SPERRY UNIVAC
8406
Diskette Subsystem

General Description

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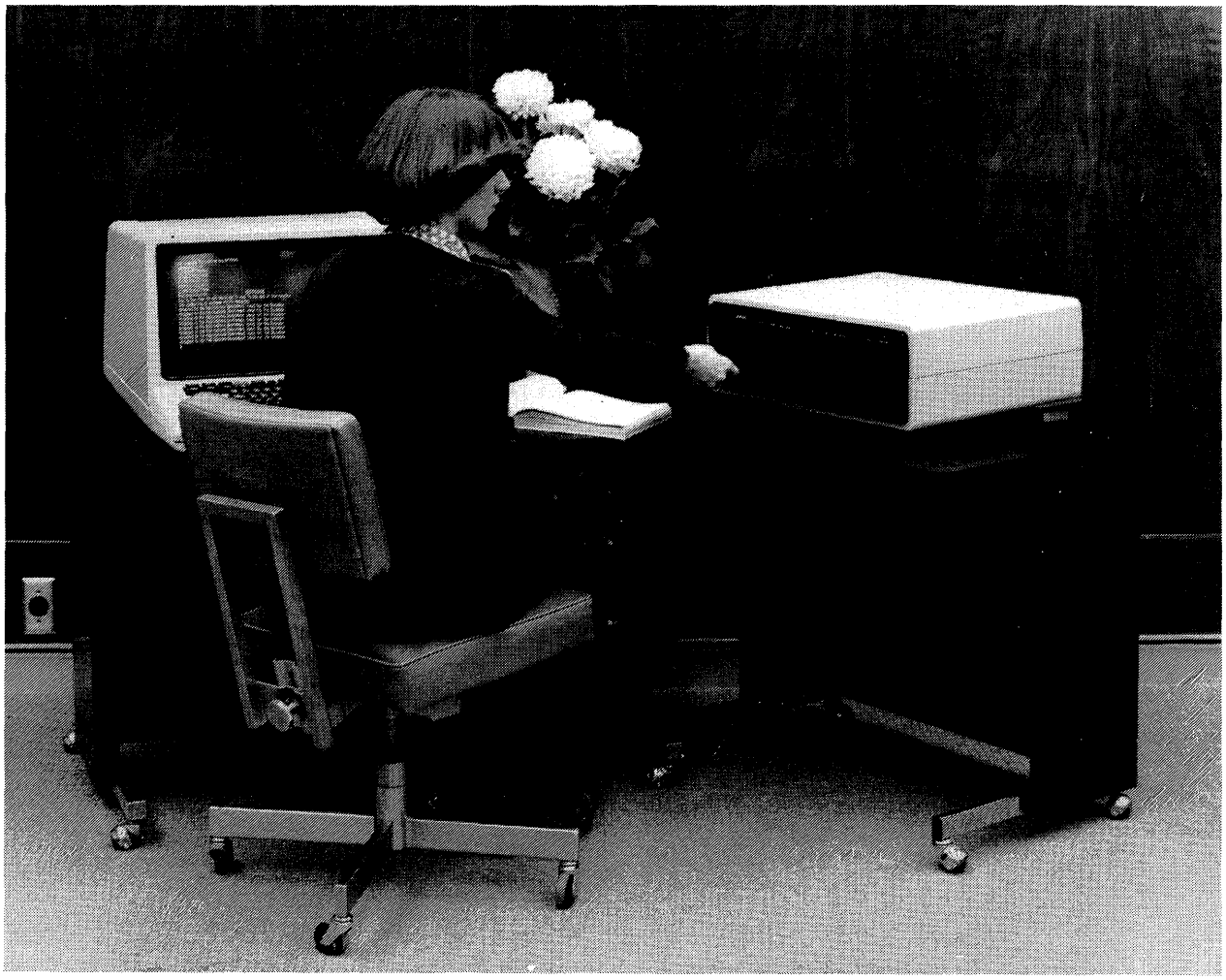

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The SPERRY UNIVAC 8406 Diskette Subsystem at Work

1. Introduction

THE CONCEPT

A terminal peripheral device combining random-access speed and large-scale storage with desk-top operation and a minimal investment — that's the SPERRY UNIVAC 8406 Diskette Subsystem!

