OS-9 Quick Reference and Programmer's Guide for the Tandy Color Computer

(Second Edition)

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OS-9 Quick Reference and Programmer's Guide for the Tandy Color Computer (Based on OS-9 Level II)

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INTRODUCTION

One of the troublesome things about learning OS-9 is that bulky manual. It takes up lots of desk space, and it's sometimes hard to find that one simple code needed to complete a project. And one has to refer to the manual a LOT when first starting out- more than one cares to admit I'm sure!

This little Quick Reference Guide was designed to get that manual off your desk and back on the bookshelf. It isn't, however, a replacement for the full manual. Only a brief description of commands and codes are given, sometimes no more than the syntax for entering. Enough information is here to jog one's memory and get back on track, but the manual will still have to be referred to for learning and heavy duty programming chores.

There are few changes between this edition and the first. A few typographical errors were corrected and a few more examples given. OS-9's built-in text editor commands, macros, and error codes were omitted. Few people use the editor, and those who do quickly learn the necessary functions. Content arrangement was also improved, with the most referred to items grouped together in the front of the book and programmer information following. Error codes remained at the back for quick access.

F.G. Swygert

A Note on Redirection

OS-9 commands generally read from the keyboard and write to the current screen. Almost all of them, however, can be sent elsewhere, using the redirection symbols < (input) > (output) >> (error output).

Some common redirections-

echo Hello>/w7 - would print 'Hello' on window 7
List file>/p - lists file to printer
utility -? >>/p - would print the help file

(note that help info often follows the error path)

1 - System Commands

Commands are given in all capital letters. Items following in *italics* are required. Items enclosed in parentheses () are optional. COMPLETE path lists must be used in paths and names (file and directory) or current is assumed (**path** is used to mean **pathlist**). Examples follow each command in bold lowercase with an explanation.
* *Commands with a leading asterics are found on the companion disk or Delphi OS-9 SIG.*

ATTR *filename* (permission) Examine or change file security attributes. filename is the name of the file to be examined or changed, permission is one or more of the options:
a - display attributes
d - file is a driectory
e - only owner can execute
r - only owner can read
s - non-shareable file
w - only owner can write
A "p" in front of e,r, or w means anyone (public) can access file. A minus sign (-) in front of a permission turns that permission off.
attr file w e r pw pe pr Gives permission for owner and public (anyone) to read, write, or execute "file".

BACKUP (options)(device1)(device2)(#nK) Backup data from one drive to another. If no drive specified, /d0 to /d1 assumed. If only device1 specified, single drive assumed. Both disks (source and destination) must be formatted the same. Options:
e - cancel on read error
s - use single drive
-v - verify off
#nK - memory used in kilobytes. Can specify up to 56K to speed process.
backup -v /d1 /d0 #40K backup, no verify, from /d1 to /d0 using 40K buffer

BUILD *filename* Creates an ASCII text file by copying keyboard input to filename. Writes to file after enter is pressed. Press enter with no text to close file.
build /d1/TEXT/textfile Copies every keypress to an ASCII file on /d1, TEXT directory, named "textfile".

CHD *path* Changes current data directory to directory named in path.

CHX *path* Changes current execution directory to directory named in path.

CMP *file1 file2* Compares binary values of data in the two files specified. Displays address and values of different bytes if encountered.

COBBLER *device* Creates OS-9 boot file on specified device. Writes kernal to track 34 and remainder to the file OS9Boot, making an exact copy of the current system. *Use with caution*- if cobbler cannot write OS9Boot into one block,(for example on an almost full disk) the boot it makes will not work.
cobbler /d1 makes the disk in /d1 a bootable disk with any current system changes (new printer baud, etc.) permanent.

CONFIG Used to create a new system disk. Follow prompts, refer to manual for more info.

COPY *path1 path2* (options) Copies from one file or device to another. Path1 is complete path and name of source, path2 complete path and name of destination. Options:

-s - single drive copy. Prompts for source and destination disks.
#nK - memory used in kilobytes. Can specify up to 56K buffer

copy /d0/text1 /d1/text2 #40K copies text1 on /d0 to text2 on /d1 using a 40K buffer.

DATE (t) Displays current system date. "t" displays current system time with date.

DCHECK (-options) *drive* Checks disk file structure in specified drive. Options:

-b - suppress listing unused clusters
-m - saves allocation map work files
-o - prints valid DCHECK options
-p - prints path for questionable clusters
-s - counts and displays number of directories and files. Only checks file descriptors.
-w=path - specifies path for work files. Uses /d0 if ommitted

Preceding dash used once, then all options can be together (no spaces between). If disk suspected bad, DO NOT put work files on disk.
dcheck -bpsw=/d1 /d0 check disk file structure on /d0; don't list unused cluster, print path for questionable cluster, count and display number of directories and files, store work files on /d1.

DEINIZ *device1* (device2) (etc.) Deinitializes and detaches specified device(s). One should only DEINIZ a device that was initialized with INIZ.
deiniz w4 removes window 4, returning all memory used by w4
DEL (-x) *file1* (file2) (etc.) Delete (erase) the specified file(s). -x assumes file is in current execution directory. Uses current directories unless otherwise specified. Can only DEL files you have permission to write to (see ATTR, page 5).

DELDIR *directory* Deletes specified directory along with all associated subdirectories and files.
deldir TEXT deletes the directory TEXT and all files within it

DIR (options) (path) Display contents of directory named in path. If no options or path specified, current data directory is assumed. Options:

e - displays size, address, owner, permissions, and last date/time modified.
x - current execution directory

Options can be used without path and vice-versa.
dir e /d0 diplays directory of /d0 listing size, address, etc.

***DMODE *drive* (options)** Modifies disk drive device descriptors. Use without options to display current drive parameters, follow option with desired HEX value to change. Use COBBLER to make permanent.Options are as follows:

drv - drive number
stp - step rate in ms (00=35, 01=20, 02=12, 03=6)
typ - drive type (20 indicates 5.25" CoCo format)
dns - density (tracks per inch- 1=40, 3=96)
cyl - cylinders (tracks- 23=35, 28=40, 50=80)
sid - number of sides
vfy - write verify on (0)/off(1)
sct - sectors per track (12=18)
tos OR t0s - sectors per track, track 0 ONLY
ilv - sector interleave factor (normally 3)
sas - number of sectors allocated at one time (normally 8)

dmode /d1 stp=03 cyl=28 sid=2 Change the current 35 track drive 1 descriptor to 40 track double sided, 35ms access

NOTE: /d0 & /dd must be changed for the default drive!

DISPLAY *hex#1* (hex#2) (etc.) Reads hexadecimal number hex#, converts to ASCII character, and writes to standard output device (always the current window unless redirected). Can redirect output to other devices, such as printer. For screen, 32=text, 33=background, and 34=border color. REF. Color Codes page 18, Device Windows page 19, & Window Text Commands page 20.
display 1b 33 08 changes the current window (1b) background (33) to white (08).
display 41 42 43 prints ABC on the screen (standard output path)
NOTE: It is legal to use the foreground color numbers for any of the three areas. OS-9 converts decimal to hex. Output can be redirected.

