DataGeneral

Technical Reference

DGC DISPLAY 6012

014-000049-01

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SECTION 1

INTRODUCTION

THE DGC DISPLAY 6012

The DGC display 6012 is an alphanumeric cathode ray tube (CRT) I/O terminal which is used to enter, display, edit, retrieve and update data files.

The terminal is comprised of two major subsystems; a keyboard and a CRT display, both of which operate with eight level serial asynchronous ASCII codes. The keyboard can transmit 98 out of the possible 128 eight-level codes. The display can receive all 128 codes. However, of these, 96 are decoded, stored and plotted as the 64 ASCII ALPHANUMERICS; 14 are decoded and interpreted as control characters; and the remaining 18 are decoded but ignored. All codes which represent alphanumerics are stored in an internal, 1920 character semiconductor memory which refreshes the CRT at the line frequency. The CRT plots the characters corresponding to these codes as 5 by 7 dot matrices. The 12 inch screen has an active area 6 by 9 inches wide which is formatted as a page of 24 lines with 80 characters per line.

The terminal operates in one of two transmission modes, full or half-duplex, and three switch selectable modes called Page-buffered, Page, and Roll. Page-buffered mode allows an entire page of data to be entered into the terminal's memory, edited off line and then transmitted to the computer in part or in whole. Page mode allows a file to be transmitted to the terminal and any desired changes made simultaneously to both the information stored in the terminal's memory and the corresponding characters stored in the computer's memory. Roll mode simulates a teletypewriter.

In both Page-buffered and Page mode, all characters stored in the display can be protected for form entry, and made to blink for highlighting.

Figure 1-1 is an exploded view of the major components of the DGC display. All the control and memory electronics are mounted on one printed circuit board. Two power supplies are mounted inside the chassis: the first provides power to the memory and control electronics while a second independent supply provides the high voltage necessary for the CRT's screen electronics. All connections between the printed circuit board, the keyboard and the display electronics are through convenient, reliable edge connectors.

Internal switches select full or half-duplex operation, even or odd parity and the choice of 9 baud rates: 110, 150, 300, 600, 1200, 1800, 2400, 3600, or 4800. When the terminal is operating at 4800 baud, the entire display screen of 1920 characters can be filled in 4 seconds. Either 10-bit or 11-bit codes can be selected; 10-bit codes have one stop bit while 11-bit codes have two stop bits. The code length, parity and baud rates must be compatible with the controller in use.

The controllers normally used with the display are the 4010, 4023, 4026, 4060-4063 and the 4100. The interface between the display and the controller is switch selectable for the 20mA current loop, 60mA current loop or the standard EIA Voltage interface, type RS-232C.

The DGC display 6012 is a tabletop device 13 inches high, 18 1/4 inches wide and 23 3/4 inches deep. Power options are:

1.	6012	100-130Vac, single phase 60Hz ±5% @ 1.2A
2.	6012-1	100-130Vac, single phase 50Hz ±5% @ 1.2A
3.	6012-2	200-269Vac, single phase 50Hz ±5% @ .6A

When ordering specify the appropriate model for the primary line voltage, the controller used and the processor used.

Table 1-1

The DGC Display 6012 Specifications

PROPERTIES	
Mounting	Tabletop, 13 x 18 1/4 x 23 3/4 inches
Weight	35 pounds
Operating Temperature Range	5° to 45° Centigrade
Operating Humidity Range	10% to 95% non-condensing
Power Requirements	100-130Vac, single phase 60Hz ±5% 1.2A, 140 watts or 100-130Vac, single phase 50Hz ±5% 1.2A, 140 watts or 200-269Vac, single phase 50Hz ±5% .6A, 140 watts
SYSTEM CAPACITY	
Number of displays/system	Depends on controller
Display Information Capacity	1920 characters, formatted as 24 lines, 80 characters/line displayed in a 6 by 9 inch area on a 12 inch CRT
CHARACTERISTICS	
Data Transmission Mode	Serial, bit by bit, character by character, lower order bit transmitted first. Full- or half-duplex, user selectable
Code Format	ASCII; 10 or 11-bit, user selectable Even or odd parity user selectable at the terminal
Interface	20mA current loop 60mA current loop EIA - RS-232C
Keyboard Codes	98 seven bit codes plus a parity bit
Display Codes	64 seven bit codes plus a parity bit which is ignored by the terminal. Letters are upper case only; lower case will be displayed as upper case
Character Transfer Rate	User selectable: 110, 150, 300, 600 1200, 1800, 2400, 3600, or 4800 baud limited by controller in use.
Screen Fill Time	4 sec. @ 4800 baud to 3 min. @ 110 baud.

