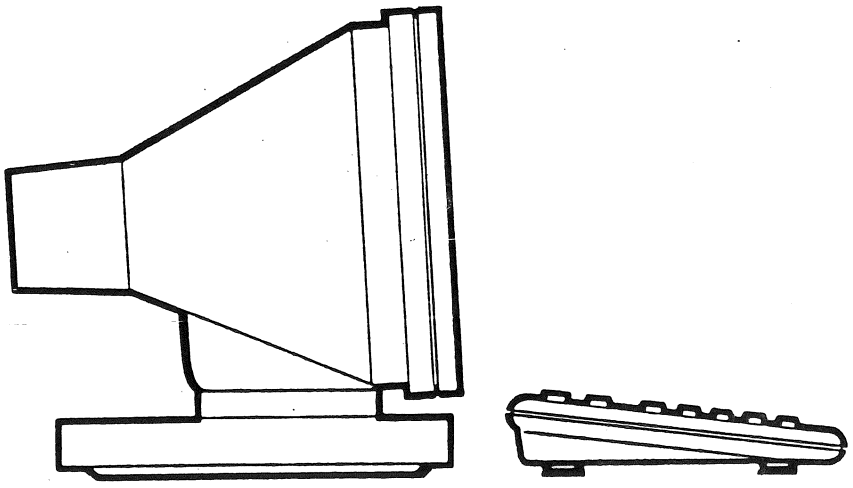
VISUAL

Visual 603

Programmer's Reference Manual



Visual 603

Programmer's Reference Manual

Visual Technology Incorporated
1703 Middlesex Street
Lowell, Mass 01851

Disclaimer:

The information contained in this manual is believed to be accurate and reliable. However, Visual Technology Incorporated assumes no responsibility for any errors, omissions or inaccuracies whatsoever. Without limiting the foregoing, VISUAL TECHNOLOGY INCORPORATED DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE INFORMATION CONTAINED IN THIS MANUAL AND THE HARDWARE AND FIRMWARE DESCRIBED HEREIN. The entire risk as to the quality and performance of such information and equipment is upon the buyer or user. Visual Technology Incorporated shall not be liable for any damages, including special or consequential damages arising out of the use of such information or equipment even if Visual Technology Incorporated has been advised in advance of such damages. The use of the information contained in this manual and the equipment described herein is subject to Visual Technology Incorporated's standard license agreement which must be executed by the buyer or user before the use of such information or firmware.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you.

FCC Notice:

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause interference to radio communications. The Visual 603 terminal has been tested and found to comply with the FCC limits set for a Class A computing device, pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when operating in a commercial environment. Shielded interface cables were used on all ports for FCC radiated emission testing. Operation of the equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be appropriate to correct the interference.

Table Of Contents

CHAPTER 3 TERMINAL CONTROL CODES

CHAPTER 4 RECEIVED CODES

CHAPTER 5 TEKTRONIX 4010/4014 GRAPHICS MODE

FIGURES

TABLES

PREFACE

This Visual 603 Programmer`s Reference Guide provides information required to program the Visual 603 Integrated Text and Graphics (ITAG) station/terminal.

Chapter 1. Introduction - Chapter 1 provides a product overview that sets operational and functional expectations and acquaints the reader with the Visual 603 terminal.

Chapter 2. Code Tables and Character Sets - Chapter 2 provides information needed to understand how code tables are organized to accomodate the various character sets available for the Visual 603. Other information includes procedures for mapping hard (ROM-based) and soft (down line loadable) character sets into code tables, and procedures for designing, down line loading and clearing the soft character set.

Chapter 3. Terminal Control Codes - Chapter 3 provides information about the codes that are transmitted by the various keys. These descriptions help the programmer to access the necessary codes for programming.

Chapter 4. Received Codes - Chapter 4 describes the effects of received codes on the Visual 603 terminal. These descriptions help the programmer to fully control all of the terminal's resources.

Chapter 5. Tektronix 4010/4014 Graphics Mode - Chapter 5 provides the control commands to operate the graphics capabilities of the Visual 603.

Appendices

The appendices include miscellaneous information and summaries of other topics discussed in the document. The appendices include:

- Appendix A, Terminal Specifications
- Appendix B, Visual 603 Terminal Set-Up Menus
- Appendix C, National Language Keyboards
- Appendix D, Quick Reference for Graphics Commands

CHAPTER 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The Visual 603 Integrated Text and Graphics (ITAG) station/terminal is a high resolution, monochromatic, bit-mapped text and graphics display station/terminal. The Visual 603 design provides it with the flexibility and power to emulate Digital Equipment Corporation's VT220, Tektronix 4010/4014, and the Visual 550 terminals.

The Visual 603 terminal can run any application(s) that are run on a DEC VT220 terminal. It can also provide Tektronix 4010/4014 and Visual 550 enhanced graphics. The Visual 603 terminal is illustrated in Figure 1-1.

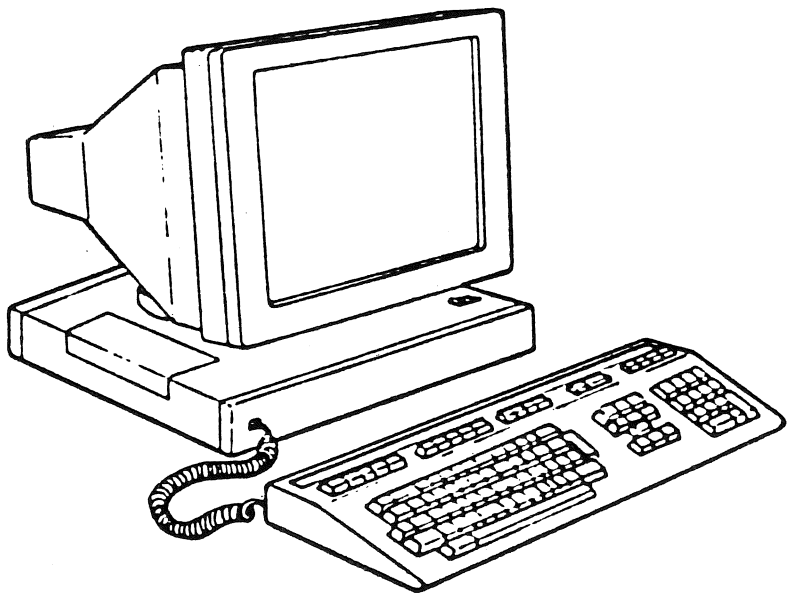


Figure 1-1 Visual 603 Integrated Text and Graphics Station/Terminal

The Visual 603 terminal provides a variety of character sets, which enables the Visual 603 to be easily adapted to many different alphabets including English, French, German and others. An added feature is the ability for programmers to design custom-tailored character sets.

The programmer can also better integrate the terminal to software applications through a variety of function keys, many of which are programmable.

1.2 Physical Description

The Visual 603 terminal is made up of the following parts:

- o CRT Cabinet (contains the monitor, system unit and power cable). Display and Logic (H xW x D): 13 in. x 12.5 in. x 12.5 in. Weight: 21 lbs.
- o Low-profile detachable keyboard and 6 Ft. keyboard cable. (H x W x D): 1 in. x 20.75 in. x 7.5 in. Weight: 5 lb.
- o Personality Module (provides the Visual 603 functional capabilities.) Weight: .25 lbs.

The CRT cabinet, (comprised of a permanently attached monitor and base) offers the operator a wide range of tilt and swivel positions to choose from for maximum operator comfort.

The low-profile keyboard attaches to the CRT cabinet via a 6 Ft. coiled cable.

The personality module is installed in the personality module compartment. (Refer to the Visual 600 Series Owner's Guides.)

1.3 FUNCTIONAL DESCRIPTION

The functions and features of the Visual 603 terminal are described in this section. The terminal includes:

- o Four alphanumeric character sets including:
  - ASCII characters
  - DEC Multinational characters
  - DEC Special Graphics
  - Downloadable
- o Four additional character fonts provided for Tektronix mode graphics.
- o A writable character generator allows creation of user-defined characters and character sets.
- o The Visual 603 keyboard is a typewriter style DEC VT220 keyboard with an improved return key, built-in home, Escape and backspace keys.

  In addition, the Visual 603 keyboard provides the following:

  - 106 keys with 59 key alpha cluster, 18 key numeric pad, 15 function keys and 11 key editing cluster providing functional control over the terminal and application software.

- N-key rollover prevents the loss of characters should two or more keys be pressed simultaneously.

o Forty-five function keys (15 fixed, 30 shifted User Programmable and Non-volatile allow maximum control of application software as well as local terminal functions. There are three groups of function keys.

  - The twenty top-row function keys (F1 through F20) provide single functions such as controlling Set-Up mode menu parameters.

  - 15 non-volatile host-programmable function keys (F6 through F20) accept up to 30 programmable sequences (with up to 1024 characters total).

    When pressed alone, each programmable function key transmits a permanently programmed sequence to the host system.

    When pressed in combination with the Ctrl or the Shift key, each key can transmit either of two programmed sequences to the host system.

  - Function key sequences may be sent to the host or locally to the screen only.

o A status line indicates the current operating mode (i.e., On Line or local), the time and the current cursor location. This status line appears on the 25th line of the display. This leaves 24 display lines that may be used by application software.

o Configurable functions such as communications parameters or terminal modes may be selected from the keyboard via Set-Up Mode. Refer to Appendix B for the Visual 603 Set-Up menus.

o Visual character attributes include double high/wide characters; bold, blink, blank, underscore, dim, reverse, and normal video.

o The Visual 603 has the following graphics features:

  - attributes include 17 characters sizes.

  - operating modes of alphagrahics, graphics, integrated text and graphics

  - graphing modes: vector plot, point plot, incremental point plot, alphagraphics, GIN

1.4 OPERATING STATES

The Visual 603 terminal has three operating states but only operates in one at any given time. The operating states are:

- o On-line
- o Local
- o Set-Up

1.4.1 On Line

Data is routed to the host computer when the terminal is On line. A Local Echo feature (if enabled in Set-Up) also routes data from the keyboard to the monitor screen.

This is the normal operating state used when running applications with the terminal. The On Line state is entered via the mini-menu display. The mini-menu is entered when the Set-Up key is pressed.

1.4.2 Local

In the Local state, terminal transmission and reception of data is 'frozen'. Keyboard data is routed to the monitor screen only. The Local state is entered via the mini-menu display. The mini-menu is entered when the Set-Up key is pressed.

1.4.3 Set-Up

Set-Up is similar to the Local state in that transmission and reception of data is suspended. Set-Up is used to select or change the terminal's operating parameters and is entered (and exited) by pressing the Set-Up key (F3) then the right arrow (--->) key on the keyboard. Refer to Appendix B for the Visual 603 Set-Up menus.

1.5 OPERATING MODES

In order to ensure compatability with the DEC VT220 and Tektronix 4010/4014 terminals, the Visual 603 has these four operating modes:

- o VT220 compatible mode
- o VT100 compatible mode
- o VT52 compatible mode
- o Tektronix 4010/4014 Graphics mode
- o Integrated Text and Graphics (ITAG) mode

1.5.1 VT220 Compatible Mode

This mode is used to execute standard ANSI functions and utilizes the full range of VT220 features.

This mode is typically used with application programs that expect 8-bit control characters and DEC multinational characters.

1.5.2 VT100 Compatible Mode

This mode executes standard ANSI functions and should be used with application programs that require strict compatibility with VT100 terminals.

1.5.3 VT52 Compatible Mode

This mode executes standard ANSI functions and should be used with application programs that require strict compatibility with VT52 terminals.

1.5.4 Tektronix 4010/4014 Mode

This mode is a graphics mode that executes Tektronix graphics functions, plus adds Visual 550 graphics extensions along with many new graphics features.

1.5.5 Integrated Text and Graphics (ITAG) Mode

The ITAG mode allows alpha text and graphics to be displayed at the same time. This is done by allowing graphics mode and 132 alpha text mode to be entered and exited without clearing the screen.

1.6 OPERATING MODE DIFFERENCES

Table 1-1 lists the available operating modes and highlights some differences among them.

Table 1-1 Terminal Mode Comparison

Mode	Control codes executed	Received codes executed	Transmitted codes
VT220 compatible (8-bit controls)	ANSI	7- and 8-bit	7- and 8-bit
VT100 compatible	ANSI	7-bit	7-bit
VT52 compatible	DEC private	7-bit	7-bit
Tektronix	ANSI	7-bit	7-bit

1.7 TERMINAL ENHANCEMENTS

The Visual 603 terminal provides many enhancements not found on the DEC VT220, Tektronix 4010/4014 or the Visual 550 terminals. Table 1-2 highlights just some of the enhancements that are found on the Visual 603 terminal.

Table 1-2 Visual 603 Terminal Enhancements

Visual 603 Terminal	DEC VT220 Terminal
14" CRT P192 (Page white) Phosphor (green or amber optional).	12" CRT.
13 x 16 pixel resolution.	10 x 10 pixel resolution.
Status line on 25th line.	Status line on 24th line.
Home cursor key.	No such key.
Tilt and swivel base.	Tilt only.

Other Visual 603 enhancements are:

- o Tilt adjustable keyboard
- o 50 line mode (132 characters)
- o Small computer system interface (SCSI) Port (phase B)
- o 70 Hz screen refresh and a 32 KHz for a stable, flicker-free high resolution image (1056 x 400 pixels)
- o Overscanned video
- o Two pages of graphics display memory (so that as one graphics page is being downloaded, the other graphics page is displayed)
- o Integrated text and graphics on the same plane of memory (so software can be written to display a graphics image, then display alphanumeric data - with any VT220 display attribute mixed with the graphics image.

1.7.1 Windows

The Visual 603 supports the creation of a user-defined window that may be any size and appear anywhere on the screen.

1.8 OPTIONS

The Visual 603 supports the following optional peripheral devices:

- o Printers:
  - DEC LA50/100, Okidata ML 182, Datasouth DS180, Hewlett-Packard Laser Jet Plus, Epson FX-80, Epson LQ-1000
- o Plotters:
  - Hewlett-Packard 7470
- o Bit Pads:
  - GTCO Digi-Pad 515A, Summagraphics Bit-Pad One, Summagraphics Bit-Pad two
- o Mice:
  - Summagraphics MM Mouse, Genius Mouse

1.9 Special User Features

The Visual 603 provides the following desk top accessories:

- Calendar
- Calculator
- Alarm Clock

Refer to the Visual 600 Series Terminal Owner's Guide for more about the User Features.

CHAPTER 2
CODE TABLES AND CHARACTER SETS

2.1 OVERVIEW

This chapter describes how code tables are organized to accomodate the various character sets available for the Visual 603 Integrated Text and Graphics(ITAG) Station/terminal. Other information includes:

- Procedures for mapping hard (ROM-based) and soft (down-line loadable) character sets into code tables.
- Procedures for designing, down-line loading and clearing soft character sets.

2.2 CODE TABLES

The Visual 603 ITAG Station/terminal can generate and interpret seven- and eight-bit characters. A code table provides a "picture" of how seven- and eight-bit codes are organized for use by the Visual 603 ITAG Station/terminal. Since the terminal supports several character sets, it is essential to know which groups of characters in the code table are replaced when character sets are interchanged.

Up to 128 character codes can be represented using seven bits (The eighth bit is not set and is assumed to be 0). These codes and their character equivalents occupy the left half of the table. In seven-bit environments, only the codes in the left half of the table are used. The codes in the right half cannot be used.

Up to 256 character codes can be represented using eight bits. These codes and their character equivalents occupy the right half of the table. In eight-bit environments, the codes in the entire table may be used.

Figure 2-1 illustrates the Multinational Character set which is a typical code table for seven-bit and eight-bit characters.

				BIT 8	0	0	0	0	0	0	0	0
				BIT 7	0	0	0	0	1	1	1	1
				BIT 6	0	0	1	1	0	0	1	1
				BIT 5	0	1	0	1	0	1	0	1
BIT 4	BIT 3	BIT 2	BIT 1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	_	o	DEL

C0 CODES ASCII GRAPHIC CHARACTERS

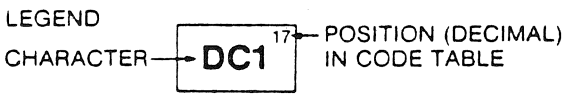
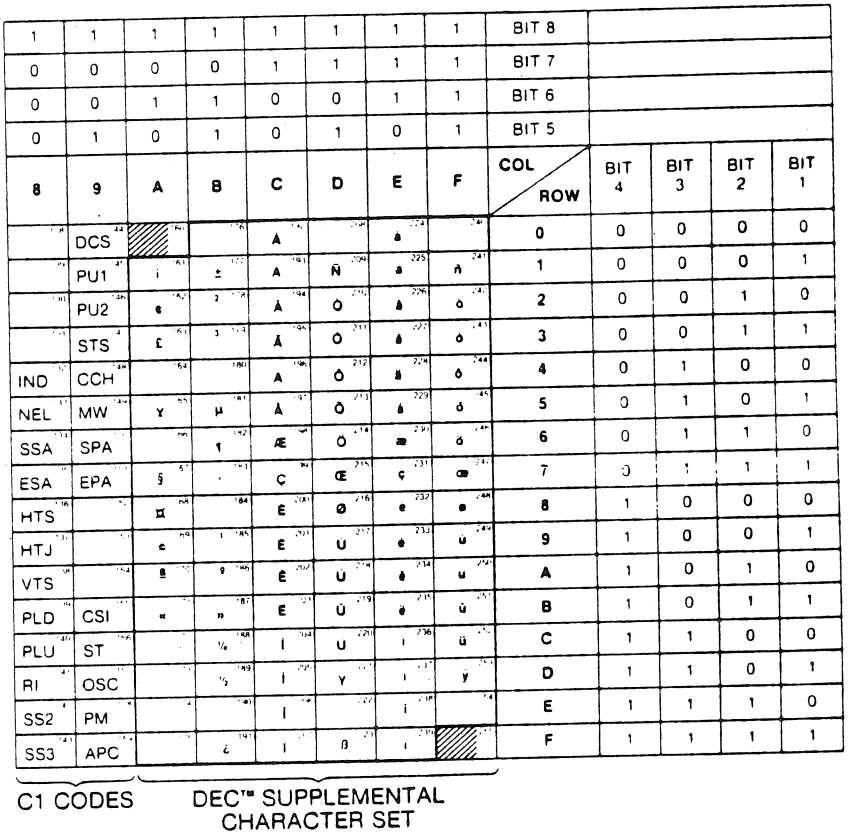


Figure 2-1 Typical Code Table for Seven-Bit and Eight-Bit Characters (Sheet 1 of 2)



1	1	1	1	1	1	1	1	BIT 8				
0	0	0	0	1	1	1	1	BIT 7				
0	0	1	1	0	0	1	1	BIT 6				
0	1	0	1	0	1	0	1	BIT 5				
8	9	A	B	C	D	E	F	COL / ROW	BIT 4	BIT 3	BIT 2	BIT 1
	DCS			A		à		0	0	0	0	0
	PU1	¡	±	A	Ñ	à	ñ	1	0	0	0	1
	PU2	¢	2	Á	Ò	á	ò	2	0	0	1	0
	STS	£	3	Â	Ó	â	ó	3	0	0	1	1
IND	CCH			A	Ô	ã	ô	4	0	1	0	0
NEL	MW	¥	µ	Ä	Ö	ä	õ	5	0	1	0	1
SSA	SPA		¶	Æ	Ö	æ	ö	6	0	1	1	0
ESA	EPA	§	·	Ç	Œ	ç	œ	7	0	1	1	1
HTS		¤		È	Ø	è	ø	8	1	0	0	0
HTJ		¢	1	É	U	é	u	9	1	0	0	1
VTS		£	º	Ê	U	ê	u	A	1	0	1	0
PLD	CSI	«	»	E	Ü	ë	ü	B	1	0	1	1
PLU	ST		¼	Í	U	ì	ü	C	1	1	0	0
RI	OSC		½	Í	Y	í	y	D	1	1	0	1
SS2	PM			Î		î		E	1	1	1	0
SS3	APC		¿	Ï	ß	ï		F	1	1	1	1

C1 CODES

DEC™ SUPPLEMENTAL CHARACTER SET

Figure 2-1 Typical Code Table for Seven-Bit and Eight-Bit Characters (Sheet 2 of 2)

A code table is divided into four regions as shown in Figure 2-2. The regions have the following functions:

- The C0 (control 0) region contains 7-bit ASCII (Americal Standard Code for Information Interchange) control characters. These characters are not usually displayed but they do perform special functions in data communications and text processing.

- The C1 (control 1) region contains 8-bit ASCII control characters that provide additional data communication and text processing functions.

- The GL (graphics left) region may contain up to 94 seven-bit characters that can be displayed on a terminal. The graphic characters may include alphanumeric characters as well as punctuation marks and other symbols. SP (space) is considered to be apart from all character sets. DEL (delete) is always ignored by the terminal.

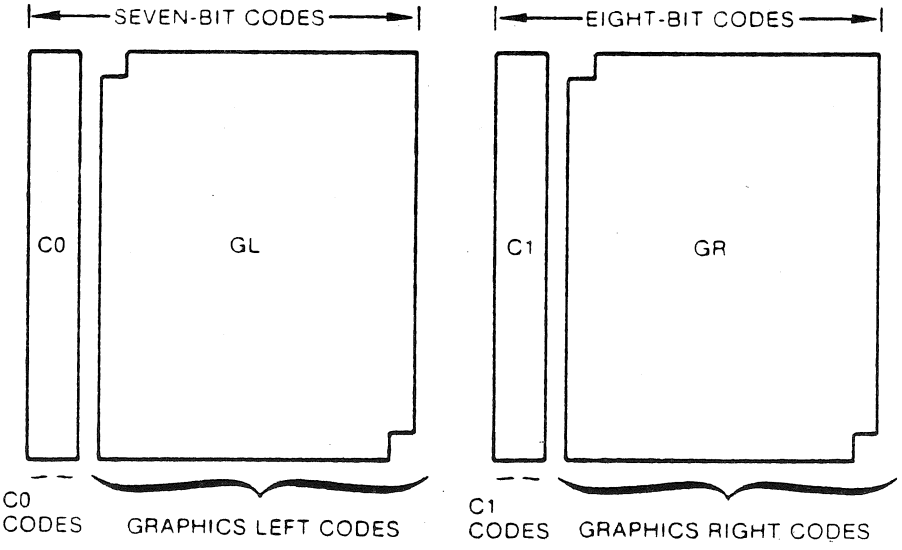


Figure 2-2 Four Regions of the 8-Bit Code Table

- The GR (graphics right) region may contain up to 94 eight-bit characters that can be displayed on a terminal. The graphic characters may include alphanumeric characters as well as punctuation marks and other symbols.

2.3 CHARACTER SETS

The Visual 603 ITAG Station/terminal supports a variety of "hard" and "soft" character sets. The hard character sets are permanently stored in read-only memory (ROM) and cannot be changed by users. Hard character sets include:

- ASCII Graphics Set
- DECtm Special Graphics
- DECtm Multinational Character Set (ASCII Graphics Set and DECtm Supplemental Graphics Set).
- United Kingdom National Set
- Display Controls Set
- Tektronix Graphics Character Sets (four sizes)

Soft character sets may be designed by a programmer and then down-line loaded to the terminal from a host computer. Soft character sets may include up to 94 characters.

Hard and soft character sets may be "mapped" into the GL and/or GR regions of the code table. The C0 and C1 regions of the Table always contain the ASCII control codes with their predefined functions.

NOTE

Each Alpha mode character set consists of one set of characters for 80 column mode and another set for 132 column mode.

The Tektronix Graphics character sets work in graphics (132 column) mode only.

Soft character sets must be designed with the particular screen width desired in mind.

2.3.1 ASCII Character Set

The ASCII Character Set is shown in Table 2-1. This character set contains control and graphic characters defined by ANSI X3.4

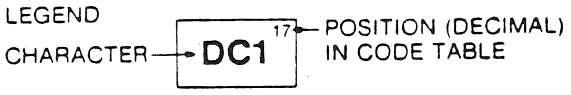
2.3.2 United Kingdom National Set

The United Kingdom National Set differs from the ASCII Character Set only in that the # sign is replaced by the - sign. This set is available for use only in the VT100 or VT52 compatible modes.

Table 2-1. ASCII Character Set Code Table

				BIT 8	0	0	0	0	0	0	0	0
				BIT 7	0	0	0	0	1	1	1	1
				BIT 6	0	0	1	1	0	0	1	1
				BIT 5	0	1	0	1	0	1	0	1
BIT 4	BIT 3	BIT 2	BIT 1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	_	o	DEL

C0 CODES ASCII GRAPHIC CHARACTERS



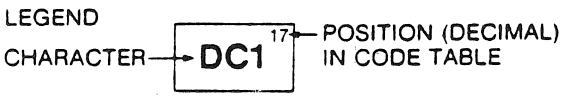
2.3.3 DEC Special Graphics

The DEC Special Graphics Set includes ASCII C0 control codes, some alphanumeric graphic characters and a set of special symbols and line segments. The symbols and line segments can be used for drawing simple figures while in text mode. This set is shown in Table 2-2.

Table 2-2. DECtm Special Graphics Set

				BIT 8	0	0	0	0	0	0	0	0
				BIT 7	0	0	0	0	1	1	1	1
				BIT 6	0	0	1	1	0	0	1	1
				BIT 5	0	1	0	1	0	1	0	1
BIT 4	BIT 3	BIT 2	BIT 1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	♦	– SCAN 3
0	0	0	1	1	SOH	DC1	!	1	A	Q	▒	– SCAN 6
0	0	1	0	2	STX	DC2	"	2	B	R	␉	– SCAN 8
0	0	1	1	3	ETX	DC3	#	3	C	S	␌	– SCAN 11
0	1	0	0	4	EOT	DC4	$	4	D	T	␍	├
0	1	0	1	5	ENQ	NAK	%	5	E	U	␊	┤
0	1	1	0	6	ACK	SYN	&	6	F	V	°	┴
0	1	1	1	7	BEL	ETB	'	7	G	W	±	┬
1	0	0	0	8	BS	CAN	(	8	H	X	␤	│
1	0	0	1	9	HT	EM	)	9	I	Y	␋	≤
1	0	1	0	A	LF	SUB	*	:	J	Z	┘	≥
1	0	1	1	B	VT	ESC	+	;	K	[	┐	π
1	1	0	0	C	FF	FS	,	<	L	\	┌	≠
1	1	0	1	D	CR	GS	-	=	M	]	└	£
1	1	1	0	E	SO	RS	.	>	N	^	┼	·
1	1	1	1	F	SI	US	/	?	O	_	– SCAN 9	DEL

C0 CODES DEC™ SPECIAL GRAPHICS SET



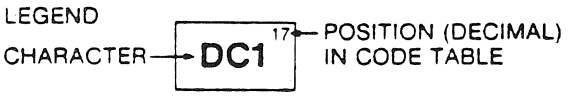
2.3.4 DEC Multinational Character Set

The DEC Multinational Character Set (see Table 2-3)is made up of the ASCII Character Set, the C1 control codes and the DEC Supplemental Graphics Set (the DEC Supplemental Graphics Set occupies the GR region of the code table)

Table 2-3. DECtm Multinational Character Set (Sheet 1 of 2)

				BIT 8	0	0	0	0	0	0	0	0
				BIT 7	0	0	0	0	1	1	1	1
				BIT 6	0	0	1	1	0	0	1	1
				BIT 5	0	1	0	1	0	1	0	1
BIT 4	BIT 3	BIT 2	BIT 1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	_	o	DEL

C0 CODES ASCII GRAPHIC CHARACTERS



The DEC Supplemental Graphics Set includes alphabetic characters with diacritical marks that appear in major Western European alphabets. The DEC Supplemental Graphics Set is not available in the VT100 and VT52 modes.

