



MODEL ONE Programming Reference Card

The following summary of the graphics commands supported by the standard firmware in the Model One product family. Brackets [] indicate the hexadecimal opcode of each command.

HELP	List all command mnemonics.
HELP mnemonic	Give command information.
Graphics Primitives	
ARC rad, a1, a2	Draw arc of radius rad. Starting angle is a1; ending angle is a2. [11 _H]
AREA1	Area fill. Boundary is any pixel different in value from the current point. The area is filled with current value. [13 _H]
AREA2 vreg	Area fill. Boundary pixel value given in vreg. [14 _H]
CIRCl creg	Draw circle. Location given by creg lies on the circumference. [10 _H]
CIRCLE rad	Draw a circle of radius rad. [0E _H]
CIRCXY x, y	Draw circle. Point x, y lies on the circumference. [0F _H]
CLEAR	Flood current window to current pixel value. [87 _H]
DRW2R dx, dy	Draw vector relative by dx, dy. [84 _H]
DRW3R dx, dy	Draw vector relative by dx, dy. [83 _H]
DRWABS x, y	Draw vector from current point to the point x, y. [81 _H]
DRWl creg	Draw vector to location given by creg. [85 _H]
DRWREL dx, dy	Draw vector relative by dx, dy. [82 _H]
FILMSK rmsk, gmsk, bmsk	Image data is ANDed with mask before checking value in AREA fill commands. [9F _H]
FLOOD	Flood displayed image memory to current pixel value. [07 _H]
MOV2R dx, dy	Move relative by dx, dy. [04 _H]
MOV3R dx, dy	Move relative by dx, dy. [03 _H]
MOVABS x, y	Move absolute location of current point to x, y. [01 _H]
MOVl creg	Move to location given by coordinate register creg. [05 _H]
MOVREL dx, dy	Move relative by dx, dy. [02 _H]
POINT	Set current point to current pixel value. [88 _H]

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SEGPID pickid	Defines the pickid for primitives within segment until next SEGPID or SEGEND command. [D9 _H]
SEGREF segment	Nest specified segment within current segment. [D8 _H]
SEGREN segment2, segment1	Renames segment1 to segment2. [DA _H]
SET global,value	Set PICKAP aperture; set PIDREG value; set SEGREG value. [46 _H]
SETATR segment,attribute, flag	Sets VISibility or PICKability of segment. flag = 1 or ON enables attribute (VIS or PICK); flag = 0 or OFF disables attribute. [E6 _H]
SYSTAT	Returns system memory usage and availability. [E4 _H]

††Optional Firmware for Model One/25, Model One/40, and Model One/60.

Display List Firmware††

DEFVW view, wcsreg1, wcsreg2, dcsreg1, dcsreg2, upreg1, upreg2, .rotate, xform, backvreg, bitm, bankm, hiseg	Defines the view into the World Coordinate System. view gives the view number; wcsreg1 and wcsreg2 define the WCS corners; dcsreg1 and dcsreg2 define the display viewport; upreg1 and upreg2 give the ends of the UP vector; rotate defines the WCS window rotation center; xform specifies the transformation type; backvreg gives the ackground color; for bitm and bankm, see the WRMASK command; hiseg specifies the segment nesting. [EB _H]
DELPIID	Delete primitives with PIDREG and SEGREG. [EC _H]
HILITE view, flag, vreg	Highlight view in the color specified by vreg. flag = 1 or ON highlights primitives; flag = 0 or OFF draws primitives normally. PIDREG and SEGREG (see SET) are used. [DF _H]
PICKCR view, dcsreg, searchflag	Perform pick search; view is picked, using the dcsreg coordinates. searchflag = 1 or ON, search from current tree location; searchflag = 0 or OFF, search from the top of the segment. [E3 _H]
RDPID	Reads and returns the graphics primitives with PIDREG and SEGREG (see SET). [ED _H]
RDREG	Reads and returns the current SEGREG and PIDREG (see SET and PICKCR). [EO _H]
RDTREE	Returns the PICKCR hierarchical history. [EE _H]
REDRAW view, flag	Redisplay view; flag = 1 or ON clears the window to the background color before display. view = - 1 redisplay all views. [E2 _H]
SEGAPP segment	Open segment to append graphics primitive commands. SEGEND ends the append. [DB _H]
SEGCOP segment2, segment1	Copies segment1 into segment2. [EA _H]
SEGDEF segment	Begins definition of segment. [DC _H]
SEGDEL segment	Deletes segment. [DE _H]
SEGEND	End segment definition begun with SEGDEF or SEGAPP. [DD _H].
SEGINI words	Initializes Display List Firmware; words gives the number of data words per segment block. [E1 _H]
SEGINQ segments	Returns the attributes of segment. See SETATR. [E5 _H]

