

---

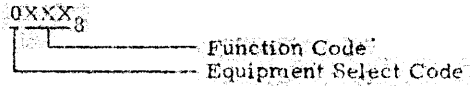
**CONTROL DATA®**  
**DISK STORAGE SUBSYSTEM**  
**7054-1 DISK STORAGE CONTROLLER**  
**10285-1 DUAL CHANNEL SWITCH OPTION**  
**7054-2 DISK STORAGE CONTROLLER**  
**7654-1 DISK STORAGE CONTROLLER**  
**844-2 DISK STORAGE UNIT**

---

**OPERATION AND PROGRAMMING MANUAL**

# 7X54/844-2 PROGRAMMING INFORMATION SUMMARY

## COMMAND FORMAT



## COMMANDS

| Function Code | Parameter Output | Status Input | Command Name                | Page |
|---------------|------------------|--------------|-----------------------------|------|
| 0000          | 1 word           | -            | Connect                     | 1-7  |
| 0001*         | 4 words          | -            | Seek, 1:1 Interlace         | 1-7  |
| 0002          | 4 words          | -            | Seek, 2:1 Interlace         | 1-8  |
| 0003*         | 1 word           | -            | I/O Length                  | 1-9  |
| 0004          | -                | -            | Read                        | 1-9  |
| 0005          | -                | -            | Write                       | 1-10 |
| 0006          | -                | -            | Write Verify                | 1-10 |
| 0007          | -                | -            | Read Checkword              | 1-10 |
| 0010          | -                | -            | Operation Complete          | 1-11 |
| 0011          | -                | -            | Disable Reserve             | 1-11 |
| 0012          | -                | 1 word       | General Status              | 1-11 |
| 0013          | -                | 12 words     | Detailed Status             | 1-15 |
| 0014          | -                | -            | Continue                    | 1-22 |
| 0015          | -                | -            | Drop Seeks                  | 1-25 |
| 0016          | 7 words          | -            | Format Packs                | 1-25 |
| 0017*         | -                | 1 word       | On-Sector Status            | 1-30 |
| 0024          | -                | -            | Gap Sector - Read           | 1-30 |
| 0025          | -                | -            | Gap Sector - Write          | 1-31 |
| 0026          | -                | -            | Gap Sector - Write Verify   | 1-31 |
| 0027          | -                | -            | Gap Sector - Read Checkword | 1-31 |
| 0414          | -                | -            | Start Memory Load           | 1-31 |

\*TTPPs only  
 \*6TTPPs only

## ADDRESS FORMAT FOR SEEK COMMANDS

|        | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|----|----|---|---|---|---|---|---|---|---|---|---|
| WORD 1 |    |    |   |   |   |   |   | D | D | D | D | D |
| WORD 2 |    |    |   |   |   |   |   | C | C | C | C | C |
| WORD 3 |    |    |   |   |   |   |   |   |   | T | T | T |
| WORD 4 |    |    |   |   |   |   |   |   |   |   | S | S |

D = DSU NUMBER. C = STARTING CYLINDER NUMBER.  
 T = STARTING TRACK NUMBER. S = STARTING SECTOR NUMBER.

## SECTOR LENGTH

502<sub>8</sub> (322<sub>10</sub>) 12-bit words.  
 1204<sub>8</sub> (644<sub>10</sub>) 6-bit characters.

## GENERAL STATUS WORD

|    |                              |
|----|------------------------------|
| 11 | ABNORMAL TERMINATION         |
| 10 | DUAL ACCESS COUPLER RESERVED |
| 9  | NON-RECOVERABLE ERROR        |
| 8  | RECOVERY IN PROGRESS         |
| 7  | CHECKWORD ERROR              |
| 6  | CORRECTABLE ADDRESS ERROR    |
| 5  | CORRECTABLE DATA ERROR       |
| 4  | DSU MALFUNCTION              |
| 3  | DSU RESERVED                 |
| 2  | MISCELLANEOUS ERROR          |
| 1  | BUSY                         |
| 0  | NONCORRECTABLE DATA ERROR    |



## PREFACE

---

This manual contains reference information for CONTROL DATA® disk storage subsystems using one or more CONTROL DATA® 7X54 Series Disk Storage Controllers to handle CONTROL DATA® 844-2 Disk Storage Units. Section 1 gives programming information for computer systems accessing 7X54/844-2 subsystems. Section 2 provides operator's information for these subsystems.

It is assumed that the reader is familiar with peripheral processor (PP) programming techniques used with one or more of the following CONTROL DATA computer systems.

6000 Series

CYBER 70 Models 72, 73, 74

7000 Series

CYBER 70 Model 76

The Disk Storage Subsystem General Information Manual (Publication No. 60364400) describes 7X54/844-2 subsystem products and discusses subsystem configuration. The reader may wish to reference the following manuals for computer system I/O channel requirements.

| <u>Control Data Document</u>   | <u>Publication No.</u> |
|--|------------------------|
| CYBER 70 Model 72, 73, 74 Input/Output Specifications Manual (applies to 6000 series also) | 60352500               |
| 7600/CYBER 70 Model 76 Hardware Reference Manual   | 60367200               |

# CONTENTS

## 1. PROGRAMMING

|  |      |  |      |
|--|------|--|------|
| Introduction                             | 1-1  | Drop Seeks (0015 <sub>g</sub> )                  | 1-25 |
| 7X54/844-2 Subsystems                    | 1-1  | Format Pack (0016 <sub>g</sub> )                 | 1-25 |
| Configuration                            | 1-1  | On-Sector Status (0017 <sub>g</sub> )            | 1-30 |
| DSC Initialization                       | 1-1  | Gap Sector - Read (0024 <sub>g</sub> )           | 1-30 |
| Disk Pack Initialization                 | 1-1  | Gap Sector - Write (0025 <sub>g</sub> )          | 1-31 |
| Subsystem Performance                    | 1-3  | Gap Sector - Write Verify (0026 <sub>g</sub> )   | 1-31 |
| Subsystem Commands                       | 1-5  | Gap Sector - Read Checkword (0027 <sub>g</sub> ) | 1-31 |
| Connect (0000 <sub>g</sub> )             | 1-7  | Start Memory Load (0414 <sub>g</sub> )           | 1-31 |
| Seek, 1:1 Interlace (0001 <sub>g</sub> ) | 1-7  | Programming Sequences                            | 1-32 |
| Seek, 2:1 Interlace (0002 <sub>g</sub> ) | 1-8  | 6TPP/DSC Communication Procedure                 | 1-32 |
| I/O Length (0003 <sub>g</sub> )          | 1-9  | 6TPP Command Sequences                           | 1-34 |
| Read (0004 <sub>g</sub> )                | 1-9  | 6TPP Deadman Timer Operation                     | 1-40 |
| Write (0005 <sub>g</sub> )               | 1-10 | 7TPP/DSC Communication Procedure                 | 1-41 |
| Write Verify (0006 <sub>g</sub> )        | 1-10 | DSC Autodump                                     | 1-43 |
| Reac Checkword (0007 <sub>g</sub> )      | 1-10 |  |      |
| Operation Complete (0010 <sub>g</sub> )  | 1-11 |  |      |
| Disable Reserve (0011 <sub>g</sub> )     | 1-11 |  |      |
| General Status (0012 <sub>g</sub> )      | 1-11 |  |      |
| Detailed Status (0013 <sub>g</sub> )     | 1-15 |  |      |
| Continue (0014 <sub>g</sub> )            | 1-22 |  |      |
| Drop Seeks (0015 <sub>g</sub> )          | 1-25 |  |      |
| Format Pack (0016 <sub>g</sub> )         | 1-25 |  |      |
| On-Sector Status (0017 <sub>g</sub> )    | 1-30 |  |      |

## 2. OPERATION

|                         |     |                        |     |
|-------------------------|-----|------------------------|-----|
| Controls and Indicators | 2-1 | DSC Power Adjust Panel | 2-1 |
| DSC PWR On Indicator    | 2-4 | DSC Auxiliary Panel    | 2-4 |
| DSU Control Panel       | 2-4 | Operating Instructions | 2-5 |
| Disk Pack Exchanging    | 2-6 |                        |     |

## FIGURES

|   |      |                                 |      |
|---|------|---------------------------------|------|
| 1-1 Disk Storage Subsystem Configurations | 1-2  | 1-4 Format 2/1 Transfer         | 1-44 |
| 1-2 Disk Pack Information Divisions       | 1-4  | 2-1 DSC Controls and Indicators | 2-2  |
| 1-3 Start Memory Load Transfer Map        | 1-32 | 2-2 DSU Controls and Indicators | 2-3  |

TABLES

|     |   |      |     |                               |      |
|-----|---|------|-----|-------------------------------|------|
| 1-1 | Disk Storage Subsystem<br>Performance Summary | 1-3  | 1-4 | Re-Read Sequence              | 1-16 |
| 1-2 | Subsystem Commands                            | 1-6  | 1-5 | Format Control                | 1-29 |
| 1-3 | General Status Interrogation                  | 1-12 | 1-6 | Autodump Controlware<br>Block | 1-44 |

---

## INTRODUCTION

7X54/844-2 Disk Storage Subsystems can provide high-speed random-access mass storage for CDC 6000 series, 7000 series, and CYBER 70 computer systems.

This section gives an overview of 7X54/844-2 subsystems, describes subsystem commands and associated parameter formats, and provides sample program sequences. The General Information Manual describes products used in these subsystems and explains product interaction in a subsystem environment.

## 7X54/844-2 SUBSYSTEMS

### CONFIGURATION

These subsystems consist of one or two 7X54 Series Disk Storage Controllers (DSC) (single or dual computer access) and a minimum of two 844-2 Disk Storage Units (DSU). Each DSC can interface one or two peripheral processor (PP) I/O channels (depending upon DSC type) with a maximum of eight DSUs. Dual access DSCs serve I/O channels on a one-at-a-time basis. Each DSU can connect to one or two DSCs. DSUs connected to two DSCs serve the DSCs on a one-at-a-time basis. Figure 1-1 shows some possible subsystem configurations.

### DSC INITIALIZATION

Since DSCs are software controlled, a PP must autoloading a DSC with an appropriate controlware package (nonalterable software) before the DSC can respond to other commands. The start memory load command (used for autoloading) is the only command that a DSC can execute before controlware is loaded.

### DISK PACK INITIALIZATION

Each disk pack must be initialized before it can be used for data transfer operations. The format pack command provides for this initialization.