(continued on next page)

DISPLAY *(continued from page 7)*

Display Codes

Windows	**G/P Buffers**	**Colors**
1b20 DWSet	1b29 DfnGPBuf	1b30 DefColor
1b21 Select	1b2a KillBuf	1b31 Palette
1b22 OWSet	1b2b GPLoad	1b32 ForeColor
1b23 OWEnd	1b2c GetBlk	1b33 BackColor
1b24 DWEnd	1b2d PutBlk	1b34 Border
1b25 CWArea	1b2e PSet	
	1b2f LSet	

Graphics Text	**Graphics**		**Both**
1b35 ScaleSw	**Absolute**	**Relative**	1b4e PutGC
1b36 DWProtSw	1b40 DPtr	1b41	1b4f FFil
1b39 GCSet	1b42 Point	1b43	1b50 Circle
1b3a Font	1b44 Line	1b45	1b51 Ellipse
1b3c TCharSw	1b46 LineM	1b47	1b52 Arc
1b3d BoldSw	1b48 Box	1b49	
1b3f PropSw	1b4a Bar	1b4b	

DSAVE (options) (device) (path) >*path* Copies (backs up) all files to specified directory. /d0 assumed if no device given. Path is a command procedure file DSAVE stores it's output in. Options:

-b - copies source disk's boot file (if present)
-b=path - same as -b except OS9Boot comes from specified path
-i - indents directory levels
-l - don't process directories below current level
-m - don't include MAKDIR in path
-s# - amount of memory for copy to use in kilobytes.
-v - verify copy by forking to CMP after each file

Can also be 'piped' to a shell for immediate execution.
dsave /d0 > /d1/makecopy make a procedure file on /d1 called make copy that will copy all files on /d0 to another disk. To copy, chd to the destination drive, then run makecopy.
chd /d0; dsave -s40 /d0 /d1 ! shell change data directory to source drive; copy using 40K buffer all files on /d0 to /d1 (pipe to shell to copy NOW)

ECHO *text* Prints text to standard output, usually the current screen (can de redirected). Used to create messages in procedure files or to send initialization strings to a terminal. Can be redirected to any device.
echo hello displays "hello" on screen
echo hello; list textfile >/p prints "hello"on screen; prints textfile.

EDIT ***(oldfile) (newfile)*** Loads and starts the built-in text editor. Oldfile is a file being read in to edit, newfile a newly created file. A temporary file called Scratch will be created for output. Oldfile will be updated upon leaving the editor (DEL and RENAME must be present for updating to occur). If the file edited remains unchanged, or edit gives you a 218 error, look for the file Scratch. In it will be a copy of your last edit. Rename scratch to save, or delete the file if not wanted.

ERROR ***number*** Opens /dd/SYS/errmsg, searches for error number, and displays message for specified code (same as in Error Codes, page 38).

EX (file) Terminates current shell then runs file (if given). If no other shell open, OS-9 will crash. Must always be the last command on a line.
ex basic09 starts Basic09 without a shell, saves memory.

FORMAT ***device*** **(options) (name)** Formats device using options and assigning name. Options:

r - don't display prompts
1 - format single sided disk
2 - format double sided disk
'#' - format # of tracks
:#: - sector interleave value #
name - disk name

If formatting a hard drive, first use the command "**tmode -pause**" to turn screen pause off. Otherwise format will stop whenever the screen fills with verified sectors. Standard CoCo floppy interleave value is 3.
format /d1 -r 1 '35' "boot" formats a single sided 35 track disk in /d1 named boot without any prompts interrupting

FREE ***drive*** Displays number of unused sectors, name, date created, and cluster size of disk in specified drive. Default drive used if none specified.

HELP ***command1*** **(command2) (etc.)** Displays help file for specified command(s). File "helpmsg" must be in SYS directory. Many third party utilities have a built in help file. Use utilityname -? to view.

IDENT ***name*** **(options)** Displays header information for file or module name. Options:

-m - assume name is a module in memory
-s - display edition byte, type language byte, module CRC, & module name on one line. If CRC verifies, a period will be displayed, question mark if not.
-v - don't verify module CRC
-x - assume file name is in execution directory

ident -m dir displays info for dir command in memory

INIZ *device1* (device2) (etc.) Initializes the specified device driver(s). **iniz /p** initializes a newly attached printer

***IPATCH *patchfile oldfile newfile* (-v)** Creates newfile from oldfile using changes specified in patchfile. Patchfile is created using **makpatch** (see below). File names may contain paths. -v enables display of installation process on screen. Many patchfiles are available in the Delphi OS-9 SIG. **ipatch patch.ipc file file.new -v** patches file and creates file.new, displays process on screen

KILL *processID* Terminates specified processID number. Can only terminate a process with your user number attached. Attached to shell, not in CMDS directory.

LINK *module* Increases module link count by one. When a module is loaded, link count is 1. Count becomes 2 when module is run. When finished, count drops by 1, but module remains. Modules run from disk only has a count of 1, and will be dropped as soon as it's finished. Can switch to another window and link a module rather than reloading. Once the count is reduced to 0, module "disappears" from memory and must be re-loaded.

LIST *file1* (file2) (etc.) Lists the contents of specified text file(s). Can list to screen or other device. May be redirected.
list /d1/textfile lists "textfile" on /d1 to screen
list /d1/textfile >/p lists "textfile" on /d1 to the printer

LOAD *path* Loads module(s) specified in path into memory.
load format places the format command in memory for fast execution

LOGIN Provides security for timeshare systems. Requests username and password and checks against validation file. Automatically sets usernumber, execution and data directories, and executes a program in password file. Automatically called by TSMON.

MAKDIR (path) *name* Makes directory name in current data directory unless path is specified. As a general rule, all OS-9 directories use all uppercase letters in the name, filenames are all lowercase or mixed.
makdir /d1/CMDS creates a CMDS directory on /d1

***MAKPATCH *oldfile newfile patchfile* (-v)** Creates patchfile which describes differences between oldfile and newfile. Patchfile contains a header followed by a series of "patch entries". Each entry contains an eight bit type (0=deletion, 1=addition, 3=disparate size change, 4=done), and three 16 bit unsigned values (offset in oldfile where patch applies, size of old

(continued on page 11)

MAKPATCH *(continued from page 10)*
area to patch, size of new area). -v enables display of installation process on screen. Must be knowledgeable with m/l to use! WARNING: newfile will be overwritten if in current path (see **ipatch**, page 10).

MDIR (e) Displays names of modules currently in memory. e lists extended physical address, size, type, revision level, re-entran attribute, link count, and name of each module. Numbers shown in hexadecimal.

MERGE *(file1) (file2)* (etc.) Copies file(s) to standard output path. Output can be redirected to any device.
merge file1 file2 >file3 combines files1&2 into file3 in the current directory and drive.

MFREE Displays block number, beginning and ending address, and size of unassigned RAM blocks.

MONTYPE *type* Sets monitor type, where type is **r** for RGB, **c** for composite color, or **m** for composite monochrome

OS9GEN *device* (options) Creates a bootable disk by creating and linking modules listed in required OS9Boot file. Device is the drive with the disk to be made bootable. Use ONLY on a newly formatted disk! Options:

-s - use single drive

#nK - memory used in kilobytes. Use up to 56K to speed process.

To use os9gen, create a text file with the modules desired, and place it in the MODULES directory. Chd to this directory and redirect os9gen's input with **os9gen /dx /dx <textfile**. Alternately, each file to be added can be input separately:
OS9: **os9gen /d1** (/d1 is receiving drive)
OS9: **/d0/os9boot** (use all modules in current boot)
OS9: **/d1/new.driver** (file to be added)
OS9: **/d1/new.driver** (file to be added)
OS9: (press BREAK)

PROCS (e) Displays list of processes currently running. Shows ID#, user#, priority, etc. e displays processes of all users.

PWD Shows path from root directory to current data directory.

PWX Shows path from root directory to current execution directory.

***PCDOS -*command* (options) *device* (DOS path) (OS9 path)** displays a directory and transfers files to/from MS-DOS, Atari ST DOS disks, and OS-9 disks. Blank MS/Atari disk MUST be pre-formatted. Requires patched version of CC3Disk or SDisk3 for OS-9 Level II (on CoCo 3). Automatically converts text files to proper format. Mainly used for ASCII text file transfers.

