

Terminal Interface

Operator's Manual

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Revision Number	Revision History	Date
-00	First Issue Describes the Terminal Interface. The Terminal Interface is compatible with Omega display controller board version 05 and above (models 300 and 400) and version 01 and above (model 500). Also compatible with microcode version 3.6 and above (models 300 and 400) and version 2.5 and above (model 500).	8/84

This equipment complies with the requirements in part 15 of FCC rules for a class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct interference.

SERVICE INFORMATION

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- (1) You must provide these three items when you call or write to the service center:

Model Number
Serial Number
Purchase Order Number

Model numbers and serial numbers are marked on the outside of the chassis packaged products, on the board artwork, or on the firmware. The purchase order number authorizes the service center to charge for services. They can also provide the latest upgrade and service contract costs.

- (2) Obtain a Return Authorization (RA) number from the service center BEFORE sending any equipment. Use this number in all correspondence.

Contact the Service Center at this address:

Graphics System Service Center
Metheus Corporation
5510 N. E. Elam Young Parkway
Hillsboro, Oregon 97123

(503) 640-8000

PREFACE

This manual describes how to install and use the METHEUStm Terminal Interface with Omega Series display controllers. The Terminal Interface allows you to use your display controller as a computer graphics terminal. In addition, the Terminal Interface can act as a TEKTRONIXtm* 4014-compatible terminal.

As you read this manual, you may also want to refer to your Omega manual or 4014 manual (see *Related Publications*, below).

CHAPTERS AT A GLANCE

Chapter 1 — Overview

Provides an overview and block diagram of the Terminal Interface.

Chapter 2 — Getting Started

Shows how to use the SETUP menus for changing user-definable options, lists the Terminal Interface's default option settings, and shows examples of common display tasks using the Terminal Interface. This chapter assumes the Terminal Interface has already been installed (see Chapter 5, Installation).

Chapter 3 — Using the Terminal Interface

Contains the detailed reference for the Terminal Interface's operating modes and keyboard.

Chapter 4 — Function Reference

Briefly describes the commands for the Terminal Interface.

Chapter 5 — Installation

Gives step-by-step instructions for installing the Terminal Interface in an Omega display controller

* TEKTRONIX is a registered trademark of Tektronix, Inc., Beaverton, OR

Preface

Terminal Interface

Appendix A — Differences Between Terminal Interface and 4014

Appendix B — Keyboard Control Codes

Appendix C — ASCII Chart

RELATED PUBLICATIONS

Ω400/DC Display Controller and Ω400/GS Graphics Subsystem Operator's Manual. *Order Number 004-01085*

Ω300 and Ω400 Display Controller Reference Manual. *Order Number 091-02808*

Ω500 Display Controller Reference Manual. *Order Number 004-02207*

4014 Computer Display Terminal Operator's Manual. Contact Tektronix, Inc., P.O. Box 500, Beaverton, OR 97007, for the title and order number for the 4014 manual.

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Chapter 1

Overview

This chapter contains:

- An overview of the Terminal Interface
- A block diagram of the Terminal Interface

TERMINAL INTERFACE

The Metheus Terminal Interface allows an Omega Display Controller and monitor to act as a computer terminal.

The Terminal Interface supports all the features of an Omega display controller, including:

- High-resolution color display
- High-speed drawing
- Area-fill and image display instructions
as well as vector-drawing instructions

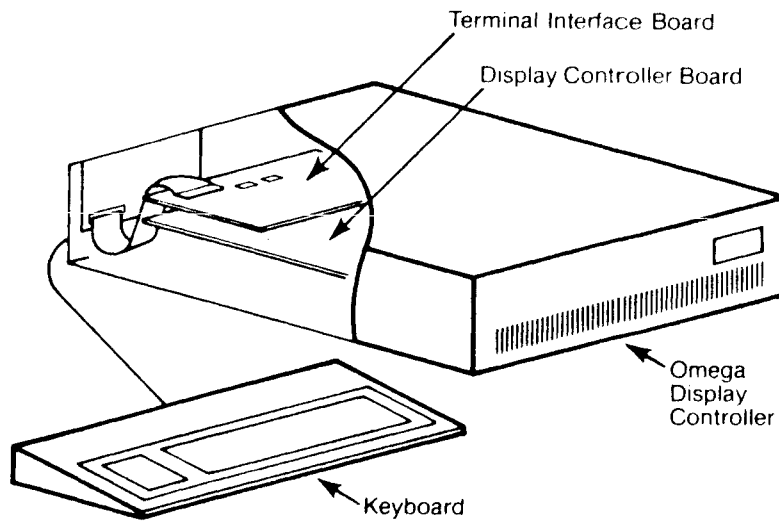
In addition, the Terminal Interface emulates a TEKTRONIX 4014 Computer Display Terminal (hereafter referred to as "4014"). Any software (e.g. the TEKTRONIX PLOT 10tm* package) that runs on a 4014 can be used with the Terminal Interface.

(Any technical differences between the Terminal Interface and the 4014 are listed in Appendix A, *Differences*.)

Because you can always access Omega commands with the Terminal Interface, you can add graphics extensions that are not possible on a 4014, such as color-selective erase, seed fill, polygon fill, and other Omega display controller features.

Figure 1-1 shows a typical Omega display controller with a Terminal Interface installed.

* PLOT 10 is a registered trademark of Tektronix, Inc.



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Figure 1-1. Terminal Interface with Omega

The Terminal Interface consists of a circuit board that attaches to an Omega display controller and a keyboard. A mouse or bit pad (purchased separately) can also be used for graphics input. The Terminal Interface is connected to the host computer via an RS-232 cable.

This circuit board also houses Terminal Interface firmware and DIP switches for options that are in effect at powerup, for example baud rate, parity/stop bits, and flow control.

KEYBOARD

The Terminal Interface comes with a low-profile 83-key detachable keyboard, with preprogrammed function keys, cursor addressing keys, and programmable break key. The SETUP menu allows you to set Terminal Interface options through software selections displayed on the screen.

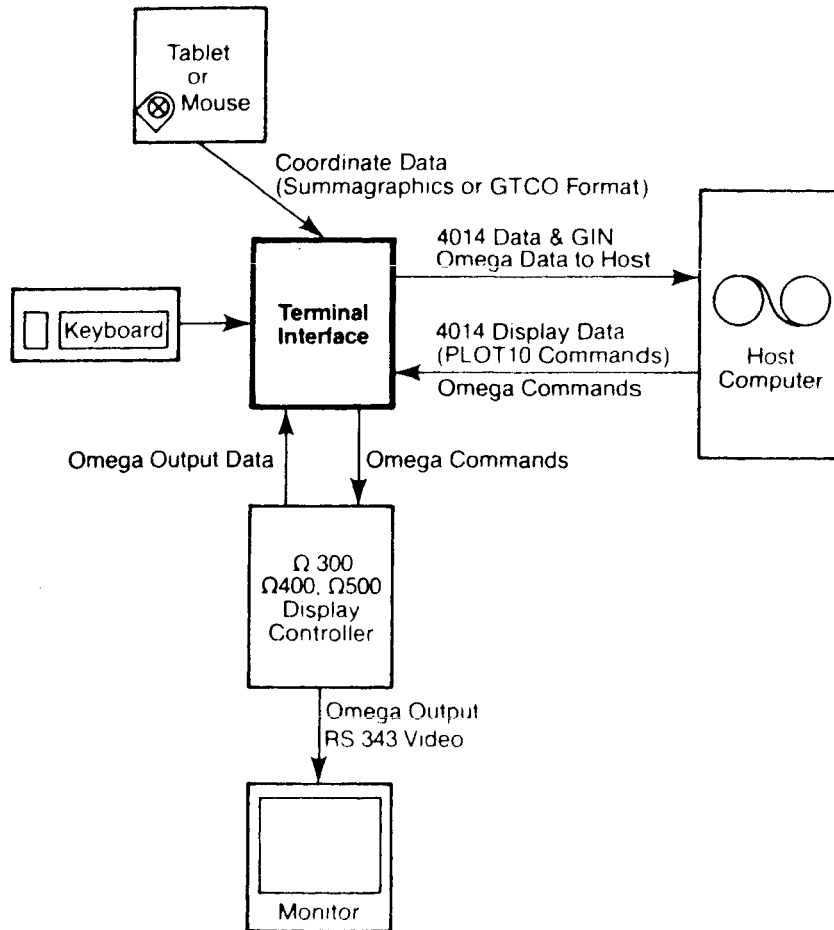
OPTIONAL GRAPHICS INPUT DEVICE (BIT-PAD OR MOUSE)

You may connect a separately-purchased mouse or bit pad to use for graphics input to the computer. You may use any graphic input device that sends in Summagraphicstm or GTCOtm format.*

BLOCK DIAGRAM

Figure 1-2 shows how the Terminal Interface interacts with the host computer and the Omega display controller. All input, from the keyboard or graphic input device, is sent through the Terminal Interface to the host computer. Similarly, all computer output is first sent through the Terminal Interface, where the output is translated into Omega commands. Finally, the Omega displays the results on the monitor.

* Summagraphics is a registered trademark of Summagraphics Corporation. GTCO is a registered trademark of GTCO Corporation.



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Block Diagram for the Terminal Interface

Chapter 2

Getting Started

The previous chapter introduced the "big picture" of the Terminal Interface and how it interacts with the host computer and the Omega display controller. This chapter contains some "hands-on" demonstrations and examples to get you started using the Terminal Interface.

