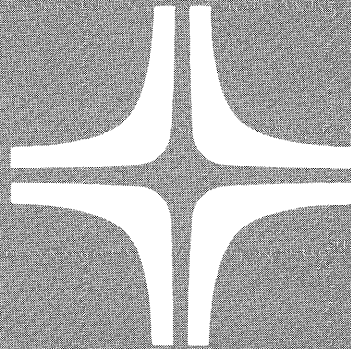# SPERRY

This Library Memo announces the release and availability of "SPERRY® 8430/8433 Disk Drives General Description", UP-10028.

The SPERRY 8430/8433 Disk Drive general description provides a functional description and operation of the disk drive hardware. This includes the configurations, specifications, operator controls and indicators, interfaces, power requirements, physical characteristics, and environmental requirements.

Additional copies may be ordered by your local Sperry representative.

8430/8433 Disk Drives

General Description

Contents

CONTENTS

4. INTERFACE

1. Introduction

The SPERRY 8430 and 8433 Disk Drives (Figure 1–1) are freestanding, random-access mass storage units.

The 8430 is a processing system component that provides a gross per drive capacity of 100 megabytes (MB) and a data transfer bit rate of 6.45 megahertz (MHz). The 8430 operates slaved to a compatible Sperry storage control unit. Disk packs recorded on an 8430 and/or a similar disk drive may be interchanged among 8430 units.

The 8433, depending upon the model option, features removable and interchangeable disk packs. These drives operate as slaves to compatible Sperry control units and provide 100, 200, or 339.8 MB of storage and data rates of 6.45 or 10.08 Mbits/second.
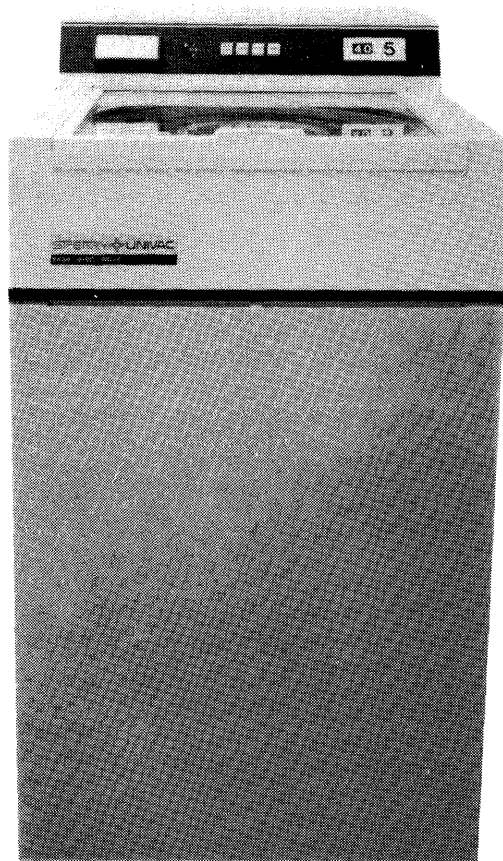

Figure 1–1. SPERRY 8430 and 8433 Disk Drives

2. Functional Description

2.1. GENERAL PERFORMANCE

A disk drive is connected to its controller or between two controllers by 18 bus lines that carry control, addressing, data, and status intelligence. Two other lines permit drive-drive connection.

The controller supplies filtered, 3-phase primary power (either 50 or 60 Hz) to the drive. Internal power sequencing is initiated when the operator sets the drive power switch; such sequencing can occur only when primary power is supplied by the controller. When a drive is connected between two controllers, only one controller supplies primary power.

The logical drive address is set by a color-coded and mechanically interlocked plug. For diagnostic operation, a spare plug is installed in the drive that will undergo testing. For read and write operations, the cylinder, head, track, and sector addresses are determined by the controller with the appropriate function selected. During a write operation, the data is serialized by the controller and transferred to the drive for recording. Data transfer takes place at a 6.45 or 10.08 Mbit rate, depending upon the disk drive model.

The disk drive includes the read circuits needed to recover data from the selected platter and serialize it for transfer to the control unit. When data is written to a disk, an error condition code is appended to it. Upon receiving data from the disk drive, the controller and software use the appended code for data correction after transferring it to the system.

The format used by the control unit effectively defines the placement of address marks on the disk. Therefore, the maximum storage capacity of the disk drive is a function of the system format.

2.2. DISK PACKS

2.2.1. Disk Assembly

The 8430 and 8433 disk packs (Figure 2-1) consist of 20 platters mounted on a vertical spindle; each platter has its own read/write head. Circular protective plates are mounted above the top platter and under the bottom platter. Of the 20 platters, 19 are available to the system for data transactions. The 20th platter is reserved for the servo. The entire disk platter assembly rotates at a nominal speed of 3600 rpm.