Compatible with the latest SPERRY UNIVAC intelligent terminals and data communications controllers, the diskette subsystem offers:

- Peripheral storage on flexible diskettes
- Instant data access
- Simple and reliable operation
- Versatile design

The flexible diskette is an inexpensive and reusable medium for quick-change data storage. A diskette stores up to 2 million bits of information and can be used on any 8406 diskette subsystem. The diskette subsystem retrieves data from a flexible diskette by random-access techniques, reducing data recovery rates and minimizing the need for extensive file directories. Editing capabilities make data update a simple, quickly performed procedure. Partial or complete files can be stored as called from a remote host processor, or working files can be prepared for later transmission to the host processor. You will be able to develop numerous other uses for this versatile storage device.

At your terminal, you can select the disk drive to read or write data and to seek new storage locations from any position, or your host processor can do the same things from a remote location with simple coded procedures. You can list stored data — whether sent to you over the communications line or entered at your terminal — from diskette to a printer, and you can copy the data on another medium, such as a second diskette. Depending on your application, you can even merge existing data from one diskette with new data entered from your terminal keyboard and create a composite record of old and new data stored on another diskette. Thus, the diskette subsystem offers not only efficient data storage but a flexible data-handling system, easily adapted to the highly developed applications of your intelligent terminal and its supporting equipment.

CHARACTERISTICS

The diskette subsystem (Figure 1) is a freestanding, moving-head disk storage device. Designed for use with data terminals and as convenient for desk-top operation as a modern typewriter, the diskette subsystem provides random-access data storage in a compact device at a low cost. For a storage medium, the diskette subsystem uses industry-standard 8-inch flexible diskettes. Access doors in the front of the cabinet accommodate quick insertion and loading of diskettes.

A single disk drive is supplied with the diskette subsystem; the subsystem can be optionally equipped with two disk drives. The diskette subsystem controller contains control circuitry for either single or dual disk drive equipment. Disk drives and controller are mounted in a common cabinet, providing a self-contained freestanding device. A separate external power cable supplies primary power to cabinet equipment.

An interface and cable connection allows the diskette subsystem to be used as a peripheral device by a host controller. The interface is located in the host controller. Several diskette subsystems, as well as other peripheral equipment compatible with an 8-bit interface, can share the same peripheral interface in the host controller.

Data transfer between the interface and diskette subsystem occurs in the form of 8-bit characters. The parallel transfer of each character includes a parity bit for error checking. Commands from the host controller and status reports from the diskette subsystem are also presented to the interface as complete 8-bit information bytes.

FUNCTIONS AND APPLICATIONS

Basic functions provided by the diskette subsystem include:

- Reading and writing of 8-bit characters
- High-speed positioning to any location
- Recording on standard 8-inch flexible diskettes
- Storage capacity of 256,000 8-bit bytes on a single diskette
- Write protection capability for recorded diskettes
- Generating and checking character and block parity
- Complete addressability as a peripheral device
- Full compatibility with processor-controlled data communications networks

The diskette subsystem offers compact size, attractive design, and modest pricing. It is easy to use with a variety of host terminals because data formatting operations are largely built in, and its

simple read, write, and seek operations can easily be commanded by host operations to create many highly sophisticated functions for the most advanced of terminal applications.

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Figure 1. SPERRY UNIVAC 8406 Diskette Subsystem

2. Equipment Description

The SPERRY UNIVAC 8406 Diskette Subsystem weighs about 35 pounds with a single disk drive and 50 pounds with two disk drives. The components are housed in a compact case. The lightweight yet rugged aluminum construction of the case permits diskette subsystems to be stacked one on top of another to conserve space in crowded work areas. A front panel contains operator controls and indicators, and spring-loaded doors permit direct access to each disk drive for easy loading and unloading of flexible diskettes.

Each disk drive has its own read/write head, driving mechanism, and related electronic components and circuitry. A single diskette subsystem controller provides the control circuitry for both disk drives. Disk drives are selected one at a time for any operation, and operations performed on one disk drive can be performed on the other. With two disk drives, the diskette subsystem can contain a flexible diskette in each drive and perform operations on either drive.

Indicators on the front panel inform the operator of the operating status of the diskette subsystem. Status reports to the host controller can also be used to relay diskette subsystem operating information to the operator.

