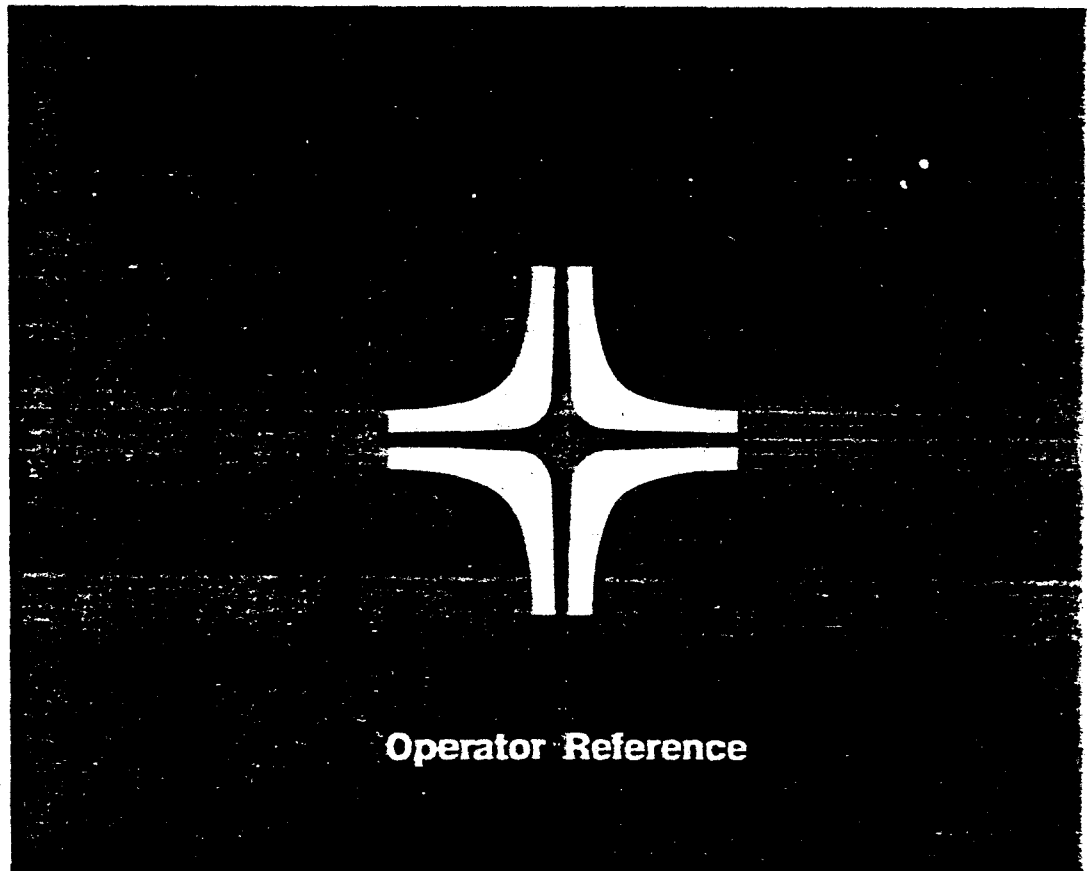


8470 Disk Drive



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WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been 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 interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Compliance is based upon a system configuration that includes SPERRY peripherals/subsystems so labeled, and cables furnished by Sperry or built to Sperry specifications and assembly procedures.

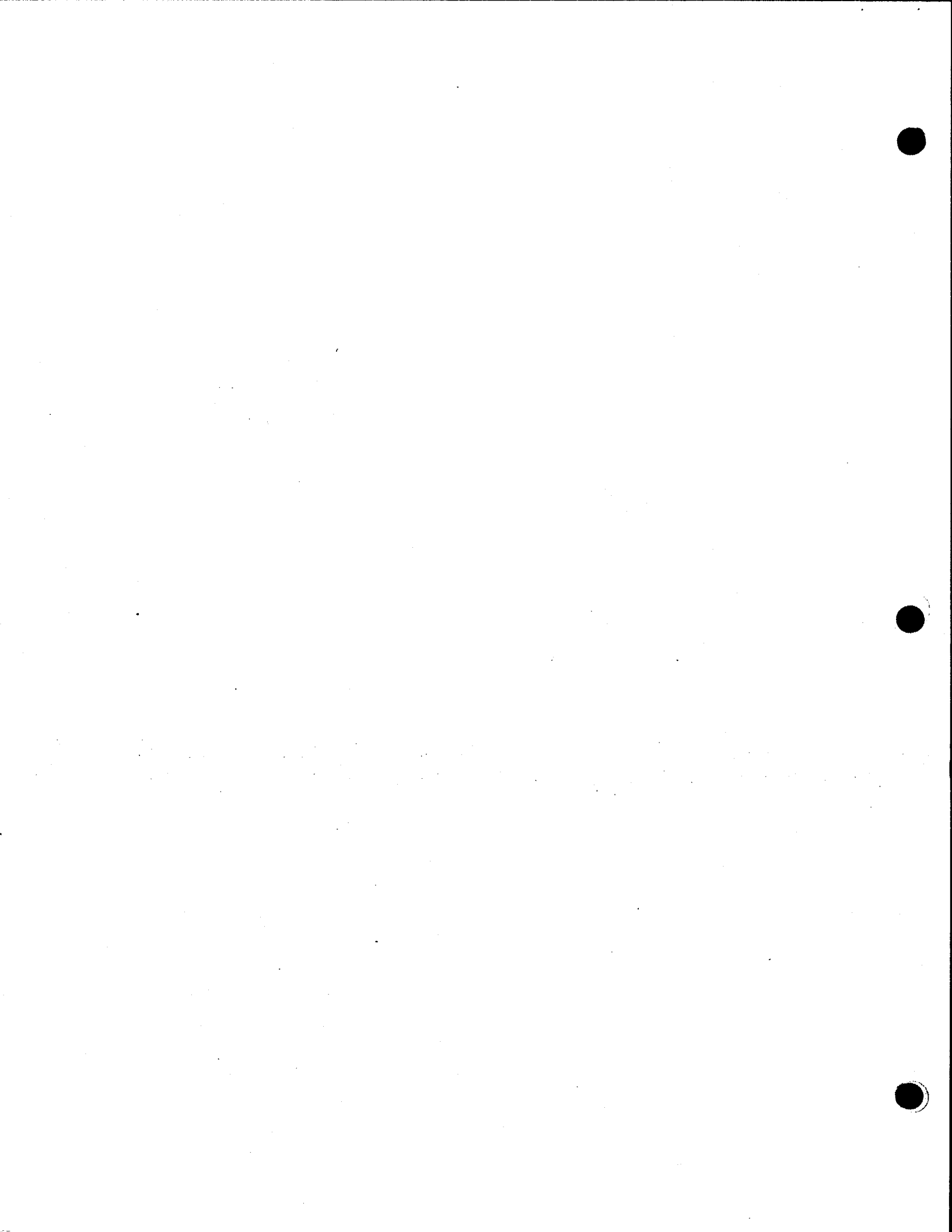
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1. Introduction