The DEC Multinational Character Set is the (factory programmed) default character set that is mapped into the code table.

Table 2-3. DECtm Multinational Character Set (Sheet 2 of 2)

1	1	1	1	1	1	1	1	BIT 8				
0	0	0	0	1	1	1	1	BIT 7				
0	0	1	1	0	0	1	1	BIT 6				
0	1	0	1	0	1	0	1	BIT 5				
8	9	A	B	C	D	E	F	COL / ROW	BIT 4	BIT 3	BIT 2	BIT 1
	DCS			A		à		0	0	0	0	0
	PU1	¡	±	A	Ñ	à	ñ	1	0	0	0	1
	PU2	¢	²	Á	Ò	á	ò	2	0	0	1	0
	STS	£	³	Â	Ó	â	ó	3	0	0	1	1
IND	CCH			A	Ô	ã	ô	4	0	1	0	0
NEL	MW	¥	µ	Ä	Õ	ä	õ	5	0	1	0	1
SSA	SPA		¶	Æ	Ö	æ	ö	6	0	1	1	0
ESA	EPA	§	·	C	Œ	ç	œ	7	0	1	1	1
HTS		¤		È	Ø	è	ø	8	1	0	0	0
HTJ		©	¹	É	U	é	u	9	1	0	0	1
VTS		ª	º	Ê	U	ê	u	A	1	0	1	0
PLD	CSI	«	»	Ë	Ü	ë	ü	B	1	0	1	1
PLU	ST		¼	I	U	ì	ü	C	1	1	0	0
RI	OSC		½	I	Y	í	ÿ	D	1	1	0	1
SS2	PM			I		î		E	1	1	1	0
SS3	APC		¿	Ï	ß	ï		F	1	1	1	1

C1 CODES — DEC™ SUPPLEMENTAL CHARACTER SET

2.3.5 Display Controls Character Set

The Display Controls character set is mapped into the code table when the "display controls" mode is selected from the display Set-Up menu. When this mode is selected, the control codes are displayed on the terminal screen. The controls are not executed (except for VT, LF, and FF which perform a new line function after the code is displayed). The Display Controls character set is shown in Table 2-4.

Table 2-4. Display Controls Character Set (Sheet 1 of 2)

				BIT 8	0	0	0	0	0	0	0	0
				BIT 7	0	0	0	0	1	1	1	1
				BIT 6	0	0	1	1	0	0	1	1
				BIT 5	0	1	0	1	0	1	0	1
BIT 4	BIT 3	BIT 2	BIT 1	COL / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	$^{N}_{U}$	$^{D}_{L}$		0	@	P		p
0	0	0	1	1	$^{S}_{H}$	$^{D}_{1}$	!	1	A	Q	a	q
0	0	1	0	2	$^{S}_{X}$	$^{D}_{2}$	"	2	B	R	b	r
0	0	1	1	3	$^{E}_{X}$	$^{D}_{3}$	#	3	C	S	c	s
0	1	0	0	4	$^{E}_{T}$	$^{D}_{4}$	$	4	D	T	d	t
0	1	0	1	5	$^{E}_{Q}$	$^{N}_{K}$	%	5	E	U	e	u
0	1	1	0	6	$^{A}_{K}$	$^{S}_{Y}$	&	6	F	V	f	v
0	1	1	1	7	$^{B}_{L}$	$^{E}_{B}$	'	7	G	W	g	w
1	0	0	0	8	$^{B}_{S}$	$^{C}_{N}$	(	8	H	X	h	x
1	0	0	1	9	$^{H}_{T}$	$^{E}_{M}$	)	9	I	Y	i	y
1	0	1	0	A	$^{L}_{F}$	$^{S}_{\uparrow}$	*	:	J	Z	j	z
1	0	1	1	B	$^{V}_{T}$	$^{E}_{C}$	+	;	K	[	k	{
1	1	0	0	C	$^{F}_{F}$	$^{F}_{S}$	,	<	L	\	l	|
1	1	0	1	D	$^{C}_{R}$	$^{G}_{S}$	-	=	M	]	m	}
1	1	1	0	E	$^{S}_{O}$	$^{R}_{S}$	.	>	N	^	n	~
1	1	1	1	F	$^{S}_{I}$	$^{U}_{S}$	/	?	O	_	o	DEL

C0 CODES

DISPLAY CONTROLS CHARACTERS

Table 2-4 Display Controls Character Set (Sheet 2 of 2)

1	1	1	1	1	1	1	1	BIT 8				
0	0	0	0	1	1	1	1	BIT 7				
0	0	1	1	0	0	1	1	BIT 6				
0	1	0	1	0	1	0	1	BIT 5				
8	9	A	B	C	D	E	F	COL / ROW	BIT 4	BIT 3	BIT 2	BIT 1
8_0	9_0	A_0	°	À	D_0	à	F_0	0	0	0	0	0
8_1	9_1	¡	±	Á	Ñ	á	ñ	1	0	0	0	1
8_2	9_2	¢	²	Â	Ò	â	ò	2	0	0	1	0
8_3	9_3	£	³	Ã	Ó	ã	ó	3	0	0	1	1
8_4	9_4	A_4	B_4	Ä	Ô	ä	ô	4	0	1	0	0
8_5	9_5	¥	µ	Å	Õ	å	õ	5	0	1	0	1
8_6	9_6	A_6	¶	Æ	Ö	æ	ö	6	0	1	1	0
8_7	9_7	§	·	Ç	Œ	ç	œ	7	0	1	1	1
8_8	9_8	¤	B_8	È	Ø	è	ø	8	1	0	0	0
8_9	9_9	‘	¹	É	Ù	é	ù	9	1	0	0	1
8_A	9_A	“	º	Ê	Ú	ê	ú	A	1	0	1	0
8_B	9_B	«	»	Ë	Û	ë	û	B	1	0	1	1
8_C	9_C	A_C	¼	Ì	Ü	ì	ü	C	1	1	0	0
8_D	9_D	A_D	½	Í	Ý	í	ý	D	1	1	0	1
8_E	9_E	A_E	B_E	Î	D_E	î	F_E	E	1	1	1	0
8_F	9_F	A_F	¿	Ï	ß	ï	□	F	1	1	1	1

C1 CODES

DISPLAY CONTROLS CHARACTERS

2.4 CHARACTER SETS AND NATIONAL ALPHABETS

The following example describes what happens when a key is pressed on a national keyboard (such as German) and that keyboard has been selected from the keyboard Set-Up menu.

The annotated illustration (Figure 2-3) aids in describing the process that takes place. The circled numbers in the illustration correspond with the numbered steps below.

1. The B key (unshifted) on the German keyboard sends a 2B (hex) scan code to the Visual 603 ITAG Station/terminal (the 2B [hex] scan code corresponds to the key's position on the keyboard).
2. The terminal reads the keyboard scan code and interprets it as 0DF (hex).
3. The hex code (0DF) is sent to the host system which processes the code according to the current application.
4. If echo is enabled, the 0DF code is sent (returned) to the Visual 603 Integrated ITAG Station/terminal.
5. The terminal sees the 0DF code from the host and fetches the character from the corresponding position in the 8-bit code table.
6. If the Multinational Character set is invoked (as shown in Table 2-3), the B character is sent to the monitor screen.

NOTE

The character that is sent to the monitor screen depends on the character set invoked into that region of the code table.

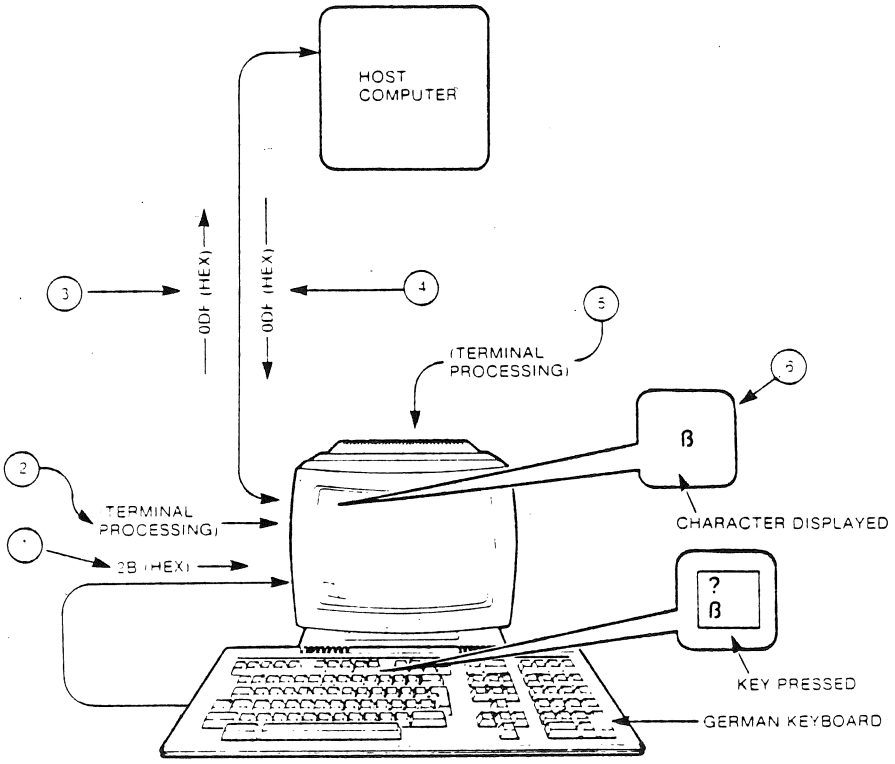


Figure 2-3. Keyboards and Character Sets

2.5 CHARACTER SET SELECTION

This section describes the procedures for designating hard and soft character sets. The procedures for mapping designated sets into the code table are also described.

2.5.1 Default Character Set

Each time the Visual 603 ITAG Station/terminal is powered-up or reset, the DEC Multinational Character Set is mapped into the code table.

2.5.2 Changing Character Sets

Once the Visual 603 ITAG Station/terminal is powered-up or reset, hard character sets can be "designated" and then mapped into specified regions of the code table.

In VT200 compatible mode a soft character set defined by a programmer can be down-line loaded to a font-buffer (soft character sets may contain up to 94 characters each). The soft character set may be designated and then mapped into the code table.

NOTE

Soft character sets are not supported in the VT100 compatible mode.

Figures 2-4 and 2-5 illustrate the concept of designating and mapping character sets in VT100 and VT200 modes respectively.

2.5.2.1 Designating Hard Character Sets --Before any other character set can be mapped into the code table, it must first be designated as G0, G1, G2, or G3. Once designated, a character set is "on call" for use by the program.

Hard (ROM-based) character sets (ASCII, U.K. National, DEC Supplemental, and DEC Special Graphics Set) can be designated using the escape sequences shown in Table 2-5.

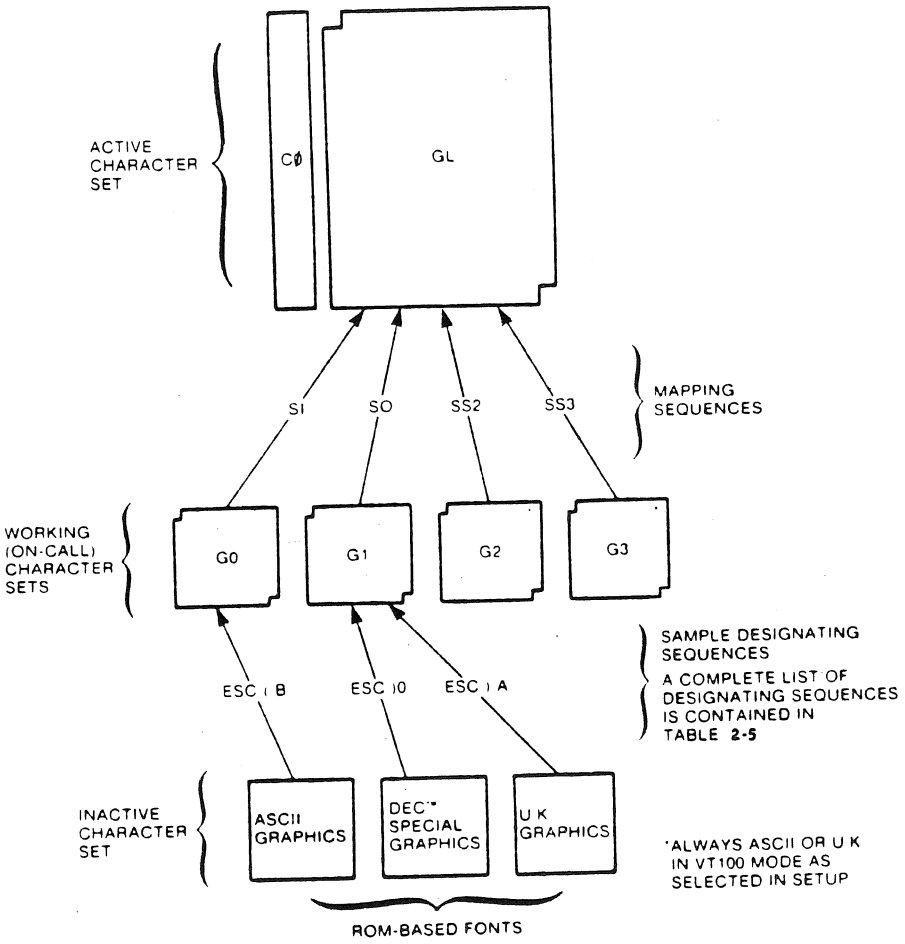


Figure 2-4. Designating and Mapping Character Sets (VT100 Mode)

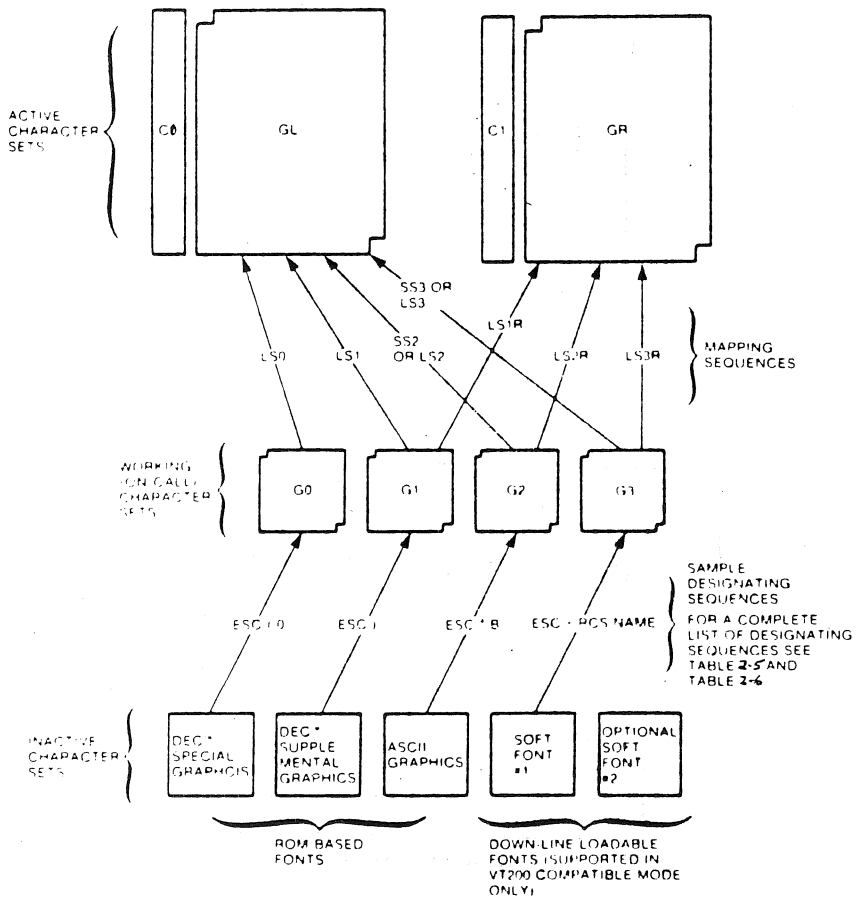


Figure 2-5. Designating and Mapping Character Sets (VT200 Mode)

Table 2-5 Designating Hard Character Sets

Character Set	Designate As:	Use Coding Sequence
ASCII	G0 (Default)	ESC (B
	G1	ESC) B
	G2 (VT200 Mode only)	ESC * B
	G3 (VT200 Mode only)	ESC + B
DEC Special Graphics	G0	ESC (0
	G1 (Default)	ESC) 0
	G2 (VT200 Mode only)	ESC * 0
	G3 (VT200 Mode only)	ESC + 0
DEC Supplemental (VT200 Mode only)	G0	ESC (<
	G1	ESC) <
	G2 (Default)	ESC * <
	G3 (Default)	ESC + <
U.K. National (VT100 Mode Only)	G0	ESC (A
	G1	ESC) A

2.5.2.2 Designating Soft Character Sets -- A soft character set may be designated when the Visual 603 ITAG Station/terminal is in the VT200 compatible mode.

There is only font buffer space for soft character set available. The character set may be loaded to work in 80 or 132 column mode, but the same set may not be used for both. The download PCMS (parameter character matrix size) sets the RCS cell size depending on the character compatible mode desired (i.e. DEC VT220, Visual 220 or Visual 603 modes). The PMCS has been expanded to the following:

- o 0-4 = 10 high cell. Font will be moved down 5 scan lines. This is to stay compatible with DEC.
- o 5-8 = 12 high cell. Font will be moved down 3 scan lines. This is to staty compatible with the Visual 220.
- o 9-12 = 16 high cell. The font must be loaded with 3 sixel (six pixels) patterns. The first 2 patterns with 6 significant bits. The third sixel with 4 significant bits for a 16 high cell.

The downline load sequence width parameter (Pw) currently has no effect. Therefore, no matter what font width is ascribed to Pw, i.e.: 0 and 4 or 5 and 9, etc. all fonts are treated in the same manner.

The downline load text sequence parameter (Pt) which specifies whether the software treats the font as a text font or a full cell font is reserved for future use and is ignored by the terminal.

NOTES

- Soft character sets are not supported in VT100 or VT52 modes.
- Before a soft character set can be designated, it must be down-line loaded into the Visual 603 ITAG Station/terminal font buffer (see Down-Line Loading Characters).

The soft set may be designated to replace or be used in addition to hard character sets.

The soft character set may be designated using the escape sequences in Table 2-6.

Table 2-6 Designating Soft Character Sets

Escape Sequence *	Designate As:
ESC (RCS name	G0
ESC) RCS name	G1
ESC * RCS name	G2
ESC + RCS name	G3

* An RCS name is a variable that specifies the soft character set. An RCS name must be previously assigned to any soft character set that is to be down-line loaded.

The RCS name specifies the desired soft character set and has the following syntax:

RCS name	Description
I I F	RCS name syntax
	An RCS name can contain from zero to two intermediate values (I) and one final value (F). The intermediate values are in the range of SP to / (column 2 in the code table). Final values are in the range of 0 to ~ (column 3 through column 7 excluding DEL in the code table).
	21,567 RCS names can be generated according to the above scheme.

Examples of RCS names are as follows:

SP @	Defines the character set as an unregistered soft set. This value is the recommended default value for user-defined sets.
B	Defines the character set to be ASCII.
0	Defines the character set to be DEC special graphics.
% $ V	Defines the character set to be % $ V. This is currently an unregistered set.

NOTE

If the RCS name is that of an existing character set (ASCII [B], Special Graphics [0] or Supplemental [<], the existing character set is replaced only until the terminal is reset or the soft character set is renamed.

2.5.3 Invoking Character Sets

Once a character set has been designated, it is placed in the working set of character sets. It can then be mapped into the desired GL or GR region of the code table. Character sets can be "lock shifted" or "single shifted" into the code table.

2.5.3.1 Using Locking Shifts to Invoke Character Sets -- Locking shifts imply that the character set is shifted into the code table and locked there. A lock-shifted set remains active until it is temporarily displaced by a single shift or permanently replaced by another lock-shift. Other conditions that may result in replacement of lock-shifted sets include:

- Hard reset or soft reset
- Changing terminal emulation

Character sets may be lock-shifted into the code table by using the coding sequences shown in Table 2-7.

Table 2-7 Invoking Character Sets Using Locking Shifts

Control Mnemonic	Name Meaning	Coding	Function
LS0	Lock Shift G0	SI	Map set G0 into GL (Default setting)
LS1	Lock Shift G1	SO	Map set G1 into GL.
LS2 *	Lock Shift G2	ESC n	Map set G2 into GL. This sequence may cause software compatibility problems.
LS3 *	Lock Shift G3	ESC o	Map set G3 into GL. This sequence may cause software compatibility problems.
LS1R *	Lock Shift G1, Right	ESC ~	Map set G1 into GR. This sequence may cause software compatibility problems.
LS2R *	Lock Shift G2, Right	ESC }	Map set G0 into GR.
LS3R *	Lock Shift G3, Right	ESC |	Map set G0 into GR.

* Used in VT200 compatible modes only.

2.5.3.2 Using Single Shifts to Invoke Character Sets -- Single shifts imply that the desired character set is temporarily shifted into the code table. A single shifted set remains active only for the next single graphic character. After the single shifted character has been processed, the previous character set is returned to its original region in the code table.

Character sets may be single-shifted into the code table using eight-bit control codes (SS2 and SS3). These codes can be expressed as escape sequences when coding for a seven-bit environment. Table 2-8 shows the coding sequences for both environments.

Table 2-8 Invoking Character Sets Using Single Shifts

Coding Sequence 8-Bit	7-Bit	Function
SS2	ESC N	Map G2 into GL for the next graphic character.
SS3	ESC O	Map G3 into GL for the next graphic character.

2.6 DESIGNING A CHARACTER SET

The Visual 603 allows users to design a redefinable character set (RCS) containing up to 94 characters in a Visual 603 mode, a DEC VT200 compatible mode and a Visual 220 compatible mode. Once created, these characters can be down-line loaded into the terminals font buffer using a device control string (DCS).

NOTE

These characters are not loaded into the terminal's saveable RAM and are lost when the terminal power is shut off.

The Visual 603 enhanced RCS cell size is 13 x 16 (13 pixels across and 16 pixels high). Therefore, the largest character can be 13x16 pixels. Figure 2-6 shows the full 13x16 Visual 603 RCS cell.

Of course, creating a character to the full RCS cell size (13 x 16) will present spacing problems when characters are displayed on the screen (i.e., characters colliding). When designing a character, keep in mind that a portion of the RCS cell bordering the character should not be used. This blank border is required, to provide proper spacing between characters when they are displayed on the screen and thereby avoid character collision.

2.6.1 Visual 603 Upper Case Characters

Figure 2-7 shows a typical upper case 'W'. Notice that all upper case characters are 11 x 11. This provides propler spacing and avoids the collison of characters when the characters are displayed on the screen.

In Figure 2-7, notice that the top two rows of the RCS cell are blank, the bottom three rows and columns 1 and 13 are blank. These unused (blank) pixels around the character ensure appropriate spacing between characters when they are displayed on the screen.

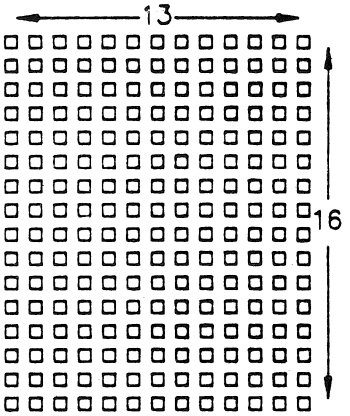


Figure 2-6. Visual 603 RCS Cell Size

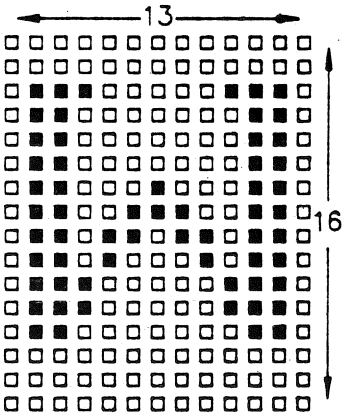


Figure 2-7 Visual 603 Upper Case `W'

2.6.2 Lower Case Characters

Typical Visual 603 lower case characters are a 7 x 11 size. Figure 2-8 shows a typical lower case 'w'. In Figure 2-8, notice that the top six rows are blank, the bottom three rows and columns 1 and 13 are blank. Unused (blank) pixels around the character ensure appropriate spacing between characters when they are displayed on the screen.

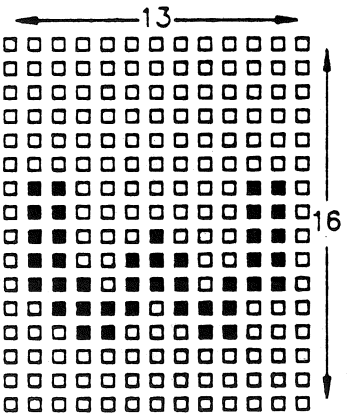


Figure 2-8 The Visual 603 Lower Case `w'

NOTE

However, the programmer can create a character of any size within the 13 x 16 RCS cell size. The programmer should consider spacing and sizing dimensions before designing the RCS characters.

2.6.3 Character Design Examples

The following example illustrates how to design a typical upper case `W' character for the Visual 603 16 scan RCS cell.

Characters are created by designating certain picture elements (pixels) in the RCS cell to be on or off. Pixels that are defined outside the RCS cell are ignored.

1. Design the character as it would appear in the RCS cell. Figure 2-9 shows a typical design for the letter 'W'.

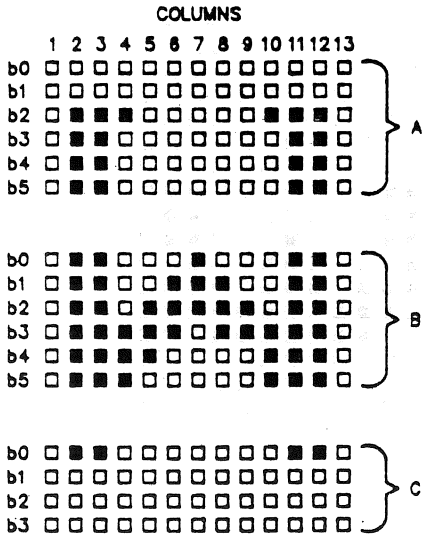


Figure 2-9 Typical RCS Character in RCS Cells

2. Divide and annotate the cell as shown in Figure 2-9. This scheme provides the basis for naming individual pixels in the RCS cell.

   The two upper segments (A & B) are made up of 13 sixel (six-pixel) columns. Each pixel has an assigned bit position with the top pixel in each column corresponding with the least significant bit. The bottom pixel in each column corresponds with the most significant bit.

   The lowest segment is made up of 13 four-pixel columns. Again, the top pixel in each column corresponds with the least significant bit. The bottom pixel in each column corresponds with the most significant bit.

3. Represent each column value by a character from the ASCII code table. Use Figure 2-1 for binary to decimal character conversion. The characters must be between ? and ~ (position 63 and 126 in the ASCII code table).

a. Convert each binary column code to its decimal value.

b. Add the offset (63) to the decimal value to determine each corresponding character position in the ASCII code table.

For example, column 1 of segment A (Figure 2-9) is decoded as follows:

- All pixels off = 000000 = 0 (decimal column value)
- 0 + 63 (offset) = 63 (position in code table)

- Position 63 contains a ? character

One more example, column 2 of segment A (Figure 2-9) is decoded as follows:

- The four most significant bits on, the least significant 2 bits off. This bit setting 111100 = 60 (decimal value)

- 60 + 63 (offset) = 123 (position in code table).
- Position 123 contains a { character.