Default Port Configurations

Port Mnemonic	RTS	CTS	Baud	Parity	XIN	XOUT	CTRL	STOP	NBITS
MODEMSIO	off	off	1200	none	on	off	off	1	8
KEYBSIO	off	off	300	none	on	off	on	1	8
TABLETSIO	off	off	1200	none	on	off	off	2	8
GRINSIO	off	off	1200	none	off	off	off	2	8
HOSTSIO	off	off	9600	none	off	on	off	2	8
ALPHASIO	off	off	9600	none	on	off	on	2	8

Alphanumeric Terminal Emulation**

ALPHEM** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) the alphanumeric terminal emulator. Routes text to selected window. [C2 _H]
BOLD** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) drawing to bold text. [CC _H]
DEFWIN** window ,x1, y1, x2, y2, x-size, y-size, bitm, bankm	Defines size and positions of indicated window number. (x1,y1) defines first corner; (x2,y2) defines diagonal corner. x-size, y-size define text size; bitm, bankm define write mask for window (see WRMASK command). [CO _H]
DELWIN** window	Deletes window. [C3 _H]
DIRCUR** x,y	Moves cursor to character position x,y within window. [C4 _H]
GETCUR**	Returns Model One coordinates of cursor in currently-selected window. [C9 _H]
GETPOS**	Returns character position of cursor in currently-selected window. [C5 _H]
GETWIN**	Returns number of active window (-1 for no active window). [CE _H]
HOME**	Moves cursor to character position (0,0), the upper-left corner of the window. [CF _H]
MOVCUR** x,y	Moves cursor to Model One coordinate x,y within window limits. [C8 _H]
OVRSTK** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) overstriking of text. [CD _H]
SCROLL** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) scrolling of text.
SELWIN** window	Select window as defined by DEFWIN. Sets routing for ALPHEM command. [C1 _H]
SETCUR** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) cursor. [C7 _H]
SETSIZ** xscale,yscale	Sets x,y scaling (multiples of 16 pixels). Default is (1,1). [C6 _H]
WRAP** flag	Enables (flag = 1 or ON) or disables (flag = 0 or OFF) wraparound of text. [CB _H]

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CREG 13*	Defines start corner for PIXMOV: destination window.
CREG 14*	Controls direction of pixel writing for PIXMOV destination window.
CREG 15*†	Screen origin of overlay plane 0.
CREG 16*†	Screen origin of overlay plane 1.
CREG 17-19	Reserved for future definition.
CREG 20-63	Unassigned. Available for temporary coordinate storage.

*Option Card Users Only
†Model One/20 and Model One/25 Users Only

Value Register Assignments

VREG 0 Current Value	The value used in all graphics primitives commands.
VREG 1	Value used for crosshair 0.
VREG 2	Value used for crosshair 1.
VREG 3	Fill Mask used for Area fills.
VREG 4*†	Color assignment for overlay plane 0.
VREG 5*†	Color assignment for overlay plane 1.
VREG 6	For future definition.
VREG 7-15	Available for temporary value storage.
VREG 16, 19...40**	Foreground color, alphanumeric windows 0-8.
VREG 17, 20...41**	Background color, alphanumeric windows 0-8.
VREG 18, 21...42**	Cursor color, alphanumeric windows 0-8.
VREG 43-50	For future definition.
VREG 51-63	Available for temporary value storage.

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System Configuration Commands**

DFTCFG	Restore all ports to default configurations.
DISCFG	Display current system configurations.
SAVCFG	Save configuration set with SYSCFG.
SYSCFG HOST	Mode [ASCII/BINARY]
SYSCFG IEEE	[address] [NORMAL] [TALK] [LISTEN]
SYSCFG SERIAL	[Port-mnemonic] [RTS on/off] [CTS on/off] [STOP 1/2] [BITS 7/8] [PARITY e/o/1/h/n] [BAUD rate] [XIN on/off] [XOUT on/off] [CTRL on/off]
SYSCFG SERIAL	TABLET [GTCO/SUMMA].

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POLYGN npoly, verts Draw polygons. Npoly gives number of polygons; for each polygon, verts gives number of vertices and the vertices. [12_H]

PRMFIL flag Primitive fill. Filled primitives are drawn if flag=1. If flag=0, the perimeter of graphics primitives is drawn. [1F_H]

RECREL dx, dy Draw rectangle. Diagonal corner is dx, dy away from current point. [8E_H]

RECTAN x, y Draw rectangle. Point x, y specifies diagonal corner [89_H]

RECTI creg Draw rectangle. Location given by creg is diagonal corner. [8F_H]

TEXT1 string Draw text string with font 1. [90_H]

TEXT2 string Draw text string with font 2. [91_H]

TEXTC size, ang Specify size of text and draw at angle ang. [92_H]

TEXTDN char, veclst Define downloaded character in font 2. [26_H]