A removable dust cover is an integral part of the interchangeable pack handle. The disk pack is placed on the drive spindle before the cover and handle can be removed. The pack and its dust cover may be stored in a stack rack when not in use.

2
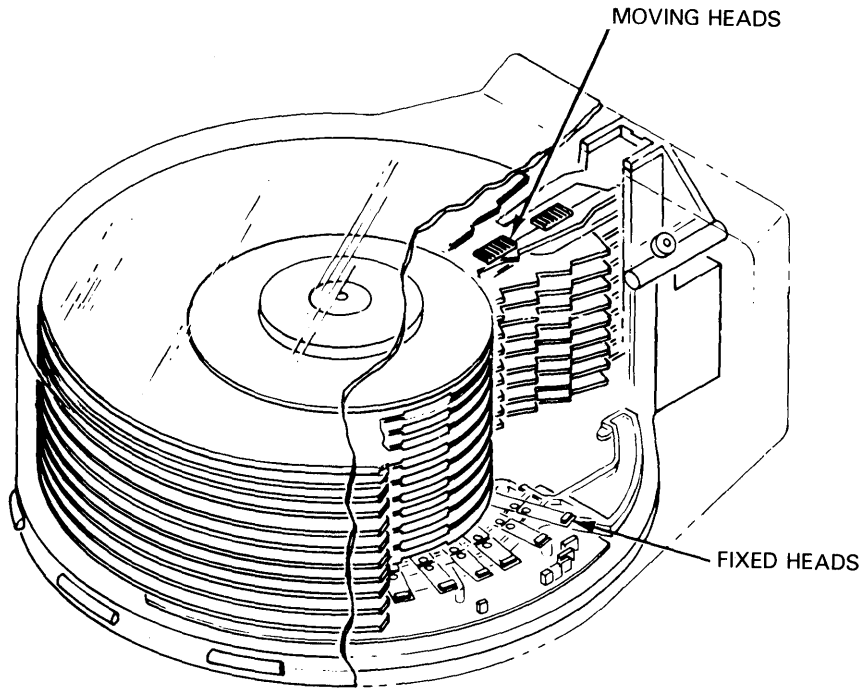
a.   Disk Pack Assembly
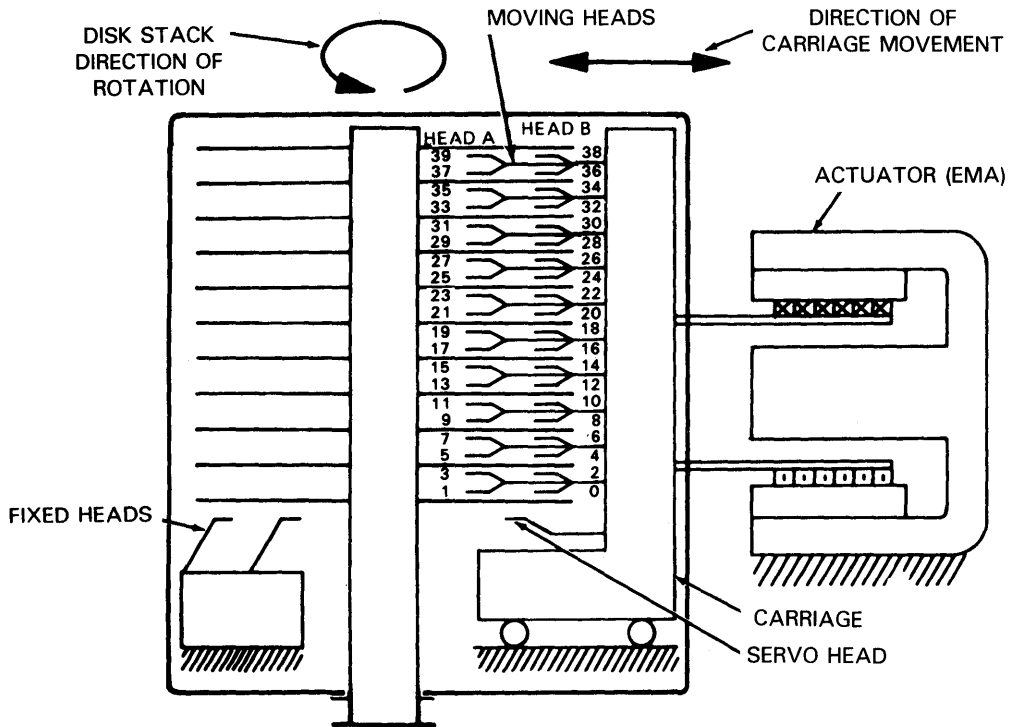
b.   Read/Write and Servo Head Assembly

Figure 2–1.   8430/8433 Disk Pack Configuration

2.2.2. File Organization

Each disk pack has 19 data surfaces; the number of tracks per surface depends upon the drive model as does the bit density per track. Capacities for each drive model are supplied in Table 2-1.

