2500 SERIES USER'S GUIDE – PART 3

Table of Contents

Commands

The 2500 tablet can accept the command set of the CalComp 2000 series tablets as well as commands of the standard CalComp 9100 series tablets. There are a few commands specific to the 2500 tablet.

With these commands, you may override the default operating parameters set in the soft switches without leaving operating mode. For instance, as drafting projects change, you may adjust the resolution of the tablet or the number of points per second transmitted to the host.

You may use any of the following to enter commands:

1. Terminal or host computer
2. Buttons on the 16-button cursor (limited command set)
3. Stylus or cursor, in conjunction with the menu overlay

The commands and command sources may be disabled if they interfere with the host or software. The 9100 commands, 2000 commands, menu and 16-button cursor commands may be enabled or disabled by setting the soft switches. They will remain that way until the switch settings are changed.

NOTES:

- Commands cannot change the settings of the soft switches although they can override them.

- Some commands may interact with others. You will be advised of the interactions.

- 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 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 **ON** or **OFF.**

The 2500 commands will be explained in the following order:

1. Commands that control the command sources.
2. Commands that regulate communication between tablet, operator and host.
3. Commands that manage the tablet during a work session.

Entering Commands

Command Prefix

To alert the digitizer that a 9100 compatible or 2500 unique command is coming, the host must send a **COMMAND PREFIX** before each command (the 2000 series commands are a single character). The digitizer will treat all characters between the command prefix and the next carriage return character as a command. The default command prefix and the one used in all of the examples in this manual are **ESC %**.

You may enter the commands from the host keyboard or they may be sent from the host under the control of a custom digitizing program. A command from the host follows the general format: **ESC % a b (b) CR**

ESC %	Command prefix, the ESC key followed by the % key
a	One or more ASCII characters which activate a command
b	One or more ASCII characters; required parameters of the command
(b)	Optional parameters are indicated by parentheses
CR	ASCII carriage return character
n	Numeric variable

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

NOTE: The host must be configured 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 a b (b) E**

F F	F button pressed twice is the command prefix
a	Single button code for the command
b	Any required parameter of the command
(b)	Optional parameters
N	Numeric variable
E	E button ends the command string with a CR

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

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.

Entering Commands from the Menu

The menu refers to the tablet region dedicated to issuing commands and the Mylar overlay for that region. The overlay is only an aid for the operator; its position must coincide with the menu region on the tablet surface. When the menu has been enabled, the menu region transmits commands or ASCII characters instead of position data.

The four rows of blank blocks may be used to activate a custom menu. If the menu is enabled, picking these blocks transmits a coordinate pair. The Mode Status character is an *M* for *MENU*, the X-axis data is the block number (1 to 64) and the Y-axis data is not significant. The block numbers may be used by a custom program as commands. The blocks are numbered from 1 at the lower left corner to 65 in the upper right corner of the blank area.

NOTE: The output format must contain a Mode Status character or the software will not receive an indication that the custom menu is being used.

Menu commands take the general format: *[a] [b] [CR]*

[a]	A function code block or blocks. The contents of one block are indicated by [] brackets.
[b]	Any required parameter of the function, picked out on the ASCII blocks.
([b])	Optional parameters
[n]	A numeric variable
[CR]	Carriage Return block, which terminates the command sequence.

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

NOTE: Picking the [ESC] [%] blocks from the ASCII portion of 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.

Enabling and Disabling Command Sources

The 2500 tablet can accept commands from the host, 16-button cursor, menu or soft switches. The command sources may be disabled if they interfere with the operation of the tablet.

The 2000 and 9100 compatible host commands may only be enabled and disabled by the soft switches.

The 16-button cursor commands may be enabled and disabled by the host commands, menu commands or soft switch settings. It may disable itself.

The menu may be enabled and disabled by host or soft switch commands. It may disable itself.

The software switches may be enabled or disabled by a host or menu command. They will also be enabled by powering the tablet off and on, or pressing the reset button.

Command Source Control Commands

Set Command Prefix

Set Command Prefix changes the default prefix from ESC % to one of your choice. The new prefiex 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) (FF HEX)** and **@ (40 HEX)**. The new prefix will take effect immediately upon entering the command; the default prefix ESC % will immediately cease to function.

Host = **ESC % S b1 (b2) (b3) CR**

Menu = **[SET COMD CHAR] [b1] ([b2]) ([b3]) [CR]**

Where:

b1   First command prefix character
b2   Second, optional, command prefix character
b3   Third, optional, command prefix character

EXAMPLE:

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

Host = ***ESC % S * $ X CR***

Menu = ***[SET COMD CHAR] [*] [$] [X] [CR]***

NOTE: It's not recommended to use 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.

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 soft switches. Any commands stored for power-up use are invoked.

The tablet may also be reset by pressing the reset button located between the transducer and output ports.

Host = ***ESC % V R CR***

Menu = ***[SYSTEM FUNC 2] [R] [CR]***

Enable/Disable Bank and Select

This command disables or enables the BANK and SELECT blocks. The soft switches will not be accessible if the blocks are disabled, to prevent them from being altered by the operator. Power-on or reset cancels this command, enabling the BANK and SELECT blocks of the user menu.

Host = ***ESC % V m (b) CR***

Menu = ***[SYSTEM FUNC 2] [m] [b] [CR]***

Where b can equal 0 or 1 or no entry:

If b = 0   BANK and SELECT blocks are enabled.
If b = 1   BANK and SELECT blocks are disabled.
If no b is entered   The condition toggles.