Thus the example letter 'W' is represented by the following:

- ?{{C?????C{{/ The slash (/) advances pixel interpretation from the upper segment A RCS columns to the middle segment B RCS columns.

- ?~~WGMFMGW~~?/ The slash (/) advances pixel interpretation from the middle segment B columns to the lower segment C RCS columns.

- ?@@????????@@?

2.6.4 Compensating for DEC-Compatible RCS Characters

The Visual 603 has RCS cells that are 16-scan lines high (refer to Figures 2-6 thru 2-11). For compatibility with the DEC VT220 and Visual 220 terminals, the Visual 603 is capable of displaying 10 scan and 12 scan as well as 16 scan line high cells.

The DEC VT220 terminal has Redefinable Character Set (RCS) cells that are 8 columns across by 10 scan lines (scans) high. The Visual 220 terminal has RCS cells that are 8 columns across by 12 scan lines (scans) high. See Figure 2-10.

To compensate for the scan line differences mentioned above, the Visual 603 automatically shifts DEC-compatible characters down 3 scan lines for Visual 220 RCS cell compatability and 5 scan lines for DEC RCS cell compatability.

When designing a character set to be compatible with the DEC VT 220 mode, use a character size of 7 x 8 (scan lines high). When designing a character set to be compatible with the Visual 220, use a character of 7 x 9 (scan lines high). Figure 2-11 shows the character `W' for both the DEC VT220 mode and the Visual 220 mode and the ASCII code characters used to generate them. Refer to Section 2.7 for information on down line loading characters and selecting various cell sizes.

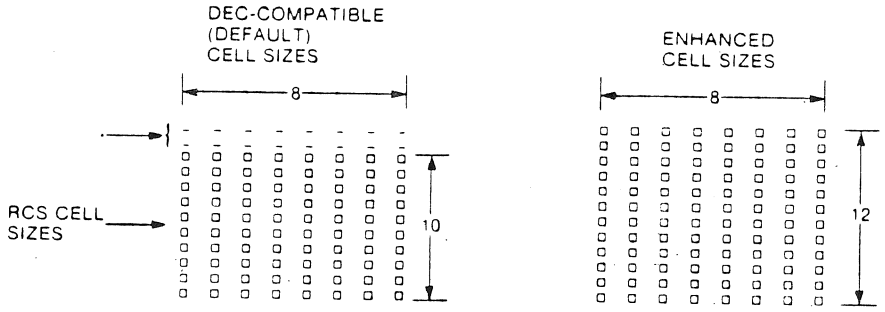


Figure 2-10 DEC VT220 and Visual 220 RCS Cell Sizes

The letter `W' is represented by the following:

o ~?_O_?~/A@???@A for 10-scan RCS cells (DEC VT220 compatible). The slash (/) advances the pixel interpretation from the upper RCS column to the lower column.

o }??????}/NCA@ACN for 12 scan RCS cells (Visual 220 compatible).

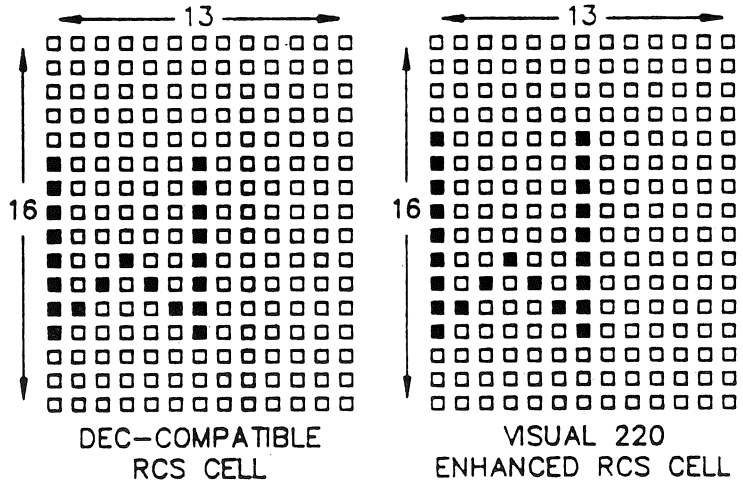


Figure 2-11 DEC VT220 and Visual 220 Character Size

2.7 DOWN-LINE LOADING CHARACTERS

RCS characters and other soft characters can be down-line loaded into the Visual 603 ITAG Station/terminal font buffer. The font buffer has a capacity of 94 characters.

The following device control string (DCS) may be used for down-line loading soft characters:

```
DCS Pfn;Pcn;Pe;Pccs;Pw;Pt { RCS name  Bp1;Bp2;Bp3;...Bpn ST
```

Character groupings in the soft character down-line load DCS are described in Table 2-9.

Table 2-9 Down-Line Load DCS Description

DCS Characters	Description
DCS	Introduces a device control string. DCS is an eight-bit control character that can also be expressed as ESC P when coding for a seven-bit environment.
Pfn;Pcn;Pe;Pccs;Pw;Pt	A parameter substring. The parameter values are discussed in Table 2-10.
{	Identifies the end of the parameter substring and specifies a down-line load sequence.

Table 2-9 Down-Line Load DCS Description (Contd.)

DCS Characters	Description
RCS name	Defines the name for the soft character set. The RCS name is also used in the escape sequence for designating a soft character set (see Section 2.5.2.2).
Bp1;Bp2;Bp3;...Bpn	Character bit patterns for individual RCS characters. Each character bit pattern is separated by a semicolomn (;). Up to 94 bit patterns may be included in the DCS.
ST	String Terminator. ST is an eight-bit control character that can be expressed as ESC \ when coding for seven-bit environments.

Table 2-10 names and describes the parameters for an RCS down-line load sequence.

Table 2-10 Down-Line Load Sequence Parameter Values

Parameters	Name	Description
Pfn	Buffer Number	Specifies the RCS font buffer to be used. Legal values and their definitions are: 0 or 1 = Use standard font buffer.

Table 2-10 Down-Line Load Sequence Parameter Values (Contd.)

Parameters	Name	Description
Pcn	Starting Character Number	Specifies the position in the ASCII code table (and the font buffer) where the first character is to be loaded. 1 specifies position 33 (! in the ASCII table. 94 specifies position 126 (~ in the ASCII table. Default = ! in the ASCII table.
Pe	Erase Control	Specifies which characters in the font buffer are erased before new characters are loaded. Legal values and their definitions are as follows: 0 = erase all characters in the font buffer. 1 = erase those characters that are being reloaded. 2 = erase all characters in all font buffers (standard and optional).
Pccs	Character Cell Size	Specifies the expected limit of the RCS cell size. Legal values and their definitions are as follows:

(DEC)	(Visual 220)	(Visual 603)
0 = Device default (7x10)	5 = (not used)	9 = 11x16
1 = (not used)	6 = 5x12	10 = 11x16
2 = 5x10	7 = 6x12	11 = 11x16
3 = 6x10	8 = 7x12	12 = 11x16
4 = 7x10		

Table 2-10 Down-Line Load Sequence Parameter Values (Contd.)

Parameters	Name	Description
* Pw	Width	Specifies the display width attribute as follows: 0 = Device default 1 = 80 column 2 = 132 column
* Pt	Text/ Full Cell	Specifies whether software treats the font as a text font or a full cell font. Legal values and their definitions are as follows: 0 = Device default (text) 1 = Text 2 = Full cell (not used) Text fonts typically cannot address all pixels individually within a cell. Full cell fonts can individually address all pixels in a cell.

* These parameters are defined for future use. Currently they have no effect.

2.7.1 Down-Line Load Example

The following example describes how to down-line load a typical RCS (Redefinable Character Set). The first letter of this RCS is the letter W that is used in the previous example for designing a character set.

```
DCS 1;1;1 {%$V @?{{?????C{{/?~~WGMFMGW~~?/?@@????????@@? (next
          character);..... ST
```

Table 2-11 describes various parts of the down-line load sequence used in the above example.

Table 2-11 Down-Line Load Example Description

Characters	Description
DCS	Introduces the string
1;1;1	Three parameters define the following: o Selects the standard RCS font buffer. o Specifies the first character as position 33 in the ASCII code table. o Erases those characters that are to be loaded. Note that the parameters Pccs, Pw, and PT are not specified. They default to 0 values.
{	Signals the end of the parameter characters and specifies a down-line load sequence.
%$V	Names the soft character set to be loaded. This RCS name is also used when designating a soft character set.
@?{{C?????C{{	Specifies the pixel positions for the upper 6 rows by 13 columns of the first RCS character
/	Advances the display to the middle columns of the RCS character.
?~~WGMFMGW~~?	Specifies the pixel positions for the lower columns of the first RCS character.
/	Advances the display to the lower columns of the RCS character.
?@@????????@@?	Specifies the pixel positions for the lower columns of the first RCS character.
\	Signals the end of the first RCS character.
ST	Signals the end of the DCS.

2.7.2 Clearing a Down-Line Loaded Character Set

Down-line loaded character sets may be cleared by the following down-line load device control strings:

Control String:	Effect:
DCS 1;1;0 { SP @ ST	Clear font buffer

or

DCS 1;1;2 { SP @ ST

Other ways to clear a down-line loaded character set include:

- Turning off or resetting the terminal.
- Performing Set-Up Recall or Default functions.
- Performing a hard terminal reset (using ESC c sequences).

CHAPTER 3
TERMINAL CONTROL CODES

3.1 OVERVIEW

This chapter provides information required for programming the Visual 603 terminal. Information in this section is divided into the following three topics:

- Operating mode differences. This information helps the programmer to optimize the terminal's capabilities.
- Codes transmitted by the various keys. These descriptions help the programmer to access the necessary codes for programming.
- Effects of received codes. These descriptions help the programmer to fully control all of the terminal's resources.

3.2 OPERATING MODE DESCRIPTIONS

This section describes the four operating modes of the Visual 603 terminal. The mode descriptions assume a compatible communications and host application environment.

There are differences among the operating modes of the Visual 603 that place certain restrictions on some coding sequences. That is, some coding sequences are not supported in every terminal operating mode. These differences are noted within the code descriptions for those coding sequences that are affected.

3.2.1 VT200 Mode (7-bit Controls)

This mode converts 8-bit control codes to the equivalent 7-bit escape sequences before they are sent to the host. Received codes are treated as 8-bit codes. This mode is intended for use in a 7-bit environment. Many VT100-compatible applications operate correctly in this mode.

3.2.2 VT200 Mode (8-bit Controls)

This mode sends and receives 8-bit ANSI codes and utilizes the full range of Visual 603 features. This mode is intended for use in an 8-bit environment.

3.2.3 VT100 Mode

This mode is selected for compatibility with applications and environments intended for use with VT100 terminals. In this mode, the terminal expects and processes 7-bit ANSI codes and certain private functions. The 8th bit of 8-bit codes is ignored.

3.2.4 VT52 Mode

VT52 mode is selected to execute private (non-ANSI) functions only. This mode is used for VT52-compatible applications.

3.2.5 Mode Differences

Some differences between the VT100 and VT200 modes of operation are described in Table 3-1.

Table 3-1 VT100 and VT200 Mode Differences

Area Affected	VT200 Mode	VT100 Mode
Keyboard	Full keyboard capabilities.	VT100 keys only. Function keys F11, F12 and F13 send ESC, BS and LF respectively. Other keys do nothing.
Received Codes	The 8th bit is significant.	The 8th bit is ignored (set to zero).
Character Sets	All Visual 603 character sets (except U.K.) are available.	ASCII, Special Graphics and U.K. only.
C1 Control Codes	Transmitted as 8-bit codes if 8-bit mode is selected.	Transmitted as 7-bit escape sequences.

3.3 TRANSMITTED CODES

This section describes the codes generated by the Visual 603 keyboard. The code descriptions assume that The DECtm Multinational Character Set is mapped into the 8-bit code table as described in Chapter 2.

NOTE

Some codes may be generated internally as a response to codes received from a host system. These codes are described in Section 3.4.

The Visual 603 keyboard shown in Figure 3-1 includes 106 keys that are divided into four groups of keys. The groups are:

- Main keypad
- Editing/Cursor keypad
- Numeric/Application keypad
- Top-row function keys

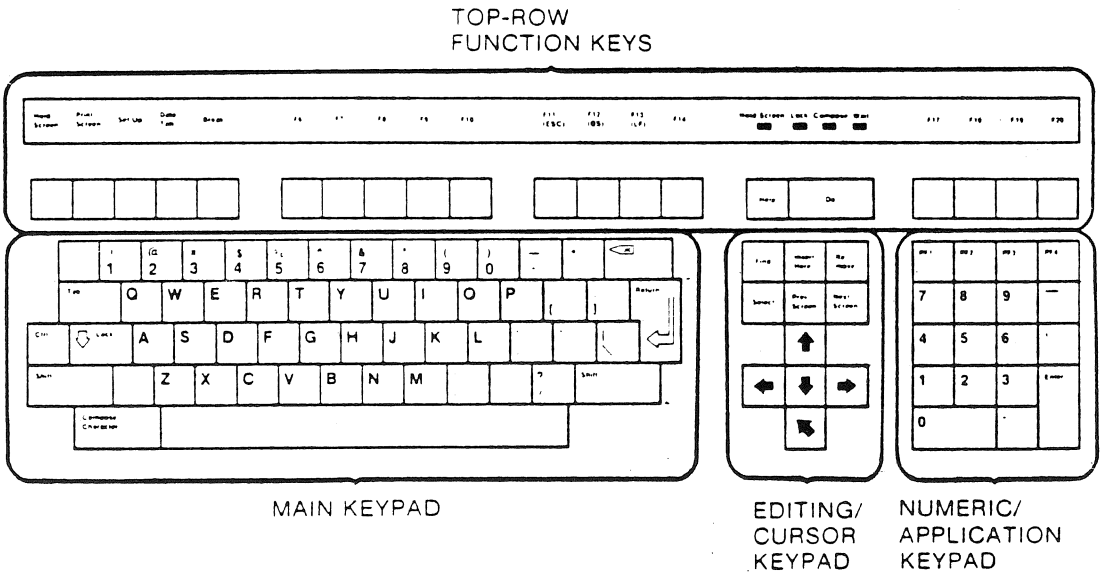


Figure 3-1 Visual 603 (North American) Keyboard

3.3.1 Main Keypad

The main keypad includes standard keys and special action keys. Both types of keys are described below.

3.3.1.1 Standard Keys -- Standard keys generate codes for alphanumeric characters, punctuation marks and other symbols. These keys may be used alone or in combination with special action keys (such as Shift or Control). The character generated depends on several variables including:

- o the character set currently in use,
- o whether Typewriter or Data Processing mode is selected is Set-Up.

3.3.1.2 Special Action Keys -- The main keypad special action keys generate control codes that perform special functions when used alone or in combination with other keys. Table 3-2 describes the function of these keys.

Table 3-2 Main Keypad Special Action Key Functions

Key	Function
Ctrl	This key does not transmit a code. If depressed in combination with another key it transmits control codes to the system. Control codes direct the system to perform predefined operations (see Section 3.3.5).
Shift	This key does not transmit a code. However, when depressed with another alpha-numeric key it causes the generation of the upper case of that letter or the alternate character (if any) printed on that keycap. There are two of these keys for operator convenience.

Table 3-2 Main Keypad Special Action Key Functions (Contd.)

Key	Function
Lock	This key alternately locks or unlocks the alpha characters. When locked, the codes are upper case letters. If Caps Lock is selected, only the alphabetic keys are affected. If Shift Lock is selected, the alpha keys generate only uppercase codes and the numeric/symbol keys generate codes for the alternate (upper) character printed on the keycap.
TAB	This key transmits a horizontal tab code (HT) that moves the cursor to the next tab stop.
RETURN	This key transmits a Carriage Return code. If New Line is enabled this key transmits a Carriage Return and a Linefeed code.
<X| (delete)	Pressing the <X| key generates a DEL or backspace character depending on the Set-Up menu setting. See Appendix B.
Space Bar	Depressing the Space Bar causes a space code to be transmitted.
Compose Character	The Compose Character key is used to create characters that do not exist as standard keys on the selected keyboard.

3.3.2 Editing Keypad

The Editing Keypad contains editing keys and cursor control keys. Editing keys are used by the application program to edit data already entered on the display. The codes generated by the editing keys are shown in Table 3-3.

Table 3-3 Editing Key Codes *

Key	Code Generated
Find	CSI 1 ~
Insert Here	CSI 2 ~
Remove	CSI 3 ~
Select	CSI 4 ~
Prev. Screen	CSI 5 ~
Next Screen	CSI 6 ~

* The editing keys do not generate codes in VT100 or VT52 modes.

Cursor control keys move the cursor. When they are pressed, different codes are generated depending on whether the terminal is in ANSI or VT52 mode. Additionally, codes may differ depending on whether the cursor key mode is set for "normal" (ANSI) cursor control sequences or "application" control sequences.

Cursor key codes generated when the terminal is in ANSI mode are listed in Table 3-4. Cursor key codes generated when the terminal is in VT52 mode are listed in Table 3-5.

Table 3-4 Cursor Key Codes (ANSI Mode *)

Key	Cursor Key Mode	
	Normal	Application
Cursor Up	CSI A	SS3 A
Cursor Down	CSI B	SS3 B
Cursor Right	CSI C	SS3 C
Cursor Left	CSI D	SS3 D
Cursor Home	CSI H	SS3 H

* ANSI mode applies to VT100 and VT200 compatible modes only.

Table 3-5 Cursor Key Codes (VT52 Mode *)

Key	Cursor Key Mode	
	Normal	Application
Cursor Up	ESC A	ESC A
Cursor Down	ESC B	ESC B
Cursor Right	ESC C	ESC C
Cursor Left	ESC D	ESC D
Cursor Home	ESC H	ESC H

* VT52 mode is not ANSI compatible.

3.3.3 Numeric/Application Keypad

Codes generated by the numeric/application keypad may differ depending on whether the terminal is in ANSI or VT52 mode. Additionally, codes may differ depending on whether the numeric/application keypad mode is set to generate "numeric" or "application" control sequences. All of the codes are listed in Table 3-6.

Table 3-6 Numeric/Application Keypad Codes

	ANSI MODE*		VT52 MODE	
Key	Numeric/Application Mode		Numeric/Application Mode	
	Numeric	Application	Numeric	Application
0	0	SS3 p	0	ESC ? p
1	1	SS3 q	1	ESC ? q
2	2	SS3 r	2	ESC ? r
3	3	SS3 s	3	ESC ? s
4	4	SS3 t	4	ESC ? t
5	5	SS3 u	5	ESC ? u
6	6	SS3 v	6	ESC ? v
7	7	SS3 w	7	ESC ? w
8	8	SS3 x	8	ESC ? x
9	9	SS3 y	9	ESC ? y
,	,	SS3 l	,	ESC ? l
-	-	SS3 m	-	ESC ? m
.	.	SS3 n	.	ESC ? n
+ ENTER	CR or CR LF	SS3 M	CR or CR LF	ESC ? M
PF1	SS3 P	SS3 P	ESC P	ESC P
PF2	SS3 Q	SS3 Q	ESC Q	ESC Q
PF3	SS3 R	SS3 R	ESC R	ESC R
PF4	SS3 S	SS3 S	ESC S	ESC S

* ANSI mode applies to VT100 and VT200 modes only.

+ The Enter key transmits a carriage return (CR) or a carriage return and linefeed (CR LF), depending on the New Line setting.

3.3.4 Top-Row Function Keys

The twenty top-row function keys include local function keys (F1 through F5) and programmable function keys (F6 through F20).

3.3.4.1 Local Function Keys -- Local function keys F1 to F5 of the top-row function keys have local functions and do not transmit codes to a host computer. These keys are described in Table 3-7.

Table 3-7 Local Function Key (F1 - F5) Functions

Key	Function(s)
F1 - Hold Screen	Pressing this key freezes the screen and prevents any new characters from being displayed (the Hold Screen LED illuminates). Pressing the key again returns the screen to normal operation. Pressing Hold Screen does not send an XOFF code to the host system. However, if the host is sending data, the terminal transmits an XOFF code when the selected XOFF point is reached.
F2 - Print Screen	If the printer is available, pressing the Print Screen key sends the screen data to the printer. The amount of data sent depends on the print extent selected (Print Full Page/ Scroll Region) from the printer Set-Up menu. Pressing Control-Print Screen toggles Normal/Auto-Print mode from the printer Set-Up menu.
F3 - Set-up	Pressing the Set-up Key causes the terminal to enter or exit Set-up mode.
F4 - Data/Talk	This key has no function.
F5 - Break	Depressing the break key alone causes the terminal to transmit a break signal if break is enabled from the Keyboard Set-up menu (the transmit data line [TXD] is held low.)

Table 3-7 Local Function Key (F1 - F5) Descriptions (Contd.)

Key	Function(s)
	Depressing shift and break simultaneously causes the terminal to turn off Data Terminal Ready (DTR) and Request To Send (RTS). The Transmit Data Line (TXD) is held low. After 0.22 seconds, the terminal tests the condition of Data Set Ready (DSR). When DSR turns off (or after 1.8 seconds), the disconnect is complete. Depressing control and break simultaneously causes the answerback message to be transmitted (the answerback message is controlled from the Keyboard Set-Up menu).

3.3.4.2 Programmable Function Keys -- Each of the top-row programmable function keys (F6 through F20) may have up to three separate functions depending on the condition of the Shift and Ctrl keys.

When the Shift key is shifted (held down), the function keys F6 through F20 are assigned host-programmable messages for application purposes. When the Ctrl key is held down, alternate host-programmable messages are assigned.

When the Shift key is unshifted, the top-row function keys F6 through F20 (including HELP and DO) of the top-row function keys have functions that are described in Table 3-8.

NOTE

The normal and shift position sequences may be exchanged (one for the other) if desired, via the Set-Up menu Parameters. Refer to Appendix B for the Visual 603 Set-Up menus.

Table 3-8 Programmable Function Key (F6 - F20) Descriptions

	Function Key Number (Name)	Codes Generated VT200 Mode	VT100/VT52 Mode
	F6	CSI 17 ~	- - -
	F7	CSI 18 ~	- - -
	F8	CSI 19 ~	- - -
	F9	CSI 20 ~	- - -
	F10	CSI 21 ~	- - -
*	F11 (ESC)	CSI 23 ~	ESC (Escape)
*	F12 (BS)	CSI 24 ~	BS (Backspace)
*	F13 (LF)	CSI 25 ~	LF (Linefeed)
	F14	CSI 26 ~	- - -
	F15 (HELP)	CSI 28 ~	- - -
	F16 (DO)	CSI 29 ~	- - -
	F17	CSI 31 ~	- - -
	F18	CSI 32 ~	- - -
	F19	CSI 33 ~	- - -
	F20	CSI 34 ~	- - -

* The name in parentheses is applicable only in VT100 or VT52 modes.

3.3.5 Generating C0 Control Codes

C0 control codes (7-bit codes) can be generated using Ctrl key sequences (Ctrl key sequences are created by holding down the Ctrl key and pressing other specified keys). Table 3-9 provides the sequences used to generate C0 control codes.

3.3.6 Generating C1 Control Codes

C1 (8-bit) control codes can be generated using 7-bit code extension techniques. In general, any C1 code can be expressed by sending the C0 code ESC followed by a second ASCII character that is 64 (decimal) less that that of the C1 character. For example, the C1 characters IND, CSI and SS2 can be expressed as follows:

C1 Character	Code Extension Equivalent
IND	ESC D
CSI	ESC [
SS3	ESC O

Table 3-9 Keystroke Sequences for Generating C0 Control Codes

C0 Control Code Mnemonic	Key pressed with Ctrl (All Modes)	Dedicated Function Key or Special Action Key
NUL	2 or space	
SOH	A	
STX	B	
ETX	C	
EOT	D	
INQ	E	
ACK	F	
BEL	G	
BS	H	F12 (BS) *
HT	I	Tab
LF	J	F13 (LF) *
VT	K	
FF	L	
CR	M	Return
SO	N	
SI	O	
DLE	P	
DC1 (XOFF)	Q +	
DC2	R	
DC3 (XON)	S +	
DC4	T	
NAK	U	
SYN	V	
ETB	W	
CAN	X	
EM	Y	
SUB	Z	
ESC	3 or [	F11 (ESC) *
FS	4 or /	
GS	5 or]	
RS	6 or ~	
US	7 or ?	
DEL	8	<X_|

* Pertains to VT100- and VT52-compatible modes only.

+ If XON/OFF flow control is enabled, these keys (pressed in combination with the Ctrl key) toggle the Hold Screen state.

CHAPTER 4
RECEIVED CODES

This chapter describes how the Visual 603 responds to the various control codes received from an application or a host system.

Control codes are used in programs to determine how the terminal handles data from an application or a host system. Control codes can determine such things as:

- o setting the operating mode of the terminal.
- o setting specified tab stops.
- o moving the cursor to predefined points on the display.
- o changing character sets.

All control codes can be expressed as single-byte or multi-byte codes. Single-byte codes (C0 and C1 codes) generate a limited number of control functions. Multi-byte codes, however, can perform many more functions due to the variety of combinations possible. The multi-byte codes are divided into three categories:

- o Escape Sequences
- o Control Sequences
- o Device Control Strings

Escape sequences are made up of one or more 7-bit codes (represented by ASCII characters) that are preceded by the code for the C0 character "ESC".

An example of an escape sequence is ESC [2 J. This sequence causes the entire display to be erased (the cursor does not move).

Control sequences are made up of one or more 7-bit codes (represented by ASCII characters) that are preceded by the code for the C1 character "CSI". Note that CSI can also be expressed as the escape sequence ESC [.

NOTE
CSI may be used whenever possible to gain processing speed.

An example of a control sequence is CSI K. This sequence causes the line to the right of the cursor to be erased (including the character in the cursor position). The cursor does not move. The equivalent escape sequence for this control sequence is ESC [K.

Device control strings are used to down-line load character set, program function keys F6 through F20 and to program the time-of-day clock.

A device control string is made up of an opening delimiter a data stream and a closing delimiter and has the following format:

DCS Control String Data ST

DCS (C1 code 90 hex) is the opening delimiter that can also be described as the escape sequence ESC P. ST (string terminator) is the closing delimiter. ST can also be expressed as the escape sequence ESC \.

4.1 C0 and C1 Control Characters

This section describes how the Visual 603 responds to C0 and C1 Control Characters that are received from the application or host system. Not all control characters have an effect on the Visual 603. Table 4-1 describes the allowable C0 Control Codes.

Table 4-1 C0 Control Code Functions

Code	Hex Value	Terminal's Response
NUL	00	Ignored when received.
ENQ	05	Initiates Answerback message. .
BEL	07	Rings bell if Warning Bell is enabled.
BS	08	Moves cursor one position to the left. No action occurs if cursor is at left margin.
HT	09	Moves cursor to next tab stop, or to end of line if no more tab stops.
LF	0A	Moves cursor down one line or to the left margin depending on the setting of new line mode. Causes a scroll if the cursor is at the bottom line of the scroll region. Also causes printing of current line if auto print is enabled.
VT	0B	Same as LF.
FF	0C	Same as LF.
CR	0D	Moves cursor to first column of current line (this action is not affected by the setting of the New Line mode).
SO	0E	Invokes G1 character set into GL.
SI	0F	Invokes G0 character set into GL.
DC1	11	XON code.
DC3	13	XOFF code.
CAN	18	If received during an escape or control sequence, cancels the sequence. No error character is displayed.
SUB	1A	Same as CAN, except causes a reverse question mark ( ) to be displayed.
ESC	1B	Initiates control sequence.
DEL	7F	Ignored. Should not be used as a filler.

The C1 control characters require 8-bit codes and are recognized only when the terminal is in 8-bit compatible mode. Table 4-2 describes the terminal's response to C1 control characters. Equivalent 7-bit escape sequences are provided for coding in a 7-bit environment.

