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METRIC

2.5 AND 10 MEGABYTE REMOVABLE CARTRIDGE DISC

PROGRAMMING MANUAL

INFORMATION CONTAINED IN THIS MANUAL IS SUBJECT TO DESIGN CHANGE OR PRODUCT IMPROVEMENT

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PREFACE

This manual provides information applicable to programming the Removable Cartridge Disc System.

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2.5 AND 10 MEGABYTE REMOVABLE CARTRIDGE DISC PROGRAMMING MANUAL

INTRODUCTION

Perkin-Elmer Disc Systems provide a random access, rotating memory, storage facility for the family of Perkin-Elmer computers. Table 1 lists Product Numbers associated with each Controller. The system contains a single Controller which can handle up to four Disc Drives. There are two types of PC boards employed in this application, i.e. 381 mm (15") and 254 mm (10") PC boards. Appendix 1 specifies the differences between the 254 mm (10") and 381 mm (15") Controllers.

Data is recorded in a fixed-sector format, where each sector contains 256 data bytes. Data transfers are under control of a Selector Channel and can be from 1 to 12,288 bytes since the Controller permits data transfers across sector and head boundaries. Simultaneous seek and overlapping seek/data transfers are permitted in systems with multiple disc drives.

Table 2 summarizes specifications pertinent to programming the systems, and shows the differences in 2.5 and 10 Megabyte Disc Drives.

TABLE 1. DISC SYSTEMS

M46-420 (2.5 Megabyte)	M46-410	(2.5 Megabyte Removable Cartridge Drive)
	M46-414	(2.5 Megabyte Removable Cartridge Drive 50Hz)
	M46-411	(2.5 Megabyte Expansion Drive)
	M46-422	(2.5 Megabyte Moving Head Fixed Disc)
	M46-423	(2.5 Megabyte Moving Head Fixed Disc 50Hz)
M46-421 (10 Megabyte)	M46-416	(10 Megabyte Removable Drive)
	M46-417	(10 Megabyte Removable Drive 50 Hz)
	M46-418	(10 Megabyte Expansion Drive)
	M46-419	(10 Megabyte Expansion Drive 50 Hz)

CONFIGURATION

The Disc System must operate through a Selector Channel. The Selector Channel must be assigned a high priority on the memory bus to insure that the 180K byte or 310K byte transfer rate can be maintained for 2.5MB or 10MB Disc respectively.

TABLE 2. DISC SYSTEM SPECIFICATIONS

DATA STORAGE CHARACTERISTICS

10 MBYTE USES IBM 5440-TYPE CARTRIDGES, DOUBLE FREQUENCY RECORDING AT 2200 BITS PER INCH AND 200 TRACKS PER INCH.

2.5 MBYTE USES IBM 2315-TYPE CARTRIDGES, DOUBLE FREQUENCY RECORDING AT 2200 BITS PER INCH AND 100 TRACKS PER INCH.

	**10 MEGABYTE	2.5 MEGABYTE
TRANSFER RATE:	310K BYTES/SEC.	180K BYTE/SEC.
START-UP TIME:	1 MINUTE	1 MINUTE
*ACCESS TIME:		
AVERAGE LATENCY:	12.5 MILLISECONDS	20 MILLISECONDS
MAXIMUM LATENCY:	25 MILLISECONDS	40 MILLISECONDS
AVERAGE HEAD POSITIONING:	38 MILLISECONDS	70 MILLISECONDS
MAXIMUM HEAD POSITIONING:	70 MILLISECONDS	150 MILLISECONDS
MAXIMUM BETWEEN ADJACENT CYLINDERS	8 MILLISECONDS	15 MILLISECONDS
CAPACITY:		
SECTOR	256 DATA BYTES	256 DATA BYTES
TRACK	6,144 DATA BYTES	6,144 DATA BYTES
CYLINDER	12,288 DATA BYTES	12,288 DATA BYTES
FORMAT:		
SECTORS PER TRACK	24	24
TRACKS PER CYLINDER	2	2
CYLINDER PER PACK	408	203
TRACKS PER PACK	816	406
PARITY:	HALFWORD EVEN LONGITUDINAL PARITY	HALFWORD EVEN LONGITUDINAL PARITY
WRITE PROTECT:	PROTECTS FULL CARTRIDGE	PROTECTS FULL CARTRIDGE

*INCLUDES HEAD-SETTLING TIME

**THE 10MB DISC DRIVE IS COMPRISED OF A 5MB REMOVABLE PLATTER, AND A 5MB FIXED PLATTER. EACH PLATTER OF THE 10 MEGABYTE DRIVE IS IDENTIFIED BY A UNIQUE ADDRESS. PREFERRED DEVICE ADDRESSES ARE LISTED UNDER DEVICE NUMBER.

OPERATING PROCEDURES

The 2.5 and 10 Megabyte Discs provide the following switches and indicators.

LOAD/RUN Switch — This two position switch is located at the left of the front panel. In the LOAD position, the drive is not operating, the door may be opened, and cartridges may be loaded or unloaded.

When the switch is moved to the RUN position, the drive begins its start-up cycle which lasts for approximately one minute. Checks are made to insure that the door is closed and locked, a cartridge is in place, and that the correct spindle speed has been reached. After one minute has elapsed and the checks are completed successfully, the drive is ready for operation.

LOAD — This lamp lights to indicate that the drive is ready to load or unload cartridges; that the spindle has stopped turning, the heads are positioned away from the Disc surface, and the door is unlocked. The LOAD lamp goes off when the LOAD/RUN switch is moved to the RUN position.

READY — This lamp lights when the drive is ready to receive commands. This lamp goes on at the same time the File Ready line goes "TRUE". The lamp goes out when the LOAD/RUN switch is moved to LOAD position.

CHECK — This lamp indicates the same status as the WRITE CHK status, except for the temporary voltage fluctuation condition. The WRITE CHECK is reset by moving the LOAD/RUN switch to LOAD, then back to RUN.

POWER — This lamp indicates that power is available to the drive. When power is not available, the door is locked and a flag is imposed between the door and the cartridge receiver. This prevents inadvertent loading or unloading of cartridges in an unpowered condition.

NOTE

For 2.5 Megabyte Drives only, when the Write Protect Option is installed, the POWER lamp is replaced by the PROTECT Indicating switch. In this case, the operator may observe whether power is available by viewing the other three lamps. One of these is always lit, except during cycle-up and cycle-down operations.

WRITE PROTECT — The Write Protect Option enables the operator to protect a cartridge against inadvertent Write operations. He does this through the operation of the LOAD/RUN switch and the PROTECT switch. The PROTECT switch is also an indicating lamp.

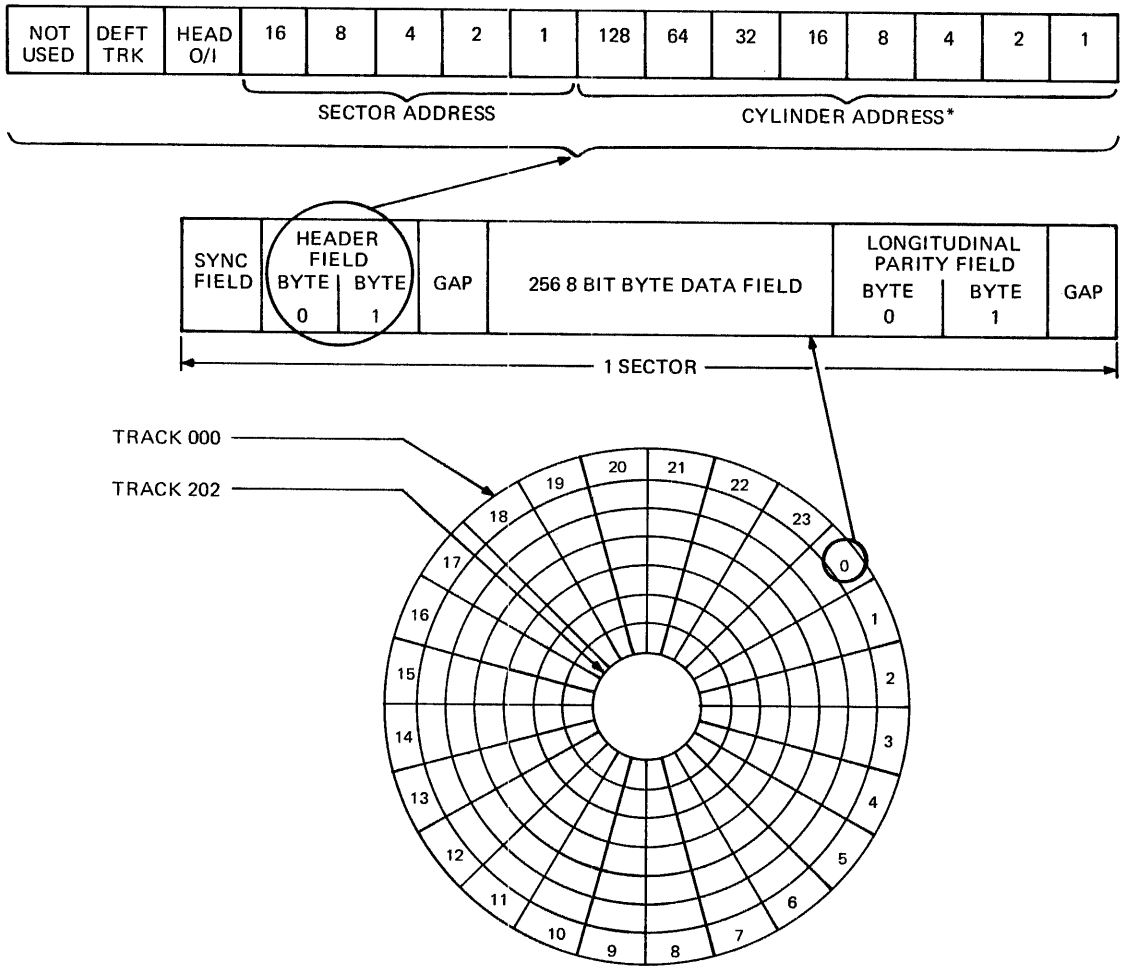
The Write Protect function is automatically set during each cycle-up (each time the LOAD/RUN switch is moved into the RUN position). To allow writing on a disc after a cycle-up, the operator must momentarily depress the PROTECT switch. This turns the lamp off and resets the Write Protect Status line. The operator may set the Write Protect by moving the LOAD/RUN switch to LOAD, then immediately back to RUN.

DATA FORMAT

Disc Format

The Disc is segmented into 24 sectors per track. Each sector contains a two byte header field and a 256 byte data field followed by a two byte longitudinal parity field. See Figure 1. The number of bytes in a data transfer is not limited to sector or track boundaries. Therefore, as few as one byte and as many as 12,288 bytes may be transferred at one time. However, the Disc continues the Write or Read operation until a complete sector is encountered, even if a complete sector is not specified. In a Write operation, the sector is "filled" with the last data byte specified. In the Read Mode, the bytes that were specified are read into the SELCH and it interrupts when this is complete, but the Controller continues reading until the sector boundary is reached. At this time, the user may interrogate the Controller status to verify that the data transfer was error free.

The header field in Figure 1 is not normally written or read. It is used when formatting the Disc. A Disc format program is run on each Disc to insure the integrity of the Disc. This is normally performed by commanding the Controller into the Write Format Mode and then writing a worst case pattern (or patterns) into the complete sector including header and data fields. The program then commands the Controller into the Read Format Mode and reads the sector. If the data compares, the user may then Write the correct address into the header field with the DEF TRK Bit = 0 and continue to the next sector. If the data does not compare, the user may choose to do a more complete surface analysis and, based on the results, program the DEF TRK Bit to a 1 or 0. The user can access the header field by programming the FORMAT Mode and also by operating the FORMAT switch in the Controller. The hardware uses the header field for two purposes: to inhibit data transfers on tracks which are flagged as defective and to guard against attempted transfers where the heads are not properly positioned.



