

PART TWO

This section contains brief explanations of the operating parameters you selected during installation with the DIP switches. It explains the operating modes, standard formats and how to use the commands of a STANDARD 9100 tablet.

A summary of all 9100 commands lies between parts 2 and 3.

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SWITCH CONTROLLED PARAMETERS

The power-on default state of the following operating parameters is controlled by the setting of the DIP switches on the Digitizing Processor Board or the Communication Interface Board. Most of the settings may be overridden by commands from the host, menu or cursor. If the Universal Formatter option is installed, it may store setup parameters to override some of the switch settings. The switch controlled parameters differ between GPIB-equipped tablets and those with RS-232C or RS-449 interfaces.

The settings are listed on pages 16 and 17.

OPERATING MODE

Selects the conditions under which data will be transmitted by the tablet - continuously, each time a button is pressed, etc. May be changed by command.

OUTPUT FORMAT

Selects the style in which data will be transmitted. There is no command to change formats in the standard tablets. The Universal Formatter option may be used to create custom formats.

RESOLUTION

Selects the resolution of the tablet. May be changed by command.

TABLET SIZE

These switches are set at the factory. If you are replacing the Digitizing Processor Board, set these switches to match the settings of the board originally in your tablet.

PARITY

The parity bit is used as an error checking bit. The 9100 does not check parity when receiving characters. It inserts a parity bit into every character it transmits according to the switch settings.

STOP BITS

The number of stop bits transmitted with each byte of data.

DATA BITS

The number of bits (7 or 8) of an eight-bit byte which will be used to transmit data.

BAUD RATE

The maximum number of bits transmitted in one second. The baud rate must match the host's rate.

LINE FEED

Terminates each coordinate pair character string with a line feed, or not, depending on the switch settings. The two ports operate independently. May be changed by command.

PORT ON/OFF

Controls data transmission from either or both ports. May also be changed by command.

CURSOR COMMANDS

The 16-button cursor commands may be ON or OFF at power up (GPIB tablets are always ON). They may also be turned ON or OFF by command.

SMALL MENU

The Small Fixed Menu may be enabled or disabled at power-up (it is always enabled on GPIB tablets). There are commands that duplicate its functions, although there are no host or menu commands that control the Small Menu.

ECHO

The tablet will send all characters it receives back (via port B/D) to the sending terminal if "echoing" is enabled. If echo is disabled, only the digitizer output will be sent to the terminal. (Always enabled on GPIB tablets.) Echo may also be enabled or disabled by command.

SERIAL POLL

If this is enabled, the digitizer will activate the SRQ line every time a character is loaded for output. (GPIB tablets only)

OPERATING MODES

The operating mode of the digitizer determines the conditions under which data is transmitted by the digitizer to the host system. In the mode descriptions below, it is assumed that the transducer is in tablet proximity and on the active area except where noted. Data points are never transmitted when the transducer is in the margin or out of tablet proximity, unless permitted by host or operator command. Data points transmitted follow the output format selected (see Output Data Formats on page 44).

HALT

The digitizer accepts commands, but transmits no data until a new mode is selected.

POINT

The digitizer will transmit one coordinate pair data point whenever a cursor button or the stylus tip is depressed. To transmit another coordinate pair, the button or stylus tip must be released and depressed again.

RUN

The digitizer will transmit coordinate pair data points continuously, regardless of the status of the cursor buttons or stylus tip.

TRACK

The digitizer will transmit coordinate pair data points continuously while a cursor button or the stylus tip is depressed. Upon release of the stylus tip or cursor button, the digitizer completes the point currently in transmission, then halts until the stylus or a cursor button is depressed again.

LINE

The digitizer will transmit coordinate pair data points continuously whenever a cursor button or the stylus tip is depressed. Upon release of the stylus tip or cursor button, the digitizer completes the point currently in transmission, then transmits one more data point containing the pen-up or no-button status in the status position. After the transmission of the final pen-up data point, data output ceases until the stylus or a cursor button is again depressed. The purpose of the final data point is to alert the host computer that the line being traced has come to an end.

INCREMENT MODES

The digitizer transmits its first coordinate pair when the stylus tip or a cursor button is depressed. After that it transmits another coordinate pair each time the transducer is moved a specific distance in the X or Y direction. The increment distance requirement of each axis works independently of the other. See page 71 for more detail on setting up increment distances.

The 9100 system uses three Increment modes: Increment Track, Increment Run and Increment Line. These operating modes follow all the rules of the parent mode plus the increment distance while outputting data.

NOTE

The increment distance interacts with the Resolution command. Please read the discussion of resolution that begins on page 68.

PROMPTING

Prompting is a modification which can be applied to any mode.

All the normal operating mode requirements for transmitting a coordinate pair must be satisfied and a prompt received before the digitizer will transmit data. The normal data rate limitation also applies; the digitizer will not transmit data any faster than the commanded rate, even if prompting characters come in more quickly than that.

If, for example, the digitizer is in Point mode, the digitizer will not transmit a coordinate pair until a cursor button or the stylus tip is depressed and the host sends a prompt. In Track mode, for another example, the digitizer transmits a coordinate pair for each prompt received only if a cursor button or the stylus tip is depressed.

SELECTING A MODE OF OPERATION

The 9100 Digitizer will power up in Run, Point, Line, or Track modes, depending on the position of the on-board DIP switches. Any mode may be selected by commands issued by the host, the menu or the 16-button cursor. The digitizer will immediately assume the new mode as soon as the command has been received.

DATA OUTPUT FORMATS

The output format is the manner in which various alphanumeric ASCII characters or binary bytes are assembled to make up the data string which represents a coordinate pair, or data point. This data represents the X and Y position as computed by the 9100, the status of the transducer and the tablet itself, and other predetermined characters.

On power-up, the 9100 system will default to one of its standard formats based on the position of the on-board DIP switch. See page 16 for specific settings.

STANDARD FORMATS

Default formats 1-4 are identical to CalComp 9000 formats 1-4.

In all the standard formats the data reads from most-significant character to least-significant. Formats 1,2 and 3 are integer outputs, while format 4 is a floating-point output. Format 5 is a high-resolution binary output. Note that the format 5 cursor output is different between 4 and 16-button cursors.

The output of the X and Y data may be altered by the resolution command. The formats shown are the default outputs. Format character definitions are on page 46.

The Universal Formatter option is used to produce user-defined output. See page 95.

FORMAT	RESOLUTION	ASCII OUTPUT
1	1000 LPI, 40 LPmm 100 LPmm	TMC XXXXX YYYYY CR TMC XXXXXX YYYYYY CR
2	1000 LPI, 40 LPmm 100 LPmm	XXXXX, YYYYY, T M C CR XXXXXX, YYYYYY, T M C CR
3	1000 LPI, 40 LPmm 100 LPmm	CP XXXXX YYYYY CR CP XXXXXX YYYYYY CR
4	1000 LPI 100 LPmm 40 LPmm	SP XX.XXX, SP YY.YYY, TMC CR SP XXXX.XX, SP YYYY.YY, TMC CR SP XXXXX., SP YYYYY., TMC CR
5	1000 LPI	binary output shown on next page

BINARY FORMAT

If the revision level on component U3 on the digitizing processor board is "F" or above, the digitizer can produce binary output for either a stylus, 4-button or 16-button cursor.

THIS FORMAT CANNOT BE USED WITH SMART UNITS. THEY WILL NOT PRODUCE BINARY OUTPUT AT ANY TIME.