TEXTRE Restore default character set. [B1_H]

VAL1K val Set current pixel value (for 1K mode). [B0_H]

VAL8 val Set current pixel value to val, val, val. [86_H]

VALUE r, g, b Set current pixel value to r, g, b. [06_H]

VTEXT1 string Vertical text string with font 1. [93_H]

VTEXT2 string Vertical text string with font 2. [94_H]

Look-Up Table Commands

LUT8 index, r, g, b Make entry r, g, b at location given by index in Red, Green, and Blue LUTs. [1C_H]

LUTA index, entry Make entry in all LUTs. Place entry at location given in index. [1B_H]

LUTB index, entry Make entry in Blue LUT. Place entry at location given in index. [1A_H]

LUTG index, entry Make entry in Green LUT. Place entry at location given in index. [19_H]

LUTR index, entry Make entry in Red LUT. Place entry at location given in index. [18_H]

LUTRMP code, sind, eind, sent, ent Load LUTs with ramp function [1D_H]

LUTRTE† func Change LUT routing function specified by func. [1E_H]

†Model One/20 and Model One/25 Users Only

Image Transmissions

PIXEL8 nrows, ncols, val Pixel by pixel image definition. Pixel values are val, val, val. [29_H]

PIXELS nrows, ncols, r, g, b Pixel by pixel image definition. Pixel values are r, g, b. [28_H]

RUNLEN nrows, ncols, r, g, b, cnt Run-length encoded stream. Pixel value is r, g, b. Horizontal count is cnt. [2A_H]

RUNLN8 nrows, ncols, val, cnt Run-length stream. Pixel value is val, val, val. Horizontal count is cnt. [2B_H]

Display Control

ASCII flag Sets host port input as free format ASCII if flag=1, if flag=0 binary. [9B_H]

BLANK flag Blanks screen when flag=1, normal video is restored when flag=0. [31_H]

COLD Coldstart. Reset the Model One. [FD_H]

CORORG x, y Loads coordinate origin register with x, y. [37_H]

FIRSTP flag First pixel on vectors is inhibited when flag=1, uninhibited when flag=0. [2F_H]

MODDIS flag Select display mode. 512 mode is selected if flag=0, 1K mode is selected if flag=1. [2C_H]

MODE1K func† Select output data routing in 1K mode. [2D_H]

OVRRD*† plane, flag Display specified overlay plane when flag=0, inhibit display when flag=1. [BA_H]

OVRVAL*† plane, flag Set bits to 1 in specified overlay plane when flag=1, reset bits to 0 when flag=0. [B9_H]

OVRZM*† plane, flag Display plane at scale factor 1:1 if flag=0, display at same scale fact as image memory if flag=1. [B8_H]

PIXCLP flag Pixel processor clipping status. Clip on over/underflow flag=1. [3C_H]

PIXFUN mode Set pixel processor mode. All vectors and DPMA writes are affected. [3B_H]

PIXMOV* Initiate pixel mover transfer. Move window specified by CREG 11 and 12 as controlled by CREG 13 and 14. [BB_H]

PMCTL* 0 0 0 0 redrte, greenrte, bluerte, and bluerte control writing into the red, green, and blue banks. [BF_H]

QUIT Exit graphics mode. [FF_H]

RDMASK mask Set Read Mask. All pixel values read from image are ANDed with mask. [9E_H]

SCRORG x, y Set screen origin register to x,y [36_H]

SPCHAR char, flag, code Redefine special characters (see Special Characters below). If flag=0, disable, flag=1, enable. [B2_H]

TEKEM flag Invoke Tektronix emulator. [39_H]

VECPAT mask Vector generator pattern register is set to mask. [2E_H]

VGWAIT frames Inhibit transfer of vectors from vector queue for frames frame times. [30_H]

WAIT frames Wait for given number of frame times before continuing command execution. [3D_H]

WARM Warmstart. Reinitialize Model One. [FE_H]

WINDOW x1, y1, x2, y2 Set current window. Defined by diagonal x1,y1 and x2,y2. [3A_H]

WRMASK bitm, bankm Set Write-Enable Mask. Bit planes indicated by bitm and banks indicated by bankm are write-enabled. [9D_H]

XHAIR num, flag Enable/Disable Crosshair number num. If flag=1 enable, if flag=0 disable. [9C_H]

ZOOM fact Zoom by factor of fact=1, 2, 4 or 8. [34_H]

ZOOMIN Zoom in by factor of 2. [35_H]

*Option Card Users Only
†Model One/20 and Model One/25 Users Only

Special Characters (Default Values)

ASCII Code	Char	Purpose
CTL D	0	ENTER GRAPHICS
CTL P	1	Break
ESC or CTL[2	Warmstart
@	3	Line Kill
CTL H	4	Backspace
CTL F	5	ACK
CTL U	6	NACK
CTL X	7	Invoke Debug
CTL S	8	Suspend Communications
CTL Q	9	Resume Communications

FORTRAN Utility Subroutines

Call EMPTYB Empty Buffers

Call ENTGRA Enter Graphics Mode

Call SEND1 (val) Send one byte to output buffer.