-dir - list directory of DOS disk.
-del - delete file on DOS disk
-id - display MS-DOS BIOS id info
-get - import file FROM DOS disk
-put - export file TO DOS disk
Options:
-all - use ONLY after -dir to display hidden DOS files.
-raw - use ONLY after -put/-get to prevent text file conversion.

pcdos -dir -all /d1 displays a directory of all files on MS-DOS disk in /d1
pcdos -get /d1 file.txt /d0/text.file copies "file.txt" from MS-DOS disk in /d1 to OS-9 format file "text.file" on /d0

RENAME *path name* Renames the file or directory found in path to name. Only the first parameter is a complete path. **rename /d1/cmds/util util2**

*** RSDOS -*command* (options) *device* (DECB path) (OS9 path)** Displays a directory and transfers files to/from DECB disks and OS9 disks. Blank DECB disk MUST be pre-formatted. Requires patched version of CC3Disk or SDisk3 for OS-9 Level II (on CoCo 3). Commands:

-dir - list directory of DECB disk
-del - delete file on DECB disk
-get - import file FROM DECB disk
-put - export file TO DECB disk

Options (used ONLY with -put):

-b - BASIC binary program (type 0)
-d - BASIC data file (type 1)
-m - executable M/L program (type 2)
-t - text editor source file (type 3)
-a - ASCII file (text or BASIC)
-f=x - sets type to number x (0-255)

NOTE: default format is BASIC binary program (0).
rsdos -dir /d1 displays a directory of the DECB disk in /d1
rsdos -put -a /d1 file.txt /d0/text.file copies OS-9 format ASCII text file "text.file" in /d0 to DECB file "file.txt" in /d1

***SDUMP &** Loads SDUMP, which waits in background until called with SHIFT-CTRL-ALT to print current text screen. Works with multiple windows, just run once.

SETIME (yy/mm/dd hh:mm(:ss)) Sets system date and time to year (yy), month (mm), day (dd), hour (hh), minutes (mm), and optionally seconds (ss). Date and time can also be separated by colons, spaces, or slashes, but NOT commas. No separaters need be used, just a space between date and time.
setime 910501 1330 sets date and time to 91,May 1,1:30 pm

SETPR *processID* # Changes *processID* priority to #. Can set only for processes with your user number attached. Lowest priority is 1, highest 255.

SHELL *list* Causes the shell to run *list* of commands, load list of parameters, and/or list of options. Refer to manual chapter 3.

TSMON *(terminal#)* Monitors idle terminals on a timesharing system. Initiates a login sequence when an idle terminal is requested. Logoff by sending end-of-file character (BREAK/ESCAPE).

TUNEPORT (device) (-s=x) Allows testing and setting delay loop for serial port. Device to be tested/set is printer (/p) or terminal (/t1). Test by typing **tuneport (device)**. Current baud rate will be displayed (and test data sent to printer if selected). Current delay will be displayed and user prompted for a new value (in decimal). Continue until proper rate is found. Set new rate with **tuneport (device) -s=x** where x is the new decimal value. Use cobbler (page 6) to make change(s) permanent.

UNDEL *(path)* (directory)** Scans directory for deleted files/directories and prompts for the first letter of the deleted file/directory if recoverable (remainder of file name will be displayed). Use uppercase letter if undeleting a directory, lower case for files. Press enter to skip file. Current directory scanned if no path given. ***DO NOT USE UPPERCASE FIRST LETTER OF A FILE! A disk editor will have to be used to remove the directory attribute if this happens. If a directory is given a lowercase letter, DEL then UNDEL again using uppercase.
undel /d0/CMDS displays all recently deleted files, prompts for recovery

UNLINK *module1* (module2) (etc.) Reduces named program or command link count by one. Will be unloaded from memory once count reaches 0. If a module is named that wasn't loaded or is being used by another process, that process will crash, usually with error 221 (module not found). Modules that are part of a merged file cannot be unlinked except for first module in file, which is the "master" file. Unlink the master and the entire group count will be reduced. All files merged in the group will show a count of 0. The file just before the 0s is the master file (shows count for group).

TMODE (path#) (option1) (option2) (etc.) Displays or changes terminal parameters (options). Path# is one of the standard path numbers: .0-input, .1-output, .2-error output. Options (default value is hexadecimal unless otherwise noted). Refer to manual page 6-87):

bsb - backspace erases characters (default)
-bsb - backspace doesn't erase characters
bsl - backspace-space-backspace deletes terminal display line
-bsl - disable backspace over a line
echo - input characters echo to screen
-echo - disable echo
lf - turn on auto line feed to screen
-lf - disable auto line feed
upc - uppercase characters only. Converts lower to upper.
-upc - upper and lower case characters
pause - turn on screen pause when full, press space to resume
-pause - disable screen pause
abort=x - sets terminate character, normally CONTROL C
baud=x - sets baud rate, word length, and stop bits for software controlled interface. Bits 0-3 control baud rate (0=110, 1=300, 2=600, 3=1200, 4=2400, 5=4800, 6=9600, 7=19200 with ACIAPAK, 7=32000 w SIO). Bit 4 is reserved. Bit 5-6 is word length (00=8 bits, 01=7 bits). Bit 7 is stop bits (0=1, 1=2)
bell=x - sets bell character (output)
bse=x - set backspace char. (output)
bsp=x - sets backspace char. (input)
del=x - sets delete line char. (input)
dup=x - sets character to duplicate last input line
eof=x - sets end-of-file char. (input)
eor=x - sets end-of-record character (carriage return, input),
null=x - sets null count (number of nulls after carriage return)
pag=x - sets # of video display lines (decimal). Affects pause.
psc=x - sets pause character, default=17
quit=x - sets quit character (normally CONTROL E)
reprint=h - sets reprint line character (hex)
type=x - use for ACIA initialization. Bit 0= true lowercase for TERM-VDG (1=yes, 0=no). Set to 80 to specify a window device for TERM-WIN. Bit 4 sets auto-answer modem feature (1=on, 0=off). Bits 5-7 set MARK(101), SPACE (111), no parity(000), even parity (011), or odd parity (001) for all ACIA devices.

WCREATE (-?) (-z) */wpath* (-s=type) *xpos ypos xsize ysize forecolor backcolor* (border) Used to intitialize and create a window. /wpath - device name of window (W, W1, W2, and W5-W7). Options:

-? - display help message
-z - accepts input redirected from a file, either a named file or a following line in the same file.
-s=type - screen type: 1=40 col., 2=80col., 3=640x192 two color, 4=320x192 four color, 5=640x192 four color, 6=320x192 sixteen color
xpos - x coordinate for upper left corner of screen
ypos - y coordinate for upper left corner of screen
xsize - number of columns across screen (1-80)
ysize - number of lines in screen(1-24)
forecolor - foreground or lettering color
backcolor - background color
border - border color (default is black). Border must be specified if using -s=type.

wcreate -z < file (windowinstructions in file)
wcreate /w1 -s=2 0 0 80 24 7 4 1 (sets up 80 column window as /w1)
Also see "Device Windows", page 19, and page 18 for color codes.

***WMODE (parameters) /wx** Displays or changes window attributes of an initialized window, where /wx is the desired window descriptor. Use parameters as specified under WCREATE. Built-in help displayed if no parameters given. Does NOT change items specified under XMODE or TMOD
wmode forecolor 04 /w1 changes forground color (letters) to red in /w1

XMODE *device* (option1) (option2) (etc.) Displays initialization parameters of any SCF-type device (screen, printer, RS-232 port, etc.) if no options listed. Changes initialization parameters to those listed when option list is included. Similar to TMODE, but XMODE updates remain as long as the computer is on during current session. TMODE only works on open paths so effects are gone once current path is closed. Options are same as TMODE (see for list). Use COBBLER to make changes permanent.