* IN THE CASE OF A 10 MEGABYTE DRIVE WITH A CYLINDER ADDRESS $\geq 256_{10}$, THE CYLINDER ADDRESS PORTION OF THE HEADER = ACTUAL CYLINDER ADDRESS -256_{10}.

Figure 1. Removable Cartridge Disc Format

Disc Test/Format

Each cartridge supplied by Perkin-Elmer is tested to insure the integrity of the Disc surface. The Common Disc Test Program 06-173F01 and the Common Disc Formatter 06-173F02 perform this qualification.

Figure 2 shows the data format for a sector.

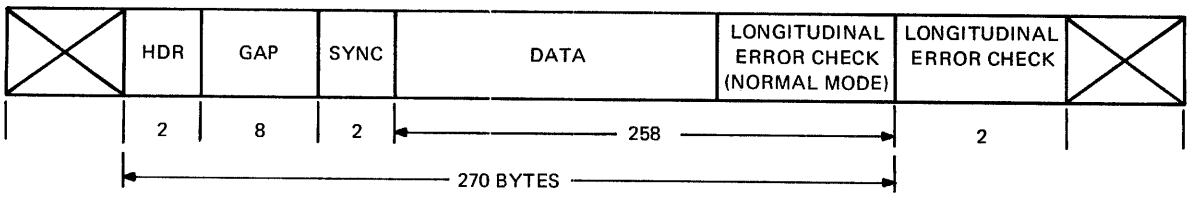


Figure 2. Sector Format (For Format Mode Only)

In the Format Mode, the Formatter program will Write/Read the 270 bytes in the sequence shown. Note that the data field in this case is 258 bytes. This permits testing the field which contains the Longitudinal Parity bytes in the normal data mode. For this reason, the sequence Normal Write/Read Format or Write Format/Normal Read generally produces Longitudinal Parity errors and/or bad data.

The Format Program Writes a prescribed pattern, reads it back a specified number of times and verifies that the data is correct and that there are no Longitudinal Parity errors. If there are no errors on any of the read operations, the program writes the header with the correct address with the DEF TRK bit=0.

If a data or Longitudinal Parity error is detected on any of the read operations, the program will set DEF TRK=1. Using this method, each 2.5MB disc cartridge supplied by Perkin-Elmer is specified to have at least 400 of its 406 tracks error-free.

PROGRAMMING INSTRUCTIONS

Processor Instructions

Data transfers to and from the Disc are accomplished via the Selector Channel (SELCH); but the Processor I/O instructions are used to communicate with the Disc, Controller, and SELCH. The following is a brief description of each of these instructions.

SENSE STATUS (SS OR SSR)	Used to interrogate the Disc and Controller to insure that data transfers are complete and correct. It may also be used to determine if the Selector Channel is busy.
OUTPUT COMMAND (OC OR OCR)	Used to control Disc operations and to set up the desired mode of operation and to initialize and set up the SELCH.
WRITE DATA (WD OR WDR)	Loads the Cylinder Address, Sector Address, and Head Number in the Controller and loads the SELCH Address Registers.
READ DATA (RD OR RDR)	Used to determine the current rotational position of an addressed Disc and to interrogate the Address Register in the SELCH to determine if a data transfer terminated correctly.
ACKNOWLEDGE INTERRUPT (AI OR AIR)	Used to service the Controller and SELCH interrupts. It also returns the interrupting device number and status.

The Controller and each Disc have a separate address. This is a strap option which can be altered with a minor wiring modification (refer to *Removable Cartridge Disc System Instruction Manual,* Publication Number 29-289. The Controller is always the lowest address. The Disc addresses follow in sequence by adding one to the most significant hexadecimal digit. The standard addresses are:

2.5 Mega-Byte Disc

X'B6'	CONTROLLER
X'C6'	DISC 0
X'D6'	DISC 1
X'E6'	DISC 2
X'F6'	DISC 3

10 Mega-Byte Disc)

X'B6'	CONTROLLER
X'C6'	DISC 0, REMOVABLE DISC
X'D6'	DISC 1, REMOVABLE DISC
X'E6'	DISC 2, REMOVABLE DISC
X'F6'	DISC 3, REMOVABLE DISC
X'B6'	CONTROLLER
X'C7'	DISC 0, FIXED DISC
X'D7'	DISC 1, FIXED DISC
X'E7'	DISC 2, FIXED DISC
X'F7'	DISC 3, FIXED DISC

TABLE 3. CONTROLLER COMMAND, STATUS, AND DATA BYTES

INST BIT	0	1	2	3	4	5	6	7	
CMD	X	X	X	X	0	0	0	1	READ
	X	X	X	X	0	0	1	0	WRITE
	X	X	X	X	0	0	1	1	READ CHECK
	X	X	X	X	0	1	0	1	READ FORMAT
	X	X	X	X	0	1	1	0	WRITE FORMAT
	X	X	X	X	1	X	X	X	RESET
WD	0	0	HEAD 0/1	SECT 16	SECT 8	SECT 4	SECT 2	SECT 1	
WD	CYL 128	CYL 64	CYL 32	CYL 16	CYL 8	CYL 4	CYL 2	CYL 1	
RD (CONTROLLER IDLE)	0	0	0	SECT 16	SECT 8	SECT 4	SECT 2	SECT 1	
SS	OVER-RUN	ADDR COMP FAIL	DEF TRK	CYL OV	BSY	EX	CONT IDLE	DATA TRANSFER ERROR	

X = DON'T CARE

Controller Command Definitions

The Controller contains interrupt circuits which are always enabled, therefore, the standard Enable/Disable Command bits are not used.

READ

Enables the Controller to perform a normal data read. The Selector Channel must be set up prior to the Command, the heads must be positioned and the Sector Address loaded in the Controller. The data transfer from the Controller will delay for at least 90 microseconds after a sector match. The Selector Channel must be started before this time. If the last sector read is not a complete sector, the Selector Channel will terminate after the last byte is read into core, but the Controller will continue reading until the Longitudinal Parity Error Check Word is verified, and then set CONT IDLE.

WRITE

Enables the Controller to perform a normal Data Write. The Selector Channel must be set up prior to the Command, the heads must be positioned and the Sector Address must be loaded into the Controller. Data transfer to the Controller will delay for at least 90 microseconds after a sector match. The Selector Channel must be started before this time. If the last sector written is not a complete sector, the Selector Channel terminates after the last data byte is written, but the Controller continues and fills the remainder of the sector with the last data byte, writes the Longitudinal Parity Error Check Word, and then sets CONT IDLE.

READ CHECK

Causes the Controller to perform an off-line Read of a single sector. The Selector Channel is not used but the heads must be positioned and the Sector Address must be loaded before this Command is issued. While in the READ CHECK Mode, no data is passed to the Selector Channel, but the Disc Interface cannot be used until this mode is terminated (Controller Idle=1). The OVERRUN, ADDR COMP FAIL, DEF TRK, CONT IDLE, and LONGITUDINAL PARITY ERROR status bits have the same meaning as in the normal Read. An interrupt will be generated when the READ CHECK is completed (CONT IDLE → 1). The Selector Channel can be used following the issue of the READ CHECK command.

WRITE FORMAT — This command, together with the FORMAT switch in the Controller ON position, permits writing into the header field of the sector. This is normally used only when performing a surface analysis of a new cartridge. Normally, 270_{10} bytes are written in the FORMAT Mode. This includes the synch field, header field, gap, data field, and longitudinal parity error check word field in that order. See Figure 2 and refer to Disc Test Format for a complete discussion of the FORMAT Mode.

READ FORMAT — This command, together with the FORMAT switch in the Controller ON position, permits reading from the header field of the sector. This is normally used only when performing a surface analysis of a new cartridge. Figure 2 and Disc Test/Format show the details for the FORMAT Mode.

RESET — This command disarms all the files, resets the Attention flip-flop, Mode flip-flop, Head Select flip-flop, Data Input Register, OVERRUN, ADDR COMP FAIL, DEF TRK, CYL OV, LONGITUDINAL PARITY ERROR and WPV and sets CONT IDLE, and Controller BUSY. In addition, it terminates any data transfers in progress and inhibits writing. This command does not affect a SEEK in progress. This command is normally required to reset status bits.

NOTE

If a non-valid command is issued to the controller, or a format command is issued when the controller format switch is in the non-format mode, the controller status will become busy until a reset command or a system clear is received.

Controller Read Data Definition (2.5 and 10 Megabyte Systems)

This Read Data must be issued when CONT IDLE=1 and causes the Sector Byte of the previously selected Disc to be returned to the Processor. This sector byte may be changing at the time of the RD. For this reason, it is necessary to issue consecutive RDs and verify that the bytes are the same; if not, it will be necessary to issue another RD.

Controller Write Data Definition (2.5 and 10 Megabyte Systems)

This byte represents the starting sector and head address for a data transfer and must be loaded before every data transfer. Sector Addresses between zero and 23_{10} only, are valid. Any out-of-range sector address will result in an OVERRUN status.

Controller Status Definitions (Table 3 Summarizes the Controller Status Byte)

OVERRUN — This status bit is active if the sector address (set up by the WD), does not compare with any sector address from the selected disc. This bit is active after two revolutions of the Disc when a sector match is not found and sets EX to generate a SELCH interrupt. When OVERRUN → 1, CONT IDLE will be set to one. OVERRUN is reset by INITIALIZE or a command to the Controller. OVERRUN occurs as a result of the program selecting a sector address > 23_{10}' or for certain hardware malfunctions.

ADDRESS COMPARE FAILURE — This status bit is set only in the normal READ, normal WRITE, or READ CHECK Modes if the CYLINDER ADDRESS, head and sector bytes from the Processor do not agree with the cylinder address, head and sector read from the header. (See Figure 1.) The cylinder address and sector are only tested on the first sector of a record. The Head bit, however, is tested on each sector of a record. ADDRESS COMPARE FAILURE will cause the READ/WRITE /READ CHECK to abort (no further data transfers will occur). EX is set and an interrupt is generated when this bit gets set. This bit is reset by INITIALIZE or a command to the Controller.

DEF TRK — This status bit is set only in the normal READ, normal WRITE, or READ CHECK Modes when a data transfer is attempted on a sector which is flagged as defective (DEF TRK bit in the header field is set). The data transfer is aborted and DEF TRK sets EX and generates a SELCH interrupt. This bit is reset by INITIALIZE or by a Command to the Controller. This bit is tested on each sector of a record.

CYL OV — Cylinder Overflow is set when a data transfer is attempted across a cylinder boundary (Head 1, Sector 23). CYL OV will set EX and generate a SELCH interrupt. CYL OV is reset by INITIALIZE or a Command to the Controller. In the latter case, CYL OV is reset while CONT IDLE is being set.

BSY — This status bit is only used by the SELCH and should be ignored by Programmers.

EX — EXAMINE will be active while any of the following bits are set: OVERRUN + ADDR COMP FAIL + DEF TRK + CYL OV. EX, when set, causes a SELCH interrupt.

CONTROLLER IDLE — This bit will be ZERO when a command is sent to the Controller or when a Seek or Restore command is being initiated on a DISC. It is set when the operation is complete, or by INITIALIZE, or by COMMAND RESET or by OVERRUN. In the case of Seek or Restore, it will be reset for approximately 40 microseconds after receipt of the command.

DATA TRANSFER ERROR — This status bit has the following meaning: ERROR

LONGITUDINAL PARITY ERROR — If the Controller is in the READ, READ FORMAT, or READ CHECK Mode, this bit is set if a Longitudinal Parity Error occurs. For multi-sector Read Operations, this bit may be set at the end of any sector. In the case of a partial sector Read operation, the SELCH interrupts after the last byte is read from the DISC, but the Controller continues reading until the end of sector and sets CONT IDLE. If this sector has a Longitudinal Parity Error, this status bit is set before CONT IDLE →1. This status bit is reset by INITIALIZE or a command to the Controller.