Throughout this chapter, we assume the Terminal Interface has already been installed into the Omega display controller. (If you need to install the Terminal Interface, read Chapter 5, *Installation*, before continuing with this chapter.) Also, we assume you are using the Terminal Interface default option settings.

This chapter contains:

- A demonstration of Alpha mode (default or "normal" mode), where characters appear on the display.
- A brief summary of the Terminal Interface's default option settings, such as baud rate, colors, parity, end-of-line characters, and so on.
- A demonstration of the SETUP menus (changing colors, etc.)
- Brief examples of drawing graphic objects with the Terminal Interface.

NOTATION CONVENTIONS

Throughout this manual, Terminal Interface commands are represented as follows:

ESC FF Uppercase letters with no angle brackets represent a Terminal Interface command. Example = ESC FF, clear the screen and home the cursor.

<CR> One or more characters enclosed in angle brackets represent a key to be pressed. Example = a carriage return.

F A single letter represents a key to be pressed. Example = the F key.

<CTRL>-E Two keypresses joined by a minus sign means hold down the first key and press the second. Example = Hold down the CTRL key and press the E key.

Commands to operate the Terminal Interface can be signals sent from a program on the host computer, OR keypresses typed directly from the keyboard. Thus each Terminal Interface command has an ASCII equivalent, to be used when writing a host computer program, and a keyboard equivalent, to be used when entering data from the keyboard.

For example, the command to clear the screen and home the cursor has the following name and keyboard equivalent:

ESC FF	Terminal Interface command to erase and home the cursor
27,12	ASCII equivalent
<ESC> <CTRL>-L	Keyboard equivalent

For this chapter, we use keyboard equivalents for simplicity's sake. But in most applications you would include Terminal Interface commands in your host computer program, entering them in whatever form is most convenient for your programming language from the ASCII chart in Appendix C.

ALPHA MODE DEMONSTRATION

The Terminal Interface is in Alpha mode when you first turn it on. Alpha mode displays alphanumeric characters, and controls character size, cursor movement, and the number of columns on the display. These Alpha-mode features are covered in the next few paragraphs:

- Move the cursor while in Alpha mode.
- Change the Terminal Interface's character size.
- Clear the screen and home the cursor.

Moving the Cursor in Alpha Mode

You may want to experiment with moving the cursor in Alpha mode. The keypresses to move the cursor are:

up	<CTRL>-K
down	<CTRL>-I or <CTRL>-J
right	<CTRL>-I or <TAB>
left	<Back Space>

NOTE:

The arrow keys <↑> <↓> <→> <←> do NOT control cursor motion in Alpha mode. Instead, the arrow keys send control codes to the host computer which may affect your display (see Appendix B, *Keyboard Control Codes* for information on which keys send which codes.)

Changing Character Size

The Terminal Interface has four possible character sizes. For example, to see the change from the default character size to the largest possible character size, press the following keys:

lkdglskgsdl	enter some random characters
<ESC> 8	command to use largest characters
ejklskjowie	enter some random characters again, to see the difference
<ESC> ;	return to default characters

Clearing the Screen and Homing the Cursor

To clear the screen and home the cursor, press the function key <F2>.

Chapter 3, *Using the Terminal Interface*, discusses Alpha mode in more detail.

The next sections summarize the default option settings for the Terminal Interface, and show how to change options with the SETUP menus.

SETUP DEMONSTRATION

This section shows:

- Initial settings for the Terminal Interface.
- How to enter SETUP mode
- How to move the cursor while in SETUP mode
- How to change the Terminal Interface's background color.
- How to move to a different menu to choose an option

Initial Settings for the Terminal Interface

Table 2-1 shows the Terminal Interface switch settings at powerup. It shows which options are changed by setting a DIP switch, which can be changed using the SETUP menus, and which can be changed by sending a command from the host computer. If you change an option with a DIP switch, the new setting will be in effect each time the Terminal Interface is turned on. Otherwise, the change only lasts until the Terminal Interface is turned off or reset.

The options summarized in Table 2-1 are discussed more fully in Chapter 3, *Using the Terminal Interface*.

Table 2-1. Default Terminal Interface Settings

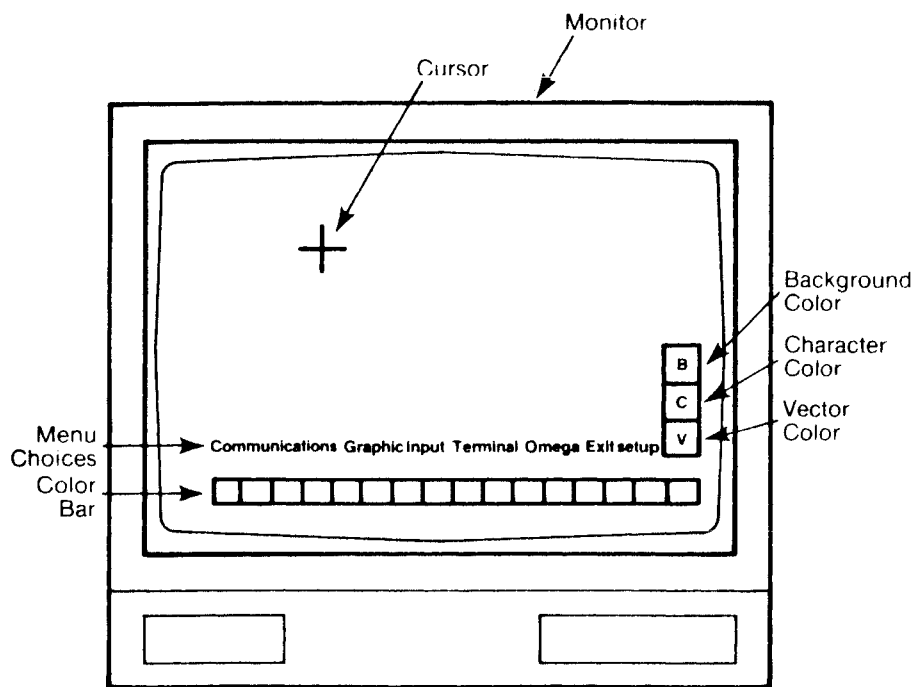
Option	Default	How to Change *
Host baud-rate	9600	SETUP or DIP
Host parity	Odd	SETUP or DIP
Host bits-per-character	7	SETUP or DIP
Xon/Xoff or modem	Xon/Xoff	SETUP or DIP
Raw/hex Omega data	Hex	SETUP or DIP
Tablet format	Summagraphics	SETUP or DIP
Tablet baud	9600	SETUP or DIP
Host CR → CR/LF	Disabled	SETUP or DIP or HOST
Host LF → CF/LF	Disabled	SETUP or DIP or HOST
Ignore deletes from host	Disabled	SETUP or DIP or HOST
Clear on page full	Disabled	SETUP
Wait on page full	Disabled	SETUP
Margins	1	SETUP
GIN mode terminator	CR	SETUP or HOST
Terminal Colors	Black background White characters White vectors	SETUP or HOST
Vector style	Solid lines	HOST
Character size	Smallest	HOST
Operating mode	Alpha	HOST
Default color map	Terminal Inter- face color map (not Omega color map)	SETUP or HOST

* DIP = change a value by setting DIP switches on the interface board;
 SETUP = change a value using the SETUP menus;
 HOST = change a value by sending the command from the host computer

Entering SETUP

To enter SETUP, press the function key labeled <F10> near the lower left corner of the keyboard

At this point, your monitor screen should contain the SETUP display as shown in Figure 2-1



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Figure 2-1. Terminal Interface SETUP Display

To exit from SETUP at any time, press function key <F10> again

Moving the SETUP Cursor

You can move the cursor in SETUP mode with keys on the keyboard or with a graphic input device.

Keyboard

To move the cursor with keys, hold down the <ALT> key and press an arrow key to set the direction the cursor travels. For example, <ALT>-<↑> moves the cursor up.

Holding down the <ALT> key and pressing a number key, such as 3, sets the distance the cursor moves for each keypress in that direction. The distance equals 2^N pixels. For example, <ALT>-<0> moves just one pixel at a time, <ALT>-<6> moves 64 pixels (medium jumps), and <ALT>-<8> moves 256 pixels (big jumps).

Graphic Input Device

If you have a graphic input device such as a mouse or bit pad, you can use that device instead of the keyboard to move the cursor.

Changing the Background Color

Changing the color involves choosing the item to be colored, then choosing a color. For example, the following steps change background color to red:

- (1) Move the cursor to the box labeled "B".
- (2) Press <SPACEBAR> or a graphic input device button to select "background".

(Actually, if you're using the keyboard, any key **except** <ALT>, the arrow keys, or the number keys will select the background. We are using <SPACEBAR> arbitrarily.)

- (3) Now move the cursor to the red box in the color bar at the bottom of the display.
- (4) To select that color, press <SPACEBAR> again on the keyboard, or any button on the graphic input device. The "background" box should turn red. (The screen's background turns red when you exit SETUP with key <F10>.)

You can change the background back to its original color by choosing the box "B" and the color black.

Using this same method, you can set the character color and the vector color, one at a time.

Moving to a Different Menu

Moving to another menu in SETUP is done by selecting an item on the main menu. The main menu is the first menu you will see when entering SETUP. For example the following steps move to the "Omega" menu

- (1) Move the cursor onto the word "Omega" on the SETUP display. (Notice that "Omega" is highlighted by a rectangle when the cursor is on that option.)
- (2) To select, press <SPACEBAR> or any graphic input device button.
- (3) The main menu goes away, and is replaced by the "Omega" menu choices. All possible choices are represented in that line.
- (4) To change an Omega option, move the cursor to that option and select, again with <SPACEBAR> or a graphic input device button. For example, to select "Reset Omega", move the cursor to "Reset Omega" and press <SPACEBAR> or a graphic input device button.
- (5) The color bar will change to the Omega default color map; to reset the 4014 color map, move the cursor left to "Reset Color Map", and press <SPACEBAR> to reset.