Menu – Locate, Erase or Restore

The optional 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 reappear 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 required.

The default menu position is at the lower left corner of the active area. If you enable the menu without specifying a location, it will appear here.

Host = ***ESC % V b CR (dpoint)***

Menu = ***[SYSTEM FUNC 2] [b] [CR] [dpoint]***

Where b can equal L, M or N.

If b = L, the ***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 cannot 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.

If b = M, the ***Large Menu*** will be temporarily erased. The menu region stops sending commands and begins to output position data. You may digitize past the overlay.

If b = N, the ***Large Menu*** will be restored at its previous position.

NOTE: The menu may erase itself, but the command to restore the menu must come from the host or soft switches.

Using the Soft Switches to Control the Menu

Three of the switches in bank seven are dedicated to a three-choice menu that may be used to enable, disable or move the larger command menu. Pick BANK and block number seven and then SETUP to gain access to these switches.

SWITCH 3   Locates the lower left corner of the menu at the next point picked on the active area.
SWITCH 4   Erases the menu from its current location.
SWITCH 5   Restores the menu at the location from which it was last erased.

Pick the switch you want. The change will take effect as soon as you select BANK once more to go back to operating mode.

Enable/Disable Cursor Commands

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 *FF0E*, but once disabled, it must be enabled by a command from the host or menu.

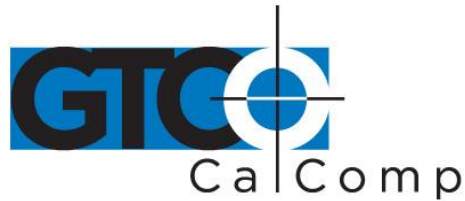The soft switch settings control whether the cursor commands will be enabled or disabled at power-up.

Host = *ESC % K (b) CR*

Menu = *[CURSOR FUNC ON/OFF] ([b]) [CR]*

Cursor = *FF 0 E (disable only)*

Where b can equal 0 or 1 or no entry:

If b = 0   Cursor function commands are disabled.
If b = 1   Cursor function commands are enabled.
If no b is entered   The condition toggles.

Changing the Character Constants 9100 Formats Only

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.

After the change is entered, the new character will be transmitted whenever applicable. For example, if you insert the character "*****" in position four, the digitizer will transmit a "*****" as the mode status character when it is in POINT mode.

You do not have to enter all 44 characters; only characters up to the highest position to be changed need entered. The characters must be posted in the following order:

Position In String	Default Value	Function Indicated by Character
1	A	Tablet status (remains constant)
2	A	(unused – for 9100 compatibility 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	0-9	Cursor Status – cursor button 0-9 down
23 thru 28	A thru F	Cursor Status – cursor button A thru F

Host = **ESC % G b1 b2 bn CR**

Menu = **[SET CHAR CONST] [b1] [b2] [bn] [CR]**

Where b1: bn = string of ASCII character constants.

EXAMPLE:

To change the Run mode character to the new character "**&**" and leave all others at their default values, enter the following command:

Host = ***ESC % G A A I P U & CR***

Menu = ***[SET CHAR CONST] [A] [A] [I] [P] [U] [&] [CR]***

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

Send Tablet Size

The tablet sends a coordinate pair representing the distance between the upper right corner of the tablet and origin. The data represents the distance, in inches or millimeters, multiplied by the current resolution in lines per inch or millimeter.

Host = ***ESC % V S CR***

Menu = ***[SYSTEM FUNC 1] [S] [CR]***

Communication Commands

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

Enable/Disable Output Port

This command allows you to control output from the RS-232C port. The command affects only digitizer data output. Incoming commands from the host are not affected.

Host = ***ESC % a (b) CR***

Cursor = ***FF a (b) E***

Menu = ***[ENABLE/DISABLE I/O PORT A] (b) [CR]***

Menu = ***[ENABLE/DISABLE I/O PORT B] (b) [CR]***

Where a for the host or cursor can equal A or B.

If a = A   Command applies to Port A
If a = B   Command applies to Port B

Where b can equal 0, 1 or no entry.

If b = 0   Output port is disabled.
If b = 1   Output port is enabled.
If no b is entered   The function will toggle.

NOTE: The 2500 tablet has only one output port. It is enabled or disabled by either command. This command includes two ports for compatibility with 9100 applications programs.

Set Data Rate

This command sets the maximum data output rate, which usually becomes significant in Run or Track mode. The other modes are affected more by the user's manual digitizing speed.

The 2000 compatible commands set data rate and operating mode simultaneously.

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 also limited by the selected baud rate. 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 lost.
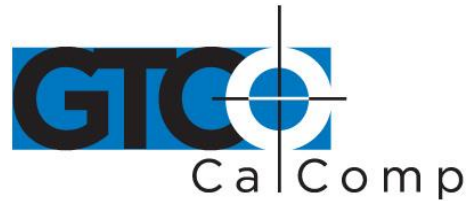
Host = **ESC % W n CR**

Menu = **[DATA RATE] [n] [CR]**

Cursor = **FF 7 n E**

Where n can be 0-125.