2.2.3. Accessor Assembly

The accessor mechanism (Figure 2-1) comprises 20 arms, one for each platter surface. The support tower that carries the arms is moved to any of the track positions by an electromagnetic closed loop positioning system. The vertical alignment of the heads is referred to as a cylinder. The access mechanism moves the head directly from one cylinder to any other without returning to a home position. Access to recorded data is obtained by moving the read-write head assembly to the required position.

Programmed servo offset enables the drive to respond to a command to move the accessor in increments of plus or minus 12.5 microinches from its designated track location. This function may be used to recover marginal data due to servo positioning inaccuracies, or to recover data if a non-recoverable data error occurs due to small magnetic defects.

If the data cannot be recovered after all servo offset combinations have been tried, the error is considered non-recoverable. If an offset function is selected, it must be reset before a write operation. If a write command is attempted while the servo offset is active, the drive will not enable the write gate. The drive provides a sense signal (while writing) that the control unit monitors.

2.3. SAFETY CIRCUITS

Any of the following conditions can trigger a DEVICE CHECK condition:

1. WRITE READY UNSAFE

    The write gate is active but the heads are not on the cylinders.

2. HEADS UNSAFE

    Either several heads have been selected or the wrong head was selected.

3. DC WRITE UNSAFE

    Write current is sensed with the write gate inactive. The current sink circuit is inactive with the write gate inactive. Even and odd write circuits enabled at the same time. The write current sensed is different from the programmed write current.

4. AC WRITE HEADS UNSAFE

    There are no write transitions with the write gate active and the search/write AM inactive. Write transitions are detected with the write gate inactive.

5. PLO UNSAFE

    Indicates loss of synchronization with the read/write PLO.

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6. 30VDC UNSAFE

Possible malfunction of the drive power supply. The heads will unload.

7. PACK SPEED UNSAFE

Indicates the pack speed is less than about 80 percent of normal when the heads are extended. The heads will unload.

8. VELOCITY UNSAFE

Possible fault in the access electronics. The heads will unload.

9. SERVO UNSAFE

Possible fault in the servo electronics. The heads will unload.

10. UNSAFE

Indicates any unsafe. With UNSAFE asserted but all of the above unsafes negated, two more unsafes are defined:

a. An index error occurred with the write gate active.

b. Write overrun — The write gate was active during index time.

2.4. SPECIFICATIONS

Table 2–1 lists the general specifications for the 8430 and the 8433 disk drives.

Table 2–1. Specifications for Mass Storage (Disk Drives 8430 and 8433) (Part 1 of 2)

Specification	8430	8433-00/01	8433-02/03	8433-04/05
Maximum data capacity (MB)	Depends on system format	Depends on system format	Depends on system format	339.8 (Note 1)
Track capacity (bytes): Maximum Single record	System-dependent System-dependent	Approx. 200 System-dependent	Approx. 100 System-dependent	21,000 20,120
Positioning times (millisec): Track-track Average Full stroke	7 27 50	7 30 55	7 27 50	7 30 55
Number of read/write heads (Note 2)	20	20	20	20
Number of cylinders	411	815	411	885
Nominal data rates: Bit rates (Mbits/sec) Byte rate (Kbytes/sec)	6.45 806	6.45 806	6.45 806	10.08 1,260

Specification	8430	8433-00/01	8433-02/03	8433-04/05
Disk rotational speed (rpm) @60 Hz @50 Hz	3600 ± 2% 3600 ± 2.5%	3600 ± 2% 3600 ± 2.5%	3600 ± 2% 3600 ± 2.5%	3600 ± 2% 3600 ± 2.5%
Maximum bit density (bits/inch)	4040	4040	4040	6060
Track density (tracks/inch)	192	370	192	402
Number of tracks/ disk surface	411	815	411	887 (Note 3)
Number of disk surfaces (Note 2)	20	20	20	20
Latency times (ms): ½-revolution (avg.) 50 Hz 60 Hz 1-revolution (max.) 50 Hz 60 Hz	 8.33 ± 2% 8.33 ± 2.5% 16.67 ± 2% 16.67 ± 2.5%	 8.33 ± 2% 8.33 ± 2.5% 16.67 ± 2% 16.67 ± 2.5%	 8.33 ± 2% 8.33 ± 2.5% 16.67 ± 2% 16.67 ± 2.5%	 8.33 ± 2% 8.33 ± 2.5% 16.67 ± 2% 16.67 ± 2.5%
Start-up time (sec)	15	15	15	15
Stop time (sec)	15	15 (average) 20 (maximum)	15 (average) 20 (maximum)	20