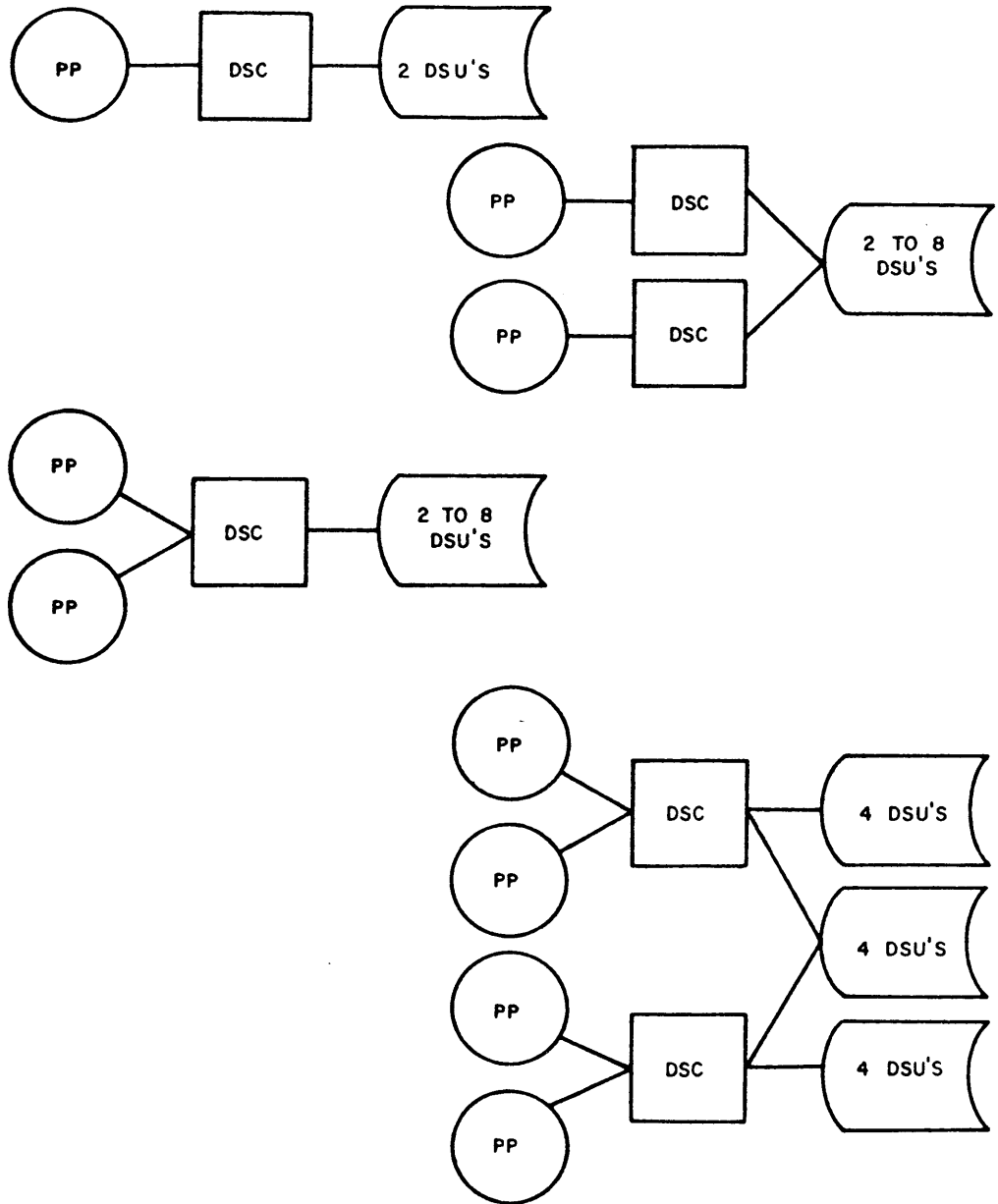


Figure 1-1. Disk Storage Subsystem Configurations



## SUBSYSTEM PERFORMANCE

Table 1-1 gives disk storage subsystem data capacity, access time, and transfer rate. The following paragraphs clarify Table 1-1.

TABLE 1-1. DISK STORAGE SUBSYSTEM PERFORMANCE SUMMARY

| DATA CAPACITY<br>(6-bit characters)                        |         |                      |               |                    |         |
|--|---------|----------------------|---------------|--------------------|---------|
| Per Sector   |         | Per Track            |               | Per Cylinder       |         |
| 644  |         | 15,456               |               | 293,664            |         |
| Per Disk Pack<br>118,640,256                               |         |                      |               |                    |         |
| ACCESS TIME<br>(milliseconds)                              |         |                      |               |                    |         |
| Random Seek  |         | Cylinder to Cylinder |               | Rotational Latency |         |
| Max  | Average | Max                  | Average       | Max                | Average |
| 55   | 30      | 10                   | 6             | 16.7               | 8.3     |
| TRANSFER RATE<br>(millions of 6-bit characters per second) |         |                      |               |                    |         |
| 1:1 Interlace  |         |                      | 2:1 Interlace |                    |         |
| 0.925  |         |                      | 0.462         |                    |         |

### DATA ORGANIZATION

Information on a disk pack is divided into cylinders, tracks, and sectors as shown in Figure 1-2. A cylinder consists of all the information accessible by all heads in one position. It includes one track for each recorded disk surface in the pack. A track consists of all the information accessible by one head in one position. A track is further divided into sectors. A sector is the smallest addressable area on a disk pack.

### DATA CAPACITY

The on-line data capacity of a disk storage subsystem depends upon the number of DSUs in the subsystem and also upon DSC determined sector parameters. Each DSC in the 7X54 series drives from one to eight DSUs and specifies a sector length of 644 6-bit characters.

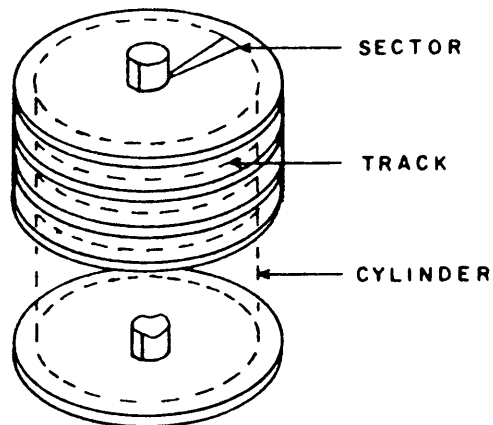


Figure 1-2. Disk Pack Information Divisions

#### ACCESS TIME

This is the time a DSU requires to locate the addressed sector. Before transferring data, a DSU moves the heads to a cylinder and selects one of the data heads. The selected head then transfers data as the appropriate sector passes under (or over) it. Thus, total access time consists of the time required for head movement plus time spent waiting for the appropriate sector to reach the selected head (rotational latency). Head select time is negligible.

#### DATA TRANSFER RATE

The transfer rates are the average rates at which from 2 to 456 sectors ( on the same cylinder) can be transferred. Both rates take into account facility overhead time required for addressing, error checking, etc. The 2:1 interlace transfer rate is half the 1:1 interlace rate since the 2:1 mode transfers only half the sectors on a track per disk revolution.

## SUBSYSTEM COMMANDS

The following general considerations apply to all subsystem commands.

### 1. PP Type

Some command related procedures vary according to the requesting PP type. In the following discussion, the acronym 6TPP (6000 Type Peripheral Processor) refers to PPs in 6000 series and CYBER 70, Model 72, 73, 74 Computer Systems. The acronym 7TPP (7000 Type Peripheral Processor) refers to PPs in 7000 series and CYBER 70 Model 76 Computer Systems. Statements that apply to both types of PPs use the acronym PP.

### 2. Bit Positions

Bit positions are numbered from right to left as follows:

|     |    |   |   |   |   |   |   |   |   |   |     |  |  |  |  |  |  |  |  |  |  |
|-----|----|---|---|---|---|---|---|---|---|---|-----|--|--|--|--|--|--|--|--|--|--|
| MSB |    |   |   |   |   |   |   |   |   |   | LSB |  |  |  |  |  |  |  |  |  |  |
| 11  | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0   |  |  |  |  |  |  |  |  |  |  |

### 3. Bit Fields

All numbers placed in specified parameter fields must be right justified and zero filled. Likewise, a DSC right justifies and zero fills all numbers placed in specified status fields.

### 4. Routine Status

After processing a 7TPP command, a DSC returns a 12-bit status word to the requesting 7TPP (via the status/control channel) to indicate the status of the current operation. A 6TPP must issue a general status (0012<sub>8</sub>) command, followed by a single word input in order to receive current status.

### 5. Interlacing

Depending upon PP selection (via seek, X:1 interlace commands), a subsystem can store data blocks either in consecutive sectors (1:1 interlace) or in alternate sectors (2:1 interlace). The 2:1 interlace (which must be used by 6TPPs) allows a PP one sector time of nonsubsystem related program activity for each sector time of data transfer. When the 2:1 interlace is utilized, the cylinder processing order is as follows:

- From sector 0, track 0 (the first even sector on the cylinder) the DSC increments to sector 2, track 0, etc.
- From sector 22, track 18 (the last even sector on the cylinder) the DSC increments to sector 1, track 0 (the first odd sector on the cylinder) and processes odd sectors.

- After sector 23, track 18 (the last odd sector on the cylinder) has been processed, the PP must issue another seek command to move processing to another cylinder.

## 6. Command Listing

Table 1-2 lists subsystem commands in numerical order. All commands processed by a subsystem are 12 bits in length. The upper three bits designate the subsystem equipment number ( $0_8$ ). The lower nine bits comprise a three-octal digit function code.

In Table 1-2, commands which must supply parameters to a DSC show the parameter length (in 12-bit words) in the parameter output column. Commands which cause a DSC to return status to a PP show the status length (in 12-bit words) in the status input column.

TABLE 1-2. SUBSYSTEM COMMANDS

| Function Code | Parameter Output | Status Input | Command Name                |
|---------------|------------------|--------------|-----------------------------|
| 0000          | 1 word           | -            | Connect                     |
| 0001*         | 4 words          | -            | Seek, 1:1 Interlace         |
| 0002          | 4 words          | -            | Seek, 2:1 Interlace         |
| 0003*         | 1 word           | -            | I/O Length                  |
| 0004          | -                | -            | Read                        |
| 0005          | -                | -            | Write                       |
| 0006          | -                | -            | Write Verify                |
| 0007          | -                | -            | Read Checkword              |
| 0010          | -                | -            | Operation Complete          |
| 0011          | -                | -            | Disable Reserve             |
| 0012**        | -                | 1 word       | General Status              |
| 0013          | -                | 12 words     | Detailed Status             |
| 0014          | -                | -            | Continue                    |
| 0015          | -                | -            | Drop Seeks                  |
| 0016          | 7 words          | -            | Format Packs                |
| 0017*         | -                | 1 word       | On-Sector Status            |
| 0024**        | -                | -            | Gap Sector - Read           |
| 0025**        | -                | -            | Gap Sector - Write          |
| 0026**        | -                | -            | Gap Sector - Write Verify   |
| 0027**        | -                | -            | Gap Sector - Read Checkword |
| 0414          | -                | -            | Start Memory Load           |
| *7TPPS only   |                  |              |                             |
| **6TPPs only  |                  |              |                             |

### NOTE

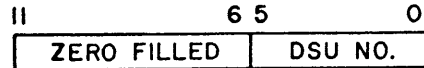
All commands except operation complete ( $0010_8$ ), reserve the DSC.

## CONNECT (0000<sub>8</sub>)

This command and its associated one-word output parameter permits a PP to reserve a DSU without initiating head movement. The DSU remains reserved until the PP issues either an operation complete (0010<sub>8</sub>) or drop seeks (0015<sub>8</sub>) command. For dual DSC subsystems, a disable reserve (0011<sub>8</sub>) command received by one DSC can release a DSU previously reserved by a connect command through the other DSC.

### PARAMETER FORMAT

After receiving a connect command, a DSC performs a one-word input to determine the DSU to be reserved.



Bits 0 through 5 specify the number of the DSU. Bits 6 through 11 must be zero filled.

## SEEK, 1:1 INTERLACE (0001<sub>8</sub>)

### NOTE

Only 7TPPs can issue this command.

A 7TPP issues this command and its associated four-word output parameter to condition a DSC for a 1:1 interlace\* data transfer. Upon receipt of this command and its parameter array, a DSC initiates head movement in the addressed DSU unless the DSU already has its heads in motion, is already on-cylinder, or has already been reserved by the other access or the other DSC (dual DSC subsystems only).

A 7TPP can determine if the specified DSU is on-cylinder by checking the general status word on the status/control channel from the DSC. Refer to general status (0012<sub>8</sub>) in this section. When the general status word is zero, the specified DSU is on-cylinder and the seek operation has been completed normally. When the selected DSU's heads are in motion, bit 1 (busy) of the general status word is set.

---

\*A DSC processes consecutive physical sectors during the transfer.