For a complete list of diskette subsystem specifications, refer to Section 5.

DISKETTES

The diskette used in the diskette subsystem is a self-contained cartridge consisting of a flexible magnetic disk in an enclosing jacket (see Figure 2). The diskette jacket is inserted into a disk drive, and the magnetic disk is free to rotate within the jacket. A wiping material lines the interior of the jacket and cleans the magnetic disk of foreign material. An access slot on the side of the jacket allows the read/write head of the disk drive to make contact with the magnetic disk. Only one side of the magnetic disk — providing a storage capacity of 2,000,000 bits — is used. Each magnetic disk has a small index hole punched near its center. With each revolution of a spinning disk, this hole rotates past an access window in the jacket to provide timing and indexing information to the diskette subsystem circuitry. A hole is also punched in the diskette jacket when the user wants the

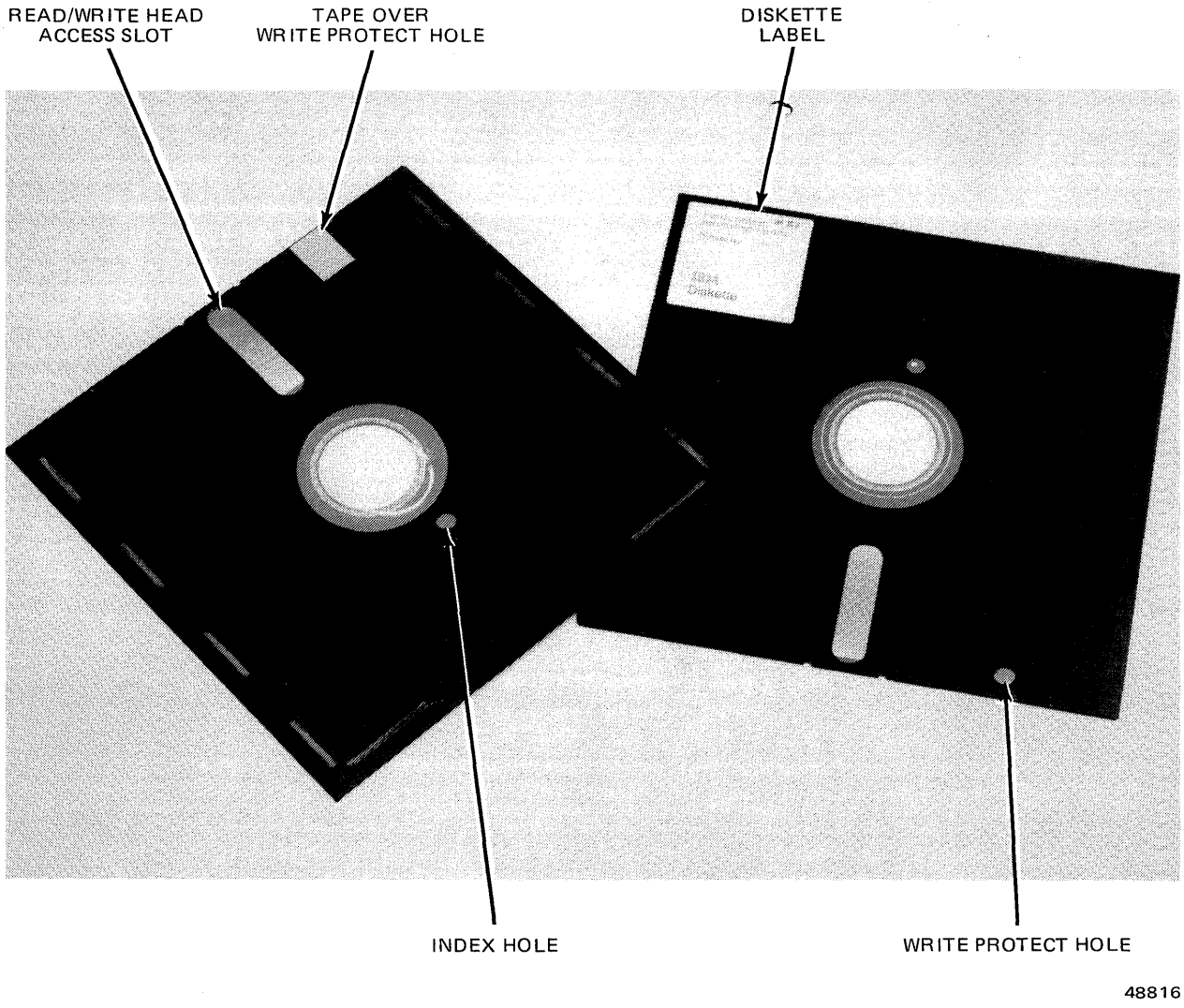

Figure 2. Diskettes for Diskette Subsystem

magnetic disk inside the jacket to be write protected; once punched, the hole can be covered with opaque tape to permit writing on the diskette. Figure 2 identifies the index hole and the correct location of the write protect hole.

The diskette is inserted into the horizontal opening of the disk drive with the diskette label facing down and the read/write slot toward the back (away from the disk drive door). The diskette can be loaded or unloaded with all power on and the disk drive spindle rotating.

Diskette specifications and sources of supply are located in Section 5.

