob	R0.A = x, R1.A = y --> D0 = body Makes a grob of size x,y Prolog is in D0-20
1165A	w->W	Calculates GROB width A.A=width in pixels -> A.A=width in nibbles Basically the same as 8 / CEIL 2 * since the width must be an even number of nibbles

7.8 Popping and Pushing

7.8.1 Pointers

03249	DropLoop	Pop stack, Loop
60F83	4DropLoop	Pop 4, Loop
03672	GPOverWrALp	<see>GETPTR , OverWr A, Loop
0366F	GPOverWrR0Lp	<see>GETPTR , OverWr R0, Loop
54266	GPPushA	<see>GETPTR , Push A, Clear Carry
3251C	PopASavptr	Pop to A.A, <see>SAVPTR
3251F	PopSavptr	Pop <see>SAVPTR
03A86	PUSHA	Push A, Loop

7.8.2 TRUE and FALSE

26FAE	GETPTRFALSE	<see>GETPTR , Do FALSE
25CE1	GETPTRTRUE	<see>GETPTR , Do TRUE
62096	GPOverWrFLp	<see>GETPTR , OverWr FALSE, Loop
62076	GPOverWrTLp	<see>GETPTR , OverWr TRUE, Loop
62073	GPOverWrT/FL	<see>GETPTR , OverWr TRUE/FALSE, Loop
620D2	GPPushFLoop	<see>GETPTR , Push FALSE, Loop
267D5	GPPushFTLp	<see>GETPTR , Loop to FalseTrue
620B9	GPPushTLoop	<see>GETPTR , Push TRUE, Loop
620B6	GPPushT/FLp	<see>GETPTR , Push TRUE/FALSE, Loop
620A0	OverWrFLoop	OverWr FALSE, Loop
62080	OverWrTLoop	OverWr TRUE, Loop
6209D	OverWrT/FLp	OverWr TRUE/FALSE, Loop
61A02	popflag	Pop to A.A, if TRUE then set carry
620DC	PushFLoop	Push FALSE, Loop
620C0	PushF/TLoop	Push FALSE (CRY)/TRUE, Loop
620C3	PushTLoop	Push TRUE, Loop
620D9	PushT/FLoop	Push TRUE (CRY)/FALSE, Loop aka: PushT/F
267DC	(PushFTLp)	Loop to False/True

7.8.3 System Binary Integers (BINT)

06641	POP#	Pop # to A.A
03F5D	POP2#	(#1 #2 -->) Pop #1 to A.A and #2 to C.A
06537	PUSH#	<see>GETPTR , Push R0 as #

03DC7	Push#Loop	<see>SAVPTR , R0=A, <see>PUSH# , Loop
06529	PUSH2#	<see>GETPTR , Push R0 & R1 as #
0357F	PUSH#LOOP	<see>GETPTR , Push R0 as #, Loop
0357C	PUSH#ALOOP	<see>GETPTR , Push A as #, Loop
03F14	Push2#Loop	<see>GETPTR , Push R0 & R1 as #, Loop
627EB	Push2#aLoop	<see>GETPTR , Push R0 & A as #, Loop
036F7	Push#TLoop	<see>GETPTR , Push R0 as #, Do TRUE
2E31F	Push#FLoop	<see>GETPTR , Push R0 as #, Do FALSE

7.8.4 HXS and ZINTs

53F8D	(POPHXS)	Pop hxs to A, <see>SAVPTR , Clear Carry
53F77	(POP2HXS)	Pop hxs to C and hxs to A, <see>SAVPTR , Clear Carry P has current wordsize.
5422C	PUSHhxs	Push A.WP as hxs
0596D	PUSHhxsLoop	Push A.WP as hxs, Loop

7.8.5 Real and Complex Numbers

29FD0	POP1%SPLITA	(%pop -> x) Pop %, convert to %%, <see>SAVPTR
29FDA	POP1%	(%pop -> A) Pop %, <see>SAVPTR
2A002	POP2%	(%pop1 %pop2 -> A,C) Pop 2 reals, <see>SAVPTR
2A188	PUSH%	(A -> %push) Push A as %, <see>GETPTR
2A23D	PUSH%LOOP	(A -> %push) Push A as %, <see>GETPTRLOOP
52AB7	(POPC%)	(C%pop -> A:C) Pop C% (<see>SETDEC)
52B57	(POPC%%)	(C%%pop -> A:B C:D) Pop C%% (<see>SETDEC)
52ADB	(PUSHC%)	(A:C -> C%push) Push C%
52B95	(PUSHC%%)	(A:B:C:D -> C%%push) Push C%%

7.9 Keyboard Handling

04988	(Attn?)	Sets carry when ATTNFLG <> 0.
0CA60	ATTNchk	ATTN exit check with restoreiram
009A5	Debounce	Scans keyboard until no more instabilities detected returns a map of the pressed keys in A.W 48G[X+] Keymap nibbles: (Nibble: [Bit1 Bit2 Bit3 Bit4]) 0: [ON + SPC .] 1: [0 ’ - 3] 2: [2 1 A RS] 3: [* 6 5 4] 4: [MTH LS / 9] 5: [8 7 SIN alpha] 6: [BackSp DEL EEX +/-] 7: [ENTER 1/x y^x SQRT] 8: [TAN COS right down] 9: [left EVAL STO NXT] A: [up VAR CST PRG] B: [F E D C] C: [B none none none] 49G Keymap nibbles: 0: [ON RS LS alpha] 1: 2: [right down left up] 3: 4: [A B C D] 5: [E F none APPS] 6: 7: [EEX y^x HIST MODE] 8: [0 1 4 7] 9: [+/- SQRT CAT TOOL] A: [. 2 5 8] B: [1/x SIN EQW VAR] C: [SPC 3 6 9] D: [X COS SYMB STO] E: [ENTER + - *] F: [/ TAN BackSp NXT]
04999	KeyInBuff?	Carry if true
00C74	OnKeyDown?	Carry if true
00C80	OnKeyStable?	Carry if true
00D57	Flush	Flushes key buffer.
00D8E	FlushAttn	Flushes attn counter.

04840	POPKEY	(-> C.A) Sets carry if buffer is empty.Else returns key in C.B (and in @KEYSTORE) Uses: A.S C.S C.A D1 (sets P=0)
007B5	SrvcKbdAB	(A.W ->) Sets KEYSTATE and KEYBUFFER

7.10 Various ML Entries

0D5E5	ASRW5	ASR.W 5 times
0D5F6	ASLW5	ASL.W 5 times
2BEE1	CCSB1	Uses D.S to set SB, clears carry
018E2	clkspd	Measure CPU clock speed Interrupts off on entry and exit -> A.A=spd/16 B.A=loops/16s Uses C.A D0 P CRY
0D607	CSRW5	CSR.W 5 times
0D618	CSLW5	CSL.W 5 times
04292	DeepSleep	Puts calc into "deep sleep" Low power mode, display off Wakeup on ON key or interrupt
5F090	(doskip)	Exit to rpl SKIP
5F09D	(docola)	Exit to rpl COLA
2FFB4	GetStrLenStk	Pop $ -> C.A = length, D1 = body
2FFB7	GetStrLenC	D1 = C, <see>GetStrLen
2FFBA	GetStrLen	D1=$ -> C.A = length, D1 = body
54021	(getwordsize)	Fetches current word size to A, Clear Carry
017A6	makebeep	C = msec, D = Hz Checks BEEP flag.
04929	liteslp	Puts calc into "lite sleep" Low power mode with display on Wakeup on any key or interrupt

7.11 Object Types

029E8	DOARRY	Array prologue 5 size 5 prologue of objects 5 # of dimensions 5n dimensions .. objects (content only)

02B62	DOBAK	Backup prologue 5 size 2 # of chars in name .. name .. object 5 DOBINT 5 CRC Apparently unused on the 49
02911	DOBINT	BINT prologue 5 number (hex)
029BF	DOCHAR	Character prologue 2 character
02977	DOCMP	Complex number prologue 3 real exponent 12 real mantissa 1 real sign 3 complex exponent 12 complex mantissa 1 complex sign
02DCC	DOCODE	Code prologue 5 length .. machine code
02D9D	DOCOL	Secondary prologue .. objects 5 SEMI
02A2C	DOCSTR	String prologue 5 length .. characters
0299D	DOECMP	Long complex prologue 5 real exponent 15 real mantissa 1 real sign 5 complex exponent 15 complex mantissa 1 complex sign
02955	DOEREL	Long real prologue 5 exponent 15 mantissa 1 sign
02ADA	DOEXT	Unit object prologue .. object (usually a real) .. unit 5 SEMI
02B1E	DOGROB	GROB prologue 5 size 5 height 5 width

02A4E	DOHSTR	HXS prologue 5 length .. hex digits, reverse order aka: DOHXS
02E48	DOIDNT	Global name (ID) prologue 2 # of characters .. characters
02E6D	DOLAM	Local name (LAM) prologue see <see>DOIDNT
02A0A	DOLNKARRY	Linked array prologue Not used by the system.
02B40	DOLIB	Library prologue 5 size 2 # of characters .. name 2 # of characters (unless 0) 3 library ID 5 hash table offset 5 message table offset 5 link table offset 5 config object offset .. contents 4 CRC ; XLIBs: 1 or 3: kind 3 library ID 3 command ID .. object -- <REF>TEXT:Libraries
02A74	DOLIST	List prologue see <see>DOCOL
02933	DOREAL	Real number prologue 3 exponent 12 mantissa 1 sign
02E92	DOROMP	XLIB prologue 3 library ID 3 command #

```
02A96      DORRP               Directory prologue
                               Home directory:
                               3  # of attached libs
                               n*[
                                 3  library ID
                                 5  address of hash table
                                 5  address of message table
                               ]
                               5  offset of last object
                               *[
                                 5  offset to previous object
                                    00000 for the first one
                                 2  # of characters
                                 .. name of object
                                 2  # of characters
                                 .. object
                               ]
                               ;
                               Subdirectories:
                               3  # of attached library
                                  7FF if none
                               5  offset of last object
                               .. same as above
02AB8      DOSYMB              Symbolic prologue
                               .. objects
                               5 SEMI
02AFC      DOTAG               Tagged object prologue
                               2 # of chars in tag
                               .. tag
                               .. object
02B88      DOEXT0
02BAA      DOEXT1
                               aka: DOACPTR
02BCC      DOEXT2
02BEE      DOEXT3
02C10      DOEXT4
```

8 RAM entries

Note that pointers (->...) are always 5 nibbles wide.

8.1 RPL pointers

The contents of the following four locations are only valid after SAVPTR.

807ED	AVMEM	Free mem / 5 (5)
806F8	DSKTOP	->Data stack
806F3	RSKTOP	->Return stack
8072F	INTRPPTR	->RPL runstream aka: OBUPSTART

8.2 Memory management pointers

806E9	TEMPOB	->Beginning of TempOb area
806EE	TEMPTOP	->End of TempOb area
80711	USEROB	->UserOb Area (HOME)

8.3 Screen related

806D5	ADISP	->Stack grob
806E4	GDISP	->Blackboard grob
806DA	VDISP	->Display grob aka: VDISP1, SYSUPSTART
806D0	VDISP2	->Menu grob
806DF	VDISP3	->Not displayed grob <see>VDISP

8.4 Annunciators

80841	ANNUNCIATORS	Annunciator flags (2)
00004	Ann_Susp.b	
00010	Ann_Shift.b	
00001	Ann_RAD.b	
00002	Ann_IO.b	
00080	Ann_Busy.b	
00040	Ann_Alpha.b	

00008	Ann_Alert.b
00020	Ann_ALT.b

8.5 Save areas

805DB	INTRAM	Save area for the interrupt sys (16)
806C0	R1[A]save	Used by PrintLCD inside the interrupt system (5)
806BA	R2[A]save	<see>R1[A]save (5)
806BF	R2[S]save	<see>R1[A]save (1)
80831	SAVECLK	Save of CLKON state (1)
808D8	SAVECROSS	cursor moves in plotting (10)
805F5	SAVE_A	<see>INTRAM (16)
80608	SAVE_B	<see>INTRAM (16)
805F0	SAVE_C[A]	<see>INTRAM (5)
806C5	SAVE_BO	Save BitOffset (1)
80618	SAVE_D	<see>INTRAM (16)
8063D	SAVE_DO	<see>INTRAM (5)
806C6	SAVE_LC	Save LineCount (2)
806C8	SAVE_LN	Save LineNibs (3)
805EB	SAVE_MODES	<see>INTRAM (5)
806CB	SAVE_OFFSET	Save Window Offset (5)
80638	SAVE_PC	<see>INTRAM (5)
80628	SAVE_R0	<see>INTRAM (16)
80605	SAVE_ST	<see>INTRAM (3)
8069C	Stk0save	RSTK0 used by PrintLCD inside the interrupt sys (5)
806A1	Stk1save	RSTK1 <see>Stk0save (5)
806A6	Stk2save	RSTK2 <see>Stk0save (5)
806AB	Stk3save	RSTK3 <see>Stk0save (5)
806B0	Stk4save	RSTK4 <see>Stk0save (5)
806B5	Stk5save	RSTK5 <see>Stk0save (5)

8.6 System and User Flags

80843	SystemFlags	128 System flags (16)
80853	UserFlags	128 User Flags (16)

8.7 Internal System Flags

Unless otherwise indicated, the description of each MASK shows what this bit means if it's set.

80801	SysNib1	ISysFlags 1
00101	NoRolDA2MASK	DA2 can't be rolled up to become valid <see>SysNib1
00201	AbbrStkMASK	Display obj types only <see>SysNib1
00401	DA2bIsEdMASK	DA2b shows the edit line <see>SysNib1
00801	IgnorAlmMASK	Ignore <see>ALARMSDUE in <see>GETKEY <see>SysNib1
80802	SysNib2	ISysFlags 2
00102	ReqClkOnMASK	Flag for System Request of CLKON state <see>SysNib2
00202	ServModeMASK	Server mode on <see>SysNib2
00402	TrackMASK	New context needs to be compared with old <see>SysNib2
00802	BadMenuMASK	Menu system corrupt <see>SysNib2
80803	SysNib3	ISysFlags 3
00103	UNDOMASK	Automatic stack save <see>SysNib3
00203	INSERTMASK	Insert/replace mode <see>SysNib3
00403	ALGMASK	Algebraic entry mode <see>SysNib3
00803	PRINTINGMASK	<see>SysNib3
80804	SysNib4	ISysFlags 4
00104	DA2aTempMASK	DA2a temporarily valid <see>SysNib4
00204	DA2bTempMASK	DA2b temporarily valid <see>SysNib4
00404	DA3TempMASK	DA3 temporarily valid <see>SysNib4
00804	RebuildMASK	Menu requires TOUCHTAB rebuild each time it is redisplayed <see>SysNib4
80805	SysNib5	ISysFlags 5
00105	COMMANDMASK	CMD history enabled <see>SysNib5
00205	BLINKMASK	Active Timer1 Int's <see>SysNib5
00405	LOWERMASK	Lowercase keys <see>SysNib5
00805	STKDCMASK	Decompilation for stack display (not editing) <see>SysNib5
80806	SysNib6	ISysFlags 6
00106	Do1UserMASK	One-key user mode <see>SysNib6

00206	ASuspOKMASK	Suspending current environment is allowed <see>SysNib6
00406	BadPOLUIMASK	POL UI possibly corrupt <see>SysNib6
00806	DA1TempMASK	DA1 temporarily valid <see>SysNib6
80807	SysNib7	ISysFlags 7
00107	DA1ValidMASK	DA1 known to be valid <see>SysNib7
00207	DA2aValdMASK	DA2a known to be valid <see>SysNib7
00407	DA2bValdMASK	DA2b known to be valid <see>SysNib7
00807	DA3ValidMASK	DA3 known to be valid <see>SysNib7
80808	SysNib8	ISysFlags 8
00108	DA1NoChMASK	DA1 not changed <see>SysNib8
00208	DA2aNoChMASK	DA2a not changed <see>SysNib8
00408	DA2bNoChMASK	DA2b not changed <see>SysNib8
00808	DA3NoChMASK	DA3 not changed <see>SysNib8
80809	SysNib9	ISysFlags 9
00109	DA1BadMASK	DA1 invalid <see>SysNib9
00209	DA2aBadMASK	DA2a invalid <see>SysNib9
00409	DA2bBadMASK	DA2b invalid <see>SysNib9
00809	DA3BadMASK	DA3 invalid <see>SysNib9
8080A	SysNib10	ISysFlags 10 aka: EDITFLAG, EDITLFLAG
0010A	EDITLMASK	Edit line exists <see>SysNib10
0020A	NAppKeyMASK	Non-app keys allowed in POL <see>SysNib10
0040A	NUsrKeyMASK	Non-user keys allowed in USR mode <see>SysNib10
0080A	AppModeMASK	POL application running <see>SysNib10
8080B	SysNib11	ISysFlags 11 aka: ParenModFLAG
0010B	ParenModMASK	Implicit parenthesized "/", "^", and "SQRT" in EQW <see>SysNib11
0020B	1PDCMASK	Partial DeCompile info will not be saved <see>SysNib11
0040B	NewEditLMASK	New one-line edit line has been created <see>SysNib11
0080B	DoStdKeyMASK	Do only standard keys <see>SysNib11
8080C	SysNib12	ISysFlags 12
0010C	DispTimeMASK	Status bar clock may be displayed <see>SysNib12
0020C	NOP2MASK12	unused <see>SysNib12
0040C	NOP4MASK12	unused <see>SysNib12
0080C	NOP8MASK12	unused <see>SysNib12