Since the general status word changes only after a DSC processes a command, a 7TPP waiting for a specific seek operation to complete should use the following sequence.

1. Issue seek command and address.
2. Wait for general status to be updated.
3. Go to step 1 if bit 1 of the general status word is set.
4. Continue if status word is zero.

A 7TPP can use the on-sector status (0017<sub>g</sub>) command in conjunction with multiple seek, 1:1 interlace commands to optimize rotational latency in a subsystem. Refer to on-sector status (0017<sub>g</sub>).

#### PARAMETER FORMAT

After receiving a seek, 1:1 interlace command, a DSC performs a two-word input to determine the disk address to be sought.

|        | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|----|----|---|---|---|---|---|---|---|---|---|---|
| WORD 1 |    |    |   |   |   |   | D | D | D | D | D | D |
| WORD 2 |    |    | C | C | C | C | C | C | C | C | C | C |
| WORD 3 |    |    |   |   |   |   |   |   | T | T | T | T |
| WORD 4 |    |    |   |   |   |   |   |   | S | S | S | S |

D = DSU NUMBER. C = STARTING CYLINDER NUMBER.

T = STARTING TRACK NUMBER. S = STARTING SECTOR NUMBER.

#### SEEK, 2:1 INTERLACE (0002<sub>g</sub>)

A PP issues this command and its associated four-word output parameter to condition DSC for a 2:1 interlace\* data transfer.

The parameter format, suggested PP wait sequence, and DSC status related to this command are the same as those listed under seek, 1:1 interlace (0001<sub>g</sub>). (A 6TPP must use the general status (0012<sub>g</sub>) command to determine the current status of a seek, 2:1 interlace operation.)

\*A DSC processes alternate physical sectors during the transfer.

## I/O LENGTH (0003<sub>g</sub>)

### NOTE

Only 7TPPs can issue this command.

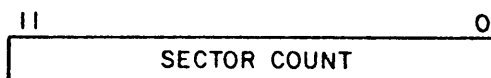
This command and its associated one-word output parameter specify the number of sectors to be processed by subsequent read (0004<sub>g</sub>), write (0005<sub>g</sub>), write verify (0006<sub>g</sub>), or read checkword (0007<sub>g</sub>) commands. A DSC retains the current I/O length and applies it to any of the above four commands. In order to change the current I/O length, a 7TPP must issue a new I/O length command. The sector count can range from 1 to 456<sub>10</sub> (maximum of one cylinder).

When a 7TPP specifies a 1:1 interlace mode and is processing consecutive data blocks (length specified by I/O length command), a DSC provides one unused sector (gapsector) after each block. This allows 7TPP overhead program activity between data blocks. A DSC resumes processing of the next data block upon receipt of one of the above four commands during the unused sector's rotational period.

A 7TPP can eliminate the unused sector by issuing a seek, 1:1 interlace command specifying the next sequential sector after processing a data block. However, this procedure requires an additional disk revolution for each data block processed.

### PARAMETER FORMAT

After receiving an I/O length command, a DSC inputs the sector count word.



## READ (0004<sub>g</sub>)

This command initiates data transfer from a selected disk sector (specified by a prior seek command) to a PP. A read command from a 6TPP transfers one sector (644 characters) of data. A read command from a 7TPP transfers the number of sectors specified by a preceding I/O length (0003<sub>g</sub>) command. After issuing a read command, a PP must initiate a block input of appropriate length to receive the read data.

As long as either consecutive (1:1 interlace) or alternate (2:1 interlace) sectors are being read, a PP issues another seek command only when data transfer must resume at another cylinder.

#### **WRITE (0005<sub>g</sub>)**

This command initiates data transfer from a PP to the disk sector specified by a prior seek command. A write command from a 6TPP transfers one sector (644 characters) of data. A write command from a 7TPP transfers the number of sectors specified by a preceding I/O length (0003<sub>g</sub>) command. After issuing a write command, a PP must initiate a block output of appropriate length to transmit the write data. As long as either consecutive (1:1 interlace) or alternate (2:1 interlace) sectors are being written, a PP issues another seek command only when data transfer must resume at another cylinder.

#### **WRITE VERIFY (0006<sub>g</sub>)**

This command conditions a DSC to perform a bit-by-bit comparison of data from a PP with data on a disk. A prior seek command specifies the starting sector and interlace mode for the compare operation.

A write verify command from a 6TPP enables the comparison of one sector (644 characters) of data. A write verify command from a 7TPP enables the comparison of the number of sectors specified by a preceding I/O length (0003<sub>g</sub>) command. After issuing a write verify command, a PP must initiate a block output of appropriate length to supply the data to be compared.

#### **READ CHECKWORD (0007<sub>g</sub>)**

This command conditions a DSC to test for checkword errors in one or more sectors of data already stored on a disk. A prior seek command specifies the starting sector and interlace mode for the check.

A read checkword command from a 6TPP enables one sector (644 characters) of data to be checked. A read checkword command from a 7TPP enables checking of the number of sectors specified by a preceding I/O length (0003<sub>g</sub>) command.



## **OPERATION COMPLETE (0010<sub>g</sub>)**

A PP issues this command to release the reserve of the last DSU functioned by the DSC. Other DSUs must previously have been released by a drop seeks (0015) command. In addition, a 6TPP must issue this command to a dual access DSC to release the DSC for use by a 6TPP connected to the other DSC access. Do not issue a general status function following this command unless it is intended to reserve the DSC again.

## **DISABLE RESERVE (0011<sub>g</sub>)**

A disable reserve command to one DSC permits that DSC to release all DSUs currently reserved to the other DSC. A PP should issue this command only after it has determined that one or more DSUs are currently reserved to an inoperative DSC.

## **GENERAL STATUS (0012<sub>g</sub>)**

### **NOTE**

Only 6TPPs use this command to receive the current general status word. A DSC sends the current general status word to a 7TPP on the status/control channel after processing each command. The general status word structure is the same for both types of PPs.

A 6TPP should issue a general status command followed by a single-word input after issuing any other command. Normal command completion results in a zero filled general status word. If the general status word is nonzero, always examine bit 10 first to determine if the DSC is reserved by the alternate access. If bit 10 is clear, check bit 11 to determine if the previous operation was abnormally terminated. If neither of these bits is set, check the bit or bits which are associated with the previously requested operation.

Table 1-3 specifies which subsystem commands must be followed by interrogation of general status. A 6TPP issues a general status command to interrogate the status. A 7TPP merely inputs the status word on its status/control channel.

TABLE 1-3. GENERAL STATUS INTERROGATION

| Subsystem Command            | Interrogate by<br>6TPP | Interrogate by<br>7TPP |
|------------------------------|------------------------|------------------------|
| Start Memory Load            | No                     | No                     |
| Format Pack                  | Yes                    | Yes                    |
| Seek 1:1 Interlace           | NA**                   | Yes                    |
| Seek 2:1 Interlace           | Yes                    | Yes                    |
| I/O Length                   | Yes                    | Yes                    |
| Read*                        | Yes                    | Yes                    |
| Write*                       | Yes                    | Yes                    |
| Write Verify*                | Yes                    | Yes                    |
| Read Checkword*              | Yes                    | Yes                    |
| Operation Complete           | No                     | Yes                    |
| Disable Reserve              | Yes                    | Yes                    |
| Detailed Status              | No                     | No                     |
| Continue*                    | Yes                    | Yes                    |
| Drop Seeks                   | Yes                    | Yes                    |
| On-Sector Status             | NA                     | Yes                    |
| Connect                      | Yes                    | Yes                    |
| Read (Gap Sector)*           | Yes                    | NA                     |
| Write (Gap Sector)*          | Yes                    | NA                     |
| Write Verify (Gap Sector)*   | Yes                    | NA                     |
| Read Checkword (Gap Sector)* | Yes                    | NA                     |

\*These commands require that general status be interrogated after each sector of data has been processed by the DSC.

\*\*NA-not applicable.

The general status word is structured as follows:

NOTE

A bit set to one indicates that its corresponding status exists.

|    |                              |
|----|------------------------------|
| 11 | ABNORMAL TERMINATION         |
| 10 | DUAL ACCESS COUPLER RESERVED |
| 9  | NONRECOVERABLE ERROR         |
| 8  | RECOVERY IN PROGRESS         |
| 7  | CHECKWORD ERROR              |
| 6  | CORRECTABLE ADDRESS ERROR    |
| 5  | CORRECTABLE DATA ERROR       |
| 4  | DSU MALFUNCTION              |
| 3  | DSU RESERVED                 |
| 2  | MISCELLANEOUS ERROR          |
| 1  | BUSY                         |
| 0  | NONCORRECTABLE DATA ERROR    |

BIT 11, ABNORMAL TERMINATION

The preceding command terminated abnormally. Either general status bit 8 or 9 specifies whether or not recovery is possible. The PP must examine the detailed status block to determine the cause of the abnormal termination. For all abnormal terminations, the detailed status block should be logged for future use.

BIT 10, DUAL ACCESS COUPLER RESERVED

The DSC is currently reserved to the other I/O channel. When this bit is set, all other general status bits are meaningless.

BIT 9, NONRECOVERABLE ERROR

An error has occurred which is nonrecoverable. A PP must examine word 7 of the detailed status to determine the cause.

BIT 8, RECOVERY IN PROGRESS

The DSC is ready to respond to one or more continue (0014<sub>g</sub>) commands to attempt error recovery.

BIT 7, CHECKWORD ERROR

A checkword error has occurred. Either bit 5 or 6 of the general status word specifies the type of error.

BIT 6, CORRECTABLE ADDRESS ERROR

A correctable read address checkword error has occurred. A continue (0014<sub>g</sub>) command causes the data to be processed on a subsequent disk revolution.

BIT 5, CORRECTABLE DATA ERROR

The last sector of data read contains a correctable checkword error. The location of the error and a correction vector are specified in the detailed status block.

BIT 4, DSU MALFUNCTION

A DSU related error condition exists. Words 9 through 11 of the detailed status block specify the DSU status at the time of the malfunction.

BIT 3, DSU RESERVED

The specified DSU is currently reserved by the other DSC.

BIT 2, MISCELLANEOUS ERROR

The existing error condition is specified in word 3 of the detailed status block.

**BIT 1, BUSY**

The specified DSU and/or the DSC is busy.