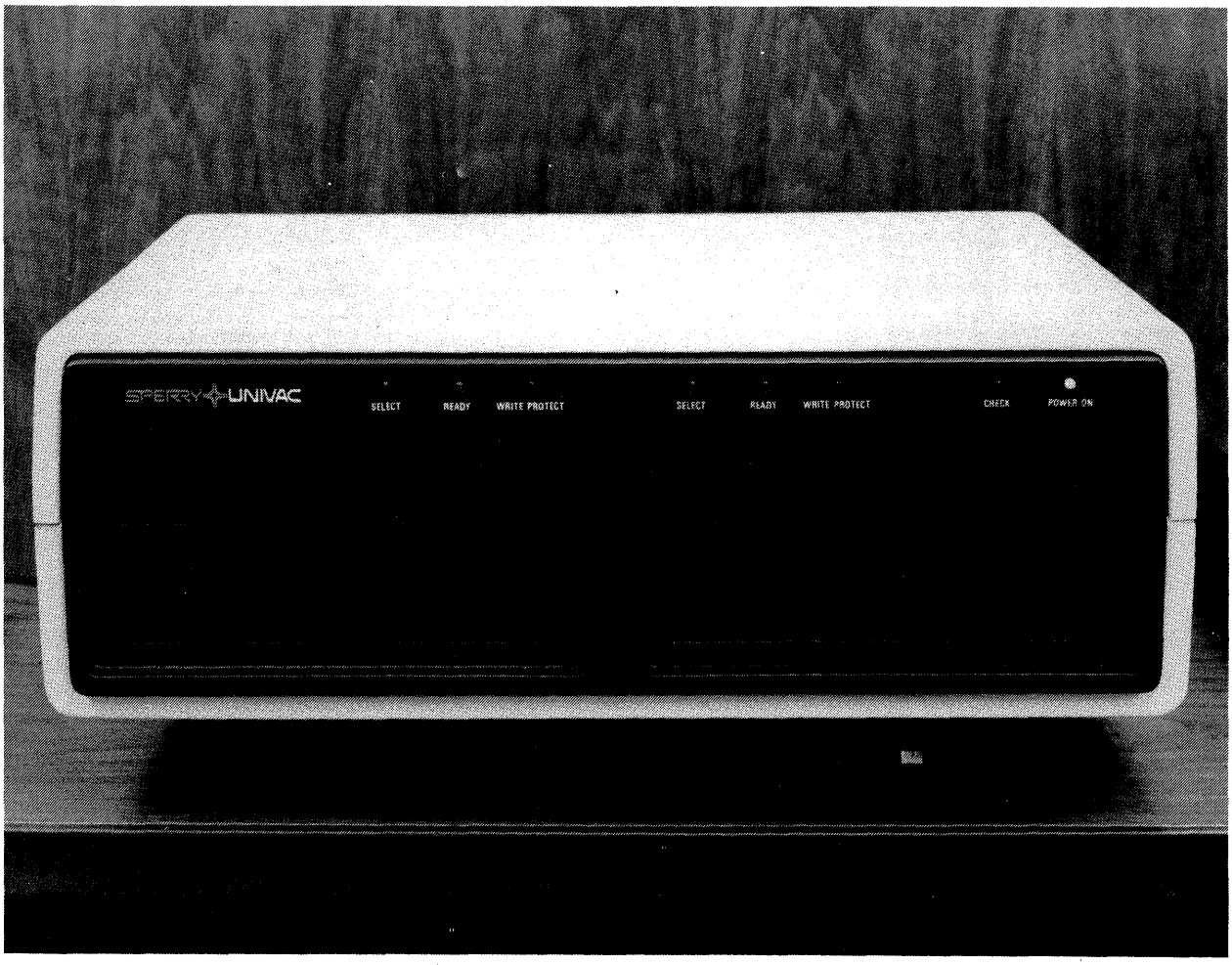

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Figure 3. Diskette Subsystem: Controls and Indicators

CONTROLS AND INDICATORS

The diskette subsystem contains few controls and indicators. These are used for preparing the device for use and for indicating the operating state of the device. A set of indicators is present for each of two disk drives, whether or not a second disk drive is installed. Figure 3 illustrates the location of the controls and indicators on the diskette subsystem, and Table 1 summarizes their functions.

CONFIGURATIONS

Diskette Subsystem

The diskette subsystem configuration is simply determined: the diskette subsystem either has one or two disk drives (Figure 4). This is the only option offered.

Table 1. Diskette Subsystem Controls and Indicators

Control	Function
POWER	Pushbutton switch/circuit breaker applies or removes primary input power to the diskette subsystem.
POWER ON	When lit, indicates that primary power is applied.
CHECK	When lit, indicates that an error was detected during a diskette subsystem operation.
SELECT (one for each disk drive)	When lit, indicates that the associated disk drive is selected.
READY (one for each disk drive)	When lit, indicates that the associated disk drive is ready for operation: diskette is installed, disk drive door is closed, and disk drive is spinning.
WRITE PROTECT (one for each disk drive)	When lit, indicates that the associated drive has a write protected diskette installed.
Busy	This unlabeled indicator is located in the door latch of each disk drive. Lights to indicate the disk drive is engaged in a read, write, or search operation and the read/write head is loaded.

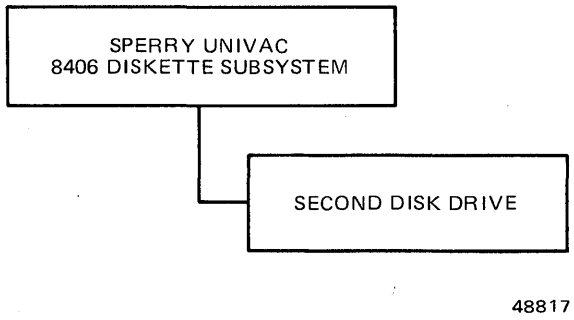

Figure 4. Diskette Subsystem Configurations

Diskette Subsystem/Host Controller Configurations

