EY–1173E–WB–0101

RA60 Disk Drive Maintenance Course

Workbook I

digital

EY-1173E-WB-0101

RA60 Disk Drive Maintenance Course

Workbook I

Videotape Lessons 1 Through 5

A Portion of Course
EY-1173E-V0-VU01

FOR INTERNAL USE ONLY

Prepared by Educational Services

Digital Equipment Corporation

First Edition, July 1983

The material in this manual is for information purposes and is subject to change without notice.

Digital Equipment Corporation assumes no responsibility for any errors which may appear in this manual.

Printed in U.S.A.

Class A Computing Devices

Notice: This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such radio frequency interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case, the user at his own expense may be required to take corrective measures.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

Dec	DECnet	OMNIBUS
DECUS	DECsystem-10	OS/8
DIGITAL	DECSYSTEM-20	PDT
Digital Logo	DECwriter	RSTS
PDP	DIBOL	RSX
UNIBUS	EduSystem	VMS
VAX	IAS	VT
UDA50	MASSBUS	RA80
HSC50	RA60	RA81

CONTENTS

Page

ILLUSTRATIONS

LESSON 1: PART LOCATION

INTRODUCTION

This videotape lesson introduces the RA60 Disk Drive and shows the location of all drive parts.

OBJECTIVES

After completing this lesson, you will be able to locate all the RA60 Field Replaceable Units (FRUs).

RESOURCES

The resources required for this lesson are:

- Videotape player
- Video monitor
- RA60 videotape
- RA60 Disk Drive User Guide (EK-ORA60-UG)
- RA60 Disk Drive Service Manual (EK-ORA60-SV)

NOTE

At this time, look at the RA60 Part Location videotape module.

SUMMARY

The RA60 Disk Drive has the following features.

- Removable media
- 205 megabytes of data storage (16 bit format)
- Operates on the SDI cable

Figure 1 shows the front and exterior drive parts.

- Front bezel
- Control panel
- Front cover latch button
- Front cover
- Rear cover

Figure 2 shows the rear of the drive and cabinet parts.

- Rear cabinet door
- I/O bulkhead
- I/O bulkhead connector
- SDI cables
- Power controller
- Power controller circuit breaker
- Drive circuit breaker
- DC fans

Figure 3 shows the drive diskwell parts.

- Diskwell assembly
- Disk spindle
- Read/write heads

PART LOCATION

Figure 4 shows the drive front internal parts.

- Absolute filter
- Spindle motor assembly

Figure 5 shows the drive rear internal parts.

- Positioner motor
- Preamp module
- Logic cage
- Drive logic module
- ASCII port connector
- SDI interface module
- Post amp/data separator module
- Transformer assembly
- Power supply assembly
- Cap rectifier assembly

Figure 6 shows the following three power supply assembly modules.

- Motor control module
- Regulator module
- Heat sink module

NOTE

At this time, answer the exercise questions.