WRITE PROTECT VIOLATION (WPV) — If the Controller is in the WRITE or WRITE FORMAT Mode, this bit is set when a WRITE PROTECTed Disc is addressed and the Controller is commanded to the WRITE or WRITE FORMAT Mode. This bit, when set, will cause a SELCH interrupt. This status bit can only be reset by manually removing the WRITE PROTECT condition or by issuing a command to the Controller which does not specify WRITE or WRITE FORMAT. WRITE PROTECT is optional on each physical disc. If this option is not provided, the WPV status is forced to ZERO. Any Read operation is performed normally on a Write Protected Disc. Note that each Disc has a separate status byte which includes a bit to indicate that the Disc is or is not Write Protected.

DEVICE UNAVAILABLE — If set (DU=1), this condition indicates that the selected Disc drive is not supplied with proper power, or not loaded with a Disc cartridge, or the LOAD/RUN Switch is in the LOAD position, or the Disc start-up cycle is not completed, or the Write Check flip-flop is set. It is reset (DU=0) when none of the above conditions are true.

WRITE CHECK — If set ((Write Check → 1), this condition indicates that during a Write operation the Write Check flip-flop is set or the supplied voltage to the Disc drive has dropped to less than a nominal voltage. If this occurs, it may be desirable to re-write the affected record. It is reset by INITIALIZE or a command to the Controller.

DATA OVERFLOW — This is set to indicate that the Buffer Register was loaded from the Disc before the previous data has been transferred to the SELCH or the same data is transferred twice to the Disc before the next data has been sent out from the SELCH. It is reset by INITIALIZE or a command to the Controller.

NOTE

When system power is just turned on, the Controller may select any Disc. If a non-existent Disc is selected, the Device Unavailable status bit will cancel out any operation. So before sensing the Controller status bits for the first time after power failure, an output command to the existent Disc should be issued. For example: issue an OC DISARM.

Disc Command, Status and Data Bytes (Table 4)

TABLE 4. DISC COMMAND, STATUS, AND DATA BYTES

BITS INST.	0	1	2	3	4	5	6	7	
CMD	DIS	EN	X	X	X	X	SEEK	RESTORE	
WD								256	CYLINDER ADDRESS*
WD	128	64	32	16	8	4	2	1	BYTE
SS	WRT PROT	WRT CHK	ILL ADDR	DISC ADDR INTLK	RSRW	EX	SEEK INC	DISC READY	

*The greater track density of the 10 Megabyte Drive requires that 2 Write Data instructions or 1 Write Halfword instruction be used to transfer cylinder address information to the drive. In the case of a 2.5 Megabyte Drive one Write Data as shown in Table 4 is sufficient.

The Command, Status, and Data Bytes in Table 4 are valid for each Disc. If a Command is directed to an unequipped Disc, the hardware will respond as if the Disc was equipped, i.e., a False Synch will not result. If the Command specifies SEEK or RESTORE, the Controller will lock up waiting for control signals from a non-existent Disc. In this case, it is necessary to issue a Controller Command RESET.

If a Write Data is directed to an unequipped Disc, the hardware responds as if the Disc was equipped.

If a Sense Status is directed to an unequipped Disc, the returned status byte is X'09'.

Disc Command Definitions

DISABLE/ENABLE — These bits control the Enable/Disable/Disarm functions as follows:

BIT NUMBER 0	1	
1	1	DISARM – Interrupts are not queued.
1	0	DISABLE – Interrupts are queued, but not passed to the Processor.
0	1	ENABLE – Interrupts are passed to the Processor as they occur.
0	0	NO CHANGE

SEEK — This command is used to reposition the heads to a different cylinder. The user must issue a WD CYL ADDR prior to issuing a Command SEEK. The status bits SEEK INC, $\overline{\text{RSRW}}$ and DISC ADDR INTLK must be inactive (0) before issuing a SEEK. The success or failure of a SEEK will be reflected in the $\overline{\text{RSRW}}$ and SEEK INC status bits. When attempting consecutive SEEKS to more than one drive, the user must Sense Status of CONT IDLE and wait for CONT IDLE ➔1 (no interrupt will be generated in this case).

After issuing a SEEK to the first Disc, it will take approximately 40 microseconds for CONT IDLE ➔1.

RESTORE — This command causes the heads to move to Cylinder 000. A command RESTORE is required to clear the SEEK INC status. The $\overline{\text{RSRW}}$ bit need not be ZERO before issuing this command, but while a RESTORE is in progress, $\overline{\text{RSRW}}$ will be active. DISC ADDR INTLK must be ZERO before issuing a RESTORE. Worst case RESTORE time is 1.75 seconds.

Disc Write Data Definition

This Write Data is used to load the Cylinder Address prior to a SEEK or RESTORE. A Cylinder Address of 000 to 202_{10} is valid. Cylinder 000 is at the outer periphery of the disc and 202_{10} is at the inner periphery. An out-of-range Cylinder Address will result in ILL ADDR when a SEEK or RESTORE is attempted.

Disc Status Definitions (Valid Only When CONT IDLE=1)

WRT PROT — If the Write Protect option is equipped and activated (as indicated by the PROTECT lamp on the Disc being ON), this status bit is active. This status bit should be tested before attempting a WRITE or WRITE FORMAT operation. See WRITE PROTECT manual controls.

WRT CHK — This status bit is active if the Disc hardware detects a fault which would affect reliable WRITE operations. This fault can be improper hardware head selection or DC voltages out of specification. A permanent fault will latch WRT CHK and also activate DISC NOT READY to generate an interrupt. A voltage fluctuation can cause this bit to become momentarily active. If this bit is permanently active, the Disc must be shut down to determine the fault. No software recovery is possible.

ILL ADDR — This status bit is active when a SEEK or RESTORE is attempted to an out-of-range cylinder address. If a SEEK is attempted to an out-of-range address, the SEEK will not occur. If a RESTORE is attempted to an out-of-range address, the operation will continue normally. ILL ADDR is only reset by a legal (in-range) SEEK or a RESTORE.

DISC ADDR INTLK — This bit is active when CONT IDLE is inactive or when the Disc is in the WRITE/WRITE FORMAT Mode and is in the process of Writing or tunnel erase. This bit is active for approximately 160 micro-seconds after CONT IDLE ➔1 at the termination of a WRITE/WRITE FORMAT. At the termination of the above operation, the user must verify that DISC ADDR INTLK ➔0 before addressing any other Disc. It also sets EX. The user can sense CONT IDLE status through this bit.

$\overline{\text{RSRW}}$ — Not Ready to SEEK, READ, or WRITE – This bit is active while the heads are being repositioned as a result of a SEEK or RESTORE. This bit must be inactive before a SEEK, READ, or WRITE. When this status bit goes inactive a Read or Write may be performed. Note that if a SEEK is attempted to the present cylinder address, $\overline{\text{RSRW}}$ will not become active but an interrupt will be generated.

EX=WRT CHK + ILL ADDR + DISC ADDR INTLK

SEEK INC — This bit becomes active if the disc is unable to complete a SEEK operation. This is probably a hardware fault and can only be cleared by a RESTORE. When SEEK INC goes active, $\overline{\text{RSRW}}$ will also be active and will also be cleared by RESTORE.

DISC $\overline{\text{READY}}$ — Active if Disc is not operational, i.e., power not applied, cartridge not loaded, etc. A non-equipped Disc will respond with DISC $\overline{\text{READY}}$ and $\overline{\text{RSRW}}$ (X'09') to a Sense Status.

TABLE 5. CONTROLLER STATUS

(2.5 and 10 MEGABYTE DRIVES)

0 OVER-RUN	1 ADDR COMP FAIL	2 DEF TRK	3 CYL OV	4 BSY	5 EX	6 CONT IDLE	7 DATA TRANS ERROR	
✓	✓	✓	✓					SETS EXAMINE AND GENERATES A SELCH INTERRUPT IF SELCH IS TRANSFERRING DATA.
✓	✓	✓	✓				✓	SETS CONT IDLE (GENERATES CONTROLLER INTERRUPT.)
						✓		CONTROLLER IDLE SET WHEN OPERATION IS COMPLETE OR BY INITIALIZE, COMMAND RESET, OR OVERRUN.
✓	✓	✓	✓	X	✓		✓	RESET BY OC RESET
						✓		SET AT END OF TRANSFER AND GENERATES CONTROLLER INTERRUPT.
0	0	0	0	X	0	1	0	STATE AFTER OC RESET.
								X = DON'T CARE

PROGRAMMING SEQUENCES

Disc Operations

Appendices 2 and 3 illustrate programming examples for Disc operations. To initiate Disc operations, certain mandatory instruction sequences must be followed if Controller and/or file status is unknown. The following sections provide a guide to performing stand-alone Disc I/O. When used in conjunction with the flowcharts in Appendix 2, all possible variations of functional Disc operation are presented.

Sense-Status Seek Operation

(Refer to Appendix 2 or 3: Sense Status Seek Operation)

The mandatory sequence to *initiate* a SEEK operation is shown in the flowchart of Appendix 2. In addition, the following points *must be* especially noted:

1. If ADS INTERLOCK = 0; (file status Bit-3), file status may be sensed, and a file operation performed. If ADS INTERLOCK = 1; no command may be given to the file, and the remaining status bits are undefined. Ignore the device until ADS INTERLOCK resets.

2. DISC $\overline{\text{READY}}$=1 (file status Bit-7=1), the file is unavailable for any operation.

3. If SEEK INCOMPLETE=1 (file status Bit-6=1), then $\overline{\text{RSRW}}$ (file status Bit 4) will never go to ZERO, and the file must be restored by issuing a RESTORE command.

4. If $\overline{\text{RSRW}}$=1 (file status Bit-4) and SEEK INCOMPLETE=0 (file status Bit 6 = 0) then a SEEK or RESTORE is in progress if previously commanded.

Sense Status Read/Write Operation

(Refer to Appendix 2 or 3 Sense Status Read/Write Operation)

The mandatory sequence to initiate a Sense-Status Read/Write operation is shown in the flowchart of Appendix 2. The following items must be especially noted:

1. If OVERRUN status is set (Controller Bit-0 = 1), the Controller becomes idle.

2. If the DATA TRANSFER status is set (Controller status Bit-7 = 1), the data transfer was in error, or the Disc file status is in error.

3. As a result of sensing file status in (2); if DISC $\overline{\text{READY}}$ is set (file status Bit-7 = 1), or if on a Write operation, WRITE CHECK status is set (file status Bit-1 = 1) or WRITE PROTECT (file status Bit-0 = 1) status is set, for a Write operation the program should not attempt recovery.

4. A RESET command to the Controller resets all error status bits and reinitializes the device for subsequent operations.

5. In sensing Controller status for the Controller Idle ➔1 condition, the programmer is cautioned that an undesired Controller interrupt will queue. This occurs because Controller interrupts cannot be disabled or disarmed in either the 2.5 or 10 Megabyte Disc Controllers.

Interrupt Read/Write Operation

(Refer to Appendix 2 or 3 Interrupt Read/Write Operation)

The mandatory sequence to initiate an interrupt Read/Write Operation is shown in the flowchart of Appendix 2. The following items must be especially noted:

1. If OVERRUN is set (Controller status Bit-0 = 1), then CONTROLLER IDLE sets (Controller status Bit-6 = 1) but a Controller interrupt is *not* generated.

2. If OVERRUN is not set, the program should enable interrupts and acknowledge the impending Controller interrupt. If a sense status loop is employed in waiting for CONTROLLER IDLE ➔1, an undesired Controller interrupt will queue.

Multi-Disc Operation

Refer to Appendices 2 and 3:(Multi Disc Operation)

Simultaneous seek and overlapping seek/data transfer operations are permitted in multi-disc systems. Sequences as previously identified are applicable to individual file operations and are illustrated in the Multi-Disc Driver in Appendices 2 and 3.

In addition, special attention should be given to the following:

1. Prior to initiating simultaneous seek operations, insure that CONTROLLER IDLE=1 and ADDR INTERLOCK=0 for the desired file.

2. OVERRUN status from the Controller should be sensed by the SELCH interrupt handler as the Controller interrupt will never be generated if OVERRUN=1.