- (6) To return to the main menu, move the cursor to "Return to main" and select
- (7) Exit SETUP by pressing <F10>.

Figure 2-2 shows each of the SETUP menus and their options. The default settings are enclosed in the boxes, and the other options are listed below the appropriate box. For a more detailed explanation of SETUP, refer to Chapter 3, *Using the Terminal Interface*.

EXAMPLES

This section contains examples of simple display tasks. These examples assume an Ω 400's display size and resolution and a Terminal Interface with default settings.

Normally, you draw graphics by sending Omega or 4014 display instructions from programs on the host computer. However, for these short examples, we enter the data directly from the keyboard for simplicity's sake.

If you try these examples, be sure to first set your host computer so that it does NOT process your keypresses, but instead sends them back to the Terminal Interface exactly as entered.

Also, you need to enter the bytes exactly as shown, with no backspaces, carriage returns, or other data-entry characters you may be used to

Main Setup Menu					
Communications	Graphic input	Terminal	Omega	Exit setup	
Communications Menu					
Baud rate 9600	Flow control Xon/Xoff	Parity Odd	Bits character Seven (7)	Stop Bits One (1)	Return to main
4800 2400 1200 300 110 38400 19200	Cts Rts	Even	Eight (8)	Two (2)	
Graphic Input Menu					
Baud rate 9600	GIN terminator Cr (0D)	Table type SUMMA	Return to main		
4800 2400 1200 300 110 38400 19200	Cr EOT (0D 04) (nn, mm)	GTCC			
Terminal Menu					
Two margins 1 Margin	Page hold Disabled	Page clear Disabled	Ignore deletes Disabled	Lt ctrl Disabled	Cr ctrl Disabled
2 Margins	Enabled	Enabled	Enabled	Enabled	Enabled
Omega Menu					
Cursor type line	Break sends Break (50 Ms.)	Receive format ASCII hex	Transmit format ASCII hex	Reset color map	Reset Omega
Box None	Control C Control D Control F Control Z Escape (1B)	Binary	Binary		Return to main

Figure 2-2. SETUP Menus

Drawing PLOT 10 Vectors

This example uses Graph mode to draw 5 lines (vectors) forming a rectangle with a diagonal line inside, one vector in each 4014 line style.

Because you are entering 4014 coordinate conversion data instead of hex data, case is important. Note that the uppercase T is very different from the lowercase t, and enter the data carefully. (You may want to refer to the 4014 Coordinate Conversion chart as you enter this data.)

If you do make a typing mistake, type the following characters and start again

<CR>	leave Graph mode, reenter Alpha mode
<F2>	clear screen and home the cursor

To draw the example lines, send the following data from the host to the Terminal Interface.

Byte	Explanation
<CTRL>-]	Enter 4014 Graph mode (cursor disappears)
/t&H	Starting point at (200, 500)
<ESC> a	Start dotted vectors
/t/T	Draw vector to point (500, 500)
<ESC> b	Start dot-dash vectors
,p/T	Draw vector to point (500, 400)
<ESC> c	Start short-dash vectors
,p&H	Draw vector to point (200, 400)
<ESC> d	Start long-dash vectors
/t&H	Draw vector to point (200, 500)
<ESC> .	Start normal vectors (use the single-quote character found under the tilde mark, ADE code 96)
,p/T	Draw vector to point (500, 400)
<CR>	Exit Graph mode, return to Alpha mode (cursor reappears)
<F2>	Clear screen and home the cursor

Drawing an Omega Vector

To draw a line from the upper left corner of the monitor to the lower right corner, send the following sequence of hexadecimal bytes to the Terminal Interface from the host:

Byte	Explanation
<ESC> <SHIFT>-O	Enter Omega mode (cursor disappears)
4E	SETCOL Set Omega color to
0F	light blue
52	MOVP1: Move Pointer 1
00	low-x (coordinates of
00	high-x screen position 0,0)
00	low-y
00	high-y
53	MOVP2: Move Pointer 2
FF	low-x (coordinates of
03	high-x screen position 1023,767)
FF	low-y
02	high-y
61	DRAW: Draw from Pointer 1 to Pointer 2
FE	Exit Omega mode, return to
	Alpha mode (cursor reappears)
<F2>	Clear screen and home cursor
	Note that light blue is still
	the current color!
<F10>	Enter SETUP to reset color
<F10>	Exit SETUP (restores the default color)

Drawing an Omega Circle

To draw a circle with its center at screen position (512, 360) and a radius of 128 pixels, send the following sequence of hexadecimal bytes to the Terminal Interface:

Byte	Explanation
<ESC> <SHIFT>-0	Enter Omega mode (cursor disappears)
4E	SETCOL Set Omega color to
0F	light blue
52	MOVP1: Move Pointer 1
00	low-x (center of circle, coordinates
02	high-x of screen position 512,360)
68	low-y
01	high-y
53	MOVP2: Move Pointer 2
00	low-x (point on radius: coordinates of
03	high-x screen position 512,384)
E8	low-y
01	high-y
62	ARC: Draw an Arc
D8	length (number of pixels in this circle)
02	
FE	Exit Omega mode
<F2>	Clear screen, return to Alpha mode
	Note that light blue is still
	the current color!
<F10>	Enter SETUP to reset color
<F10>	Exit SETUP (restores the default color)

Chapter 3

Using The Terminal Interface

This chapter discusses:

- Terminal Interface operating modes
 - Alpha mode (characters)
 - GIN mode (4014-style graphic input)
 - Graph mode (4014-style vectors)
 - Point Plot mode (4014-style points)
 - Setup mode (menus)
 - Omega mode (Omega commands)
- Keyboard codes
- Terminal Interface options
- Default color map

You might also want to refer to your Omega manual or 4014 manual for more information.

MODES IN GENERAL

At powerup, the Terminal Interface is in Alpha mode, with the cursor in the home position.

Using the 4014 and Omega Together

The 4014 drawing instructions are faster than Omega drawing instructions, due to their encoding method (the instructions need less information than Omega instructions). Omega mode, however, accesses graphics commands not available with the 4014. You can use the best features of the 4014 modes and Omega mode, depending on your application.

For example, when drawing many vectors, such as rotating a cube, you would use a 4014 mode. When filling large areas, such as repainting backgrounds, you would use Omega mode.

Note that the origin (point 0,0) for Omega is in the upper left corner of the display, but the origin for 4014 is in the lower left corner.

Figure 3-1 shows the modes for the Terminal Interface and the commands used to move from one mode to another. You do not have to study and understand all the relationships before using the Terminal Interface, but you may want to refer back to this diagram as you work.

Figure 3-1 also shows the relationships of the modes as state diagrams. For example, in the diagram with Alpha mode in the center, you would use the command GS to enter Graph mode and one of the commands ESC FF, CR, US, or <F2> to return to Alpha mode.

ALPHA MODE

This is the default mode, the one you normally use while talking to the host computer. Alpha mode is in effect at power-up. You can reenter Alpha mode with the following commands:

Command	Keyboard Equivalent	Explanation
US	<CTRL>-<SHIFT>-_	Set Alpha mode
ESC FF	<ESC>-<CTRL>-L	Erase and home
CR	<CR>	Carriage return
<F1>	<F1>	Home the cursor, no erase

The command US enters Alpha mode with the cursor at the current position. For example, if you move the cursor while in GIN mode, the cursor stays in that position when you enter Alpha mode with US. The command ESC FF clears the screen, moves the cursor to the upper left character position, and enters Alpha mode. The command CR enters Alpha mode with the cursor at the beginning of the current line.