TABLET OUTPUT

Binary Format:

BYTE	MSB							LSB	
	7	6	5	4	3	2	1	0	
1	1	C4	C3	C2	C1	C0	X15	X14	
2	0	X13	X12	X11	X10	X9	X8	X7	
3	0	X6	X5	X4	X3	X2	X1	X0	
4	0	0	0	0	X16	Y16	Y15	Y14	
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7	
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0	

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CURSOR OUTPUTS

BUTTON PRESSED	STYLUS or 4-BUTTON Binary	16-BUTTON Binary
NONE	0 0 0 0 0	0 0 0 0 0
(Pen down) 0	0 0 0 0 1	1 0 0 0 0
1	0 0 0 1 0	1 0 0 0 1
2	0 0 1 0 0	1 0 0 1 0
3	0 1 0 0 0	1 0 0 1 1
4		1 0 1 0 0
5		1 0 1 0 1
6		1 0 1 1 0
7		1 0 1 1 1
8		1 1 0 0 0
9		1 1 0 0 1
A		1 1 0 1 0
B		1 1 0 1 1
C		1 1 1 0 0
D		1 1 1 0 1
E		1 1 1 1 0
F		1 1 1 1 1

FORMAT DEFINITIONS

@	An ASCII @ symbol (HEX 40) in the output.
C	Cursor Status Character. In ASCII formats, "C" represents a single character.
Cn	Cursor Status Bit. In Binary formats, the highest number "Cn" is the most significant bit, "C0" is the least significant bit.
Comma (,)	An ASCII comma (HEX 2C) in the output.
CR	Carriage return. An ASCII carriage return (HEX 0D) in the output.
Decimal Point (.)	An ASCII decimal point (HEX 2E)
Line feed LF in output format	Line feed. An ASCII line feed command (HEX 0A) in the output.
LPmm, LPI	Lines per millimeter, lines per Inch.
M	Mode Status Character. In ASCII formats, "M" is a single character representing the current operating mode.
MSB, LSB	Most significant bit, least significant bit.
N	Near Proximity. In Binary formats, this bit is set when the transducer is out of proximity.
P	Pen (Cursor) Status. In ASCII formats, a character reading "D" when the stylus tip or any cursor button is depressed and "U" when the stylus tip or all cursor buttons are up.
Space SP in output	Space Character. In ASCII formats, SP represents a literal space character (HEX 20).
Sx and Sy	Sign Character or Bit. In ASCII formats, a "+" for positive and a "-" for negative. In binary formats, a "0" bit for positive and a "1" bit for negative.
T	Tablet Status. A single character reading "A". Included for CalComp 9000 compatibility.
X or Y	Data Digit. In ASCII formats, a numeric character representing coordinate data. The number of X or Y symbols represents the allowable number of digits in any output.
Xn or Yn	Data Bit. In binary formats, a bit representing coordinate data. The highest numbered "n" is the most significant bit.

COMMANDS

You may override most of the default operating parameters set in the switch banks. For instance, as drafting projects change, you may change the resolution of the tablet or the number of points per second transmitted to the host. Format may be changed without changing the switches only if the tablet has the Universal Formatter option installed.

You may use any of the following sources to enter commands:

1. The terminal or host computer.
2. The buttons on the 16-button cursor (limited command set).
3. The stylus or cursor, in conjunction with the menu overlay.

NOTES:

The command to change baud rate, parity and start bits will only work if the tablet has Revision F or higher firmware.

Some commands may interact with others. Tablet resolution affects the increment and the Universal Formatter commands; baud rate, data rate, prompting and operating mode may all interact.

Command sources may not be mixed. For example, a command begun by the host must be finished by the host, not the tablet menu or the 16-button cursor.

If a space character is required in a command, it will be designated by SP. All other spaces in the commands are included only to make the command more legible.

"Toggling" a command will turn the function off, if it was on; it will turn the function on, if it was off. Unless you are certain of the state of the function it is better to specify what you want, ON or OFF.

How to use each command source will be explained. Then the 9100 commands will be explained in the following order:

1. Commands that control the command sources - the host, cursor and menu.
2. Commands that control communication between tablet, operator and host.
3. Commands that control the STANDARD tablet during a work session.
4. Universal Formatter option commands.
5. SMART option commands.
6. Dataqueue option commands.

ENTERING COMMANDS FROM THE HOST

COMMAND PREFIX

To alert the digitizer that a command is coming, the host must send a "COMMAND PREFIX" before each command. The digitizer will treat all characters between the command prefix and the next carriage return character as a command to be followed. The default command prefix, and the one used in all of the examples in this manual, is ESC % . The command prefix may be changed, as explained under CHANGING THE COMMAND PREFIX, page 51, if ESC % interferes with other functions of the host.

You may enter the commands by typing them on the host keyboard, or the commands may be sent from the host under the control of a custom digitizing program. A command from the host follows the general format:

ESC % h {b} [b] CR

where:

- ESC % = the command prefix, the ESC key followed by the % key
- n = an integer
- h = an ASCII character to invoke the command
- {0|1} = 0 or 1 will set the function to a definite state (see specific commands). No entry will toggle the function.
- { } = required variable of the command
- [] = optional variables
- {n1 | n2} = one of the variables separated by the " | " character may be chosen
- CR = an ASCII carriage return character
- < dpoint > = a point on the tablet surface, digitized to indicate where you want the command to take effect

The command will take effect immediately after the carriage return is entered.

NOTE

The host must be set to transmit the commands to the tablet.

ENTERING COMMANDS FROM THE 16-BUTTON CURSOR

The 16-button cursor may be used to send a limited number of commands to the tablet. The general format of the command is:

F F b {b} [b] E

Where:

FF	= the 'F' button, pressed twice, is the command prefix
b	= the button code for the command
{Ø 1}	= Ø or 1 will set the function to a definite state (see specific commands). No entry will toggle the function.
{ }	= enclose any required parameter of the command
[]	= enclose optional parameters
E	= the 'E' button, terminates the command string

The command will take effect as soon as the " E " button is pushed.

The cursor does not need to be on the tablet surface to send a command, but it must be enabled. The 4-button cursor cannot be used for cursor commands.

A summary of the 16-button cursor commands is on page 80.

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ENTERING COMMANDS FROM THE MENU

The menus are both the tablet regions dedicated to issuing commands and the Mylar overlays for those regions. An overlay is only an aid for the operator; its position must coincide with the menu region on the tablet surface.

When a menu has been enabled, the menu region does not transmit position data from the transducer. Picking the labelled blocks on the menu sends commands as if it were a keyboard.

Menu commands take the general format:



where:

- A = a function code block or blocks to invoke the command
- h = parameters of the function
- {Ø|1} = Ø or 1 will set the function to a definite state (see specific commands). No entry will toggle the function.
- { } = required parameter
- [] = optional parameter
- {n1 | n2} = select one of the variables separated by the "|" character
- CR = the Carriage Return block terminates the command sequence
- <dpoint> = a point on the tablet surface, digitized to indicate where you want the command to take effect

The command will take effect as soon as the Carriage Return block is picked.

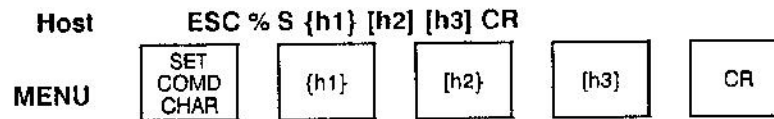
NOTE

Picking the "ESC %" blocks from the menu will not activate any commands. The command prefix for the menu commands is included in the function code block represented by [a] and cannot be changed.

COMMAND SOURCE CONTROL COMMANDS

SET COMMAND PREFIX

SET COMMAND PREFIX changes the default prefix from ESC % to one of your choice. The new prefix may be from one to three characters in length; it may use any ASCII characters except BACKSPACE (08 HEX), CARRIAGE RETURN (0D HEX), RUBOUT (or DEL) (7F HEX), and @ (40 HEX). The new prefix will take effect immediately upon entering the command; the default prefix ESC % will immediately cease to function.

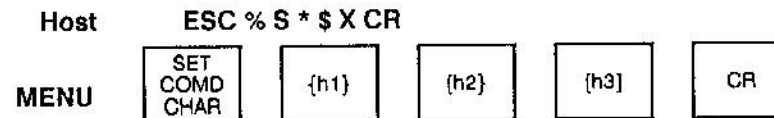


Where:

- h1 = the first command prefix character.
- h2 = the second, optional, command prefix character.
- h3 = the third, optional, command prefix character.

Example

To change the command prefix to the characters "*" "\$" "X", enter:



NOTE

If it is difficult to transmit the ESC character from the host, use the menu to change the command prefix to a character that may be transmitted. Most PC type computers interpret ESC as one of their own commands and transmitting ESC to the tablet is difficult.

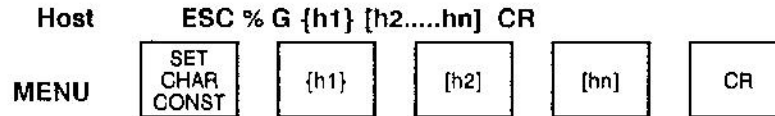
It is a good idea to avoid a command prefix that can be accidentally entered if you bump the keyboard. Use keys that are on opposite ends of the keyboard or a prefix with an ESC or SHIFT.

SET CHARACTER CONSTANTS

The tablet transmits ASCII characters to represent Tablet status, Mode status, Pen status, and Cursor status as well as position data. One or all of these characters may be changed with this command. The command affects the data output from the digitizer and the mode status character on the LCD display but it has no effect on the System status character of the LCD Display.