Table 4-2 C1 Control Code Functions

Code Name	Hex Value	7-Bit Code Equivalent	Terminal's Response
IND	84	ESC D	Moves cursor down one line in the same column. If cursor is at bottom margin, initiates scroll up.
NEL	85	ESC E	Moves cursor to first column of next line. Initiates scroll up if cursor is at bottom margin.
HTS	88	ESC H	Sets a horizontal tab at the cursor position.
RI	8D	ESC M	Moves cursor up one line in the same column. If cursor is at top margin, initiates scroll down.
SS2	8E	ESC N	Invokes G2 character set into GL for next character only.
SS3	8F	ESC O	Invokes G3 character set into GL for next character only.
DCS	90	ESC P	Recognizes opening delimiter of Device Control String.
CSI	9B	ESC [	Recognizes opening delimiter of extended escape sequences.
ST	9C	ESC \	Recognizes closing delimiter of Device Control String.

4.2 Control Sequences Recognized in ANSI (X3.64) Mode

This section describes those control sequences recognized by the Visual 603 that conform to the basic format specified by ANSI X3.64. Example (spaces are for clarity only):

ESC [Ps/Pn X or CSI Ps/Pn X

Certain control sequences that are not actually specified in the X3.64 standard are noted. The following conventions are used to identify non-ANSI (X3.64) control sequences:

- Non-ANSI DEC sequences are marked "(private)".
- Sequences that are not present in the DEC VT220 are marked "[VISUAL]". These sequences are enhancements to the DEC VT220.

4.2.1 Mode Set and Reset Control Sequences

Control sequences allow the host to set (and reset) terminal parameters. The parameters that are menu-selectable (in Set-Up) can be saved in non-volatile memory.

NOTE

Certain paremeters can be "locked" by using Set-Up mode. Features that are locked cannot be changed by the host.

This section identifies control sequences and parameter values required to set and reset various Visual 603 operating modes. The following sequences are only valid in ANSI mode.

SET MODE COMMAND — CSI Ps ; Ps ; ... Ps h

The Set Mode command is the control sequence used to change Visual 603 operating modes or parameters.

Ps represents a single mode value. A Set Mode control sequence can contain up to 16 different mode values. The modes and values are provided in Table 4-3.

An example of a Set Mode sequence is CSI 12 ; 7 ; 8 h. This sequence configures the terminal for local echo.

RESET MODE COMMAND — CSI Ps ; Ps ; ... Ps l

The Reset Mode command is the control sequence used to reset ANSI and non-ANSI modes. The various modes are described in Table 4-3.

Table 4-3 describes the set/reset modes available in the Visual 603. The modes that include the question mark (?) as part of the selected parameters are private modes that enhance the operation of the Visual 603.

NOTE

If a question mark (?) is used, it must be the first character in the parameter string. All subsequent parameters in the sequence are affected by the question mark.

Table 4-3 Set/Reset Mode Ps Values and Definitions

Mode Name	Ps Value	Function
50/25 Line Mode	1	When set, this command sets the screen to 50 lines if the terminal is in 132 column mode (the command has no effect in if the terminal is in 80 column mode). When reset, this command sets the screen to the previous mode.
Keyboard Action	2	When set, this command locks the keyboard. When reset, this command unlocks the keyboard.
Control Representation Mode [VISUAL]	3	When set, this command causes all characters, including control characters to be displayed on the screen. Control characters are represented by the underlined capital letter corresponding to their position while other characters are displayed with normal attributes. Setting this mode prevents any control sequences from being acted upon except for the code to reset control representation mode. When reset, control characters are only acted upon, not displayed.

Table 4-3 Set/Reset Mode Ps Values and Definitions (Contd.)

Mode Name	Ps Value	Definition
Insertion-Replacement	4	The terminal displays received characters at the cursor position. This mode determines how the terminal adds characters to the screen. When set, insert mode displays the character and moves previously displayed characters to the right. Characters never wrap past the end of the line. When reset, replace mode adds characters by replacing the character at the cursor position.
Send/Receive Mode	12	When set, no local echo of transmitted data occurs. When reset, this mode causes the transmitted data to be echoed back to the terminal display.
Linefeed / New Line Mode	20	When set, this mode causes the Return key to generate the CR (carriage return) and LF (line feed) codes. When reset, the return key generates a CR code only. LF is generated by the Line Feed key.
Cursor Key Mode (private)	? 1	When set, this mode causes the cursor positioning keys to generate special escape sequences. When reset, the cursor position keys transmit their normal ANSI mode sequences. Cursor Key / Set / Reset UP: SS3 A / CSI A DOWN: SS3 B / CSI B LEFT: SS3 C / CSI C RIGHT: SS3 D / CSI D HOME: SS3 H / CSI H

Table 4-3 Set/Reset Mode Ps Values and Definitions (Contd.)

Mode Name	Ps Value	Definition
VT52/ANSI Mode (private)	? 2	The set mode sequence is not applicable for VT52/ANSI Mode. Use ESC<. When reset, this mode causes the terminal to respond to DEC VT52 mode control sequences.
80/132 Column (private)	? 3	When set, this mode configures the terminal for 132 column display width. When reset, the terminal is configured for 80 column display width.
Scrolling Mode (private)	? 4	When set, the terminal goes into smooth scrolling mode. When reset, the terminal goes into step scrolling mode.
Reverse Video (private)	? 5	When set, this mode causes the screen t form characters with dark dots on a light background. When reset, the screen forms characters with light dots on a dark background.
Origin Mode (private)	? 6	When set, this mode causes line and column numbers to be dependent on the selected scrolling region and home in the scrolling region. The cursor moves to the new home position after the mode changes. When reset, line and column numbers are independent of the selected scrolling region.
Autowrap Mode (private)	? 7	When set, this mode causes the cursor to automatically advance to the first position of the next line when characters are entered after the last column position is reached. When reset, the cursor does not move (wrap) to the next line. This function does not affect Tab, however. Tab never moves the cursor to the next line.

Table 4-3 Set/Reset Mode Ps Values and Definitions (Contd.)

Mode Name	Ps Value	Definition
Autorepeat Mode (private)	? 8	When set, this mode causes most keys to be autorepeating. When reset, no keys autorepeat.
Status Line Visibility (private)	? 9	When set, the status line is invisible. When reset, the status line is visible.
Clock Visibility (private)	? 10	When set the clock is not displayed. When reset, the clock is displayed.
Text Cursor Enable (private)	? 25	When set, this mode causes the text cursor to be visible. When reset, the text cursor is not displayed.
ITAG Mode	? 50	When set, the terminal enters 80 column integrated text and graphics (ITAG) mode. When reset, the terminal exits ITAG mode to the previous mode.

4.2.2 Define Scrolling Region -- This (private) command selects the portion of the terminal screen to be used for displaying data.

SCROLLING REGION COMMAND CSI r1 ; r2 r (private)

The scrolling region command is used to set the top and bottom lines of the screen scrolling region where "r1" defines the first line of scrolling region and "r2" defines the last line of the scrolling region. The minimum number of scrolling lines are two. The default values are 1 for r1 and 24 for r2. The following examples illustrate the effect of various scrolling region commands.

Command Examples	Lines Included in Scrolling Region
ESC [r	1 - 24
ESC [10; 20 r	10 - 20
ESC [10 r	10 - 24
ESC [; 20 r	1 - 20

Once the scrolling region is defined, the cursor positioning commands may move the cursor into but not out of the scrolling region. The only exception to this rule is when Origin Mode is reset and the Absolute Cursor Addressing commands are used. After this command is executed, the cursor moves to the home position, as defined by Origin Mode.

4.2.3 Cursor Control Commands -- The Visual 603 provides a wide variety of cursor motions to insure that the operator can position the cursor most efficiently. The default value of all cursor movement commands is one.

The cursor positioning commands described in this section may cause a varying action depending on two factors: The defined scrolling region and the current state of the Origin mode. Once the scrolling region is defined, incremental cursor positioning commands, (Up, Down, Right, Left) can position the cursor anywhere within the scrolling region, but cannot position the cursor outside of the scrolling region. The Absolute Cursor Positioning command remains unaffected by the screen scrolling region unless the Origin Mode is set.

CURSOR UP CSI Pn A

This command moves the cursor up Pn lines. Pn can be 1 to 255. The cursor cannot move past the top margin.

CURSOR DOWN CSI Pn B

This command moves the cursor down Pn lines. Pn can be 1 to 255. The cursor cannot move past the bottom margin.

CURSOR RIGHT CSI Pn C

This command moves the cursor right Pn characters. Pn can be 1 to 255. The cursor cannot move past right margin.

CURSOR LEFT CSI Pn D

This command moves the cursor left Pn characters. Pn can be 1 to 255. The cursor cannot move past the left margin.

ABSOLUTE CURSOR POSITIONING

CSI r ; c H
CSI r ; c f

Either of the absolute cursor positioning commands may be used to position the cursor anywhere on the terminal screen between lines (rows) 1 and 24 for the line count and between columns 1 and 80 (or 1 and 132) for the character count. The default values are 1. The line (row) count is specified by r and the column count by c.

If an attempt is made to position the cursor past the screen boundaries, the cursor moves to the screen boundary. If r or c are not selected or selected as 0, the cursor moves to the first line or column, respectively.

CURSOR INDEX

ESC D

This command causes the cursor to move down one line in the scrolling region. If the cursor moves to the maximum boundary of the scrolling region the terminal scrolls up one line.

CURSOR REVERSE INDEX

ESC M

This command causes the cursor to move up one line in the scrolling region. If the cursor moves to the minimum boundary of the scrolling region the terminal scrolls down one line.

NEXT LINE

ESC E

This sequence causes the cursor to move to the beginning of the next line. If the cursor is positioned on the bottom line of the screen or the bottom of the screen scrolling region, the contents of the scrolling screen or scrolling region scrolls up one line.

SAVE CURSOR

ESC 7 (private)

This (private) sequence causes the cursor position, character set, origin mode selection and graphic rendition to be saved in memory. If the terminal power is shut off or a reset occurs, these values are lost.

RESTORE CURSOR ESC 8 (private)

This sequence causes restoration of the previously saved cursor position, character set, origin mode selection and graphic rendition.

4.2.4 Erasure Commands -- A wide variety of erasing commands permits characters to be removed from the screen without affecting other characters. Characters are lost when they are erased.

ERASE IN PAGE CSI Ps J

This command erases some or all the data on a page depending on the value of Ps (Ps values are described below).

Ps Value	Action
0 (default)	Erase from cursor to end of page, including cursor position.
1	Erase from beginning of screen to cursor, including cursor position.
2	Erase page, all lines changed to single width. Cursor does not move.

ERASE IN LINE CSI Ps K

This command erases some or all the data on a line according to the Ps value (Ps values are described below).

Ps Value	Action
0 (default)	Erase from cursor to end of line, including cursor position
1	Erase from start of line to cursor, including cursor position.
2	Erase line

SELECTIVE ERASE IN PAGE CSI ? Ps J

This (VT200 mode only) command erases some or all erasable data on a page, depending on the value of Ps (Ps values are described below). Erasable characters are those whose logical attribute is set to "erasable".

Ps Value	Action
0 or none	Erase all "erasable" characters from and including the cursor to the end of the screen
1	Erases all "erasable" characters from the beginning of the screen to and including the cursor.
2	Erases all "erasable" characters in the entire display.

SELECTIVE ERASE IN LINE CSI ? Ps K

This (VT200 mode only) command erases some or all erasable data on a line, depending on the value of Ps (Ps values are described below). Erasable characters are those whose logical attribute is set to "erasable".

PS Value	Action
0 or none	Erases all "erasable" characters from the cursor to the end of the line.
1	Erases all "erasable" characters from the beginning of the line up to and including the cursor position.
2	Erases all "erasable" characters on the line.

ERASE CHARACTER CSI Pn X

This (VT200 mode only) command erases characters at the cursor position and the next Pn-1 characters.

4.2.5 Tabbing Commands -- Tabbing commands permit setting and clearing of tab stops.

TABS CLEAR CSI Ps g

This command clears one or more tabs stops depending on the value of Ps (Ps values are described below).

Ps Value	Action
0 (default)	Clears tab at current column
3	Clears all tab stops

SET TAB ESC H

This command sets a Tab Stop at the current cursor position.

4.2.6 Screen Alignment -- The screen alignment command is typically used by field maintenance personnel.

SCREEN ALIGNMENT COMMAND ESC # 8

The screen alignment command fills the screen with upper case E's and may be used to focus and align the terminal display.

DISPLAY CHARACTER SET ESC # 7

The display character set command fills the screen with a character set. The characters on the bottom half of the screen are in double width.

4.2.7 Report Commands and Responses -- The commands in this section allows the host to ask the terminal various questions about its status. The terminal typically responds by returning a specified sequence.

PRIMARY TERMINAL CSI c
CSI 0 c
ESC Z

This command allows the host to ask the terminal to identify itself. A terminal's typical response is shown below.

Terminal's Response:	Meaning
CSI ? 62; 1; 2; 6; 7; 8c	I am a service class 2 (VT200 family) terminal (62) with 132 columns (1), printer port (2), selective erase (6), RCS characters (7) and programmed function keys (8).

TERMINAL CONDITION — CSI 5 n

This command allows the host to ask the terminal's condition. The terminal's response is shown below.

Terminal's Response:	Meaning
CSI 0 n	I have no malfunction.
CSI 3 n	I have a malfunction.

READ CURSOR LOCATION — CSI 6 n

This command allows the host to find out where the terminal's cursor is located. The terminal's response is shown below.

Terminal's Response:	Meaning
CSI r ; c R,	"r" is the row (line) number and "c" is the column number. No parameters or parameters of 0 indicate the cursor is at the home position.

SECONDARY TERMINAL ID — CSI > c or CSI > 0c

This command asks what type of terminal it is, what the firmware version is, and what hardware options you have installed.

Terminal's Response:	Meaning
CSI > Pt; Pv; Po c	I am a Visual ___ terminal (Pt), my firmware rev is (Pv) and I have (Po) options installed.

Parameters	Values	Definitions
Pt	1	Visual 603 terminal
	2	Visual 240/241 terminal
Pv		Decimal (X10) version number Example; Version 3.2 = 32
Po	0	No options

USER DEFINED KEY LOCK CSI ? 25n

This sequence asks the terminal whether the user defined function keys are locked or unlocked. The terminal response may be either of the following:

CSI ? 20 n	User defined keys are unlocked
CSI ? 21 n	User defined keys are locked

4.2.8 Video Attributes -- Characters may be displayed on the terminal in any combination of the following attributes: Bold, Underline, Blank Blink, and Reverse Video.

VIDEO ATTRIBUTE COMMAND CSI Ps ; ... Ps m

This command turns on any or all video attributes. The video attributes are cumulative. When an attribute or combination of attributes is turned on, all subsequently displayed characters remain affected until the attribute (or attributes) is turned off.

Table 4-5 provides the sequences for setting individual attributes.

Table 4-5 Video Attribute Control Sequences

Attribute	Ps Code	Control Sequence
Normal	0 (default)	CSI m
Bold	1	CSI 1 m
Blank	2	CSI 2 m [VISUAL]
Underline	4	CSI 4 m
Blink	5	CSI 5 m
Reverse	7	CSI 7 m
Dim	8	ESC [28 m Off
Dim	8	ESC [8 m On
Display Normal Intensity	22	ESC [22m
Display Not Underlined	24	ESC [24 m
Display not Blinking	25	ESC [25 m
Display Positive Image	27	ESC [27 m

4.2.9 Logical Attributes -- Characters may be assigned an "erasable" or "non-erasable" logical attribute.

SELECT LOGICAL ATTRIBUTES CSI Ps " q

Characters entered on the display may be selected as "erasable" or "non-erasable" using this command. Characters selected as "non-erasable cannot be erased using selective erase control sequences. Once the logical attribute is set, all subsequent characters entered on the display are affected. The video attributes are not affected by this command.

Selectable parameter (Ps) values are shown below.

Ps	Effect
0	All logical attributes off
1	Designate characters as non-erasable
2	Designate characters as erasable

4.2.10 Character Size Commands (Private) -- Characters may be formed on the screen in three different sizes: single height-single width, double height-double width, or single height-double width. When using double size characters, the number of characters per line is halved.

This section describes the various character size commands.

SINGLE HEIGHT - SINGLE WIDTH LINE ESC # 5

This command causes the characters in the line marked by the cursor to be single height-single width.

SINGLE HEIGHT - DOUBLE WIDTH LINE ESC # 6

This command causes the characters in the line marked by the cursor to be single height-double width.

If the line was previously single height-single width, any characters in the right half of the display are lost. The cursor remains under the same character position, unless its character (column) position is lost, in which case the cursor is moved to the right margin.

DOUBLE HEIGHT - DOUBLE WIDTH LINE (TOP HALF) ESC # 3
DOUBLE HEIGHT - DOUBLE WIDTH LINE (BOTTOM HALF) ESC # 4

These two commands are used as a pair, on adjacent lines to form double height-double width characters. The same character must be sent to the same column of both lines to form each character. If the line was previously single-height single-width, all characters from the middle of the line to the end of the line are lost. The cursor remains in the same character position unless the character position is lost, in which case the cursor is moved to the right margin.

4.2.11 Reset Commands -- This section describes hard and soft reset commands. Data not stored in NVR (non-volatile RAM) is lost when these commands are used.

HARD RESET ESC c

This command causes the terminal to reset, and has the same effect as powering-down then powering-up the terminal. All set-up parameters are replaced by their NVR values, or power-up default values if NVR values do not exist.

In addition, this command:

- o performs a communications line disconnect.
- o clears user-defined keys (except non-volatile keys).
- o clears all down-line loaded character sets.
- o clears the display.
- o returns the cursor to the home position.
- o sets the video attributes to normal.
- o resets the selective erase attribute.
- o sets all character sets to the default.

SOFT RESET CSI ! p

The Soft Terminal reset sequence sets the terminal to the power-up default status listed in Table 4-6.

Table 4-6 Soft Terminal Reset Status

Terminal Parameter	Status
Text Cursor	On*
Insert/Replace	Replace
Origin Mode	Absolute
Autowrap	Off*
Keyboard Action	Unlocked
Keypad Mode	Numeric
Cursor Key Mode	Normal
Top Margin	1
Bottom Margin	24
Character Sets:	
G0, G1, GL	ASCII
G2, G3, GR	DEC Supplemental Character Set
Video Character Attributes	Normal
Selective Erase Attributes	Normal (erasable)
Restore Cursor State	
Cursor Position	Home
Character Sets	VT200 defaults
Selective Erase Attribute	Off
Video Attributes	Normal
Origin Mode	Absolute
Character Shift (G0 to GL, G2 to GR, no shifts)	Power Up Defaults

* Ignores the "saved" value in the terminal's non-volatile memory.

4.2.12 Numeric/Application Keypad Commands -- The commands in this section invoke a special set of codes for the Numeric/ Application Keypad. These codes may be used by an application to perform specialized functions.

ENTER APPLICATION KEYPAD MODE ESC =

This sequence causes the terminal to enter Application Keypad mode. When entered, this mode causes keys on the numeric keypad to transmit special escape sequences as opposed to their regular codes. These codes are as follows:

Key	Application Keypad Code
0	SS3 p
1	SS3 q
2	SS3 r
3	SS3 s
4	SS3 t
5	SS3 u
6	SS3 v
7	SS3 w
8	SS3 x
9	SS3 y
-(minus)	SS3 m
,(comma)	SS3 l
.(period)	SS3 n
ENTER	SS3 M
PF1	SS3 P
PF2	SS3 Q
PF3	SS3 R
PF4	SS3 S

EXIT APPLICATION KEYPAD MODE ESC >

This sequence causes the terminal to exit Application Keypad mode. The Numeric/Application keypad keys resume their numeric code functions.

4.2.13 Editing Commands -- The following commands allow the host to delete characters or line and insert lines.

INSERT LINE CSI Pn L

This command insert Pn lines (where Pn can vary from 1 to 255) starting at the line with the cursor. Lines displayed below the cursor move down. Lines moved past the bottom margin are lost. This sequence is ignored when the cursor is outside the scrolling region.

DELETE LINE CSI Pn M

This command deletes Pn lines (where Pn can vary between 1 and 255) starting at the line with the cursor. As lines are deleted, lines below the cursor move up. Lines added to bottom of screen have spaces with same character attributes as last line moved up. This sequence is ignored when the cursor is outside the scrolling region.

INSERT CHARACTER CSI Pn @

This (VT200 mode only) command inserts Pn blank characters at the cursor position, with the character attributes set to normal.

DELETE CHARACTER CSI Pn P

Deletes Pn characters starting with the character at the cursor position. When a character is deleted , all characters to the right of the cursor move left. This creates a space character at the right margin with the character attributes set to normal.

SELECT EMULATION MODE CSI Ps1 ; Ps2 ; " p

This command selects the emulation mode (Ps1) and the control codes for the terminal. The parameter values (Ps1 and Ps2) are defined in Table 4-7.

Table 4-7 Parameter Value Definitions

Parameter	Parameter Value	Definition
Ps1	61	Places the terminal in VT100 mode.
	62	Places the terminal in VT200 mode.
Ps2	0	Selects 8 bit controls (8-bit controls can be transmitted to the host application software).
	1	Selects 7 bit controls (7-bit controls can be transmitted to the host application software).
	2	Selects 8 bit controls.

NOTE

VT200 Modes selected using this control sequence may be altered by also using the sequences to select 7- or 8-bit control codes.

4.2.14 Selecting 7/8 Bit Control Code Transmission -- This section describes commands that may used to determine whether 8-bit control codes or their equivalent 7-bit extensions are sent to the host application.

SELECT 7-BIT CONTROLS ESC sp F

Causes all C1 codes returned to the application program to be converted to their equivalent 7-bit extensions.

Causes the terminal to return C1 codes to the application without converting them to their equivalent 7-bit extensions.

4.2.15 Programming Top-Row Function Keys -- Each top-row function key (F6 through F20) can be programmed with two different values. Programmed values are assigned to key numbers that correspond to function keys pressed in combination with special action keys Shift or Ctrl.

The function keys can be programmed using the following device control string:

DCS Pc; Pl| Kyl/stl; ky2/st2;...kyn/stn ST

String parameters (Pc and Pl) and their effects are described in Table 4-8. Key numbers (kyn) are identified in Table 4-9.

String data (stn) is made up of hexidecimal numbers that correspond to the code table position (hex) of the desired character. Stn data cannot exceed 256 bytes for any single key number. A maximum of 1024 bytes may be shared among all function keys.

Table 4-8 Function Key Control String Parameter Effects

Parameter	Value	Effect
Pc (Clear)	0 or none	Clear all keys before loading new values.
	1	Load new values, clear old only where defined.
Pl (Lock)	0 or none	Lock the keys against future redefinition
	1	Do not lock the keys against future redefinition *

* A Pl value of 1 does not "unlock" locked keys.

Table 4-9 identifies the key numbers for Function keys that are pressed in combination with the Shift or Ctrl keys.

Table 4-9 Top-Row Function Key Numbers

Function Key	Key Number When Pressed in Combination With:	
	Shift	Ctrl
F6	17	35
F7	18	36
F8	19	37
F9	20	38
F10	21	39
F11	23	40
F12	24	41
F13	25	42
F14	26	43
HELP	28	44
DO	29	45
F17	31	46
F18	32	47
F19	33	48
F20	34	49

The following example illustrates a device control string that programs function key F12 (pressed with Ctrl) with the escape sequence ESC [2 J.

DCS 1; 1 | 44 / 1B 5B 32 4A

The following device control string (DCS) may be used for down-line loading soft characters:

DCS Pfn;Pcn;Pe;Pccs;Pw;Pt { RCS name Bp1;Bp2;Bp3;...Bpn ST

String variables are described in Table 4-10. The parameter sub-string (Pfn;Pcn;Pe;Pccs;Pw;Pt) is further defined in Table 4-11.

Table 4-10 Soft Character Down-Line Load DCS Description

DCS Characters	Description
DCS	Introduces a device control string. DCS is an eight-bit control character that can also be expressed as ESC P when coding for a seven-bit environment.
Pfn;Pcn;Pe;Pccs;Pw;Pt	A parameter substring. The parameter values are discussed in Table 4-11.
{	Identifies the end of the parameter substring and specifies a down-line lo d sequence.
RCS name	Defines the name for the soft character set. The RCS name is also used in the escape sequence for designating a soft character set.
Bp1;Bp2;Bp3;...Bpn	Character bit patterns for individual RCS characters. Each character bit pattern is separated by a semicolomn (;). Up to 94 bit patterns may be included in the DCS. Bit patterns are fully described in Chapter 7.
ST	String Terminator. ST is an eight-bit control character that can be expressed as ESC \ when coding for seven-bit environments.

4.2.16 Printer Control Sequences -- The Visual 603 terminal provides a variety of commands to enhance terminal/printer performance.

PRINT PAGE — CSI i or CSI 0 i

XOFF code is sent to host to suspend transmission. Contents of screen or scrolling region are transmitted to printer with CR/LF codes or only CR (depending on New Line selection from the General Set-Up menu) after each line. XON code sent to host to resume transmission once the Print Page function is complete.

If print extent is reset, only the scrolling region is sent to the printer. If print extent is set, the entire screen is transmitted.

If print termination character is set to FF (from the Printer Set-Up menu), a FF character is appended to the end of the transmission.

PRINT CURSOR LINE — CSI ? 1 i

XOFF code is sent to the host to suspend transmission. Contents of cursor line are transmitted to printer with CR/LF codes or only CR (depending on New Line/No New Line Mode selection) after line. XON code sent to host to resume transmission once the Print Line function is complete.

PRINT LINE "P" — CSI ? 1 ; P i [VISUAL]

XOFF code is sent to the host to suspend transmission. Contents of line "P" transmitted to printer with CR/LF codes or only CR (depending on New Line/No New Line Mode selection) after line. XON code is sent to the host to resume transmission once the Print Line function complete.

Line P is in decimal notation between the limits of 1 and 24.

PRINT LINES "P" THROUGH "Q" — CSI ? 1 ; P ; Q i [VISUAL]

XOFF code is sent to the host to suspend transmission. Contents of lines "P" through "Q" are transmitted to printer with CR/LF or only CR (depending on New Line/No New Line Mode selection) after each line. XON code is sent to the host to resume transmission once the Print function complete.

Line P and Q are both in decimal notation between the limits of 1 and 24. This command works independently of the print extent setting.

ENTER PRINTER CONTROLLER MODE CSI 5 i

Data sent from host is passed through the terminal to the printer. XOFF code is sent to host in response to printer busy. XON code sent to host in response to printer not busy.

EXIT PRINTER CONTROLLER MODE CSI 4 i

The terminal exits printer controller mode, and automatically appends the CAN or DEL code (as dictated by the CANCEL SELECT feature). If the PRINTER TYPE feature is on, no code is appended.

ENTER COPY MODE CSI ? 7 i

The terminal enters copy mode. Data sent from host is passed through the terminal to the printer. The data is also displayed on the terminal screen. XOFF code is sent to host in response to printer busy. XON code sent to host in response to printer not busy.

EXIT COPY MODE CSI ? 6 i

The terminal exits copy mode.

ENTER AUTO PRINT MODE CSI ? 5 i

On receipt of LF code, XOFF code is sent to the host. Contents of line are transmitted to printer with CR/LF or only CR (depending on New Line/No New Line Mode selection) after the line. XON code sent to the host after the line is transmitted.

EXIT AUTO PRINT MODE CSI ? 4 i

The terminal exits Auto Print mode.