**BIT 0, NONCORRECTABLE DATA ERROR**

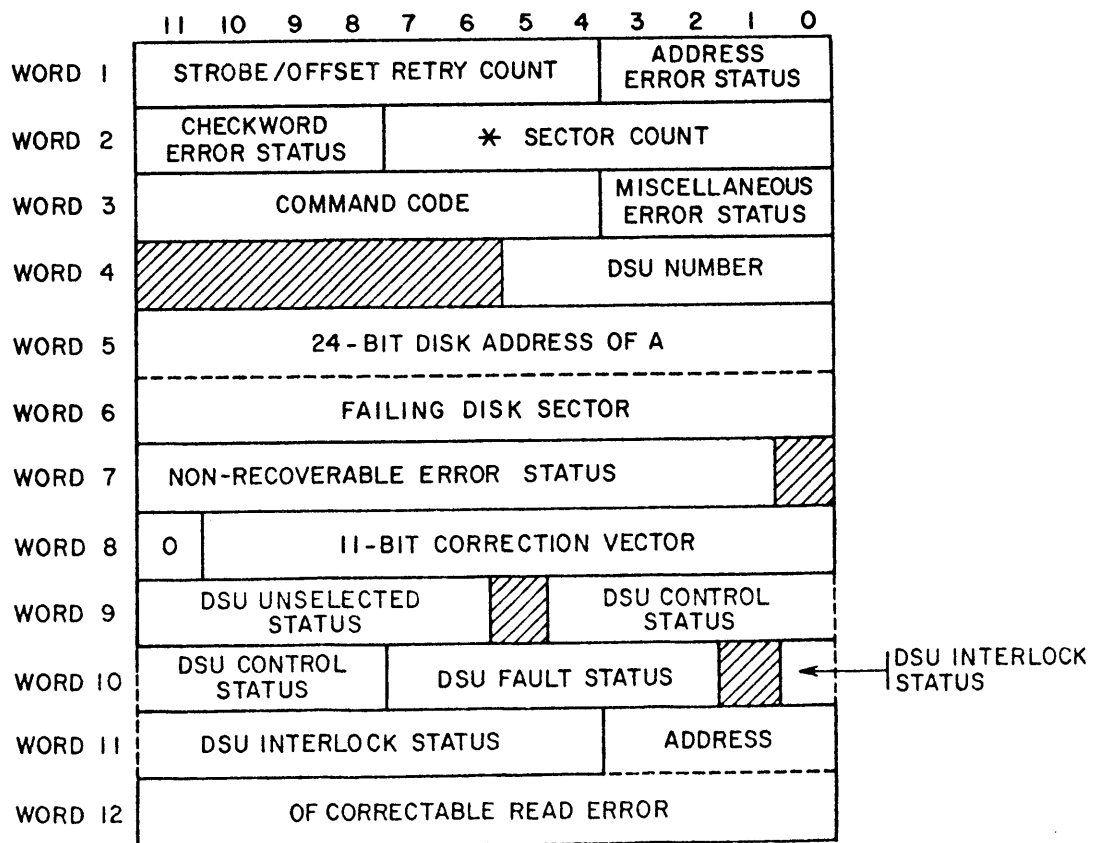
The last sector of data read contains an error which cannot be corrected by an 11-bit correction vector.

**DETAILED STATUS (0013<sub>g</sub>)**

This command causes a DSC to supply a 12-word detailed status block to the requesting PP. The detailed status block is available immediately upon abnormal command termination and applies to the currently selected DSU.

After an abnormal command termination, a PP should obtain error logging information by issuing a detailed status command followed by a block input of appropriate length. The PP may then attempt error recovery with one or more continue (0014<sub>g</sub>) commands or elect to try a new command.

The detailed status block format is as follows:



## DETAILED STATUS INTERPRETATION

### NOTE

In the detailed status block, an individual status bit set to one indicates that its corresponding status condition exists.

### WORD 1

#### BITS 4 THROUGH 11

These bits provide the number of the data strobe/head positioner offset retry attempt just completed. Refer to continue (0014<sub>g</sub>). DSC error recovery procedures allow for a maximum of 27<sub>10</sub> retries (three retries at each of nine combinations of strobe/offset). Retry attempt numbers correspond to strobe/offset conditions as shown in Table 1-4.

TABLE 1-4. RE-READ SEQUENCE

| Re-Read Attempt Number | Offset  | Strobe  |
|------------------------|---------|---------|
| 1, 2, 3                | Nominal | Nominal |
| 4, 5, 6                | Nominal | Early   |
| 7, 8, 9                | Nominal | Late    |
| 10, 11, 12             | Reverse | Nominal |
| 13, 14, 15             | Reverse | Early   |
| 16, 17, 18             | Reverse | Late    |
| 19, 20, 21             | Forward | Nominal |
| 22, 23, 24             | Forward | Early   |
| 25, 26, 27             | Forward | Late    |

#### BIT 3

The disk address specified by the PP does not compare with the address field read (or read/corrected) from the disk sector.

#### BIT 2

An incorrect cylinder number was read.

#### BIT 1

An incorrect track number was read.

#### BIT 0

An incorrect sector number was read.

### WORD 2

#### BIT 11

A checkword error occurred in reading the address field.

BIT 10

The address field read from the disk sector cannot be corrected by an 11-bit correction vector. Words 5 and 6 contain the address of the failing disk sector.

NOTE

Whenever a correctable address checkword error occurs, a DSC corrects the error with an 11-bit correction vector.

BIT 9

A checkword error occurred in reading the data field.

BIT 8

The data field read from the disk sector cannot be corrected by an 11-bit correction vector. Words 5 and 6 contain the address of the failing disk sector.

BITS 0 THROUGH 7

NOTE

Significant for 7TPPs only.

These bits specify the number of sectors within the current data block that were successfully processed. This field is not used during pack formatting.

WORD 3

BITS 4 THROUGH 11

This field contains the lower eight bits of the PP command causing this detailed status block.

BIT 3

A compare operation for an address field or data field did not complete.

BIT 2

A write verify operation failed, indicating that the data field is in error.

BIT 1

Either 6TPP disconnected the I/O channel or a 7TPP sent a record flag when the DSC expected more data.

BIT 0

The PP attempted to access a DSU not listed in the DSC's active drive table.

WORD 4

BITS 6 THROUGH 11

Not assigned.

**BITS 0 THROUGH 5**

This field specifies the DSU number associated with this copy of detailed status.

**WORDS 5 AND 6**

This 24-bit field (which is filled whenever either a positioning error occurs or a defective sector is referenced) contains the address of a failing disk sector. The field format is as follows:

|        |    |    |   |   |   |   |   |   |   |   |   |   |
|--------|----|----|---|---|---|---|---|---|---|---|---|---|
|        | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| WORD 5 | C  | C  | C | C | C | C | C | C | C | T | T | T |
| WORD 6 | T  | T  | S | S | S | S | S | A | B | U | U | U |

- C = CYLINDER NUMBER
- T = TRACK NUMBER
- S = SECTOR NUMBER
- A = SECTOR FLAW BIT
- B = TRACK FLAW BIT
- U = ZERO FILLED

**NOTE**

If the DSC cannot read the address field of the failing disk sector, it supplies the address from the last seek command. Refer to parameter format seek, 1:1 interlace (0001<sub>8</sub>).

**WORD 7**

**BIT 11 INVALID COMMAND**

Either the preceding command/output parameter was invalid or the command was issued when not expected.

**BIT 10 SECTOR LENGTH ERROR**

The preceding data transfer operation was not equal in length to the DSC sector size (644 characters).

**BIT 9 LOST DATA**

Either the PP did not accept data from the DSC fast enough during a read operation or the PP did not supply data to the DSC fast enough during a write operation.

**BIT 8 SYNC ERROR (ADDRESS FIELD)**

The DSC cannot locate the sync pattern or the sync byte in the address field of the selected disk sector.

**BIT 7**

DSC memory parity error.



#### BIT 6 DSC HARDWARE ERROR

One or more of the following conditions exist.

1. The DSC's internal composite status bit is set, although none of the conditions normally causing it to be set are present.
2. No error status is available after an error correction attempt.
3. The re-seek operation following a head positioning error did not initiate head movement.
4. The DSC has entered an error recovery sequence even though the read/corrected address compares with the address supplied by the PP.
5. The DSC has entered an error recovery sequence without either a data field or an address field being specified.

#### BIT 5 WRITE ERROR

The DSC detected a write error after writing the data portion of a sector.

#### BIT 4 DEFECTIVE TRACK

The DSC has failed to read successfully one or more address fields within the track and has set the track flaw bit in all address fields of the track.

#### BIT 3 DEFECTIVE SECTOR

The DSC has failed to read successfully the data field of a sector and has set the sector flaw bit in that sector's address field.

#### BIT 2 SYNC ERROR (DATA FIELD)

The DSC cannot locate either the sync pattern or the sync byte in the data field of the selected disk sector.

#### BIT 1 DEADMAN TIMER EXPIRED (See deadman timer description.)

BIT 0 Not assigned.

#### WORD 8

#### BIT 11

Zero filled.

#### BITS 0 THROUGH 10

After a correctable read error occurs, this field contains an 11-bit correction vector. In order to correct the last sector of data received from the DSC, the PP must exclusive OR the correction vector with sector data beginning at the bit location specified by words 11 and 12 of the current detailed status block.

WORD 9

NOTE

Words 9, 10, and bits 4 through 11 of word 11 contain status from the selected DSU. The DSC copies this status after any abnormal command termination. Bits identified with an asterisk (\*) are dynamic and may not have significance for a PP. Diagnostic programmers should reference appropriate DSU manuals for complete information about these status bits.

BIT 11

Sector alert.

\*BIT 10

DSU seek error.

BIT 9

DSU busy.

BIT 8

DSU selected.

BIT 7

DSU ready.

BIT 6

DSU on-line.

BIT 5

Not assigned.

\*BIT 4

Amplitude monitor 3.

\*BIT 3

Amplitude monitor 2.

BIT 2

DSU end of cylinder.

\*BIT 1

Amplitude monitor 1.

\*BIT 0

Track index.

WORD 10

BIT 11

On cylinder.

BIT 10

Seek error.

BIT 9

Disk pack unsafe.

\*BIT 8

Sector mark.

BIT 7

Seek error.

BIT 6

DSU negative voltages more positive than normal.

BIT 5

DSU positive voltages more negative than normal.

BIT 4

Current fault.

BIT 3

A read and write operation have been attempted simultaneously.

BIT 2

The DSC attempted a data transfer when the DSU was not on cylinder.

BIT 1

Not assigned.

BIT 0

The DSU logic temperature is normal.

WORD 11

BIT 11

The DSU power supply temperature is normal.

BIT 10

The spindle motor is on.

BIT 9

The DSU power sequencing is not under control of the DSC.

**BIT 8**

The DSU START switch is ON.

**BIT 7**

The disk pack brush cycle is in progress.

**BIT 6**

Heads are loaded.

**BIT 5**

The sector block is in position to sense the sector disk.

**BIT 4**

A disk pack is mounted.

**BITS 0 THROUGH 3**

These are the upper four bits of a (16-bit) bit address of the first bit of a correctable read error. The bit address is a bias relative to the leading edge of either the address field or the data field of the sector. (General status specifies whether the correctable error occurred in the address field or the data field.)

**WORD 12**

**BITS 0 THROUGH 11**

These are the lower 12 bits of a (16-bit) bit address of a correctable read error.

**CONTINUE (0014<sub>g</sub>)**

This command permits a PP to step a DSC through a semiautomatic error recovery sequence if the recovery in progress bit in the general status word is set. A PP can use the continue command to attempt recovery during read (0004<sub>g</sub>), write (0005<sub>g</sub>), read checkword (0007<sub>g</sub>), format pack (0016<sub>g</sub>), and on-sector status (0017<sub>g</sub>) operations. When attempting recovery from an abnormally terminated read or write operation, a PP must also reinitiate an input or output block transfer following each continue command. The type of operation currently undergoing DSC error recovery procedures determines the effect of a continue command as follows:

**NOTE**

The following descriptions of the effect of continue commands on a DSC assume that the recovery in progress bit in the general status word is set. When the nonrecoverable error bit is set, the DSC has aborted the current error recovery sequence and does not accept further continue commands.

#### CONTINUE: DURING PACK FORMATTING

When a DSC is processing a format pack (0016<sub>8</sub>) command with bit 9 of output parameter word 2 set, it stops formatting operations when error conditions occur which can set track or sector flaw bits. After taking appropriate action, a PP issues a continue command to restart the formatting operation. A DSC sets track or sector flaw bits after receiving a continue command.

#### CONTINUE: DURING OTHER OPERATIONS

When a DSC is processing read (0004<sub>8</sub>), write (0005<sub>8</sub>), read checkword (0007<sub>8</sub>), or on-sector status (0017<sub>8</sub>) commands, it continually looks for error conditions. The continue command controls recovery from the following types of errors.

1. Address field correctable checkword error.
2. Address field noncorrectable checkword error.
3. Seek error.
4. Data field noncorrectable checkword error.
5. Data field correctable checkword error (7TPPs only).