NOTES:

1. User capacity depends on system format.

2. A total of 19 user-addressable read-write heads; the 20th head is reserved for the servo.

3. A total of 885 user-addressable; two are reserved for service.

2.5. CONFIGURATIONS

Figure 2-2 shows the configurations for the 8430 and the 8433 disk drives. Table 2-2 describes the variations of the 8430 and the 8433 in terms of their features.
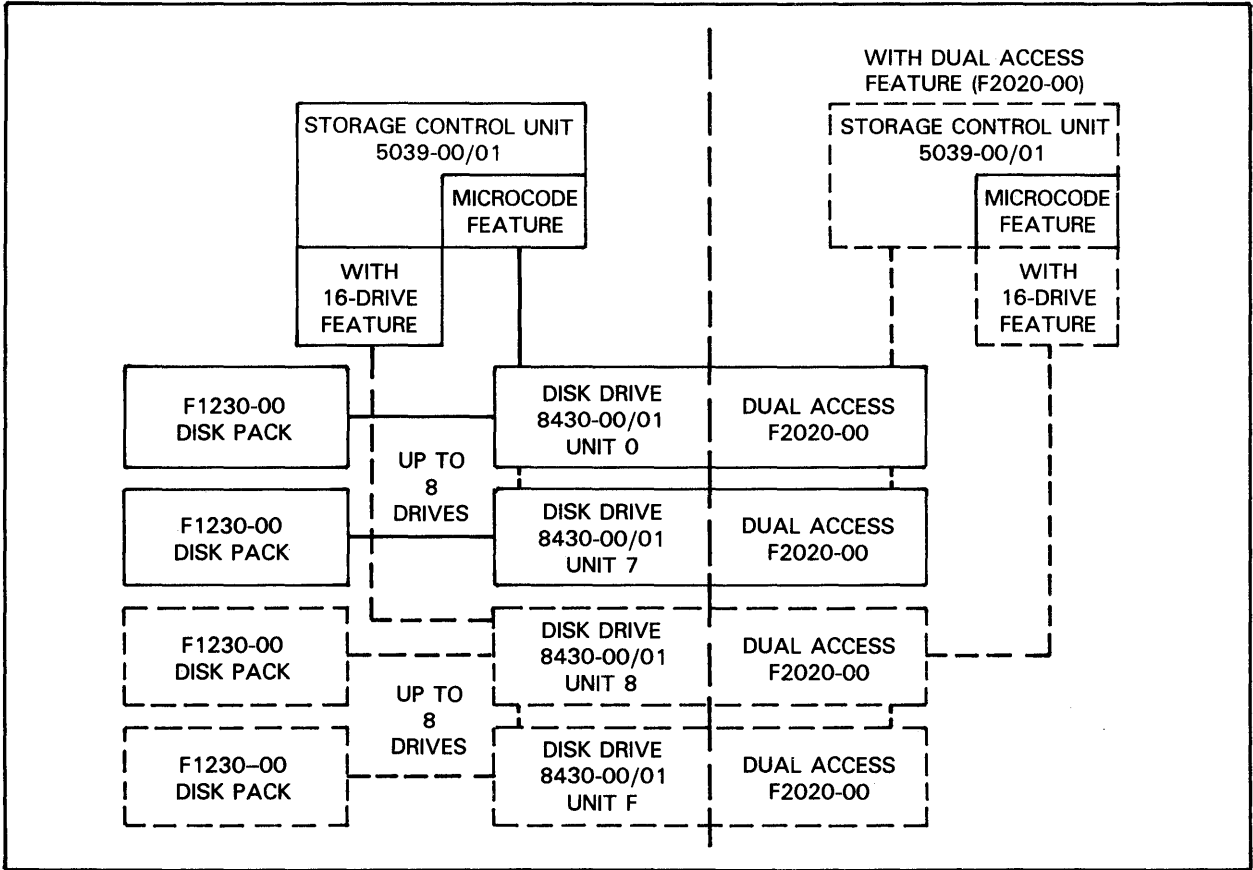
a. 8430 configurator
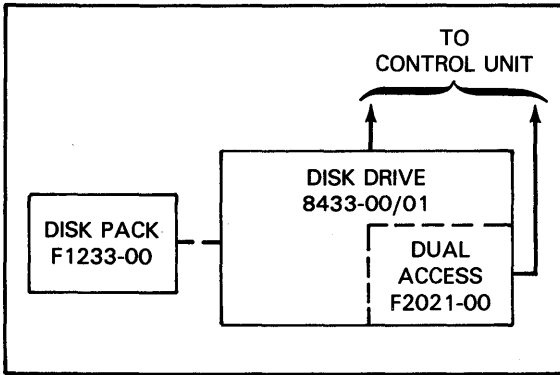
b. 8433-00/01 configurator   c. 8433-02/03 configurator

NOTE:

Disk pack F1223-00 is required if F2342-00 is installed in 8433-02/03.