PRINTER STATUS REPORT CSI ? 15 n

This command allows the host to initiate a test of the printer status. When the terminal receives this command it checks the status of the printer's DTR line and responds in the following manner:

Terminal Response	Meaning
CSI ? 13 n	The printer is not connected. This is detected by verifying that printer DTR has not been on since the terminal was turned on.
CSI ? 11 n	The printer is connected but not ready to print. This is detected by verifying that printer DTR has been on at some time since the terminal was turned on but is not on at present.
CSI ? 10 n	The printer is connected and ready to print.

4.2.17 Printer Set and Reset Modes -- This section defines modes that may be used to control a printer that is connected to the Visual 603 terminal. The parameters that are menu selectable (in Set-Up) can be saved in non-volatile memory.

NOTE
More information on Set and Reset Mode Commands may be found in Section 4.4.2.1.

SET MODE CSI Ps ; Ps ; ... Ps h

This command is used to set certain terminal operating parameters. The Ps (selectable parameter) values are described in Table 4-12. Additional Ps values may be found in Table 4-12.

RESET MODE CSI Ps ; Ps ; ... Ps l

This command is used to reset certain terminal operating parameters. The Ps (selectable parameter) values are described in Table 4-12. Additional Ps values may be found in Table 4-12.

Table 4-12 Printer Set/Reset Mode Parameter Value Definitions

Mode Name	Ps Value	Set/Reset Definitions
Printer Form Feed	? 18 (private)	When set, this mode selects form feed (FF) as the print termination character. The terminal transmits this character to the printer after each print screen. When reset, no print termination character is selected.
Printer Extent	? 19 (private)	When set, the terminal prints the full screen after receiving a print screen command. When reset, the terminal only prints the scrolling region after receiving a print screen command.

4.2.18 Programming the Time-Of-Day Clock

A device control string (DCS) programs the time-of-day clock. The DCS has the following form:

DCS 1; Ps ~ hh : mm : ss ST

Selectable parameters (Ps) values are described as follows:

Ps Value	Effect
0	Use value selected in setup
1	Set to a.m. (standard)
2	Set to p.m. (standard)
3	Use military (24-hour) time

The following examples illustrate the effects of typical device control strings that set the time-of-day clock:

DCS	Effect
DCS 1; 1 ~ 10: 23: 00 ST	10:23 am
DCS 1; 3 ~ 14: 45: ST	14:45 am

4.3 Control Sequences Recognized in VT52 Mode

This section describes those control sequences that are recognized in VT52 mode. Terminal and printer control sequences are discussed.

NOTE
These codes may have an unpredictable effect if used when the terminal is in ANSI mode.

4.3.1 Terminal Control Sequences -- The following control sequences are used to control the terminal when it is in VT52 mode.

MOVE CURSOR UP — ESC A

This sequence causes the cursor to move up one line. If the cursor is positioned on the top line no action occurs.

MOVE CURSOR DOWN — ESC B

This sequence causes the cursor to move down one line. If the cursor is positioned on the bottom line no action occurs.

MOVE CURSOR RIGHT — ESC C

This sequence causes the cursor to move right one position. If the cursor is positioned on the last column of a line no action occurs.

MOVE CURSOR LEFT — ESC D

This sequence causes the cursor to move left one position. If the cursor is positioned in the first column of a line no action occurs.

ENTER GRAPHICS MODE — ESC F

This sequence causes the terminal to enter Graphics mode. When graphics mode is entered, all received lower-case ASCII codes (octal 137-172) and the ASCII codes for {,|,} and ~ (octal 173-176) are displayed as graphic characters.

EXIT GRAPHICS MODE ESC G

This sequence causes the terminal to exit graphics mode.

CURSOR HOME ESC H

This sequence causes the cursor to move to the home position (upper left-hand corner of the screen).

REVERSE LINE FEED ESC I

This sequence causes the cursor to move up one line. If the cursor is positioned on the top line, the contents of the screen scroll down one line.

ERASE TO END OF SCREEN ESC J

This sequence causes erasure of all data from the cursor position to the end of the screen, including cursor position.

ERASE TO END OF LINE ESC K

This sequence causes erasure of all data from the cursor position to the end of the line.

CURSOR ADDRESSING ESC Y r c

This sequence is used for positioning the cursor on an absolute basis. The next two codes following this sequence are to be interpreted as the new line and column positions respectively. Line and column numbers are ASCII characters whose codes are their octal value plus octal 37.

IDENTIFY ESC Z

This sequence requests the terminal to verify that it is a VT52 and is switched on and ready for commmunication. If this is the case, the terminal responds with the VT200 identification sequence (see Section 4.4.2.8).

ENTER APPLICATION KEYPAD MODE

ESC =

This sequence causes the terminal to enter Application Keypad mode. When entered, this mode causes keys on the numeric keypad to transmit special escape sequences as opposed to their regular codes. These codes are as follows:

Key	Application Keypad Codes
0	ESC ? p
1	ESC ? q
2	ESC ? r
3	ESC ? s
4	ESC ? t
5	ESC ? u
6	ESC ? v
7	ESC ? w
8	ESC ? x
9	ESC ? y
-(minus)	ESC ? m
,(comma)	ESC ? l
.(period)	ESC ? n
ENTER	ESC ? M
PF1	ESC P
PF2	ESC Q
PF3	ESC R
PF4	ESC S

EXIT APPLICATION KEYPAD MODE

ESC >

This sequence causes the terminal to exit Application Keypad mode.

ENTER ANSI MODE

ESC <

This sequence causes the terminal to enter ANSI mode.

4.3.2 Printer Control Sequences -- The Visual 603 terminal provides commands to control printer operation when it is in VT52 mode.

PRINT PAGE ESC]

XOFF code is sent to the host to suspend transmission. Contents of the screen are transmitted to the printer with CR/LF codes or only CR (depending on the New Line/No New Line Mode selection) after each line. XON code is sent to the host to resume transmission once the Print Page function is complete.

PRINT LINE Esc V

XOFF code is sent to the host to suspend transmission. Contents of the cursor line are transmitted to the printer with CR/LF codes or only CR (depending on the New Line/No New Line Mode selection) after line. XON code is sent to the host to resume transmission once the Print Line function is complete.

ENTER PRINTER CONTROLLER MODE Esc W

Data sent from the host is passed through terminal to the printer. XOFF code is sent to the host in response to printer busy. XON code is sent to the host in response to printer not busy.

EXIT PRINTER CONTROLLER MODE Esc X

The terminal exits printer controller mode, and automatically appends the CAN or DEL code (as dictyated by the CANCEL SELECT feature). If the PRINTER TYPE feature is on, no code is appended.

ENTER AUTO PRINT MODE Esc ^

On receipt of LF code, XOFF code is sent to the host. Contents of the current line are transmitted to the printer with CR/LF or only CR (depending on the New Line/No New Line Mode selection) after the line. XON code is sent to host after the line is transmitted.

EXIT AUTO PRINT MODE Esc _

The terminal exits Auto Print mode.

4.3.3 Added Escape Sequences

The following escape sequences work in alpha or graphics mode:

ESC [?38h	Sets graphics mode.
ESC [?381	Reset terminal back to alpha mode. The terminal will be put into the mode it was in when graphics mode was entered. If the previous emulation was Tektronix 4010/14, then the terminal returns to Visual 220 7 bit mode.
ESC [?40h	Enter ITAG mode. This mode enables entering and exiting graphics mode without clearing the screen. When graphics mode is exited, the terminal enters 132 column, and whatever emulation it was in when ITAG mode was entered.
ESC [?401	Exit ITAG mode and return to video mode that terminal was in when ITAG mode was entered.
ESC/1 E	Display page 1 (first or default page)
ESC/2 E	Display page 2 (second page)
ESC/1 U	Write to page 1
ESC/2 U	Write to page 2

The following sequences work in alpha mode only.

ESC [2m	Start blank.
ESC [8m	Start dim video.
ESC [28m	Stop dim video.
ESC #7	Fill screen with character set. (test pattern).

4.3.4 ITAG Mode Operation

ITAG mode allows alpha text and graphics to be displayed at the same time. This is done by allowing graphics mode and 132 column alpha mode to be entered and exited without clearing the screen.

An escape sequence puts the terminal in and out of ITAG mode. Note that scrolling is allowed in alpha and graphics modes.

The following escape sequences are used for ITAG mode:

ESC [? 40 h Clears the screen, sets ITAG mode, and enters graphics mode.

After this sequence is received, the normal escape and control sequences may be used to exit (^X) and enter (^/) graphic mode. The screen will not be affected except that status line information will appear on the status line unless it is blanked.

ESC [? 40 l Screen is cleared, terminal goes back into the mode it was in when it received the ESC[?40h sequence.

4.3.5 Windows

The Visual 603 supports the creation of a user defined window that may be any size and appear anywhere on the screen. The window may be opened with the following sequence:

ESC [scol;srow;ecol;erow w

To close the window use the sequence:

ESC [x

NOTE

Starting a second window will automatically close any currently open window, then open the new window. Only <u>one</u> window may be opened on the screen at any given time.

4.3.6 Special Keys

Some keys on the keyboard perform special functions. The following is a list of these special keys:

SHIFT PF1 = Enters graphics alpha-graphics mode. (^_)

SHIFT PF2 = Enable mouse (Visual 630 only)

SHIFT PF3 = Enters interlaced graphics (Visual 630 only)

SHIFT PF4 = Prints the page. (Alpha or graphic)

SHIFT SELECT = Same as ^J. Linefeed.

SHIFT NEXT SCREEN = Clears the alpha or graphics page.

CONTROL SHIFT DELETE = Reset terminal (cold start)

CHAPTER 5
TEKTRONIX 4010/4014 GRAPHICS MODE

5.1 OVERVIEW

This chapter explains to the programmer the use of control and format instructions and graphics commands required to display, transmit, process and represent graphics data. This chapter also provides the syntax and parameter values of graphic commands.

5.2 GRAPHICS DISPLAY COORDINATES

The graphics display is a rectangular grid comprised of 1056 horizontal and 400 vertical coordinates. Anyone of the more than 400,000 grid coordinates are specified by the respective X (horizontal) and Y (vertical) value. Each of these displayable points is a pixel.

Figure 5-1 shows the coordinates of the four corners and then center of the graphics display. The origin (X=0, Y=0) is at the lower left hand corner of the grid.

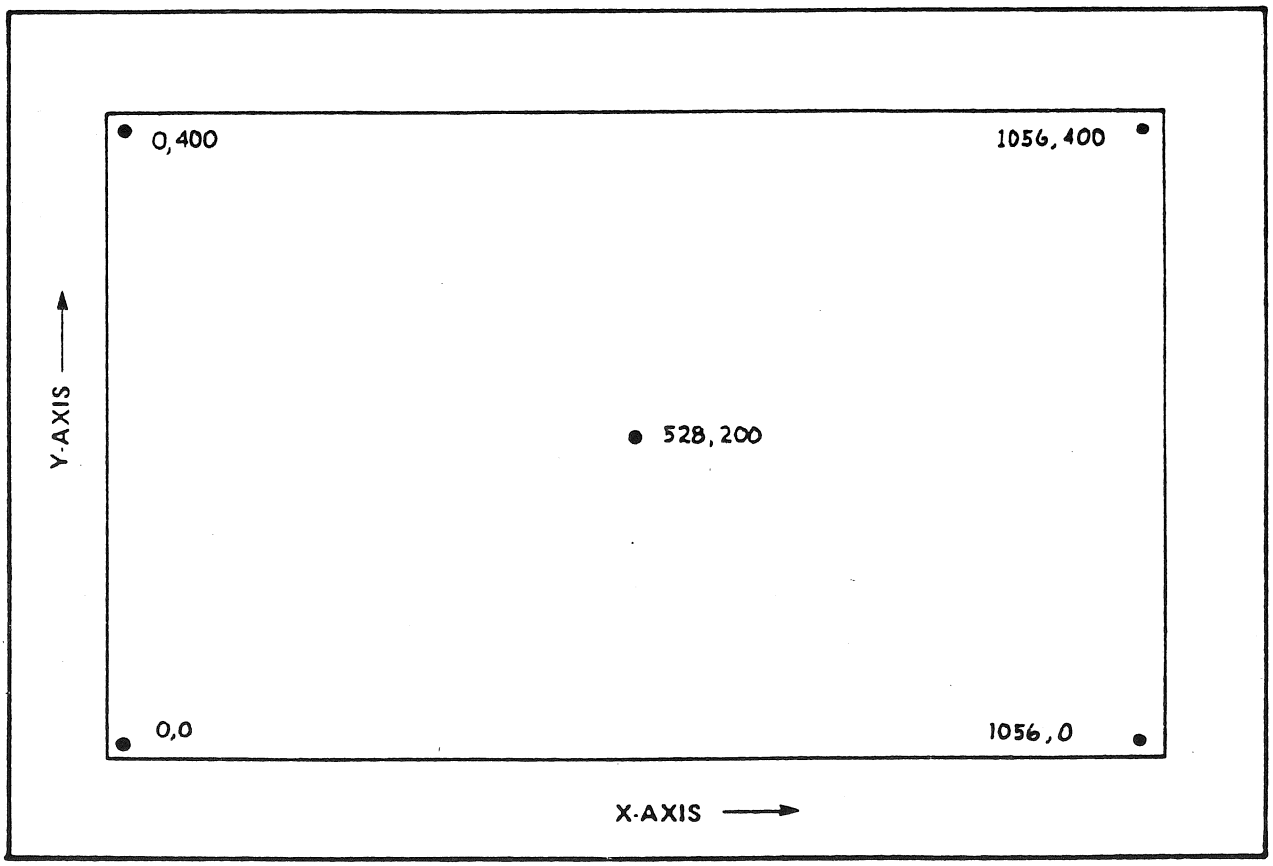


Figure 5-1 Screen Format

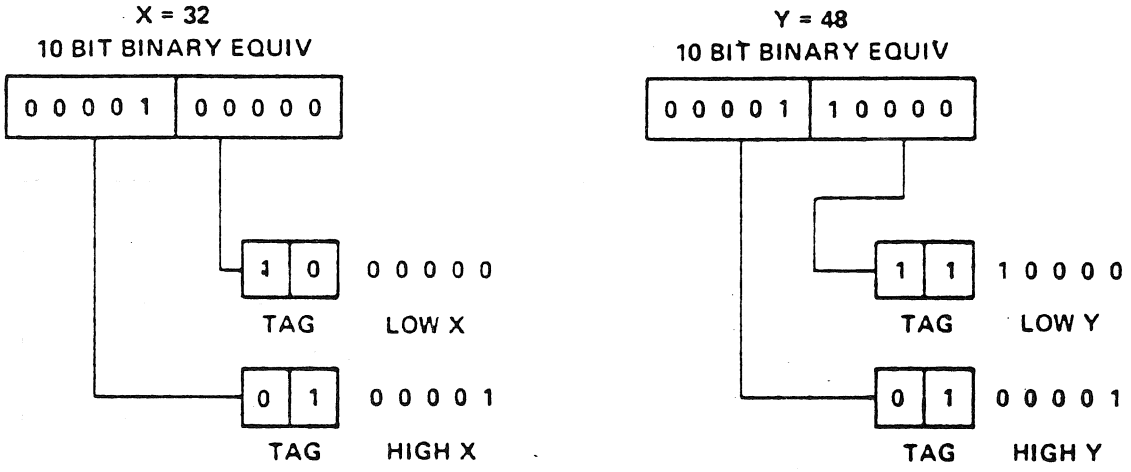
5.2.1 Display Coordinate Format

Each of the X and Y coordinates are converted to a 10 bit binary equivalent as shown in Figure 5-2. Each is then divided into the high and low 5 bits of each axis. The Visual 603 receives this display data in four byte sequences in the following sequence:

BYTE 1	HIGH Y	P01	Y9	Y8	Y7	Y6	Y5
BYTE 2	LOW Y	P11	Y4	Y3	Y2	Y1	Y0
BYTE 3	HIGH X	P01	X9	X8	X7	X6	X5
BYTE 4	LOW X	P10	X4	X3	X2	X1	X0

Each byte may contain parity (P) and two tag bits and thus encodes to an ASCII character. The ASCII equivalents of grid coordinates are listed in Table 5-1.

Example: To convert X,Y display coordinates to a 4 byte format:



		7 BIT ASCII	HEX	ASCII CHAR
BYTE 1	HIGH Y	0 1 0 0 0 0 1	21	!
BYTE 2	LOW Y	1 1 1 0 0 0 0	70	P
BYTE 3	HIGH X	0 1 0 0 0 0 1	21	!
BYTE 4	LOW X	1 0 0 0 0 0 0	40	@

To plot a point at coordinate 32, 48 the code sequence is

FS	CTRL\	ENTER POINT PLOT MODE
HIGH Y	!	BYTE 1
LOW Y	P	BYTE 2
HIGH X	!	BYTE 3
LOW X	@	BYTE 4

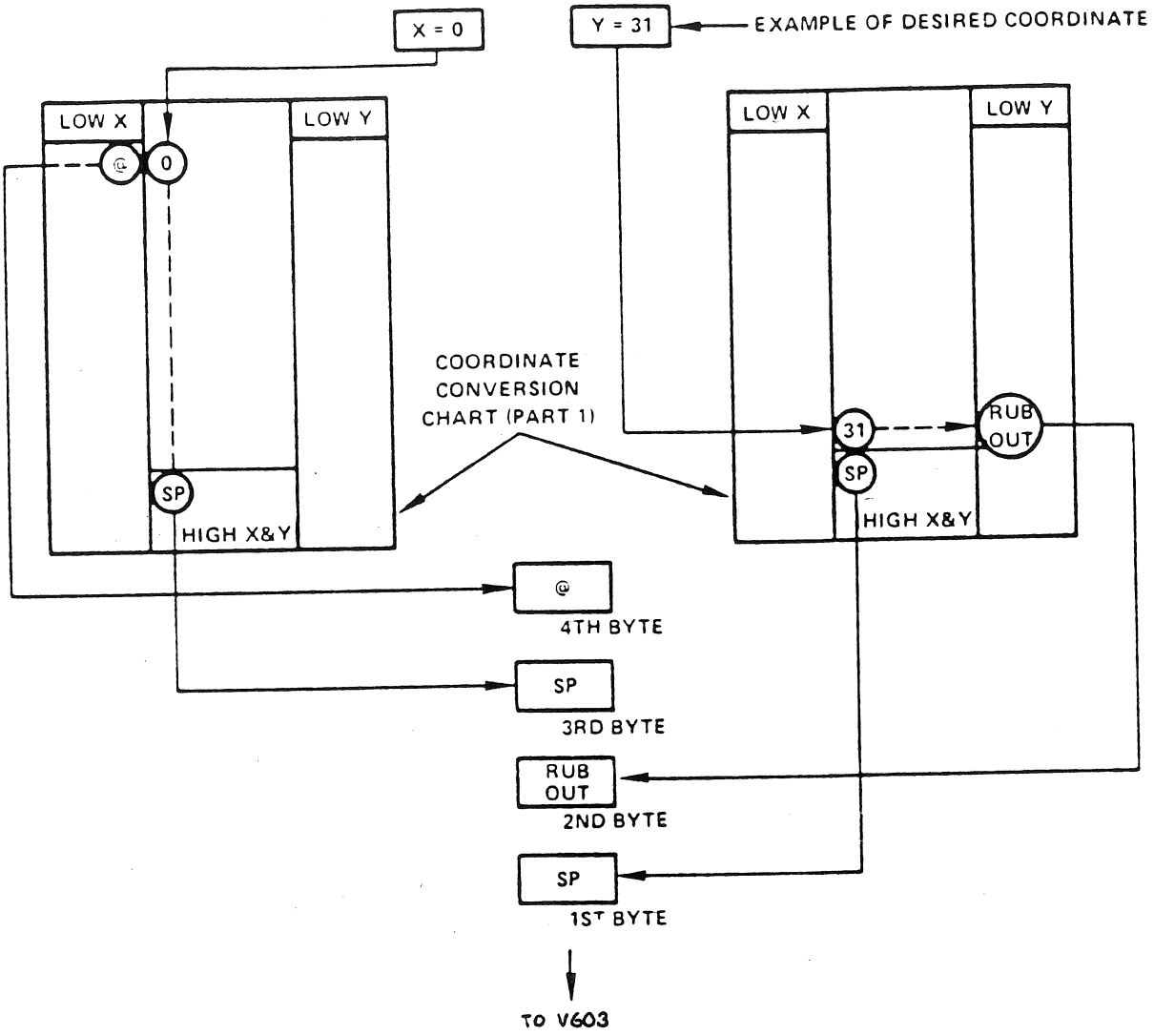


Figure 5-2. How to Use Table 5-1

Table 5-1

Low Order X ASCII	DEC.	X or Y Coordinate								Low Order Y ASCII	DEC.
@	64	0	32	64	96	128	160	192	224	`	96
A	65	1	33	65	97	129	161	193	225	a	97
B	66	2	34	66	98	130	162	194	226	b	98
C	67	3	35	67	99	131	163	195	227	c	99
D	68	4	36	68	100	132	164	196	228	d	100
E	69	5	37	69	101	133	165	197	229	e	101
F	70	6	38	70	102	134	166	198	230	f	102
G	71	7	39	71	103	135	167	199	231	g	103
H	72	8	40	72	104	136	168	200	232	h	104
I	73	9	41	73	105	137	169	201	233	i	105
J	74	10	42	74	106	138	170	202	234	j	106
K	75	11	43	75	107	139	171	203	235	k	107
L	76	12	44	76	108	140	172	204	236	l	108
M	77	13	45	77	109	141	173	205	237	m	109
N	78	14	46	78	110	142	174	206	238	n	110
O	79	15	47	79	111	143	175	207	239	o	111
P	80	16	48	80	112	144	176	208	240	p	112
Q	81	17	49	81	113	145	177	209	241	q	113
R	82	18	50	82	114	146	178	210	242	r	114
S	83	19	51	83	115	147	179	211	243	s	115
T	84	20	52	84	116	148	180	212	244	t	116
U	85	21	53	85	117	149	181	213	245	u	117
V	86	22	54	86	118	150	182	214	246	v	118
W	87	23	55	87	119	151	183	215	247	w	119
X	88	24	56	88	120	152	184	216	248	x	120
Y	89	25	57	89	121	153	185	217	249	y	121
Z	90	26	58	90	122	154	186	218	250	z	122
[	91	27	59	91	123	155	187	219	251	{	123
\	92	28	60	92	124	156	188	220	252	¦	124
]	93	29	61	93	125	157	189	221	253	}	125
^	94	30	62	94	126	158	190	222	254	~	126
_	95	31	63	95	127	159	191	223	255	RUBOUT (DEL)	127
		32	33	34	35	36	37	38	39		
		SP	!	"	#	$	%	&	'		

High Order X & Y

Table 5-1 (Cont.)

Low Order X										Low Order Y	
ASCII	DEC.	X or Y Coordinate								ASCII	DEC.
@	64	256	288	320	352	384	416	448	480	`	96
A	65	257	289	321	353	385	417	449	481	a	97
B	66	258	290	322	354	386	418	450	482	b	98
C	67	259	291	323	355	387	419	451	483	c	99
D	68	260	292	324	356	388	420	452	484	d	100
E	69	261	293	325	357	389	421	453	485	e	101
F	70	262	294	326	358	390	422	454	486	f	102
G	71	263	295	327	359	391	423	455	487	g	103
H	72	264	296	328	360	392	424	456	488	h	104
I	73	265	297	329	361	393	425	457	489	i	105
J	74	266	298	330	362	394	426	458	490	j	106
K	75	267	299	331	363	395	427	459	491	k	107
L	76	268	300	332	364	396	428	460	492	l	108
M	77	269	301	333	365	397	429	461	493	m	109
N	78	270	302	334	366	398	430	462	494	n	110
O	79	271	303	335	367	399	431	463	495	o	111
P	80	272	304	336	368	400	432	464	496	p	112
Q	81	273	305	337	369	401	433	465	497	q	113
R	82	274	306	338	370	402	434	466	498	r	114
S	83	275	307	339	371	403	435	467	499	s	115
T	84	276	308	340	372	404	436	468	500	t	116
U	85	277	309	341	373	405	437	469	501	u	117
V	86	278	310	342	374	406	438	470	502	v	118
W	87	279	311	343	375	407	439	471	503	w	119
X	88	280	312	344	376	408	440	472	504	x	120
Y	89	281	313	345	377	409	441	473	505	y	121
Z	90	282	314	346	378	410	442	474	506	z	122
[	91	283	315	347	379	411	443	475	507	{	123
\	92	284	316	348	380	412	444	476	508	¦	124
]	93	285	317	349	381	413	445	477	509	}	125
^	94	286	318	350	382	414	446	478	510	~	126
_	95	287	319	351	383	415	447	479	511	RUBOUT (DEL)	127
		40	41	42	43	44	45	46	47		
		(	)	*	+	,	-	.	/		

High Order X & Y

Table 5-1 (Cont.)

Low Order X										Low Order Y	
ASCII	DEC.	X or Y Coordinate								ASCII	DEC.
@	64	512	544	576	608	640	672	704	736	`	96
A	65	513	545	577	609	641	673	705	737	a	97
B	66	514	546	578	610	642	674	706	738	b	98
C	67	515	547	579	611	643	675	707	739	c	99
D	68	516	548	580	612	644	676	708	740	d	100
E	69	517	549	581	613	645	677	709	741	e	101
F	70	518	550	582	614	646	678	710	742	f	102
G	71	519	551	583	615	647	679	711	743	g	103
H	72	520	552	584	616	648	680	712	744	h	104
I	73	521	553	585	617	649	681	713	745	i	105
J	74	522	554	586	618	650	682	714	746	j	106
K	75	523	555	587	619	651	683	715	747	k	107
L	76	524	556	588	620	652	684	716	748	l	108
M	77	525	557	589	621	653	685	717	749	m	109
N	78	526	558	590	622	654	686	718	750	n	110
O	79	527	559	591	623	655	687	719	751	o	111
P	80	528	560	592	624	656	688	720	752	p	112
Q	81	529	561	593	625	657	689	721	753	q	113
R	82	530	562	594	626	658	690	722	754	r	114
S	83	531	563	595	627	659	691	723	755	s	115
T	84	532	564	596	628	660	692	724	756	t	116
U	85	533	565	597	629	661	693	725	757	u	117
V	86	534	566	598	630	662	694	726	758	v	118
W	87	535	567	599	631	663	695	727	759	w	119
X	88	536	568	600	632	664	696	728	760	x	120
Y	89	537	569	601	633	665	697	729	761	y	121
Z	90	538	570	602	634	666	698	730	762	z	122
[	91	539	571	603	635	667	699	731	763	{	123
\	92	540	572	604	636	668	700	732	764	¦	124
]	93	541	573	605	637	669	701	733	765	}	125
^	94	542	574	606	638	670	702	734	766	~	126
_	95	543	575	607	639	671	703	735	767	RUBOUT (DEL)	127
		48	49	50	51	52	53	54	55		
		0	1	2	3	4	5	6	7		
		High Order X & Y									

Table 5-1 (Cont.)