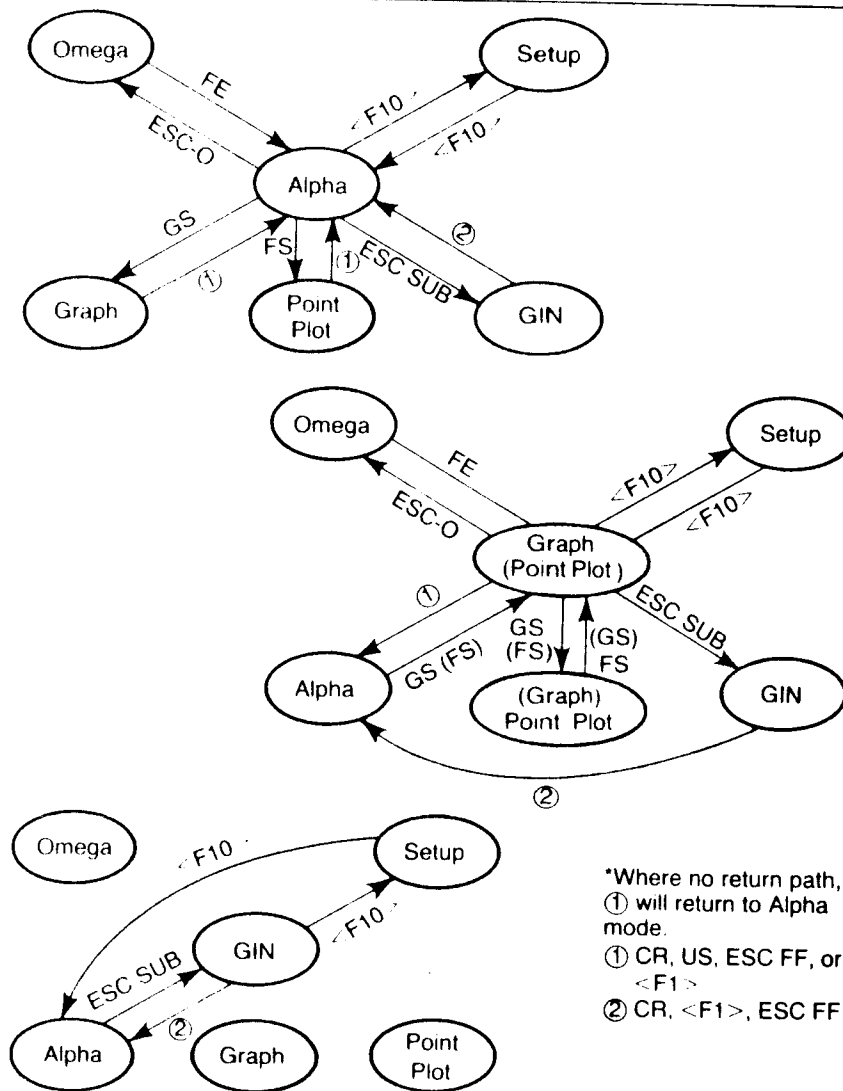


Figure 3-1. Operating Modes for the Terminal Interface

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In Alpha mode, data enters the Terminal Interface and is decoded. If the character is a displayable alphanumeric character, the Terminal Interface writes the character at the current cursor position and the cursor is updated to the next valid character position. If the character is a cursor control command, the Terminal Interface performs the cursor function, updating the cursor.

While you are in Alpha mode, you can use the following commands to move the cursor:

Command	Keyboard Equivalent	Explanation
(none)	<F2>	Erase and home the cursor
CR	<CR>	Return cursor to left margin
LF	<CTRL>-L or <CTRL>-J	Down one line
HT	<TAB> or <CTRL>-I	Right one character
BS	<Back Space>	Left one character
VT	<CTRL>-K	Up one line

The Terminal Interface also has options to alter the Alpha mode display (see the discussion on "Terminal Options" in the *Terminal Interface Options* section later in this chapter).

GIN MODE

The object of GIN mode is to send the current cursor position to the host computer by pressing a key or input-device button, or by sending an inquiry from the host. You enter GIN mode with the following Terminal Interface command:

Command	Keyboard Equivalent	Explanation
ESC SUB	<ESC> <CTRL>-Z	Enter GIN mode

When you are in GIN mode, the crosshair cursor is displayed, and you can use the keyboard arrow keys with the <ALT> key or graphic input device to move the cursor around. When you press a keyboard key other than the cursor movement keys, or a graphic input device button, the coordinates of the crosshair cursor's position are sent to the host computer.

NOTE

The arrow keys <↑> <↓> <→> <←> without the <ALT> key do NOT control cursor motion in GIN mode. Instead, the arrow keys send control codes to the host computer, in addition to the cursor coordinates, which may affect your display. (See Appendix B, *Keyboard Control Codes* for information on which keys send which codes.)

When the Terminal Interface sends information about the cursor position to the host computer, it actually sends five bytes of data:

1. a byte corresponding to the key or button that is pressed
2. high x byte
3. low-x byte
4. high-y byte
5. low-y byte

After these five bytes of data, the Terminal Interface sends 0-2 GIN termination characters.

You can use the 4014 Coordinate Conversion chart, found in the 4014 user's manual (listed in the Preface), to convert from the high- and low- bytes to Cartesian coordinates. See also the program segments in "Sample Code for Conversion", later in this chapter.

In addition, the ESC ENQ command sent from the host computer will also send the current cursor position to the host. In this case, you do not need to press a key or a button.

Other Terminal Interface commands cannot be executed while GIN mode is in effect. To enter further Terminal Interface commands, you must first terminate GIN mode by entering Alpha mode with ESC FF or CR.

The Terminal Interface also has options for GIN mode (see the discussion on "Graphic Input Options", in the section on *Terminal Interface Options* later in this chapter).

GRAPH MODE

Graph mode is used for drawing 4014-style lines (vectors). You can enter Graph mode with the following command:

Command	Keyboard Equivalent	Explanation
GS	<CTRL>-]	Graph start

In Graph mode, data enters the Terminal Interface and is decoded. If the character is a GS command (DRAW), the Terminal Interface will draw vectors (lines) with the encoded coordinates. Coordinates are sent in four bytes in the following order: high-y, low-y, high-x, low-x. All bytes do not have to be sent every time if they do not change. See the 4014 manual for specifics on which bytes need to be sent when.

The first line drawn after the GS command is invisible unless a BEL (<CTRL>-G) follows the GS command.

You can use the 4014 Coordinate Conversion Chart (found in the 4014 user's manual) to convert from Cartesian coordinates to 4014 values. See also the program segments in "Sample Code for Conversion", later in this chapter.

Remember to suppress carriage returns from the host computer while working in Graph mode. Otherwise, a CR takes you out of Graph mode and returns you to Alpha mode.

POINT PLOT MODE

Point Plot mode is used for drawing 4014-style points. You can enter Point Plot mode with the command:

Command	Keyboard Equivalent	Explanation
FS	<CTRL>-\ <CTRL>-]	Enter Point Plot mode

In Point Plot mode, the Terminal Interface draws a 1 pixel point at the requested position. The first point drawn is invisible unless a BEL (<CTRL>-G) follows the FS command.

As with Graph mode, you can use the 4014 Coordinate Conversion Chart (see the 4014 user's manual listed in the Preface) to convert from Cartesian coordinates to 4014 values

Sample Code for Conversion

The following program segments can be used as a model for converting between Cartesian coordinates and 4014 data.

```

... (calling program)...

x(i)=shift(highx)*32+shift(lowx)
y(i)=shift(highy)*32+shift(lowy)

...(end of calling program)...
#
#   This function converts PLOT-10 characters to
#   x,y Cartesian coordinates
#
function shift(byte)
integer byte,itmp
itmp=int(byte/32)
shift=byte-(itmp*32)
return
end
#
#   This subroutine converts an x,y coordinate to it's Plot-10 ASCII
#   equivalent.
#
subroutine getpos(x,y)
integer x,y,highx,highy,lowx,lowy
100 format(4a1)

highx=int(x/32)
highy=int(y/32)
lowx=(x-(highx*32))+64
lowy=(y-(highy*32))+96
highx=highx+32
highy=highy+32
return
end

```

SETUP MODE

You can enter SETUP from any mode except Omega mode. Chapter 2, *Getting Started*, explains how to move the cursor and select items from the SETUP menus.

As explained in Chapter 2, you can choose colors for background, characters, and vectors one at a time. You can also program keys to set colors for background, characters, and vectors, more than one at a time.

For example, the following steps program the keys J, K, and L for setting background, character, and vector colors:

- move the cursor to B and select it with key J
- move the cursor to C and select with key K
- move the cursor to V and select with key L

Then, to set colors:

- move the cursor to a color and press J,
the background indicator box changes to that color,
- move to another color and press K,
and the character indicator box changes to the second color;
- move the cursor to a third color and press L,
and the vector indicator box changes to the third color.

The display is set to the indicated colors upon exiting from SETUP.

OMEGA MODE

Omega mode allows you to send Omega instructions directly to the Terminal Interface. You can enter Omega mode with the following command:

ESC O <ESC> <SHIFT>-O Enter Omega

You can exit Omega mode with the Omega "exit" instruction

FE (hexadecimal)

Chapter 2, *Getting Started*, shows examples of data sent to the Terminal Interface to draw simple objects using Omega instructions

NOTE

- (1) Note that Omega GRAFIN is not supported at this time.
- (2) Some changes made in Omega mode may adversely affect the display in all other modes. For example, setting Omega "zoom" or "pan" may cause the SETUP display to be drawn in a undisplayed portion of the screen. You can correct these effects by:
 - o choosing item "Reset Omega" from the Omega SETUP menu,
 - o making sure to undo any changes made after each sequence of Omega commands, or
 - o rebooting the Terminal Interface when the display is affected.

See the discussion "Changing Modes" earlier in this chapter for more information.

CHANGING MODES

The Terminal Interface keeps track of certain drawing attributes for the 4014 modes Alpha, Graph, and Point Plot.

The drawing attributes which can be temporarily changed by calling Omega mode from the appropriate 4014 mode are:

Alpha Mode

Attribute	4014 Value
Character color	Last color set with SET-UP or ESC S C n2
Pattern	solid (if applicable)
Font size	8 x 16

Graph Mode and Point Plot Mode

Attribute	4014 Value
Color	Last color set with SET- UP or ESC S V n2
Pattern	Last pattern set with ESC 8, 9, :, or :

If you change any of these attributes while in a 4014 mode by sending 4014 commands, the attributes are permanently changed.

If you change any of the attributes while in Omega mode, the changes are temporary; they last only until you enter a 4014 mode other than the one that called Omega mode. That is, when you enter a new 4014 mode, the Terminal Interface discards those particular Omega changes and restores drawing attributes from the previous use of that 4014 mode.

When returning to Alpha mode from Omega mode, character size and spacing are reset to their previous values.

Note that entering GIN mode does not reset any of the attributes; entering any other 4014 mode, including SETUP, does reset the attributes.

In addition to the drawing attributes for each 4014 mode, some Omega mode drawing attributes **do** affect your displays globally. These changes stay in effect until they are reset in Omega mode, or through SETUP menu item "Reset Omega", and affect the display in all other modes.