3. In operating Multi-Disc systems on a Perkin-Elmer standard 32-bit Processor, the status of an interrupting device is returned to the interrupt handler by a micro-coded sequence. The normal sequence of interrupts being processed from the Disc in a single Disc system would be, 1.) File interrupt, 2.) Selch interrupt and, 3.) Controller interrupt. In a Multi-Disc operating environment, these interrupts can also occur in the following sequence, 1.) SELCH Interrupt, 2.) File interrupt, and 3.) Controller Interrupt since simultaneous Seek operations and overlapped Seek/data transfer operations are allowed. In processing the file interrupt in this sequence, the file status that is returned to the user by the microcode may be incorrect. Care should be taken to insure that *the subsequent Controller interrupt is processed prior to sensing the desired file status* and performing the required error checking. The Multi-Disc programming examples demonstrate a sequence to avoid processing erroneous file status.

4. If CYL OVERFLOW = 1 when the Controller Data Transfer interrupts occur, the indication is that the Data Transfer is not yet complete and the program should begin Reading/Writing the next cylinder. This may be done as follows:

   Read the address of the last Data Transfer from the Selector Channel. Due to the indeterminate timing of the CYL OVERFLOW error with respect to the Selector Channel/Memory cycle, this address may not be correct. Therefore:

   Subtract the starting address and add two to the result.

   Clear the low-order byte of the result and add the start address. This is the new starting address for the following data transfer.

   Set up the SELCH with the new starting address and previously issued ending address.

5. If the SELCH is busy (SELCH status Bit 12 = 1) Controller and/or file status is unavailable to the Processor. Any attempt to sense the status returns the false sync status (X'04').

6. The Controller RESET command resets all status bits and pending (queued) interrupts. Therefore, it must not be issued while multi-file Data Transfers are in progress.

7. Simultaneous seek and overlapped Seek/I/O operations are not possible between the platters of a single 10 megabyte file.

INTERRUPTS

The Controller will cause a SELCH interrupt to be generated if a SELCH transfer is in progress and any of the lower three bits of the Controller status byte are set. The Controller and each Disc also generate interrupts. The Controller interrupts are always enabled and the individual Disc interrupts may be programmed ENABLE/DISABLE/DISARM. To select the fixed Disc of the 10 Megabyte Drive, use addresses X'C7', X'D7', X'E7', X'F7' for files 0, 1, 2, 3, respectively. The Controller will always return the interrupting address with X'C6' X'D6', X'E6' and X'F6' for files 0, 1, 2, 3, respectively, even if the fixed Disc is selected. The interrupt priority is:

SELCH
Controller
Disc 0
Disc 1
Disc 2
Disc 3

The interrupt conditions are:

CONT IDLE ← 1 (unless OVERRUN = 1)
ILL ADDR ← 1
$\overline{\text{RSRW}}$ ← 0
SEEK $\overline{\text{INC}}$ ← 1
DISC $\overline{\text{READY}}$ ← 1

INITIALIZATION

Initialization causes the following: Disarms all Disc interrupts; terminates a data transfer in progress; resets the Controller Command Register to zeros (no operation); resets OVERRUN, ADDR COMP FAIL, CYL OV; and sets CONT IDLE.

DEVICE NUMBER

Preferred Device addresses are listed below:

2.5 Mega-Byte Disc

X'B6' CONTROLLER
X'C6' DISC 0
X'D6' DISC 1
X'E6' DISC 2
X'F6' DISC 3

10 Mega-Byte Disc

X'B6' CONTROLLER
X'C6' DISC 0, REMOVABLE DISC X'C7', DISC 0, FIXED DISC
X'D6' DISC 1, REMOVABLE DISC X'D7', DISC 1, FIXED DISC
X'E6' DISC 2, REMOVABLE DISC X'E7', DISC 2, FIXED DISC
X'F6' DISC 3, REMOVABLE DISC X'F7', DISC 3, FIXED DISC

SAMPLE PROGRAMS

Sample Programs are provided in Appendices 2 and 3.

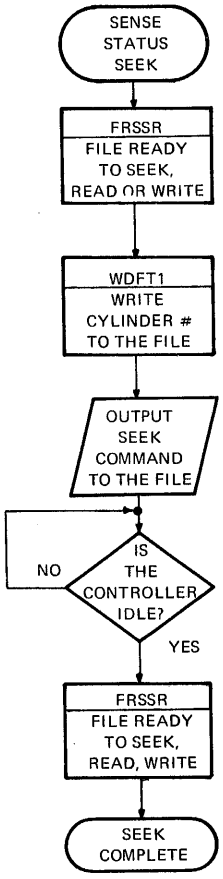
APPENDIX 1

DIFFERENCES BETWEEN 254 mm (10") and 381 mm (15") CONTROLLERS

The following table lists the differences between 254 mm (10") and 381 mm (15") Disc Controllers:

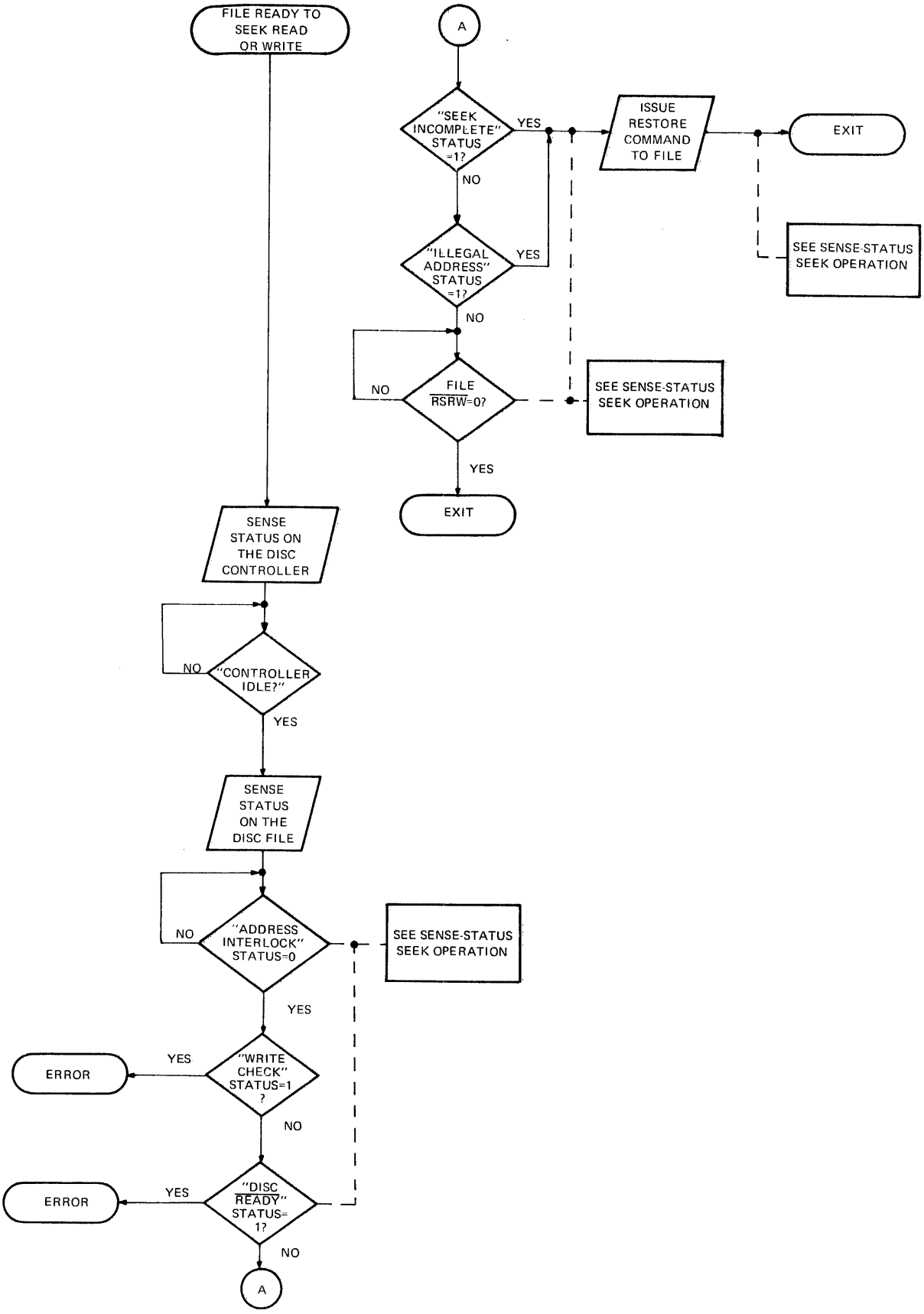
	254 mm (10") CONTROLLER	381 mm (15") CONTROLLER (described in this document)
1.	The Controller Status Bit-7 consists of: Parity Check Error Write Protect Violation	The Controller status Bit-7 consists of: Parity Check Error Write Protect Violation Device Unavailable Write Check Data Transfer Error
2.	The COMMAND RESET is 11001000.	The COMMAND RESET is XX001000. Where X = Don't Care.
3.	Only performs single SELCH operation.	Performs single or MUX SELCH operation.
4.	If OVERRUN gets set, CONT IDLE will not set, the system will hang up.	If OVERRUN gets set, CONT IDLE will set.
5.	DISC ADDRESS INTERLOCK = WRITE GATE.	DISC ADDRESS INTERLOCK = WRITE GATE + NOT CONTROLLER IDLE.
6.	WRITE PROTECT status cannot be sensed after the completion of operation.	WRITE PROTECT status can be sensed after the completion of operation.
7.	Works only on 2.5 Megabyte disc.	Works on both 2.5 and 10 Megabyte disc.

APPENDIX 2
2.5 AND 10 MEGABYTE DISC PROGRAMMING EXAMPLES
FUNCTIONAL FLOW CHART OF SENSE-STATUS SEEK OPERATION

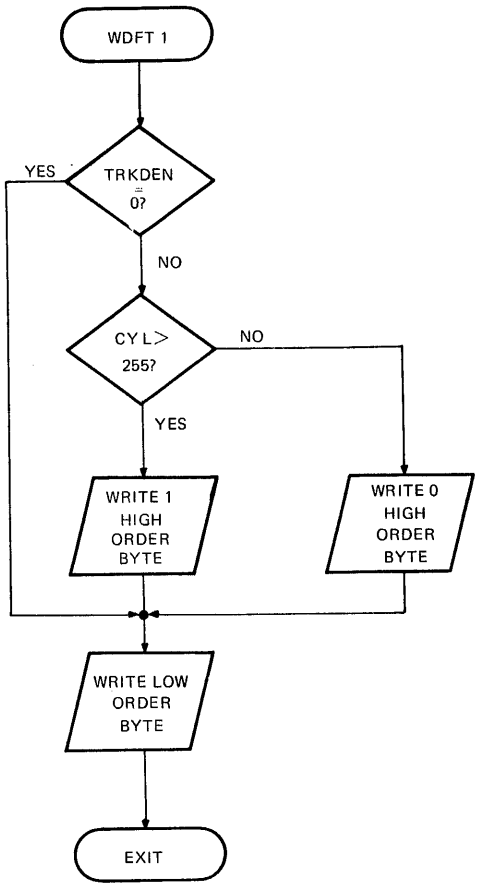


APPENDIX 2 (Continued)