The maximum usable data rate depends not only on the speed of the interface, but also on the number of characters in the coordinate pair output format and the number of bits in

each byte frame. The table below shows the maximum usable data rates for the seven 2500 RS-232 output baud rates, based on a 19 character format and a ten-bit frame:

Baud Rate	Maximum Data Rate (points per second)
19200	100
9600	50
9800	25
2400	12
1200	6
600	3
300	1.5

Enable/Disable Echo

Some terminals have no connection between their keyboard and 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 back to the terminal for display on the screen. The default state of the **ECHO** is controlled by the soft switches, Bank 5, switch 1.

Host = **ESC % E (b) CR**

Menu = **[ECHO ON/OFF] (b) [CR]**

Cursor = **FF E (b) E**

Where b can equal 0, 1 or no entry.

If b = 0	Echo will be disabled.
If b = 1	Echo will be enabled.
If no b is entered	Echo function will toggle.

Enable/Disable Line Feed

It is often useful to include a line feed character *(0A HEX)* after every carriage return character to advance the paper in a printer or move down the host's display screen. The power-on default condition of the linefeed is controlled by the soft switches.

Host = **ESC % L b CR**

Menu = **[LINE FEED ON/OFF] [b] [CR]**

Where b can equal 0, 1 or no entry.

If b = 0   Line Feed will be disabled.
If b = 1   Line Feed will be enabled.
If no b is entered   The function will toggle.

Enable/Disable or Change Prompt Character

The prompt character is sent by the host to the digitizer, requesting transmission of a coordinate pair. When prompting is enabled, 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 a coordinate pair must be satisfied and a prompt character received, before the digitizer will transmit a coordinate pair. The data rate limitation also applies; the digitizer will not transmit data any faster than the commanded maximum rate, even if prompting characters come in at a faster rate.

Cancel prompting by giving this command without a prompt character in the command string; the digitizer will resume normal, non-prompt operation in its current mode.

The default prompt character is a "**?**".

Host = **ESC % Q b CR**

Menu = **[SET PROMPT] ([b]) [CR]**

Where b1 is the desired prompting ASCII character.

b1 may be any ASCII character except **CR**, **BS**, **RUB** or **@**.

Prompting will be disabled if b1 is not entered.

EXAMPLE:

To set up prompting using "**&**" for the prompt character:

Host = **ESC % Q & CR**

Menu = **[SET PROMPT] [&] [CR]**

To cancel prompting, enter:

Host = **ESC % Q CR**

Menu = **[SET PROMPT] [CR]**

Messages and Indicators

The operator may send messages to the host, picking out the numbers and some characters on the buttons of the 16-button cursor. The menu may be used to send messages, up to 100 characters. The LED's of the cursor, whether 4- or 16-button, may be lit and extinguished to serve as user-defined indicators. The host may also light any of the numbered LED's on the tablet display as indicators.

Enable/Disable Beep

The 2500 system produces two indicator tones to inform you of system conditions. The lower tone 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 2500 system fails any of the power-up system tests.

The higher 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 also sounds on power-up to indicate the 2500 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 2500 generates only the error tone. You may still sound the higher tone by sending a BEL or Control G character to the tablet.

Host = **ESC % V b CR**

Menu = **[SYSTEM FUNC 2] [b] [CR]**

Where b can equal 8 or 9.

If b = 8   Only the error tone will be sounded.
If b = 9   Normal 2500 audio tones will be enabled.

Messages from the Cursor to the Host

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.

Cursor = F b1 – b99 F (or 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

Messages from the Menu to the Host

The menu can be used to send more complex messages to the host. Up to 100 characters may be sent as one message. It will be transmitted after the CR block is picked. There is no command prefix; if the menu is active the tablet will transmit any characters selected. Typically, a block in the user portion of the menu is used by the software to serve as the indicator that what follows is a message for the host and not data.

Menu = *([b1]) ([b2]) ([bn]) [CR]*

Where b1 and b2, bn are up to 100 characters from the ASCII portion of the menu.
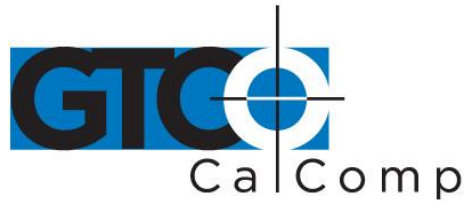
User 1 and User 2 LED's

User 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. LED's 1, 4, 5, 6, 7 and 8 are normally under the control of the tablet to indicate system status.

Host = *ESC % V b CR*

Menu = *[SYSTEM FUNC 2] [b] [CR]*

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

If b = 0	LED #2 will extinguish
If b = 1	LED #2 will light
If b = 2	LED #3 will extinguish
If b = 3	LED #3 will light

Controlling the Tablet Displays LED's 2500 Unique Commands

This command may control all the numbered LED's of the tablet display. The normal indicator function of that LED will be overridden by this command. For example, if you have ordered LED #4 to light, it will no longer be the proximity indicator.

Host = ***ESC % V l a (b) CR (lowercase L)***

Menu = ***[SYSTEM FUNC 2] [l] [a] [b] [CR]***

Where a is the number, from one to eight, of the desired LED.

Where b is 0, 1 or no entry.

If b = 0	LED will extinguish.
If b = 1	LED will light.
If no b is entered	The LED will toggle.

Set Serial Communications Parameters 2500 Unique Command

This command configures the output port. The baud rate, parity, data bits, start bits, stop bits and handshaking that were set in the soft switches can be overridden by the command. The tablet will recognize the command whether you specify Port A, Port B or no port. That portion of the command was included for 9100 compatibility.