The following "global" attributes, if changed while in Omega mode, affect the display of all other modes:

CMAP	WRMASK
CRTWR	RDMASK
BLANK	PPAN
BLINK	ZOOM

The Terminal Interface assigns default values to the "global" attributes at powerup time. You can also restore these values by choosing Omega SETUP menu item "Reset Omega".

The following sequence illustrates the affects of temporary Omega changes on 4014 modes:

- (1) Enter Alpha mode. At this point, characters are drawn with the same set of drawing attributes as last set in Alpha mode.
- (2) Enter Omega mode.
- (3) Set half-tone area pattern.
- (4) Exit from Omega mode.
- (5) Print text on screen. The text is drawn in the Omega half-tone stipple. This stipple appearance only lasts as long as you are in this particular invocation of Alpha mode. When you leave this Alpha mode, the stipple instruction no longer has any affect.
- (6) Enter Graph mode. Lines are drawn with the same drawing attributes last set in Graph mode, and no stipple appears.
- (7) Enter Alpha mode. Again, characters are drawn with no stipple, because the stipple only lasted while that previous Alpha mode was in effect. The only way to change the appearance of characters in Alpha mode and have those changes affect all further invocations of Alpha mode is to make the changes in 4014 Alpha mode instead of Omega mode.

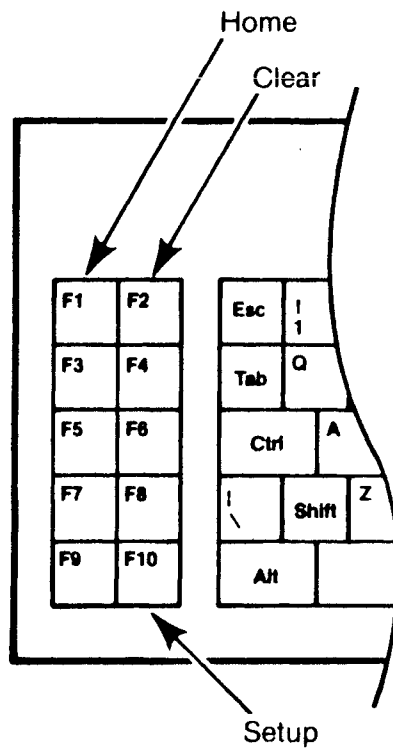
The next few sections discuss each of the modes for the Terminal Interface.

KEYBOARD

The Terminal Interface includes keys programmed for functions HOME (F1), HOME AND CLEAR (F2), and SETUP (F10). HOME returns the cursor to the upper left corner of the screen; CLEAR clears the screen

and homes the cursor; and SETUP allows you to set Terminal Interface options after the Omega has been powered up, through menu selections. The other function keys are reserved for future use by the Terminal Interface.

Figure 3-2 shows a diagram of the function keys on the Terminal Interface keyboard. Appendix B, "Keyboard Control Codes", lists the codes sent by all the keys.



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Figure 3-2. Function Keys on the Keyboard

The functions of the arrow keys depend on the mode of the Terminal Interface. In SETUP mode, the arrow keys position the cursor on selections within the SETUP display, when <ALT> is being pressed at the same time. Pressing any key other than <ALT>, <ALT> with 0-9, or <ALT> with arrows will toggle that selection. During SETUP, the Terminal Interface does not transmit any cursor position coordinates back to the host computer.

TERMINAL INTERFACE OPTIONS

The following paragraphs discuss the options you can change with the Terminal Interface.

Communications Options

Flow control. The Terminal Interface provides two selections for flow control methods. Flow control ensures that data transmission does not overrun the buffers in the display controller or in the host, resulting in lost data. The two selections for flow control are through the Xon/Xoff characters or Cts/Rts controls.

Xon/Xoff. When the Terminal Interface is set to Xon/Xoff flow control, Xon (<CTRL>-Q from the keyboard, or 11 hexadecimal) resumes data transmission. When Xon is received by the host, the host may resume sending data to the Terminal Interface. When Xon is received by the Terminal Interface, the Interface may resume sending data to the host.

Xoff (<CTRL>-S from the keyboard, or 13 hexadecimal) stops data transmission. When Xoff is sent to the Terminal Interface, the Terminal Interface stops sending data to the host. Similarly, when the Terminal Interface sends Xoff to the host, the host should stop sending data as soon as possible.

Cts/Rts. With the Modem Control Line method, flow is controlled through the Cts (Clear To Send) and Rts (Request to Send) control lines. These lines are normally asserted; the signal level is greater than 0 volts.

When the Terminal Interface input buffer is full, the Cts line is turned

off (less than 0 volts). This tells the host to stop sending data. In the same manner, the host computer may set the Rts line low (less than or equal to -3 volts), telling the Terminal Interface to stop sending to the host.

Graphic Input Options

GIN Terminator. You can choose the signals you want to use for GIN termination, either carriage return or carriage return/end of transmission. In addition, you may program your own GIN terminator. If you do, your choice shows up on the SETUP menus in the form:

nn,mm

where *nn* is the first hexadecimal byte and
mm is the second hexadecimal byte.

Tablet Type. Choose Summagraphics or GTCO high resolution graphic input device format.

Terminal Options

Two Margins. When "1 Margin" is chosen, characters are displayed in a single column in Alpha mode. With "2 Margins", characters are shown in two columns (left-hand column is filled first).

Page Hold. Specify whether to wait (page-hold enabled) for a keypress before continuing display, when the screen becomes full in Alpha mode.

Page Clear. Specify whether to erase the screen (page-clear enabled) or overwrite the current display (page-clear disabled) when the screen becomes full in Alpha mode.

Ignore Deletes. If this switch is disabled, the key is interpreted as a low-y code. If this switch is enabled, it prevents deletes from being used as a low-y. Software sends ESC ? to compensate for the host's inability to use as low-y.

If=crlf. For some host computers, you may want the Terminal Inter-

face to automatically convert linefeeds to carriage return/linefeeds.

Cr=crlf. For some host computers, you may want the Terminal Interface to automatically convert carriage returns to carriage return/linefeeds.

Omega Options

Cursor Type. Choose a line, a box, or none (no cursor).

Break Sends. Choose the character sent by the Break key from among the choices in the SETUP menu.

Receive Format. Choose whether data is interpreted by the Omega as ASCII hexadecimal (0-9,A-F) or binary format (8 bits).

Transmit Format. Choose whether the Omega sends data in hexadecimal format or binary format in Omega mode.

Reset Color Map. This option resets the Terminal Interface color map to its default values (useful when you have made many color map changes).

Reset Omega. This option sends an Omega INIT (5E hex). (Useful when you have made many changes in Omega mode.) See your Omega manual for a more complete description of a reset.

THE TERMINAL INTERFACE COLOR-MAP

The Terminal Interface replaces the Omega default color-map with an 8-color, linear-intensity color-map, suitable for shaded images. (For more information on the Omega default color-map, refer to your Omega display controller manual's, CMAP instruction.) The new color-map is loaded with the information summarized in Tables 3-1 and 3-2 (depending on the number of bit-planes your Omega model supports).

Table 3-1. Terminal Interface Color-Map (8 Bit-Planes)

Color Number	Color Name
0-31	0 = Black 31 = White
32-63	32 = Dark Blue 63 = Light Blue
64-95	64 = Dark Yellow 95 = Light Yellow
96-127	96 = Dark Violet 127 = Light Violet
128-159	128 = Dark Red 159 = Light Red
160-191	160 = Dark Green 191 = Light Green
192-223	192 = Dark Orange 223 = Light Orange
224-255	224 = Dark Cyan 255 = Light Cyan

Table 3-2. Terminal Interface Color-Map (4 Bit-Planes)

Color Number	Color Name
0-1	0 = Black 1 = White
2-3	2 = Dark Blue 3 = Light Blue
4-5	4 = Dark Yellow 5 = Light Yellow
6-7	6 = Dark Violet 7 = Light Violet
8-9	8 = Dark Red 9 = Light Red
10-11	10 = Dark Green 11 = Light Green
12-13	12 = Dark Orange 13 = Light Orange
14-15	14 = Dark Cyan 15 = Light Cyan

To reset the Omega to the Omega's original color map, enter Omega mode and send an INIT (5E hex), or choose SETUP menu item "Reset Omega". Either method reloads the color map with the Omega default.

CHAPTER 4

FUNCTION REFERENCE

This chapter contains a brief description of the commands for the Terminal Interface, listed both by function and alphabetically by command name.

GROUPED LIST OF FUNCTIONS

FUNCTION	EXPLANATION
----------	-------------

Operating Modes

(powerup)	Alpha mode
ESC FF	Erases screen and returns to Alpha mode
FS	Enter Point Plot mode
GS	Enter Graph mode
ESC SUB	Enter GIN mode
ESC O	Enter Omega mode
FE (hex)	Exit Omega mode

Moving the Cursor

GIN mode (keyboard only - no mouse or bit pad)

ALT-↑	Up
ALT-↓	Down
ALT-→	Right
ALT-←	Left
ALT-n	Move 2 ⁿ pixels in the arrow-key direction. n = 0 through 9

Alpha (character) mode:

VT	Move up one character
LF	Move down one character
HT	Move right one character
BS	Move left one character
F1	Home position (upper left corner)
F2	Clear screen, home cursor

Screen Display

Alpha mode

ESC 8	Double-wide/double-high characters
ESC 9	Double-wide/single-high characters
ESC ;	Single-wide/single-high characters
ESC :	Single-wide/double-high characters

Graph mode

ESC '	Normal (solid) vectors
ESC a	Dotted vectors
ESC b	Dot-dash vectors
ESC c	Short-dash vectors
ESC d	Long-dash vectors

ESC S n1 n2 Set colors, n1 = B, V, or C, n2 = 00 through FF (hex)

Communications

ESC ENQ	Sends status of terminal to host
ESC ?	Ignore deletes coming from host (toggle)
ESC	Escape character tells Terminal Interface that a command is coming

ALPHABETICAL LIST OF FUNCTIONS

ESC Keyboard equivalent: ESC
Terminal arming character. Makes the terminal sensitive to certain control characters received immediately after the ESC.