The diskette subsystem is connected to the host controller through a peripheral interface. The interface is part of the host controller and provides a standard parallel connection between the host and diskette subsystem. "Daisy chain" methods of interconnecting cables permit four peripheral devices, including not only diskette subsystems but other devices compatible with an 8-bit interface, to share the peripheral interface in the host. Cable distance from the peripheral interface to the diskette subsystem (or to the last link in a daisy chain connection) cannot exceed 200 feet.

STANDARD FEATURES

All diskette subsystems are equipped to perform the following functions:

- Format and prepare new disks for data storage
- Read data
- Write data
- Seek stored data and storage locations from any position
- Select disk drives
- Report status
- Detect and report errors
- Exercise maintenance routines for the onsite customer engineer or remote host processor

3. Operating Characteristics

The SPERRY UNIVAC 8406 Diskette Subsystem accepts data from a SPERRY UNIVAC data communications controller or terminal; each character is recorded on magnetic disk as an 8-bit byte. Data recording, data retrieval, random-access searching, and disk preparation, as well as other diskette subsystem operations, are directed by single 8-bit command bytes. These operations are entered under the control of a host controller, such as an intelligent display terminal or processor. For each command function, the diskette subsystem reports status, noting the successful completion of the command or the occurrence of an error. Status can also be reported upon request. Automatic error recovery, parity safeguards, and built-in maintenance routines further increase the operational reliability of the diskette subsystem. These and other functions of the diskette subsystem are described in the following paragraphs.