8080D	SysNib13	ISysFlags 13
0010D	NOP1MASK13	unused <see>SysNib13
0020D	NOP2MASK13	unused <see>SysNib13
0040D	NOP4MASK13	unused <see>SysNib13
0080D	NOP8MASK13	unused <see>SysNib13
8080E	SizeMLDisp	aka: SysNib14
0010E	NOP1MASK14	unused <see>SysNib14
0020E	NOP2MASK14	unused <see>SysNib14
0040E	NOP4MASK14	unused <see>SysNib14
0080E	NOP8MASK14	unused <see>SysNib14
8080F	SysNib15	ISysFlags 15
001CE	BadTOLUIMASK	TOL UI potentially corrupt <see>SysNib15 aka: NOP1MASK15
002CE	NoAlgProcess	EVAL-> will not create a list nor return NOVAL <see>SysNib15 aka: NOP2MASK15
004CE	InSimplyExpr	<see>SysNib15 aka: NOP4MASK15
008CE	DoCreateMenu	<see>SysNib15 aka: NOP8MASK15
80810	SysNib16	ISysFlags 16 (unused)
00110	NOP1MASK16	<see>SysNib16
00210	NOP2MASK16	<see>SysNib16
00410	NOP4MASK16	<see>SysNib16
00810	NOP8MASK16	<see>SysNib16
80811	SysNib17	ISysFlags 17 (unused)
00111	NOP1MASK17	<see>SysNib17
00211	NOP2MASK17	<see>SysNib17
00411	NOP4MASK17	<see>SysNib17
00811	NOP8MASK17	<see>SysNib17
80812	SysNib18	ISysFlags 18 (unused)
00112	NOP1MASK18	<see>SysNib18
00212	NOP2MASK18	<see>SysNib18
00412	NOP4MASK18	<see>SysNib18
00812	NOP8MASK18	<see>SysNib18
80813	SysNib19	ISysFlags 19 (unused)
00113	NOP1MASK19	<see>SysNib19
00213	NOP2MASK19	<see>SysNib19
00413	NOP4MASK19	<see>SysNib19

00813	NOP8MASK19	<see>SysNib19
80814	SysNib20	ISysFlags 20 (unused)
00114	NOP1MASK20	<see>SysNib20
00214	NOP2MASK20	<see>SysNib20
00414	NOP4MASK20	<see>SysNib20
00814	NOP8MASK20	<see>SysNib20

8.8 Warmstart log

80010	FAILSTK1	Warmstart log 1st (newest) entry (18) Each entry consists of a one-nibble cause (as displayed by WSLOG), a 13-nibble time stamp and a 4-nibble CRC of the previous 14 nibbles.
80022	FAILSTK2	<see>FAILSTK1 2nd entry (18)
80034	FAILSTK3	<see>FAILSTK1 3rd entry (18)
80046	FAILSTK4	<see>FAILSTK1 4th entry (18)

8.9 Command line management

8086A	CR_COUNT	# of newlines in editline (5)
80882	CURSOR	Cursor editline position (5) aka: CURSOREPOSN
8088F	CURSORCHR	Char under Cursor (2)
80891	CURSORGROB	Cursor Grob Data (40)
8088C	CURSOROFFSET	Cursor position from left of screen (2) aka: CURSORPOSN
80887	CURSORPART	Cursor display row (5) aka: CURSORROW
8088E	CURSORSTATE	Show cursor/char underneath (1)
808B9	CURSORX	Pxl X-Coord of Cursor (5)
808BE	CURSORY	Pxl Y-Coord of Cursor (5)
806FD	EDITLINE	->Command line

8.10 POL variables

80815	AppCount	# of nested POLs (2)
80784	AppDisplay	->App display object

80793	AppError	->App error handler
8078E	AppExitCond	->App exit condition
80789	AppKeys	->App key assignments

8.11 UART buffering

80519	uart_buf_end	# of bytes in the UART buffer (2)
8051C	uart_buf_st	UART buffer offset (2)
80319	uart_buffer	UART buffer area (512)
8051B	uart_error	UART error flag (1)
8051E	uart_handshk	UART handshake (1)
8051F	uart_modes	UART mode (1)
80520	uart_parity	(1)
80521	uart_timeout	(2)

8.12 ROM Part Tables

809A3	ROMPTAB	Library table (3+n*16) Header: 3 number of libraries For each library: 3 library ID 5 address 5 switch routine (0 if none) 3 000 aka: RESRAMEND, FlashROMPTAB

8.13 Constants

The entries in this section do not denote actual memory addresses, but constants related to them.

00008	IRAMHOMEmsn	MSN of the IRAM base address
00011	LOCUPSIZE	Number of variables between <see>SYSUPSTART and <see>OBUPSTART
00025	OBUPSIZE	Number of variables between <see>OBUPSTART and <see>OBUPEND
00001	mEditLExists	aka: ParenModmask
00036	SYSUPSIZE	<see>OBUPSIZE + <see>LOCUPSIZE

8.14 Other/Uncategorized

80912	ACCUM	(1)
8072A	ALARMS	->System Alarm List (5)

80832	ALARMSDUE	Flags Alarm Due (1)
80836	ALARM#	
807F7	ATTNFLG	Counts ON presses (5)
800E6	AccessInit	Saved value of INITEN & sALLOWINTR (2)
80000	CMOS	Quick RAM corrupt check (5) aka: HARDROMEND, RAMSTART
80922	COLCOUNT	Dot Cols on line (2)
80914	COLWIDTH	(2)
80524	CONFRAM	RAM configuration (7) Port1: 1 Status [r w s 0] 1 Size/Address Code Port2: 1 Status [r w s 0] 1 Size/Address Code where r=readable, w=writable, s=system RAM 2 #banks 1 ID
8052B	CONFTAB	RAM configuration with CRC (11) 4 nibbles for CRC 7 nibbles as in CONFRAM
8071B	CONTEXT	->Current dir
800EB	COVERsave	Save area for G/DoCovered (10)
800E8	COVERstate	Iram state before uncovering (3)
80076	TIMEOUTCLK	ScratchPad (4)
80655	CSPEED	CPU speed (16hz units) (5)
808C3	CURRENTMENU	Menu ID of current menu (2)
8091B	ClkOnNib	Clock display on/off (1)
80798	CtlAlarm	->Control alarm data
8081D	DEPTHSAVE	Saved user stack depth (5)
8065B	DISABLE_KBD	Keyboard handshake (1) aka: HANDSHK
8068D	DISP1CTLg	Ghost for DISP1CTL (5)
80695	DISP2CTLg	Ghost for DISP2CTL (5)
80707	DOLPENV	->DO LOOP environments
80834	DOUSEALARM	Flags Deactivate Curr Alarm (1)
8064A	DREND	Display Refresh Hi Bound (5)
80645	DRSTART	Display Refresh Lo Bound (5)
808EE	DcompWidth	String Decomp Width (2)
8091E	DelayCt	REDEYE Print time/line (2)
80863	ELEMENT	decompile obj depth counter (2)
80916	ENTRWISE	(1)
807F2	ERROR	(5)
8077F	EXITMSG	->msg set by user in EXIT word
8094C	EqPtr	Points to Curr Eqn in EqList (5)
80865	FIRSTCHAR	offset to 1st visible (5)

807FC	FIRSTPROC	->StartupProc Secondary (5)
808F2	FONTCOUNT	counter (3)
808F0	FONTHEIGHT	font-height selector (1)
808F1	FONTWIDTH	font-width selector (1)
80085	FailTime	SelfTest Fail Time (Ticks) (13)
8092A	FifoByteCt	Sum of FIFO Line Counts (2)
808CE	GARBSCRATCH1	Saves 1 RSTK level in G.C. (5)
808D3	GARBSCRATCH2	Saves counter in G.C. (5)
80920	GCOLCOUNT	Graphics #Cols (2)
8030E	GraphPrtHook	(11) aka: IRAMBEND
90000	HARDRAMEND	IRAM Home ends at #7FFFF Appears to be an obsolete constant from the 48G, where IRAM was only 32kB big and thus ranged from #80000 to #8FFFF. The description even seems to come from the 48S!
8075C	HISTORY1	-> $ with the most recent CMD history entry
80761	HISTORY2	->2nd entry <see>HISTORY1
80766	HISTORY3	->3rd entry <see>HISTORY1
8076B	HISTORY4	->4th (oldest) entry <see>HISTORY1
8087A	HISTORYLEVEL	which stack level is next (1)
8000A	HOMEMASK	Home Size of RAM (mask) (5)
8000F	HRAMEND	M.S.N. of size of RAM chip (1)
8065A	INITEN	Warmstart Enable flag (1)
80669	INPUTSTREAM	Key Buffer (max 15 keys). (34) aka: KEYBUFFER
80523	IOCNIB	Saves IOC in OUTUART (1)
80927	IOCsave	Save of IOC before change (1)
80654	IOSAVE	Saves HiNib of ANNCTRL (1)
00219	IRAMBSIZE	Size of <see>IRAMBUFF
800F5	IRAMBUFF	Exec Buff (code under IRAM) (537)
80127	IRAMBUFF2	<see>IRAMBUFF +50
80005	IRAMMASK	IRAM Size Config Mask (5)
8064F	IREG	Saves Interrupt History (3)
80817	ITEM1LINES	# display lines currently (1)
80757	ITEM1STATE	->list of lists describing stack level 1
80775	KERMERRM	->Kermit error message aka: PDCSYMB
808ED	KERMMODE	Kermit Mode information (1)

8090C	KEYLIST	(5)
80911	KEYLOCK	(1)
8065C	KEYSTATE	location of kbd state (16)
807DE	KeyOb	->Pending key-object
80951	KeyRomPtr0	RomPtr for KeyOb (11)
8095C	KeyRomPtr1	RomPtr for MenuKey 1 (11)
80967	KeyRomPtr2	RomPtr for MenuKey 2 (11)
80972	KeyRomPtr3	RomPtr for MenuKey 3 (11)
8097D	KeyRomPtr4	RomPtr for MenuKey 4 (11)
80988	KeyRomPtr5	RomPtr for MenuKey 5 (11)
80993	KeyRomPtr6	RomPtr for MenuKey 6 (11)
80739	LASTARG	->1st argument saved in CK<n> aka: LASTARG1
8073E	LASTARG2	->2nd <see>LASTARG
80743	LASTARG3	->3rd <see>LASTARG
80748	LASTARG4	->4th <see>LASTARG
8074D	LASTARG5	->5th <see>LASTARG
8087B	LASTARGCOUNT	# of args saved by CK<n> (1)
8087C	LASTARGf	Flag #Args>3 (1)
8087D	LASTERROR	Save area for error number (5)
80879	LASTLAST?	true if lastkey was last hit (1)
808FB	LASTOP	3-state encoding of operand/ unary/binary (1)
807D9	LASTROMWDOB	->Last user-level ROM-WORD evaluated (set by CK<n>)
808FC	LEFTTREE	(3)
8069A	LINECOUNTg	Ghost for LINECOUNT (2)
80692	LINENIBSg	Ghost for LINENIBS (3)
80840	LPD_HIST	Low Power Detect History (1)
807B1	LabelDef	->How to make menu labels
807CA	LastContext	->RRP saved for CheckContext
807A2	LastMenuDef	->Last menu definition
8099E	LastMenuRow	(5)
8092C	LastPrntTime	Time (Upper 11 nibs) (11)
80928	LineByteCt	Line Byte Counter (2)
80077	LoBatTime	Flag periodic ((*)) updates (1)
808C5	MENULEVEL	User-menu level (5)
807A7	MenuData	->Menu data for touch table
8079D	MenuDef	->Current menu definition

807D4	MenuExitAct	->Menu exit action definition
807BB	MenuKeyLS	->Left-shift menu key handler
807B6	MenuKeyNS	->No-shift menu key handler
807C0	MenuKeyRS	->Right-shift menu key handler
80947	MenuRow	(5)
807AC	MenuRowAct	->Prev/Next action definition
80058	NEXTIRQ	Time at next Timer2 int. (13)
80835	NOALARMSRV	Flags Disable Alarm Service (1)
808F5	NODECOUNT	expr-tree node count (3)
808F8	OBTREELEN	object length (3)
808CA	OLDMENU	Saves previous menu number (2)
80642	SAVE_OR	aka: ORghost
80913	OB/EXP?	
80734	OSAVE	
808CD	PADCOUNT	Indentation count for decomp (1)
808E2	PADJSAVE1	Status save in PTRADJUST (1)
808E3	PADJSAVE2	RSTK save in PTRADJUST (10)
8077A	PAINTTREE	->hxs of "textbook-mode" graphics
80917	PARENCOUNT	(2)
80902	PARENTTREE	(3)
80833	PASTDUE	Flags Past Due Alarm (1)
8083B	PASTDUE#	
80770	PDCHXS	->hxs map of outermost symbolic
80937	PFIFO	FIFO Buffer (16)
8068B	POPPEDKEY	Last Key from POPKEY (2)
80536	PORT0EOS	(5)
8053B	PORT1EOS	(5)
80540	PORT2EOS	(5)
80905	PRECSTACK	Op Precedence textbook entry (7)
800E2	Port1CRC	CRC for Device in Port1 (4)
800E1	PortStat	Copy of CARDSTAT Nib (1)
80924	PrtStatus	CPU Status Bits et al. (3)
807E8	RAMEND	->End of RAM aka: SYSNOUPSTART
808FF	RIGHTTREE	(3)
80822	RNSEED	Random number seed (15)
80716	ROMPARTS	->RomParts Area
807C5	ReviewKey	->Review-key definition

80652	SEMAPH	Saves control byte for IREG (2)
8086F	STACKNUM	ref. number of 1st visible (5)
80720	STOPSIGN	(5)
80919	STRETCHCOUNT	(2)
800D4	SW_ETime	Stopwatch Elapsed Time Ticks (13)
800BE	SW_Image	"HH:MM:SS:ss" Stopwatch (22)
80078	StartTime	SelfTest Start Time (Ticks) (13)
808CC	T1COUNT	Decremented by srvc_timer1 (1)
80702	TEMPENV	->LAM environments (5)
80092	TESTMSG	SelfTest Msg Buffer (44)
80065	TIMECRC	CRC CheckSum for NEXTIRQ (4)
80069	TIMExmit	Time at scheduled timeout (13) aka: TIMEOUT
80874	TOPLINE	Editline-segment which appears first on the screen (5)
8070C	TOUCHTAB	(5)
807CF	TrackAct	->Action when CONTEXT changes
80725	UserKeys	->User key assignments (5)
80818	VIEWLEVEL	stack element currently viewed (5)
8091C	XmitSrcvTOut	XMIT/SRECV timeout (2)
80752	leeway	->hxs which will be GC'ed in a very-low-memory condition