ESC ENQ Keyboard equivalent: <ESC> <CTRL>-E
Enables bypass and creates one of the following conditions:

- 1) Sends terminal status and address of the lower left corner of the alpha cursor to the computer in alpha mode.
- 2) Sends terminal status and address of the current cursor position to the computer in graph mode.
- 3) Sends location of crosshair cursor in GIN mode (5 bytes).

ESC FF Keyboard equivalent: <ESC> <CTRL>-L
Erases the screen and homes the alpha cursor, returns to alpha mode and clears any bypass condition.

ESC K I n Keyboard equivalent: <ESC> K I n
If n=1, all DEL signals are ignored. In this case the host should substitute ESC ? for any DEL characters it would otherwise send. If n=0, the Terminal Interface responds properly to any DEL characters.

ESC K R < n Keyboard equivalent: <ESC> K R < n
If n=1, a CR also implies a LF. If a CR is received from the host, or as an echo, a CR/LF is displayed. If <RETURN> is pressed, the LF generated is not sent to the host. If n=0, CR implies just CR.

ESC N C c1 c2 Keyboard equivalent: <ESC> N C c1 c2
Set one or two EOM (End of Message) characters. c1 = first character, c2 = second character. An ASCII NUL may not be used as an EOM character. To designate no EOM characters, both parameters should be set to zero.

ESC N U c1 Keyboard equivalent: <ESC> N U c1
Set bypass-cancel character. Define which ASCII character is to be the bypass-cancel character for removing the terminal from bypass mode. If c1 = NUL then the bypass-mode feature is disabled.

The bypass-cancel character should equal the last character the host sends as it echos a text line to the device.

ESC O Keyboard equivalent: <ESC> <SHIFT>-O
Enter Omega mode. The terminal will pass all data received directly to the Omega (if in binary mode), or will convert two characters from hexadecimal to binary (if in hex mode) and then send data to Omega. To exit from this mode, enter FE (hex).

ESC S n1 n2 Keyboard equivalent: <ESC>S n1 n2
Set color. (n1) = 'B', 'V' or 'C' corresponding to Background, Vector or Character. (n2) = 00 - FF (hex) for all Omega500s or Omega440, 0 - 15 for Omega420 or all Omega300s, corresponding to the color index.

ESC SUB Keyboard equivalent: <ESC> <CTRL>-Z
Enables GIN mode, starts cursor tracking, clears graph mode, and sets bypass condition.

ESC ` Keyboard equivalent: <ESC> `
Selects normal vectors (solid). Keyboard equivalent uses the left single-quote (ADE 96) usually found under the tilde (~) NOT an apostrophe or right single-quote.

ESC 8 Keyboard equivalent: <ESC> 8
Selects double-wide / double-high characters. Largest (16 x 32 pixels).

ESC 9 Keyboard equivalent: <ESC> 9
Selects double-wide / single-high characters. 16 x 16 pixels.

ESC ; Keyboard equivalent: <ESC> ;
Selects single-wide / single-high characters, smallest (8 x 16 pixels)

ESC : Keyboard equivalent: <ESC> :
Selects single-wide / double-high characters. 8 x 32 pixels

ESC ? Keyboard equivalent: <ESC> ?
Ignores "delete" characters coming from host. This switch is accessible from the DIP switches on the interface board, from the SETUP menus, and by entering <ESC> K I < 1 = ignore deletes, 0 = respond to deletes>.

ESC a Keyboard equivalent: <ESC> a
Selects dotted vectors.

ESC b Keyboard equivalent: <ESC> b
Selects dot-dash vectors.

ESC c Keyboard equivalent: <ESC> c
Selects short-dash vectors.

ESC d Keyboard equivalent: <ESC> d
Selects long-dash vectors.

FE (hex) Keyboard equivalent: (none)
Exits Omega mode. Must be in Omega mode, in a command field (start of Omega command) or command will be interpreted as a data item.

FS Keyboard equivalent: <CTRL>-\
Enter Point Plot mode.

GS Keyboard equivalent: <CTRL>-]
Graph Start. Sets Terminal Interface to graph mode.

HT Keyboard equivalent: <TAB> or <CTRL>-I
Horizontal Tab. Moves one character-space to the right. If a margin is encountered, generates an automatic CR/LF.

LF Keyboard equivalent: <CTRL>-J
Line feed. Cursor moves down one line. If cursor moves past the bottom of the display, the cursor wraps around and appears at the top of the display. Clears bypass condition. A switch in the setup menu can be set so LF also causes a carriage return. See also "Two Margins" discussion in Chapter 3, "Terminal Options".

Function Reference

Terminal Interface

US Keyboard equivalent: <CTRL>-<SHIFT>-
Resets terminal from graph mode to alpha mode, clears bypass condition.

VT Keyboard equivalent: <CTRL>-K
Vertical tab. Moves cursor up 1 line, except at the top of the display.

(none) Keyboard equivalent: <ALT> arrow-key
Moves the cursor in the desired direction, if there is no mouse or bit pad. See also "ALT n", which selects how many pixels to move in the chosen direction.

(none) Keyboard equivalent: <ALT> n
Selects number of pixels the cursor moves when using keyboard arrow keys. n = 0 to 9. Number of pixels = 2^n . Examples: ALT 0 moves 1 pixel, ALT 2 moves 4 pixels, ALT 4 moves 16 pixels.

(none) Keyboard equivalent: <F1>
Brings the cursor to the home position and enters Alpha mode.

(none) Keyboard equivalent: <F2>
Clears the Terminal Interface display memory and brings the cursor to home position. Does not change modes unless current mode is GIN.

(none) Keyboard equivalent: <F10>
Enters and exits from SETUP mode

Chapter 5

Installation

These instructions describe how to install the Terminal Interface board onto an Ω300, Ω400, or Ω500 Display Controller, and how to change DIP switches on the Terminal Interface board. Read and follow these instructions carefully before operating an Omega display controller with the Terminal Interface.

These instructions apply only to Ω300 and Ω400 display controllers with microcode version numbers 3.6 and above, and Ω500 display controllers with microcode version numbers 2.5 and above. The instructions also only apply to Ω300 and Ω400 display controllers with board version numbers 05 and above, or Ω500 display controller board version numbers 01 and above. If your display controller has an earlier microcode version, or an earlier board version, contact the Metheus Graphics System Service Center (GSSC), at the address listed in the Service Information page, for proper installation instructions.

CAUTION

Only qualified service personnel should follow these instructions. Because you must remove the cover of the Omega display controller to install or modify the Terminal Interface board, you can be exposed to hazardous voltages. Always remove the power cord before servicing this equipment.

TOOLS NEEDED

- (1) 1/4" wrench
- (2) Posidrive screwdriver

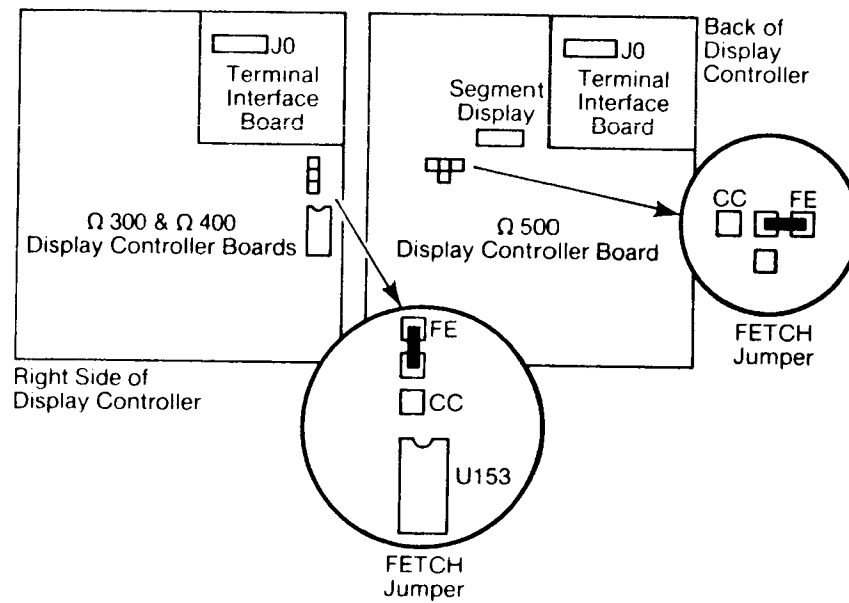
REMOVING OMEGA COVERS AND I/O BOARDS

- (1) Remove the screws that attach the top and bottom covers of the Omega system, and remove them.
- (2) Remove any installed I/O boards. Save the screws and washers because they are reused when installing the Terminal Interface board.

WARNING

The Terminal Interface board must not be used in conjunction with other interface or GRAFIN boards. If you install boards in addition to the Terminal Interface board, damage to equipment may result.

- (3) Remove the Omega interface back panel from the cutout at the back of the Omega's chassis, by unscrewing the nuts (with captive lockwashers) from the inside
- (4) Install the FETCH signal jumper on the display controller board. On the $\Omega 300$ and $\Omega 400$ Display Controller boards, this jumper is near IC U153. On the $\Omega 500$ Display Controller board, this jumper is near the red segment display. Figure 5-1 shows the location and correct installation of this jumper.



