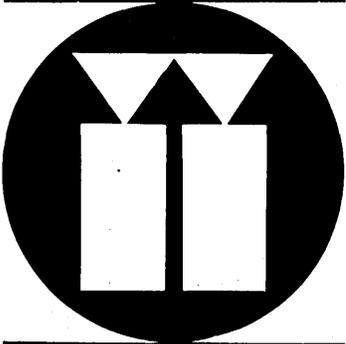


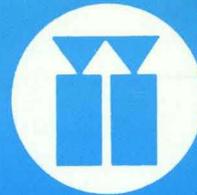
AUG 28 1973

TECHNICAL USER'S MANUAL

VISTA PLUS



Infoton



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GENERAL DESCRIPTION

The INFOTON VISTA PLUS is a stand-alone alphanumeric CRT display terminal for use in message oriented data entry and retrieval systems. A VISTA PLUS contains a keyboard, cathode ray tube display screen, control and refresh electronics, and one of several data interfaces. In addition, the VISTA PLUS can accommodate a number of optional peripherals and accessories.

DISPLAY CHARACTERISTICS

SCREEN SIZES

Characters/Line	40	40	80	80
Lines/Display	10	20	10	20
Character Set	64 character ASCII (upper case)			
Character Format	5 x 7 dot matrix (upper case)			
Character Size	0.08" x 0.19" nominal			
Cursor	Non-destructive blinking underscore			
Refresh Rate	50 or 60 Hz			
Viewing Area	9" x 7"			
Color	White — P4 phosphor			
Readability	Screen easily read without disruptive reflections in 100 foot candle illumination			
Size	15" high, 17" wide, 27" long			
Weight	65 pounds			
Power	150 watts			
	105-125 volts, 60 Hz			
	105-125 volts or 205-250 volts, 50 Hz (Export Model)			
Temperature	0° to 40° C (operating)			
	-30° to 70° C (storage)			
Humidity	0 to 95% non-condensing			

COMMAND FUNCTIONS

Cursor Right, Left, Up, Down, and Home
New Line, Carriage Return

Blink Start, Blink End
Roll Mode
Page Erase, Field Erase
Insert Character, Insert Line, Delete Character, Delete Line
Transmit Page, Transmit Field
Print Page, Print Field (with P-102 Printer Interface)
Protect Start, Protect End (Insert, Delete, Erase, Transmit, and Print commands are modified if issued between Protect Start and Protect End).
Tab, Backtab

INTERFACE

Maximum data rates are as follows:

Asynchronous to Internal Timing —

820 characters/second (when in ROLL mode, input during rolling action should be limited to 500 characters/second, unless two NULL characters are added after the character which causes the rolling action.)

Demand-Response

1500 characters/second average

Data Interface Modules

Each VISTA PLUS terminal is supplied with one of the following customer-selected data interface modules as standard equipment.

Asynchronous Serial Communication Interface, Multi-Speed (I-103)

EIA RS-232C interface to modems, couplers, or other equipment. Nine switch selectable speeds (110, 150, 300, 600, 1200, 1800, 2400, 3600, 4800 baud). Even, odd, or mark parity bit, switch selectable.

Transmits 11 bits at 110 baud, 10 bits at higher speeds. Receives 10 or 11 bits. A 20 ma signal output is provided to drive a copying device with the data as received on the data line.

Asynchronous Serial Current Loop (TTY) Interface, Multi-Speed (I-104)

Provides 20 or 60 ma current loop (TTY) interface for direct connection to computer or other equipment at distances of up to 1000 feet or more. Switch selectable speeds, selectable parity and 20 ma signal to copying device are same as with I-103 interface.

Parallel Interface Line Driver (I-106)

Allows transmission and reception of data on parallel lines up to 1000 feet or more in length.

Synchronous Serial Interface (I-107)

EIA RS-232C interface compatible with Western Electric 201A and 201B modems. Accepts external clocks at EIA levels. Character format is 8-bit, with odd character parity. Text messages followed by longitudinal redundancy check (LRC) character.

Asynchronous Serial Interface with LRC (I-108)

EIA RS-232C interface for applications which require asynchronous (10-bit) character format, character parity, and message parity. Character parity is even. Message parity is provided by longitudinal redundancy check (LRC) character. The interface has 1200 baud internal speed and an external clock position.

Asynchronous Serial Interface to Message Concentrator (I-109)

Used in VISTA PLUS if and only if VISTA PLUS is connected to the A-101 Message Concentrator. Transmits and receives data at 9600 baud in asynchronous format.

KEYBOARD

Layout

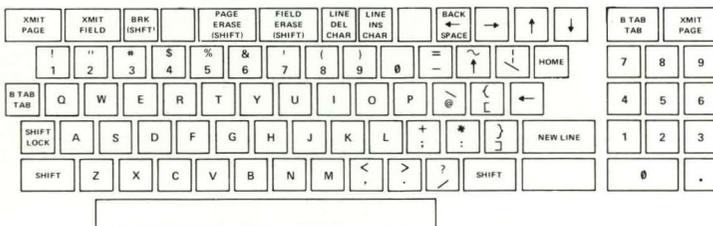
Keys for displaying characters are arranged to conform with the proposed ANSI standard for keyboards with logical bit pairing.

Rollover

When one key is already depressed and a second key is then depressed, the code for the second key will not be generated until the first key is released.

Repeat

When a code or function-generating key is depressed for more than 0.4 second, the code or function will be repeated at a rate of 10 per second.



OPTIONS

Interface

Multipurpose Asynchronous Serial Interface, Multi-Speed (I-105)

Contains all capabilities of both the I-103 and I-104 interface.

Peripherals

Printer Interface (P-102)

Provides interface to one of several popular printers. Up to 10 VISTA PLUS terminals (with printer interface) may share the same printer. Output to printer is from CRT display. Both EIA RS-232C and 20 ma current loop output are available at 10, 30, 120 or 600 characters per second.

Polling Module (P-301)

Allows addressing of individual VISTA PLUS displays on multi-dropped line. Includes acknowledgment (ACK) and negative acknowledgment (NAK) to indicate terminal status or status of received message.

Acknowledgment (P-302)

Provides acknowledgment (ACK) to indicate receipt of message or negative acknowledgment (NAK) to indicate receipt of erroneous data. Terminal retransmits on receipt of NAK from data line.

Integral Modem (P-401/402/403/404)

Built-in modem compatible with Western Electric 103A, 103F, 202C, or 202D. Output connects to Data Access Arrangement or to private line.

Accessories

Message Concentrator (A-101)

Allows the concentration of up to 64 VISTA PLUS terminals (in increments of 8 channels) on one communication line, each terminal individually addressable. A-101 itself contains electronics for 8 terminals. May be used with P-301 polling module to provide polling of individual VISTA PLUS terminals.

Message Concentrator Expansion, 8 Channels (A-102)

Provides additional 8-terminal expansion of Message Concentrator.

Lower Case Character Group (A-202)

Increases character set to 96 displayable ASCII characters. Lower case characters are presented in a 5 x 9 dot matrix.

Infotone (Bell) (A-203)

Generates a short, audible signal whenever the cursor reaches the tenth position from the end of a line or when the BELL code is received by the terminal.

Light Pen (A-204)

Includes photo-detecting light pen, associated circuitry, and interface electronics. The light pen will cause the transmission of a message containing the row and column position of the character at which the pen is pointed.

INFOTON

TECHNICAL USER'S MANUAL

VISTA PLUS

#00915
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PREFACE

This document is a revision of INFOTON Document #00753 (26 January 1971), entitled "Technical User's Manual - VISTA 2 E-H".

Chapter 1 describes the operation of the VISTA PLUS terminal, including the commands which are available from the keyboard and from the data line.

Chapter 2 introduces the system configurations based upon the VISTA PLUS, including clusters of terminals attached to the Message Concentrator and configurations that use polling.

A description of all the data interfaces which are used in the VISTA PLUS is contained in Chapter 3.

Chapter 4 consists of descriptions of peripherals and accessories for the VISTA PLUS that are not described in detail elsewhere in this manual.

Chapter 5 contains a number of useful notes of interest to persons who are writing computer programs for the VISTA PLUS.

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 TECHNICAL USER'S MANUAL
 VISTA PLUS

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INTRODUCTION

The INFOTON VISTA PLUS is a stand-alone alphanumeric display terminal for use in data entry and retrieval systems where a highly flexible interaction between man and machine is desired. The VISTA PLUS incorporates such important features as line and character editing, protected fields, tabbing, and block transmission of data.

In a typical VISTA PLUS application, an operator enters data on the screen, visually verifies or edits the data, and then initiates data transmission by depressing a transmit key. The VISTA PLUS is ideally suited for a wide variety of information systems, such as reservation systems, credit verification systems or text preparation and editing.

The VISTA PLUS is functionally different from the INFOTON VISTA BASIC and VISTA STANDARD, which are teletype-compatible terminals that transmit each character as its key is depressed. With the VISTA PLUS, a computer may send messages to define protected fields; the operator may enter and edit data in any unprotected field on the screen prior to block transmission.

A VISTA PLUS consists of a keyboard, cathode ray tube display screen, refresh electronics, and one of several data communications interfaces. Furthermore, several optional features are available with the VISTA PLUS. These options include a magnetic tape cassette storage unit, electronics to drive a printer, a light pen, a built-in modem, and a polling module which allows more than one VISTA PLUS to be attached to the same communications line.

The VISTA PLUS may be incorporated into many system configurations. In a local environment, the VISTA PLUS may be connected to a computer without modems; in a remote environment, the VISTA PLUS may be connected to a modem, which allows data transmission over telecommunication lines. By use of the polling

option, several VISTA PLUS displays may be multidropped on a dedicated telecommunication line.

Furthermore, VISTA PLUS terminals can be attached to the INFOTON A-101 Message Concentrator, which allows up to 64 display terminals to be attached to the same line, in either a remote or local environment.+ Figure 1 illustrates the possible configurations. A more detailed description of the various system configurations is contained in Chapter 2.

+When the A-101 Message Concentrator is equipped with a P-301 Polling Module with the two-character address option, then more than 64 VISTA PLUS terminals can be attached to the same line.

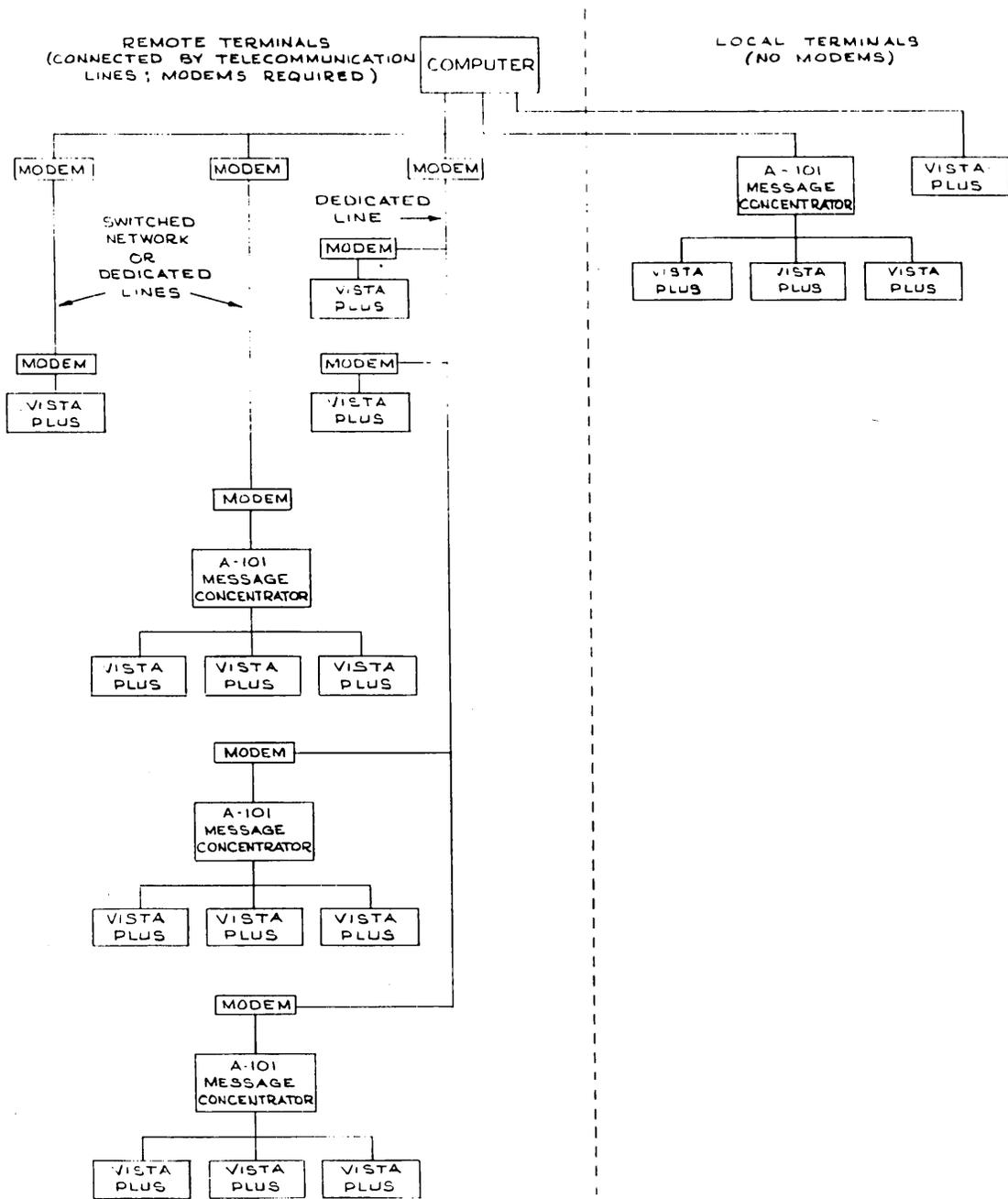


FIGURE 1

INFOTON VISTA PLUS SYSTEM CONFIGURATIONS

OPTIONAL PERIPHERALS SUCH AS HARD COPY DEVICES ARE NOT ILLUSTRATED

CHAPTER 1

PRINCIPLES OF OPERATION

VISTA PLUS DESIGN

A system block diagram of the VISTA PLUS is shown in Figure 2. The video generator logic provides video signals that display on the screen the images of the characters stored in the memory. In addition, a blinking underscore, called the cursor, is always displayed on the screen. The cursor marks the character position at which the next character from the keyboard, from the data line or from the option interface will be displayed.

The characters presented on the screen should be thought of as an image of the contents of the internal memory of the VISTA PLUS. When a character is entered into the memory, the image on the screen is automatically updated. The details of the method whereby a character is inserted at the proper position of the circulating MOS shift register memory need not be considered by a user of the VISTA PLUS. In fact, the only access which the system user or designer has to the internal memory of the VISTA PLUS is through the keyboard, the data interfaces, or the option interfaces supplied by INFOTON.

A specification sheet for the VISTA PLUS is contained in Table 1.

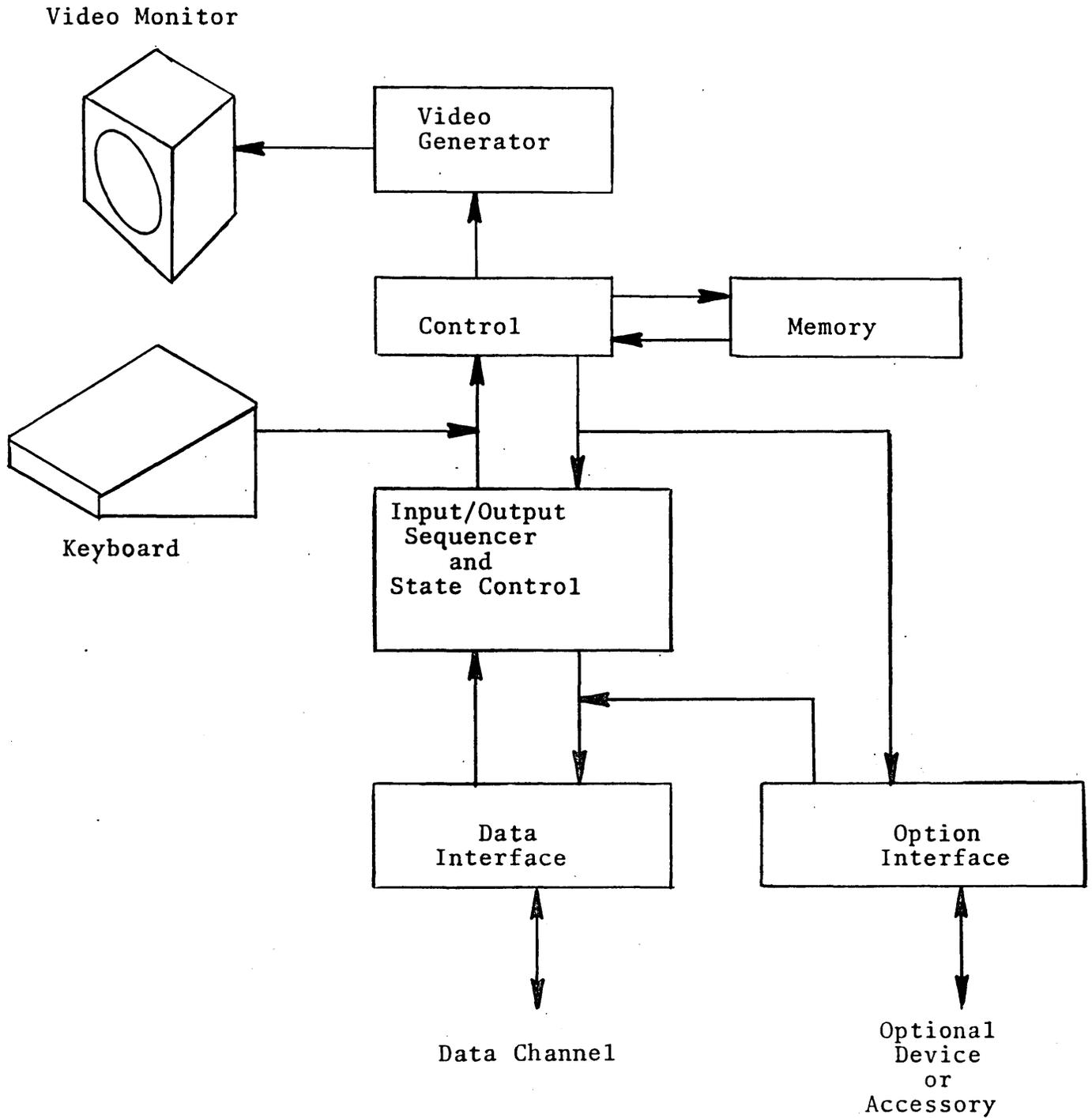


FIGURE 2: SYSTEM BLOCK DIAGRAM FOR VISTA PLUS

I. Specifications for Separate Models

		<u>SCREEN SIZE</u>		
Characters per Line	40	40	80	80
Number of Lines	10	20	10	20
Width of Screen Displayed (inches)	4	4	8	8
Height of Screen Displayed (inches)	2.5	5	2.5	5

II. Specifications Applicable to all VISTA PLUS Models

TV Screen Size	12" Diagonal
TV Phosphor	P4 (white characters on dark background)
Readability	Screen easily read without disruptive reflections in 100 foot candle illumination
Neutral Density Filter with Anti-Reflective Coating	
Character Size (Nominal)	.08" wide x .19" high
Character Format	5 x 7 dot matrix (upper case) 5 x 10 matrix (lower case option)
Displayable Character Set	64 character ASCII (standard) 96 character ASCII (with A-202 lower case option)
Cursor	Non-destructive blinking underscore
Refresh Rate	50 or 60 Hz, depending upon frequency of AC power
Memory	MOS shift registers
Power	150 watts 105-125 volts; 60 Hz 105-125, 205-250 volts; 50 Hz (export model)
Dimensions	15" High 17" Wide 27" Long
Weight	65 pounds

Temperature	0° to 40°C operating -30° to 70°C storage
Humidity	0 to 95%, non-condensing
Serial Interface	Current Loop or RS-232C
Parallel Interface	TTL Logic, Bit-Parallel, Demand-Response Control
I/O Rate	1500 character/second, parallel up to 820 characters/second, serial

TABLE 1: SPECIFICATIONS OF INFOTON VISTA PLUS

CODE SET

The code set for the VISTA PLUS is contained in Tables 2A, 2B and 3. Table 2A is a chart of the bit patterns of codes used by the standard VISTA PLUS with the 64 character ASCII set; Table 2B is a similar chart for VISTA PLUS models equipped with the A-202 option (96 character ASCII set, including lower case). Empty spaces in Tables 2A and 2B denote codes which are neither generated nor recognized by the VISTA PLUS. INFOTON may assign control functions to these codes at a later date. Table 3 contains the same information as Tables 2A and 2B, but in a different format.