Host = ***ESC % C (b1) b2 b3 b4 b5 (b6) CR***

Menu = ***[COM] ([b1]) [b2] [b3] [b4] [b5] ([b6]) [CR]***

Where:

(b1) = A, for Port A, B for Port B or no entry.
b2 = baud rate code number
    0 = 19200
    1 = 9600
    2 = 4800
    3 = 2400
    4 = 1200
    5 = 600
    6 = 300
    7 = RESERVED
b3 = parity code letter
    E = Even
    M = Mark
    N = None
    O = Odd
    S = Space
b4 = 7 or 8; the number of data bits.
b5 = 1 or 2; the number of stop bits.
(b6) = 1 or 0; to enable or disable hardware handshaking.
    1 enables
    0 disables
If b6 is not specified, the handshaking is not changed.

EXAMPLE:

To set Port A (although the tablet does not require that a port be specified) for 1200 baud, even parity, 7 data bits, 2 stop bits and no hardware handshaking, enter:

Host = **ESC % C A 4 E 7 2 0 CR**

Menu = **[COM] [A] [4] [E] [7] [2] [0] [CR]**

Digitizing Commands

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; baud rate, data rate, prompting and operating mode interact. Interactions are explained under one command. The other affected commands will refer you to the explanation.

Changing the 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 individual sources. The cursor can only change to Increment Track mode, of the possible Increment modes.

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 (Uppercase i)

MODE	HOST COMMAND	CURSOR COMMAND	MENU BLOCKS
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]

DELTA MODES (Uppercase i)

MODE	HOST COMMAND	CURSOR COMMAND	MENU BLOCKS
POINT	ESC % IDP CR	NONE	[INCR] [D] [P] [CR]
RUN	ESC % IDR CR	NONE	[INCR] [D] [R] [CR]
TRACK	ESC % IDT CR	NONE	[INCR] [D] [T] [CR]
LINE	ESC % IDU CR	NONE	[INCR] [D] [U] [CR]

NOTE: The increment distance must be set before you change the tablet to increment mode.

If you set the increment distance, use Increment mode and exit to another mode; the increment distance is stored by the tablet. You may return to Increment mode without entering the distance again if the resolution has not been changed.

The 2000 Series compatible commands to change operating mode also set the data rate.

Set Increment Value

This command sets the X and Y distances the transducer must move to cause the output of a new data point when the digitizer is in Increment mode. The command does not invoke the Increment mode.

The value of n is the size of the increment distance, expressed in the number of resolution lines at the current resolution. Changing resolution will change the increment distance as the size of the lines changes.

The maximum usable increment value depends on the resolution setting; the value for "*n*" is the resolution times the tablet dimensions. At 1000 LPI, a 12 x 18 inch tablet has a maximum Y increment of 12,000 and a maximum x increment of 18,000. The minimum "*n*" is one resolution line. The tablet will accept values up to 65,535, but the increment distance would be larger than the tablet.

Host = *ESC % X n CR*

Host = *ESC % Y n CR*

Cursor = *FF 8 n E (sets X increment)*

Cursor = *FF 9 n E (sets Y increment)*

Menu = *[SET X INC] [n] [CR]*

Menu = *[SET Y INC] [n] [CR]*

Where n equals the desired increment value.

Resolution

When the transducer is placed on the active area of the tablet, the tablet calculates its X and Y position relative to the origin. Those calculations are not in inches, millimeters or any other standard units. Those numbers represent **counts**, arbitrary units of measurement calculated by the digitizer. If the cursor is moved to the right until the X value output increases by one, the cursor has been moved over by one count. The digitizer keeps track of how many counts lie between the tablet origin and the cursor position. It outputs the number of counts as the coordinate pair. The digitizer always outputs counts, although they may be sized to represent millimeters or inches. The number of counts per inch or millimeter may be varied by this command.

Any number of lines (counts) per inch or millimeter may be selected, up to the maximum resolution. The counts will be sized accordingly. A round number does not need to be selected.

Host = ***ESC % J R n1 n2 CR (lines per inch)***

Host = ***ESC % J M n1 n2 CR (lines per millimeter)***

Menu = ***[SYSTEM FUNC 1] [R] [n1] [,] [n2] [CR] (lines per inch)***

Menu = ***[SYSTEM FUNC 1] [M] [n1] [,] [n2] [CR] (lines per millimeter)***

Where:

n1 is the desired resolution in lines per inch, 1 to 2540 or lines per millimeter, 1 to 100.

n2 may range from 0 to 6. n2 determines the offset for the decimal point in the output field. If a zero is input for this number, the decimal point will be located to the right of the right-most digit and the output will be expressed in whole counts.

Half Resolution Compared to True Resolution

The maximum specified resolution of the tablet is 50 lines per millimeter or 1280 lines per inch.

If the resolution is 1000 lines or counts per inch, each count is 1/1000th of an inch long. A transducer placed 13 inches to the right and 7 inches above the origin will produce an output of X13000, Y7000. Inches are easy to read at this resolution because the first two digits show the number of full inches and the last three digits display the fractional thousandths of an inch.