9 Miscellaneous Entries

9.1 Undescribed Entry Points

```
1EFD2      xDER
1F640      xFCNAPPLY
1F223      xINTEGRAL
1F3F3      xWHERE
560ED      xssgeneral
50E59      !#1+IF<dim-1
50EA5      !#1-IF>0
2B789      1/X15
648BD      >LASTRAM-WORD
715B1      ?ACCPTR>
39BF3      ?RollUpDA2
39FB0      AbbrevStack?
2B7DC      ADDF
1265A      addrADISP
4226A      addrATTNFLG
0E7D3      addrClkOnNib
00D48      addrKEYSTATE
136AC      addrLINECNTg
0188D      addrORghost
04E66      addrTEMPENV
179E8      addrTEMPTOP
1263A      addrVDISP
1264A      addrVDISP2
1605F      addtics
42EC7      AdjEdModes
047CF      adrDISABLE_K
32CB6      adrGraphPrtH
047DD      adrKEYBUFFER
42284      adrTIMEOUTCLK
312DA      adr_uart_han
2B770      aH>HMS
42113      ALARMxcp
3981B      AlgEntryStat
```

```
1568F     ALGeq?
001FF     allkeys
2B67D     aMODF
39673     AngleStatus
47984     APPprompt1!
479A7     APPprompt2
420F5     ATTNxcp
70601     BANKMTHDS
44F42     BindMatVars
008E6     BITMAP
2E108     BUILDKPACKET
27D00     check_pdata
32CAF     ChkGrHook
49C54     CkEQUtil
40882     (CkSecoType)
0D9C7     CKTIME
0CD3F     (CLKADJ*)
0D7A1     CLKUTL1
39FD2     ClrAbbrevStk
0ED78     (ClrDouseAlm)
2BBE2     CLRFRC
423D3     clrtimeout
5573D     COLAthexFCN
01FD3     Coldstart
09B73     COMPCONFCRC
396C8     ComVecStatus
256E4     convertbase
4651C     CopyColsLeft
4677E     CopyColsRght
46625     CopyRowsDown
46409     CopyRowsUp
7DF87     COPYVAR
137DC     corner
15941     CRUNCHNoBlame
4248E     CtlAlarm!
424A1     (CtlAlarm@)
4E442     CURRENTMARK?
427AF     Cursor&Disp
```

```
13F01     (CURSOR+)
53A05     (DO=ALoop)
39371     (DA2bTemp?)
25223     DaDGNTc
0D4AD     DAY#
0D744     Day>Date
424DA     DCursor
2512D     delimcase
7DC54     derprod1
7DC0E     derquot
13B51     DISPCHAR+PC
133AB     disprange
153FC     DispVarsUtil
2BBB5     DIV2
42475     DoCAlarmKey
3ADED     DoPlotMenu
31EE2     DOPRLCD
0DB51     dowutil
4C639     drax
2DDC4     DropSysErr$
18308     DropSysObs
641CC     DupAndThen
00003     DZP
7DC88     easyabs
3EE47     Echo2Macros
039EF     ECUSER
44730     EDITPARTS
00019     ENTERCODE
4E46A     EQCURSOR?
32B08     ErrFixEIRU
0CBC4     ErrTime
1583C     EVALCRUNCH
4CF68     ExitFcn
4CE4C     EXITFCNsto
25C41     Extobcode
49BA5     FcnUtilEnd
32B1A     FixEIRU
17ADB     FixRRP
```

```
0D6D8      FLOAT
2BFFD      GETAB0
2BFE3      GETAB1
0D809      getBPOFF
21922      GetBVars
2C031      GETCD0
45D1F      GetElt
40BDD      (GetLastEdit)
45AE0      GetMat/Vec
138EF      GETPIX
138F2      GETPIX3
514AF      GETRHS
012EE      GetTimChk
0130E      GetTime++
0C50B0    ~gFldVal
4CEE7      GraphicExit
1518D      GsstFIN
53860      HISTON?
0970A      InitEnab
45023      InitOldMat
385E8      InitSysUI
00110      IOC
0011F      IRAM@
0011A      IRC
3E5CD      IStackKey
426F1      LastERow?
50D78      LASTPT?
6515C      (lbrac)
4256B      LCursor
4E37E      LINECHANGE
39F6F      LINESOFSTACK
24C0D      List
15E83      longhxs
2D564      Loop
62ABB      MACRODCMP
7DF0E      MANMENU*/
7DF03      MANMENU+-
7DF66      MANMENUATG
```

```
7DF3A      MANMENUCSIV
7DF50      MANMENUCX
7DF45      MANMENUEQ
7DF24      MANMENUEXP
7DF2F      MANMENULN
7DF5B      MANMENUTRG
7DF19      MANMENU^
643F9      matchob?Lp
0120E4    ~MESRclEqn
0D8AE      mpop1%
7DEED      nCOLCTQUOTE
255FB      need'case
25632      newBASE
4C09B      NEWINDEP
4E4B0      NEWMARK
6443A      nextpos
179D0      NEXTRRPOB
4BFAE      NEXTSTEP
29A8D      nextsym'R
255BD      ngsizecase
7DEA0      nINTGACOS
7DECC      nINTGALOG
7DE95      nINTGASIN
7DEAB      nINTGATAN
7DE5E      nINTGCOS
7DE7F      nINTGCOSH
7DED7      nINTGEXPM
7DE27      nINTGINV
7DEB6      nINTGLN
7DEC1      nINTGLOG
7DE32      nINTGSIGN
7DE53      nINTGSIN
7DE74      nINTGSINH
7DE48      nINTGSQ
7DE3D      nINTGSQRT
7DE69      nINTGTAN
7DE8A      nINTGTANH
53AE4      NoIgnoreAlm
```

```
01FDA      norecCSseq
3303F      NUMSOLVE
7DBAB      nWHEREDER
7DBD7      nWHEREFCNAPP
7DBA0      nWHEREIFTE
7DBB6      nWHEREINTG
7DBC1      nWHERESUM
7DBCC      nWHEREWHERE
216D8      OB>BAKcode
6207D      OverWrF/TLp
62B1F      PALPTRDCMP
39971      PathStatus
0630E3    ~PCunpack
138CA      pixon2
49AD3      PointDerivUt
49F06      PointMoveCur
38B45      POLErrorTrap
0D92C      POPDATE%
0D948      POPTIME%
1BB41      preFACT
4E497      PREMARKON
39853      PrgmEntrStat
028FC      PRLG
323E9      PSubErr
5133C      PtoR
7DF71      PTYPE>PINFO
2C04B      PUTAB0
30E4E      PutSerialECk
4AB2A      PvarsC%0
00114      RBR
01AD7      RCKBp
00111      RCS
265ED      realPAcode
510D5      RECORDX&YC%
53A20      REPLACE_MODE
0C147      restoreiram
2BEEC      RNDC[B]
61FCF      Rom-Word?
```

```
49BD2      RootUtil
45C2F      RowElt#
4489E      ROWNUM
1B185      rpnXROOT
71DB2      RPTRACC
0A532      SAFESKIPOB
0000F      sALLOWINTR
61D3A      SAVELAM
01307      SavPtrTime*
00008      sBEG
00004      sBPOFF
07661      SET
39FC1      SetAbbrevStk
38CDF      (SetBadPOLUI)
53B31      setflag
539F9      SetISysFlag
4CF41      SETLOOPENV
21CBA      SETROMPART
423BB      settimeout
00001      Sfkey1
00006      Sfkey6
0D50B0    ~sFldVal
42131      SLEEPxcp
00002      sNEGATE
                                  aka: sFLUSH
7DEF8      SPLITWHERE
2BA0F      SQRF
0131D      srvc_timer2
1686A      stackitw
3858E      StartupProc
47467      STOAPPLDATA
00001      sTRUNC
29BC2      subpdcdptch
5A310      symbn
32FF9      SYMBNUMSOLVE
38728      SysErrorTrap
08D66      SysPtr@
40792      SystemLevel?
00116      TBR
```

```
00112      TCS
4227F      TIMEOUT?
0012E      TIMERCTRL.1
0012F      TIMERCTRL.2
3E586      TogInsertKey
4272D      TopERow?
2BD76      TST15
3A9CE      TurnOffKey
42660      UCursor
39748      UserFlagStat
397BB      UserKeysStat
0580E7    ~UTTYPEEXT0?
0110E7    ~UTVUNS1Arg
17B86      VLM
31416      (WaitTbz0)
01FBD      Warmstart
                                  aka: norecPWLseq
136AA      WindowXY
0931B      X@
2BD32      Y<=X
0DB3A      YMD>Ticks
4E776      Z-BOX
```

10 Entries sorted by address

Here follows a list of entries sorted by address. Six-digit addresses are always sorted after five-digit addresses. The six-digit addresses for rompointers and flashpointers consist of the pointer number (first three digits) and the flashbank/library id (last three digits). Sorting of these addresses uses first the flashbank/library id and then the pointer number, so 000123 will be sorted after FFF122.

```
00001   Ann_RAD.b
00001   sTRUNC
00001   Sfkey1
00001   mEditLExists
00001   ParenModmask
00002   sFLUSH
00002   sNEGATE
00002   Ann_IO.b
00003   DZP
00004   Ann_Susp.b
00004   sBPOFF
00006   Sfkey6
00008   IRAMHOMEmsn
00008   Ann_Alert.b
00008   sBEG
0000A   portnotaverr
0000F   sALLOWINTR
00010   Ann_Shift.b
00011   LOCUPSIZE
00019   ENTERCODE
00020   Ann_ALT.b
00025   OBUPSIZE
00036   SYSUPSIZE
00040   Ann_Alpha.b
00080   Ann_Busy.b
00100   DISPIO
00101   NoRolDA2MASK
00101   CONTRAST
00102   ReqClkOnMASK
00102   DISPTEST
00103   UNDOMASK
00104   DA2aTempMASK
00104   CRC
00105   COMMANDMASK
00106   Do1UserMASK
00107   DA1ValidMASK
00108   DA1NoChMASK
00108   POWERSTATUS
00109   POWERCTRL
00109   DA1BadMASK
0010A   EDITLMASK
0010B   ParenModMASK
0010B   ANNCTRL
0010C   ANNCTRL2
0010C   DispTimeMASK
0010D   NOP1MASK13
0010E   NOP1MASK14
00110   NOP1MASK16
00110   IOC
00111   NOP1MASK17
00111   RCS
00112   TCS
00112   NOP1MASK18
00113   CRER
00113   NOP1MASK19
00114   NOP1MASK20
00114   RBR
00116   TBR
0011A   IRC
0011F   IRAM@
00120   DISPADDR
00125   LINEOFFS
00128   LINECOUNT
0012E   TIMER1CTRL
0012E   TIMERCTRL.1
0012F   TIMER2CTRL
0012F   TIMERCTRL.2
00130   MENUADDR
00137   TIMER1
00138   TIMER2
001CE   NOP1MASK15
001CE   BadTOLUIMASK
001FF   allkeys
00201   AbbrStkMASK
00202   argtypeerr
00202   ServModeMASK
00203   INSERTMASK
00203   argvalerr
00204   DA2bTempMASK
00205   BLINKMASK
00206   ASuspOKMASK
00207   DA2aValdMASK
00208   DA2aNoChMASK
00209   DA2aBadMASK
0020A   NAppKeyMASK
0020B   1PDCMASK
0020C   NOP2MASK12
0020D   NOP2MASK13
0020E   NOP2MASK14
00210   NOP2MASK16
00211   NOP2MASK17
00212   NOP2MASK18
00213   NOP2MASK19
00214   NOP2MASK20
00219   IRAMBSIZE
002CE   NOP2MASK15
```

002CE NoAlgProcess
00301 posunferr
00302 negunferr
00303 ofloerr
00305 infreserr
00401 DA2bIsEdMASK
00402 TrackMASK
00403 ALGMASK
00404 DA3TempMASK
00405 LOWERMASK
00406 BadPOLUIMASK
00407 DA2bValdMASK
00408 DA2bNoChMASK
00409 DA2bBadMASK
0040A NUsrKeyMASK
0040B NewEditLMASK
0040C NOP4MASK12
0040D NOP4MASK13
0040E NOP4MASK14
00410 NOP4MASK16
00411 NOP4MASK17
00412 NOP4MASK18
00413 NOP4MASK19
00414 NOP4MASK20
004CE NOP4MASK15
004CE InSimplyExpr
007B5 SrvcKbdAB
00801 IgnorAlmMASK
00802 BadMenuMASK
00803 PRINTINGMASK
00804 RebuildMASK
00805 STKDCMASK
00806 DA1TempMASK
00807 DA3ValidMASK
00808 DA3NoChMASK
00809 DA3BadMASK
0080A AppModeMASK
0080B DoStdKeyMASK
0080C NOP8MASK12
0080D NOP8MASK13
0080E NOP8MASK14
00810 NOP8MASK16
00811 NOP8MASK17
00812 NOP8MASK18
00813 NOP8MASK19
00814 NOP8MASK20
008CE NOP8MASK15
008CE DoCreateMenu
008E6 BITMAP
009A5 Debounce
00A03 intrptderr
00B02 constuniterr
00C02 timeouterr
00C06 xferfailerr
00C0D kermsendmsg
00C0E kermrecvmsg
00C10 kermpktmsg
00C13 prtparerr
00C14 lowbaterr
00C74 OnKeyDown?
00C80 OnKeyStable?
00D48 addrKEYSTATE
00D57 Flush
00D71 FLUSHKEYS
00D71 FLUSH
00D8E FlushAttn
010E5 AllowIntr
01115 DisableIntr
0115A AINRTN
01160 CINRTN
012EE GetTimChk
01307 SavPtrTime*
0130E GetTime++
0131D srvc_timer2
017A6 makebeep
0188D addrORghost
018E2 clkspd
01AD7 RCKBp
01B8F DispOn
01BBD DispOff
01C31 D0->Row1
01C58 D0->Sft1
01F6D CLCD10
01FA7 CLEARLCD
01FBD norecPWLseq
01FBD Warmstart
01FD3 Coldstart
01FDA norecCSseq
0210F DOROMPOLL
021DD ROMPOLL
028FC PRLG
02911 DOBINT
02933 DOREAL
02955 DOEREL
02977 DOCMP
0299D DOECMP
029BF DOCHAR
029E8 DOARRY
02A0A DOLNKARRY
02A2C DOCSTR
02A4E DOHSTR
02A4E DOHXS
02A74 DOLIST
02A96 DORRP
02AB8 DOSYMB
02ADA DOEXT
02AFC DOTAG
02B1E DOGROB
02B40 DOLIB
02B62 DOBAK
02B88 DOEXT0
02BAA DOEXT1
02BAA DOACPTR
02BCC DOEXT2

02BEE DOEXT3
02C10 DOEXT4
02D9D DOCOL
02DCC DOCODE
02E48 DOIDNT
02E6D DOLAM
02E92 DOROMP
02FD6 DoLam
02FEF ROMSEC
03019 SKIPOB
0312B SEMI
0314C DEPTH
03188 DUP
031AC 2DUP
031D9 NDUP
03223 SWAP
03244 DROP
03249 DropLoop
03258 2DROP
0326E NDROP
03295 ROT
032C2 OVER
032E2 PICK
03325 ROLL
0339E UNROLL
03442 MAKEARRY
03562 ARSIZE
0357C PUSH#ALOOP
0357F PUSH#LOOP
035A9 DIMLIMITS
0366F GPOverWrROLp
03672 GPOverWrALp
03685 ARRYEL?
03685 FINDELN
036F7 Push#TLoop
0371D GETATELN
03991 MUL#
039BE GETTEMP
039EF ECUSER
03A81 TRUE
03A86 PUSHA
03AC0 FALSE
03ADA XOR
03AF2 NOT
03B2E EQ
03B46 AND
03B75 OR
03B97 EQUAL
03C64 TYPE
03CA6 #0=
03CC7 #0<>
03CE4 #<
03D19 #=
03D4E #<>
03D83 #>
03DBC #+
03DC7 Push#Loop
03DE0 #-
03DEF #1+
03E0E #1-
03E2D #2+
03E4E #2-
03E6F #2*
03E8E #2/
03EB1 #AND
03EC2 #*
03EF7 #/
03F14 Push2#Loop
03F24 IntDiv
03F5D POP2#
03F8B TYPEREAL
03F95 TYPECMP
03F9F TYPELIST
03FA9 TYPEIDNT
03FB3 TYPECOL
03FBD TYPESYMB
03FC7 TYPERRP
03FD1 TYPELAM
03FDB TYPEEREL
03FE5 TYPEEXT
03FEF any
03FEF ZERO
03FEF BINT0
03FF9 real
03FF9 BINT1
03FF9 MEMERR
03FF9 ONE
04003 BINT2
04003 TWO
04003 cmp
0400D str
0400D BINT3
0400D THREE
04017 FOUR
04017 BINT4
04017 arry
04021 FIVE
04021 BINT5
04021 list
0402B id
0402B BINT6
0402B SIX
0402B idnt
04035 lam
04035 BINT7
04035 SEVEN
0403F seco
0403F EIGHT
0403F BINT8
04049 symb
04049 BINT9
04049 NINE
04053 sym
04053 BINT10

```
04FAA   SETLBERR
04FB6   SETMEMERR
04FBB   DOMEMERR
04FC2   SETDIRRECUR
04FCE   SETLAMERR
04FDA   SETCORPORT
04FE6   SETOBINUSE
04FF2   SETPORTNOTAV
04FFE   SETNOROOM
0500A   SETXNONEXT
05016   SETROMPERR
05023   Errjmp
05040   ATTNFLG@
05068   ATTNFLGCLR
05089   CARCOMP
050ED   CAR$
05143   GETPTRLOOP
05153   CDRCOMP
0516C   CDR$
0518A   &HXS
05193   &$
0521F   &COMP
0525B   >H$
052C6   >HCOMP
052EE   >T$
052FA   >TCOMP
05331   COMPN
05445   ::N
05459   {}N
0546D   SYMBN
05481   EXTN
054AF   INNERCOMP
0554C   DOGARBAGE
05566   NULLHXS?
0556F   NULL$?
055B7   NULLCOMP?
055D5   NULLHXS
055DF   NULL$
055E9   NULL{}
055F3   NULLSYMB
055FD   NULL::
05616   LENHXS
05622   OVERLEN$
05636   LEN$
0567B   LENCOMP
056B6   NTHELCOMP
05733   SUB$
05815   SUBHXS
05821   SUBCOMP
05902   OSIZE
05944   OCRC
0596D   PUSHhxsLoop
0597E   DoCRCc
05981   DoCRC
059CC   #>HXS
05A03   HXS>#
05A51   CHR>#
05A75   #>CHR
05AB3   CHANGETYPE
05ACC   !CHANGETYPE
05AED   ID>LAM
05B01   LAM>ID
05B15   $>ID
05B79   MAKE$
05B7D   MAKE$N
05BE9   ID>$
05C27   %>C%
05C72   %%>C%%
05D2C   C%>%
05DBC   C%%>%%
05E81   >TAG
05E9F   {}>TAG
05EC9   TAG>
05F2E   ID>TAG
05F42   GARBAGE
05F61   MEM
0613E   GARBAGECOL
064BD   TOTEMPOBADJ
064D6   DOADJ1
064E2   DOADJ
06529   PUSH2#
06537   PUSH#
065AA   GPMEMERR
065D9   PTRREFD?
065E5   REFERENCED?
06641   POP#
06657   TOTEMPOB
066B9   MOVEUP
0670C   MOVEDOWN
0675C   WIPEOUT
0679B   SAVPTR
067D2   GETPTR
06806   ROOM
06992   MOVERSD
069C5   MOVEDSU
069F7   ADJMEM
06A1D   MOVEDSD
06A53   MOVERSU
06A8E   DIV5
06AD8   CREATETEMP
06B3E   FREEINTEMP?
06B4E   INTEMNOTREF?
06BC2   NOTREF?
06DDE   >TOPTEMP
06E8E   NOP
06E97   '
06EEB   'R
06F66   'REVAL
06F8E   EVAL
06F9F   >R
06FB7   RDROP
06FD1   COLA
07012   R@
0701F   R>
```