The codes for SOH, EOT, ACK, NAK and SYN are used only in communications dialog. They cannot be generated from the VISTA PLUS keyboard. If sent to the VISTA PLUS as text in the text stream, they will not be recognized.* Their functions in communications are described in Chapter 2.

In the standard VISTA PLUS with the 64 character ASCII set, the lower case codes are not generated from the keyboard; the upper case alphabetic codes are generated when the "SHIFT" key is not depressed. Nevertheless, if lower case codes are received through a VISTA PLUS I/O interface, they will be stored in memory as lower case codes, but displayed as upper case. When transmitted from the memory through the data interface or through an option interface, these lower case codes will be transmitted as lower case codes.

In a later section of this chapter the operation of the VISTA PLUS will be described in terms of the commands to which the display responds. Most of these commands may be initiated both from the keyboard and from the data line, by receipt of the appropriate code. The VISTA PLUS responds to a command in the same manner, whether received from the data line as a code or from the keyboard.

*However, NAK will be recognized if sent after the VISTA PLUS has transmitted; a retransmission will occur automatically. Generation of a NAK by the VISTA PLUS requires the P-301 or P-302 modules.

BITS 4,3,2,1		BITS 7, 6, 5						
000	001	010	011	100	101	110	111	
0000	NULL	SPACE	0	@	P	@	P	
0001	(1) SOH	XMIT PAGE	!	1	A	Q	A Q	
0010	STX	PRINT FIELD	"	2	B	R	B R	
0011	ETX	PRINT PAGE	#	3	C	S	C S	
0100	(1) EOT	DC4 XMIT FIELD	\$	4	D	T	D T	
0101	ENQ I/O RESET	(1) NAK	%	5	E	U	E U	
0110	(1) ACK	(1) SYN	&	6	F	V	F V	
0111	BELL		'	7	G	W	G W	
1000	HOME	ROLL	(	8	H	X	H X
1001	FORWARD TAB	CURSOR RIGHT	)	9	I	Y	I Y
1010	NEW LINE	CURSOR LEFT	*	:	J	Z	J Z	
1011	FIELD ERASE	(2) ESC	+	;	K	[	K [
1100	PAGE ERASE	CURSOR UP	,	<	L	—	L —	
1101	CARRIAGE RETURN	CURSOR DOWN	-	=	M	]	M]
1110	PROTECT END	PROTECT START	.	>	N	↑	N ↑	
1111	BLINK END	BLINK START	/	?	O	←	O (3) GEN ADD	

The area enclosed by dashed lines is reserved for lower case

- (1) Reserved for communications; not generated or recognized internal to the VISTA PLUS
- (2) Used as an extension code in certain sequences used with A-204 Light Pen
- (3) General address; used only with A-101 Message Concentrator and P-301 Polling Module with two-character address; not generated or recognized internal to VISTA PLUS.

TABLE 2A - VISTA PLUS CODE SET, 64 CHARACTER ASCII

(upper case alphabetic characters only)

BITS

BITS 7, 6, 5

4,3,2,1 000 001 010 011 100 101 110 111

0000	NULL		SPACE	0	e	P	~	p
0001	(1)SOH	XMIT PAGE	!	1	A	Q	a	q
0010	STX	PRINT FIELD	"	2	B	R	b	r
0011	ETX	PRINT PAGE	#	3	C	S	c	s
0100	(1)EOT	DC4 XMIT FIELD	\$	4	D	T	d	t
0101	ENQ I/O RESET	(1)NAK	%	5	E	U	e	u
0110	(1)ACK	(1)SYN	&	6	F	V	f	v
0111	BELL		'	7	G	W	g	w
1000	HOME	ROLL	(	8	H	X	h	x
1001	FORWARD TAB	CURSOR RIGHT	)	9	I	Y	i	y
1010	NEW LINE	CURSOR LEFT	*	:	J	Z	j	z
1011	FIELD ERASE	(2)ESC	+	;	K	[	k	{
1100	PAGE ERASE	CURSOR UP	,	<	L	\	l	|
1101	CARRIAGE RETURN	CURSOR DOWN	-	=	M	]	m	}
1110	PROTECT END	PROTECT START	.	>	N	↑	n	~
1111	BLINK END	BLINK START	/	?	O	←	o	(3)GEN ADD

- (1) Reserved for communications; not generated or recognized internal to the VISTA PLUS
- (2) Used as an extension code in certain sequences used with A-204 Light Pen
- (3) General address; used only with A-101 Message Concentrator and P-301 Polling Module with two-character address; not generated or recognized internal to VISTA PLUS

TABLE 2B - VISTA PLUS CODE SET FOR MODELS WITH 96 CHARACTER ASCII SET

#00915

(as provided by A-202 Lower Case Character Option)

28 June 1971

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TABLE 3 - VISTA PLUS CODE SET

<u>OCTAL CODE (7 BITS)</u>	<u>HEXIDECIMAL CODE (7 BITS)</u>	<u>CHARACTER NAME</u>	<u>REMARKS</u>
000	00	NULL	
001	01	SOH	Start of header. Used only in communications.
002	02	STX	START OF TEXT
003	03	ETX	END OF TEXT
004	04	EOT	END OF TRANSMISSION (used only in communications)
005	05	I/O RESET | ENQ	I/O RESET: Internal to VISTA PLUS ENQ: Polling Code, used only in communications.
006	06	ACK	ACKNOWLEDGE. Used only in communications.
007	07	BELL	Used with INFOTONE (BELL) option
010	08	CURSOR HOME	
011	09	(FORWARD) TAB	
012	0A	NEW LINE (LF)	This is the ASCII Line Feed Code
013	0B	FIELD ERASE	
014	0C	PAGE ERASE	
015	0D	CARRIAGE RETURN	
016	0E	PROTECT END	
017	0F	BLINK END	
020	10		Not used at present
021	11	XMIT PAGE	
022	12	PRINT FIELD	
023	13	PRINT PAGE	
024	14	XMIT FIELD/ DC4	XMIT FIELD: Internal to VISTA PLUS DC4: Polling code, used only in communications.

<u>OCTAL CODE (7 BITS)</u>	<u>HEXIDECIMAL CODE (7 BITS)</u>	<u>CHARACTER NAME</u>	<u>REMARKS</u>
025	15	NAK	Negative Acknowledge. Used only in communi- cation.
026	16	SYN	Synchronous Idle Character. Used only in communication.
027	17		Not Used at Present.
030	18	ROLL	
031	19	CURSOR RIGHT	
032	1A	CURSOR LEFT	
033	1B	ESC	Used as extension code in certain sequences used with A-204 Light Pen.
034	1C	CURSOR UP	
035	1D	CURSOR DOWN	
036	1E	PROTECT START	
037	1F	BLINK START	
040	20	SPACE	
041	21	!	
042	22	"	
043	23	#	
044	24	\$	
045	25	%	
046	26	&	
047	27	'	
050	28	(
051	29)	
052	2A	*	
053	2B	+	
054	2C	,	
055	2D	-	
056	2E	.	
057	2F	/	

<u>OCTAL CODE (7 BITS)</u>	<u>HEXIDECIMAL CODE (7 BITS)</u>	<u>CHARACTER NAME</u>	<u>REMARKS</u>
060	30	0	
061	31	1	
062	32	2	
063	33	3	
064	34	4	
065	35	5	
066	36	6	
067	37	7	
070	38	8	
071	39	9	
072	3A	:	
073	3B	;	
074	3C	<	
075	3D	=	
076	3E	>	
077	3F	?	
100	40	@	
101	41	A	
102	42	B	
103	43	C	
104	44	D	
105	45	E	
106	46	F	
107	47	G	
110	48	H	
111	49	I	
112	4A	J	
113	4B	K	
114	4C	L	

<u>OCTAL CODE (7 BITS)</u>	<u>HEXIDECIMAL CODE (7 BITS)</u>	<u>CHARACTER NAME</u>	<u>REMARKS</u>
115	4D	M	
116	4E	N	
117	4F	O	
120	50	P	
121	51	Q	
122	52	R	
123	53	S	
124	54	T	
125	55	U	
126	56	V	
127	57	W	
130	58	X	
131	59	Y	
132	5A	Z	
133	5B	[
134	5C	\	
135	5D]	
136	5E	↑	
137	5F	←	
140	60	@	@ in 64 character model, ^ in 96 character model
141	61	a	
142	62	b	
143	63	c	
144	64	d	
145	65	e	
146	66	f	
147	67	g	
150	68	h	
151	69	i	

<u>OCTAL CODE (7 BITS)</u>	<u>HEXIDECIMAL CODE (7 BITS)</u>	<u>CHARACTER NAME</u>	<u>REMARKS</u>
152	6A	j	
153	6B	k	
154	6C	l	
155	6D	m	
156	6E	n	
157	6F	o	
160	70	p	
161	71	q	
162	72	r	
163	73	s	
164	74	t	
165	75	u	
166	76	v	
167	77	w	
170	78	x	
171	79	y	
172	7A	z	
173	7B	[	[ in 64 character model, { in 96 character model
174	7C	\	\ in 64 character model, , in 96 character model
175	7D	]	] in 64 character model, } in 96 character model
176	7E	†	† in 64 character model, ~ in 96 character model
177	7F	GEN ADD	Polling Code - Used only in communications.

KEYBOARD

Figure 3 is a drawing of the VISTA PLUS keyboard. The displaying characters in the 64 (or 96) character ASCII sets are arranged on the keyboard in accordance with the proposed ANSI standard (x4A9/199B) for a keyboard with logical bit pairing.

The numeric key pad, which is standard on the VISTA PLUS, duplicates keys that are located elsewhere on the keyboard. The numerals on the pad are arranged in the format of a 10-key adding machine.

The keyboard provides an automatic repetition of any key that is continuously depressed. Specifically, if a key is depressed normally for a 0.4 second duration, its code is generated at a rate of 10 characters per second until the key is released.

The keyboard generates the 7-bit ASCII code outputs on seven parallel data lines; it also generates a strobe pulse on a separate line to indicate when the data on the data lines is valid. The pulse width of the strobe is 200 ± 100 nanoseconds.

If a single key is depressed, then the appropriate code and the strobe are generated. If a second coded key is depressed while the first is still depressed, then a second strobe pulse will not be generated so long as both keys are depressed. This feature is commonly called interlock. When either key is released, the code and strobe for the other is generated, provided that this other key remains depressed. This feature is commonly called rollover.

Figure 3 shows keys marked

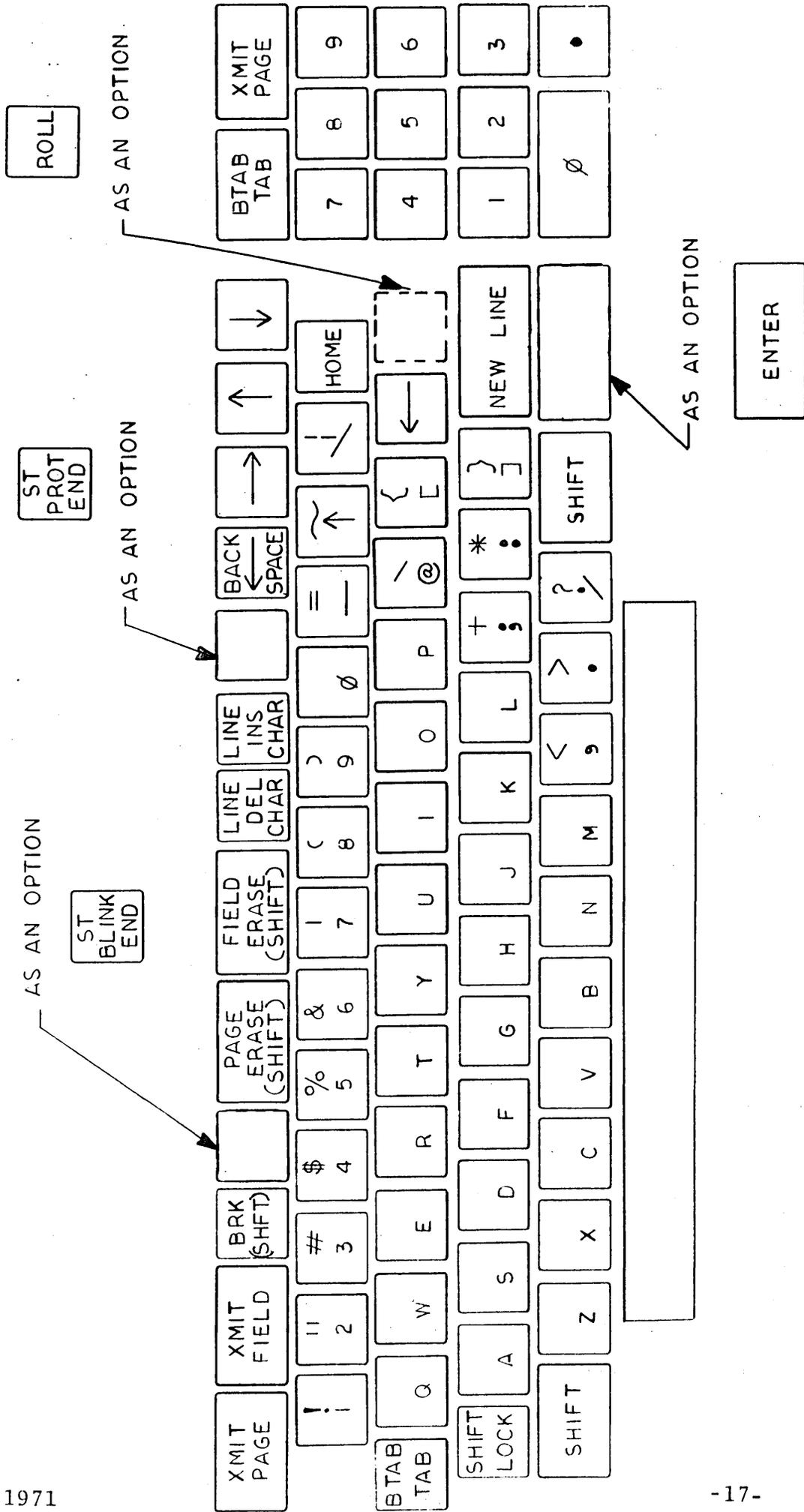
ST
BLNK
END

ST
PROT
END

ROLL

ENTER

, and . These keys will not be operative on the VISTA PLUS unless specifically requested. Their operation is explained in subsequent sections of this chapter.



VISTA PLUS KEYBOARD

FIGURE 3

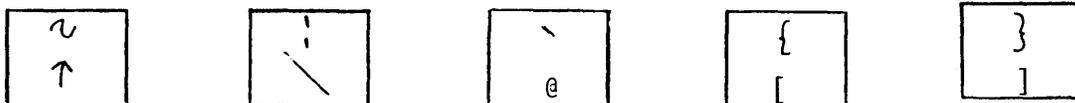
Keys Which Relate to the Keyboard Operation

ENTER - Unless otherwise specified, the VISTA PLUS will be manufactured without the key labeled ENTER. If this key is present, however, it is necessary to depress it in order to activate the keyboard and permit codes to be generated by the keyboard. The "ENTER" key does not cause any transmission of data through a communication interface.

SHIFT - The "SHIFT" key operates only when depressed in conjunction with a second key. When depressed, it causes the keyboard to generate the code associated with the character or function printed on the upper half of the second key depressed.

SHIFT LOCK - When depressed, the "SHIFT LOCK" key will initiate and maintain the shift function. Afterwards, depressing the "SHIFT" key will release the shift function.

In the standard VISTA PLUS with the 64-character ASCII set, the keyboard generates the 26 upper case alphabetic characters, regardless of whether the "SHIFT" key is depressed. Furthermore, in the standard VISTA PLUS the keys are labeled:



always generate the lower character (i.e., ↑, \, @, [and]), regardless of whether the "SHIFT" key is depressed. All other keys labeled with separate upper and lower designations generate the upper character when the "SHIFT" key is depressed and the lower character otherwise.

In the VISTA PLUS models with the A-202 option, (the full 96-character ASCII set), the keyboard generates the 26 upper case alphabetic characters when the "SHIFT" key is depressed and the lower case alphabetic characters otherwise. All keys labeled with separate upper and lower case designations generate the upper character when the "SHIFT" key is depressed and the lower character otherwise.

Note that the following keys can operate only in conjunction with the "SHIFT" key:

BRK (SHFT)

PAGE ERASE (SHIFT)

FIELD ERASE (SHIFT)

VISTA PLUS COMMANDS

In this section all the commands associated with the VISTA PLUS are described. The commands are classified in two ways. First, certain commands enter characters into memory and others do not. A second classification may be based upon whether a command is available from the data line, from the keyboard or control panel, or from both.

Commands Which Enter Characters Into Memory

The 95⁽¹⁾ ASCII codes from 040₈ through 176₈ are entered into the VISTA PLUS memory either when received from the data line or when their respective keys are depressed. With the exception of the SPACE (040₈), all of these codes result in the display of a character on the VISTA screen.

In addition to the command for SPACE, the commands for BLINK START and BLINK END also cause a non-displaying code to be entered in memory. These three commands are summarized below.

SPACE (from data line or from space bar on keyboard) - This command enters the SPACE code at the present cursor position.

The 96th code, 177₈, is not recognized internal to the VISTA PLUS. It is reserved as a GENERAL ADDRESS code for use with the A-101 Message Concentrator.

The cursor advances one position. The space code may be used to erase a single character, word, or line without disturbing the rest of a message on the screen, since the space code replaces the character indicated by a blank. To move the cursor to the right without erasing a character, the CURSOR RIGHT command (see below) should be used.

BLINK START (from data line or from keyboard, if equipped with the necessary key) - This command enters a BLINK START code in memory, and a blank appears on the screen at the corresponding position. Every character on the screen from the BLINK START character to the first BLINK END character will blink. From the keyboard, the BLINK START command is initiated by depressing the "SHIFT" key together with the key labeled

ST
BLNK
END

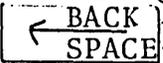
BLINK END (from data line or from keyboard, if equipped with the necessary key) - This command enters a BLINK END code in memory, and a blank appears on the screen at the corresponding position. Note that a blinking message can be made to cease blinking only by replacing the BLINK START with some other character, such as the space. The BLINK END command is initiated from the keyboard by depressing the key labeled

ST
BLNK
END

Commands Which Do Not Enter Characters into Memory

HOME (from data line or from keyboard) - The HOME command moves the cursor to the home position, which is the first character position of the first line. Thus, home is the upper left-hand corner of the screen.

CURSOR RIGHT (from data line or from keyboard, by key labeled ) - The CURSOR RIGHT command moves the cursor one character position to the right. If the cursor is at the last position of a line, this command will move the cursor to the first character of the line below. If the cursor is at the last position of the last line, then it will move to the home position.

CURSOR LEFT (from data line or from keyboard, by key labeled ) - The CURSOR LEFT command moves the cursor one character position to the left. If the cursor is at the first position of a line, this command will move the cursor to the last character of the line above. If the cursor is at the home position, it will move to the lower right corner of the screen.

CURSOR UP (from data line or from keyboard, by key labeled ) - The CURSOR UP command moves the cursor one line above its present position. If the cursor is in the first line, this command will move the cursor to the corresponding position in the bottom line.

CURSOR DOWN (from data line or from keyboard, by key labeled ) - The CURSOR DOWN command moves the cursor one line below its present position. If the cursor is in the bottom line, this command will move the cursor to the corresponding position in the top line.

ROLL (from the data line or from keyboard, if equipped with the necessary key) - The VISTA PLUS is normally in page mode. The ROLL command places the terminal in roll mode. In page mode, an attempt to write past the bottom line moves the cursor to the top line, which will be overwritten.

In roll mode, whenever the cursor is in the last position of the bottom line and a code is entered into memory, then the top line moves off the screen, all the other lines automatically

shift upward by one line, and the character is written at the beginning of the bottom line, which is now free for new data. Rolling also occurs when the cursor is anywhere in the bottom line and a NEW LINE command is received. Rolling is never caused by any of the four cursor commands.

Once the terminal is placed in the roll mode, it may be returned to page mode by the ERASE command.

NEW LINE (from data line or from keyboard) - This command moves the cursor to the first position of the next line. If the cursor is on the last line, then NEW LINE will move the cursor to the home position if the terminal is in page mode; if it is in roll mode, the entire display will shift up one line and the cursor will move to the start of the blank line at the bottom of the screen.