1.1. GENERAL

This manual contains information and procedures for operating the SPERRY 8470 Disk Drives. The disk drives operate as a subsystem in conjunction with an integrated controller located inside the system processor cabinet, or with a freestanding control unit. Whether the disk drives operate with an integrated controller or freestanding control unit depends on the system in which the drives operate. This manual is limited to a discussion of the disk drives; additional information concerning the integrated controller or freestanding control unit is contained in system-related manuals.

The 8470 disk drive (Figure 1-1) uses a fixed disk assembly that is not removed by the operator. Up to 32 disk drives can be included in a subsystem, depending on the controller type.

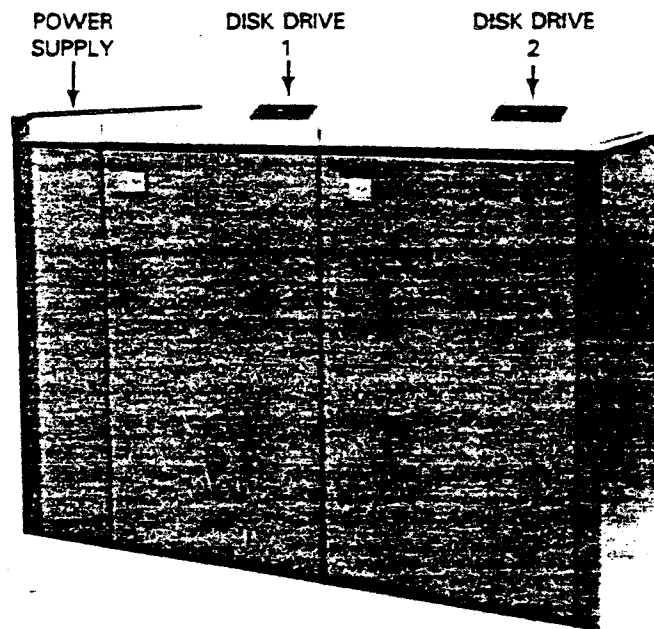


Figure 1-1. SPERRY 8470 Disk Drives

1.2. OPERATOR RESPONSIBILITIES

The operator is responsible for preparing the disk drive for operation and continuing efficient operation. To assume these responsibilities, the operator must be aware of the locations and functions of all operator-oriented controls and indicators involved in daily use of the disk drive. The operator must:

- turn power on and off at the disk drive when required;
- observe and respond to fault indications; and
- protect data from erasure (by a file-protect switch) during read-only operations.

2. Component Description

2.1. GENERAL

The 8470 disk drive is a random access storage device. It provides a processing system with storage of up to 645 million bytes on a permanently fixed disk assembly when prepped at 1792 words per sector for cache/disk mode of operation. The disk drive operates at a throughput rate of 2.1 megabytes per second, with an average seek time of 23 milliseconds. The disk drive operates with a freestanding type 5056 or 5057 control unit, or with an integrated controller located in the host processor cabinet.

The 8470 disk drive has an operator control panel. A microprocessor diagnostic capability with associated control panel for maintenance personnel is also included. An optional feature permits access capabilities from multiple sources.

2.2. DISK DRIVE

Each 8470 disk drive uses a nonremovable disk pack; that is, the recording media is not removable or interchangeable by the operator. Each disk drive contains its own operator control panel. A single disk drive is contained in each 8470 drive cabinet.

2.2.1. Head/Disk Assembly

The disk drive contains a single head/disk assembly (HDA) consisting of:

- 9 disk platters (disk media);
- 16 data surfaces;
- a single servo surface; and
- read/write heads.

The HDA (Figure 2-1) is a nonremovable assembly enclosed in a protective cover containing the electronics control circuits and hardware to control head movement and reading or writing on the disk platters. The HDA, through the servo function, secures the read/write heads and positions them to the proper cylinder position on the disk media according to directions from the controller/control unit.

The servo head/arm assembly with carriage, mounted in the HDA, controls accessor arms when accessing data on the disk platters. The carriage is moved to any selected cylinder by an electronically controlled loop servo positioning system. Read/write heads are moved by the access mechanism from one cylinder directly to any other cylinder without returning to home position.

