

**SX-530**  
**Disk Memory Exerciser**  
**Operator's Manual**

Copyright © 1981, WILSON  
LABORATORIES, all rights  
reserved. Printed in the United  
States of America

Document # **650074**  
Rev E  
November 11, 1981

WILSON LABORATORIES  
reserves the right to change  
specifications without notice or  
obligation.

WILSON LABORATORIES  
2237 N. BATAVIA  
ORANGE, CA 92665  
(714) 998-1980



**SECTION 1  
INTRODUCTION**

1.1	SCOPE .....	1-1
1.2	GENERAL .....	1-1
1.3	PHYSICAL DESCRIPTION .....	1-3

**SECTION 2  
DISK DRIVE PRINCIPLES**

2.1	SCOPE .....	2-1
2.2	GLOSSARY .....	2-1
2.3	MAGNETIC DISK STORAGE PRINCIPLES .....	2-2
2.3.1	Magnetic Disk Subsystem .....	2-2
2.3.2	Storage Medium .....	2-2
2.3.3	Data Coding .....	2-3
2.3.4	Data Addressing .....	2-4
2.3.5	Basic Operations .....	2-4
2.3.6	Head Positioning .....	2-6
2.3.7	Cylinder Detection .....	2-6
2.3.8	Index Pulse and Rotational Speed Detection .....	2-6

**SECTION 3  
EXERCISER DESCRIPTION**

3.1	GENERAL .....	3-1
3.2	FUNCTIONAL DESCRIPTION .....	3-1
3.2.1	Drive Connection .....	3-1
3.2.2	Power Sequencing .....	3-1
3.2.3	Drive Select/Status .....	3-1
3.2.4	Seek Functions .....	3-1
3.2.5	Reset .....	3-3
3.2.6	Formatting .....	3-3
3.2.7	Format Timing .....	3-4
3.2.8	Skip Track .....	3-4
3.2.9	Write/Read .....	3-4
3.2.10	Data Patterns .....	3-4
3.2.11	Strobe and Offset Margin Testing .....	3-5
3.2.12	Digital Display .....	3-5
3.2.13	Volume .....	3-5
3.3.14	Test Points .....	3-6
3.3	PHYSICAL DESCRIPTION .....	3-6
3.3.1	Construction .....	3-6
3.3.2	Exerciser Assembly Removal and Re-installation .....	3-9
3.3.3	I/O Adapter Interface Card Removal and Reinstallation .....	3-9

## SECTION 4 CONTROLS AND INDICATORS

4.1	GENERAL .....	4-1
	Drive Select .....	4-1
	Drive Status .....	4-3
	Index Sector .....	4-3
	Offset .....	4-4
	Strobe .....	4-4
	Volume .....	4-4
	Test Points .....	4-5
	Seek Control .....	4-5
	Head Address .....	4-7
	Address Mark .....	4-8
	Write/Read .....	4-8
	Data .....	4-9
	Reset .....	4-10
	Digital Information Control .....	4-11
	Cylinder Address .....	4-12
	Errors .....	4-12
	Action .....	4-13

## SECTION 5 GENERAL OPERATING PROCEDURES

5.1	GENERAL .....	5-1
5.2	TESTER CONNECTION .....	5-2
	5.2.1 Procedure .....	5-2
5.3	SELECT DRIVE .....	5-2
	5.3.1 Procedure .....	5-4
5.4	SELECT INDEX SECTOR .....	5-4
	5.4.1 Procedure .....	5-4
5.5	BASIC EXERCISER/DRIVE CHECK .....	5-4
	5.5.1 Procedure .....	5-5
5.6	SET MAXIMUM CYLINDER ADDRESS .....	5-6
	5.6.1 Procedure .....	5-6
5.7	SEEK OPERATIONS .....	5-6
	5.7.1 Procedure — Manual Seek Operation, No Data .....	5-7
	5.7.2 Procedure — Manual Seek Operation, With Data .....	5-7
	5.7.3 Procedure — Automatic Seek Operations .....	5-7
5.8	FORMATTING .....	5-11
	5.8.1 Procedure — Format All Tracks .....	5-11
	5.8.2 Procedure — Format Single Track .....	5-12
	5.8.3 Procedure — Format All Cylinders On Single Disk Surface .....	5-12

5.9	SKIP TRACK .....	5-12
5.9.1	Procedure — SKIP Format Single Track .....	5-13
5.10	WRITE/READ OPERATIONS .....	5-13
5.10.1	Data Patterns .....	5-13
5.10.2	Procedure — Write, Read, or Write/Read .....	5-14
5.11	STOP ON ERROR RECOVERY PROCEDURE .....	5-15
5.11.1	CYCLIC/SWITCH DATA Recovery Procedure .....	5-15
5.11.2	RANDOM CYL Recovery Procedure .....	5-16
5.11.3	RANDOM PASS Recovery Procedure .....	5-16
5.12	HEAD SELECTION—CMD DRIVE .....	5-17

**SECTION 6**  
**SELECTED OPERATIONS**

6.1	GENERAL .....	6-1
6.2	DISK SURFACE TEST — REMOVABLE .....	6-1
6.2.1	Procedure .....	6-1
6.3	DISK SURFACE TEST — FIXED .....	6-3
6.3.1	Procedure .....	6-3
6.4	RELIABILITY (BURN-IN) TEST .....	6-4
6.4.1	Procedure .....	6-4
6.5	SEEK TIME READING .....	6-5
6.5.1	Procedure — Maximum Access Time .....	6-6
6.5.2	Procedure — Minimum Access Seek Time .....	6-6
6.5.3	Procedure — Average Access Seek Time .....	6-6
6.6	SEEK ERROR RATE TEST .....	6-6
6.6.1	Procedure .....	6-7
6.7	LOCATE ALL BAD TRACKS .....	6-8
6.7.1	Procedure .....	6-8
6.8	FIND/VERIFY NUMBER OF BAD TRACKS .....	6-9
6.8.1	Procedure .....	6-10
6.9	OPERATING SX-530 WITH ALIGNMENT DISK PACKS .....	6-11
6.9.1	Procedure — Initial Setup .....	6-11
6.10	OFFSET MARGIN AND STROBE TIMING TEST .....	6-12

## LIST OF ILLUSTRATIONS

### Figure

1-1	SX-530 Disk Exerciser .....	1-2
2-1	Head and Cylinder Addressing .....	2-5
2-2	Head Positioning .....	2-6
3-1	Typical Daisy Chained Disk Subsystem .....	3-2
3-2	Typical Subsystem with Drive 2 Removed for Testing .....	3-2
3-3	Typical Track Format .....	3-3
3-4	Header and Data Field Detail .....	3-5
3-5	SX-530 Exerciser .....	3-7
3-6	Power Switch and Indicator Location .....	3-8
3-7	Tester Assembly .....	3-8
3-8	Assembly Removal .....	3-11
3-9	Nylon Standoffs and Latches .....	3-11
4-1	SX-530 Control Panel .....	4-2
5-1	Head Selection for CDC CMD Drive .....	5-18

## LIST OF TABLES

### Table

3-1	SX-530 I/O Adapters .....	3-10
4-1	Illegal Operations .....	4-14
5-1	Static Control Panel .....	5-3

# SECTION 1

## INTRODUCTION

### 1.1 SCOPE

This manual describes the Wilson Laboratories' SX-530 Disk Memory Exerciser. The manual is written using the storage module (SMD) type interface as the basis, however, interface adapter addendums are included as part of this document so the reader may easily adapt the methods described herein to other drive types supported by the SX-530 Exerciser.

This manual consists of six sections and addendums as required and described briefly as follows:

- Section 1 – Introduction and general description including physical and environmental characteristics.
- Section 2 – A brief explanation of disk drive theory to establish common terminology.
- Section 3 – A functional and physical description of the Exerciser including assembly and adapter removal and reinstallation information.
- Section 4 – A description of the controls and indicators in a manner so they may be easily found and referenced.
- Section 5 – General operating procedures as they relate to the Exerciser functions and modes.
- Section 6 – A group of suggested special procedures that may be performed during acceptance testing and field maintenance applications.
- Addendum – Each addendum describes an I/O Interface Adapter Card for a specific drive type and associated mini-panel assembly (as required). Also included are applicable operating instructions and a discussion of the PROM and its format timing for that interface.

SX-530 Exerciser Theory of Operations and Logic Description is provided in a separate manual which can be obtained from the factory by signing a non-disclosure letter of agreement.

### 1.2 GENERAL

The SX-530 Disk Memory Exerciser, Figure 1-1, is designed for testing disk drive models with Storage Module type interface and Winchester fixed and/or removable cartridge type disk drive in either 5¼", 8", or 14" media from most manufacturers. It can be used for all off-line drive exerciser/test functions including manufacturing QC testing to insure trouble-free operation before shipment, QA incoming inspection, field service testing to isolate and repair drive problems and for engineering evaluation of peripherals. The SX-530 is housed in a suitcase type enclosure which makes it convenient for all applications.

The SX-530 reads and writes data in four formatted modes using a selection of three fixed data patterns and one user programmable data pattern. Error indicators show the type and location of errors and manual controls permit single step or continuous running with error indication or stop on error capability.

Single steps, seek delay, alternate set, stop on error, offset and marginal strobe control combine to make trouble shooting by the operator a quick and easy function. Trouble shooting operation includes the ability to introduce errors and check out specific areas of drive performance.

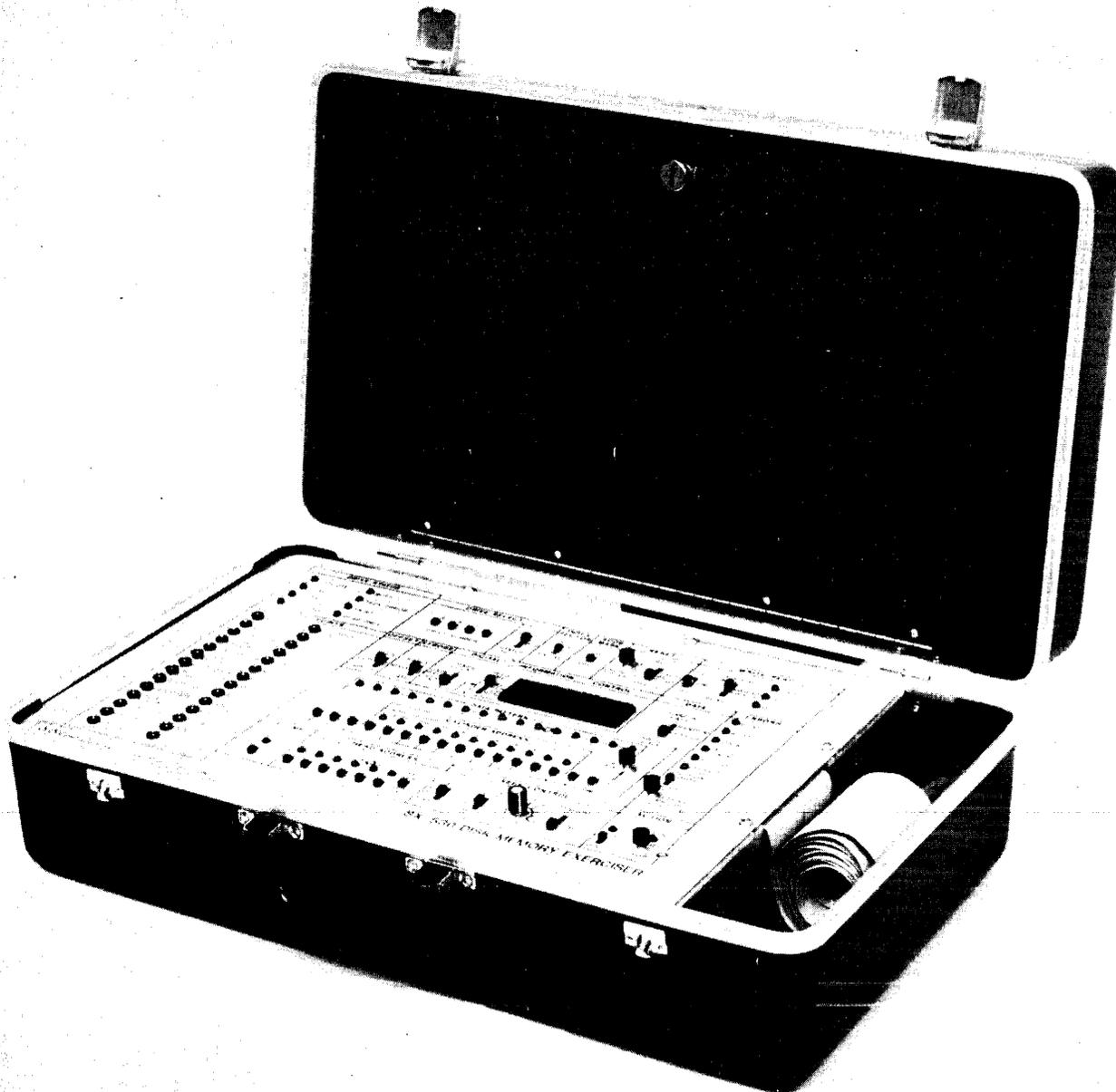


Figure 1-1. SX-530 Disk Exerciser

Drive variations are accommodated by plug-in interface cards and include the following manufacturers' models:

- CDC SMD 9760/9762/9764/9766 and other SMD compatible interfaces such as:
  - CDC CMD, MMD, FMD and LARK
  - FUJITSU
  - AMPEX 9300
  - AMPEX DFR
  - MICRODATA Reflex
  - MEMOREX
  - NEC
  - Storage Technology Corporation
- Kennedy 5300
- Trident T25/T50/T80/T200/T300 - BALL BD and BF Series
- PRIAM DISKOS 3350
- BASF 6170 Series - Disk Bus
- PERTEC D8000
- IMI 7700 Series
- ANSI STD X3T9 (8" Hard Disk)
- SEAGATE ST506 and other compatible 5¼" hard disks
- SLI
- SHUGART SA1000
- Other compatible interfaces

### 1.3 PHYSICAL DESCRIPTION

The SX-530 Exerciser, a portable, off-line tester designed to be hand carried, is contained in an attache case with a removable cover (see Figure 1-1). The remaining base half contains the operator console and includes all electronics.

When the Exerciser is not in use, the connected I/O cable and power cable are stored in the case along with extra adapters, I/O cables and the manuals.

I/O Adapters are mounted on the underside of the Exerciser electronics board with positive locking standoffs. Captive fasteners are utilized to allow quick console and electronics removal from the case for adapter and I/O cable changes to accommodate different drive interface requirements.

The SX-530 Exerciser physical characteristics are as follows:

- Size
  - Length – 21 inches
  - Width – 13 inches
  - Depth – 7 inches
- Weight – 12 pounds
- Power
  - 100, 115/120, 200, 215, 230/240 VAC
  - 50/60 Hertz
  - 0.5 Amperes
- Temperature – 0 to 45 degrees Centigrade non-condensing
- Electronics – TTL Logic
- Timing – Crystal Controlled
- Humidity – 10% to 95% with no condensation



## SECTION 2

### DISK DRIVE PRINCIPLES

#### 2.1 SCOPE

The purpose of this section is to offer a common terminology for all readers/users by briefly describing some common features basic to most types of disk drives.

The discussion begins with a glossary of disk-associated terminologies, as employed in the manual, and continues with general disk principles.

#### 2.2 GLOSSARY

The purpose of this brief glossary is to provide a common understanding of the terms.

**ADDRESS MARK** – An area of a track (usually 24 bits long) which is erased by the disk controller by means of a unique interface signal. This erased area is detected during read by the drive and activates a unique interface signal. The Address Mark feature is used by the controller for writing “variable sector” sector formats on a track where the placement of the Address Mark determines the beginning of each sector.

**CELL TIME (or BIT CELL TIME)** – The amount of time, at operational speed, that the disk surface must pass under the head to record or read back the flux reversals associated with one bit of data.

**CYLINDER** – The selected, synchronous position of all heads in a disk drive. It is analogous to servo track position; e.g., if Head 0 is positioned over track 100, then all the other heads are also positioned over their respective track 100's. Envisioning these circular tracks in a vertical stack creates the image of a cylinder. When performing a seek, the drive is commanded to seek to a particular “CYLINDER ADDRESS,” not to a track, per se. (See TRACK.)

**DISK (or DISK PLATTER)** – A flat, circular plate, coated on both sides (surfaces) with some form of recording medium (usually iron oxide), which is used for storage of data.

**DISK MODULE (or DISK PACK)** – A precision-assembled unit consisting of a varying number of disk, arranged vertically. It may be permanently installed in the drive (fixed media), or of the type which may be removed and changed by the operator (removable media).

**ERROR, HARD** – Permanent errors that occur at the same location on the disk surface during each test. Typical hard errors are caused by drastic imperfections in the disk surface.

**ERROR, SOFT** – Intermittent errors that occasionally occur when testing a disk surface. Generally caused by minor imperfections in the disk coating or as a result of random electronic errors.

**HEAD, READ/WRITE** – Electromagnetic devices which perform the actual recording of data onto, or reading of data from, the disk.

**HEAD, SERVO** – A read head which reads head positioning information from the Servo Disk surface.

**INDEX** – A reference point or “starting point” for each disk track. It provides initial synchronization for sector addressing on each individual track.

**MEDIA** – See DISK MODULE

**MODIFIED FREQUENCY MODULATION (MFM)** – A “double frequency” method for magnetic recording of digital data, whereby flux reversal patterns are variable, depending on the data pattern. This method provides a self clocking capability.

**NON-RETURN-TO-ZERO (NRZ)** – A method for magnetic recording of digital data in which the level at each cell time denotes the logic state (1 or 0). This method requires a companion clock for definition of cell time.

**RETURN TO ZERO SEEK (REZERO)** – A disk drive function which results in the heads being retracted to Cylinder 0 regardless of the current location of the heads.

**SECTOR** – The lowest-addressable-unit of storage in a disk drive, a sector is a portion of an individual data track. The number of sectors per track is generally drive selectable and this number will, of course, determine the maximum data storage capacity per sector.

**SEEK** – A general term for the movement of the heads to any specific valid cylinder address (as opposed, for example, to a “head retract”).

**SERVO DISK** – One of the disk module surfaces containing servo information prerecorded at the factory to be used by the disk drive to generate head positioning information and various timing signals.

**TRACK** – The complete circular portion of an individual disk platter surface over which a stationary head is positioned at any given time. It is quite similar to a groove in a phonograph record, except that instead of spiralling inward, the track is a concentric circle with respect to the circumference of the disk. Tracks are not directly addressed as such; once all heads are at a given cylinder address, one specific head is selected to read or write on the track over which it happens to be positioned.

**VOLUME** – The highest-addressable-unit of storage within a disk drive. It may refer to a particular disk module, cartridge, or pack. In the CMD type drives, the removable cartridge is addressed as “Volume 0,” and the fixed module as “Volume 1.”

## **2.3 MAGNETIC DISK STORAGE PRINCIPLES**

The following explanatory discussion is meant to cover the main principles, concepts and terminology relative to magnetic disk data storage in general. In the interest of brevity, however, concepts with a broad range of diverse applications are covered to highlight only that aspect which is pertinent to the SX-530 Exerciser application.

### **2.3.1 Magnetic Disk Subsystem**

A magnetic disk subsystem provides high-performance, high-capacity auxiliary data storage for the central processor. Its ability for fast, direct access to specific areas of the storage medium, enables high speed data storage and retrieval operations, making it ideally suited for a wide variety of processing applications.

A magnetic disk subsystem consists of a controller and one or more disk drives (see Figure 3-1). The storage and recovery of data by the magnetic disk subsystem is accomplished through the recording of information on, and retrieval of information from, disk packs. The disk drive contains the rotational drive, access mechanism and read/write components and circuitry to record data on and reproduce data from the disk pack. The controller receives commands from the processor, and interprets them to initiate operations with the disk drives in the subsystem. Data is then transferred between the processor and disk drive. The controller provides data buffering to relieve the processor of stringent timing requirements. The controller also provides the processor with the status of both the controller and that of all the attached disk drives in the magnetic disk subsystem.

### **2.3.2 Storage Medium**

The storage medium used in a disk drive is disk pack. The disk pack, either fixed or removable, consists of multiple disks made of metal with a magnetic coating on both sides. The disks are stacked on a vertical hub. Fixed disk packs contain all usable disk surfaces, therefore, a disk pack consisting of five disks will have 10 usable surfaces. Removable disk packs do not use the top or bottom disk surfaces.

In both disk packs, one of the usable disk surfaces contains servo positioning information prerecorded at the factory. Hence, a fixed disk pack containing five disks has ten usable surfaces and nine data surfaces.

### **2.3.3 Data Coding**

#### ***Coding Methods***

The most common method of data interfacing for data-processing applications is "Non-Return-to-Zero" (NRZ or "change on one's"). The method of recording is Modified Frequency Modulation (MFM). In current Winchester technology, data is recorded in MFM but the drive interface presents NRZ data.

#### ***Recording Format***

The format according to which data is recorded on the disk is determined by the controller logic. Proper formatting of the data is enabled and monitored using the index pulse. These consecutive pulses enable the controller to format the data and signals the beginning and subsequent ending of all recording tracks at each complete revolution of the disk pack. This index pulse is used to start the recording of data on the disks in the form of sectors containing a number of records, with each record containing a number of bytes.