DISKETTE FORMAT

To read and write data, the diskette subsystem uses the specialized format seen in Figure 5. As the figure shows, diskettes contain 77 tracks; 74 of the tracks are used for recording data and three are held in reserve. Tracks are divided into 26 sectors, each with a storage capacity of 128 bytes of data. Proper track and sector formatting is accomplished by host command before a diskette receives data. This disk preparation procedure is largely an automatic function of the diskette subsystem; the host controller, however, must supply permanent addresses to each track and sector to identify their locations on disk.

DISK PREPARATION

Disk preparation consists of mapping out the tracks and sectors over the entire surface of the diskette, identifying each track and sector with an address supplied by the host controller, and filling each sector with zeroes. A command from the host initiates the preparation of each track, and about 3 minutes are required to complete the preparation of an entire diskette. Disk preparation is a one-time operation for each new diskette; the procedure can also be applied to used diskettes to strip them of old data in preparation for complete rewriting.

Deleting Bad Tracks

Of the 77 tracks on a magnetic disk, the diskette subsystem can use 74 for storing data. The remaining three tracks are held in reserve in case unusable tracks are discovered during disk preparation procedures. Bad tracks are deleted by host command, with the diskette subsystem flagging the track as permanently unusable. If more than three bad tracks are discovered during disk preparation, the diskette cannot be used.

Addressing Conventions

Track and sector addresses are provided at the time of disk preparation. A numerical sequence of 74 addresses is supplied for the tracks, and a numerical sequence of 26 addresses — repeated for each track — is supplied for the sectors. The host controller supplies the addresses one track at a time. The diskette subsystem protects each address by recording CRC block parity characters with the arriving addresses. To indicate the end of a track, a last-character signal is recorded with the 26th sector address.

Although each of the sectors in a track is given a sequential address, address assignments do not have to follow the physical sequence of track sectors. In a series of sector addresses, for example, the second sector in the series need not be located next to the first sector, nor the third next to the fourth; instead, a defined number of physical sectors separates each sector in the entire series. This method of assigning sector addresses provides an efficient means of accommodating the diskette subsystem to the input/output rates of different host controllers.

DISK DRIVE SELECTION

To begin a diskette function, the host controller must first issue a command selecting a disk drive. Once selected, a disk drive remains available for diskette operations until another disk drive is selected.

SEEK TO TRACK

Seek-to-track commands, issued by the host controller, relocate the read/write head of a disk drive to new track positions.

Home Position

An internal track counter in the diskette subsystem is used to determine the track position of the read/write head. When the diskette subsystem receives power and turns on, read/write heads move to the first track — home position or track 00 — and the internal track counter is reset to zero.* When a seek-to-track command requests a new track position, the read/write head moves across the diskette and the track counter adjusts its count for each track passed. When the track count matches the track number requested by the seek-to-track command, the seek operation is completed.

** Disk drive doors must also be closed to permit the read/write head to return to home position when the diskette subsystem receives power.*