2 - Special Keys

KEY(S)	FUNCTION
ALT x	Displays graphic characters on VDG screen,international characters in window (x is any key)
CLEAR	selects next window (when windows are used)
CTRL	control key
CTRL -	prints underline (_)
CTRL ,	prints left curly brace ({)
CTRL .	prints right curly brace(})
CTRL /	prints back slash (\)
CTRL 0	shift lock on/off
CTRL 1	prints vertical bar (|)
CTRL 3	prints tilde (~)
CTRL 7	prints up arrow (^)
CTRL 8	prints left bracket ([ )
CTRL 9	prints right bracket ( ])
CTRL A	displays last line typed with cursor at end. Press ENTER to execute or edit by backspacing. Repeat to display edited line.
CTRL C or	
CTRL D	redisplay command line
CTRL E or	
BREAK	halts current program
CRTL H or	moves cursor one space left
CTRL W	temporarily halts video (scrolling). Any keyrestarts.
CTRL X or	
SHIFT	delete current line
CTRL BREAK	same as ESCape, sends end-of-file to program receiving keyboard input. Must be first on a line.
CTRL CLEAR	toggles “keyboard mouse” on/off. Keyboard mouse uses arrow keys for directions, F1 and F2 for buttons. Normal arrow/F key operation suspended when keyboard mouse is active.
SHIFT BREAK	similar to CTRL C but only interrupts current screen, program continues running in background.
SHIFT CLEAR	selects previous window (when windows are used)
ENTER	carriage return or execute current command line

3 - Keyboard Codes

Listing consists of **KEY-VALUE** (values in hexadecimal)

NORM	SHIFT	CTRL	NORM	SHIFT	CTRL
0-30	0-30		G-47	g-67	BEL-07
1-31	!-21	-7C	H-48	h-68	BSP-08
2-32	“-22	00	I-49	i-69	HT-09
3-33	#-23	-7E	J-4A	j-6A	LF-0A
4-34	-24	00	K-4B	k-6B	VT-0B
5-35	%-25	00	L-4C	l-6C	FF-0C
6-36	&-26	00	M-4D	m-6D	DR-0D
7-37	‘-27	5E	N-4E	n-6E	CO-0E
8-38	(-28	[-5B	O-4F	o-6F	CI-0F
9-39	)-29	]-5D	P-50	p-70	DLE-10
:-3A	*-2A	00	Q-51	q-71	DC1-11
;-3B	+-2B	00	R-52	r-72	DC2-12
,-2C	<-3C	7B	S-53	s-73	DC3-13
—2D	=-3D	5F	T-54	t-74	DC4-14
.-2E	>-3E	7D	U-55	u-75	NAK-15
/-2F	?-3F	\-5C	V-56	v-76	SYN-16
@-40	60	NUL-00	W-57	w-77	ETB-17
A-41	a-61	SOH-01	X-58	x-78	CAN-18
B-42	b-62	STX-02	Y-59	y-79	EM-19
C-43	c-63	ETX-03	Z-5A	z-7A	SUM-1A
D-44	d-64	EOT-04			
E-45	e-65	EMD-05			
F-46	f-46	ACK-06			

Function Keys

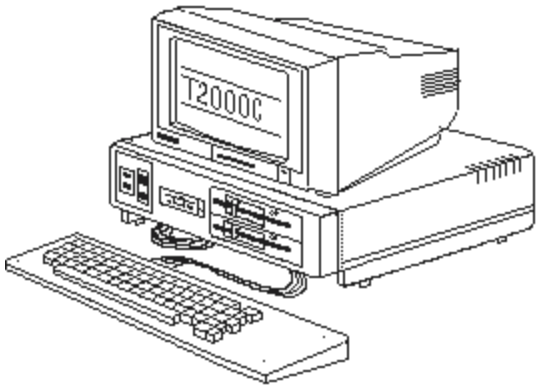
KEY	NORM	SHIFT	CTRL
BREAK	05	03	1B
ENTER	0D	0D	0D
SPACE	20	20	20
LT ARROW	08	18	10
RT ARROW	09	19	11
DN ARROW	0A	1A	12
UP ARROW	0C	1C	13

4 - Screen Color Codes

HEXADECIMAL CODES

Foreground	Background	Color
00	08	white
01	09	blue
02	0A	black
03	0B	green
04	0C	red
05	0D	yellow
06	0E	magenta
07	0F	cyan

10 or more (decimal - actually a hex number greater than 0F, which is nonexistant) also produces black. If the foreground color code is used for a background, OS-9 will automatically translate to correct color.



The T-2000C: A Color Computer 3 mounted in a Tandy 2000 case.
(as outlined in "the world of 68' micros", Volume 1 Number 3)

5 - Device Windows

A device window can run a program or utility. Each window acts as if it were an individual terminal. Use the CLEAR key to page between device windows. Use INIZ /wx to open a device window, where x is one of the following window types (1-7 are predefined on the OS-9 disk, 8-15 are on Multi-Vue disk.):

No.	Size	Type	Colors	RAM used
0	32x16	VDG	(requires VDGINT)	
1	40x24	text	16	1.6K
2	80x24	text	16	4K
5	640x192	gfx	2	16K
6	320x192	gfx	4	16K
7	640x192	gfx	4	32K

The window parameters (type, start position, and size) can be changed by following INIZ /wx with the WCREATE or DISPLAY commands (see below). Windows CANNOT overlap! A shell must then be forked to the new window with the SHELL command. SHELL i=/wx will create an immortal window, or one that will not die if you exit with CTRL-BREAK (refer to manual, chapter 3, for SHELL parameters).

```
   DISPLAY 1b 20 02 00 00 50 18  01 00 00 >/wx
WCREATE /wx-s= 02 00 00 80 24 01 00 00
               |  |  |  |  |  |  |  |
               |  |  |  |  |  |  |  border color
               |  |  |  |  |  |  background color
               |  |  |  |  |  foreground color
               |  |  |  |  length in rows
               |  |  |  width in columns
               |  |  starting Y position
               |  starting X position
               window type code
```

WCREATE accepts decimal input, while DISPLAY 1b 20 requires hex. DISPLAY is, however, always in RAM (no loading).

6 - Window Text Commands

The following hexadecimal codes are used with the DISPLAY command to control cursor and text in alpha and graphics windows (unless otherwise stated).

CODE	FUNCTION
01	HOME- put cursor in upper right corner.
02 x y	CURSOR XY- move cursor to row X of line Y. Add 20 to positions to get hex values.
03	ERASE LINE
04	ERASE TO END OF LINE (from cursor)
05 20	CURSOR OFF
05 21	CURSOR ON
06	CURSOR RIGHT (one position)
07	RING BELL
08	CURSOR LEFT (one position)
09	CURSOR UP (one line)
0A	CURSOR DOWN (line feed)
0C	CLEAR SCREEN
0D	RETURN (carriage return)
1F 20	REVERSE VIDEO ON
1F 21	REVERSE VIDEO OFF
1F 22	UNDERLINE ON
1F 23	UNDERLINE OFF
1F 24	BLINKING ON (alpha only)
1F 25	BLINKING OFF (alpha only)
1F 30	INSERT LINE
1F 31	DELETE LINE
1F 3C 00	TRANSPARENT OFF- draw alphanumeric characters with back and fore ground colors (default- graphics only).
1F 3C 01	TRANSPARENT ON- draw alphanumeric characters using current background color (graphics only).
1F 3D 00	BOLD OFF (graphics only)
1F 3D 01	BOLD ON (graphics only)
1F 3F 00	PROPORTIONAL OFF- proportional character spacing (default- graphics only)
1F 3F 01	PROPORTIONAL ON (graphics only)

7 - User Mode System Calls

System call format is: name: mnemonic, software interrupt code2, request code (in hexadecimal). See manual for more info (pages 8-7 thru 8-43). ADDR = address, CLR = clear, CHR = character, REV = revision. # = number, DIR =directory, INI = initialization.

