CONTROL DATA

Student Training Manual for

CYBER 170 DISPLAY SUBSYSTEM INTRODUCTION

An Individualized Course

REVISION RECORD

REVISION	DESCRIPTION
A	MANUAL RELEASED
B	CC545 G/H included as Module 3, Lab is changed to Module 4.
9/1/82	
	Printing, 9/10/82
C	Manual Revised: Pages 4-17, 4-18
2/18/83	
	Printing, 8/15/83
	Printing, 11/18/83

Publication No.
75445735

CONTENTS

CONTENTS (Contd)

APPENDIXES

FIGURES

TABLES

INTRODUCTION

This course is based on the CC545-C/D/E/F CYBER 170 Display Station, the CC545 G/H CYBER 170 Display Station, and the Display Station Controller (DSC) associated with the CYBER 170 Models 720 through 760. The course uses the CDC CYBER 170 Display Station manual (publication number GF62952600), revision level S for CC545 C, D, E and F, CDC CYBER 170 Display Station manual, publication number 62940018, revision A, for CC545 G/H models, and the DSC portions of the PPS CYBER 170 Models 720 through 760 manual (publication number GF60456120), revision level AE. Always use your site manuals as reference for the equipment you are maintaining. Previous display console maintenance experience is not necessary but you should be familiar with the theory of operation of a cathode-ray tube (CRT).

This course provides overall concepts of the CYBER 170 Display Subsystem. You will learn the location and purpose of major display subsystem components. You will learn how the logic of the console and controller is organized through a primary block diagram, detailed-pak diagrams, and pak logic diagrams.

The PLM course includes an individualized, self-study package that allows you to learn at your own pace and a laboratory module that requires an instructor and lab equipment. The lessons use microfiche, reading assignments, and review exercises to provide you with an effective learning experience. Allow approximately 4 hours for the laboratory module. Contact your course administrator to schedule the lab.

Before you begin the course, check this course package to make sure it contains the following items.

- Student manual containing module 1 through 4 and appendixes A through C.
- Training microfiche titled Display Station Controller.
- CDC CYBER 170 Display Station manual, microfiche publication number GF62952600, revision level S, numbers 124 through 132.
- CDC CYBER 170 Display Station, Hardware Reference/CE manual 62940018 Rev. A.

If this is your first experience with PLATO-Assisted Learning, read appendix A, Using Individualized Instruction, before you sign on to the terminal. This appendix explains the basic philosophy and organization of self-study courses. Appendix B explains the correct procedure for signing on to the PLATO terminal. Appendix C describes the use of microfiche.

Begin course by reading module 1.

MODULE 1
CYBER 170 DISPLAY CONTROLLER

This module introduces the major elements and theory of the CYBER 170 Display Controller. You will learn the elements and theory through block and logic diagram analysis.

PRETEST

To start this module, sign on to the PLATO terminal and read the objectives. If you feel you are able to satisfy one or more of these objectives, take the module test. After evaluating the results of the test, PLM will assign the learning activities you should study next. If, however, you do not wish to take the test first, ask for an assignment.

LEARNING ACTIVITIES

In the Assigned column below, place a check mark by each activity assigned to you by PLM. Then proceed through your assigned activities. Put a check in the Completed column as you complete each assigned activity. You may choose to do all of these activities or do some activities more than once.

Assigned	Completed	Activity	Description	Page
_____	_____	1-A	Text Reading: Introduction to the Display Subsystem. This activity describes the basic theory and components of the CYBER 170 display subsystem.	1-3
_____	_____	1-B	Reference Reading: Introduction to the Display Station Controller. This activity describes the basic operation of the display station controller (DSC).	1-12
_____	_____	1-C	Exercise: Introduction Review. This activity reinforces what you learned in learning activities 1-A and 1-B.	1-13

LEARNING ACTIVITY 1-A. TEXT READING: INTRODUCTION TO THE DISPLAY SUBSYSTEM

This activity describes the basic theory and components of the CYBER 170 display subsystem.

OBJECTIVE

- You will be able to identify the major CYBER 170 display subsystem components and describe the function of each.

The CYBER 170 display console (equipment number CC545) is used for visual monitoring and manual control of computer operations. The display console receives symbol and position information from the display station controller (DSC) and displays it on the console cathode ray tub (CRT). The display console also contains an alpha-numeric keyboard, which enables an operator to send data through the controller to the computer. Figure 1-1 shows the CYBER 170 Display Station.

It should be noted that the display station controller described in this manual is representative of several types (CYBER 170 Models A, B and C; CYBER 170 Models 720/730; and CYBER 180). The module types and locations may differ, but the logic should be functionally the same or equivalent.

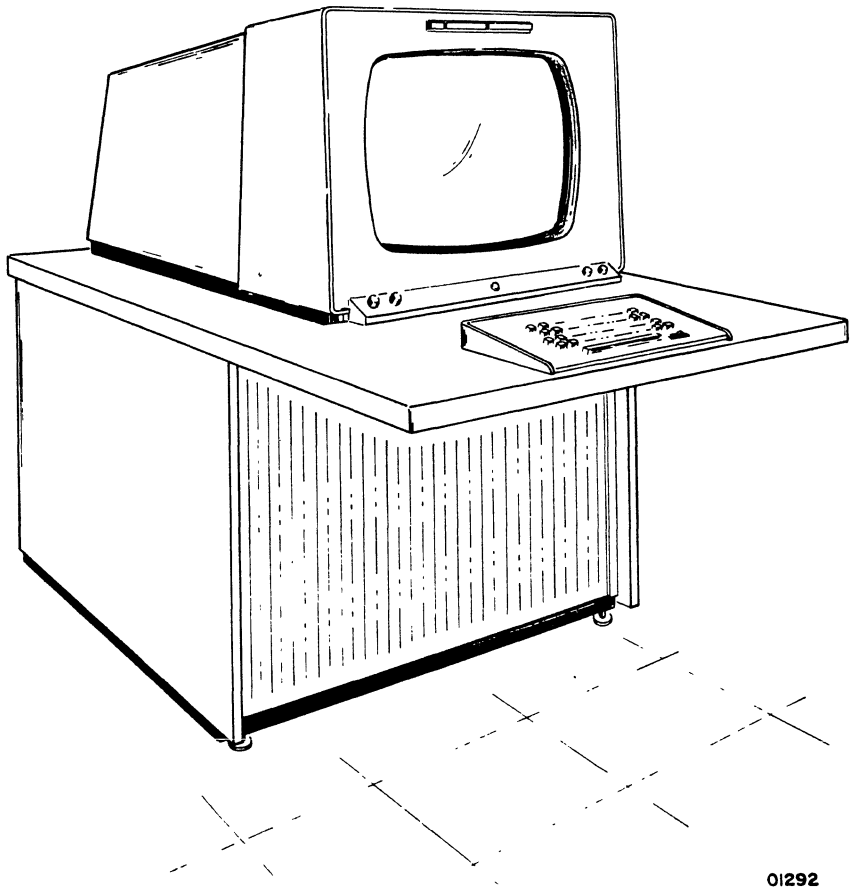


Figure 1-1. CYBER 170 Display Station

The display consoles used on the 6000 and CYBER 70 systems have two CRTs, left and right screens. The display console usually receives unrelated display data for each screen. The CYBER 170 Display Console has one CRT, but the display data is sent for two CRTs, so the screen is divided into a left and right half. A switch allows the operator to control whether the left, right, or both displays are visible on the CRT screen.

An electron beam in the CRT produces a visible display when it strikes the phosphor-coated CRT screen, causing the portion of the phosphor to glow briefly. Normally the glow fades within a fraction of a second, too soon for the human eye to perceive and identify the

image. The display image must be redrawn continuously at a rate which makes the display appear steady and of uniform intensity to the observer. This is called refreshing the display.

Positioning of the electron beam on the face of the CRT is referred to as beam deflection. The horizontal (left/right) beam deflection information is called the X coordinate address. The vertical (up/down) beam deflection information is called the Y coordinate address. The display console converts the X and Y coordinate address into an analog voltage to control the electron beam position on the face of the CRT. This analog voltage is applied to deflection coils or yokes on the CRT. These X and Y coordinate addresses comprise a square grid of possible beam positions. This display area on the CRT screen is called a raster. There are adjustments to control the size, shape, and intensity of the raster.

After the beam is positioned at the desired area of the CRT screen, small analog voltages are generated to deflect the beam enough to draw or paint the symbol (characters, letters, numbers, and so forth). This is also called push-pull symbol deflection. The turning on of the CRT electron beam to paint the symbol is called unblanking. Turning off the beam is referred to as blanking. To ensure a good quality display, symbol size and shape adjustments and checks must periodically be performed.

The CRT portion of the display console uses high voltages. For example, the high voltage supply, which supplies the accelerating voltage for the CRT, generates +20 kilovolts. It is important to use caution when making voltage adjustments on the display console because of the lethally high voltages.

Blowers provide enough air flow to cool the logic and power supplies. It is an important maintenance task to clean the air filters and ensure proper air flow from the blowers.

The alphanumeric keyboard provides the operator with data entry capability. Depression of each key generates a unique code to the DSC.

The DSC is an integral part of the standard peripheral processor subsystem (PPS) chassis. It can control one CC545 display console. Earlier versions of the controller could control two CC545 display consoles. In the PPS chassis, the DSC is hardwired to I/O channel 10 (octal).

Figure 1-2 shows the PPS/DSC interface signals.

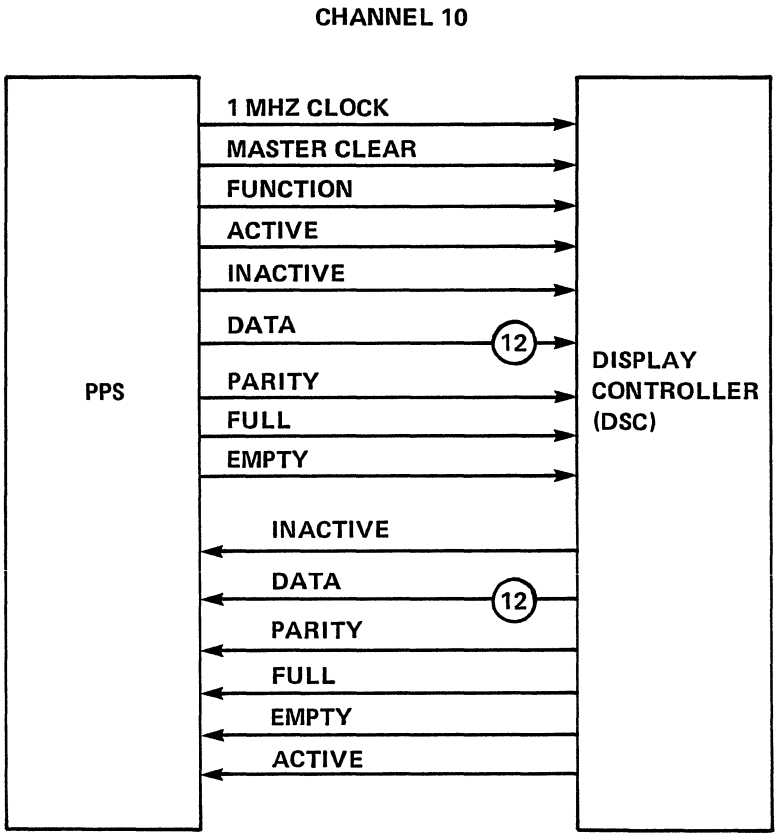


Figure 1-2. PPS/DSC Interface Diagram

The purpose of each PPS/controller signal is as follows:

- Full signal. This signal indicates to the receiver that the word formed by the 12 data signals can be accepted.
- Empty signal. This signal indicates to the transmitter that the receiver has accepted the word accompanying the last Full signal.

- Inactive signal. The controller replies to a Function signal (and its associated function code) with an Inactive signal. An Inactive signal may also be used by either the PPS or the controller to terminate communication.
- Data 0-11 signals. These 12 signals carry data, function, and keyboard codes between the PPS and the controller.
- Active signal. The PPS sends this signal to initiate or resume communication with the controller for a data transfer operation.
- Function signal. This signal identifies the accompanying 12 data signals as a function code.
- Master Clear signal. The PPS sends this signal to clear the controller as part of a computer system deadstart.
- Parity signal. This signal provides odd parity for the 12 data signals it accompanies.
- 1 megahertz clock. The controller uses this signal to generate timing signals.

The DSC generate graphical (Dot mode) or alphanumeric (Character mode) displays. The alphanumeric characters can be displayed in one of three sizes (small, medium, or large). A single function word is transmitted to select the presentation, mode, and character size. Figure 1-3 illustrates the function word.

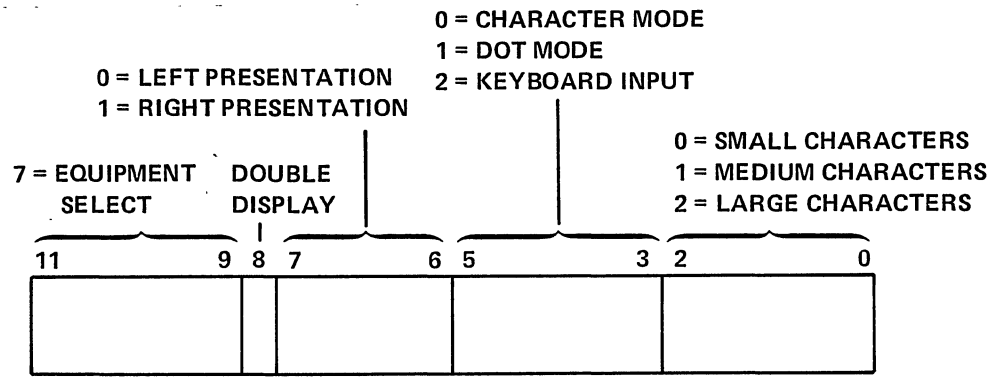


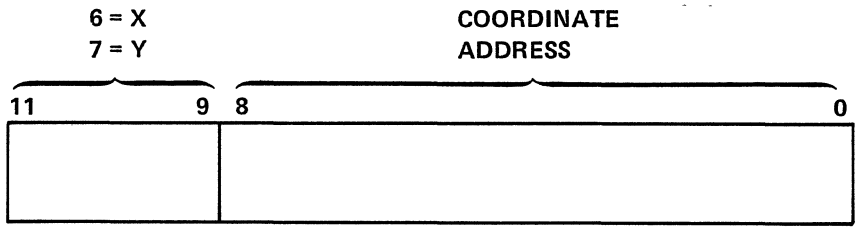
Figure 1-3. Function Word

The upper three bits specify the DSC (and must always be 7 octal). The next three bits specify if the display is to be on the left side, right side, or both sides of the display console CRT. The next three bits specify either the display mode (Character or Dot) or keyboard input.

The lower three bits of the function word specify the size of the alphanumeric character. In Character mode, large, medium, and small characters are provided. Large characters are arranged 16 characters per line. Medium characters are arranged 32 characters per line. Small characters are arranged 64 characters per line.

A function code of 7020 octal requests data from the keyboard of the CC545. The code prepares the display controller for an input operation. The PPS activates the input channel and receives one character from the keyboard of the CC545 through the DSC. The keyboard character enters the PPS on channel 10 as the lower six bits of the data word. The upper bits are clear.

The PPS must supply the X and Y coordinate and the character to be displayed. The PPS does this by outputting data words. When the upper three bits are a 6 or 7 octal, a X or Y coordinate address is specified in the lower nine bits. Figure 1-4 illustrates the X/Y coordinate data word.



NOTE:
IN DOT MODE, EACH Y CORDINATE TRANSMITTED FORCES A DOT DISPLAY

Figure 1-4. Coordinate Data Word

The alphanumeric characters are specified two to a data word. The character codes are 00 through 57, so no character data word starts with a 6 or 7. Figure 1-5 illustrates the character data word.

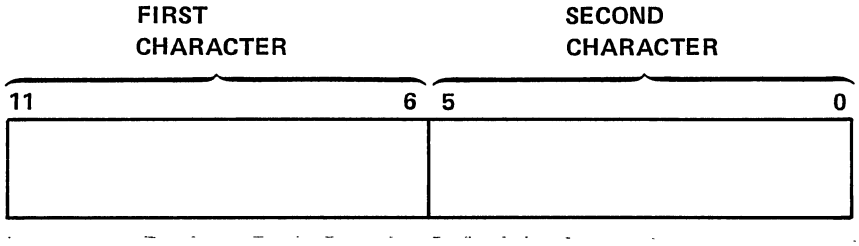


Figure 1-5. Character Data Word

A new coordinate data word must be sent to start each line. Character sizes can be mixed by sending a new function word and coordinate word for each size change. Spacing on a line can be varied by sending a coordinate word for the character which is to be spaced differently.

In Dot mode, display dots are positioned by the X and Y coordinates. The X coordinates position the data horizontally. The Y coordinates position the data vertically and unblank the CRT for each dot. Horizontal lines are formed by a series of X and Y coordinates. Vertical lines are formed by a single X coordinate and a series of Y coordinates.

The display information is sent from the DSC to the CC545. Figure 1-6 shows the DSC/CC545 interface signals.

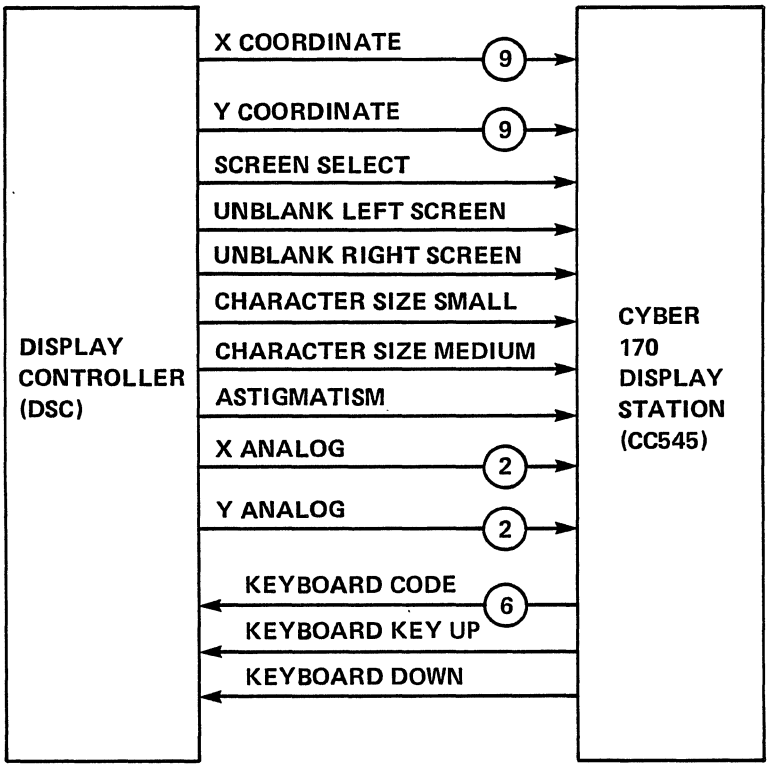


Figure 1-6. DSC/CC545 Interface Diagram

The purpose of each DSC/CC545 signal is as follows:

- X Coordinate. Digital horizontal beam positioning information to the CC545.
- Y Coordinate. Digital vertical beam positioning information to the CC545.
- Screen Select. Selects right or left display when both the left and right displays are seen on the CRT.
- Unblank Left/Right screen. Turns on the CRT beam.
- Character Size Small/Medium. Specifies the alphanumeric character size to be displayed in character mode. The absence of small or medium specifies large size.
- Astigmatism. Not used by the CC545-C/D/E/F.
- X/Y Analog. Paints the alphanumeric characters on the CRT.

- Keyboard Code. The character code that is sent to the DSC.
- Keyboard Key Up. Specifies to the DSC that no keyboard keys are depressed.
- Keyboard Key Down. Denotes a keyboard key has been depressed to the DSC.

This activity has described the basis theory and components of the CYBER 170 Display Subsystem.

You have now completed learning activity 1-A.

LEARNING ACTIVITY 1-B. REFERENCE READING: INTRODUCTION TO THE DISPLAY STATION CONTROLLER

This activity describes the basic operation of the DSC.

OBJECTIVE

- You will be able to identify the major CYBER 170 Display Subsystem components and describe the function of each.

Place the Display Station Controller Training Microfiche in your microfiche reader. Read the information at grid coordinates B1 through B5.

STUDENT NOTES

LEARNING ACTIVITY 1-C. EXERCISE: INTRODUCTION REVIEW

This activity reinforces what you learned in learning activities 1-A and 1-B.

OBJECTIVE

- You will be able to identify the major CYBER 170 display subsystem components and describe the function of each.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The equipment number for the CYBER 170 Display Station is _____.
2. The CYBER 170 Display Station contains _____ CRT(s).
3. The _____ (horizontal/vertical) beam deflection information is called the X coordinate address.
4. The display area on the CRT screen is called a _____.
5. Turning off the CRT electron beam is called _____ (blanking/unblanking).
6. Depression of a key on the CYBER 170 Display Station keyboard generates a _____-bit code to the DSC.
7. The _____ signal identifies the 12 data signals from the PPS as a function code.
8. The _____ signal indicates the 12 data signals from the PPS can be accepted as a coordinate or character data word.
9. The _____ signal is sent to the controller from the PPS before a data transfer operation begins.

10. An octal function code of 7010 indicates _____ mode, display on the _____.

11. An octal function code of _____ specifies keyboard input.

12. An octal data word of 7000 specifies _____.

13. To display a character of P a character code of _____ must be specified.

14. An octal data word of 0727 specifies _____ _____.

15. When the X coordinate = 000, the _____ (left/right) side of the display area is specified.

16. When the Y coordinate = _____, the top of the CRT display area is specified.

17. In Dot mode, the _____ coordinate positions the dot _____ and unblanks the CRT for each dot.

18. The display area is divided into _____ addressable horizontal dot positions.

19. Instructions that specify beam movements for specific characters are stored in _____ in the DSC.

20. There can be a maximum of _____ medium-sized characters displayed in one line.

The answers to this learning activity are on the following page.

ANSWERS FOR LEARNING ACTIVITY 1-C

1. CC545
2. Two
3. horizontal
4. raster
5. blanking
6. 6
7. Function
8. Full
9. Active
10. Dot, left
11. 7020
12. Y coordinate zero
13. 20
14. first character = G, second character = W
15. left
16. 777
17. Y, vertically
18. 512
19. preprogrammed read-only memories
20. 32

LEARNING ACTIVITY 1-D. TEXT READING: DSC PRIMARY BLOCK DIAGRAM

This activity describes the theory and components of the DSC primary block diagram.

OBJECTIVE

- You will be able to identify the display controller primary block diagram components and describe the function of each.

Place the display station controller training microfiche in your microfiche reader. Go to grid coordinate C1/C2. The diagram is titled, Primary Block Diagram, Display Station Controller, DSC 1.0, in the lower right corner below the C1/C2 index grid coordinate label. NOTE: The DSC 1.0 Block Diagram is also on the next two pages of this manual. You may use it for note taking and reference.

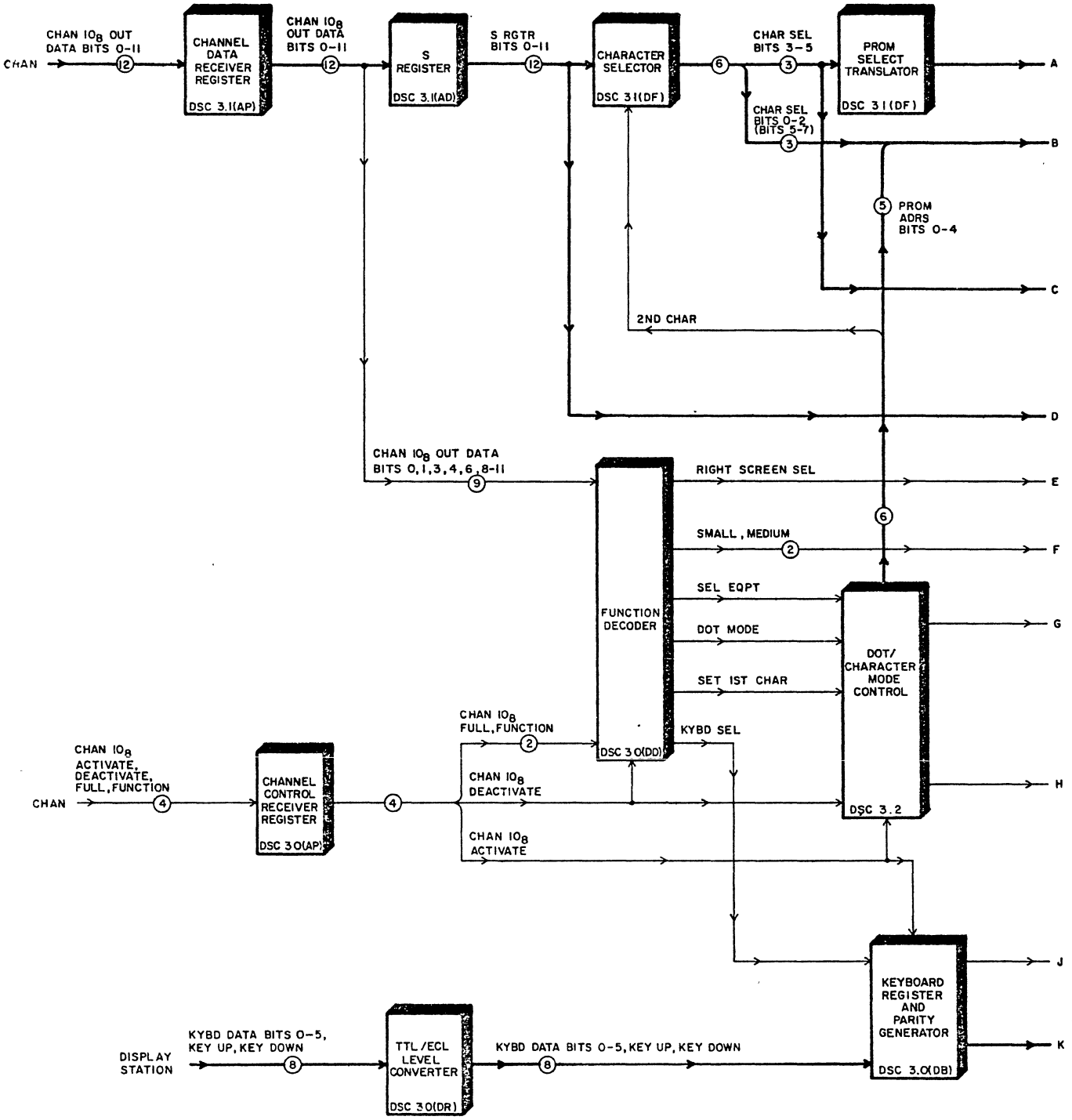
Locate the block labeled Channel Data Receiver Register in the upper left corner of the block diagram. The block is also labeled DSC 3.1, and (AP). The DSC 3.1 tells you the block is shown in more detail in detailed-pak diagram 3.1. The (AP) indicates the Channel Data Receiver Register is on an AP type of pak (logic module). You will study the detailed-pak diagrams and logic diagram in later learning activities. Other blocks on the primary block are labeled similarly.

Along the left side of the block diagrams are two inputs labeled Chan. One goes into the Channel Data Receivier Register, the other goes into the Channel Control Receiver Register. The top line out of the Channel Data Receiver Register is labeled Chan $10_{(8)}$ Out, (the DSC is always on channel $10_{(8)}$), data bits 0 through 11. The 12 on the line indicates the 12 bits (0 through 11). The 12 data bits may be a function word indicating left or right screen, character on Dot mode, and so forth. The 12 data bits could also be a data word specifying X or Y coordinates or character codes.

The other Chan line, to the Channel Control Receiver Register, is labeled Chan $10_{(8)}$ Fctn, Active, Deactive, and Full to indicate the four interface signals into that receiver pak.