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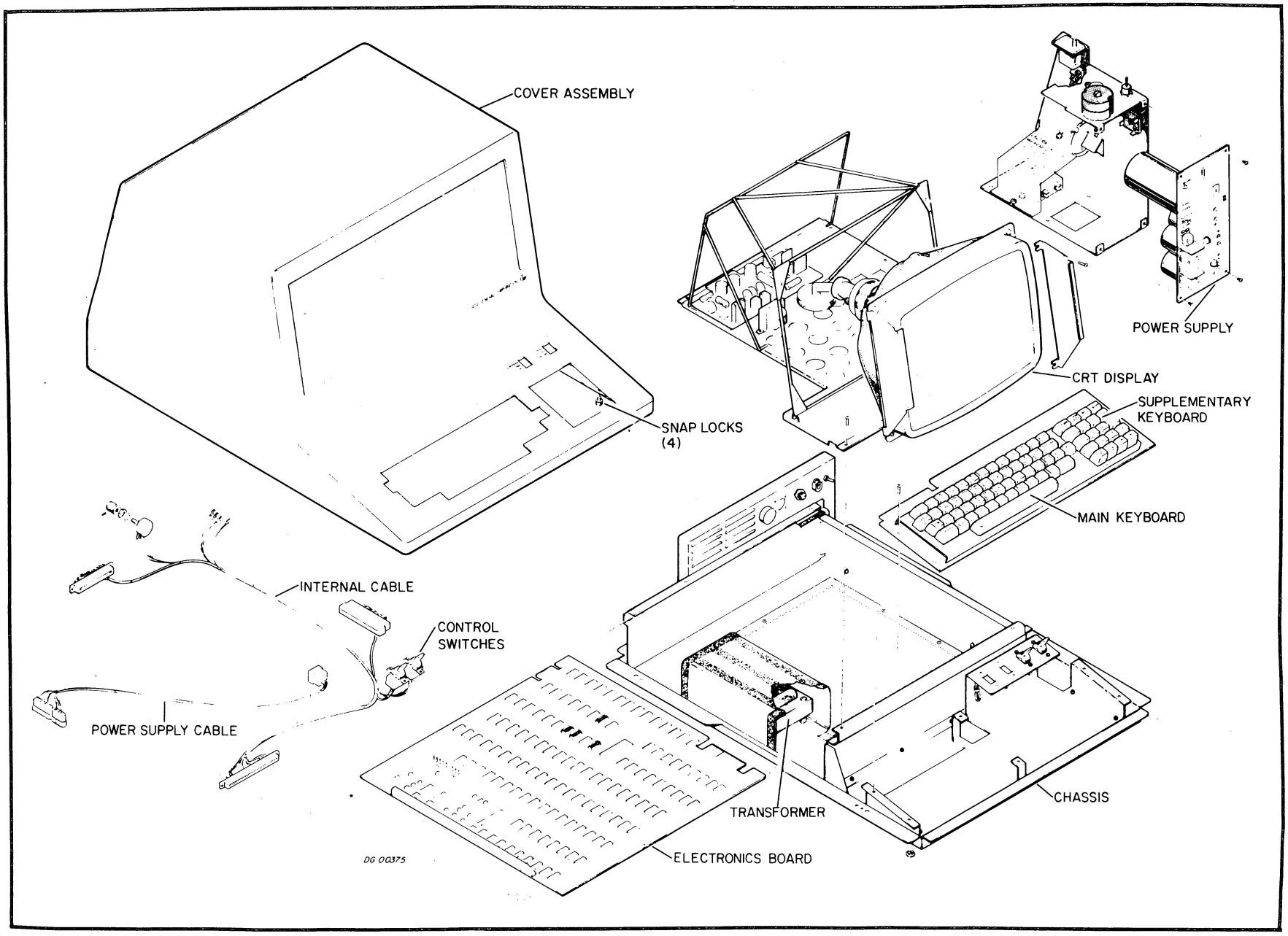

Figure 1-1 The DGC Display 6012

SECTION 2

PRINCIPLES OF OPERATION

THE TERMINAL

The DGC display 6012 is two separate I/O devices; a console and an alphanumeric CRT display, shown in Figure 2-1. The console is comprised of a standard 53-station teletypewriter stype ASCII keyboard, a supplementary 20-station ASCII keyboard and two switches. The first switch has three positions labeled LOCAL, OFF, and ON LINE. The ON LINE position connects the terminal to the computer. LOCAL, used primarily for testing, puts the terminal off line from the computer and connects the keyboard to the display. OFF removes power from the device. The second switch has three positions labeled BUFFERED, PAGE and ROLL. The position of this switch selects the terminal's operational mode.

The screen is a 12 inch CRT with an active area of 6 by 9 inches, formatted into a twenty-four line by 80 character page. The characters that appear on this screen are from the standard 64 character subset of ASCII, listed in Table 2-1.

DATA TRANSMISSION

When a key (or combination of keys) is depressed on the keyboard, a corresponding ASCII code is transmitted to the display and/or the computer. There are 98 possible ASCII codes that can be generated from the keyboard and these codes are classified into three categories; codes which represent commands to the display, listed in Table 2-2, codes which represent ASCII characters which can be plotted by the display, listed in Table 2-1 and codes which can be used for protocol, listed in Table 2-3.

When a code is received and decoded by the terminal, it responds in one of three ways: if the code represents a control character, listed in Table 2-2 and explained under CONTROL CHARACTERS, the display carries out the associated command; if the code represents a printable character, that character is stored in the terminal's memory and plotted on the screen; if the code does not fall into either of these categories, it is ignored.

When the display receives a code which represents a printable, ASCII character, that character is placed in a memory location in the terminal which is determined by a pointer called the cursor, whose position on the screen is represented by a blinking underscore. After a character is placed in the terminal's memory and displayed, the cursor automatically advances to the next available location.

When the display receives a control character, the associated command is carried out. These manipulate the terminal's memory by moving the cursor, setting protected or blinking areas, clearing areas of the screen and transmitting information from the terminal's memory to the computer. The specific effects of each command are determined by the operational mode of the terminal.

OPERATIONAL MODES

On line, the terminal operates in three switch-selectable modes called Page-buffered, Page, and Roll. Page-buffered mode allows an entire page of data to be entered into the terminal's memory, edited locally and then transmitted to the computer in part or in whole. In this mode there are six commands for positioning the cursor, and ten additional commands for defining protected and blinking areas, setting tabs, clearing areas of memory, and transmitting characters from memory to the computer.

Page mode allows a file to be transmitted to the terminal and any desired changes made simultaneously to both the information in the terminal's memory, through the terminal hardware, and the corresponding characters stored in the computer's memory, by means of software. The control characters are the same for both Page-buffered and Page modes; the only difference between them is that the keyboard in Page-buffered mode is directly coupled to the display and is off-line from the computer until a special transmit key (XMIT) is used, while the keyboard in Page mode is always on-line.

Roll mode simulates a teletypewriter. In this mode there are five control characters for positioning the

cursor and three additional control characters for clearing areas of memory and transmitting data. All data is entered into the terminal's memory locations which correspond to the bottom line of the display screen. A line feed causes all lines on the screen to move up one; the bottom line becomes blank and the top line is lost.

Off line, the terminal operates in Page or Roll mode.

TRANSMISSION PATHS

The transmission paths linking the terminal's memory, the keyboard and the computer depend on two variables; the transmission mode of the controller and the operational mode of the terminal. Page and Roll modes operate in full- or half-duplex. Page-buffered mode operates in full-duplex only.

All the possible combinations of the interfacing arrangements are shown in Figure 2-2. In full-duplex, operating in either Roll or Page mode, the keyboard transmits to the computer, and the display receives codes from only the computer. In half-duplex, operating in either Roll or Page mode, the keyboard transmits to both the computer and the display. The display can receive from either the keyboard or the computer.

In full-duplex, Page-buffered mode, the keyboard normally transmits to the display and the display receives from either the keyboard or the computer. However, a special key, XMIT, is provided which allows the keyboard to transmit directly to the computer.