This command also is used by the Universal Formatter option to control the value of status characters that are placed in a custom format or manipulated by the logic commands.

After the command is entered, the character for a certain function will be transmitted whenever applicable. For example, if you insert the character "*" in position 4, the digitizer will transmit a "*" as the mode status character when it is in Point mode.



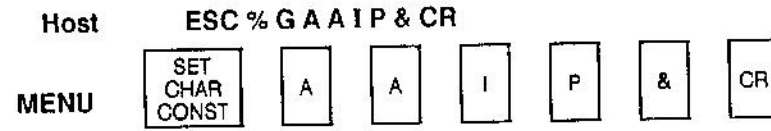
Where h1....hn = a string of ASCII characters constants.

This command does not require you to enter all 28 characters each time it is used. Only characters up to the highest position to be changed need be entered. The characters must be entered in the command in the following order:

Position In String	Default Value	Function
1	A	Tablet status (remains constant)
2	A	Answer Flag (SMART only)
3	I	Mode status - Increment mode
4	P	Mode status - Point mode
5	U	Mode status - Line mode
6	R	Mode status - Run mode
7	T	Mode status - Track mode
8	M	Transducer over Menu
9	X	Transducer out of proximity
10	U	Pen Status - stylus up
11	D	Pen Status - stylus down
12	U	Cursor Status - all cursor buttons up
13-22		Cursor Status - button 0-9 down
23 thru 28		A thru F - Cursor Status - cursor button A thru F

EXAMPLE

To change the Line mode character to the new character "&" and leave all other characters at their system default values, enter the following command:



The characters that came before (those in lower positions than) the Line mode character were re-assigned their same values; the new Line mode character is the last character entered. All characters coming later (those in higher positions) remain unchanged.



ENABLE/DISABLE CURSOR

The 16-button cursor may be used to send commands to the tablet, or messages to the host. This command enables or disables that function without interfering with the use of the cursor for digitizing. The cursor may disable itself, with the command FFØE, but once disabled it must be enabled by a command from the host or menu.

The switch settings control whether the cursor commands will be enabled or disabled at power-up.

Host	ESC % K [Ø/1] CR		
MENU	CURSOR FUNC ON/OFF	[Ø 1]	CR

Cursor FF Ø E (disable only)

Where b can equal Ø or 1 or no character.

If b = Ø, cursor function commands are disabled.

If b = 1, cursor function commands are enabled.

If no b is entered, the condition toggles.

TABLET RESET

This command has the same effect as powering the digitizer off and on. The digitizer reverts to the default operating settings determined by the switches on the electronics boards. On units equipped with the UNIVERSAL FORMATTER option, any commands stored for power-up use are invoked.

Host	ESC % V R CR		
MENU	SYSTEM FUNC 2	R	CR

LOCATE, DISABLE OR MOVE LARGE COMMAND MENU

The large menu is never enabled at power-up. You must enable it, specifying its location. Once the menu has been enabled, you may use the erase and restore commands to make it appear and disappear from the tablet surface. The menu will re-appear where it was when you erased it; the Mylar overlay may be left in this position, used for the menu when needed, and ignored when not needed.

These commands perform the same function as the three blocks of the Small Fixed Menu.

LOCATE MENU

Host ESC % V { L } CR < dpoint >
 MENU SYSTEM { L } CR < dpoint >
 FUNC
 2

- L The Large Menu will be enabled. Its lower left corner will be located under the first point digitized after the CR has been entered. The bottom edge of the overlay must be aligned with the X-axis of the tablet and the menu must be right side up with respect to the tablet logo. Although you can't enter this command from the menu to enable it, the command may be used to move the menu to a new location once it has been enabled.

ERASE AND RESTORE LARGE MENU

Host ESC % V { M | N } CR
 MENU SYSTEM { M | N } CR
 FUNC
 2

- M The Large Menu will be temporarily erased. The menu region stops sending commands and begins to output position data. You may digitize over the overlay. Like the cursor, the menu may erase itself, but the command to restore the menu must come from the host or the Small Fixed Menu.
- N The Large Menu will be restored at its previous position. If you RESTORE the menu before it has been LOCATED, it will appear at the default location 0, 0 (the lower left corner of the active area)

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THE SMALL FIXED MENU

The region below the origin is dedicated to a three-choice menu that may be used to enable, disable or move the larger command menu. Unless this small menu has been disabled by the switch settings it will always be active. Digitizing over its location may cause the larger command menu to appear at unexpected locations, with unpredictable results. If you will not be using the small menu to control the large menu, disable it by setting switch 5 of the switch bank on the Digitizing Processor Board to the closed position.

If you pick LOCATE LARGE MENU, the menu will become active at the next point on the tablet surface that you digitize.

LOCATE LARGE MENU

 < dpoint >

ERASE LARGE MENU inactivates the large menu, freeing its position for normal digitizing. RESTORE LARGE MENU reactivates the large menu at its last location.

ERASE LARGE MENU	RESTORE LARGE MENU
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The Mylar overlay is printed with both menus. Aligning the three-block menu directly under the lower left corner of the active area will align the large menu with the X axis. If this is not a convenient location for the large menu, cut them apart.

USING THE MENU FOR USER-DEFINED COMMANDS

The four rows of blocks between the tablet commands and the ASCII characters are reserved for user-defined commands. Each block has an assigned number which is transmitted by the tablet. The host must be programmed to respond to the numbers as commands.

49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Fig 28. User Menu, Number Assignments



When one of the User Menu blocks is picked, the tablet transmits the block identification number as part of a normal coordinate pair. The mode status will be "M", indicating Menu; the X data will equal the number of the user menu block picked; the Y data is not significant.

The output format must include a mode status character; without that character the output will be indistinguishable from normal digitizing data.

EXAMPLE

You are using Format 1, and digitize the block which corresponds to block 28 of the user menu. The tablet will transmit the information as if it were a normal data point, using the format:

T M C < SP > < SP > < SP > 28 YYYYY CR

where:

- A The tablet character, which is always "A"
- M The MODE status character, "M" for MENU to signal that this is a MENU choice, not a data point
- C Cursor status, varies depending on which button is pressed
- 28 The block you picked
- YY Y data (not significant)
- CR ASCII Carriage return character.

COMMUNICATION COMMANDS

The commands that follow are used to control communication between the tablet, host and operator. They control the host display screen, tablet LCD display, cursor LEDs, data output from the tablet, and messages from the large menu to the host or the host to the LCD display.

ENABLE/DISABLE OUTPUT PORT OR DISPLAY

This command allows you to control output to the host port, the terminal port, or both. This command affects only digitizer output; normal messages from the terminal to the host and from host to terminal will pass through the digitizer whether the ports are disabled or not. On single-port models, enabling or disabling a non-existent port has no effect.

This command also disables and enables the display. The characters on the display when the disable command is received will freeze until the display is re-enabled.

Host **ESC % h1 [0 | 1] CR**

MENU

ENABLE/DISABLE
I/O PORT
A | B

[0 | 1]

CR

MENU

DISPLAY
ON/OFF

[0 | 1]

CR

Cursor **FF a [0 | 1] E**

Where h1 for the host or cursor can equal A, B, or D.

If h1 = A, the command applies to Port A/C

If h1 = B, the command applies to Port B/D

If h1 = D, the command applies to the LCD display

Where you may specify 0, 1, or no entry

If [0 | 1] = 0, the output port is disabled.

If [0 | 1] = 1, the output port is enabled.

If no number is entered, the function will toggle.

SET SERIAL COMMUNICATIONS PARAMETERS

Communication parameters may be changed by host or menu command IF component U3 on the Digitizing Processor Board is Revision "F" or higher. U3 is at the opposite end of the board from the power switch.

THIS COMMAND WORKS ONLY IF A DUAL-PORT RS-232C BOARD IS INSTALLED. It will not work with single port RS-232, RS-449, or GPIB boards. It will not work with SMART units.

Host = ESC % C {n1} {h1} {n2} {1} CR

MENU

COM	n1	h1	n2	1	CR
-----	----	----	----	---	----

(If the block is unlabelled, the block to the left of [DISPLAY ON/OFF] is the menu command block Fourth row, fourth block.)