The resolution of 50 lines per millimeter is the maximum specified metric resolution for the 9100 Digitizer. The coordinate pair is not easy to read at this resolution. The output mist be divided by 5 or multiplied by 2 to show the counts as whole and fractional millimeters. The half-resolution mode can convert the 50 counts per millimeter into 100 counts per millimeter before outputting the coordinate pair. The true resolution is still 50 lines per millimeter, but the output is easier to read. At this resolution, 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, the tablet automatically changes to half-resolution mode. The effective resolution will be half of the value entered. In this mode, it is necessary to move the stylus or cursor a distance of two counts to produce a change of one count in the output. The output will increase or decrease by twos. No odd numbers will be output in half-resolution mode. At a resolution setting of 70 lines per millimeter, the true resolution is 35 lines per millimeter, counting by twos to show 70 counts in each millimeter.

The inches resolution also has half-resolution mode. At a setting above 1280 lines per inch, the digitizer begins counting by twos and effective resolution drops to half of the setting. At a 2000 lines per inch setting, the effective resolution is 1000 lines per inch. The maximum setting is 2540 lines per inch, an effective resolution of 1270 lines per inch. This is the same resolving power as the half-resolution 100 lines per millimeter setting.

EXAMPLES:

You want the output in printer's points (1/6 inch) and tenths of points for a page layout program. A resolution of 60 LPI and an offset of 1 will give that measurement. The command would be:

Host = ***ESC % J R 60 1 CR***

Menu = ***[SYSTEM FUNC 1] [R] [,] [1] [CR]***

You are digitizing an old map with a scale of 1:24,000 and would like the output to be in distance. A resolution of 2400 LPI would make ten distance units on the map equal one line on the tablet. This is half-resolution mode, so the output distances would be in even units only. The offset could be 0 and the output multiplied by 10; 1 and the output multiplied by 100; or the power of ten you want.

Host = ***ESC % J R 2400 0 C R***

Menu = *[SYSTEM FUNC 1] [R] [2400] [,] [0] [CR]*

Change Format

To change the operating format, use the below command:

Host = *ESC % ^ (n) CR*

Menu = *[SELECT FORMAT] [n] [CR]*

Move Origin

The origin is the place on the tablet where the X and Y position reads 0,0. The default origin is the lower left corner of the active area on the tablet surface. It may be relocated to any port 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 impact data output other than changing the polarity of the data.

Host = *ESC % J b CR (<dpoint>)*

Menu = *[SYSTEM FUNC 1] [b] [CR] (<dpoint>)*

Where b = LL, LR, UL, UR, C or O.

If b = LL   Origin moves to the lower left corner of the active area.
If b = LR   Origin moves to the lower right corner of the active area.
If b = UL   Origin moves to the upper left corner of the active area.
If b = UR   Origin moves to the upper right corner of the active area.
If b = C   Origin moves to the center of the active area.
If b = O   Origin will move to the next point selected 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 and then move the origin.

Enable/Disable Margin Data

The margin is the remainder of the tablet surface surrounding the active area. Under default conditions, no data is transmitted 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 will read **X**. Also, the out-of-proximity LED (LED 4) on the tablet display will light, even though the tablet is transmitting data.

Host = **ESC % N b CR**

Menu = **[MARGIN DATA ON/OFF] [b] [CR]**

Where b can equal 0 or 1:

If b = 0	Data will be transmitted from the tablet's margin area (enabled).
If b = 1	Data will not be transmitted from the tablet's margin area (disabled).
If no b is entered	The condition of the feature will toggle.

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

Create Window

This command is used to create an active window on the tablet surface. The window may be any size larger than the active area, enable the margin data. To move a window, create a new one. To restore the full active area, cancel the window.

All the proximity indicators are triggered by the window edge as though it were the margin edge.

Create Window:

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

Menu = **[SYSTEM FUNC 1] [W] [CR] <dpoint 1> <dpoint 2>**

Cancel Window:

Host = **ESC % J w CR (lowercase w)**

Menu = **[SYSTEM FUNC 1] [w] [CR] (lowercase w)**

Where:

<dpoint 1>   Point selected in the active area to become the lower left corner of the new active area.

<dpoint 2>   Point selected in the active area to become the upper right corner of the new active area.

NOTES: <dpoint 2> must be above and to the right of <dpoint 1>. The entire surface will become inactive if <dpoint 2> is below or to the left of <dpoint 1>. If that happens, cancel the window and create a new one. Only one window may exist at a time. The origin does not automatically move with this command.

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.

The window will not affect the menu, if the menu is enabled.

Aligning Media Using the Window Command

If you need to precisely 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 edges of the active area.

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 or width of the media is best. As 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.

5. For dpoint 1, pick a point on the selected line as far to the left (for horizontal line) or bottom (for a vertical line) as possible. This locates one corner of the window directly under one end of the line.

6. For dpoint 2, select a point at the right end of the selected line and several inches above it (for a horizontal line) or at the top of the line and several inches to the right of it (for a vertical line). The exact location isn't important as long as the window is the full length of the line. At the free end of the line, move the transducer back and forth until you locate the spot where the out-of-proximity LED lights. Keep the crosshairs or stylus tip over this point, lift the transducer slightly to allow the media to move under it.

7. Move the free end of the media until the selected line is directly under the crosshairs or stylus tip. You have aligned the line with the edge of the window, which is aligned with the axes of the tablet.

8. Secure the remaining corners of the media.

9. Check the alignment; does the out-of-proximity LED light as the transducer cross the line? Check both ends to make sure the media did not slip.