070C3 RPITE
070FD RPIT
0712A ?SKIP
0712A NOT_IT
0714D SKIP
0715C 2SKIP
0716B IDUP
071A2 BEGIN
071AB AGAIN
071C8 UNTIL
071E5 REPEAT
071EE WHILE
07221 INDEX@
07249 ISTOP@
07258 JINDEX@
07264 JSTOP@
07270 INDEXSTO
07295 ISTOPSTO
072AD JINDEXSTO
072C2 JSTOPSTO
07321 STOPLOOP
07334 LOOP
073A5 +LOOP
073C3 ZERO_DO
073CE ONE_DO
073DB #1+_ONE_DO
073F7 DO
07497 ABND
074D0 BIND
074E4 DOBIND
075A5 GETLAM
075E9 PUTLAM
07638 SETHASH
0764E SETMESG
07661 SET
076AE OFFSRRP
07709 TOSRRP
0778D ONSRRP?
077E4 MAKERRP
078E9 FIRST@LAM
078F5 NTH@LAM
07943 @LAM
0797B @
07C18 COMPILEID
07D1B STOLAM
07D27 STO
07E50 #>ROMPTR
07E76 PTR>ROMPTR
07E99 ROMPTR@
07F86 ROMPART
08081 ROMPART>ADDR
080BF ROMPARTSIZE
080DA NEXTROMPID
08112 GETHASH
08130 GETMSG
0813C GETLINK
08157 GETCONFIG
08199 ROMPARTNAME
081D9 BAKNAME
081DE LIB>#
081E3 PTR>ID
081FB ROMPTRDECOMP
082E3 RAM-WORDNAME
08309 MYRAMROMPAIR
08326 LASTRAM-WORD
08376 PREVRAM-WORD
083D1 GETRRP
085D3 REPLACE
08696 CREATE
08C27 PURGE
08CCC ROMPTR>#
08D08 CONTEXT!
08D4A STOPSIGN!
08D5A CONTEXT@
08D66 SysPtr@
08D82 STOPSIGN@
08D92 SYSCONTEXT
08D92 HOMEDIR
08DC4 SYSSTOPSIGN
08DD4 SYSRRP?
08DF2 CREATERRP
0931B X@
0948E BAK>OB
0970A InitEnab
09B73 COMPCONFCRC
0A00E CKLBCRC
0A532 SAFESKIPOB
0AAB2 PORTSTATUS
0AB22 PORTEND
0AB82 NEXTLIBBAK
0B409 MERGE
0BBED TrueTrue
0BC01 failed
0BC6F !*trior
0BCCF !*triand
0BD54 tok8cktrior
0BD60 tok8trior
0C147 restoreiram
0C501 GETEL
0C506 rGETATELN
0CA60 ATTNchk
0CBAE NOALARMERR
0CBC4 ErrTime
0CBFA TOD
0CC0E DATE
0CC39 DDAYS
0CC5B DATE+DAYS
0CD2B >DATE
0CD3F CLKADJ
0CD3F CLKADJ*
0CD53 >TIME
0CF5B Ticks>wd$
0CFD9 Date>d$
0D06A TOD>t$

185C7 DoHere:
18621 LastNonNull
1863A PrevNonNull
18653 CkNonNull
1867F DODIRPRG
186E8 DOTVARS%
18779 DOVARS
1884D 0LASTOWDOB!
1884D 0LastRomWrd!
18873 AND$
18887 OR$
1889B XOR$
188D2 NOT$
188E6 !AND$
188F5 !OR$
18904 !XOR$
18961 !NOT$
18A15 CK0NOLASTWD
18A1E CK0
18A5B CK3
18A68 CK3NOLASTWD
18A80 CK2
18A8D CK2NOLASTWD
18AA5 CK1
18AB2 CK1NOLASTWD
18B6D CK5
18B7A CK5NOLASTWD
18B92 CK4
18B9F CK4NOLASTWD
18C34 CKN
18C4A CKNNOLASTWD
18C92 SETNONEXTERR
18CA2 SETSIZEERR
18CA7 DOSIZEERR
18CB2 SETTYPEERR
18CC2 SETSTACKERR
18CD7 %ABSCOERCE
18CEA COERCE
18DBF UNCOERCE
18E45 DNOTSYMB?SEMI
18EBA COMPEVAL
18ECE CK1&Dispatch
18EDF CK2&Dispatch
18EF0 CK3&Dispatch
18F01 CK4&Dispatch
18F12 CK5&Dispatch
18F23 EvalNoCK
18F6A 'EvalNoCK:_sup
18F6A EvalNoCK:
18F9D CK&DISPATCH0
18FA9 CK&DISPATCH2
18FB2 CK&DISPATCH1
191B9 #*OVF
19207 CKNFLOATS
19294 >ARRY
19350 NOTINHARDROM?
193DA COERCE{}2
194F7 COERCE2
1950B UNCOERCE2
19529 UNCOERCE{}2
1957B xASR
1959B xRL
195BB xRLB
195DB xRR
195FB xRRB
1961B xSL
1963B xSLB
1965B xSR
1967B xSRB
1969B xR>B
196BB xB>R
196DB xCONVERT
1971B xUVAL
1974F x>UNIT
19771 xUBASE
197A5 xUFACT
197C8 UMFACT
197F7 xTIME
19812 xDATE
1982D xTICKS
19848 xWSLOG
19863 xACKALL
1987E xACK
1989E xSETDATE
198BE xSETTIME
198DE xCLKADJ
198FE xSTOALARM
19928 xRCLALARM
19948 xFINDALARM
19972 xDELALARM
19992 xTSTR
199B2 xDDAYS
199D2 xDATE+
199EB DoInputForm
1A105 xCRDIR
1A125 xPATH
1A140 xHOME
1A15B xUPDIR
1A16F UPDIR
1A194 xVARS
1A1AF xTVARS
1A1D9 xBYTES
1A1FC OCRC%
1A265 VARSIZE
1A2BC xNEWOB
1A2DA INHARDROM?
1A303 xKILL
1A31E xOFF
1A339 xDOERR
1A36D xERR0
1A388 xERRN
1A3A3 xERRM
1A3BE xEVAL
1A3FE xIFTE

1A4A3 %IFTE
1A4CD xIFT
1A52E xSYSEVAL
1A584 xDISP
1A5A4 xFREEZE
1A5C4 xBEEP
1A5E4 x>NUM
1A604 xLAST
1A71F xWAIT
1A738 Wait/GetKey
1A7B5 dowait/quit?
1A7C9 dowait
1A7ED wait
1A858 xCLLCD
1A873 xKEY
1A8BB xCONT
1A8D8 x=
1A995 xNEG
1AA1F xABS
1AA6E xCONJ
1AABD xPI
1AADF xMAXR
1AB01 xMINR
1AB23 xCONSTANTe
1AB45 xi
1AB67 x+
1AC93 SWAP>HCOMP
1ACDD xNEGNEG
1AD09 x-
1ADEE x*
1AF05 x/
1B02D x^
1B185 rpnXROOT
1B1CA xXROOT
1B278 xINV
1B2DB xARG
1B30D %ARG
1B32A xSIGN
1B374 xSQRT
1B3F5 CK%SQRT
1B426 xSQ
1B47B %SQ
1B48F C%C*C
1B4AC xSIN
1B505 xCOS
1B55E xTAN
1B5B7 xSINH
1B606 xCOSH
1B655 xTANH
1B6A4 xASIN
1B6EA CK%ASIN
1B72F xACOS
1B775 CK%ACOS
1B79C xATAN
1B7EB xASINH
1B830 xACOSH
1B86C CK%ACOSH
1B8A2 xATANH
1B8DE CK%ATANH
1B905 xEXP
1B94F xLN
1B995 CK%LN
1B9C6 xLOG
1BA0C CK%LOG
1BA3D xALOG
1BA8C xLNP1
1BAC2 xEXPM
1BB02 xFACT
1BB41 preFACT
1BB6D xIP
1BBA3 xFP
1BBD9 xFLOOR
1BC0F xCEIL
1BC45 xXPON
1BC71 xMAX
1BCE3 xMIN
1BD55 xRND
1BDD1 xTRNC
1BE4D xMOD
1BE9C xMANT
1BEC8 xD>R
1BEF4 xR>D
1BF1E x>HMS
1BF3E xHMS>
1BF5E xHMS+
1BF7E xHMS-
1BF9E xRNRM
1BFBE xCNRM
1BFDE xDET
1BFFE xDOT
1C01E xCROSS
1C03E xRSD
1C060 x%
1C0D7 x%T
1C149 x%CH
1C1B9 xRAND
1C1D4 xRDZ
1C1F6 xCOMB
1C236 xPERM
1C274 xSF
1C2D5 xCF
1C313 xFS?
1C360 xFC?
1C399 xDEG
1C3B4 xRAD
1C3CF xGRAD
1C3EA xFIX
1C41E xSCI
1C452 xENG
1C486 xSTD
1C4A1 xFS?C
1C4CE TestUserClr
1C4EC TestSysClr
1C520 xFC?C

1C559 xBIN
1C574 xDEC
1C58F xHEX
1C5AA xOCT
1C5C5 xSTWS
1C5FE xRCWS
1C619 xRCLF
1C637 RCLSYSF
1C64E RCLUSERF
1C67F xSTOF
1C6A2 DOSTOALLF0
1C6CF STOALLFcont
1C6E3 DOSTOSYSF
1C6F7 STOUSERF
1C731 STOSYSF
1C783 x>LIST
1C79E xR>C
1C7CA xRE
1C819 xIM
1C85C xSUB
1C8BB XEQSUB$
1C8EA xREPL
1C95A xLIST>
1C973 XEQLIST>
1C98E xC>R
1C9B8 xSIZE
1CA0D DROP%1
1CA26 LEN$>%
1CA3A LENCOMP>%
1CAB4 xPOS
1CAD7 XEQPOS$
1CB0B x>STR
1CB26 xSTR>
1CB46 xNUM
1CB66 xCHR
1CB86 xTYPE
1CB90 XEQTYPE
1CC03 %11
1CC1D %12
1CC37 %13
1CC51 %14
1CC6B %20
1CC85 %15
1CCA4 %21
1CCC3 %22
1CCE2 %23
1CD01 %24
1CD20 %25
1CD3A %16
1CD54 %17
1CD69 BINT_AFh
1CD73 %26
1CD8D %27
1CDF2 %18
1CE07 %19
1CE28 xVTYPE
1CEE3 xEQ>
1CF2E SPLITEQ
1CF42 drppargsym
1CF7B xOBJ>
1CFD0 EXPR>
1D009 x>ARRY
1D02C XEQ>VECTOR
1D054 XEQ>ARRAY
1D054 XEQ>ARRY
1D092 xARRY>
1D0AB DOARRY>
1D0DF xRDM
1D186 xCON
1D2DC xIDN
1D392 xTRN
1D407 xPUT
1D5DF xPUTI
1D7C6 xGET
1D8C7 xGETI
1DABB #1+ROT
1DBB0 BANGARRY
1DC00 PUTLIST
1DD06 xV>
1DE66 x>V2
1DEC2 x>V3
1E04A xINDEP
1E07E xPMIN
1E09E xPMAX
1E0BE xAXES
1E0E8 xCENTR
1E126 xRES
1E150 x*H
1E170 x*W
1E190 xDRAW
1E1AB xAUTO
1E1C6 xDRAX
1E1E1 xSCALE
1E201 xPDIM
1E22B xDEPND
1E25F xERASE
1E27A xPX>C
1E29A xC>PX
1E2BA xGRAPH
1E2D5 xLABEL
1E2F0 xPVIEW
1E31A xPIXON
1E344 xPIXOFF
1E36E xPIX?
1E398 xLINE
1E3C2 xTLINE
1E3EC xBOX
1E416 xBLANK
1E436 xPICT
1E456 xGOR
1E4E4 xGXOR
1E572 xLCD>
1E58D x>LCD
1E5AD x>GROB

1E5D2	xARC	1F27A	XEQINTEG	1FE48	xSUMY2
1E606	xTEXT	1F38B	SYMWHERE	1FE63	xSUMXY
1E621	xXRNG	1F3F3	xWHERE	1FE7E	xMAXSIGMA
1E641	xYRNG	1F439	XEQSYMWHERE	1FE99	xMEAN
1E661	xFUNCTION	1F43E	CKWHEREARGS	1FEB4	xMINSIGMA
1E681	xCONIC	1F500	xQUOTE	1FECF	xSDEV
1E6C1	xPARAMETRIC	1F5C5	xAPPLY	1FEEA	xTOT
1E6E1	xTRUTH	1F640	xFCNAPPLY	1FF05	xVAR
1E701	xSCATTER	1F9C4	x->Q	1FF20	xLR
1E721	xHISTOGRAM	1F9E9	x->QPI	1FF7A	xPREDV
1E741	xBAR	1FA59	xMATCHUP	1FF9A	xPREDY
1E761	xSAME	1FA8D	xMATCHDN	1FFBA	xPREDX
1E783	xAND	1FAEB	xFORMUNIT	1FFDA	xXCOL
1E809	xOR	1FB5D	xPREDIV	1FFFA	xYCOL
1E88F	xNOT	1FB87	xDUP	2001A	xUTPC
1E8F6	xXOR	1FBA2	xDUP2	2003A	xUTPN
1E972	x==	1FBBD	xSWAP	2005A	xUTPF
1EA9D	x#?	1FBD8	xDROP	2007A	xUTPT
1EBBE	x<	1FBF3	xDROP2	2009A	xSIGMACOL
1EC5D	x>	1FC0E	xROT	200C4	xSCLSIGMA
1ECFC	x<=?	1FC29	xOVER	200F3	xSIGMALINE
1ED9B	x>=?	1FC44	xDEPTH	2010E	xBINS
1EE38	xOLDPRT	1FC64	xDROPN	20133	xBARPLOT
1EE53	xPR1	1FC7F	xDUPN	20167	xHISTPLOT
1EE6E	xPRSTC	1FC9A	xPICK	2018C	xSCATRPLOT
1EE89	xPRST	1FCB5	xROLL	201B1	xLINFIT
1EEA4	xCR	1FCD0	xROLLD	201D6	xLOGFIT
1EEBF	xPRVAR	1FCEB	xCLEAR	201FB	xEXPFIT
1EF43	xDELAY	1FD0B	xSTOSIGMA	20220	xPWRFIT
1EF63	xPRLCD	1FD2B	xCLSIGMA	2025E	xBESTFIT
1EFD2	xDER	1FD46	xRCLSIGMA	202CE	xSINV
1F0F5	XEQSYMDERSTEP	1FD61	xSIGMA+	2034D	xSNEG
1F113	XEQSYMDERCON	1FD8B	xSIGMA-	203CC	xSCONJ
1F133	xRCEQ	1FDA6	xNSIGMA	2044B	xSTO+
1F14E	xSTEQ	1FDC1	xCORR	20538	xSTO-
1F16E	xROOT	1FDDC	xCOV	2060C	xSTO/
1F201	XEQINTEGID	1FE12	xSUMY	20753	xSTO*
1F223	xINTEGRAL	1FE2D	xSUMX2	208F4	xINCR

209AA xDECR
20A15 xCOLCT
20A49 xEXPAN
20A7D xRULES
20A93 xISOL
20AB3 xQUAD
20AD3 xSHOW
20B00 XEQSHOWLS
20B20 xTAYLR
20B40 xRCL
20B81 XEQRCL
20B9A LISTRCL
20CAD PICTRCL
20CCD xSTO
20D65 xDEFINE
20EFE xPURGE
20F8A XEQPURGEPICT
20FAA xMEM
20FD9 xORDER
20FF2 XEQORDER
210FC xCLUSR
2115D xTMENU
21196 xMENU
211B4 ID_CST
211E1 xRCLMENU
211FC xPVARS
2123A xPGDIR
2125A xARCHIVE
2133C xRESTORE
2137F xMERGE
213D1 xFREE
2142D xLIBS
21448 xATTACH
2147C xDETACH
21660 SWAPDROPTRUE
21674 >BAK
216D8 OB>BAKcode
21922 GetBVars
21B4E DOAPWL
21B5A XEQIOBACKUP
21C47 MEMSKIP
21C6F XEQSETLIB
21CBA SETROMPART
21E75 xXMIT
21E95 xSRECV
21EB5 xOPENIO
21ED5 xCLOSEIO
21EF0 xSEND
21F24 xKGET
21F62 xRECN
21F96 xRECV
21FB6 xFINISH
21FD1 xSERVER
21FEC xCKSM
2200C xBAUD
2202C xPARITY
2204C xTRANSIO
2206C xKERRM
22087 xBUFLEN
220A2 xSTIME
220C2 xSBRK
220DD xPKT
22352 %1200
22367 %2400
2237C %4800
22391 %9600
224CA xINPUT
224F4 xASN
22514 xSTOKEYS
22548 xDELKEYS
22586 xRCLKEYS
225A4 ID_S
225BE x->TAG
225F5 USER$>TAG
22618 %>TAG
22633 xDTAG
22EC3 xIF
22EFA xTHEN
22F68 SYMCRUNCH1
22F86 SYMCRUNCH2
22FB5 xELSE
22FD5 xIFEND
22FEB xALG->
23033 xWHILE
2305D xREPEAT
230C3 xDO
230ED xUNTIL
23103 xSTART
231A0 xSTARTVAR
2324C xNEXT
23380 xSTEP
233DF xIFERR
23472 xHALT
2349C xSILENT’
234C1 xRPN->
235FE x>>ABND
2361E x<<
23639 x>>
23654 x’
23679 xENDTIC
23694 xWHILEEND
236B9 xENDDO
2371F xERRTHEN
23768 CKOATTNABORT
2378D xCASE
237A8 xTHENCASE
23813 xDIR
23813 xGROB
23824 xPROMPT
238A4 palparse
23EED ONE{}N
24C0D List
2512D delimcase
2520A ’Rapndit