When a character is written on the last position of a line, the cursor will automatically advance to the first position of the next line. When this happens, in order to prevent inadvertent double spacing, the first NEW LINE command received prior to the receipt of a displaying character will be ignored.

CARRIAGE RETURN (from data line only) - This command moves the cursor to the first position of the line in which it is located.

BELL (from data line or from keyboard) - If the VISTA PLUS is equipped with the A-203 Infotone (Annunciator) option, then a short, audible signal is generated whenever the cursor moves to the tenth character position from the end of a line or when the BELL command code is received from the data line.

PROTECT START (from data line or from keyboard, if equipped with the necessary key) - The PROTECT START command places the VISTA PLUS into protected input mode. The VISTA PLUS remains in protected input mode until a PROTECT END command is received. When the VISTA PLUS is in protected

input mode, all data entered into memory will be protected. In addition, the various Insert, Delete, Erase, Transmit and Print commands are modified when the VISTA PLUS is in protected input mode. From the keyboard, the PROTECT START command is initiated by depressing the "SHIFT" key together with the key labeled

ST
PROT
END

PROTECT END (from data line, or from keyboard, if equipped with the necessary key) - The PROTECT END command removes the VISTA PLUS from protected input mode. From the keyboard, the PROTECT END command is initiated by depressing the key labeled

ST
PROT
END

Note that the ASCII codes for PROTECT START and PROTECT END do not occupy positions in memory. (The protect logic is implemented by an eighth bit which is set for all characters which enter memory while the VISTA PLUS is in protected input mode.)

The only command which can remove the VISTA PLUS from the protected input mode is PROTECT END.

Protected data is underlined with dashes when displayed on the screen. (If desired, the VISTA PLUS may be ordered without the protect underscore feature.)

Any codes that enter memory (including SPACE, BLINK START, and BLINK END) in protected input mode will be protected. Cursor movement commands do not go into memory and therefore do not create protected spaces.

Protected data can be erased by issuing either of the two Erase commands when the VISTA PLUS is in protected input mode. Protected data may also be overwritten by other protected data, when the VISTA is in protected input mode.

If the VISTA PLUS is not in protected input mode, and an attempt is made to write over a protected character location, then the cursor will advance, but the contents of the location will remain unchanged.

The consecutive unprotected memory locations between protected character strings comprise a field. The tabbing, editing, and transmission operations of the VISTA PLUS are oriented toward fields.

With few exceptions, the VISTA PLUS commands that remain to be described are modified in the protected input mode. These commands will be described in both the ordinary and protected input modes.

PAGE ERASE (from data line or from keyboard) - In the unprotected mode, the PAGE ERASE command erases all the unprotected characters, places the cursor at the home position, and establishes the page mode.

In the protected input mode, the PAGE ERASE command erases all data, both protected and unprotected. The command also homes the cursor and establishes page mode.

From the keyboard the PAGE ERASE command is initiated by depressing the "SHIFT" key together with the key labeled

PAGE ERASE (SHIFT)

FIELD ERASE (from data line or from keyboard) - In the unprotected mode, the FIELD ERASE command erases from the cursor position to the end of the field or to the end of the page, whichever comes first. The cursor does not move.

In the protected input mode, the FIELD ERASE command will erase all characters from the cursor position through the end of the next protected area. Thus, this command erases

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the protected data between the cursor position and the next field. The cursor does not move. The FIELD ERASE command in the protected input mode is the only command which allows the selective erasure of protected characters.

From the keyboard, the FIELD ERASE command is initiated by depressing the "SHIFT" key together with the key labeled

FIELD
ERASE
(SHIFT)

FORWARD TAB (from data line or from keyboard) - The FORWARD TAB command moves the cursor to the first unprotected character following a protected character or to the home position, whichever comes first. The action of this command is the same in the unprotected and protected input modes.

From the keyboard the FORWARD TAB command is initiated by depressing either of the two keys labeled

BTAB
TAB

Throughout this manual, the command TAB will refer to FORWARD TAB. (The backward tab always will be explicitly called BACKTAB.)

BACKTAB (from keyboard only) - In the unprotected mode the BACKTAB command moves the cursor backward to the first unprotected character to the right of a protected character or to the home position, whichever comes first.

In the protected input mode the BACKTAB command will position the cursor in the home position.

The BACKTAB command is initiated by depressing the "SHIFT" key together with either of the two keys labeled

BTAB
TAB

INSERT CHARACTER (from keyboard only) - This command is initiated by depressing the key labeled

LINE	In
INS	
CHAR	

the unprotected mode, the effect of the INSERT CHARACTER command may be described as follows:

- (1) If there is no protected data on the line to the right of the cursor, then the command creates a null at the cursor position, and all data from the cursor position to the end of the line is moved right one position. The last character on the line is lost. The cursor does not move.
- (2) If there is protected data on the line to the right of the cursor, then the command creates a null at the cursor position and all data from the cursor position to the first protected character is moved right one position. The first protected character acts as the end of the editing field. The first protected character and all characters to its right remain unaltered. The character just to the left of the first protected character is lost. The cursor does not move.

In the protected input mode all data can be edited as though it were unprotected. Thus, the operation is as described in (1) above.

DELETE CHARACTER (from keyboard only) - This command is initiated by depressing the key labeled

LINE
DEL
CHAR

. In the unprotected

mode, the effect of the DELETE CHARACTER command may be described as follows:

- (1) If there is no protected data on the line to the right of the cursor, then the command causes all data from the cursor position to the end of the line to be moved left one position. The character at the cursor position is lost. A null is inserted at the end of the line. The cursor does not move.
- (2) If there is protected data on the line to the right of the cursor, then the command causes all the data from the cursor position to the first protected character to be moved left one position. The

character at the cursor position is lost. A null is inserted in the position immediately to the left of the first protected character. The first protected character and all characters to its right are unaltered. The cursor does not move.

In the protected input mode all data can be edited as though it were unprotected. Thus, the operation is as described in (1) above.

INSERT LINE (from keyboard only) - This command is initiated by depressing the "SHIFT" key together with the key labeled

LINE
INS
CHAR

In the unprotected mode the effect of the INSERT LINE command may be described as follows:

- (1) If there is no protected data to the right of the cursor or on any line below, then the INSERT LINE command creates nulls at the cursor position and the 79 (or 39, on the models with a 40-character line) following positions. If the cursor is not under the first character on a line, then the 79 (39) nulls will wrap around to the next line. The data from the cursor position to the end of the page is moved down one line, and the last line on the page is lost. The cursor does not move.
- (2) If there is protected data to the right of the cursor or on a line below, then the first protected character between the cursor and the end of the page acts as the end of the editing field. The insertion of nulls and the downward shifting of lines (or part of a line) proceed until the first protected character is encountered. The first protected character, all characters to its right, and all characters on lower lines are not altered. The cursor does not move.

In the protected input mode all data can be edited as though it were unprotected. Thus, the operation is as described in (1) above.

DELETE LINE (from keyboard only) - This command is initiated by depressing the "SHIFT" key together with the key labeled

LINE
DEL
CHAR

. In the unprotected mode the effect of the

DELETE LINE command may be described as follows:

- (1) If there is no protected data to the right of the cursor or on any line below, then the DELETE LINE command causes all data from the cursor position to the end of the page to move up one line. The character at the cursor position and the 79 (or 39, on the models with a 40-character line) characters to its right are lost. If the cursor is not under the first character on a line, then the string of 79 (39) characters lost will wrap around the next line. The cursor does not move.
- (2) If there is protected data to the right of the cursor or on a line below, then the first protected character between the cursor and the end of the page acts as the end of the editing field. The insertion of nulls and the upward shifting of lines (or part of a line) occur only between the cursor and the first protected character. The first protected character, all characters to its right, and all characters on lower lines are not altered. The cursor does not move.

In the protected input mode all data can be edited as though it were unprotected. Thus, the operation is as described in (1) above.

BREAK (from keyboard only) - This command, when used with a VISTA PLUS equipped with a serial data interface, places a

"space" (logical "0") on the data line as long as the operator depresses both the "SHIFT" key and the key labeled

BREAK (SHIFT)

.

The operation of this key is independent of whether the display is in the unprotected or protected input mode.

TRANSMIT PAGE (from data line or from keyboard) - In the unprotected mode the TRANSMIT PAGE command moves the cursor home and causes the transmission of all unprotected data on the screen. At the end of the transmission the cursor will be in the last character position of the last line.

In the protected input mode the TRANSMIT PAGE command moves the cursor home and causes the transmission of all data on the screen, both protected and unprotected. The cursor is in the last position of the last line at the end of the transmission.

From the keyboard, the TRANSMIT PAGE command is initiated by depressing either of the two keys labeled

XMIT PAGE

.

TRANSMIT FIELD (from data line or from keyboard) - In the unprotected mode the TRANSMIT FIELD command backspaces the cursor to the first character of the field and transmits from there to the end of the field. The cursor ends up within the field or at the first protected character following the field. Prior to the issue of a TRANSMIT FIELD command the cursor may be positioned anywhere within the field. If the cursor is placed below a protected character, then the TRANSMIT FIELD command will cause the cursor to backspace to the first character of the preceding field and transmit that field.

In the protected input mode the TRANSMIT FIELD command performs exactly as does the TRANSMIT PAGE command in the protected input mode.

From the keyboard the TRANSMIT FIELD command is initiated by depressing the key labeled

XMIT FIELD

.

PRINT PAGE (from data line or from "PRINT PAGE" switch on control panel) - This command is available with VISTA PLUS displays equipped with the P-102 Printer Interface option. In the unprotected mode the PRINT PAGE command homes the cursor and transfers all the unprotected data on the screen to an attached hard copy device. Protected data is skipped over and a TAB character sent to the printer instead. At the end of the operation, the cursor is located at the last character on the last line.

(As an option, the PRINT PAGE command can be specified so that all data on the screen, including protected data, is transferred to the printer.)

In the protected input mode the PRINT PAGE command will transfer all data, including protected data, to the printer.

PRINT FIELD (from data line or from "PRINT FIELD" switch on control panel) - This command is available with VISTA PLUS displays equipped with the P-102 Printer Interface option. In the unprotected mode the PRINT FIELD command backspaces the cursor to the beginning of the field and transfers all the data in the field to the printer. At the end of the operation the cursor is located within the field or at the first protected character following the field.

(With the option to print all data, including protected data, the PRINT FIELD command will cause the entire page to be printed.)

In the protected input mode the PRINT FIELD command will transfer all data on the page, including protected data, to the printer.

I/O RESET (from data line or from switch on control panel) - This command terminates any I/O operation in progress, resets the peripherals, resets the parity error light, and places the cursor in the home position.

The operation of the I/O RESET command is independent of whether the terminal is in the unprotected or protected input mode.

The I/O RESET command is available from the control panel of all VISTA PLUS displays. The use of the I/O RESET command from the data line is governed by the following restrictions:

- (1) The I/O RESET command will not be recognized if received from the data line by a VISTA PLUS terminal equipped with the P-301 (Polling) or the P-302 (Acknowledgment) modules.
- (2) I/O RESET must be the last character of text in a message sent to a VISTA PLUS display equipped with the I-107 Synchronous Interface.
- (3) In a VISTA PLUS display with Longitudinal Redundancy Check (LRC) parity checking (i.e., a display with either the I-107 or I-108 Interface), parity computation and checking will be terminated upon receipt of the I/O RESET code. The LRC character for the message will not be checked.

CONTROL PANEL

Figure 4 shows the control panel of the VISTA PLUS. Indicator lights are used to signal the following conditions:

POWER - Indicates that the VISTA PLUS is turned on and power is applied.

PARITY - Indicates that an error has been detected in a message received by the VISTA PLUS.

I/O BUSY - Indicates that I/O transfer is in progress on the data line or to an attached peripheral device.

ENTER - Indicates that the VISTA PLUS is in the ENTER state and that data may be entered on the screen from the keyboard.

The following knobs and switches are located on the control panel:

OFF-ON-I/O RESET - This is a three position switch. The OFF and ON positions control the electrical power. The I/O RESET position is spring-loaded. The I/O RESET switch on the control panel terminates any I/O operation in progress, resets the peripherals, resets the PARITY light, and sends the cursor to the home position.

LOC-LINE - This is a two position switch. In the LOC (for local) position the display terminal is not connected with the data line. In the LINE position communication with the data channel is enabled.

PRINT FIELD - PAGE - This is a two-position spring-loaded switch for initiating either the PRINT FIELD or PRINT PAGE command.

HORIZ, VERT, INTENSITY - These three control knobs are identical to the horizontal, vertical, and intensity controls on an ordinary television receiver.

STATES OF THE VISTA PLUS

The INFOTON VISTA PLUS is always in one of six primary states or four intermediate states, which are controlled from the data channel and from the keyboard and controls of the terminal. The primary states and their meaning are as follows:

NULL - This is the state of the terminal when its power is first turned on. The unit returns to the NULL state when print, transmit, or receive operations terminate. The VISTA PLUS must be taken out of the NULL state by a keyboard or data channel command in order to do any useful work.

ENTER - In the ENTER state, the VISTA PLUS keyboard is enabled. In terminals without the "ENTER" key the transition from the NULL to the ENTER state is automatic, and there is,

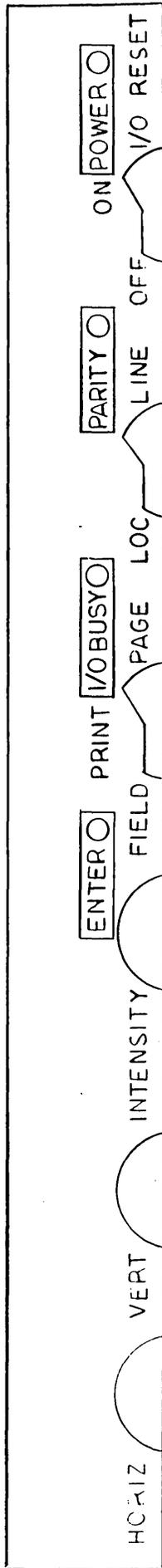


FIGURE 4: VISTA PLUS CONTROL PANEL

in fact, no distinction between the two states. In terminals equipped with the optional "ENTER" key, the ENTER state can be activated only by depressing the "ENTER" key.

RECEIVE - In this state the VISTA PLUS may receive data from the data channel. The RECEIVE state is activated by receipt of an STX character. After receipt of an ETX, the VISTA PLUS returns to the NULL state.

ERROR - The VISTA plus enters this state when a parity error (either a character parity error or a longitudinal redundancy check error) is detected or when a timeout period is exceeded. The timeout period internal to the VISTA PLUS is 300 + 100 milliseconds.* An I/O RESET command returns the VISTA PLUS to the NULL state.**

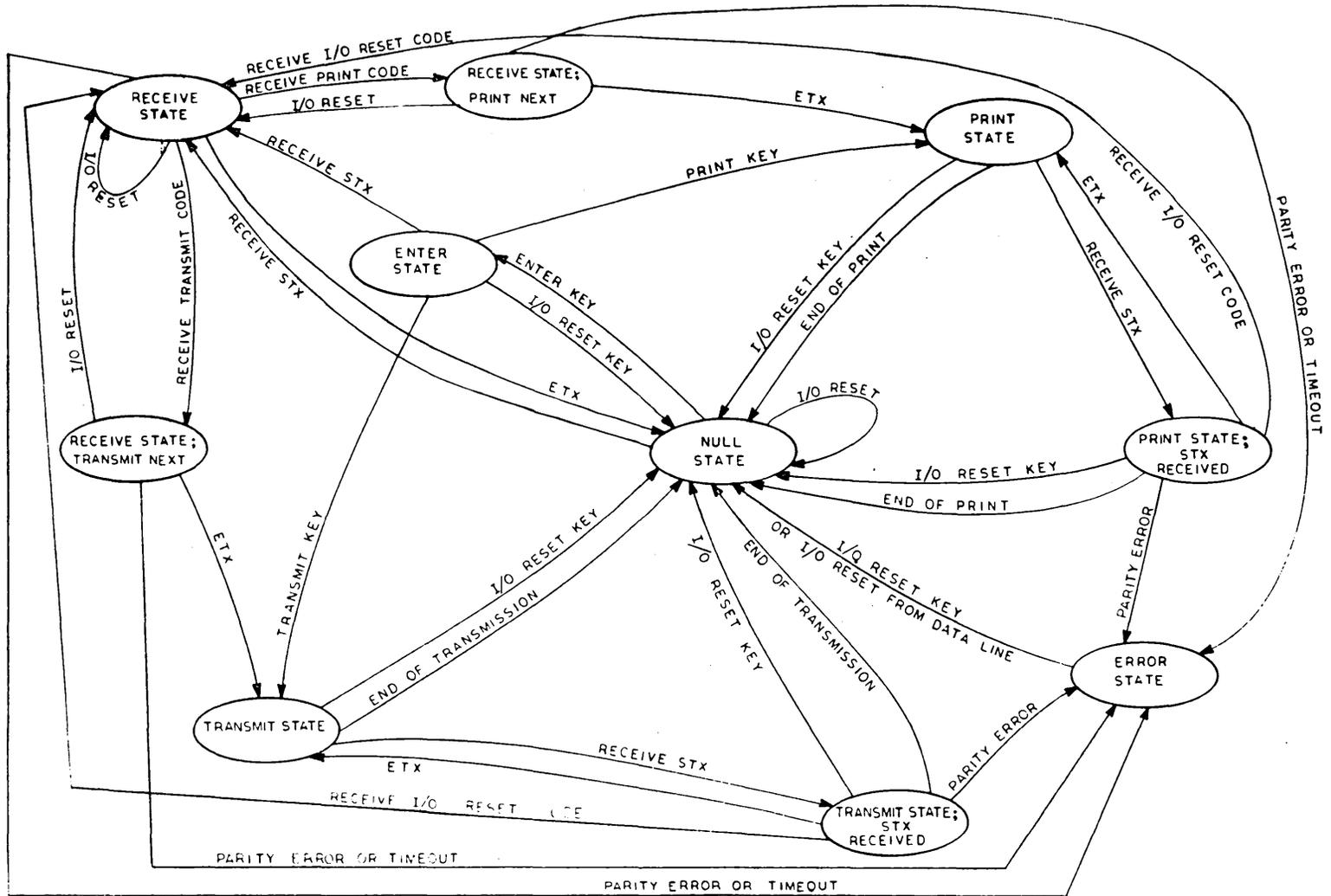
TRANSMIT - In this state the VISTA PLUS is transmitting data. The TRANSMIT state is entered by transmit commands either from the data channel or from the keyboard. At the end of a transmission the VISTA PLUS returns to the NULL state.

PRINT - In this state the VISTA PLUS is transmitting data from its memory to an attached printer, through the P-102 Printer Interface. The PRINT state is entered by the PRINT PAGE or PRINT FIELD commands, either from the data channel or from the control panel. When the print operation is completed, the terminal returns to the NULL state. If no printer is connected, the terminal returns to the NULL state.

The four intermediate states are explained in the next section in connection with transitions between states.

* In the I-107 and I-108 serial data interfaces this timeout period is superseded by a shorter fixed timeout period of 50 ms.

** In terminals without the P-301 Polling Module or P-302 Acknowledgment Module. Terminals with the P-301 or P-302 Module are controlled by dialog which uses ASCII communication control characters.



VISTA PLUS STATE TRANSITION DIAGRAM
(TERMINALS WITHOUT POLLING MODULE)

FIGURE 5

Transitions Between States of the VISTA PLUS; Priorities

Figure 5 illustrates the relative priorities of states of the VISTA PLUS and the transitions between these states.

Note that if either of the transmit codes (TRANSMIT PAGE or TRANSMIT FIELD) or either of the print codes (PRINT PAGE or PRINT FIELD) is included in the TEXT of the message (i.e., after STX in a message with the format STX, TEXT, ETX), then the appropriate transmit or print operation will commence after receipt of the ETX. Two intermediate states, which are called "RECEIVE STATE; TRANSMIT NEXT" and "RECEIVE STATE; PRINT NEXT" are shown in Figure 5 to illustrate pending transmission or print operations.

If I/O RESET is part of the TEXT received (i.e., after STX in a message with the format STX, TEXT, ETX), then I/O RESET takes priority over any transmit or print codes.* To emphasize that the VISTA PLUS monitors the data channel for an I/O RESET following an STX, Figure 5 shows two intermediate states called "TRANSMIT STATE; STX RECEIVED" and "PRINT STATE; STX RECEIVED".