Low Order X										Low Order Y	
ASCII	DEC.	X or Y Coordinate								ASCII	DEC.
@	64	768	800	832	864	896	928	960	992	`	96
A	65	769	801	833	865	897	929	961	993	a	97
B	66	770	802	834	866	898	930	962	994	b	98
C	67	771	803	835	867	899	931	963	995	c	99
D	68	772	804	836	868	900	932	964	996	d	100
E	69	773	805	837	869	901	933	965	997	e	101
F	70	774	806	838	870	902	934	966	998	f	102
G	71	775	807	839	871	903	935	967	999	g	103
H	72	776	808	840	872	904	936	968	1000	h	104
I	73	777	809	841	873	905	937	969	1001	i	105
J	74	778	810	842	874	906	938	970	1002	j	106
K	75	779	811	843	875	907	939	971	1003	k	107
L	76	780	812	844	876	908	940	972	1004	l	108
M	77	781	813	845	877	909	941	973	1005	m	109
N	78	782	814	846	878	910	942	974	1006	n	110
O	79	783	815	847	879	911	943	975	1007	o	111
P	80	784	816	848	880	912	944	976	1008	p	112
Q	81	785	817	849	881	913	945	977	1009	q	113
R	82	786	818	850	882	914	946	978	1010	r	114
S	83	787	819	851	883	915	947	979	1011	s	115
T	84	788	820	852	884	916	948	980	1012	t	116
U	85	789	821	853	885	917	949	981	1013	u	117
V	86	790	822	854	886	918	950	982	1014	v	118
W	87	791	823	855	887	919	951	983	1015	w	119
X	88	792	824	856	888	920	952	984	1016	x	120
Y	89	793	825	857	889	921	953	985	1017	y	121
Z	90	794	826	858	890	922	954	986	1018	z	122
[	91	795	827	859	891	923	955	987	1019	{	123
\	92	796	828	860	892	924	956	988	1020	¦	124
]	93	797	829	861	893	925	957	989	1021	}	125
^	94	798	830	862	894	926	958	990	1022	~	126
_	95	799	831	863	895	927	959	991	1023	RUBOUT (DEL)	127
		56	57	58	59	60	61	62	63		
		8	9	:	;	<	=	>	?		
		High Order X & Y									

5.3 SCREEN FORMAT 4010/4014 COMPATIBILITY

Grid coordinates may be considered to measure 1024 by 400. The automatic scaling feature will scale the coordinates to insure compatibility with Tektronix Plot 10 software. The coordinates are scaled to the following relationship:

X' = .75X
Y' = .75Y

5.4 CONTROL CODES

Table 5-2 lists the control codes that the Visual 603 responds to in ALPHAGRAPHICS VECTOR and POINT PLOT MODES.

TABLE 5-2 Graphics Control Codes

BEL	CTRL G	Rings bell
BS	CTRL H	Move left one character space
HT	CTRL I	Move right one character space
LF	CTRL J	Move down one character space
VT	CTRL K	Move up one character space
CR	CTRL M	Enter alphagraphics mode
CAN	CTRL X	Enter alphanumeric mode
ESC	CTRL [	Begin escape sequence
FS	CTRL \	Enter point plot mode
GS	CTRL]	Enter vector mode
RS	CTRL ^	Enter incremental point mode
US	CTRL -	Enter alphagraphics mode
EM	CTRL Y	Home alphagraphics cursor, reset margin one flag

BEL CTRL G

Sounds an audible tone on receipt of BEL CODE (HEX 07)

BS CTRL H

Moves the cursor left one character space on receipt of BS CODE (HEX 08). The cursor moves 10 pixel positions.

HT CTRL I

Moves the cursor right one character space on receipt of HT CODE (HEX 09). The cursor moves 10 pixel positions.

LF CTRL J

Moves the cursor down one character space on receipt of LF CODE (HEX 0A). The cursor moves 17 pixel positions. (15 pixel positions if 10x15 cell size is selected.

VT CTRL K

Moves the cursor up one character space on receipt of VT CODE (HEX 0B). The cursor moves 17 pixel positions. (15 pixel positions if 10x15 cell size is selected).

EM CTRL Y

Positions the ALPHAGRAPHICS cursor at the home position of 0,568 @ 1:1 scaling with a 10 x 17 cell size or 0,570 @ 1:1 scaling and a 9x15 cell size.

5.5 ALPHANUMERIC MODE

The alphanumeric mode is entered automatically upon power up of the Visual 603 integrated text and graphics station. This mode allows the terminal to function as a full feature alphanumeric device using a display memory separate from the graphics display memory. ALPHANUMERIC mode operation is independent of and transparent to graphics mode operation.

CAN CTRL X

Enters alphanumeric mode upon receipt of CAN CODE (HEX 1B). If a CAN CODE is received when the terminal is already in ALPHANUMERIC then the command will abort an ESC sequence.

ALPHANUMERIC CURSOR

The ALPHANUMERIC mode cursor is user selectable to either solid or blinking cursor. Refer to the Set-Up menus in Appendix B for details.

5.6 ALPHAGRAPHICS MODE

The Alphagraphics mode allows full 96 character alphanumerics to be written at any location on the graphics display. The ALPHAGRAPHICS mode allows four character sizes (1X, 2X, 3X, 4X) and the margin 1 feature for full compatability with Plot 10 software. An Alphagraphics cursor is displayed on the screen to indicate the character position.

CR CTRL M

Enters ALPHAGRAPHICS mode upon receipt of CR CODE (HEX 00). If and only if the Visual 603 is already in vector, point plot or incremental point plot mode.

NOTE

This command also performs a carriage return and sets the data level to dots on.

US CTRL -

Enters ALPHAGRAPHICS mode upon receipt of US CODE (HEX 1F).

NOTE

A carriage return is not performed and data level is unchanged.

ESC FF ESC, CTRL L

Enters ALPHAGRAPHICS mode upon receipt of ESC, FF CODE (HEX 1B, 0C)

NOTE

This command also homes the ALPHAGRAPHICS cursor, clears the graphics memory, sets the data level to dots on and resets the character size and line styles.

5.6.2 ALPHAGRAPHICS CURSOR

Alphagraphics cursor is a blinking underline: the ALPHAGRAPHICS may be positioned in one of three ways:

1. Use of the BS, HT LF, VT, CR, EM CTRL codes.

2. The ALPHAGRAPHICS cursor is always positioned at the last grid coordinates accessed in vector or point plot modes. Thus the alphagraphics cursor may be positioned by entering point plot or vector mode, sending the desired 4 byte X and Y coordinate and then entering alphagraphic mode by use of the US command.

3. Use of the cursor positioning keys on the keyboard. The home position for the Alphagraphics is the upper left hand corner.

5.6.3 Alphagraphics Character Size

The ALPHAGRAPHICS mode offers four character sizes listed in Table 5-3. Each is selected by the appropriate escape sequence for the character size desired. Character size is not line dependent and characters of different size may be mixed. However the line format will change per Table 5-3.

TABLE 5-3. ALPHAGRAPHICS CHARACTER SIZE

Char Size	Escape Sequence	Screen Format
Normal	ESC 0	80 X 34
2X	ESC 1	40 X 17
3X	ESC 2	26 X 11
4X	ESC 3	20 X 8

5.6.4 Alphagraphics Margins

Two margins are available in the alphagraphics mode.

Margin 0 is at the left hand side of the screen (column 0). Attempts to enter alphagraphics beyond the screen limits will generate a local carriage return and line feed.

Margin 1 is at the center of the screen. Margin 1 is automatically enabled when the alphagraphics cursor is positioned on the last available line and a line feed is received.

Margin 1 is useful in creating two columns of text and is compatible with Plot 10 software.

NOTE

Any characters that extend beyond the center of the screen may be written over when Margin 1 is enabled.

The numeric column location of Margin 1 and the numeric last available line vary with character size per Table 5-4.

TABLE 5-4 Margin 1 Location

Char Size	Margin 1 Col #	# of Lines Available
1X	40	34
2X	20	17
3X	13	11
4X	10	8

5.7 POINT PLOT MODE

The Point Plot mode allows individual points to be plotted on the graphics display screen of the Visual 603. Point plot is entered by a FS code. The point to be plotted is specified via the same addressing scheme as that used for specifying the end points of vectors, the only exception being that only the end point dots are plotted and not the whole vector.

FS CTRL \

Enters point plot mode upon receipt of a FS CODE (HEX1C). The data level and status of the alpha and graphics memory are unchanged. There is no POINT PLOT mode cursor.

NMN	ASCII CODE	ACTION
FS	P 0 0 1 1 1 1 0 0	ENTER POINT PLOT MODE
HIGH Y	P 0 1 Y_9 Y_8 Y_7 Y_6 Y_5	Y COORDINATE
LOW Y	P 1 1 Y_4 Y_3 Y_2 Y_1 Y_0	
HIGH X	P 0 1 X_9 X_8 X_7 X_6 X_5	X COORDINATE
LOW X	P 1 0 X_4 X_3 X_2 X_1 X_0	
HIGH Y	P 0 1	2ND POINT TO BE PLOTTED
LOW Y	P 1 1	
HIGH X	P 0 1	
LOW X	P 1 0	
LOW X	P 1 0	3RD POINT, Y-AXIS DID NOT CHANGE
HIGH Y	P 0 1	4TH POINT, X-AXIS DID NOT CHANGE
HIGH Y	P 0 1	5TH POINT, NEW X AND Y-AXIS
LOW Y	P 1 1	
HIGH X	P 0 1	
LOW X	P 1 0	
	•	
	•	
	•	
	•	
GS	P 0 0 1 1 1 0 1	TRANSITION TO VECTOR MODE

Figure 5-3. Data Sequence Point Plot Mode

5.8 INCREMENTAL POINT PLOT MODE

INCREMENTAL POINT PLOT mode allows points to be plotted in one of eight directions related to the current position. The absence of dots (DATA OFF) may be plotted by use of the "PEN UP" and "PEN DOWN" characters.

5.8.1 RS CTRL ^

Enters incremental POINT PLOT mode upon receipt of RS CODE (HEX 1E). Points are incrementally plotted in the direction defined by the received character. Figure 5-4 shows the direction of each character. The action of "drawing pen" is defined by the ASCII characters:

ASCII	ACTION
SP	PEN UP
P	PEN DOWN

Example: the received chaacter string

RS, P,E,E,E,E,E

would enable incremental point plot mode, issue a "PEN DOWN" and plot five incremental points at a 45 degree angle in a northeasterly direction.

5.9 VECTOR MODE

Vector Mode allows the Visual603 to automatically draw vectors connecting two specified points. The first coordinate received specifies the begin point and second coordinate specifies the end point. A third coordinate received would connect a vector from coordinate two to coordinate three. Each subsequent coordinate received defines the end point of the vector.

Up to eight styles are available in vector mode. Three of these line styles may be user defined.

5.9.1 GS CTRL]

VECTOR MODE is entered upon receipt of a CODE GS (HEX 1D). If the Visual 603 is already in VECTOR mode, the CODE GS will draw a dark vector from the current point to the next point received.

Graphic plotting information is sent from the computer in a 4 byte sequence containing High and Low order Y, and High and Low order X. Each byte contains the two tag bits plus 5 binary bits. Each byte thus encodes to an ASCII character.

To obtain the 4 ASCII characters for each addressable point on the display, use the instruction as outlined on Page 5-2 and the Conversion chart Part 1 through 4 as shown in Table 5-1. With X=0 and Y=31 as an example of a desired coordinate display. This chart is useful for determining the ASCII encoding of a coordinate when it is not convenient to use a computer subroutine.

Figure 5-5 shows a method of computing the 4 bytes using the example of the desired coordinates of X=32 and Y=48. The numbers are converted to a 10-bit binary equivalent.

Each is divided into High and Low 5 bits. The bytes are assembled as shown with the two tag bits added. This method is used where computer sub-routines are set up to do this conversion.

Required Coordinate Bytes

HIY	LOY	HIX	LOX
X	X	X	X
X	X		X
X			X
	X	X	X
	X		X
			X

X = changed or required byte.

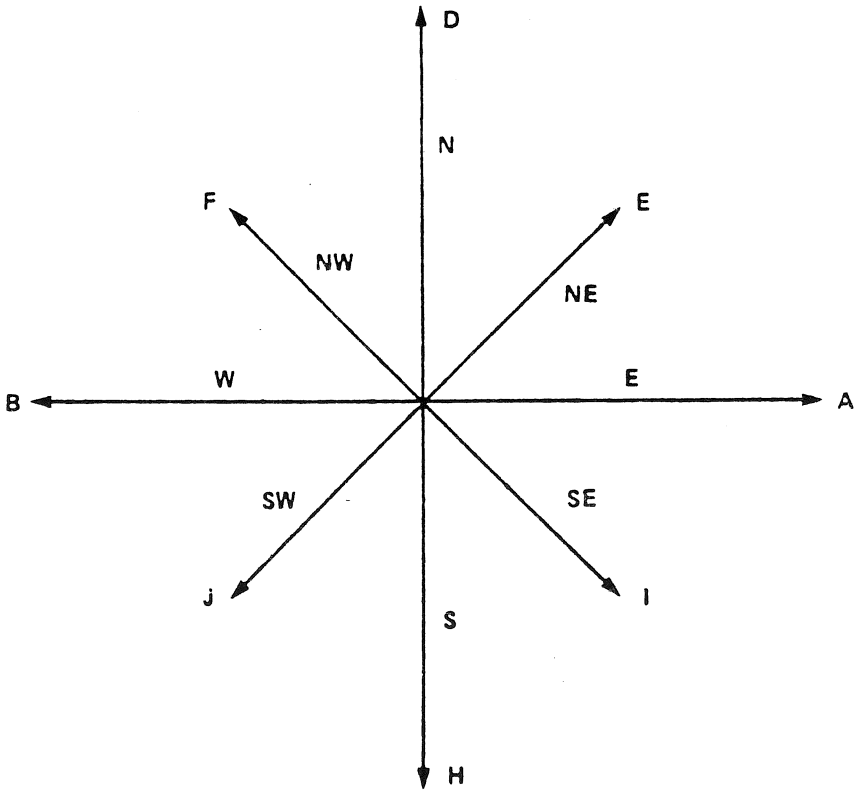


Figure 5-4 Incremental Point Plot Directional Characteristics

NMN	ASCII CODE	ACTION
GS	P 0 0 1 1 1 0 1	ENTER VECTOR MODE
HIGH Y	P 0 1 Y_9 Y_8 Y_7 Y_6 Y_5	Y COORDINATE — VECTOR BEGIN POINT
LOW Y	P 1 1 Y_4 Y_3 Y_2 Y_1 Y_0	
HIGH X	P 0 1 X_9 X_8 X_7 X_6 X_5	X COORDINATE — VECTOR BEGIN POINT
LOW X	P 1 0 X_4 X_3 X_2 X_1 X_0	
HIGH Y	P 0 1	Y COORDINATE — VECTOR END POINT
LOW Y	P 1 1	
HIGH X	P 0 1	X COORDINATE — VECTOR END POINT
LOW X	P 1 0	
HIGH Y	P 0 1	Y COORDINATE — VECTOR END POINT
LOW Y	P 1 1	
HIGH X	P 0 1	X COORDINATE — VECTOR END POINT
LOW X	P 1 0	
GS	P 0 0 1 1 1 0 1	REINITIALIZE VECTOR MODE
HIGH Y	P 0 1	Y COORDINATE — VECTOR BEGIN POINT
LOW Y	P 1 1	
HIGH X	P 0 1	X COORDINATE — VECTOR BEGIN POINT
LOW X	P 1 0	
HIGH Y	P 0 1	Y COORDINATE — VECTOR END POINT
LOW Y	P 1 1	
HIGH X	P 0 1	X COORDINATE — VECTOR END POINT
LOW X	P 1 0	
ESC	P 0 0 1 1 0 1 1	ESCAPE CODE
a	P 1 1 0 0 0 0 1	SELECT DOTTED LINE STYLE
	•	
	•	
	•	
	•	
	•	
FS	P 0 0 1 1 1 0 0	TRANSITION TO POINT PLOT MODE

Figure 5-5 Data Sequence Vector Mode

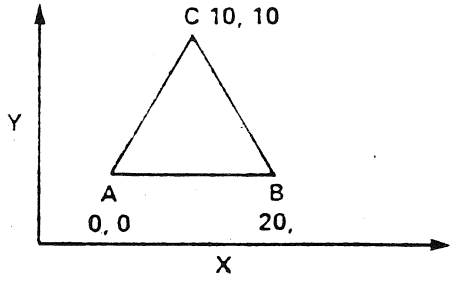
INCREMENTAL PLOT CHARACTERS

CHAR	CODE	DIR	ANGLE
D	44	N	90°
E	45	NE	45°
A	41	E	0°
I	49	SE	315°
H	48	S	270°
J	4A	SW	225°
B	42	W	180°
F	46	NW	135°

The data sequence for vector mode is defined in Figure 6-6.

There is no cursor displayed in vector mode.

Example: To draw the triangle ABC then the



The following ASCII character sequence would be sent to the V500.

ASCII Character	Action
GS	Enter Vector Mode
SP	High Y Coordinate A
\	Low Y Coordinate A
SP	High X Coordinate A
@	Low X Coordinate A
T	Low X Coordinate B
j	Low Y Coordinate C
J	Low X Coordinate C

NOTE

That after the first 4 bytes are sent only those bytes that change must be sent. However, although not evident in this example, if the High X byte changes then the Low X byte must be re-sent.

5.9.2 Line Types

Up to eight line types or styles are available in vector mode. The Visual 603 is set to "normal" line at power up. The received GS code does not reset the selected line style.

5.9.2.1 Select Line Style ESC Ps

The CODE ESC followed by the appropriate character listed in Table 5-5 selects the desired line style.

Line style is set to normal (reset) on Power on and upon entering alphagraphics mode by use of the ESC FF command. User defined line styles are selected by the appropriate character, but must have been previously defined.

Table 5-5 LINE STYLES

Ps	LINE STYLE SELECTED
ESC\	NORMAL_____
ESCa	DOTTED. . . . .
ESCb	DOT DASH .-.-.-.-.-.-.-.-.-.
ESC c	SHORT DASH - - - - - - - - - -
ESC d	LONG DASH_ _ _ _ _ _ _ _ _ _
ESC x	USER DEFINED #1
ESC y	USER DEFINED #2
ESC z	USER DEFINED #3

NOTE
The line style select command must precede a GS command.

5.9.2.2 Define User Line Styles

User line styles are defined by the following commands:

ESC/Pn a Style #1
ESC/Pn b Style #2
ESC/Pn c Style #3

where Pn is a decimal number derived by considering the line type definition to be a sixteen bit binary number with each bit defining a dot or pixel of the line. The Low Order bit is the first dot in the line style.

A binary "1" is a dot on. A binary "0" is a dot off.
The value of Pn is the range of 0 to 65535 inclusive.

5.10 RECTANGULAR DRAW AND FILL

The Visual Visual 603 is capable of drawing a rectangle by specifying a starting point and the delta distance along the X and Y axis. The rectangle may be automatically filled with any one of eight filling styles. Additionally, the rectangle may be rotated in 45 degree increments.

5.10.1 ESC/x;y; ^X;^Y x

The above command will cause a rectangle to be drawn, starting at coordinate X Y that is ^ X dots wide and ^ Y dots high. The values are specified in decimal format.

Figure 5-6 shows a rectangle that begins at location coordinate 20,50 and 50 dots square. The figure is drawn by the following sequence being received by the Visual 603:

ESC/2 0 ; 5 0 ; 5 0 ; 5 0 x

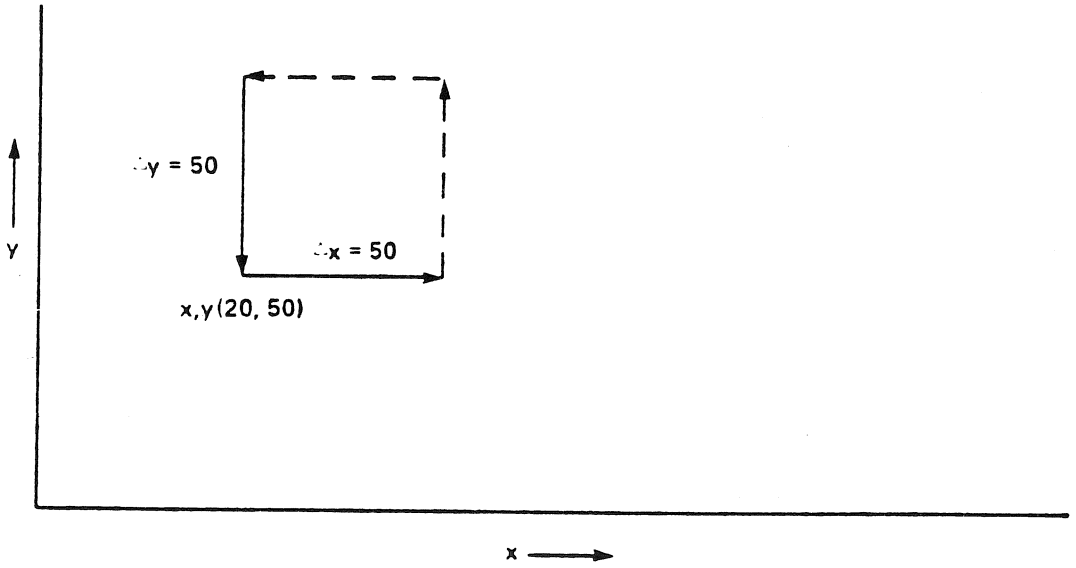


Figure 5-x Rectangular Draw

5.10.2 ESC/x;y;^x;^y y

The above command will cause a rectangle to be drawn and filled with one of the selected filling styles. The rectangle begins at location coordinate x,y, and is ^x dots wide and ^y dots high. The values are specified in decimal format. The data sequence is identical to a rectangular draw with the exception of the last character being an ASCII y rather than an ASCII x.

The desired filling style must be selected (or enabled) by one of the 14 commands defined in Paragraph 5.10.3. Filling is between the boundaries of the defined rectangle.

5.10.3 Filling Command

The filling style ID is defined by the following commands:

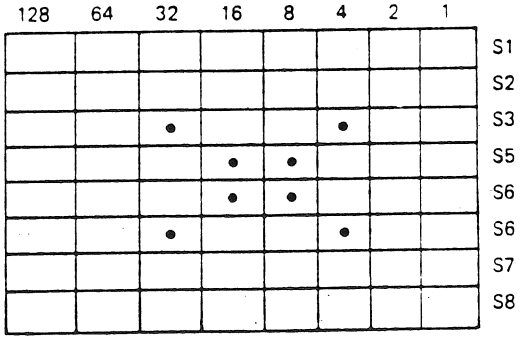
```
ESC @  Select Solid Fill
ESC A  Select Gray Fill
ESC B  Select 45 Deg. Sloping Lines, sloping up to left
ESC C  Select 45 Deg. Sloping Lines, sloping up to right
ESC D  Select Horizontal Lines
ESC E  Select Vertical Lines
ESC F  Select 45 Deg. Slanted Cross Hatch
ESC G  Select Vertical/Horizontal Cross Hatch
ESC H  Select Checkerboard Fill
ESC I  Select Dotted Fill
ESC J  Select Horizontal Herringbone
ESC K  Select Vertical Herringbone
ESC L  Select User Defined Fill Pattern #1
ESC M  Select User Defined Fill Pattern #2
```

The filling style must be selected before a rectangular draw and fill command is received.

5.10.4 User Definable Fill Patterns (two)

```
Commands :  ESC/S1;S2;S3;S4;S5;S6;S7;S8 C  Define #1
            ESC/S1;S2;S3;S4;S5;S6;S7;S8 D  Define #2
```

Where: S1,S2,S3,S4,S5,S6,S7 and S8 represent the data for the pattern. The pattern is an 8 x 8 bit cell which is repeated both horizontally and vertically in the area being filled. The data is defined as follows:



Draw the dot pattern you wish in grid above and then add the values above each column together for each dot you have in a horizontal row. The resulting value is the data for each parameter. The parameters are decimal, i.e., if you get one row which equals 25, then the parameter for that row is an ASCII 2 followed by an ASCII 5.

Example (shown in grid):

```
  ESC/0;0;36;24;36;0;0;C (User Define Pattern #1
```

5.10.4.1 Rectangle Draw and Fill Alternate Method

Command: ESC / X; Y; Delta X; Delta y; F y

5.10.4.2 Rectangle Fill Commands (F)

0 = Use previously selected pattern
1 = Solid Fill
2 = Half-Tone (Gray) Fill (Every other dot is off)
3 = 45 Deg. Sloping Lines, sloping up to left
4 = 45 Deg. Sloping Lines, sloping up to right
5 = Horizontal Lines
6 = Vertical Lines
7 = 45 Deg. Sloped Cross Hatch
8 = Vertical/Horizontal Cross Hatch
9 = Checkerboard Fill
10 = Dotted Fill
11 = Horizontal Herringbone Fill
12 = Vertical Herringbone Fill
13 = User Defined Fill Pattern #1
14 = User Defined Fill Pattern #2
15 = Blank Fill, i.e. draw borders only

5.10.4.3 Direction Command

A defined rectangle may be rotated on its X axis in 45 degree increments by use of the direction command.

ESC/Ps e

Where Ps is a selective parameter from 0 to 7 defining the direction of the X axis. The Y axis will always be defined as 90 degrees from the X axis. Example: If the rectangle defined in Figure 5-6 had been prefaced by the command ESC/4e then it would appear rotated 90 degrees.

The direction of the X-axis remains as selected until either a new direction command is received or a power on resets the X-axis to the default value:

X = 0

Table 5-6 Selective Parameters Direction Command

Ps	Degrees
2	0
3	45
4	90
5	135
6	180
7	225
0	270
1	315

5.10.5 Alphagraphics Direction

The direction command may also be used to position characters in alphagrahics mode. The selective parameters define the axis and direction of cursor movement in alphagraphics mode per Table 5-7.

Table 5-7. Alphagraphics Direction Commands

Ps	X Axis	Cursor Movement
2	0	Left to right
4	90	Top to bottom
6	180	Right to left
0	270	Bottom to top

5.11 DATA LEVEL

Data is plotted into alphagraphics, point plot, vector or incremental plot mode according to one of four data level settings: dots on, dots off, compliment, and replace.

5.11.1 ESC/Ps d

The above command sets the data level according to the value of the selective parameter (Ps).

Ps Value	Data Level
0	Dots on
1	Dots off
2	Compliment
3	Replace

The data level is set to dots on upon power up and by entering alphagraphics mode by use of an ESC FF command.

DOT ON - The normal data level whereby plotted data, vectors or alphagraphics characters are visible.

DOTS OFF - Used to draw invisible vectors or to selectively erase dots or vectors by turning the data level off and replotting or redrawing the data.

COMPLIMENT - Causes the data stored in graphics memory to be complimented when replotted or redrawn with the data level set to compliment. Compliment is also used to selectively erase graphics data.

REPLACE - Causes the ata being plotted to replace unconditionally the data already in the display bit map.

5.12 CROSSHAIR MODE

Cross hair mode is used primarily to allow interaction between the host and the operator in graphics mode.

When entered, a full screen cursor (crosshair) is displayed at the last point or vector coordinate. The crosshair may be positioned in one of eight directions by depressing the desired key on the numeric keypad.

Each depression of the key selected will move the intersection of the crosshair one dot (pixel) in the direction on the key. If the FAST MOVE key is depressed then the crosshair will move eight dots (pixels) in the indicated direction.

5.12.1 ESC SUB or ESC CTRL Z

These commands cause the Visual 603 to enter crosshair mode.

The cursor is displayed at the last leaded dot or vector location. The crosshair may then be positioned by use of the cursor movement keys.

The location coordinates are transmitted to the host by depressng any alphanumeric key. The Visual 603 will transmit the code (ASCII) of the alphanumeric key and the location coordinates of the crosshair. The byte coordinates are in the format specified in Section 5.13.

NOTE

Transmission of crosshair coordinates causes the Visual 603 to enter alphagraphics mode.

The transmission sequence in crosshair mode is as follows:

High X
Low X
High Y
Low Y
Trailer 1
Trailer 2

5.12.2 Load Crosshair ESC/f

The load crosshair command positions the crosshair to the defined coordinates. Example:

To position the crosshair to location 60,40 the following code sequence would be used.