10. Cancel the window or create one large enough to surround the entire drawing.

Enable/Disable Non-Proximate Data

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 the host by pressing various cursor buttons; the identities of the pressed buttons are coded into the **Cursor** status character in the output format. The stylus may be pressed against any surface to transmit a **PEN DOWN** signal.

Host = **ESC % Z b CR**

Menu = **[PROX DATA ON/OFF] [b] [CR]**

Where b can equal 0, 1 or no entry:

If b = 0   Digitizer will transmit coordinate pairs whether the transducer is in proximity or not.

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

If no b is entered   The condition toggles.

Storing and Recalling Setup Parameters

Factory Settings

The factory settings and default operating characteristics, such as origin and prompt character, are stored in a permanent memory location. They may be recalled by picking Switch 6 of Bank 7. They will overwrite the current switch settings.

Baseline Settings

You may store a second set of switch settings and parameters as baseline settings by picking Switch 8 of Bank 7 after the switches are set as desired. The tablet also stores the origin, Increment values, command prefix, character constants, menu location and status, the prompt character and the location of any window. These settings may be recalled by picking Switch 7 of Bank 7. They will overwrite the current switch settings.

Current Settings

A third set of operating parameters may be stored in a non-volatile memory separate from the baseline settings. In addition to the current soft switch settings, the tablet will store the current origin, menu location and status, location of a window, increment values, prompt character, command prefix and the character constants. This command may come from the host or menu, but not the switch banks.

Host = **ESC % V F CR**

Menu = **[SYSTEM FUNC 1] [F] [CR]**

If you have changed a parameter from its soft switch setting by using a host or menu command, it will **NOT** be saved by the command. The tablet does not change the soft switches as commands from the menu or host. It will change them in response to the Recall Baseline and Recall Factory Settings switches of Bank 7.

Erase Current Settings from Memory

The current settings may be cleared from the memory. Writing a new set of parameters replaces the old settings with new ones. This command erases the memory, leaving no stored parameters.

Host = *ESC % V E CR*

Menu = *[SYSTEM FUNC 1] [E] [CR]*
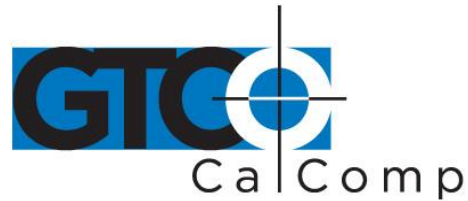
2000 Series Compatible Command Summary

The 2000 series compatible commands are a single letter transmitted from the host. There is no command prefix. If you are not using the 2500 tablet to emulate a 2000 and wish to disable the 2000 series commands, set Switch 7 in Bank 5 to 1.

HOST COMMAND	OPERATING MODE
@	TRACK, 1 PPS
A	TRACK, 5 PPS
B	TRACK, 10 PPS
C	TRACK, 20 PPS
D	TRACK, 40 PPS
E	TRACK, 75 PPS
F	TRACK, 100 PPS
G	TRACK, 125 PPS
H	RUN, 1 PPS
1	RUN, 5 PPS
J	RUN, 10 PPS
K	RUN, 20 PPS
L	RUN, 40 PPS
M	RUN, 75 PPS
N	RUN, 100 PPS
O	RUN, 125 PPS
P	POINT
Q	PROMPTED POINT
R	PROMPTED RUN
S	HALT
T	PROMPTED TRACK MODE
CONTROL S	X-ON: TABLET TRANSMITS
CONTROL Q	X-OFF: TABLET NOT TRANSMITTING

16-Button Cursor Command Summary

The 16-button cursor has 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 set Switch 5 in Bank 5 to a **0**.

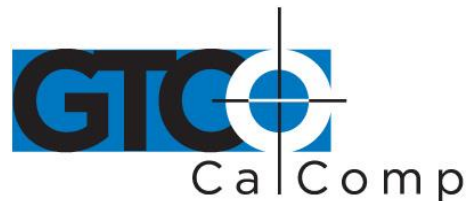| CURSOR CODE	COMMAND DESCRIPTION
FF 0 E	Disable Cursor Commands
	SET OPERATING MODE
FF 1 E	Halt
FF 2 E	Increment Track
FF 3 E	Point
FF 4 E	Run
FF 5 E	Track
FF 6 E	Line
	SET DATA RATE
FF 7 n E	n may be from 1 PPS to 125 PPS
	INCREMENT VALUE
FF 8 n E	Set X Increment Value
FF 9 n E	Set Y Increment Value
	SET OUTPUT PORTS
FF A [0/1] E	Enable/Disable or Toggle Port A
FF B [0/1] E	Enable/Disable or Toggle Port B
FF E [0/1] E	Enable/Disable or Toggle Echo

Host and Menu 9100 Series Compatible Command Summary

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.

<div align="center">

LEGEND

</div>

|	
a	An ASCII character or characters which invokes a command
b1...bn	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.
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.
[]	Menu block to pick.
...	The information may be repeated as needed.
[0/1]	0 will DISABLE the function; 1 will ENABLE it. Entering neither 0 nor 1 will toggle the function when CR is entered.
n	A numeric variable.