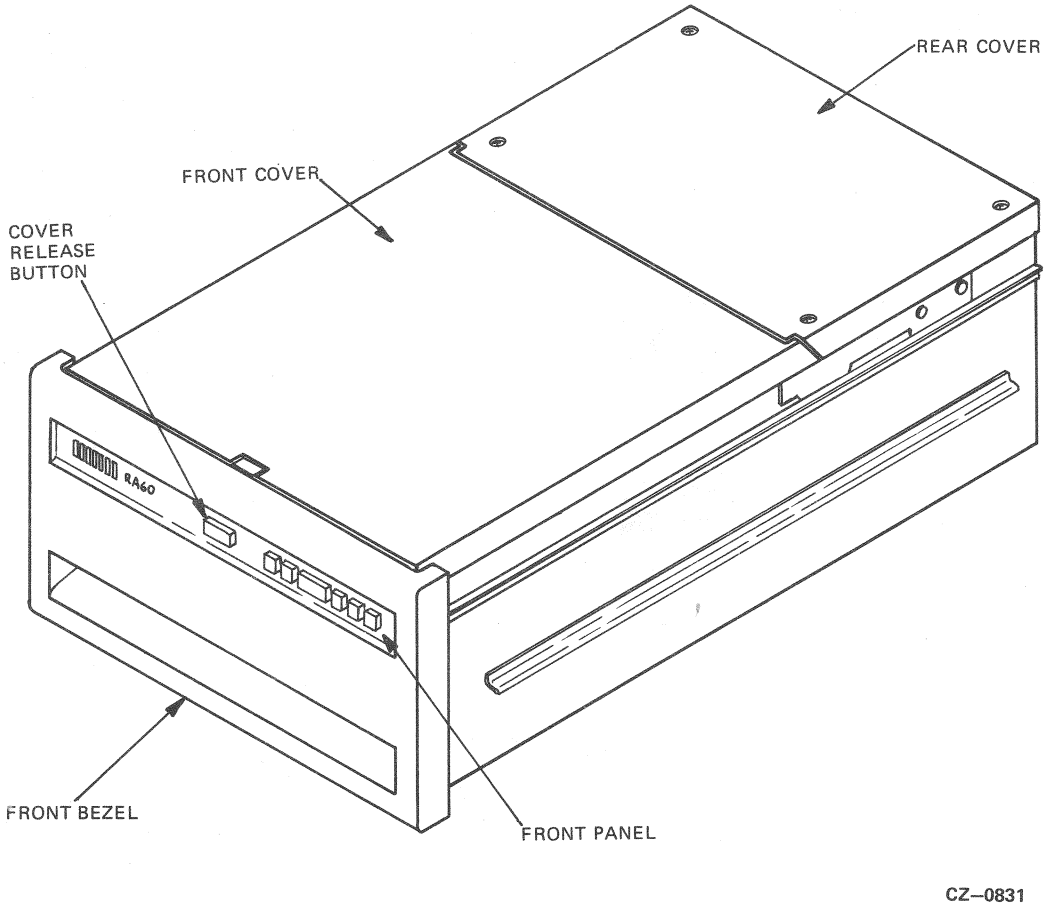


Figure 1 Front and Exterior of RA60

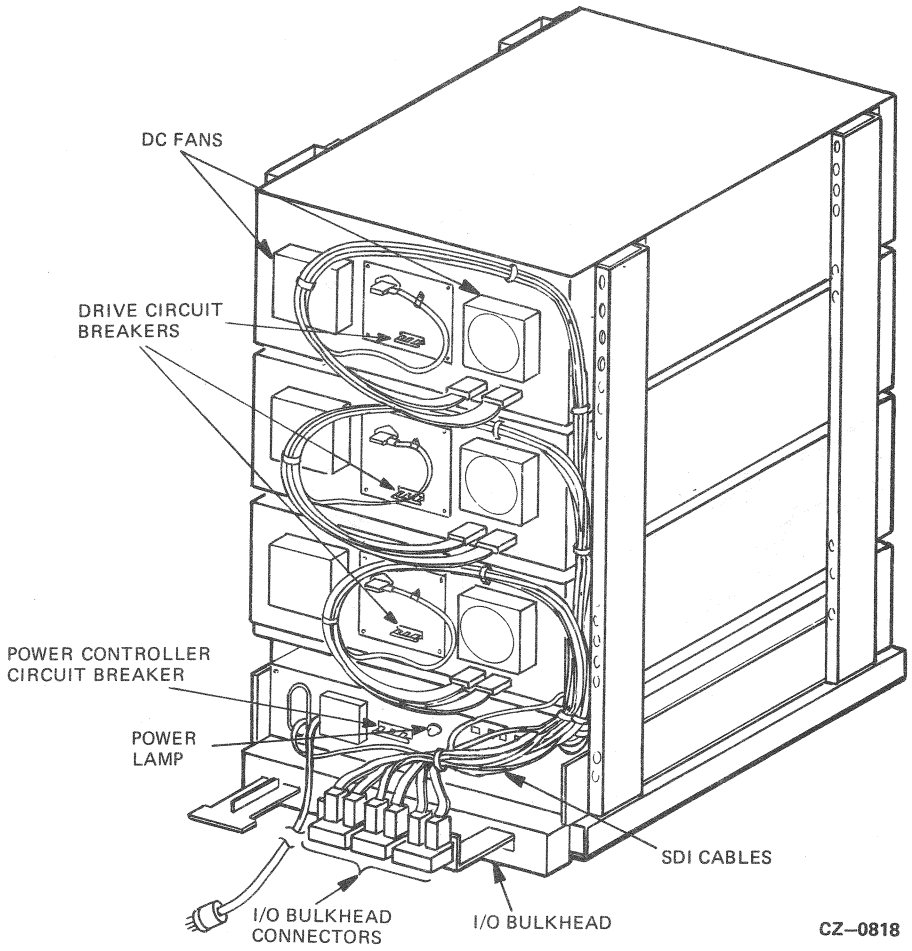


Figure 2 Rear View of RA60 Drive Cabinet

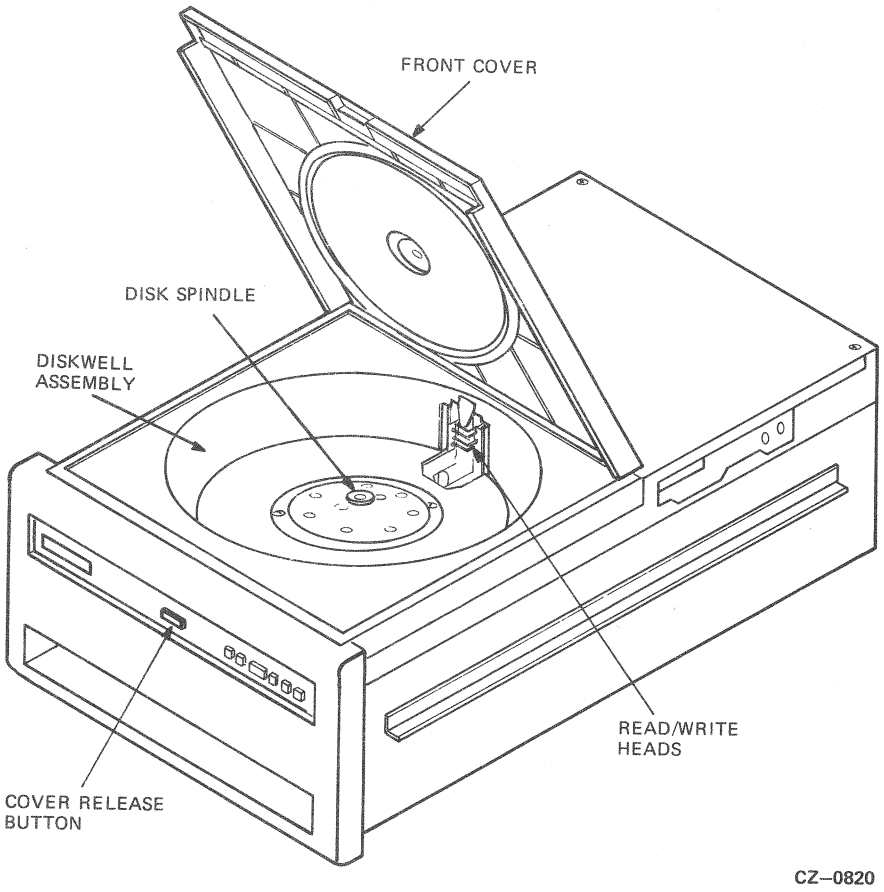


Figure 3 RA60 Diskwell Area

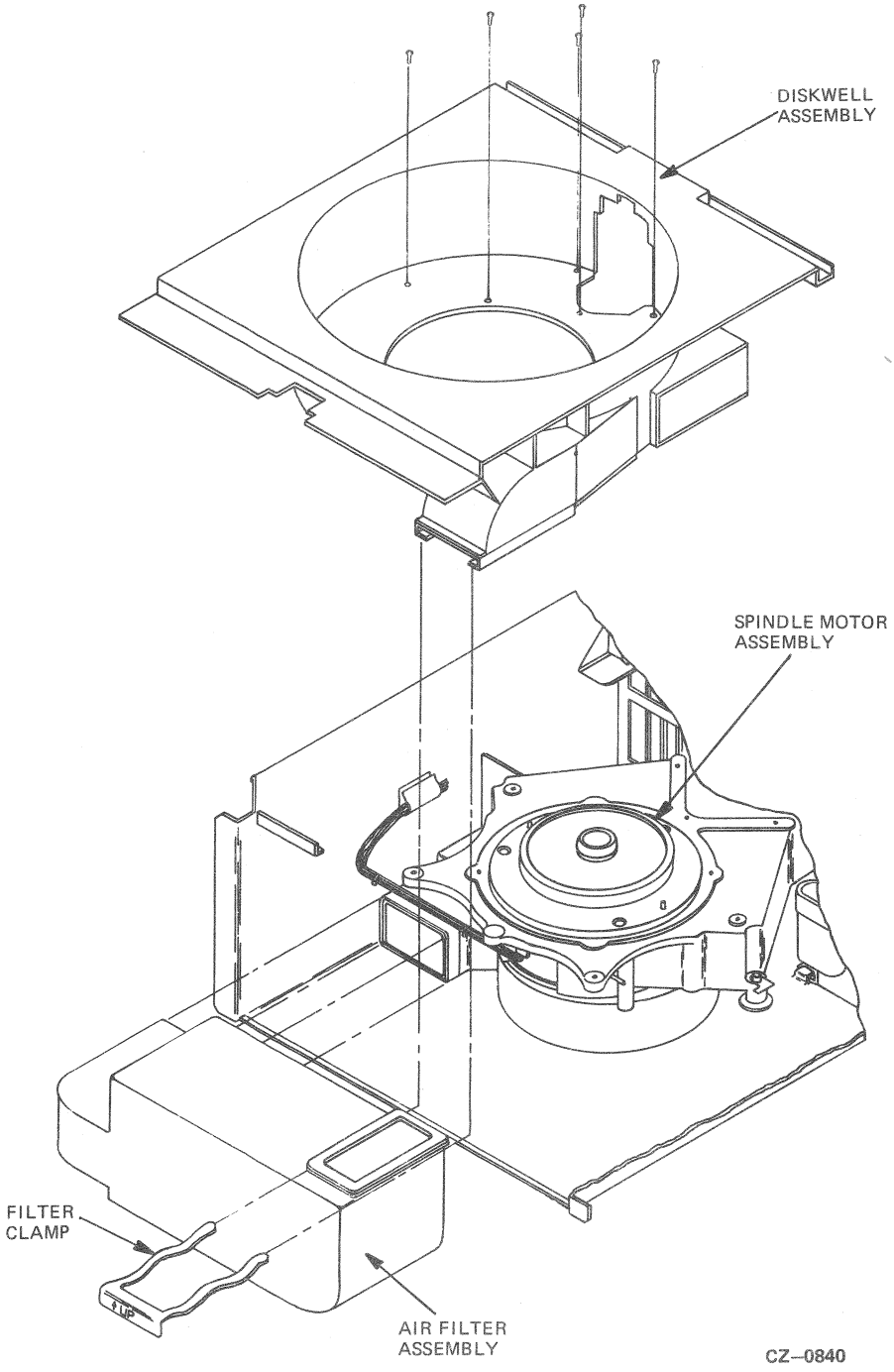


Figure 4 RA60 Front Internal Parts

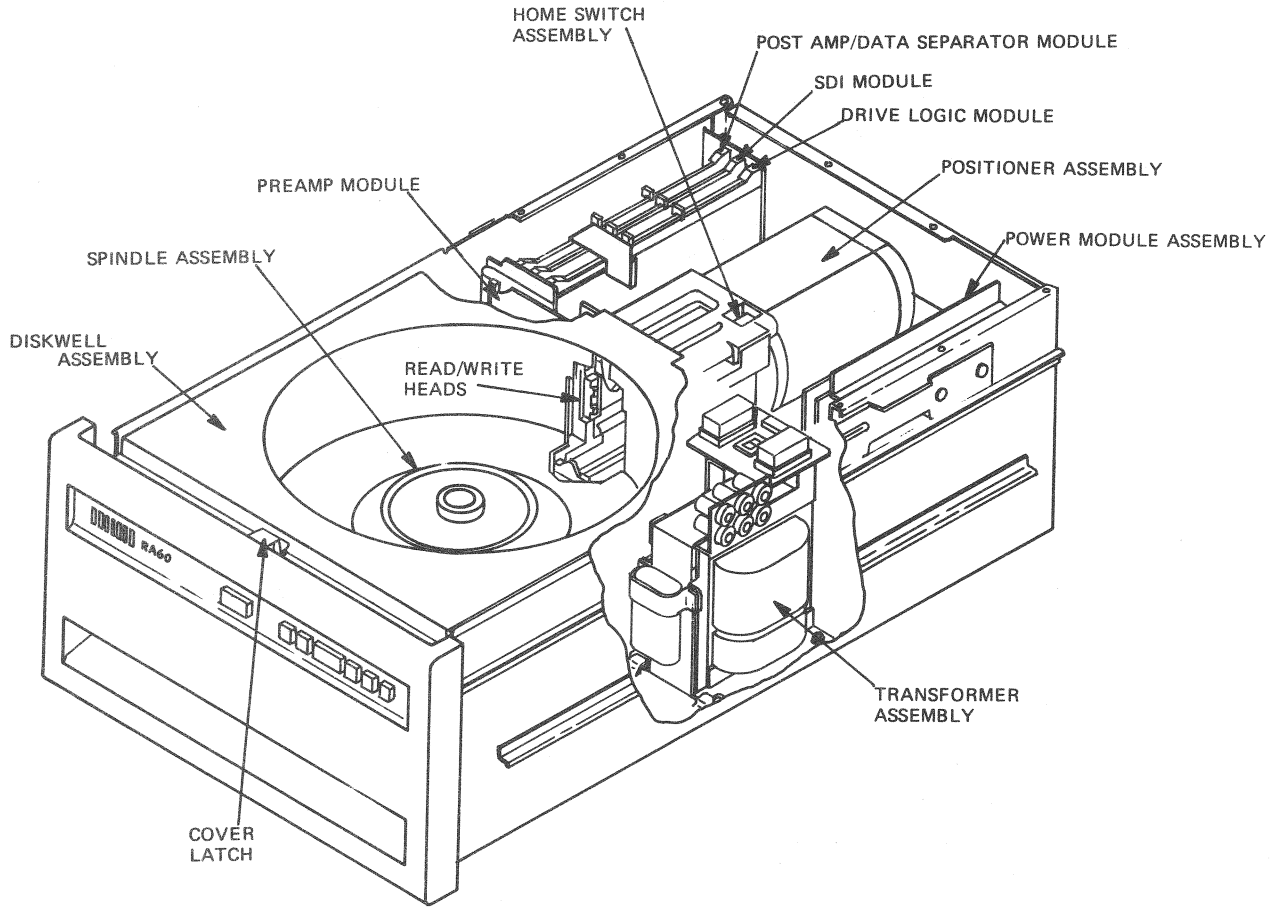


Figure 5 RA60 Rear Internal Parts

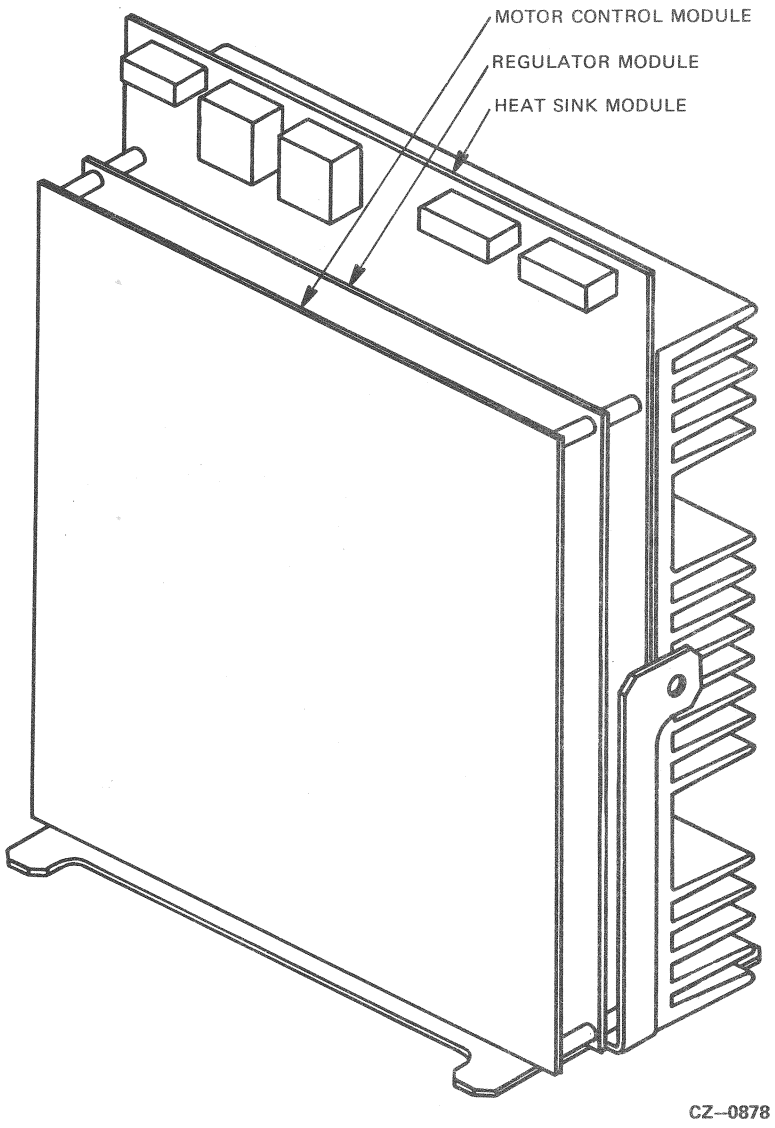


Figure 6 RA60 Power Supply Assembly

EXERCISES

1. How is the front cover of the RA60 Disk Drive opened?

   A. By pushing the cover latch button when power is either on or off

   B. By turning the hex lock key clockwise

   C. By pushing the cover latch button when power is on

   D. By turning the hex lock and pushing the cover latch button

2. Where is the absolute filter located?

   A. At the rear of the drive

   B. Under the positioner motor

   C. On the inside of the front bezel

   D. Under the diskwell assembly

3. Where is the preamp module located?

   A. On the positioner motor assembly

   B. In the logic cage

   C. On the heat sink assembly

   D. On the chassis side wall

SOLUTIONS

1. C. The front cover may be opened by pushing the cover latch button, but only when the drive power is on. The button will not release the cover if the power is off or if the spindle is still turning.

2. D. The absolute filter is mounted on the bottom of the diskwell assembly.

3. A. The preamp module is mounted onto a bracket at the front of the positioner motor assembly.

NOTE

Continue to Lesson 2, Drive Installation.

LESSON 2: DRIVE OPERATION

INTRODUCTION

This videotape lesson shows the service person how to prepare and install the RA60 Disk Drive for customer operation.

OBJECTIVES

After completing this lesson, you will be able to describe the installation procedure using the RA60 Disk Drive User Guide as a reference.

RESOURCES

The resources required for this lesson are:

- Videotape player
- Video monitor
- RA60 videotape
- RA60 Disk Drive User Guide (EK-ORA60-UG)
- RA60 Disk Drive Service Manual (EK-ORA60-SV)

NOTE

At this time, look at the Drive Installation videotape lesson.

SUMMARY

Drive Cabinet Capacity

Each RA60 drive cabinet can hold up to three disk drives. This may be a mixture of RA60s, RA80s, and RA81s.

Safety Labels

There are three safety labels located on the back of the RA60 Disk Drive. Refer to Figure 7.

- Label 1 gives the current drive voltage and frequency settings.
- Label 2 cautions the service person to extend the cabinet stabilizer foot before sliding the drive to its service position. Refer to Figure 8.
- Label 2 also cautions the service person to reengage the slide restraint mechanism after working on the disk drive.

WARNING

If the slide restraint mechanism is not locked after servicing the drive, the cabinet can accidently tip over on an operator trying to load a disk pack. The slide lock prevents the drive from being slid beyond the operator position.

- Label 3 cautions the user to find out what voltage and frequency the drive is set for before applying power. As mentioned earlier, the voltage and frequency setting is given on Label 1.

Future disk drives will have two new safety labels on the diskwell assembly. One label, on the front right side of the diskwell, cautions the operator to remove the disk pack only after disk rotation has stopped. Normally, a cover interlock prevents the operator from opening the cover before disk rotation has stopped. If the interlock fails, the label gives a warning in several languages.

The second label on the diskwell assembly will be located on the inside rear wall of the diskwell. This label cautions the drive installer to remove the head locking pin. This is a new feature planned for future drives to allow the head locking pin to be removed through the diskwell opening, rather than from

inside the drive. When the locking pin is removed from the locked position hole, it is stored in the adjacent storage hole. A disk pack cannot be loaded into the drive while this carriage locking pin is still in the locked position.

READY Indicator Cap

The READY indicator cap on the drive control panel serves as both a READY indicator light and as the drive unit address plug. The drive unit address is set by cutting off plastic tabs on the rear of the READY cap. Figure 9 shows the rear view of the READY cap. Note the binary values assigned to the plastic tabs. You may program any number from 0 to 251 into this plug. Software requirements make the numbers from 252 to 255 invalid. It is important to note the drive number you wish to use before you break off the plastic tabs because the process is irreversible. If it is done incorrectly, obtain a new READY cap.

Voltage and Frequency Range

The voltage and frequency range of the RA60 may be changed internally for either 120 volt 60 hertz operation or 240 volt 50 hertz operation. Figure 10 shows the voltage switch and frequency plug configuration for both ranges.

Head Locking Pin

The head locking pin keeps the read/write heads from sliding forward during shipment. The location of the head locking pin is shown in Figure 11. During installation, remove the head locking pin from its shipping hole and place it in its storage hole.

Engineering is planning to redesign the carriage assembly so that the head locking pin may be removed through the diskwell opening rather than by removing the rear cover. In this new design, the head locking pin will be located on the front of the carriage assembly. During installation, the pin must be unscrewed from its locked position and screwed into the storage hole. Until this is done, a disk pack cannot be mounted into the drive.

SDI Cables

The external SDI cables plug into the bottom of the I/O bulkhead connector shown in Figure 12. The internal SDI cables plug into the top of the I/O bulkhead connector. Note that the I/O bulkhead connector is removed from the I/O bulkhead bracket to ease the installation of the external SDI cables. Note also that the RA60 does not require power sequencing cables like the RA80 and RA81 Disk Drives. This is because the RA60 uses a dc spindle motor that requires significantly less start up power than the other two drives.

Diagnostics

After the RA60 drive has been installed, the drive ROM-based diagnostics will check out the drive sanity when you power up the drive.

Next, you should test the drive operation under system control. This is done by running the four subsystem diagnostic tests. On VMS systems, these are called EVRLA. On PDP-11 RSTS systems, these are called CZUDC. These diagnostics run under their respective diagnostic supervisor programs.

The four subsystem diagnostic tests are:

- Test 1: UDA50 diskless test
- Test 2: Runs the drive-resident diagnostics
- Test 3: Performs a drive seek test
- Test 4: Performs a read/write test on the diagnostic cylinders only

After running the four subsystem diagnostic tests, run the subsystem exerciser program (UETP or DBEXER) for your appropriate operating system.