#### ADDRESS FIELD CORRECTABLE CHECKWORD ERROR

A continue command causes the DSC to read-skip the address field on the next disk revolution and begin processing the data field.

#### ADDRESS FIELD NONCORRECTABLE CHECKWORD ERROR

Each continue command causes a re-read attempt on the address field as shown in Table 1-4.

#### NOTE

The number of the last re-read attempt appears in bits 4 through 11 of the detailed status block. Refer to detailed status (0013<sub>8</sub>).

If a re-read attempt results in a correctable checkword error, the next continue command causes the DSC to read-skip the address field on the next disk revolution and begin processing the data field. If none of the re-read attempts are successful, the DSC sets the nonrecoverable error bit in the general status word.

When the correct cylinder is located, the subsystem verifies the track and sector portions of the address prior to performing data transmission. If the track and sector cannot be verified after one retry, the DSC sets the nonrecoverable error bit in the general status word.

#### SEEK ERROR

The first continue command causes the DSC to compute the difference between the current cylinder and the correct cylinder. The heads are then moved accordingly. When this fails to locate the correct cylinder, a second continue command causes a return to zero seek followed by one direct seek. If this procedure also fails, the DSC sets the nonrecoverable error bit in the general status word.

#### DATA FIELD NONCORRECTABLE CHECKWORD ERROR

Each continue command causes a re-read attempt on the data field as shown in Table 1-4. If a re-read attempt results in a correctable checkword error, a PP should examine the detailed status block for the correction vector and bit address with which to modify the last input block of data (read operations only). If none of the re-read attempts are successful, the DSC sets the nonrecoverable error bit in the general status word.

#### NOTE

Once a DSC has set the recovery in progress bit in the general status word, a minimum of one and a maximum of 27 continue commands (and associated block transfers for read or write operations) may be required for recovery from the current error condition. After processing a continue command, a DSC may determine that the error condition is not recoverable and set the nonrecoverable error bit in the general status word. Thus, a PP should ensure that the recovery in progress bit is set before issuing any continue command.

If a PP issues a command other than the continue command while the recovery in progress bit is set, the DSC exits from the error recovery sequence and begins processing the new command.

#### DATA FIELD CORRECTABLE CHECKWORD ERROR (6TPPs ONLY)

The 6TPP must correct the faulty data with information from the detailed status block. A continue command causes the DSC to read the next sector of data.

## DATA FIELD CORRECTABLE CHECKWORD ERROR (7TPPs ONLY)

The 7TPP must correct the faulty data with information from the detailed status block. A continue command causes the DSC to read the remaining sectors (if any) of the current data block.

### **DROP SEEKS (0015<sub>g</sub>)**

This command causes a DSC to release all DSUs reserved to the DSC, except for the DSU which has just returned on-cylinder or on-sector status to the requesting PP. After a drop seeks command, released DSUs are available to either DSC. Before issuing a drop seeks command, a PP should use one of the following procedures to locate a DSU for subsequent operations.

#### ON-CYLINDER CHECK

The PP issues a seek command and its associated output parameter, and then checks the general status word. When all bits of the general status word are zero, the DSU specified in the previous seek is on-cylinder. In order to locate the first DSU to complete its seek, a PP must use the seek/check general status sequence on all DSUs reserved to the PP which are currently moving heads. The PP then issues a drop seeks command and proceeds with the desired operation.

#### ON-SECTOR CHECK

#### NOTE

Only 7TPPs can use this sequence.

After issuing multiple seek commands (and associated output parameters) the 7TPP issues an on-sector status (0017<sub>g</sub>) command and then interprets the on-sector status word which the DSC returns over the status/control channel. Refer to on-sector status (0017<sub>g</sub>). When an on-sector DSU has been located, the 7TPP issues a drop seeks command and proceeds with the desired operation.

### **FORMAT PACK (0016<sub>g</sub>)**

This command and its associated seven-word output parameter cause a DSC to write information fields on a disk pack to prepare the pack for further operations. Since formatting a full pack (7809 tracks) requires at least 5 minutes, the output parameter provides start

and stop fields which permit a single format pack command to prepare as little as one track. This allows a PP to interleave format pack commands directed to one DSU with I/O commands for other DSUs. (DSC availability for I/O commands is reduced during command inter-leaving, since a DSC is busy during processing of format pack commands.)

A format pack command causes a DSC to write the following information contiguously into each sector of the specified track(s). Head positioner offset and data strobe remain at nominal settings during pack formatting.

| <u>Item</u>          | <u>Bit Length</u>          |
|----------------------|----------------------------|
| Head gap 1           | 120 zero bits              |
| Address sync pattern | 300 zero bits              |
| Address sync byte    | 6 bits                     |
| Address field        | 24 bits                    |
| Address checkword    | 32 bits                    |
| Head gap 2           | 120 zero bits              |
| Data sync pattern    | 78 bits                    |
| Data sync byte       | 6 bits                     |
| Data field           | 3864 bits (644 characters) |
| Data checkword       | 32 bits                    |
| End of record byte   | 6 bits                     |
| Tolerance gap        | <u>134 bits</u>            |

Total: 4722 bits

The sector address field is described under detailed status (0013<sub>8</sub>), words 5 and 6. The data field consists of the duplication of the character provided in word 7 of a format pack command's output parameter.

#### PARAMETER FORMAT

After receiving a format pack command, a DSC inputs a seven-word parameter from the PP to specify format conditions.



|        | 11                       | 10 | 9 | 8 | 7 | 6 | 5            | 4 | 3 | 2 | 1 | 0 |
|--------|--------------------------|----|---|---|---|---|--------------|---|---|---|---|---|
| WORD 1 | 0                        | 0  | 1 | 0 | 1 | 0 | 0            | 0 | 0 | 1 | 0 | 0 |
| WORD 2 | FORMAT CONTROL           |    |   |   |   |   | DSU NUMBER   |   |   |   |   |   |
| WORD 3 | STARTING CYLINDER NUMBER |    |   |   |   |   |              |   |   |   |   |   |
| WORD 4 | STARTING TRACK NUMBER    |    |   |   |   |   |              |   |   |   |   |   |
| WORD 5 | ENDING CYLINDER NUMBER   |    |   |   |   |   |              |   |   |   |   |   |
| WORD 6 | ENDING TRACK NUMBER      |    |   |   |   |   |              |   |   |   |   |   |
| WORD 7 |                          |    |   |   |   |   | DATA PATTERN |   |   |   |   |   |

### WORD 1

#### BITS 0 THROUGH 11

This field must contain the 7X54 sector length of  $644_{10}$  ( $1204_8$ ) characters.

### WORD 2

#### BIT 11

When this bit is 1, a DSC sets sector and track flaw bits (in sector address fields) only when noncorrectable checkword errors occur. When this bit is 0, the DSC sets appropriate flaw bits for all checkword errors.

#### BIT 10

When this bit is 1 and words 3 through 6 of the output parameter are zero, a DSC formats the entire pack. When this bit is 0, words 3 through 6 determine the portion of the pack to be formatted in response to the current command. In this case, a seek command to the starting cylinder must precede the Format Pack command.

#### BIT 9

When this bit is 1, a DSC interrupts the format operation and prepares a general status word whenever a checkword error occurs which would set a flaw bit. The DSC sets the flaw bit(s) and resumes formatting when the PP issues a continue ( $0014_8$ ) command.

#### BITS 6 THROUGH 8

Not assigned.

#### BITS 0 THROUGH 5

These bits specify the DSU to be used for the format operation.

### WORD 3

#### NOTE

When words 3 through 6 are nonzero, bit 10 of word 2 must be 0.

#### BITS 0 THROUGH 11

This field specifies the starting cylinder number. Valid numbers are from 0 to  $410_{10}$  ( $0632_8$ ).

### WORD 4

#### BITS 0 THROUGH 11

This field specifies the starting track number. Valid numbers are from 0 to  $18_{10}$  ( $0022_8$ ).

### WORD 5

#### BITS 0 THROUGH 11

This field specifies the ending cylinder number. Valid numbers are from 0 to  $410_{10}$  ( $0632_8$ ).

### WORD 6

#### BITS 0 THROUGH 11

This field contains the ending track number. Valid numbers are from 0 to  $18_{10}$  ( $0022_8$ ).

### WORD 7

#### BITS 6 THROUGH 11

Not assigned.

#### BITS 0 THROUGH 5

This field specifies the character to be written  $644_{10}$  times in the data field of each sector to be formatted.

#### FORMATTING SEQUENCE

The format control octal digit (formed by bits 9, 10, and 11 of output parameter word 2) specifies DSC performance during a format pack operation. Table 1-5 shows DSC responses to possible values of the format control digit. The table is a synopsis of information contained in the descriptions for bits 9, 10, and 11 of word 2.

TABLE 1-5. FORMAT CONTROL

| Format Control Digit (Bits 9, 10, and 11 of Word 2) | 11  | 10   | 9   |
|---|---|--|---|
|   | Set Flaw Bits for All Checkword Errors or Non-correctable Checkword Errors Only | Format Portion of Pack (Specified by Words 3 Through 6) or Entire Pack | Interrupt Formatting Before Setting Flaw Bits |
| 0   | All   | Portion  | No  |
| 1   | All   | Portion  | Yes   |
| *2  | All   | Entire   | No  |
| *3  | All   | Entire   | Yes   |
| 4   | Noncorrectable  | Portion  | No  |
| 5   | Noncorrectable  | Portion  | Yes   |
| *6  | Noncorrectable  | Entire   | No  |
| *7  | Noncorrectable  | Entire   | Yes   |
| *Words 3 through 6 must be zero.                    |   |  |   |

FLAW BITS

NOTE

Refer to detailed status (0013g), words 5 and 6 for the locations of these bits in the address field of a sector.

A DSC sets the sector flaw bit of a sector's address field under the following conditions.

1. Bit 11 of output parameter word 2 is 0 and a checkword error occurred in the sector's data field.
2. Bit 11 of word 2 is 1 and a noncorrectable checkword error occurred in the sector's data field.

A DSC sets the track flaw bit of all address fields within a track under the following conditions.

1. Bit 11 of word 2 is 0 and a checkword error occurred in an address field within the track.
2. Bit 11 of word 2 is 1 and a noncorrectable checkword error occurred in an address field within the track.

## ON-SECTOR STATUS (0017<sub>8</sub>)

### NOTE

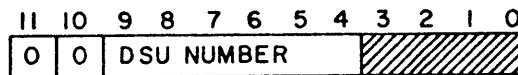
Only 7TPPs can issue this command.

After initiating seek operations on two or more DSUs, a 7TPP issues an on-sector status command to cause a DSC to look for the first DSU to achieve on-sector status. The 7TPP then checks the status/control channel for a word flag and its associated status word.

During execution of an on-sector status command, the DSC provides either an on-sector status word or a general status word to the 7TPP. An on-sector status word indicates normal command processing and specifies the number of the DSU which will reach its addressed sector in from 1390 to 2085 microseconds. A general status word indicates that on-sector status command processing has terminated abnormally or that the DSC is currently reserved to its other access.

The 7TPP determines whether the status word is either on-sector or general by examining bits 11 and 10. When both of these bits are zero, the word is an on-sector status word. When either of these bits is one, the word is a general status word.

The on-sector status word has the following format.



Refer to general status (0012<sub>8</sub>) for the general status word format.

## GAP SECTOR - READ (0024<sub>8</sub>) (6TPPs ONLY)

The gap sector commands (0024, 0025, 0026, and 0027) permit a gap sector to exist between consecutive data blocks which are written in 2:1 interlace format. This feature permits multiple data blocks to be transferred without the loss of a disk revolution between data blocks. These commands must be used in lieu of a seek command to ensure that lost disk revolutions do not occur due to normal seek command processing overhead. The gap sector functions cause the subsystem to process a data transmission command and skip three physical sectors, rather than only one, after performing the data transfer operation in 2:1 interlace format. The second of the three sectors is a permanent gap sector and the other two sectors are used during subsequent 2:1 interlace processing. Error recovery procedures and status processing for all data transmission commands using this feature are not affected.