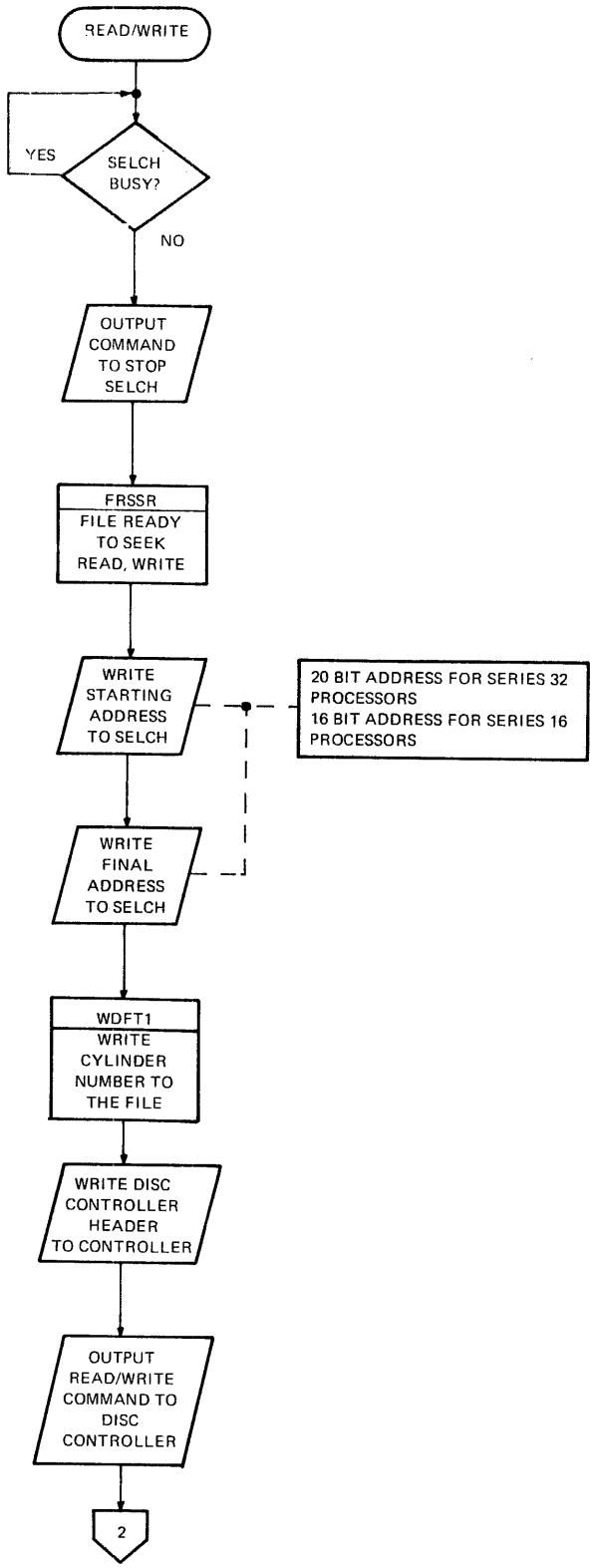
FUNCTIONAL FLOW CHART OF FILE READY TO SEEK READ OR WRITE OPERATION

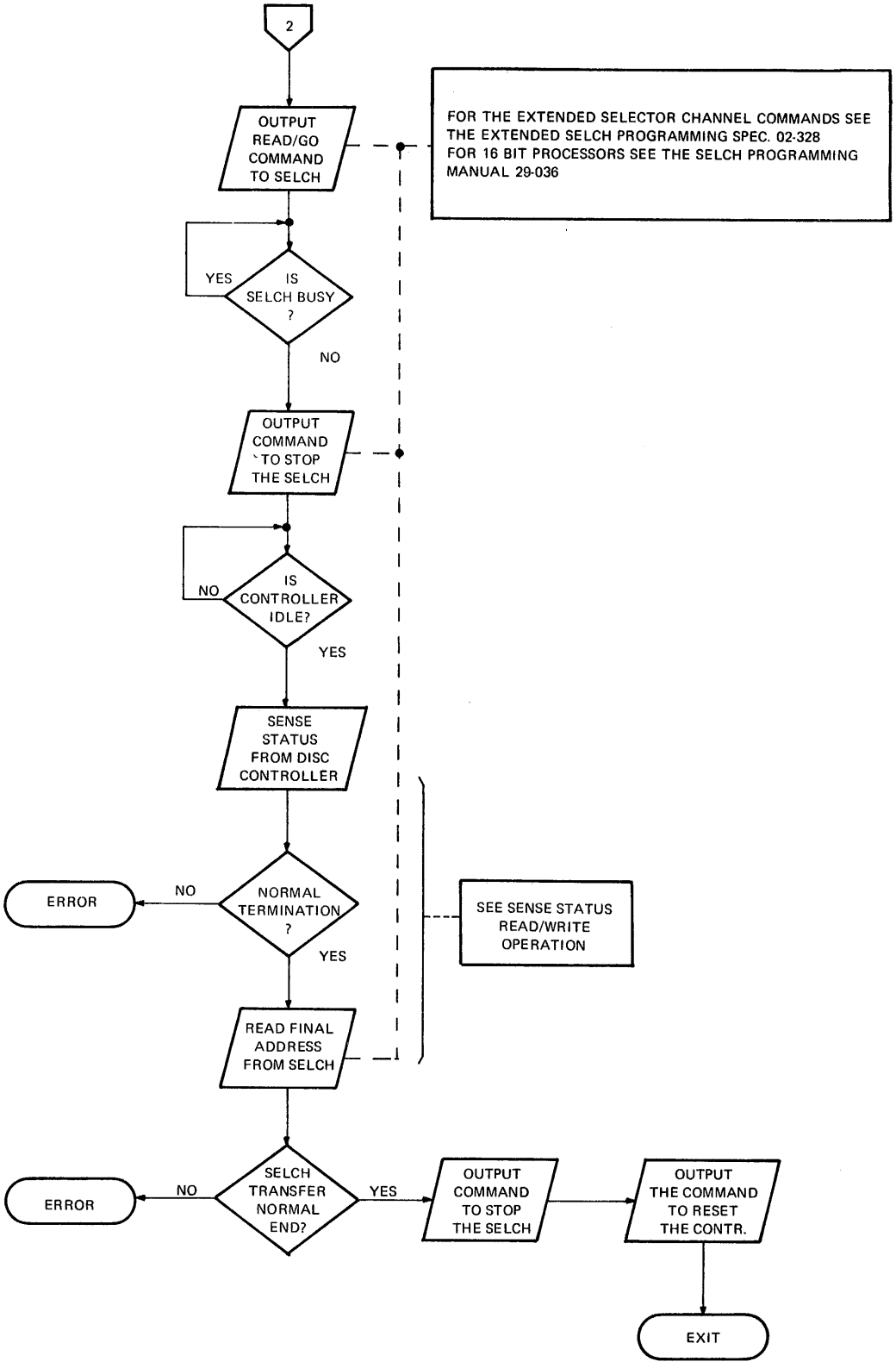


FUNCTIONAL FLOW CHART OF WRITE CYLINDER NUMBER TO FILE OPERATION

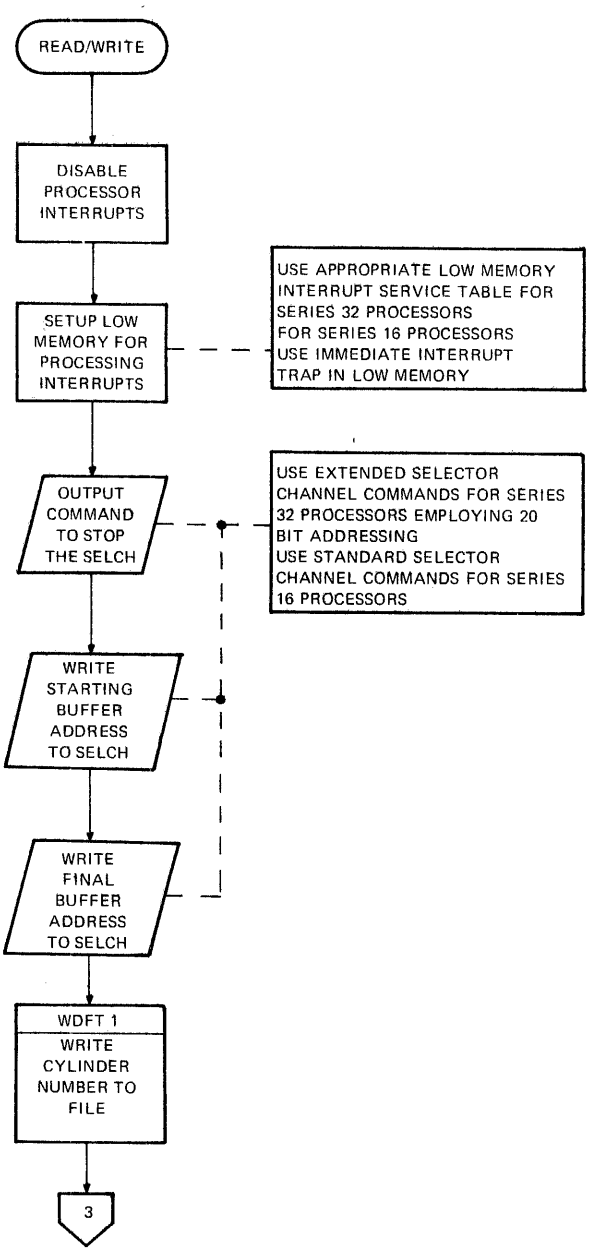


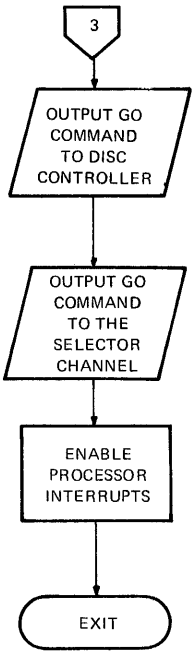
FUNCTIONAL FLOW CHART OF READ/WRITE (SENSE STATUS) OPERATION

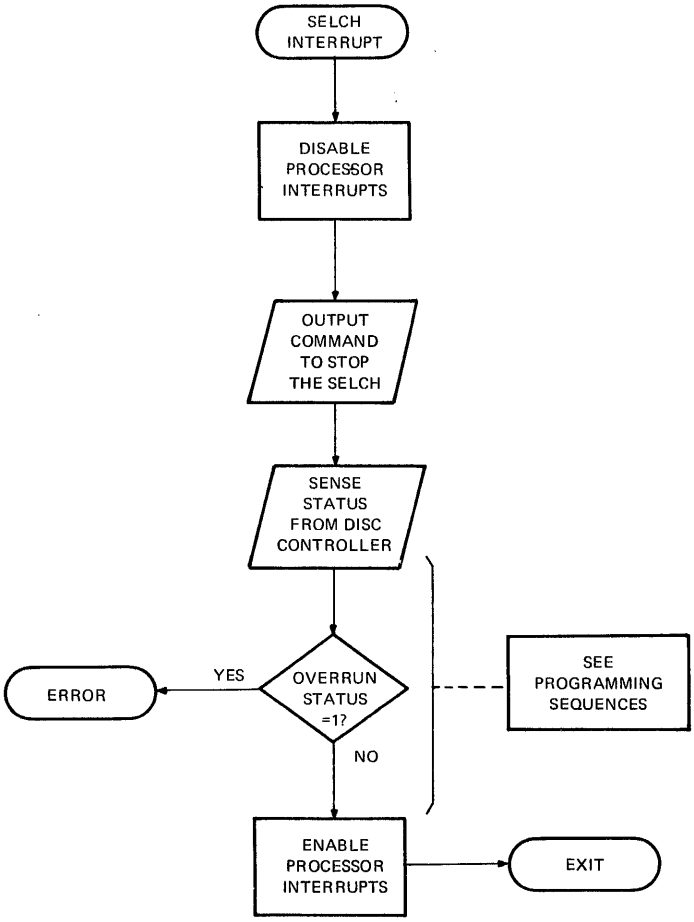


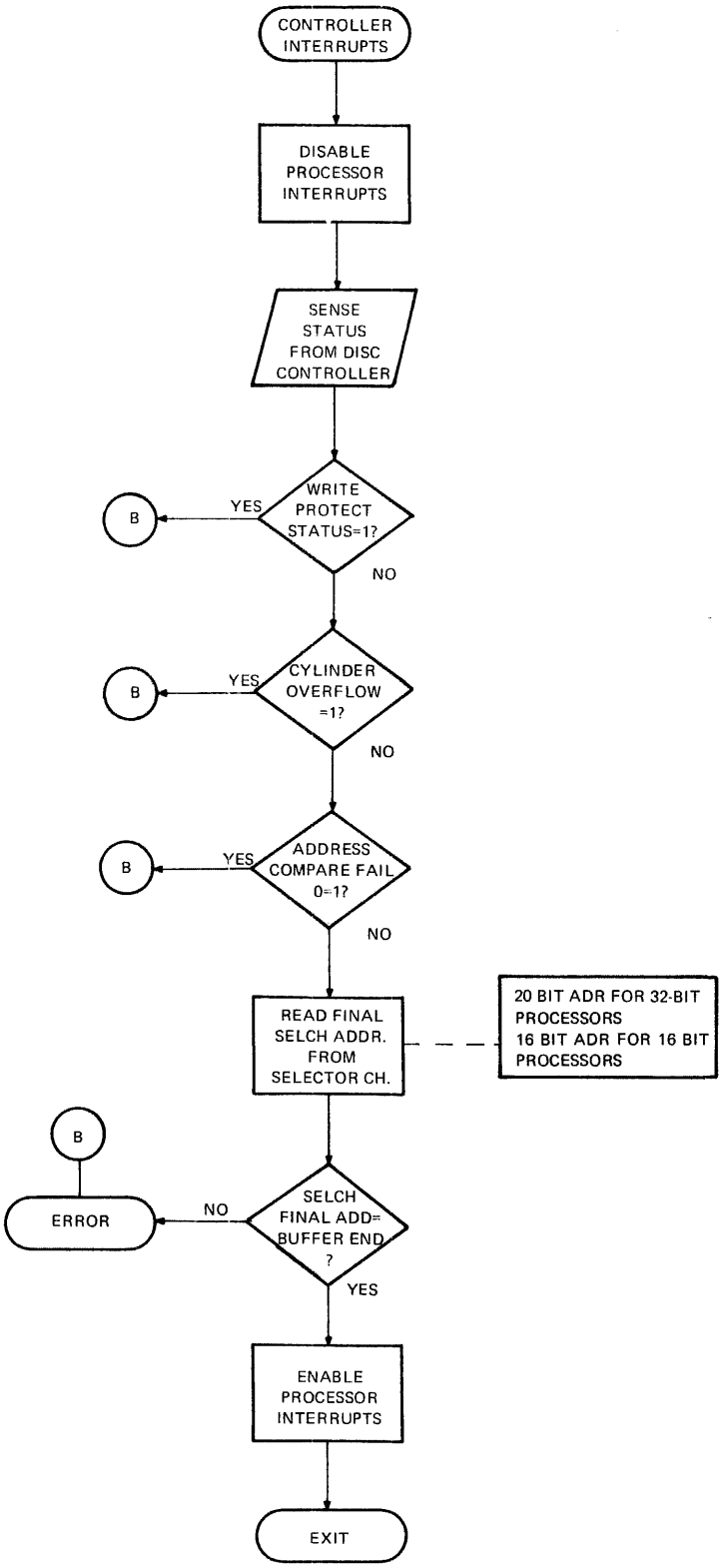

2
OUTPUT READ/GO COMMAND TO SELCH
FOR THE EXTENDED SELECTOR CHANNEL COMMANDS SEE THE EXTENDED SELCH PROGRAMMING SPEC. 02-328
FOR 16 BIT PROCESSORS SEE THE SELCH PROGRAMMING MANUAL 29-036
YES
IS SELCH BUSY ?
NO
OUTPUT COMMAND TO STOP THE SELCH
NO
IS CONTROLLER IDLE?
YES
SENSE STATUS FROM DISC CONTROLLER
ERROR
NO
NORMAL TERMINATION ?
YES
SEE SENSE STATUS READ/WRITE OPERATION
READ FINAL ADDRESS FROM SELCH
ERROR
NO
SELCH TRANSFER NORMAL END?
YES
OUTPUT COMMAND TO STOP THE SELCH
OUTPUT THE COMMAND TO RESET THE CONTR.
EXIT

FUNCTIONAL FLOW CHART OF READ/WRITE (INTERRUPT) OPERATION




3
OUTPUT GO COMMAND TO DISC CONTROLLER
OUTPUT GO COMMAND TO THE SELECTOR CHANNEL
ENABLE PROCESSOR INTERRUPTS
EXIT


SELCH INTERRUPT
DISABLE PROCESSOR INTERRUPTS
OUTPUT COMMAND TO STOP THE SELCH
SENSE STATUS FROM DISC CONTROLLER
OVERRUN STATUS =1?
YES
ERROR
SEE PROGRAMMING SEQUENCES
NO
ENABLE PROCESSOR INTERRUPTS
EXIT


CONTROLLER INTERRUPTS
DISABLE PROCESSOR INTERRUPTS
SENSE STATUS FROM DISC CONTROLLER
WRITE PROTECT STATUS=1?
YES
B
NO