Note that a message (other than I/O RESET) sent to the VISTA PLUS will be ignored if the terminal is in the TRANSMIT or PRINT state. In order for the I/O RESET code to be received while the VISTA PLUS is transmitting, the data channel between the VISTA PLUS and computer must be full duplex. With the exception of the I/O RESET code, all internal operation of the VISTA PLUS requires only a half duplex channel, since the VISTA PLUS may transmit a message which has been prepared at the keyboard or receive a message from the computer, but may not do both simultaneously.

* Restrictions on the use of I/O RESET with I-107 and I-108 Interfaces and with the P-301 and P-302 options were noted in the section on VISTA PLUS COMMANDS.

DATA TRANSMISSION FORMAT

The exact format of a message sent to or received from the VISTA PLUS depends upon the details of the system configuration - in particular whether an A-101 Message Concentrator, a P-301 Polling Module or an I-107 Synchronous Interface is used. Nevertheless, the basic message format is determined by the internal structure of the VISTA PLUS, and is the same, regardless of the system configuration. The basic message format, that of a single unpolled VISTA PLUS, is described below. In Chapter 2 the variations of this format will be described.

Messages from the VISTA PLUS

The format for messages transmitted from the VISTA PLUS is:

STX
TEXT
ETX,

where STX is the ASCII start of the text code, TEXT is the string of characters in the message, and ETX is the ASCII end of text code.

For both XMIT PAGE and XMIT FIELD the following conventions apply to the determination of what is included in the TEXT transmitted by the VISTA PLUS.

- (1) Each block of mixed spaces and nulls (in any combination) at the right hand end of a line will be omitted. This feature is referred to as data compression.

Furthermore, data compression applies to fields contained on a single line; a block of mixed spaces and nulls (in any order) preceding protected data will be omitted if they are on the same line protected data.

- (2) A line feed character, denoted by NEW LINE in Tables 2A and 2B, will be inserted at the end of each line, with the exception that line feeds within a protected block are suppressed.

(3) Significant null characters (those not eliminated by data compression) will be transmitted as spaces.

If the transmit command is XMIT PAGE, then each contiguous block of protected data will be replaced by a TAB character.

If the transmit command is XMIT FIELD, no TAB character is ever generated.

Messages to the VISTA PLUS

The format for messages transmitted to the VISTA PLUS is

STX
TEXT
ETX

Any message to the VISTA PLUS which is not preceded by a STX character will be ignored. If a message is not terminated by an ETX, then the VISTA PLUS will remain in the RECEIVE state until a time out period has passed.

The TEXT sent to the VISTA PLUS can be any message. When an XMIT PAGE command is given and TEXT is sent to the computer, then the computer can erase the unprotected data on the screen and recreate the original screen presentation by sending the identical TEXT back to the display. The TAB and LF characters in the TEXT assure this property of the message.

CHAPTER 2

VISTA PLUS SYSTEM CONFIGURATIONS

Figure 1 in the Introduction illustrates several VISTA PLUS system configurations. The figure does not in itself attempt to distinguish terminals or Message Concentrators which use polling from those which do not.

The purpose of the present chapter is to classify all the possible system configurations and to describe the associated data transmission formats. Such a classification must necessarily refer to the various data interfaces, which will be explained in detail in Chapter 3. For reference purposes the summary chart of the interfaces is reproduced in the present section as Table 4.

The possible VISTA PLUS system configurations are summarized in outline form in Table 5. Before proceeding to the detailed descriptions, it is worthwhile to summarize the contents of Table 5.

In all the configurations in Item I, each terminal is connected to its own line interface at the computer. This mode of operation is common with minicomputers: the line interface interprets each character received and interrupts the central processor in order to transfer a character to main memory. When modems are not used, we refer to the connection as local; operation with modems is said to be remote.

In Item II, VISTA PLUS terminals contend for the use of the data channel between the Message Concentrator and the computer. As many as 64 VISTA PLUS terminals can be connected to a single Message Concentrator.

Item III covers two situations. In the first, a single terminal equipped either with the Polling Module or the Acknowledgment Module may be attached to the data channel. In general, any configuration in which only one terminal is attached to a computer line interface is said to be point-to-point.

<u>Product Number</u>	<u>Name</u>	<u>Where Used</u>
I-103	Asynchronous Serial Communication Interface, Multispeed	In a stand-alone VISTA PLUS, with or without the P-301 Polling Module or the P-302 Acknowledgment Module
I-104	Asynchronous Serial Current Loop (TTY) Interface, Multispeed	In the data line interface of an A-101 Message Concentrator, either with or without the P-301 Polling Module
I-105	Multipurpose Asynchronous Serial Interface, Multispeed	
I-106	Parallel Interface Line Driver	In a stand-alone VISTA PLUS, without the P-301 Polling Module or the P-302 Acknowledgment Module
I-107	Synchronous Serial Interface	In a stand-alone VISTA PLUS, with or without the P-301 Polling Module or the P-302 Acknowledgment Module.
I-108	Asynchronous Serial Interface with LRC	In the data line interface of an A-101 Message Concentrator, either with or without the P-301 Polling Module.
I-109	Asynchronous Serial Interface to Message Concentrator	In a VISTA PLUS which is connected to the A-101 Message Concentrator.

TABLE 4 - SUMMARY OF VISTA PLUS INTERFACES

TABLE 5 - OUTLINE OF VISTA PLUS SYSTEM CONFIGURATIONS

- I. Single VISTA PLUS Without Polling or Acknowledgment Options
 - A. Communication (RS-232C) Interface (I-103, I-105, I-107, I-108)
 - 1. With modems
 - 2. Without modems
 - B. Current Loop Interface (I-104, I-105)
 - C. Parallel Interface (I-106)
- II. Cluster of VISTA PLUS Terminals Attached to A-101 Message Concentrator (Contention Mode; No Polling). Interface in VISTA PLUS itself is always I-109. Interfaces below refer to connection between Message Concentrator and data line.
 - A. Communication (RS-232C) Interface (I-103, I-105, I-107, I-108)
 - 1. With modems (not recommended; configuration IV.A.1 is preferred)
 - 2. Without modems
 - B. Current Loop Interface (I-104, I-105)
- III. Single VISTA PLUS with Polling or Acknowledgment Option. With Polling, Multidropped Operation is Possible
 - A. Communication (RS-232C) Interface (I-103, I-105, I-107, I-108)
 - 1. With modems
 - 2. Without modems
 - B. Current Loop Interface (I-104, I-105)
- IV. Cluster of VISTA PLUS Terminals Attached to A-101 Message Concentrator Equipped with P-301 Polling Module. Multidropped Operation is Possible. Interface in VISTA PLUS itself is always I-109. Interfaces below refer to connection between Message Concentrator and data line.
 - A. Communication (RS-232C) Interface (I-103, I-105, I-107, I-108)
 - 1. With modems
 - 2. Without modems
 - B. Current Loop Interface (I-104, I-105)

In addition, Item III covers the case in which several VISTA PLUS terminals, each equipped with its own P-301 Polling Module, are attached to a single line. This configuration is said to be multidropped. Each terminal may be individually addressed by the computer. This configuration is possible either in the local or remote mode of operation.

Finally, Item IV describes the configuration in which the A-101 Message Concentrator is equipped with the P-301 Polling Module, so that the attached terminals are functionally equivalent to a set of multidropped VISTA PLUS displays, each with its own P-301 Polling Module. As a further possibility, the Message Concentrator may have a P-301 Polling Module with the two-character address option. In principle 64 such Message Concentrators, each with 64 terminals, can be attached to a single line.

The message formats described in the following sections do not include the synchronizing (SYN) characters generated by the I-107 Synchronous Serial Interface. The longitudinal redundancy check (LRC) character used with the I-107 interface and with the I-108 Asynchronous Serial Interface will be enclosed in brackets (i.e., [LRC]) to show that its use depends upon the interface.

SINGLE UNPOLLED VISTA PLUS

As described in Chapter 1, the format of messages transmitted to or from a VISTA PLUS is

STX
 TEXT
 ETX
 [LRC]

CLUSTER OF VISTA PLUS TERMINALS ATTACHED TO THE A-101 MESSAGE
 CONCENTRATOR (CONTENTION MODE; NO POLLING)

The INFOTON A-101 Message Concentrator allows up to 64 VISTA PLUS terminals to contend for the same communication line

to a computer. In this mode the Message Concentrator should be connected directly (local attachment) to the computer.

In the contention mode of operation only one Message Concentrator is attached to a single data line on the computer. The Message Concentrator allows only one VISTA PLUS terminal at a time to transmit to the computer; it also receives each message from the computer and routes it to the appropriate terminal.

Line discipline between the computer and the Message Concentrator can be maintained in the local environment by control lines other than the data line. These lines, known as Request to Send, Carrier Detect, and Clear to Send are contained in the VISTA interfaces that conform to EIA specification RS-232C.*

In the contention mode, the Message Concentrator scans the terminals sequentially at a speed of 1 microsecond per terminal position (this rate is adjustable). When the Message Concentrator encounters a terminal which is contending for transmission to the computer, it stops scanning and allows that terminal to transmit its complete message to the data line. Immediately after this message has been transmitted, the Message Concentrator scan recommences with the next position.

For example, suppose that 16 VISTA PLUS terminals are connected to the Message Concentrator, and that terminal 1 is transmitting and terminal 16 is waiting to transmit. Next, suppose that the "TRANSMIT" key of terminal 5 is depressed

*The design of the A-101 Message Concentrator allows the computer to control line discipline in the local mode; however, without the P-301 Polling Module in the Message Concentrator, such control is not possible if a modem is used in the connection between Message Concentrator and computer.

while terminal 1 is transmitting (after terminal 16 requested to transmit). When the transmission at terminal 1 is completed, the Message Concentrator will scan positions 2, 3, 4 and 5 and immediately start the transmission from terminal 5. The scan will reach position 16 after the intervening positions have had one opportunity to transmit.

If the data channel between the Message Concentrator and the computer is full duplex, then the computer can send a message through the Message Concentrator to one terminal at the same time as another terminal is transmitting to the computer.

If the data channel between the Message Concentrator and the computer is half duplex, then the Message Concentrator will not be allowed to transmit to the computer when the computer is transmitting to the Message Concentrator.

The format for messages transmitted through the Message Concentrator to the computer is

STX
DA
TEXT
ETX
[LRC]

where DA is the device address of the VISTA PLUS at which the message originated. The TEXT is identical to that transmitted from a stand-alone VISTA PLUS. In fact, the VISTA PLUS transmits STX, TEXT, ETX to the Message Concentrator, which inserts DA immediately after STX.

The longitudinal redundancy check [LRC], if any, is computed in the Message Concentrator by the I-107 or I-108 interface.

The format for messages transmitted from the computer to the Message Concentrator is

SOH
DA
STX
TEXT
ETX
[LRC]

where SOH is the ASCII start of header character. The Message Concentrator recognizes the SOH and interprets the next character (DA) to route the message to the appropriate VISTA PLUS. The rest of the message, which is sent to the VISTA PLUS, is STX, TEXT, ETX [LRC] just as in the stand-alone case.

In full duplex operation, subsequent messages to the same terminal need only send STX, TEXT, ETX, [LRC]. Another terminal may be selected by SOH, DA, STX, TEXT, ETX, [LRC].

VISTA PLUS TERMINALS EQUIPPED WITH P-301 POLLING MODULE; VISTA PLUS TERMINALS ATTACHED TO A-101 MESSAGE CONCENTRATOR WITH P-301 POLLING MODULE

Polling is a method for controlling the transmission of data on a communication line. It may be used when one or more terminals are attached to the line.

The operation of polling logic of the INFOTON VISTA PLUS is independent of the type of data line interface used.

When only one terminal is attached to a line (point-to-point transmission), polling is an alternative to contention line discipline. Its advantage over the contention mode is that it gives the computer complete control over the incoming stream of messages from a terminal, as well as error indications if a message sent to a terminal is not received. These advantages are of primary interest when the terminal is remote, and telecommunications lines are involved.

Polling is essential when several terminals are connected to the same (multidropped or "party") line without the use of a Message Concentrator. The P-301 polling module in the VISTA PLUS allows the computer to communicate with one terminal at a time, in such a way that only the appropriate terminal receives its message.

Polling may also be used in conjunction with terminals attached to the INFOTON A-101 Message Concentrator as an alternative to contention line discipline. The polling

option is placed in the Message Concentrator only. From the point of view of the computer, a configuration of "n" VISTA PLUS terminals, each equipped with the polling option and each attached somewhere along a multidropped line, is indistinguishable from "n" VISTA PLUS terminals attached to a Message Concentrator equipped with the polling option. It should be noted that individual polled VISTA PLUS terminals and polled Message Concentrators with attached VISTA PLUS displays may be connected to the same multidropped line.

The standard P-301 polling module uses a single character device address (DA). If individual polled VISTA PLUS terminals and A-101 Message Concentrators equipped with this standard polling module are attached to the same multidropped line, then the total number of terminals attached to the line may not exceed 64.

As an option, the P-301 Polling Module may be ordered with a two-character device address. If this modified polling module is placed in an individual VISTA PLUS, then the first character of the address is the ASCII NULL character, and the second character is the terminal address. If the modified polling module is placed in an A-101 Message Concentrator, then the first character is the address of the Message Concentrator, and the second character is the address of the terminal.* Since each of the two address characters may have one of 64 values (from 20₁₆ to 5F₁₆, inclusive), a total of 4096 terminals may, in principle, be connected to a single communication line.

* On the P-301 Polling Module there is only one set of switches to select one of 64 addresses. If the Polling Module is in a terminal not attached to a Message Concentrator, then the hardware address identifies the terminal. If the Polling Module is in a Message Concentrator, then the hardware address identifies the concentrator; the terminal is identified by its connection to one of the 64 channel positions in the Message Concentrator.

The use of the two-character polling address in conjunction with the Message Concentrator also allows a general poll of all the terminals attached to a Message Concentrator. The first character is the address of the Message Concentrator and the second character is $7F_{16}$ (i.e. all bits in the address code are 1). The Message Concentrator which receives this poll then operates as an unpolled device; that is, it scans the VISTA PLUS terminals in sequence until it comes to one that is waiting to transmit. After a terminal has transmitted its message, the computer may respond with ACK to advance the scan to the next terminal waiting to transmit. The use of a general poll to a Message Concentrator reduces the number of "read" polls which must be issued to service the terminals, since each terminal need not be polled individually. Of course, a "write" poll requires that the second character of the address be the actual address of the terminal.

If individual VISTA PLUS terminals and VISTA PLUS terminals clustered about A-101 Message Concentrators are attached to the same multidropped line, then the P-301 Polling Modules must all be of the same type, that is, they must all have the same number of address characters.

Details of Polling Dialog

Descriptions of the polling dialog are included in the next three subsections. In all cases, the device address (DA) transmitted from the computer to the terminal will be one or two characters, depending upon the version of the P-301 Polling Module. In either case the response from the terminal or Message Concentrator will be a single character, the address of the particular terminal.

When the "XMIT PAGE" or "XMIT FIELD" operation is initiated at a VISTA PLUS terminal, that terminal will wait for a "read" poll from the computer before responding with its message. The initiation of "read" poll commands is under control of a program in the computer.

In order for the computer to cause a message to be transmitted from an unattended polled terminal (for test purposes, say) it is necessary to send one of the two transmit commands in TEXT as part of a "write" poll sequence. After the Transmit command is received, it is not executed immediately, but the terminal then waits for a "read" poll, just as it would if the operator had depressed a Transmit key.

Figure 6 is a diagram of the "read" poll. It contains one branch which applies only to the general poll command. Otherwise, the dialog is the same for stand-alone VISTA PLUS terminals equipped with the P-301 Polling Module and for VISTA PLUS terminals clustered around an A-101 Message Concentrator equipped with the Polling Module.

Figure 7 illustrates the ordinary "write" poll. Figure 8 shows the "write" poll dialog for a P-301 Polling Module that has the optional Fast-Select feature. Both of these diagrams are applicable to stand-alone polled terminals and terminals attached to a polled Message Concentrator.

Read Poll (Figure 6)

When a Transmit command is initiated, the keyboard of a polled VISTA PLUS is locked. The computer sends a "read" poll to determine if a terminal has a message to transmit. The format of the "read" poll is

SOH^{*}
DA
ENQ,

where SOH is the ASCII start of header code, DA is the address of the terminal, and ENQ is the ASCII inquiry code.

* EOT may also be used

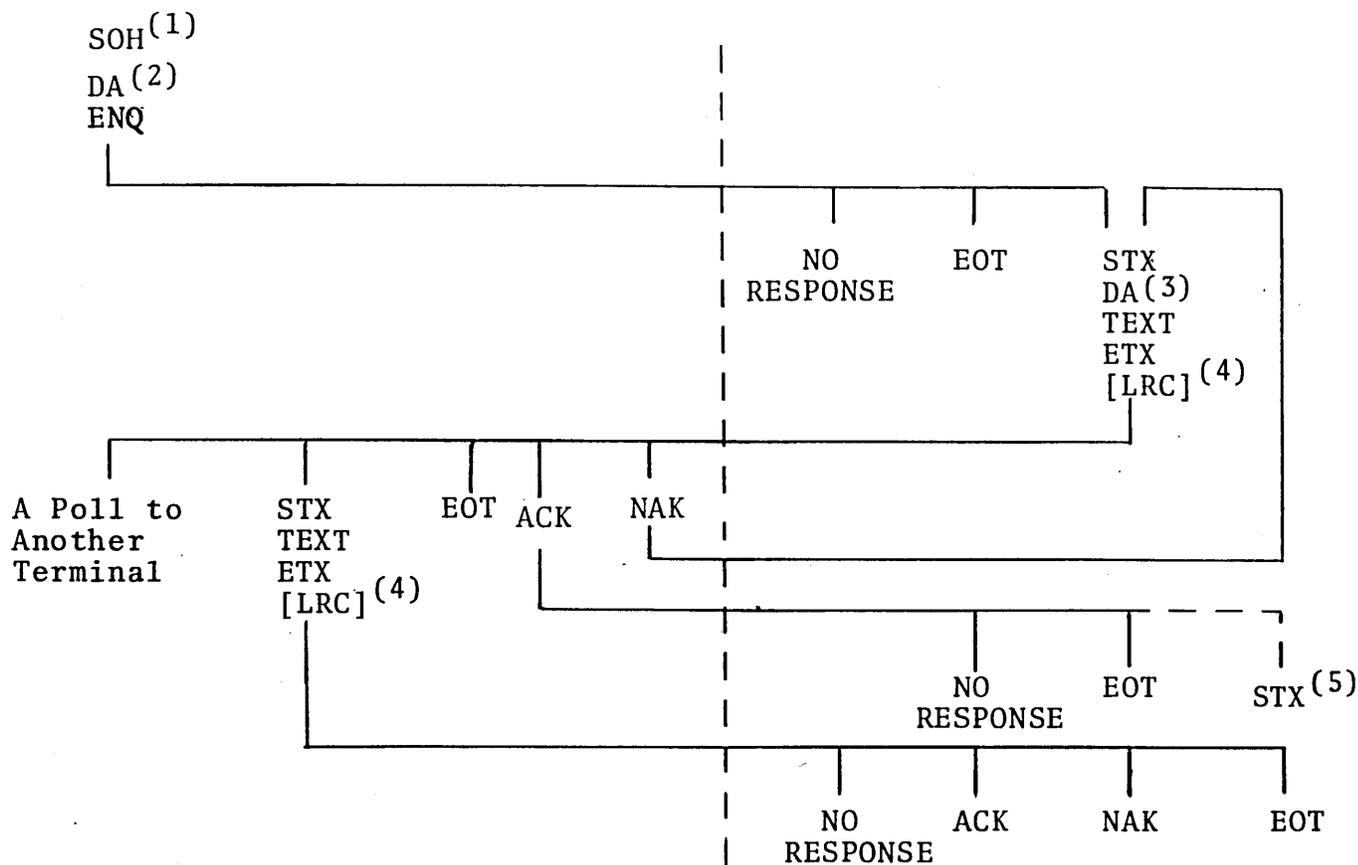


FIGURE 6: "READ" POLL DIALOG -
INFOTON VISTA PLUS WITH P-301 POLLING MODULE

- (1) EOT may be used instead of SOH
- (2) The device address may be one or two characters
- (3) The terminal responds with a single-character address. (If attached to an A-101 Message Concentrator, the Concentrator address is not included in the response.
- (4) LRC is provided by the I-107 Synchronous Serial Interface or by the I-108 Asynchronous Serial Interface.
- (5) This branch is possible only if the ACK was sent in response to a message that was transmitted as the result of a General Poll. The ACK causes the Message Concentrator to advance to the next terminal that is waiting to transmit.