## NOTE

To ensure continuous data block transfer, the gap sector commands must be issued only when transferring the last sector of a data block in 2:1 interlace format because the disk address is updated immediately following the data transfer operation. The PP is responsible for issuing a seek command to position the disk heads to the next cylinder whenever a data block is split between cylinder boundaries.

The gap sector - read command permits use of the gap sector feature during a read in 2:1 interlace format.

### **GAP SECTOR - WRITE (0025<sub>g</sub>) (6TPP<sub>s</sub> ONLY)**

This command permits use of the gap sector feature during a write operation in 2:1 interlace format.

### **GAP SECTOR - WRITE VERIFY (0026<sub>g</sub>) (6TPP<sub>s</sub> ONLY)**

This command permits use of the gap sector feature during a write verify operation using 2:1 interlace format.

### **GAP SECTOR - READ CHECKWORD (0027<sub>g</sub>) (6TPP<sub>s</sub> ONLY)**

This command permits use of the gap sector feature during a read checkword operation in 2:1 interlace format.

### **START MEMORY LOAD (0414<sub>g</sub>)**

A PP uses this command for autoloading a DSC. It is the only command that a DSC can execute before controlware is loaded. Upon receipt of this command, a DSC prepares for a block transfer from the PP to DSC memory, beginning at DSC memory location 0000.

A DSC controlware block consists of less than 4096 16-bit words. These words are transferred between a PP and DSC memory as shown in Figure 1-3. The block transfer terminates when either a 6TPP disconnects the I/O channel or when a 7TPP sends a record flag.

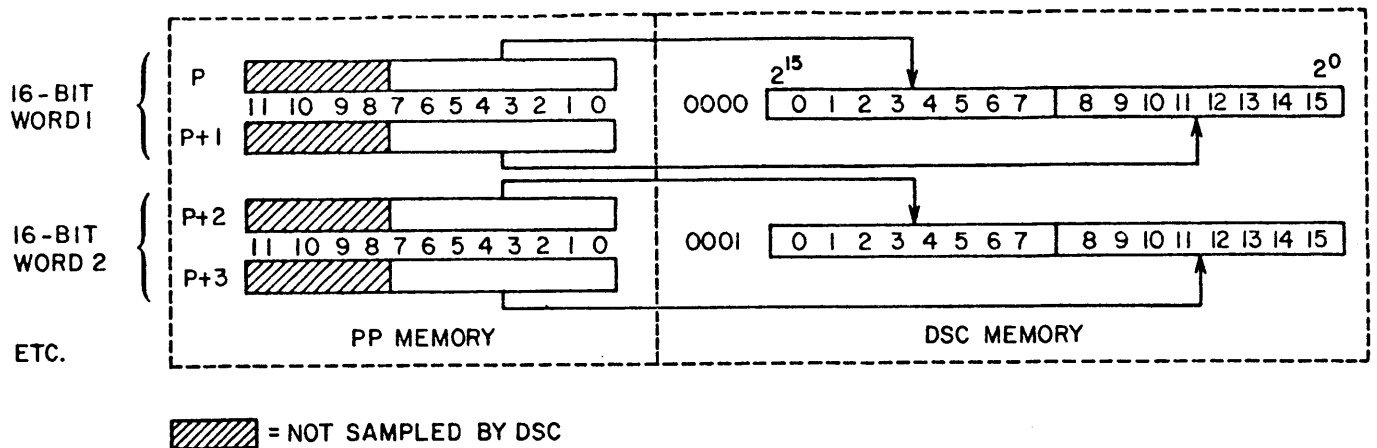


Figure 1-3. Start Memory Load Transfer Map

## PROGRAMMING SEQUENCES

This section describes PP/DSC communication and provides examples of command sequences for typical disk operations.

### 6TPP/DSC COMMUNICATION PROCEDURE

Commands, output parameters, data, and status pass between a 6TPP and a DSC over a single, 6000 series type I/O channel as described below. In the following sequence, two digit numbers refer to 6TPP octal operation codes and four digit numbers are DSC commands.

1. (65) The 6TPP checks the I/O channel connected to the DSC to ensure that the I/O channel is inactive (disconnected).
2. (76 or 77) The 6TPP sends a command to the DSC.

#### NOTE

When two I/O channels are tied to a dual access DSC, the first command sent to the DSC over either I/O channel should be a general status (0012<sub>o</sub>) command. The 6TPP should then interpret the general status word to determine if the DSC is currently reserved to the other I/O channel. If a 6TPP issues a command other than a general status command to a DSC currently reserved to the other I/O channel, the DSC does not indicate acceptance of the command until the DSC finishes the current operation.

3. The DSC disconnects the I/O channel to indicate acceptance of the command.
4. At this time, the 6TPP is waiting for the I/O channel to become inactive (65). When the command issued in step 2 requires additional input/output, the 6TPP activates the I/O channel (74) and performs the necessary input/output. All commands except the following require subsequent input/output after command initiation.

Read Checkword (0007<sub>g</sub>)  
 Operation Complete (0010<sub>g</sub>)  
 Disable Reserve (0011<sub>g</sub>)  
 Continue (0014<sub>g</sub>) (During pack formatting)  
 Drop Seeks (0015<sub>g</sub>)

5. After issuing a command or a command sequence, the 6TPP should monitor the operation's progress or verify the operation's completion with one or more general status commands. If the general status word indicates an error condition, the 6TPP should issue a detailed status (0013<sub>g</sub>) command to obtain error information.
6. When an I/O channel is disconnected during an output parameter, data, or status transfer, the 6TPP must issue a new command before communication with the DSC can resume. The 6TPP or the DSC disconnects the I/O channel during an output parameter, data, or status transfer under the following conditions.
  - a. The 6TPP disconnects the I/O channel after sending the last word when auto-loading the DSC with a start memory load (0414<sub>g</sub>) command.
  - b. The 6TPP disconnects the I/O channel after issuing the output parameter associated with one of the following commands.

Connect (0000<sub>g</sub>)  
 Seek, 2:1 Interlace (0002<sub>g</sub>)  
 Format Pack (0016<sub>g</sub>)

- c. The 6TPP disconnects the I/O channel after outputting 644 characters (322 12-bit words) of data during execution of the following commands.

Write (0005<sub>g</sub>)  
 Write Verify (0006<sub>g</sub>)  
 Continue (0014<sub>g</sub>) (During write error recovery)

- d. The DSC disconnects the I/O channel after successfully processing a read (0004<sub>g</sub>), general status (0012<sub>g</sub>), or detailed status (0013<sub>g</sub>) command.

- e. The DSC disconnects the I/O channel when an error is detected during processing of a read (0004<sub>8</sub>), write (0005<sub>8</sub>), or write verify (0006<sub>8</sub>) command.

#### NOTE

To avoid hanging the 6TPP, the following restrictions govern the disconnect channel d (75) instruction.

1. A jump if channel d inactive (65) instruction should precede every (75) instruction to ensure that the I/O channel is currently inactive.
  2. A 6TPP should execute a (75) instruction only after having transferred the expected number of words of output parameter, data, or status.
- f. The DSC disconnects the I/O channel if the deadman timeout expires.
7. After completing a command or a command sequence, the 6TPP must issue an operation complete (0010<sub>8</sub>) command to release the reserve on all DSUs and the DSC.

## 6TPP COMMAND SEQUENCES

This part describes typical 6TPP disk operations and provides sample command sequences. Refer to 6TPP/DSC communication procedure for general guidelines relating to I/O channel protocol. The following entries deal only with 6TPP/DSC communication and do not cover 6TPP/central memory communication.

### AUTOLOADING DSC CONTROLWARE

The computer system transfers DSC controlware from cards or magnetic tape to a 6TPP. The 6TPP then uses a start memory load (0414<sub>8</sub>) command and a block output to autoloading a DSC. The DSC is ready to accept other commands as soon as the I/O channel disconnects after the controlware transfer.



SEQUENCE

| Command   | Purpose                    | Notes |
|---|----------------------------|-------|
| Issue start memory load (0414 <sub>8</sub> ). Output controlware block. | Autoloads DSC controlware. | -     |
| Issue operation complete (0010 <sub>8</sub> ).                          | Releases reserve on DSC.   |       |

PACK FORMATTING

The 6TPP generates a seven-word format pack output parameter, initiates the format operation, and then monitors the operation to obtain flaw map information.

SEQUENCE

| Command  | Purpose  | Notes  |
|--|--|--|
| Issue general status (0012). Input one word (status).  | Ensures that DSC is not reserved.  | Zero filled status indicates DSC is ready.   |
| Issue connect (0000 <sub>8</sub> ). Output one word (DSU number).<br>Issue general status (0012 <sub>8</sub> ). Input one word (status). | Either reserves DSU or determines that the DSU is reserved to the other DSC. | If the DSU is reserved to the other DSC, there may be a system problem.  |
| Issue format pack (0016 <sub>8</sub> ). Output seven words (parameter).  | Initiates format operation.  | -  |
| 1. Issue general status (0012 <sub>8</sub> ). Input one word (status).   | Monitors format operation.   | If busy, repeat 1; if recovery in progress, go to 2; if status is zero filled, go to 4; if nonrecoverable, log status. |
| 2. Issue detailed status (0013 <sub>8</sub> ). Input 12 (14 <sub>8</sub> ) words (status).   | Provides sector and track flaw information for generation of flaw map.       | -  |
| 3. Issue continue (0014 <sub>8</sub> ). Go to 1.   | Restarts format operation. Writes flaw bits as required.                     | -  |
| 4. Issue operation complete (0010 <sub>8</sub> ) or exit this sequence.  | Releases reserves on DSU and DSC.  |  |
|  | -  |  |

## SEEK/ON-CYLINDER CHECK

In preparation for data transfer or data verification operations, the 6TPP initiates head movement (if required) on one or more DSUs. The first DSU to achieve on-cylinder status is then selected.

### SEQUENCE

| Command  | Purpose  | Notes   |
|--|--|---|
| Issue general status (0012 <sub>8</sub> ). Input one word (status).  | Ensures that DSC is not reserved.                              | -   |
| Issue connect (0000 <sub>8</sub> ). Output one word (DSU number).<br><br>Issue general status (0012 <sub>8</sub> ). Input one word (status).           | Reserves DSU, or determines that DSU is reserved to other DSC. | Repeat for each DSU to be positioned.   |
| Issue seek, 2:1 interlace (0002 <sub>8</sub> ). Output two words (address).  | Initiates head movement.                                       | Repeat for each DSU to be positioned.   |
| Issue seek, 2:1 interlace (0002 <sub>8</sub> ). Output two words (address).<br><br>Issue general status (0012 <sub>8</sub> ). Input one word (status). | Locates the first DSU to achieve on-cylinder status.           | Issue seek and check status for each seek initiated. Zero filled status indicates on-cylinder. Repeat until zero filled status is received. |
| Issue drop seeks (0015 <sub>8</sub> ).   | Releases the reserve on all but the last DSU referenced.       |   |
| -  | -  | Continue with data transfer or data verification operation.   |

READ

After one DSU is on-cylinder, the 6TPP inputs one or more 644 character (322 word) data blocks starting at the sector specified by a prior seek, 2:1 interlace (0002<sub>g</sub>) command.