Call SEND2 (val) Send 2 bytes (16 bits) to output buffer.

Readback Commands

All Read commands require a 7-bit ASCII ACK.

RDMODE flag Set readback mode to ASCII decimal (flag = OFF or 0) or binary (flag = ON or 1). [D3_H]

READBU flg, cflg Read button number. If flag=1 wait for next button. If flag=0 send number of last button pushed. If cflg=1 send current digitizing tablet coordinate, if cflg=0 send current joystick/trackball coordinate. [9A_H]

READCR creg Read coordinate register. Send x,y to port in graphics mode. [98_H]

READER Return byte with number of first error. [38_H]

READF func Sets pixel readback format. Func specifies format. [27_H]

READP Read Pixel. Send value of pixel to port in graphics mode. [95_H]

READVR vreg Read value register. Send pixel value to port in graphics mode. [99_H]

READW nrows, ncols, bf Read Window. Send value of pixels in window to port in graphics mode. [96_H]

READWE nrows, ncols, bf Read Window run-length encoded. Send values of pixels in window in run-length encoded form to port in graphics mode. [97_H]

Register Operations

CADD csum, creg Place result of csum+creg in csum. [A2_H]

CLOAD creg x, y Load coordinate register creg with x,y. [A0_H]

CMOVE cdst, csrc Move contents of csrc into cdst. [A1_H]

CSUB cdif, creg Place result of cdif-creg in cdif. [A3_H]

VADD vsum, vreg Place result of vsum+vreg into vsum. [A6_H]

VLOAD vreg, r, g, b Load contents of value register vreg with r, g, b. [A4_H]

VMOVE vdst, csrc Move contents of vsrc into vdst. [A5_H]

VSUB vdif, vreg Place result of vdif-vreg into vdif. [A7_H]

Software Development

ALPHAO strlen, string Program comment [80_H]

Send text string to local alpha-numeric display. [B4_H]

DEBUG flag Enter/Exit Command Stream Translator. Exit when flag=0, else enter. [A8_H]

DELAY factor Delay transmission of characters. [B6_H]

DNLOAD Download Z8002 object code. String format is Tektronix Hex. [FB_H]

HOSTO strlen, string Send a text string to the host. [B5_H]

NULL No operation. [00_H]

PEEK addr Display contents of CPU memory. [BD_H]

POKE addr, data Change contents of addr in CPU memory. [BE_H]

REPLAY Dump last 32 characters of HOSTSIO input buffer to ALPHASIO port. [BC_H]

Macro Programming

MACDEF num Define Macro number num. Macro is terminated by MACEND command. [8B_H]

MACEND End of Macro definition. [0C_H]

MACERA num Erase Macro num. [8C_H]

MACRO num Execute Macro num. [0B_H]

Interactive Device Support

BLINKC Clear blink table. [23_H]

BLINKD lut, index Disable Blink of specified lut, index. [21_H]

BLINKE lut, index, entry1, entry2 Enable Blink specified lut, index. Use entry 1 and entry 2 as alternate values. [20_H]

BLINKR frames Blink rate is frame times. [22_H]

BUTTB index, nmac Place Macro nmac in Button Table at location index. [AA_H]

BUTTON index Execute Macro indicated by Button Table at location index. [AB_H]

FLUSH Empty function button event queue. [15_H]

RDPIXR vreg Places value of pixel at current point in specified value register vreg. [AF_H]

Coordinate Register Assignment

CREG 0 Current Point. Starting point of graphics primitives. Updated by a MOVE or DRAW command.

CREG 1 Joystick/Trackball Cursor Location. Current coordinate from the joystick or trackball. Updated automatically.

CREG 2 Digitizing Tablet Cursor Location. Current coordinate from the digitizing tablet. Updated automatically.

CREG 3 Coordinate Origin. Coordinate of the center of image memory.

CREG 4 Screen Origin. Coordinate of the pixel in the center of the screen.

CREG 5 Crosshair 0 Location in Image Memory.

CREG 6 Crosshair 1 Location in Image Memory.

CREG 7*† Crosshair 2 Location in Image Memory.

CREG 8*† Crosshair 3 Location in Image Memory.

CREG 9 Clipping Window Origin. Lower left corner of current clipping window. All vectors are clipped to this window.

CREG 10 Clipping Window Origin. Upper right corner of current clipping window. All vectors are clipped to this window.

CREG 11*, 12* Diagonal corners for PIXMOV command source window definition.