Allocate Bits: FAllBit 103F 13 - set bits in allocation bit map. Bit numbers from 0 to one less than number of bits in map.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
D= # of first bit	CC=carry set
X=start ADDR of bit map	B=error code
Y= # of bits to set	

Chain: FChain 103F 05 - load & execute new primary module, no new process created.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=language/type code	CC=carry set
B=size of data area (in pages)	B=error code
X=ADDR of module/file name	
Y=parameter area in pages	
U=start ADDR of parameter area	

Compare Names: FCmpNam 103F 11 - compare two strings.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=length of first string	CC=carry CLR
X=ADDR of first string	
Y=ADDR of second string	

Copy External Memory: FCpyMem 103F 1B - read external memory into buffer.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
D=DAT image pointer	CC=C bit set
X=begin copy offset	B=error code
Y=byte count	
U=destination buffer	

CRC: FCRC 103F 17 - calcualte module CRC

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=start byte ADDR	Updates CRC accumulator
Y= # of bits	
U=CRC accumulator ADDR	

Deallocate Bits: FDelBit 103F 14 - clear allocation map bits.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D= # of first bit	None
X=start ADDR of bit map	
Y= # of bits to set	

Exit: FExit 103F 06 - terminates calling.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=return status code	Process terminated

Fork: FFork 103F 03 - creates child process.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=language/type code	X=last name ADDR byte +1
B=data area (pages)	A=new process
Y=parameter area (pages)	
U=start ADDR of parameter ID #area	
ERROR OUTPUT:	
B=error code	
CC= carry set	

Get System Block Map: FGBlkMp 103F 19 - get copy of system block map.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=pointer to 1K buffer	D=bytes per block
ERROR OUTPUT:	Y=system block map size
CC=carry set	
B=error code	

Get Module Directory: FGModDr 103F 1A - get copy of system module directory.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=pointer to 2K buffer	CC=carry set
Y=end of copied DIR	B=error code
U=start of system DIR	

Get Process Descriptor: FGPrDsc 103F 18 - get copy of process descriptor.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process ID	CC=carry set
X=pointer to 512 byte buffer	B=error code

Intercept: FIcpt 103F 09 - set signal intercept trap.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=ADDR of intercept routine	Signal sent to process causes intercept
U=ADDR of routine memory	to be called, process not killed.

Get ID: FID 103F 0C - get process ID and user ID

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
None	A=process ID
	Y=user ID

Link: FLink 103F 00 - link to named module.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=type/language	A=type/language
X=ADDR of module	B=ATTR/REV
ERROR OUTPUT:	X=last name ADDR byte +1
CC=C bit set	Y=module entry point ADDR
	U=module header ADDR

Load: FLoad 103F 01 - load module(s) from file.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=language/type	A=language/type
X=pathlist ADDR	B=ATTR/REV
ERROR OUTPUT:	X=last path ADDR byte +1
CC=carry set	Y=module entry point ADDR
	U=module header ADDR

Memory: FMem 103F 07 - change process data memory.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D=memory size in bytes	Y=upper memory ADDR
ERROR OUTPUT:	D=memory size in bytes
CC=carry set	
B=error code	

Link to a Module: FNMLink - link to module, module not mapped in user address space.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=type/language	A=type/language
X=module ADDR	B=module REV
ERROR OUTPUT:	X=last module ADDR byte+1
CC=carry set	Y=module memory requirement
B=error code	

Load a Module: FNMLoad - load module(s) from file, module(s) not mapped in user address space.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=type/language	A=type/language
X=path ADDR	B=module REV
ERROR OUTPUT:	X=last module ADDR byte+1
CC=carry set	Y=module memory requirement
B=error code	

Print Error: FPerr 103F 0F - writes error message to standard path.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
B=error code	CC=carry set
	B=error code

Parse Name: FPrsNam - scan input string for valid OS-9 name.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=path ADDR	X=optional slash ADDR+1
ERROR OUTPUT:	Y=ADDR of last name CHAR+1
CC=carry set	A=trailing byte
B-error code	B=name length
	Y=ADDR of first non-delimiter

Search Bits: FSchBit 103F 12 - search memory allocation bit map for free memory block of specified size.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D=start bit	D=start bit
X=map start ADDR	Y=bit count
Y=bit count	**ERROR OUTPUT:**
U=map end ADDR	CC=C bit set

Send: FSend 103F 08 - send signal to process.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process ID	CC=carry set
B=signal code	B=error code

Sleep: FSleep 103F 0A - temporarily turn process off.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=sleep time (ticks)	X=sleep time (ticks slept)
X=0 (indefinate sleep)	
X=1 (sleep through current time slice)	
ERROR OUPUT:	
CC=carry set	
B=error code	

Set Priority: FSPrior 103F 0D - change priority.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process ID	CC=carry set
B=priority (0-255)	B=error code

Set SWI: FSSWI 103F 0E - set SWI2 and SWI3 vectors.

ENTRY CONDITIONS:	**EXIT CONDITIONS**:
A=SWI type	CC=carry CLR
X=ADDR of interrupt routine	B=error code

Set Time: FSTime 103F 16 - set system time and date.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=ADDR of time packet	CC=C bit set
	B=error code

Set User ID: FSUser 103F 1C - change current user ID, doesn't check for errors or caller' ID.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
Y=new user ID	CC=carry set
	B=error code

Time: FTime 103F 15 - get system date and time.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=date/time storage area	X=date and time

ERROR OUTOUT:
CC=carry set
B=error code

Unlink: FUnLink 103F 02 - unlinks unused module with link count of 0.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
U=ADDR of header	CC=carry set
	B=error code

Unlink Module by Name: FUnLoad 103F 1D- decrements module link count, removes if result is 0.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=type	CC=carry set
X=name pointer	B=error code

Wait: FWait 103F 04 - temporarily turn off calling process.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process ID	CC=carry set
B=exit status code	B=error code

8 - I/O User Mode System Calls

System call format is: name: mnemonic, software interrupt code2, request code (in hexadecimal). See manual for more info (pages 8-44 thru 8-65).

Attach: IAttach 103F 80 - attach or verify a device to system.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=access mode	X=updated device name
X=device name string ADDR	U=device table entry ADDR
ERROR OUTPUT:	ACCESS MODE PARAMETERS:
CC=carry set	0=special device abilities
B=error code	1=read only
	2=write only
	3=update

Change Directory: ICHGdir 103F 86 - change working directory.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=access mode	X=updated path
X=path ADDR	ACCESS MODE PARAMETERS:
ERROR OUTPUT:	1=read only
CC=carry set	2=write only
B=error code	3=update
	4=execute

Close Path: IClose 103F 8F - terminate I/O path.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=path #	CC=carry set
	B=error code

Create File: ICreate 103F 83 - create and open disk file.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=access mode (write or update)	A=path #
B=attributes	X=last path ADDR byte +1
X=path ADDR	
ERROR OUTPUT:	**ATTRIBUTE BITS:**
B=error code	0=read 4=public write
CC=carry set	1=write 5=public exec.
	2=execute 6=shareable
	3=public read

Delete File: IDelete 103F 87 - delete disk file.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=path ADDR	X=last path ADDR byte +1
ERROR OUTPUT:	
CC=carry set	
B=error code	

Delete A File: IDeletX 103F 90 - deletes from current data or execution directory.

ENTRY CONDITIONS:
A=access mode
X=path ADDR

EXIT CONDITIONS:
X=last path ADDR byte +1

ERROR OUTPUT:
CC=carry set
B=error code

Detach Device: IDetach 103F 81 - remove device from system.

ENTRY CONDITIONS:
U=device table entry ADDR

ERROR OUTPUT:
CC=carry set
B=error code

Duplicate Path: IDup 103F 82 - second path number for same (duplicate) path (used to redirect I/O).

ENTRY CONDITIONS:
A= # of path to copy

EXIT CONDITIONS:
A=new path #

ERROR OUTPUT:
CC=carry set
B=error code

Get Status: IGetStt 103F 8D - status of file or device.

ENTRY CONDITIONS:
A=path
B=function code

ERROR OUTPUT:
CC=carry set
B=error code

Make Directory: IMakDir 103F 85 - create and initialize directory.

ENTRY CONDITIONS:
B=ATTR
X=path ADDR

EXIT CONDITIONS:
X=last path ADDR byte +1

ERROR OUTPUT
CC=carry set
B=error code

ATTRIBUTE BITS:

0=read	4=public write
1=write	5=public exec.
2=execute	6=single user
3=public read	7=any user/type

Read: IRead 103F 89 - read number of bytes from path.

ENTRY CONDITIONS:
A=path
Y= # of bytes to read
X=storage ADDR

EXIT CONDITIONS:
Y= # of bytes to read

ERROR OUTPUT:
CC=carry set
B=error code

Open Path: IOpen 103F 84 - open path to existing file or device.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=access mode	A=path #
X=path ADDR	X=last path ADDR byte +1
ERROR OUTPUT:	**ACCESS MODE PARAMETERS:**
CC=carry set	D=directory PE=public exec.
B=error code	E=execute PR=public read
	R=read PW=public write
	S=not shareable

Read Line with Editing: IReadLn 103F 8B - read line of text and activate line editing.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=path	Y= # of bytes to read
X=storage ADDR	**ERROR OUTPUT:**
Y=max # of bytes to read	CC=carry set
	B=error code

Seek: ISeek 103F 88 - reposition file pointer.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=path	CC=carry set
X=MS 16 bits of file position	B=error code
U=LS 16 bits of file position	

*MS=most significant, LS=least significant.