Figure 2-2. 8430/8433 Disk Drive Configurations (Part 1 of 2)

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d. 8433-04/05 configurator

Figure 2–2. 8430/8433 Disk Drive Configurations (Part 2 of 2)

Table 2–2. 8430/8433 Disk Drive Configuration Descriptions (Part 1 of 2)

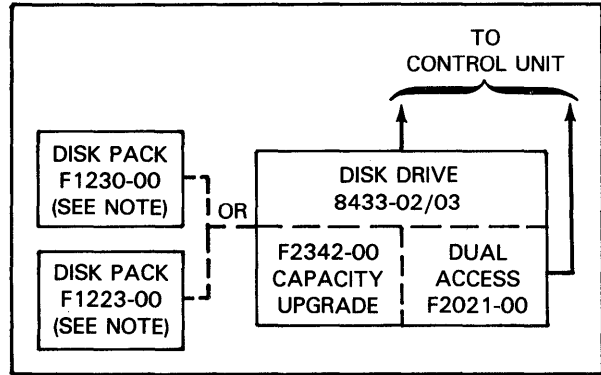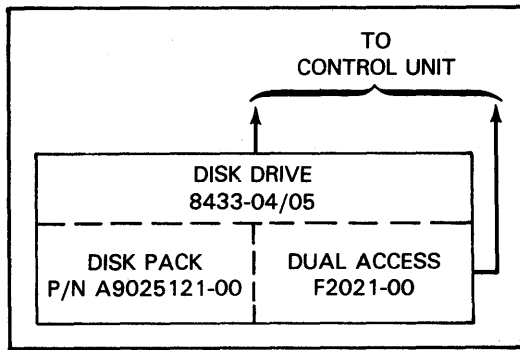| Type/Feature No.t050 Number	Name	Description
8430	Disk Drive	Provides direct access storage using removable disk pack feature F1230-00. Average head positioning time is 27 ms. Average latency time is 8.33 ms. Transfer rate is 806 KB/second. Used with 5039-00 Storage Control Unit (60 Hz) or 5039-01 Storage Control Unit (50 Hz).
F1230	8430 Disk Pack	This is an interchangeable disk pack that has all the properties of the IBM 3336 Model I (or equivalent).
F2020	Dual Access	Provides operation of the 8430 with two storage control units. The drives may be shared dynamically by the storage control units or assigned to a specific storage control unit at the user's option.
8433-00	Disk Drive	Provides direct access storage using removable disk pack feature F1223. Average head positioning time is 30 ms. Average transfer latency is 8.33 ms. Transfer rate is 806 KB/second. Nominal capacity is 200 MB. Used with Storage Control Unit 5039-00/02 (60 Hz).
8433-01	Disk Drive	Same as 8433-00, except used with Storage Control Unit 5039-01/03 (50 Hz).
8433-02	Disk Drive	Provides direct access storage using removable disk pack feature F1230. Average head positioning time is 27 ms. Average latency time is 8.33 ms. Transfer rate is 806 KB/second. Nominal capacity is 100 MB. This unit may be upgraded to the equivalent of 8433 with the addition of F2342. Upgraded unit required disk pack F1223.
F1223		This is an interchangeable disk pack that has all the properties of the IBM 3336 Model II (or equivalent).
F2342	Capacity Upgrade	Converts an 8433-02/03 to the equivalent of an 8433-00/01. Installation of this feature requires the use of disk pack F1223.
F2021	Dual Access	Provides for operation of the 8433 with two storage control units. The drives may be shared by the storage control units or assigned to a particular storage control unit through user selection.

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Type/Feature No.t050 Number	Name	Description
8433-04	Disk Drive	Provides direct access storage for up to 339.5 MB. Average head positioning time is 30 ms. Average latency time is 8.33 ms. Transfer rate is 1.26 MB/second. Used with Storage Control Unit 5046 or 5039-02.
8433-05	Disk Drive	Same as 8433-04, except 50 Hz. Used with Storage Control Unit 5046-01 or 5039-03.
F2391	Capacity Upgrade	Converts an 8433-00/01 to the equivalent of an 8433-04/05 (not field installable).
F2529	Capacity Upgrade	Converts an 8433-02/03 to the equivalent of an 8433-04/05 (not field installable).