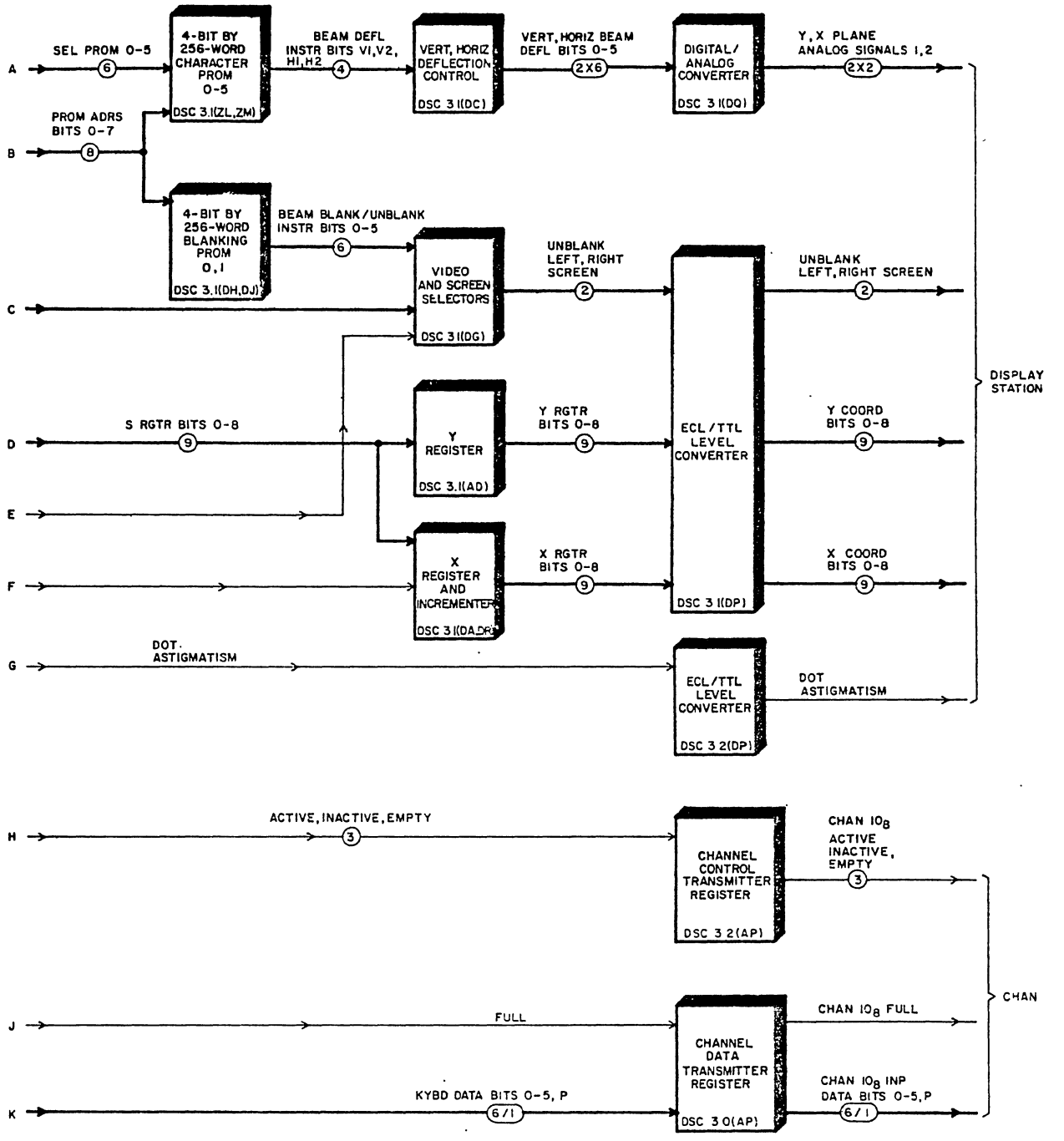
These are the two input lines on the primary block diagram from PPS channel 10 to the DSC.

The other input line to the DSC, shown in the lower left of the block diagram, is from the CC545 display station keyboard. The eight signals are the 6-bit Keyboard Character Code and the Key Up, Key Down signal. The signals go through the TTL/ECL Level Converter on



PRIMARY BLOCK DIAGRAM DISPLAY STATION CONTROLLER	DSC 1.0-L

Figure 1-7. DSC 1.0L



PRIMARY BLOCK DIAGRAM DISPLAY STATION CONTROLLER	DSC 1.0-R

Figure 1-8. DSC 1.OR

the (DR) pack, to the Keyboard Register and Parity Generator (DB) pak. The keyboard information will be passed to the Channel Data Transmitter Register (AP) pak if the previous function was a keyboard select. Keyboard Select is the left top input to the Keyboard Register and Parity Generator from the Function Decoder (DD) pak. Notice that inputs to the Function Decoder include data bits and the Function signal from the receivers. A Keyboard Select signal will be generated if the last function was a keyboard select. The other enable is the Active signal, which tells the DSC that the PPS is ready for a data transfer. The Active signal, from its receiver, is the top input to the Keyboard Register and Parity Generator pak.

The six Keyboard Data bits and a Parity bit are sent through Channel Data Transmitter Register to the PPS on channel 10 clocked by a Full signal. The other signals sent to the PPS on channel 10 are the Active, Inactive, and Empty, (shown directly above the keyboard bits). These three signals are sent by the Channel Control Transmitter Register.

The remaining signals along the right side of the block diagram are sent to the display station to control what is displayed on the CRT. They are generated because of the function and data words coming into the receiver on the left side of the block diagram, from the PPS on channel 10.

For example, to display small characters on the left side of the CRT, the DSC will receive a Function signal and function code of 7000 from the PPS. It decodes as follows. The 7 specifies DSC equipment selected, the X0XX equals left screen, the XX0X character mode, and the XXX0 small characters. The Function Decoder (DD) pak, left center of the block diagram, will generate the Select Equipment, Small, and will not generate the Right Screen Select signal. The absence of the Right Screen Select signal specifies the left screen. No Dot Mode or Keyboard Select signals are generated, which specifies the Character mode. The Small signal goes to the X Register and Incrementer. It is not shown on the block diagram, but the Small or Medium signal also goes through the ECL/TTL Level Converter (DP) pak to the display station.

The X and Y coordinates must be specified to begin displaying the small characters. The DSC will receive an Active signal and two data words, each accompanied by a Full signal from the PPS. The DSC will transmit an Empty signal back to the PPS on channel 10 after each data word. If the data words were a 7XXX and a 6XXX, the Function Decoder will generate Y Enable and X Enable signals. Because it was a data word, the Function Decoder also generates an S Enable signal. These signals are not shown on the block diagram. Each data word will be gated into the S Register (AD) pak, top left of the block

diagram. The 7XXX data word will be gated into the Y Register (AD) pak. The 6XXX data work will be gated into the X Register and Incrementer (DA,DR) paks. From there, the nine bits of the X and Y Register go through the ECL/TTL Level Converter (DP) pak to be transmitted to the display station. The contents of the X and Y registers specify the starting point on the CRT screen at which to paint a character. Upon completion of the paint, an increment circuit, in the X Register and Increment pak, increases the address in the X Register by an amount dependent upon the character size selected. The CRT beam is directed horizontally to the right, to paint the next character. A new Y coordinate word must be sent to the DSC from the PPS, to select a new vertical position on the CRT.

The characters to be displayed must now be specified. The DSC will receive a data word, from the PPS, that does not begin with a 6 or 7. The Function Decoder will generate an S Enable signal (not shown in the block diagram) to load the 12-bit data word which contains two character codes, the upper six bits and the lower six bits. The Function Decoder also generates a Set First Character signal that goes to the Dot/Character Mode Control block, in the center of the block diagram. This block represents a number of paks (logic modules) that generate signals to control the character painting operation. Follow the line out of the top of the Dot Character Mode Control, to the upper left, labeled 2nd Char, to the Character Selector (DF) pak. For the first character, the Second Character term would be false, enabling the first character, bits 11 through 6 of the data word, into the Character Selector. From the Character Selector the upper three bits, 3 through 5, go to the PROM Select Translator (DF) pak. The translator generates Select PROM 0 through 5 signals to select one of the six character PROMs on the 4-bit by 256-word Character PROM 0-5 (ZL, ZM) paks. The lower three bits from the Character Selector, Character Select bit 0 through 2 (bits 5 through 7 are shown in parentheses because bits 0 through 2 become bits 5 through 7 of the PROM Address bits 0 through 7) are joined by PROM Address bits 0 through 4 from the Dot/Character Mode Control. The line is now labeled PROM Address bits 0 through 7 and also goes to the 4-bit by 256-word Character PROM 0 through 5 paks.

The lower three bits of the 6-bit Character Select code specify the starting address in the selected character PROM. The PROM Address bits 0 through 4 provide the incrementing signals, to increment the PROM address as the character is formed. The output of the Character PROM, 4 signals labeled Beam Defl Instr Bits V1, V2, H1, H2, goes to the Vertical, Horizontal Deflection Control (DC) pak. There are six output lines for each horizontal and vertical deflection. The total active represents the beam position relative to the character's starting point. These signals go the Digital/Analog Converter (DQ) pak, which generates analog X and Y deflection signals to the display station CRT.

The PROM Address bits 0 through 7 also go to the 4-bit 256-word Blanking PROM 0, 1 (DH, DJ) pak. The lower three bits of the 6-bit character select code specify the starting address in the blanking PROMs. The PROM Address bits 0 through 4 provide the incrementing signals to increment the PROM address as the character is formed.

The Blanking PROMs produce six signals labeled Beam Blank/Unblank Instr bits 0-5 to the Video and Screen Selectors (DG) pak. The upper three bits of the character code also go to the pak to select the correct blanking pulse from the PROMs. The pak also has the gating circuits to generate the Unblank Left or Right or Left and Right signals to the ECL/TTL Level Converter (DP) pak. The Unblank Left, Right Screen signals are then transmitted to the display console.

To paint the second character from the 12-bit data word, bits 0 through 5 are gated from the S Register to the Character Selector. The entire sequence is repeated using the PROMs to generate the Unblanking and Y, X Plane Analog signals to the display station CRT to paint the character.

When the Function Decoder translates a dot mode function, it sends a signal labeled Dot Mode to the Dot/Character Mode Control paks. Remember, the DSC only needs to receive the X and Y coordinate data words. The character code is not needed, because the Y coordinate also forces the painting of a dot. Doit/Character Mode Control generate control signals (not shown in the block diagram) that go to the Video and Screen Selectors (DG) pak.

The Function Decoder also sends the Dot Mode signal to the Video and Screen Selectors where the Unblank signal is then generated to paint the dot. The Dot/Character Mode Control also generates a signal labeled Dot Astigmatism to the EXL/TTL Level Converter (DP pak), then to the display station.

This activity has described the theory and components of the DSC 1.0 primary block diagram.

You have now completed learning activity 1-D.

LEARNING ACTIVITY 1-E. EXERCISE: DSC PRIMARY BLOCK DIAGRAM REVIEW

This activiy reinforces what you learned in learning activity 1-D.

OBJECTIVE

- You will be able to identify the display controller primary block diagram components and describe the function of each.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The Function Decoder is a DD type of logic module.
2. The [illegible] (data/function) word is loaded into the S Register.
3. The keyboard data is a 6-bit code sent to the DSC from the Display Station.
4. The designation 3.2 on the Dot/Character Mode Control block tells you that [illegible] on Detailed Block Diagram 3.2.
5. The DSC is always on channel 0.
6. The vertical position data word takes the path from the Channel Data Receiver Register, to the S, to the Y, to the ECL/TTL level converter, to the display station.
7. There are 6 Character PROMs.
8. There are 2 Blanking PROMs.
9. The lower three bits of the 6-bit character code specifies the display scan line in the selected Character PROM.
10. In Dot mode the Y coordinate also forces the painting of a dot.

11. The blocks involved in generating the X, Y Plane Analog signals 1, 2 are the Channel Data Receiver Register, the ____________, the ____________, the ____________, ____________, the ____________, the ____________, ____________, and the Digital Analog Converter.

12. The ___6___ Keyboard Data bits and the Parity bit are accompanied by a ____________ signal to the channel.

13. The ____________ are contained in the DH and DJ logic module.

14. For the first character to be displayed bits ___C___ through ___11___ of the data word are gated into the Character Selector.

15. The Blanking PROMs produce ___6___ signals labeled ____________ to the Video and Screen Selectors.

The answers to this learning activity are on the following page.

ANSWERS TO LEARNING ACTIVITY 1-E

1. DD
2. data
3. 6, display station
4. the block is shown in more detail on the 3.2 detailed-pak diagram.
5. $10_{(8)}$
6. S Register, Y Register, ECL/TTL Level Converter
7. 6
8. 2
9. starting address
10. Y
11. S Register, Character Selector, PROM Select Translator, 4-bit by 256-word Character PROM 0-5, Vertical Horizontal Deflection Control
12. six used, Full
13. 4-bit by 256-word Blanking PROM 0,1
14. 11,6
15. six, Beam Blank/Unblank Instr Bits 0-5

LEARNING ACTIVITY 1-F. TEXT READING: DSC DETAILED-PAK DIAGRAMS

This activity describes the functional area of the three DSC detailed-pak diagrams.

OBJECTIVE

- You will be able to list the functional areas of the DSC detailed-pak diagrams and describe the purpose of each area.

Place the Display Station Controller Training Microfiche in your microfiche reader. Go to grid coordinate D1/D2. The diagram is titled Detailed-Pak Diagram, Display Station Controller, Function Decoder; Keyboard Data Path (DSC 3.0) in the lower right corner.

Go to grid coordinate D3/D4. This detailed-pak is titled, Display Data Path (DSC3.1). Go to grid coordinate D5/D6, titled Dot/Character Mode Control (DSC 3.2). These are the three detailed-pak diagrams. They show more detail of the DSC than the primary block diagram. Begin with the diagram titled, Function Decoder; Keyboard Data Path (DSC 3.0). Go back to coordinate D1/D2.

The 3.0 diagram is divided horizontally by a dashed line. Along the left side of the diagram, the words Function Decoder indicate that the area above the dashed line is logic involved in the function decode operation. The words Keyboard Data Path designate the logic below the dashed line pertains to keyboard operations. First look at the Functional Decoder area. Remember to refer to the primary block diagram for the overall picture of where each area fits into the DSC.

Look at the block in the upper left corner of the 3.0 detailed-pak diagram. Inside the block is a box labeled Chan Cont Rcvr Rgtr (Channel Control Receiver Register) with two input lines. The bottom input line is labeled with an R, indicating a reset or clear for the receiver register. The upside V labeled with 04 indicates test point 4 on the logic module. At the top left of the block is an AP and a Q38. The AP indicates an AP type of logic module. The Q38 is the module's location in the DSC logic chassis, row Q, slot 38.

The bottom left input to the AP pak (logic module) at location Q38 is labeled Reset Recvr Rgtr (Reset Receiver Register). It goes to a small square box with a dot in the center. This indicates an AND gate. The bottom input is a line labeled T3, which indicates a time 3 clock pulse that gates the Reset Receiver Register signal through

to clear the Channel Control Receiver Register. Note that throughout the detailed-pak diagrams the same symbol is used for an AND gate. A small box with a plus sign (+) indicates an OR gate. A minus sign (-) indicates inversion.

The labeling DSC 3.2 (DA) tells us the Reset Receiver Register signal came from a DA type of pak on the 3.2 detailed-pak diagram of the DSC.

There are four other signals coming into the AP pak at location Q38. One is labeled Chan $10_{(8)}$ Fctn (function). The labeling Chan 3.0 (UB) indicates it came from the channel portion of the PPS manual. The other three signals (indicated by the circle with a 3 in it) are labeled Activate, Deactivate, and Full from channel $10_{(8)}$. They join the function line to become the four (indicated by the circle with a 4 in it) signals into the Channel Control Receiver Register.

The one line out of the AP pak (Q38) represents the four (the circle with a 4 in it) signals. The signals can be scoped at test points 13, 12, 3, and 4. The line goes straight across the page to the DD pak at locaton R30. It also fans out to other logic modules and detailed-pak diagrams. The DD pak at location R30 is the Function Decoder. The other inputs to the Function Decoder are the Inactive signal (bottom left) and the Channel $10_{(8)}$ Out Data bits 0, 1, 3, 4, 6, 8-11 (middle left).

The AP registers hold and synchronize the input word and control signals. The nine relevant bits of the input word are applied to the Function Decoder (DD pak location R30). When the channel 10 function line is active, the input code is examined to see if the DSC is being addressed (that is, the code is 7XXX). If this condition is satisfied, the Select Equipment signal is raised with the result that six control lines determining the DSC's mode of operation are enabled by the Inactive signal.

Bits 0 and 1 govern character size. Bit 4, if active, sets the Keyboard Select FF. If the keyboard is not selected, bit 3 determines whether the DSC operates in Dot or Character mode. Bits 6 and 8 select either the left, right, or both screens for display. All six control lines are latched and do not change until another function code is received.

After a function is processed, the channel 10 (octal) Full signal enables the Set X and Y Coordinate FFs. Completion of such processing is flagged by the setting of Equipment Select FF and the absence of channel 10 (octal) Function signal. A 6XXX or 7XXX code then sets a X and Y latches, respectively. When either latch is set, the Set Dot Mode flag is raised.

With a function processed, the S Enable signal enables the S Register (DSC 3.1) to load the complete 12-bit code word. The nine least significant bits are used to specify X and Y coordinates.

The outputs from the Function Decoder go to DP logic module to be transmitted to the display station and fan out to other logic modules and detailed-pak diagrams.

The portion of the detailed-pak diagram below the dashed line shows the logic modules involved in the Keyboard Data Path. Notice the DR pak at location R36 has the bottom left input tied to a logic one. The signal is labeled Kybd Enbl (keyboard enable) and goes to a switch (SW1) on the DR pak. This switch must be closed to enable the Key Up/Key Down signal to the remaining logic. If the switch is not closed, the keyboard is effectively disabled. Remember to check this switch setting on your controller.

The six data bits from the keyboard output are loaded into the Keyboard Register (DB pak) at a time delayed from the Key Down signal. The loading sequence is locked off by the Key Up signal. On an XX2X (keyboard select) function, the Keyboard Select signal activates a 100-nanosecond one-shot signal, which simultaneously gates data and a Full signal to the channel. Transmission is completed at the end of the one-shot signal, at which time the Keyboard Register clears.

The display of data is not automatic. The keyboard data is passed to the channel and depends upon programming for retransmission to the DSC.

Go to grid coordinate D3/D4, on the display data path (DSC 3.1) detailed-pak diagram.

The instructions for painting each character are stored in PROMs. Six of these (three on ZM and three on ZL paks) contain the beam deflection instructions and two (one on each pak) contain the beam blank/unblank instructions. Each character is painted within an 8 by 8 matrix and the distance between each point on the matrix is governed by the character size selection.

Each PROM contains the paint instructions for eight characters. There are six character PROMs in the system, and one of these is addressed by the most significant bits of the character code. The three least significant bits of the code address start the one of eight series of paint instructions stored in that PROM. On receipt of a Start Character Mode signal, the address is incremented by the output of a counter in the DE pak (DSC 3.2), and the PROM produces the series of instructions required to paint the selected character. Refer to table 1-1.

TABLE 1-1. PROGRAMMABLE READ-ONLY MEMORIES

Pak Type and Location	Addressed By	PROM ADRS Bit	05	04	03	02	01	00	07	06
			0	1	0	1	0	1	0	1
			0	0	1	1	0	0	1	1
			0	0	0	0	1	1	1	1
ZL(R41) -- B6	SEL PROM	0			A	B	C	D	E	F	G
ZL(R41) -- A6		1		H	I	J	K	L	M	N	O
ZL(R41) -- A1		2		P	Q	R	S	T	U	V	W
ZM(R42) -- B6		3		X	Y	Z	0	1	2	3	4
ZM(R42) -- A6		4		5	6	7	8	9	+	-	*
ZM(R42) -- A1		5		/	(	)		=		,	.

There are four parallel outputs from each PROM. Those from the character PROMs are designated V1, V2, H1, and H2. An output from V1 alone is an instruction to increment the matrix address one point in the vertical direction; V2 alone increments the vertical address two points. When V1 and V2 occur at the same time, it is interpreted as an instruction to change the direction of following vertical plane instructions (that is, from up to down or vice versa). The H outputs are interpreted in a similar manner, but apply to the horizontal plane. The blanking PROMs are addressed by the three least significant bits of the character code and produce six streams of blank/unblank pulses.

The correct stream of blank/unblank pulses is selected in the (lower right) DG pak by the three most significant bits of the Character mode. A further selection of blanking pulse stream or single-dot pulse (Dot mode) is made by Display Count=14 through 17 (octal). The final selector on this pak chooses left, right, or both screens.

The DC paks (upper right) decode the vertical and horizontal instructions and sum them with the results of previous instructions in the same character paint. This decode represents beam position relative to the character's starting point. An increment-by-one

instruction activates one of the output lines while increment-by-two activates two lines. Similarly, decrement instructions deactivate one or two lines. There are six output lines each for horizontal and vertical deflection; the total active in the six represents beam position relative to a character's starting point.

Each character sequence begins with a Start Character Mode signal that clears the output lines to all zeros and sets the increment/decrement condition to increment. Thereafter, the coincidence of the by-one and by-two instructions reverses the increment/decrement condition on the vertical and horizontal axis, respectively. The six output lines are applied to summing networks in the DQ paks where analog driver signals are produced for the CRT. Beam deflection instructions for creating the character P appear in the DC paks at locations R38 and R39.

The display area of the screen is divided into 512 horizontal lines, each with 512 dot locations on it. Each of these positions has been allocated an X coordinate (horizontal) and a Y coordinate (vertical). The address X=000, Y=000 is located at the bottom left-hand corner of the screen, and X=777 (octal), Y=777 (octal) is at the top right-hand corner. These bit addresses are stored in the Y Coordinate Register, AD pak location Q42, and the X Coordinate Register DR, and DA paks locations R36 and Q39.

In the Dot mode, the entry of a Y coordinate forces the painting of a dot at the location specified by it and the contents of the X Register.

In the Character mode, the contents of the X and Y registers specify the start point for a character paint. Upon completion of the paint, an increment circuit increases the address in the X Register by an amount dependent upon the character size selected (small equals 8, medium equals 16, and large equals 32). The beam moves that number of screen lines to the right on the CRT for the next character paint.

Go to grid coordinate D5/D6 the Dot Character Mode Control (DSC 3.2) detailed-pak diagram.

The DE pak (location Q40) produces the pulses necessary to address the series of instructions stored in the PROMs. It also produces timing signals associated with both dot and character displays. The DX (location R31) pak produces timing delays associated with both type displays.

In Dot mode, the display is initiated by the Set Dot Mode signal, which is delayed in the DX module. The delayed Start Dot Mode sets the Dot mode 2 FF in the DE pak, starting the Display Timing Counter. The outputs of this counter are decoded to produce the

Display Count=14 through 17 (octal) pulse. The counter is reset after it reaches a count of 27 (octal).

In Character mode, the Set First Character signal sets the First Character FF in the DE pak. The resultant Start Character Delay signal starts the Character mode delay count in the DX pak. The delayed Start Character Mode starts the DE pak display timing counter, whose outputs address the PROMs. A decoded count of 25 (octal) produces Display Count=25 (octal), which starts the X coordinate incrementer in the DA pak (DSC 3.1). A decoded count of 27 (octal) resets the counters and sets the Second Character FF in the DE pak. The sequence is repeated, and in addition, at a count of 26 (octal), an Empty signal is generated and sent to the PPS.

This activity has described the functional areas of the three DSC detailed-pak diagrams.

This completes learning activity 1-F.

LEARNING ACTIVITY 1-G. EXERCISE: DSC DETAILED-PAK DIAGRAMS REVIEW

This activity reinforces what you learned in learning activity 1-F.

OBJECTIVE

- You will be able to list the functional areas of the DSC detailed-pak diagrams and describe the purpose of each area.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true. The following questions refer to the 3.0 detailed-pak diagram.

1. A function word, with bit 4 a one, will set the LOAD ____ FF on the DD pak at location R30.
2. The S Enable signal, from the DD pak at location R30, goes to a AD pack on the 3. 1 detailed-pak diagram.
3. To generate the Y Enable a T2, HOLD FULL, and SET Y CLOCK must be present at the DD pak at location R30.
4. The Channel $10_{(8)}$ Function signal comes into the 3.0 detailed-pak diagram through the AP pak at location C3F.
5. The Mode Select FF can be scoped at test point 6 ____ on the DD pak at location R30.
6. To load the Keyboard Register on the DB pak at location Q41, a 25-nanosecond one-shot signal is clocked by a 1 megahertz Clock signal and a 4-microsecond delay clocked by a 10 megahertz Clock signal and the KEY DOWN FF.
7. To enable the Key-Up/Key Down signals through the DR pak at location R36 SW1 must be CLOSED (open/closed).

8. The Right Screen Select signal is sent to the display station by the DP pak at location R33.

9. The Set DOT MODE signal is generated by the DD pak at location R30 when Hold Full and Set X Coordinate or Set Y Coordinate FFs are set.

10. The AP pak at location Q33 transmits bits 4 5, Parity, and the FULL signal to channel 10.

Directions: The following questions refer to the 3.1 detailed-pak diagrams. Fill in the blank(s) with a word or words to complete the statement and make it true.

11. The DA pak at location Q39 increments the X Register by 8 for small, 16 for medium, and 32 for large sized characters.

12. There are 32 character PROMs on the ZM pak at location R42 and 1 blanking PROM(s).

13. The horizontal deflection steps to paint the character P are shown as an example on the DC pak at location R39.

14. The vertical deflection step 3 caused the beam to move UP (up/down) while painting the character P.

15. To cause the beam to move down by 2, the V1 bit must be FALSE (true/false) and the V2 bit must be TRUE (true/false) while painting the character P.

16. The small square with a plus sign (+) in it to the right of the ZL, ZM paks at locations R41 and R42 represents an OR (OR/AND) gate.

17. The START CHAR. MODE signal can be scoped at test point 6 on the DG pak at location R37.

18. Each character PROM contains the paint instructions for 64 characters.

19. The correct stream of blank/unblank pulses is selected in the DG pak at locations R37 by Character Select bits 3, 4, 5.

Directions: The following questions refer to the 3.2 detailed-pak diagram.

20. The Display Timing Counter is on the DE pak at location Q40.

21. The Channel $10_{(8)}$ Active signal is always a logical one (one/zero).

22. The Start Character Mode signal or the DOT MODE 2 FF and T2 increment the Display Timing Counter.

23. A Character mode and the Display Timing Count equal to 25 gates the X Coord Modulo in the DA pak at location Q23 on the 3.1 detailed-pak diagram.

24. The EMPTY signal is generated by the DE pak at location Q40 when Channel Active, Count=26 $_{(8)}$, and second character or dot mode 2 conditions are present.

25. The PROM Address bits 0 through 4 from the Display Timing Count are used to INCREMENT (increment/decrement) the (DSC 3.1) PROMs from the starting address specified by Character Select bits 0 through 2.

ANSWERS TO LEARNING ACTIVITY 1-G

1. Keyboard Select
2. AD, 1
3. Hold Full, Set Y Coordinate
4. AP, Q38
5. 6
6. 1, 1, Key Down
7. closed
8. DP, R33
9. Dot Mode
10. 4, 5, Full $10_{(8)}$
11. 8, 16, 32
12. 3, 1
13. DC, R39
14. up
15. false, true
16. OR
17. Start Character Mode
18. eight
19. 3, 4, and 5
20. DE, Q40
21. zero
22. Dot Mode 2
23. X coordinate XLTR, Q39

24. Empty

25. increment, 0 through 2

LEARNING ACTIVITY 1-H. TEXT READING: DSC LOGIC DIAGRAMS

This activity describes the pak logic diagrams of the DSC.

OBJECTIVE

- You will be able to correlate the primary block diagram and the detailed-pak diagram to the pak logic diagrams.

Place the Display Station Controller Training Microfiche in your microfiche reader. The logic diagrams for the DSC are located from grid coordinates E1 through F8.

Go to grid coordinate E1. In the upper right corner is the title block (above the Control Data label). The block is titled, 3AD0 Pak-DSC 3.1 S, Y Registers. The 3AD0 breaks down as follows. The first number tells the revision level of the pak, in this case, 3. Next are two letters that indicate the pak type, AD. The last digit is a code indicating where the pak was manufactured, code 0. The DSC 3.1 tells you this pak is on the 3.1 detailed-pak diagram. The S, Y Registers tell you that the logic on this pak is the DSC's S and Y Registers. Go to the primary block diagram and locate the AD blocks of the S and Y registers. Go the the 3.1 detailed-pak diagram and locate the AD paks of the S and Y registers. In this learning activity, we will sequentially describe each pak in the logic diagrams. Before reading each description, locate the pak on both the primary and detailed-pak block diagrams. This will help you keep the overall concept of the DSC and where each pak fits in.

To the right of the Control Data label locate a Q35, 42 term. This indicates the pak locations in the logic chassis.

The pak logic diagrams are provided in the PPS CYBER 170 manual for test point and connector information. It is assumed that you are already familiar with the ECL (emitter coupled logic) symbols and logic levels.

Vertically down the center of the diagram is the 10131 circuits that make up the S or Y Register. The S Register is a 12-bit register, while the Y Register is only a 9-bit register. Notice the three top right output pins (6, 20, and 26) are labeled S Register bits and NC (no connection or not used). The remaining nine output pins from the 10131 circuits are labeled S Register bits (ADSSOX) or Y Register bits (ADDYOX). The bottom right output pin and the 10160 circuit are not used. The test points are all labeled. For example, test point 12 is for bit 7 into the 10131 circuit. It is from input pin 23 into

the pak. It is labeled DSD07 for the S Register input and ADDS07 for the Y Register input. The first two letters of the input term designate the type of pak it came from.

Go to coordinate E2, the AP pak logic diagram, Channel Data Receiver Register. It takes three of these paks at locations P36, Q36, and Q37 to receive the 12 data bits from channel $10_{(8)}$. Each pak receives four bits along the left side of the diagram in the TR00 and 10114 circuits. At the bottom right are 10192 and TR00 transmitter circuits, but they are not used in the Channel Data Received Register.