Set Status: ISetStt 103F 8E - set status of file or device.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
U=path	CC=carry set
B=function code	B=error code

Write: IWrite 103F 8A - write to file or device.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=path	Y= # of bytes written
X=write data start ADDR	**ERROR OUTPUT:**
Y= # of bytes to write	CC=carry set
	B=error code

Write Line: IWritLn 103F 8C - write to file or device until carriage return.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=path	Y= # of bytes written
X=write data address	**ERROR OUTPUT:**
Y=maximum # of bytes to write	CC=carry set
	B=error code

9 - Privileged Mode System Calls

System call format is: name: mnemonic, software interrupt code2, request code (in hexadecimal). See manual for more info (pages 8-67 thru 8-111).

Alarm Set: FAlarm 103F 1E - set alarm.

ENTRY CONDITIONS:
X=time packet address

ERROR OUTPUT:
CC=carry set
B=error code

Allocate 64 Bytes: FAll64 103F 30 - dynamically allocate 64 byte memory blocks.

ENTRY CONDITIONS:
X=page table base ADDR
(0=table not allocated)

EXIT CONDITIONS:
A=block #
X=page table base ADDR
Y=block ADDR

ERROR OUTPUT:
CC=carry set
B=error code

Allocate High RAM: FAllHRam FAllHRam - allocate system memory from high memory.

ENTRY CONDITIONS:
B= # of memory blocks

ERROR OUTPUT:
CC=carry set
B=error code

Allocate Image: FAllImage 103F 3A - allocate RAM for DAT image.

ENTRY CONDITIONS:
A=starting block #
B= # of blocks
X=descriptor pointer

ERROR OUTPUT:
CC=carry set
B=error code

Allocate Process Descriptor: FAllPrc 103F 4 - allocate and initialize 512 byte process descriptor.

ENTRY CONDITIONS:
none

EXIT CONDITIONS:
U=descriptor pointer

ERROR OUTPUT:
CC=carry set
B=error code

Allocate RAM: FAllRAM 103F 39 - allocates desired number of contiguous RAM blocks.

ENTRY CONDITIONS:
B= # of desried blocks

ERROR OUTPUT:
CC=carry set
B=error code

Allocate Process Task Number: FAllTsk 103F 3F - determine if task has number, if not allocate one.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=descriptor pointer	CC=C bit set
	B=error code

Insert Process: FAProc 103F 2C - insert process for execution into active process.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=process descriptor ADDR	CC=carry set
	B=error code

Bootstrap System: FBoot 103F 35 - links boot module (or other module named in the INIT module).

ENTRY CONDITIONS:	**ERROR OUTPUT:**
none	CC=C bit set
	B=error code

Bootstrap Memory Request: FBtMem 103F 36 - allocates requested memory (in blocks) in system address space.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D=requested # of bytes	D=bytes granted
ERROR OUTPUT:	U=memory granted pointer
CC=C bit set	
B=error code	

Clear Specified Block: FClrBlk 103F 50 - marks requested blocks in DAT area as unallocated.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B= # of requested blocks	none
U=first block ADDR	

DAT to Logical Address: FDATLog 103F 44 - convert DAT image and block offset to logical address.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=DAT image offset	X=logical ADDR
X=block offset	**ERROR OUTPUT:**
	CC=carry set
	B=error code

Deallocate Image RAM Blocks: FDelImg 103F 3B - deallocate image RAM blocks.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=starting block #	CC=C bit set
B= # of blocks	B=error code
X=descriptor pointer	

Deallocate Process Descriptor: FDelPrc 103F 4C - free process descriptor memory for other use.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process ID	CC=C bit set
	B=error code

Deallocate RAM Blocks: FDelRAM 103F 51 - free RAM block in memory block map.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B= # of blocks	none
X=starting block #	

Deallocate Task Number: FDelTsk 103F 40 - release specified task number.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=process descriptor pointer	CC=C bit set
	B=error code

Link Using Module Directory Entry: FELink 103F 4D - link using pointer to directory entry.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=module type	U=module header ADDR
X=directory entry pointer	Y=module entry point
ERROR OUTPUT:	
CC=C bit set	
B=error code	

Find Module Directory Entry: FFmodul 103F 4E - return pointer to module directory entry.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=module type	A=module type
X=pointer to name	B=module rev.
Y=DAT image pointer	X=update name
ERROR OUTPUT:	U=directory entry pointer
CC=C bit set	
B=error code	

Find 64 Byte RAM Block: FFind64 - find address of 64 byte RAM block.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=block #	Y=block ADDR
X=block address	CC=carry set if not in use or allowed

Get Free High Block: FFreeHB 103F 3E - search DAT image for highest free blocks of requested size.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=blocks requested	A=starting block #
Y=DAT image pointer	**ERROR OUTPUT:**
	CC=C bit set
	B=error code

Get Free Low Block: FFreeLB 103F 3D - search DAT image for lowest free blocks of requested size.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=blocks requested	A=starting block #
Y=DAT image pointer	**ERROR OUTPUT:**
	CC=C bit set
	B=error code

Compact Module Directory: FGCMDir 103F 52 - compact entries in module directory. ***FOR INTERNAL OS-9 USE ONLY! DO NOT CALL FROM PROGRAM!***

Get Process Pointer: FGProcP 103F 37 - get process pointer.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=process ID	B=process pointer
ERROR OUTPUT:	
CC=carry set	
B=error code	

I/O Delete: FIODel 103F 33 - delete unused I/O module.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=I/O module address	CC=carry set
	B=error code

I/O Queue: FIOQu 103F 2B - insert calling process into another process I/O queue, put calling process to sleep.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=process #	CC=carry set
	B=error code

Set IRQ: FIRQ 103F 2A - add or remove device from polling table.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
D=device status register ADDR	CC=carry set
X=0 to remove device	B=error code
X=ADDR of packet to add device	
(address at X=flip byte, X+1=mask byte, X+2 =priority byte)	

Load A from Task B: FLDABX 103F 49 - load A from 0,X in B.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=task #	A=byte at 0,X
X=data pointer	**ERROR OUTPUT:**
	CC=carry set
	B=error code

Get One Byte: FLDAXY 103F 46 - load A from X,Y

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=block offset (X)	A=byte at Y,X
Y=DAT image pointer	**ERROR OUTPUT:**
	CC=carry set
	B=error code

Get Two Bytes: FLDDDXY 103F 48 - load D from D+X,Y

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D=offset to offset in DAT image	D=bytes at D+X,Y
X=offset in DAT image	**ERROR OUTPUT:**
Y=DAT image pointer	CC=carry set
	B=error code

Map Specific Block: FMapBlk 103F 4F - map block into process space.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
X=start block #	U=first block ADDR
B= # of blocks	**ERROR OUTPUT:**
	CC=carry set
	B=error code

Move Data: FMove 103F 38 - move data from one address to another.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=source task	CC=carry set
B=destination task	B=error code
X=source pointer	
Y= # of bytes	
U=destination pointer	

Next Process: FNProc 103F 2D - execute next process in active queue.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
none	control not returned to caller

Release a Task: FRelTsk 103F 43 - release task from use, make hardware available for another task.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
B=task #	CC=carry set
	B=error code

Reserve Task Number: FResTsk 103F 42 - reserve DAT task number.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
none	B=task #

ERROR OUTPUT:
CC=carry set
B=error code

Return 64 Bytes: FRet64 103F 31 - deallocate 64 byte block of RAM.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=block #	CC=carry set
	B=error code

Set Process DAT Image: FSetImg 103F 3C - copy all or part of DAT image into process descriptor.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=start image block	CC=carry set
B= # of blocks	B=error code
X=process pointer	
U=new image pointer	

Set Process Task DAT Registers: FSetTsk 103F 41 - write to hardware DAT registers.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
X=process descriptor pointer	CC=carry set
	B=error code

System Link: FSLink 103F 34 - add module to current address space from outside.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
A=module type	A=module type
X=module pointer	B=module rev.
Y=DAT image pointer name	X=updated name pointer
ERROR OUTPUT:	Y=module entry point
CC=carry set	U=module pointer
B=error code	

Request System Memory: FSRqMem 103F 28 - allocate RAM from top of available RAM (for system use only).