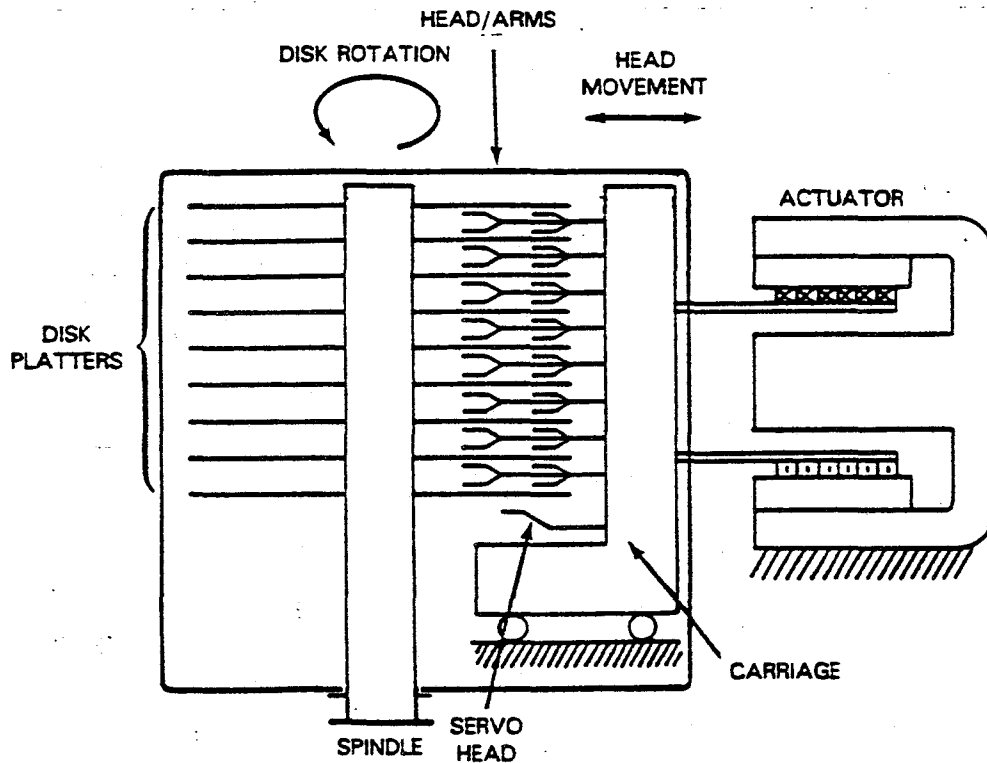


Figure 2-1. Schematic Diagram of HDA and Actuator

2.2.2. Read/Write Heads

Two read/write heads are provided for each of 16 disk platter (Figure 2-1) surfaces. Data on all of these surfaces is accessed by both heads on each surface. Thus, there is a total of 32 read/write movable heads for the 16 disk surfaces.

2.2.3. Microprocessor

Most functions of the disk drive are controlled by an internal microprocessor. Other functions are controlled by the controller/control unit. The microprocessor provides the controller/control unit with sense and status information on the disk drive. It also provides some error recovery functions as well as information on error logging.

Microprocessor functions include:

- Power sequencing
- Data seeking
- Calibration of selected analog signals
- Track following
- Recalibration of the actuator

2.2.4. Control Panels

The operator is concerned only with the operator control panel for using the disk drive and for assigning disk drives to the controller/control unit. Normally, the only operations required are control of the write protection function, which is controlled from a switch on the operator control panel. An additional control panel is provided on the disk drive for use by maintenance personnel. The maintenance control panel (not accessible to the operator) allows diagnostic input to isolate trouble and rapidly restore the disk drive to normal operation.

2.3. DISK MEDIA

The fixed media used on the disk drive consists of nine disk platters, each 14 inches (35.56 cm) in diameter. The disks are mounted on a single spindle and enclosed in a metallic case for protection (Figure 2-2). The disk surfaces are coated with magnetic-oriented ferric oxide and lubricant.

Each disk surface has a total of 1260 tracks, divided into two sections: 630 tracks each for head A and head B. This provides 630 cylinders for each movable head on all 16 disk surfaces. The bottom disk surface has 630 servo tracks. This provides the user with a total of 625 cylinders and 5 alternate cylinders. One additional track is available for each movable head, which is used only by maintenance personnel.