Go to coordinate E3, another AP pak logic diagram, but now at location P37 and used as the Channel Control Transmitter Register. The transmitters at the bottom right send the Empty, Inactive, and Active signals to channel $10_{(8)}$. Read note 2 (the 2 in the triangle) on the Active signal.

Go to coordinate E4. This AP logic diagram is used as the Channel Data Transmitter Register, which is at locations Q33 and 34. Refer to the 3.1 detailed-pak diagram and you will see the two AP paks are required to send the Keyboard bits, Parity, and Full signal to channel $10_{(8)}$. Locate these signals on the transmitters at the bottom right of the AP logic diagram at coordinate E4.

Go to coordinate E5, another AP pak logic diagram, but at location Q38 and used as the Channel Control Receiver Register. This AP pak receives the 1 megahertz Clock, Function, Full, Deactive, and Active signals along the left side of the pak logic diagram.

Go to coordinate E6. This is a DA pak at location Q39, the X Register and Incrementer. This pak holds bits 2 through 8 of the X Register in the 10131 circuits down the center of the diagram and the 10136 circuit at the upper right. Most of the remaining circuits deal with incrementing the value in the X Register by 8, 16, or 32, depending on the size of character being displayed.

Go to coordinate E7 (a DB pak), the Keyboard Register. The register consists of the 10130 circuits at the bottom left of the diagram. The Keyboard Data bits are from the display console receivers and the outputs along the bottom right side of the diagram are going to the channel $10_{(8)}$ transmitter. Parity has to be generated and this is done by the 10107 circuits labeled Parity Gen at the bottom center of the diagram. The circuits in the top half of the diagram generate the Full signal for channel $10_{(8)}$ and the gating pulses for the Keyboard Register FFs.

Go to coordinate E8, a DC pak, the Vertical, Horizontal Deflection Control. There are two paks, one for vertical and one for horizontal. Notice the dual labeling on the logic diagram. This pak generates six Vertical or Horizontal signals out the right side to the D/A converter. These six signals are generated from the V1, V2, or H1, H2 signals that enter the left center of this pak logic diagram. These signals control the Beam Deflection Incrementer/Decrementer, 10131, circuits in the center of the diagram that generate Vertical or Horizontal Beam Deflection bits. The Inactive or Empty signals are gated through the 10131 circuits at the upper right of the diagram.

Go to coordinate E9, a DD pak, the Function Register and Decoder. The Function Register consists of the 10131 circuits located vertically down the center of the diagram. The decoder portion is made up of the 10105 circuits.

Go to coordinate E10, A DE pak, the Display Timing Counter. The Display Counter is the 10136 circuit at the bottom center of the diagram. The output of the counter produces five PROM Address bits out the bottom right of the diagram to increment the PROM address. Specific counts from the CNTR are decoded by the 10161 decoder circuit at the bottom center of the diagram. The remaining 10131 FFs, 10117 gates, and so forth, produce the timing signals associated with both dot and character displays.

Go to coordinate E11, a DF pak, the Character Selector. This pak gates six bits from the 12-bit S Register, controlled by the Second Character signal (upper left) through the Character Selector 10117 circuits located vertically down the center of the diagram. Bits 0, 1, and 2 outputs of the Character Selector go through 10125 ECL/TTL converter circuits to become PROM Address bits 5, 6, and 7. The bit 3, 4, and 5 outputs of the Character Selector go through a 10161 decoder to one of the remaining 10125 ECL/TTL converter circuits to select one of six character PROMs. Bits 3, 4, and 5 from the Character Selector also go out the top right of the diagram, pins 26, 9, and 11, to the Video and Screen Selectors.

Go to coordinate E12, a DG pak, the Video and Screen Selectors. The PROM Address bits 0 through 3 pass through the ECL/TTL converters, at the top center of the page, on the way to the character PROMs. The remaining logic generates the Unblank Left Screen/Unblank Right Screen signals, for the CRT, out the bottom left of the diagram.

Go to coordinate F1, the ECL/TTL Level Converters. There are two DP paks at location R32 and R33, notice the dual labeling on the input and output pins. The outputs go to the display console with the exception of the top right output. The PROM Address bit 4, along with PROM Address bits 0 through 3 on the DG pak, go to the character PROM paks.

Go to coordinate F2, a DQ pak, the Digital Analog Converter. There are two paks. One generates the X (horizontal) and one generates the Y (vertical) character painting analog signals, out the lower right of the diagram, to the display console.

Go to coordinate F3, another DQ pak. Notice the paks at coordinate F2 and F3 are basically the same with the exception one is revision level 4 and the other is revision level 5.

Go to coordinate F4, a DR pak, at location R36. This pak contains bits 0 and 1 of the X Register, in the 10133 circuits, at the bottom center of the diagram. Directly above are the two Busy FFs, 10131 circuits. Above the FFs is SW1, the keyboard enable switch. This switch enables the Key Up and Key Down signals through this pak. The TTL/ECL Level Converters, 10124 circuits, pass the 6-bit keyboard code and Key Up/Key Down signals through the top center of the diagram.

Go to coordinate F5, a DX pak, the Display Delay Counters. The two 10136 counter circuits are labeled on the diagram for character and dot mode displays.

Go to coordinate F6, a UV Inverter pak. The bottom 10105 gate, test point 02, is used for the Screen Select signal.

Go to coordinate F7, a ZL pak, the Programmable Read Only Memory. The four IM5603 circuits are labeled on the diagram as the three character PROMs and one Blanking PROM.

Go to coordinate F8, a ZM pak, the Programmable Read Only Memory. The four IM5603 circuits are labeled on the diagram as the Blanking PROM and three character PROMs.

This activity has briefly described the pak logic diagrams of the DSC.

You have now completed learning activity 1-H.

LEARNING ACTIVITY 1-I. EXERCISE: DSC LOGIC DIAGRAMS REVIEW

This activity reinforces what you learned in learning activity 1-H.

OBJECTIVE

- You will be able to correlate the primary block diagram and the detailed-pak diagram with the pak logic diagrams.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The Y Enable signal, into the AD pak (Q35, 42), can be scoped at test point 13 and comes from a DD pak.
2. The S Register is the AD pak at location Q35.
3. The AP paks at locations Q37, Q36, and P36 comprise the Channel Data Receiver Register.
4. The channel $10_{(8)}$ Empty signal is transmitted to the PPS by the AP pak at location P37 on output pin number 2.
5. The AP pak at locations Q33, 34 is the Channel Data Transmitter Register.
6. The 10192 circuits are part of the XMTR (XMTR/RCVR) on the AP paks.
7. The EM Hi Clock signal comes into the AP pak at location Q38 on input pin number 26.
8. The DA pak at location Q39 is the X Register and Incrementer.
9. X Register bits 6, 7, and 8 are stored in a 10136 circuit on the pak at location Q39.

10. X Register bit 3 can be scoped at test point 7 on the pak at location Q39.

11. The Keyboard Data Parity bit can be seen at output pin number 9 on the DB pak at location Q41.

12. The 10141 circuit on the DB pak is used as a PULSE shaper.

13. The term name for the signal on input pin number 5 on the pak at location R38 is [illegible].

14. Vertical or Horizontal Beam Deflection bits 0 through 5 are generated by the DC pak. Bit 1 passes through the gate at test point 4.

15. A function code with 4 set will set the KBD SPC FF on the pak at location R30.

16. The - Inactive signal into the pak at location R30 comes from a DA pak at location Q39.

17. The pak at location Q40 is shown on the 3.2 detailed-pak diagram.

18. Locate the DF pak at location R40 on the 3.1 detailed-pak diagram. There is an input labeled Second Character. This signal can be scoped at test point 09, or input pin number 8 as shown on the pak logic diagram.

19. PROM Address bits 0 through 3 pass through the ECL/TTL Converters on the video and SCREEN pak.

20. Other than the PROM Address bits the signals generated by the DG pak are the UNBLANK LEFT SCREEN and UNBLANK RIGHT SCREEN signals.

21. The signal sent by the DP paks that does not go to the display console is PROM ADRS BIT 4.

22. There are 2 (one/two/three) DQ pak(s) used in the DSC.

23. The Y or X Plane Analog signals can be scoped at test points 08 and 09 on the DQ pak.

24. The keyboard enable switch, (SW1) is on the DR pak at location R36.

25. The DX pak, Display Delay Counters, is part of the block labeled DOT/CHARACTER MODE CONTROL on the primary block diagram.

26. The signal used by the pak at Q31 is Right screen select.

27. Blanking PROM zero (zero/one) is on the pak at location R41.

28. The signal that enables Character PROM 5 is DFCR05 and it comes into the ZM pak on pin 17 test point 09.

29. PROM Address bits 0 through 7 specify the address in the character and SCANNING PROMs.

30. The Beam Deflection Instruction bits DHV1 and DHV2 signals are generated by the character PROMs on the pak at location R41.

The answers to this learning activity are on the following page.

ANSWERS TO LEARNING ACTIVITY 1-I

1. 13, DD
2. Q35
3. P36, Q36, Q37
4. AP, 2
5. DATA
6. XMTR
7. 1 megahertz Clock
8. AD
9. 10136
10. 03
11. 24, Q41
12. 1-microsecond pulse
13. DHV2
14. 5, 1
15. Keyboard Select
16. DA, Q39
17. 2
18. 3, 10
19. 3, Screen Selector
20. Unblank Left Screen, Unblank Right Screen
21. PROM Address bit 4
22. two
23. 08, 09

24. DR, R36

25. Dot/Character Mode Control

26. Right Screen Select

27. zero

28. Select PROM 5, 17, 09

29. 7, blanking

30. R41

CYBER 170 Display Subsystem
Module 1

POST TEST

When you have completed the learning activities assigned for module 1, sign on to the PLATO terminal and take the module 1 test.

You may use your student manual and your reference manuals during the test. Be sure to take them with you to the PLATO terminal.

Depending on the results of the test, you will be told either to review some of the activities in this module or go on to module 2.

MODULE 2
CYBER 170 DISPLAY CONSOLE

This module introduces the major components and theory of the CYBER 170 Display Console. You will learn the location and function of the components through location diagrams, block diagrams, and logic diagrams.

PRETEST

To start this module, sign on to the PLATO terminal and read the objectives. If you feel you are able to satisfy one or more of these obectives, take the module test. After evaluating the results of the test, PLM will assign the learning activities you should study next. If, however, you do not wish to take the test first, ask for an assignment.

LEARNING ACTIVITIES

In the Assigned column below, put a checkmark by each activity assigned to you by PLM. Then proceed through your assigned activities. Put a check in the Completed column as you complete each assigned activity. You may choose to do all of the activities or do some activities more than once.

Assigned	Completed	Activity	Description	Page
_____	_____	2-A	Reference Reading: CC545 General Description. This activity describes the major components and basic theory of the CC545 display console.	2-4
_____	_____	2-B	Exercise: CC545 General Description Review. This activity reinforces what you learned in learning activity 2-A.	2-6
_____	_____	2-C	Reference Reading: Operation and Programming. This activity provides operational and programming information necessary for effective use of the CC545.	2-12

CYBER 170 Display Subsystem
Module 2

LEARNING ACTIVITY 2-A. REFERENCE READING: CC545 GENERAL DESCRIPTION

This activity describes the major components and basic theory of the CC545 display console.

OBJECTIVES

- You will be able to describe the function of the three major operational areas of the CC545.
- You will be able to list the major functional areas of the display station functional block diagram and describe the function of each.
- You will be able to describe the beam positioning and symbol painting operation of the CC545.

Read, in the CYBER 170 Display Station manual (publication number GF62952600), section 1, General Description, on microfiche number 124, coordinates D2 through D11. The Display Station Functional Block Diagram from the CC545 Manual, is also on the next page (figure 2-1). You may use it for note taking and reference. Study the location of all labeled assemblies in figures 2-2 and 2-3.

STUDENT NOTES

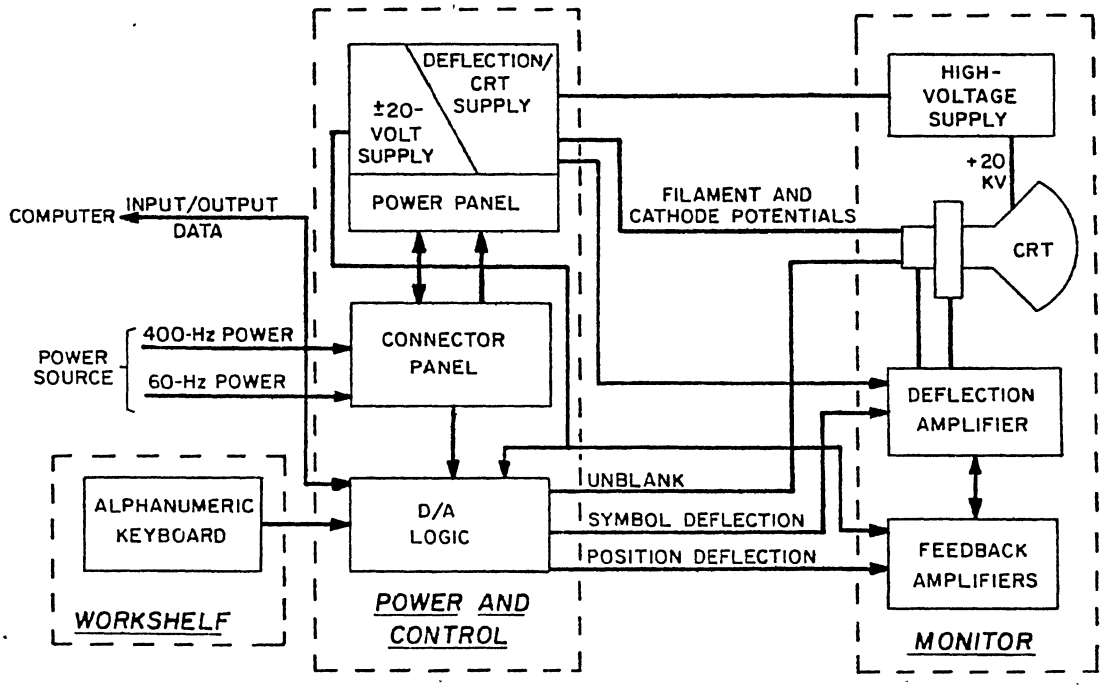


Figure 2-1. Display Station Functional Block Diagram

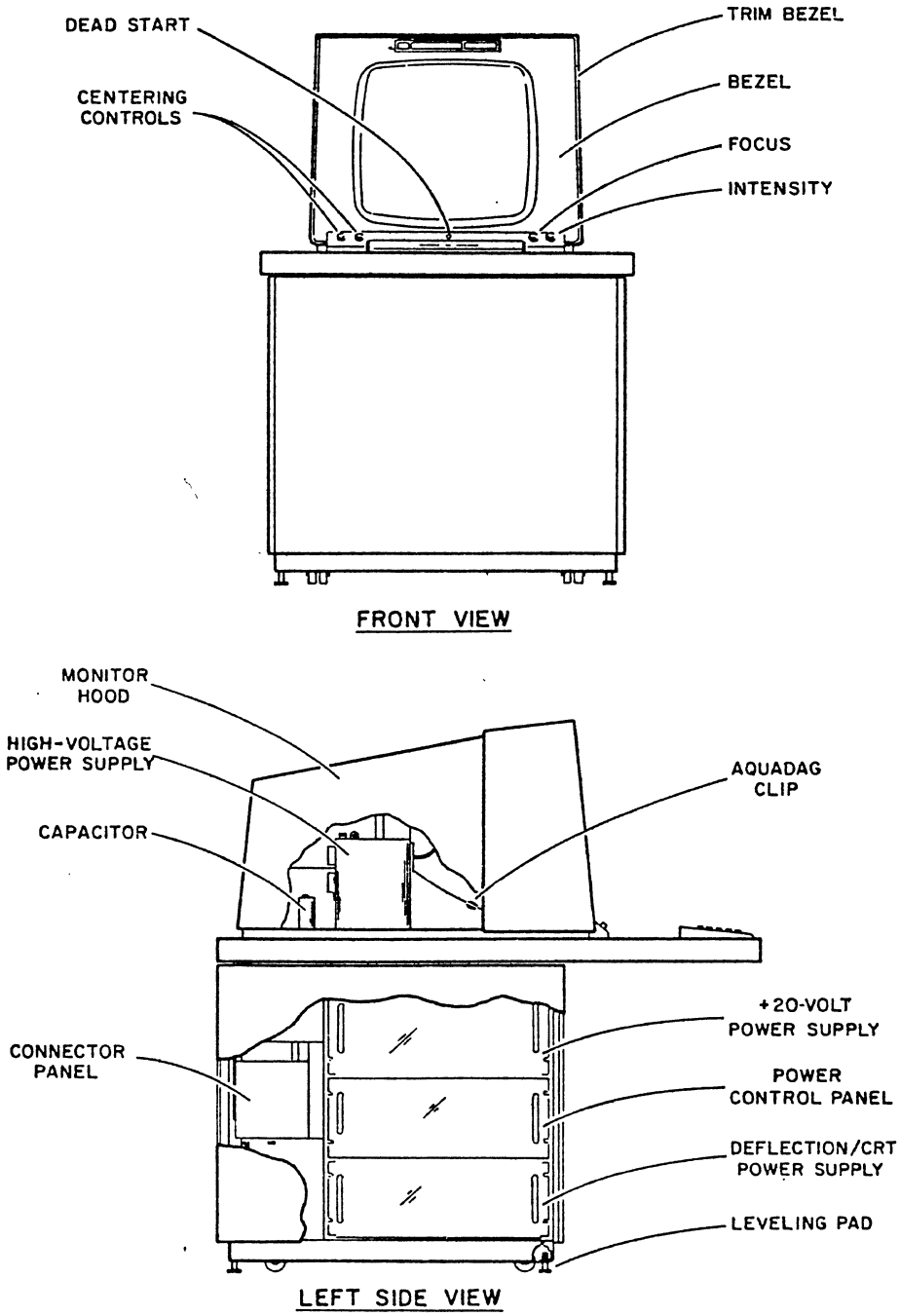


Figure 2-2. Display Station Front and Left Side Views

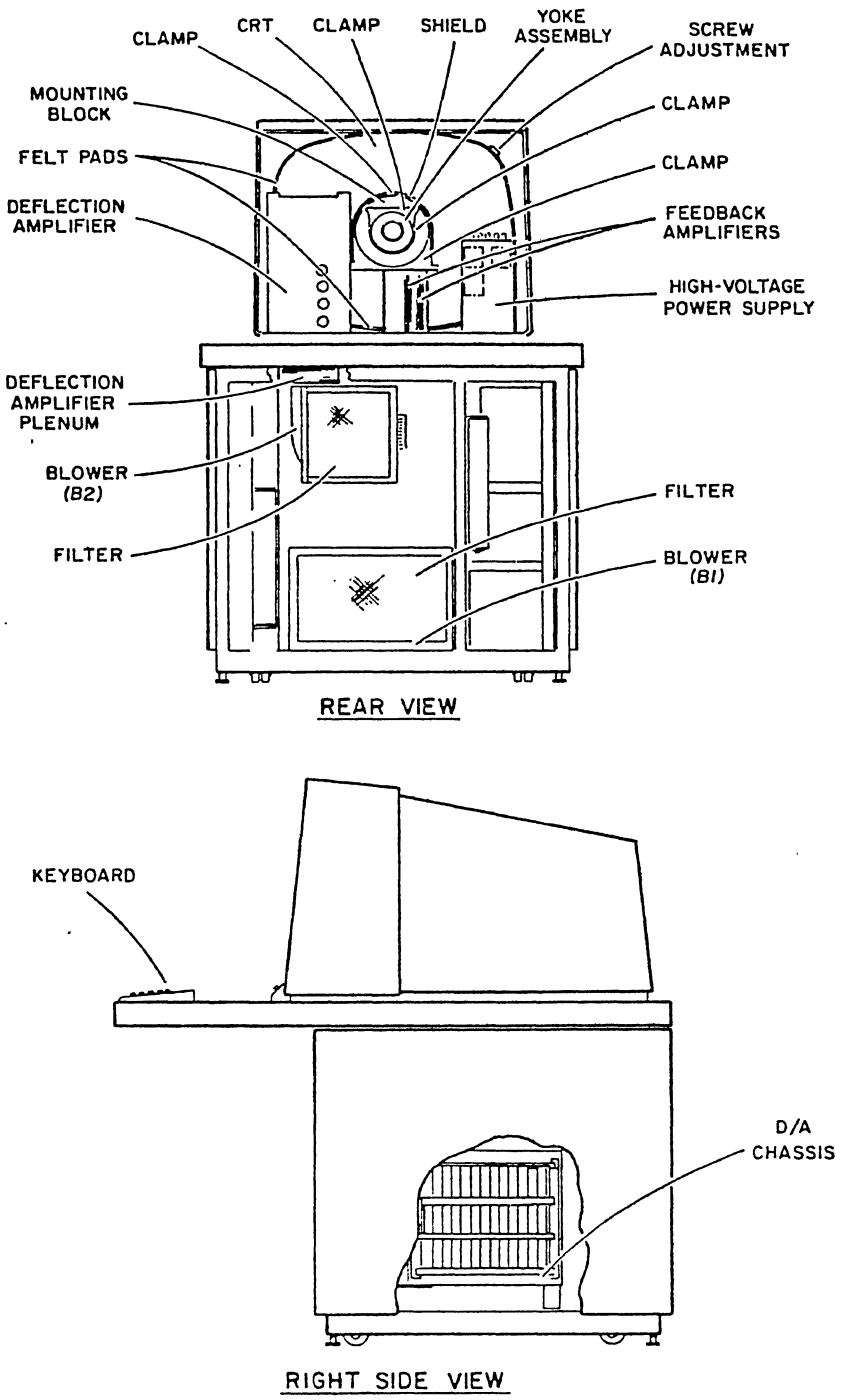


Figure 2-3. Display Station Rear and Right Side Views

LEARNING ACTIVITY 2-B. EXERCISE: CC545 GENERAL DESCRIPTION REVIEW

This activity reinforces what you learned in learning activity 2-A.

OBJECTIVES

- You will be able to describe the function of the three major operational areas of the CC545.
- You will be able to list the major functional areas of the display station functional block diagram and describe the function of each.
- You will be able to describe the beam positioning and symbol painting operation of the CC545.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the following questions, and write your response in the blanks provided.

1. The CC545 is divided into what three major operation areas? _____.
2. What are the three positions of the PRESENTATION CONTROL switch? _____.
3. The PRESENTATION CONTROL switch is part of what major operation area of the CC545? _____.
4. The logic chassis is part of what major operation area of the CC545? _____

Directions: Refer to the display station functional block diagram to answer the following questions.

5. What are the four blocks in the Monitor? _____.
6. Which signals, generated by the D/A logic, are sent to the Monitor? _____.
7. The Workshelf interfaces with what area of Power and Control? _____.

8. What is the voltage applied to the CRT by the High Voltage Supply? 20 Kilovolts.

9. The computer (DSC) supplies data to what area of Power and Control? D/A Logic.

10. What are the input power requirements for the CC545? 60 Hz 1 Ø

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

11. The power control panel routes power from the ±20 volt power supply to the deflection/CRT supply, the Deflection Amp Regulating Transistors, and the D/A Logic.

12. Power off and high-temperature thermal delays provide 15 seconds between the dropping of the high voltage to the CRT and the turning off of all power.

13. The D/A logic accepts data from the alphanumeric keyboard and transmits the codes to the Display Memory Control.

14. The _____ volt supply furnishes power to the symbol yoke on the CRT.

15. The ±20 V supply provides two +40-volt outputs for the X and Y position yoke on the CRT.

16. The deflection/CRT supply has a thermal delay that turns on the High voltage supply and applies focus potential to the CRT approximately 15 seconds after applying power to the rest of the CC545.

17. The X and Y coordinates specify a raster of 512 by 512 selectable positions.

18. The CC545 uses a 21 -inch CRT with an 8-inch by 8 -inch normal mode (displaying Left or Right) raster or an 8-inch by 16 -inch maintenance (displaying both) raster.

19. X coordinate of $000_{(8)}$ and Y coordinate of $777_{(8)}$ specifies the upper (upper/lower) left (left/right) corner of the raster.

20. The DSC directs CRT beam painting of symbols within imaginary 8 by 8 (small), 16 by 16 (medium) or 32 by 32 (large) symbol matrixes by supplying the analog push-pull X/Y symbol voltage.

21. The Power Control Panel is located above (above/below) the deflection/CRT power supply.

22. From the front, the D/A chassis is located on the right (right/left) side of the display station.

23. Blower B2 is used to cool the deflection amplifier.

24. When facing the front of the display console, the High-voltage Power Supply is on the left (left/right) side of the CRT.

25. Blower B 1 is used to cool the D/A chassis.

The answers for learning activity 2-B are on the following page.

ANSWERS FOR LEARNING ACTIVITY 2-B

1. Power and Control, Monitor, Workshelf
2. Left, Right, and Both (also called Maintenance mode)
3. Workshelf
4. Power and Control
5. High Voltage Supply, CRT, Deflection Amplifier, Feedback Amplifiers
6. Unblank, Symbol Deflection, Position Deflection
7. D/A logic
8. +20 kilovolts adjusted to +18 kilovolts
9. D/A logic
10. 60 hertz and 400 hertz power
11. deflection amplifier high-temperature thermostat, D/A chassis
12. 15, CRT
13. Display Station Controller
14. $\pm$20
15. deflection/CRT
16. high voltage, 15
17. 512
18. 21, 8, 12
19. upper, left
20. 16, 32, 32
21. above
22. Right

23. Deflection

24. Left

25. 1

LEARNING ACTIVITY 2-C. REFERENCE READING: OPERATION AND PROGRAMMING

This activity provides operational and programming information necessary for the effective use of the CC545.

OBJECTIVES

- You will be able to list the CC545 controls and indicators and describe the function of each.
- You will be able to describe the beam positioning and symbol painting operation of the CC545.

Read, in the CYBER 170 Display Station manual (publication number GF62952600), section 2, Operation and Programming, on microfiche number 124, coordinates E2 through E12. Go to microfiche number 126, coordinate C11, and read the paragraph under Maintenance Mode.

STUDENT NOTES

LEARNING ACTIVITY 2-D. EXERCISE: OPERATION AND PROGRAMMING REVIEW

This activity reinforces what you learned in learning activity 2-C.

OBJECTIVES

- You will be able to list the CC545 controls and indicators and describe the function of each.
- You will be able to describe the beam positioning and symbol painting operation of the CC545.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The intensity control adjusts overall brightness while the focus control adjusts display clarity.
2. The DEAD START push button on the CC545 is one of the maintenance controls.
3. When the H key is pressed, an octal code of 10 is sent to the DSC.
4. An octal code of 55 is produced when the 1 key in the top row is pressed.
5. Simultaneous depression of more than one key results in a logical OR combination of the individual key codes.
6. The Light Temp indicator lights when the deflection amplifier has a internal temperature of 190°F or greater.
7. The Thermostat Bypass switch can be used to override the deflection amplifier high-temperature thermostat.
8. Circuit Breaker CB2 controls application of 60 hertz to the CC545.
9. The Ready indicator on the power control panel lights to indicate the high-voltage supply and the CC545 is ready for display.
10. On the ±20 volt power supply, test point TP2 can be used to monitor the +20 volts and R 1 can be used to adjust the 20 volts.

11. CB1, on the _____, enables application of 400 hertz from the _____ to the deflection/CRT power supply.

12. The X coordinate data word, in Maintenance mode, is described as a 10-bit word because it includes the 9-bit position address and the _____ signal.

13. To paint a symbol, the DSC supplies the Symbol Analog signals and the _____ signals.

14. The display refresh rate should be 50 hertz.

15. Maintenance mode is selected when the PRESENTATION CONTROL switch is in the _____ position so the operator's view left _____ (and/or) right presentation(s) _____ (simulataneously/singularly).

The answers to learning activity 2-D are on the following page.

ANSWERS TO LEARNING ACTIVITY 2-D

1. Intensity, focus
2. Monitor
3. 10
4. right most or 13th
5. OR
6. HIGH TEMP
7. THERMOSTAT BY-PASS
8. 2
9. READY, Power Control Panel
10. 2.1
11. deflection/CRT power supply, Power Control Panel
12. 10, Screen Select
13. Unblank
14. 50
15. middle, and, simultaneously

LEARNING ACTIVITY 2-E. TEXT READING: THEORY OF OPERATION

This activity describes the theory of the CC545 logic areas.

OBJECTIVE

- You will be able to list the major functional areas of the CC545 system block diagram and describe the function of each.

Before you begin this text reading, turn to page 1-10 in this manual. Study Figure 1-6 the DSC/CC545 Interface Diagram and read the description of each interface signal.