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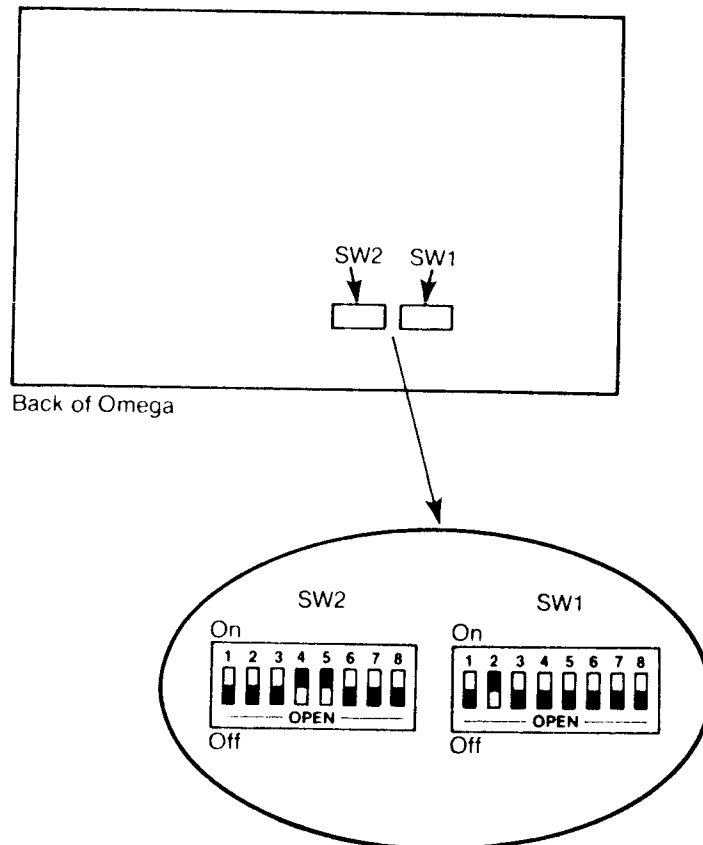
Figure 5-1. Installing the FETCH Jumper

SETTING THE DIP SWITCHES

The DIP switches allow you to specify functions of the Terminal Interface that you want to be in effect at powerup, i.e. every time you turn it on. These functions include baud rate, parity, flow control, and so on.

These switches are preset to commonly used settings, so you probably will not have to change anything. However, if you need more information, Chapter 3, *Using the Terminal Interface* discusses in more detail the Terminal Interface functions controlled by these DIP switches.

Figure 5-2 shows the location of DIP switches one (SW1) and two (SW2), and their default settings. Tables 5-1 and 5-2 show the available settings.



Note: Filled-in end of switch indicates direction the switch is pressed.

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Figure 5-2. Locating and Setting the DIP Switches

Table 5-1. DIP Switches (SW1)

Switch number	Name	OFF/ON *
1 - 3	Host baud rate	
	38400 =	OFF OFF OFF
	19200 =	OFF OFF ON
	9600 =	OFF ON OFF (default)
	4800 =	OFF ON ON
	2400 =	ON OFF OFF
	1200 =	ON OFF ON
	300 =	ON ON OFF
	110 =	ON ON ON
4	Stop bits	OFF = One (1) (default) ON = Two (2)
5	Bits per character	OFF = Seven (7) (default) ON = Eight (8)
6	Flow control	OFF = Xon/Xoff (default) ON = DTR/RTS
7	Parity	OFF = Odd (default) ON = Even
8	Not Used	

* Open = OFF

Table 5-2. DIP Switches (SW2)

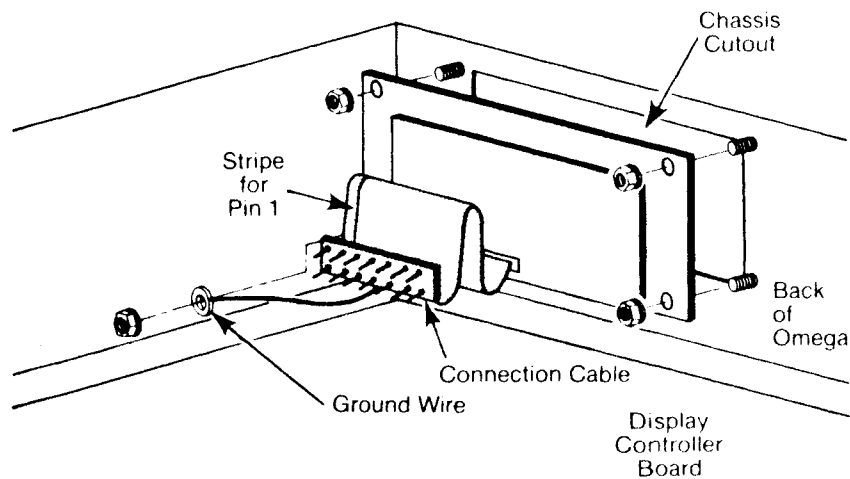
Switch Number	Name	OFF / ON *
1 - 2	Tablet baud rate	
	9600 =	OFF OFF (default)
	4800 =	OFF ON
	1200 =	ON OFF
	300 =	ON ON
3	Tablet format	OFF=Summagraphics (default) ON=GTCO
4	Omega receive format	ON=hex (default) OFF=binary
5	Omega transmit format	ON=hex (default) OFF=binary
6	CR = CR/LF	OFF = CR → CR (default) ON = CR → CR/LF
7	LF = CR/LF	OFF = LF → LF (default) ON = LF → CR/LF
8	Ignore deletes	OFF = normal (default) ON=ignore deletes

* Open = OFF

INSTALLING THE INTERFACE BOARD, BACK PANEL, AND CABLES

- (1) Attach the Terminal Interface back panel to the Omega display controller board, reusing nuts from the old back panel as shown in Figure 5-3.

Be sure to attach the ground wire to the back panel with the nut that fits into the lower left, rear corner of the Omega.



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Figure 5-3 Installing the Terminal Interface Back Panel

- (2) Remove and the two screws and washers holding Omega display controller board in the chassis. (Washers may be glued down. If so, do not remove.) Their location is shown in Figure 5-4, farthest way from the connector on the right-hand side.

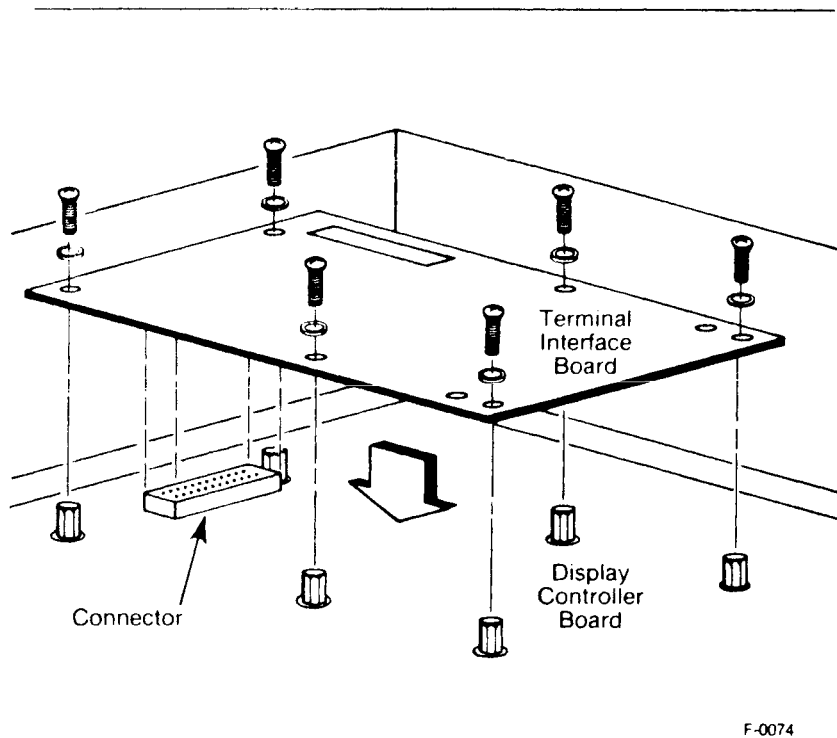


Figure 5-4. Installing the Terminal Interface

- (3) Install the four washers you saved when you removed the I/O boards and the two washers you saved from the last step. There are extra washers in the installation kit. Use the thinner, larger diameter ones. Install the saved standoffs and two more from the kit over these washers.
- (4) Position the connector on the underside of the Terminal Interface board over the corresponding connector on the display controller board and plug them together. Figure 5-4 shows the location of these connectors.