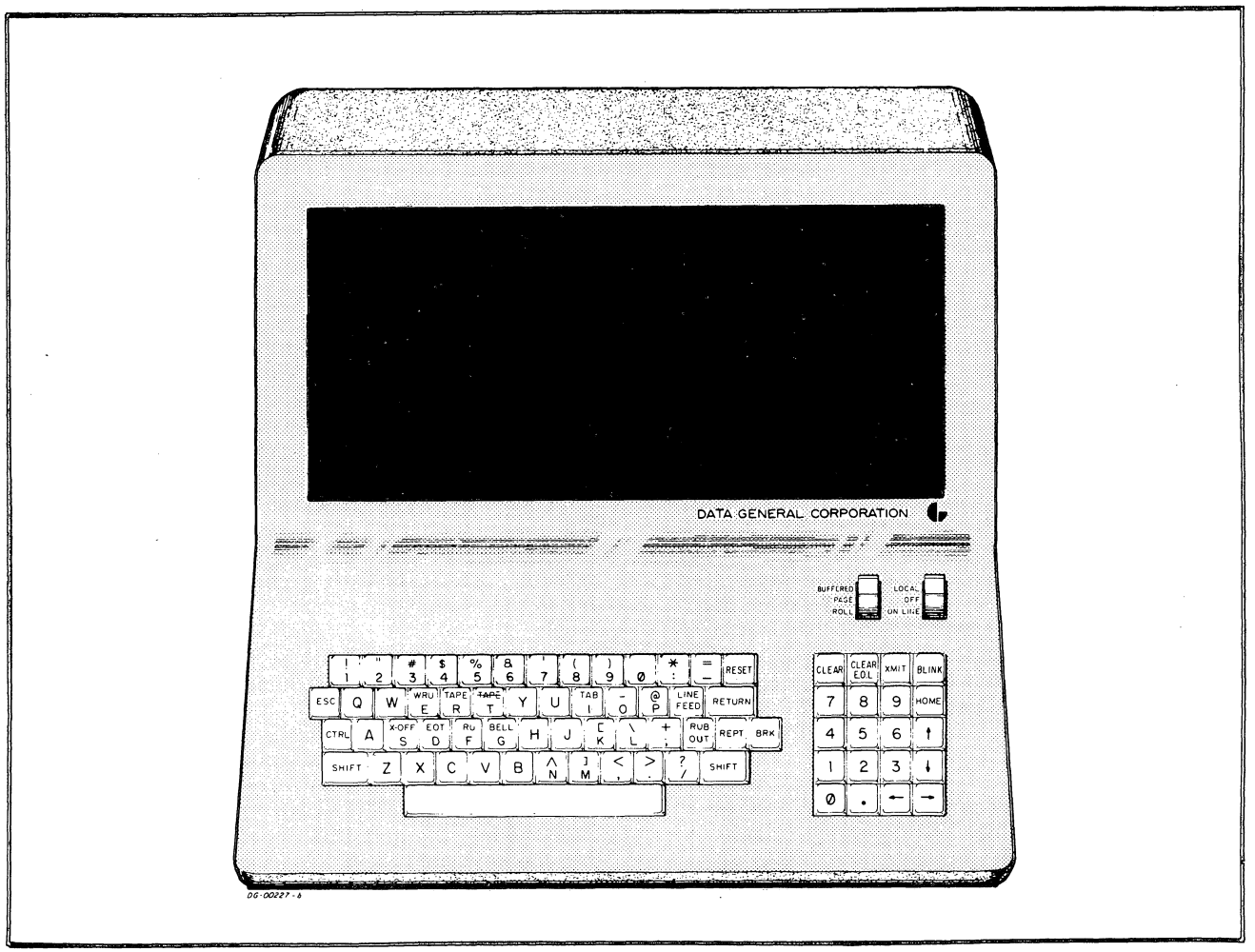

Figure 2-1 The Display Terminal

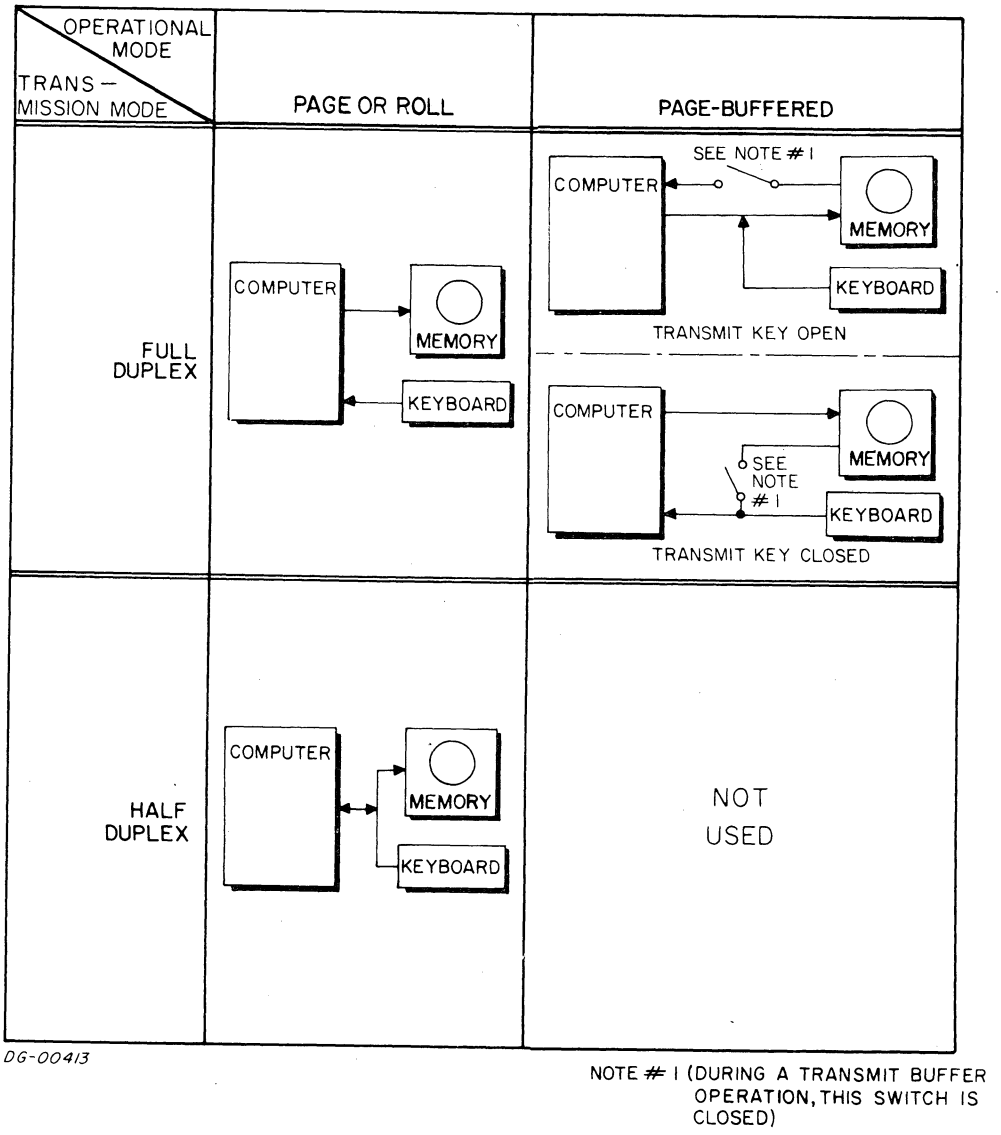

Figure 2-2 DGC Display On Line Data Transmission Paths

Table 2-1

ASCII Character Codes Plotted by the Display

Name	Symbol Display	Octal Code	Key	
			Main Keyboard	Suppl. Keyboard
Space	Non Printing	040	Space Bar	-
Exclamation Mark	!	041	SH 1	-
Quotation Marks	"	042	SH 2	-
Number Sign	#	043	SH 3	-
Dollar Sign	$	044	SH 4	-
Percent	%	045	SH 5	-
Ampersand	&	046	SH 6	-
Apostrophe	'	047	SH 7	-
Opening Parenthesis	(	050	SH 8	-
Closing Parenthesis	)	051	SH 9	-
Asterisk	*	052	SH :	-
Plus	+	053	SH ;	-
Comma	,	054	,	-
Hyphen (Minus)	-	055	-	-
Period (Decimal Point)	.	056	.	-
Slant		057	/	-
Zero	0	060	0	0
One	1	061	1	1
Two	2	062	2	2
Three	3	063	3	3
Four	4	064	4	4
Five	5	065	5	5
Six	6	066	6	6
Seven	7	067	7	7
Eight	8	070	8	8
Nine	9	071	9	9
Colon	:	072	:	-
Semicolon	;	073	;	-
Less Than	<	074	SH ,	-
Equals	=	075	SH -	-
Greater Than	>	076	SH .	-
Question Mark	?	077	SH /	-
Commercial At	@	100 (140)	SH P	-
A	A	101 (141)	A, SH A	-
B	B	102 (142)	B, SH B	-
C	C	103 (143)	C, SH C	-
D	D	104 (144)	D, SH D	-
E	E	105 (145)	E, SH E	-
F	F	106 (146)	F, SH F	-
G	G	107 (147)	G, SH G	-
H	H	110 (150)	H, SH H	-
I	I	111 (151)	I, SH I	-
J	J	112 (152)	J, SH J	-
K	K	113 (153)	K,	-
L	L	114 (154)	L,	-
M	M	115 (155)	M,	-
N	N	116 (156)	N,	-
O	O	117 (157)	O,	-
P	P	120 (160)	P,	-
Q	Q	121 (161)	Q, SH Q	-
R	R	122 (162)	R, SH R	-
S	S	123 (163)	S, SH S	-
T	T	124 (164)	T, SH T	-
U	U	125 (165)	U, SH U	-
V	V	126 (166)	V, SH V	-
W	W	127 (167)	W, SH W	-
X	X	130 (170)	X, SH X	-
Y	Y	131 (171)	Y, SH Y	-
Z	Z	132 (172)	Z, SH Z	-
Opening Bracket	[	133 (173)	SH K	-
Reverse Slant	\	134 (174)	SH L	-
Closing Bracket	]	135 (175)	SH M	-
Or				
Underline	—	137 (177)	SH O	-

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Lower case are displayed as upper case
Bracketed codes are not generated by the Keyboard
but are displayed as their unbracketed equivalents.

Table 2-2

Control Characters

Name	Octal Code	Main Keyboard	Supplementary Keyboard	Function*
HOME	010	CTRL H	HOME	Moves cursor to first unprotected position on the screen
TAB	011	CTRL I	-	Moves cursor to position following the first unprotected TAB STOP/END protect character to the first unprotected end character
LINE FEED	012	LINE FEED or CTRL J	1	Moves cursor down one line
CLEAR TO END OF LINE	013	CTRL K	CLEAR EOL	Erases unprotected data to end of line. Cursor does not move