CYLINDER OVERFLOW =1?
YES
B
NO
ADDRESS COMPARE FAIL 0=1?
YES
B
NO
READ FINAL SELCH ADDR. FROM SELECTOR CH.
20 BIT ADR FOR 32-BIT PROCESSORS
16 BIT ADR FOR 16 BIT PROCESSORS
B
SELCH FINAL ADD= BUFFER END ?
NO
ERROR
YES
ENABLE PROCESSOR INTERRUPTS
EXIT

The Multi-Disc flowcharts outline the functional requirements of an Operating System driver designed to support simultaneous Seek/Data transfer operations for a system configured with 4 Disc drives on 1 Disc Controller. The driver is called once for a Seek/Read or Seek/Write operation. The address of a parameter block which contains all the information necessary to complete the desired operation is transferred to the driver in the calling sequence (see the listing in APPENDIX 2 MULTI-DISC OPERATIONS).

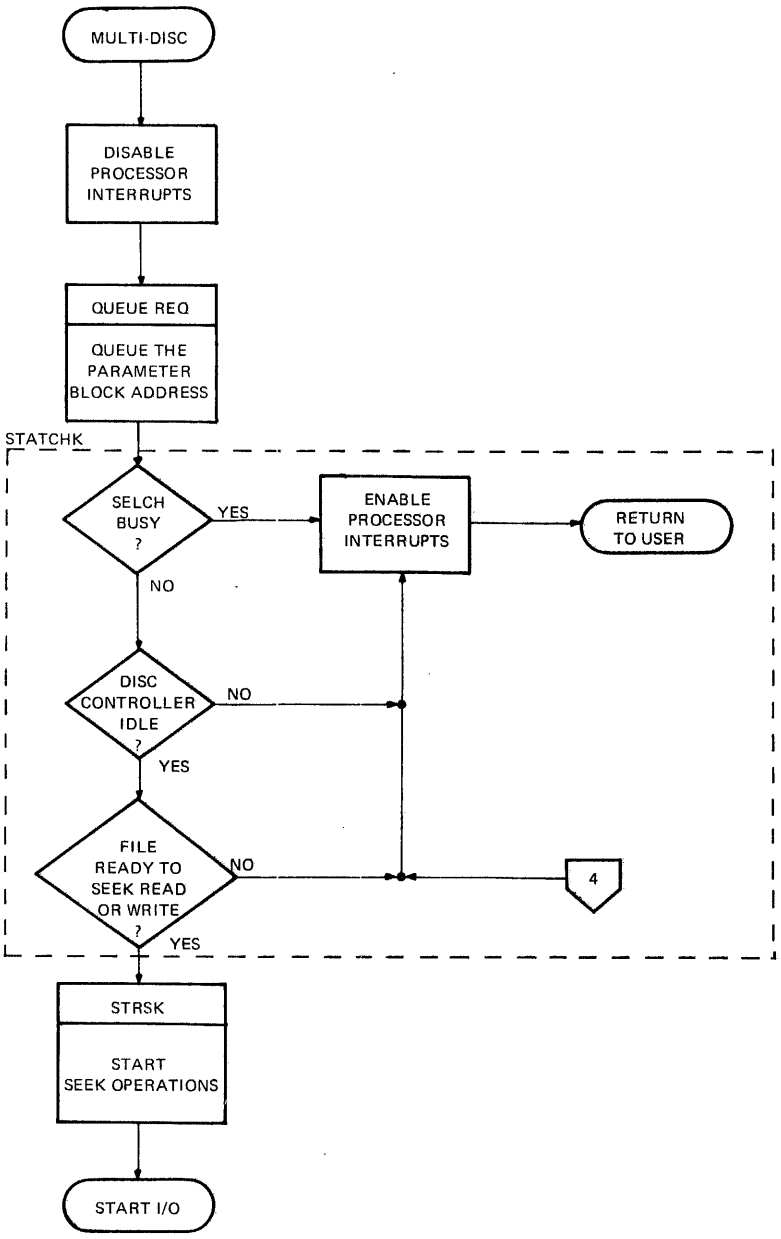
PARAMETER BLOCK FORMAT

LOCATION	BYTE 0	BYTE 1	BYTE 2	BYTE 3
	0 7		15	23 31
X'0'	START ADDRESS OF BUFFER			
X'4'	END ADDRESS OF BUFFER			
X'8'	CYLINDER NUMBER		HEAD NO.	SECTOR NO.
X'C'	SEEK QUEUE FLAG	READ/WRITE QUEUE FLAG	READ/WRITE IDENTIFIER	I/O COMPLETE FLAG
X'10'	LOGICAL FILE IDENT.	ERROR STATUS SAVE AREA		

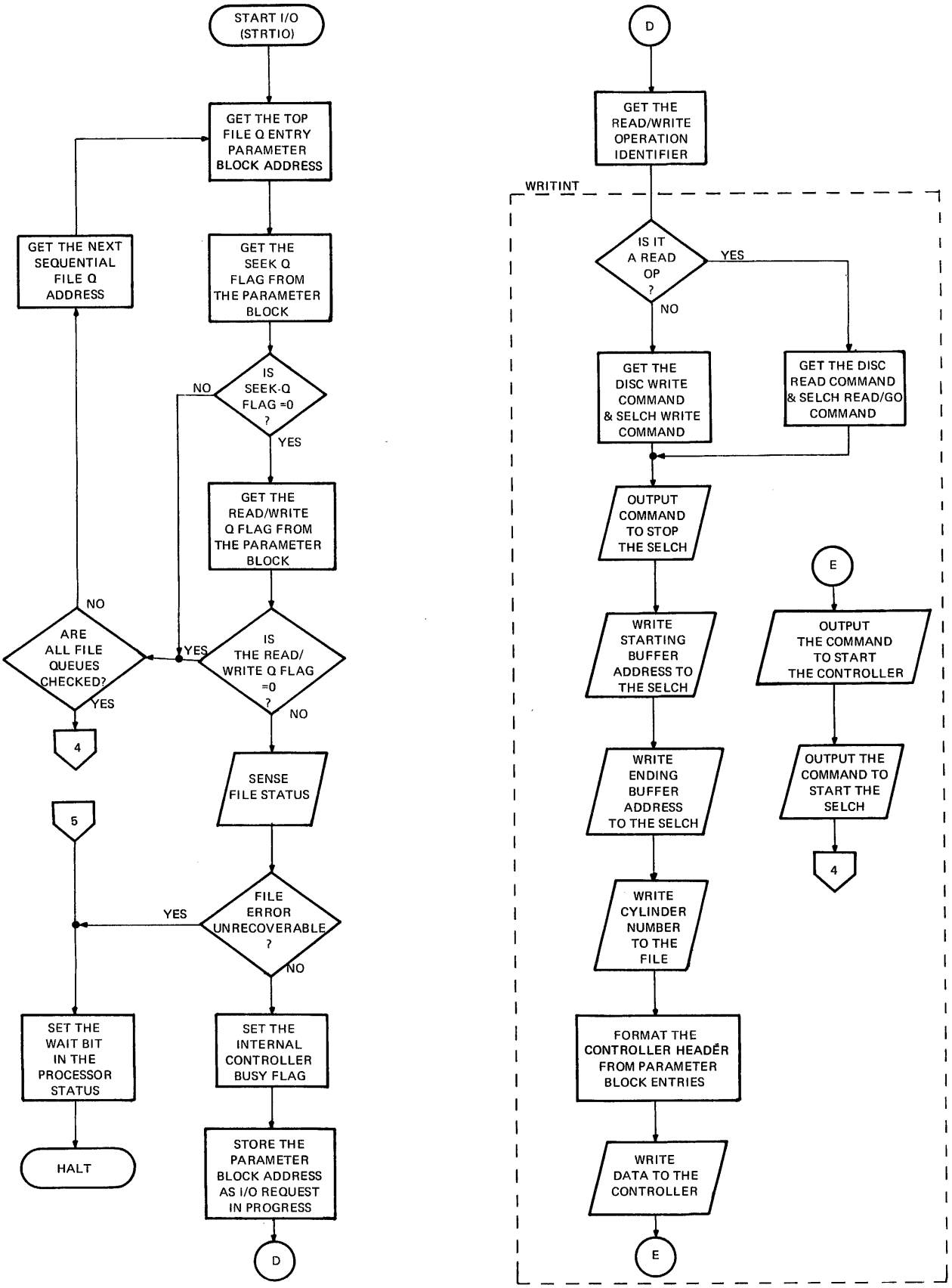
The flowcharts are presented in such a manner that functions relating directly to the programming of the Disc Controller and file are easily identifiable by the outlined blocks. Those functions outside the blocks identify queueing, parameter block maintenance and error handling* techniques in support of file operations:

Flowchart Label	Function
STATCHK	Relates to initial status checking of Disc Controller, File and Selch
INTSK1	Describes the programming sequence necessary to initiate simultaneous seek operations in a Multi-Disc environment
WRITINT	Illustrates the sequence necessary to initiate an I/O data transfer to an available file
SELCHINT	Describes the processing of SELCH interrupts
CONTRLIT	Illustrates Controller Interrupt handling
FILINT	Illustrates file interrupt handling and file status error checking (see Programming Specification Section 6.5)

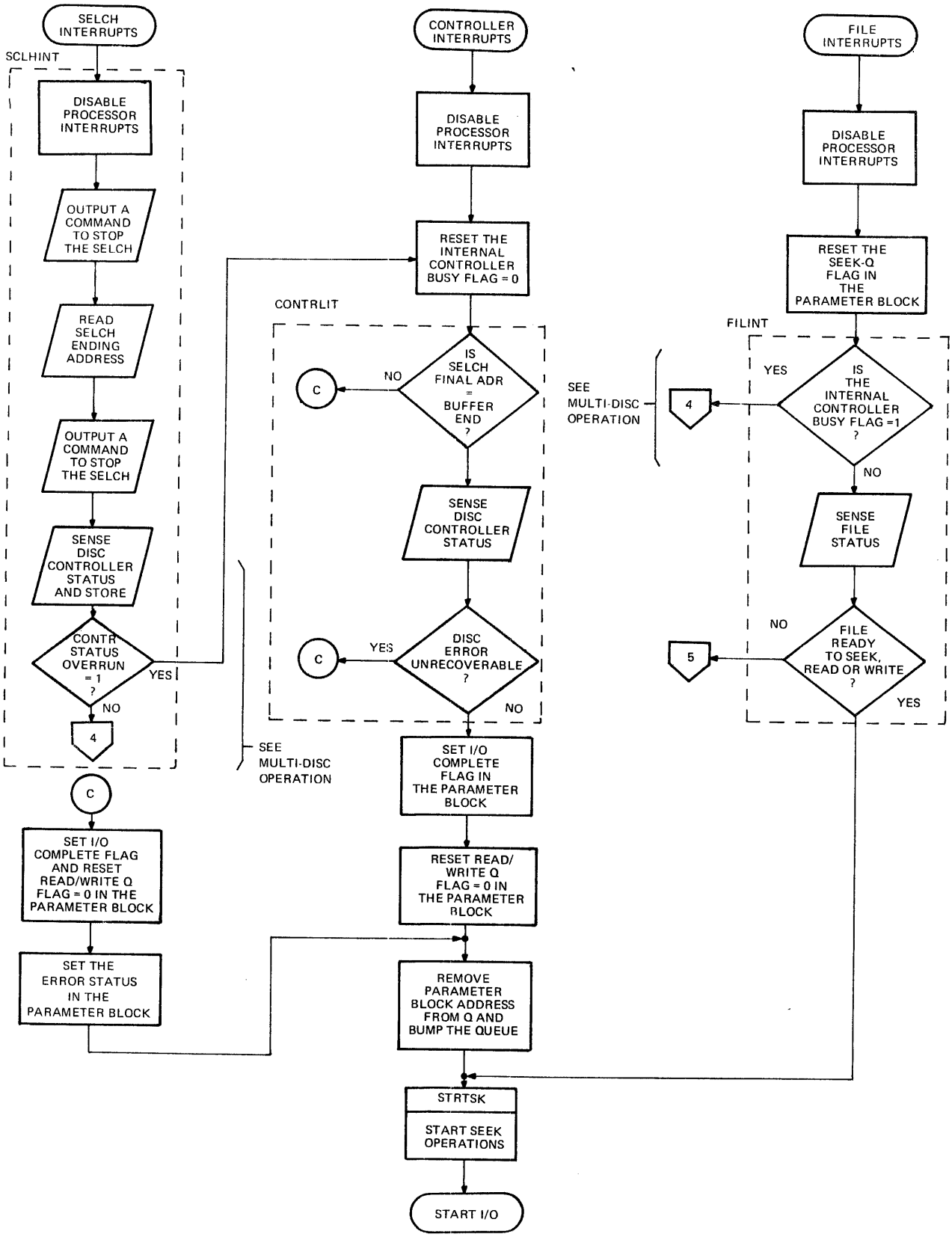
*Error handling techniques are *not* represented as optimal routines to demonstrate RESTORE and error retry procedures.


MULTI-DISC
DISABLE PROCESSOR INTERRUPTS
QUEUE REQ
QUEUE THE PARAMETER BLOCK ADDRESS
STATCHK
SELCH BUSY ?
YES
ENABLE PROCESSOR INTERRUPTS
RETURN TO USER
NO
DISC CONTROLLER IDLE ?
NO
YES
FILE READY TO SEEK READ OR WRITE ?
NO
4
YES
STRSK
START SEEK OPERATIONS
START I/O

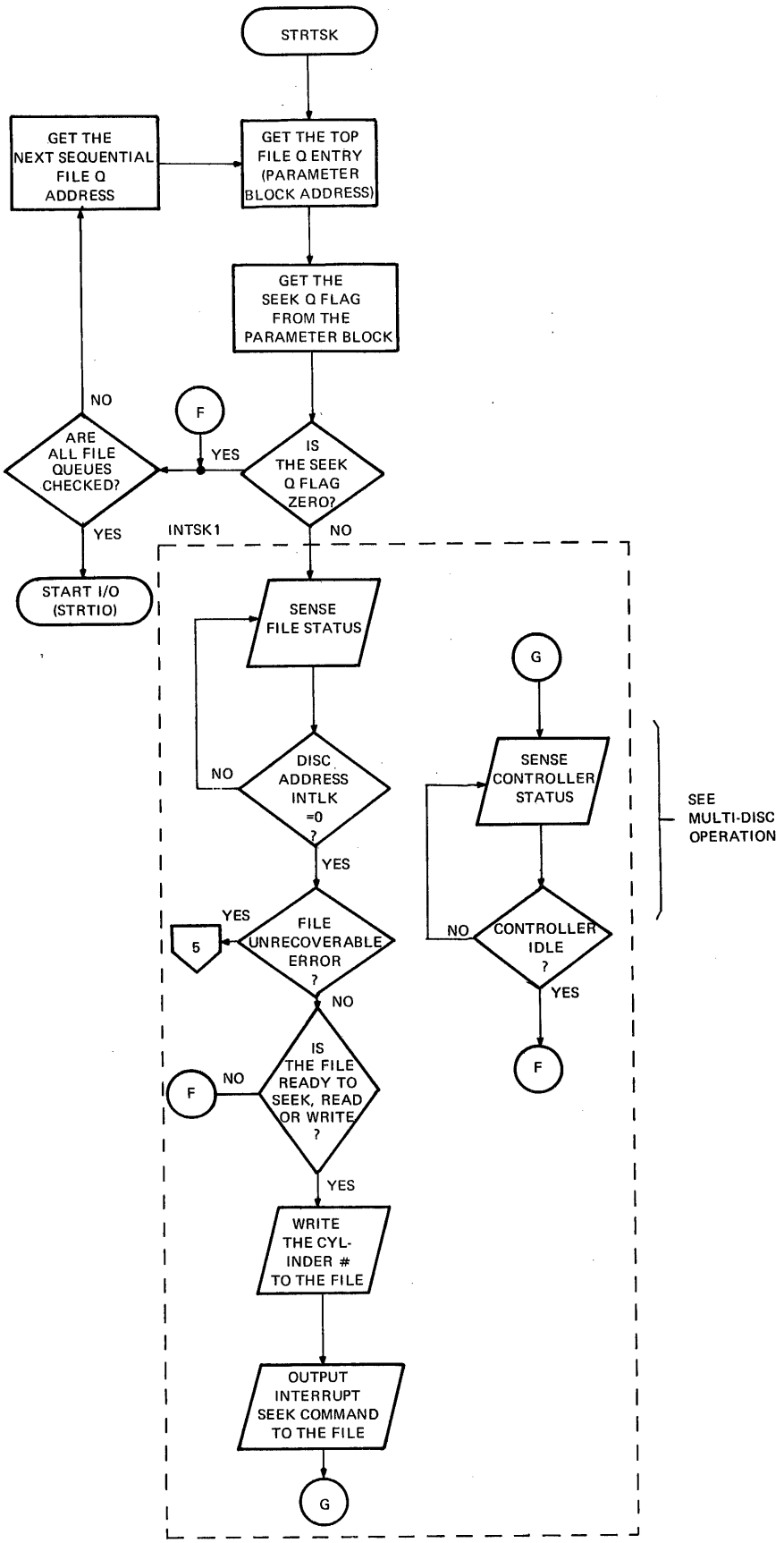
FUNCTIONAL FLOW CHART OF MULTI-DISC OPERATION