Where:

n1 = baud rate code number
 0 = 19200
 1 = 9600
 2 = 4800
 3 = 2400
 4 = 1200
 5 = 600
 6 = 300
 7 = RESERVED

h1 = parity code letter
 E = Even
 M = Mark
 N = None
 O = Odd
 S = Space

n2 = 7 or 8; the number of data bits.
 1 = The number of stop bits (must be 1)

EXAMPLE

To set the 9100 for 1200 baud, even parity, and 7 data bits, enter:

Host = ESC % C 4 E 7 1 CR

ENABLE/DISABLE PROMPTING

The prompt character is sent by the host to the digitizer, requesting transmission of a coordinate pair. The resend character is sent by the host to request re-transmission of the last coordinate pair sent by the digitizer. When prompting is activated, the digitizer will transmit one coordinate pair each time it receives a prompt character from the host.

The normal rules of the digitizer's current operating mode still apply during prompting. All the normal operating mode requirements for transmitting must be satisfied, and a prompt character received, before the digitizer will transmit. The data rate limit also applies; the digitizer will not transmit data faster than the commanded maximum rate, even if prompting characters come in at a faster rate.

Cancel prompting by giving this command without h1 or h2 character in the command string. The digitizer will resume normal operation in its current mode.

NOTE

Select the operating mode FIRST, then activate prompting. It may not function properly if you change operating modes while prompt is being used.

Host ESC % Q {h1} [h2] CR

MENU SET PROMPT { h1 } [h2] CR

h1 = the desired prompting character

h2 = the optional resend character. h1 and h2 must be different
h1 and h2 may be any ASCII characters except CR, BS, RUB, or @.

EXAMPLE

To set up prompting mode using "?" for the prompt character and "*" for the resend character, enter:

Host ESC % Q ? * CR

MENU SET PROMPT ? * CR

To cancel prompting, enter:

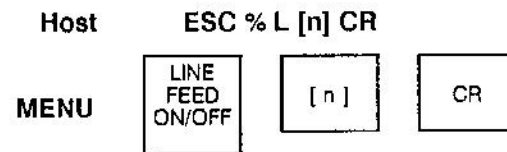
Host ESC % Q CR

MENU SET PROMPT CR

ENABLE/DISABLE LINEFEED

It is often useful to include a linefeed character (0A HEX) after every carriage return character. This command enables and disables the automatic linefeed option on the output ports.

The power-on default condition of the Port A linefeed is controlled by a switch on the Communications Interface Board. On RS-232 models of the 9100, the power-on condition of the Port B linefeed is also controlled by a switch on the same board. On GPIB models, the Port B linefeed is always enabled at power-on.



Where n can equal Ø, 1, 2, 3 or no entry.

If n = Ø, then Line Feed at Port B/D will be disabled.

If n = 1, then Line Feed at Port B/D will be enabled.

If n = 2, then Line Feed at Port A/C will be disabled.

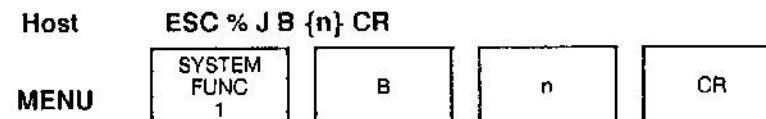
If n = 3, then Line Feed at Port A/C will be enabled.

If n = no entry, the line feed on Port B will toggle

SET BUFFER SIZE

The tablet has a small buffer for both output coordinate pairs and incoming characters to be echoed out to Port B. The level to which the buffer must empty before it will accept more coordinate pairs is controlled by this command.

The buffer serves primarily to smooth out the flow of data from the tablet.



where n is the number of characters from Ø to 1ØØ.
Default buffer size is 64.

SEND TABLET SIZE

This command will cause the tablet to transmit a data point, representing the upper right corner of the active area. The coordinates of the point represent the length of the axis multiplied by the current resolution, which gives the tablet size expressed as lines of resolution per axis.

The coordinate pair will be sent in the format which is currently active.

Host = ESC % V S CR

MENU

SYSTEM FUNC 2	S	CR
---------------------	---	----

ENABLE/DISABLE ECHO

Some terminals have no connection between their keyboard and their display, so the operator cannot see on the screen what has been entered on the keyboard. These terminals will only show characters they have received from an external device. Echo sends all characters received by the tablet through Port B back out to the Port B device for display on the screen.

On RS-232 models of the 9100, the power-on default of the Echo is controlled by the switch settings. On GPIB models, it is always enabled at power-on.

Host ESC % E [0 | 1] CR

MENU

ECHO ON/OFF	[0 1]	CR
----------------	-----------	----

Where b can equal 0, 1, or no entry.

b = 0, the Echo at Port B/D will be disabled.

b = 1, the Echo at Port B/D will be enabled.

If no b is entered, the function will toggle.

MESSAGES

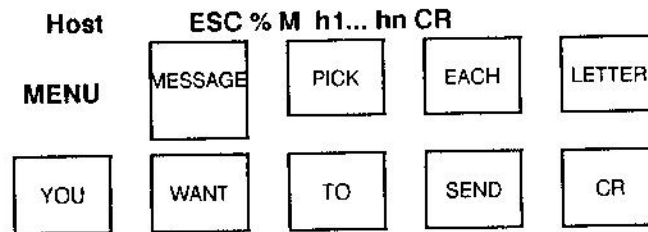
Messages may be sent from the host to the optional LCD display, from the menu to the display, or from the cursor to the host.

The LEDs of the cursor, whether 4- or 16-button, may be used as user-defined indicators, perhaps to send system status to the operator.

MESSAGE TO TABLET DISPLAY

Message characters are placed from left to right across the display face. Old information will remain on the display unless you include spaces to bring the message length to thirty-two characters. Messages over thirty-two characters in length are truncated.

The display is disabled following the message. The message will remain on the display until the display is re-enabled for data by the ENABLE/DISABLE OUTPUT PORT command or until another message is received.



Where h1...hn are the characters of the message sent to the LCD display. The message may contain up to 32 characters.

EXAMPLE

To center the message "System fully operational" on the display, enter:

```
ESC % M # # # # System# fully# operational # # # # CR
```

(# is the space character on the LCD display)

MESSAGE FROM THE TABLET MENU TO THE HOST

Although there is no specific command, when the menu is active, you may send messages to the host by picking the blocks containing the characters of the message.

The message may contain up to 99 ASCII characters. If you make a mistake, use the RUB OUT block to erase it. The message will be echoed on the LCD display, if one is installed and active. The message will be transmitted from all active ports as soon as the [CR] block is picked.

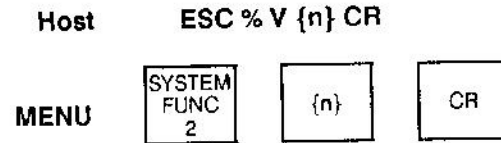
MESSAGE FROM THE CURSOR TO THE HOST

The 16-button cursor may send numbers to the host, which may be used as messages. The digitizer stops output when the F button is pressed. No data will be output until the 'E' or 'F' button is pressed to terminate the message. The message will be transmitted from all active ports. The digitizer will sound a tone confirming each pressed button unless the tone has been disabled.

Cursor	F h1...h99 { F E }
Button	Character Transmitted
0-9	numerals 0-9
A	"-" (minus sign)
B	Rubout
C	"," (comma)
D	"." (period or decimal point)
E	End message with a Carriage Return
F	End message with a comma

CURSOR LEDS

Cursor LED indicators #2 and #3 may be lit and extinguished by host or menu command. They may be used as user-defined indicators with a custom digitizing program. LEDs 1 and 4 are under the control of the tablet to indicate button pressed and cursor out of proximity.



Where n can equal 0, 1, 2, or 3.