SEQUENCE

| Command  | Purpose   | Notes   |
|--|---|---|
| -  | Positions DSU heads to a specified cylinder.                                  | See seek/on-cylinder check.   |
| 1. Issue read (0004 <sub>g</sub> ). Input 322 (502 <sub>g</sub> ) words (data).  | Transfers one sector of data from the DSU to the 6TPP memory.                 | When the input terminates, the 6TPP should check the contents of the A register to determine the actual number of words transferred.                                      |
| 2. Issue general status (0012 <sub>g</sub> ). Input one word (status).   | Confirms successful completion of read.                                       | Zero filled status indicates successful completion; go to 5. Nonzero status should be analyzed. If error, go to 3.  |
| 3. Issue detailed status (0013 <sub>g</sub> ). Input 12 (14 <sub>g</sub> ) words (status).   | Obtains error correction, error recovery, or error logging information.       | If correctable checkword error, apply correction vector and go to 5. If recovery in progress, more disk revolutions are required; go to 4. Any other bits, log status.    |
| 4. Issue continue (0014 <sub>g</sub> ). Input 322 (502 <sub>g</sub> ) words (data).<br>Issue general status (0012 <sub>g</sub> ). Input one word (status). | Attempts re-reads using different positioner offset and data strobe settings. | Repeat after each unsuccessful re-read attempt as long as recovery in progress bit is set. Use detailed status (0013 <sub>g</sub> ) commands to log status, if necessary. |
| 5.   | -   | Go to 1 if next alternate sector is to be read. Otherwise continue.   |
| Issue operation complete (0010 <sub>g</sub> ) or exit this sequence.   | Releases reserve on DSU and DSC.  |   |
|  | -   |   |

WRITE

After one DSU is on-cylinder, the 6TPP outputs one or more 644 character (322 word) blocks, starting at the sector specified by a prior seek, 2:1 interlace (0002<sub>g</sub>) command.

SEQUENCE

| Command  | Purpose   | Notes   |
|--|---|---|
| -  | Positions DSU heads to a specified cylinder.                        | See seek/on-cylinder check.   |
| 1. Issue write (0005 <sub>g</sub> ).<br>Output 322 (502 <sub>g</sub> ) words (data).   | Transfers one sector of data from the 6TPP memory to the DSU.       | When the output terminates, the 6TPP should check the contents of the A register to determine the actual number of words transferred. |
| 2. Issue general status (0012 <sub>g</sub> ). Input one word (status).   | Confirms successful completion of write.                            | Zero filled status indicates successful completion; go to 5. Non-zero status should be analyzed. If error, go to 3.                   |
| 3. Issue detailed status (0013 <sub>g</sub> ). Input 12 (14 <sub>g</sub> ) words (status).   | Obtains error recovery and/or error logging information.            | If recovery in progress, one more disk revolution is required; go to 4. Otherwise log status.   |
| 4. Issue continue (0014 <sub>g</sub> ).<br>Output 322 (502 <sub>g</sub> ) words (data).<br><br>Issue general status (0012 <sub>g</sub> ). Input one word (status). | Causes DSC to read-skip address field and write the sector of data. | Repeat as long as recovery in progress bit is set. Use detailed status commands to log status.  |
| 5. -   | -   | Go to 1 if next alternate sector is to be written. Otherwise continue.  |
| Issue operation complete (0010 <sub>g</sub> ) or exit this sequence  | Releases reserve on DSU and DSC.                                    |   |

WRITE VERIFY

After a DSU is on-cylinder, the 6TPP outputs one or more 644 character (322 word) blocks to be compared with recorded data. The compare operation starts at the sector specified by a prior seek, 2:1 interlace (0002<sub>8</sub>) command.

SEQUENCE

| Command  | Purpose  | Notes   |
|--|--|---|
| -  | Positions DSU heads to a specified cylinder.             | See seek/on-cylinder check.   |
| 1. Issue write verify (0006 <sub>8</sub> ). Output 322 (502 <sub>8</sub> ) words (data).   | Initiates verify operation and provides comparison data. | When the output terminates, the 6TPP should check the contents of the A register to determine the actual number of words transferred. |
| 2. Issue general status (0012 <sub>8</sub> ). Input one word (status).                     | Confirms successful completion of compare.               | Zero filled status indicates successful completion; go to 4. Non-zero status is non-recoverable.                                      |
| 3. Issue detailed status (0013 <sub>8</sub> ). Input 12 (14 <sub>8</sub> ) words (status). | Obtains error logging information.                       | -   |
| 4. -   | -  | Go to 1 if next alternate sector is to be verified. Otherwise continue.   |
| Issue operation complete (0010 <sub>8</sub> ) or exit this sequence.                       | Releases reserve on DSU and DSC.                         |   |

## READ CHECKWORD

After one DSU is on-cylinder, the 6TPP requests that the DSC examine one or more sectors for checkword errors. The examination starts at the sector specified by a prior seek, 2:1 interlace command.

### SEQUENCE

| Command   | Purpose   | Notes   |
|---|---|---|
| -   | Positions DSU heads to a specified cylinder.                                  | See seek/on-cylinder check.   |
| 1. Issue read checkword (0007 <sub>8</sub> ).   | Initiates read checkword operation.   | -   |
| 2. Issue general status (0012 <sub>8</sub> ). Input one word (status).                                      | Confirms successful completion of read checkword operation on this sector.    | Zero filled status indicates successful completion; go to 5. Non-zero status should be analyzed. If error, go to 3.   |
| 3. Issue detailed status (0013 <sub>8</sub> ). Input 12 (14 <sub>8</sub> ) words (status).                  | Obtains error logging information.  | The 6TPP should determine whether to attempt re-reads (go to 4) or to proceed with the operation after error logging (go to 5).   |
| 4. Issue continue (0014 <sub>8</sub> ). Issue general status (0012 <sub>8</sub> ). Input one word (status). | Attempts re-reads using different positioner offset and data strobe settings. | Repeat after each unsuccessful re-read attempt as long as recovery in progress bit is set. Use detailed status (0013 <sub>8</sub> ) commands to log status, if necessary. |
| 5.  | -   | Go to 1 if next alternate sector is to be verified. Otherwise continue.   |
| Issue operation complete (0010 <sub>8</sub> ) or exit this sequence.  | Releases reserve on DSU and DSC   |   |

## 6TPP DEADMAN TIMER OPERATION

The 6000 system coupler incorporates a deadman timeout feature which prevents the channel from hanging for an extended period of time. The deadman timer is enabled

whenever the coupler is reserved by a 6TPP. Each time a function word or a data word is transferred across the channel, the deadman timer is reset to zero and the time-out period is reinitiated. If another function word or data word is not transferred within 2 seconds, the time out period expires, the reserved condition is cleared, and an inactive signal is sent to the PP. The only exception is an operation complete function which disables the deadman timer and clears the reserved condition. Once the deadman timer has expired, the only function which is recognized by the subsystem is a request for general status (0012<sub>g</sub>). Any other function is illegal and causes the channel to hang. In this situation, the PP should time out and then perform a general status function to determine if the deadman timer has expired. No reply to a general status function indicates that the subsystem is inoperative and requires an autoload of the complete controlware package from the PP.

Expiration of the deadman timer is a nonrecoverable error which voids any I/O operation or error recovery operation which may have been in progress. This means that the continue function is illegal and that any I/O operation must be preceded by a seek function.

If the deadman timer expires in a dual access configuration, the first PP to request general status will reserve the coupler. The PP which acknowledges the deadman timeout status must inform the other PP that a deadman timeout has occurred.

## 7TPP/DSC COMMUNICATION PROCEDURE

A 7TPP uses two of its eight bidirectional channels to communicate with a DSC as described below. One channel (status/control channel) transfers commands, general status words, and on-sector status words between the 7TPP and the DSC. The other channel (data channel) transfers output parameters, data, and detailed status blocks. In the following sequence, two-digit numbers refer to 7TPP octal operation codes and four digit numbers are DSC commands.

1. The 7TPP checks for an input record flag on the status/control channel (62) indicating that the deadman timer has expired. If the deadman timer has expired, an output record pulse on the status/control channel is necessary to drop the static resume on the data output channel (74).
2. The 7TPP then checks for an input word flag on the status/control channel (60). If a status word is available, it should be input and considered to be residue from some previous operation. It is not current status.

3. The 7TPP issues a command to the DSC on the status/control channel (72 or 73). The 7TPP then checks for the output word flag on the status/control channel to drop, indicating that the DSC has accepted the command (65).
4. The 7TPP checks for an input record flag on the status/control channel, (65) indicating that the deadman timer has expired. The current procedure must be restarted at step 1 if the timer did expire.
5. The 7TPP then checks for an input word flag on the status/control channel (60), inputs the current general status word (70), and ensures that the DSC is not reserved to the other computer access.
6. When the command issued in step 3 requires output parameters or data to be sent to the DSC, the 7TPP outputs the appropriate number of words on the data channel (72 or 73) and sends a record pulse on the data channel to terminate the transfer (72). When the command issued in step 3 instructs the DSC to send data or detailed status to the 7TPP, the DSC sends the appropriate number of words over the data channel and follows the data with an input record flag.

After a 7TPP executes a block transfer on the input or output data channel (71 or 73), a check should be made for an input record flag on the status/control channel (62), indicating that the block transfer instruction was terminated by the deadman timer. If the timer did expire, an output record pulse on the status/control channel is necessary to clear the static resume on the output data channel (74).

The following commands require no additional input/output after command initiation.

Read Checkword (0007<sub>8</sub>)  
 Operation Complete (0010<sub>8</sub>)  
 Disable Reserve (0011<sub>8</sub>)  
 Continue (0014<sub>8</sub>) (During pack formatting)  
 Drop Seeks (0015<sub>8</sub>)

7. The 7TPP checks for an input word flag on the status/control channel (60), and then inputs the current general status word (70) to verify successful completion of the last command or command sequence. Refer to Table 1-3 to find when this status should be interrogated.



8. After completing a command or command sequence, the 7TPP must send a record flag on the status/control channel (74) before the DSC can accept commands from the 7TPP on the other access.
9. After completing operations on one or more DSUs, a 7TPP should issue an operation complete (0010<sub>8</sub>) command to release reserved DSUs for use by other 7TPPs.

## DSC AUTODUMP

A PP uses a start memory load (0414<sub>8</sub>) command to load the DSC with an autodump controlware block. After the autodump controlware block has been loaded, the DSC can respond only to the autodump discussed in the following paragraphs or to the start memory load command.

AUTODUMP: FORMAT 2/1 (0001<sub>8</sub>)

This command initiates an output block transfer from DSC memory, starting at the DSC location specified in autodump controlware location C<sub>16</sub> (Table 1-6). The length of the transfer (in 12-bit PP words) is 2/1 times the DSC word count specified in autodump controlware location 0, since one 16-bit DSC word fills the lower eight bit positions of two PP memory locations. (The upper four bits of PP memory locations are zero filled.) Figure 1-4 shows how DSC words are transferred into PP memory in response to an autodump: format 2/1 command.