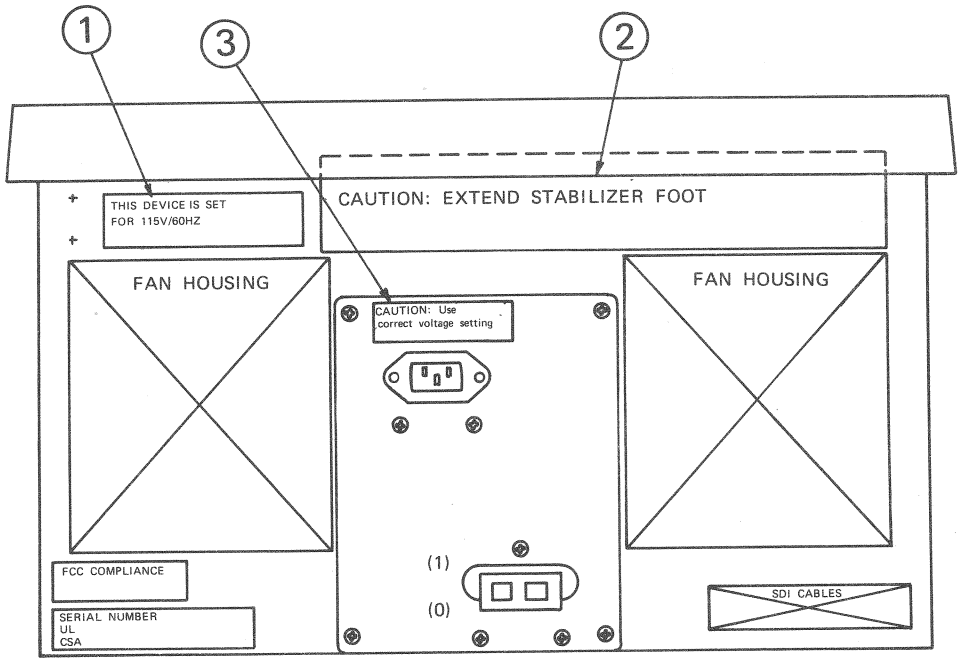


Figure 7 RA60 Safety Labels

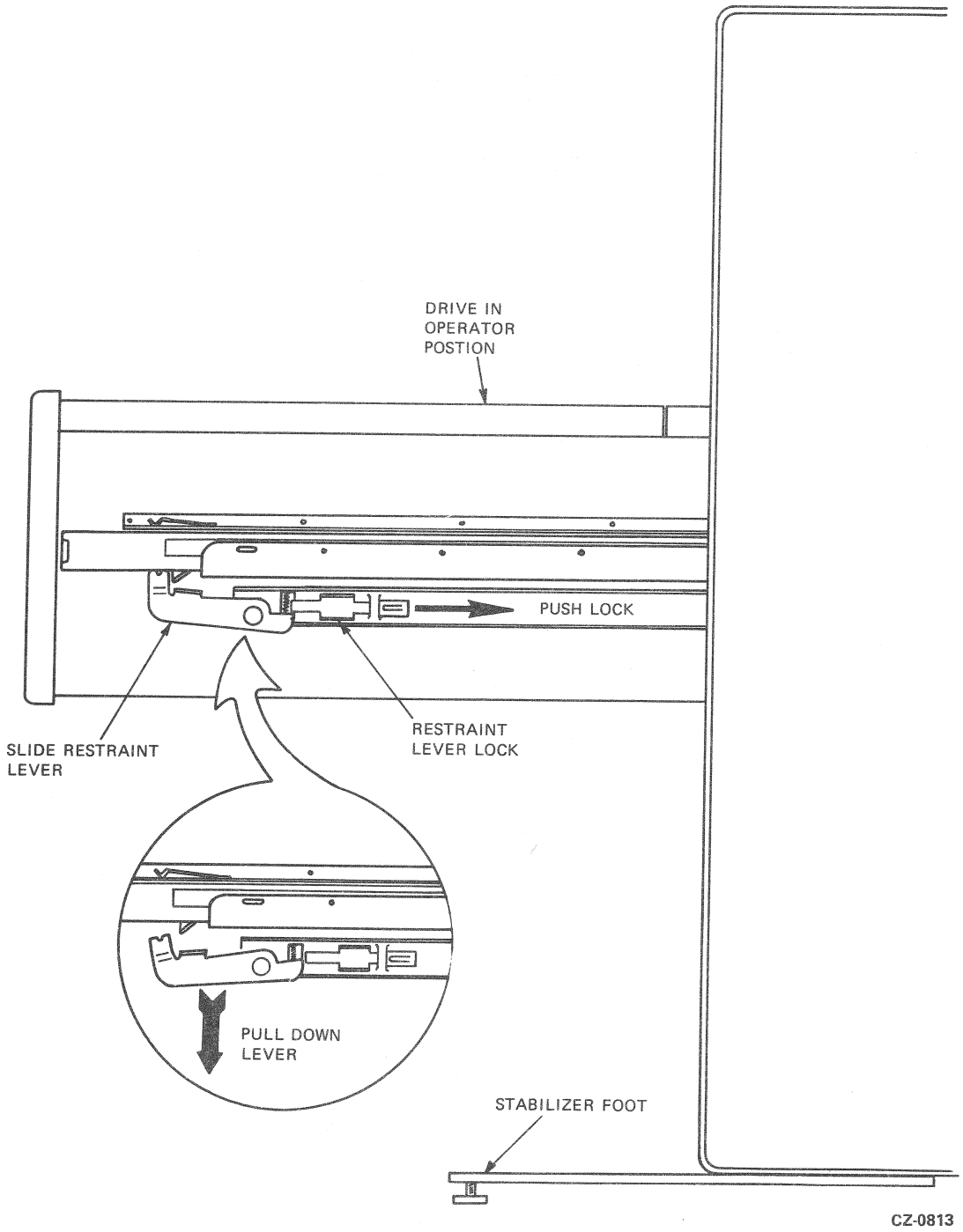


Figure 8 RA60 Drive Slide Restraint Mechanism

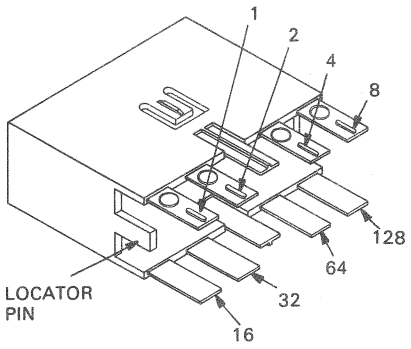


Figure 9 Rear View of RA60 READY Cap

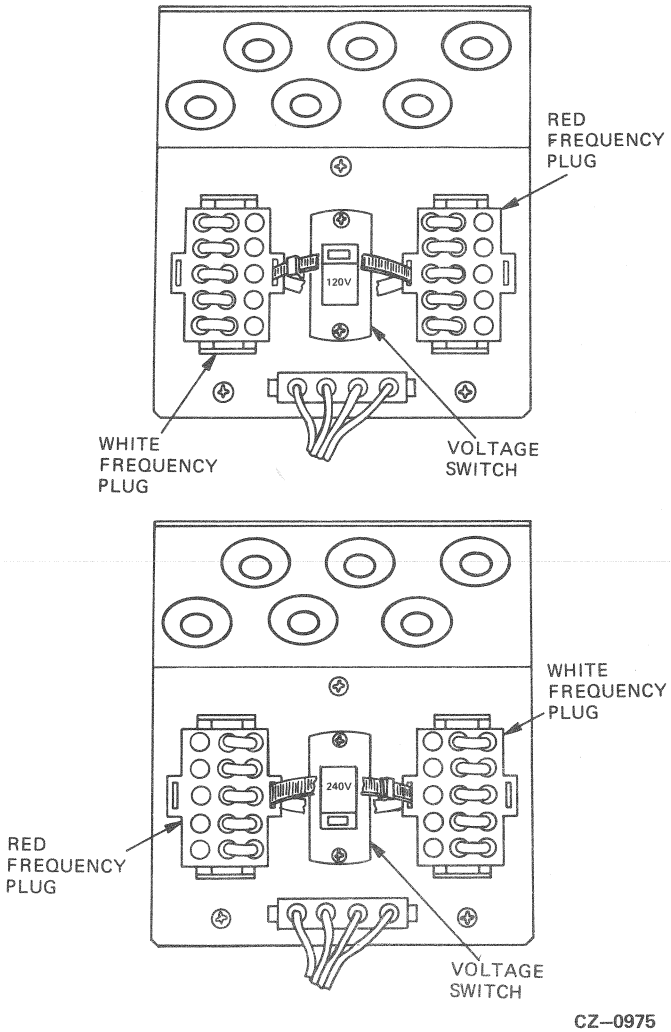


Figure 10 Voltage and Frequency Range Configurations

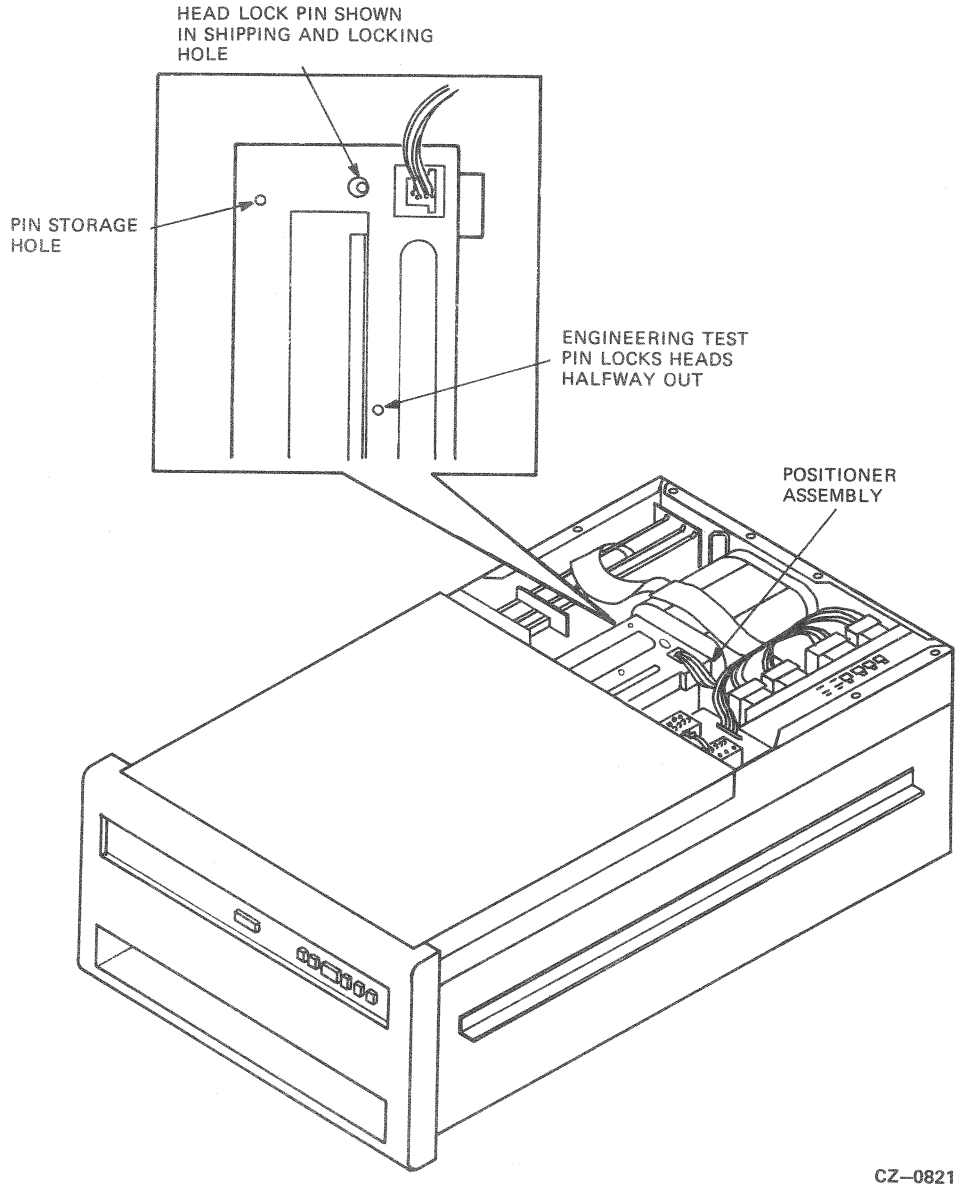


Figure 11 Location of the Head Locking Pin

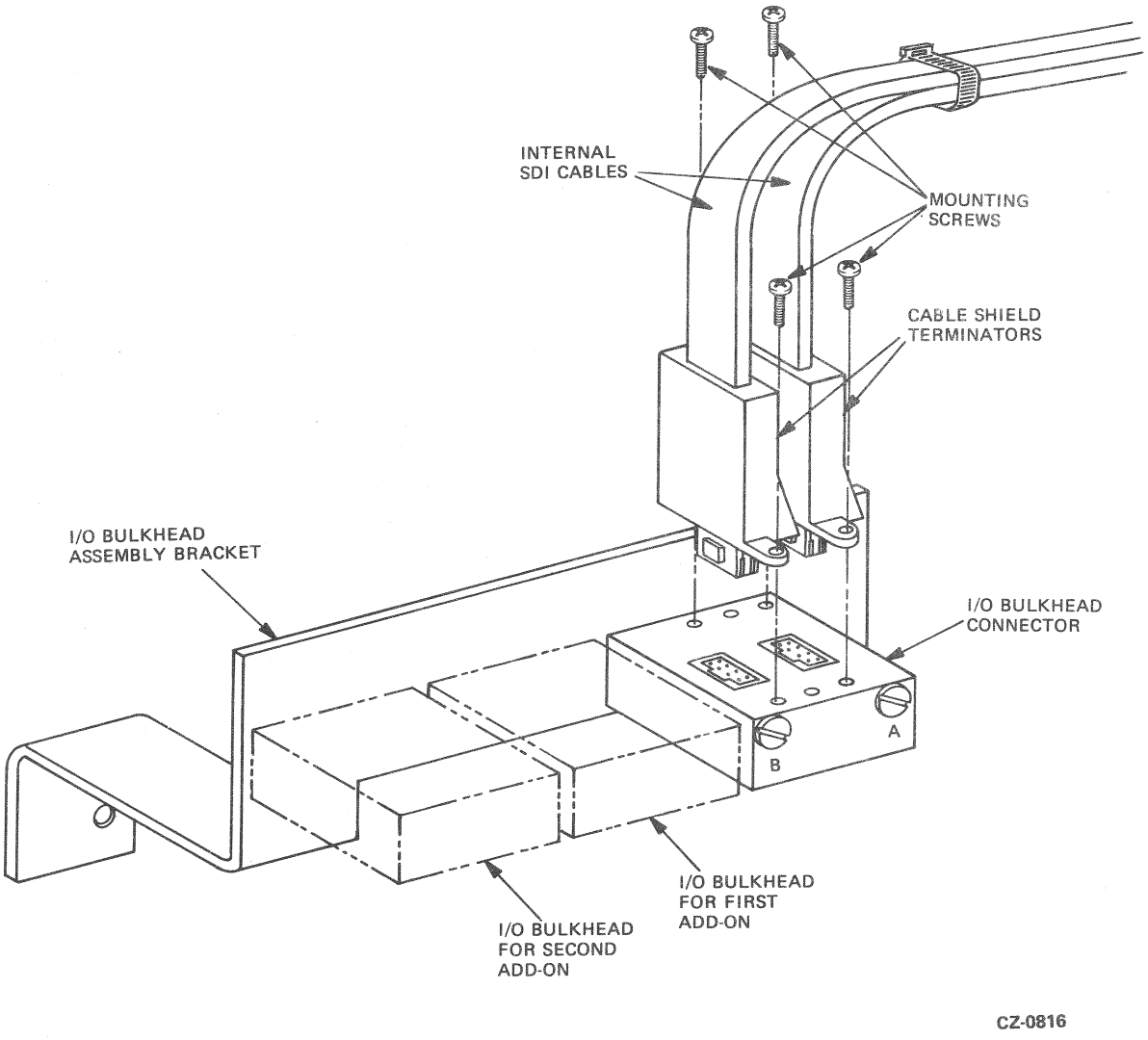


Figure 12 I/O Bulkhead Connector

EXERCISES

1. Which disk drives may be used in the RA60 drive cabinet?

   A. Only RA60 Disk Drives

   B. Only RA60 and RA80 Disk Drives

   C. Only RA60 and RA81 Disk Drives

   D. All three types of RA drives may be mixed

2. What should you do to keep the drive cabinet from tipping when installing an add-on disk drive?

   A. Make sure that the cabinet is resting on its leveller feet instead of the wheels.

   B. Tilt the front of the cabinet up slightly.

   C. Extend the cabinet stabilizer foot forward.

   D. Have two persons hold the cabinet while the new drive is added.

3. How is the drive unit address plug programmed?

   A. With tabs on the back of the READY indicator cap

   B. With jumpers on the backplane

   C. With jumpers on the control panel

   D. With microswitches on the drive logic module

4. How do you change the frequency range of the RA60 drive?

   A. With a switch on the regulator module

   B. By installing a new transformer assembly

   C. By interchanging the position of the two frequency plugs on the transformer assembly

   D. With the voltage range switch on the transformer assembly

DRIVE INSTALLATION

5. What is the first thing you should check if a newly installed RA60 will not load the read/write heads onto the disks?

   A. Check if the motor control module is bad.

   B. Check if the head locking pin was left in its shipping hole.

   C. Check if the drive logic module is bad.

   D. Check if the heat sink module is bad.

SOLUTIONS

1. D. The RA60, RA80, and RA81 Disk Drives may all be mixed in the same drive cabinet.

2. C. Extend the cabinet stabilizer foot to prevent the cabinet from tipping when you are installing an add-on drive or when you are servicing a drive.