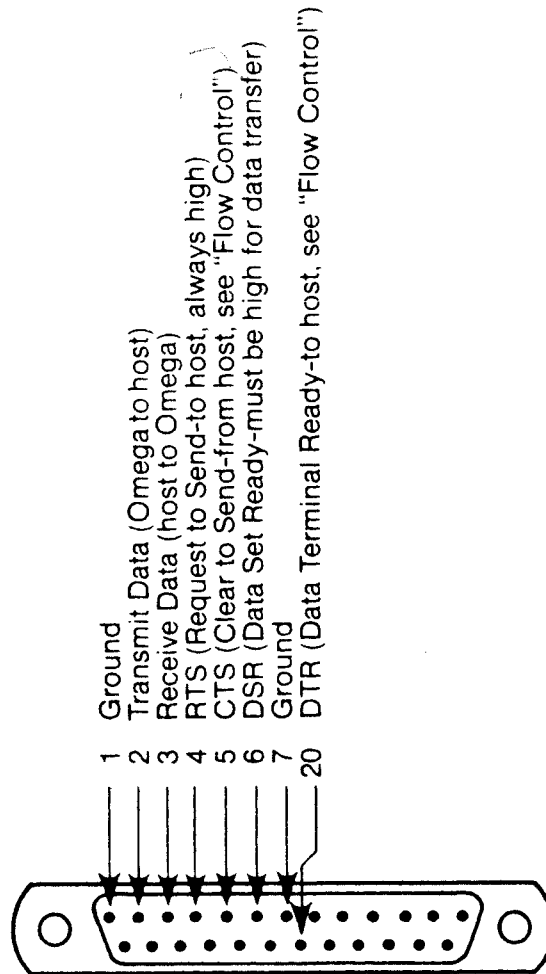
- (5) Attach the Terminal Interface board to the Omega display controller board with the six screws (four you saved and two more from the kit) and six plastic washers (four you saved and two more from the kit, use the smaller, thicker ones). Place one screw and washer at each corner and one in the middle of each long side of the board, as shown in Figure 5-4.

Notice that at the upper right and lower right corners of the interface board there are two holes close together. Use the holes closest to the edge when installing in an $\Omega 400$ or $\Omega 300$ display controller. Use the other holes when installing in an $\Omega 500$ display controller. (In other words, use whichever right-edge holes line up between the interface board and the display controller board, and ignore the extra holes.)

- (6) Attach the cable between the connector on the Terminal Interface board and the Terminal Interface back panel as shown in Figure 5-3.

Although the cable can be swapped end for end, it is not keyed, so be sure to match pin 1's or your system may not operate properly. Pin 1's are marked with an embossed arrow on the connector and a colored stripe on the cable. The bottom cover must be off to see the embossed arrows.

- (7) Replace the top and bottom covers and connect the Omega display controller to the power source.
- (8) Attach the keyboard's jack to the back panel.
- (9) Attach the 25-pin data-transmission connector to the port labeled "Computer" on the Omega back panel. Figure 5-5 details the pin connections for the 25-pin female connector used for RS-232 transmission. (The end that plugs into the Omega port labeled "Computer" is female.)



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Figure 5-5. 25-Pin Data Transmission Connector

Appendix A

Differences Between the 4014 and the Terminal Interface

This appendix lists the differences between the Terminal Interface and a 4014 Computer Display Terminal.

Omega Mode. The Terminal Interface supports Omega mode, a new mode to allow Omega instructions to be sent directly to the display controller, with no processing by the Terminal Interface.

Make Hard Copy (ESC ETB). Not supported.

4014 Local Mode. Not supported.

Alternate Character Set. Not supported.

Incremental Plot Mode. Not supported.

Entering Graph Mode. Use instead of 4014 keyboard character <CTRL>-M to enter Graph mode.

Entering Point Plot Mode. Use keyboard character <CTRL>-N instead of 4014 keyboard character <CTRL>-L to enter POINT PLOT mode.

4014 RESET Key. Corresponds to Terminal Interface key <F1>.

4014 PAGE Key. Corresponds to Terminal Interface key <F2>, but does not put you back into Alpha mode.

4014 Margin Control Switch. Corresponds to Terminal Interface SETUP menu item "Margins".

4014 RUBOUT Key. Corresponds to Terminal Interface key.

Appendix B

Keyboard Control Codes

Table B-1. Keyboard Control Codes

KEYTOP	UNSHIFT	SHIFT	CONTROL	CONTROL-SHIFT
Function keys				
F1 Clear	80	-	-	-
F2 Home	81	-	-	-
F3 - F9	-	-	-	-
F10 SETUP	8A	-	-	-
Numeric key pad				
Num Lock	-	-	-	-
Scroll Lock	8B	8B	8B	8B
7 Home	B7	37	B7	37
8 ↑	11	38	11	38
9 Pg Up	B9	39	B9	39
-	2D	2D	2D	2D
4 ←	12	34	12	34
5	35	35	35	35
6 →	13	36	13	36
+	2B	2B	2B	2B
1 End	B1	31	B1	31
2 ↓	1R	32	14	32
3 Pg Dn	B3	33	B3	33
Enter	0D	0D	0D	0D
0 Ins	B0	30	B0	30
. Del	7F	2E	7F	2E

Keyboard Control Codes
Terminal Interface

KEYTOP	UNSHIFT	SHIFT	CONTROL	CONTROL-SHIFT
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Standard keyboard

Esc	1B	1B	1B	1B
1	31	21	31	21
2	32	40	32	00
3	33	23	33	23
4	34	24	34	24
5	35	25	35	25
6	36	5E	36	1E
7	37	26	37	26
8	38	42	38	2A
9	39	28	39	28
0	30	29	30	29
` _	2D	5F	1F	1F
+ =	3D	2B	3D	2B
Back Space	08	08	08	08
Tab	09	89	09	89
Q	71	51	11	11
W	77	57	17	17
E	65	45	05	05
R	72	52	12	12
T	74	54	14	14
Y	79	59	19	19
U	75	55	15	15
I	69	49	09	09
O	5F	4F	0F	0F
P	70	50	10	10
{ [	5B	7B	1B	1B
}]	5D	7D	1D	1D
~ .	60	7E	60	7E
A	61	41	01	01
S	73	53	13	13
D	64	44	04	04
F	66	46	06	06
G	67	47	07	07
H	68	48	08	08
J	6A	4A	0A	0A
K	6B	4B	0B	0B

Terminal Interface

Keyboard Control Codes

KEYTOP	UNSHIFT	SHIFT	CONTROL	CONTROL-SHIFT
L	6C	4C	0C	0C
::	3B	3A	3B	3A
""	27	22	27	22
RETURN	0D	0D	0D	0D
|	5C	7C	1C	1C
Z	7A	5A	1A	1A
X	78	58	18	18
C	63	43	03	03
V	76	56	16	16
B	62	42	02	02
N	63	4E	0E	0E
M	6D	4D	0D	0D
< ,	2C	3C	2C	3C
> .	2E	3E	2E	3E
? /	2F	3F	2F	3F
PrtSc *	2A	AA	2A	AA
ALT	-	-	-	-
SPACEBAR	-	-	-	-
Caps Lock	-	-	-	-

Appendix C

ASCII Code Conversion Chart

Table C-1. ASCII Code Conversion Chart

ASCII	DECIMAL	OCTAL	HEX
NUL	0	0	0
SOH	1	1	1
STX	2	2	2
ETX	3	3	3
EOT	4	4	4
ENQ	5	5	5
ACK	6	6	6
BEL	7	7	7
BS	8	10	8
HT	9	11	9
LF	10	12	A
VT	11	13	B
FF	12	14	C
CR	13	15	D
SO	14	16	E
SI	15	17	F
DLE	16	20	10
DC1	17	21	11
DC2	18	22	12
DC3	19	23	13
DC4	20	24	14
NAK	21	25	15
SYN	22	26	16
ETB	23	27	17
CAN	24	30	18
EM	25	31	19
SUB	26	32	1A
ESC	27	33	1B
FS	28	34	1C

ASCII Code Conversion Chart

Terminal Interface

ASCII	DECIMAL	OCTAL	HEX
GS	29	35	1D
RS	30	36	1E
US	31	37	1F
SP	32	40	20
!	33	41	21
"	34	42	22
#	35	43	23
\$	36	44	24
%	37	45	25
&	38	46	26
'	39	47	27
(	40	50	28
)	41	51	29
*	42	52	2A
+	43	53	2B
,	44	54	2C
-	45	55	2D
/	47	57	2F
0	48	60	30
1	49	61	31
2	50	62	32
3	51	63	33
4	52	64	34
5	53	65	35
6	54	66	36
7	55	67	37
8	56	70	38
9	57	71	39
:	58	72	3A
;	59	73	3B
<	60	74	3C
=	61	75	3D
>	62	76	3E
?	63	77	3F
@	64	100	40
A	65	101	41
B	66	102	42
C	67	103	43

ASCII	DECIMAL	OCTAL	HEX
D	68	104	44
E	69	105	45
F	70	106	46
G	71	107	47
H	72	110	48
I	73	111	49
J	74	112	4A
K	75	113	4B
L	76	114	4C
M	77	115	4D
N	78	116	4E
O	79	117	4F
P	80	120	50
Q	81	121	51
R	82	122	52
S	83	123	53
T	84	124	54
U	85	125	55
V	86	126	56
W	87	127	57
X	88	130	58
Y	89	131	59
Z	90	132	5A
[	91	133	5B
	92	134	5C
]	93	135	5D
^	94	136	5E
_	95	137	5F
.	96	140	60
a	97	141	61
b	98	142	62
c	99	143	63
d	100	144	64
e	101	145	65
f	102	146	66
g	103	147	67
h	104	150	68
i	105	151	69

ASCII Code Conversion Chart

Terminal Interface

ASCII	DECIMAL	OCTAL	HEX
j	106	152	6A
k	107	153	6B
l	108	154	6C
m	109	155	6D
n	110	156	6E
o	111	157	6F
p	112	160	70
q	113	161	71
r	114	162	72
s	115	163	73
t	116	164	74
u	117	165	75
v	118	166	76
w	119	167	77
x	120	170	78
y	121	171	79
z	122	172	7A
{	123	173	7B
|	124	174	7C
}	125	175	7D
~	126	176	7E
RUBOUT (DEL)	127	177	7F