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
B=module type	U=header ADDR
X=directory entry pointer	Y=entry point
ERROR OUTPUT:	
CC=C bit set	
B=error code	

Return System Memory: FSRtMem 103F 29 - deallocates block of RAM (for system use only).

ENTRY CONDITIONS:	**ERROR OUTPUT:**
U=start block ADDR	CC=C carry set
D= # of bytes requested	B=error code

Set SVC: FSSvc 103F 32 - add or replace a system call. See manual for table format.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
Y=system call initialization table address	CC=C bit set B=error code

Store Byte in Task: FSTABX 103F 4A - store byte A at 0,X in task B. Similar to M/L instruction STA 0,X, except that X is in the task address space, not current.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
A=byte to store	CC=carry set
B=task #	B=error code
X=storage address	

Install Virtual Interrupt: FVIRQ 103F 27 - install virtual interrupt handling routine. For use with Multi-Pak or similar device. Refer to technical reference chapter 2 for details.

ENTRY CONDITIONS:	**ERROR OUTPUT:**
D=starting count value	CC=carry set
X=0 to delete entry, 1 to install	B=error code
Y=5 byte address	

Validate Module: FVModul 103F 2E - check header parity and CRC of a module.

ENTRY CONDITIONS:	**EXIT CONDITIONS:**
D=DAT image pointer	U=module dir ADDR
X=new block offset	ERROR OUTPUT:
	CC=carry set
	B=error code

10 - Mouse Get Status System Calls

Get Status System Calls are used with the RBF manager routine GETSTA. The Get Status routines pass the register stack and specified code to the device driver. Only the mouse status is referred to in this QRG due to its frequent use. Refer to the manual for additional Get Status System Calls (pages 8-112 thru 8-150; mouse is on pages 8-124 thru 8-128)

SS.Mouse: function code 89 - passes information on the current mouse (or joystick) and its fire button(s). A 32 byte **data packet** is created by SS.Mouse that provides position and button information. "A"= Button A, "B"= Button B. Button B is the second button on two button devices (black on Deluxe Joystick, right on two-button mouse). The mouse is scanned every time the keyboard is scanned. Support modules are CC3IO, GrfInt, and WindInt.

ENTRY CONDITIONS:
A=Path #
B=89
X=data storage area ADDR
Y=mouse port select
0=automatic
1=right port
2=left port

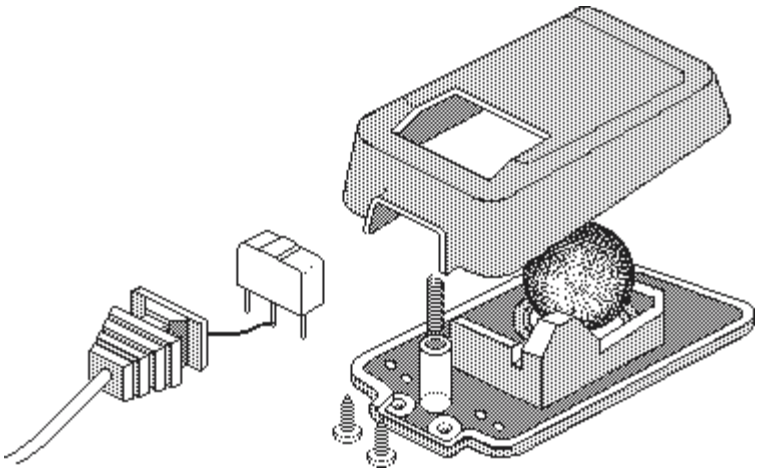
EXIT CONDITIONS:
X= data storage area ADDR

ERROR OUPUT:
CC=carry set
B=error code

DATA PACKET:
Pt.Valid (rmb 1) 0=info not valid, 1=info valid.
Pt.Actv (rmb 1) 0=port off, 1=right port active (default), 2=left port active
Pt.ToTm (rmb 1) initial timeout (countdown) value.
Pt.TTTo (rmb 1) time until timeout
Pt.TSSt (rmb 2) time since counter start
Pt.CBSA (rmb 1) "A" state (0=button open)
Pt.CBSB (rmb 1) "B" state (0=button open)
Pt.CCtA (rmb 1) "A" click count
Pt.CCtB (rmb 1) "B" click count
Pt.TTSA (rmb 1) "A" time this counter
Pt.TTSB (rmb 1) "B" time this counter
Pt.TLSA (rmb 1) "A" time last counter
Pt.TLSB (rmb 1) "B" time last counter
(rmb 2) RESERVED FOR FUTURE USE

Pt.TTSx is the number of clock ticks that have passed during the current button state as defined by Pt.CBSx. Starts at one and increases as long as button remains in same state. TLSx is the number of ticks that a button is in the opposite state. Using these counts, one can determine how a button was even if the system returns the packet changes after the button state changes. Use to define clicks, drags, holds, etc. (along with state and click count).

Pt.BDX (rmb 2) button down frozen (X). Copy of Pt.AcX when button changes states(open to closed/closed to open).
Pt.BDY (rmb 2) button down frozen (Y). Copy of Pt.AcY when button changes states(open to closed/closed to open).
Pt.Stat (rmb 1) window pointer type location. 0=current working area, 1=control region (for Multi-View), 2=out of current window. If Pt.Valid=0, then Pt.Stat=0 and is not accurate.
Pt.Res (rmb 1) resolution. 0=low (X:10,y:3), 1=high (x,y:1). The Hi-Res adapter or keyboard mouse must be used for high resolution.
Pt.AcX (rmb 2) actual X resolution value. 0-639 for high, 1:10 ratio for low.
Pt.AcY (rmb 2) actual Y resolution value. 0-191 for high, 1:3 ratio for low.
Pt.WRX (rmb 2) window relative X
Pt.WRY (rmb 2) window relative Y
Values for Pt.WRX and Pt.WRY are read from mouse minus starting coordinates of the current window working area. Divide window relative values by 8 for absolute character positions.
Pt.Siz (equ.) packet size
SPt.SRX (rmb 2) screen relative X (for system use only)
SPt.SRY (rmb 2) screen relative Y (for system use only)
SPt.Siz (equ.) size of packet (for system use only)



11 - System/Basic09 Error Codes

Only built-in error codes are listed. Programs and programming languages may define their own codes, which will not appear in the following listing. Entries are **decimal number (hexadecimal number) NAME**

Signal Error Codes

001 (01) UNCONDITIONAL ABORT- unrecoverable error has occured, all processes terminated.
002 (02) KEYBOARD ABORT- BREAK pressed.
003 (03) KEYBOARD INTERRUPT- SHIFT BREAK was pressed.