3. A. The drive unit address is programmed by cutting off plastic tabs on the back of the READY indicator cap.

4. C. The frequency range of the RA60 is changed by interchanging the position of the two frequency plugs on top of the transformer assembly.

5. B. The first thing to check is whether the head locking pin is still in the shipping hole on the positioner motor assembly. This is the easiest of the corrective actions you can take, and in the case of a newly installed drive, it is the most likely cause of the problem. Remember that on the new RA60s, the head locking pin will be on the front of the positioner motor assembly rather than on the top.

LESSON 3: DRIVE OPERATION

INTRODUCTION

This videotape lesson describes the functions of the control panel switches and indicators. It also shows how to load and unload an RA60 disk pack.

OBJECTIVES

At the completion of this lesson, you will be able to describe the function of each control panel switch and describe how to load and unload an RA60 disk pack.

RESOURCES

The resources required for this lesson are:

- Videotape player
- Video monitor
- RA60 videotape
- RA60 Disk Drive User Guide (EK-ORA60-UG)
- RA60 Disk Drive Service Manual (EK-ORA60-SV)

NOTE

At this time, look at the Drive Operation videotape lesson.

SUMMARY

The control panel consists of the following five switches and one plug. Figure 13 shows a close-up of the control panel module.

- RUN/STOP switch
- FAULT switch
- READY cap
- WRITE PROTECT switch
- PORT A switch
- PORT B switch

RUN/STOP Switch

After the disk pack is loaded, push the RUN/STOP switch to initiate the disk spin-up sequence. The RUN/STOP indicator will light immediately and stay on as long as the spindle is turning. Release the RUN/STOP switch to initiate the spin-down sequence. The RUN/STOP indicator will go off only after the spindle has stopped.

If the RUN/STOP switch is released during the middle of a read or write operation, the drive will complete all outstanding read and write commands issued by the disk controller before spinning down.

If the RUN/STOP switch was already pushed before power is applied, the switch must be reset by releasing it and pushing it in again before you can start the spin-up sequence.

FAULT Switch

If the FAULT indicator is not on, you may push in the FAULT switch to perform a control panel lamp test. All the indicators will stay on as long as the FAULT switch is held in.

The FAULT indicator will light whenever there is a serious fault condition in the drive. The FAULT indicator may go off by itself if the fault cause was software correctable with a DRIVE CLEAR command. If the fault is not software correctable, the FAULT indicator will stay on until the physical cause of this condition is removed.

When the FAULT indicator is on, you may display the blinking hexadecimal fault code in the control panel indicators by pushing the FAULT switch once. Tables interpreting these control panel hexadecimal fault codes are found in the RA60 User Guide, RA60 Service Manual, and RA60 Maintenance Guide. The blinking fault code will remain displayed until the FAULT button is pushed a second time. If successful, the fault will be cleared and the FAULT indicator will go out. If unsuccessful, the FAULT indicator will stay on and the failing unit must be replaced.

READY Cap

The READY cap serves both as a drive ready indicator and as a drive unit address plug. The READY indicator will light after the RUN/STOP switch has been pushed and the drive has completed a successful spin-up sequence. This process takes about 45 seconds. The READY light indicates that the drive is ready to receive read and write commands. The light will go off when the drive is performing seek operations or when the RUN/STOP switch is released to spin-down the disks.

As shown in the drive installation lesson, the READY cap also serves as a drive unit address plug. The drive unit address is selected by cutting off the plastic tabs on the back of the READY cap.

WRITE PROTECT Switch

Push in the WRITE PROTECT switch to disable the write circuitry and prevent the data from being written on the disk. The WRITE PROTECT indicator should light whenever the WRITE PROTECT switch is pushed in, and the indicator should be off whenever the switch is released.

PORT A and B Switches

The RA60 is a dual ported drive that can be controlled from two disk controllers. The PORT A and B switches determine which disk controller can have access to the drive. Push in the PORT A switch to make the disk drive available to a controller through

port A. Similarly, push in the PORT B switch to make the drive available to a controller on port B. If both PORT switches are pushed, the drive will be available to either disk controller when it is not busy on the other port. When both PORT A and B switches are released, the drive is not available to any disk controllers.

Loading the RA60 Disk Pack

The steps for loading the RA60 disk pack into the drive are as follows.

1. Push the cover latch button on the front of the drive and raise the front cover. Refer to Figure 14.

2. Pick up the disk pack by its handle and remove its bottom cover by squeezing the two slides together underneath it. Refer to Figure 15.

3. Lower the disk pack onto the spindle hub.

4. Hold the storage canister with one hand and rotate the pack handle to the right about three revolutions until it is snug.

5. Give one last twist to the pack handle and lift the storage canister off the pack.

6. Close the front cover of the drive, making sure that it is properly latched.

7. Push in the RUN/STOP button and wait for the READY indicator to light. The drive will then be ready to receive read and write commands.

Unloading the RA60 Disk Pack

The steps for unloading an RA60 disk pack from the drive are as follows.

1. Release the RUN/STOP switch to spin-down the disks.

2. Wait for the RUN/STOP indicator light to go off, an indication that the disks have stopped rotating.

3. Push in the cover latch button on the front of the drive and raise the front cover.

4. Pick up the disk pack storage canister by its handle and lower it over the disk pack in the diskwell.

5. Twist the canister slightly until it locks into the ring of teeth near the center of the disk pack. Refer to Figure 16.

6. Hold the plastic canister with one hand while rotating the pack handle to the left for six full revolutions. The current RA60 does not have a spindle lock like other drives, so you will not hit a stop when twisting the pack handle to the left. Future RA60s will have a spindle lock.

7. Raise the disk pack out of the diskwell by the pack handle and restore the bottom pack cover on the canister by squeezing the bottom slides.