The interface signals are physically sent between the DSC and the CC545 on two cables. The "A" cable and the "B" cable. The "A" cable carries the nine bit X coordinate (beam position) address and the nine bit Y coordinate address from the DSC to the CC545. The "B" cable carries the Screen Select signal, the four X and Y Symbol Analog signals, the two Character Size signals, and the two Unblank Left/Right Screen signals from the DSC to the CC545. The "B" cable also carries the six bit Keyboard Code, the Key Up, and the Key Down signal from the CC545 to the DSC. The signal from the console Dead Start pushbutton also travels on the "B" cable to the computer dead start circuits.

The purpose of the CC545 display console is to display dots and characters received from the DSC and to send a binary code representing the depressed keyboard key to the DSC.

To display a dot or character the electron beam must be positioned to the desired spot on the face of the CRT. This is done with the nine bit X (horizontal) and nine bit Y (vertical) signals from the DSC. The display console converts this digital information into a analog voltage that is applied to the deflection coils (yokes). The deflection yokes create a magnetic field that deflects the electron beam to one of the 512 by 512 positions on the face of the CRT.

Figure 2-4 is the System Block Diagram that illustrates how the logic of the CC545 is organized.

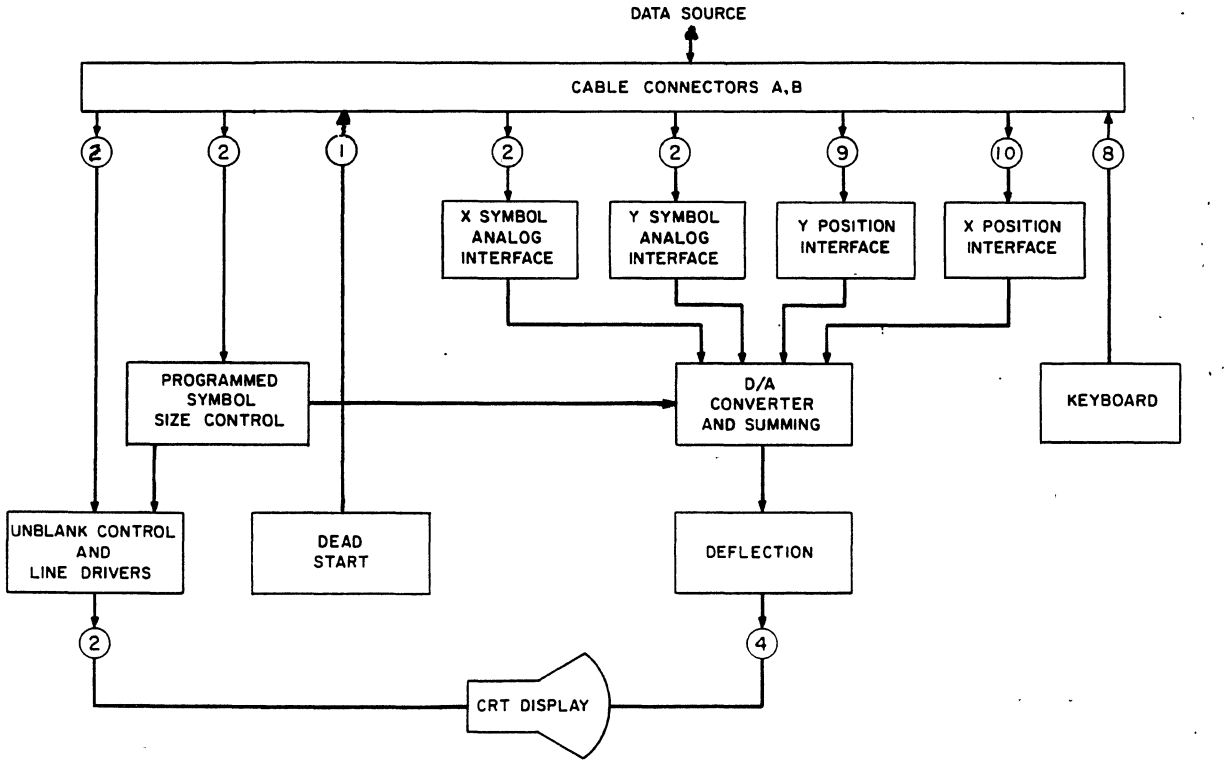


Figure 2-4 System Block Diagram

All interface signals between the DSC (data source) and the CC545 pass through the A and B Cable Connector block on the System Block Diagram.

The nine bit Y coordinate address is received in the block labeled Y Position Interface. The circle with a 9 in it indicates the number of bits. The Y position address is applied to the block labeled D/A Converter and Summing. This block contains a separate digital to analog converter network that generates a analog voltage for the Y deflection. The Y analog signal goes through a Y amplifier in the block labeled Deflection to the Y deflection yoke on the CRT. This positions the beam vertically.

The nine bit X coordinate address and Screen Select signal is received in the block labeled X Position Interface. From the X position interface receivers the X position address follows the same path, in the System Block Diagram, as the Y position address to the CRT. The X signals pass through their own X D/A converter circuits and X deflection amplifier circuits to the X deflection yoke on the CRT. This positions the beam horizontally.

The Screen Selection signal is only used when the presentation switch is in the both position (left and right both displayed on the CRT). The Screen Select signal controls the amount of X analog voltage that is developed by the D/A converter. When both left and right are being displayed the horizontal width of each is smaller than when either is displayed alone.

Once the electron beam is positioned to the desired X/Y coordinate the symbol analog signal paints the character. The symbol analog voltage is generated in the DSC. The two Y Analog Symbol signals are received in the block labeled Y Symbol Analog Interface. The two Y signals (up/down) are an example of the push-pull deflection used by the CC545 circuits. Greater up voltage and the beam moves up, greater down voltage and the beam moves down, equal up and down voltage and the beam remains stationary. The two X analog symbol signals are received in the block labeled X Symbol Analog Interface.

The X and Y symbol analog signals each go through their own amplifier circuits in the block labeled D/A Converter and Summing. The amount of symbol analog voltage is controlled by the input from the Programmed Symbol Size Control block. The two signals from the DSC into this block are the Medium and Small Character size signals. Absence of the medium or small signals indicates large size characters.

The X and Y symbol analog signals from the D/A Converter and Summing block go through individual deflection amplifier circuits to the symbol deflection yokes on the CRT.

Their are four deflection yokes on the CRT. One for the X position deflection, one for the Y position deflection, one for the X symbol analog, and one for the Y symbol analog. This is indicated by the circle with a 4 in it on the System Block Diagram.

The Unblank Left/Right Screen signals are received in the block labeled Unblank Control and Line Drivers. The Programmed Symbol Size Control block controls the amplitude of the unblank signal. This is determined by the size of the character to be displayed. The Unblank signal goes to the CRT to turn the electron beam on or off.

The block labeled Keyboard represents the six bit Key Code and Key Up/Key Down signals that are generated and sent to the DSC from the CC545.

The block labeled Dead Start represents the Dead Start pushbutton located on the CC545. The Dead Start signal is sent to the computer dead start circuits.

This activity has used the System Block Diagram to describe the theory of the logic areas of the CC545. You have now completed learning activity 2-E.

LEARNING ACTIVITY 2-F. EXERCISE: THEORY OF OPERATION REVIEW

This activity reinforces what you learned in learning activity 2-E.

OBJECTIVE

- You will be able to list the major functional areas of the CC545 system block diagram and describe the function of each.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. Cable A carries the X and Y _____ signals to the display console.
2. Cable B carries one screen select signal, X and Y Symbol Analog signals, two Symbol _____ signals, and the unblank signals _____ (to/from) the display console.
3. The eight keyboard signals and the Dead Start signal are carried _____ (to/from) the display console on the _____ cable.
4. The 10 bits to the X position interface block includes the nine bits of X position and the _____ bit, which is used only in Maintenance mode.
5. The D/A converter and summing block uses all signals from the Controller except the unblank signals.
6. The amplitude of the Unblank signal is greater when large (small/medium/large) size symbols are painted.
7. The keyboard interface lines consist of 6 lines which encode the symbol of the key that is depressed and two control lines labeled key up and key down.
8. The magnetic fields produced by the symbol yokes modify the fields produced by the position yokes to paint symbols.
9. The X and Y position addresses go to separate (separate/combined) digital to analog converter circuits in the D/A Converter and Summing block.
10. The analog signals generated by the DSC are received in the X and Y summing amplifier blocks in the block diagram.

CYBER 170 Display Subsystem
Learning Activity 2-F

ANSWERS TO LEARNING ACTIVITY 2-F.

1. X and Y Deflection
2. four, size, to
3. from, B
4. Screen Select
5. Unblank
6. large
7. 6, Key Up, Key Down
8. Position
9. Separate
10. X and Y Symbol Analog Interface

LEARNING ACTIVITY 2-G. TEXT READING: INTERCONNECTION DIAGRAMS

This activity introduces the interconnection diagrams in the CC545 manual.

OBJECTIVE

- You will be able to trace the signal flow through the diagrams of the CC545.

Place microfiche number 125, from the CYBER 170 Display Station manual (publication number GF62952600) in your microfiche reader. Go to grid coordinate B1 and read the introduction to section 5, Diagrams.

Go to grid coordinate B3/B4. This diagram is titled, at the bottom right, Cabling Diagram Display Station 60 Hz. It shows the cables, jacks, and plugs used to interconnect the assemblies of the CC545. Notice at the bottom right the illustration of the CRT V1, part number 51601007. There are four lines into the base, right side, of the CRT. The second line from the top can be traced back, labeled 0V-700V, to the deflection/CRT power supply at the top right of this diagram. The line is labeled W7P1 (cable 7 plug 1) as it is tied through the focus control potentiometer as 700 volts common to J5 (jack 5) of the deflection/CRT power supply. This is just one example, as all cables, jacks, and plugs can be followed on this cabling diagram to identify how the assemblies of the CC545 are interconnected.

Go to coordinate B5/B6. This diagram is titled at the bottom right Schematic Diagram, Station Console, Power 60 Hz. This diagram shows in detail the power connections between the assemblies of the CC545. Once again, follow how the focus potential is applied to the CRT. At the bottom of the diagram, and to the right of center, is an illustration of the CRT. The connecting pins on the base of the CRT are labeled. Follow pin number 6 back up the page and you will see it goes through the focus control. The pins on the control are also labeled, 1 common, 2 wiper, and 3 +700 volts dc. The focus control can be followed back through W7P1, pins A and B, J5 to the deflection/CRT Power Supply.

All other power connections between the assemblies of the CC545 can be identified using this schematic diagram.

Go to coordinate B7/B8. This cabling diagram is similar to the one at coordinate B3/B4, except it is for a 50 hertz display console.

Go to coordinate B9/B10. This schematic diagram is similar to the one at coordinate B5/B6, except it is for a 50 hertz display console.

This activity has introduced you to the CC545 interconnection diagrams.

You have now completed learning activity 2-G.

LEARNING ACTIVITY 2-H. EXERCISE: INTERCONNECTION DIAGRAMS REVIEW

This activity reinforces what you learned in learning activity 2-G.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The keyboard data travels between the D/A chassis and the Keyboard on cable W 12 P2.
2. The OAGD Preamplifiers for X and Y position are connected to J 7 of the +20 volt power supply by Cable W 3 P 1.
3. The 400 hertz comes into the CC545 at connector panel TB 1.
4. The Safety Ground is tied to TB2 pin 3 on the connector panel.
5. The deflection/CRT power supplies provide 4120 volts to pin 10 of the CRT.
6. The 400 hertz from the connector panel goes through the A1P7 to the deflection/CRT power supply.
7. The DEADMAN switch is connected to the D/A chassis by cable W9.
8. 61369500 is the part number for the deflection/CRT power supply.

ANSWERS TO LEARNING ACTIVITY 2-H

1. 12P2
2. 2, W3P1
3. 1
4. 3
5. +420
6. power control panel assembly
7. DEAD START
8. deflection/CRT

LEARNING ACTIVITY 2-I. TEXT READING: LOGIC DIAGRAMS INTRODUCTION

This activity introduces you to the logic diagrams in the CC545 manual.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Place microfiche number 125, from the CYBER 170 Display Station manual (publication number GF62952600), in your microfiche reader. Go to grid coordinate D3/D4, tilted X Deflection, Symbol Deflection, and Symbol Size Logic. Now go to grid coordinate D5/D6 titled, Y Deflection, Keyboard, and Unblank. These two diagrams show the logic circuits of the CC545. Go back to grid coordinate D3/D4. The System Block Diagram (Figure 2-4) described in Learning Activity 2-E will be used for reference during this Learning Activity.

Along the left side of the diagram, the signals are labeled Cable A or B, designating the cable from the DSC. The pin in the cable is also specified. For example, at the bottom left of the diagram the Screen Select signal comes in on pin W of the B Cable. Directly above, X position coordinate 2^0 comes in on pin A of the A Cable. This area is represented by the Cable Connector blocks in the Figure 2-4 block diagram. The Screen Select and $X2^0$ through 2^8 signals are received by 619 type of logic cards. The 619 cards for $X2^0$ through 2^2 are labeled 619C, 619B, and 619A. Directly below each card is the card location, row and slot in the D/A chassis. The 619 card at location A09 (row A slot 9) has three logical sections. Section A receives $X2^2$, section B receives $X2^1$, and section C receives $X2^0$. This area is represented by the X Position Interface block in the Figure 2-4 block diagram.

If you want more information on the 619 card, or any type of logic card, refer to section 7, Maintenance Aids. For example, put microfiche number 127 in your microfiche reader and go to grid coordinate F6. (Use the Quick Index for the fiche/grid of any type card you want more information on.) At grid coordinate F5/F6 is the Schematic Diagram for the 619 logic card. Notice the three sections. Go to grid coordinate E5/E6 and read the theory of operation for the 619 card. Theory information is located at the grid coordinate above the schematic diagram of each card type. Go back to microfiche number 125, grid coordinate D3/D4.

Beside each 619 card is a triangle with a one in it that refers to the note in the upper right corner of the diagram.

The output of the 619 cards go to the 002C-5ADD-5AED resistor selection switch cards. The switch cards, the 4AKD power supply card (that supplies the reference voltage to the 002C cards), the two 4DMD resistor network cards, and the two 4DND summing amplifier cards generate the X position push-pull analog voltage from the digital position address sent by the DSC. The summing amplifiers supply the voltage to the OAGD Feedback Amplifier. These circuits are represented by the D/A Converter and Summing block in the figure 2-4 block diagram.

The output of the OAGD Feedback Amplifier goes to the X Deflection Amplifier portion of the Deflection Amplifier. The Deflection Amplifier is represented by the block labeled Deflection in the Figure 2-4 block diagram.

The output of the X position portion of the Deflection Amplifier goes to the X position yoke assembly on the CRT.

The OAGD Feedback Amplifier card has two potentiometers, level and gain, that must be adjusted for proper display area size and quality.

Refer to figure 2-3 and locate the Feedback Amplifier cards and the Deflection Amplifier. Notice they are not located in the logic chassis.

The Screen Select signal goes through its 619 card, 002C card, to the relay switch 4DLD card. The signal is only used in Maintenance mode. The PRESENTATION CONTROL switch sends a +20 volt signal to the pin 8 input of the 4DMD summing amplifier location A16 to change the gain of the amplifier. The signal from the presentation switch is also passed out pin 9 to pin 8 of the other 4DND amplifier at location A13 to change the gain of that amplifier. The signal from the presentation switch goes out pin 9 to the 4DLD relay switch to enable the Screen Select signal to pin 11 of the two 4DMD resistor network cards. The reason for this is to change the amount of X deflection analog voltage generated in Maintenance (both) mode so a 12 by 8 raster area can be displayed. Notice the output wave shapes for the OAGD amplifier shown at the bottom right of the diagram.

In the upper left corner of the diagram the Medium and Small symbol size signals enter through a pair of 619 logic circuits at location A07. The signals go to a decoder network of 1222RS circuits, at the top center of the diagram. This area is represented by the Programmed Symbol Size Control in the Figure 4-2 block diagram.

The decoders send small, medium, and large (absence of small or medium) signals to the other diagram page and down the center of this diagram to control the X and Y Symbol Deflection Circuits.

The X and Y symbol analog signals from the DSC enter the diagram in the upper left corner labeled Left, Right, Up, and Down. The signals go across to the center of the diagram through 620 logic cards. This area is represented by the X and Y Symbol Analog Interface in the Figure 4-2 Block Diagram. The symbol analog signals then go to a 5AHD-0 amplifier card for X symbol deflection and to a 4ALD amplifier card for Y symbol deflection with the size controlled by 016-D logic cards. There are potentiometers on these cards that must be adjusted for proper symbol size. The relay switch 4DLD card (C12), located above the X symbol Deflection Amplifier, is controlled by the presentation switch to change the gain of the amplifier. The amplified X and Y analog symbol deflection signals go through their amplifier circuits in the Deflection Amplifier to the X and Y symbol yokes on the CRT.

Go to grid coordinate D5/D6. The lower left side of the diagram and across the bottom of the diagram are the logic circuits that generate the Y analog position voltage and send it to the Y deflection yoke on the CRT. Notice it is very similar to the X deflection circuits, but some of the card types are different. Refer to Section 7 Maintenance Aids if a detailed description of each card type is desired.

The DEAD START switch is shown in the upper left corner of the diagram.

Directly below the DEAD START switch the Large, Medium, and Small signals enter from the previous diagram.

The other signals that enter the diagram in the upper left corner are the Unblank Right and Unblank Left from the DSC. The Unblank signals go to the center of the diagram where they are received by 4AMD delay cards at location C22 and C23. These circuits are represented by the Unblank Control and Line Drivers block in the Figure 2-4 block diagram. The cards at locations C22 and C23 have adjustable tapped delay lines.

The PRESENTATION CONTROL switch is also shown in the center of the logic diagram. Below is the 4DLD relay switch card at location C12. Parts of this 4DLD card were also shown on the previous

diagram. The proper Unblank signal is enabled through the 4AMD cards to the 207 card at location C24. The Small, Medium, or Large signals, through the 4APO-1 and 4AND cards, control the amplitude of the Unblank signal. There are three potentiometers on the 4APO-1 card that are used to control the Unblank intensity for small, medium, and large size characters. R4 is the operator intensity control. There is also a potentiometer on the 207 card that is used to adjust the unblank signal.

The Unblank signal then goes through a 0KGD arc-over protect circuit to the CRT.

The keyboard logic cards, in the upper right corner of the diagram, generate the 6-bit alphanumeric code and Key Up/Key Down signals out the B Cable to the DSC. The 4AJD card at location A03 has a potentiometer that is used for the keydown repeat adjustment. If a key is held depressed, the Key Down signal can be adjusted to repeat every one to three seconds. You will perform this and the other adjustments during the laboratory portion of this course.

This activity has introduced you to the CC545 logic diagrams.

You have now completed learning activity 2-I.

LEARNING ACTIVITY 2-J. REFERENCE READING: LOGIC DIAGRAMS DESCRIPTION

This activity decribes the logic diagrams in the CC545 manual.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Place microfiche number 125, from the CYBER 170 Display Station manual (publication number GF62952600), in your microfiche reader.

Read the paragraphs under X Deflection, Symbol Deflection, and Symbol Size Logic at coordinate C3/C4 while studying the diagram at coordinate D3/D4.

Read the paragraphs under Y Deflection, Keyboard, and Unblank at coordinate C5/C6 while studying the diagram at coordinate D5/D6.

Read section 4, Theory of Operation on microfiche number 124, coordinates G2 through G7, while studying the logic diagrams on microfiche 125, coordinates D3/D4 and D5/D6.

Remember additional information on specific types of logic cards is contained in Section 7, Maintenance Aids, on microfiche numbers 127 and 128.

STUDENT NOTES

LEARNING ACTIVITY 2-K. EXERCISE: LOGIC DIAGRAM REVIEW

This activity reinforces what you learned in learning activities 2-I and 2-J.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Direction: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. The 619 logic card at chassis location A11 receives the X 26 through 8 bits from the DSC.
2. The Medium symbol signal enters the display console on pin N of the 12 (A/B) Cable.
3. The 4ALD type of logic card is at location C07.
4. Pin 5 of the 4DMD card ties to a 72.5K ohm resistor.
5. The output of the + or - X Summary Amplifier varies from 0 volts to -2 volts.
6. The +5 reference voltage is supplied to the 002C cards by the 4AMD type card at location C14.
7. The +Y positioning summing amplifier card is at location B16.
8. A 5P.1D card may be used interchangeably with a 619 card.
9. The resistor selection switch cards used in the D/A converter for the X position address are types 002C, 5ADD, and CAED.
10. The resistor selection switch card used in the D/A converter for the Y position address is type 002C.
11. The analog output signals are input to the 620 cards.
12. The Large symbol signal is generated when the Small and Medium signals are coincident.

13. The Y Symbol Deflection Amplifier is a 4ALD type of card that applies the signal to the Deflection Amplifier.

14. The 4APD card modulates the symbol [illegible] according to the size selected.

15. The 4AJD card develops the [illegible] signals to the DSC.

16. The card at location 4ABD sends the Keyboard data out the B (A/B) cable.

17. The [illegible] switch in the [illegible] position causes the relays on the 4DLD card to energize.

18. The [illegible] signal passes through the OKGD (arc-over protect circuit) to the CRT.

19. The output of the Y position Deflection Amplifier goes to the [illegible].

20. The unblank pulse to the control grid on the CRT can vary from -15 to +18 volts.

21. Refer to figure 4-2 in the CC545 Manual. The switches shown in the Resistor Selection are actually logic gates on a OODC type of logic card.

22. Refer to figure 4-2 in the CC545 Manual. The Resistor Network is on 027 or 4DAAD type of logic cards.

23. The value of the resistor for bit $X2^2$ is 6.30 K ohms.

24. Figure 4-2, in the CC545 Manual, illustrates the D to A connector network for the X (X/Y) position address that generates the push-pull deflection.

25. The 4DND type of logic cards are used for the summing amplifiers.

26. Both Summary Amplifiers output -1 volts to the Feedback Amplifier when the beam is centered.

27. The Feedback Amplifier is a OAGD type of card.

28. The output of the Feedback Amplifier goes to the Deflection Amplifier, which provides push-pull outputs for the deflection coils (yokes) on the CRT.

29. The Symbol Analog signal from the DSC goes through a 620 type of logic card then to the Summing Amplifier drivers (4ALD and 5AHD-0 type of cards).

30. If a key is depressed continuously, the Key Up/Key Down signal will [illegible].

CYBER 170 Display Subsystem
Learning Activity 2-K

ANSWERS TO LEARNING ACTIVITY 2-K

1. $X26$, $X28$
2. N, B
3. C07
4. 77.5 K
5. -2
6. 4AKD, C14
7. B16
8. 8BMD
9. 5ADD, 5AED
10. 002C
11. Analog Symbol
12. absent
13. 4ALD, Deflection
14. intensity
15. Key Down/Key Up
16. A02, B
17. presentation, middle (Maintenance)
18. Unblank
19. Deflection Yoke on CRT
20. -15, +18
21. 002
22. 4DMD
23. 630

24. D to A, X

25. Summing

26. -1

27. OAGD

28. Deflection

29. 620, Symbol Deflection

30. Toggle

LEARNING ACTIVITY 2-L. REFERENCE READING: SCHEMATIC DIAGRAM DESCRIPTIONS

This activity describes the schematic diagrams in the CC545 manual.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Place microfiche number 125 from the CYBER 170 Display Station manual (publication number GF62952600), in your microfiche reader.

Go to coordinate C7/C8 and read the paragraphs under Deflection Amplifier while studying the diagram at coordinate D7/D8.

Go to coordinate C9/C10 and read the paragraphs under Deflection Amplifier while studying the diagram at coordinate D9/D10.

Go to coordinate C11/C12 and read the paragraphs under Power Control Panel while studying the diagram at coordinate D11/D12.

Go to coordinate E1/E2 and read the paragraph under Deflection/CRT Power Supply while studying the diagrams at coordinate F1/F2 and G1/G2.

Go to coordinate E3/E4 and read the paragraphs under Deflection/CRT Power Supply while studying the diagrams at coordinate F3/F4 and G3/G4.

Go to coordinate E5/E6 and read the paragraphs under 20 kilovolt Power Supply while studying the diagram at coordinate F5/F6.

Go to coordinate E7/E8 and read the paragraphs under Keyboard Switches and Diode Encoder while studying the diagram at coordinate F10.

Go to coordinate E11/E12 and read the paragraph under +20 volt and -20 volt Power Supply while studying the diagram at coordinate F11/F12.

STUDENT NOTES

LEARNING ACTIVITY 2-M. EXERCISE: SCHEMATIC DIAGRAM DESCRIPTION REVIEW

This activity reinforces what you learned in learning activity 2-L.

OBJECTIVE

- You will be able to trace signal flow through the diagrams of the CC545.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true.

1. Within the Deflection Amplifier there are 64 high temperature thermostats that open when the temperature rises above 170 °F.

2. The X-Symbol Out signal leaves the Deflection Amplifier on TB1 pin number 5.

3. The +X and -X symbol input to the Deflection Amplifier both equal 6 volts when the electron beam is centered in the matrix.

4. In the Power Control Panel, 400 hertz is sent to the 20-volt supply immediately after relay K4 energizes.

5. The contacts of relay K2 provide a hold path for K6 in the Power Control Panel.

6. The POWER OFF switch causes relay K1 to energize in the Power Control Panel.

7. When a high-temperature thermostat in the deflection Amplifier opens, relay K7 in the power control panel de-energizes (energizes/de-energizes), this removes +20 volts from the [illegible] supply and turns on the [illegible] indicator.

8. After line power is applied to the filaments of relay K3 the contacts open (open/close) after 15 seconds.

9. Thermal relays K1 and K2, in the deflection/CRT power supply, delay the +20, 420, and 700 -volt outputs for 15 seconds during power on.

10. The +6.3 volts, from the deflection/CRT power supply, is applied to the CRT filament.

11. The deflection/CRT power supply provides +40 -volts for the X position yoke.

12. The 20 kilovolt power supply provides 18K -volt output for the CRT post accelerator anode from a 20 volt input.

13. Pressing an alphanumeric keyboard key, applies ground to its associated diodes.

14. The 6 -bit key code is applied to the logic cards in the D/A chassis.

15. The +20 volt and -20 volt power supplies are (are/are not) adjustable.

The answers for learning activity 2-M are on the following page.

ANSWERS TO LEARNING ACTIVITY 2-K

1. four, 190°
2. 5
3. 6
4. K4
5. K2
6. K1
7. Deflection, de-energized, high-voltage, HIGH TEMPERATURE
8. open, 15
9. +420, +700
10. CRT filament
11. +40
12. +18K, +20
13. ground
14. 6, D/A
15. are

POST TEST

When you have completed the learning activities assigned for module 2, sign onto the PLATO terminal and take the module 2 test.

You may use your student manual and your reference manuals during the test. Be sure to take them with you to the PLATO terminal.

Depending on the results of the test, you will be told either to review some of the activities in the module or to go on the module 3.

Module 3
CYBER 170 Display Console
CC545 C, D, E, and F to CC545 G/H Differences

This module covers the differences between the CC545 C, D, E, and F and the CC545 G/H models. Material covered includes: General Description, Operation and Programming, Theory of Operation, Interconnection Diagrams, Structured-Analysis-Method Troubleshooting (SAM) and Maintenance Procedures for the CC545 G/H. A large portion of the reference material for the CC545 G/H duplicates the reference material for the CC545 C, D, E, and F which was used in module 2. In order to maintain continuity, a review of the previous material is necessary in exploring the differences between the two model groups.

The major product differences are as follows: a) Approximately 60 logic modules, located in three rows of modules in the CC545 C, D, E, and F, have been reduced to three PC boards in the CC545 G/H, b) The +20 Volt Power Supply in the CC545 C, D, E, and F has been replaced by a Logic Power Supply which provides additional voltages in the CC545 G/H, c) The High Voltage Power Supplies are slightly different, d) The display adjustments vary because of changes in modules, but the procedure for making adjustments remain similar, and e) The Deflection Amplifiers are changed slightly in that the CC545 G/H has an amplifier stage removed from the Deflection Amplifier board and placed on the Digital to Analog board.

PRETEST

To start this module sign on to the PLATO terminal and read the objectives. If you feel you are able to satisfy one or more of these objectives, take the module test. After evaluating the results of the test, PLM will assign the learning activities you should study next. If, however, you do not wish to take the test first, ask for an assignment.

CYBER 170 Display Subsystem
Module 3

LEARNING ACTIVITIES

In the Assigned column below, place a checkmark by each activity assigned to you by PLM. Then proceed through your assigned activities. Put a check in the Completed column as you complete each assigned activity. You may choose to do all of the activities or do some activities more than once.

Assigned	Completed	Activity	Description	Page
____	____	3-A	Text Reading: CC545 General Description - Major Differences. This activity describes the major differences between the CC545 C, D, E, and F and the CC545 G/H.	3-5
____	____	3-B	Reference Reading: CC545 G/H General Description. This activity describes the general characteristics of the CC545 G/H.	3-9
____	____	3-C	Exercise: CC545 General Description Review. This activity reinforces what you learned in learning activities 3-A and 3-B.	3-12
____	____	3-D	Reference Reading: CC545 G/H Operation and Programming. This activity describes the differences between the Operation and Programming the CC545 G/H and those for the CC545 C, D, E, and F.	3-15
____	____	3-E	Exercise: CC545 G/H Operation and Programming Review. This activity reinforces what you learned in learning activity 3-D.	3-16
____	____	3-F	Text Reading: CC545 G/H Theory of Operation. This activity describes the display control circuits used in the CC545 G/H.	3-19

LEARNING ACTIVITY 3-A. TEXT READING: CC545 GENERAL DESCRIPTION - MAJOR DIFFERENCES

This activity describes the major differences between the CC545 C, D, E, and F covered in module 2 and the CC545 G/H.