### **2.3.4 Data Addressing**

To be able to locate the exact same area on the disk pack repeatedly, each area on the disk pack must be made unique. This is accomplished by adopting an imaginary cylinder concept and assigning a horizontal and vertical addressing scheme to it.

#### ***Vertical Addressing***

Assume a disk pack has nine data recording surfaces (one additional surface contains servo data). Vertical addressing is accomplished by assigning the numbers 00 through 08 to each of the nine data surfaces, in consecutive order, from top to bottom (Figure 2-1).

#### ***Horizontal Addressing***

Horizontal addressing is accomplished by assigning numbers to concentric circles on each disk surface starting at 0 for the outermost circle. The concentric circles form the centers of recording tracks.

#### ***Cylinder Concept***

Ten recording tracks having the same horizontal address designation, lie in the same circular, vertical plane, and can therefore be thought of as a cylinder containing ten vertically aligned tracks. Hence, it is possible to address data in any track (with the exception of the servo track) within any cylinder by positioning all the heads at that particular cylinder and selecting the particular head associated with the desired track.

#### ***Data Access***

Every area on the disk pack can be accessed through the combined, straight line travel of the read/write heads radially across the disk surfaces, and the rotational motion of the disks. Any track can be accessed specifying a cylinder address and a head address.

### **2.3.5 Basic Operations**

The purpose of the magnetic disk subsystem is to store information on the disk pack and to recover this same information when needed at a later time. To enable the recovery of the stored data, the subsystem must be able to:

1. Control precisely where on the disk pack the information is to be recorded.
2. Return to the exact same location on the disk pack for recovery of the recorded information.

The three basic operations of the subsystem therefore are:

1. Seek.
2. Write.
3. Read.

Although there are many commands used in conjunction with the magnetic disk subsystem, each command normally causes the subsystem to execute one or more or a combination of these three operations.

### **2.3.6 Head Positioning**

The read/write heads in the disk pack are supported by the rotational velocity of the disks in combination with the aerodynamic properties of the head pads. The resultant physical effect is a high density air layer, which functions as an air bearing for the head pad to ride on. Each head pad is connected to a head mounting arm (see Figure 2-2). These head assemblies are mounted to a movable head stack carriage. An electromagnetic servo controlled linear motor or equivalent device moves the carriage to position the heads at any of the cylinders.

Position and feedback input to the carriage motor is derived from information read from the servo disk surface by the servo read head. This information is recorded in specific patterns of flux reversals (dibits) that provide positive detection of servo head positioning over a track.

The heads are designated according to the corresponding disk surfaces, i.e., head 00 is opposite recording surface 00, head 01 is opposite recording surface 01, etc. After the heads have been positioned at the desired cylinder, the head carriage is held in place through electronic control by detecting any positional deviation of the heads and counteracting it electrically.

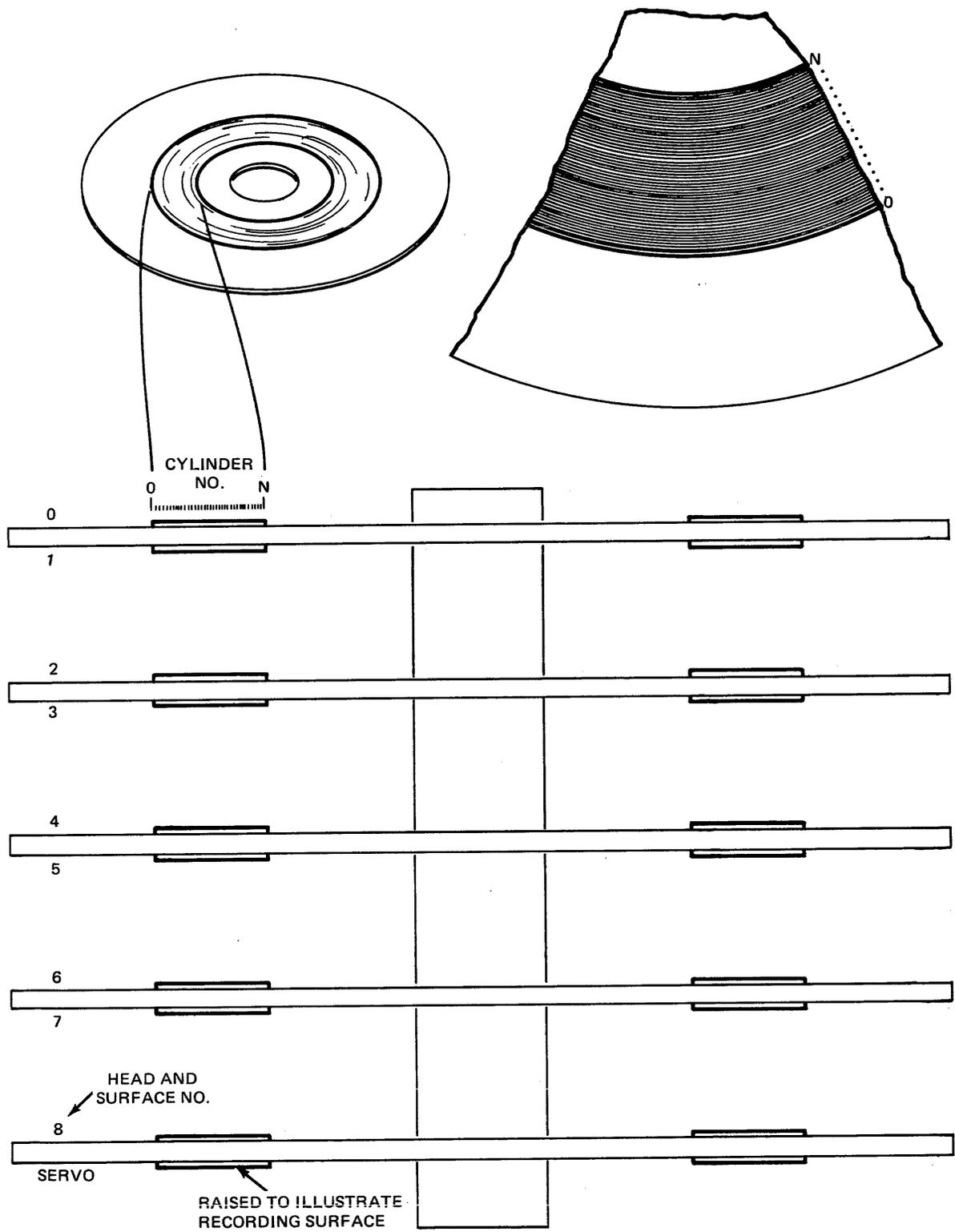
### **2.3.7 Cylinder Detection**

During the head positioning process the travel of the heads must be monitored. Every time the heads cross a cylinder, this is registered, and the end result is then communicated to the controller. This means the drive does *not* signal every cylinder crossed over—just when it gets to the desired cylinder.

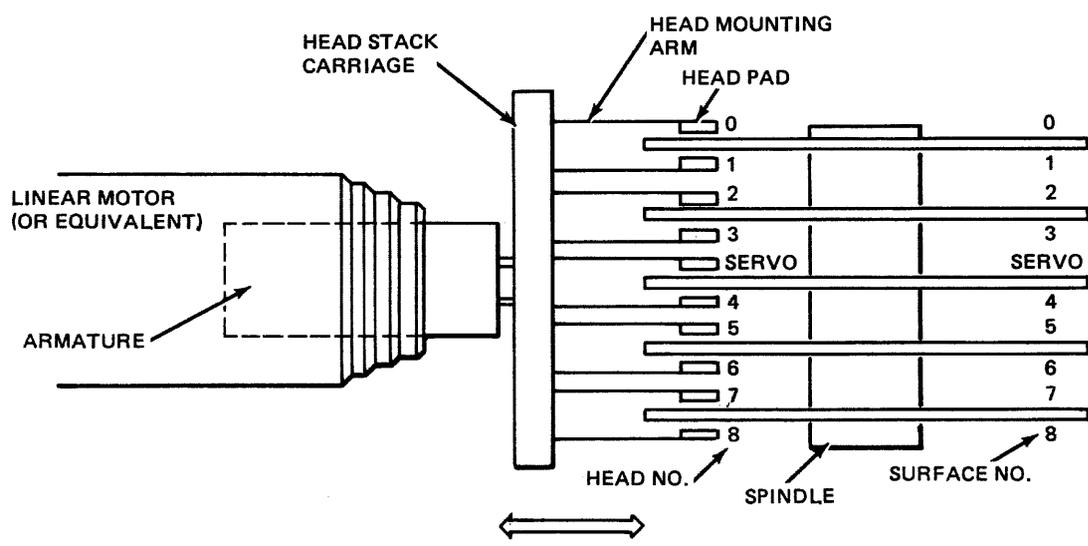
### **2.3.8 Index Pulse and Rotational Speed Detection**

Each track of the servo disk contains a pattern of missing dibits which is used to generate an index pulse. The index pulse is used by the controller as a homing pulse, i.e., it indicates the beginning and subsequent ending of all the tracks in the disk pack.

In addition, the index pulse is used by the disk drive itself to monitor the rotational velocity of the disk pack. Attainment and maintenance of this rotational speed is extremely important in maintaining correct bit densities in the tracks.



**Figure 2-1. Head and Cylinder Addressing**



**Figure 2-2. Head Positioning**

## SECTION 3

### EXERCISER DESCRIPTION

#### 3.1 GENERAL

This section contains both a functional and physical description of the Exerciser. The functional description orients the user to the operational capabilities of the Exerciser. The physical description provides detailed information on the Exerciser's construction leading to how to remove and reinstall the Operator's console and the I/O adapter boards.

#### 3.2 FUNCTIONAL DESCRIPTION

##### 3.2.1 Drive Connection

As previously stated in Section 2, a disk subsystem typically consists of a controller and one or more disk drives. Figure 3-1 illustrates a typical daisy chained subsystem. The controller is connected to Drive 1 through two cables: a daisy chain (link) cable and a smaller radial cable. The remaining drives are connected to the controller through a "linked" cable to Drive 1 and a directly connected radial cable. The last drive in the sequence (Drive 4) must be terminated.

A disk drive to be tested with the SX-530 Exerciser must be taken "off-line" to the subsystem as shown in Figure 3-2. The Exerciser connects to a single disk drive with either one or two cables depending on the drive types. *The drive under test must also be terminated.*

The Exerciser tests a single drive at a time as it provides a single radial cable connection.

##### 3.2.2 Power Sequencing

Storage module (SMD) type drives typically have a Remote/Local switch which controls whether the drive is powered up (spin up) from the drive or the controller. In the Local position, the drive "power on" sequence is started when the drive Start switch is pressed. In Remote position, the power on sequence is started when the Start switch is pressed and sequence power ground is received from the controller. The SX-530 Exerciser provides the sequence power ground by "hard grounding" the Pick and Hold lines on the SMD interface causing the device to start the power up sequence.

##### 3.2.3 Drive Select/Status

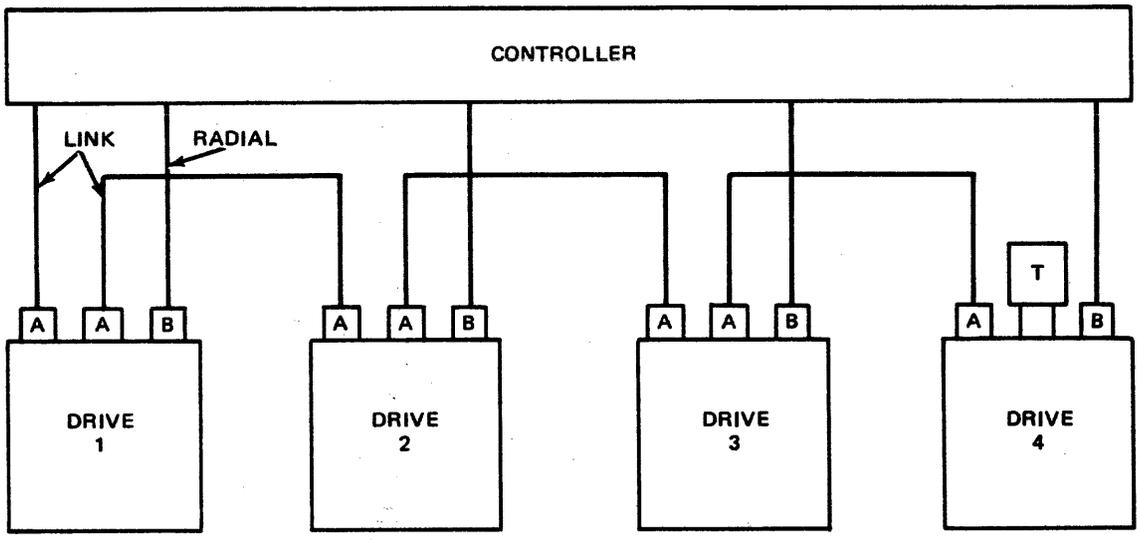
The drive number is manually selected and sets the signal level on the drive's Unit Select lines. Drive status is constantly displayed by eight LEDs on the Exerciser.

##### 3.2.4 Seek Functions

Prior to performing read and write operations, the drive must move the heads to the desired position on the disk surface. This is done by the drive servo circuits in response to Exerciser commands.

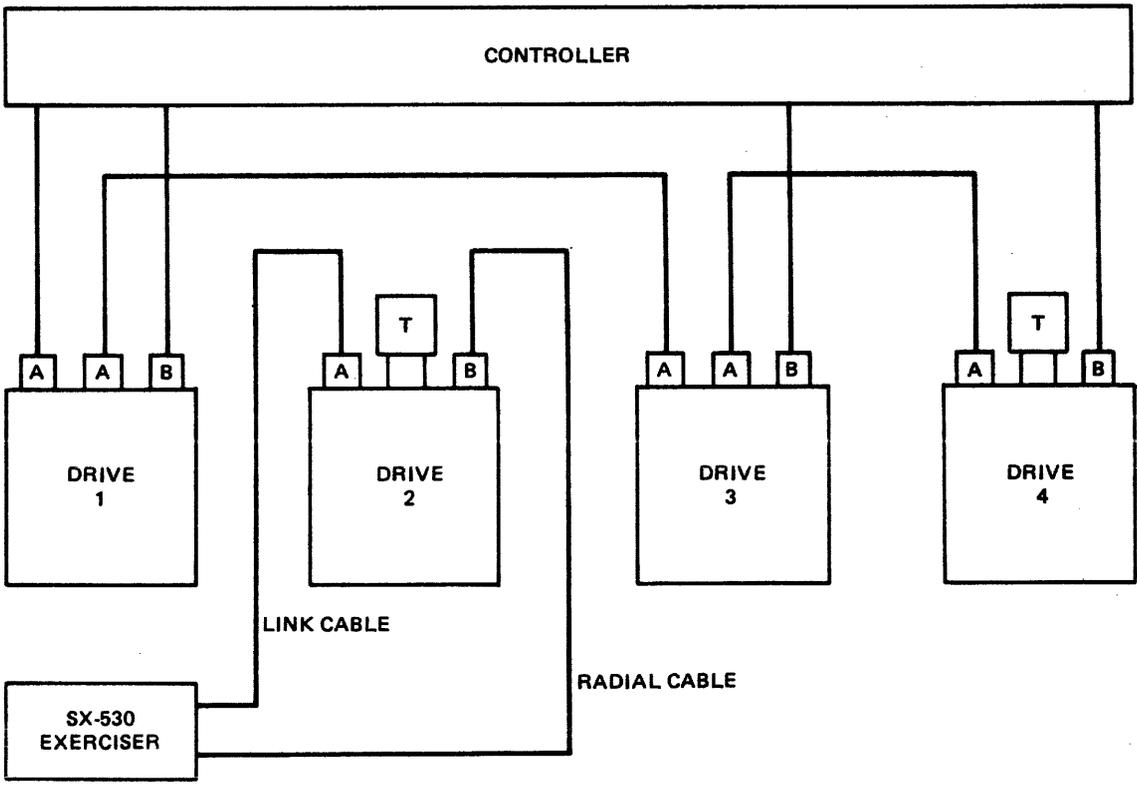
The Exerciser provides four basic seek modes:

1. Set
2. Increment
3. Decrement
4. Random



A = LINK OR DAISY CHAIN CABLE CONNECTION  
 B = RADIAL CABLE CONNECTION  
 T = TERMINATOR PLUG

**Figure 3-1. Typical Daisy Chained Disk Subsystem**



**Figure 3-2. Typical Subsystem with Drive 2 Removed for Testing**

Seek action may be selected without data action. When combined with data action, the seek action will always precede the data action.

In the Set (manual) Mode, repeated seeks to a user selected cylinder address will be made.

In the Incrementing Mode, the seeks are performed from one cylinder address to another sequentially until a maximum address is reached at which time the address returns to zero and the incrementing pattern is repeated.

The Decrement Mode is the reverse of the Increment Mode.

Random seek operations are facilitated by high speed counting of the address register between seek actions thus generating random seek addresses.

Each of the four seek modes can be modified by the Alternate Mode thus providing seek action between a fixed address (alternate) and the selected mode address. A Seek Delay feature providing variable delay up to 3.0 seconds is included to slow the action to allow visual monitoring of seek operations. A Seek Off control is provided to allow writing and reading without seek action. Switches and indicators are provided to set the maximum and alternate cylinder addresses up to 2047.

### 3.2.5 Reset

Provisions have been included for manual generation of cylinder rezero and fault clear commands and for automatic resetting of fault and seek error occurrences.

### 3.2.6 Formatting

Formatting is the writing of both the header and the data fields by the Exerciser on a selected track. If the drive and the media are to be completely tested, then all tracks (the combination of all cylinder addresses and all head addresses) must first be formatted. Write or read action attempted by the Exerciser on any track that has not been formatted by the Exerciser will result in data and/or address errors. The general format of a track is illustrated in Figure 3-3. Data patterns are defined in paragraph 3.2.10. The details of the header and data field are shown in Figure 3.4

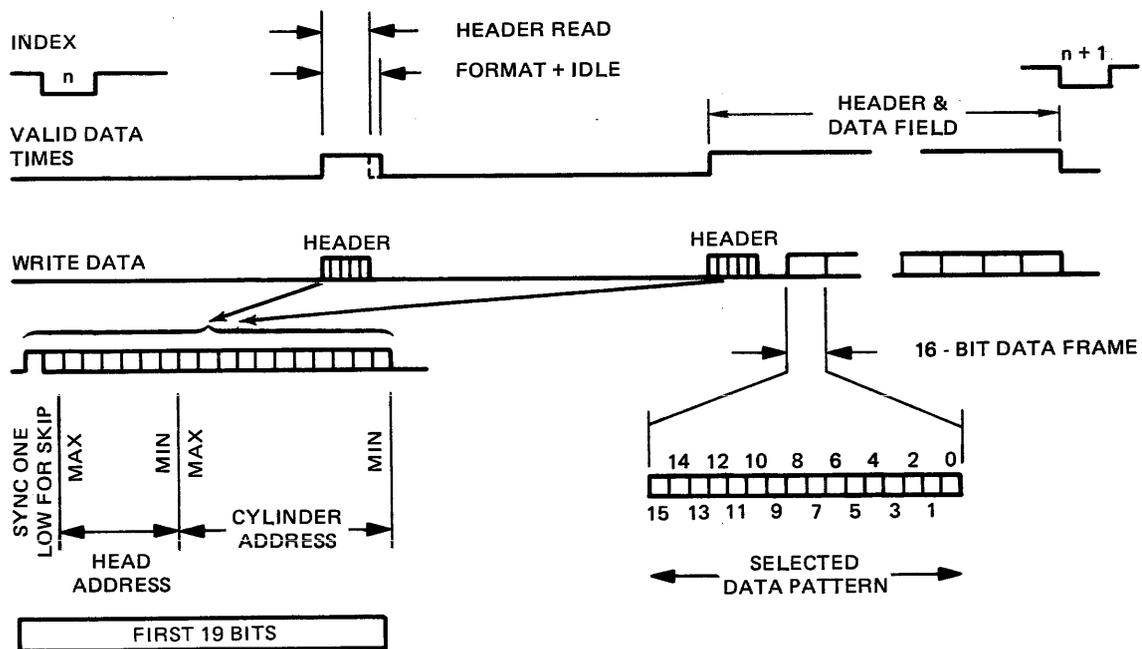


Figure 3-3. Typical Track Format

### 3.2.7 Format Timing

The timing relationships for the data format on each track depends on the particular drive under test as the timing is determined by the PROM installed in the adapter board. The PROM coding determines the byte count as measured from the index for the location of:

- Two write gate enables
- Two read gate enables
- Two write sync bytes
- Write address mark

Two counts for each of the write gate enables, read gate enables, and write sync byte are needed because the format consists of both a single header and a second header followed by a single data field which continues to index. The spacing between the write gate enable count and the write sync byte count is the length of the all-zeros preamble. The write data following the sync byte is not PROM changeable and is always the format shown in Figure 3-4. The Address Mark selection may also modify the write gate, read gate, and sync bit location.

### 3.2.8 Skip Track

The SKIP feature allows a known bad track to be read without flagging either an Address or a Data error. The desired track is formatted to add a bad track bit to the header pattern. If the bad track bit is detected when the header is read, then the error flagging is inhibited for the entire track.