8. Close the front cover of the drive when not in use to keep dust out.

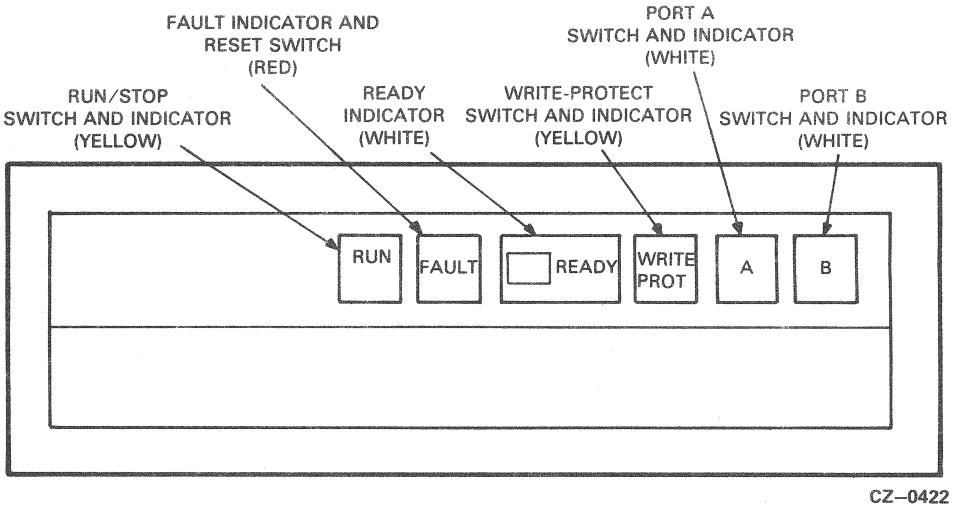


Figure 13 RA60 Control Panel

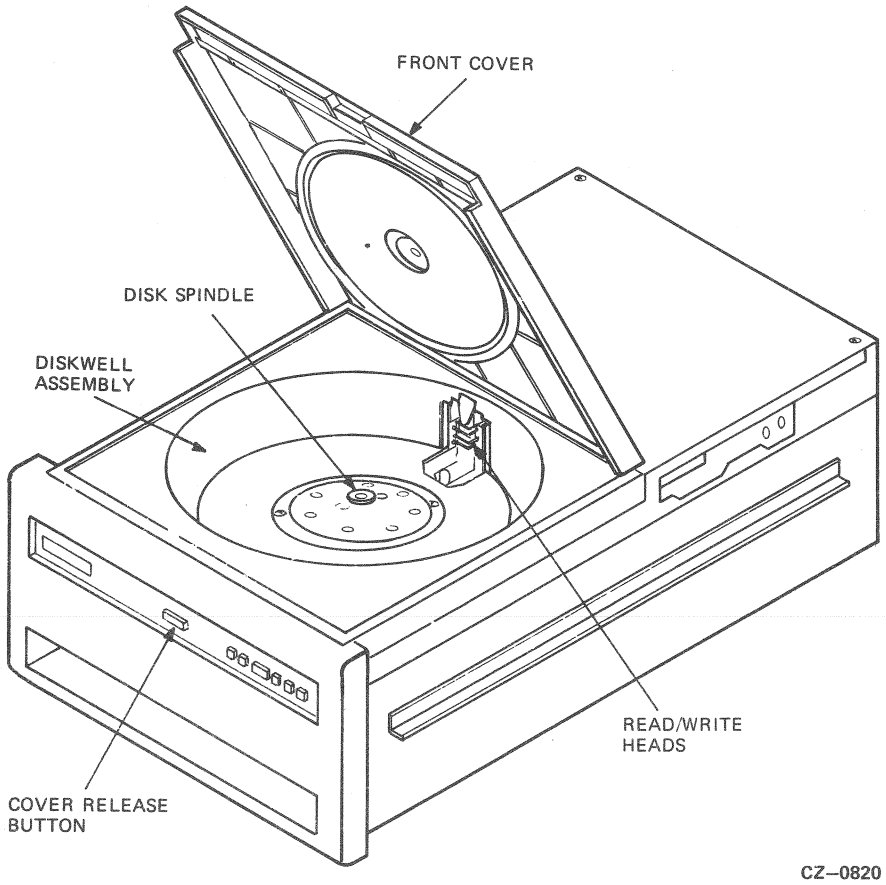


Figure 14 RA60 Cover Latch Button

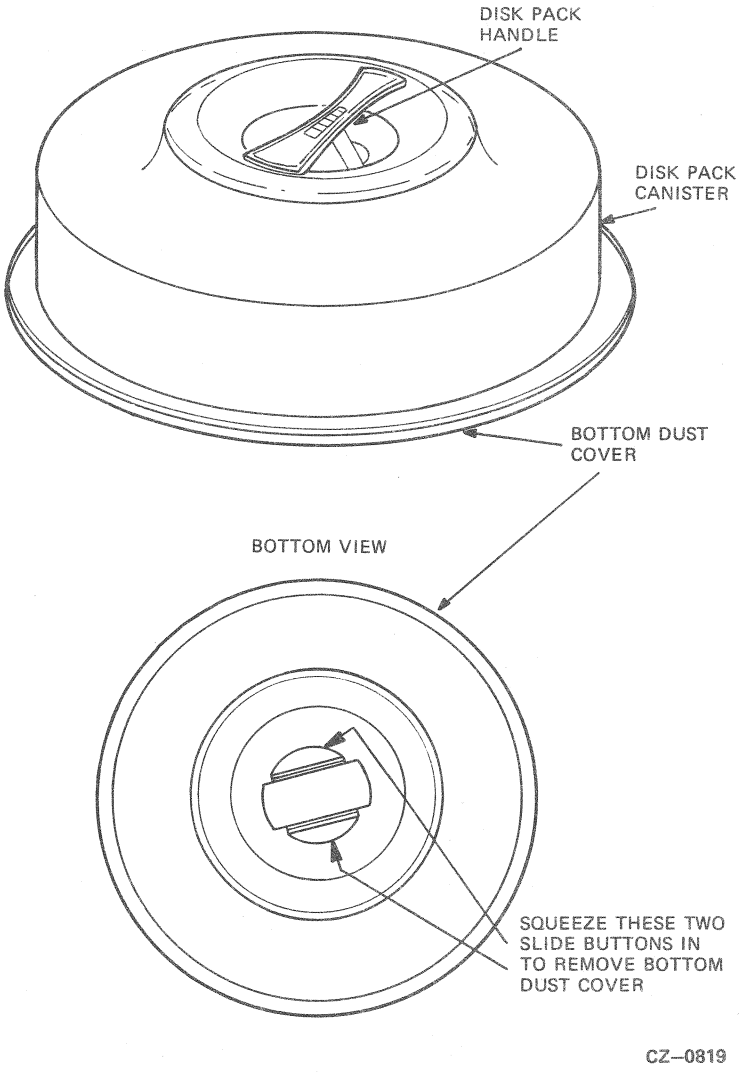


Figure 15 RA60 Disk Pack Bottom Cover Removal

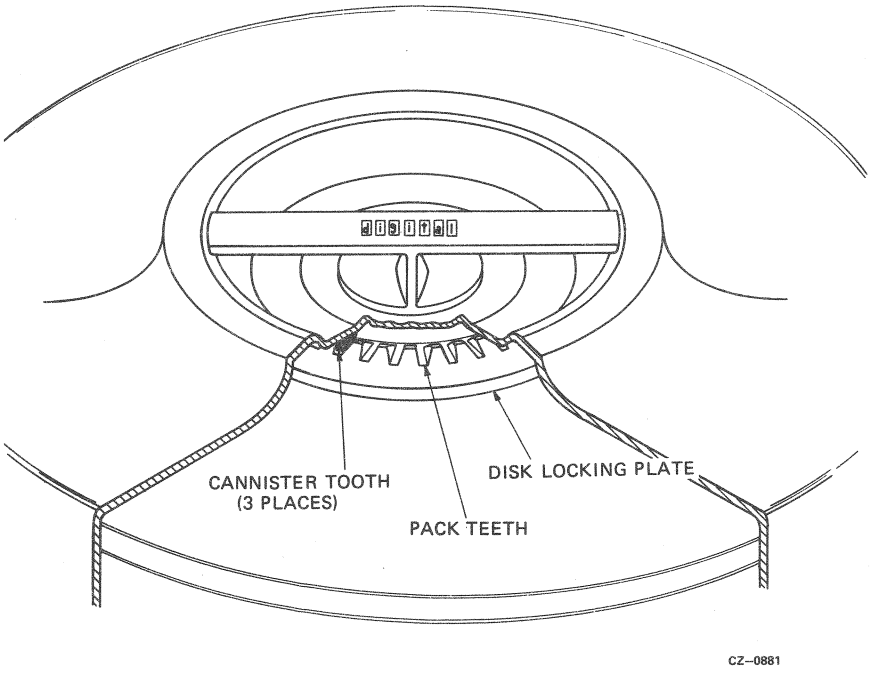


Figure 16 Mesh Canister Cover with Disk Pack Teeth

EXERCISES

1. Which of the following statements is true if the RUN/STOP switch was pushed when drive power is applied?

   A. The RUN/STOP switch must be released and pushed again to spin-up the drive.

   B. The drive will spin-up automatically on power up.

   C. The drive will pause 30 seconds before spin-up after power is applied.

   D. The RUN/STOP switch will have to be reset while power is off.

2. How do you display the control panel fault code after the FAULT light comes on?

   A. Push the RUN/STOP switch once to display the fault code.

   B. Push the WRITE PROTECT switch once to display the fault code.

   C. Push the FAULT switch once to display the fault code.

   D. Push the FAULT switch twice to display the fault code.

3. What is indicated when the READY light is on?

   A. That disk power is on

   B. That the disks are in the process of spinning up

   C. That the disk spin-up sequence is complete and the drive is ready to read and write

   D. That the drive is performing a seek command

4. Which indicator cap serves as a drive unit address plug?

   A. The RUN/STOP indicator cap

   B. The READY indicator cap

   C. The FAULT indicator cap

   D. The WRITE PROTECT indicator cap

5. What is the state of the drive when both PORT A and B w pressed in.

   A. The drive is accessible to a disk controller only through port A.

   B. The drive is accessible to a disk controller only through port B.

   C. The drive is accessible to a disk controller on both port A and B.

   D. The drive is not accessible to disk controllers on either port.

6. What is the proper way to load a disk pack on an RA60?

   A. Hold the canister with one hand and turn the handle counterclockwise.

   B. Hold the canister with one hand and turn the handle clockwise.

   C. Hold the canister with both hands and turn the canister clockwise.

   D. Hold the canister with both hands and turn the cannister clockwise.

SOLUTIONS

1. A. The RUN/STOP switch must be released and pushed again if it was already pushed before the drive power was applied.

2. C. If the FAULT light is already on, the FAULT switch need only be pushed once to display the blinking hexadecimal fault code.

3. C. When the READY light is on, it means that the disk spin-up sequence is complete and that the drive is now ready to read and write.

4. B. The READY indicator cap is the only one that serves as a drive unit address plug.

5. D. When both drive port switches are in their out positions, the drive is off-line and not available to any disk controllers.

6. B. Hold the canister with one hand and turn the handle clockwise.

NOTE

At this time, continue to the next lesson.

LESSON 4: PART REPLACEMENT

INTRODUCTION

This videotape lesson shows the service person how to remove all the RA60 field replaceable units (FRUs). Before you view the video segment on part replacement, open your RA60 Service Manual to Chapter 2. Take a few minutes to review this chapter.

OBJECTIVES

Upon completion of this lesson, you will be able to identify the procedures in the RA60 Service Manual for the removal of all the FRUs within the RA60 Disk Drive.

RESOURCES

The resources required for this lesson are:

- Videotape player
- Video monitor
- RA60 videotape
- RA60 Disk Drive Service Manual (EK-ORA60-SV)

NOTE

At this time, view the Part Replacement videotape sequence and then return to your workbook summary on the next page.

SUMMARY

This lesson has shown you how to remove all the FRUs in the RA60 Disk Drive. While you are not expected to memorize the procedures you have seen, you are expected to know how to use your RA60 Service Manual as a reference on service calls. There is useful information in the this manual, so use it to your advantage to properly maintain the RA60.

The following are a few points you should remember when removing the FRUs shown in the video portion of this lesson.

- Before you remove any FRU, turn off the power to the drive.
- When you use any procedure requiring the front cover to be lifted or removed, turn off the drive power after you lift the cover.
- Before removing any FRU, consult the part replacement flow chart in the service manual to see what other FRUs must be removed first.
- Use the illustrations given in this workbook to help you locate the FRUs in the RA60.
- Refer to Figure 17 to see how to gain access to the inside rear of the drive.
- When replacing the absolute filter, make sure that the filter clamp is installed in the position shown in Figure 18.
- When removing the spindle motor assembly, refer to Figure 19 for the location of the connectors.
- Refer to Figure 20 for the logic module locations in the logic cage.
- Refer to Figure 21 for an illustration of the power supply assembly connectors.
- Refer to Figure 22 for removing the transformer assembly.
- Figure 23 shows the location of the cap/rectifier assembly.
- Refer to Figure 24 to determine the physical location of the head number you wish to replace.

PART REPLACEMENT

- Refer to Figure 25 for use of the head insertion tool.
- Refer to Figure 26 for a close-up of the preamp module.
- Refer to Figure 27 for an overview of all the connector locations in the disk drive.
- Refer to Figure 28 for the locations of the dc fans.

NOTE

At this time, complete lesson 4 exercises.