CLEAR	014	CTRL L	CLEAR	Clears all unprotected data on screen and moves cursor to first unprotected position on the screen
CARRIAGE RETURN	015	RETURN or CTRL M	-	Moves cursor to first unprotected position in its line
TRANSMIT BUFFER	016	CTRL N	-	Transmits the unprotected contents of terminal's memory from cursor position to the end of the page
CURSOR UP	017	CTRL 0	C↑	Moves the cursor up one line
CURSOR RIGHT	030	CTRL X	C→	Moves the cursor right one position
CURSOR LEFT	031	CTRL Y	C←	Moves the cursor left one position
FORCE ERASE	034	CTRL SHIFT L	-	Erases all protected and unprotected data on the screen
TAB STOP/END PROTECT	035	CTRL SHIFT M	-	Is both a Tab Stop and the end delimiter of a protect zone
START PROTECT	036	CTRL SHIFT N	-	Is the starting delimiter of a protected zone
BLINK	037	CTRL SHIFT O	BLINK	Delimits a blinking zone

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*NOTE: See Section on COMMANDS for details

Table 2-3

Protocol Characters

Name	Standard Mnemonics	Octal Code	Key	
			Main Keyboard	Supplementary Keyboard
NULL	NUL	0	CTRL SH P	-
START OF HEADING	SOH	1	CTRL A	-
START OF TEXT	STX	2	CTRL B	-
END OF TRANSMISSION	ETX	3	CTRL C	-
END OF TEXT	EOT	4	CTRL D	-
ENQUIRY	ENQ	5	CTRL E	-
ACKNOWLEDGE	ACK	6	CTRL F	-
RING BELL	BEL	7	CTRL G	-
DATA LINK ESCAPE	DLE	20	CTRL P	-
DEVICE CONTROL 1	DCH1	21	CTRL Q	-
DEVICE CONTROL 2	DC2	22	CTRL R	-
DEVICE CONTROL 3	DC3	23	CTRL S	-
DEVICE CONTROL 4	DC4	24	CTRL T	-
NEGATIVE ACKNOWLEDGE	NAK	25	CTRL U	-
SYNCHRONOUS IDLE	SYN	26	CTRL V	-
END OF TRANSMISSION BLOCK	ETB	27	CTRL W	-
BREAK	BRK	Sends Nulls	BREAK	-

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CONTROL CHARACTERS

The following list of commands for the DGC display 6012 is formatted as follows:

NAME-CODE (LOCATION) D and/or ND
Functional Description

NAME:	Command Name
CODE:	Octal command code
LOCATION:	Keyboard location
D	Destructive to some information on the screen
ND	Non-destructive to information on the screen
FUNCTION:	Effect of the command

START PROTECT-36 (CTRL SH N) D

In Page-buffered and Page modes, START PROTECT is displayed as a space and is the delimiter of the beginning of a protected region. The end of the protected region is delimited by the first TAB STOP/END PROTECT character encountered, scanning from left to right and downward on the screen from the START PROTECT character. If any command moves the cursor into a protected region, the cursor will move to the first character position following the TAB STOP/END PROTECT character for that region.