There are three possible actions which the terminal can take to the "read" poll:

1. No response at all - This response indicates that the terminal is not connected to the data line, or that the "read" poll contained a parity error.
2. Reply with an EOT - The ASCII end of transmission code is a negative response, which means that the terminal is not in the TRANSMIT state (i.e. no messages are waiting to be transmitted.) NOTE: This response would also be sent if the data line between a terminal and a concentrator was broken.*
3. Send a message to the computer - This is the positive response; the message waiting for transmission will be sent in the following format:

STX
DA
TEXT
ETX
[LRC]

At the conclusion of the transmission, the keyboard of the VISTA PLUS remains locked. As will be explained in the next paragraph, certain computer responses will unlock the keyboard, while others will leave it locked.

If the terminal sends the positive response (i.e. the message that was waiting for transmission), then the computer, under control of its program may elect one of five responses:

* This situation could occur if the terminal was in the LOCAL instead of the LINE mode, or if the terminal was not connected to its proper connector on the Message Concentrator channel board.

1. Reply with a NAK - The ASCII negative acknowledge character will cause the terminal to retransmit the message.* A NAK is most commonly sent to the terminal when the message contained a parity error. NAK does not unlock the keyboard.
2. Reply with an ACK - The keyboard is unlocked. If the terminal is not attached to a Message Concentrator, then it responds with an EOT, unless the ACK was not received, in which case the terminal does not respond. If the ACK is sent to a terminal attached to a Message Concentrator, in response to a message that was transmitted as the result of a General Poll, then the ACK causes the Message Concentrator to advance to the next terminal that is waiting to transmit. The General Poll scan starts at the lowest address and proceeds until every terminal has had one opportunity to transmit. An EOT is returned at the end of this sequence.
3. Reply with an EOT - The transmission with the terminal is terminated. The keyboard is not unlocked. To reinitiate the path to the terminal, the computer must send out a "read" or "write" polling header.
4. Send a reply - The format is:

STX
TEXT
ETX
[LRC]

Note that since the data path between computer and terminal is already established, no device address

*The logic of the VISTA PLUS will respond with the transmission of a page or transmission of the appropriate field, depending upon what the previous transmission was. If the original message came from the A-204 Light Pen, then the NAK will cause a repeat of that transmission.

has to be specified at this point in the dialog.

5. Poll another terminal - Either a "read" poll or a "write" poll may be initiated. A poll initiated at this point should begin with EOT. The EOT is necessary at this point in order to reset the polling logic of the terminal which is presently selected.

In response to a message in item 4 above, the terminal has four options:

1. No response - This response indicates that the terminal is no longer connected to the data line, as would be the case if a stand-alone terminal was placed in the LOCAL mode, or if its power was turned off. A no response would also occur if the STX character was not received.
2. Transmit an ACK - This response indicates that the message was received correctly. The keyboard is unlocked.
3. Transmit a NAK - The response means that the message was incorrectly received. The keyboard remains locked. The reasons for transmitting a NAK are:
 - a. The message contained a parity error.
 - b. A timeout occurred because the message was not entirely received.
 - c. A loss of carrier occurred (I-107 and I-108 interfaces only).
4. Transmit an EOT - This response indicates that the entire message was lost. It could occur at this point in the polling dialog only if the data line between a terminal and a concentrator was broken.

Write Poll (Figure 7)

The initial poll to the VISTA PLUS has the format:

SOH*
DA
DC4**

where DC4 is an ASCII code which is used to identify the poll as a "write" poll.

There are three possible actions which the terminal can take to a "write" poll, namely:

1. No response - This response indicates that the terminal is not connected to the data line, or that the "write" poll contained a parity error.
2. Reply with an EOT - An EOT code will be transmitted if the terminal is in any state other than NULL or ENTER. For example, if the terminal is driving an attached printer when the poll is received, it will respond with EOT. Note that the "write" poll does override a terminal in ENTER mode. The EOT response would also be sent if the data line between a terminal and a concentrator was broken.
3. Reply with an ACK - This response indicates that the computer may send its message. The keyboard is not locked by this response.

* EOT may also be used.

** The fact that DC4 is the same code as XMIT FIELD is of no significance. As codes in the polling header, both DA and DC4 are interpreted only by the polling logic and are not sent on to the internal logic of the VISTA PLUS. To accomplish the XMIT FIELD operation, the code must be contained as text in a message preceded by a STX and followed by an ETX.

Sequences and Responses
from Computer

Responses from Polled
VISTA PLUS

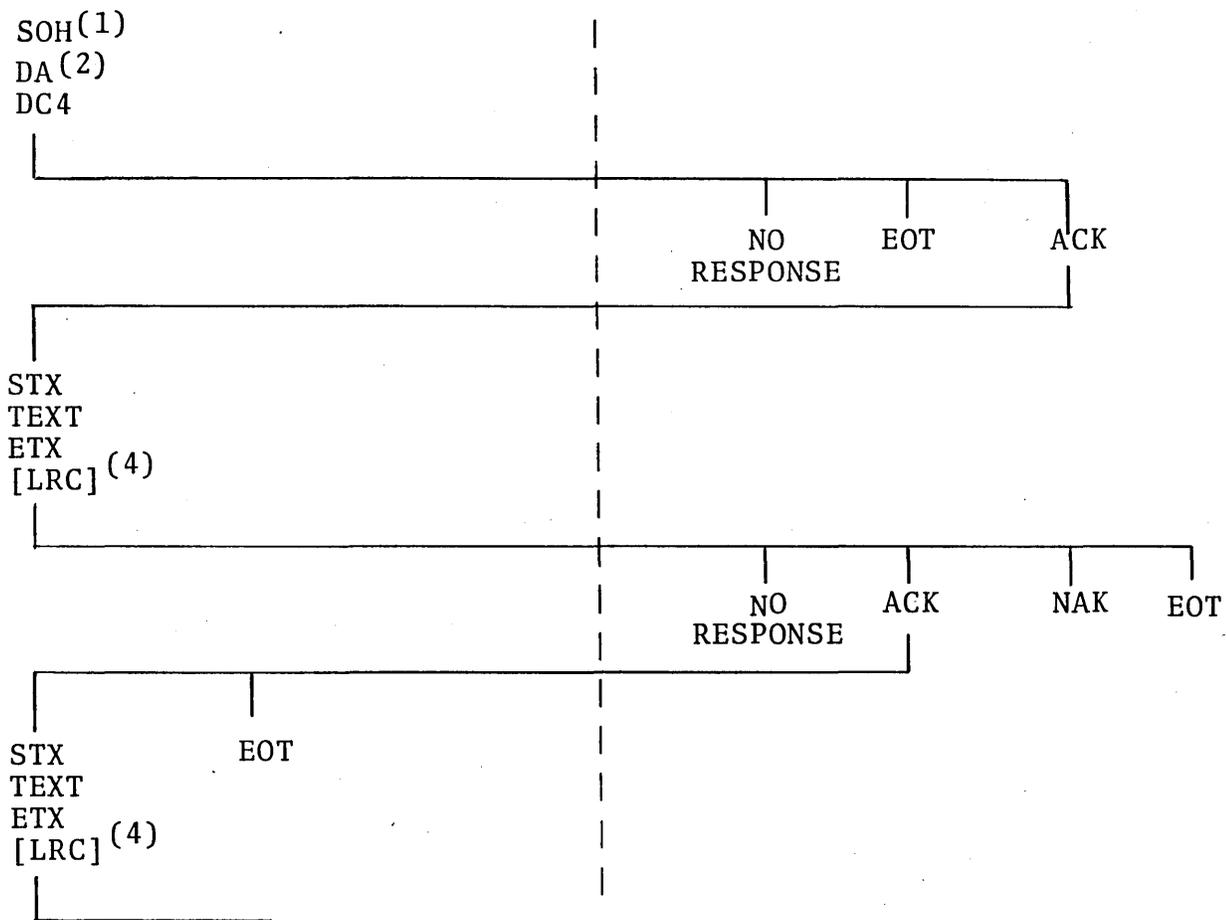


FIGURE 7: "WRITE" POLL DIALOG -
INFOTON VISTA PLUS WITH P-301 POLLING MODULE

In response to the ACK (item 3 above) the computer sends its message in the following format:

STX
TEXT
ETX
[LRC]

The keyboard remains locked after the receipt of the message. In response to the preceding message, the terminal has four possible replies:

1. No response - This response indicates that the terminal is no longer connected to the data line, as would be the case if a stand-alone terminal was placed in the LOCAL mode, or if its power was turned off. A no response would also occur if the STX character was not received.
2. Transmit an ACK - This response indicates that the message was received correctly. The keyboard is unlocked. The data path between computer and terminal is maintained, and the computer may either send another message or terminate communication by sending an EOT.
3. Transmit a NAK - This response indicates that the message was incorrectly received. The keyboard remains locked. The reasons for replying with a NAK are:
 - a. The message contained a parity error.
 - b. A timeout occurred because the message was not entirely received.
 - c. A loss of carrier occurred (I-107 and I-108 interfaces only).
4. Transmit an EOT - This response indicates that the entire message was lost. It could occur at this point in the polling dialog for two reasons:
 - a. The data line between a terminal and a concentrator was broken.
 - b. The operator initiated a Print or Transmit operation after the terminal had sent the ACK to the "write"

poll header and before the message could be received. In order for the computer to recover from this situation, a "read" poll is necessary to clear a pending Transmit command. If the terminal is busy because the operator initiated a print command, then the "read" poll will not clear the terminal. It will be necessary to wait until the print operation is completed.

Write Poll with Fast Select (Figure 8)

The Fast Select feature is an option which may be incorporated in the P-301 Polling Module at the time of manufacture. It allows the text of a message to be appended directly to the "write" poll header. This option results in better utilization of communication lines, particularly in situations where line turnaround time in modems is significant.

The initial message from the computer to a terminal is:

SOH*
 DA
 DC4
 STX
 TEXT
 ETX
 [LRC]

The keyboard is locked after receipt of the message.

In response to the message, the terminal has four possible responses:

1. No response - This response indicates that the terminal is not connected to the data line, or that the polling header (SOH, DA, DC4) contained a parity error.

* EOT may also be used.

Sequences and Responses
from Computer

Responses from
Polled VISTA PLUS

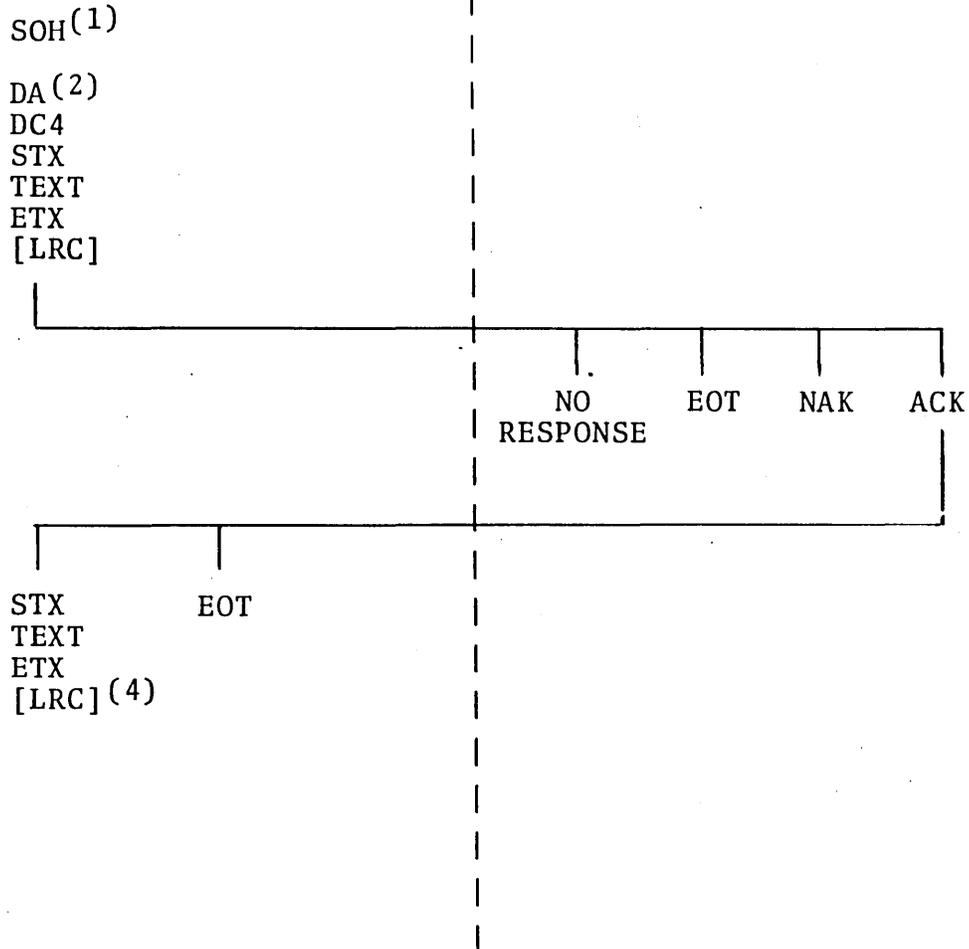


FIGURE 8: "WRITE" POLL DIALOG WITH OPTIONAL FAST SELECT FEATURE-
INFOTON VISTA PLUS WITH P-301 POLLING MODULE

2. Reply with an EOT - An EOT will be transmitted if the terminal is in any state other than NULL or ENTER (for example, the PRINT state). The EOT response would also be sent if the data line between the terminal and a concentrator was broken.
3. Reply with an ACK - This response indicates that the message was received correctly. The keyboard is unlocked. The data path between computer and terminal is maintained, and the computer may either send another message or terminate communication by sending an EOT.
4. Transmit a NAK - This response indicates that the message was incorrectly received. The keyboard remains locked.

VISTA PLUS TERMINAL EQUIPPED WITH P-302 ACKNOWLEDGMENT MODULE

General Description

In system configurations that are point-to-point, rather than multidropped, the complete communication dialog provided by the P-301 Polling Module is not always needed. In particular, the address recognition logic in polling does not satisfy any basic requirement of a point-to-point configuration.

Nevertheless, a positive acknowledgment (using the ACK character) or a negative acknowledgment (using the NAK character) is frequently desirable in point-to-point configurations in order to ensure that messages transmitted and received by the VISTA PLUS are not in error. The INFOTON P-302 Acknowledgment Module performs these functions that ensure message integrity.

It should be emphasized that the P-302 Acknowledgment Module is not applicable to multidropped configurations; furthermore, it cannot be employed as part of a system that uses a Message Concentrator.

Details of Operation - Messages Received by VISTA PLUS

The format of a message sent to a VISTA PLUS with the P-302 Acknowledgment Module is

STX
TEXT
ETX
[LRC]

If no error conditions are detected in the message, then the Acknowledgment Module causes an ACK code to be transmitted. The keyboard is unlocked.

If an error is detected in the message, then the Acknowledgment Module causes a NAK character to be transmitted. The keyboard remains locked. It will be unlocked by a successful retransmission of the message, or by depression of the I/O RESET switch on the VISTA PLUS control panel.

The following error conditions will cause the terminal to respond with a NAK:

1. A character parity error
2. An LRC error (checked by I-107 or I-108 interfaces)
3. A timeout (If the character stream stops before the receipt of the ETX code, a timeout error will be flagged after 50 milliseconds.)
4. A loss of carrier (in I-107 or I-108 interfaces)

If STX is not received, then the terminal will not respond.

Details of Operation - Messages Transmitted by VISTA PLUS

The format of a message transmitted by a VISTA PLUS with the P-302 Acknowledgment Module is

STX
TEXT
ETX
[LRC]

After the message is transmitted, the keyboard of the VISTA PLUS will remain locked. It may be unlocked by certain computer responses described below, or by depression of the I/O RESET switch on the VISTA PLUS control panel.

The computer may reply to the message from the VISTA PLUS in two ways:

1. Transmit a NAK - This response will cause the terminal to retransmit its message.* The keyboard remains locked.
2. Transmit an ACK - This response unlocks the keyboard.
3. Transmit a message with the format

STX
TEXT
ETX
[LRC]

At this point the remainder of the dialog is identical to that explained in the previous section.

It should be noted that whenever the VISTA PLUS keyboard is unlocked, then the terminal will transmit immediately when a Transmit command is issued. If there is a requirement to delay the message until the computer is ready to receive it, then the P-301 Polling Module with its complete communication dialog must be used.

*The NAK will cause an automatic retransmission provided that responses 2 and 3 below have not previously been sent.

TREATMENT OF ERRORS IN VISTA PLUS SYSTEMS

The procedures for handling data transmission errors are very important, particularly in systems that use telecommunication lines. Because of the modularity of construction of the INFOTON VISTA PLUS family of products, the treatment of errors is divided among the internal logic of the VISTA PLUS, the data interface, and the optional polling module. In order to give a unified presentation, the subject of error handling is summarized in this section.

There are basically two types of error conditions that must be considered - parity errors and loss of data. The VISTA PLUS interfaces all check character parity. The I-103, I-104, I-105 and I-106 interfaces have selectable (even or odd parity); the I-107 interface has odd parity; the I-108 interface uses even parity. In addition, the I-107 Synchronous Interface and the I-108 Asynchronous Serial Interface also check the parity of an entire message by performing a longitudinal redundancy check (LRC).

If, after a message has begun, a certain interval of time passes without the receipt of a character, then a timeout error is detected. The length of the timeout period depends upon the interface to the data line. If the interface is I-103, I-104, I-105 or I-106, then the timeout period is 300 ± 100 milliseconds. If the I-107 or I-108 interface is used, then the timeout period is 50 milliseconds.*

The loss of carrier signal from a modem indicates a possible loss of data. The I-107 and I-108 interfaces detect loss of carrier (even if intermittent) and treat this condition in the same way as a character parity error is treated.

* In addition, terminals with the P-302 Acknowledgment Module will have a timeout period of 50 ms, even if equipped with the I-103, I-104, or I-105 interface.

The action to be taken when an error is detected depends upon the system configuration. Certain actions are always taken, but the recovery from the error is automatic if the system uses the P-301 Polling Module or the P-302 Acknowledgment Module. In systems without these modules, error recovery must be initiated by the terminal operator.

Several visual indications of errors are provided by the VISTA PLUS. The error light on the VISTA PLUS control panel is illuminated when a character parity error, an LRC error, or a timeout error is detected. When a character parity error occurs in a message received by the VISTA PLUS, then the character in error is displayed on the screen as a solid block (on the 5 x 7 dot matrix). All forms of errors cause any text which is received after the detection of the error to be ignored.*

If a message contains a detected error, then any pending action command contained in the message, such as a TRANSMIT or PRINT command, will be cancelled.

With the P-301 Polling Module or P-302 Acknowledgment Module the keyboard of the VISTA PLUS remains locked after the receipt of a message with an error; in addition, a NAK is transmitted.

The A-101 Message Concentrator checks for even parity of each character transmitted to it from the I-109 interface in the VISTA PLUS. If a character parity error is detected, then

* Since transmission errors frequently occur in groups, it is likely that there might be undetected character parity errors in the characters which immediately follow a detected error. To prevent a spurious command such as ERASE, PROTECT START, or BLINK START from being processed, all characters received after a detected error will be ignored.

the character in error is replaced by the ASCII CAN character (030_g). If the data interface in the Message Concentrator calculates LRC, then CAN will be used in the LRC calculation instead of the character in error. CAN is the same code as the ROLL code for the VISTA PLUS. This code cannot be generated by the VISTA PLUS, so there is no ambiguity in meaning when the code is received by the computer which communicates with the Message Concentrator. If transmitted to the Message Concentrator by the computer, this code will simply be passed on to the VISTA PLUS and interpreted as a command to place the display in the Roll mode.

The following chart summarizes the treatment of error in unpolled VISTA PLUS terminals and in VISTA PLUS terminals attached to an unpolled Message Concentrator. With the exception of LRC errors, which are detected only by the I-107 and I-108 interface, the entries in the chart are applicable to all the data interfaces.

Action Taken	ILLUMINATE ERROR LIGHT	IGNORE FURTHER TEXT	PLACE SOLID BLOCK CHAR ON SCREEN	CANCEL PENDING COMMANDS
Cause of Error				
Character Parity Error	Yes *	Yes *	Yes	Yes
LRC Parity Error (I-107 & I-108 Only)	Yes *	Yes *	No	Yes
Timeout	Yes *	Yes *	No	Yes

* Until reset by I/O RESET command, either from data line or by switch on control panel.