### 3.2.9 Write/Read

In addition to the formatting mode, the Exerciser provides three modes of WRITE/READ action:

READ: This function reads the header and reads the data field

*Note*

*In all Read actions, the 18 bits of header and all of the data field up to index are bit by bit compared for error after SYNC is found.*

WRITE: This function reads the header field and writes the data field.

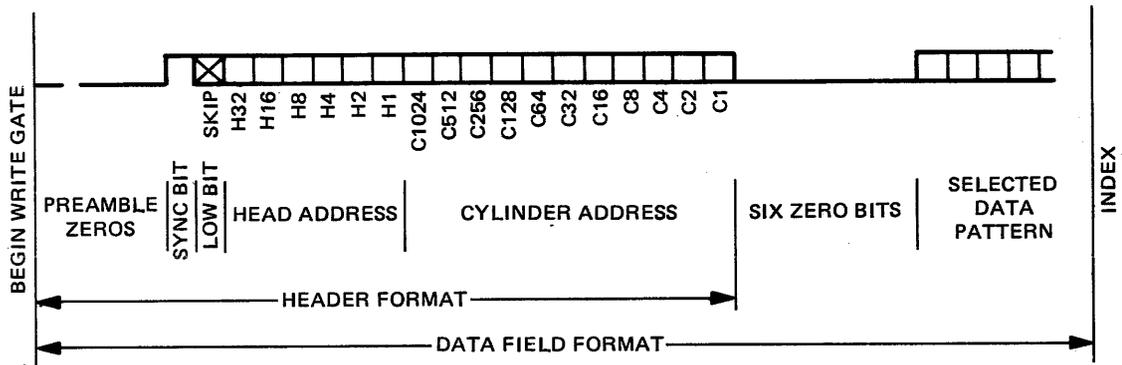
WR/RD: (Write/Read) This function first reads the header and writes the data field, then rereads the header and reads the data field.

### 3.2.10 Data Patterns

Three data sources are selectable for data transfer operations:

1. Cyclic – a continuously varying 16-bit pattern uniquely different for each track.
2. Random cylinder and pass – a 16 bit random data pattern generated by high speed counting.
3. Switch – user selected data through the 16 data switches.

The Random data pattern is user selectable by pass or by cylinder. The Random Pass data pattern provides a unique data pattern for each pass through all cylinders and heads. Each pass consists of first writing the pattern on all tracks then reading from all tracks. The data pattern is then changed and the next pass is run. Random by Cylinder pattern provides a unique data pattern for each cylinder.



**Figure 3-4. Header and Data Field Detail**

Sixteen data pattern LEDs show the generated data pattern, when running in the random modes.

In the Cyclic and Switch Data modes, these LEDs are blurred during run. When halted, the last 16-bit word is displayed as it was read from drive.

### 3.2.11 Strobe and Offset Margin Testing

Two switches provide margin testing of the media, heads and read amplifier and the head alignment: Strobe and Offset. Strobe controls the timing position of the data strobe: early, normal and late. Offset controls the position of the drive servo actuator relative to nominal "on cylinder" position. The combination of the two controls apply worst case margin testing to the drive.

### 3.2.12 Digital Display

Seven different values are selectable for display in the digital display:

1. Count of passes through all cylinders.
2. Servo clock bit rate.
3. Current sector count per revolution.
4. Time required for a drive to perform a seek action.
5. Byte count of the track.
6. Count of revolutions containing errors.
7. Decimal equivalent of cylinder address.

### 3.2.13 Volume

For those drive types which contain both a fixed and removable pack (i.e., CMD drive), a Volume switch provides the media volume selection command. The ON position enables the volume change command bit. The volume change is effected on the first seek after the volume selection is changed. This control is required due to the two servo heads in this drive type.

### **3.2.14 Test Points**

Twenty-eight test points are provided on the panel front to permit easy access to pertinent drive signals for scoping and metering purposes.

## **3.3 PHYSICAL DESCRIPTION**

As previously stated in Section 1, the SX-530 Disk Exerciser is a portable, off-line tester designed to be hand carried to the site where it will be used.

The unit is packaged in a suitcase style carrying case with a self-contained power supply and compartments for the power cord, adapter boards, I/O cables, mini-panel assemblies, and manuals.

The following paragraphs provide details on the following:

- Construction
- Console removal and reinstallation
- Adapter board removal and reinstallation

### **3.3.1 Construction**

The Exerciser consists of the following components:

- Carrying case with detachable cover
- Operator console front panel
- Main logic board
- I/O interface adapter card(s)
- Power supply
- Power cord
- I/O interface cables

Figure 3-5 is a view of the tester with the cover open and the cables in place for shipping.

The cover can be detached by sliding it to the right to separate the hinges. Internal to the cover is a compartment for the storage of manuals and extra I/O cables and adapters.

Storage of attached I/O cables and the AC power cable is provided in the well to the right side of the console in the base. Also in the well, on the vertical wall at the end of the console, is a rocker type AC power switch and a neon power indicator, and a line fuse (see Figure 3-6).

The Exerciser Assembly, minus the right end bracket and power supply, is removable from the base half of the tester (see Figure 3-7).

The main logic board is attached to the Operator Console front panel by eight standoffs (not to be removed by user). The I/O Adapter Interface board is attached to the main logic board by five or seven latching standoffs for easy removal.

The power supply is attached to and supported by the right end bracket which forms the wall of the cable well.

Electrical connection from the main logic board to the adapter board is through a 72 pin socket and header. The I/O cables are plugged into headers on the adapter.

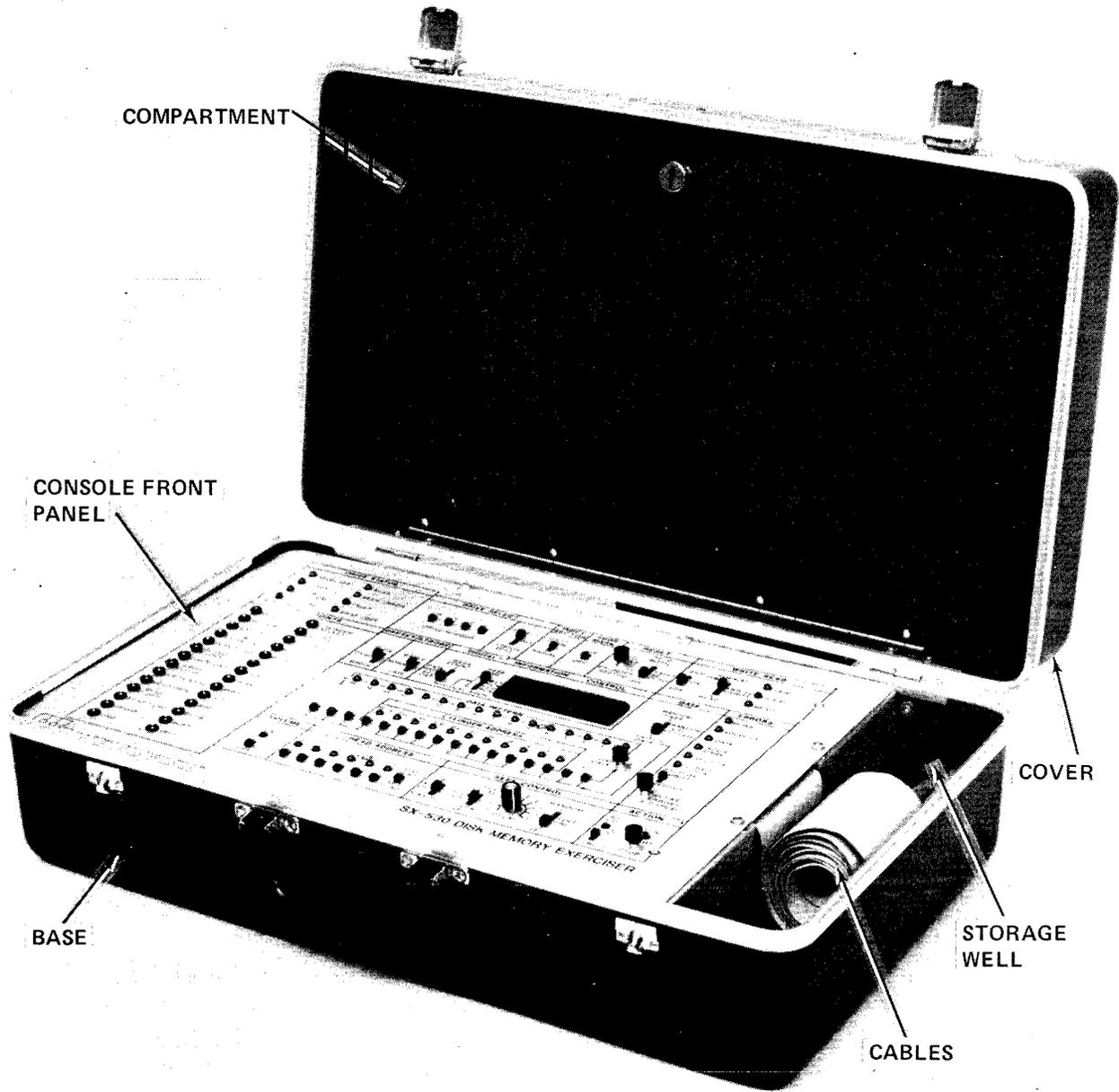
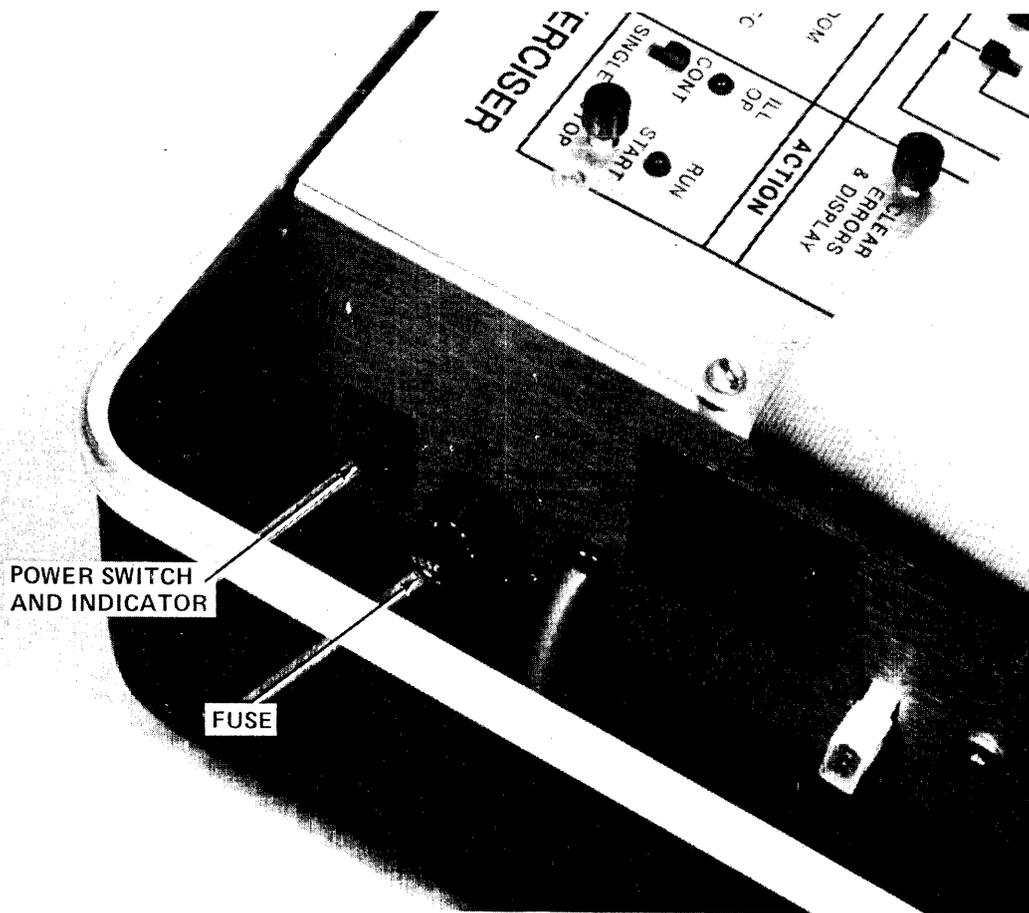
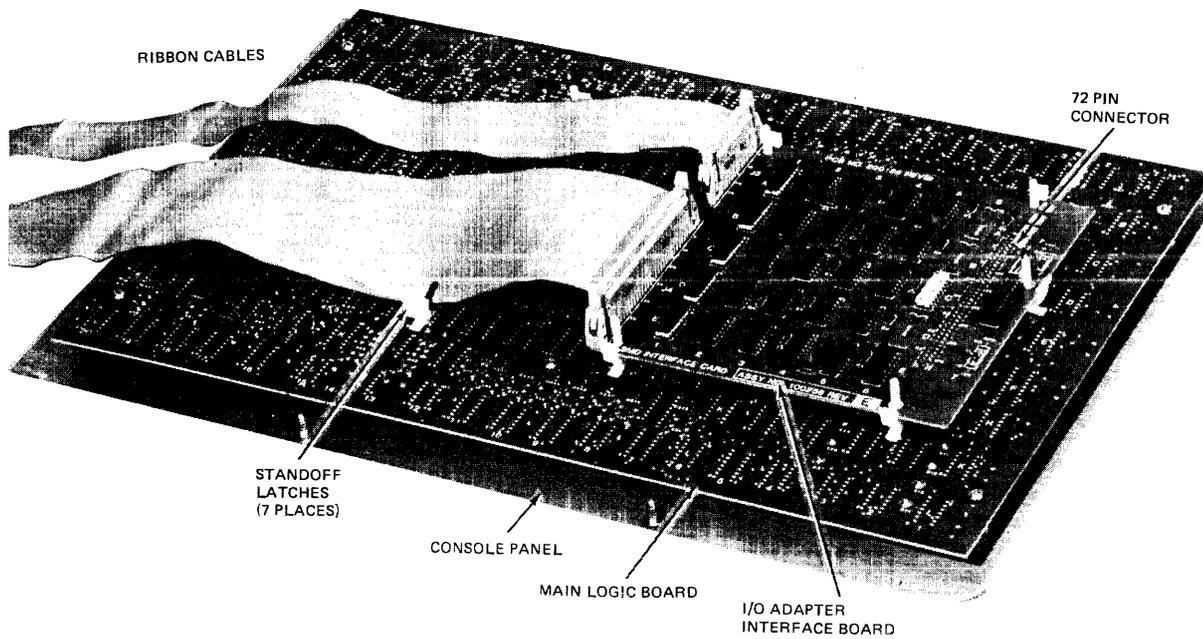


Figure 3-5. SX-530 Exerciser



**Figure 3-6. Power Switch and Indicator Location**



**Figure 3-7. Tester Assembly**

The adapter boards for a number of different drives require the use of a Mini-Panel assembly. The Mini-Panel, located in a small box, connects to the adapter board with a flat ribbon cable and is designed for storage in the well at the right side of the console panel.

The adapter board contains a socket mounted PROM. The PROM configuration controls the formatting detail of gap and preamble lengths, address mark location, and write and read gate timing. The PROM can be field exchanged to incorporate other format details as required. PROM must be obtained from the factory.

The I/O adapter boards available for the SX-530 Exerciser are listed in Table 3-1, by drive manufacturer and drive model. The I/O adapter Shipping Assembly *includes* the I/O interface adapter card, PROM, cables and the Mini-Panel assembly (if required). The cable and Mini-Panel designations are included for reference. The two digit numbers shown for each cable designates the number of conductors in each cable required.

### 3.3.2 Exerciser Assembly Removal and Reinstallation

**Caution**

*Before removing the Exerciser assembly from the case, disconnect AC power cord from wall outlet.*

To remove the complete Exerciser assembly from the base half of the case, perform the following:

1. Detach the cover by sliding it to the right to separate the hinges.
2. Unfasten the six captive screws (see Figure 3-8).
3. Lift out the Exerciser Assembly (minus power supply and end bracket).
4. Unplug 3-pin MOLEX power connector.

To reinstall the assembly, perform the above steps in reverse order.

**Caution**

*Before turning power on in the Exerciser, the Exerciser assembly must be installed in the case. Fasten the six captive release screws to lock the assembly in place. The I/O ribbon cables should lie flat under the edge of the panel centered in the space provided.*

### 3.3.3 I/O Adapter Interface Card Removal and Reinstallation

To remove the I/O Adapter Interface Card from the main logic board, perform the following:

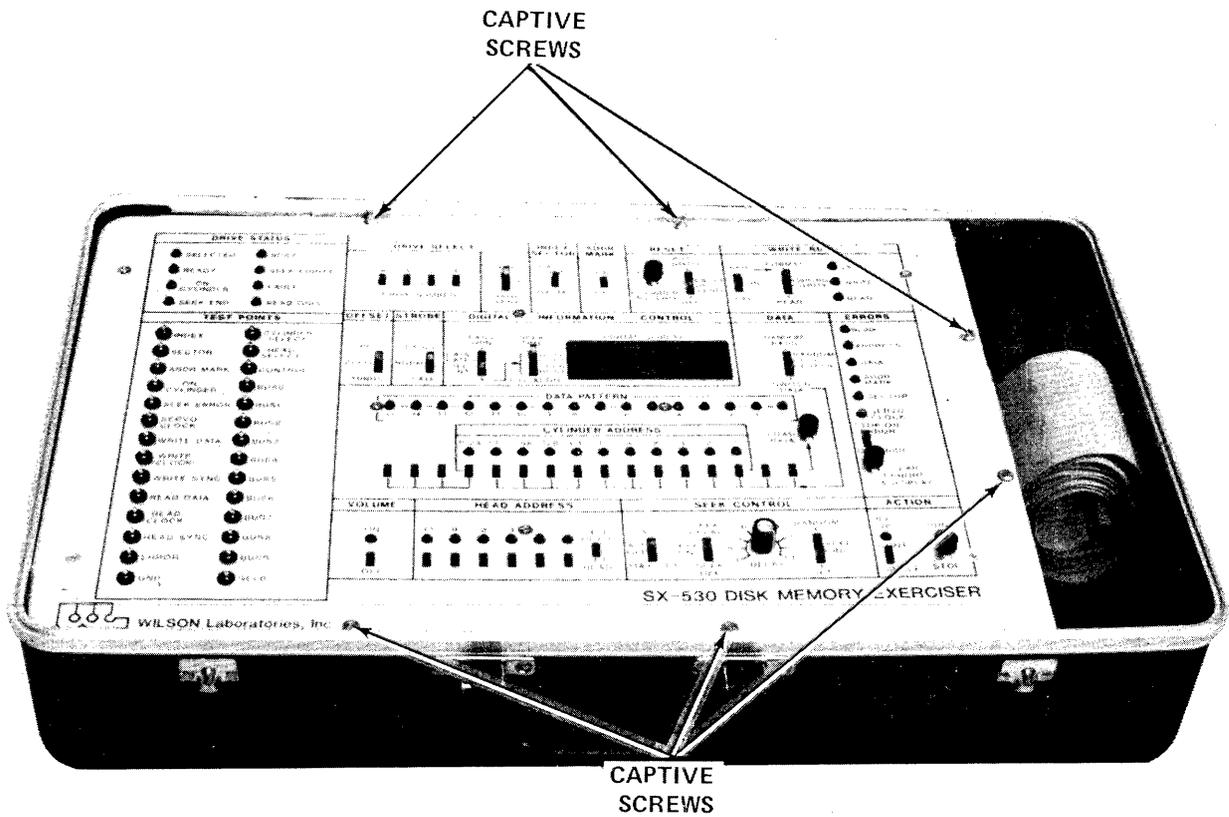
1. Remove Exerciser assembly from case (see paragraph 3.3.2).
2. Orient the assembly so that the adapter card is accessible.
3. Remove I/O cables from adapter.
4. Pry out the latches from the five or seven nylon standoffs (see Figure 3-9).
5. Lift off the adapter card.