- If n = 0, then cursor LED #2 will extinguish
- If n = 1, then cursor LED #2 will light
- If n = 2, then cursor LED #3 will extinguish
- If n = 3, then cursor LED #3 will light

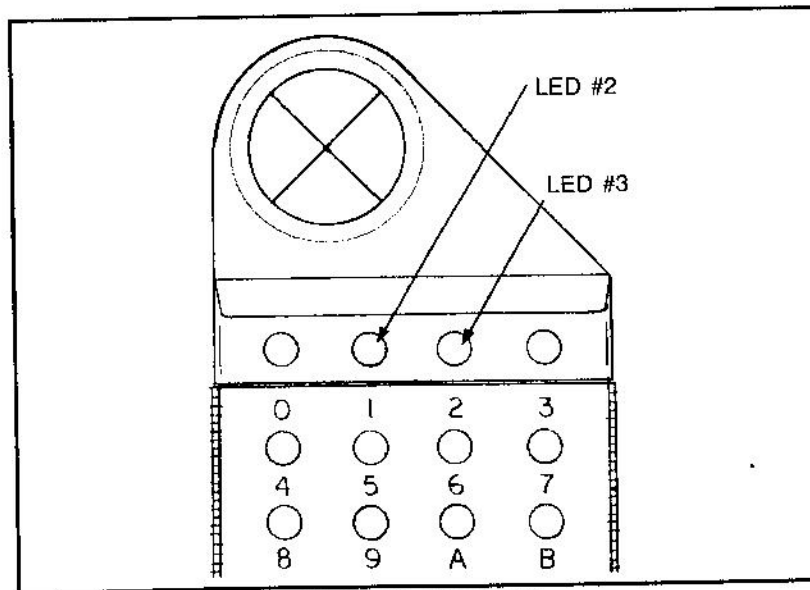


Fig 29. Cursor LEDs

INDICATOR TONE CONTROL

The 9100 system produces two indicator tones to inform you of system conditions. The lower tone, 400 Hz, is the system error tone. This tone sounds whenever a mistake is made in command entry or message mode. It also sounds on power-up if the 9100 system fails any of the power-up system tests.

The higher, 800 Hz, tone is the system utility tone. It sounds whenever a menu block is digitized or when a cursor button is depressed in a command or message mode. It sounds on power-up to indicate the 9100 system is ready for operation. Transmission of the ASCII BEL character (control G on most terminals or 07 HEX) from the host will also sound this tone.

When the normal tone program is disabled, the 9100 generates only the error tone. You may still sound the high tone by sending a BEL character to the tablet.

Host	ESC % V { 8 9 } CR					
MENU	<table border="1"><tr><td>SYSTEM FUNC 2</td></tr></table>	SYSTEM FUNC 2	<table border="1"><tr><td>{ 8 9 }</td></tr></table>	{ 8 9 }	<table border="1"><tr><td>CR</td></tr></table>	CR
SYSTEM FUNC 2						
{ 8 9 }						
CR						

Where n can equal 8 or 9.

If 8, then certain audio tones will be disabled.

If 9, then normal 9100 audio tones will be enabled.

DIGITIZING COMMANDS

OVERVIEW

The following commands are those you might use while digitizing. They include changing operating modes, data rate and resolution. Moving the origin, making active windows, and using the margin area are explained here.

Commands may interact with others. Tablet resolution affects the increment and the Universal Formatter commands; baud rate, data rate, prompting and operating mode interact.

NOTE

Tablets with the SMART option installed may have different commands for certain functions. Commands that are specific to SMART, such as calculating areas, are explained in Section four.

RESOLUTION

When the transducer is placed on the active area of the tablet, the tablet calculates its X and Y position by counting the number of resolution lines between the transducer and the origin. If the cursor is moved to the one line, the X value output increases by one. The digitizer always outputs lines, although they may be sized to represent millimeters or inches.

Any number of lines per inch or millimeter may be selected, up to the maximum resolution.

"HALF-RESOLUTION" AND TRUE RESOLUTION

The maximum specified resolution of the tablet is 50 lines per millimeter or 1279 lines per inch.

If the resolution is 1000 lines per inch, a transducer placed 13 inches to the right and 7 inches above the origin will produce an output of X13000, Y7000. This resolution is easy to read - the first two digits show the number of full inches, and the last three digits show the fractional thousandths of an inch.

The resolution of 50 lines per millimeter is the maximum specified metric resolution for the 9100 Digitizer. The output must be divided by 5 or multiplied by 2 to show the data as whole and fractional millimeters. The **half-resolution mode** multiplies the output by two before outputting the coordinate pairs, for an apparent resolution of 100 LPmm. The **true resolution** is still 50 lines per millimeter, but the output is easier to read - the first three digits of the output numbers represent whole millimeters and the last two represent the fractional hundredths of a millimeter.

If you enter a resolution above the maximum true resolution of 50 LPMM or 1279 LPI, the tablet changes to half-resolution mode. The effective resolution will be half of the value entered. In this mode, the output will increase or decrease by twos. At a resolution setting of 70 lines per millimeter the true resolution is 35 lines per millimeter.

The inches output also uses half-resolution mode. At settings above 1279 lines per inch, the digitizer counts by twos and effective resolution drops to half of the setting. The maximum setting is 2540 lines per inch, effective resolution 1279 LPI. This has the same resolving power as the half-resolution 100 lines per millimeter setting.

DEFAULT RESOLUTION SETTINGS

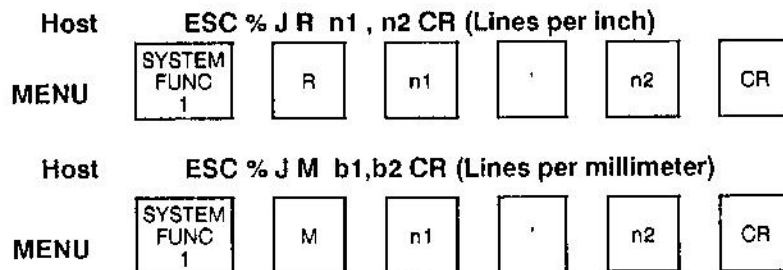
The default power-up resolution is determined by the position of the on-board DIP switches. They may be set for 1000 LPI for programs that use inches, 100 LPmm (half-resolution) for 50 LPmm resolution with easily readable output, or 40 LPmm for compatibility with older metric programs.

If the output format has a decimal point, the **offset** of the resolution command may be used to move that decimal place zero to six places to the left. 1000 LPI has a default offset of 3, to read out in inches and thousandths; 100 LPmm has a default offset of two, for readout as if it were in millimeters and hundredths; 40 LPmm has an offset of 0, reading out in lines with no fractional output.

RESOLUTION	OUTPUT
1000 LPI	XX.XXX
100 LPmm	XXX.XX
40 LPmm	XXXXX.

2

SET RESOLUTION



Where n1 is the desired resolution in lines per inch or lines per millimeter and n2 is the offset.

- n1 can be from 1 to 2540 lines per inch or
can be from 1 to 100 lines per millimeter
- "," separates the resolution digits from the offset digits in the command
- n2 can equal 0 to 6.
n2 determines the offset for the decimal point in the displayed output field. If a zero is input for this number, the decimal point will be located to the right of the right-most digit.

SEE EXAMPLES ON THE NEXT PAGE --- > >

EXAMPLE

In these examples, the cursor is at a point 5 inches to the right (X) and 10 inches above (Y) the origin. The tablet is using Format 4, the floating-point format, and 500 LPI.

Notice the changes in the position of the decimal point as the offset changes.

COMMAND: ESC % J R 500 , 0 CR	OUTPUT: 2500, 5000, T M C CR
COMMAND: ESC % J R 500 , 1 CR	OUTPUT: 250.0, 500.0, T M C CR
COMMAND: ESC % J R 500 , 2 CR	OUTPUT: 25.00, 50.00, T M C CR
COMMAND: ESC % J R 500 , 3 CR	OUTPUT: 2.500, 5.000, T M C CR
COMMAND: ESC % J R 500 , 4 CR	OUTPUT: .2500, .5000, T M C CR
COMMAND: ESC % J R 500 , 5 CR	OUTPUT: .02500, .0500, T M C CR

SET INCREMENT VALUE

This command sets the minimum number of lines that must be crossed in the X and Y axes before a new data point will be output when the digitizer is in an Increment mode. This command does not invoke the Increment mode, it only sets the value.

NOTE

See page 145 for the SMART version.

The Digitizer may overrun the number of lines you select. For maximum accuracy, move the transducer slowly.

The digitizer counts lines, it does not measure distance. Changing the resolution (lines per inch or lines per millimeter) will change the distance the transducer must travel before crossing the number of lines set by this command.

X and Y axes may have different increments. They must be set separately.

Host	ESC % X n CR					
Host	ESC % Y n CR					
MENU	<table border="1"><tr><td>SET Y INC</td></tr></table>	SET Y INC	<table border="1"><tr><td>n</td></tr></table>	n	<table border="1"><tr><td>CR</td></tr></table>	CR
SET Y INC						
n						
CR						
MENU	<table border="1"><tr><td>SET Y INC</td></tr></table>	SET Y INC	<table border="1"><tr><td>n</td></tr></table>	n	<table border="1"><tr><td>CR</td></tr></table>	CR
SET Y INC						
n						
CR						
Cursor	FF 8 n E (sets X Increment)					
Cursor	FF 9 n E (sets Y increment)					

Where n equals the desired increment value as follows:

0 - 64,000

EXAMPLE

You want the increment distance to be 0.1 inch. The current resolution is 20 LPI. Multiply the desired increment by the resolution to calculate the increment.

$$20 \times 0.1 = 2 \text{ (the number to enter in the increment command)}$$

If the resolution is changed to 1000 LPI, without changing the increment distance, the new increment distance would be two thousandths of an inch.