3. Controls and Indicators

3.1. CONTROL AND INDICATOR DESCRIPTIONS

Operator controls and indicators are located on the top left portion of the disk drive (Figure 3–1). Table 3–1 describes each control and indicator.
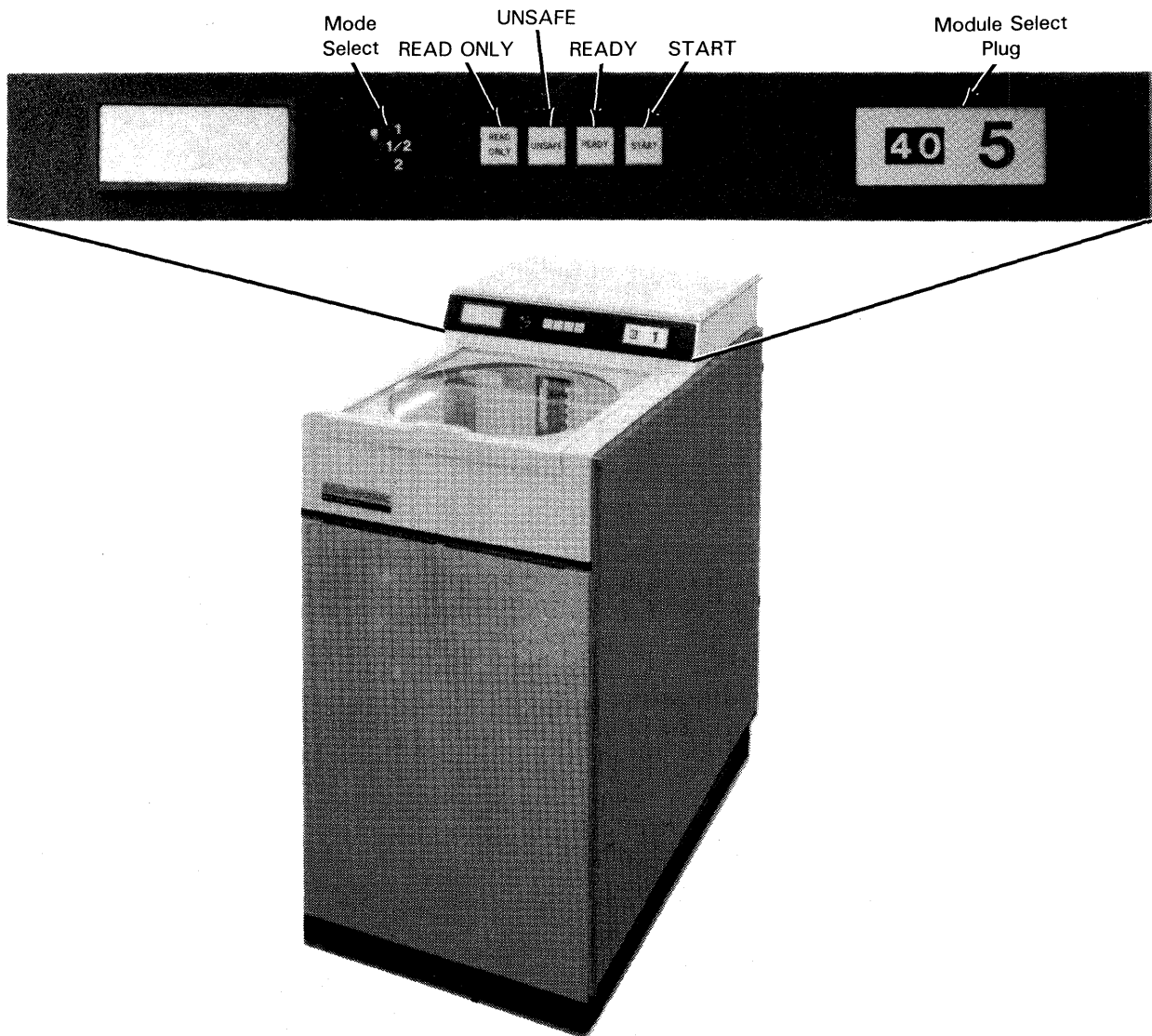