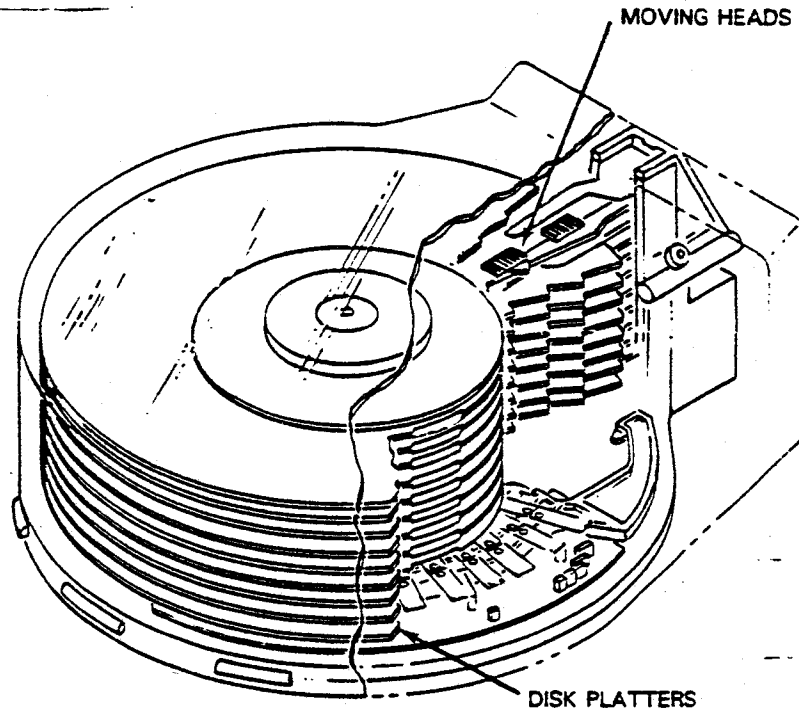
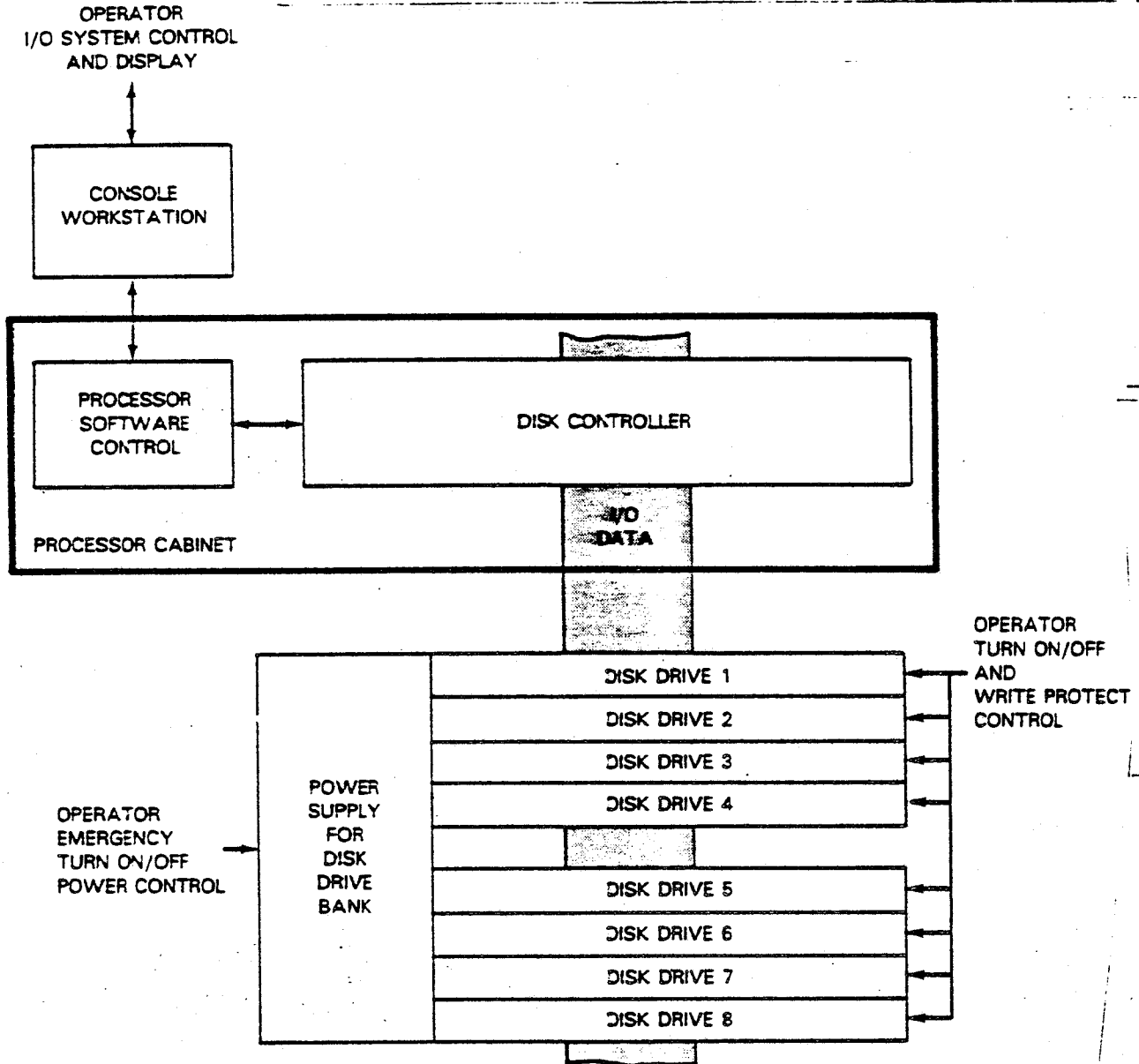


Figure 2-2. HDA Used on 8470 Disk Drive

2.4. SUBSYSTEM CONTROL

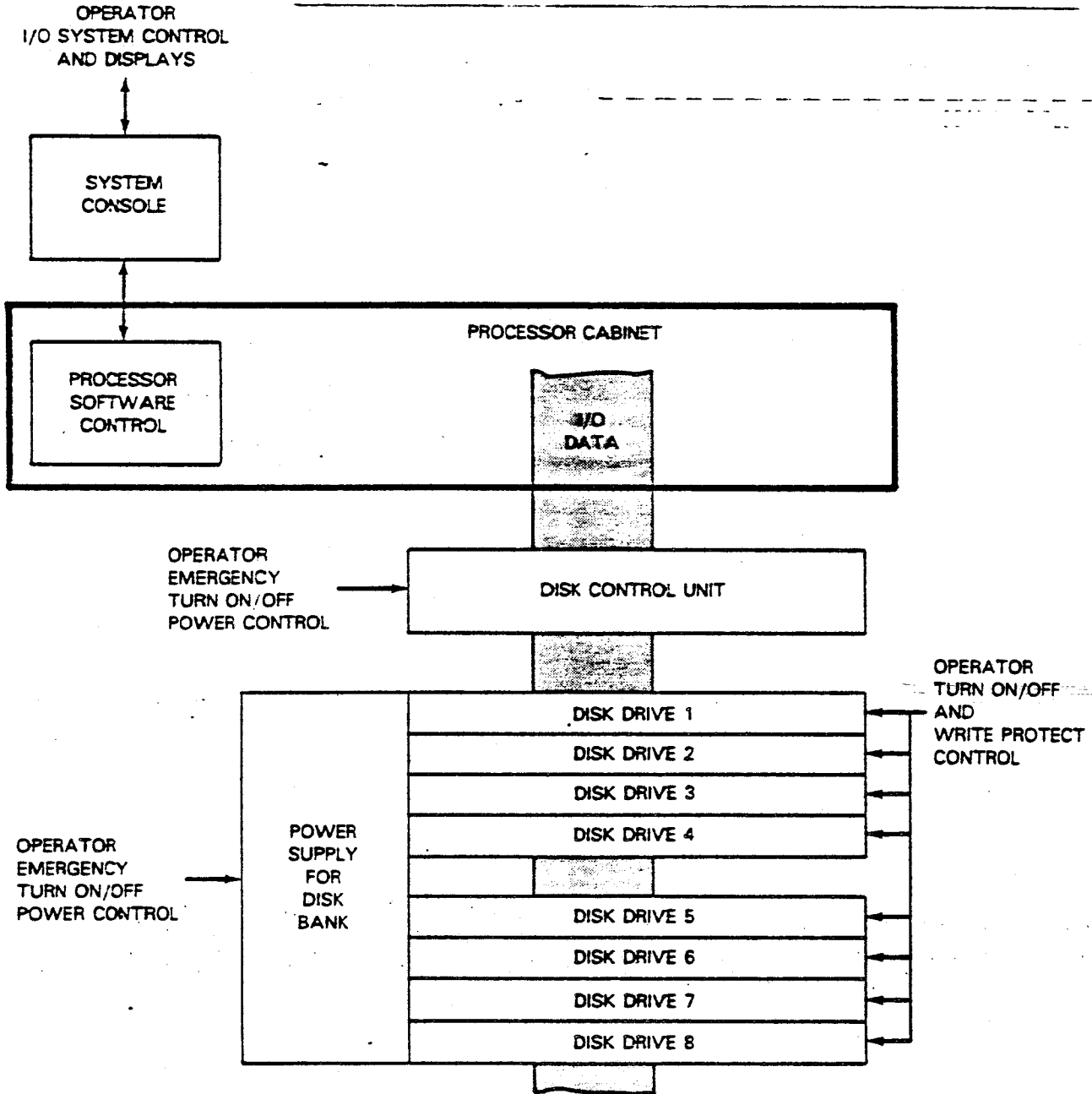
Each disk drive in the subsystem is controlled by software through the controller/control unit (Figure 2-3). The host processor sends commands through an input/output channel to the disk subsystem controller/control unit. Each disk drive in the subsystem then returns its own status and sense information that may affect its operation.