TREATMENT OF ERROR CONDITIONS IN UNPOLLED VISTA PLUS

The following chart summarizes the treatment of errors by a VISTA PLUS equipped with the P-301 Polling Module, or by a configuration with VISTA PLUS terminals attached to an A-101 Message Concentrator with the P-301 Polling Module. The chart also applies to a VISTA PLUS terminal with the P-302 Acknowledgment Module.

Action Taken						
Cause of Error	ILLUMINATE ERROR LIGHT	IGNORE FURTHER TEXT	PLACE SOLID BLOCK CHARACTER ON SCREEN	CANCEL PENDING COMMANDS	KEEP KEYBOARD LOCKED	TRANSMIT A NAK
Character Parity Error	Yes *	Yes *	Yes	Yes	Yes	Yes
LRC Parity Error	Yes *	Yes *	No	Yes	Yes	Yes
Timeout	Yes *	Yes *	No	Yes	Yes	Yes

* Resetting of the error light and enabling the reception of further text will occur at slightly different times, depending on the system configuration.

Specifically:

On stand-alone terminals, reset action will occur when the NAK is sent.

In configurations with a polled Message Concentrator, reset action will occur when the first character of the next message is received.

TREATMENT OF ERROR CONDITIONS IN SYSTEMS WITH P-301 POLLING MODULE
OR P-302 ACKNOWLEDGMENT MODULE

CHAPTER 3

INTERFACES OF THE VISTA PLUS

The data interfaces which are used by the INFOTON VISTA PLUS are described in Table 6. To summarize, the following interfaces may be used in the data line interface of either a VISTA PLUS or the A-101 Message Concentrator:

- (1) I-103 Asynchronous Serial Communication Interface, Multispeed
- (2) I-104 Asynchronous Serial Current Loop (TTY) Interface, Multispeed
- (3) I-105 Multipurpose Asynchronous Serial Interface, Multispeed
- (4) I-107 Synchronous Serial Interface
- (5) I-108 Asynchronous Serial Interface with LRC

The I-106 Parallel Interface Line Driver may be used with a VISTA PLUS (but not with the A-101 Message Concentrator).

The I-109 Asynchronous Serial Interface to Message Concentrator is used in a VISTA PLUS which is connected to an A-101 Message Concentrator. This is the only application of the I-109 interface.

Any of these interfaces occupies the primary I/O port of the VISTA PLUS.

The standard VISTA PLUS is provided with the customer's choice of an I-103, I-104, I-106, I-107, I-108 or I-109 interface. The I-105 interface (which incorporates all the features of both the I-103 and I-104) may be ordered at a small additional cost. In any case, only one of the seven interfaces may be used with a single VISTA PLUS.

The interface module chosen depends upon the communications environment in which the terminal will be used. The interface

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<u>Product Number</u>	<u>Name</u>	<u>Where Used</u>
I-103	Asynchronous Serial Communication Interface, Multispeed	In a stand-alone VISTA PLUS, with or without the P-301 Polling Module or the P-302 Acknowledgment Module
I-104	Asynchronous Serial Current Loop (TTY) Interface, Multispeed	
I-105	Multipurpose Asynchronous Serial Interface, Multispeed	
I-106	Parallel Interface Line Driver	In a stand-alone VISTA PLUS, without the P-301 Polling Module or the P-302 Acknowledgment Module
I-107	Synchronous Serial Interface	In a stand-alone VISTA PLUS, with or without the P-301 Polling Module or the P-302 Acknowledgment Module.
I-108	Asynchronous Serial Interface with LRC	
I-109	Asynchronous Serial Interface to Message Concentrator	In a VISTA PLUS which is connected to the A-101 Message Concentrator.

TABLE 6 - SUMMARY OF VISTA PLUS INTERFACES

module makes the necessary conversion between the electrical operating levels of the VISTA and those of the particular external circuit or computer with which the interface module is designed to operate. Also, the interface arranges data in the format required by the circuit or computer.

The capabilities of the available interfaces allow the VISTA PLUS to be attached to a wide range of computer systems at low, medium, or high data rates. The interfaces are described in the following sections. The I-105 interface is described in detail first, and the I-103 and I-104 are described in terms of the I-105 interface.

I-105 MULTIPURPOSE ASYNCHRONOUS SERIAL INTERFACE, MULTISPEED

General Description

The Multipurpose Asynchronous Serial Interface is multipurpose in the sense that it provides both a communication interface compatible with EIA Specification RS-232C and a current loop interface in one printed circuit card. The interface provides an exposed panel in the rear of the terminal (see Figure 9) on which one may select various modes of operation. Specifically, the panel shown in Figure 9 contains:

1. A rotary switch used to select the data transmission rate.
2. A switch for full duplex/half duplex operation.*
3. A switch to select 20 ma or 60 ma current loop operation.

*The setting of the FDX/HDX switch is of no consequence to the VISTA PLUS when the communication interface is used. When the current loop interface is used, the switch must be in the FDX position, but the nature of the data channel is determined by the customer's wiring to the current loop terminal strip.

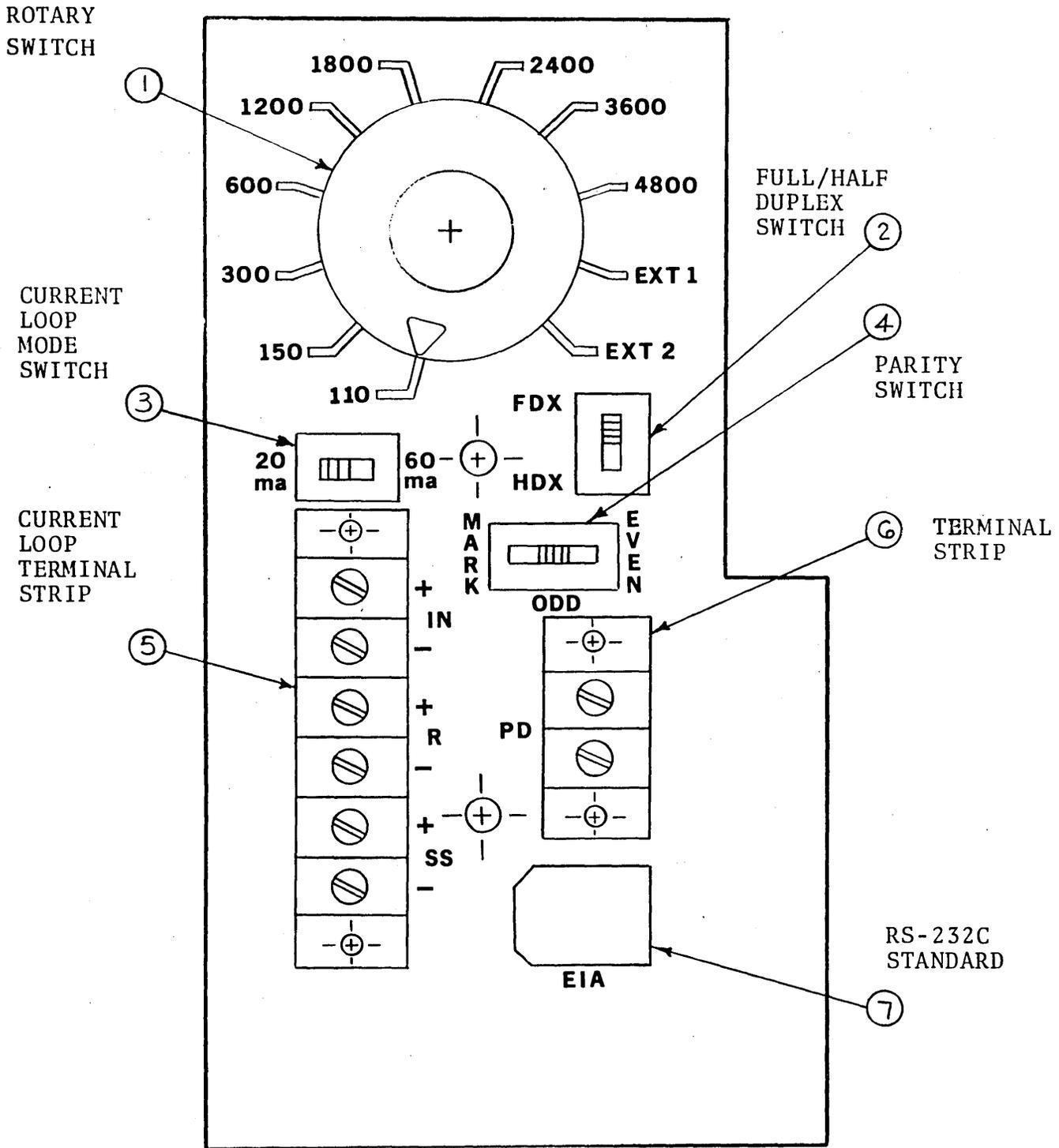


FIGURE 9: CONTROL PANEL OF ASYNCHRONOUS SERIAL INTERFACES I-103, I-104, and I-105

4. A switch to select parity - odd, even, or mark (i.e., parity bit set to 1)
5. A terminal strip used for connecting to the current loop interface. [Note: In some versions the connectors labeled "R" in Figure 9 are denoted "OUT", and the connectors labeled "SS" are not marked.]
6. A terminal strip which provides a 20 ma output of all data received by the interface. This may be used to drive a teletypewriter or similar device from the data line. [Note: In some versions the connectors are labeled "20 ma" instead of "PD".]
7. A MOLEX plug receptacle used for an RS-232C standard communication interface.

The code used by the interface is 7 level ASCII. Communication is in bit serial, character asynchronous mode, which is commonly known as START/STOP communication.

The START/STOP character format contains one START and one or two STOP bits bracketing the eight (seven plus one parity) serial data bits. The START bit allows the receiving VISTA PLUS to initiate its timing in proper synchronism with the incoming data. The STOP bits ensure that the data line is returned to the marking condition ready for a new START.

The order of transmission of the bits is as follows:

1. START - "space" polarity - first bit transmitted
2. b 1 - least significant data bit
3. b 2 - data bit
4. b 3 - data bit
5. b 4 - data bit
6. b 5 - data bit
7. b 6 - data bit
8. b 7 - most significant data bit

9. Parity bit
10. STOP - "mark" polarity
11. STOP - "mark" polarity (Note comments below on 11th bit).

When the interface is transmitting, it adds the START bit, computes and adds the parity bit, and adds the STOP bit to every seven-bit code being sent. When it is receiving, it removes the START and STOP bits, and transfers only the seven information bits to the internal logic of the VISTA PLUS.

In receiving, the interface will operate with 10 or 11 bit formats. At 110 baud the interface transmits in 11 bit format to be compatible with teletypewriter-like devices; however, at speeds higher than 110 baud, 10 bits are transmitted.*

The data transmission rate is determined by the setting of the rotary switch (reference point 1, Figure 9). The nine standard baud rates are 110, 150, 300, 600, 1200, 1800, 2400, 3600 and 4800. These rates are available with both the RS-232C and current loop interfaces of the multipurpose asynchronous serial interface; an internal crystal clock controls these nine rates.

The setting EXT 1 on the rotary switch permits the VISTA PLUS to handle data rates other than the nine standard speeds. An external free-running, non-synchronized clock with a frequency 8 times the data rate is connected to the MOLEX pin 10 (refer to Table 7). The clock frequency may differ from eight times the data rate by no more than 1 per cent. The maximum data rate is 8200 baud; the maximum clock frequency is thus 65,600 Hz. This rate is the maximum rate of any VISTA PLUS serial interface, although higher rates are possible in a parallel demand-response mode using the I-106 interface. The EXT 1 external clock is available from the standard serial interfaces of several minicomputers.

* On a special order, 11 bits can be transmitted at all speeds.

The setting EXT 2 on the rotary switch is not used.

The interface contains a connection to a local teletypewriter-like device at the terminal strip (reference point 6, Figure 9). Terminal #7 (+) of the Teletype is connected to the (+) terminal on the INFOTON asynchronous interface, and Teletype terminal #6 (-) is connected to the (-) terminal. The signal at the terminal of the INFOTON interface is a 20 ma output of all the ASCII characters received by the VISTA PLUS interface from the data channel.* (This terminal block is not to be confused with the selective output to a hard copy device, which is initiated by the PRINT PAGE or PRINT FIELD commands.)

EIA RS-232C Interface

The VISTA PLUS is delivered with a 6-foot detachable cable which is used to connect the unit to a computer or appropriate modem. On one end of the cable is a MOLEX plug which fits into the rear of the VISTA PLUS (reference point 7, Figure 9). The other end of the cable has a 25 pin standard EIA connector, which is attached to the customer's modem or computer. The pin connections for the MOLEX and EIA connectors are specified in Table 7, along with the RS-232C designations of the signals.

The maximum length of cable between the VISTA PLUS and another device depends upon the electrical noise environment, but under ordinary conditions the I-103 or I-105 asynchronous RS-232C interface will drive 1000 feet of cable at 1200 baud. The maximum baud rate varies linearly with the cable length; thus, 2000 feet of cable may be used at 600 baud, and 500 feet at 2400 baud.

* Note that the TEXT sent to the VISTA PLUS may contain TAB characters, which may not be properly interpreted by the peripheral device.

One of the most common uses of the RS-232C interface is as an input to a modem. The asynchronous communication interface allows a connection to modems equivalent to Western Electric 103A, 103F, 202C or 202D.

When the RS-232 communication interface is used, the position of the Full Duplex/Half Duplex switch (reference point 2, Figure 9) is immaterial. The communication channel itself may be full duplex or half duplex, depending upon the system design.*

The 110, 150 and 300 baud settings on the speed selector switch are appropriate for Western Electric 103A (switched network) modems or 103F (private line) modems. These modems are asynchronous, and can operate at any speed up to 300 baud in full duplex mode.

The 600 and 1200 baud settings on the asynchronous communication interface are appropriate for Western Electric 202C (switched network) modems or 202D (private line) modems.

The 1800 baud setting is appropriate for the Western Electric 202D (private line) modem.

The 202C modem operates in asynchronous mode at any speed up to 1200 baud; the 202D, also an asynchronous modem, can operate at any speed up to 1800 baud. The 202C modem is typically half duplex but a 4-wire version (which requires two simultaneous switched network calls) may be ordered for full-duplex operation. Similarly, if a 202D modem is to be used for full duplex operation, a 4-wire private line must be specified.

* For many applications, half duplex communications are adequate. A full duplex communication channel may increase system throughput by reducing the time required for "line turnaround". In addition, if full duplex communications are used, the VISTA PLUS can receive an I/O RESET command from the data channel while transmitting.

These advantages must be weighed against the possibly higher cost of full duplex communications.

EIA RS-232C Name	Description	EIA Pin No.	MOLEX Pin No.	Comments
BA	Data Transmitted from Terminal	2	1	Logical "1" = OFF = -6V Logical "0" = ON = +6V 3000 ohm minimum load impedance
CA	Request to Send Signal from Terminal	4	2	Goes high (+6V) when the terminal is ready to transmit
CB	Clear to Send Signal to Terminal	5	3	Must be high to allow terminal to send; is supplied by a modem
BB	Data Transmitted to Terminal	3	4	Logical "1" = OFF = -5V to -25V Logical "0" = ON = +5V to +25V 3000 ohm minimum load impedance
CF	Carrier Present Signal to Terminal	8	5	Must be high to allow terminal to receive; is supplied by a modem
CD	Data Terminal Ready Signal from Terminal	20	8	+12 Volt power supply
	External Clock Input at TTL Logic Levels	No Connec- tion to EIA Inter- face	10	For use with Selector Switch in EXT 1 position
AB	Signal Ground	7	12	

TABLE 7: PIN CONNECTIONS FOR I-105
(and I-103)
ASYNCHRONOUS SERIAL INTERFACE

Current Loop Interface

The I-105 asynchronous serial interface contains a current loop interface which is compatible with the current/no current input and output of Teletype equipment. The sensitivity of the interface may be set to 20 or 60 milliamperes by a switch (reference point 3, Figure 9).

When the interface is operating in the current loop mode, the full duplex/half duplex switch (reference point 2, Figure 9) must be in the full duplex (FDX) position. The actual choice between a full or half duplex data channel is made by the wiring to the terminal strip (reference point 5, Figure 9). Figure 10 shows the wiring for the two choices. The numbers on the connectors in Figure 10 refer to the number of the corresponding pins on a Teletype barrier strip. Two-wire twisted pair or four-wire twisted pair cabling is recommended for half or full duplex operation, respectively.

If the current loop interface is used either in a VISTA PLUS or an A-101 Message Concentrator that is equipped with the P-301 Polling Module, then the four-wire current loop connection must be used.

On output, 20 or 60 milliamperes is a mark, and zero current is a space. The maximum voltage is 120 volts.

The specifications for input are as follows:

20 ma sensitivity

20 + 6 ma = MARK

0 + 6 ma = SPACE

60 ma sensitivity

60 + 20 ma = MARK

0 + 20 ma = SPACE

The current loop interface does not contain a current source. The current source must be supplied externally.

Over limited distances (less than 250 feet) it is preferable to use a true current source on input to the interface, so that voltage drops in the circuits and line do not affect the signal current.

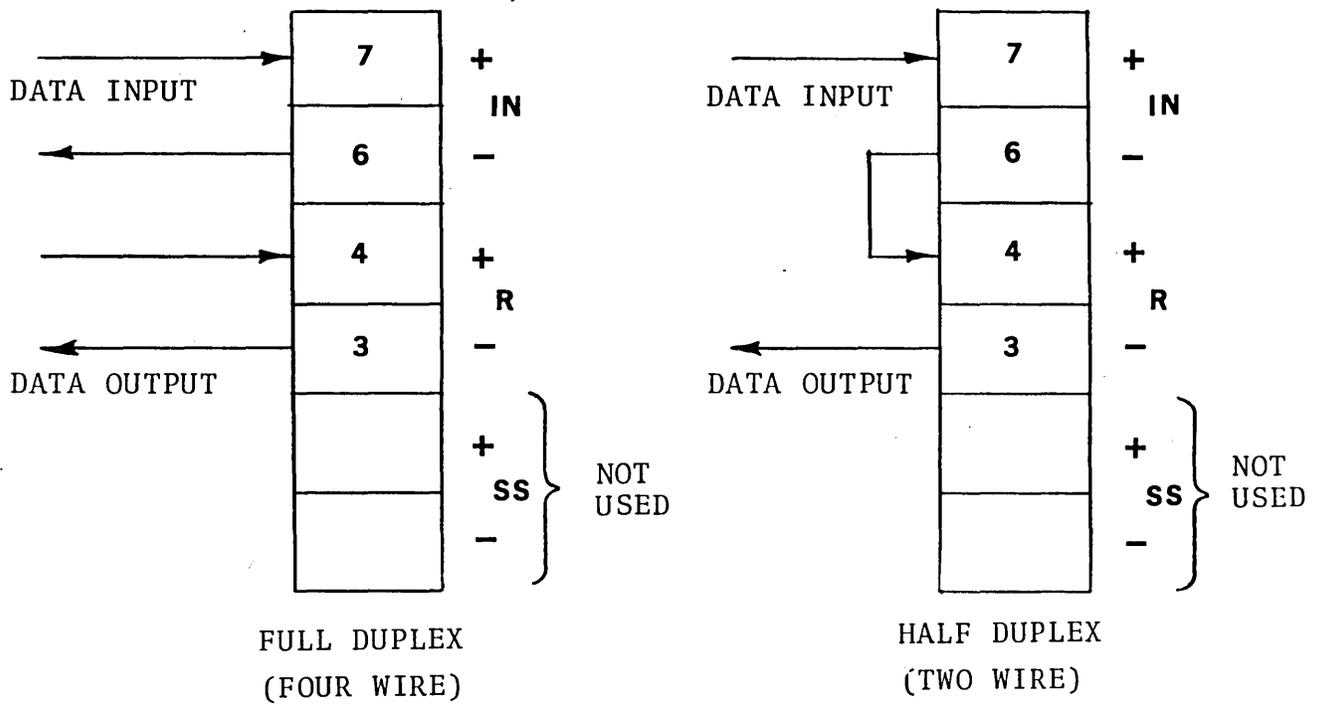


FIGURE 10: CURRENT LOOP CONNECTIONS
 FOR I-105 (and I-104)
 ASYNCHRONOUS SERIAL INTERFACE

For driving long lines (greater than 250 feet) a simple voltage-resistor driving source may be used.* Figure 11 shows the maximum data rates as a function of cable length for two voltages and two currents. The resistor value in the driving source is chosen to account for the voltage drops in the loop. Note that for a given length of cable the highest data rate is obtained when the driving source has a high current and low voltage.