To maintain the increment distance of 0.1 inch, enter (1000 x 0.1) or 100 lines as the new value.

SET OPERATING MODE

The operating modes may be changed by command from the host, cursor or menu. The power-on default mode is controlled by the switch settings. The table below lists the commands for each mode from each source. The cursor can only be used to select Increment Track mode, of the possible Increment modes. Operating modes are explained on page 42.

NOTE:

The cursor can be used to select only one of the three increment modes, Increment Track.

Increment mode will use the most recently entered Increment value.

If you want to use PROMPT, first change the digitizer to the operating mode you want. Then, set the prompt and resend characters as described on page 60. If you change operating modes while prompting is active it may not function properly.

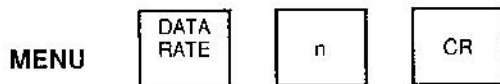
OPERATING MODE COMMANDS

MODE	HOST COMMAND	CURSOR COMMAND	MENU BLOCKS
POINT	ESC % P CR	F F 3 E	[POINT] [CR]
RUN	ESC % R CR	F F 4 E	[RUN] [CR]
HALT	ESC % H CR	F F 1 E	[HALT] [CR]
TRACK	ESC % T CR	F F 5 E	[TRACK] [CR]
LINE	ESC % U CR	F F 6 E	[LINE] [CR]
INCREMENT MODES			
RUN	ESC % IR CR	NONE	[INCR] [R] [CR]
TRACK	ESC % IT CR	F F 2 E	[INCR] [T] [CR]
LINE	ESC % IU CR	NONE	[INCR] [L] [CR]

SET DATA RATE

This command determines the maximum rate at which the tablet will attempt to transmit coordinate pairs to the host. The maximum usable data rate is limited on RS-232 models by the selected baud rate, and on GPIB models by the ability of other devices on the bus to accept the digitizer output. In either case, the digitizer may produce more coordinate pairs than can be physically transmitted over the communications interface. When the digitizer runs faster than the interface, some data points will be lost. Each time the output port becomes free, the digitizer outputs the latest pair made available for transmission; previous points waiting to be transmitted are canceled.

Host = ESC % W n CR



Where n can be 0 - 100.

NOTE

The maximum usable data rate depends not only on the speed of the physical interface, but also on the number of characters in the coordinate pair output format, and in the case of the RS-232 interface, on the number of bits in each byte frame. The table below shows the maximum usable data rates for the seven 9100 RS-232 output baud rates, based on a nineteen-character format and a ten-bit frame:

Baud Rate	Maximum Data Rate (points per second)
19200	100
9600	50
4800	25
2400	12
1200	6
600	3
300	1.5



ENABLE/DISABLE MARGIN DATA

Under default conditions, no data is output when the transducer moves into the margin. Most of the margin is electronically functional however, and may be used.

When margin data is enabled and the transducer is over the margin area, the Mode status character in the output format and on the LCD display will read "X". Also, the out-of-proximity LED (LED 4) on the cursor will light, even though the tablet is transmitting data.

NOTE:

The margin area has lower resolution and accuracy than the active area. Do not attempt to use it for high accuracy digitizing.

Host = ESC % N [Ø | 1] CR

MENU

MARGIN DATA ON/OFF

[Ø 1]

CR

Where b can equal Ø, 1, or no entry.

If b = Ø, then data will be transmitted from the tablet's margin area (enabled)

If b = 1, then data will not be transmitted from the tablet's margin area (disabled).

If no b is entered, the condition will toggle.

ENABLE/DISABLE DATA PROXIMITY

This command allows the digitizer to transmit coordinate pairs when the transducer is away from the tablet surface. The X and Y data transmitted is invalid. However, this feature is useful for sending signals to a host computer. The identities of the buttons pressed is coded into the Cursor Status Character in the output format. The stylus may be pressed against any surface to transmit a coordinate pair.

Host = ESC % Z [Ø | 1] CR

MENU

PROX DATA ON/OFF

[Ø 1]

CR

Where b can equal Ø, 1, or no entry.

If b = Ø then the digitizer will transmit coordinate pairs whether the transducer is in proximity or not.

If b = 1 then the digitizer will only transmit coordinate pairs when the transducer is in proximity.

If no b is entered, the condition toggles.

2

MOVE ORIGIN

The origin is the place on the tablet where the X and Y position reads 0,0. The origin is the lower left corner of the active area. It may be relocated, to any point on the surface. The polarity of X and Y data surrounding the origin follows the rule of the cartesian plane. All X locations to the left of the origin are negative; all points to the right are positive. All Y locations below the origin are negative; all points above it are positive.

Moving the origin does not affect the active area or margins. Crossing from positive to negative regions or back again does not affect data output other than changing the polarity of the data.

Host ESC % J { hh } CR
 MENU SYSTEM
 FUNC
 1 { hh } CR

Where hh = LL, LR, UL, UR, or C.

- LL the origin moves to the lower left corner of the active area.
- LR the origin moves to the lower right corner of the active area.
- UL the origin moves to the upper left corner of the active area.
- UR the origin moves to the upper right corner of the active area.
- C the origin moves to the center of the active area.

Host ESC % J { O } CR <dpoint >
 MENU SYSTEM
 FUNC
 1 hh CR <dpoint >

- O the origin will move to the next point you pick on the tablet surface. After entering the carriage return, pick the new origin.

NOTE:

If you want the new origin to be under a certain feature of a drawing, secure the drawing to the tablet surface first, then move the origin.

SMART tablets may move the origin to a point on or off the tablet surface. See the TRANSLATE command on page 142.

SET WINDOW OPENING

This command is used to create an active window on the tablet surface. The window may be any size up to the full active area size, or if data from the margin area is enabled, the window may be as large as the entire frame opening. The window may be moved, by creating a new window, or canceled, restoring the full active area.

All the proximity indicators are triggered by the window edge as though it were the margin edge. This is useful if you want to align drawings with the axes of the tablet (see ALIGNING MEDIA, next page).

NOTES:

Only one window may exist at a time.

The margin area has lower resolution and accuracy than the active area. The margin should be used only for non-critical uses. Do not attempt to use it for high accuracy tracing.

If margin data is disabled **after** a window has been established, any portion of the window lying in the margin will be disabled. The portion that was in the active area will remain active.

Create Window:

Host ESC % J W CR < dpoint 1 > < dpoint 2 >

MENU SYSTEM
 FUNC
 1 W CR < DPOINT 1 > < DPOINT 2 >

< dpoint1 > is the point you pick on the tablet surface to be the lower left corner of the new active area.

< dpoint2 > is the point you pick on the tablet surface to be the upper right corner of the new active area.

NOTE:

< dpoint2 > must be above and to the right of < dpoint1 > . The entire surface will become inactive if < dpoint2 > is below, or to the left, of < dpoint1 > . If that happens, create a new window.

Cancel Window:

Host ESC % J w CR (lowercase w)

MENU SYSTEM
 FUNC
 1 w CR

ALIGNING MEDIA

If you need to align a drawing with the axes of the tablet, follow the steps below:

1. Place the media on the active area and visually align it with the edge of the tablet frame.
2. Fasten the lower left corner of the media securely to the tablet.
3. Select a line which is to be aligned with one of the axes. A line which extends the full height of the left side or width of the bottom of the media is best. The edge of the media may not be parallel with the line to be aligned; it is best not to use the edges.
4. Enter the CREATE WINDOW command (see the previous page).
5. For dpoint 1, pick a point on the selected line as far to the left (for an X-axis line) or bottom (for a Y-axis line) as possible. This establishes one corner of the window directly under one end of the line.
6. For dpoint 2, pick a point at the right end of the selected line and several inches above it (for X-axis alignment) or at the top of the line and several inches to the right of it (for Y-axis alignment). The exact location isn't important, as long as it makes a window the full length of the selected line. At the free end of the selected line, move the cursor back and forth until you locate the spot where the out-of-proximity LED lights.
7. If you are using a stylus, observe the digitizer output to find the spot where the digitizer starts to transmit. Keep the crosshairs or stylus tip at this point. Lift the transducer from the surface just enough to allow the media to move under it.
8. Move the unsecured corner of the sheet until the selected line is directly under the crosshairs or stylus tip. You have aligned the line with the edge of the window, which in turn is aligned with the axes of the tablet.
9. Secure the remaining corners of the media.
10. Check the alignment. Does the out of proximity LED light, or the output stop, as the transducer crosses the line. Check both ends of both lines you used to make sure the media didn't slip.
11. Cancel the window, or create one large enough to surround the entire drawing.