All communications between the I/O channel and disk drives are controlled by the controller/control unit. The operator or system software originates commands for reading, writing, or searching data constructed by the controller/control unit to accommodate disk drive logical functions.



a. Disk subsystem with integrated controller

Figure 2-3. Control Paths for Disk Drives in a Subsystem (Part 1 of 2)



b. Disk subsystem with freestanding control unit

Figure 2-3. Control Paths for Disk Drives in a Subsystem (Part 2 of 2)

2.5. CONFIGURATION

The 8470 disk subsystem can be configured for single or dual access from the host I/O channel. In either configuration, the subsystem may use a controller or control unit, depending on the system with which it is used. With single access, a single controller or control unit may control 1 to 32 disk drives in a subsystem. In a dual configuration, two controllers or control units provide a dual access capability for the same number of disk drives.

The basic subsystem consists of one controller/control unit and up to eight disk drives. Three additional 8-drive banks may be added to the minimum subsystem to reach a maximum of 32 drives for the subsystem.

Figures 2-4 and 2-5 illustrate the disk subsystem configurations.

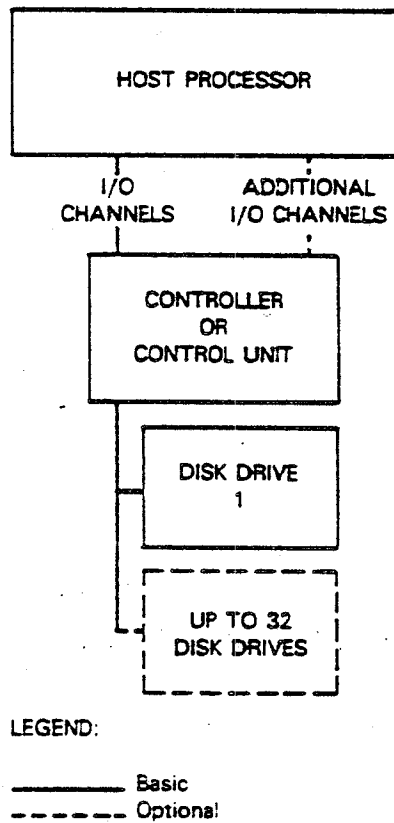
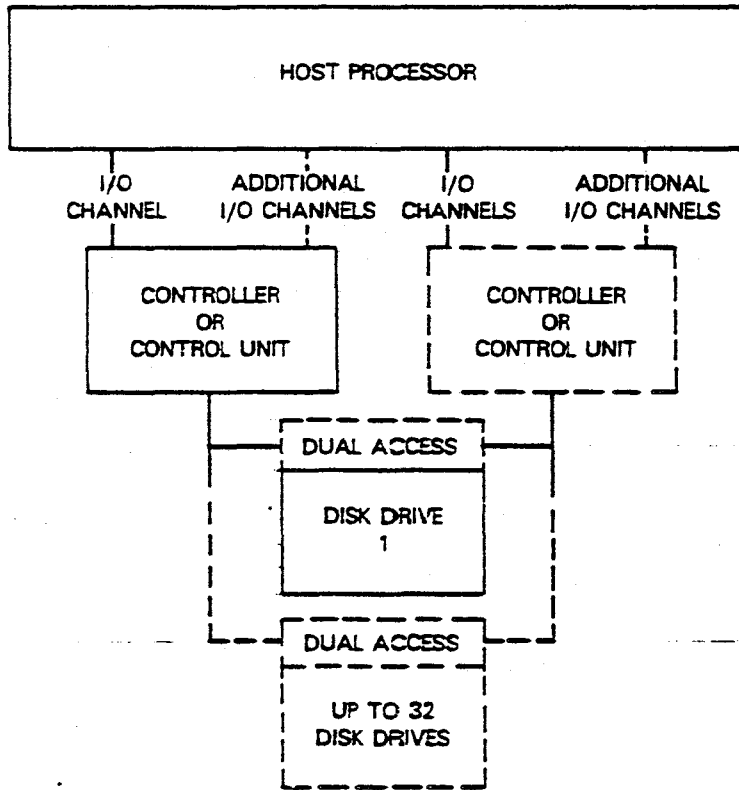


Figure 2-4. Disk Drives in Single Access Configuration



LEGEND:

- Basic
- Optional

Figure 2-5. Dual Access Disk Drive Configuration

3. Controls and Indicators

3.1. GENERAL

The operator is concerned only with controls and indicators on the operator control panel of each disk drive during normal operation. For initial power turn-on or emergency power turn-off, however, the operator should also be familiar with the power control panel on the rear of the power supply cabinet. The power supply cabinet is used only in subsystems having an integrated controller. Subsystems using a freestanding control unit are powered from the control unit.