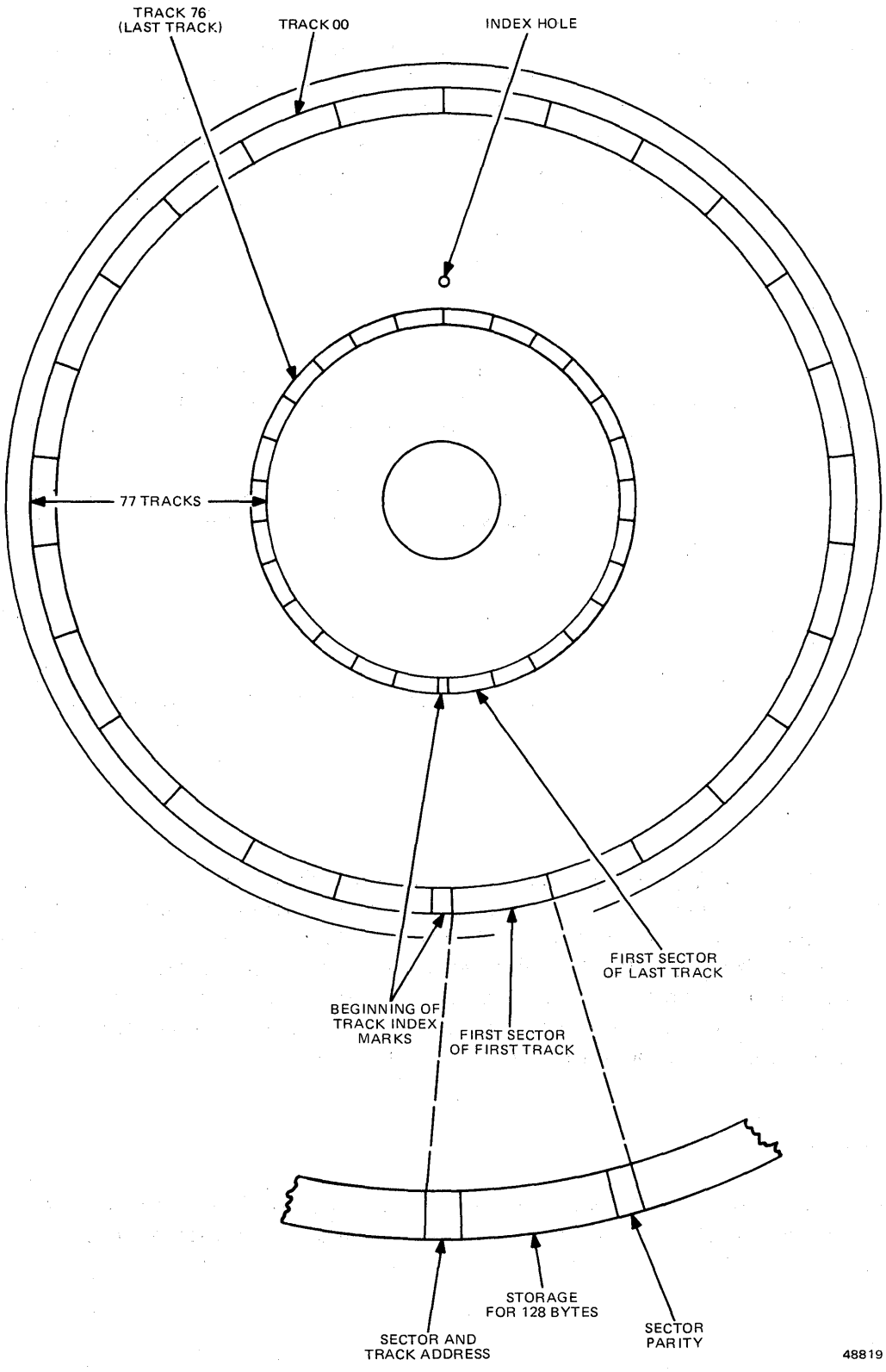

Figure 5. Diskette Track and Sector Format

Random-Access Seeking

Once in position over a track, the read/write head of a disk drive does not return home before performing a new seek-to-track command. Instead, the diskette subsystem automatically moves the read/write head in the direction of the requested track, with the track counter adjusting its count up or down until the right match occurs. The read/write head even remains in position when the door of an operating disk drive is opened to remove or insert a diskette. Track count circuitry also remains undisturbed and accommodates insertion of a new diskette. A command to seek track 00 will return the read/write head to home position.

Error Prevention

The diskette subsystem checks the track number in each seek-to-track command to determine if it is a legal address. During read and write operations, the diskette subsystem also reads the track and sector addresses recorded on magnetic disk to validate the track position of the read/write head.

During disk preparation, the deletion of a bad track may disturb the sequence of usable tracks on a diskette. For this circumstance, the diskette subsystem provides an automatic track-finding routine that prevents errors in track counting circuitry.

WRITE OPERATION

A write operation, initiated by a command from the host controller, stores data on the magnetic disks of the diskette subsystem.

Sector Writing

The host controller transfers data a sector at a time to the diskette subsystem. A write command prepares the diskette subsystem to write each sector of information and also identifies the sector address for storing the information on disk. Data is transferred from the host buffer to the diskette subsystem in sector-size blocks (up to 128 bytes of data). If the data contains less than 128 bytes, the end of the transfer is indicated by a last-character interface signal; the diskette subsystem then fills all remaining storage space in a sector with zeroes. A status report from the diskette subsystem to the host completes the writing of each sector of data on disk.