OBJECTIVE

- You will be able to identify the major functional differences between the CC545 G/H and the CC545 C, D, E, and F.

The CC545 G/H models differ from the CC545 C, D, E, and F models in the following areas: a) the digital to analog logic, b) high voltage power supplies, c) logic power supplies, d) display adjustments, and e) slight changes to the deflection amplifiers

There are approximately 60 logic modules mounted in three rows in CC545 C, D, E, and F models that have been reduced to three PC boards using integrated circuits in CC545 G/H. The "Level of Repair" for the PC boards is to the board assembly.

The High Voltage Power Supply (part number 51918275) in CC545 G/H differs in that it is maintained only to replacement of the entire assembly, rather than to the component replacement as in the High Voltage Power Supply used in the CC545 C, D, E, and F models. The new HV Power Supply is interchangeable with the old HV Power Supply, which is no longer manufactured.

The Logic Power Supply used in CC545 G/H supplies +5, +15, +20, -18.5, and +30 volts compared to only +20 volts from the +20 volt power supply used in CC545 C, D, E, and F. Both types of power supplies are maintained to component replacement of boards, transistors, semiconductors, and so forth.

The display adjustments are similar for both model groups, but logic changes have resulted in different modules, test points, and adjustment potentiometers.

It should be noted that the deflection amplifiers are slightly different in the CC545 G/H, although they are functionally equivalent to those for the CC545 C, D, E, and F models. One stage of amplification has been removed from the Deflection amplifier and placed on the Digital to Analog boards.

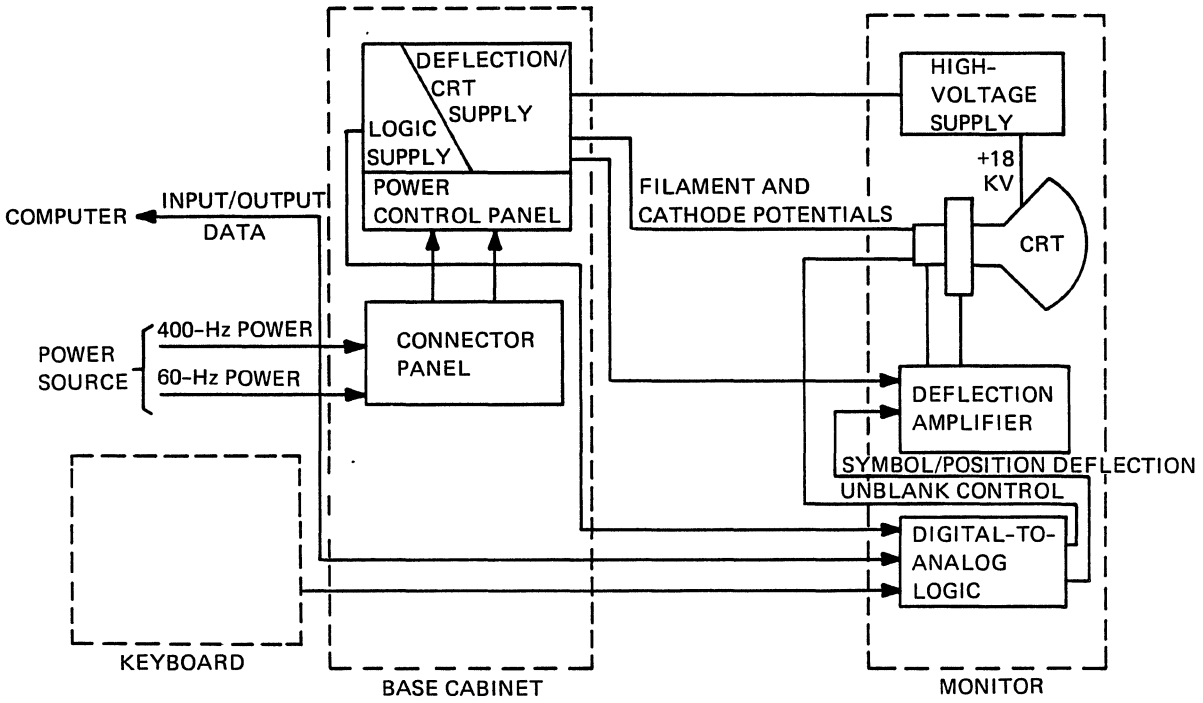


Figure 3-1. CC545 G/H Display Station Block Diagram

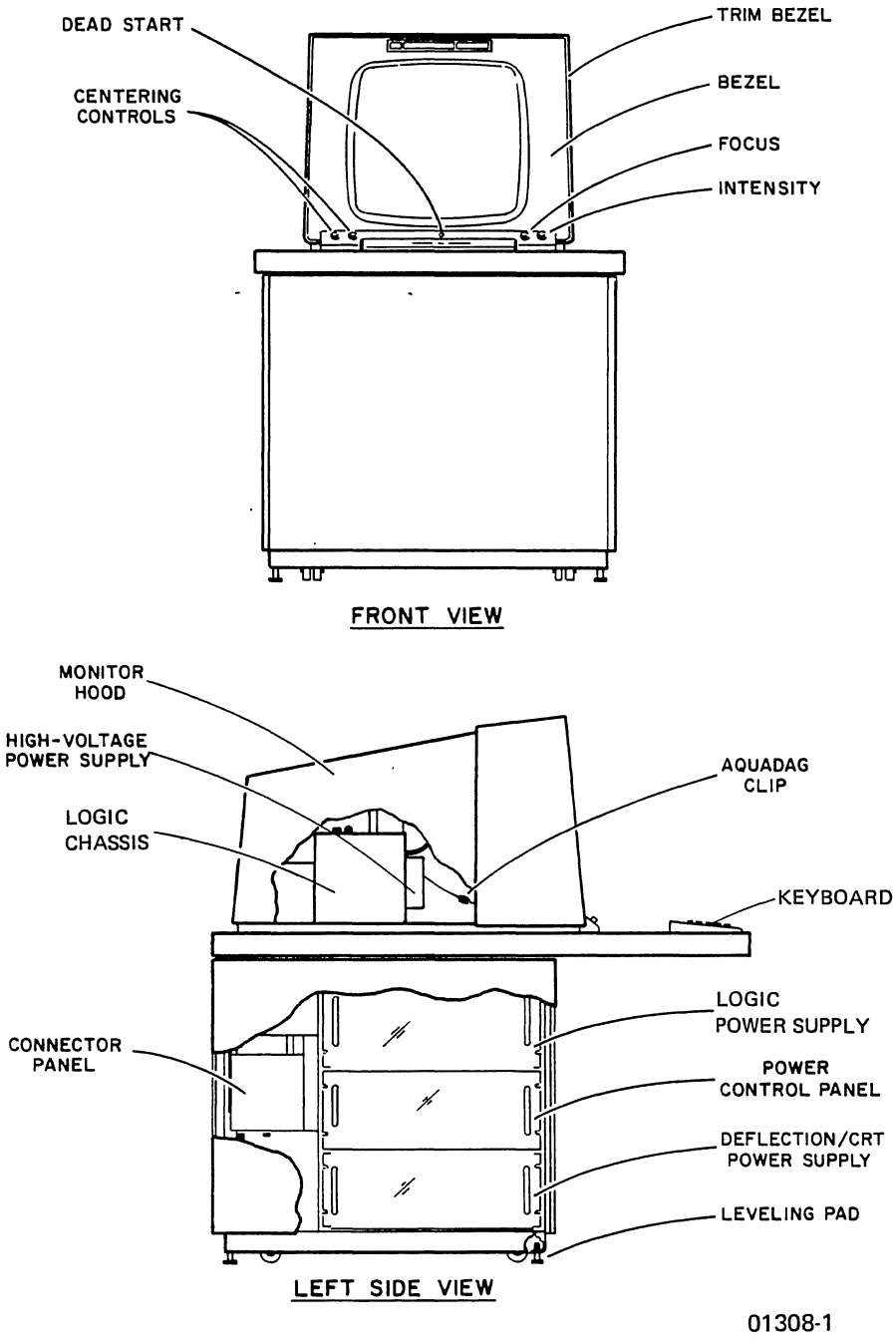


Figure 3-2. CC545 G/H Display Station Front and Left Side Views

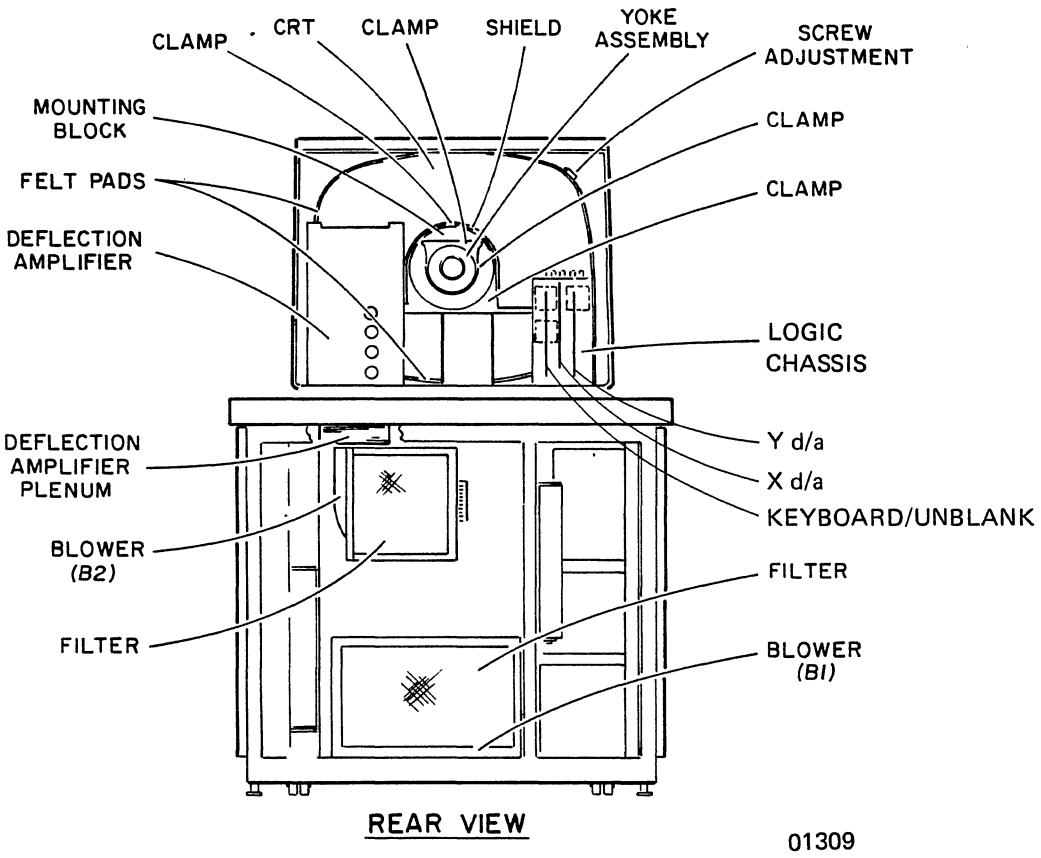


Figure 3-3. CC545 G/H Display Station Rear View

LEARNING ACTIVITY 3-B. REFERENCE READING: CC545 G/H GENERAL DESCRIPTION

This activity describes the general characteristics of the CYBER 170 Display Station, models G and H.

You will find that the General Description material provided in the CC545 G/H Hardware Reference Manual is very similar to the same material covered in the Hardware Reference Manual for the CC545 C, D, E, and F. Particular attention should be given to the D/A Logic, Logic power Supply and the High Voltage Power Supply.

OBJECTIVE

- You will be able to identify the major functional differences between the CC545 G/H and the CC545 C, D, E, and F.

Read section 1, General Description, CYBER 170 Display Station, CC545 G/H, Hardware Reference/CE Manual, publication number 62940018. A large portion of this section duplicates material covered in module 2 for CC545 C, D, E, and F.

The following paragraphs will define figures of diagrams or pictorials to be compared in the Hardware Reference/CE Manuals for both the CC545 G/H and CC545 C, D, E, and F.

A copy of some of these figures for the CC545 G/H is included in this section for your own notes, identification of parts, and so forth.

Compare the following figures:

- Compare the Functional Block Diagram for the CC545 G/H, figure 1-2, publication number 62940018, (also included as figure 3-1 of this manual) with the Functional Block Diagram for the CC545 C/D, E and F, figure 1-3, publication number GF62952600. Note the relocation of the D/A Logic in the CC545 G/H.

- Compare the CC545 G/H front, side and rear views, figures 6-1 and 6-2, publication number 62940018 (also shown included as figures 3-2 and 3-3 of this manual) with those for the CC545 C, D, E, and F, figures 3-2 and 3-3, publication number GF62952600. Note the Logic Chassis, X d/a, Y d/a and Unblank/Keyboard, Logic Power Supply and High Voltage Power Supply locations in the CC545 G/H.

- Compare the Logic Power Supply for the CC545 G/H, figure 2-4, publication number 62940018 (also included as figure 3-4 of this manual), with the +20 Volt Power Supply for the CC545 C, D, E, and F, figure 6-10, publication number GF62952600. Note the additional voltages provided in the Logic Power Supply for the CC545 G/H.

- Compare the High Voltage Power Supply, part number 51918275, used in the CC545 G/H shown as figure 6-10, publication number 62940018 (also included as figure 3-5 of this manual) with the High Voltage Power Supply, part number 61369600, used in the CC545 C, D, E, and F, shown as figure 6-11, publication number GF62952600. Note the size and shape of the different power supplies as well as the difference in adjustment positions.

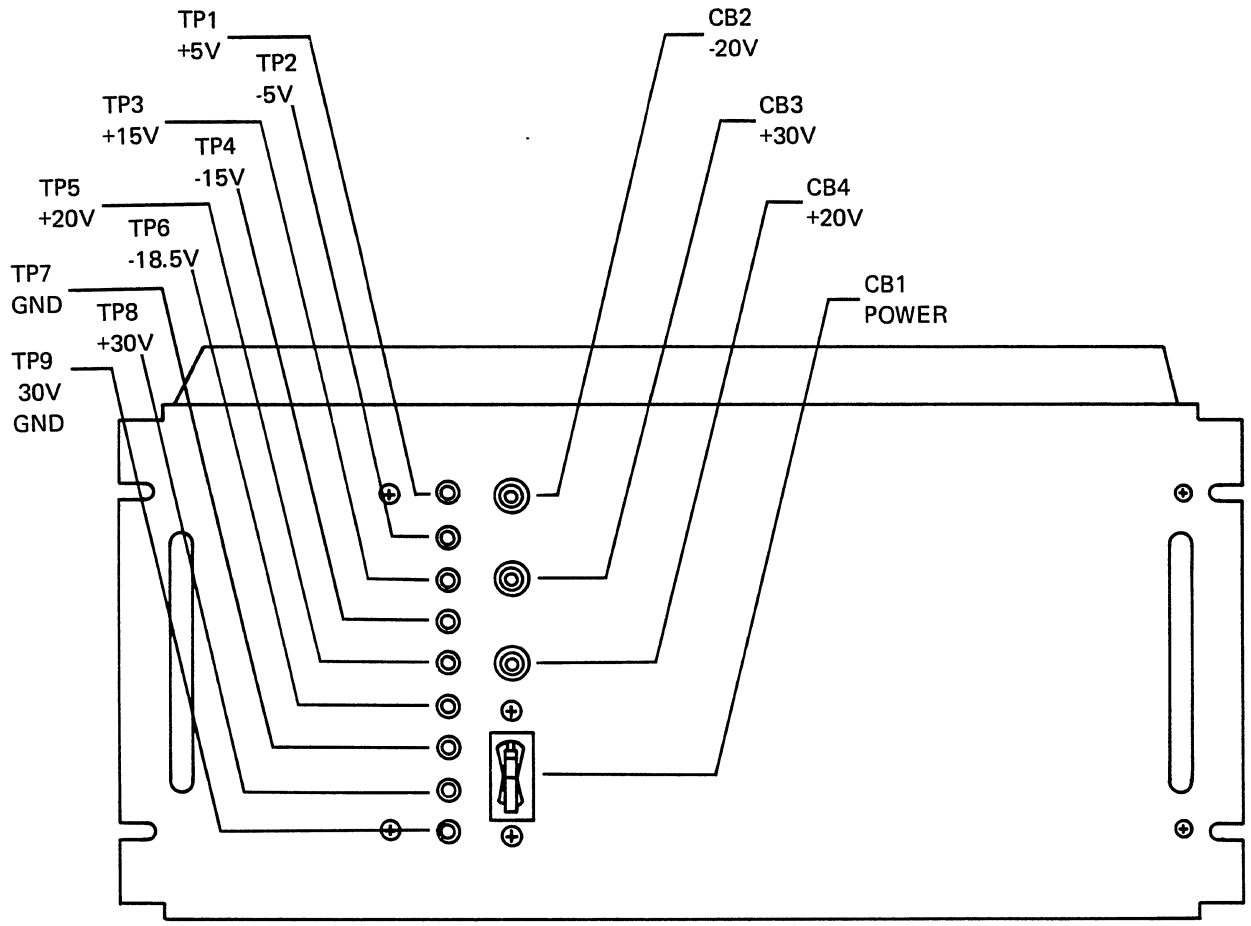


Figure 3-4. Logic Power Supply (CC545 G/H)

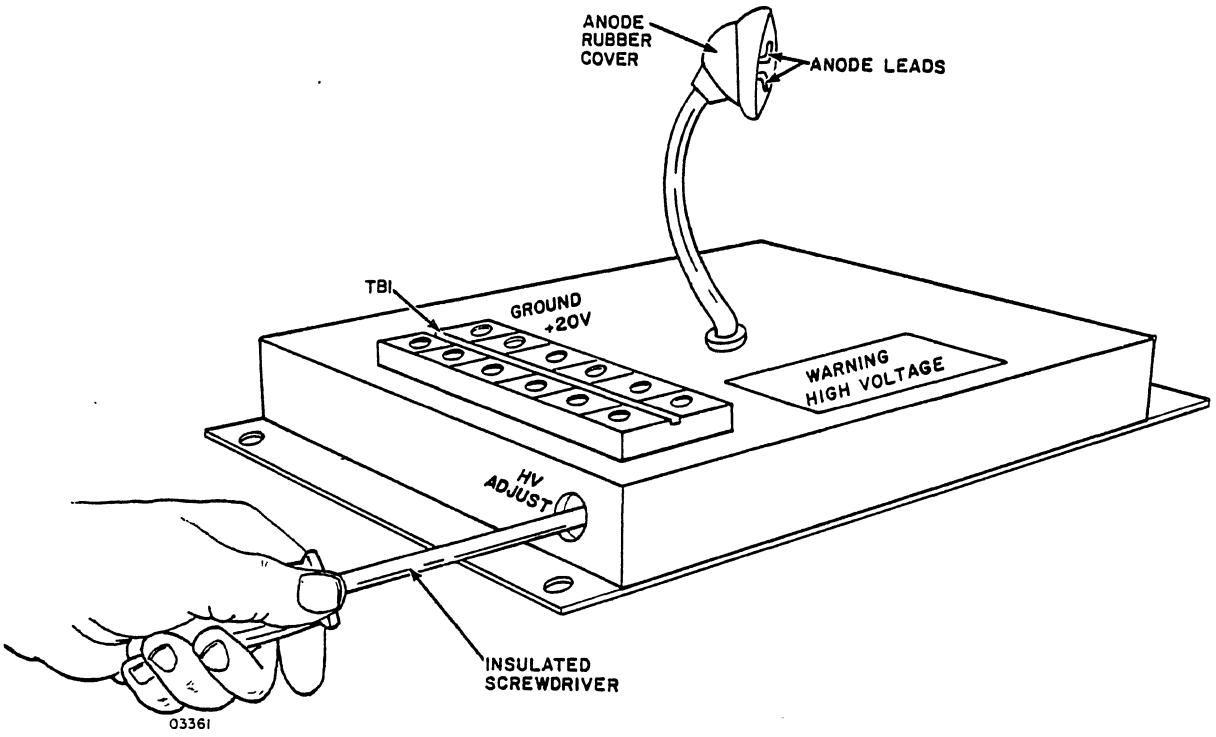


Figure 3-5. High Voltage Power Supply (CC545 G/H)
Part Number 51918275

LEARNING ACTIVITY 3-C. EXERCISE: CC545 G/H GENERAL DESCRIPTION REVIEW

This activity reinforces what you learned in learning activities 3-A and 3-B.

OBJECTIVE

- You will be able to identify the major functional differences between the CC545 G/H and the CC545 C, D, E, and F.

After completing the exercise, check the answers with those given at the end of this learning activity.

Directions: Read each of the following questions and write your response in the blanks provided.

1. What are the most significant differences between the CC545 G and the CC545 H models? _____

2. Identify the 3 major functional areas of the CC545 G/H, using figure 3-1. _____, _____, and _____.

3. How do the 3 major functional areas of the CC545 G/H shown in figure 1-2, publication number 62940018, compare to those for the CC545 C, D, E, and F shown in figure 1-3, publication number GF62952600? _____

4. List the 4 major functional areas of the monitor as shown in the block diagram of the display station, figure 1-2, publication number 62940018. _____, _____, _____, and _____.

5. List the 4 major functional areas of the Base Cabinet as shown in the block diagram of the display station, figure 1-2, publication number 62940018. _____, _____, _____ and _____.

6. Why is the D/A logic in the CC545 G/H not part of the power and Control section as it was in the CC545 C, D, E, and F? _____

7. What voltages are provided by the Logic Power Supply in the CC545 G/H? _____, _____, _____, _____, _____, _____, _____.

8. Why are the Feedback Amplifiers not shown as a separate block in the monitor as shown in figure 1-3, publication number GF62952600? _____

9. Identify the location of the X d/a board as viewed from the rear of the display station. _____

10. Identify the location of the Y d/a board as viewed from the rear of the display station. _____

11. Identify the location of the Unblank/Keyboard board as viewed from the rear of the display station. _____

CYBER 170 Display Subsystem
Learning Activity 3-C

ANSWERS TO LEARNING ACTIVITY 3-C

1. CC545 G is 60 Hz
   CC545 H is 50 Hz

2. Monitor, Base Cabinet, and Keyboard

3. The Power and Control block has been changed to Base Cabinet in the CC545 G/H; the workshelf block has been changed to keyboard in the CC545 G/H.

4. Digital to analog logic; deflection amplifier; CRT; High Voltage Supply

5. Connector Panel; Power Control Panel; Logic Supply; Deflection/CRT Supply

6. The Digital to analog circuitry has been reduced from 3 rows and over 60 modules to 3 PC boards in the CC545 G/H. These 3 modules are physically located in the Display or Monitor Cabinet.

7. +5, -5, +15, -15, +20, -18.5, +30 volts

8. Feedback amplifiers are included as part of the X and Y d/a boards.

9. Center of three PC boards

10. Board to the right

11. Board to the left

LEARNING ACTIVITY 3-D. REFERENCE READING: CC545 G/H OPERATION AND PROGRAMMING

This activity describes the differences between the operation and programming of the CC545 G/H compared to the CC545 C, D, E, and F.

OBJECTIVE

- You will be able to list and describe the CC545 G/H controls and indicators that are different from those for the CC545 C, D, E, and F.

Read in CYBER 170 Display Station CC545 G/H Hardware Reference Manual, publication number 62940018, section 2, Operation and Programming.

This section is essentially a review except for the Logic Power Supply which replaces the ± Volt Power Supply used in the CC545 C, D, E, and F.

LEARNING ACTIVITY 3-E. EXERCISE: CC545 G/H OPERATION AND PROGRAMMING REVIEW

This activity reinforces what you learned in learning activity 3-D.

OBJECTIVE

- You will be able to list the CC545 G/H controls and indicators that are different from those in the CC545 C, D, E, and F.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the following questions and write your response in the blanks provided.

1. What differences exist between the programming and operation of the CC545 G/H compared to the CC545 C, D, E, and F? Hint: Logic Power Supply

2. What is the purpose of the CB1 on the Logic Power Supply?

3. What is the purpose of the CB2 on the Logic Power Supply?

4. What is the purpose of CB3 on the Logic Power Supply?

5. What is the purpose of CB4 on the Logic Power Supply?

6. What is the purpose of the adjusting potentiometer on the front panel of the Deflection/CRT Power Supply?

7. What is the purpose of the following indicators/switches on the Power Control Panel?

a. High Temperature above 190

b. Thermostat By-pass

c. Ready

d. Power ON

e. Power OFF

ANSWERS TO LEARNING ACTIVITY 3-E

1. The ±20 Volt Power Supply has been replaced by a Logic Power Supply in the CC545 G/H. The ±20 volts are not adjustable in the Logic Power Supply.

2. CB1 - 400 Hz power

3. CB2 - -18.5 volt protection

4. CB3 - +30 volt protection

5. CB4 - +20 volt protection

6. Adjustment for the +15 to +110 volts

7. a. High Temp Indicator - Internal deflection amplifier temp over 190 F.

   b. Thermostat By-pass - Action switch/indicator, overrides the deflection amplifier high temperature thermostats - Action switch/indicator.

   c. Ready - indicator, indicates high voltage is on and station is ready for display.

   d. Power ON - Momentary switch/indicator, turns on station power and illuminates.

   e. Power OFF - Momentary switch - turn off high voltage immediately, imposes 15 second delay to remaining power supplies.

LEARNING ACTIVITY 3-F. TEXT READING: CC545 G/H THEORY OF OPERATION

This activity describes the display control circuits used in the CC545 G/H.

OBJECTIVE

- You will be able to list and describe the purpose of the principal assemblies comprising the display control circuits for the CC545 G/H.

The Block Diagram of Station Display - Control Circuits, figure 4-1, publication number 62940018, describes the CC545 G/H, also shown as figure 3-6 in this training manual.

It should be noted that the X D/A Converter and the Y D/A Converter (type 1ADD Boards) are identical and interchangeable, except for minor adjustments for symbol size and shaping.

The Unblank/Keyboard board (type 1ABD Board) is unique in the CC545 G/H. The 1ADD and 1ABD boards are considered replaceable to the board level.

Troubleshooting training will be limited in this course to the training necessary to adequately understand the logic necessary to isolate problems to the board replacement, if the failure is actually on one of the three PC boards.

Portions of the Theory of Operation section from the CYBER 170 Display Station, CC545 G/H Hardware Reference Manual, publication number 62940018, are included in this section of the training manual. If the student desires, he or she may read the complete Theory of Operation, section 4, for an in-depth study of the workings of the 1ABD and 1ADD boards, although these boards are replaceable as an assembly and therefore will not be covered in-depth in this course.

THEORY OF OPERATION

Figure 3-6 is a block diagram that depicts the station interface and indicates the principal assemblies comprising the display control circuits of the station.

The interface cables connect the display station to the host central processor unit (CPU) via a controller which resides in the CPU chassis. The CPU ultimately provides the display and position control inputs for the display station. Operator inputs via the station keyboard pass first to the CPU before being returned to the station as display symbol information. The CPU passes gross beam positioning information to the station via the X and Y deflection signal lines, and it passes symbol painting information to the station via the X symbol analog signal lines. The blank and unblank signals control the actual painting of symbols on the display screen as the deflection signals manipulate the beam across the face of the screen.