25223 DaDGNTc
25322 4psh
2534A nultrior
25446 tok->
25452 getmatchtok
255BD ngsizecase
255FB need'case
25632 newBASE
256E4 convertbase
25B0B #+OVF
25C41 Extobcode
25CE1 GETPTRTRUE
26162 GetNextToken
265ED realPAcode
267D5 GPPushFTLp
267DC PushFTLp
26A2D ?OKINALG
26FAE GETPTRFALSE
27224 DNOTBAKcase
27234 DNOTLIBcase
27244 NOTLISTcase
27254 NOTSECOcase
27264 NOTROMPcase
27D00 check_pdata
28296 metatail
283C4 COLAskipcola
283D8 3SKIP
28558 #1-UNROT
2856C tok=casedrop
29A8D nextsym'R
29BC2 subpdcdptch
29DCC POSFLOWERR
29DDC NEGFLOWERR
29DEC OVERFLOWERR
29DFC SETIVLERR
29E0C INFRESERR
29E21 PACKSB
29E46 PACK
29FD0 POP1%SPLITA
29FDA POP1%
2A002 POP2%
2A188 PUSH%
2A23D PUSH%LOOP
2A2B4 %0
2A2C9 %1
2A2DE %2
2A2F3 %3
2A308 %4
2A31D %5
2A332 %6
2A347 %7
2A35C %8
2A371 %9
2A386 %-1
2A39B %-2
2A3B0 %-3
2A3C5 %-4
2A3DA %-5
2A3EF %-6
2A404 %-7
2A419 %-8
2A42E %-9
2A443 %PI
2A458 %%PI
2A472 %MAXREAL
2A487 %-MAXREAL
2A49C %MINREAL
2A4B1 %-MINREAL
2A4C6 %%0
2A4E0 %%1
2A4FA %%2
2A514 %%3
2A52E %%4
2A548 %%5
2A562 %%.1
2A57C %%.5
2A596 %%10
2A5B0 %%>%
2A5C1 %>%%
2A5D2 SETDEG
2A5F0 SETRAD
2A604 SETGRAD
2A622 %D>R
2A62C PI/180
2A655 %R>D
2A673 %>HMS
2A68C %HMS>
2A6A0 %HMS+
2A6C8 %HMS-
2A6DC %%MAX
2A6F5 %MAX
2A70E %MIN
2A727 %%0<
2A738 %0<
2A75A %%0=
2A76B %0=
2A788 %%0>
2A799 %0>
2A7BB %%0<>
2A7CF %0<>
2A7E3 %%0>=
2A7F7 %0>=
2A80B %%0<=
2A81F %%<
2A871 %<
2A87F %%>
2A88A %>
2A895 %%>=
2A8A0 %>=
2A8AB %%<=
2A8B6 %<=
2A8C1 %=
2A8CC %<>
2A8D7 %SGN

2A8F0 %%ABS
2A900 %ABS
2A910 %%CHS
2A920 %CHS
2A930 %MANTISSA
2A943 %%+
2A94F %%-
2A95B %>%%-
2A974 %+
2A981 %-
2A99A %%*
2A9BC %*
2A9C9 %OF
2A9E8 %%/
2A9FE %/
2AA0B %T
2AA30 %CH
2AA5F %%^
2AA70 %^
2AA81 %NROOT
2AA92 %%1/
2AA9E %>%%1/
2AAAF %1/
2AAEA %%SQRT
2AAF6 %>%%SQRT
2AB09 %SQRT
2AB1C %%EXP
2AB2F %EXP
2AB42 %EXPM1
2AB5B %%LN
2AB6E %LN
2AB81 %LOG
2AB94 %%LNP1
2ABA7 %LNP1
2ABBA %ALOG
2ABDC %MOD
2ABEF %SIN
2AC06 %%SIN
2AC17 %%SINDEG
2AC27 %%SINRAD
2AC40 %COS
2AC57 %%COS
2AC68 %%COSDEG
2AC78 %%COSRAD
2AC91 %TAN
2ACA8 %%TANRAD
2ACC1 %ASIN
2ACD8 %%ASINRAD
2ACF1 %ACOS
2AD08 %%ACOSRAD
2AD21 %ATAN
2AD38 %ANGLE
2AD4F %%ANGLE
2AD5B %>%%ANGLE
2AD6C %%ANGLEDEG
2AD7C %%ANGLERAD
2AD95 %%SINH
2ADAE %SINH
2ADC7 %%COSH
2ADDA %COSH
2ADED %TANH
2AE00 %ASINH
2AE13 %ACOSH
2AE26 %ATANH
2AE39 %EXPONENT
2AE4C %NFACT
2AE62 %COMB
2AE75 %PERM
2AF27 %%H>HMS
2AF4D %FP
2AF60 %IP
2AF73 %CEIL
2AF86 %FLOOR
2AF99 %%FLOOR
2AF99 %%INT
2AFAC %INT
2AFC2 %RAN
2B044 %RANDOMIZE
2B07B DORANDOMIZE
2B0C4 %FACT
2B1FF %%7
2B2DC %%12
2B300 %%60
2B3DD %%.4
2B45C 2%>%%
2B470 2%%>%
2B48E %REC>%POL
2B498 %%R>P
2B4BB %POL>%REC
2B4C5 %%P>R
2B4F2 %SPH>%REC
2B529 RNDXY
2B53D TRCXY
2B67D aMODF
2B770 aH>HMS
2B789 1/X15
2B7A7 RSUB1
2B7B0 RADD1
2B7CA RADDF
2B7DC ADDF
2B91E MULTF
2B977 DIVF
2BA0F SQRF
2BBB5 DIV2
2BBE2 CLRFRC
2BC4A SPLITA
2BCA0 SPLTAC
2BD32 Y<=X
2BD76 TST15
2BE53 XYEX
2BE61 STAB0
2BE6F STAB2
2BE7D STCD0
2BE8B STCD2

2BE99 EXAB0
2BEA7 EXAB2
2BEB5 RCAB0
2BEC0 RCAB2
2BECB RCCD0
2BED6 RCCD2
2BEE1 CCSB1
2BEEC RNDC[B]
2BFE3 GETAB1
2BFFD GETAB0
2C031 GETCD0
2C04B PUTAB0
2C1F3 STATSTO
2C1FD ID_SIGMADAT
2C22F STATCLST
2C270 STATRCL
2C535 STATN
2C558 STATSMAX
2C571 STATMEAN
2C58A STATSMIN
2C5A3 STATSTDEV
2C5BC STATTOT
2C5D5 STATVAR
2C675 STATCOL
2C6B6 STATXCOL
2C6CF STATYCOL
2C6F2 STATGETXCOL
2C706 STATGETYCOL
2C83C STATCORR
2C8E6 STATCOV
2C940 STATX
2C959 STATY
2C972 STATXX
2C99A STATYY
2C9C2 STATXY
2CA0D STATLR
2CADA STATPREDY
2CB4D STATPREDX
2CCBA ColumnMAX
2CCD3 ColumnMIN
2CCDF ColumnTOT
2CCEE ColumnMEAN
2CCFD ColumnVAR
2CD09 ColumnTDEV
2D396 MAXRETRY
2D3A0 LAMPKNO
2D3B1 LAMPACKET
2D3C6 LAMRETRY
2D3D9 LAMERRMSG
2D3EE LAMKP
2D3FB LAMLNAME
2D40E LAMOBJ
2D41D LAMOPOS
2D42E LAMEXCHP
2D441 'LamKPSto
2D45A LAMKLIST
2D46D LAMKMODE
2D480 LAMKPTRN
2D493 LAMKRM
2D4A2 LAMMaxR
2D517 EXCHINITPK
2D564 Loop
2D58C SENDEOT
2D5E1 SEND_PACKET
2D730 KDispRow2
2D74E KDispStatus2
2D816 DORECN
2D9A1 SetServMode
2D9B2 ClrServMode
2D9F5 DOSERVER
2DDC4 DropSysErr$
2E0A9 SENDNAK
2E0C7 SENDERROR
2E0F4 SENDPKT
2E108 BUILDKPACKET
2E31F Push#FLoop
2E4DC APNDCRLF
2E4F0 CRLF$
2E5AB SENDNAME
2E6BE InitIOEnv
2E6EB SENDLIST
2E7EF GETNAME
2E876 DOFINISH
2E8D1 DOPKT
2E99E StdIOPAR
2E9CB StoIOPAR
2E9E6 SysSTO
2EA4F GetIOPAR
2EA6A Sys@
2EAE2 KERMOPEN
2EB37 DOOPENIO
2EB62 OpenIO
2EC11 %IP>#
2EC25 IOCheckReal
2EC34 SetIOPARerr
2EC84 DOBAUD
2ECCA DOPARITY
2ED10 DOTRANSIO
2ED4C DOCKSM
2EDA6 DOKERRM
2EDE1 DOBUFLEN
2EDF5 DOSTIME
2EE18 DOSBRK
2EE6F DOXMIT
2EE97 DOSRECV
2EEC4 SendSetup
2EFD7 TRPACKETFAIL
2F211 LAMKML
2F383 IncrLAMPKNO
2F39C GetKermPkt#
2F542 2DROPTRUE
2F934 FalseFalse
2F989 RecvNextPkt
2FEA1 SENDACK

2FEB5 SENDNULLACK
2FEC9 KVISLF
2FEDD KVIS
2FFB4 GetStrLenStk
2FFB7 GetStrLenC
2FFBA GetStrLen
3016B KINVISLF
3037A VERSTRING?
30794 VERSTRING
307E2 GETKP
30805 SUB$1#
30914 ACK_INIT
30B1D CHOOSE_INIT
30BBE ENCODE1PKT
30BD7 ENCODE
30D31 DECODE
30E4E PutSerialECk
30ED2 OUTUART
31289 POPUART
312DA adr_uart_han
3133B UARTBUFLEN
3136C FLUSHRSBUF
31416 WaitTbz0
31444 PUTSERIAL
314E5 GETSERIAL
315C6 CLOSEUART
315F9 CloseUart
31608 OpenUart?Clr
3161E OpenUartClr
31854 docr
31868 DOCR
3187C OpenIOPrt
31EE2 DOPRLCD
31F4A StdPRTPAR
31F7D StoPRTPAR
31FFD DODELAY
3205C GetChkPRTPAR
320B1 %80
32161 PRINT
32387 PRINTxNLF
323E9 PSubErr
323F9 REMAP
324A6 AllowPrlcdCl
3251C PopASavptr
3251F PopSavptr
3252B SetEcma94
325AA ChkLowBat
32B08 ErrFixEIRU
32B1A FixEIRU
32B74 PrintGrob
32CAF ChkGrHook
32CB6 adrGraphPrtH
32FF9 SYMBNUMSOLVE
3303F NUMSOLVE
3306C 7NULLLAM{}
34301 Attn#
34301 ATTN#
34D2B 1NULLLAM{}
34D30 NULLLAM
353AB FINDVAR
35491 apndvarlst
3558E PULLEL
355B8 PULLREALEL
355C8 PULLCMPEL
355D8 PULLLONGEL
35602 PULLEREALEL
35628 PUTEL
3566F PUTREALEL
356F3 PUTCMPEL
357A8 MDIMS
35B47 SWITCHFLOATS
35B88 SWITCH2FLOATS
35C2C DOARRYPRG1
35C63 DOARRYPRG2
35CAE MATCON
35D08 DROP3PICK
35D35 MATIDN
35DEB MATNEG
35E2C MATRND
35EA9 MATTRNC
35F30 MATCONJ
35F8F MATRE
35FA3 DUP%0CON
35FEE MATIM
36039 MATR>C
360B6 MATC>R
36115 MAT+
36278 MAT-
362DC MATFLOAT*
363DB MATFLOAT/
36444 MATSQ
3644E MAT*
365BB MATRSD
36705 MATDOT
36791 MATCROSS
368F4 MATRNRM
3690D MATCNRM
369E9 MATABS
36A48 MATDET
36A99 MATINV
36AC3 MAT/
3742D !MAKEHXS
3745E SWAPROWS
37508 SWAPCOLUMNS
37B17 3NULLLAM{}
37B44 CKREF
37BCB ONE_DO_ARRY
37BE9 L%+
37C0C L%-
37C2F L%*
37C52 L%/
37C75 B%ABS
37CD3 B%NEG
37D19 F%>L%

37DB9 2NULLLAM{}
37DF6 B%0=
37E0F MATREDIM
37E0F METREDIM
3811F MATTRN
3858E StartupProc
385E8 InitSysUI
3866F SysMenuCheck
386A1 SysDisplay
386D8 ?FlashAlert
38728 SysErrorTrap
38908 DoWarning
38926 FlashWarning
38985 ParOuterLoop
38994 POLSet&KeyUI
389BC POLSaveUI
389CB RclUI
38A11 RclHPUI
38A3E LAMSavedUI
38A3E SavedUILS
38A64 POLSetUI
38AEB POLKeyUI
38B09 1POLKeyUI
38B45 POLKeyErr
38B45 POLErrorTrap
38B77 POLResUI&Err
38B90 POLRestoreUI
38BD6 NormAppFlags
38BD6 InitPOLVars
38C08 AppDisplay!
38C18 AppDisplay@
38C28 NoAppDisplay!
38C38 AppKeys!
38C48 AppKeys@
38C58 NoAppKeys!
38C58 AppKeys0
38C68 AppExitCond!
38C78 AppExitCond@
38C88 NoAppExitCnd!
38C98 AppError!
38CAB AppError@
38CBE NoAppError!
38CD1 AppError?
38CDF SetAppError
38CDF SetBadPOLUI
38CED ClrAppError
38CFB AppMode?
38D09 SetAppMode
38D17 ClrAppMode
38D25 NAppKeyOK?
38D33 SetNAppKeyOK
38D41 ClrNAppKeyOK
38D4F DoStdKeys?
38D5D SetDoStdKeys
38D6B ClrDoStdKeys
38D79 AppSuspOK?
38D8A SetAppSuspOK
38D9B ClrAppSuspOK
38DAC DA1OK?
38DE8 SetDA1BadT
38DFC DA2aOK?
38E38 SetDA2aBadT
38E4C DA2bOK?
38E88 SetDA2bBadT
38E9C DA2OK?
38EB5 DA3OK?
38EF1 SetDA3BadT
38F05 DAsOK?
38F28 DA1OK?NOTIT
38F41 DA2aOK?NOTIT
38F5A DA2bOK?NOTIT
38F73 DA3OK?NOTIT
38F8C InitDispModes
38FB9 DA2aLess1OK?
38FD2 SetDA1Valid
38FEB SetDA2aValid
38FFF SetDA2bValid
39018 SetDA3Valid
3902C SetDA1Temp
39045 SetDA2aTemp
39059 SetDA2bTemp
39072 SetDA3Temp
39086 SetDA2Echo
39086 SetDA2aEcho
39086 ?SetEditRoll
390A4 MENoP&FixDA1
390B3 MENP&FixDA12
390CC ClrDA1OK
390E5 ClrDA2aOK
390FE ClrDA2bOK
39117 ClrDA2OK
3912B ClrDA3OK
39144 ClrDAsOK
3915D SetDA2Valid
39171 SetDAsValid
3918A SetDA2NoCh
3919E SetDA12NoCh
391B2 SetDA23NoCh
391C6 SetDA13NoCh
391DA SetDA12a3NoCh
391DA SetDA12a3NCh
391EE SetDAsNoCh
391EE SetDA123NoCh
39207 SetDA2OKTemp
3921B SetDA12Temp
3922F SetDAsTemp
39248 DAsBad?
39275 DA1ValidF?
39283 SetDA1ValidF
39291 ClrDA1ValidF
3929F DA2aValidF?
392AD SetDA2aValidF
392BB ClrDA2aValidF
392C9 DA2bValidF?

392D7 SetDA2bValidF
392E5 ClrDA2bValidF
392F3 DA3ValidF?
39301 SetDA3ValidF
3930F ClrDA3ValidF
3931D DA1TempF
3932B SetDA1TempF
39339 ClrDA1TempF
39347 DA2aTempF?
39355 SetDA2aTempF
39363 ClrDA2aTempF
39371 DA2bTempF?
39371 DA2bTemp?
3937F SetDA2bTempF
3938D ClrDA2bTemp
3938D ClrDA2bTempF
3939B DA3TempF?
393A9 SetDA3TempF
393B7 ClrDA3TempF
393C5 DA1NoCh?
393D3 SetDA1NoCh
393E1 ClrDA1NoCh
393EF DA2aNoCh?
393FD SetDA2aNoCh
3940B ClrDA2NoCh
39419 DA2bNoCh?
39427 SetDA2bNoCh
39435 ClrDA2bNoCh
39443 DA3NoCh?
39451 SetDA3NoCh
3945F ClrDA3NoCh
3946D DA1Bad?
3947B SetDA1Bad
39489 ClrDA1Bad
39497 DA2aBad?
394A5 SetDA2aBad
394B3 ClrDA2aBad
394C1 DA2bBad?
394CF SetDA2bBad
394DD ClrDA2bBad
394EB DA3Bad?
394F9 SetDA3Bad
39507 ClrDA3Bad
39515 DA1IsStatus?
39515 DA1IsStat?
39515 DispTime?
39523 SetDA1IsStat
39531 ClrDA1IsStat
3953F DA2bIsEdL?
3953F DA2bEdit?
3954D SetDA2bIsEdL
3954D SetDA2bEdit
3955B ClrDA2bEdit
3955B ClrDA2bIsEdL
39569 NoRollDA2?
3957A SetNoRollDA2
3958B ClrNoRollDA2
3959C ?DispStatus
395BA DispStatus
39632 Blank&GROB!
39673 AngleStatus
396C8 ComVecStatus
39748 UserFlagStat
397BB UserKeysStat
3981B AlgEntryStat
39853 PrgmEntrStat
3988B DispDir?Time
398F4 DispDir?Tim1
39958 DispDir?Tim2
39971 PathStatus
39AF1 DispTimeReq?
39B0A DispStsBound
39B2D LineGrob
39B85 ?DispStack
39BF3 ?RollUpDA2
39F6F LINESOFSTACK
39FB0 AbbrevStack?
39FC1 SetAbbrevStk
39FD2 ClrAbbrevStk
3A00D DispEditLine
3A1CA ?DispMenu
3A1E8 DispMenu
3A1FC DispMenu.1
3A260 >MENU
3A260 StdLabelDef
3A297 Grob>Menu
3A2B5 Str>Menu
3A2C9 Seco>Menu
3A2DD Id>Menu
3A328 MakeStdLabel
3A337 NullMenuLbl
3A38A MakeBoxLabel
3A399 BoxLabelGrob
3A3EC MakeDirLabel
3A3FB DirLabelGrob
3A44E MakeInvLabel
3A45D InvLabelGrob
3A4AB MakeLabel
3A4CE Disp5x7
3A546 BlankDA1
3A55F BlankDA2
3A578 BlankDA12
3A591 BlankDA2a
3A71C DoNextRow
3A735 DoPrevRow
3A9B8 'DROPFALSE
3A9CE TurnOffKey
3A9E7 SetSomeRow
3AA0A 1A/LockA
3ADED DoPlotMenu
3B211 DoFirstRow
3BDFA EditMenu
3BE54 DoSolvrMenu
3E2DD <SkipKey