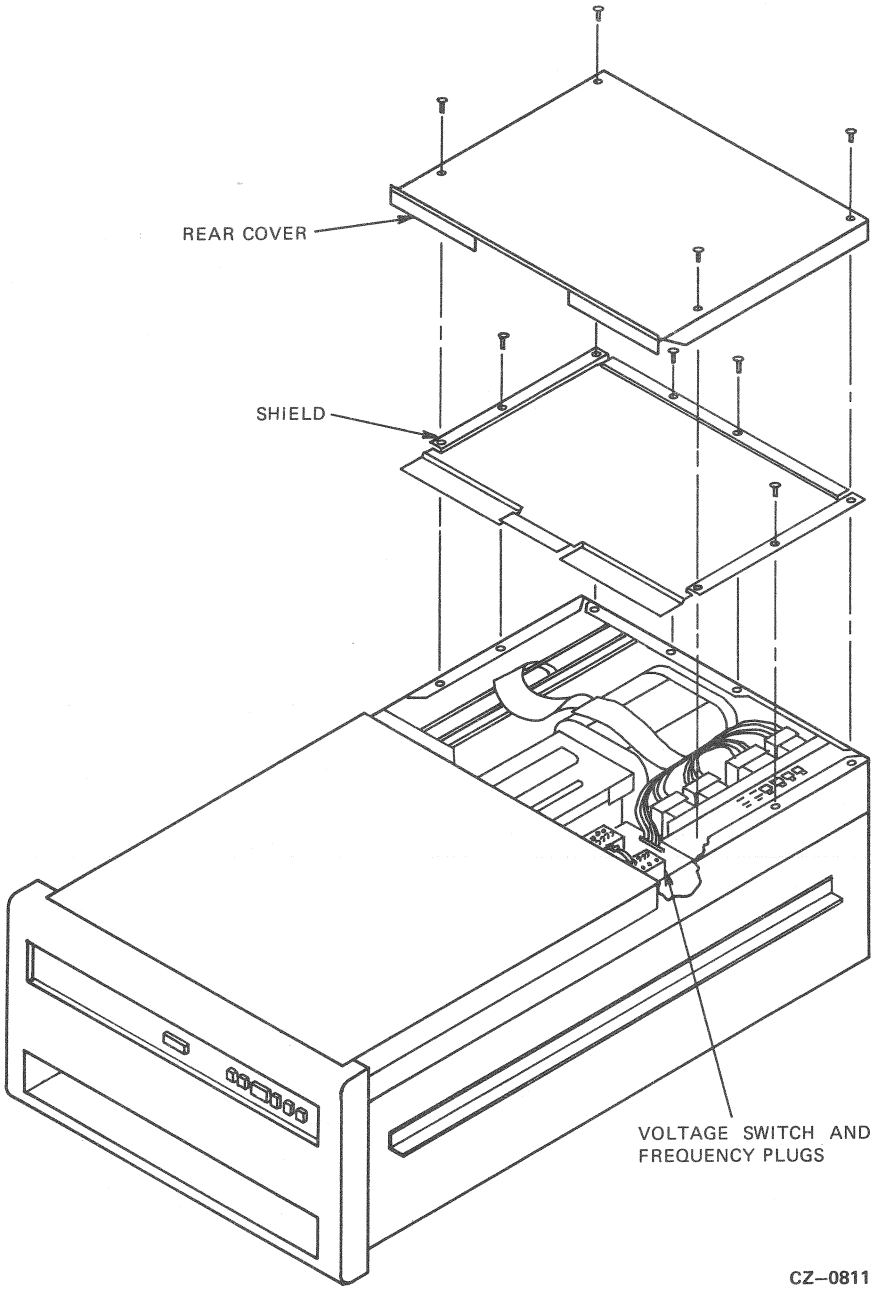


Figure 17 Drive Cover Removal

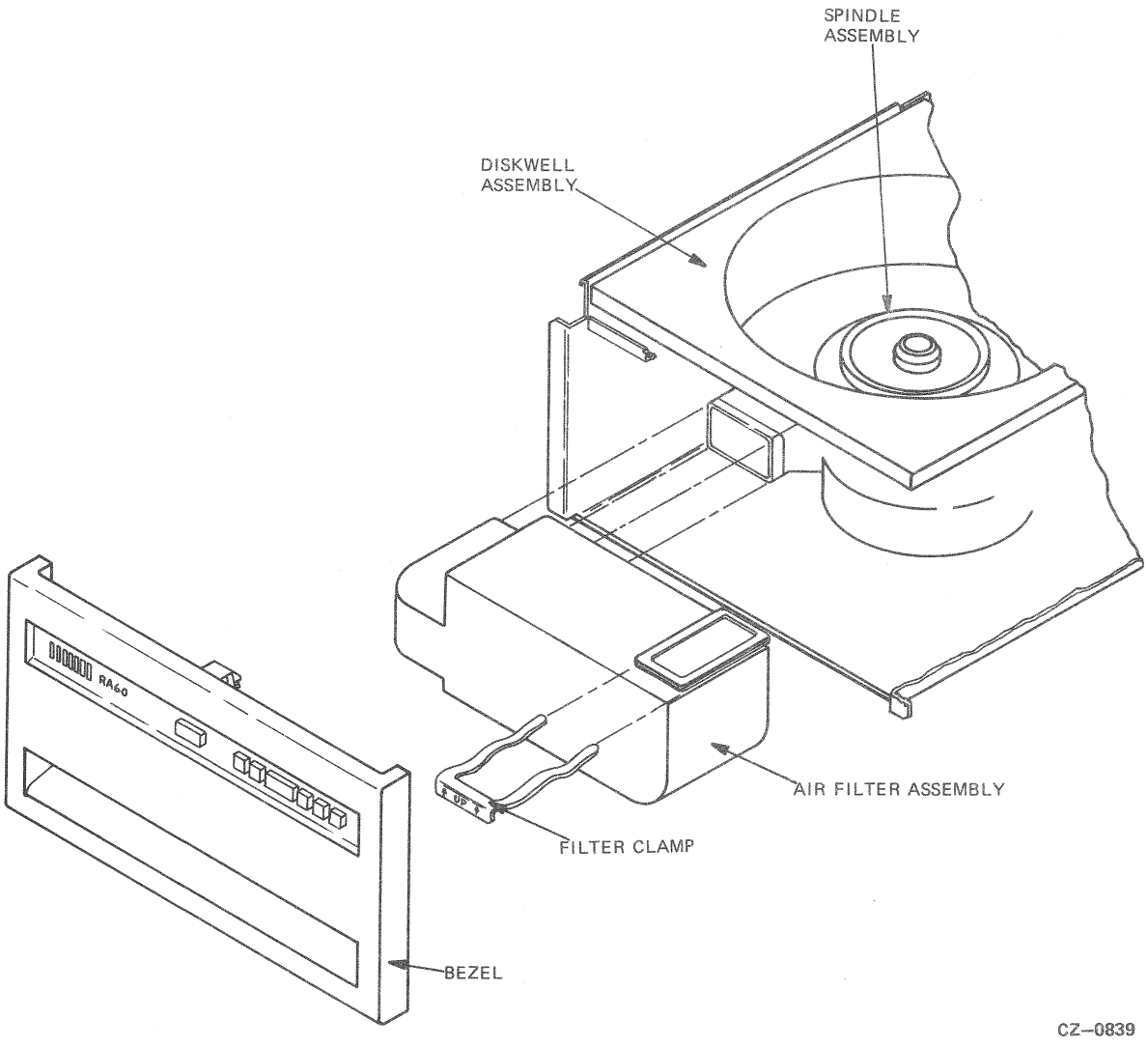


Figure 18 Installation of the Absolute Filter Clamp

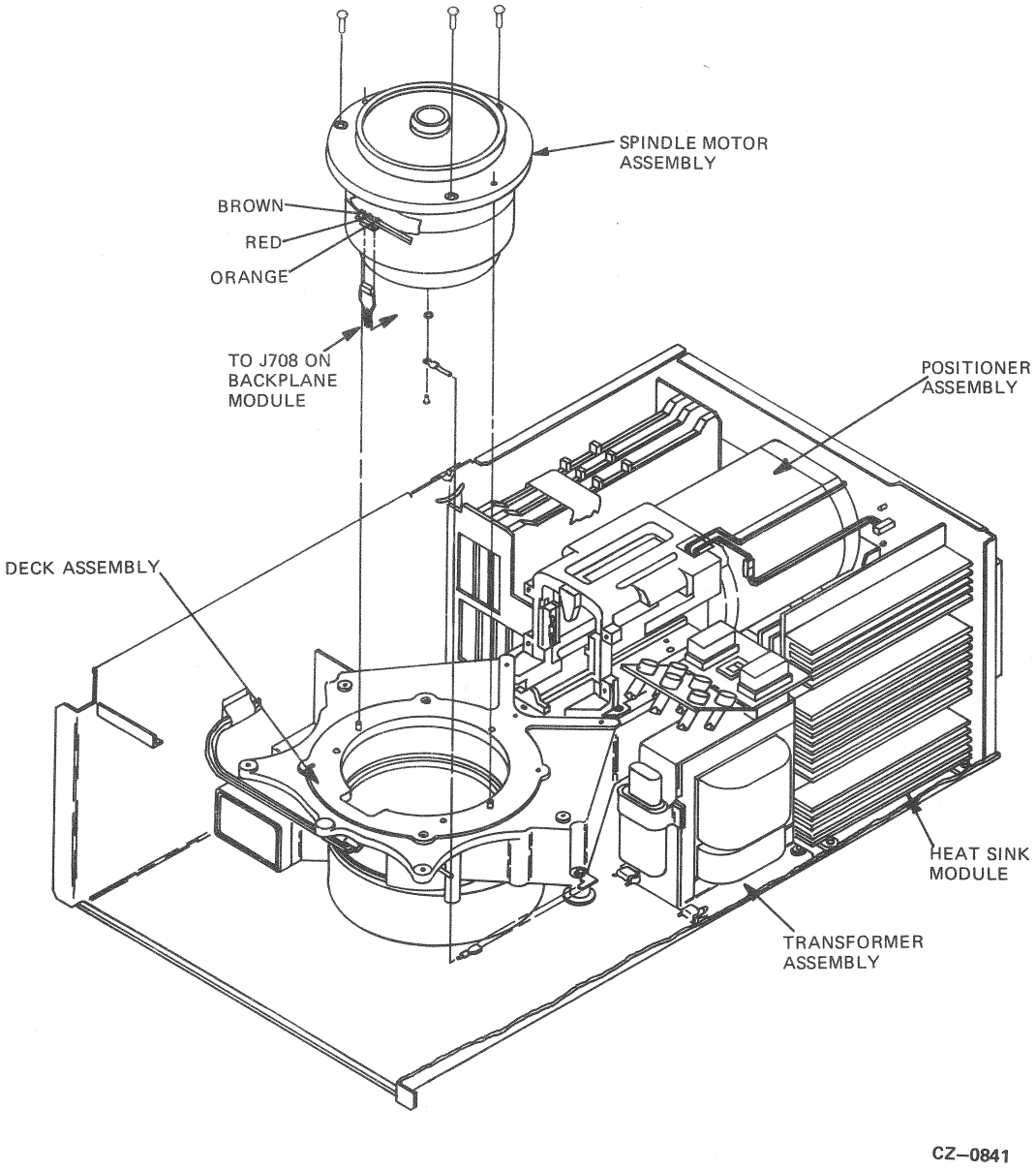


Figure 19 Spindle Motor Connectors

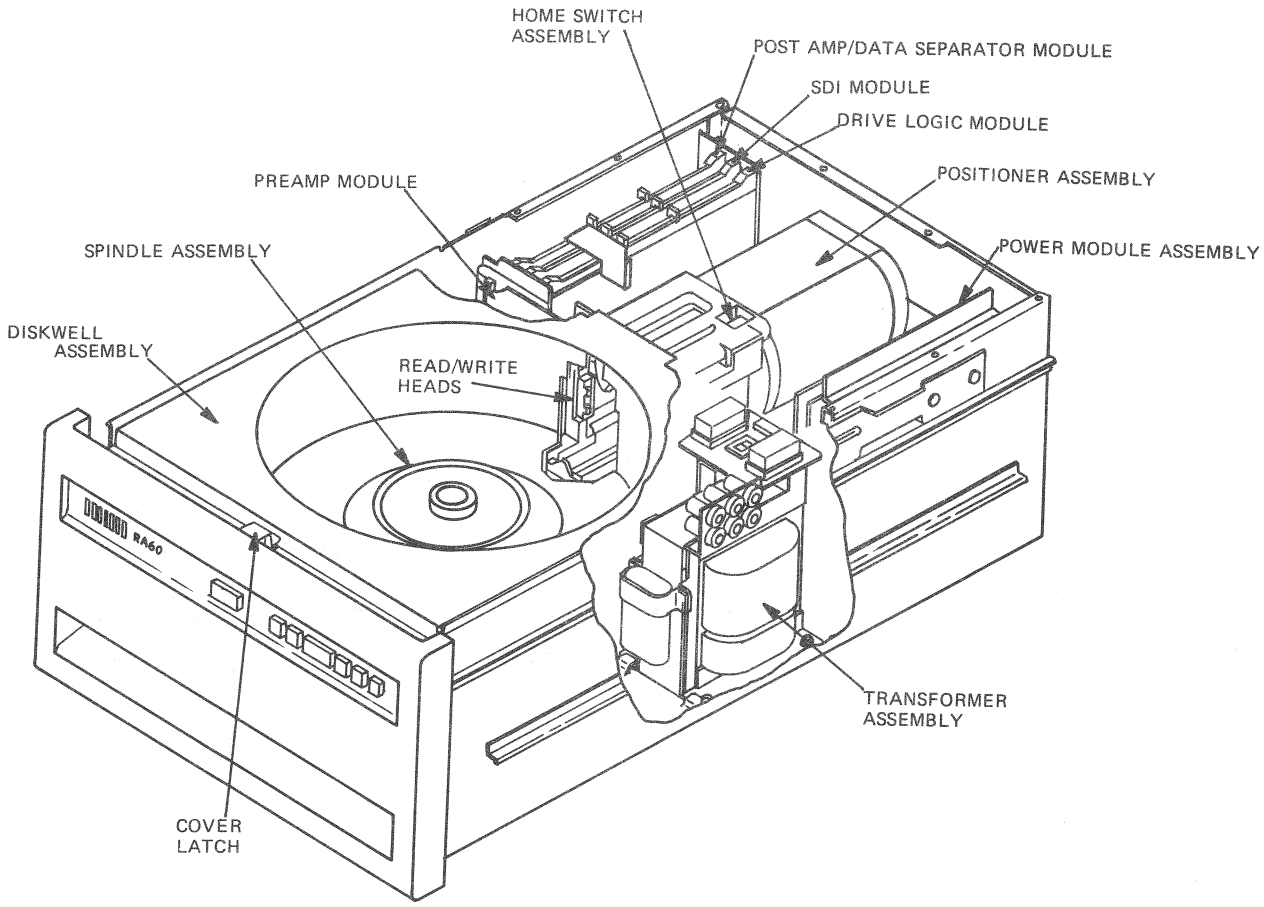


Figure 20 Logic Module Locations

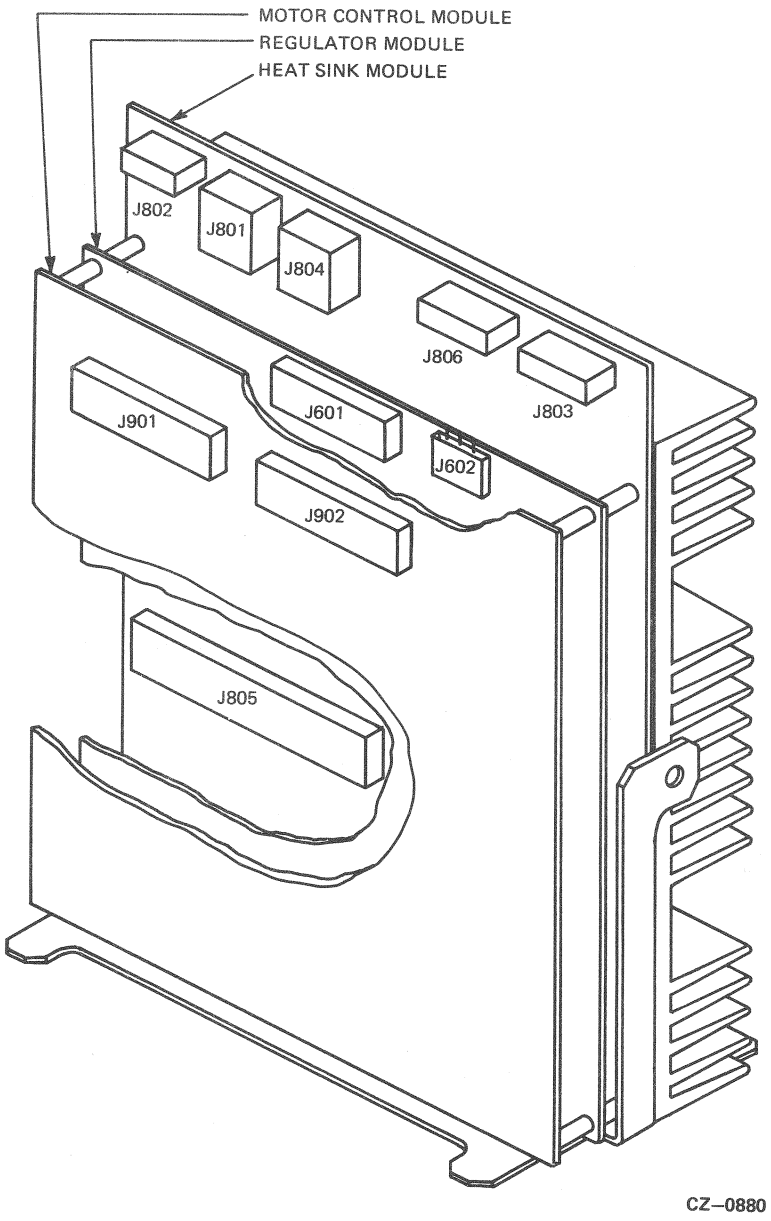


Figure 21 Power Supply Connectors

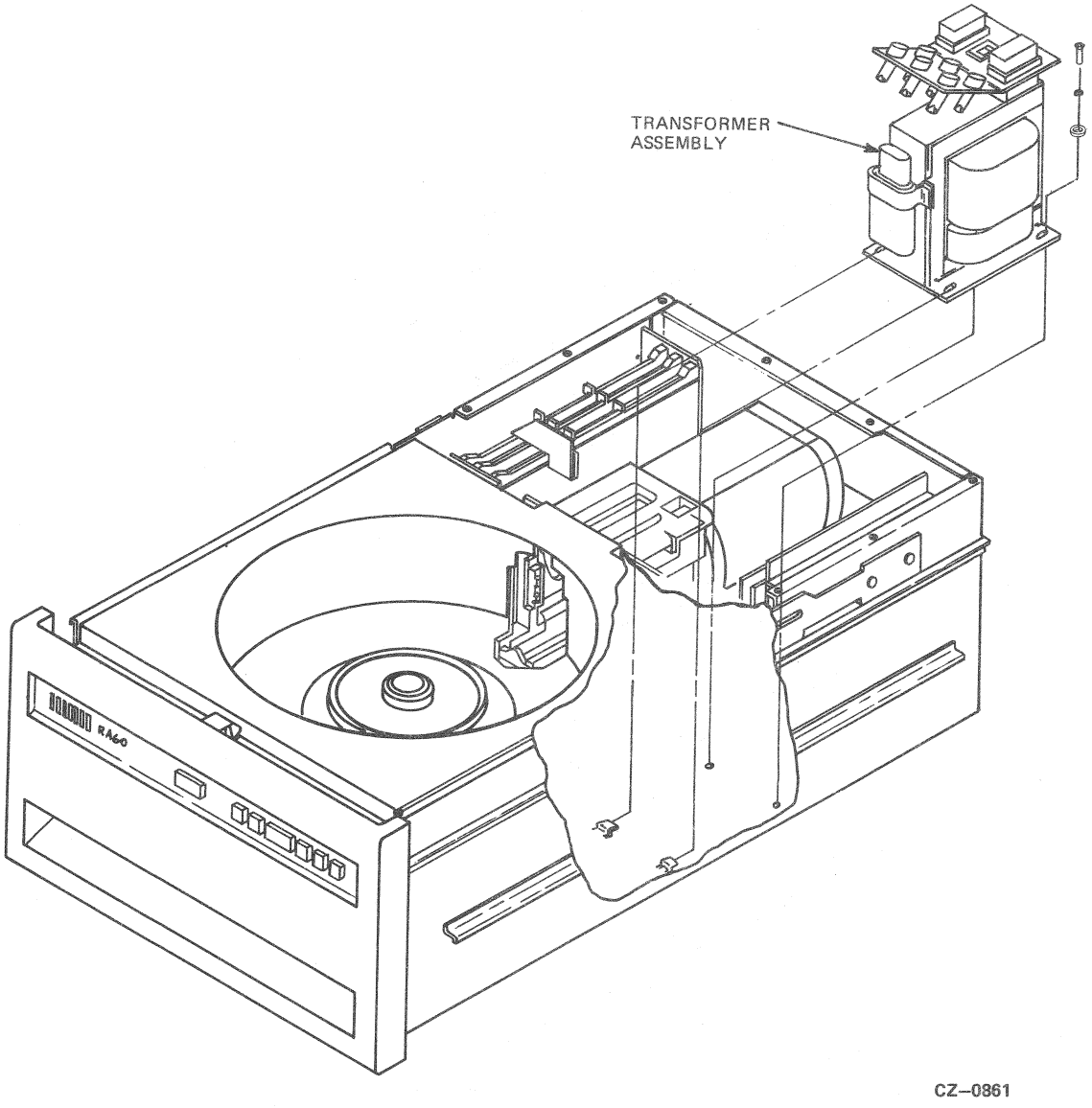