Figure 3–1. 8430/8433 Controls and Indicators

Table 3-1. 8430/8433 Control and Indicator Descriptions

Control/Indicator	Description
Module select plug	Defines the logical address of the drive from OOH through OFH or spare. Selection is made by inserting the appropriately numbered plug in a designated drive. If the controller has diagnostic capabilities, the spare plug is inserted in the drive to be diagnosed. Insertion of the plug causes the drive to recalibrate in all cases. Module select plugs are mechanically interlocked, but not portable from device type to device type (i.e., 8430, 8433-00 through -03, and 8433-04/05 plugs are not interchangeable).
START switch/indicator	When depressed for starting, the START indicator illuminates, and the drive upsequences if all logical conditions are satisfied. The disk heads will be loaded. When deselected, the heads will retract, and the spindle motor will stop.
READY switch/indicator	Illuminated when the power-on sequence completes and the drive can accept commands. Darkens when the START switch is deselected, system power drops, a seek incomplete occurs, or the module select plug is removed.
UNSAFE indicator	Illuminates when the drive safety circuits defect an unsafe condition. The unsafe condition can be reset by a Control Reset command or by stopping and restarting the drive with the START switch.
READ ONLY switch/indicator	Latching this switch with Module Select negated places the drive in the READ ONLY mode. If depressed with Module Select asserted, the drive will not go into READ ONLY mode. The READ ONLY indicator illuminates when the drive is in READ ONLY mode.
Mode select switch	In position 1, access one is enabled; access two is disabled if a start sequence has been initiated by depressing the START switch. If the drive is in a neutral state, position 1 enables access one and disables access two. Position 2 operation is the reverse of position 1 operation. Position 1/2 of this switch enables both accesses if a start sequence has been initiated. In the neutral state (i.e., no access by either controller), placing the switch to position 1/2 enables both accesses.

3.2. OPERATOR ACCESS COVER

When installing or removing a disk pack from a drive, the access cover is opened to expose the disk pack. With the cover open, the drive cannot be turned on. When the cover is closed, the drive cycles up as if the ON sequence switch was engaged.

3.3. POWER CONTROLS

Cabinet power is obtained from the servo control unit. The 8430/8433 drives include a power panel accessed by opening the front casework. The power panel includes two main circuit breakers with associated indicators, power supply fuses, and auxiliary circuit breakers.

4. Interface

4.1. OUTPUT LINES

The controller-to-disk drive interface includes 18 tag out, bus out, and bus in lines. A separate line is used for drive-drive sequence enabling. The organization and contents of the controller-to-disk drive interface lines are shown in Figure 4–1.

4.2. INPUT LINES

The input lines comprise 20 device control functions and two drive-drive functions. The two drive-drive lines are Sequence Pick Out and Sequence Enable. The Sequence Pick Out is the Sequence Pick In line from the controller. The Sequence Enable line, when asserted, enables the disk drive to up-sequence if other required logical conditions prevail.

The bus in (i.e., input) lines carry interrupts, operational status, addressing, and the status of key unsafes identified in Figure 4–1. Other lines carry information indicative of in-progress drive operations, such as heads extended or drive selected.

4.3. DUAL ACCESS OPERATION

With both accesses enabled by the mode selection switch, the drive will respond to commands from either access. A control unit must establish control of the drive in order to execute all of the drive commands. Without established control, only three commands may be issued to a drive: Mod Select, Poll Interrupt, and Read Dual Port. The drive access arbiter determines which access has control of the drive by breaking ties and maintaining control during command execution.

TAG DECODE ▷

BUS OUT

	0	1 SET SECTOR	2 POLL DEV. INTERRUPT	3 MODULE ADDRESS	4 REQUEST STATUS 1	5 REQUEST ADDRESS	6 SET CYLINDER	7 SET HEAD	8 SET DIFF/OFFSET	9 CONTROL #1	10 CONTROL #2	11 OPERATE	12 DIAGNOSTIC	13 UNSAFE STATUS	14	15
P																
128							128	REVERSE	128/REV		RESERVE	AM				
64		64	READ D.P. STATUS #	LONG SELECT			64	CAR 256	64		RELEASE	FORMAT				
32		32					32	DIFF 256	32/800 μin	OFFSET START						
16		16		SPARE		READ DIFF	16	16	16/400 μin	SEEK START	RESET DIFF	HEAD SELECT				
8		8		8		READ HAR	8	8	8/200 μin	RECAL		HEAD ADVANCE				
4		4	SPR DRIVE	4		READ CAR	4	4	4/100 μin			WR GATE	SERVO STATUS			
2		2	DRIVE 8 F	2			2	2	2/50 μin	CONTROL RST	DECREMENT DIFF	RD GATE	POLL DIAG INT & HDSEL	SERVO		
1		1	DRIVE 0 7	1		READ SAR	1	1	1/25 μin	RST INTERRUPT	OFFSET RESET	STORE SEC COUNT	FORCE UNSAFES	RD/WR		

MOD SELECT NOT REQ'D (under columns MODULE ADDRESS – REQUEST STATUS 1)