3E35F >SkipKey
3E3E1 <DelKey
3E4CA >DelKey
3E586 TogInsertKey
3E5CD IStackKey
3EC71 NullMenuKey
3EC85 NoExitAction
3EC99 Box/StdLabel
3ECB2 Box/StdLbl:
3ECD0 FStd/BoxLbl:
3ECEE FBox/StdLbl:
3ED0C Std/BoxLabel
3ED25 BBox/StdLbl:
3ED48 MBox/StdLbl:
3ED6B DirLabel:
3EDA2 TogSysFlag
3EDF2 Do1st/1st+:
3EE1A Do1st/2nd+:
3EE47 Echo2Macros
3F78C DUPExitAtLOOP
3F7EB ExitAtLOOPDUP
3FA57 Key>U/SKeyOb
3FA7A ?Key>UKeyOb
3FACF ID_SKEY
3FAE8 LAM_SKEY
3FB1A Key>StdKeyOb
3FCAF SetKeysNS
3FDBD 2DropBadKey
3FDC7 DropBadKey
3FDD1 DoBadKey
3FDFE 'DoBadKey
3FE12 'DoBadKeyT
3FE26 H/WKey>KeyOb
3FE44 H/W>KeyCode
3FE7B ModifierKey?
3FF1B ?CaseKeyDef
3FF48 ?CaseRomptr@
3FF75 NonUsrKeyOK?
3FF86 SetNUsrKeyOK
3FF97 ClrNUsrKeyOK
4019D StdMenuKeyNS
401D4 StdMenuKeyLS
40337 DoNameKeyRS
40350 DoNameKeyLRS
40454 DoKeyOb
40788 TakeOver
40792 SystemLevel?
407FB MenuMaker
40828 MenuKey
4085A Modifier
40882 CkSecoType
408AA ImmedEntry?
40A6F KeyOb!
40A82 KeyOb@
40A95 KeyOb0
40AD9 Parse.1
40B2E ParseFail
40B56 DispBadToken
40BC9 AtUserStack
40BDD GetLastEdit
40C76 SaveLastEdit
40C94 CMDSTO
40CE9 CacheStack
40D25 LockAlpha
40D39 UnLockAlpha
40D93 NoEdit?case
40DC0 DoMenuKey
40DD4 DoDelim
40DF7 DoDelims
40E3D ?ClrAlg
40E5B ?ClrAlgSetPr
40E88 REPEATER
40EE7 SLOW
40F02 VERYSLOW
40F12 VERYVERYSLOW
40F22 XEQStoKey
40F86 InitMenu
41008 StartMenu
410C6 SetThisRow
41111 CheckMenuRow
41175 LoadTouchTbl
4139B SaveLastMenu
41422 >Review$
414BD $_:
415C9 GetMenu%
415F1 %100
41679 InitMenu%
41741 InitTrack:
417F3 SetRebuild
41848 MenuRow!
4185B MenuRow@
4186E LastMenuRow!
41881 LastMenuRow@
418A4 MenuDef@
418D4 MenuRowAct!
418F4 LabelDef!
41904 DoLabel
41914 MenuKeyNS!
41924 MenuKeyNS@
41934 DoMenuKeyNS
41944 MenuKeyLS!
41964 MenuKeyRS!
41984 ReviewKey!
419C4 MenuExitAct!
419E4 LastMenuDef!
419F4 LastMenuDef@
41A39 'idUserKeys
41A43 ID_UserKeys
41A5F 'idUserKeys.
41A69 ID_UserKeys.
41A8D UserKeys?
41AA1 Ck&AsnUKeys
41B28 XEQAsnKey
41B3C XEQDelKeys

41B69 Ck&ClrUKey
41B8C DelKey
41C02 XEQRclKeys
41CA2 Ck&DecKeyLoc
41D92 CodePl>%rc.p
41E32 StoUserKeys
41E78 StoUserKeypatch
41F13 ClrUserKeys
41F2C UserKeys!
41F3F GetUserKeys
41F52 PgUserKeys
41F65 WaitForKey
4203C GetKeyOb
42078 ?BlinkCursor
420A0 GETKEY*
420F5 ATTNxcp
42113 ALARMxcp
42131 SLEEPxcp
42145 UARTxcp
42159 GETKEY
42249 UART?
42262 ATTN?
4226A addrATTNFLG
4227F TIMEOUT?
42284 adrTIMEOUTCLK
422A1 ALARM?
423BB settimeout
423D3 clrtimeout
42402 KEYINBUFFER?
4243E ?ATTNQUIT
4243E ?ATTN_QUIT
4245C NoAttn?Semi
42475 DoCAlarmKey
4248E CtlAlarm!
424A1 CtlAlarm@
424DA DCursor
4256B LCursor
42660 UCursor
426F1 LastERow?
4272D TopERow?
427AF Cursor&Disp
42AE4 EchoChrKey
42BB6 Echo$NoChr00
42BD4 Echo$Key
42C3D CkChr00
42CFB InsertEcho
42D32 EditLevel1
42D46 ViewLevel1
42D82 CharEdit
42DC8 ObEdit
42E27 Roll&Do:
42E86 Rcl&Do:
42EC7 AdjEdModes
42F44 InputLine
430CF DispILPrompt
43179 InputLEnter
43200 InputLAttn
4325A SetCursor
4334F DRPExitAtLOOP
44277 InitEd&Modes
4428B InitEdLine
44394 InitEdModes
443CB EditString
444A5 CURSOR_END?
444EE Char>Edit
44683 EDITLINE$
44730 EDITPARTS
4488A NoEditLine?
4489E ROWNUM
448C1 ?TogU/LCase
44C31 DoNewMatrix
44F42 BindMatVars
44FE7 DoOldMatrix
45023 InitOldMat
45676 Blank$
45AE0 GetMat/Vec
45C2F RowElt#
45D1F GetElt
46409 CopyRowsUp
4651C CopyColsLeft
46625 CopyRowsDown
4677E CopyColsRght
4744F 'IDX
47467 STOAPPLDATA
47984 APPprompt1!
479A7 APPprompt2
48FF9 SORTASLOW
491D5 AUTOSCALE
494B4 %.1
495AA %.15
49709 PromptIdUtil
49AD3 PointDerivUt
49BA5 FcnUtilEnd
49BD2 RootUtil
49C54 CkEQUtil
49CD6 ROLL{}
49F06 PointMoveCur
4A055 DISPCOORD2
4A0AA GetEqN
4A95A ICMPDRPRTDRP
4A9AF CHECKPVARS
4AAEA MAKEPVARS
4AB1C ID_X
4AB2A PvarsC%0
4AB59 ID_Y
4ADB0 GETSCALE
4AE3C PUTSCALE
4AF63 GETINDEP
4AF77 PUTINDEP
4AF8B PUTINDEPLIST
4AFDB GETRES
4B012 PUTRES
4B062 GETPTYPE
4B076 PUTPTYPE

51703 JUMPRIGHT
51735 REPEATERCH
5179E DUPGROBDIM
517F3 EQUALcasedrop
517FE EQUALcasedro
5182F ISTOP-INDEX
51843 SWAP#1+SWAP
51857 SWAP#1-SWAP
5187F GBUFFGROBDIM
51893 ORDERXY#
518CA ORDERXY%
5193B C%%1
5196A C%-1
5198F DROP%0
519A3 C>Re%
519B7 C>Im%
519CB C%>%%
519DF C%>%%SWAP
519F8 C%%>C%
51A07 %%>C%
51A37 Re>C%
51A4A C%*i
51A5F C/i
51A71 2%>%%SQR
51A94 %%SQR
51AB7 %MAXIMIZE
51B2A C%%0=
51B43 C%0=
51B70 C%CHS
51B91 C%%CHS
51BB2 C%CONJ
51BC1 C%%CONJ
51BD0 C%C+R
51BE4 %+SWAP
51BF8 C%R+C
51C16 C%C+C
51C3E C%%C+C
51C6B SWAP2C%>%
51C84 SWAP2C%%>%%
51C9D C%%C+R
51CB1 C%%R+C
51CD4 C%R-C
51CE8 C%C-R
51CFC C%C-C
51D10 C%%C-C
51D24 C%%R-C
51D38 C%%C-R
51D4C C%C*R
51D60 C%R*C
51DAB C%%C*R
51DBF C%%R*C
51DE2 C%%C*C
51E19 C%R/C
51E64 C%C/R
51EC8 C%C/C
51EFA C%1/
51F13 C%%C/C
51F3B C%%R/C
51F7C C%%C/R
52062 C%ABS
52080 C%%ABS
52099 C%ARG
520B2 2DUP%%R
520CB C%SGN
52107 C%SQRT
52193 C%EXP
521E3 C%LN
5226F SYMUVAL
522BF C%LOG
52305 C%ALOG
52342 C%R^C
52360 C%C^R
52374 C%C^C
524AF C%0
524F7 C%1
52530 C%SIN
52571 C%COS
525B7 C%TAN
5262F C%SINH
52648 C%COSH
5265C C%TANH
52675 C%ATAN
5267F C%i
526AE C%-i
527EB C%ATANH
52804 C%ASIN
5281D C%ASINH
52836 C%ACOSH
52863 C%ACOS
52AB7 POPC%
52ADB PUSHC%
52B57 POPC%%
52B95 PUSHC%%
52C36 CALCINTEG
52D26 4NULLLAM{}
53725 SetUserFlag
53731 SetSysFlag
53755 ClrUserFlag
53761 ClrSysFlag
53778 TestUserFlag
53784 TestSysFlag
5380E COERCEFLAG
53860 HISTON?
538C0 UNDO_ON?
538CE UNDO_ON
538DC UNDO_OFF
538F8 NOBLINK
53968 AlgEntry?
53976 SetAlgEntry
53984 ClrAlgEntry
539F9 SetISysFlag
53A05 D0=ALoop
53A20 REPLACE_MODE
53A2E INSERT_MODE

53A3C INSERT?
53A4A EditLExists?
53A90 ClrNewEditL
53AE4 NoIgnoreAlm
53B31 setflag
53B61 NumbMode
53B88 CLRNUM
53B9C SETNUM
53BB0 NOTNUM?
53BC9 DEG?
53BDD RAD?
53C0A NOTCONST?
53C23 PRSOL?
53C37 DOHEX
53C43 DOBIN
53C4F DOOCT
53C5B DODEC
53C96 XEQSTWS
53CAA dostws
53CF0 XEQRCWS
53D04 bitAND
53D15 bitOR
53D26 bitXOR
53D4E bitNOT
53D5E bitSL
53D6E bitSLB
53D81 bitSR
53D91 bitSRB
53DA4 bitRR
53DE1 bitRRB
53E0C bitRL
53E3B bitRLB
53E65 bitASR
53EA0 bit+
53EB0 bit-
53EC3 bitNEG
53ED3 bit*
53EE4 MPY
53F05 bit/
53F77 POP2HXS
53F8D POPHXS
54021 getwordsize
54039 WORDSIZE
54050 BASE
54061 HXS>$
5407A BASECHAR
540BB hxs>$
5422C PUSHhxs
54266 GPPushA
5429F bit%#/
542BD bit#%/
542D1 bit%#*
542EA bit#%*
542FE bit%#-
5431C bit#%-
54330 bit%#+
54349 bit#%+
5435D #>%
5435D HXS>%
543F9 %>#
544D9 HXS==HXS
544EC HXS#HXS
54500 HXS>HXS
5452C HXS>=HXS
5453F HXS<=HXS
54552 HXS<HXS
54564 SYMIFTE
545A0 cknumdsptch1
54609 MetaIFTE
54653 NumIFTE
547B5 SYMBWHERE
547E2 WHERE1
5483C COLAkeep1st
54887 WHEREN
548AA revpull&psh
54954 SYMDER
54977 SYMDERSTEP
5499F Repl0ABND
549DB lam'dvar
549EC MetaConcase
54A9C DROP%1ABND
54AE0 SYMRE
54B1E DROP%0ABND
54C4F RDROPCOLATRUE
54C63 nmetasyms
54CB3 SWAPDROPLOOP
54CEF Cr
54CEF SYMBN:
54DBC ckseval1:
54E2A ckevaleq1
54EB9 SYMIM
54ED2 SYMNOT
54EEB SYMNEG
54F04 SYMABS
54F1D SYMCONJ
54F36 SYMINV
54F4F SYMARG
54F68 SYMSIGN
54F81 SYMSQRT
54F9A SYMSQ
54FB3 SYMSIN
54FCC SYMCOS
54FE5 SYMTAN
54FFE SYMSINH
55017 SYMCOSH
55030 SYMTANH
55049 SYMASIN
55062 SYMACOS
5507B SYMATAN
55094 SYMASINH
550AD SYMACOSH
550C6 SYMATANH
550DF SYMEXP
550F8 SYMLN

```
55111   SYMLOG
5512A   SYMALOG
55143   SYMLNP1
5515C   SYMEXPM
55175   SYMFACT
5518E   SYMIP
551A7   SYMFP
551C0   SYMFLOOR
551D9   SYMCEIL
551F2   SYMEXPONENT
5520B   SYMMANT
55224   SYMD>R
5523D   SYMR>D
55256   SYMUBASE
55288   1GETLAMSWP1+
5529C   MetaSINH
552B0   MetaCOSH
552C4   MetaTANH
552D8   MetaEXP
552EC   MetaALOG
55300   MetaEXPM
55314   ?addinver:
5533C   MetaSIN
55378   MetaCOS
553A5   MetaTAN
553D2   MetaNEG
553EB   MetaINV
5540E   ?addrever
5542C   MetaRE
55477   replfunc
55495   MetaIM
554B3   repl%1
5551C   Repl0
55535   Repl1
5554E   Repl-1
55567   MetaCONJ
555B2   MetaABS
555E9   MetaSQ
55607   repl%-1
55657   cknum2:
5573D   COLAthexFCN
5575B   cknseval:
5576F   cksneval2:
557EC   cksseval2:
558BE   ?spliteq
558DC   sscknum2
558F5   sncknum2
5590E   nscknum2
5599A   SYM%AND
559B3   %SYMAND
559CC   SYMAND
559E5   SYM%OR
559FE   %SYMOR
55A17   SYMOR
55A30   SYM%XOR
55A49   %SYMXOR
55A62   SYMXOR
55A7B   SYMFLOAT==
55A94   FLOATSYM==
55AAD   SYM==
55AC6   SYMFLOAT<>
55ADF   FLOATSYM<>
55AF8   SYM<>
55B11   SYM%<
55B2A   %SYM<
55B43   SYM<
55B5C   SYM%>
55B75   %SYM>
55B8E   SYM>
55BA7   SYM%<=
55BC0   %SYM<=
55BD9   SYM<=
55BF2   SYM%>=
55C0B   %SYM>=
55C24   SYM>=
55C3D   SYM%%OF
55C56   %SYM%OF
55C6F   SYM%OF
55C88   SYM%%CH
55CA1   %SYM%CH
55CBA   SYM%CH
55CD3   SYM%%T
55CEC   %SYM%T
55D05   SYM%T
55D1E   SYM%COMB
55D37   %SYMCOMB
55D50   SYMCOMB
55D69   SYM%PERM
55D82   %SYMPERM
55D9B   SYMPERM
55DB4   SYM%RND
55DCD   SYMRND
55DE6   RNDSYM
55DFF   SYM%TRNC
55E18   TRCNYM
55E31   SYMTRCN
55E4A   SYM%MAX
55E63   %SYMMAX
55E7C   SYMMAX
55E95   SYM%MIN
55EAE   %SYMMIN
55EC7   SYMMIN
55EE0   SYM^0
55EF9   0^SYM
55F12   SYM^
55F2B   SYM+0
55F44   0+SYM
55F5D   SYM+
55F76   SYM-0
55F85   0-SYM
55F8F   SYM-
55FC1   SYM*0
55FDA   0*SYM
55FF3   SYM*
```