Figure 22 Removal of the Transformer Assembly

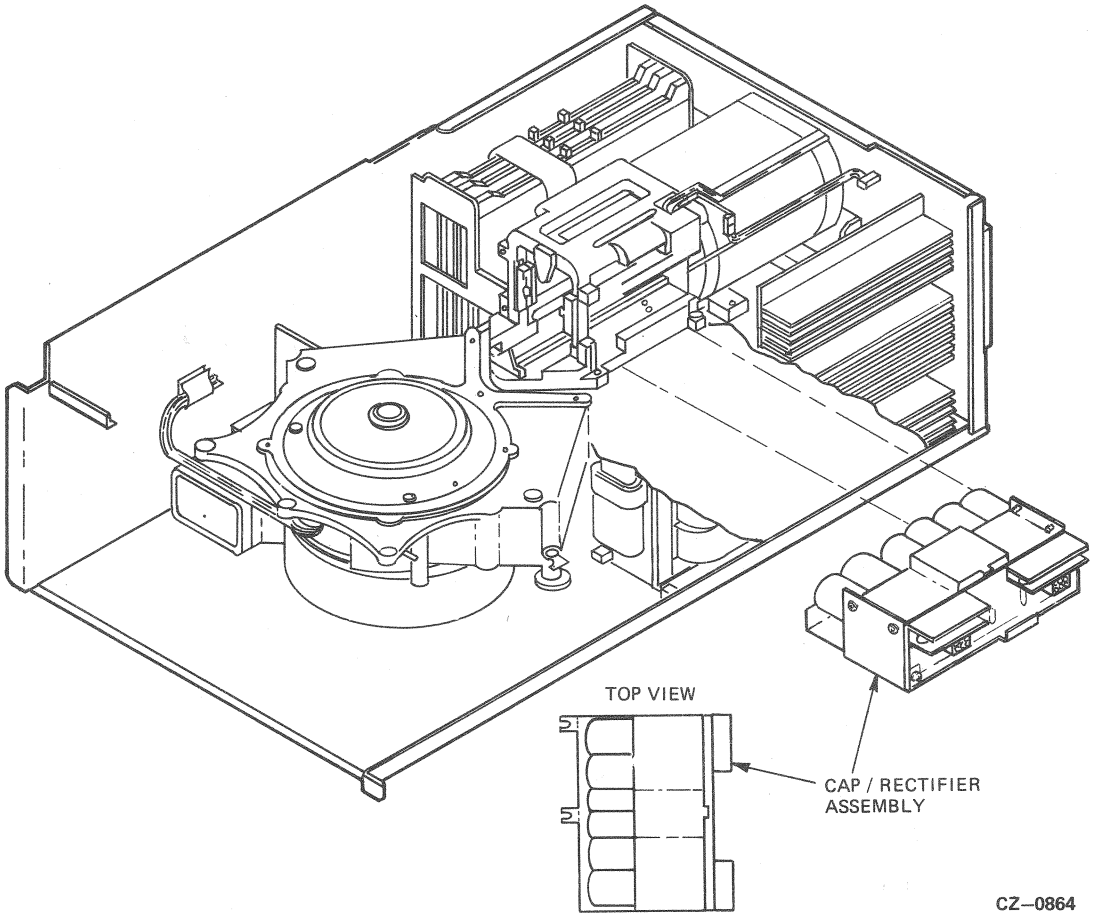


Figure 23 Location of the Cap/Rectifier Assembly

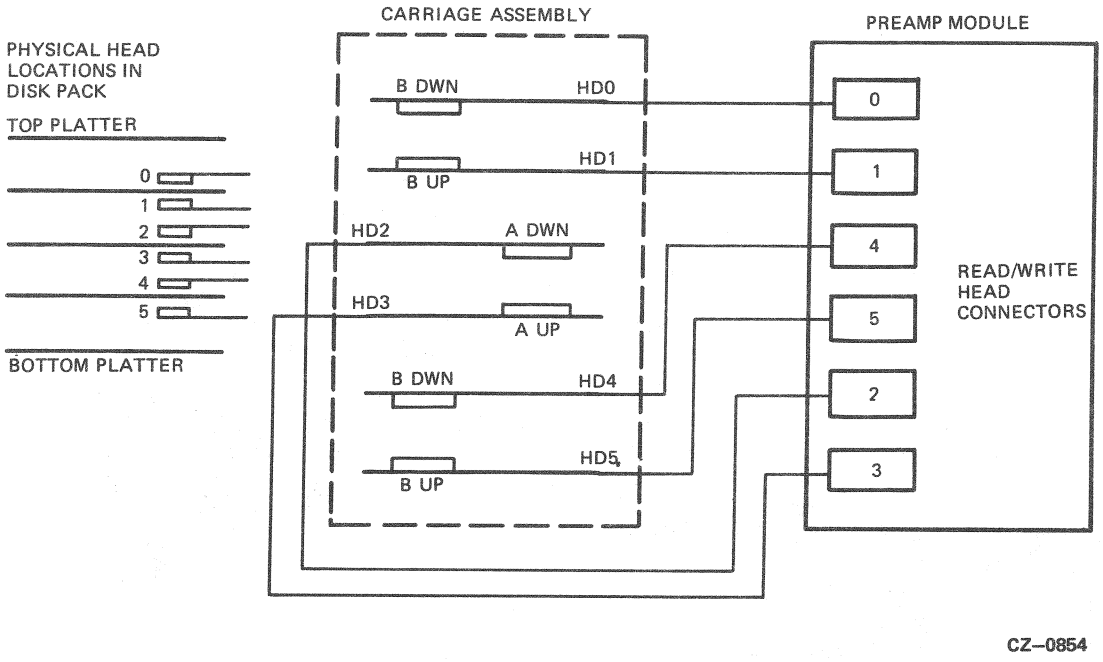


Figure 24 Physical Head Location

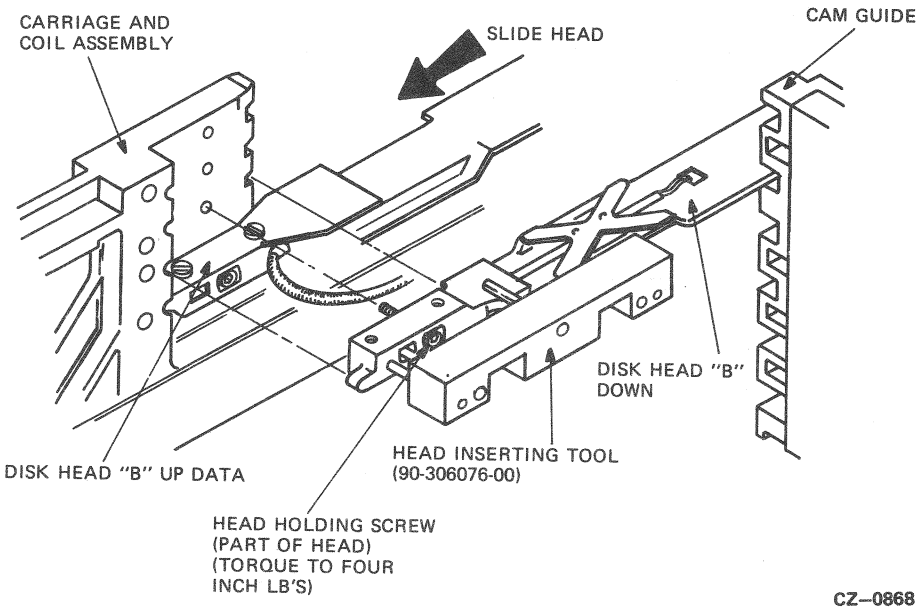


Figure 25 Installation of Head Insertion Tool

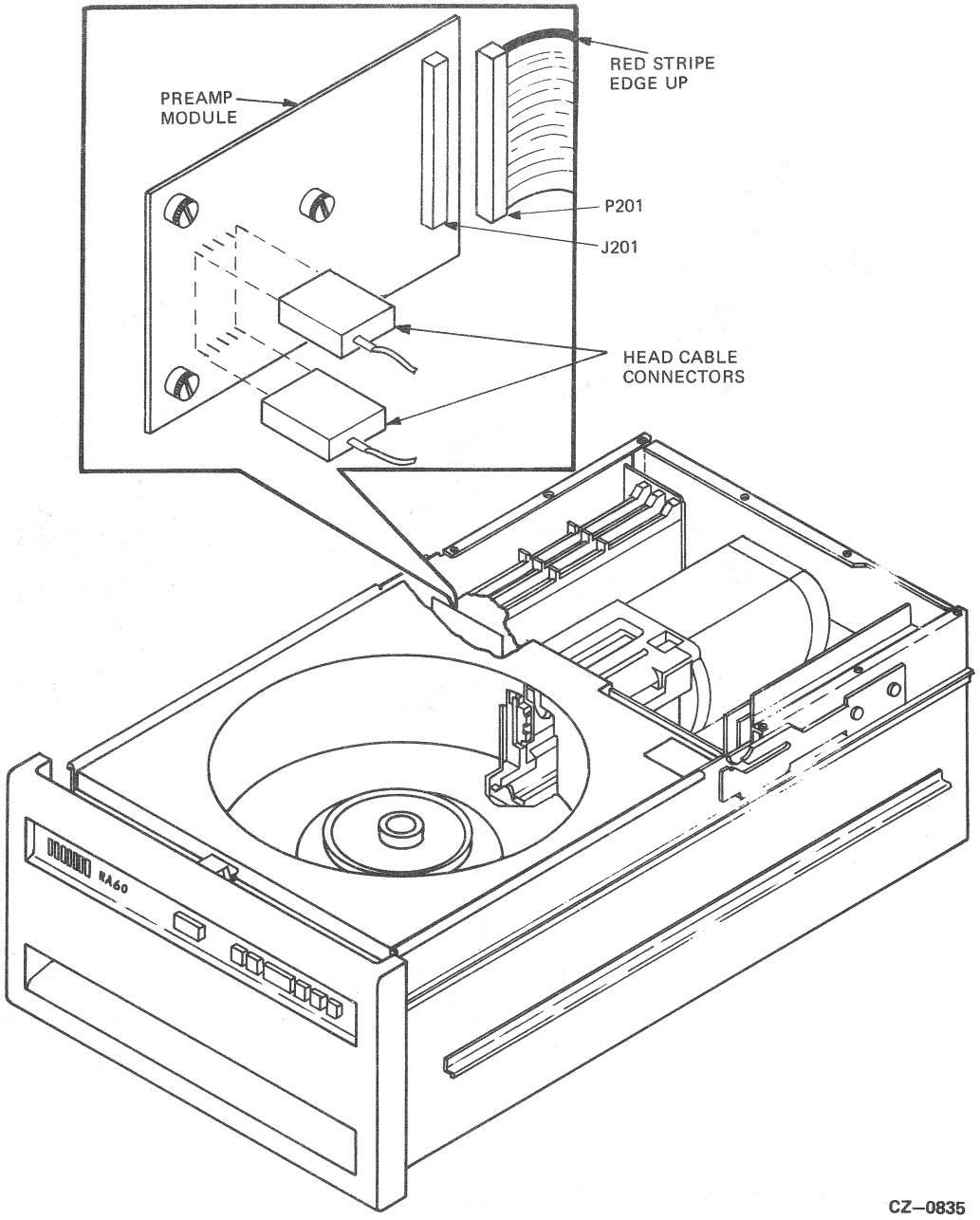


Figure 26 Closeup of the Preamp Module

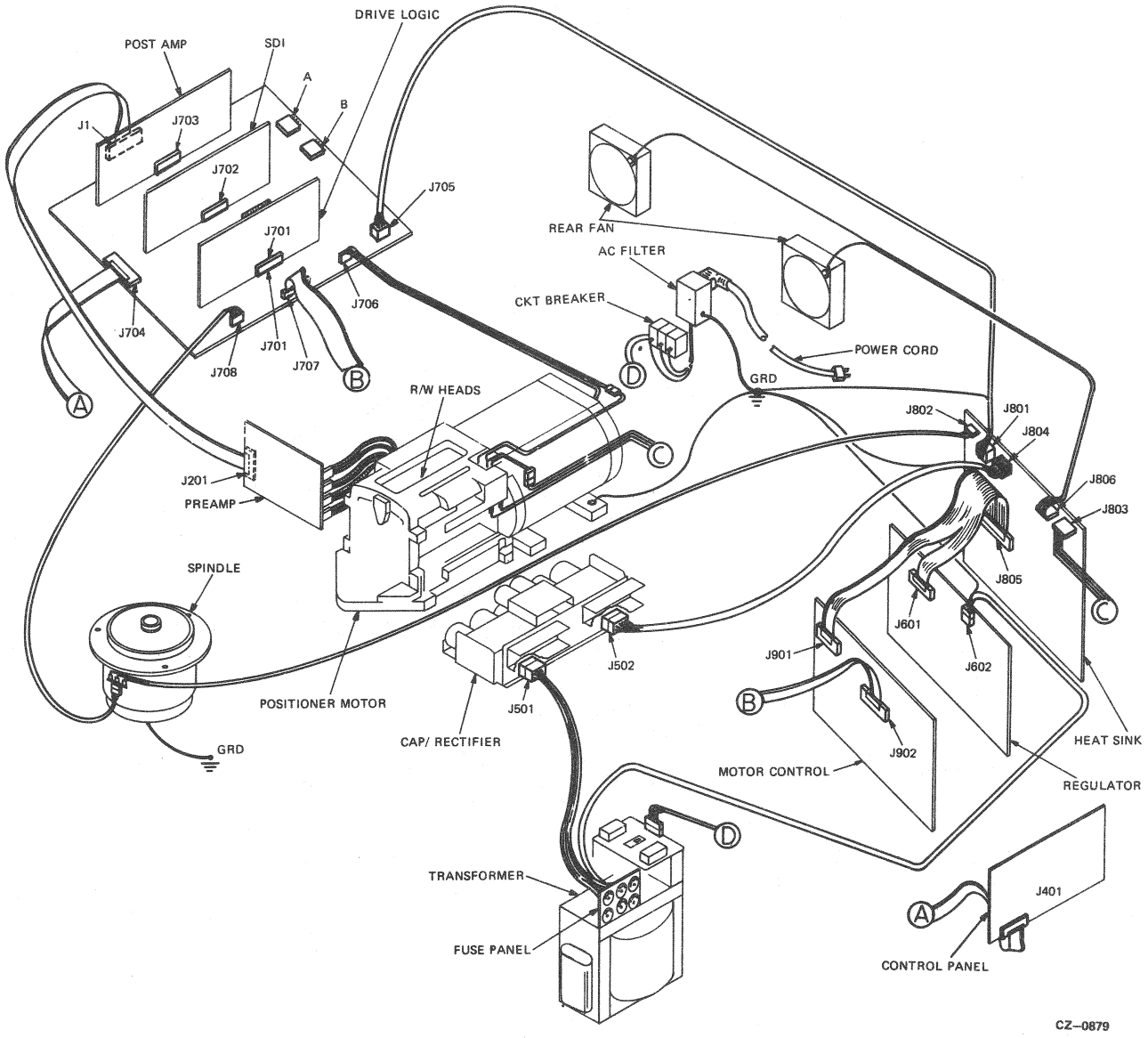
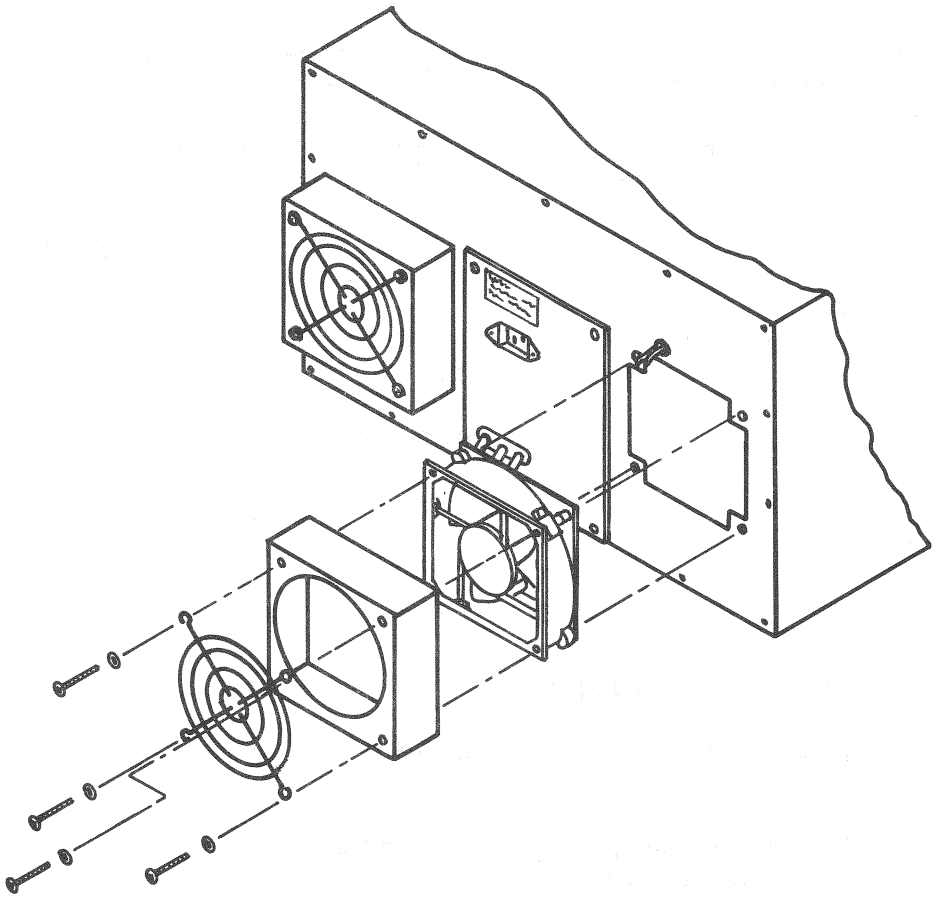