BUS IN

		SECTOR		STATUS I	STATUS 1			CAR	HEAD	DIFF	STATUS 1	STATUS 3	STATUS 2		
P															
128		HI SIDE OF SECTOR		INDEX ERROR	INDEX ERROR			128	REVERSE	128/REV	INDEX ERROR	RESERVED	INDEX ERROR		
64		64		OFFSET ACTIVE	OFFSET ACTIVE			64	CAR 256	64	OFFSET ACTIVE	RELEASED	OFFSET ACTIVE		
32		32		SEEK INCOMPLETE	SEEK INCOMPLETE			32	DIFF 256	32/800 μin	SEEK INCOMPLETE				
16		16		SK/OFF/FMT /RLSD	SK/OFF/FMT /RLSD			16	16	16/400 μin	SK OFF FMT /RLSD		READ ONLY		
8		8		ON LINE	ON LINE			8	8	8/200 μin	ON LINE	ON LINE	WRITE READY		
4		4		PACK CHANGE	PACK CHANGE			4	4	4/100 μin	PACK CHANGE		INDEX		
2		2		BUSY	BUSY			2	2	2/50 μin	BUSY		END OF CYL		
1		1		REC SRCH IN PROGRESS	REC SRCH IN PROGRESS			1	1	1/25 μin	REC SRCH IN PROGRESS		WRITE CURR SENSE		

BUS IN

	D.P. STATUS BUS OUT 64	SPR DRV BUS OUT 4	DRV 0-7 BUS OUT 1	DRV 8 F BUS OUT 2	READ DIFF BUS OUT 16	READ HAR BUS OUT 8	READ CAR BUS OUT 4	READ SAR BUS OUT 1
P								
128		SPARE	0	8	128/REV	REVERSE	128	HI SIDE OF SECTOR
64	TEMP NOT AVAILABLE		1	9	64	CAR 256	64	64
32	DUAL PORT DRIVE		2	A	32/800 μin	DIFF 256	32	32
16			3	B	16/400 μin	16	16	16
8	ON LINE		4	C	8/200 μin	8	8	8
4			5	D	4/100 μin	4	4	4
2	NOT AVAILABLE		6	E	2/50 μin	2	2	2
1			7	F	1/25 μin	1	1	1

	HEAD ALIGN BUS OUT 2	SERVO STATUS BUS OUT 4	RD/WR BUS OUT 1	SERVO BUS OUT 2
P				
128	C.E. PROG INTERRUPT	LINEAR MODE	UNSAFE	
64		1ST CYL & LIN MODE		
32	SIGN CHANGE	ACCESS RDY	WRITE RDY UNSAFE	
16		ODD CYL		SERVO UNSAFE
8		DR TO IN GB EVEN CYL	HEADS UNSAFE	ANY UNSAFE EXCEPT R/W
4		DR FWD 20" DIFF = 1	PLO UNSAFE	PACK SPEED UNSAFE
2		DR FWD 5" DIFF = 0	DC WR UNSAFE	VELOCITY UNSAFE
1		HEAD LOAD	AC WR UNSAFE	30 VDC UNSAFE

NOTES:

* INTERRUPTS
# MOD SELECT REQUIRED

PB000630
5/74

Figure 4—1. Controller-to-Disk Drive Interface Lines

5. Physical and Facility Characterisitics

5.1. ELECTRICAL REQUIREMENTS

3-phase Voltage AC (vac) @ 60 Hz (±2%)

> 200 (+10, −15%)
>
> 208 (+6, −15%)
>
> 230 (+10, −15%)

3-phase vac @ 50 Hz (±2%)

> 200 (+10, −15%) (delta)
>
> 220 (+10, −15%) (delta)
>
> 230 (+10, −15%) (delta)
>
> 240 (+6, −15%) (delta)
>
> 380 (+10, −15% (star with neutral)
>
> 400 (+10, −15%) (star with neutral)
>
> 416 (+6, −15%) (delta)

Surge current

> Does not exceed 30 amperes (5 x running current)

Apparent Power

> 1.8 kva @ 5 amperes

5.2. DIMENSIONS

	inches (cm)
Width*	22 (55.9)
Height	40 (101.6)
Depth	32 (81.28)
Weight*	520 lb (235.9 Kgm)
Mounting	Casters and levelers

* Includes side covers

5.3. HEATING, VENTILATION, AND AIR CONDITIONING

Cooling	No external forced air required
Temperature (max. gradient)	50–90°F (10–28°C) 20°F (11.1°C)
Heat dissipation worst case cycling	does not exceed 7,000 Btu/hr
nominal	5,500 Btu/hr
Relative humidity	20–80% max. wet bulb at 78°F (26°C)

5.4. AUDIBLE NOISE AND RFI

Audible noise	Audible noise is within noise criteria curve of NC60 (when measured as stand-alone in acoustical chamber)
Radio frequency interference	Meets Sperry Specifications