Transmission Sequence	7 bit ASCII Code	ASCII Character
High Y	01 0001	!
Low Y	11 0100	h
High X	01 0001	!
Low X	10 1110	\
ESC	0011011	ESC
\	0101111	/
f	1100110	f
ESC	0011011	ESC
SUB	0011010	SUB

5.13 INQUIRY

The Visual 603 will respond to an inquiry command in point plot, incremental plot, vector, crosshair, and alphagraphics modes.

The Visual 603 will respond to an inquiry with the following data format:

Status Word

High X
Low X
High Y
Low Y
FEOL
SEOM

NOTE
If the Visual 603 is in crosshair mode then the cursor location is the crosshair location.

The byte format for the Visual 603 response to an inquiry command is as follows:

RESPONSE BYTE FORMAT

Each of the X and Y coordinates are converted to a 10 bit binary equivalent as shown in Figure 5-7. Each is then divided into the high and low 5 bits of each axis. The Visual 603 transmits this data in four byte sequences in the following format:

BYTE 1	HIGH	Y	P01	Y9	Y8	Y7	Y6	Y5
BYTE 2	LOW	Y	P01	Y4	Y3	Y2	Y1	Y0
BYTE 3	HIGH	X	P01	X9	X8	X7	X6	X5
BYTE 4	LOW	X	P01	X4	X3	X2	1	X0

Each byte may contain parity (P) and two tag bits and thus encodes to an ASCII character. The ASCII equivalents of grid coordinates are listed in Table 5-8.

Example: To convert X,Y display coordinates to a 4 byte format

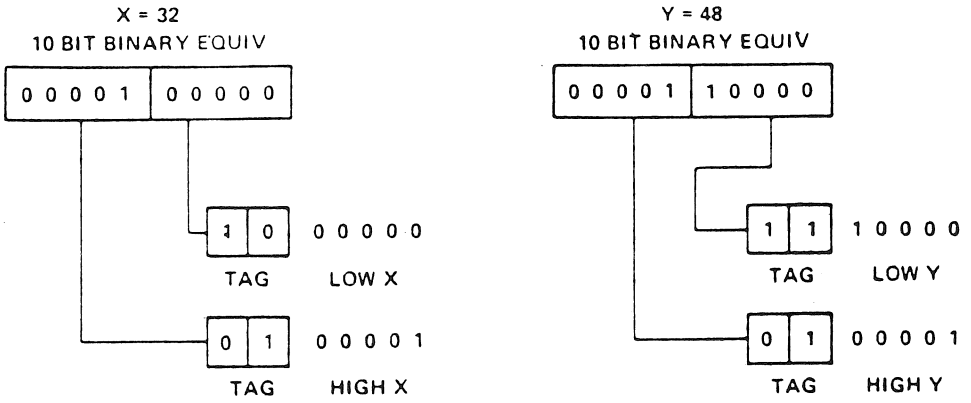


TABLE 5-8. ASCII Equivalents of Grid Coordinates

		7 Bit ASCII	HEX	ASCII CHAR
BYTE 1	HIGH Y	0 1 0 0 0 0 1	21	!
BYTE 2	LOW Y	0 1 1 0 0 0 0	30	0
BYTE 3	HIGH X	0 1 0 0 0 0 1	21	!
BYTE 4	LOW X	0 1 0 0 0 0 0	20	SP

5.13.1 ESC ENQ

Returns status information and cursor location to the host.

5.13.2 Status Word

The Visual 603 responds to an inquiry command with a status word in the following format.

PARITY 0 1 HCU 0 Mode Margin

HCU - 0 Hard Copy Unit Ready
Mode - 0 Graphics Mode Enabled
1 Alphagraphics Mode Enabled

Margin - 1 at Margin 1
0 at Margin 0

The status word is the first byte sent in response to an inquiry command (ESC ENQ).

5.14 SCALING

Two scales are available in the Visual 603:

1 : Normal Scale
2 : 4 Plot 10 Scale

See Section 5.17.1 for method of setting scale factor.

5.15 BLOCK TRANSFER

All functions of the Visual 603 graphics modes are interactive (character by character) action. However the Visual 603 can accept blocks of graphics memory data. These block transfers allow the host to rapidly update the graphics memory.

A block transfer from the host is accomplished by use of the address lead and data load commands.

A block read from the Visual 603 to the host is accomplished by use of the memory read command.

5.15.1 Address Load ESC" X;Ya

The address load command specifies the starting address of a block transfer where: X and Y are decimal numbers indicating the starting loation in graphics memory. X is in the range of 0 to 768 and Y is in the range of 0 to 585. 0,0 would represent the home position of the graphics memory.

5.15.2 Data Load ESC + <CHAR><CHAR>...#

The data load command loads the graphics memory with data beginning at the previously specified address where:

<CHAR> is an ASCII character in the range of @(HEX40) to (HEX5F).
<CHAR> represents 5 bits of data encoded into an ASCII character.

Data is loaded at the beginning address from the low order five bits of starting with D1 and ending with D5.

Example:

To lead and alternating pattern of data starting at location 10,20 of graphics memory the following sequence would be sent ot the Visual 603.

Transmission Sequence	7 Bit ASCII Code	ASCII Character
ESC	0011011	ESC
"	0100010	"
Decimal X(10)	0110001	1
	0110000	0
;	0111011	;
Decimal Y(20)	0010100	2
	0111011	0
a	1100001	a
ESC	0011011	ESC
+	0101011	+
Char 1	1001010	J
Char 2	1010101	U
o	o	o
o	o	o
o	o	o
#	0100011	#

5.16 GRAPHICS COMMUNICATIONS

When the Visual 603 sends blocks of data to the host computer the message is ended with up to two trailer codes:

TRAILER CODE #1
TRAILER CODE #2

These codes are user definable and are used to indicate the end of transmission.

5.16.1 Handshaking

A method of handshaking is normally required at transmission speeds above 2400 baud to insure that data is not lost. This is especially true when certain graphics functions such as long vectors are being plotted. Two handshaking methods are available on the Visual 603 : XON-XOFF and status readback control. Of the two, XON-XOFF is the more desirable.

5.16.1.2 XON/XOFF -- The Visual 603 terminal can operate at transmissions speeds up to 19,200 baud. However, the terminal may not be able to keep up with incoming data. The Visual 603 stores incoming characters in a buffer called FIFO and processes them on a first in/first out basis. When the FIFO begins to fill up, the terminal will transmit an XOFF (DC 3) code.

On this signal, the host is supposed to suspend to suspend its transmission to the Visual 603. Eventually, if the host stops transmitting, the terminal will process al of the characters out of the FIFO. When the FIFO is nearly empty, the terminal will transmit an XON (DC 1) code to signal the host that it may resume data transmission.

5.16.1.3 Status Readback Control -- This method uses the inquiry function to determine if the Visual 603 is ready to receive data and involves sending the Visual 603 the inquiry sequence ESC ENQ and waiting for the status byte to be returned before resuming data transmission.

Since the Visual 603 uses a transmission input buffer, it is not necessary to send an inquiry after each function. A general rule of thumb is to send an inquiry after every 20 coordinate pairs and after every long vector coordinate pair. A rectangular draw with fill is considered a long vector.

As previously stated, if the host supports XON-XOFF then this automatic protocol is more desirable.

Other "trick" methods such as sending nulls, dummy characters or breaks, used to delay communications are time consuming and should be avoided.

5.17 REMOTE PARAMETER SELECTION

The following Visual 603 graphics mode set-up parameters may be remotely set or reset by the host.

Auto Scaling
Space Code Operation
Cell Size

5.17.1 ESC/Ps h Set Parameter
ESC/Ps e Reset Parameter

PARAMETER SELECTION

Ps	Parameter	Set/Reset	Action
1	Auto Scaling	Set	1:1
1	Auto Scaling	Reset	3:4
2	SP Code Operation	Set	Destructive
2	SP Code Operation	Reset	Non Destructive
3	Cell Size	Set	10x15
3	Cell Size	Reset	10x17

5.17.2 Auxiliary Port Receive Data

This set up parameter is used for bi-directional communication using the aux port. This mode can be changed in set-up or remotely. The remote commands are as follows:

Command	Description
ESC / 1 p	Cursor Move. Data from the bit pad is used by the Visual 603 to move crosshair.
ESC / 2 p	Pass BP to Host. Data from the bit pad is passed to the host while displaying the movements on the screen.
ESC / 3 p	Pass to Host Transp. Data from the bit pad is passed to the host but not displayed on the screen.

5.18 4014 FONT COMPATABILITY

The Visual 603 firmware has a character font included for Tektronix 4014 compatability. The font is a 5 x 7 dot character (2 dot descender for lower case) in a 6 x 10 cell. With this font you can display 58 lines of 128 characters in Alphagraphis mode.

To select this font, the 4014 font commands must be used. These commands are:

<ESC>8 - Select 10 x 17 character cell size, 34 lines of 78 char.
<ESC>9 - Select 9 x 15 character cell size, 39 lines of 85 char.
<ESC>: - Select 6 x 10 character cell size, 58 lines of 128 char.
<ESC>; - Select 6 x 10 character cell size, 58 lines of 128 char.

NOTE

<ESC>; is included for 4014 code compatability.

5.19 CIRCLE AND ARC DRAW

The Visual 603 is capable of drawing a circle or an arc by specifying the starting point and radius of the circle.

5.19.1 ESC/X;Y;R;T;P A

The above command draws a circle or arc of R radius at coordinates XY, where:

X - X coordinate (decimal value) of the center of the circle
Y - Y coordinate (decimal value) of the center of the circle
R - Radius expressed in number of pixels.
T - Starting point of arc expressed in degrees
P - Length of arc expressed in degrees

if P is omitted or P=0 or P >360 degrees then a circle is drawn

Example 1

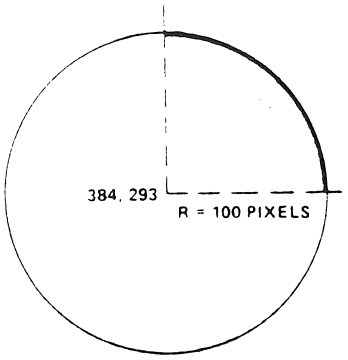
ESC/528;200;100 A

would draw a circle at coordinates 528,200 (center of screen) that has a radius of 100 pixels.

Example 2

ESC/384; 293; 100; 0; 90 A

would draw an arc whose center is at coordinates 384,293 that has a radius of 100 pixels beginning at 0 degrees and ending at 90 degrees.



5.20 CIRCLE AND ARC FILL

Command ESC / X; Y; R; T; P; FB

where:

X - X coordinate (decimal value) of the center of the circle
Y - Y coordinate (decimal value) of the center of the circle
R - Radius of curvature of APC
T - Starting point of arc expressed in degrees (o Deg. to 359 Deg.)
P - Length of arc expressed in degrees
F - Fill Pattern Selection
B - Final Character of Command (ASCII B)

NOTE

If P is zero, not present, or greater than or equal to 360 Degrees, the Visual 603 will fill an entire circle.

5.20.1 Circle and ARC Fill Patterns (F)

The fill patterns are as follows:

0 = Use previously selected pattern
1 = Solid Fill
2 = Half-Tone (Gray) Fill (Every other dot is off)
3 = 45 Deg. Sloping Lines, sloping up to left
4 = 45 Deg. Sloping Lines, sloping up to right
5 = Horizontal Lines
6 = Vertical Lines
7 = 45 Deg. Sloped Cross Hatch
8 = Vertical/Horizontal Cross Hatch
9 = Checkerboard Fill
10 = Dotted Fill
11 = Horizontal Herringbone Fill
12 = Vertical Herringbone Fill
13 = User Defined Fill Pattern #1
14 = User Defined Fill Pattern #2
15 = Blank Fill, i.e. draw borders only

ESC	CTRL [	Begin escape sequence
FS	CTRL \	Enter point plot mode
GS	CTRL]	Enter vector mode
RS	CTRL ^	Enter incremental point mode

APPENDIX A

TERMINAL SPECIFICATIONS

A.1 VISUAL V603 TERMINAL SPECIFICATIONS

A.1.1 Physical

- o Dimensions: Display and Logic (H x W x D): 13 in. x 12.5 in. x 12.5 in.

  Keyboard (H x W x D): 1 in. x 20.75 in. x 7.5 in.

- o Weight: Display and Logic: 21 lbs.

  Keyboard: 5 lbs.

  Personality Module: .75 lbs.

A.1.2 Environmental

Temperature: Operating 10 C to 40 C; Storage -20 C to 60 C

Humidity: 10% to 90% Non-condensing
Altitude: Operating 10,000 ft; Storage 40,000 ft.
Vibration: Satisfies MIL-STD-810, Method 514.2, Procedure X testing
Shock: Satisfies 50 g, .006 Second Pulse, MIL-STD-810D testing

A.1.3 Electrical

- o Source: 115/230 VAC (+10%, -20%; External Switch - selectable
- o Frequency: 50/60 Hz
- o Consumption: 50 Watts at 115 VAC Maximum

A.1.4 Data Communications

Type:	Serial Asynchronous
Speed:	110 bps to 38.4 Kbps
Method:	Character by Character (Conversational)
Mode:	Full Duplex, Local Echo
Interface:	EIA RS-422/423
Parity:	Odd, Even, Mark, Space, None
Protocol:	XON/XOFF, DTR
Answerback:	User Programmable and Non-volatile
Auxiliary Port:	Serial Asynchronous, Buffered, Bi-directional; Compatible with Various Input/Output devices.

A.1.5 Screen Display

Display Type:	Non-interlaced, Bit-mapped Raster scan; Overscanned
Screen:	14" P192 (page white) Phosphor
Resolution:	1056 x 400
Screen Refresh Rate:	70 Hz
Horizontal Frequency:	32 KHz

A.1.6 Keyboard

Type:	Detached (with 6' coiled cable, DIN Standard Low Profile
Style:	Typewriter-style (DEC VT220 Plus improved Return key, Built-in Home, Escape, Backspace keys)
Layout:	59 Key Alpha Cluster, 18 Key Numeric Pad, 15 Function keys, 11 Key Editing Cluster
Function Keys:	45 (15 Fixed, 30 Shifted User Programmable and Non-Volatile)
Rollover:	N-key
Repeat:	Typomatic. Selectable
Feedback:	Audible Keyclick, Selectable

A.1.7 Text Editing Features

Standard Text format:	25 lines x 80/132 Columns or 50 lines x 132 Columns
Status Lines:	25th line; includes Time-of-Day clock
Character Formation:	11 x 14 Dot Matrix in a 13 x 16 cell (80 Columns); 6 x 14 Dot matrix in an 8 x 14 Cell (132 Columns)
Character Set:	5 sets including DEC Multinational Set, U.K., downloadable, DEC special Graphics
Attributes:	Double high/wide characters; bold, blink, blank, underscore, dim, reverse, normal video
Scrolling:	Selectable scroll speeds; selectable scroll regions
Data Entry:	Selectable tab stops
Editing:	Insert/Delete line/Character, Selective erase page/line, erase character.
Programming:	Cursor address, read cursor position
Windowing:	Host addressable window
Desk Top Accessories:	Calendar, Calculator, Alarm Clock

A.1.8 Graphics Features

Usable Screen Resolution: Full resolution

Attributes: 17 Characters Sizes

Double Buffering: Screen buffers for 2 Graphic Pages

Cursor: Crosshair, 8 direction, 2 speed

Graphing Modes: Vector plot, Point plot, Incremental Point Plot, AlphaGraphics, GIN

Primitives: Draw points, Vectors, Circles, Arcs, and Curves

Line Styles: Programmable; 8 line styles

Patterns: Programmable; 14 Fill patterns

Fill: Circle, Arc, Rectangle

Write Modes: Replace, Complement, Overlay, Erase

Operating Modes: Alphagraphics, Graphics, Integrated Text and Graphics

Scroll Boundaries: Vertical, 1 pixel; Horizontal, 16 pixels

Peripheral Devices Supported:

Printers: DEC LA50/100, Okidata ML 182, Epson FX-80, Epson LQ-1000, Datasouth DS180, Hewlett-Packard Laser jet Plus

Plotter: Hewlett-Packard 7470

Bit Pads: GTCO Digi-Pad 515A, Summagraphics Bit-Pad One, Summagraphics Bit-Pad Two

Mice: Summagraphics MM Mouse, Genius Mouse

APPENDIX B
NATIONAL LANGUAGE KEYBOARDS

B.1 OVERVIEW

This appendix illustrates each of the national language keyboards that are available for the Visual V603 integrated text and graphics station.

The following keyboards are illustrated in alphabetical order:

- British
- Canadian (French)
- Danish
- Dutch
- Finnish
- Belgian (Flemish)
- French/Belgian
- German
- Italian
- North American
- Norwegian
- Spanish
- Swedish
- Swiss (French)
- Swiss (German)