Figure 27 Drive Connector Overview



CZ–0863

Figure 28 DC Fan Location

EXERCISES

1. Which is the correct sequence for removing the front bezel?

   A. Remove the two screws on each side of the front bezel without sliding the drive forward.

   B. Slide the drive forward and remove four screws from behind the front bezel.

   C. Raise the front cover, slide the drive forward, and remove six screws from behind the front bezel.

   D. Remove six screws from the front of the bezel without sliding the drive forward.

2. How is the absolute filter held in place?

   A. With two screws

   B. With a filter clamp

   C. By force fit

   D. With two metal clips

3. Which assemblies must be removed to replace the spindle motor assembly?

   A. The front cover, front bezel, absolute filter, and diskwell assembly

   B. The front cover and diskwell asssembly

   C. The front cover, diskwell assembly, and positioner motor assembly.

   D. The front cover, front bezel, and diskwell assembly.

4. Which assemblies or parts must be removed to replace the post amp/data separator module.

   A. The rear door, rear cover, and preamp module

   B. The rear cover, rear shield, and drive logic module

   C. The rear cover, rear shield, and SDI interface module

   D. The rear cover, rear shield, and the P1 connector

5. Which of the following is the correct top to bottom order of the head cable plugs on the preamp module?

   A. 0,1,2,3,4, and 5

   B. 0,1,4,5,2, and 3

   C. 0,1,5,4,2, and 3

   D. 0,1,4,5,3, and 2

SOLUTIONS

1. C. The correct sequence for removing the front bezel is to raise the front cover, slide the drive forward, and then remove six screws from behind the front bezel.

2. B. The absolute filter is held in place by means of a filter clamp.

3. A. To replace the spindle motor assembly, remove the rear cover, rear shield, front bezel, absolute filter, and diskwell assembly.

4. D. To replace the post amp/data separator module, remove the rear cover, rear shield and the P1 connector on the post amp/data separator module.

5. B. The correct top to bottom order of the head cable plugs on the preamp module is 0,1,4,5,2, and 3. Engineering chose this order to keep the A and B type head cables from crossing each other.

NOTE

At this time, continue to the next lesson.

LESSON 5: HAND-HELD TERMINAL

INTRODUCTION

This lesson introduces the field service diagnostic terminal. It explains the functions of the hand-held terminal buttons and some of the internal operations. The hand-held terminal is used to enter and display results of diagnostic tests on the RA60 Disk Drive. The terminal comes in the spares kit accompanied by an instruction card. The fault isolation lesson will give you more information on how the terminal is used to diagnose RA60 problems.

OBJECTIVES

After completing this module, the student will be able to identify the baud rate of the hand-held terminal and describe the purpose of each button.

RESOURCES

The resources required for this lesson are:

- Videotape player
- Video monitor
- RA60 videotape
- RA60 Disk Drive User Guide (EK-ORA60-UG)
- RA60 Disk Drive Service Manual (EK-ORA60-SV)

NOTE

At this time, view the Hand-Held Terminal videotape sequence.

SUMMARY

In your spares kit, you will find a hand-held terminal like the one shown in Figure 29. This terminal is used to communicate with the unit you are troubleshooting. It has a standard ASCII keypad and operates at 300 baud full duplex. It operates on an EIA RS-232 protocol connector located in the disk drive and requires an external five volt supply. Some other characteristics are:

- Two line LED display with 16 characters each
- Keypad with 4 characters per key

Character Keys

All of the keypad buttons have four characters on them. The center bottom character on each button is entered by pressing only that button. To enter one of the top three characters on a button, you must use the shift keys.

Shift Keys

There are three shift keys located on the right side of the hand-held terminal shown in Figure 30. One of these shift keys must be pushed simultaneously with a character key to enter one of the top three characters on a button.

The top shift key is used to enter the left-most character on the character button. The middle shift key is used to enter the middle character and the bottom shift key is used to enter the right-most character. Figure 33 gives a summary of this shift key use.

For example, to select a W, you must hold in the top shift key while you press the W character button. To select an X, you must hold in the middle shift key while you press the X character button. To select a Y, you must hold in the bottom shift key while you press the Y character button. The 9 character requires no shift key.

Delete Key

If you enter the wrong character by mistake, erase it by pressing the delete key. This key functions like the delete key on a hardcopy printer.

Control Characters

Selecting a control character is done differently than you would expect. Unlike a VT100, you do not hold the control key as

you press the other character. On the hand-held terminal, you press and release the control key and then select the character.

For example, to select a control "C"

1. Press and release the control key,
2. Hold in the bottom shift key,
3. Then press the C key.

Internal Buffer

Even though the hand-held terminal only displays 32 characters, the terminal has an internal buffer of 2,000 characters.

Scroll Key

The scroll key is a three position switch which is spring loaded to return to the center position. The scroll key allows you to move through the internal buffer 16 characters at a time.

When the scroll key is pushed down once, the display is scrolled up through the buffer by 16 characters. Push down and release the scroll key again to view another 16 characters.

Push on the scroll key again to cause the display to scroll down through the buffer by 16 characters.

Arrow Keys

The arrow keys move the display from one carriage return to another. The up arrow moves the display up through the buffer to the previous carriage return. The down arrow moves the display down to the next carriage return.

Top and Bottom Keys

The other keys that control the buffer are the top and bottom keys. These characters are located on the lower right hand key. The top key will move the display to the top of the internal buffer. The bottom key will move the display to the bottom of the internal buffer.

Escape Key

The ESC key is a standard ASCII character. It is not used on the hand-held terminal.

X Off Key

The X OFF key stops data from coming into the internal buffer. The X stands for transmit and X OFF represents transmit

off. Use this key to examine the buffer at your convenience.

X On Key

The X ON key allows data to come into the internal buffer again.

Continue Key

The continue key puts the terminal in a mode so it will not automatically send an X OFF character to the device when the buffer has been filled. This allows the data to stream through the buffer without stopping.

Clear Key

The clear key puts the terminal in a mode that automatically sends an X OFF to the device when the buffer is full. This is the default mode when power is applied to the terminal.

Case Key

The case key has no function on this model of the terminal.

NOTE

At this time, complete the module exercise.

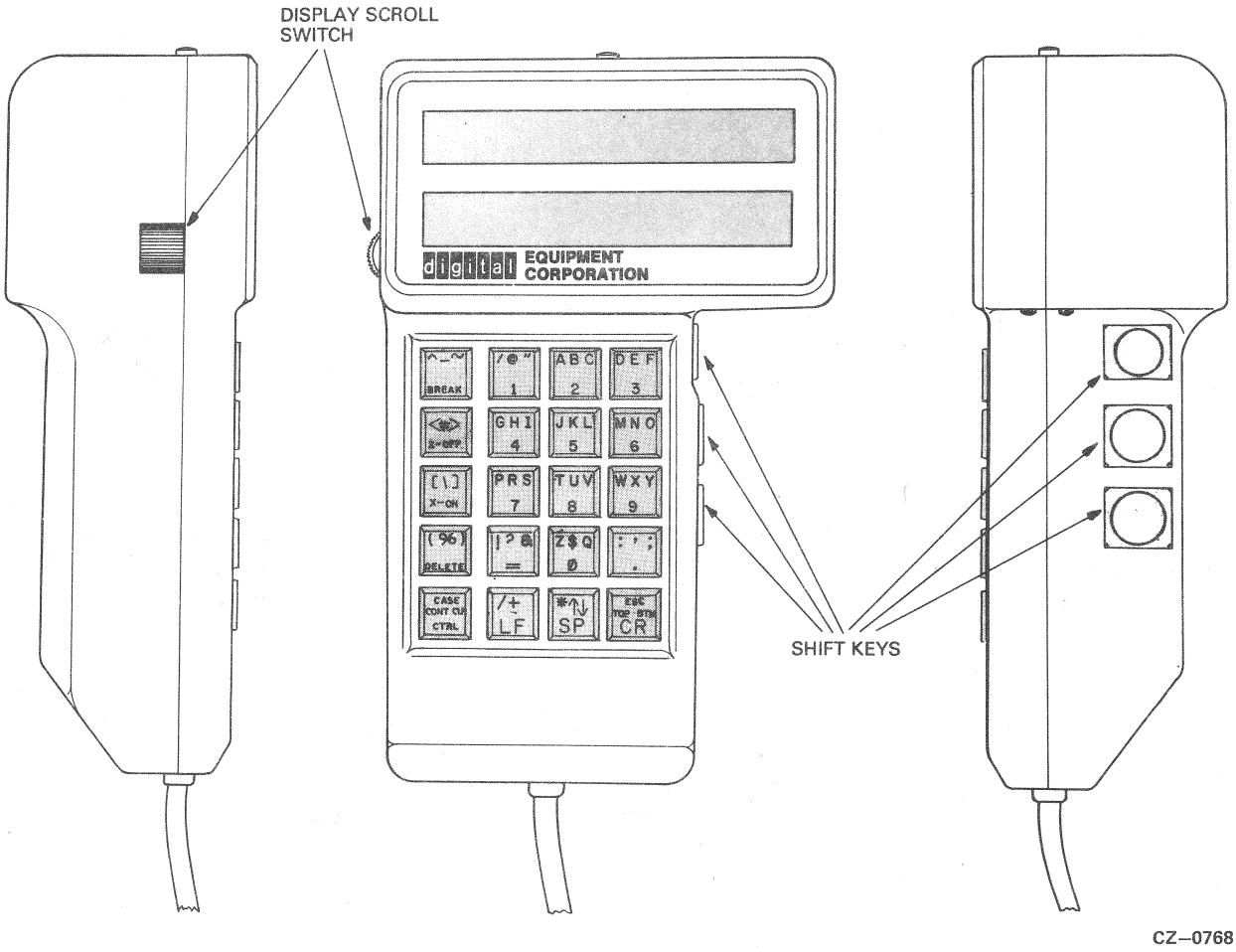


Figure 29 The Hand-Held Terminal

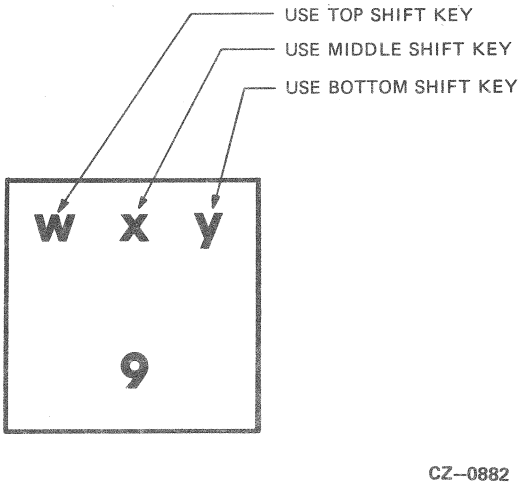


Figure 30 Shift Key Functions

EXERCISES

1. To select one of the characters on the top of the keys you must

   A. Press the scroll key.

   B. Input a control C.

   C. Hold in one of the shift keys while you press the character key.

   D. Press the character key then press one of the shift keys.

2. To select the number 9

   A. Press the top shift key and the 9 key.

   B. Press and hold in the middle shift key while you press the 9 key.

   C. Press the bottom shift key and the key.

   D. Press the 9 key.

3. The hand-held terminal operates at

   A. 300 baud full duplex

   B. 600 baud full duplex

   C. Receives at 300 baud, transmits at 1200 baud

   D. A variable transmit and receive speed

4. The display scroll switch

   A. Backs up or advances the display within the 2K buffer.

   B. Corrects mistakes in keyboard entries.

   C. Is used after typing a command string.

   D. Causes the left-most character to be displayed.

SOLUTIONS

1. C. Hold in one of the shift keys while you press a character key to enter a character in the top row on the key.

2. D. To select the number 9, press the 9 key.

3. A. The hand-held terminal operates at 300 baud full duplex.

4. A. The display scroll switch backs up or advances the display within the 2K buffer.

NOTE

This completes the video portion of this course. At this time, continue on to the next workbook.

Digital Equipment Corporation • Bedford, MA. 01730