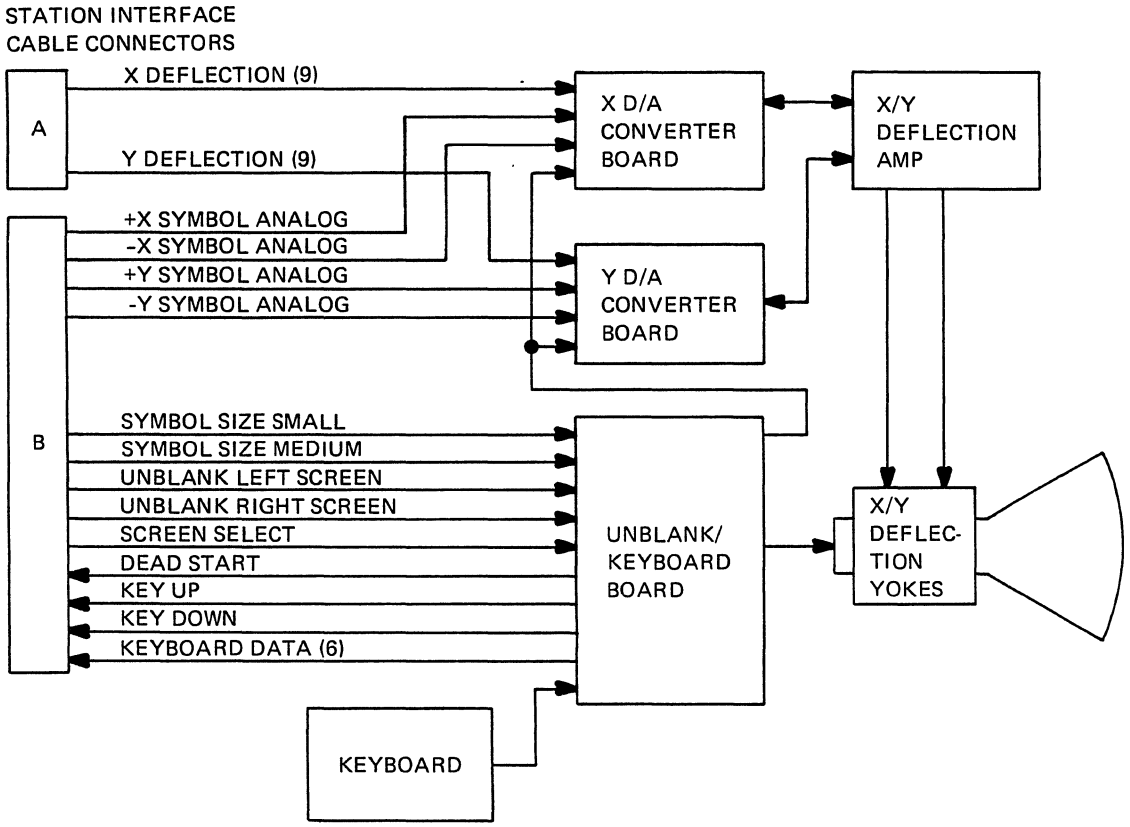


Figure 3-6. CC545 G/H Block Diagram of Station Display-Control Circuits

The remainder of this section describes the display control circuits in greater detail. The bulk of these circuits are mounted on the d/a converter boards and on the unblank/keyboard board. The text, therefore, emphasizes the circuits on these three circuit boards. Please note, however, that the X and the Y d/a converter boards are identical, and therefore, the text only actually describes the functions of a single d/a converter board rather than those of two separate ones.

D/A CONVERTER BOARD

The following paragraphs discuss the general function of the d/a converter board; they then proceed to describe its separate functions of gross beam positioning and symbol deflection (painting).

General Function

The d/a converter board processes both the gross position deflection signals (X and Y deflection in figure 3-6 and the symbol deflection information (X/Y symbol analog in figure 3-6 for a single axis (X or Y). The converter board converts the nine parallel input bits (X or Y) of gross position information into a differential analog signal. Symbol information, on the other hand, is received directly from the CPU as differential analog signals. Once received by the d/a board, the symbol positioning signals are operated upon by the circuits on the d/a board, but they remain differential analog signals. The following paragraphs explain in much greater detail how the circuits of the d/a converter board operate on both the gross-position and symbol deflection signals. Figure 3-7 is a block diagram depicting the various circuits found on the d/a converter board.

Gross Beam Positioning

The gross beam positioning circuits move the electron beam to the general area of the display screen where symbols are to be painted, and the symbol painting circuits then provide the short strokes of beam motion required to form each individual part of a character. In general, the circuits along the top half of figure 3-7 constitute the gross beam positioning circuits while those along the bottom half constitute the symbol painting circuits. The gross positioning circuits include the following:

- Line Receiver and Bit Shift
- D/A Converter and Offset
- Summing Amplifier
- Feedback Amplifier

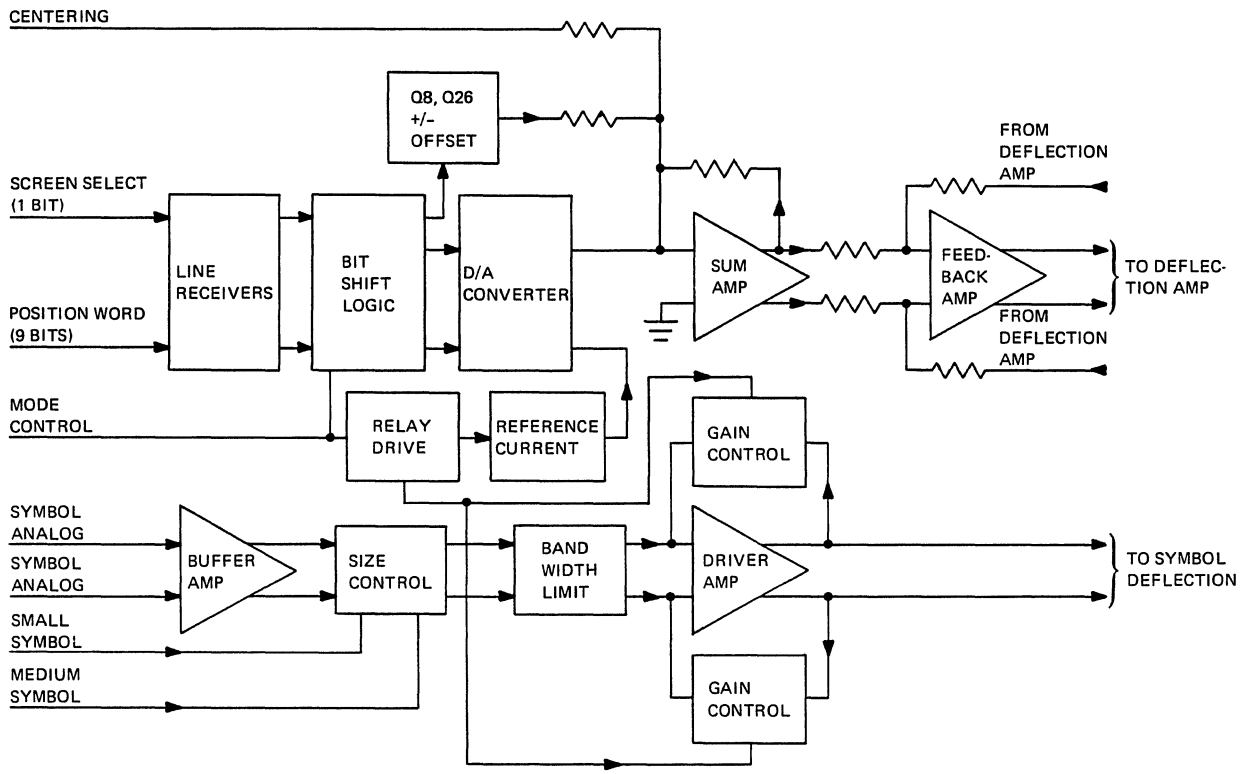


Figure 3-7. D/A Converter Board Block Diagram

Symbol Deflection

As noted earlier in this section, the symbol deflection circuits control beam motion for the short strokes that paint the symbol components on the crt screen. These circuits superimpose the symbol-positioning deflection strokes on the gross-positioning movements of the beam. The symbol deflection circuits consist of the following individual electronic circuits:

- Buffer Amplifier
- Size Control and Bandwidth Limit
- Driver Amplifier
- Relay Driver

UNBLANK/KEYBOARD BOARD

The following paragraphs first discuss the general functions of the unblank/keyboard board, and they then proceed to discuss its separate functions of unblank and keyboard signal processing.

General Function

As its name implies, the unblank/keyboard board has two general functions. The first of these is the processing of symbol-size and unblank signals from the CPU. Once processed, these signals pass on to the deflection and beam-control circuits of the crt to govern the display of symbols received from the CPU and the size (small, medium, or large) at which they are displayed. The second general function of the unblank/keyboard board is the processing of keyboard inputs. The keyboard processing circuits of this board receive signals from the keyboard and process them for transmission to the CPU. The following text describes each function of the unblank/keyboard board in greater detail. Figure 3-8 is a block diagram of the circuits on the unblank/keyboard board. Generally, the circuits on the upper half of the diagram are associated with the unblank functions of the board, and those on the lower half of the diagram are associated with the keyboard signal processing function of the board.

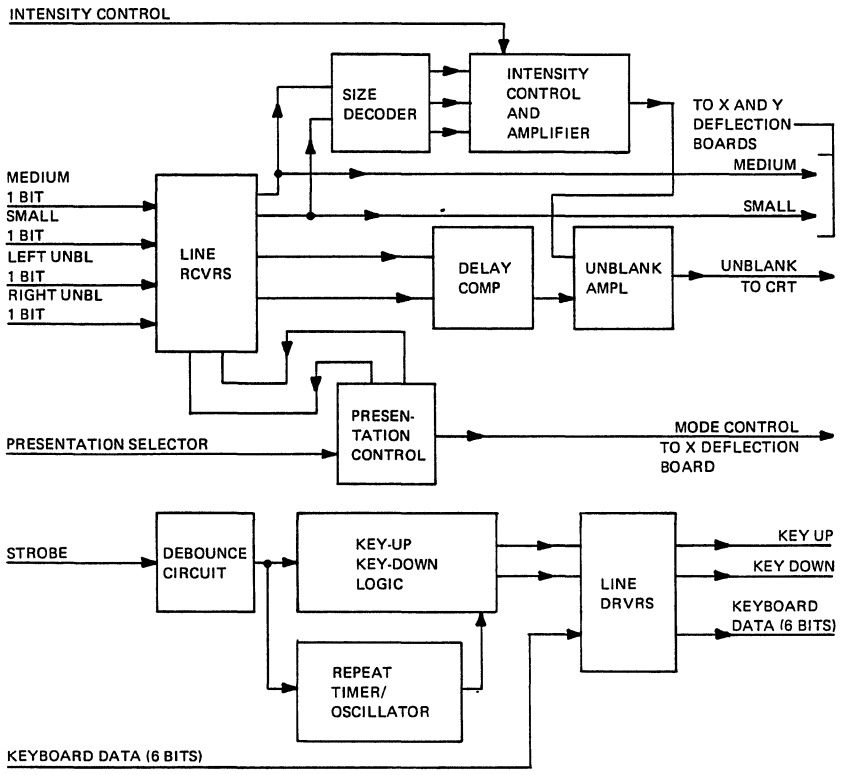


Figure 3-8. Unblank/Keyboard Board Block Diagram

Unblank Signal Processing

In figure 3-8, notice that the unblank portion of the unblank/keyboard board receives unblank signals, size-control signal, and an intensity signal. The unblank and size-control signals are received directly from the CPU interface (refer to figure 3-6) while the intensity signal is received from within the station. The board processes these signals and then uses them to control the timing and amplitude of an unblank signal to the crt. In addition, this board produces mode control, medium symbol, and small symbol signals that pass to and are used by the X-axis deflection board.

In figure 3-8, note that the unblank control portion of the unblank/keyboard board consists of the following circuits: line receivers, size decoder, intensity control and amplifier, delay compensation and unblank amplifier, and presentation control. The following paragraphs discuss each of these circuits.

Keyboard Signal Processing

The keyboard assembly is very basic in that it uses only keyswitches, a diode matrix to encode the various key-switch closures, and a strobe-signal circuit to indicate when a key is pressed. Figure 3-9 depicts the type of key-closure encoding circuit that the station keyboard uses. After being generated by the keyboard, the six data line signals and the strobe signal pass to the unblank/keyboard board for processing before being sent to the CPU. The keyboard circuitry on the unblank/keyboard board supports the function of the keyboard assembly by providing a debounce function for the key-switches, stable key-up and key-down signals, and a repeat function that is enabled by holding a key down for longer than a specified time period. In addition, the keyboard circuits include line drivers for driving the keyboard-generated signals over the transmission lines to the CPU. The remainder of this section discusses each of these functions of the keyboard circuit.

Note that this keyboard does not implement an N-key rollover function; that is, it provides no means of detecting when two or more keys are pressed simultaneously. Doing this actually produces an ORed code of the keys pressed which, of course, results in an erroneous character code.

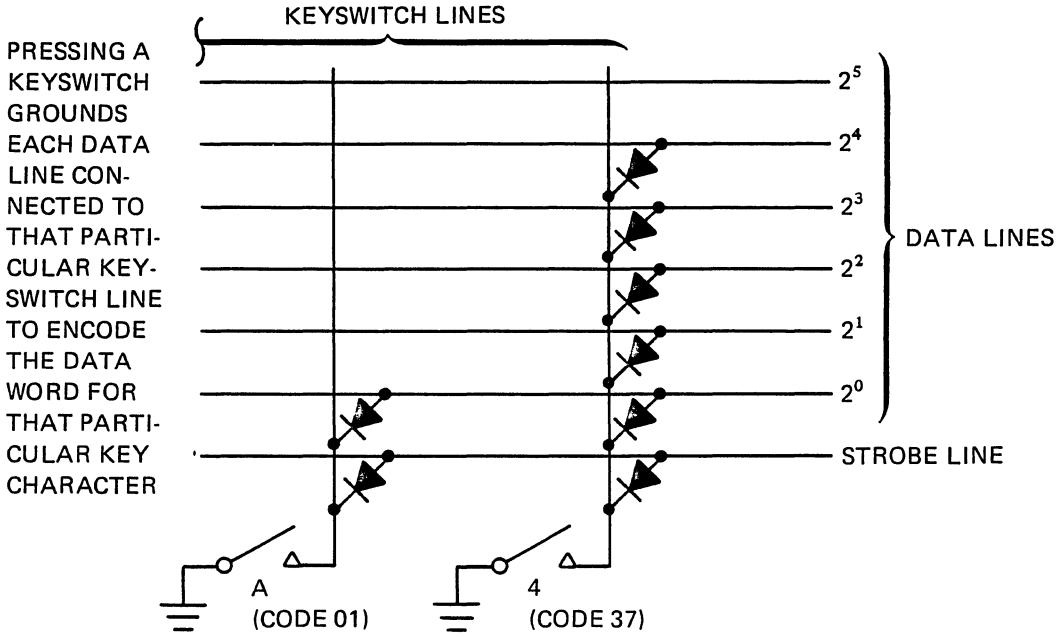


Figure 3-9. Example of Keyboard Symbol Encoding Circuits

LEARNING ACTIVITY 3-G. EXERCISE: CC545 G/H THEORY OF OPERATION REVIEW

This activity reinforces what you learned in learning activity 3-F.

OBJECTIVE

- You will be able to list and describe the purpose of the principal assemblies comprising the display control circuits for the CC545 G/H.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the questions and write your response in the blank provided or circle the correct answer.

1. What type of board is the X Digital/Analog PC board?
   IADD

2. What type of board is the Y Digital/Analog PC board?
   IADD

3. What type of board is the Unblank/Keyboard PC board?
   IADD

4. The X D/A and Y D/A boards (are)/are not interchangeable. (Circle one.)

5. The Digital to analog converter board processes both the _____ and the symbol deflection information.

6. The X and Y Deflection Amplifiers are the same/(different) in the CC545 G/H compared to the CC545 C, D, E, and F. (Circle one.)

7. What interface cables supply the X and Y deflection signals to the X d/a and the Y d/a converter boards? A

8. What interface cables supply the X and Y Symbol Analog signals to the X d/a and Y d/a converter boards? B

9. What interface cable carries the symbol size, unblock control signals, and keyboard information from the Display Station Controller to the Unblank/Keyboard PC board?

13

10. Which circuits move the electron beam to the general area of the display screen where symbols are to be painted?

11. Which circuits provide the short strokes of beam motion required to form each individual part of the character?

ANSWERS TO LEARNING ACTIVITY 3-G

1. lADD
2. lADD
3. lABD
4. Are
5. gross positioning; symbol deflection
6. Different
7. Cable A
8. Cable B
9. Cable B
10. Gross Positioning
11. Symbol Deflection

LEARNING ACTIVITY 3-H. REFERENCE READING: CC545 G/H INTERCONNECTION DIAGRAMS

This activity describes the interconnection diagrams for the CC545 G/H, with emphasis on the differences from the interconnection diagrams for the CC545 C, D, E, and F covered in module 2.

OBJECTIVE

- You will be able to trace the signal flow and power distribution through the CC545 G/H Display Station diagrams.

Refer to CYBER 170 Display Station CC545 G/H, Hardware Reference Manual, publication number 62940018, section 5, Diagrams. Use drawing numbers 62201065 and 62201064 and at location C7 you will find the cabling for the D/A Chassis, Vertical D/A, Horizontal D/A and the Unblank/Keyboard logic boards. Familiarize yourself with the cabling for these modules. Locate the Logic Power Supply at location D7 and familiarize yourself with the cabling to and from this supply.

Refer to Schematic Diagrams drawing number 62201063 for 60 Hz and drawing number 62201062 for 50 Hz systems. Familiarize yourself with the power cables for the D/A Chassis located at B7, 8 and the Logic Power Supply located at D7, 8, both are different from those diagrams covered for CC545 C, D, E, and F in module 2.

The schematic for the Power Control Panel for CC545 G/H, drawing number 62191600 is similar to that used for CC545 C, D, E, and F except that cables actually go to the Logic Power Supply rather than to the $\pm$20 volt Power Supply in the CC545 C, D, E, and F.

Familiarize yourself with the Interconnection Diagram D/A Chassis, drawing number 62201073. J1, J2, and J3 go to the Unblank/Keyboard, J4, J5, and J6 go to the Horizontal D/A, J7, J8, and J9 go to the Vertical D/A. J10 goes to the D/A Chassis.

LEARNING ACTIVITY 3-I. EXERCISE: CC545 G/H INTERCONNECTION DIAGRAMS REVIEW

This activity reinforces what you learned in learning activity 3-H.

OBJECTIVE

- You will be able to trace the signal flow and power distribution then the CC545 G/H Display Station diagrams.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the questions and write your response in the blank provided.

1. X gross positioning and X symbol analog signals are transferred from the X d/a PC board to the Deflection Amplifiers via which cable(s)? W7P1

2. Y gross positioning and Y symbol analog signals are transferred from the Y d/a PC board to the Deflection Amplifiers via which cable(s)? W7P2

3. J1, J2, and J3 from the mother board feed the [illegible] PC board.

4. J4, J5, and J6 from the mother board feed the [illegible] PC board.

5. J7, J8, and J9 from the mother board feed the [illegible] PC board.

6. J10 from the mother board feeds power to the D/A Chassis from which power supply? [illegible]

7. Identify the source or destination for each of the following plugs on the Logic Power Supply:

   a. J1 [illegible]
   b. J2 [illegible]
   c. J3 [illegible]
   d. J4 [illegible]

8. Identify the voltages associated with the following pins on J3 of the Logic Power Supply.

a. Pin #1 +5
b. Pin #2
c. Pin #3
d. Pin #4
e. Pin #5
f. Pin #6
g. Pin #7
h. Pin #8
i. Pin #9 GND

ANSWERS TO LEARNING ACTIVITY 3-I

1. W7P1
2. W7P2
3. Unblank/Keyboard
4. X d/a
5. Y d/a
6. Logic Power Supply
7. a. Power Control Panel
   b. Power Control Panel
   c. D/A Chassis
   d. Deflection Amplifier
8. a. +5
   b. Ground
   c. -5
   d. Ground
   e. Not used
   f. +15
   g. +30
   h. -15
   i. Ground

LEARNING ACTIVITY 3-J. REFERENCE READING: STRUCTURED ANALYSIS METHOD (SAM) TROUBLESHOOTING

This activity introduces you to the Structured Analysis Method (SAM). Troubleshooting and the use of the troubleshooting listings included in Section 6, publication number 62940018, CYBER 170 Display Station, CC545 G/H.

OBJECTIVE

- You will be able to list troubleshooting steps used in solving problems using the Structured Analysis Method Troubleshooting listing.

Prior to proceeding with the tracing of problems through the SAM listing, you should review the Level of Repair for Station Subassemblies, included in section 6, publication number 62940018, CYBER 170 Display Station, CC545 G/H.

Familiarize yourself with the step by step analysis of problems using the Structured Analysis Method troubleshooting listings, included in section 6, publication number 62940018, CYBER 170 Display Station, CC545 G/H. Follow the directions for their use and proceed to one of four SAM conditions which are followed by additional line items of questions which, with appropriate answers, take the troubleshooter to the procedure or action necessary to make the repair.

LEARNING ACTIVITY 3-K. EXERCISE: G/H STRUCTURED ANALYSIS METHOD TROUBLESHOOTING REVIEW

This activity reinforces what you learned in learning activity 3-J.

OBJECTIVE

- You will be able to list troubleshooting steps used in solving problems using the Structured Analysis Method troubleshooting listing.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the questions and write your response in the blank provided.

1. The Structured Analysis Method (SAM) troubleshooting assumes certain conditions exist for each of the 4 SAMs.

2. To use the SAMs, select a starting condition for the appropriate yes or no answer.

3. When directed by SAMs to a specific procedure, you should first perform the procedure directed and then return to the SAM that directed you to perform that specific procedure. (One word repeated three times.)

4. What initial conditions are assumed when using SAM 2 for no display or CRT?
   SAM 1 ok

5. What initial conditions are assumed when using SAM 3 for some display present, but incorrect?
   SAM 1 and SAM 2 ok

6. What are the first three steps to be taken when using SAM 4 at line item 18 and pressing the dead start switch does not initiate a dead start?
   1. Check J3
   2. Keyboard dead start switch
   3. Cable W10 in deflection

7. Which SAM applies to keyboard and control problems? SAM 4

The answers to this learning activity are on the following page.

ANSWERS TO LEARNING ACTIVITY 3-K

1. four

2. yes; no

3. procedure, procedure, procedure

4. Power on sequence (SAM 1) operates correctly, but No Display on CRT.

5. SAM 1 and SAM 2 have been completed successfully, but some display is present, but it is incorrect.

6. Step 1) 19 Check that J3 on backplane properly connected

   Step 2) 20 Replace DEAD START switch

   Step 3) 21 Cable W10 is defective

7. SAM 4

LEARNING ACTIVITY 3-L. REFERENCE READING: CC545 G/H MAINTENANCE PROCEDURES

This activity introduces you to the maintenance procedures for the CC545 G/H.

OBJECTIVE

- You will be able to perform all PM procedures and remove, replace, and adjust replaceable units within the CC545 G/H.

Read the following subsections in the CYBER 170 Display Station, Hardware Reference/CE Manual publication number 62940018, section 6.

- Preventive Maintenance, paying attention to the Preventive Maintenance Schedule, table 6-2; Weekly, Monthly and Quarterly Cleaning, Inspections and Tests, listed as tables 6-3, 6-4, and 6-5 respectively.

- Maintenance Procedures, which describes the display adjustments for the CC545 G/H.

- Power Supply Adjustments, which describes the adjustment procedures for the High Voltage Power Supply. The +15 to +110 volt adjustment of the Deflection Power Supply was covered in (b) under cathode emission adjustments.

- Remove/Replace Procedures, which describes the procedures to be followed for removal, installation and adjustment of Monitor CRT; Yoke Assembly; power control panel, deflection/CRT and logic power supplies; deflection amplifiers, high temperature thermostats; logic boards; high voltage power supply, keyboard assembly; and presentation switch assembly.

LEARNING ACTIVITY 3-M. EXERCISE: CC545 G/H MAINTENANCE PROCEDURES REVIEW

This activity reinforces what you learned in learning activity 3-L.

OBJECTIVE

- You will be able to perform all PM procedures, and remove, replace and adjust replaceable units in the CC545 G/H.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: Read each of the following questions and write your response in the blank provided, or circle the appropriate answer.

1. What are the Weekly PM procedures?
   a. [illegible]
   b. [illegible]
   c. [illegible]

2. What are the Monthly PM procedures?
   a. [illegible]
   b. [illegible]
   c.

3. What are the Quarterly PM procedures?
   a. [illegible]
   b. [illegible]
   c. [illegible]

4. What is the part number for the High Voltage Power Supply used in the CC545 G/H? 5191825

5. Prior to removing PC boards station power (should)/should not be removed? (Circle one.)

6. What precautions must be taken when adjusting the High Voltage Power Supply? high voltage on [illegible]

7. What adjustment procedure applies to adjustment of the +15 to +110 output of the Deflection/CRT Power Supply? Cathode Emission

8. List the nine adjustment procedures for initial set up.
   1. Cathode emission
   2. [illegible]
   3. [illegible]
   4. [illegible]
   5. [illegible]
   6. [illegible]
   7. [illegible]
   8. [illegible]
   9. [illegible]

9. The nine adjustment procedures for initial set up of the CC545 are similar to/unlike the adjustments for CC545 C, D, E, and F. (Circle one.)

ANSWERS TO LEARNING ACTIVITY 3-M

1. a. Exterior cleaning

   b. Visual inspection

   c. Diagnostic check

2. a. Interior cleaning and inspection

   b. Electrical measurements and adjustments

3. a. Clean air filters

   b. Check blowers

   c. Time-delay and high temperature checks

4. Part number 51918275

5. Should

6. The high voltage supply provides lethal voltages. Follow the CAUTION warnings for Power Supply Adjustments in section 6 of publication number 62940018.

7. Cathode Emission

8. 1. Cathode Emission

   2. Unblank rise time

   3. Unblank delay

   4. Raster size

   5. Feedback level

   6. Symbol size and shape

   7. Intensity

   8. Keyboard repeat delay

   9. Maintenance mode

9. Similar; location of modules, module types and adjustment points are different, but procedure is usually the same only on PC boards.

MODULE 4

CC545 LABORATORY

During this module you will locate subsystem components, perform all preventive maintenance (PM) tasks, and perform specified electical checks and adjustments.

This module requires an instructor and laboratory equipment for all learning activities. Allow approximately 4 hours for the laboratory activities. Contact your course administrator to schedule the laboratory. You will work in a group of no more than three students. Read and observe the safety practices on the following pages and read through the procedures of each learning activity. In the procedures portion of each learning activity are instructor checkpoints. Ask your instructor to initial all checkpoints as you complete the procedures. When you have completed all the procedures in a learning activity, ask your instructor to initial the learning activity instructor checkpoint on the module title page.

Because this module uses a laboratory instructor to verify your activities, there is no test on the objectives.

At the end of the module is an instructor confirmation page. When you have completed all learning activities, ask your instructor to sign the Instructor Comfirmation form. The signed Instructor Confirmation form should then be removed from the student manual, folded, stapled, and mailed. When the form is received by Engineering Services Education (ESE), the ESE administrator will record your successful completion of module 4.

LEARNING ACTIVITIES

At the completion of each activity, ask your instructor to initial the instructor checkpoint.

SAFETY PRACTICES

All engineers are expected to follow reasonable and appropriate precautions with respect to electrical, mechanical, and personal safety hazards while working on computer system equipment. Note the entries in the maintenance documentation labeled DANGER or WARNING that identify hazardous areas or procedures encountered in maintaining the system equipment. Follow these additional procedures when working on equipment.

PERSONAL

1. Ensure that none of your actions cause unsafe conditions that may expose customer personnel to hazards in any device.

2. Never work alone on equipment that has exposed operating mechanical parts or exposed hazardous power components. If you must do so, notify your EIC or manager. In any case, observe the following precautions.

   a. Someone familiar with the power-off controls must be in the immediate area.

   b. Personal jewelry (rings, wristwatches, bracelets, necklaces, and so forth) must be removed. A small box in the CE tool kit makes a good storage place for these items.

   c. When using only one hand, keep the other hand in your pocket.

d. Avoid wearing loose articles of clothing that can be snagged and drawn into moving machinery. Wear short-sleeved shirts or roll sleeves above the elbow. Neckties, where required, should be tucked in between the second and third shirt button or fastened about 3 inches from the end with a tie tack or tie clasp, preferably nonconductive. Clip-on neckties are preferable to the regular ones; if caught, they will pull free without causing injury.

e. Before starting equipment, make sure that no CE or customer personnel are in a position where they could get hurt.

f. While working in equipment, put red tape strips across any power controls, or use DO NOT OPERATE tags where available.

3. Keep CE tool kits out of walkways; put them on or under a desk or table.

4. Put doors and covers that you remove from a machine in a safe, out-of-the-way location where no one will trip over them or cause them to fall and injure another person. All machine covers must be in place before the machine is returned to the customer.

5. All safety covers, guards, shields, groundstraps, panels, and so forth, must properly be reinstalled after maintenance is finished.

6. Maintain good housekeeping practices during and following each maintenance activity. Do not permit tools, manuals, wipers, paper, or trash to accumulate in the work area; clean up after yourself.

ELECTRICAL

1. Shut off all ac and dc power when removing or installing major assemblies, working inside power supplies or power control enclosures, performing detailed mechanical maintenance procedures, or wiring and/or changing modules in the machine. If possible, turn off and lock or tag the circuit breaker in the service panel on the wall; unplug the main power supply cord.

2. Use only well-insulated pliers, screwdrivers, test leads, and so forth, when working on or near live circuits.

3. Do not disconnect or disable safety grounding systems even if the equipment is powered off. These are installed for your protection.

4. Avoid touching grounds, such as equipment frames, metal floor tile edgings, and electrical conduits. If possible, purchase rubber or vinyl mats.

MECHANICAL

1. Do not use chemicals, grease, oil, or solvents that have not been specifically approved by the equipment manufacturer for that device. Their recommendations are usually based on extensive experience with the equipment in service.