3.2. POWER CIRCUIT BREAKERS

Primary power for the disk drives is controlled by circuit breakers located at the lower rear of the subsystem power supply cabinet. Figure 3-1 illustrates the subsystem power control panel, and Table 3-1 lists the circuit breakers and their functions.

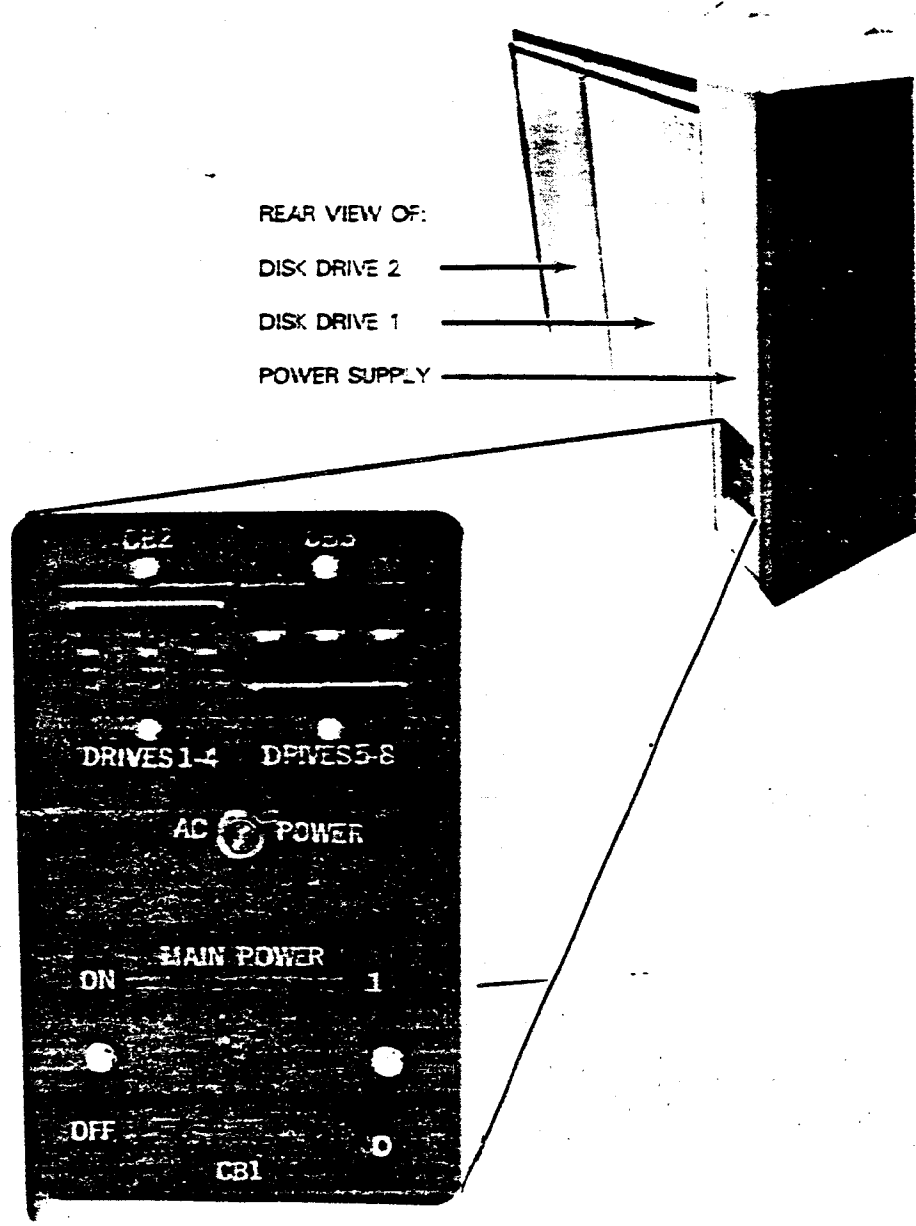


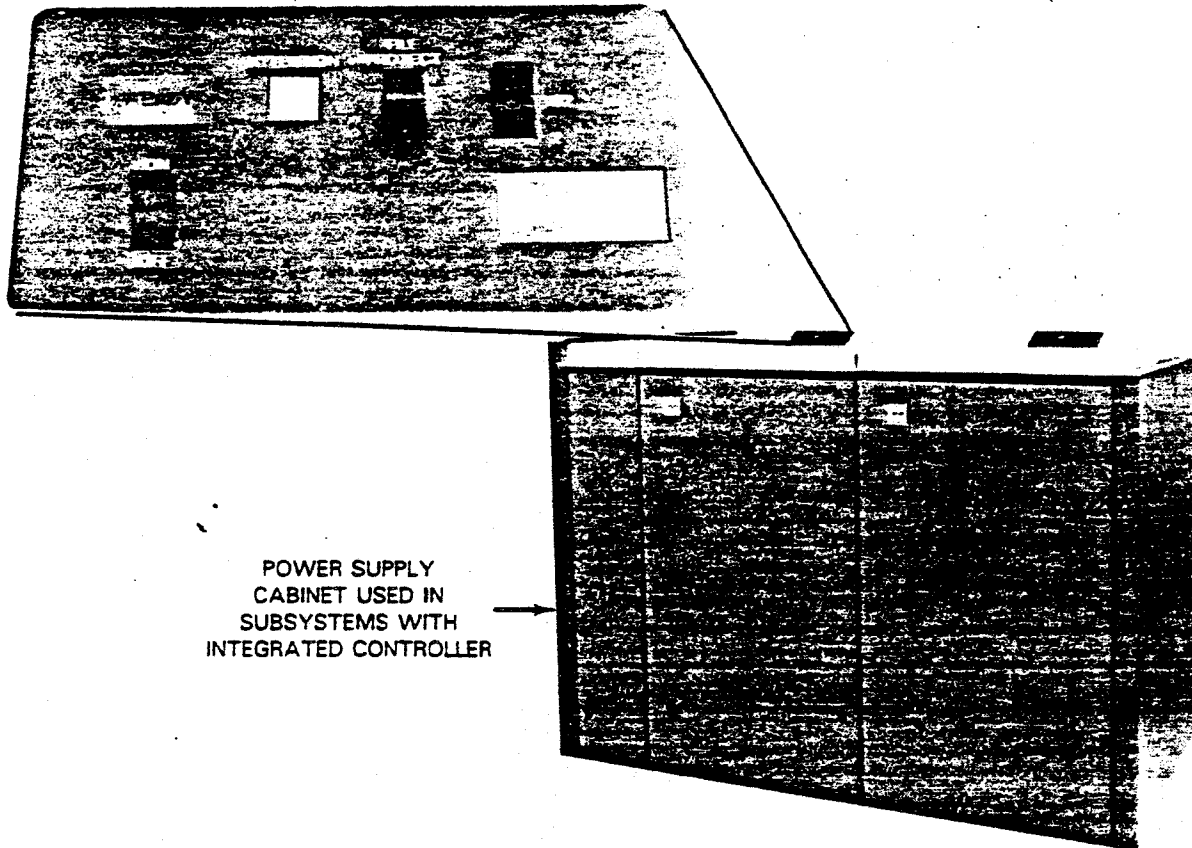
Figure 3-1. Power Control Panel on Subsystems with Integrated Controller

Table 3-1. Power Control Panel, Circuit Breakers and Indicators

Circuit Breaker/Indicator	Function
MAIN POWER CB1 circuit breaker ON/1 OFF/0	Applies main operating power for an 8-bank disk drive portion of the configuration Removes operating power for the 8-bank disk drives
AC POWER indicator	Lights when MAIN POWER circuit breaker is set to ON position and power is available to the subsystem
DRIVES 1-4 CB2 circuit breaker	Applies operating power for disk drives 1 through 4 of an 8-bank group
DRIVES 5-8 CB3 circuit breaker	Applies operating power for disk drives 5 through 8 of an 8-bank group

3.3. OPERATOR CONTROL PANEL

All 8470 disk drives in the subsystem have identical operator control panels. The operator selects the required disk drive for operation according to the logical number assigned to each disk drive for any given system. The operator control panel is illustrated in Figure 3-2. The operator controls and indicators are listed and described in Table 3-2.



POWER SUPPLY
CABINET USED IN
SUBSYSTEMS WITH
INTEGRATED CONTROLLER

Figure 3-2. Operator Control Panel

Table 3-2. Operator Control Panel, Controls and Indicators

Control/Indicator	Function
READY indicator	<p>Flashes on and off in 1-second intervals to indicate that power has been turned on for disk drive. The indicator remains lit when disk is rotating at required speed and the read/write heads are located on cylinder 0.</p> <p>The indicator also flashes on and off to alert the operator that an over-temperature condition exists or a machine error condition exists that cannot be corrected by software.</p> <p>The indicator extinguishes when power to the disk drive is turned off.</p>
ATTENTION switch	<p>Pressing this momentary-action switch:</p> <ul style="list-style-type: none"> ■ resets the operation by moving the read/write heads to cylinder 0; ■ resets the address register; and ■ sends the ATTENTION signal to the controller/control unit.