The current loop interface is a solid state device, and is especially useful for connection to minicomputers. It allows a simple, inexpensive two or four wire I/O connection. It can operate over a wide range of data rates (up to 820 characters per second) and eliminates the need for parallel I/O cabling.

Further details of the current loop operation, including sample input and output circuits for constant current operation, may be found in INFONOTE 5-71-3, entitled "Current Loop Interface".

I-103 ASYNCHRONOUS SERIAL COMMUNICATION INTERFACE, MULTISPEED

The I-103 is a multispeed communication interface which conforms to EIA specification RS-232C; it includes parity generation as well. The capability of the I-103 interface includes all features of the I-105 interface that pertain to the RS-232C operation. In other words, the I-103 interface provides everything that the I-105 does except a current loop interface.

Figure 9 illustrates the control panel for the I-103 interface. The hardware at reference points 3 and 5 is not operative in the I-103 interface.

* Current sources should not be used to drive long lines, since they produce ringing, which reduces the maximum data rate for a given cable length.

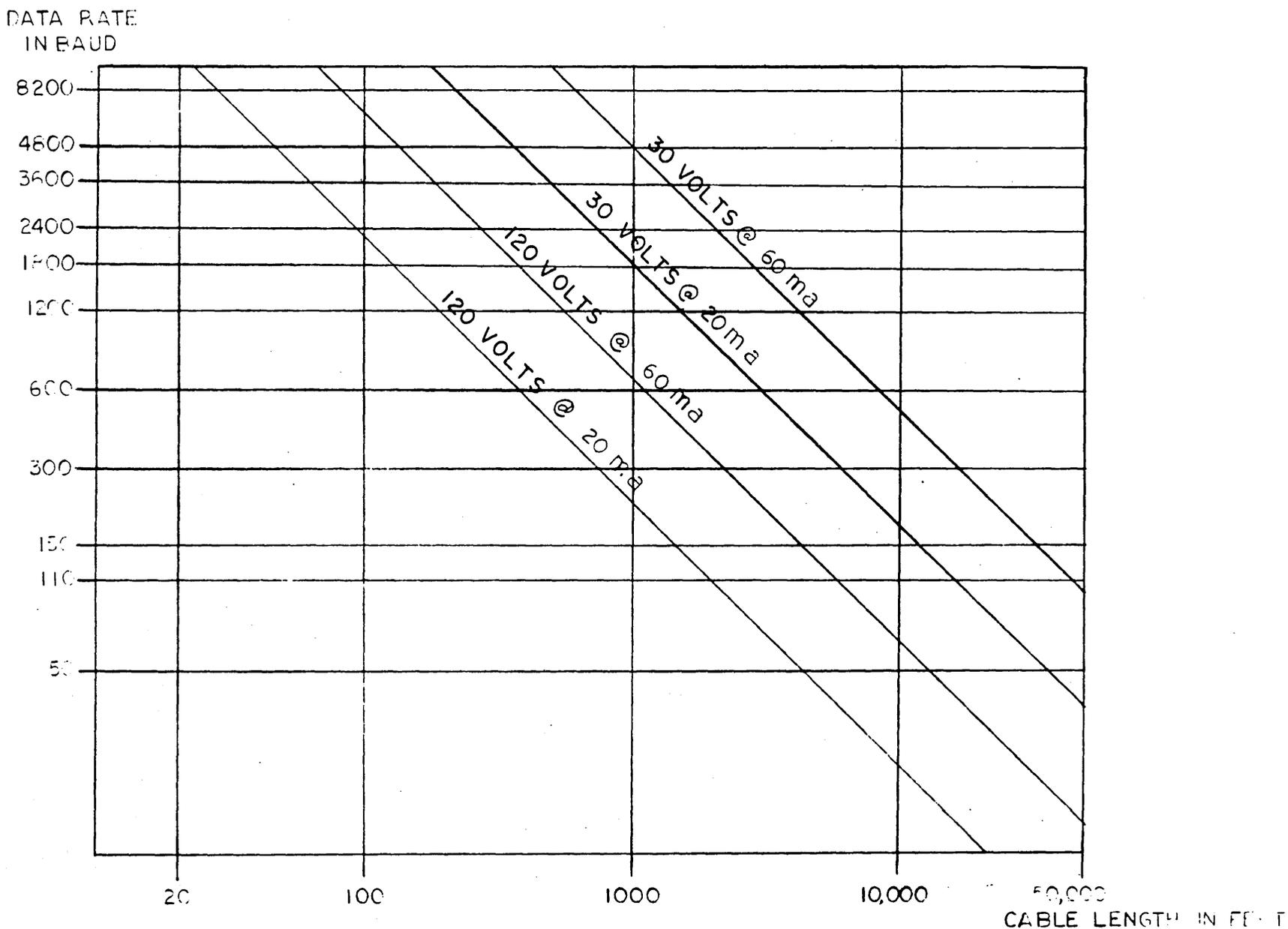


FIGURE 11: DATA RATE VS. CABLE LENGTH AS A FUNCTION OF SIGNAL LEVEL FOR INFOTON CURRENT LOOP INTERFACES I-104 and I-105

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I-104 ASYNCHRONOUS SERIAL CURRENT LOOP (TTY) INTERFACE, MULTISPEED

The I-104 interface is a multispeed 20 ma or 60 ma current loop interface which incorporates all the features of the I-105 current loop interface. It includes parity generation. Stated in other terms, the I-104 interface provides everything that the I-105 does except an interface conforming to EIA specification RS-232C.

Figure 9 illustrates the control panel for the I-104 interface. The hardware at reference point 7 is inoperative in the I-104 interface.

I-106 PARALLEL INTERFACE WITH LINE DRIVER

The I-106 parallel data interface amplifies output data from the VISTA PLUS to a differential signal capable of driving long twisted pair lines. It also uses a differential receiver which amplifies a differential input signal to levels used by the VISTA PLUS input bus. In addition, the interface is easily converted to DTL/TTL drive and reception for less demanding uses.

The I-106 interface will permit parallel data transmission and reception over 1000 foot twisted pair cabling. Connections to the interface include 8 wire input (7 bit plus parity), 8 wire output, and several control lines. Output is from the VISTA memory (i.e., the display on the screen of the CRT), not from the keyboard. The signals in the interface are shown in Table 8.

The maximum data rate is 1500 characters/second, which is obtained in a demand-response transfer. The 1500 characters/second rate is an average rate for the transfer of a number of characters. Individual characters will be transferred at higher and lower rates, but the time average is 1500 per second. Parallel transfers at fixed rates up to 820 characters/second are also possible. (In roll mode, the maximum fixed rate for parallel or serial transfer is 500 characters/second).

<u>IN/OUT</u>	<u>DESIGNATION</u>	<u>FUNCTION</u>
In	ID \emptyset	Data in (LSB)
In	ID1	Data in
In	ID2	Data in
In	ID3	Data in
In	ID4	Data in
In	ID5	Data in
In	ID6	Data in (MSB)
In	ID7	Parity in
In	IOR	Input strobe
	BUSY	Internal busy signal
Out	BST	Indicated DATA OUT is valid (strobe signal)
Out	BD \emptyset	Data Out (LSB)
Out	BD1	Data Out
Out	BD2	Data Out
Out	DB3	Data Out
Out	BD4	Data Out
Out	BD5	Data Out
Out	DB6	Data Out (MSB)
Out	PAR	Parity Out
Out	INITIAL RESET	Ext. System on "pwr ON"
Out	GND	
Out	DTL/TTL Ref.	Reference for T ² L or DTL Inputs
Out	BRK	Ground going signal when break key is depressed
In	Parity INH	Inhibits Parity Check On Input Data

TABLE 8: CONNECTIONS FOR I-106 PARALLEL INTERFACE

Further technical details on the interface, including voltage levels, timing requirements and recommended drivers and receivers at the termination of the cable from the VISTA PLUS are included in INFOTON Document 00646-S01 (December 2, 1970), entitled "INFOTON FUNCTIONAL SPECIFICATION -- I-106 PARALLEL LINE DRIVER".

I-107 SYNCHRONOUS SERIAL INTERFACE

General Description

The I-107 Synchronous Serial Interface transmits and receives 8-bit characters, which are communicated over the data line as a stream of bits at some constant rate. The output from this interface is compatible with EIA Specification RS-232C, and inputs must also conform to this specification.

The I-107 Synchronous Serial Interface takes its timing from external clocks. In typical applications, these clocks will be in a modem. The interface may be used with synchronous modems compatible with Western Electric 201A or 201B.

The maximum length of cable between the VISTA PLUS and another device depends upon the electrical noise environment, but under ordinary conditions the I-107 synchronous interface will drive 1000 feet of cable at 2400 baud. The maximum baud rate varies linearly with the cable length; thus 500 feet of cable may be used at 4800 baud.

Whereas an asynchronous interface identifies each character by its START and STOP bits, the synchronous interface must establish character synchronism from the content of the data stream itself. The interface establishes synchronism on received data by searching for two SYN characters in succession.

Message Format

A message transmitted by a single unpolled VISTA PLUS through the synchronous interface has the format:

SYN
SYN
SYN
SYN
STX
TEXT
ETX
LRC

The SYN characters allow the receiving device at the end of the data line to establish character synchronism. The characters STX, TEXT, ETX comprise the message generated by the VISTA PLUS itself (as opposed to the message with characters added by a message concentrator or by a data interface).

Each character in the entire message has eight bits - 7 bits plus an odd parity bit; the total number of "1" bits in the character is odd.

The LRC, or longitudinal redundancy check character, is formed so that the total number of "1" bits in each of the 7 data bit positions of all the characters (starting with the first character after STX and including ETX^{*}) is even. The LRC itself has odd parity, as do all the characters.

The message to be received by the VISTA PLUS has the same format, except that only two adjacent SYN characters are required. Any number of SYN characters may be received, however. As soon as the interface establishes character synchronism, subsequent SYN characters are ignored.

Details of Interface

The controls and indicators are located on a panel on the rear of the display.

* SYN characters imbedded in TEXT transmitted or received will not be included in the LRC calculation.

EIA RS-232C Name	Description	EIA Pin No.	MOLEX Pin No.	Comments
BA	Data Transmitted from Terminal	2	1	Logical "1" = OFF = -6V Logical "0" = ON = +6V 3000 ohm minimum load impedance
CA	Request to Send Signal from Terminal	4	2	Goes high(+6V) when the terminal is ready to transmit
CB	Clear to Send Signal to Terminal	5	3	Must be high to allow terminal to send; is supplied by a modem
BB	Data Transmitted to Terminal	3	4	Logical "1" = OFF = -5V to -25V Logical "0" = ON = +5V to +25V 3000 ohm minimum load impedance
CF	Carrier Present Signal to Terminal	8	5	Must be high to allow terminal to receive; is supplied by a modem.
SCR	External Receiver Clock	17	6	For use with Bell 201A or 201B Modem
CD	Data Terminal Ready Signal from Terminal	20	8	+12 Volt power supply
SCT	External Trans- mitter Clock	15	9	For use with Bell 201A or 201B Modem
AB	Signal Ground	7	12	

TABLE 9: PIN CONNECTIONS FOR I-107 and I-108 SERIAL INTERFACES

Table 9 contains a list of the pin connections for the I-107 interface.

Clocking signals, which are supplied by Western Electric 201 modems and by other synchronous modems, are denoted by EIA designations SCR and SCT in Table 9.

I-108 ASYNCHRONOUS SERIAL INTERFACE WITH LRC

General Description

The Asynchronous Serial Interface with LRC is a communication interface compatible with EIA Specification RS-232C. The interface uses a START/STOP character format with a total of 10 bits per character (except in the 110 baud test position, where an 11 bit character format is used.)

Three speed settings are provided by the interface. In the test position, an internal 110-baud clock is used. In the internal position, the transmission rate is 1200 baud; the output obtained in this position is compatible with a Western Electric 202D modem. In the external position, the speed is determined by external clocks. This speed setting allows attachment to a Western Electric 201B modem. Although this modem is synchronous, the character format is still asynchronous (START/STOP bits are used, for a total of 10 bits per character). Higher speed modems with RS-232C clock levels may also be used.

Each character has even parity; that is the total number of "1" bits in the eight data bits of the character is even.

The Request to Send line (EIA designation CA) is always high (+6 volts) when the front panel control switch is in the LINE position. Thus, the data channel must be 4-wire, rather than two-wire. This mode of operation eliminates the line turnaround time that is present when modems are used in half duplex (two wire) communications.

A longitudinal redundancy check (LRC) character may be appended after the ETX in each text message. The LRC character is formed by accumulating a binary total by bit (no carries) of

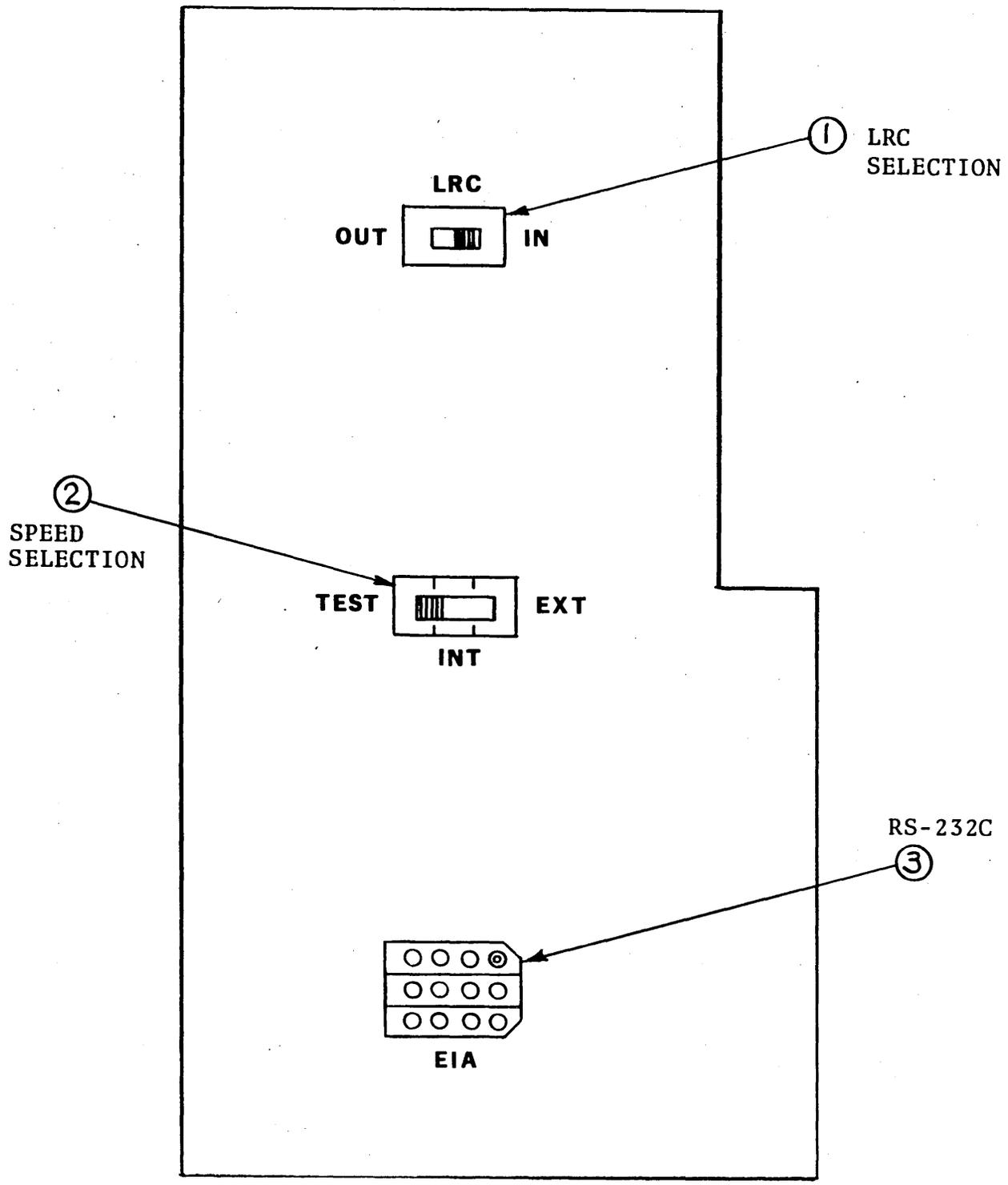


FIGURE 12: CONTROL PANEL OF I-108 ASYNCHRONOUS SERIAL INTERFACE WITH LRC

all the characters (from the first character after STX up to and including ETX). The LRC itself has even parity, as do all the characters.

Details of Interface

Figure 12 shows the exposed control panel for the I-108 interface at the rear of the terminal. There are three reference points in the figure, namely:

1. A two position slide switch which determines whether the LRC will be calculated and checked (IN position) or not (OUT position).
2. A three position slide switch for data rate selection. The positions are labeled TEST (110 baud), INT (1200 baud), and EXT (external clocking).
3. A MOLEX plug receptacle. The VISTA PLUS is furnished with a six foot cable, which connects to this plug and which terminates in a 25 pin standard EIA connector.

In the INT (1200 baud) position the I-108 interface will drive 1000 feet of cable.

In the EXT position, the maximum baud rate depends upon the baud rate. Under ordinary electrical noise conditions, the external clocked interface will drive 1000 feet of cable at 2400 baud and 500 feet of cable at 4800 baud.

Table 9 contains the pin connections for the I-108 interface. The clocking signals designated SCR and SCT are applicable only when the speed selector switch is in the EXT position.

I-109 ASYNCHRONOUS SERIAL INTERFACE TO MESSAGE CONCENTRATOR

The I-109 interface is used only in a VISTA PLUS which is connected to an A-101 Message Concentrator. The electrical characteristics of this interface do not conform to any established industry specification. The interface uses a START/STOP character format with a total of 10 bits per character.

The speed of transmission is 9600 baud, independent of the speed of the data line interface in the A-101 Message Concentrator. Clocks in the Message Concentrator govern the 9600 baud speed. The data lines in the I-109 interface remain in the mark condition in the time interval between characters.

Since 9600 baud is a higher rate than is allowed by any of the serial interfaces to a data line, there is no discrepancy in data rates. For example, suppose that the A-101 Message Concentrator contains an I-107 interface that is being operated at 4800 baud, or 600 characters per second. One character will be received from the data line every 1/600 second. After it has been processed by the Message Concentrator in parallel format, only 1/960 second is required to transmit the character to the VISTA PLUS. In remaining time (i.e., $1/600 - 1/960 = 1/1600$ sec), the line between Message Concentrator and VISTA PLUS waits in the mark condition).

Even character parity is generated and checked by the I-109 interface. Longitudinal parity is not provided.

The I-109 interface allows 1000 feet of cable to be used between the A-101 Message Concentrator and the VISTA PLUS.

The following eight signals are used by the I-109 interface:

1. Data Transmitted from Terminal
2. Data Transmitted to Terminal
3. Request to Send from Terminal
4. External Receiver Clock
5. External Transmitter Clock
6. Terminal Busy
7. RSVP
8. Signal Ground

All of these except numbers 6 and 7 have the same meaning (if not exactly the same electrical characteristics) as signals of the same name in EIA specification RS-232C. Terminal Busy informs the concentrator whether a message may be sent to the terminal. Specifically, in response to a polling header, it allows the P-301 Polling Module to respond negatively if the terminal is engaged in an I/O activity.

RSVP is a signal from the terminal which notifies the concentrator that a message sent to the terminal contained a parity error. This signal is also used by the P-301 Polling Module.

CHAPTER 4

PERIPHERALS AND ACCESSORIES

INTRODUCTION

The interface options for the VISTA PLUS were described in Chapter 3. Other optional pieces of equipment for the VISTA PLUS, which were described in Chapters 1 and 2, include the following:

P-301 Polling Module - This module, which consists of a single printed circuit board, may be placed in a designated Accessory Port of the VISTA PLUS or in the A-101 Message Concentrator.

When ordered, two manufacturing options may be specified:

1. Two-character address, rather than one-character address.
2. Fast Select "write" poll response, rather than ordinary "write" poll response.

P-302 Acknowledgment Module - This module is contained on a single printed circuit board, which is placed in a designated Accessory Port of the VISTA PLUS.

A-101 Message Concentrator - The Message Concentrator is housed in a desk-top cabinet which can contain the power supplies and necessary hardware to connect to as many as 64 VISTA PLUS terminals and the communication line. (The product designated as A-101 contains 8 of the possible 64 channels.)