Note that every START PROTECT character should have a companion TAB STOP/END PROTECT character between it and the end of the page or the entire protection mechanism is disabled in the terminal, and all START PROTECT and TAB STOP/END PROTECT characters are displayed as spaces.

In Roll mode, START PROTECT has no effect.

TAB STOP/END PROTECT-35 (CTRL SH M) D

In Page-buffered and Page modes, TAB STOP/END PROTECT is displayed as a space and does one of two things; it is either a tab stop or it is the delimiter of the end of a protected region or both. If it is a tab stop, when a TAB command is issued the cursor moves to the first character position following the first unprotected TAB STOP/END PROTECT character encountered on the screen, scanning from left to right and downward on the page from the cursor position. If it is a delimiter of the end of a protected region, then the beginning of that region must be delimited by a START PROTECT character. If any command moves the cursor into a protected region, the cursor will move to the first character position following the TAB STOP/END PROTECT character for that region.

In Roll mode, TAB STOP/END PROTECT has no effect.

HOME-10 (CTRL H) or (HOME) ND

In Page-buffered and Page modes, HOME moves the cursor to the first position in the top line on the screen. If this position is in a protected region, HOME will move the cursor to the first position following the end protect character for that region. If issued from the processor, HOME will terminate a transmission initiated by a TRANSMIT BUFFER command.

In Roll mode, HOME moves the cursor to the first position in the bottom line of the display screen. If issued from the processor, HOME will terminate a transmission initiated by a TRANSMIT BUFFER command.

CARRIAGE RETURN-15 (CTRL M) ND

In Page-buffered and Page modes, CARRIAGE RETURN moves the cursor to the first character position of the line the cursor occupies. If the first position of the line is in a protected region, the cursor will move to the first position following the TAB STOP/END PROTECT character for that region.

In Roll mode, CARRIAGE RETURN moves the cursor to the first character position in the bottom line.

LINE FEED-12 (CTRL J) or (↓) D/ND

In Page-buffered and Page modes, LINE FEED moves the cursor down the screen one line. When the cursor is in the bottom line, LINE FEED has no effect. If a LINE FEED moves the cursor into a protected region, the cursor will move to the first character position following the TAB STOP/END PROTECT character for that region.

In Roll mode, LINE FEED moves all the lines of data on the display screen up one line. The top line on the display screen is lost and the bottom line becomes blank. The cursor remains in its current position in the bottom line.

TAB-11 (CTRL I) ND

In Page-buffered and Page modes, TAB moves the cursor to the position following the TAB STOP/END PROTECT character encountered on the screen, scanning from left to right and downward on the screen. If no TAB STOP/END PROTECT character is found on the screen between the cursor position and the end of the page, the cursor moves to the first character position in the top line. If this position is in a protected region, TAB moves the cursor to the first position following the TAB STOP/END PROTECT character for that region.

In Roll mode, TAB should not be issued. If a TAB command is issued, the cursor moves to the first character position in the top line. The cursor can be returned to the bottom line by issuing a HOME command.

CURSOR UP-17 (CTRL O) or (↑) ND

In Page-buffered and Page modes, CURSOR UP moves the cursor up one line. When the cursor is in the top line of the display screen, CURSOR UP has no effect. If the command CURSOR UP moves the cursor into a protected region, the cursor will move to the first character position following the TAB STOP/END PROTECT character for that region.

In Roll mode, CURSOR UP has no effect.

CURSOR RIGHT-30 (CTRL C) or (→) ND

In Page-buffered and Page modes, CURSOR RIGHT moves the cursor one character position to the right. When the cursor is in the last character position of the line, the cursor will move to the first character position in the next line down the page. When the cursor is in the last character position of the bottom line, CURSOR RIGHT has no effect. If the command CURSOR RIGHT moves the cursor into a protected region, the cursor will move to the first position following the TAB STOP/END PROTECT character for that region.

In Roll mode, CURSOR RIGHT moves the cursor one character position to the right. When the cursor is in the last character position of the bottom line, CURSOR RIGHT has no effect.

CURSOR LEFT-31 (CTRL Y) or (←) ND

In Page-buffered and Page modes, CURSOR LEFT moves the cursor one character position to the left. When the cursor is in the first character position of a line, the cursor will move to the last character position on the line above it. When the cursor is in the first character position of the top line, CURSOR LEFT has no effect. If the command CURSOR LEFT moves the cursor into a protected region, the cursor moves to the first position following the TAB STOP/END PROTECT character for that region.

In Roll mode, CURSOR LEFT moves the cursor one character position to the left. When the cursor is in the first character position of the bottom line, CURSOR LEFT has no effect.

CLEAR TO END OF LINE-13 (CTRL K) D
or (CLEAR EOL)

In Page-buffered and Page modes, CLEAR TO END OF LINE erases all unprotected data from the cursor position to the end of the line, inclusive. The cursor does not change position.

In Roll mode, CLEAR TO END OF LINE erases all data from the cursor position to the end of the line, inclusive. The cursor does not change position.

CLEAR SCREEN-14 (CTRL L) or (CLEAR) D

In Page-buffered and Page modes, CLEAR SCREEN erases all unprotected data on the display screen. The cursor moves to the first character position of the top line. If the first position of the top line is in a protected region, CLEAR SCREEN moves the cursor to the first position following the TAB STOP/END PROTECT character for that region.

In Roll mode, CLEAR SCREEN erases all data on the screen and moves the cursor to the first character position of the bottom line. Data cannot be protected in Roll mode.