COMMAND SUMMARY TABLES

All host commands must be preceded by a command prefix and followed by CR. The command prefix from the host is ESC % unless changed by the user. The system function blocks of the menu serve as the command prefix for the menu. The tinted [CR] block on the menu terminates the command.

LEGEND

a	An ASCII character or characters which invokes a command.
h1...hn	ASCII characters which are selected by the user. Limits on the characters are explained briefly in the description column of the table and fully in the commands section.
{ }	Required parameters of the command
[]	Optional parameters of the command
CR	ASCII carriage return, or the CR block of the menu.
< dpoint >	A point on the active area which is digitized to indicate where you wish to locate a function. The < dpoint > is entered AFTER the CR.
....	The information may be repeated as needed.
[0 1]	0 or 1 will set the function to a definite state (see the specific command). If neither 0 nor 1 is entered, the function will toggle.
n	A numeric parameter of a command.
eexp	An exponential number as input.

16-BUTTON CURSOR COMMAND SUMMARY

The 16-button cursor uses a limited subset of the tablet commands. The FF serves as the command prefix. The 4-button cursor may not be used for commands.

To disable the cursor commands, either issue the command below or close switch 6 of SB2 (SW2) on the Communication Interface Board.

STANDARD COMMANDS

CURSOR CODE	COMMAND DESCRIPTION
FF Ø E	Disable Cursor Commands
SET OPERATING MODE	
FF 1 E	Halt
FF 2 E	Increment Track
FF 3 E	Point
FF 4 E	Run
FF 5 E	Track
FF 6 E	Line
SET DATA RATE	
FF 7 n E	n may be from 1 to 100 points per second
INCREMENT VALUE	
FF 8 n E	Set X Increment Value
FF 9 n E	Set Y Increment Value
SET OUTPUT PORTS	
FF A [Ø 1] E	Enable/disable Or Toggle Port A
FF B [Ø 1] E	Enable/disable Or Toggle Port B
FF D [Ø 1] E	Enable/disable Or Toggle Display

SMART COMMANDS

A	Give Answer to Area or Line Length, (depending on which is active)
FFF A E	Enable Area Calculations
FFF B eexp E	Enter A Volume Factor
FFF C E	Clear All Smart Functions And Factors
FFF Ø E	Enable Line Length Calculations
FFF 1 eexp E	Enter Line Length Factor
FFF 2 eexp1 C eexp2 C eexp3 C eexp4 E	Combined Command For Rotate, Ortho, Scaling and Translation (see page 143)
< dpoint 1 >	
< dpoint 2 >	
< dpoint 3 >	
FFF 3 E	Orthogonal correction of Data
< dpoint 1 >	
< dpoint 2 >	
FFF 4 E	Rotate X, Y Axis
< dpoint 1 >	
< dpoint 2 >	
FFF 5 eexp1 C eexp2 E	Translate Origin
< dpoint 1 >	
FFF 6 eexp E	Scale Both Axes
FFF 7 E	SMART Window
< dpoint1 >	
< dpoint2 >	
FFF 8 eexp E	Enter X Axis Scale
FFF 9 eexp E	Enter Y Axis Scale
FFF D eexp E	Enter Z Data Factor

9100 STANDARD COMMANDS

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % A [1 Ø] CR	[ENABLE/DISABLE I/O PORT A] [1 Ø] [CR]	FF A [1 Ø] E	Enable/disable/toggle data output from PORT A	58
ESC % B [1 Ø] CR	[ENABLE/DISABLE I/O PORT B] [1 Ø] [CR]	FF B [1 Ø] E	Enable/disable/toggle data output from PORT B	58
ESC % C {n1} {n2} {1} CR	[COM] [n1] [n2] [1] [CR]		Set communication parameters for RS-232 ports. If the menu block is unlabeled, use the block to the left of "DISPLAY"	59
ESC % D [1 Ø] CR	[DISPLAY ON/OFF] [1 Ø] [CR]	FF D [1 Ø] E	Enable/disable/toggle LCD display	58
ESC % E [1 Ø] CR	[ECHO ON/OFF] [1 Ø] [CR]		Enable/disable/toggle echo from PORT B	62
ESC % G {b1}...[bn] CR	[SET CHAR CONST] [b1]...[bn] [CR]		Set character constants	52
ESC % H CR	[HALT] [CR]	FF 1 E	Set operating mode to HALT	72
ESC % I CR	[INCR] [CR]	FF 2 E	Set operating mode to INCREMENT TRACK	72

ESC % I {R/T/U} CR	[INCR] [R] [T] [U] [CR]	Set operating mode to INCREMENT and change mode: b may be R = INCREMENT RUN T = INCREMENT TRACT U = INCREMENT LINE	72
ESC % J b CR	[SYSTEM FUNC 1] [b] [CR]	Locate origin: b may be LL = lower left LR = lower right UL = upper left UR = upper right C = center	76
ESC % J O CR < dpoint >	[SYSTEM FUNC 1] [O] [CR] < dpoint >	Locate origin at the next < dpoint > you pick (uppercase o, not a zero)	76
ESC % J B {n} CR	[SYSTEM FUNC 1] [B] [n] [CR]	Set buffer size. n may be Ø to 100. Default size is 64	61
ESC % J M {n1} {,} {n2} CR	[SYSTEM FUNC 1] [M] [n1] {,} [n2] [CR]	Set resolution in lines per millimeter: n1 may be 1 to 100, n2 may be Ø to 6	69
ESC % J R {n1} {,} {n2} CR	[SYSTEM FUNC 1] [R] [n1] {,} [n2] [CR]	Set resolution in lines per inch: n1 may be 1 to 2540, n2 may be Ø to 6	69
ESC % J W CR < dpoint 1 > < dpoint 2 >	[SYSTEM FUNC 1] [W] [CR] < dpoint1 > < dpoint 2 >	Create WINDOW opening: < dpoint 2 > must be above and to the right of < dpoint 1 > (uppercase W)	76

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % J w CR	[SYSTEM FUNC 1] [w] [CR]		Cancel WINDOW (lowercase W)	76
ESC % K [1 Ø] CR	[CURSOR FUNC ON/OFF] [1 Ø] [CR]		Enable/disable or toggle cursor command function	54
ESC % L [1 Ø] CR	[LINE FEED ON/OFF] [1 Ø]		Enable/disable linefeed on port B no entry will toggle linefeed on port B	61
ESC % L [2 3] CR	[LINE FEED ON/OFF] [2 3] [CR]		Enable/disable linefeed on port A port A will not toggle	61
ESC % M [h1]...[hn] CR	[MESSAGE] [h1] ... [hn] [CR]		Send message from host to LCD display; 32 character maximum may be displayed at one time	63
	[h1] ... [hn] [CR]		Send message from menu to LCD display 32 characters maximum may be displayed at one time	63
			Send message from menu to host 99 character maximum	64
		F [b1...bn] {F E}	Send message from cursor to host 99 character maximum	64
ESC % N [1 Ø] CR	[MARGIN DATA ON/OFF] [1 Ø] [CR]		Enable/disable or toggle margin data	74
ESC % P CR	[POINT] [CR]	FF 3 E	Set operating mode to POINT	72

ESC % Q {b1} [b2] CR	[SET PROMPT] [b1] [b2] [CR]	SET PROMPT and RESEND characters and enter PROMPT mode	60
ESC % Q CR	[SET PROMPT] [CR]	Cancel prompting	60
ESC % R CR	[RUN] [CR]	Set operating mode to RUN	72
ESC % S {b1} [b2] [b3] CR	[SET COMD CHAR] [b1] [b2] [b3] [CR]	Set command prefix (one to three characters): @, BS, RUB and ? may not be used	51
ESC % T CR	[TRACK] [CR]	Set operating mode to TRACK	72
ESC % U CR	[LINE] [CR]	Set operating mode to LINE	72
ESC % V Ø CR	[SYSTEM FUNC 2] [Ø] [CR]	Extinguish user indicator one (LED # 2 on the cursor)	65
ESC % V 1 CR	[SYSTEM FUNC 2] [1] [CR]	Light user indicator one (LED # 2 on the cursor)	65
ESC % V 2 CR	[SYSTEM FUNC 2] [2] [CR]	Extinguish user indicator two (LED # 3 on the cursor)	65
ESC % V 3 CR	[SYSTEM FUNC 2] [3] [CR]	Light user indicator two (LED # 3 on the cursor)	65
ESC % V {8 9} CR	[SYSTEM FUNC 2] [8 9] [CR]	Enable/disable BEEP 8 = only error and ^ G produce beep 9 = Beep on all commands and menu blocks (normal tone program)	66