FILE PROTECT switch	<p>This toggle switch protects recorded data by inhibiting the write operation when the switch is in the up position. The disk drive notifies the controller/control unit when writing is inhibited. File protection occurs at the end of any current operation, or is enabled immediately if the disk drive is not selected for operation.</p>
<p>1, 1/2, 2 switch</p> <p>1</p> <p>2</p> <p>1/2</p>	<p>Port selector switch used with dual access capability. The operator selects access paths for controllers or control units 1, 2, or both (1/2), as follows:</p> <p>Up position. Allows access path 1 only. Access path 2 is inhibited.</p> <p>Down position. Allows access path 2 only. Access path 1 is inhibited.</p> <p>Center position. Enables both access paths in a dual access configuration. Operation of the disk drive can be from two controllers or control units.</p>

NOTE:

The rectangular window located on the lower right corner of the operator control panel is not used and should be disregarded by the operator.

4. Operation

4.1. GENERAL

Operation of the 8470 disk drive includes initial power turn-on, control of write protection functions, data path selection for dual access operation, and observation and response to any subsystem fault indications that may occur during operation.

4.2. POWER CONTROL

After power is initially turned on at the disk drive, operating power is subsequently controlled at the control unit, or at the system power switch in subsystems using an integrated controller. Primary power is always present on the disk drive power control panel.

CAUTION

Prior to turning off system power, make certain that the FILE PROTECT switch on the operator control panel (Figure 3-2) is set to on (up) position. This is required to prevent possible loss of data due to partial erasure or noise transients that may occur during power turn-off.

4.2.1. Initial Power Turn-On

To turn on power initially for each 8-drive bank, proceed as follows:

1. Set the MAIN POWER circuit breaker on the integrated subsystem power control panel (Figure 3-1) to the ON/1 (up) position. Note that the AC POWER indicator lights.

NOTE:

The MAIN POWER circuit breaker applies primary power to all eight disk drives in the 8-drive bank. Primary power for each 8-drive bank should be turned on in the same manner.