FORCE ERASE-34 (CTRL SH L) D

In Page-buffered and Page mode, FORCE ERASE erases all data on the screen, including all protected areas. The cursor moves to the first character position in the first line.

In Roll mode, FORCE ERASE has no effect.

BLINK-37 (CTRL SH O) D

In Page-buffered and Page modes, BLINK causes any character, or characters, between two BLINK characters to flicker on the display screen. If a single BLINK character is entered on the page, all characters from that position to the end of the page will flicker. BLINK characters are displayed as spaces and are transmitted as underscores. The cursor moves one character position to the right.

In Roll mode, BLINK has no effect.

TRANSMIT BUFFER-16 (CTRL N) ND

In all modes, TRANSMIT BUFFER sends to the processor the contents of the terminal's memory, character by character, from the cursor position to the end of the page. Any protected regions encountered will not be transmitted. The data on the display screen will not be disturbed. TRANSMIT BUFFER moves the cursor to the last character position of the last line. If this position is protected, the cursor moves to the first unprotected position on the page. Transmission can be halted at any point by having the program issue a HOME command.

CONTROL KEYS

XMIT ND

XMIT allows the operator to transmit a message to the processor while the terminal is in Page-buffered mode. The message is sent by holding down the XMIT key while typing characters on the keyboard. If the terminal is operating in full-duplex and the program does not echo the characters back to the terminal, the data on the display screen remains undisturbed. If the terminal is operating in half-duplex or if the program echos characters, then the message entered will overwrite data on the display screen.

In Page and Roll modes, XMIT has no effect.

BREAK ND

In all modes, while BREAK is depressed, the terminal's transmitter is disabled so that no characters are transmitted from either the keyboard or the memory.

REPEAT ND

The REPEAT key provides the continuous transmission of any code as long as both the REPEAT key and the codes's corresponding key(s) are held down together.

SHIFT and CTRL ND

The SHIFT and CTRL keys produce commands or alphanumeric codes when they are depressed together with other keys.

ESC -33 (ESC) (CTRL SHIFT K) ND

In all modes, ESC sends code 33, a protocol character. ESC does not work together with REPEAT.

CTRL RESET D

CTRL RESET clears the entire display memory, initializes the control, and places the cursor in the first position of the bottom line.

OPERATIONAL CONSIDERATIONS

Contrast

A contrast control, shown in Figure 2-3, is located on the back of the terminal. Clockwise rotation of this knox decreases the contrast; counter-clockwise rotation increases the contrast.

Changing Operational Modes

The display must be RESET before it is switched from one operational mode to another, to avoid indeterminate states.

On Line Commands

The command TRANSMIT BUFFER, which is designed to be used primarily in Page-buffered mode, can also be issued when the display is in Page or Roll modes.

The command TAB, which is intended to be used in Page-buffered or Page modes, will nevertheless move the cursor to the first position position of the top line in Roll mode. The cursor can be returned to the first position of the last line by issuing a HOME command.

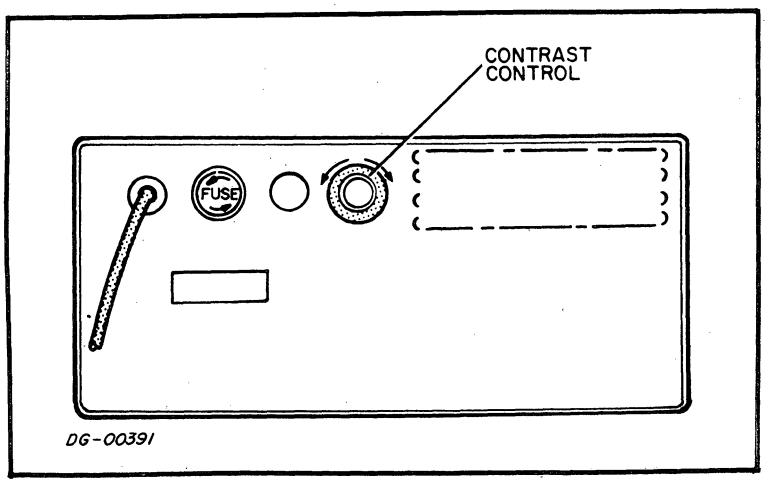


Figure 2-3 DGC Display Back Panel

SECTION 3

INSTALLATION

CABLES

The DGC display 6012 has two cables attached. One is the ac power line; the second is the cable to the controller in the computer chassis. The cable to the computer is terminated with a connector which depends on the controller and the processor being used.

The ac power line voltage and frequency should be checked for correspondence with the terminal's power requirements.

SWITCHES

All of the switches used for selecting baud rate, parity, controller interface, etc., are located inside the chassis of the DGC display 6012.

Access to these switches is gained by opening the four snap-slide latches on the underside of the terminal; the terminal does not have to be lifted to do this. The cover assembly can then be lifted off.

Caution Do not remove cover when power is on. Care should be exercised even though the power is off, since some capacitors may retain a charge for a time after power is removed.

The control switches are accessed through two holes in the video monitor chassis, as shown in Figure 3-1. Changing the switch settings can be accomplished with a pointed wooden stylus. The functions of the switches are as follows:

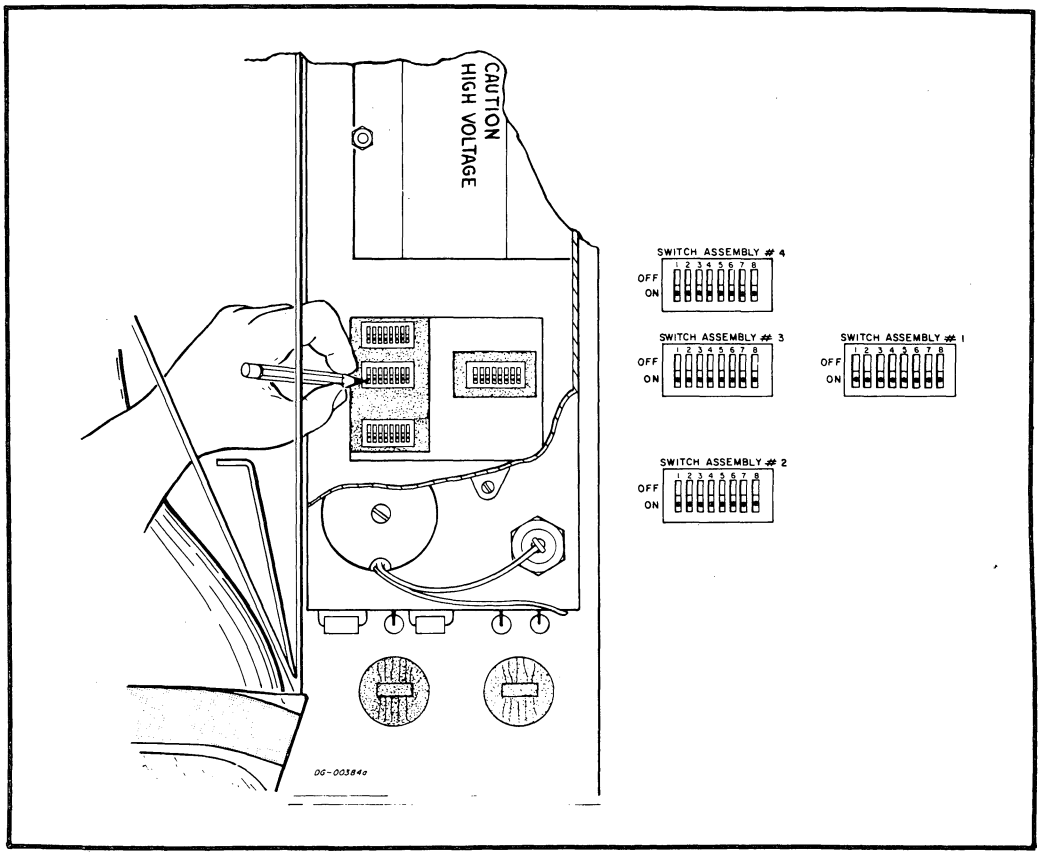


Figure 3-1 Setting the DGC Display Selection Switches

Baud Rate

Baud Rate is controlled by switch assembly 3 and switch assembly 4. Unless noted elsewhere in this manual, all other switches in switch assembly 3 and switch assembly 4 are off.

Baud Rate	Switches turned on in switch assembly 3	Switches turned on in switch assembly 4
110	6,8	3,6
150	5,6,8	5
300	4,8	4,6
600	1,4,6	4,5,6
1200	1,6	6
1800	1,5	4,6
2400	6,7	6
3600	1,4	6
4800	1,4,5	4

Interface

The interface between the DGC display 6012 and the controller is selected through switch assembly 1.

The EIA voltage interface requires switches 3, 6 and 7 to be on in switch assembly 1; all others in this assembly are off. The 20mA current loop interface requires switches 1, 2, 5 and 8 to be on in switch assembly 1; all others in this assembly are off. The 60mA current loop requires switches 1, 2, 4, 5 and 8 to be on in switch assembly 1; all others in this assembly are off.

Code Format

The code format transmitted and received by the terminal is selected through switch assembly 2.

Switch 3 selects even parity when off and odd parity when on. Switch 6 selects two stop bits when off and one stop bit when on. Switch 7 will eliminate the parity bit in transmitted and received codes when in the off position. Switch 8 should always be off.

Switches 4 and 5 select the number of bits per character for the code as follows:

Bits/Character	5	6	7	8
Switch 4	on	off	on	off
Switch 5	on	on	off	off

Half-Duplex

Half-duplex operation is selected when switch 7 in switch assembly 4 is on. Turning this switch off selects full-duplex operation.

50/60 Cycle

When the machine is operating from 50Hz power, switch 2 must be on and switch 1 must be off in switch assembly 2. When the machine is operating from 60Hz power, switch 2 must be off and switch 1 must be on in switch assembly 2.

SECTION 4

PROGRAMMING

INTRODUCTION

The DGC display 6012 is two separate I/O devices; a console and an alphanumeric CRT display, as shown in Figure 2-1. The console is comprised of a standard 53-station teletypewriter style keyboard, a supplementary 20-station keyboard and two switches. The first switch has three positions labeled LOCAL, OFF and ON LINE. The ON LINE position connects the terminal to the computer. LOCAL, used primarily for testing the display, puts the terminal off line from the computer and connects the keyboard to the display. OFF removes power from the device. The second switch has three positions labeled BUFFERED, PAGE and ROLL. Each position of this switch selects the terminal's operational mode.

The display is a 12 inch CRT with an active area of 6 by 9 inches, formatted into a twenty-four line by 80 character page. The characters that can be plotted on this screen are taken from the standard 64 character subset of ASCII, listed in Table 2-1.

The terminal operates in three switch selectable modes called Page-buffered, Page and Roll. Page-buffered mode allows an entire page of data to be entered into the terminal's memory, edited off line and then transmitted to the computer in part or in whole. In this mode there are six commands for positioning the cursor, and ten additional commands for defining protected and blinking areas, setting tabs, clearing areas of memory, and transmitting characters from memory to the computer.

Page mode allows a file to be transmitted to the terminal and any desired changes made simultaneously to both the information in the terminal's memory, through the terminal hardware, and the corresponding characters stored in the computer's memory, by means of software. The commands are the same for these two modes; the only difference between them is that the keyboard in Page-buffered mode is directly coupled to the display and is off line from the computer until a special transmit key is used, while the keyboard in Page mode is always on line.

Roll mode simulates a teletypewriter. In this mode there are five commands for positioning the cursor, and three additional commands for clearing areas of memory and transmitting data. All data is entered into memory locations which correspond to the bottom line of the display screen. A LINE FEED command causes all lines on the screen to move up one; the bottom line to become blank and the top line to be lost.

SUMMARY

MNEMONIC (FIRST CONTROLLER)

INPUT ..... TTI
OUTPUT ..... TTO

DEVICE CODE (FIRST CONTROLLER)

INPUT ..... 10_8
OUTPUT ..... 11_8

MNEMONIC (SECOND CONTROLLER)

INPUT TTI1
OUTPUT TTO1

DEVICE CODE (SECOND CONTROLLER)

INPUT ..... 50_8
OUTPUT ..... 51_8

PRIORITY MASK BIT

INPUT 14
OUTPUT 15

CHARACTERS/LINE 80

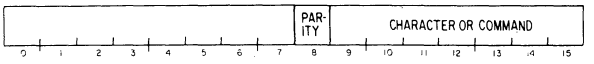
LINES/DISPLAY 24

TOTAL STORAGE
CAPACITY (7-BIT CHATACTERS).. 1920

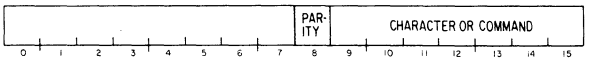
DATA TRANSFER RATE
MAX (BAUD) 4800

ACCUMULATOR FORMATS

READ CHARACTER ..... (DIA)



WRITE CHARACTER ..... (DOA)



S, C AND P FUNCTIONS

S Set Busy to 1, Done to 0 and either load the input buffer or write a character into the display's memory.