**Caution**

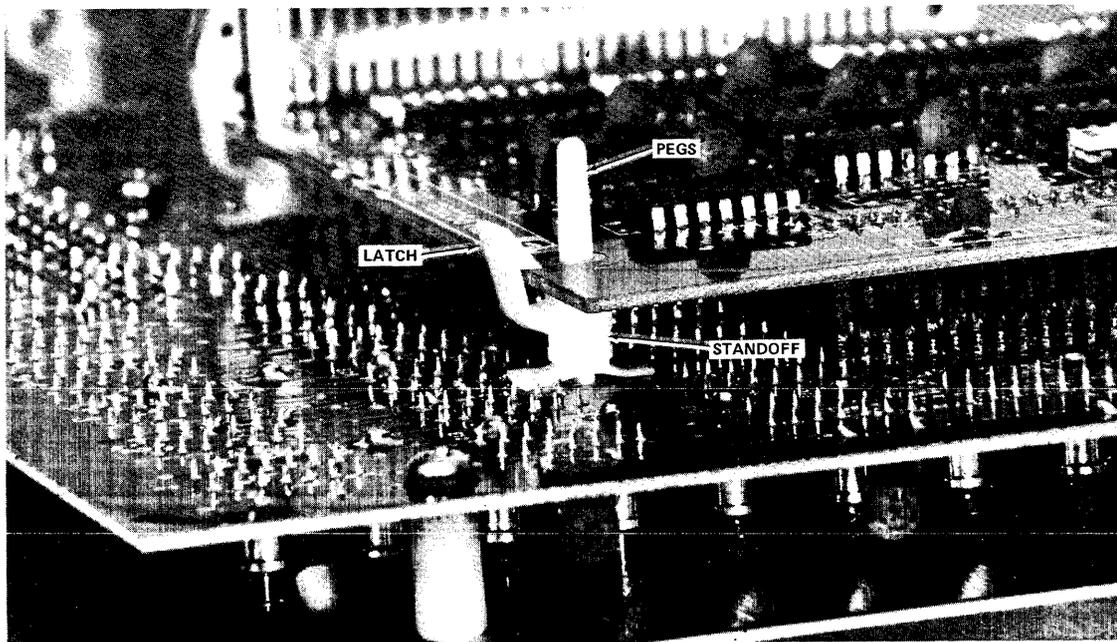
*Take special care when removing the card so as not to bend the header pins.*

**Table 3-1. SX-530 I/O Adapters**

Description	Shipping Assy	Cables									Mini Panel Assy	Drive Model
		700662 20	700478 26	700639 34	700661 40	700638 50	700477 60	700780 34	700791 20	700792 34		
SMD	100285		X				X				N/A	CDC 9760, 9762, 9764, 9766, CMD, MMD, & CDC Compatible Interfaces
KENNEDY	100286			X		X					N/A	5300
TRIDENT	100287	X			X						N/A	T25, T50, T80, T200, T300
PRIAM	100288					X					100282	DISKOS 3350
BASF	100289				X						100284	DISK BUS 6170 Series
PERTEC	100290					X					100306	D8000
IMI	100291							X			100312	7700 Series
ANSI STD	100292					X					100314	ANSI STD X 3T9, 8" Disk
5-1/4"	100293								X	X	100363	ST506



**Figure 3-8. Assembly Removal**



**Figure 3-9. Nylon Standoffs and Latches**

To install the adapter card to the main logic board, perform the following:

1. Orient the Exerciser assembly so that the main logic board is accessible.
2. Thread the standoff pegs into the holes in the adapter board.
3. Press together until the adapter header pins touch the main assembly socket.
4. Thread the pins into the socket and press together until fully seated.
5. Secure all latches on the standoffs.

*Note*

*To ensure good contact on all 72 pins, the adapter board must not be bowed away from the logic board.*

6. Plug I/O ribbon cables into the headers on adapter board.

*Caution*

*PIN 1, RED EDGE OF CABLE, MUST MATCH "PIN 1" CALLOUT ON PRINTED CIRCUIT BOARD.*

*Care must be taken when reconnecting I/O cables to ensure correct positioning of the connectors.*

7. Re-install Exerciser assembly in case (see paragraph 3.3.2).

## SECTION 4

### CONTROLS AND INDICATORS

#### 4.1 GENERAL

This section provides a description of and explains the function of the SX-530 controls and indicators. The control panel is divided in sections, each section denoting a function or group of related functions. See Figure 4-1. In the following paragraphs the controls and indicators are presented by logical groups as follows:

- Drive Setup:
  - DRIVE SELECT
  - DRIVE STATUS
  - INDEX SECTOR
  - OFFSET
  - STROBE
  - VOLUME
  - TEST POINTS
- Seek Operations Related:
  - SEEK CONTROL
  - HEAD ADDRESS
- Data Operations Related:
  - ADDR MARK
  - WRITE/READ
  - DATA
- Tester Operational:
  - RESET
  - DIGITAL INFORMATION CONTROL
  - ERRORS
  - ACTION

*Note*

*The description of the drive related control and indicator usage in the following table is for SMD Type disk drives. When the Exerciser is used with other drive types, the control and indicator usage will vary to accommodate the drive characteristics. When a non-SMD interface is installed, the changed control/indicator function and use are explained in the Addendum for that drive.*

---

#### DRIVE SELECT

---

DRIVE NUMBER 8, 4, 2, 1 Switches	Four 2-position switches which control the Unit Select lines to the drive. Used to set drive number of drive to be SELECTED.
SELECT/OFF/ STATUS TEST Switch	SELECT position sends the UNIT SELECT TAG to the drive. OFF position drops the UNIT SELECT TAG. STATUS TEST position lights all DRIVE STATUS indicators.

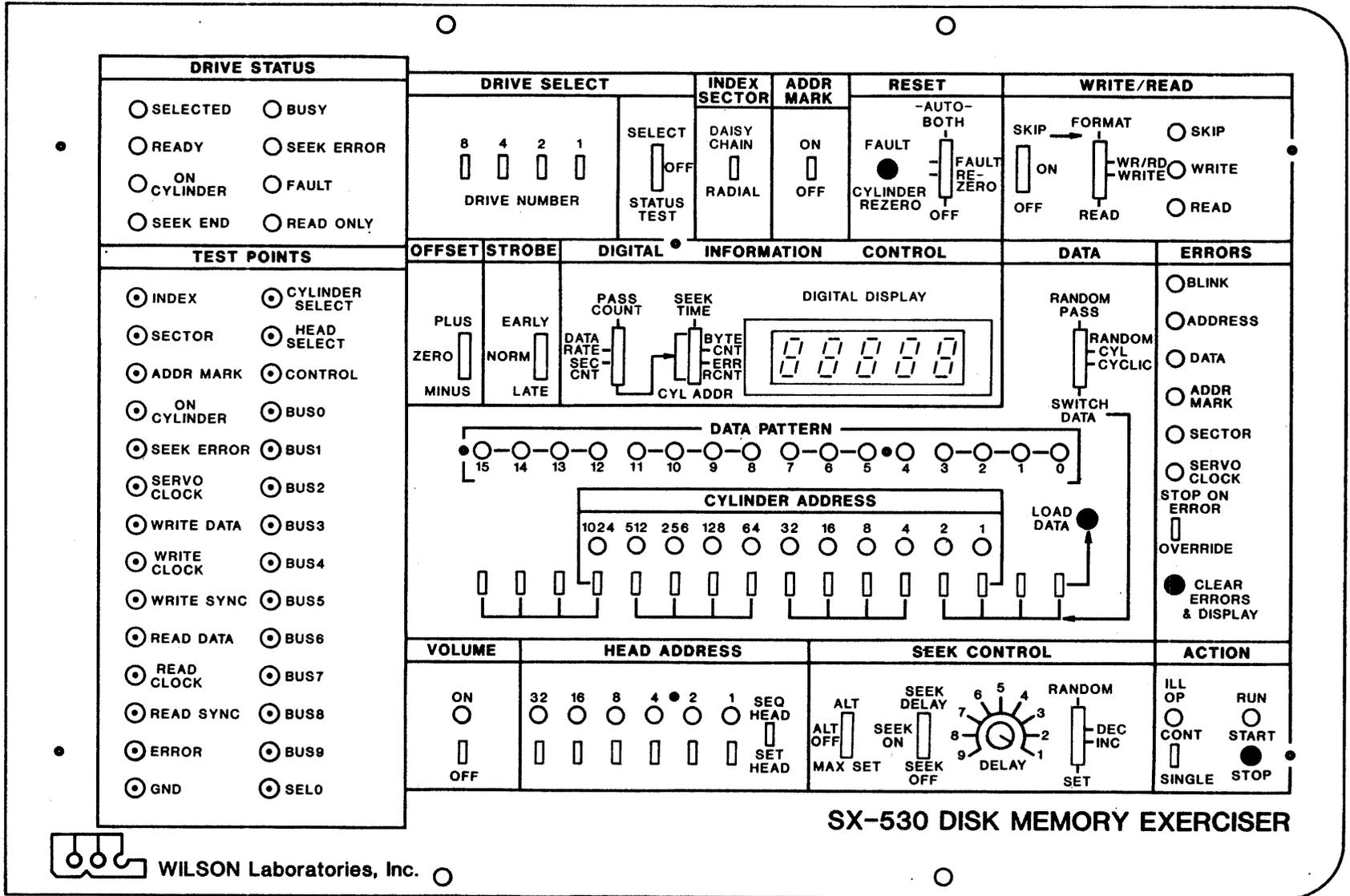


Figure 4-1. SX-530 Control Panel

---

## DRIVE STATUS

---

Drive Status Indicators	Eight LEDs monitoring the status lines from the disk drive.
SELECTED	Lights when the internal disk drive number matches the value set on the DRIVE NUMBER switches and the DRIVE SELECT switch is at SELECT.
READY	Lights when the disk drive is selected, ready for operation, and no fault conditions exist.
ON CYLINDER	Lights when the read/write heads are positioned over a track.
SEEK END	Lights when the requested seek operation has been completed or if a requested seek operation is not completed in a set period of time.
BUSY	Lights according to status of I/O signal line monitored by BUSY LED. Used only on Dual Interface Drive Systems. Not used when testing a single SMD drive.
SEEK ERROR*	Lights when a seek operation is initiated but not completed within a set period of time. Cleared by Rezero command.
FAULT*	Lights when a Fault condition exists in the drive. Cleared by Fault Clear command.
READ ONLY	Lights to indicate the drive is write protected or when a Fault condition blocks writing.

*Note*

*\*FAULT and SEEK ERROR conditions will cause the Exerciser to halt RUN mode when they occur if the STOP ON ERROR/OVERRIDE switch is in the STOP ON ERROR position.*

---

## INDEX SECTOR

---

DAISY CHAIN/ RADIAL Switch	Two position switch selecting either the daisy chain or radial cable as the source of Index and Sector signals.  DAISY CHAIN position selects the 60-conductor "A" cable. Also called the "link," "daisy chain" or "tag bus" cable.  RADIAL position selects the 26-conductor "B" cable.
-------------------------------	--

*Note*

*The Index Signal must be present to the Exerciser to allow all Exerciser functions to operate. Refer to paragraph 5.4 for verification procedure.*

---

## OFFSET

---

PLUS/ZERO/MINUS	Three position switch controlling the position of the drive servo actuator in relation to the "on cylinder" position.
ZERO	Positions the read head/cylinder relationship at the nominal "on cylinder" position. All normal drive testing will be performed in this position.
PLUS	Positions the actuator from the nominal "on cylinder" position toward the center of the disk. The amount of offset is drive dependent.
MINUS	Positions the actuator from the nominal "on cylinder" position toward the outside of the disk. The amount of offset is drive dependent.

*Note*

*Write operations are illegal when PLUS or MINUS offset is selected.*

---

## STROBE

---

EARLY/NORMAL/ LATE	Three position switch used to margin test the disk, read heads and read amplifier by modifying strobe timing within the drive; a drive dependent function.
NORMAL	Selects nominal strobe timing.
EARLY	In this position, sets strobe timing earlier than nominal. Amount of timing shift is drive dependent.
LATE	Sets strobe timing later than nominal. Amount of timing delay is drive dependent.

---

## VOLUME

---

ON/OFF Switch	This 2-position switch provides the media volume selection command to those drives that contain both a fixed and a removable disk pack (i.e., CDC CMD or AMPEX DFR).  The HEAD SELECT tag combined with BUS 4 is the Volume Select command. The volume change occurs on the first seek after the switch position is changed.
ON	This position sets the Volume Change command bit to a logic ONE indicating the fixed pack is to be addressed.
OFF	This position sets the Volume Change command bit to a logic ZERO indicating the removable pack is to be addressed.

---

## TEST POINTS

---

	Twenty-eight external test points are provided for oscilloscope connection.
INDEX	Index pulse from drive.
SECTOR	Sector pulse from drive.
ADDR MARK	Address mark signal from the drive.
ON CYLINDER	Low when the drive is ON CYLINDER.
SEEK ERROR	Seek error signal from the drive.
SERVO CLOCK	Present when the drive is operating. Present whether the drive is selected or deselected.
WRITE DATA	The data patterns generated by the tester both for writing and read comparison.
WRITE CLK	Appears when the write gate is on.
WRITE SYNC	May be used for scope synchronization for viewing the data pattern when writing.
READ DATA	Read data signal from the drive.
READ CLK	Read clock signal from the drive.
READ SYNC	Scope synchronization for viewing read data. Appears at sync found both for the header and the data field.
ERROR	A high pulse at each bit error detected when reading.
CYLINDER SELECT	Cylinder select tag sent to the drive.
HEAD SELECT	Head select tag sent to the drive.
CONTROL	Control tag signal sent to the drive for writing, reading, rezero, or fault clear.
BUS 0-9	Bus signals sent to the drive to convey cylinder address, head address, and various commands.
SEL 0	Represents BUS 10 bit when cylinder addresses above 1024 are required.

---

## SEEK CONTROL

---

These switches set and control the four basic servo modes: Set, Increment, Decrement, and Random. When combined with data action, Seek action always precedes Data action.

Seek Control Switch	Three-position switch controlling seek action and delays.
---------------------	---

---

## SEEK CONTROL (Continued)

---

SEEK OFF	This position disengages SEEK CONTROL switches overriding user control of Seek action but allows normal drive Read/Write operations.
SEEK ON	This position enables the SEEK CONTROL switches allowing user control of Seek action with Seek DELAY disabled.
SEEK DELAY	This position enables the SEEK CONTROL switches allowing user control of Seek action with Seek DELAY enabled.
DELAY	Variable position rotary adjustment providing user control of delays between seeks. Delay time varies from position 1 with near normal seek times to position 9 with delay of approximately 3.0 seconds.
MAX/ALT Switch	Three position switch allows setting of Maximum, Alternate, and Single cylinder address positions.
ALT OFF	In this position, an alternate address is not used during testing. This is the normal Seek operation mode.
MAX SET	Sets the maximum cylinder address to be addressed as selected by the Cylinder Address Select Switches.
ALT	Enables the value selected by the Cylinder Address Select Switches to be used as an alternate cylinder address.

*Note*

*Repositioning the Cylinder Address Select Switches while in the ALT position and the RUN Action Mode will change the alternate cylinder address.*

Mode Control Switch	Four position switch used to control the four basic servo modes.
SET	Allows repeated seeks to the cylinder address set in the Cylinder Address Select Switches. Changing the Cylinder Address Select Switches during RUN causes a seek to the new address.

*Caution*

*Repositioning the Mode Control Switch (RANDOM/DEC/INC/SET) while Exerciser is in RUN Mode may cause an illegal operation to occur.*

INC	Allows seeks to be made at each cylinder address in an incrementing sequence until the MAXSET address is reached. The next seek is to cylinder 0 and the incrementing pattern continues.
-----	--

---

## SEEK CONTROL (Continued)

---

**DEC** Allows seeks to be made at each cylinder address in a decrementing sequence until cylinder address 0 is reached. The next seek will be to the MAXSET cylinder address and the decrementing pattern continues.

**RANDOM** Allows seeks to be made to Exerciser selected random cylinder addresses between cylinder address 0 and the MAXSET cylinder address.

The cylinder address sought will be random if the READ/WRITE Switch is in ON position or SEEK CONTROL is in SEEK DELAY position.

*Note*

*Seek exercising in the INC, DEC, or RANDOM Modes requires a maximum cylinder address to be set prior to initiating RUN to prevent Address Faults resulting from illegal addressing.*

---

## HEAD ADDRESS

---

This set of controls and indicators allows the user to perform vertical addressing by selecting and monitoring testing on a selected disk surface or set of disk surfaces from 0 through the maximum disk recording surfaces.

*Note*

*Head Address selection and switch repositioning should be performed in the STOP Action Mode since illegal head addresses may result during switch movement.*

**SEQ HEAD** The up position of the two-position switch sets the upper limit of head addressing as selected by the six binary Head Select Switches (1 through 32). WRITE/READ operations will be performed sequentially between Head 0 and the limit selected.

**SET HEAD** The down position selects a single disk surface for testing as determined by the position of the six binary Head Select Switches (1 through 32).

**Head Address LEDs**  
1, 2, 4, 8, 16, 32 Six binary numbered LEDs displaying the value set by the six binary Head Select Switches. During RUN, displays the current Head Address.

**Head Select Switches**  
1, 2, 4, 8, 16, 32 Six 2-position switches representing binary values 1 through 32. Use determined by the mode selected by SEQ HEAD/SET HEAD Switch.

---

## ADDR MARK

---

Address Mark  
ON/OFF Switch

Two position switch.

ON position specifies the Address Mark be written in the header when Formatting and the Address Mark detected when Reading.

OFF positions disables the use of Address Mark function.

---

## WRITE/READ

---

FORMAT/WR/RD/  
WRITE/READ  
Switch

Four position switch allowing the writing and reading of address and data fields on the disk.

*Caution*

*If customer data is to be preserved, then ONLY SEEK actions may be done by the Exerciser on those cylinders that must be preserved. Format and Write should never be attempted on these cylinders. EXTREME CAUTION IS REQUIRED WITH FIXED MEDIA DRIVES.*

During all read operations, 18 bits of the header and all of the data field up to the index mark are compared bit-by-bit for error.

FORMAT

This position enables the writing of both the header and data fields. A disk must be formatted before any read or write testing may occur.

WR/RD

This position enables first the reading of the header and the writing of the data field then rereads the header and reads the data field.

WRITE

This position enables the reading of the header and the writing of the data field.

READ

This position enables the reading of the header and the data field.

SKIP/ON/OFF  
Switch

Three position switch.

SKIP

This position, used in conjunction with the FORMAT mode, allows the writing of a "Bad Track" bit into the header for that track. This allows a known bad track to be read while inhibiting all ADDR and DATA Errors detection.

ON

This position enables Read and Write operations.

OFF

This position disables all Read and Write operations. Allows Seek operations to be performed without Write or Read actions.

---

## WRITE/READ (Continued)

---

### Indicators

SKIP	Lights when track containing “Bad Track” bit is being read.
WRITE	Lights to indicate a Write operation is in progress.
READ	Lights to indicate a Read operation is in progress.  Also lights (blinks briefly—not visible to the eye) during header read portion of Write operation unless header is unreadable, then Exerciser hangs-up in header read for some portion of track and READ LED stays on for a visible period. ADDRESS Error indicator is turned on for this situation of a sync failure.

---

## DATA

---

Data Pattern Select Switch	Four position switch selecting one of three data patterns to be used during drive Read/Write testing: <ul style="list-style-type: none"><li>• RANDOM data is a pseudo random 16-bit pattern generated by high speed counting.</li><li>• CYCLIC data is a continuously varying data pattern uniquely different for each track.</li><li>• SWITCH data is a user defined data pattern composed by the 16 Data Pattern Select Switches.</li></ul>
RANDOM PASS	Selects RANDOM data pattern for each Write and Read pass through all cylinders. Data is first written on all tracks and then read compared on all tracks. When maximum cylinder address is reached in read, the pattern is changed and the next pass is run.  Legal only if READ/WRITE Switch is in WR/RD position and SEEK CONTROL Switch is in either INC or DEC position.  Press CYLINDER REZERO Pushbutton before starting this operation.
RANDOM CYL	Selects a new RANDOM data pattern for each WR/RD cycle on each cylinder seeked. Runs with any Seek mode selected or SEEK OFF.  Legal only if READ/WRITE Switch is in WR/RD position.
CYCLIC	Selects CYCLIC data pattern for Write and Read comparison. The data pattern is repeated every 128 bytes. Legal with all Seek modes.
SWITCH DATA	Selects the user defined data pattern as entered through the Data Pattern Switches. The pattern must be loaded into the register by pressing LOAD DATA Pushbutton. Legal with all Seek modes.

*Note*

*Data Errors will occur if the SWITCH DATA pattern is changed between the time of writing and the time of reading.*

---

## DATA (Continued)

---

### DATA PATTERN LEDs

Display the 16-bit data pattern selected as follows:

**RANDOM PASS** LEDs light to display the RANDOM data pattern as  
**RANDOM CYL** generated.

**CYCLIC** LEDs are blurred during RUN mode. **STOP-ON-ERROR** halt  
**SWITCH DATA** will display the last 16-bit word as read from the drive.  
**SWITCH DATA** in Select Switches can be compared for error  
bit(s).

*Caution*

*Values indicated by the DATA PATTERN LEDs after RUN is stopped are valid only after STOP-ON-ERROR condition. Values displayed following user initiated STOP are not valid.*

### Data Pattern Select Switches

Sixteen 2-position switches (including the 11 Cylinder Address Switches) representing binary 0 (down) and 1 (up) used to compose user defined data. The pattern composed will be loaded into a storage register by pressing the LOAD DATA switch. The same register is used by the random data generator so the loaded data will be disturbed by a RANDOM data operation. Also a RANDOM data exercise in process will be disturbed by pressing the LOAD DATA switch.

---

## RESET

---

### AUTO Switch

Four position switch allowing operator selection to automatically clear/reset FAULT and/or SEEK ERROR Status.

### BOTH

This position automatically generates FAULT CLEAR and REZERO commands when either a FAULT or SEEK ERROR status condition occurs. See FAULT and REZERO.

### FAULT

This position enables the FAULT/CYLINDER REZERO Pushbutton to generate a FAULT CLEAR command when depressed and automatically generates a FAULT CLEAR command on each FAULT Status occurrence.

### REZERO

This position enables the FAULT/CYLINDER REZERO Pushbutton to generate a REZERO command when depressed and automatically generates REZERO command on each SEEK ERROR Status occurrence.

### OFF

This position disables the AUTO Reset Mode and enables the FAULT/CYLINDER REZERO Pushbutton switch to provide manual REZERO.

### FAULT/CYLINDER REZERO Switch

Pushbutton switch allowing operator to manually initiate either a REZERO or FAULT CLEAR command or both depending on the position of the AUTO Switch.