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % V {L} CR < dpoint >	[SYSTEM FUNC 2] [L] [CR] { < dpoint > }		Locates large menu with lower left corner under < dpoint >	55
ESC % V {M N} CR	[SYSTEM FUNC 2] [M N] [CR]		M = Temporarily erases large menu N = Restores large menu at previous position	55
ESC % V R CR	[SYSTEM FUNC 2] [R] [CR]		RESET tablet	54
ESC % V S CR	[SYSTEM FUNC 2] [S] [CR]		Send tablet size	62
ESC % W {n} CR	[DATA RATE] [n] [CR]	FF 7 n E	Set data rate: n may be from 1 to 100 points per second	73
ESC % X {n} CR	[SET X INCR] [n] [CR]	FF 8 n E	Set x increment distance on standard tablets: n may be from 0 to 64,000	71
ESC % Y n CR	[SET Y INCR] [n] [CR]	FF 9 n E	Set Y increment distance on standard tablets: n may be from 0 to 64,000	71
ESC % Z [1 0] CR	[PROX DATA ON/OFF] [1 0] [CR]		Enable/disable/toggle non-proximate data	75

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9100 SMART AND DATAQUEUE COMMANDS

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % O {b1} {b2} CR	[DATAQUEUE] [b1] [b2] [CR]		Enable DATAQUEUE and set start and stop transmission characters	146
ESC % O CR	[DATAQUEUE] [CR]		Disable DATAQUEUE	146
ESC % ' CR (accent grave, not a quote)	[AREA ANSWER] [CR]	A	Give answer to AREA calculations cursor command functions only if area calculations have been enabled by host or menu.	135
ESC % a CR	[AREA] [CR]	FFFAE	Enable AREA calculations	135
ESC % b eexp CR	[VOLUME FACTOR] [eexp] [CR]	FFF B eexp E	Enter a VOLUME factor	136
ESC % c CR	[CLEAR ALL] [CR]	FFF C E	Clear ALL SMART functions and factors	137
ESC % d CR	[DISPLAY FACTORS] [CR]		Display active SMART factors	137
ESC % e CR	[XY ON AREA/LINE] [CR]		Toggle sending X,Y pairs during Area and Length calculations	136

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % i eexp1 eexp2 eexp3 eexp4 CR < dpoint1 > < dpoint2 > < dpoint3 >	[ROTA ORTHO SCALE TRANSL][eexp1] [eexp2] [eexp3] [eexp4][CR] < dpoint1 > < dpoint2 > < dpoint3 >	FFF 2 eexp1 C eexp2 C eexp3 C eexp4 E < dpoint1 > < dpoint2 > < dpoint3 >	Combined rotation, orthogonal correction, scaling of axes, and translation of origin	143
ESC % k CR	[ANSWER LINE LENGTH] [CR]	A	Give answer to line length calculations	133
ESC % l CR (lowercase L)	[LINE LENGTH] [CR]	FFF 0 E	Enable line length calculations	133
ESC % m eexp CR	[LENGTH FACTOR] [eexp] [CR]	FFF 1 eexp E	Enter a line length factor	134
ESC % o CR < dpoint1 > < dpoint2 >	[ORTHO] [CR] < dpoint1 > < dpoint2 >	FFF 3 E < dpoint1 > < dpoint2 >	Orthogonal correction of data	140
ESC % r CR < dpoint1 > < dpoint2 >	[ROTATION] [CR] < dpoint1 > < dpoint2 >	FFF 4 E < dpoint1 > < dpoint2 >	Rotate X, Y axes	139
ESC % s eexp CR	[SCALE] [eexp] [CR]	FFF 6 eexp E	Scale both axes by the same factor	141

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	DESCRIPTION	PAGE
ESC % t eexp1 , eexp2 CR < dpoint >	[TRANSLATE] [eexp1] [i] [eexp2] [CR] < dpoint >	FFF 5 eexp1 C eexp2 E < dpoint >	Translate origin	142
ESC % w CR < dpoint1 > < dpoint2 >	[WINDOW] [CR] < dpoint1 > < dpoint2 >	FFF 7 E < dpoint1 > < dpoint2 >	Create SMART window	138
ESC % x eexp CR	[X SCALE] [eexp] [CR]	FFF 8 eexp E	Scale X axis (note 3 "F" characters)	141
ESC % y eexp CR	[Y SCALE] [eexp] [CR]	FFF 9 eexp E	Scale Y axis (note 3 "F" characters)	141
ESC % X eexp CR	[X INC] [eexp] [CR]	FF 8 eexp E	Set X-axis increment (note 2 "F" characters)	145
ESC % Y eexp CR	[Y INC] [eexp] [CR]	FF 9 eexp E	Set Y-axis increment (note 2 "F" characters)	145
ESC % z eexp CR	[Z DATA FACTOR] [eexp] [CR]	FFF D eexp E	Enter Z data	136

UNIVERSAL FORMATTER COMMANDS

HOST COMMAND	MENU COMMAND	DESCRIPTION	PAGE
ESC % @	[STORE IN MEMORY]	Store the string of commands that follow in non-volatile memory. The commands will be active at the next powerup or reset. Commands must be separated by an @ sign.	96
NOTE			
Any legal command may be stored by the Universal formatter EXCEPT RESET and commands which need a datapoint input from the operator.			
The @ sign also serves to concatenate a string of commands.			
ESC % V E CR	[SYSTEM FUNC 2] [E] [CR]	Erase format and stored commands from non-volatile memory.	98
ESC % V K CR	[SYSTEM FUNC 2] [K] [CR]	Reset K counter	123
ESC % F [format specification] CR	[ENTER FORMAT] [format specification] [CR]	Enter format definition for data output	99

NOTE

The following expressions are parameters of the ESC % F command. They are not independent commands.

Expression	Name	Description
X	X Data	Direct Output
Y	Y Data	Direct Output
Z	Z Data	Direct Output
K	K Counter	Direct Output
lw,d	Integer	Format for Data (X,Y,Z,K)
Integer format	Integer	Format for Data (X,Y,Z,K)
Fw,d	Fixed Point Format	Format for Data (X,Y,Z,K)
Ew,d	Exponential Format	Format for Data (X,Y,Z,K)
Bw,d	Binary format	Format for Data (X,Y,Z,K)
bw,d	Binary format	Format for Data (X,Y,Z,K)
Bxx	Binary Bias	Add bias to each binary byte
Sn	Polarity and Leading Zeros for position data	n = 0 (default) Leading Spaces n = 1 Leading Zeros n = 2 Plus Sign n = 3 not used n = 4 Plus Sign, Leading Spaces n = 5 Plus Sign, Leading Zeros
T	Tablet Status	Direct Output
M	Mode Status	Direct Output
P	Pen (stylus) Status	Direct Output
C	Cursor Status	Direct Output

A	ASCII Format	Format for Status (T,M,P,C)
B	Binary Format	Format for Status (T,M,P,C)
C	Complemented Binary	Format for Status (T,M,P,C)
H	Hexadecimal Format	Format for Status (T,M,P,C)
+xx	Addition	Manipulate Status Character
-xx	Subtraction	Manipulate Status Character
^xx	Boolean OR	Manipulate Status Character
xx	Rotate Right	Manipulate Status Character
<xx	Rotate Left	Manipulate Status Character
~xx	Boolean XOR	Manipulate Status Character
*xx	Boolean AND	Manipulate Status Character
Ln	OR With Data Stream	Manipulate Status Character
"h1h2...hn"	ASCII String	Direct Output of Character String
'h1h2...hn'	ASCII String	Direct Output of Character String
nH h1h2...hn	ASCII String	Direct Output of Character String
Nxx	ASCII Character	Direct output of a single ASCII character
Rn(expression)	Repeat	Direct Output, Repeated n Times
=xx{expression}	Equality Conditional	Conditional Output
#xx{expression}	Inequality Conditional	Conditional Output
QF	Quit Format	Quit Format if conditions are met
QR	Quit Repeat	Quit Repeat if conditions are met
Ctrl G (^G)	Bell	Audible feedback (tablet beep)

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