C Sets both Busy and Done to 0 and terminates all data transfers. If issued before transmission is complete, partial character codes are received.

P No effect.

INSTRUCTIONS

The following instructions and timing information are for the DGC display 6012 when it is used in conjunction with a 4010 controller. The instruction sets for the other controllers can be found in the "How To Use The NOVA®* Computers" manual, #015-000009.

Coding Aids

The <>, and = are used in this manual to aid in defining the instructions. These symbols are not coded; they act only to indicate how an assembly language instruction may be written. Their general definition is given below:

<> Indicates optional operands. The operand enclosed in the brackets (e.g., <#>) may be coded or not, depending on whether or not the associated option is desired.

= Indicates specific substitution is required. Substitute the indicated accumulator, address, name or number.

The following abbreviations are used throughout this section:

ac or AC = Accumulator

f or F = Flag Control Field

Flag Control Functions

The display controller's Busy and Done flags are controlled using two of the device flag commands as follows:

f=C Sets Busy and Done to 0, thus stopping all data transfer operations. A Clear command issued in during a transfer will result in the partial reception of the code being transferred.

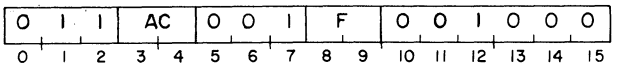
f=S Sets Busy to 1, Done to 0 and either reads a character into the input buffer or writes the character in the output buffer into the display's memory.

f=P No effect.

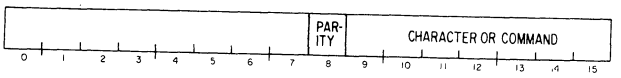
Since the display is actually two devices, both a Busy and a Done flag are available for input operations and a separate set of Busy and Done flags are available for output operations.

READ CHARACTER

DIA<f> ac, TTI



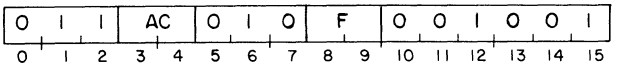
The contents of the input buffer are placed in bits 8-15 of the specified AC. Bits 0-7 of the specified AC are set to 0. After the data transfer, the controller's Input Busy and Done flags are set according to the function specified by F. The format of the specified AC is as follows:



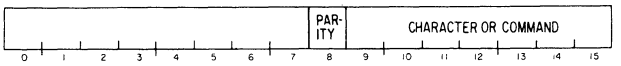
Bits	Name	Contents
0-7	---	Reserved for future use.
8	Parity	Parity bit selected at the terminal; even, odd or none.
9-15	Character	The 7-bit character or command read from the Input Buffer.

WRITE CHARACTER

DOA<f> ac, TTO



Bits 9-15 of the specified AC are loaded into the display's output buffer. After the data transfer, the controller's Output Busy and Output Done flags are set according to the function specified by F. The format of the specified AC is as follows:



Bits	Name	Contents
0-7	---	Reserved for future use (always 0).
8	Parity	Even, odd or no parity for the 7-bit code. Ignored by the display.
9-15	Character	The 7-bit character or command transmitted to the output buffer.

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TIMING

Input Timing

After Input Done is set and before another key strike can destroy the character in the input buffer, the character is available for a READ CHARACTER instruction for a time interval determined by the baud rate.

Time Available (ms)	Baud Rate
21.59	110
15.84	150
7.92	300
3.95	600
1.97	1200
1.31	1800
.98	2400
.65	3600
.49	4800

Output Timing

After Output Done is set, the program should provide another character within a time limit determined by the baud rate to keep the transmission line operating at its maximum rate.

Time Limit (ms)	Baud Rate
9.15	110
6.64	150
3.32	300
1.66	600
.83	1200
.55	1800
.42	2400
.27	3600
.21	4800

PROGRAMMING

Since the terminal is actually two separate devices, input and output are discussed separately.

Input

Neither full- nor half-duplex input operations have to be initialized by the program. Striking a key in either Page or Roll modes automatically transmits the corresponding character to the controller. While the controller is assembling the character, its Input Busy flag is set to 1. After the character is assembled, the Input Busy flag is set to 0, the Input Done flag is set to 1 and a program interrupt request is initiated.

The character can then be read by issuing a READ CHARACTER instruction (DIA). The Input Done flag should then be set to 0 with either a Start or a Clear command. This allows the next character to initiate a program interrupt request when it is fully assembled.

The TRANSMIT BUFFER command transmits the contents of the terminal's memory character by character to the controller.

Output

A character is loaded into the Output Buffer of the controller by issuing a WRITE CHARACTER instruction (DOA). The character can then be transmitted to the terminal by issuing a Start command. While the character is being transmitted, the Output Busy flag is set to 1. Upon completion of the transmission, the Output Busy flag is set to 0 and the Output Done flag is set to 1, thus initiating a program interrupt request.

Each time a character is to be sent to the terminal, the Output buffer must be reloaded with a WRITE CHARACTER instruction. A sequence of WRITE CHARACTER instructions together with Start commands is used to transmit a multi-character message. The program must allow each character to be transmitted before transmitting the next character.

Considerations

Input

The codes received from the terminal can be selected, at the terminal, to be 5, 6, 7, or 8 bits long with even, odd, or no parity bit. The programmer should determine the code structure used in the terminal and make sure that the controller is compatible.

When the terminal is operating in full-duplex, the program must "echo" the characters if they are to affect the display screen.

Half-duplex operation requires a protocol to be set up between the computer and the terminal. The protocol should be formed to resolve any conflicts over the use of the transmission line.

Output

The codes received by the terminal can be selected, at the terminal, to be 5, 6, 7, or 8 bits long. The parity bit is ignored in all codes received by the terminal.

When characters are sent to the terminal, all lower case characters are displayed as their uppercase equivalents.

Half-duplex operation requires a protocol to be set up between the computer and the terminal. The protocol should be formed to resolve any conflicts over transmission line use.

When operating in either Page-buffered or Page mode, characters will automatically continue to the next line when the end of the current line is reached. When the last line on the page is filled, any other characters received will overwrite the last character on the last line. When operating in Roll mode, the last character in the bottom line will be overwritten by subsequent characters. In order to avoid overwriting any line, both a CARRIAGE RETURN and a LINE FEED command should be issued.

[redacted]