Error Prevention

The parallel transfer of each character to the diskette subsystem is accompanied by a parity bit. Cyclical redundancy check (CRC) characters are also validated and written on disk with each sector of recorded data.

READ OPERATION

A read operation retrieves data from storage on magnetic disk. As with write operations, read operations transfer data one sector at a time by way of a command from a host controller. The read command specifies a sector address for each transfer of data. The diskette subsystem completes the read command by reporting status to the host controller.

During the read operation, character parity is generated; as data is read back to the host controller, CRC validation is also performed for each sector of recorded information.

STATUS REPORTING AND ERROR DETECTION

After executing a command, or upon the immediate detection of an error, the diskette subsystem reports status to the host controller. The host receives each status report in the form of an 8-bit status byte. By command, the host terminal can also request the status of a disk drive at any time; in response, the diskette subsystem sends the last accumulated status byte for the selected disk drive.

Error Detection

Errors reported by means of the status byte include the following:

- Incorrect character parity in data or command bytes
- Invalid block (CRC) parity in data read from disk
- Invalid block (CRC) parity in sector and track addresses
- Illegal track addresses in seek-to-track commands
- Unlocatable sector and track addresses in read and write commands

When a write protected diskette is in a disk drive, its presence is reported to the host controller by the status byte. Any physical interference with the operation of a disk drive — such as an empty disk drive or an open disk drive door — is also immediately reported to the host in the status byte.

Error Recovery

Recovery procedures for specific errors must be determined by local host controller programming procedures.

4. Maintenance Provisions

The diskette subsystem contains built-in maintenance controls that help service personnel find a quick diagnosis for equipment problems. Maintenance controls also allow a remote processor to test the availability of the interface lines to the diskette subsystem.

5. Specifications

The SPERRY UNIVAC 8406 Diskette Subsystem is designed to operate in a typical business environment. The physical, environmental, and technical specifications of the diskette subsystem are given in the following listing.

PHYSICAL CHARACTERISTICS

Width	20.25 inches (51.54 cm)
Height	9.00 inches (22.86 cm)
Depth	16.75 inches (42.55 cm)
Weight with one disk drive	35 pounds (15.88 kg)
Weight with two disk drives	50 pounds (22.68 kg)

POWER REQUIREMENTS

Voltage	100–120 Vac or 200–240 Vac
Phase	Single
Frequency	60 or 50 Hz
Wattage	300
Heat Dissipation	102.4 BTU (258 kg-cal/hr)

ENVIRONMENTAL RANGE

Temperature	50 to 93 degrees Fahrenheit (10 to 34 degrees Celsius)
Humidity	5 to 80 percent

The 80-percent limit for relative humidity is a requirement of the flexible diskette storage medium. The diskette subsystem itself will tolerate 95-percent humidity.

OPERATING CHARACTERISTICS

Read/write speed	250,000 bits per second
Rotational speed	360 rpm
Rotational period	166.67 milliseconds
Average latency	83.33 milliseconds
Byte size	8 bits per byte
Diskette format	
Total number of tracks	77
Usable number of tracks	74
Sectors per track	26
Bytes per sector	128
Bit density	Approximately 3200 bits per inch (1260 bits per cm)
Storage capacity	2 million bits (256,000 bytes)
Track-to-track access time	10 milliseconds
Settling time	10 milliseconds
Head load time (can overlap with track-to-track access time)	50 milliseconds
Head load duration	No more than three diskette revolutions without a command
Recording mode	Frequency modulation
Interface	Transfers 8-bit (plus parity) data, command, and status signals
Command functions	Seek to track
	Read sector
	Write data sector
	Write control sector
	Select drive
	Get status
	Prepare track
	Prepare deleted track
	Maintenance checks

DISKETTE SPECIFICATIONS

Diameter	7.785 inches (19.77 cm)
Jacket size	8 by 8 inches (20.3 by 20.3 cm)

Purchase specifications for diskettes are in accordance with *ANSI X3B8, American National Standard for Unrecorded Flexible Disk Cartridge — General, Physical, and Magnetic Requirements.*