611D2 #3+PICK
611E1 #4+PICK
611F9 2DUPSWAP
611F9 DUP3PICK
611FE 3PICK
6121C 4PICK
6123A 5PICK
6125E 6PICK
61282 7PICK
612A9 8PICK
612CC #-ROLL
612DE #+ROLL
612F3 #1+ROLL
61305 get1
61318 #2+ROLL
6132C #-UNROLL
6133E #+UNROLL
61353 #1+UNROLL
61365 #2+UNROLL
61380 DUPUNROT
61380 SWAPOVER
613B6 1GETLAM
613E7 2GETLAM
6140E 3GETLAM
61438 4GETLAM
6145C 5GETLAM
6146C 6GETLAM
6147C 7GETLAM
6148C 8GETLAM
6149C 9GETLAM
614AC 10GETLAM
614BC 11GETLAM
614CC 12GETLAM
614DC 13GETLAM
614EC 14GETLAM
614FC 15GETLAM
6150C 16GETLAM
6151C 17GETLAM
6152C 18GETLAM
6153C 19GETLAM
6154C 20GETLAM
6155C 21GETLAM
615E0 1PUTLAM
615F0 2PUTLAM
61600 3PUTLAM
61610 DUP4PUTLAM
61615 4PUTLAM
61625 5PUTLAM
61635 6PUTLAM
61645 7PUTLAM
61655 8PUTLAM
61665 9PUTLAM
61675 10PUTLAM
61685 11PUTLAM
61695 12PUTLAM
616A5 13PUTLAM
616B5 14PUTLAM
616C5 15PUTLAM
616D5 16PUTLAM
616E5 17PUTLAM
616F5 18PUTLAM
61705 19PUTLAM
61715 20PUTLAM
61725 21PUTLAM
61735 22PUTLAM
61745 DUPTEMPENV
61745 DUPTEMPEVN
617D8 GETLAMPAIR
6186C #=case
6187C OVER#=case
61891 DUP#0=case
61896 #0=case
618A8 DUP#0=csedrp
618BA EQcasedrop
618D3 #=casedrop
618E8 NOTcasedrop
618F7 casedrop
61910 NOTcase2drop
6191F case2drop
61933 EQcase
6194B caseDROP
61960 NOTcaseDROP
61970 case2DROP
61984 NOTcase2DROP
61993 case
619AD NOTcase
619BC IT
619CB GOTO
619E0 ?GOTO
619F3 NOT?GOTO
61A02 popflag
61A18 #0=?SEMI
61A2C NOT?SEMI
61A3B ?SEMI
61A47 SEMILOOP
61A58 ITE_DROP
61A6D COLA_EVAL
61A8E COLARPITE
61AD8 ITE
61AE9 2'RCOLARPITE
61B45 2@REVAL
61B55 3@REVAL
61B72 NOT?DROP
61B89 ticR
61C1C EXPAND
61CE9 CACHE
61D3A SAVELAM
61D41 SAVESTACK
61EA7 DUMP
61F8F undo
61FA9 DUPROM-WORD?
61FB6 ROM-WORD?
61FCF Rom-Word?
62001 2SWAP

62020 DUPTYPECHAR?
62025 TYPECHAR?
62035 DUPTYPEIDNT?
6203A TYPEIDNT?
6204A DUPTYPEEXT?
6204F TYPEEXT?
62073 GPOverWrT/FL
62076 GPOverWrTLp
6207D OverWrF/TLp
62080 OverWrTLoop
62096 GPOverWrFLp
6209D OverWrT/FLp
620A0 OverWrFLoop
620B6 GPPushT/FLp
620B9 GPPushTLoop
620C0 PushF/TLoop
620C3 PushTLoop
620D2 GPPushFLoop
620D9 PushT/F
620D9 PushT/FLoop
620DC PushFLoop
620EB OVER#=
62103 DROPTRUE
6210C DROPFALSE
62115 DUPTYPELAM?
6211A TYPELAM?
6212A DUPTYPEBINT?
6212F TYPEBINT?
6213F DUPTYPEHSTR?
62144 TYPEHSTR?
62154 DUPTYPECSTR?
62154 DTYPECSTR?
62159 TYPECSTR?
62169 DUPTYPEREAL?
62169 DTYPEREAL?
6216E TYPEREAL?
6217E DUPTYPECMP?
62183 TYPECMP?
62193 DTYPEARRY?
62193 DUPTYPEARRY?
62198 TYPEARRAY?
62198 TYPEARRY?
621A8 DUPTYPEROMP?
621AD TYPEROMP?
621BD DUPTYPERRP?
621C2 TYPERRP?
621D2 DUPTYPESYMB?
621D7 TYPESYMB?
621E7 DUPTYPECOL?
621E7 DTYPECOL?
621EC TYPECOL?
621FC DUPTYPEGROB?
62201 TYPEGROB?
62211 DTYPELIST?
62211 DUPTYPELIST?
62216 TYPELIST?
62226 DUPTYPETAG?
6222B TYPETAGGED?
6223B TYPERARRY?
62256 TYPECARRY?
62266 DUP#0=
62289 #3=
6229A #2=
622A7 #1=
622B6 #1<>
622C5 DUP#1=
622D4 DUP#0<>
622E5 !insert$
622EF SWAP&$
62312 !!append$?
62376 !append$
62394 !!insert$
623A0 !!append$
62474 'RSAVEWORD
62474 'RSaveRomWrd
624BA #MIN
624C6 #MAX
624FB #-#2/
62535 DROPZERO
6254E 2DROP00
6256A #3+
6257A #4+
6258A #5+
6259A #6+
625AA #7+
625BA #8+
625CA #9+
625DA #10+
625EA #12+
625FA #3-
6260A #4-
6261A #5-
6262A #6-
6264E #10*
62674 #8*
62691 #6*
626AE 5skipcola
626DC 3skipcola
626E5 2skipcola
626EE skipcola
626F7 DUP#2+
6270C DROPSWAP
62726 XYZ>Y
62726 DROPSWAPDROP
62726 ROT2DROP
62747 SWAPDUP
62775 ROTDUP
62794 SWAP#-
627A7 DROPDUP
627BB DUPLEN$
627D5 #+DUP
627EB Push2#aLoop
627F8 #-DUP
62809 #1+DUP

6281A #1-DUP
62830 SWAPDROPDUP
6284B SWAPDROPSWAP
6284B XYZ>ZX
6284B UNROTDROP
62864 4ROLLDROP
62880 5ROLLDROP
6289B 2DUP#<
628B5 2DUP#=
628D1 2DUP#>
628EB DUP#1+
62904 SWP1+
62904 SWAP#1+
6292F DUP#1-
62946 DROPONE
62958 RDROPCOLA
6296D COLACOLA
62986 COLAcase
629A1 COLANOTcase
629BC ORcase
629D0 REQcase
629E9 REQcasedrop
62A02 SAFESTO
62A2F DUPSAFE@
62A34 SAFE@
62A61 ?>ROMPTR
62A84 ?ROMPTR>
62ABB MACRODCMP
62B0B 2DROPFALSE
62B1F PALPTRDCMP
62B5B palrompdcmp
62B6F #0=UNTIL
62B88 INCOMPDROP
62B9C NTHCOMPDROP
62BB0 APPEND_SPACE
62BC4 7UNROLL
62BD8 RESOROMP
62BF1 %10*
62C05 DUP@
62C19 DUPROMPTR@
62C2D #=ITE
62C41 INNERDUP
62C55 NOTAND
62C69 TOTEMPSWAP
62C7D ROT2DUP
62C91 ROTAND
62CA5 ROTOVER
62CB9 DUPDUP
62CCD OVERDUP
62CE1 COERCEDUP
62CF5 UNROTDUP
62D09 4UNROLLDUP
62D1D NTHCOMDDUP
62D31 OVERUNROT
62D31 OVERSWAP
62D45 ROLLSWAP
62D59 NULL$SWAP
62D6D SUB$SWAP
62D81 %MAXorder
62D9F ?SKIPSWAP
62DB3 1ABNDSWAP
62DCC ROT+SWAP
62DCC ROT#+SWAP
62DE5 4PICK+SWAP
62DE5 4PICK#+SWAP
62DFE #+SWAP
62E12 #-SWAP
62E26 #1+SWAP
62E3A ZEROSWAP
62E4E #1-1SWAP
62E67 ONESWAP
62E7B COERCESWAP
62E8F %>%%SWAP
62EA3 %%*SWAP
62EB7 XYZ>ZTRUE
62ECB 4ROLLSWAP
62EDF 3PICKSWAP
62EF3 4PICKSWAP
62F07 1GETSWAP
62F1B ?SWAP
62F2F !append$SWAP
62F43 NOT?SWAPDROP
62F5C ?SWAPDROP
62F75 #1+NDROP
62F75 N+1DROP
62F89 ROLLDROP
62F9D MDIMSDROP
62FB1 DUPROT
62FC5 DROPROT
62FD9 #1-ROT
62FED %%*ROT
63001 FOURROLLROT
63001 4ROLLROT
63015 4UNROLLROT
63029 DROPOVER
6303D EQOVER
63051 #+OVER
63065 #-OVER
63079 ZEROOVER
6308D UNROTOVER
630A1 4ROLLOVER
630B5 3PICKOVER
630C9 4PICKOVER
630DD DUPPICK
630F1 DUPROLL
63105 OVER#2+UNROLL
63105 OVER#2+UNROL
63119 8UNROLL
6312D 10UNROLL
63141 OVERARSIZE
63155 'ERRJMP
63169 caseERRJMP
6317D ?CARCOMP
63191 NEWLINE$&$

63191 NEWLINE&$
631A5 #1-{}N
631B9 TWO{}N
631CD THREE{}N
631E1 DUPINCOMP
631F5 SWAPINCOMP
63209 DUPNULL$?
6321D DUPNULLCOMP?
63231 DUPLENCOMP
63245 #1-SUB$
63259 1_#1-SUB
63259 1_#1-SUB$
6326D LAST$
63281 #1+LAST$
63295 DUP$>ID
632A9 SWAP%>C%
632BD 'NOP
632D1 ::NEVAL
632E5 2GETEVAL
632F9 DROPRDROP
63312 SWAPCOLA
63326 XYZ>ZCOLA
6333A #0=?SKIP
63353 #1=?SKIP
6336C #=?SKIP
63385 ONE_EQ
63399 #>?SKIP
633B2 COLASKIP
633C6 NOT_UNTIL
633DF NOT_WHILE
633F8 DUP#0<>WHILE
63411 DUPINDEX@
63425 SWAPINDEX@
63439 OVERINDEX@
6344D SWAPLOOP
63466 DROPLOOP
6347F DUP#0_DO
63498 toLEN_DO
634B6 1GETABND
634CA DUP1LAMBIND
634CF 1LAMBIND
634E3 caseTRUE
634F7 TRUEFALSE
634F7 TrueFalse
6350B FALSETRUE
6350B FalseTrue
6351F ZEROFALSE
63533 ONEFALSE
63547 #=casedrpfls
6356A casedrpfls
63583 case2drpfls
6359C caseFALSE
635B0 ORNOT
635C4 EQUALNOT
635D8 2DUPEQ
635EC DUPEQ:
635F1 EQ:
63605 EQOR
63619 EQUALOR
6362D 2#0=OR
6364B OVER#0=
6365F OVER#<
63673 #<3
63687 DUP#<7
636A0 INNER#1=
636B4 #5=
636C8 #2<>
636DC OVER#>
636F0 ONE#>
636F0 #>1
63704 DUP3PICK#+
63704 2DUP#+
63718 ROT#+
6372C OVER#+
63740 3PICK#+
63754 4PICK#+
63768 ROT#-
6377C OVER#-
63790 INDEX@-
63790 INDEX@#-
637A4 SWAPOVER#-
637B8 ROT#1+
637CC #-+1
637CC #1--
637E0 SWAP#1-
637F4 DROP#1-
63808 #+-1
63808 $1-+
63808 #1-+
6381C COLAITE
6383A ERROROUT
6384E D0=DSKTOP
6385D D1=DSKTOP
6386C SWAP2DUP
63880 RSKIP
6389E GROB!ZERODRP
638B2 casedrptru
638CB NOTcaseTRUE
638E4 ?SEMIDROP
638FD SWAPUnDROP
63911 SWAPUnNDROP
63925 DUP'
63939 SWAP'
6394D DROP'
63961 OVER'
63975 STO'
63989 TRUE'
6399D ONEFALSE'
639B6 FALSE'
639CA #1+'
639DE 'R'R
639FC 'RRDROP
63A15 ONECOLA
63A29 dvarlsBIND

63A3D 'LAMLNAMESTO
63A56 'xDEREQ
63A6F DUPNULL{}?
63A88 DUPZERO
63A9C DUPONE
63AB0 SWAPONE
63AC4 ONEDUP
63AC4 ONEONE
63AD8 DUPTWO
63AEC NOTcsdrpfls
63B05 caseSIZEERR
63B19 NcaseSIZEERR
63B2D CKREAL
63B46 NcaseTYPEERR
63B5A 'x*
63B6E 'xDER
63B82 %%/>%
63B96 UNCOERCE%%
63BAA DUP%0=
63BBE SWAP%%/
63BD2 caseDrpBadKy
63BEB caseDEADKEY
63BEB caseDoBadKey
63C04 GROBDIMw
63C18 %%*UNROT
63C2C XYZW>YWZX
63C2C SWAP4ROLL
63C40 2DUP5ROLL
63C54 SWAP3PICK
63C68 3PICK3PICK
63C7C SWAP4PICK
63C90 OVER5PICK
63CA4 EQUALcasedrp
63CBD DUP#0=csDROP
63CD6 jEQcase
63CEA ANDcase
63CFE EQUALcase
63D12 #<case
63D26 #1=case
63D3A #<>case
63D4E #>2case
63D67 #>case
63D7B j%0=case
63D8F REALcase
63DA3 dARRYcase
63DB7 dLISTcase
63DCB EditExstCase
63DDF ANDNOTcase
63DF3 EQUALNOTcase
63E07 dIDNTNcase
63E1B dREALNcase
63E2F EQIT
63E48 DUP#0=IT
63E61 ANDITE
63E75 EQITE
63E89 #0=ITE
63E9D #<ITE
63EB1 #>ITE
63EC5 DUP#0=ITE
63ED9 UserITE
63EED SysITE
63F01 top&Cr
63F1A metaROTDUP
63F2E ROTUntop&
63F42 roll2top&
63F42 rolltwotop&
63F56 plDRPpZparg
63F6A &$SWAP
63F7E SWAPCKREF
63F92 pZpargSWAPUn
63FA6 DROPNDROP
63FBA 2OVER
63FCE ?Ob>Seco
63FE7 Ob>Seco
63FFB 2Ob>Seco
6400F ExitAtLOOP
6400F ZEROISTOPSTO
64023 RclHiddenVar
64037 WithHidden
64078 StoHiddenVar
6408C PuHiddenVar
640A0 SaveVarRes
640BE SetHiddenRes
640FA RestVarRes
64127 Embedded?
6416D UStackDepth
64190 Sig?ErrJmp
641CC DupAndThen
641FC ZEROZERO
64209 #ZERO#ONE
6427A #ZERO#SEVEN
6428A #ONE#27
6429D #TWO#ONE
642AF #TWO#TWO
642BF #TWO#FOUR
642D1 #THREE#FOUR
642E3 #FIVE#FOUR
64309 ZEROZEROZERO
6431D ZEROZEROONE
64331 ZEROZEROTWO
64345 SubMetaOb
643BD SubMetaOb1
643EF matchob?
643F9 matchob?Lp
64426 POSCOMP
6443A nextpos
64449 3DROPZERO
6448A #=POSCOMP
644A3 EQUALPOSCOMP
644BC NTHOF
644D0 Find1stTrue
644EE Find1stT.1
6452F Lookup
64548 Lookup.1

64593 EQLookup
645B1 POS$
645B1 POSCHR
645BD POSCHRREV
645BD POS$REV
6475C CHR>$
64775 STRIPTAGS
647A2 STRIPTAGS12
647BB TAGOBS
6480B NEXTCOMPOB
648BD >LASTRAM-WORD
64B12 BINT44
64B12 FORTYFOUR
64B1C FORTYFIVE
64B1C BINT45
64B26 BINT46
64B26 FORTYSIX
64B30 BINT47
64B30 FORTYSEVEN
64B3A BINT48
64B3A FORTYEIGHT
64B44 BINT49
64B44 FORTYNINE
64B4E BINT50
64B4E FIFTY
64B58 FIFTYONE
64B58 BINT51
64B62 BINT52
64B62 FIFTYTWO
64B6C BINT53
64B6C THREEFIVE
64B6C STRLIST
64B6C FIFTYTHREE
64B76 FIFTYFOUR
64B76 BINT54
64B80 BINT55
64B80 FIFTYFIVE
64B8A BINT56
64B8A FIFTYSIX
64B94 FIFTYSEVEN
64B94 BINT57
64B9E FIFTYEIGHT
64B9E BINT58
64BA8 BINT59
64BA8 FIFTYNINE
64BB2 SIXTY
64BB2 BINT60
64BBC SIXTYONE
64BBC BINT61
64BC6 BINT62
64BC6 SIXTYTWO
64BD0 BINT63
64BD0 SIXTYTHREE
64BDA SIXTYFOUR
64BDA BINT64
64BDA BINT40h
64BDA YHI
64BE4 BINT65
64BE4 ARRYREAL
64BEE FOURTWO
64BEE BINT66
64BF8 FOURTHREE
64BF8 BINT67
64C02 SIXTYEIGHT
64C02 BINT68
64C0C BINT69
64C0C FOURFIVE
64C16 SEVENTY
64C16 BINT70
64C20 BINT74
64C20 SEVENTYFOUR
64C2A SEVENTYNINE
64C2A BINT79
64C3A EIGHTY
64C3A BINT80
64C3E LISTREAL
64C3E EIGHTYONE
64C3E BINT81
64C48 BINT82
64C48 LISTCMP
64C52 BINT83
64C52 FIVETHREE
64C5C BINT84
64C5C FIVEFOUR
64C66 BINT85
64C66 2LIST
64C70 BINT86
64C70 FIVESIX
64C7A BINT87
64C7A LISTLAM
64C84 BINT_91d
64C84 BINT91
64C8E BINT_96d
64C8E BINT96
64C98 BINT97
64C98 IDREAL
64CA2 BINT98
64CAC ONEHUNDRED
64CAC BINT100
64CB6 BINT101
64CC0 char
64CC0 BINT111
64CCA BINT112
64CD4 BINT113
64CDE BINT114
64CE8 BINT_115d
64CE8 BINT115
64CF2 BINT_116d
64CF2 BINT116
64CFC BINT117
64D06 BINT122
64D06 BINT_122d
64D10 BINT80h
64D10 BINT128