---

## DIGITAL INFORMATION CONTROL

---

DIGITAL DISPLAY	Five position numeric decimal LED readout of values as selected by the Digital Display Select switches.
Digital Display Selector Switches	Two 4-position switches which select one of seven values to be displayed on the DIGITAL DISPLAY. The right switch is enabled when the left switch is in the full down position.
	NOTES: Values displayed, as a result of Selector Switch positioning, may be reset as follows:
	PASS COUNT Stored values that are zeroed when the Display Selector Switch is repositioned or the CLEAR ERRORS & DISPLAY Pushbutton is depressed.
	SEEK TIME
	ERR RCNT
	SEC CNT Continuously updated values during RUN Mode. When RUN Mode is stopped, the values are stored for reading. Values are zeroed when the Display Selector Switch is repositioned or the CLEAR ERRORS & DISPLAY Pushbutton is depressed.
	BYTE CNT
	DATA RATE These values are repeatedly updated based on the operation selected and are not dependent on the RUN Mode.
	CYL ADDR
PASS COUNT	Displays number of passes through all selected cylinders during Seek operation. Value increments by one at each maximum cylinder seek in the Increment and Decrement Seek modes and at each seek in the Random Seek mode. Display is cleared (zeroed) by pressing CLEAR ERRORS & DISPLAY Pushbutton or when the Display Selector Switch is moved to another position.
DATA RATE	Displays the Servo Clock Bit rate in MHz. Display is updated at one second intervals.
SEC CNT	Displays the number of sector pulses per disk revolution indicating the full current sector count per track. When RUN mode is stopped, the sector count at the time RUN was terminated will be displayed. Useful in finding faulty sector pulses.
SEEK TIME	Displays the time required for the drive to perform the current Seek operation. This time, in milliseconds, is measured from the initiation of the SEEK command to the receipt of the "on cylinder" signal from the drive. Time value displayed is for the most current seek activity and includes cylinder-to-cylinder Seeks, Auto Rezeros and Offset movement. RUN mode must be on the full time of the seek measurement.
BYTE CNT	Displays the full count of the bytes on the track during RUN and WR (or RD) Mode. When the RUN Mode is stopped, the byte count at the point at which the mode was terminated will be displayed. Useful in locating the position of defective data within a sector by using the Stop-On-Error mode.
ERR RCNT	Displays the number of disk revolutions during which one or more errors occurred.
CYL ADDR	Displays the decimal equivalent of the binary value represented by the CYLINDER ADDRESS LEDs. If SEEK CONTROL is set at MAX SET position, display is the decimal equivalent of the value selected by the CYLINDER ADDRESS Switches.

---

## CYLINDER ADDRESS

---

This set of switches and LEDs, when used in conjunction with the SEEK CONTROL ALT/MAX SET switch, allows the user to perform "horizontal" addressing between Cylinder Address 0 and the maximum addressable cylinders for the disk drive.

*Note*

*Cylinder address selection and switch repositioning may be performed during the RUN Action Mode.*

<b>CYLINDER ADDRESS LEDs</b>	Eleven binary numbered LEDs displaying the last cylinder sought. LEDs are numbered 1 through 1024.
<b>Cylinder Address Select Switches</b>	Eleven 2-position switches representing binary values 1 through 1024 used to select cylinders addresses for SET and ALT Seeks and MAX SET loading.

---

## ERRORS

---

<b>STOP-ON-ERROR/OVERRIDE Switch</b>	Two-position switch allowing the user to stop on each error condition as it occurs or continue running, overriding the halts associated with the errors.
<b>STOP-ON-ERROR</b>	<p>Stops the RUN Action when an error condition is detected allowing the user to analyze the error. Error conditions causing STOP ON ERROR are those action errors which light the ERROR LEDs with the exception of SERVO CLOCK. Drive Status FAULT and SEEK ERROR also cause STOP ON ERROR.</p> <p>The ERROR conditions are cleared by pressing CLEAR ERRORS &amp; DISPLAYS. FAULT and SEEK ERROR conditions are cleared using the RESET switch.</p>
<b>OVERRIDE</b>	Allows RUN action to continue while errors are ignored. The respective ERROR LEDs will light when an Error bit or Condition is detected. Pressing the CLEAR ERRORS & DISPLAY Pushbutton will clear the error flag/condition.
<b>Error Lights</b>	Six LEDs displaying various action error conditions.
<b>BLINK</b>	Flashes when any error condition (bit) is present. Also will light if either DRIVE STATUS FAULT or SEEK ERROR is present.
<b>ADDRESS</b>	Lights if a Read Comparison error is found in the header field.
<b>DATA</b>	Lights if a Read Comparison error is found in the data field.
<b>ADDR MARK</b>	Lights if an Address Mark was not found and the ADDR MARK switch is in the ON position. In some drive types, the LED will light if an Address Mark was read and the ADDR MARK Switch is in the OFF position.

---

## ERRORS (Continued)

---

SECTOR	Exerciser counts each sector pulse during each revolution of the disk. This LED lights if the sector count differs from one revolution to the next.
SERVO CLOCK	Exerciser counts the Servo clock pulses during each revolution from leading edge to leading edge of Index. LED lights if count differs from revolution to revolution.

*Note*

*Servo Clock errors do not cause BLINK LED to light or a STOP-ON-ERROR condition. This is required by the fact that some manufacturer's drives routinely turn off Servo Clock outputs when the Seek functions are performed, thereby activating the Exerciser SERVO CLOCK error.*

---

## ACTION

---

ILL OP	<p>LED blinks when an illegal operation is selected. A list of illegal conditions is provided in Table 4-1.</p> <p>The ILL OP LED should blink on any illegal condition. An Index pulse must be received to enable ILL OP LED to blink.</p> <p>Test the ILL OP LED by pressing and holding the CLEAR ERRORS &amp; DISPLAYS pushbutton. See paragraph 5.4.</p>
RUN	LED lights when the Exerciser is operating (RUN Mode).
SINGLE	This position of the two position switch directs the Exerciser to stop RUN after a single cycle of the combined SEEK and WRITE/READ operation has been completed.
CONT	Allows continuous cycles of selected operation until terminated by STOP-ON-ERROR or STOP switch.
START/STOP Switch	Pushbutton switch with alternate depressions starting and stopping RUN Mode.

*Note*

*If only Seek action or only Write/Read action is selected, then the position of the CONT/SINGLE switch has no effect on the operation. The RUN Mode continues until stopped.*

**TABLE 4-1. Illegal Operations**

OPERATION	CAUSE	SUGGESTED ACTION (If Appropriate)
Attempt Write Operation	Write/Read Operation selected with switch in WRITE, WR/RD, or FORMAT position while DRIVE STATUS READ ONLY LED is lit. RUN Mode is blocked.	Disable "Read Only" condition in drive.
Set Sequence Head	Sequence Head Operation is selected with switch in SEQ HEAD position and Head Select Switches at zero. RUN Mode is blocked.	Set Head Select Switches to desired maximum head address (not zero).
Clear Errors or Display	ILL OP LED blinks when the CLEAR ERRORS & DISPLAYS Switch is depressed with Index pulse present. RUN Mode is not blocked.	
Auto Reset	RESET switch set to AUTO BOTH, FAULT or REZERO when ERRORS switch is set to STOP-ON-ERROR. RUN Mode will be blocked	Set switches to OFF or OVERRIDE.  Address Mark in the header.
ILL OP light is lit but does not blink.	Index pulse is used to enable the ILL OP LED to blink. Pulse not received.	Check cable connections to drive and position of INDEX/SECTOR switch.
<p><i>Note</i></p> <p><i>If Index pulse is received in the Daisy Chain Link cable, drive must be selected.</i></p> <p><i>If pulse is received in Radial cable, the drive need not be selected for Index pulse to be present.</i></p>		
Random Pass Data	Data switch set to RANDOM PASS position with WRITE/READ switch not set to WR/RD or SEEK CONTROL switch set to either RANDOM or SET. RUN Mode is blocked.	Set SEEK CONTROL to INC or DEC and WRITE/READ switch to WR/RD.
Random Cylinder Data	DATA switch set to RANDOM CYL position with WRITE/READ switch not set to WR/RD. Run Mode is blocked.	Set WRITE/READ switch to WR/RD.
Attempt Write Operation	Write/Read Operation selected with switch in WR/RD, WRITE, or FORMAT position and OFFSET switch set to either PLUS or MINUS.  DRIVE STATUS FAULT and READ ONLY LEDs may light if RUN is on. RUN will be forced off. ILL OP LED will blink.	Set OFFSET switch to ZERO.

## SECTION 5

### GENERAL OPERATING PROCEDURES

#### 5.1 GENERAL

This section contains the general operating procedures necessary to perform basic drive operations using the Exerciser front panel controls. Using these basic procedures, the user may initiate testing of the attached drive. As he becomes more sophisticated, he can expand on and incorporate the new procedures into his testing program.

*Note*

*The operating procedures presented in this section are for SMD type disk drives. If testing other than an SMD drive, refer to the applicable addendum for your drive before initiating any of the following procedures.*

Each operating procedure presented in the following paragraphs is first briefly described as to the operation to be performed. Next is a step-by-step procedure to accomplish the operation. Where applicable, an "Initial Conditions" listing is given. This specifies those drive and tester conditions that must be met prior to initiating the steps that follow. For example, the "Initial Conditions" may be Drive Selected and Drive Formatted. This means the drive must be in a Selected and Ready Status and the disk must be formatted by the Exerciser. In general, the Static Control Panel in Table 5-1 is the baseline switch settings for all operations listed.

The operating procedures and associated paragraph reference in this section are as follows:

<i>Procedure</i>	<i>Paragraph</i>
Tester Connection	5.2
Select Drive	5.3
Select Index Sector	5.4
Basic Exerciser/Drive Check	5.5
Set Maximum Cylinder Address	5.6
Seek Operations	5.7
Manual – No Data	5.7.1
Manual – With Data	5.7.2
Automatic	5.7.3
Increment	5.7.3.1
Decrement	5.7.3.2
Random	5.7.3.3
Seeks Using Alternate Address	5.7.3.4
Formatting	5.8
Skip Track	5.9
Write Read Operations	5.10
Stop on Error Recovery	5.11

## 5.2 TESTER CONNECTION

The adapter board and the I/O cable set must be matched to the drive to be tested. Refer to Table 3-1 for the proper adapter assemblies to use with each drive type supported.

The SX-530 connects to a single drive with either one or two cables depending on the drive type. The dual cable drives provide a daisy chain ribbon cable and a narrower radial ribbon cable. The red edge marking on each cable identifies the pin 1 end of the connector. A terminator card or terminator modules must be plugged into the drive to terminate the daisy chain cable connection.

### 5.2.1 Procedure

1. Connect Daisy Chain and Radial cables for drive from drive interface connectors to SX-530 Exerciser cables.

*Note*

*Refer to applicable I/O Adapter and Drive Consideration Section and to Manufacturers' Installation and Operation Manual for correct I/O cabling.*

2. Verify drive has been terminated (if applicable).
3. Set Exerciser Panel Switches to the positions stated in Table 5-1.
4. Plug Exerciser AC power cord into 115/120 VAC, 60 Hz standard wall outlet (or 100, 200, 215, 230/240 VAC if applicable for tester).
5. Position AC Power Switch, located in cable well, to ON. AC Power Switch will light.
6. Apply power to drive and power-up the drive.
7. Spin-up drive (if applicable).

## 5.3 SELECT DRIVE

The drive under test must be selected before it will respond to any Seek or Write/Read command from the tester.

*Note*

*The function of the DRIVE SELECT switches as described in the following is for SMD type drives. Switch usage may vary for other drive types to accommodate drive characteristics. Refer to applicable Addendum.*

A drive generally has provision within it for setting a drive number in the range of 0–15. Setting the four binary-numbered select switches to match the drive number directly controls the signal levels on four UNIT SELECT lines to the drive.

Next setting the SELECT/OFF/STATUS TEST switch to SELECT sends a continuous SELECT TAG signal to the drive. At the leading edge of SELECT TAG the drive compares the tester supplied DRIVE SELECT number with its internally selected number. If these two values match, the drive will be selected.

**TABLE 5-1. Static Control Panel**

<b>SWITCH GROUP</b>	<b>SWITCH</b>	<b>POSITION</b>
Drive Select	Drive Number 8, 4, 2, and 1 Select/Off/Status Test	Down OFF
Index Sector	Daisy Chain/Radial	*
Address Mark	ON/OFF	OFF
Reset	BOTH/FAULT/REZERO/OFF	OFF
Write/Read	SKIP/ON/OFF/LOAD DATA FORMAT/WR/RD/WRITE/READ	OFF READ
Offset	PLUS/ZERO/MINUS	ZERO
Strobe	EARLY/NORM/LATE	NORM
Digital Information Control	PASS COUNT/DATA RATE/SEC CNT SEEK TIME/ERROR CNT/ERROR REV CNT/CYL ADDR	Down CYL ADDR
Data	RANDOM PASS/RANDOM CYCLE/CYCLIC/DATA PATTERN	CYCLIC
Errors	STOP ON ERROR/OVERRIDE	OVERRIDE
Data Pattern/ Cylinder Address	Data Switches 0–15 Cylinder Address Switches 1–1024	Down
Volume	ON/OFF	OFF
Head Address	Address Switches 1 through 32 SEQ HEAD/SET HEAD	Down SET HEAD
Seek Control	ALT/ALT OFF/ALT SET MAX SET SEEK DELAY/SEEK ON/SEEK OFF DELAY RANDOM/DEC/INC/SET	ALT OFF SEEK OFF 1 INC
Action	CONT/SINGLE (RUN light not lit)	CONT

---

\*Position determined by drive type. Refer to paragraph 5.4.

---

Once a drive is selected, it will send SELECTED, READY, and ON CYLINDER STATUS signals to the tester. Changing the binary-numbered SELECT Switches will have no effect on the status after the drive is selected. The drive will be deselected only if the DRIVE SELECT is set to OFF.

### 5.3.1 Procedure

1. Set SELECT/OFF/STATUS TEST Switch to STATUS TEST position.
2. Verify that the eight DRIVE STATUS LEDs light and remain lit until the SELECT/OFF/STATUS TEST Switch is moved to the OFF position.
3. Set appropriate DRIVE NUMBER Switches 8, 4, 2, and 1 to the up position to correspond to the disk drive to be selected. Set the remaining switches to the down position.

DRIVE NUMBER Switches represent digital values which added together produce the desired drive number. Example: Drive to be selected is 11. Set Switches 8, 2, and 1 up; 4 down.

4. Set SELECT/OFF/SELECT STATUS Switch to SELECT position. This sends a Drive Select signal to the disk drive. Moving the switch back to OFF will deselect the disk drive.

While switch is in the SELECT position, changing the value represented by the DRIVE NUMBER Switches has no effect.

5. Verify the DRIVE STATUS LEDs; SELECTED, READY, ON CYLINDER, and SEEK END are lit.

## 5.4 SELECT INDEX SECTOR

Most drives supply the Index and Sector signals in the daisy chain cable, while some drives provide the signals in the radial cable.

Refer to your drive manufacturer's manual to determine which cable supplies the signals. The Exerciser will not function correctly if the index signal is not received. A quick check of proper switch setting is provided in the following procedure.

### 5.4.1 Procedure

NOTE: Drive must be SELECTED. (Procedure 5.3.1)

1. Set DAISY CHAIN/RADIAL Switch to DAISY CHAIN, press and hold the CLEAR ERRORS & DISPLAYS pushbutton.
2. If ILL OP light is flashing rapidly, the DAISY CHAIN/RADIAL Switch is in the proper position and an Index pulse is being received.
3. Release CLEAR ERRORS & DISPLAYS pushbutton.
4. If the Index signal was not in the daisy chain cable, set DAISY CHAIN/RADIAL switch to the RADIAL position, and press and hold the CLEAR ERRORS & DISPLAY pushbutton.
5. The ILL OP light will flash rapidly on and off if the signal is present. If no flashing occurs, a drive connect or select problem exists.
6. Release CLEAR ERRORS & DISPLAYS pushbutton.

## 5.5 BASIC EXERCISER/DRIVE CHECK

Preliminary checks to verify that the drive is selected and correctly connected to the Exerciser are contained in the following procedure.

### 5.5.1 Procedure

Initial Conditions: Drive Selected  
Index/Sector Selected  
Remaining panel switches set to Table 5-1.

1. Set RESET AUTO Switch to BOTH position.  
The DRIVE STATUS SEEK ERROR and FAULT LEDs, if on, will go out.
2. Set BOTH/FAULT/RESET/OFF Switch to OFF.
3. If the READ ONLY LED remains on without the FAULT LED being on, reset the WRITE PROTECT controls on the drive.
4. Press the FAULT/CYLINDER REZERO Pushbutton. The drive will respond by positioning the heads at cylinder 0 (this action can normally be heard and felt).  
ALL CYLINDER ADDRESS LEDs will go out and DIGITAL DISPLAY will read 0.
5. Set RESET AUTO switch to OFF position.
6. Press and hold the CLEAR ERRORS & DISPLAY Pushbutton. All ERROR LEDs will go out and the ILL OP LED will blink.
7. Release the CLEAR ERRORS & DISPLAY Pushbutton. All ERROR LEDs will remain off and the ILL OP LED will go out.
8. Verify WRITE/READ Switch is in OFF position.
9. Set SEEK CONTROL Switch to SEEK OFF.
10. Set DIGITAL INFORMATION CONTROL Switch to SEC CNT.
11. Press ACTION START/STOP Switch to start RUN Mode. The Sector Pulse count as set by the drive configuration switches will be displayed in the DIGITAL DISPLAY.

*Note*

*If the Index pulse begins with the first sector on the drive, the sector count will be one less than the number of sectors per track. Refer to the drive manufacturer's manual.*

12. Set SEEK CONTROL Switch to MAX SET.
13. Move DIGITAL INFORMATION CONTROL left most switch from SEC CNT to down position and right most switch to CYL ADDR position.
14. Position the CYLINDER ADDRESS Switches up one at a time or in combination.  
Observe the DIGITAL DISPLAY displays the decimal sum of the binary switches as placed in the up position.
15. Set CYLINDER ADDRESS Switches to down position.
16. Set SEEK CONTROL Switch to ALT OFF position.
17. Press START/STOP Switch to halt RUN Mode.

## 5.6 SET MAXIMUM CYLINDER ADDRESS

For automatic operations requiring cylinder address boundaries, the maximum cylinder address must be set into the Exerciser. Once set, using the following procedure; the address will remain set until the Exerciser is powered down or this procedure is repeated.

### 5.6.1 Procedure

1. Set DIGITAL INFORMATION CONTROL left and right switches to down and CYL ADDR respectively.
2. Set SEEK CONTROL Switch to MAX SET.
3. Set CYLINDER ADDRESS binary numbered switches to the up position corresponding to the desired maximum cylinder address.

Switches values will be summed in DIGITAL DISPLAY. Example: CDC SMD with 823 cylinders (first cylinder is 0):

Step	Switch	Display
1	512 up	512
2	256 up	<u>+ 256</u>
		768
3	32 up	<u>+ 32</u>
		800
4	16 up	<u>+ 16</u>
		816
5	4 up	<u>+ 4</u>
		820
6	2 up	<u>+ 2</u>
		822

4. Observe desired Cylinder Address in DIGITAL DISPLAY.
5. Set SEEK CONTROL Switch to ALT OFF.

## 5.7 SEEK OPERATIONS

Seek action is the operation required to move the heads from the present cylinder address to an address as selected through the panel controls. Seek operations may be performed with or without data action. If combined with data action, then the seek action always precedes the data action. If the operation is performed in the Continuous Action Mode, seeks interleave the data action at each drive cylinder sought.

Depending on the test results desired, seek operation may be performed either manually or automatically under Exerciser control.

### 5.7.1 Procedure — Manual Seek Operation, No Data

Initial Conditions: Drive Selected  
Index/Sector and Volume Selected

1. Set DIGITAL INFORMATION CONTROL left most switch to down and right most switch to CYL ADDR position.
2. Set SEEK CONTROL Switches to ALT OFF, SEEK ON, and SET.
3. Set CYLINDER ADDRESS binary numbered switches to a value other than 0.
4. Verify RESET switch is in OFF position.
5. Press FAULT/CYLINDER REZERO pushbutton and verify CYLINDER ADDRESS LEDs are not lit.
6. Set ACTION switch to CONT Mode. CONT position initiates a seek to the new address set in the binary switches in a continuous RUN Mode.
7. Press START/STOP pushbutton to initiate RUN Mode and observe RUN LED is lit.
8. Observe the CYLINDER ADDRESS LEDs light to indicate the address sought and the address is displayed in DIGITAL DISPLAY.
9. Set CYLINDER ADDRESS binary numbered switches as desired to select new cylinder address and observe value displayed. Switches may be changed as RUN Mode continues.

*Note*

*If an address beyond the drive's capacity is selected, the ON CYLINDER LED will go off and the SEEK ERROR LED will light. In this condition, the SEEK command response is blocked until a REZERO command is sent to the drive. To generate REZERO, press the FAULT|CYLINDER REZERO pushbutton and the RUN Mode will continue. Observe the SEEK ERROR LED will go out and the ON CYLINDER LED will be lit.*

*On some drives (i.e., CDC SMD), the ON CYLINDER LED will remain lit with the SEEK ERROR LED meaning the Exerciser is sending Seek commands which the drive is ignoring.*

### 5.7.2 Procedure — Manual Seek Operation, With Data

If a Manual Seek Operation incorporating Write/Read data is needed, include the following steps prior to performing the Manual Seek Operation, No Data Procedure 5.7.1:

- Disk must be formatted.
- Verify ADDR MARK switch is set to correct position as formatted.
- Set ERRORS switch to either STOP ON ERROR or OVERRIDE as needed for test.
- Set WRITE/READ switches to ON and either WR/RD or WRITE positions.
- Select desired Head Address.