2. Use the proper tools for the job. Improper use of tools can result in personal injury or equipment damage.

3. Immediately replace worn or broken tools and test equipment.

4. If the machine is running, do not reach into the works; remember, they are your fingers and you only get one set per lifetime.

5. If using a strobe light on mechanical devices, do not touch the equipment because it may be moving.

6. Safety glasses or goggles must be used if you are:

   a. Driving pins, riveting, swaging, or similar activities.

   b. Using an electric drill, grinder, reamer, and so forth.

   c. Installing or removing springs under tension or compression.

   d. Using any type of solvent, spray, or chemical for cleaning or touch-up painting.

   e. Engaged in any other activity that may endanger the eyes. They are your eyes, and you need them for this type of work.

7. When lifting, use a method that will not injure the spine or strain back muscles. Be realistic about your capacity for lifting.

8. Use good judgment and common sense. A moment of thought before you act can save hours of agonizing afterthought.

STUDENT NOTES

LEARNING ACTIVITY 4-A. LABORATORY: COMPONENT LOCATION

During this activity you will locate the specified CC545 components, for both the CC545 C, D, E, and F and CC545 G/H.

OBJECTIVE

- You will be able to locate all specified components of the CC545 display console.

REFERENCE MATERIALS

Title	Publication Number
CYBER 170 Display Station, Hardware Reference/CE Manual CC545 C, D, E, & F	GF62952600
CYBER 170 Display Station, Hardware Reference/CE Manual CC545 G/H	62940018

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard Site Tools
- CC545 Display Console
- Microfiche Viewer

PROCEDURES

To complete this learning activity, perform the following steps.

1. Your instructor will direct you to the equipment used during this learning activity.
2. Refer to the CYBER 170 Display Station manual, section 6, figures 6-1 and 6-2, for physical illustration for CC545 C, D, E, and F and also for CC545 G/H.

3. Locate the following CC545 components.

_____ CRT
_____ Bezel and Trim Bezel
_____ Monitor Controls
  _____ HORIZONTAL CENTERING
  _____ VERTICAL CENTERING
  _____ DEAD START
  _____ FOCUS
  _____ INTENSITY
_____ Alphanumeric Keyboard
  _____ Alphanumeric Keys
  _____ SPACE BAR
  _____ PRESENTATION CONTROL switch
_____ Monitor Hood
_____ High-Voltage Power Supply
_____ Capacitor (Rear of High-Voltage Power Supply)
_____ Aquadag Clip
_____ Feedback Amplifiers
_____ Deflection Amplifier
_____ Yoke assembly
_____ End Panels (front, back, sides)
_____ D/A chassis (CC545 C, D, E, & F) or _____ D/A chassis (CC545 G/H)
  _____ Row A
  _____ Row B
  _____ Row C
  _____ A Cable
  _____ B Cable
_____ Blower (B2)
  _____ Filter
  _____ Deflection Amplifier Plenum
_____ Blower (B1)
  _____ Filter
_____ Connector Panel
  _____400 hertz input
  _____ 60 or 50 hertz input

  _____ X D/A Board
  _____ Y D/A Board
  _____ Unblank/ Keyboard board
  _____ A Cable
  _____ B Cable

_____ ± 20 Volt Power Supply

_____ CB1
_____ CB2
_____ TP1 (-20 volt)
_____ TP2 (+20 volt)
_____ TP3 (Common)
_____ R2 (-20 volt adjust)
_____ R1 (+20 volt adjust)

_____ Power Control Panel

_____ CB1 (400 hertz)
_____ CB2 (50 or 60 hertz)
_____ TIME METER
_____ HIGH TEMP indicator
_____ THERMOSTAT BY-PASS
_____ READY
_____ POWER ON
_____ POWER OFF

_____ Deflection/CRT Power Supply

_____ CB1 (400 hertz)
_____ CB2 (X yoke)
_____ CB3 (Y yoke)
_____ TP1 (+6.3 volt dc)
_____ TP2 (+15 to 110 volt)
_____ TP3 (+40 volt)
_____ TP4 (+420 volt)
_____ TP5 (+700 volt)
_____ TP6 (+20 volt)
_____ TP7 (GRD)

_____ Leveling Pads
_____ Equipment Identification Name Plate
_____ Grid Ground Connector

or Logic Power Supply
figure 2-4

_____ CB1
_____ CB2
_____ CB3
_____ CB4

_____ T1 1
_____ 2
_____ 3
_____ 4
_____ 5
_____ 6
_____ 7
_____ 8
_____ 9

Instructor checkpoint _____

Ask your instructor to initial the module title page for learning activity 4-A.

LEARNING ACTIVITY 4-B. LABORATORY: PREVENTIVE MAINTENANCE

During this activity, you will perform the preventive maintenance (PM) tasks on the CC545 C, D, E, and F as well as the CC545 G/H.

OBJECTIVE

- The student will be able to perform all PM tasks on the CC545 display console.

REFERENCE MANUALS

Title	Publication Number
CYBER 170 Display Station Manual	GF62952600
Site CC545 Diagnostic Documentation (DS1)	
CYBER 170 Display Station, Hardware Reference/CE Manual CC545 G/H	62940018

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard Site Tools
- Test equipment listed in table 6-1 of the CYBER 170 Display Station Manual
- CC545 Display Console
- CDC CYBER 17X Computer
- Microfiche Viewer

PROCEDURES

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment used during this learning activity.

2. Perform the PM tasks as listed and described in tables 6-2, 6-3, 6-4, and 6-5 in the CYBER 170 Display Station Manual.

   a. What is the interval for the maintenance task to clean air filters?

   b. Which table in the CYBER 170 Display Station manual describes the monthly PM tasks?

   c. After pressing the POWER OFF switch, how long should the blower run before turning off?

   d. After pressing the POWER ON switch, how long should it be before the READY indicator lights?

   e. How should the reusable air filter be cleaned?

   f. What electrical measurements/adjustments are specified by the monthly PM procedure?

   g. What should be used to clean the interior surface of the CC545?

   Instructor checkpoint _____

Ask your instructor to initial the module title page for learning activity 4-B.

LEARNING ACTIVITY 4-C. LABORATORY: ELECTRICAL

During this activity, you will perform specified electrical checks and adjustments on the CC545 C, D, E, and F as well as the CC545 G/H.

OBJECTIVE

- You will be able to perform specified electrical checks and adjustments on the CC545.

REFERENCE MATERIALS

Title	Publication Number
CYBER 170 Display Station, Hardware Reference/CE Manual, CC545 C, D, E, and F Site CC545 Diagnostic Documentation (DS1)	GF62952600
CYBER 170 Display Station, Hardware Reference/CE Manual CC545 G/H	62940018

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard Site Tools
- Test equipment listed in table 6-1 of the CYBER 170 Display Station Manual
- CC545 Display Console Model C, D, E, & F or CC545 Display Console Model G/H
- CDC CYBER 17X Computer
- CC545 Diagnostic (DS1)
- Microfiche Viewer

PROCEDURES FOR CC545 C, D, E, AND F MODELS

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment used during this learning activity.

2. Perform the following electrical checks and adjustments as described in section 6 of the CYBER 170 Display Station Manual.

   a. Cathode Emission

      1) Where is the potentiometer that is used for the Cathode Emission adjustment located?

      2) Is the potentiometer turned clockwise or counterclockwise for the maximum output of +110 volts?

      Instructor checkpoint _____

   b. D/A Reference Voltage

      1) What is the location of the card that should be checked for the D/A reference voltage?

      2) What value should the voltage be?

      Instructor checkpoint _____

   c. Unblank Rise Time

      1) The INTENSITY control must be turned full clockwise or counterclockwise when performing the adjustment?

      2) To what test point is the oscilloscope connected for the adjustment?

      Instructor checkpoint _____

   d. Unblank Delay

      1) What are the locations of the cards with the tapped delay line?

      Instructor checkpoint _____

e. Raster Size

1) What type of logic cards are feedlock amplifiers?

2) Is the bottom potentiometer used to adjust the level or gain?

3) Is the gain adjustment on the card at location J6 for X or Y?

Instructor checkpoint _____

f. Feedback Level

1) The X feedback level is adjusted with the potentiometer on the card at what location?

2) The feedback sawtooth wave shapes are adjusted so the bottom of the waveforms are at what voltage level?

3) Where should the oscilloscope be connected to see the -Y feedback output voltage?

Instructor checkpoint _____

g. Symbol Size and Shape

1) What characters should be displayed while performing the adjustment?

2) The small vertical size is adjusted using what potentiometers on what logic card?

3) To what size should the horizontal medium size characters be adjusted?

Instructor checkpoint _____

h. Intensity

1) What is the location of the logic card used in the intensity adjustment?

Instructor checkpoint _____

i. Keyboard Repeat Delay

1) What is the normal setting for delay before the depressed key begins to repeat?

2) What is the location of the logic card used for the repeat delay adjustment?

Instructor checkpoint _____

j. ± 20 Volt Power Supply

1) Which potentiometer is used to adjust +20 volts?

2) At what test point can the -20 volts be monitored?

Instructor checkpoint _____

k. High-Voltage Supply

1) What potentiometers are used to adjust the chopper output?

2) What potentiometer is used to adjust the output to +18 kilovolts?

Instructor checkpoint _____

3. Read through the Removal/Replacement Procedures in section 6 of the CYBER 170 Display Station Manual and locate the components specified in the procedures. Do not actually perform the procedures.

Instructor checkpoint _____

Ask your instructor to initial the module title page for learning activity 4-C.

CYBER 170 Display Subsystem
Learning Activity 4-C

PROCEDURES FOR CC545 G/H MODELS

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment used during this learning activity.

2. Perform the following electrical checks and adjustments as described in section 6 of CYBER 170 Display Station Manual.

   a. Cathode Emission

      1) Where is the potentiometer that is used for the Cathode Emission adjustment located?

      2) Is the potentiometer turned clockwise or counter-clockwise for the maximum output of +110 volts?

NOTE

When the student has completed the Cathode Emission adjustment initial the corresponding instructor checkpoint in the student manual.

Instructor checkpoint _____

   b. Unblank Rise Time

      1) The INTENSITY control must be turned full clockwise or counterclockwise when performing the adjustment?

      2) To what test point is the oscilloscope connected for the adjustment?

Instructor checkpoint _____

   c. Unblank Delay

      1) What is the location of the board with the tapped delay line?

Instructor checkpoint _____

d. Raster Size

1) What type of logic Boards are feedback amplifiers?

2) Is potentiometer #4 used to adjust the level or gain?

3) Is the gain adjustment on the card at location 02 for X or Y?

Instructor checkpoint _____

e. Feedback Level

1) The X feedback level is adjusted by the potentiometer #5 on the board at what location?

2) The feedback sawtooth wave shapes are adjusted so the bottom waveforms are at what voltage level?

3) Where should the oscilloscope be connected to see the -Y feedback output voltage?

Instructor checkpoint _____

f. Symbol Size and Shape

1) What characters should be displayed while performing the adjustment?

2) The small vertical size is adjusted using what potentiometers on what logic Board?

3) To what size should the horizontal medium size characters be adjusted?

Instructor checkpoint _____

g. Intensity

1) What is the location of the logic board used in the intensity adjustment?

Instructor checkpoint _____

h. Keyboard Repeat Delay

1) What is the normal setting for delay before the depressed key begins to repeat?

2) What is the location of the logic board used for the repeat delay adjustment?

Instructor checkpoint _____

i. Logic Power Supply - No Adjustment

1) At what test points can the +20 volt be monitored?

2) At what test point can the -18.5 volts be monitored?

Instructor checkpoint _____

j. High-Voltage Supply

1) What potentiometer is used to adjust the output to +18 kilovolts?

Instructor checkpoint _____

3. Read through the Removal/Replacement Procedures in section 6 of the CYBER 170 Display Station Manual and locate the components specified in the procedues. Do not actually perform the procedures.

Instructor checkpoint _____

Ask your instructor to initial the module title page for learning activity 4-C.

APPENDIX A
USING INDIVIDUALIZED INSTRUCTION

If this is your first experience with individualized instruction, you probably have a few questions. The information that follows will help you understand the nature of individualized instruction.

WHAT IS INDIVIDUALIZED INSTRUCTION?

Individualized instruction is a teaching method that is oriented toward the individual rather than the group. Individualized instruction--

- Determines what skills you possess that pertain to the topic of instruction.
- Determines what skills you must acquire.
- Allows you to acquire these skills at your own pace by studying a variety of learning activities.

Individualized instruction is structured around a student manual that guides you through the course and is also a learning resource. The student manual is divided into modules.

Each module contains information that will help you meet the objectives of that module. The information within the module is presented in learning activities.

MAY I WORK WITH OTHER STUDENTS?

Yes, if two or more of you are taking the course at the same time, it may be beneficial for you to do some of the learning activities together. Whether you work alone or with others depends on your needs.

HOW DO I PROCEED THROUGH THE COURSE?

You begin the course by signing on to the PLATO terminal. See appendix B for detailed instructions for signing on. You may want to take the pretest or you may ask for a full assignment that teaches all of the objectives of the first module. If you take the pretest, PLATO learning management (PLM) will evaluate the results of the test and assign the learning activities that are keyed to the objectives you did not master. Then, study the

assigned learning activities and retake the test. If you are successful, proceed to the next module and repeat the process until course completion. If not, study the assigned learning activities and retake the test until you master all the module objectives.

See figure A-1 for a flowchart illustrating your progress through the course.

HOW DO MODULES, COURSES, AND CURRICULA RELATE TO EACH OTHER?

The structure of the Engineering Services Training Program has three parts (see figure A-2):

- Module. A module is made up of learning activities. It contains objectives and test questions. A module teaches specific training tasks. For example, a module could cover electrical/mechanical adjustments.

- Course. A course is made up of modules. A course covers a single subject, for example, a course on the oscilloscope or magnetic tape unit.

- Curriculum. A curriculum is made up of courses. It covers a broad area of knowledge, for example, an entire subsystem. A curriculum may contain courses that range in complexity from introductory to advanced.

WHAT KIND OF RESOURCES ARE USED IN INDIVIDUALIZED INSTRUCTION?

Individualized learning activities use the following resources and combinations of those resources to present information.

- Text Reading. This resource presents information via the student manual and provides simplified explanations, drawings, and examples.

- Reference Reading. This resource directs you to read designated pages in a specified reference manual.

- Exercises. This resource presents information via the student manual. It uses a question/answer presentation. An exercise may be used to present new material or it may determine your comprehension of previously presented material.

- Programmed Text. This resource is a student manual text reading that presents information and asks for immediate feedback to determine your comprehension.

- Laboratory. This resource gives you actual hands-on experience with computer equipment.

- PLATO Assisted Learning. This resource presents information via the PLATO terminal.

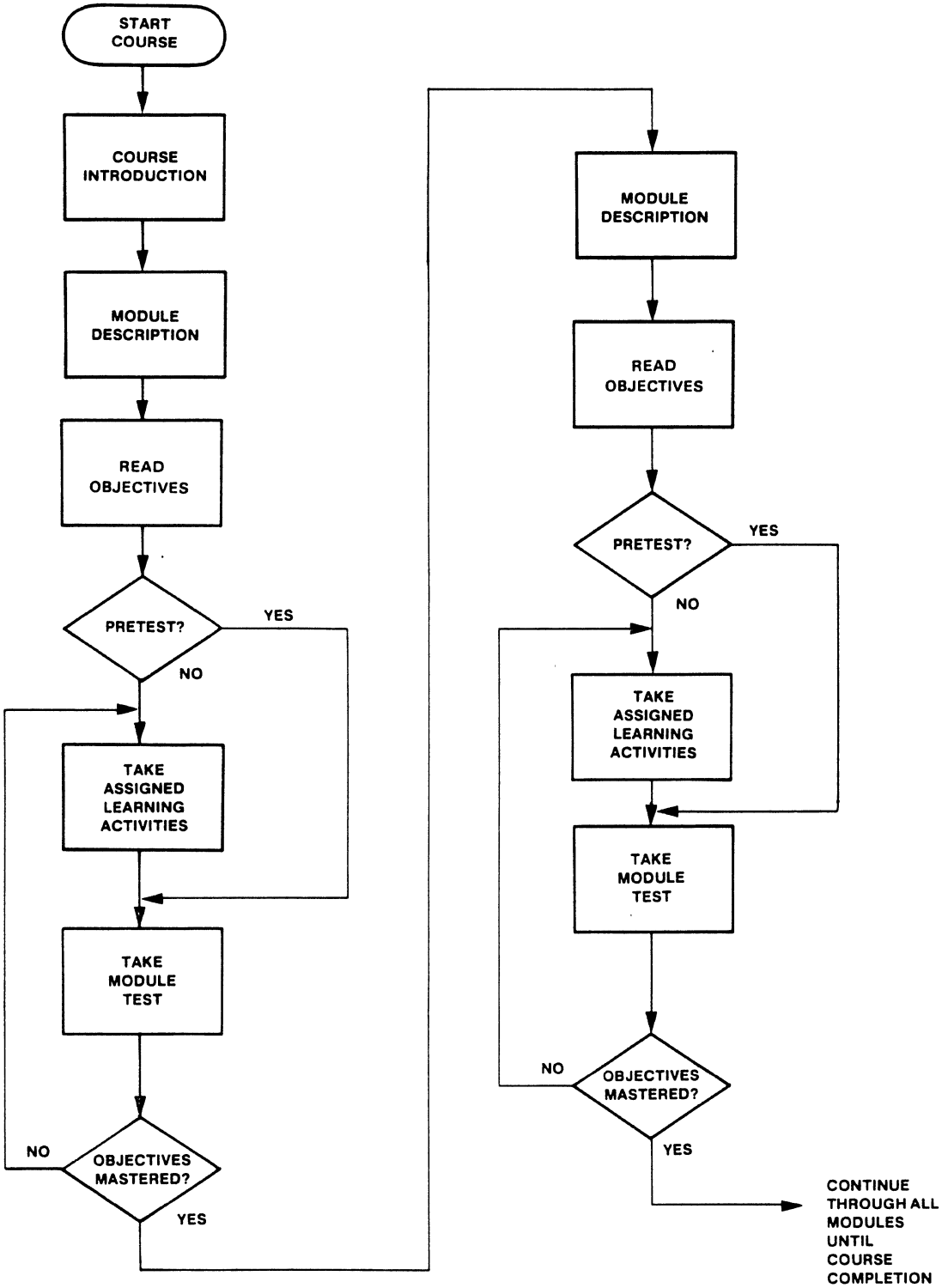


Figure A-1. Student Progress

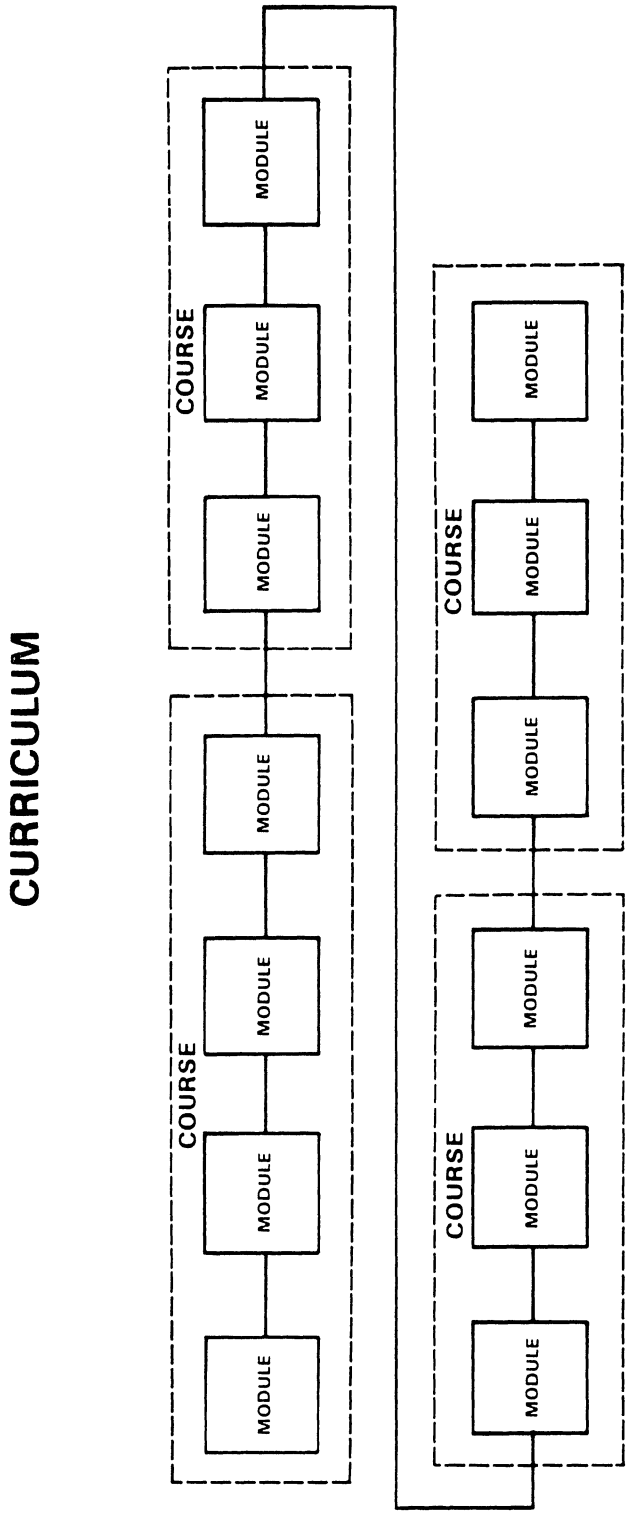


Figure A-2. Program Structure

- Audiotape. This resource presents an audio message via an audiotape machine.
- Microfiche. This resource uses a microfiche viewer and microfiche film to illustrate information.
- Videotape. This resource uses a videotape playback unit and videotape to present information.

You may proceed from one learning activity to another at your own pace. The learning activites are not long, but it is important that you take the time to understand the material before you go on to the next activity.

Each learning activity is coded with a number and a letter. The number stands for the module and the letter represents the order in which the learning activity is presented. The first learning activity of the first module is Learning Activity 1-A. The second activity is 1-B, and so on.

HOW DO I TAKE A TEST?

All testing is managed by PLATO learning management (PLM). PLM performs three important functions:

- Administers all tests.
- Assigns learning activities based on the results of the tests.
- Retains your student records for all courses you take within a curriculum.

PLM has two modes of testing, on-line and off-line. On-line testing requires that you sign on to a PLATO terminal to take the test. When you complete the test, PLM will assign learning activities based on the results of your test.

On-line testing is preferred because it saves time and enables you to proceed through your training without any delays.

Off-line testing is the more traditional method. Your administrator will give you a copy of the test and an answer sheet. Do not write on the test; record all your answers on the answer sheet. Return your test to the administrator, who will grade it and enter the results into the PLM system.

WHAT IS THE INDIVIDUALIZED INSTRUCTION TESTING PHILOSOPHY?

A test is a device that determines whether you have met the objectives of the course (module). It determines if you have acquired the skills that the course is designed to teach.

The number of times you take a test or your score on the test is not as important as the information you gain from the test results. The results tell you what areas you need to study.

Do not be alarmed if you need to take a test more than once. It is not your scores that count, it is your ability to perform your job that is important to you, Engineering Services' customers, and Control Data.

WHO ARE THE PERSONNEL INVOLVED IN INDIVIDUALIZED INSTRUCTION?

Regional Education Manager (REM)

The REM manages the training program for the region/country. He coordinates and administrates training activities to ensure that training needs are identified and fulfilled.

Regional Training Coordinator (RTC)

The RTC works with the education center manager to provide assistance as required; for example, he orders training materials, processes enrollments/confirmations, etc.

Education Center Manager (ECM)

The ECM administrates and coordinates training activities to ensure training delivery. For example, he provides a technical training advisor and identifies training materials requirements for the RTC. This individual may be a resource center manager, regional education manager, skill center manager or education center manager.

Education Training Coordinator (ETC)

The ETC manages the PLATO learning management (PLM) system. He provides the student with a student sign-on and PLM entries, and he works with the education center manager to solve PLM related problems.

Technical Advisor (TA)

The TA deals directly with the student. He monitors activities and provides guidance and assistance as required. A TA may be an engineer-in-charge, regional technical support instructor or a customer engineer with technical expertise.

Subject Matter Expert (SME)

The SME provides technical assistance for training problems that cannot be resolved by the technical advisor.

Learning Center Administrator (LCA)

The LCA works directly with the student to ensure smooth progression through the course.

APPENDIX B
PLATO SIGN-ON PROCEDURES

In order to begin the course you must first sign on to the PLATO system. Depending on where your terminal is located, you may first have to dial up the PLATO computer in order to establish communication between the computer and your terminal. If your terminal is on a direct connection, this is not necessary, and steps 2 and 3 can be skipped.

1. Turn power on.

*2. Dial the number of the PLATO system using the data phone. When the system answers, you will hear a tone. The next step must be performed within three seconds after you hear the tone.

*3. Lift exclusion button (usually located on the telephone cradle). Place the receiver on the table or in front of the cradle. Do not hang up.

NOTE

Some data phones require that you lift the exclusion button to dial, and hang up when the tone is heard.

4. Press the STOP key on the PLATO terminal keyboard.

5. Press the NEXT key on the PLATO keyboard. This causes the welcome to PLATO page to be displayed (figure B-1).

6. Enter your name exactly as you are registered in this course. Normally this will be your last name, followed by a space, and your first initial, with no capital letters (for example, smith j, as shown in figure B-2).

   If you make a mistake, you can erase it by pressing the ERASE key on the right side of the keyboard.

7. Press the NEXT key. You will then be asked to enter the name of your PLATO group . Enter the name of the PLATO group in which you are registered. Once again, the exact spelling is required.

*Dial-up system only.