Basic09 Error Codes

10 (0A) UNRECOGNIZED SYMBOL
11 (0B) EXCESSIVE VERBIAGE
12 (0C) ILLEGAL STATEMENT CONSTRUCTION
13 (0D) I-CODE OVERFLOW- need more workspace memory
14 (0E) ILLEGAL CHANNEL REFERENCE- bad path number
15 (0F) ILLEGAL MODE- read,write, update; directory only
16 (10) ILLEGAL NUMBER
17 (11) ILLEGAL PREFIX
18 (12) ILLEGAL OPERAND
19 (13) ILLEGAL OPERATOR
20 (14) ILLEGAL RECORD FIELD NAME
21 (15) ILLEGAL DIMENSION
22 (16) ILLEGAL DIMENSION
23 (17) ILLEGAL RELATIONAL
24 (18) ILLEGAL TYPE SUFFIX
25 (19) TOO-LARGE DIMENSION
26 (1A) TOO-LARGE LINE NUMBER
27 (1B) MISSING ASSIGNMENT STATEMENT
28 (1C) MISSING PATH NUMBER
29 (1D) MISSING COMMA
30 (1E) MISSING DIMENSION
31 (1F) MISSING DO STATEMENT
32 (20) MEMORY FULL- need more workspace memory
33 (21) MISSING GOTO
34 (22) MISSING LEFT PARENTHESIS
35 (23) MISSING LINE REFERENCE
36 (24) MISSING OPERAND
37 (25) MISSING RIGHT PARENTHESIS
38 (26) MISSING THEN STATEMENT
39 (27) MISSING TO
40 (28) MISSING VARIABLE REFERENCE
41 (29) NO ENDING QUOTE

42 (2A) TOO MANY SUBSCRIPTS
43 (2B) UNKNOWN PROCEDURE
44 (2C) MULTIPLY-DEFINED PROCEDURE
45 (2D) DIVIDE BY ZERO
46 (2E) OPERAND TYPE MISMATCH
47 (2F) STRING STACK OVERFLOW
48 (30) UNIMPLEMENTED ROUTINE
49 (31) UNDEFINED VARIABLE
50 (32) FLOATING OVERFLOW
51 (33) LINE WITH COMPILER ERROR
52 (34) VALUE OUT OF RANGE FOR DESTINATION
53 (35) SUBROUTINE STACK OVERFLOW
54 (36) SUBROUTINE STACK UNDERFLOW
55 (37) SUBSCRIPT OUT OF RANGE
56 (38) PARAMETER ERROR
57 (39) SYSTEM STACK OVERFLOW
58 (3A) I/O TYPE MISMATCH
59 (3B) I/O NUMERIC INPUT FORMAT BAD
60 (3C) I/O CONVERSION number out of range
61 (3D) ILLEGAL INPUT FORMAT
62 (3E) I/O FORMAT REPEAT ERROR
63 (3F) I/O FORMAT SYNTAX ERROR
64 (40) ILLEGAL PATH NUMBER
65 (41) WRONG NUMBER OF SUBSCRIPTS
66 (42) NON-RECORD-TYPE OPERAND
67 (43) ILLEGAL ARGUMANT
68 (44) ILLEGAL CONTROL STRUCTURE
69 (45) UNMATCHED CONTROL STRUCTURE
70 (46) ILLEGAL FOR VARIABLE
71 (47) ILLEGAL EXPRESSION TYPE
72 (48) ILLEGAL DECLARATIVE STATEMENT
73 (49) ARRAY SIZE OVERFLOW
74 (4A) UNDEFINED LINE NUMBER
75 (4B) MULTIPLY-DEFINED LINE NUMBER
76 (4C) MULTIPLY-DEFINED VARIABLE
77 (4D) ILLEGAL INPUT VARIABLE
78 (4E) SEEK OUT OF RANGE
79 (4F) MISSING DATA STATEMENT

80-182 NOT USED BY BASIC09 OR SYSTEM

(System Error Codes continue on next page)

System Error Codes

183 (B7) ILLEGAL WINDOW TYPE- wrong type window or parameters for given command.
184 (B8) WINDOW ALREADY DEFINED- tried to create window using an existing designation.
185 (B9) FONT NOT FOUND- window font not loaded or in specified/ current path.
186 (BA) STACK OVERFLOW- not enough stack space free.
187 (BB) ILLEGAL ARGUMENT- wrong parameters or commands used.
189 (BD) ILLEGAL COORDINATES- coordinates off screen.
190 (BE) INTERNAL INTEGRITY CHECK- system modules or data no longer reliable.
191 (BF) BUFFER SIZE IS TO SMALL- data larger than buffer.
192 (C0) ILLEGAL COMMAND- command form not OS-9.
193 (C1) SCREEN OR WINDOW TABLE IS FULL- system can't keep track of any more windows or screens.
194 (C2) BAD/UNDEFINED BUFFER NUMBER- illegal buffer.
195 (C3) ILLEGAL WINDOW DEFINITION- window parameters illegal.
196 (C4) WINDOW UNDEFINED- tried access to undefined window.

197-199 unused by Basic09 or System

200 (C8) PATH TABLE FULL- can't track any more files.
201 (C9) ILLEGAL PATH NUMBER- number to large or doesn't exist.
202 (CA) INTERRUPT POLLING TABLE FULL- interrupt can't be handled, no room for more entries in table.
203 (CB) ILLEGAL MODE- device can't perform function.
204 (CC) DEVICE TABLE FULL- no more devices can be added.
205 (CD) ILLEGAL MODULE HEADER- sync code, header parity, or CRC of module bad.
206 (CE) MODULE DIRECTORY FULL- modules can't be entered.
207 (CF) MEMORY FULL- no more available memory.
208 (D0) ILLEGAL SERVICE REQUEST- issued system call has illegal code.
209 (D1) MODULE BUSY- non-shareable module in use.
210 (D2) BOUNDARY ERROR- memory allocation or deallocation not on a page boundary.
211 (D3) END OF FILE- read terminated.
212 (D4) RETURNING NON-ALLOCATED MEMORY- attempt to deallocate non-allocated memory.
213 (D5) NON-EXISTING SEGMENT- file structure of device bad.
214 (D6) NO PERMISSION- user doesn't have access to perform specified operation.
215 (D7) BAD PATHNAME- syntax error in path.
216 (D8) PATH NAME NOT FOUND- can't find path.

217 (D9) SEGMENT LIST FULL- file to fragmented.
218 (DA) FILE ALREADY EXISTS- file exists in directory
219 (DB) ILLEGAL BLOCK ADDRESS- device file structure bad.
220 (DC) PHONE HANGUP - DATA CARRIER LOST- no carrier on RS-232 port.
221 (DD) MODULE NOT FOUND- module not in directory.
223 (DF) SUICIDE ATTEMPT- attempt to return to stack.
224 (E0) ILLEGAL PROCESS NUMBER- non-existant process.
226 (E2) NO CHILDREN- wait service issued but no dependants.
227 (E3) ILLEGAL SWI CODE- software interrupt <1 or >3.
228 (E4) PROCESS ABORTED- current process terminated.
229 (E5) PROCESS TABLE FULL- no more processes can be run.
230 (E6) ILLEGAL PARAMETER AREA- fork passed bad boundaries.
231 (E7) KNOWN MODULE- module for internal use only.
232 (E8) INCORRECT MODULE CRC- bad module CRC.
233 (E9) SIGNAL ERROR- receiving process has signal pending.
234 (EA) NON-EXISTANT MODULE- module can't be found.
235 (EB) BAD NAME- illegal name used.
236 (EC) BAD HEADER- module parity header bad.
237 (ED) SYSTEM RAM FULL- bootfile (OS9Boot) to large.
238 (EE) UNKNOWN PROCESS ID- incorrect ID number.
239 (EF) NO TASK NUMBER AVAILABLE- all in use.
240 (F0) UNIT ERROR- device unit doesn't exist.
241 (F1) SECTOR ERROR- sector # out of range.
242 (F2) WRITE PROTECT- device write protected.
243 (F3) CRC ERROR- bad CRC on read/write verify.
244 (F4) READ ERROR- disk read data error or SCF input overrun (terminal).
245 (F5) WRITE ERROR- error during device write.
246 (F6) NOT READY- device not ready.
247 (F7) SEEK ERROR- seek attempted on non-existant sector.
248 (F8) MEDIA FULL- not enough free disk space.
249 (F9) WRONG TYPE- attempt to read incompatible disk.
250 (FA) DEVICE BUSY- non-shareable device in use.
251 (FB) DISK ID CHANGE- disk changed with files still open.
252 (FC) RECORD IS LOCKED OUT- record is being used.
253 (FD) NON-SHAREABLE FILE BUSY- file being used.

"The hardest part of programming is debugging- finding out what elusive bug caused an error."
F.G. Swygert (and many other programmers, but none [myself included] usually say it as "clean" as this when the problem occurs)

PERSONAL NOTES:

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