### 5.7.3 Procedure — Automatic Seek Operations

The procedures listed in the following steps will be subdivided into three basic Seek modes. Each of the modes can be modified using the alternate Address mode. The Seek modes are INCrement, DECrement, and RANDOM.

For seek operations in the INC, DEC and RANDOM modes, the maximum cylinder address to be tested in the drive must initially be set into the Exerciser. Set the maximum CYLINDER ADDRESS desired using Procedure 5.6.

**5.7.3.1 Increment.** Seek action in the Increment Mode allows seek action to each cylinder address until the present maximum address is reached. The incrementing addresses can be viewed in the CYLINDER ADDRESS LEDs. When the present maximum address is reached, the next seek action will be to cylinder zero and the incrementing pattern repeated.

To slow the seek action, SEEK DELAY potentiometer may be used. The maximum seek delay is approximately 3.0 seconds.

Further verification of proper seek action may be achieved by repeatedly stopping and restarting RUN (using START/STOP pushbutton) and observing that the incrementing proceeds from the last cylinder seeked on the previous run.

#### **Procedure — Incrementing Seeks**

Initial Conditions: Drive Selected  
Head Address Selected  
Index/Sector and Volume Selected  
Maximum Cylinder Address Set

1. Set SEEK CONTROL switches to either SEEK ON or SEEK DELAY and INC positions.
2. Verify RESET switch is in OFF position.
3. Press FAULT/CYLINDER REZERO pushbutton.
4. Set ACTION switch to CONT position.
5. Press START/STOP pushbutton to initiate RUN Mode and observe RUN LED is lit.
6. Observe CYLINDER ADDRESS LEDs and verify the LEDs show an incrementing value, continue incrementing to maximum cylinder address, return to zero, and continue incrementing.

**5.7.3.2 Decrement.** Seek action in the Decrement Mode allows seek action to each cylinder address starting at the present address and decrementing to zero. The address will then jump to the preset maximum cylinder address after reaching zero. If RESET FAULT/CYLINDER REZERO pushbutton is depressed before RUN is started, the starting address will be the preset maximum cylinder address. Address viewing and verification is the same as for the Incrementing Mode.

#### **Procedure — Decrementing Seeks**

Initial Conditions: Drive Selected  
Head Address Selected  
Index/Sector and Volume Selected  
Maximum Cylinder Address Set

1. Set SEEK CONTROL switches to either SEEK ON or SEEK DELAY and DEC.
2. Verify RESET switch is in OFF position.
3. Press FAULT/CYLINDER REZERO pushbutton.
4. Set ACTION switch to CONT position.

5. Press START/STOP pushbutton to initiate RUN Mode and observe RUN LED is lit.
6. Observe CYLINDER ADDRESS LEDs and verify the LEDs show a decrementing value, continue decrementing to zero, return to the maximum address, and continue decrementing.

**5.7.3.3 Random Seeks.** RANDOM seek action is provided by high speed counting of the cylinder address register between seeks to generate the next seek address. To allow time for the count to be truly random, either Read/Write operations or SEEK DELAY must be selected to provide the necessary delay between seeks. By selecting SEEK DELAY to slow the action, each random address can be seen in the CYLINDER ADDRESS LEDs.

**Procedure — Random Seeks**

Initial Conditions: Drive Selected  
 Head Address Selected  
 Index/Sector and Volume Selected  
 Maximum Cylinder Address Set

*Note*

*RANDOM Seek Mode will not provide truly random addresses when the seek operation is performed with the WRITE/READ switch OFF and SEEK CONTROL switch in other than SEEK DELAY.*

*Caution*

*If a Write/Read operation is selected to provide the delay, the DATA switch cannot be set to RANDOM PASS as this mode is mutually exclusive to RANDOM Seek operations.*

1. Set SEEK CONTROL switches to SEEK DELAY and RANDOM positions.
2. Verify RESET switch is in OFF position.
3. Press FAULT/CYLINDER REZERO pushbutton.
4. Set ACTION switch to CONT position.
5. Press START/STOP pushbutton to initiate RUN Mode. Observe RUN LED is lit.
6. Observe CYLINDER ADDRESS LEDs and verify the LEDs show a random seek pattern between Cylinder 0 and the maximum cylinder address set.

**5.7.3.4 Seeks Using Alternate Address.** The SET Seek Mode combined with the ALT Seek Mode provides alternate seeks between any two fixed cylinder addresses. When the ALT Seek Mode is combined with INC, DEC, or RANDOM seek modes, seek action is as follows:

- In Increment Mode, alternating seek action is from the present address to the alternate address in an incrementing pattern until the present address reaches the maximum cylinder address. At this time the present address is set to zero and the incrementing sequence continues.

- In Decrement Mode, the alternating seek action is the same as Increment Mode except in a decrementing pattern.
- In Random Mode, the alternating seeks are between the alternate address and the random cylinder addresses between the boundaries of Cylinder 0 and the maximum cylinder address.

**Procedure — Alternate Seeks Between Two Set Addresses**

Initial Conditions: Drive Selected  
Index/Sector and Volume Selected

1. Set DIGITAL INFORMATION CONTROL switches to CYL ADDR position.
2. Set SEEK CONTROL to MAX SET position.
3. Set CYLINDER ADDRESS binary numbered switches to the up position corresponding to the desired first cylinder address.
4. Set SEEK CONTROL to ALT position.
5. Set CYLINDER ADDRESS binary numbered switches to value of second cylinder address (alternate).
6. Set SEEK CONTROL to SET and SEEK ON positions.
7. Press START/STOP pushbutton to initiate RUN mode and observe RUN LED is lit.

**Procedure — Alternate Seeks with IND, DEC and RANDOM**

Initial Conditions: Drive Selected  
Head Address Selected  
Index/Sector and Volume Selected

1. Set SEEK CONTROL switch to either SEEK ON or SEEK DELAY.
2. Set SEEK CONTROL switch to either INC, DEC, or RANDOM position.
3. Set maximum cylinder address value into CYLINDER ADDRESS binary switches.
4. Set SEEK CONTROL switch to MAX SET and than to ALT.
5. Set alternate cylinder address value into CYLINDER ADDRESS binary switches.

**Caution**

*Changing the position of the CYLINDER ADDRESS binary switches will change the alternate cylinder address.*

6. Verify RESET switch is in desired REZERO position.
7. Press FAULT/CYLINDER REZERO pushbutton.
8. Set ACTION switch to CONT position.
9. Press START/STOP pushbutton to initiate RUN Mode. Observe RUN LEDs are lit.
10. Observe CYLINDER ADDRESS LEDs and verify the LEDs show the correct incrementing, decrementing, or random seek pattern.

*Note*

*The MAXSET register value as set above becomes the new maximum value and must be again set to the drive maximum if the full range of the drive is to be tested.*

## 5.8 FORMATTING

Formatting is the writing of both the header and the data fields by the Exerciser on a selected track. If the drive and the media are to be completely tested, then all tracks (the combination of all cylinder addresses and all head addresses) must first be formatted. Write or Read action attempted by the tester on any track that has not been formatted by the tester will result in Data and/or Address errors.

*Caution*

*If user data on the disk is to be preserved, then ONLY Seek action can be performed by the Exerciser on those cylinders which must be saved.*

### 5.8.1 Procedure — Format All Tracks

Initial Conditions: Drive Selected  
Maximum Cylinder Address Set  
Maximum Head Address Set

*WARNING*

*Verify that the disk pack, if removable, does not contain user data.*

1. Set HEAD ADDRESS to SEQ HEAD position.
2. Set WRITE/READ switches to ON and FORMAT.
3. Select either CYCLIC or SWITCH DATA data pattern.

*Note*

*Random Pass and Random Cylinder data sequences cannot be used in the FORMAT Mode. If attempted, produces an ILL OP indication.*

4. Set SEEK CONTROL switches to SEEK ON, ALT OFF and INC positions.
5. Set ACTION switch to CONT.
6. Press RESET CYLINDER REZERO pushbutton to reset heads at Cylinder 0.
7. Press ACTION START/STOP switch to initiate RUN Mode. Verify RUN LED is lit.
8. Also verify the WRITE LED is flashing. This indicates the format and data fields are being written.
9. Verify that the HEAD ADDRESS LEDs are flashing in an incrementing sequence.

10. Verify that the CYLINDER ADDRESS LEDs shown an incrementing address.
11. After the cylinder address has incremented through zero, press START/STOP switch to halt RUN Mode.  
The disk is now fully formatted.
12. If a CMD type drive, repeat above steps with VOLUME switch in ON position and with proper Head Addressing selected (paragraph 5.12).

### **5.8.2 Procedure — Format Single Track**

Initial Conditions: Drive Selected

1. Set HEAD ADDRESS switch to SET HEAD position.
2. Set HEAD ADDRESS binary switches to desired Head Address.
3. Set CYLINDER ADDRESS select switches to desired Cylinder Address.
4. Set SEEK CONTROL switches to SEEK ON and SET.
5. Set WRITE/READ switches to ON and FORMAT.
6. Select either CYCLIC or SWITCH DATA data pattern.
7. Press START/STOP switch to initiate RUN Mode.
8. If in CONT, verify WRITE LED is lit.

### **5.8.3 Procedure — Format All Cylinders On Single Disk Surface**

Initial Conditions: Drive Selected  
Maximum Cylinder Address Set

1. Set HEAD ADDRESS switch to SET HEAD position.
2. Set HEAD ADDRESS binary switches to desired Head Address.
3. Set WRITE/READ switches to ON and FORMAT.
4. Select either CYCLIC or SWITCH DATA data pattern.
5. Set SEEK CONTROL switches to SEEK ON and INC.
6. Press RESET CYLINDER REZERO pushbutton.
7. Set ACTION switch to CONT.
8. Press START/STOP switch to initiate RUN Mode.
9. Verify WRITE LED is lit.
10. Verify that the CYLINDER ADDRESS LEDs show an incrementing address.
11. After address has incremented through zero, press START/STOP to halt RUN Mode.

## **5.9 SKIP TRACK**

The SKIP feature allows a known bad track or tracks to be read without flagging either an ADDRESS or a DATA error. The desired track(s) is formatted with the SKIP/ON/OFF switch in the SKIP position. This sets the bad track bit in the header pattern to zero. When the bad track bit is detected during the time the header is read, error flagging is inhibited for the entire track and the SKIP LED will light for the duration of the read revolution.

### 5.9.1 Procedure — SKIP Format Single Track

Initial Conditions: Drive Selected  
Index/Sector and Volume Selected

1. Set HEAD ADDRESS switch to SET position.
2. Set HEAD ADDRESS binary switches to desired head address.
3. Set CYLINDER ADDRESS select switches to desired cylinder address.
4. Set SEEK CONTROL to ON and SET positions.
5. Set WRITE/READ switches to FORMAT and SKIP positions.
6. Select either CYCLIC or SWITCH DATA data pattern.
7. Clear Faults and Errors.
8. Set ACTION switch to SINGLE mode.
9. Press START/STOP pushbutton to initiate RUN Mode. RUN Mode will stop automatically.
10. Verify CYLINDER ADDRESS and HEAD ADDRESS LEDs display the track number to be skipped.

### 5.10 WRITE/READ OPERATIONS

There are three modes of WRITE/READ action as selected by a WRITE/READ control switch. In each mode, the 18 bits of header and all of the data field up to index are bit by bit compared for error after SYNC is found. The modes are:

- READ — This function reads the header and reads the data field.
- WRITE — This function, with the drive formatted, reads the header fields and write the data fields.
- WR/RD — (Write/Read) This function first reads the header and writes the data field, then rereads the header and reads the data field.

For header reading, the Read gate is asserted at a PROM determined byte count (PDBC) and continues until SYNC is found and the 18 bits of header are read. For data field reading, the Read gate is asserted at another PDBC and continues to index. For data field writing, the Write gate is asserted at a PDBC and continues to index.

Write/Read operations can be performed with Seek action and varying data patterns. Seek operations and associated procedures are discussed in paragraph 5.8. The data patterns and their relationship to Write/Read action are described in the following paragraphs.

#### 5.10.1 Data Patterns

One of three data sources may be selected for WRITE/READ in the data field:

1. CYCLIC data is a continuously varying pattern uniquely different for each track.
2. RANDOM data is a 16-bit pattern generated by high speed counting. The pattern generated for writing is retained for read comparison, then altered for the next write cycle. Selectable by Cylinder or by Pass.
3. SWITCH DATA is a 16-bit pattern set by the DATA PATTERN switches and loaded by the LOAD DATA pushbutton.

The RANDOM PASS data pattern provides a unique data pattern for each pass through all cylinders and heads. Each pass consists of first writing the pattern on all tracks until the maximum cylinder address is reached, then reading from all tracks. After the maximum cylinder address is reached again, the data pattern is automatically changed and the next pass is run.

*Note*

*Selection of RANDOM PASS is only legal in INC or DEC modes with WR/RD data action selected.*

*The drive must be rezeroed before starting the RANDOM PASS test.*

The RANDOM CYL (random data pattern by cylinder) selection provides a unique data pattern for each cylinder through all heads. This data pattern is only legal with WRITE/READ data action selected. Any Seek mode or SEEK OFF may be selected.

SWITCH DATA is a user defined data pattern composed by the bank of 16 DATA PATTERN switches which include the eleven CYLINDER ADDRESS switches. The pattern is loaded into the data register by the LOAD DATA pushbutton.

*Caution*

*If the SWITCH DATA pattern is changed between the time of writing and the time of reading, DATA errors will occur.*

The generated RANDOM data pattern, when running in the RANDOM PASS and RANDOM CYL modes, is displayed on the 16 DATA PATTERN LEDs. In the CYCLIC and SWITCH DATA modes, these LEDs are blurred during run. A STOP ON ERROR halt will display the 16-bit word containing the error as it was read from drive. If SWITCH DATA was selected, the loaded word can then be compared with the DATA PATTERN LED display to determine which bit is in error and if the error bit (or bits) were picked up or dropped.

### 5.10.2 Procedure — Write, Read, or Write/Read

Initial Conditions: Drive Selected  
Disk Formatted  
Index/Sector and Volume Selected  
Faults and Errors Cleared

1. Select Seek action using Procedure 5.7.1 or 5.7.2.
2. Select head addressing.
3. Set WRITE/READ switches to ON and desired Write/Read action.
4. Set DATA switch to select data pattern to be used. If SWITCH DATA:
  - Set desired value into DATA PATTERN switches.
  - Press LOAD DATA pushbutton.

*Note*

*RANDOM data patterns are only valid with WR/RD action selected.*

*RANDOM PASS is further restricted to the Increment and Decrement mode of Seek action.*

5. Set DIGITAL INFORMATION CONTROL switches to select measurement to be displayed on DIGITAL DISPLAY.
6. Set ERROR switch to STOP ON ERROR or OVERRIDE.
7. Set ACTION switch to either SINGLE or CONT Mode.
8. Press START/STOP pushbutton to initiate RUN Mode.
9. Observe selected Write/Read operation by monitoring the WRITE/READ indicators.

*Caution*

*Value displayed in the DATA PATTERN LEDs is only valid after a STOP ON ERROR condition. LEDs are not valid after stopping RUN with the STOP pushbutton or with ACTION set to SINGLE.*

### 5.11 STOP ON ERROR RECOVERY PROCEDURE

When operating the SX-530 Exerciser in the STOP ON ERROR Mode, with Write/Read or Read and Seek action selected, the occurrence of an error causes a halt of the RUN Mode to allow operator analysis of the error. Before continuing the RUN Mode to capture further errors, the following procedures must be performed to ensure graceful tester recovery from the captured error. Attempts to restart RUN without performing the procedures will result in the following:

- The remaining heads at the current cylinder address will be skipped and therefore not tested.
- Constant errors will occur at every cylinder tested after RUN is restarted causing repeated STOP ON ERROR conditions (RANDOM CYL and RANDOM PASS data patterns only).

The required recovery procedure following a STOP ON ERROR condition is determined by the data pattern selected in the DATA switch at the time of error:

- CYCLIC or SWITCH DATA
- RANDOM CYL
- RANDOM PASS

#### 5.11.1 CYCLIC/SWITCH DATA Recovery Procedure

To sequence the remaining heads at current cylinder address:

1. Set SEEK CONTROL switch to SEEK OFF.
2. Initiate RUN Mode by pressing START/STOP.

*Note*

*The heads are now sequenced and the next head with an error will cause a STOP ON ERROR condition. If the error captured previously was a hard error, the same error may occur again on the same head.*

3. Stop RUN Mode by pressing START/STOP.

Continue testing on remaining cylinders as follows:

1. Set SEEK CONTROL to SEEK ON.
2. Initiate RUN Mode by pressing START/STOP.

### 5.11.2 RANDOM CYL Recovery Procedure

To sequence the remaining heads at the current cylinder address:

1. Set WRITE/READ switch to READ.
2. Set DATA switch to SWITCH DATA.
3. Set SEEK CONTROL to SEEK OFF.
4. Initiate RUN Mode by pressing START/STOP.

*Note*

*The heads are now sequenced and the next head with an error will cause a STOP ON ERROR condition. If the error captured previously was a hard error, the same error may occur again on the same head.*

5. Stop RUN Mode by pressing START/STOP.

Continue testing on remaining cylinders as follows:

1. Set ERRORS switch to OVERRIDE.
2. Initiate and then stop RUN Mode by pressing START/STOP pushbutton twice.
3. Set WRITE/READ switch to WR/RD.
4. Set DATA switch to RANDOM CYL.
5. Set SEEK CONTROL switch to SEEK ON.
6. Set ERRORS switch to STOP ON ERROR.
7. Initiate RUN Mode by pressing START/STOP.

### 5.11.3 RANDOM PASS Recovery Procedure

To sequence the remaining heads at the current cylinder address:

1. Set WRITE/READ switch to READ.
2. Set DATA switch to SWITCH DATA.
3. Set SEEK CONTROL to SEEK OFF.
4. Initiate RUN Mode by pressing START/STOP.

*Note*

*The heads are now sequenced and the next head with an error will cause a STOP ON ERROR condition. If the error captured previously was a hard error, the same error may occur again on the same head.*

5. Stop RUN Mode by pressing START/STOP.

Continue testing on remaining cylinders as follows:

1. Set ERRORS switch to OVERRIDE.
2. Initiate and then stop RUN Mode by pressing START/STOP pushbutton twice.
3. Set SEEK CONTROL switch to SEEK ON.
4. Set ERRORS switch to STOP ON ERROR.
5. Initiate RUN Mode by pressing START/STOP.

*Note*

*Continue operations until the current pass is completed for the entire disk surface.*

6. Stop RUN Mode by pressing START/STOP.
7. Momentarily press CYLINDER REZERO pushbutton.
8. Set DATA switch to RANDOM PASS.
9. Set WRITE/READ switch to WR/RD.
10. Initiate RUN Mode by pressing START/STOP to continue testing with new pattern.

## **5.12 HEAD SELECTION—CMD DRIVE**

If the drive to be tested is a CDC CMD type drive containing both fixed and removable disk modules, the settings of the Exerciser HEAD ADDRESS switches to correspond to disk surfaces are as shown in Figure 5-1. The setting of the VOLUME switch is as follows:

- Fixed disk — VOLUME (1) ON and HEAD ADDRESS 16 LED lit.
- Removable disk — VOLUME (0) OFF and HEAD ADDRESS 16 LED off.