2. Set DRIVES 1-4 CB2 ganged circuit breakers to the on (up) position. Then, if more than four disk drives are used in the subsystem, set DRIVES 5-8 CB2 ganged circuit breakers to on (up) position.
3. Set the ON/OFF switch on the operator control panel (Figure 3-2) to the ON (up) position. Note the READY indicator begins flashing on and off until the spindle drive motor reaches full operation speed, then remains lit. The read/write heads move to cylinder 0 when the indicator remains lit.

NOTE:

Step 3 should be repeated for each disk drive in the disk drive bank. If additional drive banks are used, steps 1 and 2 should be repeated for each bank power supply, and step 3 repeated for each drive in each bank.

4.2.2. Power Turn-Off

Power to the disk drives is normally controlled at the system with the system power on/off switch. Except in an emergency, power should be turned off only by the Sperry customer engineer.

CAUTION

Be sure that no maintenance or operations are in progress before turning power off on any disk drive or the subsystem, unless an emergency exists. Otherwise, power turn-off will interfere with set-up conditions.

To turn power off for each disk drive, independently of the system, proceed as follows:

1. Set the ON/OFF switch on the operator control panel (Figure 3-2) to the OFF (down) position. Note that the READY indicator on the operator control panel extinguishes.
2. Repeat step 1 for each disk drive of the 8-drive bank.

CAUTION

Except in an emergency, such as any abnormal noise, smoke, or burning odor emanating from the vicinity of the disk drive, primary power to the disk drives should not be turned off unless directed by the Sperry customer engineer.

3. Set the MAIN POWER circuit breaker on the power control panel (Figure 3-1) to the OFF/O (down) position.

4.3. DISK DRIVE OPERATION

Design of the disk drive has greatly simplified operation, since the disk pack is mounted inside the cabinet and not accessible to the operator. Operation is limited to protecting recorded data and selecting disk drives for operation at the system console.

CAUTION

Do not attempt to open the disk drive cabinet for any reason or to move the cabinet. A read/write head crash will result if proper conditions are not preset by the Sperry customer engineer.

4.3.1. Protecting Recorded Data

To assure file protection, proceed as follows:

1. To prevent erasure of prerecorded data, set the FILE PROTECT switch on the operator control panel (Figure 3-2) to the on (up) position to enable the write-inhibit circuits.
2. To allow programming to record new data, set the FILE PROTECT switch on the operator control panel to the off (down) position. Return the FILE PROTECT switch to the on (up) position upon completion of the new recording.

CAUTION

Do not allow the FILE PROTECT switch to remain in the off (down) position during normal operation or portions of recorded data could be overwritten under programs currently in use by the processor.

4.3.2. Online Selection

When the optional feature is included, the operator can select which channel is to supply input. Online/offline selection is also performed by the operator.

4.3.2.1. I/O Access Selection

The operator can select an input controller/control unit channel if the dual access optional feature capability is included in the subsystem. Proceed as follows:

1. To select I/O access 1 for operation, set the 1, 1/2, 2 switch on the operator control panel (Figure 3-2) to the 1 (up) position.
2. To select I/O access 2 for operation, set the 1, 1/2, 2 switch to the 2 (down) position.
3. To select both 1 and 2 accesses for dual channel operation, set the 1, 1/2, 2 switch to the 1/2 (center) position.

4.3.2.2. Online/Offline Selection

The disk subsystem or any disk drive in the subsystem is placed online or offline with the host processor by the operator at the system console or console workstation.

■ To place a subsystem or disk drive online, proceed as follows:

1. Check that the FILE PROTECT switch is set to the on (up) position (unless writing is to be performed) and that the 1, 1/2, 2 switch is set to the desired I/O channel input on the operator control panel (Figure 3-2).
2. If necessary, turn power on as directed in 4.2.1.
3. At the console workstation or system console, provide the software system with the controller/control unit (for a subsystem) mnemonic or disk drive unit number that is to be placed online.
4. Press the ATTENTION switch on the operator control panel (Figure 3-2). Note that the READY indicator remains lit to indicate that online operation may begin.

■ To place a subsystem or disk drive offline, proceed as follows:

1. At the console workstation or system console, provide the software system with the controller or control unit (for a subsystem) mnemonic or disk drive unit number that is to be placed offline.
2. Under normal operating conditions, allow the system power sequencing function to turn off power to the disk subsystem or disk drive when system power is turned off. Otherwise, turn off power as directed in 4.2.2.

4.4. OPERATOR MAINTENANCE

Operator maintenance of the 8470 disk drives is limited to keeping the disk drive cabinet clean and removing any obstacles obstructing the flow of cooling air through the cabinet. Air filters inside the cabinet are maintained, along with any other maintenance required, by the Sperry customer engineer.

CAUTION

Do not move the disk drive cabinet without first contacting the Sperry customer engineer to install a spindle-locking mechanism. Otherwise, a head crash will occur and prevent operation.

The operator should look for fault indications that may occur during operation. If any of the following indications occur, contact the Sperry customer engineer and report the condition:

1. The READY indicator on the operator control panel fails to flash on and off, or does not remain lit approximately 10 seconds after it begins flashing after the ON/OFF switch is set to ON.
2. The READY indicator continues to flash for 60 seconds or longer, indicating that the drive spindle requires more time than normal to reach operating speed.
3. The READY indicator begins flashing after it has been continuously lit.
4. The audible alarm sounds an early warning condition in the control unit.
5. Any abnormal noise, smoke, or burning odor is present near any disk drive or control unit.
6. An early warning indication is presented for a disk drive at the console workstation or system console. The disk drive continues to operate normally under this condition.

If any of these conditions occur:

1. Immediately notify the Sperry customer engineer and report the condition.
2. Terminate the current operation at the faulty disk drive as soon as possible.
3. Inform the host processor software system of the mnemonic name or disk drive number and place it offline.
4. Set the ON/OFF switch on the operator control panel to the OFF position until the Sperry customer engineer corrects the problem.