TABLE 1-6. AUTODUMP CONTROLWARE BLOCK

| Autodump Controlware Location | DSC Hex. Code | PP Memory Location | PP Octal Code | Notes  |   |
|-------------------------------|---------------|--------------------|---------------|--|---|
| 0 <sub>16</sub>               | 0XXX          | P<br>P+1           | 00XX<br>0XXX  | Number of DSC words to be autodumped. For 4095 <sub>10</sub> , enter: 0017<br>0377 |   |
| 1 <sub>16</sub>               | 0900          | P+2<br>P+3         | 0011<br>0000  | Autodump routine.  |   |
| 2 <sub>16</sub>               | EF01          | P+4<br>P+5         | 0357<br>0001  |  |   |
| 3 <sub>16</sub>               | 1801          | P+6<br>P+7         | 0030<br>0001  |  |   |
| 4 <sub>16</sub>               | 0F00          | P+8<br>P+9         | 0017<br>0000  |  |   |
| 5 <sub>16</sub>               | 0A00          | P+10<br>P+11       | 0012<br>0000  |  |   |
| 6 <sub>16</sub>               | 0B00          | P+12<br>P+13       | 0013<br>0000  |  |   |
| 7 <sub>16</sub>               | 4800          | P+14<br>P+15       | 0110<br>0000  |  |   |
| 8 <sub>16</sub>               | 0906          | P+16<br>P+17       | 0011<br>0006  |  |   |
| 9 <sub>16</sub>               | EF01          | P+18<br>P+19       | 0357<br>0001  |  |   |
| A <sub>16</sub>               | FC0C          | P+20<br>P+21       | 0374<br>0014  |  |   |
| B <sub>16</sub>               | BB00          | P+22<br>P+23       | 0273<br>0000  |  |   |
| C <sub>16</sub>               | 0XXX          | P+24<br>P+25       | 00XX<br>0XXX  |  | DSC autodump starting location. 0000<br>To start autodump at DSC location 0 <sub>16</sub> , enter: 0000 |

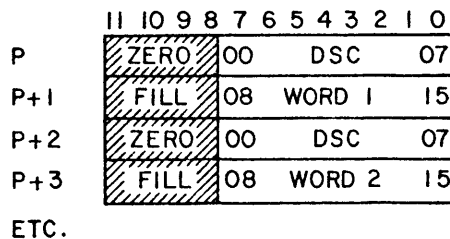


Figure 1-4. Format 2/1 Transfer

---

This section lists DSC and DSU operator controls, describes their functions, and provides operational sequences.

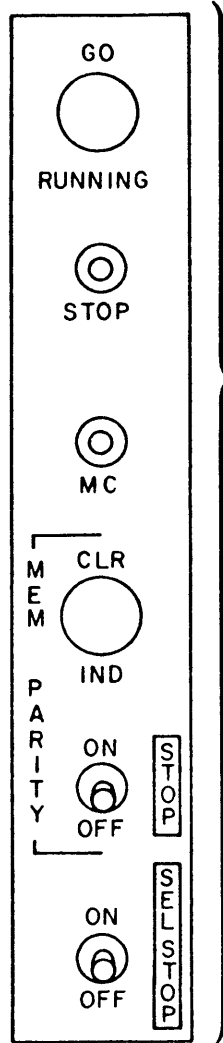
## CONTROLS AND INDICATORS

Figure 2-1 shows the location of controls on a DSC and Figure 2-2 shows the location of controls on a DSU. Refer to these figures for locations of the controls and indicators described in the following paragraphs.

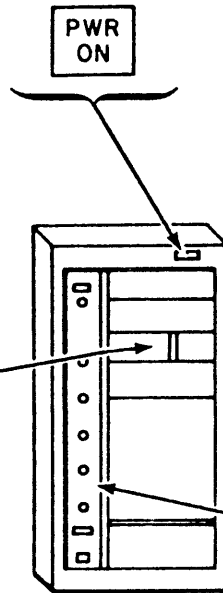
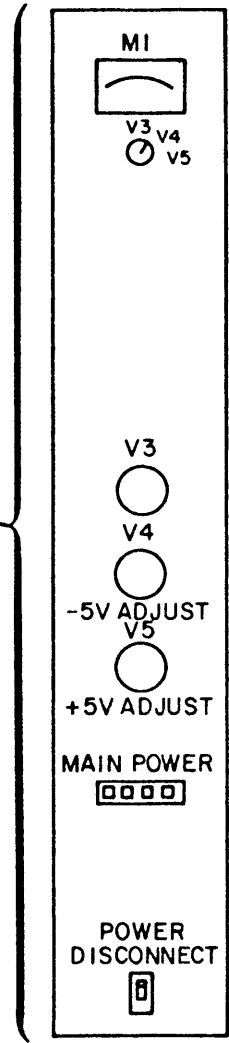
### DSC POWER ADJUST PANEL

These controls and indicators are located on the left front of the DSC. They are for maintenance purposes only and are not to be adjusted by operating personnel.

DSC AUXILIARY OPERATORS  
PANEL

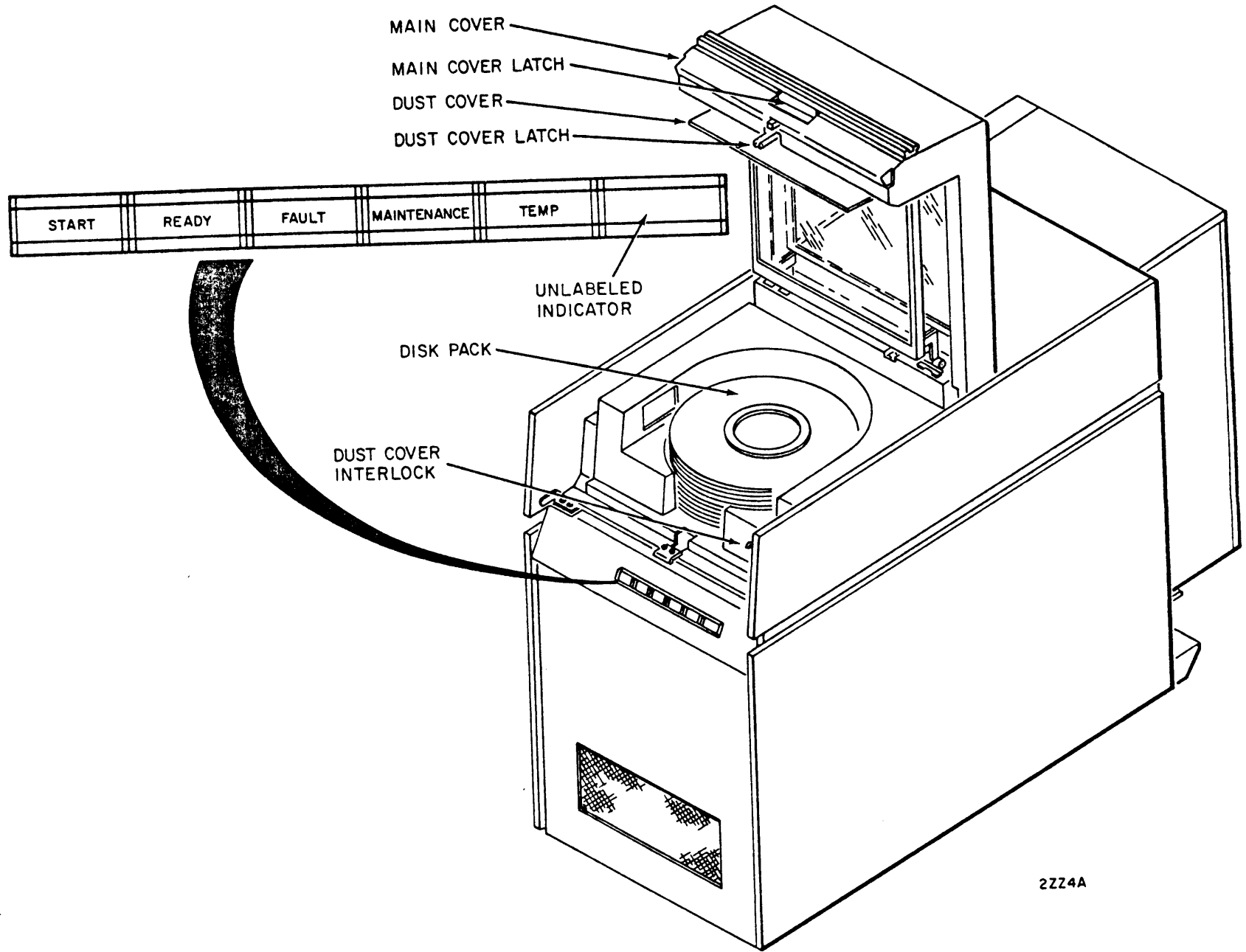


DSC POWER ADJUST  
PANEL



2223A

Figure 2-1. DSC Controls and Indicators



2224A

Figure 2-2. DSU Controls and Indicators

## DSC PWR ON INDICATOR

This indicator is located on the upper right of the DSC and lights when the MAIN POWER circuit breaker and the POWER DISCONNECT switch are both ON.

## DSC AUXILIARY PANEL

This panel is located in the DSC logic chassis. This panel is used only for maintenance purposes.

## DSU CONTROL PANEL

This panel is located on the center front of each DSU and allows the operator to monitor and control DSU operation. The controls and indicators function as follows:

|                     |  |
|---------------------|--|
| START               | This switch applies power to the DSU and causes the disk pack to rotate (providing all interlocks are properly set). |
| READY               | This indicator lights when the disk pack has reached normal speed and the heads are loaded.                          |
| FAULT               | This indicator lights to indicate a fault condition. Pressing the switch causes the indicator to go out.             |
| MAINTENANCE         | This indicator lights when a DSC is not controlling the power application for this DSU.                              |
| TEMPERATURE         | This indicator lights when an over-temperature condition exists in the DSU.  |
| Unlabeled Indicator | This indicator lights when the DSU is selected by a DSC.   |

## OPERATING INSTRUCTIONS

The following instructions assume that the DSC controlware is loaded and that the subsystem is operational.

### DISK PACK EXCHANGING

1. Make certain that the START indicator is not lighted and that disk pack is not spinning. If the START indicator is lighted, press it to turn off the light and stop the DSU.
2. When the disk pack has stopped, press the main cover latch (Figure 2-2) and lift the main cover. The dust cover opens with the main cover.

3. Place a disk pack cover over the loaded disk pack so that it engages the spindle. Turn counterclockwise until the spindle clicks and lift the cover and disk pack from the DSU.



Place one hand under the disk pack to prevent the disk pack from falling free of the cover.

4. Using its cover as a handle, place the new disk pack slowly over the DSU spindle until it engages the spindle drive unit. Turn the disk pack cover clockwise until it reaches a stop. Lift the disk pack cover from the DSU.
5. Close the main cover making sure that it latches. If the cover is not securely latched, the dust cover interlock remains open and prevents power application.
6. Press the START switch. When the disk pack is at operating speed (heads loaded) the READY indicator lights. The DSU is now ready for operation.

# COMMENT SHEET

MANUAL TITLE CONTROL DATA® DISK STORAGE SUBSYSTEM\*

Operation and Programming Manual

PUBLICATION NO. 60363900 REVISION B

**FROM:** NAME: \_\_\_\_\_  
BUSINESS  
ADDRESS: \_\_\_\_\_

## COMMENTS:

This form is not intended to be used as an order blank. Your evaluation of this manual will be welcomed by Control Data Corporation. Any errors, suggested additions or deletions, or general comments may be made below. Please include page number references and fill in publication revision level as shown by the last entry on the Record of Revision page at the front of the manual. Customer engineers are urged to use the TAR.

- \*7054-1 DISK STORAGE CONTROLLER
- 10285-1 DUAL CHANNEL SWITCH OPTION
- 7054-2 DISK STORAGE CONTROLLER
- 7654-1 DISK STORAGE CONTROLLER
- 844-2 DISK STORAGE UNIT

CUT ALONG LINE

PRINTED IN U.S.A.

AA3419 REV. 11/69

NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

FOLD ON DOTTED LINES AND STAPLE



STAPLE

STAPLE

FOLD

FOLD

FIRST CLASS  
PERMIT NO. 8241  
MINNEAPOLIS, MINN.

**BUSINESS REPLY MAIL**  
NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

POSTAGE WILL BE PAID BY  
**CONTROL DATA CORPORATION**  
Technical Publications Department  
4201 North Lexington Avenue  
Arden Hills, Minnesota 55112



CUT ALONG LINE

FOLD

FOLD