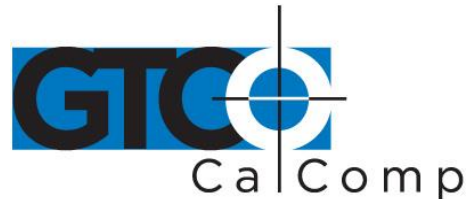| HOST COMMAND	MENU COMMAND	CURSOR COMMAND	9100	DESCRIPTION
ESC % A [1/0] CR	[ENABLE/DISABLE I/O PORT A] [1/0] [CR]	FF A [1/0] E	X	ENABLE/DISABLE OR TOGGLE DATA OUTPUT FROM PORT A: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % B [1/0] CR	[ENABLE/DISABLE I/O PORT B] [1/0] [CR]	FF B [1/0] E	X	ENABLE/DISABLE OR TOGGLE DATA OUTPUT FROM PORT B: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % C (b1) b2 b3 b4 b5 (b6) CR	[COM] ([b1]) [b2] [b3] [b4] [b5] ([b6]) [CR]			SET SERIAL COMMUNICATION PARAMETERS: See page 76 for the values of b1 through b6.
ESC % E [1/0] CR	[ECHO ON/OFF] [1/0] [CR]		X	ENABLE/DISABLE OR TOGGLE ECHO: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % G b1....bn CR	[SET CHAR CONST] [b1]...[bn] [CR]		X	SET CHARACTER CONSTANTS FOR 9100 FORMATS
ESC % H CR	[HALT] [CR]	FF 1 E	X	SET OPERATING MODE TO HALT
ESC % I CR	[INCR] [CR]	FF 2 E	X	SET OPERATING MODE TO INCREMENT TRACK
ESC % I (b) CR	[INCR] [b] [CR]		X	SET OPERATING MODE TO INCREMENT MODE AND CHANGE MODE: b MAY BE R = INCREMENT RUN T = INCREMENT TRACT U = INCREMENT LINE
ESC % I D (b) CR	[INCR] [D] [b] [CR]			SET OPERATING MODE TO DELTA MODE: b MAY BE P = DELTA POINT R = DELTA RUN T = DELTA TRACK U = DELTA LINE

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	9100	DESCRIPTION
ESC % J b CR <DPOINT>	[SYSTEM FUNC 1] [b] [CR] <DPOINT>		X	LOCATE ORIGIN: b MAY BE LL = LOWER LEFT LR = LOWER RIGHT UL = UPPER LEFT UR = UPPER RIGHT C = CENTER O = THE ORIGIN WILL MOVE TO THE NEXT <DPOINT> YOU PICK
ESC % J M (n1) , (n2) CR	[SYSTEM FUNC 1] [M] [n1] [,] [n2] [CR]		X	SET RESOLUTION IN LINES PER MILLIMETER: n1 MAY BE 1 TO 100 n2 MAY BE 0 TO 6
ESC % J R (n1) , (n2) CR	[SYSTEM FUNC 1] [R] [n1] [,] [n2] [CR]		X	SET RESOLUTION IN LINES PER INCH: n1 MAY BE 1 TO 2540 n2 MAY BE 0 TO 6
ESC % J W CR <DPOINT 1> <DPOINT 2>	[SYSTEM FUNC 1] [W] [CR] <DPOINT 1> <DPOINT 2>		X	CREATE WINDOW OPENING: <DPOINT 2> MUST BE ABOVE AND TO THE RIGHT OF <DPOINT 1>
ESC % J w CR	[SYSTEM FUNC 1] [w] [CR]		X	CANCEL WINDOW
ESC % K [1/0] CR	[CURSOR FUNC ON/OFF] [1/0] [CR]		X	ENABLE/DISABLE OR TOGGLE CURSOR COMMAND FUNCTION: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % L [1/0] CR	[LINE FEED ON/OFF] [1/0] [CR]		X	ENABLE/DISABLE OR TOGGLE LINE FEED: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % N [1/0] CR	[MARGIN DATA ON/OFF] [1/0] [CR]		X	ENABLE/DISABLE OR TOGGLE MARGIN DATA: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % P CR	[POINT] [CR]	FF 3 E	X	SET OPERATING MODE TO POINT
ESC % Q (b) CR	[SET PROMPT] [b] [CR]		X	SET PROMPT CHARACTER AND ENTER PROMPT MODE
ESC % Q CR	[SET PROMPT] [CR]		X	CANCEL PROMPTING
ESC % R CR	[RUN] [CR]	FF 4 E	X	SET OPERATING MODE TO RUN
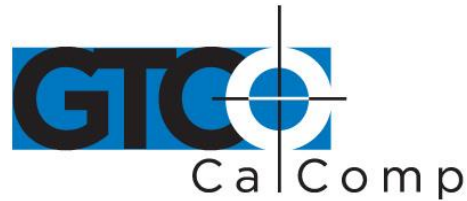
HOST COMMAND	MENU COMMAND	CURSOR COMMAND	9100	DESCRIPTION
ESC % S b1 (b2) (b3) CR	[SET COMD CHAR] [b1] ([b2]) ([b3]) [CR]		X	SET COMMAND PREFIX: b MAY NOT BE CR, BS, @ OR RUBOUT
ESC % T CR	[TRACK] [CR]	FF 5 E	X	SET OPERATING MODE TO TRACK
ESC % U CR	[LINE] [CR]	FF 6 E	X	SET OPERATING MODE TO LINE
ESC % V E CR	[SYSTEM FUNC 2] [E] [CR]			ERASE SETTINGS FROM MEMORY
ESC % V F CR	[SYSTEM FUNC 2] [F] [CR]			STORE CURRENT SETTINGS IN MEMORY
ESC % V I [1/0] (b) CR	[SYSTEM FUNC 2] [I] [b] [1/0]			LIGHT/EXTINGUISH OR TOGGLE LED INDICATORS (LOWER CASE L) 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % V m [0/1] CR	[SYSTEM FUNC 2] [m] [0/1] [CR]			ENABLE/DISABLE BANK SELECT 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES

HOST COMMAND	MENU COMMAND	CURSOR COMMAND	9100	DESCRIPTION
ESC % V b CR	[SYSTEM FUNC 2] [b] [CR]		X	LIGHT/EXTINGUISH USER INDICATOR ONE: b = 0 FOR LIGHT b = 1 FOR EXTINGUISH
ESC % V b CR	[SYSTEM FUNC 2] [b] [CR]		X	LIGHT/EXTINGUISH USER INDICATOR TWO b = 2 FOR LIGHT b = 3 FOR EXTINGUISH
ESC % V (b) CR	[SYSTEM FUNC 2] [b] [CR]		X	ENABLE/DISABLE BEEP b = 8 FOR ERROR TONE ONLY b = 9 FOR NORMAL TONE
ESC % V (b) CR	[SYSTEM FUNC 2] [b] [CR] <DPOINT>		X	ERASE/RESTORE OR LOCATE MENU b = L LOCATES MENU LOWER LEFT AT <DPOINT> b = M ERASES MENU b = N RESTORES MENU AT PREVIOUS POSITION
ESC % V R CR	[SYSTEM FUNC 2] [R] [CR]		X	RESET TABLET
ESC % V S CR	[SYSTEM FUNC 2] [S] [CR]		X	SEND TABLET SIZE
ESC % W n CR	[DATA RATE] [n] [CR]	FF 7 n E	X	SET DATA RATE: n MAY BE FROM 1 TO 125 POINTS PER SECOND
ESC % X n CR	[SET X INCR] [n] [CR]	FF 8 n E	X	SET X INCREMENT DISTANCE
ESC % Y n CR	[SET Y INCR] [n] [CR]	FF 9 n E	X	SET Y INCREMENT DISTANCE
ESC % Z [1/0] CR	[PROX DATA ON/OFF] [1/0] [CR]		X	ENABLE/DISABLE OR TOGGLE NON-PROXIMATE DATA: 1 ENABLES; 0 DISABLES NO ENTRY TOGGLES
ESC % ^ n CR	[SELECT FORMAT] [n] [CR]			SELECT OPERATING FORMAT: n MAY BE FROM 0 TO 31
ESC % _ _ (b) CR				DIAGNOSTIC TESTS (SEE TROUBLESHOOTING SECTION)
^G	[BEL]		X	SOUND TONE

Basic Program to Check Installation

The following program, written in MICROSOFT BASIC, will cause the IBM PC or compatible system to accept and display digitizer output data. Your computer must have MICROSOFT BASIC installed. If you are using another version of BASIC, this program may need changes to the statements to follow the rules of the other BASIC.

Set the soft switches according to the following table:

SWITCH	1	2	3	4	5	6	7	8
BANK #1	0	0	0	0	0	0	0	1
BANK #2	0	0	0	1	0	0	0	0
BANK #3	0	0	0	0	0	0	0	0
BANK #4	0	0	1	0	0	0	0	1
BANK #5	0	*	0	1	0	1	0	0

Type in the following three statement program:

10 OPEN "COM 1:9600, E, 7, 1, CS, DS" AS #1

20 PRINT INPUT $(1, 1);

30 GO TO 20

Place the transducer on the active area and then type **RUN** to start the program. To leave the program, press the **CTRL** and **BREAK** keys simultaneously.

The program sets the PC to accept ASCII data through communication port 1 at 9600 baud, even parity, 7 data bits, 1 stop bit and without handshaking signals. The X and Y data will be continuously displayed. If your digitizer is connected to port 2, make the first statement COM 2 instead of COM 1.

If you get an I/O ERROR message when you try to run the program, please try again. To keep the program short, we left out error checking, and the host and tablet don't always communicate on the first try.

When this program runs, the hardware is connected properly. You may have to reverse the setting of Bank 5, Switch 2. The data will appear as a column of numbers on the host display. If you move the transducer around the active area, the numbers will change.

ASCII Code Chart

ASCII Code Chart table (Control, Numbers/Symbols, Uppercase Symbols, Lowercase Symbols) with octal, hexadecimal, decimal and mnemonic representations.

† on some keyboards or systems

KEY

octal 25 / hex 15 — NK / NAK 21 — graphic representation / decimal / mnemonic

2500 Menu Overlay

POINT	SET PROMPT	RUN	SET COMP CHAR	TRACK	LINE	SYSTEM FUNC 2	DATA RATE	SET X INCR	SET Y INCR	PROG DATA ON/OFF			RE-SET INFO	SELECT FORMAT	
	ENABLE/DISABLE I/O PORT ▲ ⬤		COM		ECHO ON/OFF		SET CHAR CONST	HALT	INCR	SYSTEM FUNC 1	CURSOR FUNC ON/OFF	LINE FEED ON/OFF		MARGIN DATA ON/OFF	
p	q	r	s	t	u	v	w	x	y	z	{	:	}	~	RUB OUT
`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	◇
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	___
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
SPACE	!	"	#	$	%	&	'	(	)	*	+	,	−	.	/
DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI

USER MENU