64D1A BINT130d
64D1A XHI-1
64D1A BINT_130d
64D1A BINT130
64D24 XHI
64D24 BINT131
64D24 BINT131d
64D24 BINT_131d
64D2E #8F
64D38 SYMBREAL
64D42 SYMBCMP
64D4C SYMBSYM
64D56 SYMBUNIT
64D60 backup
64D6A SYMOB
64D74 SYMREAL
64D88 SYMLIST
64D92 SYMID
64D9C SYMLAM
64DA6 SYMSYMB
64DB0 SYMSYM
64DBA SYMEXT
64DC4 HXSREAL
64DCE 2HXS
64DD8 BINTC0h
64DE2 2GROB
64DEC TAGGEDANY
64DF6 EXTREAL
64E00 EXTSYM
64E0A 2EXT
64E14 ROMPANY
64E1E BINT253
64E28 BINT255d
64E32 REALOBOB
64E3C #_102
64E46 #SyntaxErr
64E50 BINT_263d
64E5A REALREALOB
64E64 3REAL
64E6E Err#Kill
64E78 Err#NoLstStk
64E82 #NoRoomForSt
64E8C #132
64E96 REALSTRSTR
64EA0 #134
64EAA #135
64EB4 #136
64EBE #137
64EC8 #138
64ED2 #139
64EDC #13A
64EE6 #13B
64EF0 #13D
64EFA Err#Cont
64F04 INTEGER337
64F0E CMPOBOB
64F18 Err#NoLstArg
64F22 STRREALREAL
64F2C ARRYREALREAL
64F36 ARRYREALCMP
64F40 3ARRY
64F4A ARRYLISTREAL
64F54 ARRYLISTCMP
64F5E LISTREALOB
64F68 LISTREALREAL
64F72 LISTLISTOB
64F7C IDREALOB
64F86 IDLISTOB
64F90 FSTMACROROM#
64F9A PROGIDREAL
64FA4 PROGIDCMP
64FAE PROGIDLIST
64FB8 PROGIDEXT
64FC2 ATTNERR
64FCC SYMREALREAL
64FD6 SYMREALCMP
64FE0 SYMREALSYM
64FEA SYMCMPREAL
64FF4 SYMCMPCMP
64FFE SYMCMPSYM
65008 SYMIDREAL
65012 SYMIDCMP
6501C SYMIDLIST
65026 SYMIDEXT
65030 SYMSYMREAL
6503A SYMSYMCMP
65044 3SYM
6504E XFERFAIL
65058 PROTERR
65062 InvalServCmd
6506C Connecting
65076 Retry
65080 #CAlarmErr
6508A EXTOBOB
65094 #EXITERR
6509E MINUSONE
650A8 %e
650BD %.5
650D2 %-.5
650E7 %10
650FC %180
65111 %200
65126 %360
6513B %400
65150 tok]
6515C lbrac
6516A tok[
65176 tok{
65182 tok}
6518E toksharp
6519A tokuscore
651A6 tok$
651B2 tok&
651BE tokESC

651CA tok>>
651D6 tok<<
651E2 tokexponent
651EE tokanglesign
651FA tokSIGMA
65206 tokWHERE
65212 14SPACES$
65238 NEWLINE$
65244 $DER
65254 tok_
65254 SPACE$
65260 tokUNKNOWN
65278 tokquote
65284 tok'
65290 tok,
6529C tok.
652A8 tok;
652B4 toklparen
652C0 tokrparen
652CC tok^
652D8 tok*
652E4 tok/
652F0 tok+
652FC tok-
65308 tok=
65314 tokSQRT
65320 tokDER
6532C tokCTGROB
6533E tokCTSTR
6534C tok0
65358 tok1
65364 tok2
65370 tok3
6537C tok4
65388 tok5
65394 tok6
653A0 tok7
653AC tok8
653B8 tok9
6541E CHR_00
65425 CHR_...
6542C CHR_DblQuote
65433 CHR_#
6543A CHR_*
65441 CHR_+
65448 CHR_,
6544F CHR_-
65456 CHR_.
6545D CHR_/
65464 CHR_0
6546B CHR_1
65472 CHR_2
65479 CHR_3
65480 CHR_4
65487 CHR_5
6548E CHR_6
65495 CHR_7
6549C CHR_8
654A3 CHR_9
654AA CHR_:
654B1 CHR_;
654B8 CHR_<
654BF CHR_=
654C6 CHR_>
654CD CHR_A
654D4 CHR_B
654DB CHR_C
654E2 CHR_D
654E9 CHR_E
654F0 CHR_F
654F7 CHR_G
654FE CHR_H
65505 CHR_I
6550C CHR_J
65513 CHR_K
6551A CHR_L
65521 CHR_M
65528 CHR_N
6552F CHR_O
65536 CHR_P
6553D CHR_Q
65544 CHR_R
6554B CHR_S
65552 CHR_T
65559 CHR_U
65560 CHR_V
65567 CHR_W
6556E CHR_X
65575 CHR_Y
6557C CHR_Z
65583 CHR_a
6558A CHR_b
65591 CHR_c
65598 CHR_d
6559F CHR_e
655A6 CHR_f
655AD CHR_g
655B4 CHR_h
655BB CHR_i
655C2 CHR_j
655C9 CHR_k
655D0 CHR_l
655D7 CHR_m
655DE CHR_n
655E5 CHR_o
655EC CHR_p
655F3 CHR_q
655FA CHR_r
65601 CHR_s
65608 CHR_t
6560F CHR_u
65616 CHR_v
6561D CHR_w
65624 CHR_x

6562B CHR_y
65632 CHR_z
65639 CHR_->
65640 CHR_<<
65647 CHR_>>
6564E CHR_Angle
65655 CHR_Deriv
6565C CHR_Integral
65663 CHR_LeftPar
6566A CHR_Newline
65671 CHR_Pi
65678 CHR_RightPar
6567F CHR_Sigma
65686 CHR_Space
6568D CHR_UndScore
65694 CHR_[
6569B CHR_]
656A2 CHR_{
656A9 CHR_}
656B0 CHR_<=
656B7 CHR_>=
656BE CHR_<>
656C5 $_R<<
656D5 $_R<Z
656E5 $_XYZ
656F5 $_<<>>
65703 $_{}
65711 $_[]
6571F $_''
6572D $_::
6573B $_LRParens
65749 $_2DQ
65757 $_ECHO
65769 $_EXIT
6577B $_Undefined
65797 $_RAD
657A7 $_GRAD
6594E putnibs
6595A getnibs
659DE Symb>HBuff
66EA5 BigCursor
66ECD MediumCursor
66EF1 SmallCursor
70601 BANKMTHDS
715B1 ?ACCPTR>
71C3B rNTHELCOMP
71DB2 RPTRACC
7DBA0 nWHEREIFTE
7DBAB nWHEREDER
7DBB6 nWHEREINTG
7DBC1 nWHERESUM
7DBCC nWHEREWHERE
7DBD7 nWHEREFCNAPP
7DBE2 D/D*
7DBED D/D+
7DBF8 D/D-
7DC03 D/D/
7DC0E derquot
7DC54 derprod1
7DC72 D/D=
7DC7D D/DABS
7DC88 easyabs
7DCA1 D/DACOS
7DCAC D/DACOSH
7DCB7 D/DALOG
7DCC2 D/DARG
7DCCD D/DASIN
7DCD8 D/DASINH
7DCE3 D/DATAN
7DCEE D/DATANH
7DCF9 D/DCHS
7DD17 D/DCONJ
7DD35 D/DCOS
7DD40 D/DCOSH
7DD4B D/DEXP
7DD56 D/DINV
7DD61 D/DLN
7DD6C D/DLNP1
7DD77 D/DLOG
7DD82 D/DIFTE
7DD8D D/DSIN
7DD98 D/DSINH
7DDA3 D/DSQ
7DDAE D/DSQRT
7DDB9 D/DTAN
7DDC4 D/DTANH
7DDCF D/D^
7DDDA D/D^X
7DDE5 D/D^Y
7DDF0 D/DDER
7DDFB D/DWHERE
7DE06 D/DINTEGRAL
7DE11 D/DSUM
7DE1C D/DAPPLY
7DE27 nINTGINV
7DE32 nINTGSIGN
7DE3D nINTGSQRT
7DE48 nINTGSQ
7DE53 nINTGSIN
7DE5E nINTGCOS
7DE69 nINTGTAN
7DE74 nINTGSINH
7DE7F nINTGCOSH
7DE8A nINTGTANH
7DE95 nINTGASIN
7DEA0 nINTGACOS
7DEAB nINTGATAN
7DEB6 nINTGLN
7DEC1 nINTGLOG
7DECC nINTGALOG
7DED7 nINTGEXPM
7DEE2 nCustomMenu
7DEED nCOLCTQUOTE
7DEF8 SPLITWHERE

7DF03 MANMENU+-
7DF0E MANMENU*/
7DF19 MANMENU^
7DF24 MANMENUEXP
7DF2F MANMENULN
7DF3A MANMENUCSIV
7DF45 MANMENUEQ
7DF50 MANMENUCX
7DF5B MANMENUTRG
7DF66 MANMENUATG
7DF71 PTYPE>PINFO
7DF7C MOVEVAR
7DF87 COPYVAR
80000 RAMSTART
80000 CMOS
80000 HARDROMEND
80005 IRAMMASK
8000A HOMEMASK
8000F HRAMEND
80010 FAILSTK1
80022 FAILSTK2
80034 FAILSTK3
80046 FAILSTK4
80058 NEXTIRQ
80065 TIMECRC
80069 TIMExmit
80069 TIMEOUT
80076 TIMEOUTCLK
80077 LoBatTime
80078 StartTime
80085 FailTime
80092 TESTMSG
800BE SW_Image
800D4 SW_ETime
800E1 PortStat
800E2 Port1CRC
800E6 AccessInit
800E8 COVERstate
800EB COVERsave
800F5 IRAMBUFF
80127 IRAMBUFF2
8030E GraphPrtHook
8030E IRAMBEND
80319 uart_buffer
80519 uart_buf_end
8051B uart_error
8051C uart_buf_st
8051E uart_handshk
8051F uart_modes
80520 uart_parity
80521 uart_timeout
80523 IOCNIB
80524 CONFRAM
8052B CONFTAB
80536 PORT0EOS
8053B PORT1EOS
80540 PORT2EOS
805DB INTRAM
805EB SAVE_MODES
805F0 SAVE_C[A]
805F5 SAVE_A
80605 SAVE_ST
80608 SAVE_B
80618 SAVE_D
80628 SAVE_R0
80638 SAVE_PC
8063D SAVE_D0
80642 SAVE_OR
80642 ORghost
80645 DRSTART
8064A DREND
8064F IREG
80652 SEMAPH
80654 IOSAVE
80655 CSPEED
8065A INITEN
8065B DISABLE_KBD
8065B HANDSHK
8065C KEYSTATE
80669 KEYBUFFER
80669 INPUTSTREAM
8068B POPPEDKEY
8068D DISP1CTLg
80692 LINENIBSg
80695 DISP2CTLg
8069A LINECOUNTg
8069C Stk0save
806A1 Stk1save
806A6 Stk2save
806AB Stk3save
806B0 Stk4save
806B5 Stk5save
806BA R2[A]save
806BF R2[S]save
806C0 R1[A]save
806C5 SAVE_BO
806C6 SAVE_LC
806C8 SAVE_LN
806CB SAVE_OFFSET
806D0 VDISP2
806D5 ADISP
806DA SYSUPSTART
806DA VDISP
806DA VDISP1
806DF VDISP3
806E4 GDISP
806E9 TEMPOB
806EE TEMPTOP
806F3 RSKTOP
806F8 DSKTOP
806FD EDITLINE
80702 TEMPENV
80707 DOLPENV
8070C TOUCHTAB

80711 USEROB
80716 ROMPARTS
8071B CONTEXT
80720 STOPSIGN
80725 UserKeys
8072A ALARMS
8072F INTRPPTR
8072F OBUPSTART
80734 OSAVE
80739 LASTARG
80739 LASTARG1
8073E LASTARG2
80743 LASTARG3
80748 LASTARG4
8074D LASTARG5
80752 leeway
80757 ITEM1STATE
8075C HISTORY1
80761 HISTORY2
80766 HISTORY3
8076B HISTORY4
80770 PDCHXS
80775 PDCSYMB
80775 KERMERRM
8077A PAINTTREE
8077F EXITMSG
80784 AppDisplay
80789 AppKeys
8078E AppExitCond
80793 AppError
80798 CtlAlarm
8079D MenuDef
807A2 LastMenuDef
807A7 MenuData
807AC MenuRowAct
807B1 LabelDef
807B6 MenuKeyNS
807BB MenuKeyLS
807C0 MenuKeyRS
807C5 ReviewKey
807CA LastContext
807CF TrackAct
807D4 MenuExitAct
807D9 LASTROMWDOB
807DE KeyOb
807E8 SYSNOUPSTART
807E8 RAMEND
807ED AVMEM
807F2 ERROR
807F7 ATTNFLG
807FC FIRSTPROC
80801 SysNib1
80802 SysNib2
80803 SysNib3
80804 SysNib4
80805 SysNib5
80806 SysNib6
80807 SysNib7
80808 SysNib8
80809 SysNib9
8080A EDITFLAG
8080A SysNib10
8080A EDITLFLAG
8080B ParenModFLAG
8080B SysNib11
8080C SysNib12
8080D SysNib13
8080E SizeMLDisp
8080E SysNib14
8080F SysNib15
80810 SysNib16
80811 SysNib17
80812 SysNib18
80813 SysNib19
80814 SysNib20
80815 AppCount
80817 ITEM1LINES
80818 VIEWLEVEL
8081D DEPTHSAVE
80822 RNSEED
80831 SAVECLK
80832 ALARMSDUE
80833 PASTDUE
80834 DOUSEALARM
80835 NOALARMSRV
80836 ALARM#
8083B PASTDUE#
80840 LPD_HIST
80841 ANNUNCIATORS
80843 SystemFlags
80853 UserFlags
80863 ELEMENT
80865 FIRSTCHAR
8086A CR_COUNT
8086F STACKNUM
80874 TOPLINE
80879 LASTLAST?
8087A HISTORYLEVEL
8087B LASTARGCOUNT
8087C LASTARGf
8087D LASTERROR
80882 CURSOREPOSN
80882 CURSOR
80887 CURSORPART
80887 CURSORROW
8088C CURSORPOSN
8088C CURSOROFFSET
8088E CURSORSTATE
8088F CURSORCHR
80891 CURSORGROB
808B9 CURSORX
808BE CURSORY
808C3 CURRENTMENU
808C5 MENULEVEL

808CA OLDMENU
808CC T1COUNT
808CD PADCOUNT
808CE GARBSCRATCH1
808D3 GARBSCRATCH2
808D8 SAVECROSS
808E2 PADJSAVE1
808E3 PADJSAVE2
808ED KERMMODE
808EE DcompWidth
808F0 FONTHEIGHT
808F1 FONTWIDTH
808F2 FONTCOUNT
808F5 NODECOUNT
808F8 OBTREELEN
808FB LASTOP
808FC LEFTTREE
808FF RIGHTTREE
80902 PARENTTREE
80905 PRECSTACK
8090C KEYLIST
80911 KEYLOCK
80912 ACCUM
80913 OB/EXP?
80914 COLWIDTH
80916 ENTRWISE
80917 PARENCOUNT
80919 STRETCHCOUNT
8091B ClkOnNib
8091C XmitSrcvTOut
8091E DelayCt
80920 GCOLCOUNT
80922 COLCOUNT
80924 PrtStatus
80927 IOCsave
80928 LineByteCt
8092A FifoByteCt
8092C LastPrntTime
80937 PFIFO
80947 MenuRow
8094C EqPtr
80951 KeyRomPtr0
8095C KeyRomPtr1
80967 KeyRomPtr2
80972 KeyRomPtr3
8097D KeyRomPtr4
80988 KeyRomPtr5
80993 KeyRomPtr6
8099E LastMenuRow
809A3 RESRAMEND
809A3 ROMPTAB
809A3 FlashROMPTAB
90000 HARDRAMEND
9358F TYPEARRY@
0050B0 ~IFMenuRow1
0060B0 ~IFMenuRow2
0850B0 ~grobAlertIcon
0860B0 ~grobCheckKey
0C50B0 ~gFldVal
0D50B0 ~sFldVal
0DB0B0 ~nNullBind
0000B1 ~DoMsgBox
0020B1 ~MsgBoxMenu
0000B3 ~Choose
0050B3 ~ChooseMenu0
0060B3 ~ChooseMenu1
0070B3 ~ChooseMenu2
0150B3 ~BBMoveTo
0190B3 ~BBRecalOff&Disp
0220B3 ~BBRunEntryProc
0230B3 ~BBReReadPageSize
0240B3 ~BBReReadHeight
0250B3 ~BBReReadCoords
0260B3 ~BBReReadWidth
0280B3 ~BBRunENTERAction
0290B3 ~BBRunCanclAction
02F0B3 ~BBReDrawBackgr
0370B3 ~BBGetNGrob
0380B3 ~BBGetNStr
03B0B3 ~BBRereadChkEnbl
03C0B3 ~BBRereadFullScr
03D0B3 ~BReReadMenus
03E0B3 ~BBReReadNElems
03F0B3 ~BBGetN
04B0B3 ~BBIsChecked?
0520B3 ~BBUpArrow
0530B3 ~BBDownArrow
0540B3 ~BBSpace
0590B3 ~BBPgDown
05A0B3 ~BBPgUp
05B0B3 ~BBEmpty?
05C0B3 ~BBGetDefltHeight
05F0B3 ~$>grobOrGROB
0660B3 ~ChooseSimple
0030E0 ~BRStoC1
0100E0 ~BRbrowse
0120E0 ~BRoutput
0170E0 ~BRRclCurRow
0180E0 ~BRRclC1
0630E3 ~PCunpack
0120E4 ~MESRclEqn
0110E7 ~UTVUNS1Arg
0580E7 ~UTTYPEEXT0?
01E0E8 ~INTEMPOB?

Entry Index

!

#

$

%

&

'

:

?

@

{

+

>

<

0

1

2

3

4

5

6

7

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9

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

X

Y

Z