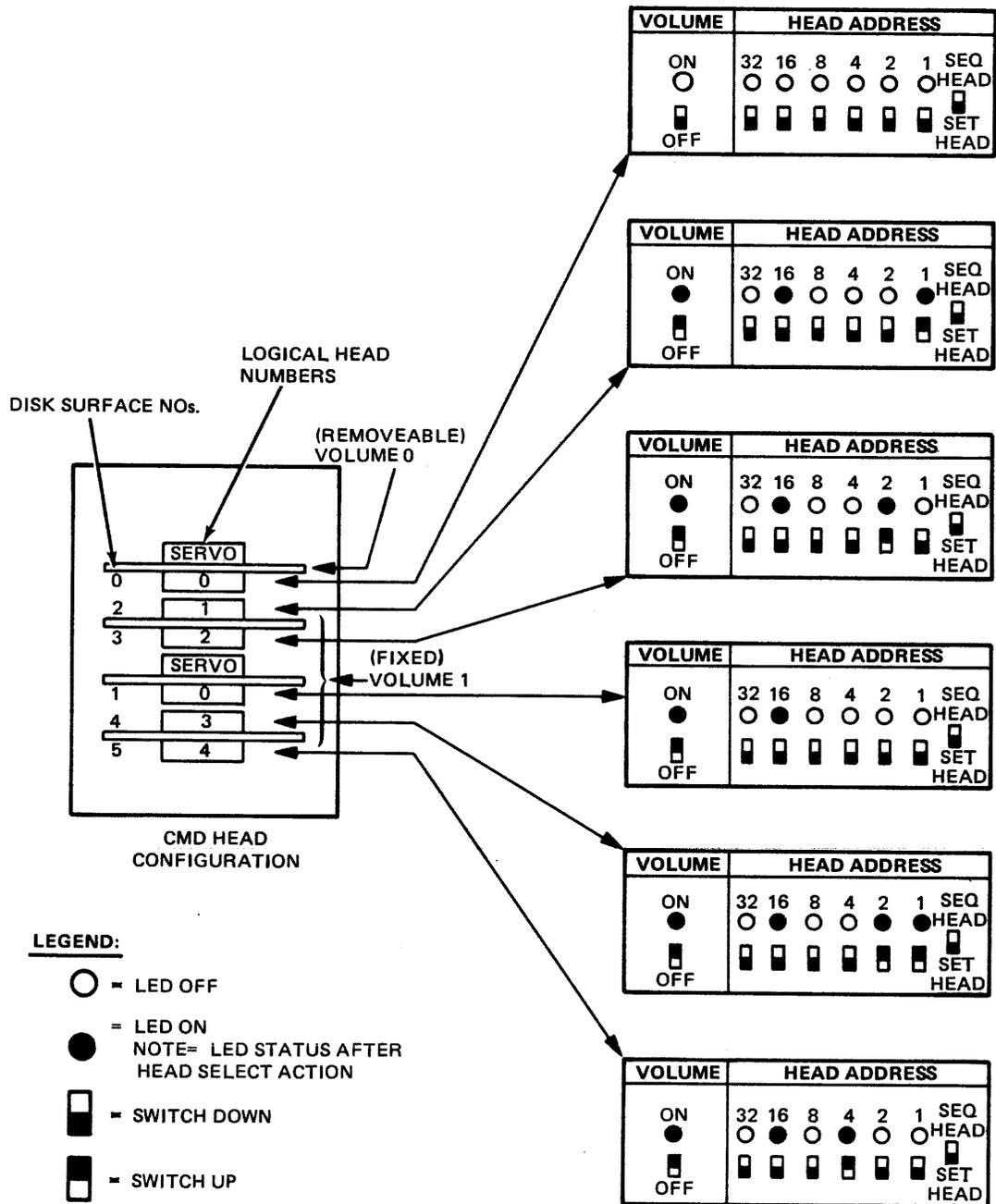


Figure 5-1. Head Selection for CDC CMD Drive

## SECTION 6

### SELECTED OPERATIONS

#### 6.1 GENERAL

This section contains a variety of suggested procedures for testing special operations of a disk drive. As can be seen, the procedures incorporate many operating sequences from the General Operating Procedures Section.

These procedures are presented here to assist you in devising a testing program. Use of the procedures and the order of their use is at the discretion of the user. Additional variations should be devised to meet special needs.

All procedures in the following paragraphs assume the control panel is configured per Table 5-1, Static Control Panel. The "Initial Conditions" listed specify those drive and Exerciser conditions that must be met prior to initiating the steps that follow.

The procedures contained in this section are presented in the order listed below:

<i>Procedure</i>	<i>Paragraph</i>
Disk Surface Test – Removable	6.2
Disk Surface Test – Fixed	6.3
Read Error Rate Test/Verification	6.4
Seek Time Reading	6.5
Seek Error Rate Test	6.6
Locate All Bad Tracks	6.7
Find/Verify Number of Bad Tracks	6.8
Operating SX-530 with Alignment Disk Packs	6.9
Offset Margin and Strobe Timing Test	6.10

#### 6.2 DISK SURFACE TEST – REMOVABLE

The following procedure tests the entire disk media as a whole for bad areas by writing all heads and cylinders with a set "worst case" data pattern and then reading sequentially through all heads and cylinders checking for the bad spots. This procedure is useful for media verification.

##### 6.2.1 Procedure

Initial Conditions: Drive Selected and Ready  
Index/Sector Selected  
Disk Formatted  
All Fault and Error Conditions Cleared

1. Set VOLUME switch to correspond to disk type.
2. Set HEAD ADDRESS binary switches to correspond to number of usable disk surfaces.
3. Set HEAD ADDRESS switch to SEQ HEAD.
4. Set maximum cylinder address (paragraph 5.6.1).
5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions.

6. Set WRITE/READ switches to WRITE and ON positions.
7. Set DATA switch to CYCLIC position.
8. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector count, Byte Count, Pass Count, Seek Time and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

9. Set ERRORS switch to STOP ON ERROR position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
10. Momentarily press REZERO pushbutton.
11. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
12. Observe RUN LED is lit. When DIGITAL DISPLAY reads 1, press START/STOP to halt RUN Mode. A single pass of the disk surface has been completed.
13. Set DIGITAL INFORMATION CONTROL switches to BYTE COUNT position.
14. Set WRITE/READ switch to READ position.
15. Press CLEAR ERRORS & DISPLAY pushbutton.
16. Momentarily press CYLINDER REZERO pushbutton.
17. Press START/STOP switch to initiate RUN Mode.
18. Observe RUN LED is lit.

If an error occurs, the RUN LED will go out and the ERROR LED corresponding to where the error was found will be lit. At this time, record the content of the DIGITAL DISPLAY (Byte Count) and the values displayed in both the HEAD ADDRESS and CYLINDER ADDRESS LEDs. This information describes the location of errors on the disk pack.

*Caution*

*Perform STOP ON ERROR Recovery Procedure 5.11 to ensure graceful Exerciser recovery following an error condition with STOP ON ERROR on.*

Press START/STOP to continue sequential reads.

*Note*

*If no errors occur, RUN action will continue through all disk media continuously. Action can be manually stopped at any time at user discretion. A full pass is completed when the CYLINDER ADDRESS LEDs indicate zero.*

### 6.3 DISK SURFACE TEST – FIXED

The following procedure tests fixed disk surfaces for bad spots. The user can characterize his disk for errors as the errors will tend to be grouped at the same place on a single surface. Testing of the disk is accomplished by writing on all tracks on one surface with a set “worst case” data pattern and then sequentially reading through all tracks on that surface repetitively recording the errors (bad spots). All surfaces are similarly checked individually. This differs from the Disk Surface Test Removable Media (paragraph 6.2) in that the testing is surface oriented due to the nature of the information required.

*Caution*

*Care must be taken not to write on tracks containing user data to be saved.*

#### 6.3.1 Procedure

Initial Conditions: Drive Selected and Ready  
Disk Formatted  
All Fault and Error Conditions Cleared

1. Set VOLUME switch to correspond to disk type.
2. Set HEAD ADDRESS binary switches to correspond to disk surface to be tested.
3. Set HEAD ADDRESS switch to SET HEAD position.
4. Set maximum cylinder address (paragraph 5.6.1).
5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions.
6. Set WRITE/READ switches to WRITE and ON positions.
7. Set DATA switch to CYCLIC position.
8. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector Count, Byte Count, Pass Count, Seek Time and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

9. Set ERRORS switch to STOP ON ERROR position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
10. Momentarily press CYLINDER REZERO pushbutton.
11. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
12. Observe RUN LED is lit. When DIGITAL DISPLAY reads one, press START/STOP to halt RUN Mode.
13. Set DIGITAL INFORMATION CONTROL switches to BYTE COUNT position.

14. Set WRITE/READ switch to READ position.
15. Press CLEAR ERRORS & DISPLAY pushbutton.
16. Momentarily press CYLINDER REZERO pushbutton.
17. Press START/STOP switch to initiate RUN Mode.
18. Observe RUN and READ LEDs are lit.

If an error occurs, the RUN LED will go out and the ERROR LED corresponding to where the error was found will be lit. At this time, record the content of the DIGITAL DISPLAY (Byte Count) and the values displayed in both the HEAD ADDRESS and CYLINDER ADDRESS LEDs. The Byte count provides an indication of the physical location of "bad spots."

*Caution*

*Perform STOP ON ERROR Recovery Procedure 5.11 to ensure graceful Exerciser recovery following an error condition with STOP ON ERROR on.*

Press START/STOP to continue sequential reads.

*Note*

*If no errors occur, RUN action will continue through all disk media continuously. Action can be manually stopped at any time at user discretion. A full pass is completed when the CYLINDER ADDRESS LEDs indicate zero.*

19. Set HEAD ADDRESS binary switches to correspond to next disk surface to be tested.
20. Return to Step 8 and repeat all subsequent steps until all disk surfaces have been tested.

## 6.4 RELIABILITY (BURN-IN) TEST

Attempting reliability testing of read error rates in the current technology of disk drives can be a long term test, since the specified error rates are very low. The test is performed by writing all disk heads and tracks with a set data pattern and then reading sequentially through all heads and tracks continuously until a STOP ON ERROR condition occurs. At this time, using the Pass Count, the bits since last error can be calculated.

### 6.4.1 Procedure

Initial Conditions: Drive Selected and Ready  
 Disk Formatted  
 All Faults and Error Conditions Cleared

1. Set HEAD ADDRESS binary switches to correspond to number of usable disk surfaces.
2. Set HEAD ADDRESS switch to SEQ HEAD.
3. Set SEEK CONTROL switch to MAX SET.
4. Set maximum cylinder address (paragraph 5.6.1).

5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions.
6. Set WRITE/READ switches to WRITE and ON positions.
7. Set DATA switch to CYCLIC position.
8. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector Count, Byte Count, Pass Count, Seek Time and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

9. Set ERRORS switch to STOP ON ERROR position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
10. Momentarily press CYLINDER REZERO pushbutton.
11. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
12. Observe RUN LED is lit. Momentarily set DIGITAL INFORMATION CONTROL switch to BYTE CNT position and record the Byte Count reading for a complete track for the drive as displayed in the DIGITAL DISPLAY.
13. When DIGITAL DISPLAY reads 1, press START/STOP to halt RUN Mode.
14. Set WRITE/READ switch to READ position.
15. Press CLEAR ERRORS & DISPLAY pushbutton.
16. Momentarily press CYLINDER REZERO pushbutton.
17. Press START/STOP switch to initiate RUN Mode.
18. Observe RUN LED is lit.

At the first occurrence of a DATA error, the Exerciser will halt (RUN LED not lit). Record the content of the DIGITAL DISPLAY (Pass Count) and the values displayed in the HEAD ADDRESS and CYLINDER ADDRESS LEDs.

Calculate the Read Error Rate as follows:

$$\begin{aligned}
 & [(Cylinders \text{ per Drive} \times Heads \text{ per Drive} \times Pass \text{ Count}) \\
 + & (Current \text{ Cylinder Address} \times Heads \text{ per Drive} + Current \text{ Head Address})] \\
 \times & (Byte \text{ Count}^* \times 8) \\
 = & \text{Total number of bits transferred until a single error has occurred}
 \end{aligned}$$

## 6.5 SEEK TIME READING

Obtaining an accurate reading of the maximum, minimum, and average Seek times between cylinders is important when performing Velocity Gain Analysis and Adjustments and when verifying drive manufacturer's access time specification. Refer to the drive manufacturer's manual for all recommended times.

\*Note that the Byte Count is the value recorded in Step 12 above.

### 6.5.1 Procedure — Maximum Access Seek Time

Initial Conditions: Drive Selected  
Disk Formatted  
Index/Sector and Volume Selected

1. Set all HEAD ADDRESS binary switches to down and SEQ HEAD/SET HEAD switch to SET HEAD position.
2. Set DIGITAL INFORMATION CONTROL switches to CYL ADDR position.
3. Set CYLINDER ADDRESS binary numbered switches 1 through 1024 to the up position to enter the desired maximum address. Enter largest numbers first.
4. Set SEEK CONTROL switch to MAX SET.
5. Set SEEK CONTROL switches to SEEK DELAY, SET and ALT OFF positions.
6. Set DIGITAL INFORMATION CONTROL switch to SEEK TIME position.
7. Set ERRORS switch to OVERRIDE and press CLEAR ERRORS & DISPLAYS pushbutton.
8. Set WRITE/READ switches to ON and either WR/RD or WRITE positions.
9. Set DATA switch to CYCLIC position.
10. Press CYLINDER REZERO pushbutton and verify CYLINDER ADDRESS LEDs are not lit.
11. Set ACTION switch to SINGLE and press START/STOP pushbutton.
12. Observe drive Seek Time in milliseconds and tenths in DIGITAL DISPLAY.

### 6.5.2 Procedure — Minimum Access Seek Time

Use the procedure for Maximum Access Time changing the following step:

3. Set CYLINDER ADDRESS binary numbered switch 1 to the up position; all others down.

### 6.5.3 Procedure — Average Access Seek time

Use the procedure for Maximum Access Time changing the following step:

3. Set the CYLINDER ADDRESS binary numbered switches 1 through 1024 to the up position to correspond to the average (one half of maximum) cylinder address of drive under test.

**Note**

*The MAXSET register value as set above (in 6.5.1–6.5.3) becomes the new maximum value and must be again set to the drive maximum if the full range of the drive is to be tested.*

## 6.6 SEEK ERROR RATE TEST

Seek errors occur when either the drive is unable to settle on a desired cylinder (drive detected seek error) or the cylinder reached is an incorrect cylinder (undetected by the drive). The Exerciser detects both error conditions.

This test is performed by initiating continuous seek actions in either the Increment, Decrement, or Random (worst case) Modes until a Seek Error or Address Error is detected. At this time, the number of seeks since last error can be calculated.

### 6.6.1 Procedure

Initial Conditions: Drive Selected and Ready  
Disk Formatted  
Faults and Error Conditions Cleared

1. Set HEAD ADDRESS binary switches to zero.
2. Set HEAD ADDRESS switch to SET HEAD.
3. Set SEEK CONTROL switch to MAX SET.
4. Set CYLINDER ADDRESS binary switches to correspond to total number of usable cylinders on disk.
5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions. DEC and RANDOM Modes may also be used for this test.

*Note*

*In RANDOM position, either SEEK CONTROL must be in SEEK DELAY or WRITE/READ switch must be in ON.*

6. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector Count, Byte Count, Pass Count, Seek Time and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

7. Set WRITE/READ switches to WRITE and ON.
8. Set DATA switch to CYCLIC.
9. Set ERRORS switch to STOP ON ERROR position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
10. Momentarily press CYLINDER REZERO pushbutton.
11. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
12. Observe RUN LED is lit.

At the first occurrence of either a SEEK ERROR or an ADDRESS error, the Exerciser will halt. Record the content of the DIGITAL DISPLAY (Pass Count) and the values displayed in the CYLINDER ADDRESS LEDs.

Calculate the Seek Error Rate as follows (INC or DEC Seek Action):

$$\begin{aligned} & \text{(Cylinders per Drive} \times \text{Pass Count)} \\ + & \text{(Current Cylinder Address)} \\ = & \text{Total number of seeks since a single error occurred.} \end{aligned}$$

*Note*

*If RANDOM Seek Action was selected, the total number of seeks is equal to the Pass Count. In the RANDOM Seek Mode, the Pass Count value will quickly reach the maximum count (99,999). Therefore the actual total count may be many multiples of this maximum value.*

## 6.7 LOCATE ALL BAD TRACKS

The following procedure locates the bad tracks on a disk pack and allows the operator to record the bad track locations and the total for later verification.

Each bad track will cause a read data error when operating the SX-530 in the sequential Seek/Read data mode causing Exerciser action to hold at, and indicate, the bad track. After recording the track identification, the Exerciser seek/read action can be continued from the current track. This halt/record/continue procedure can be used to isolate all bad tracks on a disk pack.

### 6.7.1 Procedure

Initial Conditions: Drive Selected and Ready  
Disk Formatted  
All Faults and Error Conditions Cleared

1. Set HEAD ADDRESS binary switches to correspond to number of usable disk surfaces.
2. Set HEAD ADDRESS switch to SEQ HEAD.
3. Set SEEK CONTROL switch to MAX SET.
4. Set CYLINDER ADDRESS binary switches to correspond to number of usable cylinders on disk.
5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions.
6. Set WRITE/READ switches to WRITE and ON positions.

*Note*

*Steps 7, 8 and 9 may be replaced by setting the DATA switch to the CYCLIC position.*

7. Set DATA switch to SWITCH DATA position.
8. Set DATA PATTERN switches to "worst case" data pattern for drive.
9. Press LOAD DATA pushbutton.
10. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector Count, Byte Count, Pass Count, Seek Time, and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

11. Set ERRORS switch to STOP ON ERROR position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
12. Momentarily press CYLINDER REZERO pushbutton.
13. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
14. Observe RUN LED is lit. When DIGITAL DISPLAY reads 1, press START/STOP to halt RUN Mode.
15. Set WRITE/READ switch to READ position.
16. Set DIGITAL INFORMATION CONTROL switches to CYL ADDR position.
17. Press CLEAR ERRORS & DISPLAY pushbutton.
18. Momentarily press CYLINDER REZERO pushbutton.
19. Press START/STOP switch to initiate RUN Mode.
20. Observe RUN LED is lit.

If an error occurs, the RUN LED will go out and the ERROR LED corresponding to the error will be lit. At this time, record the content of the DIGITAL DISPLAY (Cylinder Address) and the value displayed in the HEAD ADDRESS LEDs. This information defines the bad track position.

*Caution*

*Perform STOP ON ERROR Recovery Procedure 5.11 to ensure graceful Exerciser recovery following an error condition with STOP ON ERROR on.*

Repeat Steps 19 and 20 until all tracks have been tested.

*Note*

*At this point you may desire to verify the number of bad tracks found in the preceding steps. To do so, perform Steps 16 through 19, Procedure 6.8.*

*Note*

*If no errors occur, RUN action will continue through all disk media continuously. Action can be manually stopped at any time at user discretion. A full pass is completed when the CYLINDER ADDRESS LEDs indicate zero.*

## **6.8 FIND/VERIFY TOTAL NUMBER OF BAD TRACKS**

The following procedure finds or verifies the total number of bad tracks on a disk pack. Procedure 6.7 can be used to determine the actual location of each bad track.

Verification is accomplished by performing one Read pass over the entire disk pack with the STOP ON ERROR feature disabled. The DIGITAL DISPLAY ERR RCNT function indicates the total number of revolution (tracks) which contain at least one error (bad track).

### 6.8.1 Procedure

Initial Conditions: Drive Selected and Ready  
Disk Formatted  
All Faults and Error Conditions Cleared

1. Set HEAD ADDRESS binary switches to correspond to number of usable disk surfaces.
2. Set HEAD ADDRESS switch to SEQ HEAD.
3. Set SEEK CONTROL switch to MAX SET.
4. Set CYLINDER ADDRESS binary switches to correspond to number of usable cylinders on disk.
5. Set SEEK CONTROL switches to ALT OFF, SEEK ON and INC positions.
6. Set WRITE/READ switches to WRITE and ON positions.

*Note*

*Steps 7, 8 and 9 may be replaced by setting the DATA switch to the CYCLIC position.*

7. Set DATA switch to SWITCH DATA position.
8. Set DATA PATTERN switches to "worst case" data pattern for drive.
9. Press LOAD DATA pushbutton.
10. Set DIGITAL INFORMATION CONTROL switches to PASS COUNT position.

*Caution*

*Sector Count, Byte Count, Pass Count, Seek Time, and Error Revolution Count are Exerciser stored values which are zeroed out when the selector switch is repositioned to read another source of data.*

11. Set ERRORS switch to OVERRIDE position and clear errors (if any) by pressing CLEAR ERRORS & DISPLAY pushbutton.
12. Momentarily press CYLINDER REZERO pushbutton.
13. Set ACTION switch to CONT and press START/STOP pushbutton to initiate RUN Mode.
14. Observe RUN LED is lit. When DIGITAL DISPLAY reads 1, press START/STOP to halt RUN Mode.
15. Set WRITE/READ switch to READ position.
16. Set DIGITAL INFORMATION CONTROL switches to ERR RCNT position.
17. Momentarily press CYLINDER REZERO pushbutton.

18. Press START/STOP to initiate RUN Mode.
19. Observe RUN LED is lit.

When one full pass is completed (CYLINDER ADDRESS LEDs returned to zero value) and FAULT or SEEK ERROR LEDs are not lit, the contents of the DIGITAL DISPLAY is equal to the number of bad tracks identified. Verify that this value matches the number identified in Procedure 6.7.

## 6.9 OPERATING SX-530 WITH ALIGNMENT DISK PACKS

Using the SX-530 Exerciser with disk drives in which an alignment (CE) disk pack is installed requires special operating procedures. This results from the alignment disk pack not providing the normal index pulses to the Exerciser.

### *Caution*

*On Disk Drive Control Panel, set WRITE PROTECT switch to ON to inhibit writing on alignment pack.*

### 6.9.1 Procedure — Initial Setup

1. Set DRIVE SELECT DRIVE NUMBER switches per attached drive and SELECT position.
2. Set INDEX/SECTOR switch per attached drive.
3. Set ADDR MARK switch to OFF.
4. Set RESET switch to OFF.
5. Set WRITE/READ switch to ON and READ.
6. Set OFFSET switch to ZERO.
7. Set STROBE switch to NORM.
8. Set DIGITAL INFORMATION CONTROL switches to CYL ADDR.
9. Set ERRORS switch to OVERRIDE.
10. Set VOLUME switch per attached drive.
11. Set SEEK CONTROL switches to ALT OFF, SEEK OFF and SET positions.
12. Set ACTION switch to SINGLE and press START/STOP pushbutton to initiate RUN Mode.