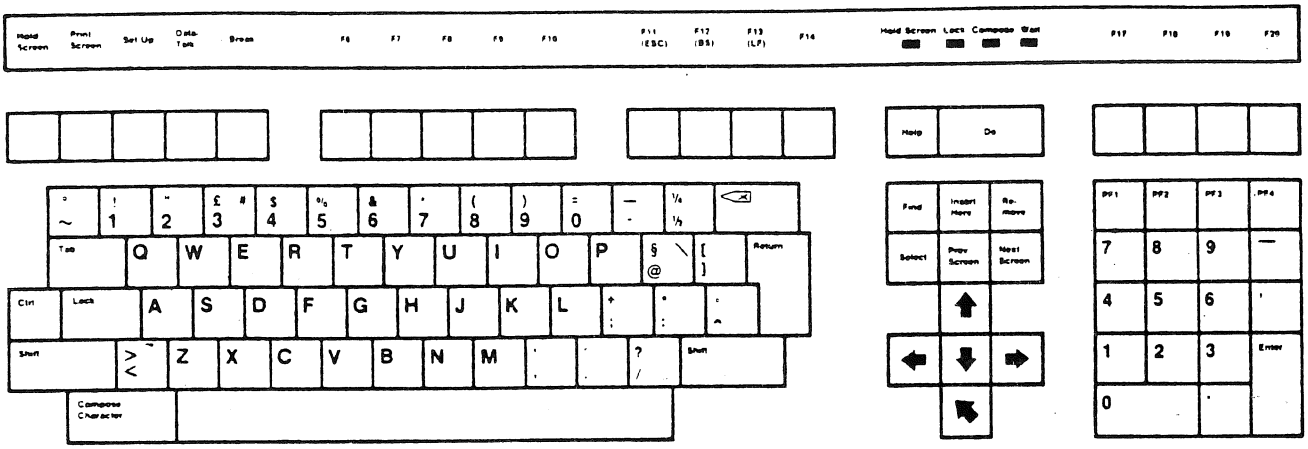


Figure B-1. British Keyboard

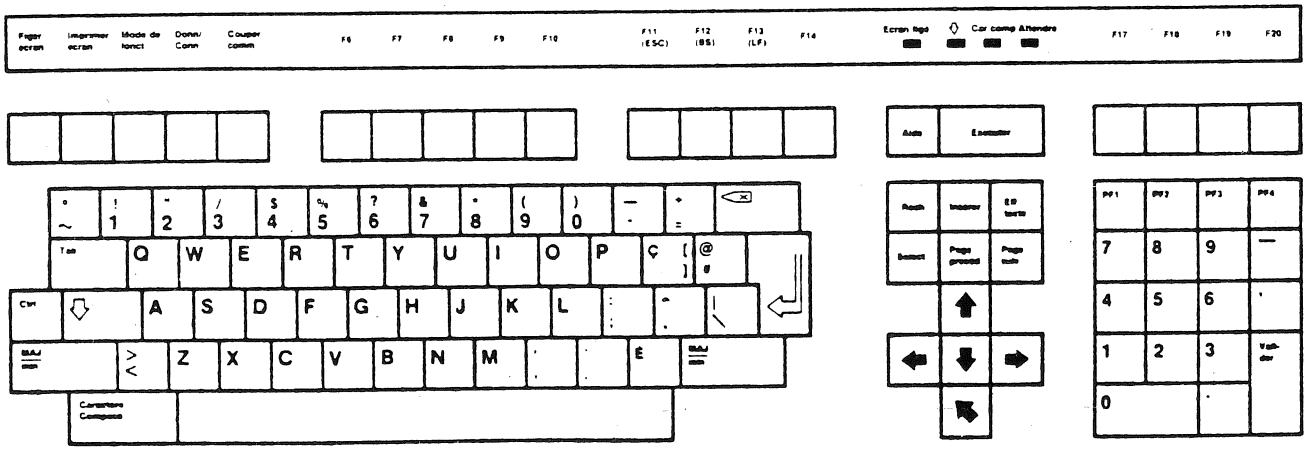


Figure B-2. Canadian (French) Keyboard

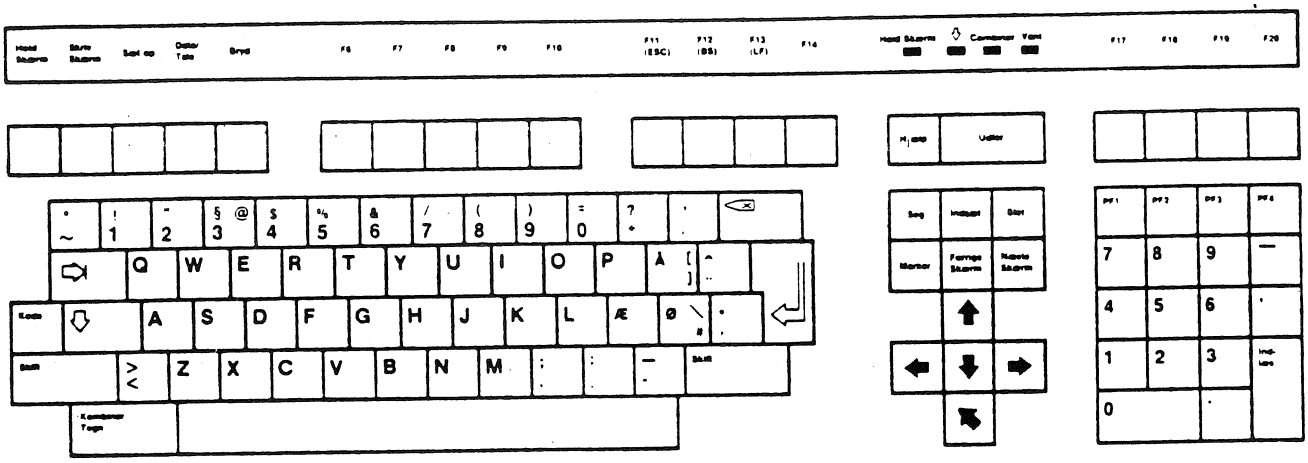


Figure B-3. Danish Keyboard

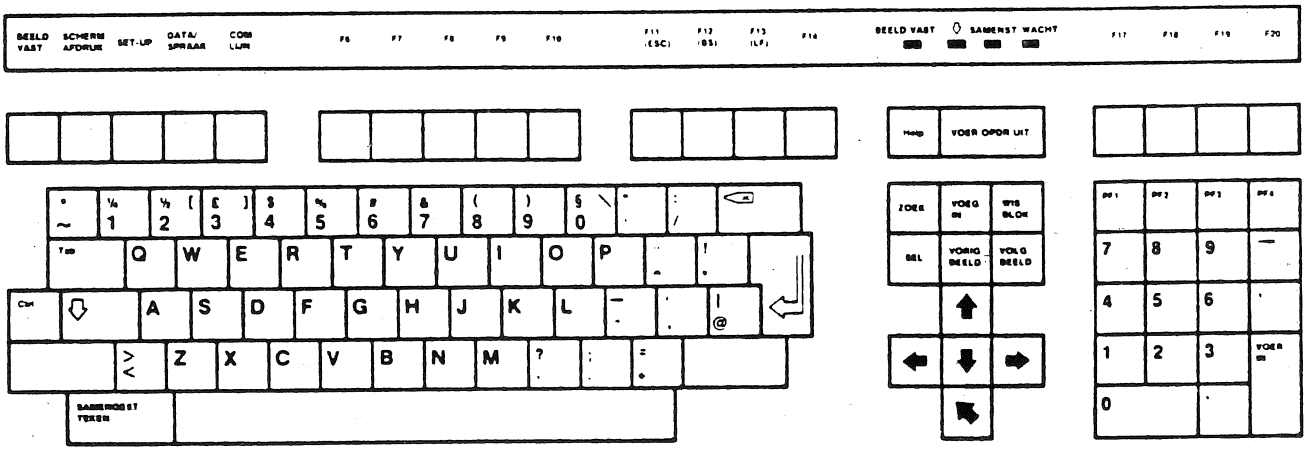


Figure B-4. Dutch Keyboard

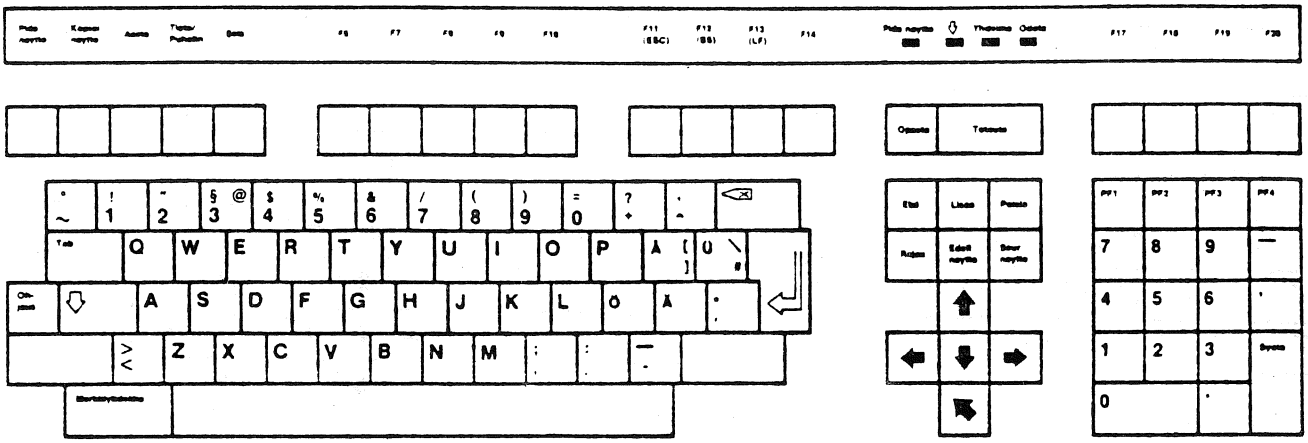


Figure B-5. Finnish Keyboard

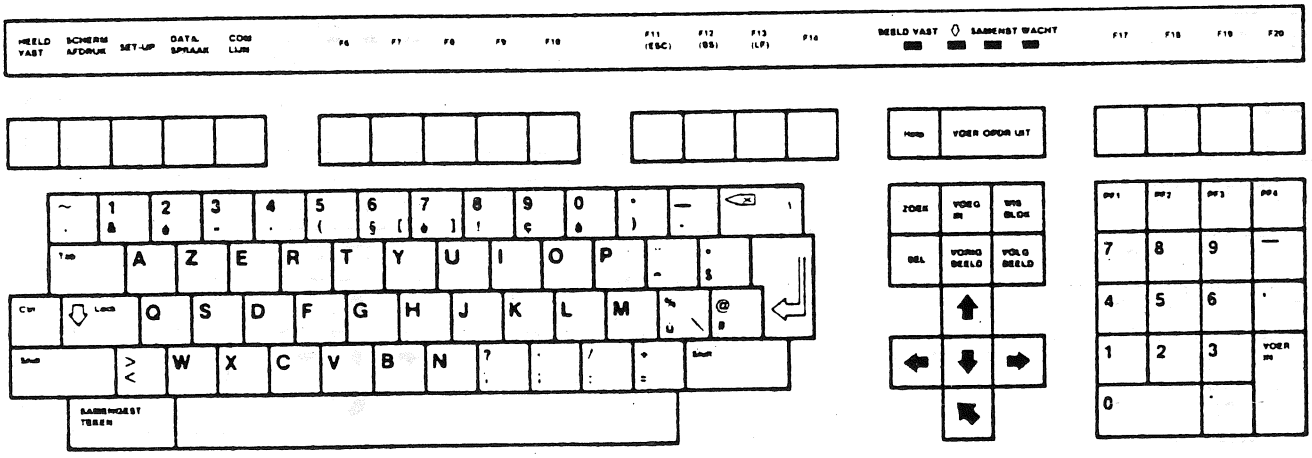


Figure B-6. Belgian (Flemish) Keyboard

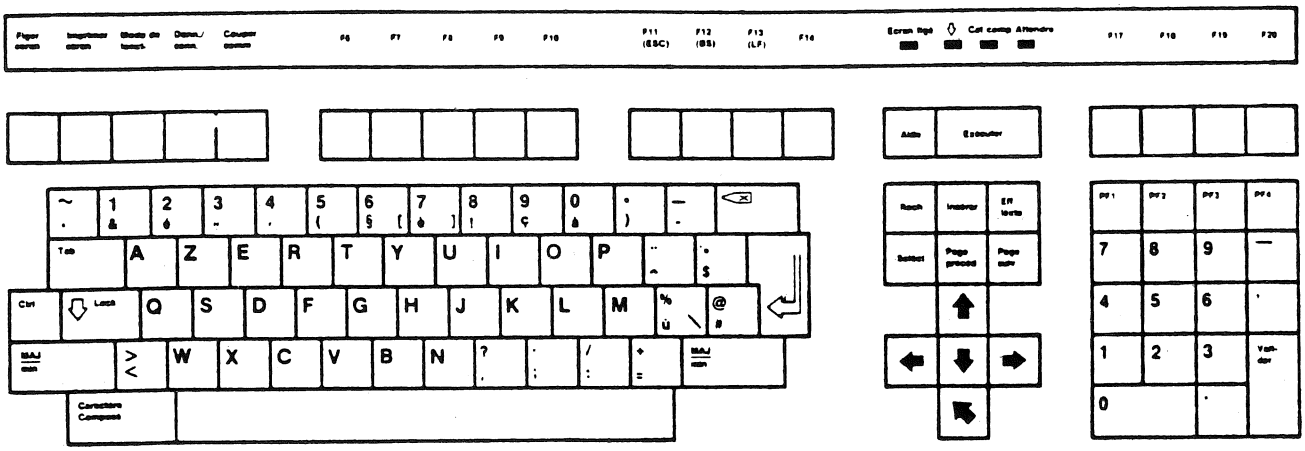


Figure B-7. French/Belgian Keyboard

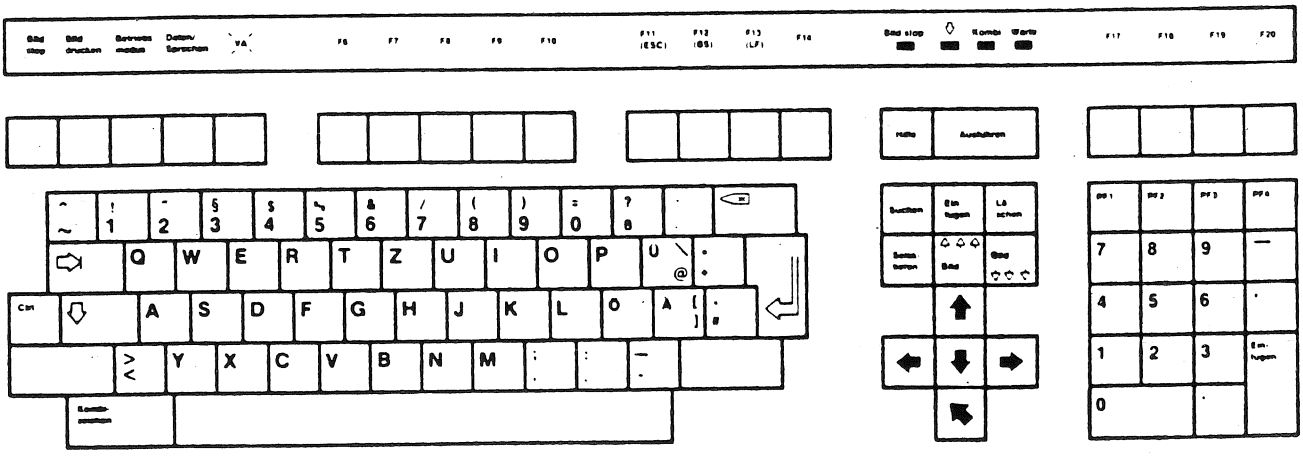


Figure B-8. German Keyboard

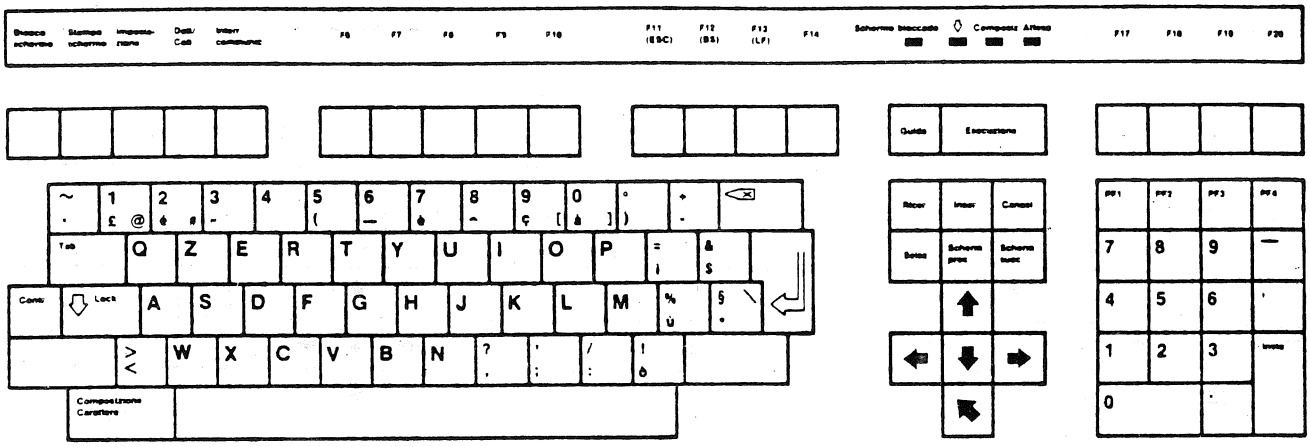


Figure B-9. Italian Keyboard

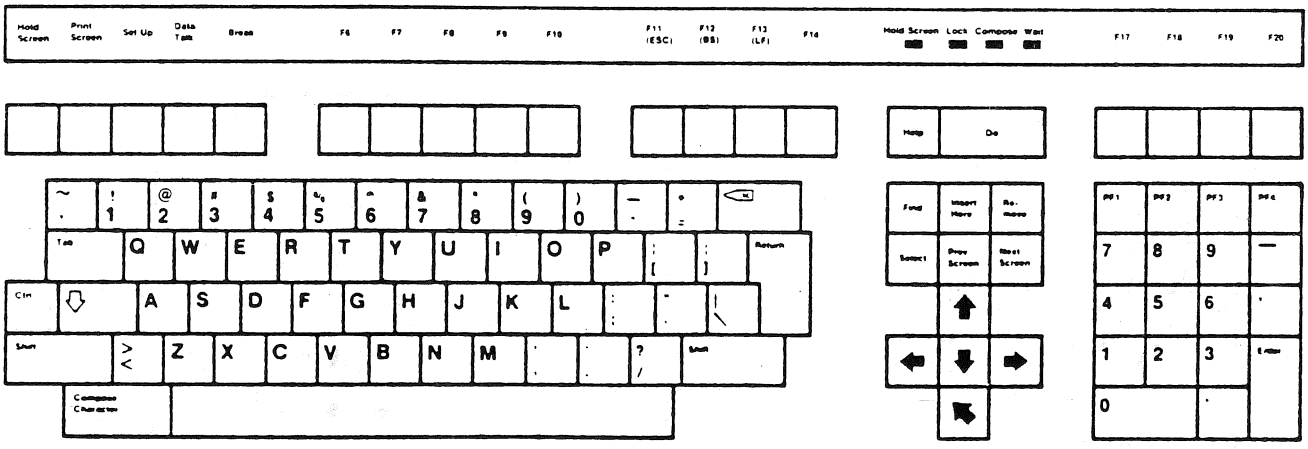


Figure B-10. North American Keyboard

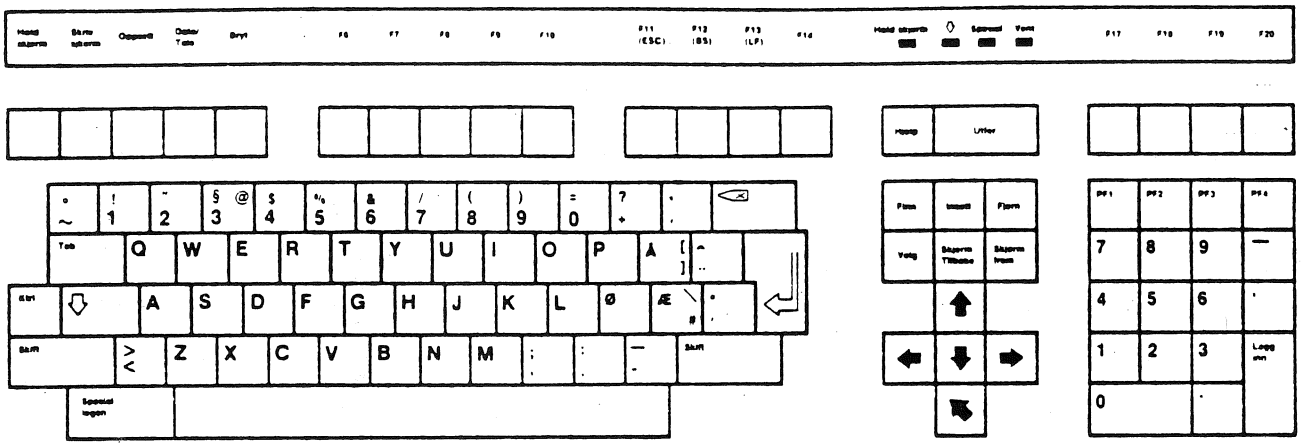


Figure B-11. Norwegian Keyboard

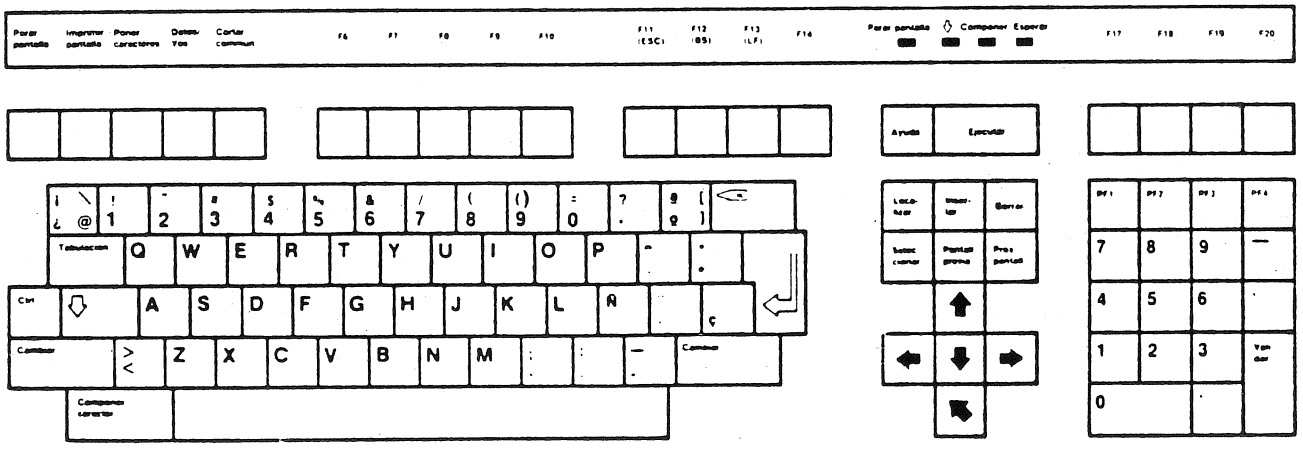


Figure B-12. Spanish Keyboard

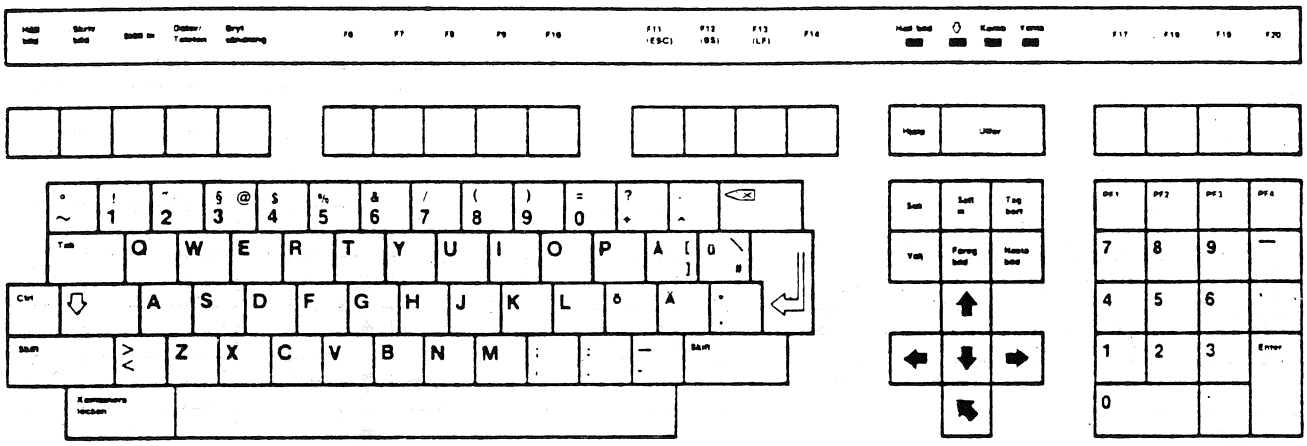


Figure B-13. Swedish Keyboard

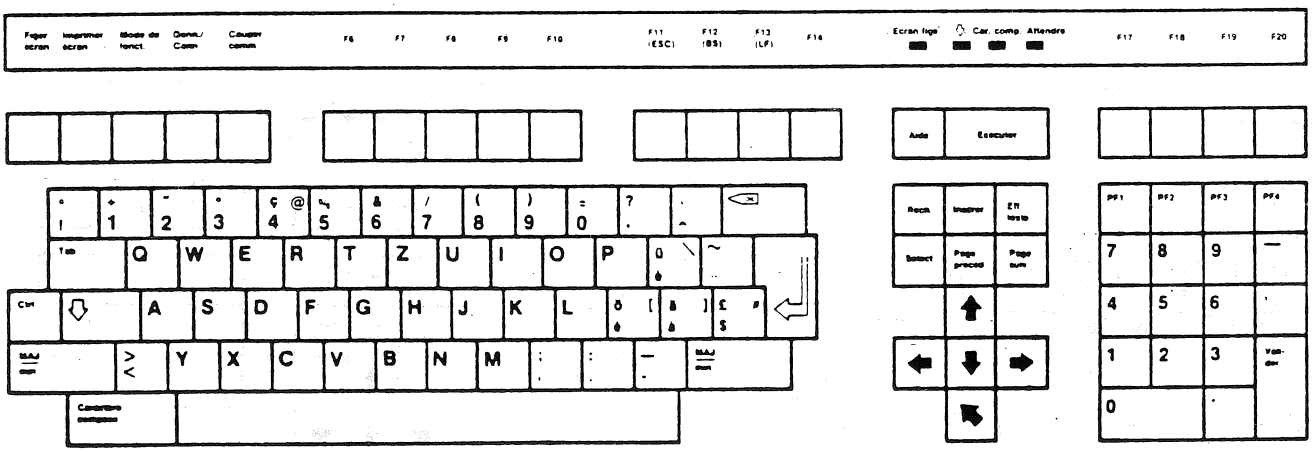


Figure B-14. Swiss (French) Keyboard

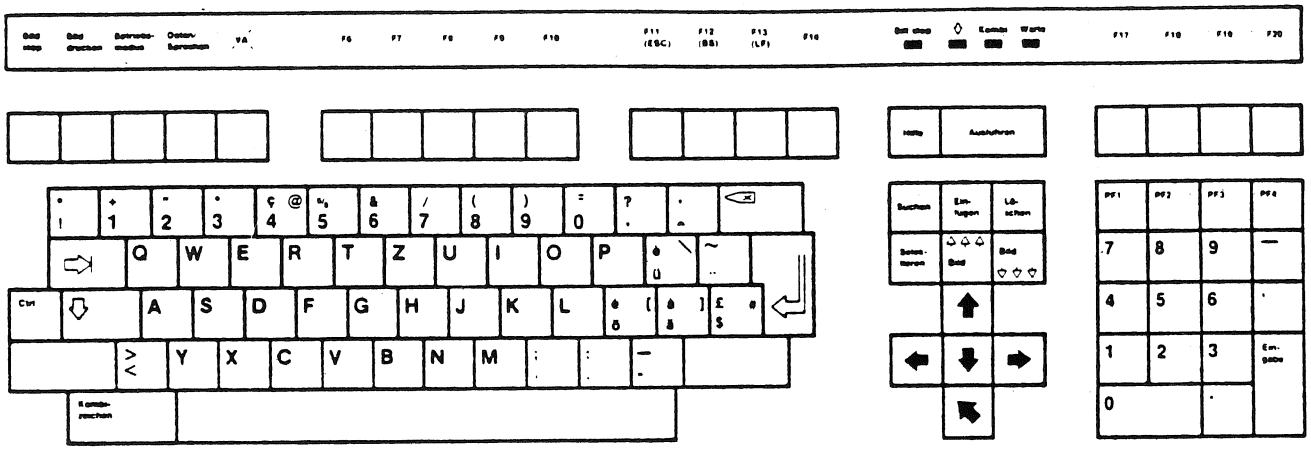


Figure B-15. Swiss (German) Keyboard

Appendix C
Graphics Mode Command Summary

(BEL) AG,V,PP,IP,XH
Ring terminal bell. Clear bypass condition.

(BS) AG
Move alphagraphics cursor left 1 space.

(HT) AG
Move AlphaGraphics cursor right 1 space.

(LF) AG
Move AlphaGraphics cursor down 1 space. Clear Bypass condition.

(LF) V,PP,IP
Clear Bypass condition.

(VT) AG
Move AlphaGraphics cursor up 1 space.

(CR) V,PP,IP,XH
Enter AlphaGraphics mode. Set data level to dots on. Set AG cursor to Margin 1 or 2. Clear Bypass condition.

(CR) AG
Perform carriage return with AG cursor. Clear Bypass Condition.

(SI) AG,V,PP,IP,XH
Clear Bypass Condition.

(CAN) AG,V,PP,IP,XH
Enter AlphaNumeric mode.

(EM) AG
Home AG cursor. Reset Margin 1 flag.

(ESC) (ENQ) AG,V,PP,IP
Status inquiry. Return to original mode with Bypass Condition set.

(ESC) (ENQ) XH
Status inquiry. Return to AG mode with Bypass Condition set.

(ESC) (FF) AG,V,PP,IP
Enter AlphaGraphics mode. Clear screen. Home AG cursor. Set data levle to dots on. Reset character size. Reset linestyle. Clear Bypass condition.

(ESC) (ETB) AG,V,PP,IP,XH
Print hardcopy. Clear Bypass Condition.

(ESC) (CAN) AG,V,PP,IP
Set Bypass Condition.

(ESC) (SUB) AG,V,PP,IP
Enter Crosshair mode.

(ESC) (SUB) AG,V,PP,IP
Enter Crosshair mode.

(ESC) "\x\;\y\a AG,V,PP,IP,XH
Load block transfer address.

(ESC) "\x\;\y\;\len\b AG,V,PP,IP,XH
Block memory read.

(ESC)+\ch\\ch\...# AG,V,PP,IP,XH
Block data load.

(ESC/f AG,V,PP,IP,XH
Load crosshair cursor position.

(ESC/\#\a AG,V,PP,IP,XH
Define user linestyle #1. Parameter has value [0,65335] whose binary representation corresponds to desired linestyle pattern.

(ESC/\#\b AG,V,PP,IP,XH
Define user linestyle #2.

(ESC/\#\c AG,V,PP,IP,XH
Define user linestyle #3.

(ESC/\#\d AG,V,PP,IP,XH
Set data level. Parameter values are as follows: 0=dots on, 1=dots off, 2=complement, 3=replace.

(ESC/\#\e AG,V,PP,IP,XH
Set rectangle direction. Parameter values are as follows: 0=270 deg, 1=315 deg, 2=0 deg, 3=45 deg, 4=90 deg, 5=135 deg, 6=180 deg, 7=225 deg.

(ESC/\#\h AG,V,PP,IP,XH
Set parameter flag.

(ESC/\#\l AG,V,PP,IP,XH
Clear parameter flag.

(ESC/\#\p AG,V,PP,IP,XH

Set bitpad (auxport) mode. Parameter values are as follows: 1=data from bitpad used to move CrossHair cursor; 2= data from bitpad passed to host, and also used for screen display; 3=data from bitpad passed to host, but not used for screen display.

(ESC)/\xc\;\yc\;\r\;\a1\;a2\A V,PP,IP,XH

Draw arc from angle a1 to a2, with center at (xc,yc) and radius r.

(ESC)/\xc\;\yc\;\r\;\a1\;a2\p#\B V,PP,IP,XH

Draw filled arc from angle a1 to a2, with center at (xc,yc) and radius r and using pattern p#. If P3 has not been specified, default pattern will be used.

(ESC)/\#1\;\#2\;\#3\;\#4\;\#5\;\#6\;\#7\;\#8\C AG,V,PP,IP,XH

Define user fill pattern #1. The parameters have values [0,255] whose binary representations correspond to the desired pattern. Parameters are listed from top to bottom of the pattern definition.

(ESC)/\#1\;\#2\;\#3\;\#4\;\#5\;\#6\;\#7\;\#8\D AG,V,PP,IP,XH

Define user fill pattern #2. The parameters have values [0,255] whose binary representations correspond to the desired pattern. Parameters are listed from top to bottom of the pattern definition.

(ESC)/\x\;\y\;\dx\;\dy\x V,PP,IP,XH

Draw rectangle frame, with lower left corner at (x,y) horizontal side of length dx, and vertical side of length dy. Rectangle will be rotated about its lower left corner if it has been so configured.

(ESC)/\x\;\y\;\dx\;\dy\;\p#\y V,PP,IP,XH

Draw rectangle as described immediately above, but with interior filled with pattern specified by p#. If p# has not been specified, default fill pattern will be used.

(ESC)0 AG,V,PP,IP,XH

Select 1X font multiplier for Alphagraphics characters.

(ESC)1 AG,V,PP,IP,XH

Select 2X font multiplier for Alphagraphics characters.

(ESC)2 AG,V,PP,IP,XH

Select 3X font multiplier for Alphagraphics characters.

(ESC)3 AG,V,PP,IP,XH

Select 4X font multiplier for Alphagraphics characters.

(ESC)8 AG,V,PP,IP,XH

Select largest Alphagraphics character cell size.

(ESC)9 AG,V,PP,IP,XH

Select second largest Alphagraphics character cell size.

(ESC): AG,V,PP,IP,XH

Select second smallest Alphagraphics character cell size.

(ESC); AG,V,PP,IP,XH

Select smallest Alphagraphics character cell size.

(ESC)@ AG,V,PP,IP,XH

Select solid pattern as default fill pattern.

(ESC)A AG,V,PP,IP,XH

Select gray pattern as default fill pattern.

(ESC)B AG,V,PP,IP,XH

Select diagonal up pattern as default fill pattern.

(ESC)C AG,V,PP,IP,XH

Select diagonal down pattern as default fill pattern.

(ESC)D AG,V,PP,IP,XH

Select horizontal line pattern as default fill pattern.

(ESC)E AG,V,PP,IP,XH

Select vertical line pattern as default fill pattern.

(ESC)F AG,V,PP,IP,XH

Select diagonal hatch pattern as default fill pattern.

(ESC)G AG,V,PP,IP,XH

Select rectilinear hatch pattern as default fill pattern.

(ESC)H AG,V,PP,IP,XH

Select checkerboard pattern as default fill pattern.

(ESC)I AG,V,PP,IP,XH

Select dotted pattern as default fill pattern.

(ESC)J AG,V,PP,IP,XH

Select horizontal squiggly pattern as default fill pattern.

(ESC)K AG,V,PP,IP,XH

Select vertical squiggly pattern as default fill pattern.

(ESC)L AG,V,PP,IP,XH

Select user-defined pattern #1 as default fill pattern.

(ESC)M AG,V,PP,IP,XH

Select user-defined pattern #2 as default fill pattern.

(ESC)P1q\sixel\\sixel\...(ESC)\ AG,V,PP,IP,XH

240ish block load using a sequence of sixels to transmit screen display data.

(ESC)` AG,V,PP,IP,XH

Select solid line as default fill linestyle.

(ESC)a AG,V,PP,IP,XH

Select dotted line as default linestyle.

(ESC)b AG,V,PP,IP,XH

Select dot-dashed line as default linestyle.

(ESC)c AG,V,PP,IP,XH

Select short dashed line as default linestyle.

(ESC)d AG,V,PP,IP,XH

Select long dashed line as default linestyle.

(ESC)x AG,V,PP,IP,XH

Select user-defined linestyle #1 as default linestyle.

(ESC)y AG,V,PP,IP,XH

Select user-defined linestyle #2 as default linestyle.

(ESC)z AG,V,PP,IP,XH

Select user-defined linestyle #3 as default linestyle.

(FS) AG,V,PP,IP

Enter point plot mode.

(GS) AG,V,PP,IP

Enter Vector mode. Clear Bypass Condition.

(RS) AG,V,PP,IP

Enter Incremental Point Plot mode.

(US) AG,V,PP,IP

Enter AlphaGraphics mode. No carriage return performed. Data level unchanged. Clear Bypass Condition.

\any alphanumeric character\ AG
Display character on screen.

\x01xxxxx\\x11xxxxx\\x01xxxxx\\x10xxxxx\ V,PP

HiY, LoY, HiX, LoX addressing sequence.

\x01xxxxx\\x11xxxxx\\x10xxxxx\ V,PP

HiY, LoY, LoX addressing sequence.

\x01xxxxx\\x01xxxxx\\x10xxxxx\ V,PP

HiY, HiX, LoX addressing sequence.

\x01xxxxx\\x10xxxxx\ V,PP

HiY, LoX addressing sequence.

\x11xxxxx\\x01xxxxx\\x10xxxxx V,PP

LoY, HiY, LoX addressing sequence.

\x11xxxxx\\x10xxxxx V,PP

LoY, LoX addressing sequence.

\x10xxxxx\ V,PP

LoX addressing sequence.

(SP) IP
Set pen up.

A IP

Plot point in east direction.

B IP

Plot point in west direction.

D IP

Plot point in north direction.

E IP

Plot point in northeast direction.

F IP

Plot point in northwest direction.

H IP

Plot point in south direction.

I IP

Plot point in southeast direction.

J IP

Plot point in southwest direction.

P IP

Set pen down.