Appendix B

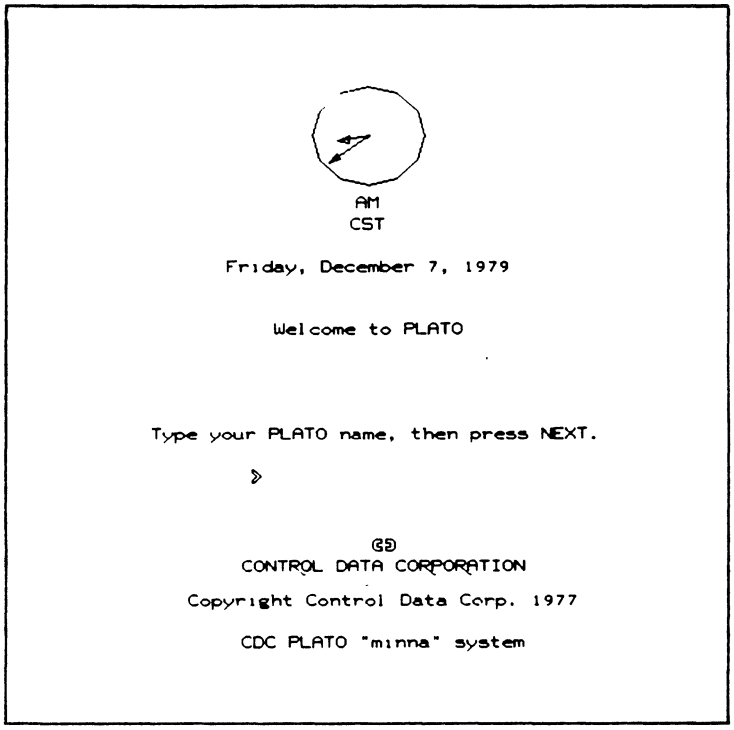


Figure B-1. Welcome to PLATO

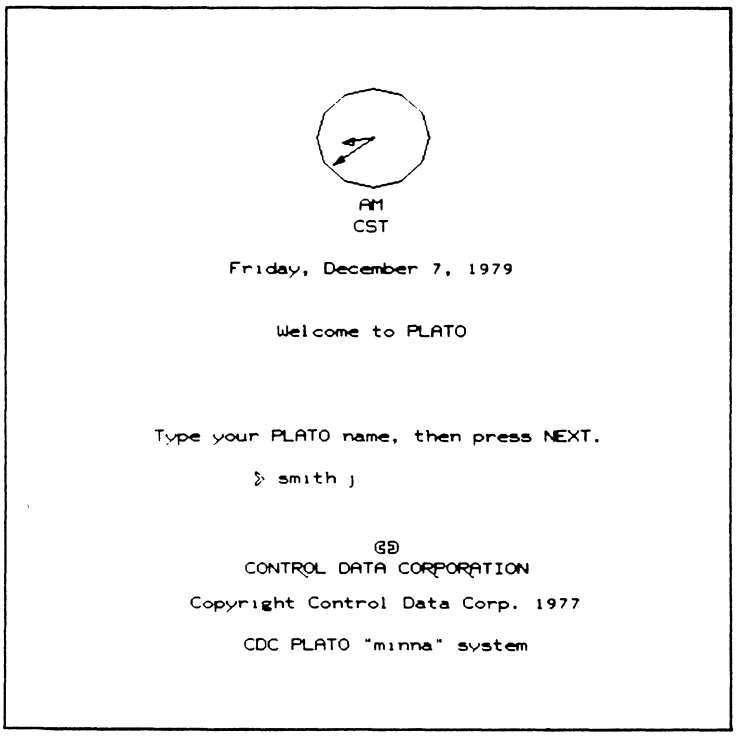


Figure B-2. Repeat

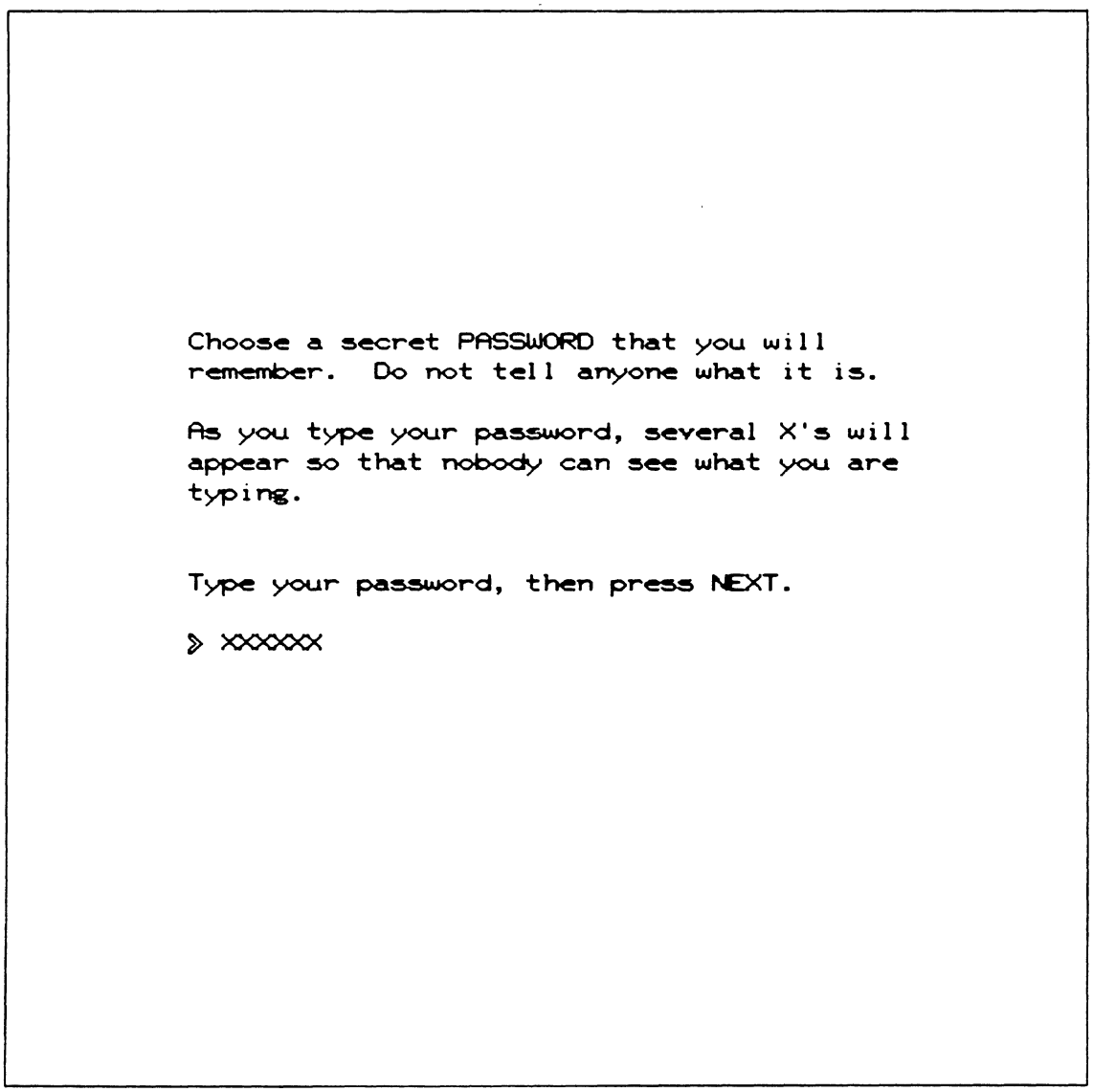


Figure B-3. Password

8. Hold down the SHIFT key and press the STOP key. You will then be asked to enter your password (figure B-3). Your password can be anything you choose, but it must be something that you can easily remember, such as a name, phone number, employee number, etc. Do not forget the password you have selected. It will become your key for gaining access to your lessons.

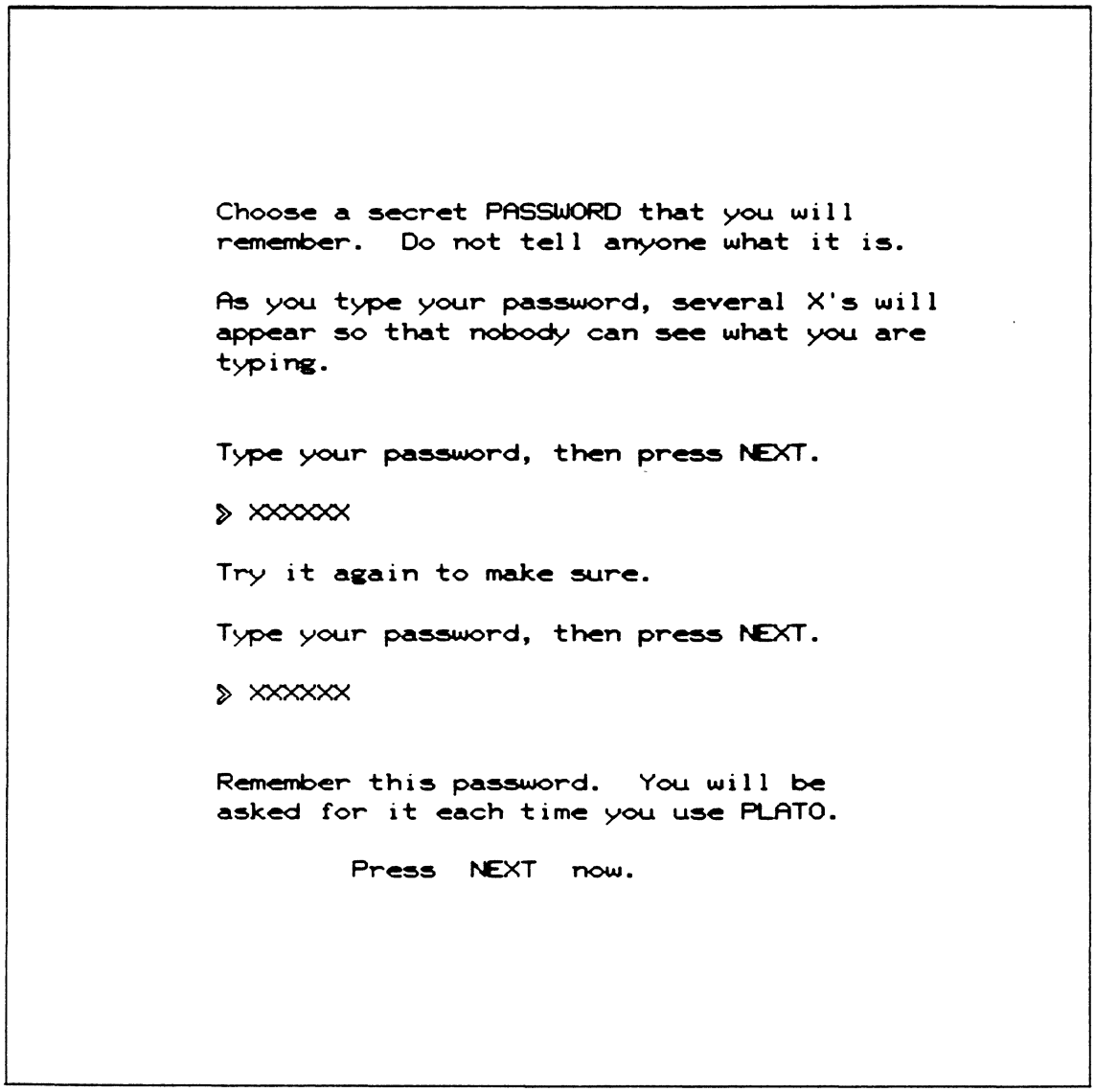


Figure B-4. Password Repeat

9. Press the NEXT key. If this is the first time you have signed on to this course, you will be asked to enter your password again (figure B-4). Enter it again, just as you did before. From this point on you will be required to enter your password only once when you sign on.

10. Press NEXT. You are now signed on to the system.

APPENDIX C
USING MICROFICHE

INTRODUCTION

This appendix provides the basics of selecting, loading, and viewing microfiche on a Micron 780 Microfiche Desk Reader or a similar reader. (See the Microfiche Handbook, available from Information Services, STP109, for more information.)

The portable microfiche desk reader may also be used since it has the same capabilities as the Micron 780.

Consult the operator's manual for specific information on the readers.

SELECTION

Select the proper microfiche by consulting the microfiche header, which contains the title of the contents and the microfiche reference number (figure C-1).

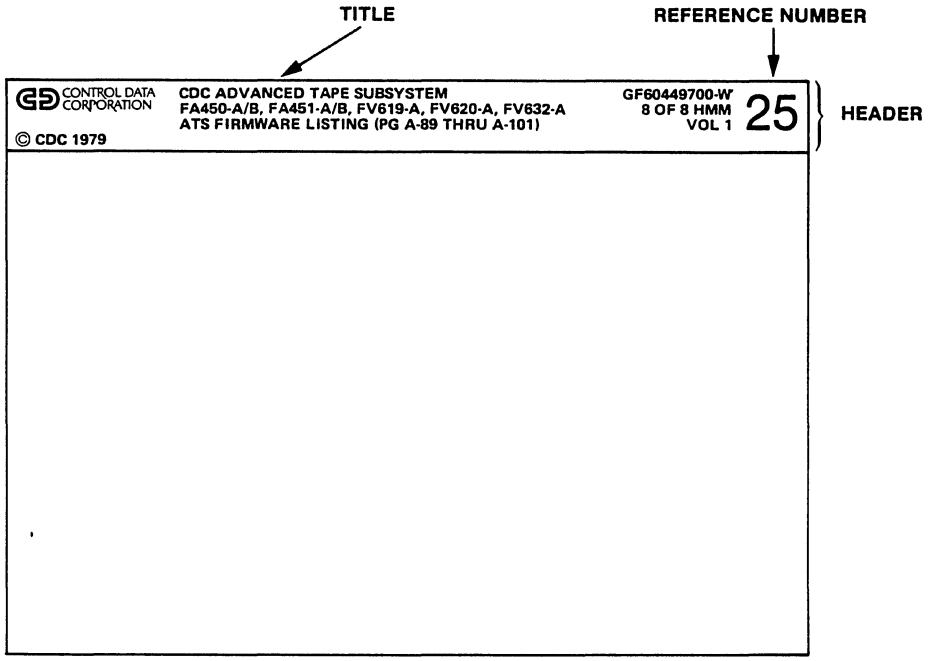


Figure C-1. Microfiche

(Manual Title)
Appendix C

LOADING

To load the Micron 780 Desk Reader or a similar desk reader, perform the following procedure (figure C-2).

1. Turn on the microfiche desk reader by pushing in on the side of the LOW-OFF-HIGH switch that indicates a low light intensity setting.

2. Pull the carriage assembly toward you until the glass covers flip up.

3. Hold the microfiche by the header with the printed information facing up (figure C-3).

4. Position the microfiche toward the upper right corner of either glass.

5. Push the carriage assembly back and position it so that a full picture with a index grid coordinate number is visible on the screen.

6. Select the proper index grid. Each microfiche desk reader is equipped with two index grids, a 24X index grid for 24X microfiche and a 42X index grid for 42X microfiche; most documentation is on 24X microfiche (figure C-4).

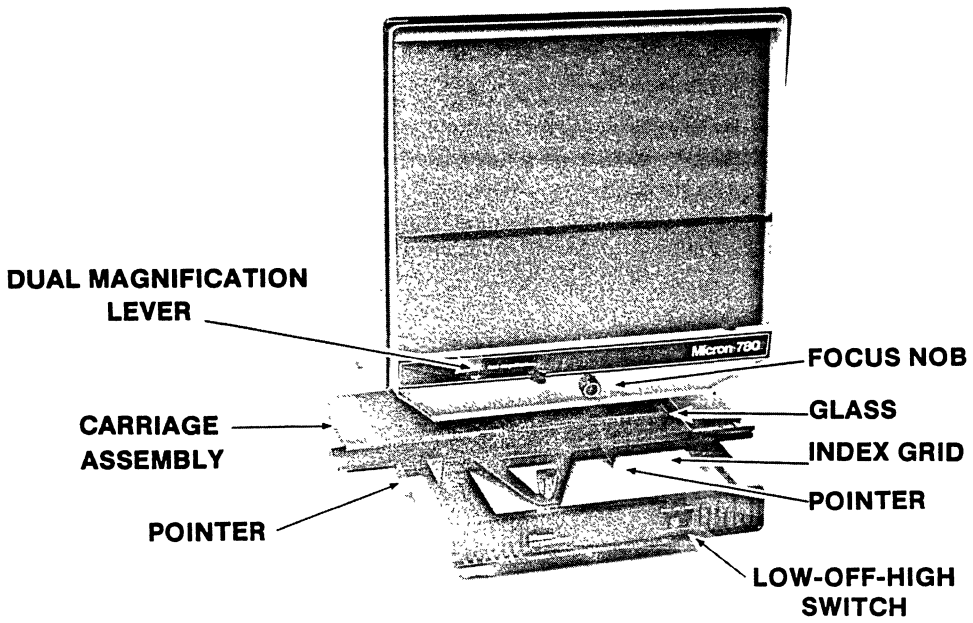


Figure C-2. Microfiche Desk Reader

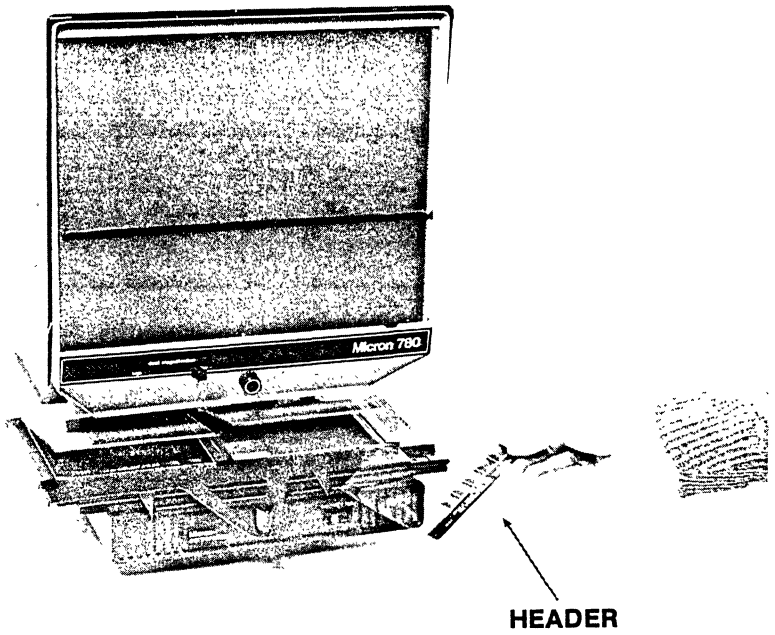


Figure C-3. Inserting Microfiche into Desk Reader

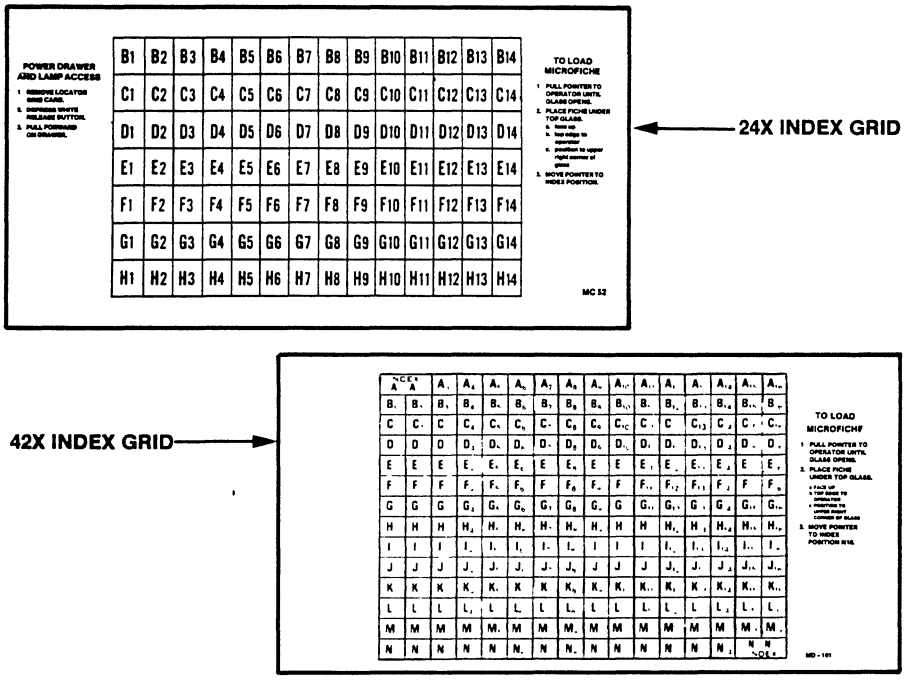


Figure C-4. 24X and 42X Index Grids

a. The 24X microfiche has a 3/8-inch header, and the 24X index grid is divided into 14 horizontal boxes.
b. The 42X microfiche has a 1/2-inch header, and the 42X index grid is divided into 16 horizontal boxes.

7. Place the proper index grid so that the carriage pointer is centered over the index grid coordinate number that appears on the screen.

VIEWING

When viewing a logic diagram with a index grid coordinate number of B1, position the carriage pointer between B1 and B2 on the index grid. Adjust the carriage to obtain a full screen picture. Student manuals and audiotapes may call the coordinates B1/B2 on the index grid. B1/B2 indicates that the carriage pointer should be positioned between B1 and B2 on the index grid (figure C-5).

Other pages of technical manual can be viewed by placing the carriage pointer in the center of the index grid coordinate number (figure C-6).

Screen Quadrants

The desk reader screen is divided into four quadrants to reference any area of the screen (figure C-7). It has a transparent horizontal yellow line for the horizontal axis; you may need to add the vertical axis. Transparent map tape, clear tape, or grease pencil work well as the vertical axis.

Magnification

A dual lense microfiche reader, such as the Micron 780, can magnify any area of a 24X microfiche by using the high (42X) lense in the following procedure.

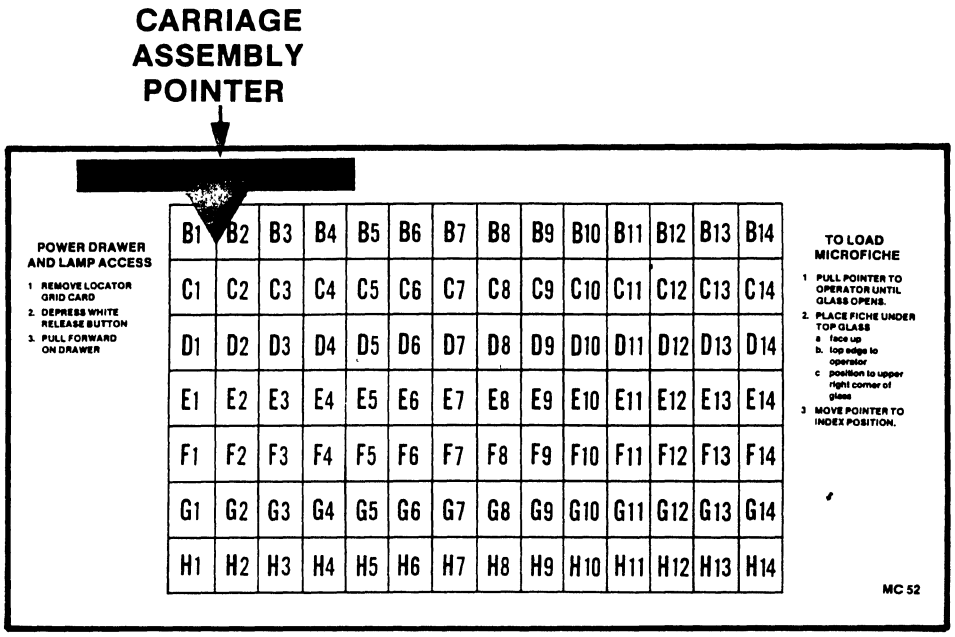


Figure C-5. Carriage Assembly Pointer Position for Technical Manuals

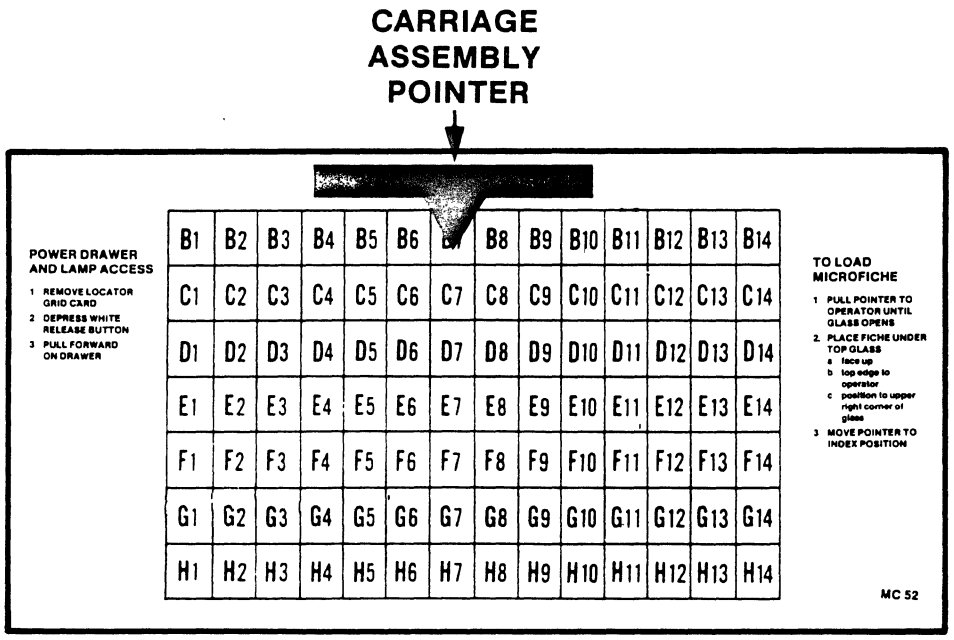


Figure C-6. Carriage Assembly Pointer Position for Logic Diagrams

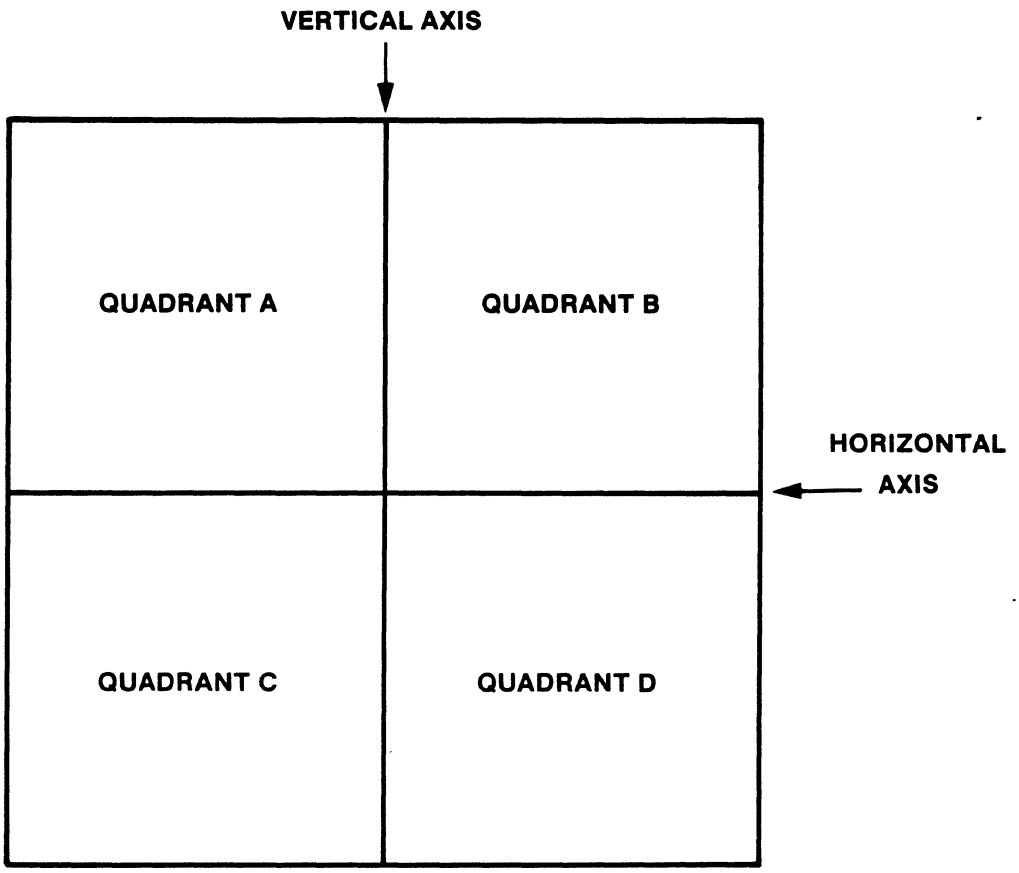


Figure C-7. Screen Quandrants

1. Position the area that you wish to magnify in the center of the screen using the carriage assembly (see figure C-2 for the location of the DUAL MAGNIFICATION lever).

2. Move the DUAL MAGNIFICATION lever to HIGH.

3. Return the magnification lever to LOW before moving on to another frame.

Light Intensity

The microfiche desk reader can deliver high or low light intensity. The Light Intensity switch is part of the LOW-OFF-HIGH switch.

The following suggestions may help reduce eye strain when using a microfiche desk reader for a long time.

- Do not watch the screen while moving to a different frame.
- Use low intensity light for low magnification and high intensity light for high magnification.
- Be sure the image on the screen is focused sharply (see figure C-2 for the location of the focus nob).
- Tilt the projector forward or backward.
- Vary the intensity of the room lighting.

Be sure to turn the viewer off whenever you are not using it. Extended exposure to light will fade the microfiche.

INSTRUCTOR CONFIRMATION

INSTRUCTIONS: When all objectives in the preceding laboratory session have been met, complete this form. Please fill in all the information asked for in each blank space. Next, the form must be signed by the lab instructor in the space provided. Then, remove this page and fold it so that the address on the back appears. Then staple it and mail it. When this form is received by ESE, the student's PLATO records will be updated to reflect mastery of this lab module.

STUDENT NAME:_____
(print)

EMPLOYEE NUMBER:_____

DEPARTMENT NUMBER:_____

PLATO SIGN-ON NAME:_____
(print)

PLATO GROUP NAME:_____

I certify that the above named student has satisfactorily completed all procedures and has met the objectives of _____ in the _____ course.

INSTRUCTOR NAME:_____
(print)

INSTRUCTOR SIGNATURE_____DATE:_____

COURSE TITLE: Cyber 170 Display Subsystem
PRODUCT NUMBER: R0405

INSTRUCTOR COMMENTS:

CUT ALONG LINE

AA3419 REV. 11/69 PRINTED IN U.S.A.

NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

FOLD ON DOTTED LINES AND STAPLE

FOLD

FOLD

FIRST CLASS
PERMIT NO. 8241

MINNEAPOLIS, MINN.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

POSTAGE WILL BE PAID BY

CONTROL DATA CORPORATION

Engineering Services Education
1009 Washington Avenue North
Minneapolis, Minnesota 55401

ATTN: Administration of Individualized
Instruction (NTHESE)

CUT ALONG LINE

FOLD

FOLD

COMMENT SHEET

MANUAL TITLE CYBER 170 DISPLAY SUBSYSTEM

PUBLICATION NO. 75445735 REVISION C Prod. No. R0405

FROM: NAME:

BUSINESS ADDRESS:

COMMENTS:

This form is not intended to be used as an order blank. Your evaluation of this manual will be welcomed by Control Data Corporation. Any errors, suggested additions or deletions, or general comments may be made below. Please include page number references and fill in publication revision level as shown by the last entry on the Record of Revision page at the front of the manual.

CUT ALONG LINE

PRINTED IN U.S.A.

AA3419 REV. 11/69

NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

FOLD ON DOTTED LINES AND STAPLE

STAPLE

STAPLE

FOLD

FOLD

FIRST CLASS
PERMIT NO. 8241

MINNEAPOLIS, MINN.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

POSTAGE WILL BE PAID BY

CONTROL DATA CORPORATION

Engineering Services Education
P.O. Box 0
Minneapolis, MN 55440

ATTN: EDUCATION QA
NTHESE

CUT ALONG LINE

FOLD

FOLD

CORPORATE HEADQUARTERS P.O. BOX 0 MINNEAPOLIS, MINNESOTA 55440