In this operating mode, observe the following:

- Cylinder Rezero can be performed using the CYLINDER REZERO pushbutton while RUN is ON and SEEK CONTROL is OFF.
- ERRORS indicators should be ignored.
- FAULT or SEEK ERROR conditions must be cleared using the RESET switch.

After performing the initial setup, specific alignment tracks may be selected (seeked) by setting the following switches:

1. CYLINDER ADDRESS binary switches to desired alignment cylinder.
2. HEAD ADDRESS binary switches to desired alignment head.
3. SEEK CONTROL switch to SEEK ON. Seek action will be performed at each RUN Mode when the START/STOP switch is activated.
4. Observe the current cylinder address is displayed in DIGITAL DISPLAY.
5. Reposition CYLINDER ADDRESS and HEAD ADDRESS binary switches as desired to select other alignment track(s).
6. Observe that the selected cylinder address is displayed in DIGITAL DISPLAY and the selected head address is displayed in HEAD ADDRESS LEDs.
7. RUN mode may be stopped after desired cylinder is reached in order to provide "clean" head alignment signals.

#### **6.10 OFFSET MARGIN AND STROBE TIMING TEST**

STROBE EARLY and STROBE LATE operation of the SX-530 will margin test the drive media, heads and read amplifier. If errors do not occur on EARLY or LATE operation, then good operating margin is assumed at NORMAL strobe.

The STROBE switch controls the timing position of the data strobe generated within the data separator logic of the drive. Timing relationship between early, normal and late strobos is dependent on the drive type in test.

Selection of STROBE EARLY/NORMAL/LATE switch positions can be made without regard to other tester mode configurations as the Early and Late command to the drive are only applied by the tester when the WRITE/READ switch is ON and READ action is necessary.

Reading with an OFFSET PLUS or MINUS tests the precision of the cylinder alignment. If errors do not occur when an OFFSET is applied, then operating margins can be judged acceptable.

The OFFSET switch controls the position of the drive servo actuator in relation to the nominal "on cylinder" position. The actual offset distances are determined by the drive type in test.

OFFSET switch must be in ZERO position for all WRITE/READ modes except READ since writing with OFFSET may force FAULT status. OFFSET may be combined with any Seek mode and HEAD ADDRESS mode.

The combination of STROBE EARLY or LATE and OFFSET PLUS or MINUS together apply worst case testing of the drive.

## Return Material to Factory

In the event that your Wilson Labs equipment should require repair, service, refurbishment, or factory modification, the standard Return Material Procedure must be followed as defined below:

- Telephone the factory and request a Return Material Authorization (RMA) number for your equipment:
  - WILSON LABS Telephone Number: (714) 998-1980
- At the time of RMA number assignment, you will be required to furnish:
  - Model and Serial number of equipment
  - Purchase Order number for all Out-of-Warranty returns
  - Customer contact name and telephone number
  - Brief description of reason for return request
- A complete, detailed, written description of the problem, failure, or reason for return *must* be placed in the tester.
- Pack the equipment in a suitable, heavy duty carton ensuring that sufficient packing material surrounds the equipment to prevent damage.
- Ship “best way” to the factory at:

WILSON LABORATORIES  
Return Material Department  
2237 N. Batavia Street  
Orange, CA 92665
- Reference the assigned RMA number on all shippers and documents.

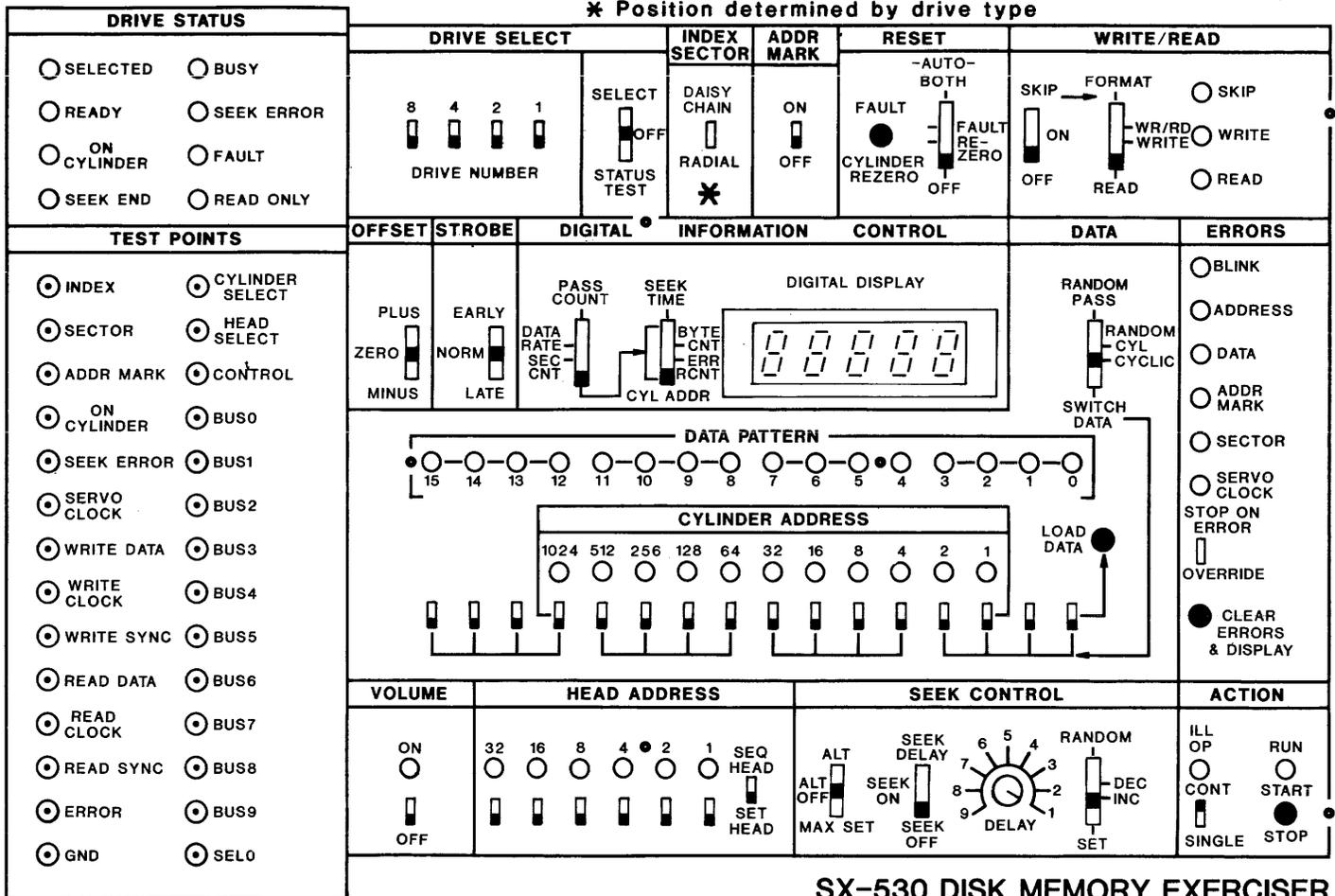
Wilson Labs provides fast and efficient handling of all returned material and will “turn-around” the equipment in an expeditious period.

## **WARRANTY**

**WILSON LABORATORIES** warrants articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service. **WILSON LABS'** obligation under this warranty is limited to making good at its factory any article of equipment which shall within 90 days after delivery of such article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective. This warranty is in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and **WILSON LABORATORIES** neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any article of equipment which shall have been repaired or altered outside the **WILSON LABORATORIES** factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or not in accord with instructions furnished by the manufacturer.

\* Position determined by drive type



## SX-530 DISK MEMORY EXERCISER

### SELECT DRIVE PROCEDURE

1. Set SELECT/OFF/STATUS TEST Switch to STATUS TEST position.
2. Verify that the eight DRIVE STATUS LEDs light and remain lit until the SELECT/OFF/STATUS TEST Switch is moved to the OFF position.
3. Set appropriate DRIVE NUMBER Switches 8,4,2, and 1 to the up position to correspond to the disk drive to be selected. Set the remaining switches to the down position. DRIVE NUMBER Switches represent digital values which added together produce the desired drive number. Example: Drive to be selected is 11. Set Switches 8,2, and 1 up; 4 down.
4. Set SELECT/OFF/STATUS TEST Switch to SELECT position. This sends a Drive Select signal to the disk drive. Moving the switch back to OFF will de-select the disk drive. While switch is in the SELECT position, changing the value represented by the DRIVE NUMBER Switches has no effect.
5. Verify the DRIVE STATUS LEDs; SELECTED, READY, ON CYLINDER, and SEEK END are lit.

### SELECT INDEX SECTOR

Most drives supply the Index and Sector signals in the daisy chain cable, while some drives provide the signals in the radial cable. Refer to your drive manufacturer's manual to determine which cable supplies the signals. The Exerciser will not function correctly if the index signal is not received. A quick check of proper switch setting is provided in the following procedure.

### PROCEDURE

NOTE: Drive must be SELECTED

1. Set DAISY CHAIN/RADIAL Switch to DAISY CHAIN, press and hold the CLEAR ERRORS & DISPLAYS pushbutton.
2. If ILL OP light is flashing rapidly, the DAISY CHAIN/RADIAL Switch is in the proper position and an Index pulse is being received.
3. Release CLEAR ERRORS & DISPLAYS pushbutton.
4. If the Index signal was not in the daisy chain cable, set DAISY CHAIN/RADIAL Switch to the RADIAL position, and press and hold the CLEAR ERRORS & DISPLAYS pushbutton.
5. The ILL OP light will flash rapidly on and off if the signal is present. If no flashing occurs, a drive connect or select problem exists.
6. Release CLEAR ERRORS & DISPLAYS pushbutton.

### SET MAXIMUM CYLINDER ADDRESS

For automatic operations requiring cylinder address boundaries, the maximum cylinder address must be set into the Exerciser. Once set, using the following procedure, the address will remain set until the Exerciser is powered down or this procedure is repeated.

### PROCEDURE

1. Set DIGITAL INFORMATION CONTROL left and right switches to down and CYL ADDR respectively.
2. Set SEEK CONTROL Switch to MAX SET.
3. Set CYLINDER ADDRESS binary numbered switches to the up position corresponding to the desired maximum cylinder address.
4. Observe desired Cylinder Address in DIGITAL DISPLAY.
5. Set SEEK CONTROL Switch to ALT OFF.

### SEEK OPERATIONS

Seek operations may be performed with or without data action. Depending on the test results desired, seek operation may be performed either manually or automatically under Exerciser control.

### PROCEDURE-MANUAL SEEK OPERATION

Initial Conditions: Drive Selected  
Index/Sector and Volume Selected

1. Set DIGITAL INFORMATION CONTROL left most switch to down and right most switch to CYL ADDR position.
2. Set SEEK CONTROL Switches to ALT OFF, SEEK ON, and SET.
3. Set CYLINDER ADDRESS binary numbered switches to a value other than 0.
4. Verify RESET switch is in OFF position.
5. Press FAULT/CYLINDER REZERO pushbutton and verify CYLINDER ADDRESS LEDs are not lit.
6. Set ACTION switch to CONT Mode. CONT position initiates a seek to the new address set in the binary switches in a continuous RUN Mode.
7. Press START/STOP pushbutton to initiate RUN Mode and observe RUN LED is lit.
8. Observe the CYLINDER ADDRESS LEDs light to indicate the address sought and the address is displayed in DIGITAL DISPLAY.
9. Set CYLINDER ADDRESS binary numbered switches as desired to select new cylinder address and observe value displayed. Switches may be changed as RUN Mode continues.

### PROCEDURE-AUTOMATIC SEEK OPERATIONS

The Seek modes are INCRement, DECRement, and RANDOM. To slow the seek action, SEEK DELAY potentiometer may be used. The maximum seek delay is approximately 3.0 seconds.

### PROCEDURE-INCREMENTING SEEKS

Initial Conditions: Drive Selected  
Head Address Selected  
Index/Sector and Volume Selected  
Maximum Cylinder Address Set

1. Set SEEK CONTROL switches to either SEEK ON or SEEK DELAY and INC positions.
2. Verify RESET switch is in OFF position.
3. Press FAULT/CYLINDER REZERO pushbutton.
4. Set ACTION switch to CONT position.
5. Press START/STOP pushbutton to initiate RUN Mode and observe RUN LED is lit.
6. Observe CYLINDER ADDRESS LEDs and verify the LEDs show an incrementing value, continue incrementing to maximum cylinder address, return to zero, and continue incrementing.

**PROCEDURE-RANDOM SEEKS**

Initial Conditions: Drive Selected  
 Head Address Selected  
 Index/Sector and Volume Selected  
 Maximum Cylinder Address Set

**NOTE**

Random Seek Mode will not provide truly random addresses when the seek operation is performed with the WRITE/READ switch OFF and SEEK CONTROL switch in other than SEEK DELAY.

**CAUTION**

If a WRITE/READ operation is selected to provide the delay, the DATA switch cannot be set to RANDOM PASS as this mode is mutually exclusive to RANDOM Seek operations.

1. Set SEEK CONTROL switches to SEEK DELAY and RANDOM positions.
2. Verify RESET switch is in OFF position.
3. Press FAULT/CYLINDER REZERO pushbutton.
4. Set ACTION switch to CONT position.
5. Press START/STOP pushbutton to initiate RUN Mode. Observe RUN LED is lit.
6. Observe CYLINDER ADDRESS LEDs and verify the LEDs show a random seek pattern between Cylinder 0 and the maximum cylinder address set.

**PRECEDURE-ALTERNATE SEEKS BETWEEN TWO SET ADDRESSES**

Initial Conditions: Drive Selected  
 Index/Sector and Volume Selected

1. Set DIGITAL INFORMATION CONTROL switches to CYL ADDR position.
2. Set SEEK CONTROL to MAX SET position.
3. Set CYLINDER ADDRESS binary numbered switches to the up position corresponding to the desired first cylinder address.
4. Set SEEK CONTROL to ALT position.
5. Set CYLINDER ADDRESS binary numbered switches to value of second cylinder address (alternate).
6. Set SEEK CONTROL to SET and SEEK ON positions.
7. Press START/STOP pushbutton to initiate RUN mode and observe RUN LED is lit.

**FORMATTING**

Formatting is the writing of both the header and the data fields by the Exerciser on a track.

**PROCEDURE-FORMAT ALL TRACKS**

Initial Conditions: Drive Selected  
 Maximum Cylinder Address Set  
 Maximum Head Address Set

**WARNING**

Verify that the disk pack, if removable, does not contain user data.

1. Set Maximum HEAD ADDRESS.
2. Set HEAD ADDRESS to SEQ HEAD position.
3. Set WRITE/READ switches to ON and FORMAT.
4. Select either CYCLIC or SWITCH DATA data pattern.

**NOTE**

Random Pass and Random Cylinder data sequences cannot be used in the FORMAT Mode. If attempted, produces an ILL OP indication.

5. Set SEEK CONTROL switches to SEEK ON, ALT OFF and INC positions.
6. Set ACTION switch to ON.
7. Press RESET CYLINDER REZERO pushbutton to reset heads at Cylinder 0.
8. Press ACTION START/STOP switch to initiate RUN Mode. Verify RUN LED is lit.
9. Also verify the WRITE LED is flashing. This indicates the format and fields are being written.
10. Verify that the HEAD ADDRESS LEDs are flashing in an incrementing sequence.
11. Verify that the CYLINDER ADDRESS LEDs show an incrementing address.
12. After the cylinder address has incremented through zero, press START/STOP switch to halt RUN Mode.

The disk is now fully formatted.

**PROCEDURE-FORMAT SINGLE TRACK**

Initial Conditions: Drive Selected

1. Set HEAD ADDRESS switch to SET HEAD position.
2. Set HEAD ADDRESS binary switches to desired Head Address.
3. Set CYLINDER ADDRESS select switches to desired Cylinder Address.
4. Set SEEK CONTROL switches to SEEK ON and SET.
5. Set WRITE/READ switches to ON and FORMAT.
6. Select either CYCLIC or SWITCH DATA data pattern.
7. Press START/STOP switch to initiate RUN Mode.
8. If in CONT, verify WRITE LED is lit.

**WRITE/READ OPERATIONS**

There are three modes of WRITE/READ action as selected by the WRITE/READ control switch. In each mode, the 18 bits of header and all of the data field up to index are bit by bit compared for error after SYNC is found. The modes are:

- READ - This function reads the header and reads the data field.
- WRITE - This function, with the drive formatted, reads the header field and writes the data field.
- WR/RD - (Write/Read) This function first reads the header and writes the data field, then rereads the header and reads the data field.

**DATA PATTERNS**

One of three data sources may be selected for WRITE/READ in the data field:

1. CYCLIC data is a continuously varying pattern uniquely different for each track.
2. RANDOM data is a 16-bit pattern generated by high speed counting. The pattern generated for writing is retained for read comparison, then altered for the next write cycle. Selectable by Cylinder or by Pass.
3. SWITCH DATA is a 16-bit pattern set by the DATA PATTERN switches and loaded by the LOAD DATA pushbutton.

**NOTE**

RANDOM data patterns are only valid with WR/RD action selected. RANDOM PASS is further restricted to the Increment and Decrement mode of Seek action.

**PROCEDURE-WRITE, READ or WRITE/READ**

Initial Conditions: Drive Selected  
 Disk Formatted  
 Index/Sector and Volume Selected  
 Faults and Errors Cleared

1. Select Seek action using SEEK Procedure.
2. Select head addressing.
3. Set WRITE/READ switches to ON and desired Write/Read action.
4. Set DATA switch to select data pattern to be used. If SWITCH DATA: Set desired value into DATA PATTERN switches. Press LOAD DATA pushbutton.
5. Set DIGITAL INFORMATION CONTROL switches to select measurement to be displayed on DIGITAL DISPLAY.
6. Set ERROR switch to STOP ON ERROR or OVERRIDE.
7. Set ACTION switch to either SINGLE or CONT Mode.
8. Press START/STOP pushbutton to initiate RUN Mode.
9. Observe selected Write/Read operation by monitoring the WRITE/READ indicators.

**CAUTION**

Value displayed in the DATA PATTERN LEDs is only valid after a STOP ON ERROR condition. LEDs are not valid after stopping RUN with the STOP pushbutton or with ACTION set to SINGLE.

**ILLEGAL OPERATIONS**

OPERATION	CAUSE	SUGGESTED ACTION (If Appropriate)
Attempt Write Operation	Write/Read Operation selected with switch in WRITE, WR/RD, or FORMAT position while DRIVE STATUS READ ONLY LED is lit.	Disable "Read Only" condition in drive.
Set Sequence Head	Sequence Head Operation is selected with switch in SEQ HEAD position and Head Select Switches at zero.	Set Head Select Switch to desired maximum head address (not zero).
Clear Errors or Display	ILL OP LED blinks when the CLEAR ERRORS & DISPLAYS Switch is depressed with Index pulse present.	
Auto Reset	RESET switch set to AUTO BOTH, FAULT or REZERO when ERRORS switch is set to STOP-ON-ERROR. RUN Mode will be blocked.	Set switches to OFF or OVERRIDE.  Address Mark in the header.
ILL OP light is lit but does not blink.	Index pulse is used to enable the ILL OP LED to blink. Pulse not received.	Check cable connection to drive and position of INDEX/SECTOR switch

**NOTE**

If Index pulse is received in the Daisy Chain Link cable, drive must be selected. If pulse is received in Radial cable, the drive need not be selected for Index pulse to be present.

Random Pass Data	Data switch set to RANDOM PASS position with WRITE/READ switch not set to WR/RD or SEEK CONTROL switch set to either RANDOM or SET.	Set SEEK CONTROL to INC or DEC and WRITE/READ switch to WR/RD.
Random Cylinder Data	Data switch set to RANDOM CYL position with WRITE/READ switch not set to WR/RD.	Set WRITE/READ switch to WR/RD.
Attempt Write Operation	Write/Read Operation selected with switch in WR/RD, WRITE or FORMAT position and OFFSET switch set to either PLUS or MINUS.  DRIVE STATUS FAULT and READ ONLY LEDs may light if RUN is on. RUN will be forced off. ILL OP LED will blink.	Set OFFSET switch to ZERO.

# USER COMMENT SHEET

Please Complete Items 1 thru 11

USE THIS FORM TO COMMUNICATE ANY ERRORS, SUGGESTIONS, OR GENERAL COMMENTS ABOUT THE DOCUMENT.

## FROM

(1) NAME
(2) COMPANY AND DEPARTMENT
(3) STREET ADDRESS
(4) CITY AND STATE

## MANUAL INFORMATION

(From Revision Record)

## DRIVE INFORMATION

(Peripherals Used On)

(5) MANUAL TITLE		(9) EQUIPMENT AND DESCRIPTION
(6) DOCUMENT NUMBER	(7) REVISION	(10) MANUFACTURER AND MODEL
(8) ADDENDUMS INCLUDED WITH MANUAL		(11) SPECIAL CONFIGURATION INFORMATION

## COMMENTS

(Please include page number, paragraph where applicable)

--

CUT ALONG LINE

ATTACH POSTAGE STAMP

Fold on Dotted Lines and Staple

LD

FOLD

FIRST CLASS  
POSTAGE  
REQUIRED

**WILSON LABORATORIES**  
Technical Publications Department  
2237 N. Batavia  
Orange, CA 92665

LD

FOLD