A-102 Message Concentrator Expansion, 8 channels - This module is added to the A-101 Message Concentrator. As many as seven additional A-102 modules may be added to the basic A-101 Message Concentrator, to achieve the maximum of 64 channels.

A-202 Lower Case Character Group - This accessory permits the VISTA PLUS to display the 96 character ASCII set, which includes lower case alphabetic characters. The additional characters added by the A-202 accessory are displayed on a 5 x 10 dot

matrix, to allow an adequate presentation of characters with descenders (namely g, j, p, q and y).

In addition to the foregoing items, there are several peripherals and accessories that are not described in any detail elsewhere in this manual. These options are summarized in the following sections.

COMMUNICATION MODEMS

A modem compatible with a Western Electric Series 103 or 202 modem may be added to the VISTA PLUS. The integral modem is built on a single printed circuit card and is placed in an Accessory Port of the VISTA PLUS.

The INFOTON product designations of the integral modems, their Western Electric equivalents, the transmit levels, and the receiver sensitivity are as follows:

Infoton Product	Western Electric Equivalent	Transmit Levels (Adj. Range)	Receiver Sensitivity
P-401	103A	0 to -12 dbm max.	0 to -40 dbm
P-402	103F	0 to -12 dbm max.	0 to -40 dbm
P-403	202C	0 to -12 dbm max.	0 to -45 dbm
P-404	202D	0 to -12 dbm max.	0 to -45 dbm

These integral modems, like their Western Electric counterparts, are asynchronous. If P-401, P-402, P-403, or P-404 is ordered, then the VISTA PLUS must be ordered with either the standard I-103 Asynchronous Serial Communication Interface or the optional I-105 multipurpose interface. (In addition, the P-404 Integral Modem may be used with the I-108 Asynchronous Serial Interface with LRC, provided the interface is set in the INT position for 1200 baud operation.)

P-102 VISTA PLUS PRINTER OUTPUT INTERFACE

The PRINT PAGE and PRINT FIELD commands for the VISTA PLUS were described in Chapter 1, where it was explained that the printer interface could be manufactured for two types of operation, namely:

1. Print unprotected data only. In this case the PRINT PAGE and PRINT FIELD commands are distinct.
2. Print all data on page, in which case the two commands are identical.

To save printing time, the interface skips over spaces and nulls between the last character on a line and the beginning of the next line. The interface inserts the necessary Carriage Return, Line Feed, and Tab codes when transmitting to the printer, in order to preserve the format of data on the screen.

As many as ten displays may share one printer in a contention mode. The first terminal to request service by the printer controls the printer until the print operation is complete, or until the I/O RESET switch on the controlling terminal is depressed, whichever comes first. If another terminal requests a print operation while the printer is busy, that terminal will indicate "I/O BUSY" until all the waiting terminals with higher priority* are serviced and its operation is performed, or until the I/O RESET switch is depressed.

To allow for different customer requirements for printers, INFOTON provides four manufacturing versions of the P-102 printer interface. All four use the same printed circuit module; variations in cabling and cable connectors accommodate differences in transmission speed and time delays for mechanical carriage returns on the printers. The four versions are described in the following chart:

* Priority is determined by wiring of terminals to printer.

<u>INFOTON Product Designation</u>	<u>Printer</u>	<u>Speed</u>	<u>Printing Process</u>
P-102 (a)	Teletype Models 33 and 35	10 char/sec	Impact
P-102 (b)	Texas Instruments Model 731	30 char/sec	Thermal
P-102 (c)	REPCO Model 120	120 char/sec	Electrostatic
P-102 (d)	Centronics Model 101	165 char/sec	Impact

The printer interface simultaneously provides 20 milliamperere current loop output and an EIA RS-232C output. The inter-terminal priority and busy lines, which are required for multiple terminals which share a printer, use RS-232C levels.

A-203 INFOTONE (ANNUNCIATOR)

The INFOTONE accessory generates a short, audible signal whenever the cursor reaches the tenth position from the end of a line or when the ASCII BELL code is received by the terminal. The maximum rate at which the tone will sound is ten times per second, so that a series of BELL codes received at a higher rate will result in a continuous tone.

The INFOTONE accessory is mounted inside the VISTA PLUS, but does not require an Accessory Port.

A-204 LIGHT PEN

General Description

The A-204 Light Pen accessory allows the operator of a VISTA PLUS terminal to transmit to the computer the position of a character on the screen by touching that character position with a hand-held light detecting cartridge that resembles a pen.

The pen contains a switch in its tip which is activated when the pen is pushed against the faceplate of the CRT. The pen is connected to electronics in the VISTA by a lightweight, flexible fiber optic light pipe.

The output of the A-204 Light Pen is a message which contains two-character ASCII codes for both the row and column number of the detected character. The message is transmitted through the VISTA PLUS data interface (I-103, I-104, I-105, I-106, I-107, I-108 or I-109) at the data rate applicable to the interface.

Operational Details

Figure 13 illustrates the operation of the A-204 Light Pen Accessory.

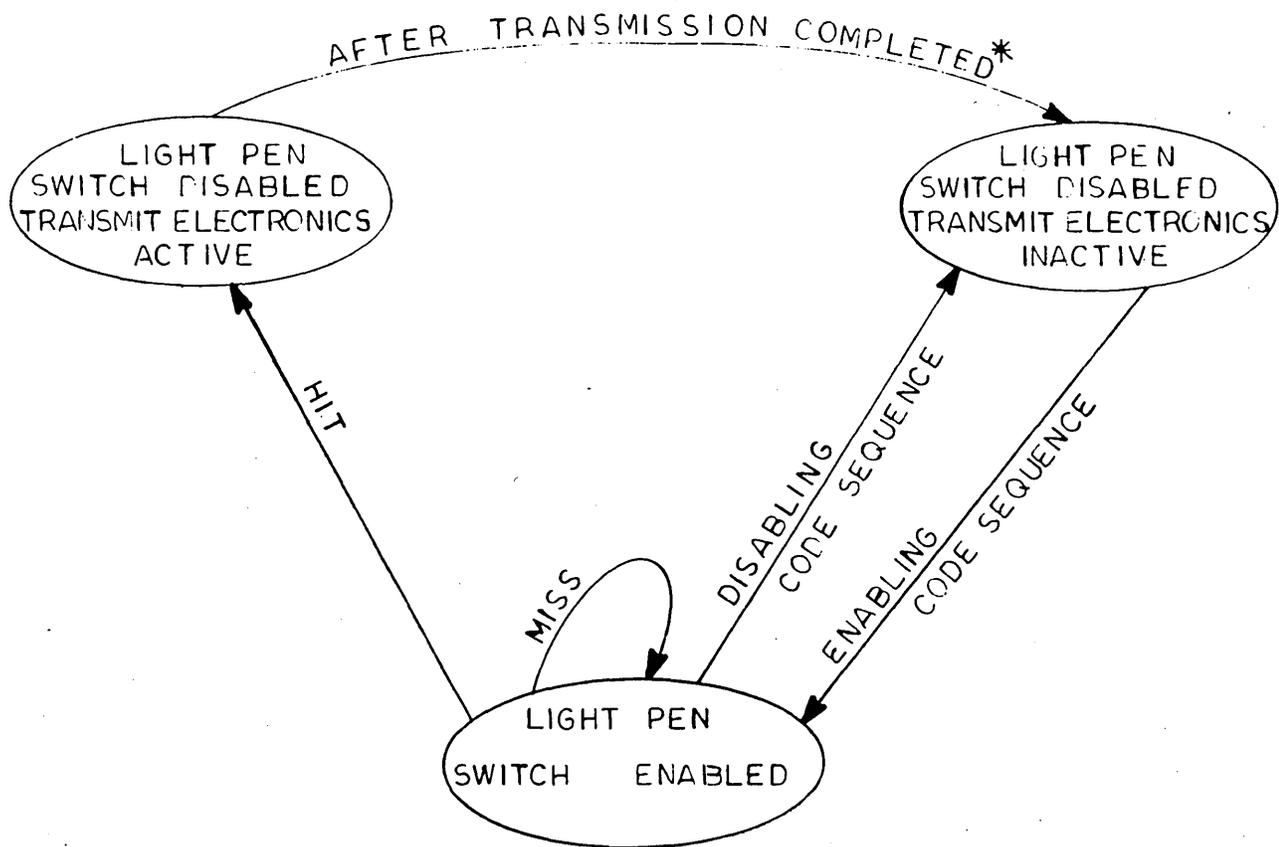
The switch in the tip of the light pen cartridge is enabled by receipt of the following message:

```
STX
ESC
140g
ETX
[LRC]
```

When the pen is enabled, its transmit electronics is activated by the detection of a light pulse on the next video frame after the switch on the light pen cartridge is depressed. The detection of a video input in the next frame after the switch is depressed will be referred to as a "hit". Failure to detect a video input within the next frame time will be called a "miss". After a miss, the light pen switch remains enabled.

After a hit, the electronics prepares the following message for transmission:

```
STX
HOME
X2
X1
Y2
Y1
ETX
[LRC]
```



* If the terminal uses the P-301 Polling Module, transmission of the light pen message waits for a "read" poll. If the "read" poll is received when the light pen is not ready to transmit, the Polling Module returns an EOT.

* If either the P-301 Polling Module or the P-302 Acknowledgment Module is used, this transition occurs after the terminal receives an ACK.

FIGURE 13 - OPERATIONAL DIAGRAM OF A-204 LIGHT PEN ACCESSORY

where X2 and X1 are a pair of ASCII codes that identify the character position within the line; Y2 and Y1 are a pair of ASCII codes that identify the line number.

For example, if the hit was on the seventh character position of the twelfth line, then, by reference to Table 3, one finds that X2 = 060₈, X1 = 067₈, Y2 = 061₈, Y1 = 062₈.

The vertical resolution of the sensing electronics is one line; the horizontal resolution is + 1 character position.

If the system uses the P-301 Polling Module, the transmission of the above message must wait for a "read" poll, just as any other terminal would.

If the P-301 Polling Module or the P-302 Acknowledgment Module is used, the light pen electronics is inactivated after receipt of an ACK response to the light pen message.

To enable the light pen to transmit another message, the enabling sequence must be retransmitted. The light pen switch may be disabled by the message:

STX
 ESC
 141₈
 ETX
 [LRC]

Two variations to the foregoing description can be specified at the time of manufacture of the A-204 Light Pen option, namely:

1. The light pen can always be enabled, so that the ESC, 140₈ and ESC, 141₈ sequences are not used.
2. In the transmission of the light pen message, ESC can be substituted for ETX.

CHAPTER 5

PROGRAMMING FOR THE VISTA PLUS

TRANSMISSION LINE CONTROLS

The method by which the flow of information on data lines to the VISTA PLUS is controlled depends upon the interface to the data channel.

If a current loop interface is used, then the VISTA PLUS without polling begins its transmission immediately after a transmit command is issued. The computer must be ready to receive whatever message is transmitted. As characters are formatted by the serial line controlling hardware of the computer, the central processor is interrupted to handle the characters. Computer instructions to handle input and output of characters are provided by common minicomputers. In larger computers with a data channel that operates independently of the central processor, software for handling input and output to a serial ASCII code device is generally supplied.

If a serial interface conforming to EIA specification RS-232C is used, and if no modems are employed, the computer can control messages from the VISTA by controlling the Clear to Send line. Popular minicomputers have instructions which allow the signals on control input lines from an EIA interface to be read or set.

The INFOTON I-106 Parallel Line Driver is a parallel interface with the necessary control lines for a demand response transfer of characters to or from the VISTA PLUS.

The full control of serial transmission from a VISTA PLUS which is connected to a computer with modems requires the P-301 Polling Module, either in the individual terminals, or in the A-101 Message Concentrator.

The polling dialog is described in Chapter 2 of this manual. The computer program is responsible for initiating the polls and responding appropriately to the various possible replies to them. The program may establish an order in which terminals are to be polled and whether some terminals will be polled more frequently. The program will control the number of attempts at retransmission in case of parity error (i.e., how many times a NAK will be sent back to a terminal to cause it to send its message again) and what action will be taken when transmission errors persist. Buffer space for messages must be allocated by the program, and if input and output queues of messages are to be established, the program must allocate them.

If a polling module with the two-character address option is used, then the program must insert the proper addresses in the polling sequence. In addition if a general poll is sent to a Message Concentrator, then the program must interpret the address of a terminal which responds to the poll.

CONTROLS IN THE DATA STREAM

The commands PRINT FIELD, PRINT PAGE, TRANSMIT FIELD, TRANSMIT PAGE, and I/O RESET are each sent to the VISTA PLUS as single ASCII characters in the data stream. All blink commands, erase commands, cursor movement commands and commands involving protected data are sent in the same way.

MESSAGE ORIENTATION OF VISTA PLUS

The basic format for messages to and from the VISTA PLUS is STX, TEXT, ETX. The modifications of message formats necessitated by the A-101 Message Concentrator, the P-301 Polling Module, the P-302 Acknowledgment Module, or the I-107 Synchronous Interface are documented in Chapter 2 and Chapter 3 .

The STX, TEXT, ETX format is particularly appropriate for data communications. Software (or hardware, as in some transmission control units) for handling a message in this format

must recognize STX and ETX as the delimiters of a message. The VISTA PLUS, it should be emphasized, is not a buffered Teletype; input routines which look for a string of characters terminated by a carriage return must be modified to handle messages from the VISTA PLUS.

A message for the VISTA PLUS which does not begin with an STX will be ignored; if a message is not terminated by an ETX, the VISTA PLUS will remain in the RECEIVE state, until the time out period has elapsed, at which time it will go into the ERROR state. Recovery from the ERROR state depends upon whether the terminal is polled or not, as described in Chapter 2.

Messages from the VISTA PLUS will have certain field delimiters inserted by the VISTA PLUS hardware. The TAB characters inserted in place of protected fields are used by a program to separate different pieces of data. The line-feed characters inserted at ends of lines are useful in processing data transmitted by the VISTA PLUS.

When the VISTA PLUS is equipped with the P-301 Polling Module, a NAK will cause the retransmission of whatever was previously transmitted. The program need not know whether it was a field or page transmission. When a TRANSMIT PAGE command is sent to the VISTA PLUS, the action is unique. However, when a TRANSMIT FIELD command is sent to the VISTA PLUS, the result of the transmission will depend upon the cursor position. Thus some care must be exercised. The best procedure is to position the cursor under program control using cursor commands which are part of the same message which contains the TRANSMIT FIELD command.

Note that the message which results from a TRANSMIT PAGE command will contain TAB characters if and only if there are protected fields on the VISTA PLUS screen. A message which results from a TRANSMIT FIELD command never has a TAB character.

The message structure of the VISTA PLUS dictates that the input/output programs be written in modular form. The I/O modules should handle the STX and ETX processing; if the A-101 Message Concentrator is used, then device address interpretation should be done in an I/O routine which can be called by the message processing program.

Use of mnemonics for the control codes such as transmit, print, erase, blink, etc., is highly recommended. It is often convenient to store these special codes in a single segment (e.g. a FORTRAN COMMON block) of a program, so that they may be referenced by several segments of a program.

PROGRAMMING CONSIDERATIONS FOR PROTECTED FORMS

The protected data features of the VISTA PLUS are very useful for data entry applications. The VISTA PLUS is operated in PAGE mode, and the protected fields contain field identifiers that would be found on a pre-printed form. (For example, the words "Name," "Address," "Telephone Number," etc.). The operator enters the variable data (a person's name, address, and telephone number) using the TAB feature and depresses the TRANSMIT PAGE key.

Figure 14 shows a hypothetical 4 line by 20 character VISTA PLUS screen arrangement with a protected form, together with the message which was used to create this form. Note that the protected fields are underlined; for ease of presentation, extra spaces have been added to left-justify the data which will be entered from the keyboard.

The first character in the text places the VISTA PLUS in protected input mode. The next character, PAGE ERASE, clears the screen of all data and places the cursor at the home position. Because the terminal is in protected input mode, the subsequent displayed characters in the message will be protected. At the end of the protected field identifiers, a LF (NEW LINE) command places

1	N	A	M	E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	A	D	D	R	E	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	T	E	L	E	P	H	O	N	E	-	-	-	-	-	-	-	-	-	-	-	-	
4																						

SAMPLE PROTECTED FORM

STX
PROTECT START
PAGE ERASE
N,A,M,E, 7 SPACES
LF
A,D,D,R,E,S,S, 4 SPACES
LF
T,E,L,E,P,H,O,N,E, 2 SPACES
PROTECT END
HOME
TAB
ETX

FIGURE 14. MESSAGE REQUIRED TO GENERATE A SAMPLE VISTA PLUS FORMAT

the cursor at the start of the nextline. When the form is completed, the terminal is removed from protected input mode. A HOME and a TAB code place the blinking cursor (not shown in Figure 14) at line 1, column 12, where keyboard data entry may begin.

It is very important to remove the terminal from protected input mode when the computer relinquishes control of the VISTA PLUS. Otherwise, anything which the operator types on the screen will be entered as protected data, which is undesirable in most applications.

It is possible to cause the terminal to transmit all data on the screen, including protected data, by the following message:

```
STX
PROTECT START
TRANSMIT PAGE
ETX
```

Immediately after receipt of the transmission from the terminal, the computer should respond with the message:

```
STX
PROTECT END
ETX
```

in order to remove the terminal from protected input mode.

MISCELLANEOUS PROGRAMMING NOTES

The full advantages of VISTA PLUS data compression (spaces and nulls at the right hand end of a line are not transmitted) are realized when data on the screen are left justified. Protected fields may be placed anywhere on the screen, but it is advantageous to left-justify them. Data compression significantly reduces the requirements for buffers in the computer memory, since it reduces the average message length. Programmers (and users) should be warned, however, that placing a single character in the right end of each line will cause TRANSMIT PAGE to transmit the entire screen (including all the blanks), whereas a single character in the left end of each line will result in data compression.

The cursor may be placed at any position on the screen by sending the proper sequence of cursor codes as text in a message to the VISTA PLUS. However, once the VISTA PLUS is no longer in the RECEIVE state and returns to the NULL state, the operator can go into the ENTER state and move the cursor, and the movements will not be communicated to the computer by the VISTA PLUS. Accordingly, a subsequent cursor movement under computer control cannot assume the starting position of the cursor; a HOME command should be used to establish the starting point.

USE OF THE VISTA PLUS WITH TIMESHARED COMPUTERS

The input/output routines of a timesharing system need to be transparent to all the codes which the VISTA PLUS can send to the computer.

In particular, the timesharing monitor must not take exception to the STX and ETX codes which are part of each message from the VISTA PLUS.

Since the VISTA PLUS cannot transmit a carriage return code (line feed is automatically inserted between lines as a separator), software modifications may be required. A carriage return may be sent to the VISTA PLUS, however; it will return the cursor to the beginning of the line.

Messages to the VISTA PLUS must be terminated with an ETX, in order to avoid a timeout error.

The buffer size of the timesharing system must be sufficient to hold the longest message that the VISTA PLUS may send.

PROGRAMMING CONSIDERATION RELATED TO DATA RATES

In parallel demand-response mode, the VISTA PLUS can transfer data at an average rate of 1500 characters per second. Individual characters will require more or less than 1/1500 second, but the average transfer rate is 1500 char/sec. This is the highest I/O speed available with the VISTA PLUS.

In PAGE mode, characters can be transferred at a maximum fixed rate of 820 characters per second, either in parallel or serial mode. To achieve the 1500 char/sec average rate, it is necessary for the computer controlling the parallel transfer to test the status of the VISTA PLUS after each transfer to see if the terminal is ready to transfer the next character. In PAGE mode, characters may be transferred at the 820/second rate without the need for testing the status of the VISTA PLUS after each transfer.

In ROLL mode, characters can be transferred at a maximum fixed rate of 500 characters/second, either in parallel or serial mode.*

When TAB or FIELD ERASE commands are used, characters can be transferred at a maximum fixed rate of 500 characters/second, either in parallel or serial mode. **

If one ASCII NULL character is inserted after each TAB or FIELD ERASE command sent to the VISTA PLUS then a message may be transmitted at fixed rate of 760 characters/second. If two NULL characters are inserted, then the 820 character/second rate may be used.

*In a demand response parallel data transfer, the effective rate can exceed 500 characters/second.

+ The 500 character/sec fixed rate applies if there is a protected character preceding an unprotected character on the screen. If there is none, then strings of TAB or FIELD ERASE characters are limited to 400 characters/sec.



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