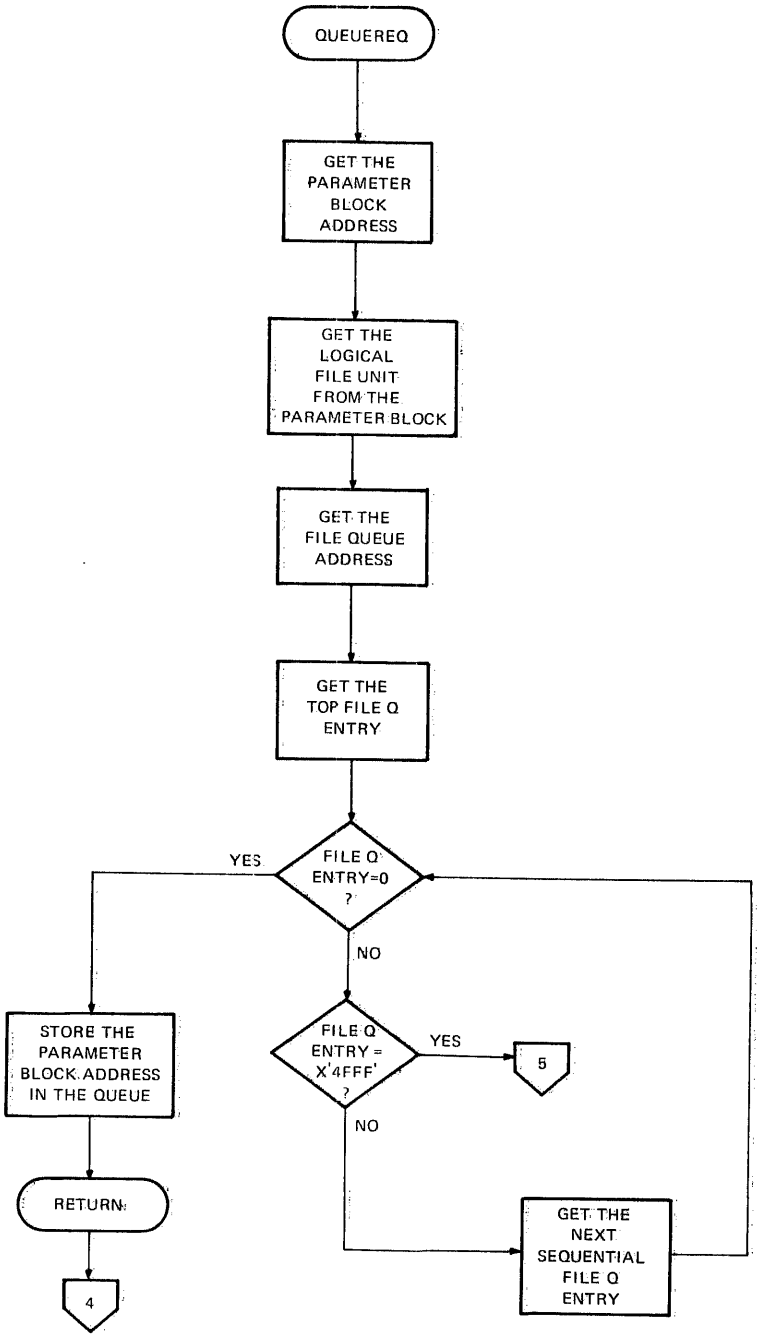


FUNCTIONAL FLOW CHART OF MULTI-DISC OPERATION



FUNCTIONAL FLOW CHART OF MULTI-DISC OPERATION




QUEUEREQ
GET THE PARAMETER BLOCK ADDRESS
GET THE LOGICAL FILE UNIT FROM THE PARAMETER BLOCK
GET THE FILE QUEUE ADDRESS
GET THE TOP FILE Q ENTRY
FILE Q ENTRY=0 ?
YES
NO
STORE THE PARAMETER BLOCK ADDRESS IN THE QUEUE
FILE Q ENTRY = X'4FFF' ?
YES
5
NO
RETURN
4
GET THE NEXT SEQUENTIAL FILE Q ENTRY

PROG= *NONE* ASSEMBLED BY CAL 05-066R05-00 (32-BIT)

```
                                    1          SCRAT                                                                DPE00010
                                    2          PROG  APPENDIX 2 16 BIT PROGRAMMING EXAMPLES                         DPE00030
                                    3          SQUEZ                                                                DPE00040
                                    4          SQCHK                                                                DPE00041
                                    5          CROSS                                                                DPE00050
                                    6          TARGT 16                                                             DPE00060
                                    7          WIDTH 120                                                            DPE00070
0000 0000                           8  R0      EQU   0            REGISTER 0-3                                    DPE00080
0000 0001                           9  R1      EQU   1            RESERVED FOR INTERRUPT USE                      DPE00090
0000 0002                          10  R2      EQU   2                                                            DPE00100
0000 0003                          11  R3      EQU   3                                                            DPE00110
0000 0004                          12  SLAD    EQU   4            SELCH ADDRESS                                   DPE00120
0000 0005                          13  FUT     EQU   5            FILE ADDRESS                                    DPE00130
0000 0006                          14  WK0     EQU   6            WORK REGISTER 0                                 DPE00140
0000 0007                          15  WK1     EQU   7            WORK REGISTER 1                                 DPE00150
0000 0008                          16  WK2     EQU   8            WORK REGISTER 2                                 DPE00160
0000 0009                          17  WK3     EQU   9            WORK REGISTER 3                                 DPE00170
0000 0002                          18  QENTRY2 EQU   2                                                            DPE00180
0000 0004                          19  QENTRY3 EQU   4                                                            DPE00190
0000 000B                          20  TRACK   EQU   11                                                           DPE00200
0000 000D                          21  STAT    EQU   13           DEVICE STATUS                                   DPE00210
0000 000E                          22  RETN2   EQU   14           RETURN REGISTER 2                               DPE00220
0000 000F                          23  RETN    EQU   15           RETURN REGISTER 1                               DPE00230
0000 000A                          24  DCAD    EQU   10           DISC CONTROLLER ADDRESS                         DPE00240
0000 000C                          25  SECT    EQU   12           DISC SECTOR NUMBER                              DPE00250
0000 0008                          26  SLCHBSY EQU   8            SELCH BUSY STATUS                               DPE00260
0000 0002                          27  CONTIDLE EQU  2            DISC CONTROLLER IDLE                            DPE00270
0000 0010                          28  ADRINTLK EQU  X'10'        FILE ADDR INTLK STATUS                          DPE00280
0000 0043                          29  FLUNRECV EQU  X'43'        WRTCHK+SEEKINC+DISCNTROY (FILE STAT)            DPE00290
0000 0008                          30  RSRWT   EQU   8            FILE READY TO SEEK,READ,OR WRITE                DPE00300
0000 0005                          31  CNTUNREC EQU  5            EX+DATATRNSFRERR (CONT STAT)                    DPE00310
0000 0080                          32  OVERRUN EQU   X'80'        CONTROLLER OVERRUN STATUS                       DPE00320
0000 00FF                          33  FLABORT EQU   X'FF'        AABORT OPERATION FILE STATUS                    DPE00330
0000 0004                          34  BUFENDAD EQU  4            PARAMETER BLOCK- BUFFER END ADDRESS             DPE00340
0000 0000                          35  BUFSTRT EQU   0            PARAMETER BLOCK- BUFFER START ADDRS             DPE00350
0000 0008                          36  CYLINDER EQU  8            PARAMETER BLOCK CYLINDER ENTRY                  DPE00360
0000 000A                          37  HEADNO  EQU   10           PARAMETER BLOCK HEAD ENTRY                      DPE00370
0000 000B                          38  SECTOR  EQU   11           PARAMETER BLOCK SECTOR ENTRY                    DPE00380
0000 000C                          39  SEEKQFLG EQU  12           PARAMETER BLOCK SEEK QUEUE FLAG                 DPE00390
0000 000D                          40  DATATRNS EQU  13           PARAMETER BLOCK DATA TRANSFER Q FLG             DPE00400
0000 000E                          41  RDWRTFLG EQU  14           PARAMETER BLOCK READ/WRITE OP IDENT             DPE00410
0000 000F                          42  IOCOMPLT EQU  15           PARAMETER BLOCK I/O COMPLETED FLAG              DPE00420
0000 0010                          43  LOGFILE EQU   16           PARAMETER BLOCK LOGICAL FILE IDENT              DPE00430
0000 0011                          44  ERRSTA  EQU   17           PARAMETER BLOCK ERROR STATUS                    DPE00440
0000 0040                          45  OLDPSWST EQU  X'40'        EXT INTERRUPT OLD PSW STATUS SAVE               DPE00450
0000 0042                          46  OLDPSWLC EQU  X'42'        OLD PSW LOCATION COUNTER                        DPE00460
0000 0044                          47  NEWPSWST EQU  X'44'        EXTERNAL INT. NEW PSW STAT                      DPE00470
0000 0046                          48  NEWPSWLC EQU  X'46'        EXTERNAL INT NEW PSW LOC.                       DPE00480
```

APPENDIX 2 SENSE STATUS SEEK

```
                                 50  * SUBROUTINE: SENSE STATUS SEEK                                                    DPE00490
                                 51  * FUNCTION:PERFORMS SENSE STATUS SEEK OPERATIONS                                  DPE00500
                                 52  * CALLING SEQUENCE: BAL RETN,SKSR                                                 DPE00510
                                 53  * INPUT                                                                           DPE00520
                                 54  * REGISTERS: TRACK= DESIRED CYLINDER NUMBER                                       DPE00530
                                 55  *            FUT= FILE ADDRESS                                                    DPE00540
                                 56  *            SLAD= SELCH ADDRESS                                                  DPE00550
                                 57  *            DCAD= DISC CONTROLLER ADDRESS                                        DPE00560
                                 58  * REGISTERS DESTROYED: SECT,RETN2,STAT                                           DPE00570
                                 59  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED                    DPE00580
                                 60  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED                     DPE00590
0000R  07CC                      61  SKSR     XHR   SECT,SECT          REGISTER SECT IS DESTROYED                    DPE00600
0002R  41E0 0014R                62           BAL   RETN2,FRSSR        FILE READY TO SEEK,READ,WRITE SEQ             DPE00610
0006R  41E0 0030R                63           BAL   RETN2,WDFT1        WRITE CYLINDER NUMBER TO FILE                 DPE00620
000AR  0E50 0409R                64           OC    FUT,SEEKC          OUTPUT SEEK COMMAND (INIPTS DISARMD)          DPE00630
000ER  41E0 0014R                65           BAL   RETN2,FRSSR        WAIT FOR SEEK COMPLETE W/ GOOD STAT           DPE00640
0012R  03UF                      66           BR    RETN               RETURN TO USER                                DPE00650
                                 67  *                                                                               DPE00660
                                 68  *                                                                               DPE00670
                                 69  *SUBROUTINE: FILE READY TO SEEK,READ OR WRITE                                   DPE00680
                                 70  *FUNCTION: PERFORMS NECESSARY STATUS CHECK ON CONTROLLER AND FILE TO             DPE00690
                                 71  *          INSURE CORRECT FILE OPERATION                                        DPE00700
                                 72  * CALLING SEQUENCE: BAL RETN2,FRSSR                                             DPE00710
                                 73  * INPUT                                                                         DPE00720
                                 74  * REGISTERS: FUT= FILE ADDRESS                                                  DPE00730
                                 75  *            SLAD= SELCH ADDRESS                                                DPE00740
                                 76  *            DCAD= CONTROLLER ADDRESS                                           DPE00750
                                 77  * REGISTERS DESTROYED: NONE                                                     DPE00760
0014R  90AD                      78  FRSSR    SSR   DCAD,STAT          SENSE DISC CONTROLLER STATUS                  DPE00770
*0016R 2221                      79           BFC   CONTIDLE,FRSSR     IF CONTROLLER NOT IDLE WAIT                   DPE00780
0018R  905D                      80           SSR   FUT,STAT           SENSE FILE STATUS                             DPE00790
001AR  C3D0 0010                 81           THI   STAT,ADRINTLK      TEST FILE STATUS FOR ADRINTLK=0               DPE00800
*001ER 2035                      82           BNZ   FRSSR              ADRINTLK=1 WAIT FOR IT TO GO TO ZERO          DPE00810
0020R  C3D0 0043                 83           THI   STAT,FUNRECV       UNRECOVERABLE FILE ERROR                      DPE00820
0024R  4230 03C0R                84           BNZ   ERRSTOP            ABORT THE OPERATION                           DPE00830
                                 85  * AT THIS POINT USER COULD ATTEMPT TO CORRECT SEEK INCOMPLETE STATUS           DPE00840
                                 86  * BY ISSUING A RESTORE COMMAND AND REPEATING THE DESIRED SEEK                  DPE00850
0028R  C3D0 0008                 87  FRSSR1   THI   STAT,RSRWT         FILE RSRWT=1                                  DPE00860
*002CR 2032                      88           BNZ   FRSSR1             IF YES WAIT FOR RSRWT=0                       DPE00870
002ER  03UE                      89           BR    RETN2              RETURN                                        DPE00880
                                 90  *                                                                               DPE00890
                                 91  *                                                                               DPE00900
                                 92  * SUBROUTINE: WRITE CYLINDER NUMBER TO THE FILE                                 DPE00910
                                 93  * FUNCTION: WRITE CYLINDER # TO THE DISC FILE                                   DPE00920
                                 94  * CALLING SEQUENCE: BAL RETN2,WDFT1                                            DPE00930
                                 95  * INPUT                                                                         DPE00940
                                 96  * REGISTERS: TRACK=DESIRED CYLINDER NUMBER                                     DPE00950
                                 97  *            FUT=FILE ADDRESS                                                   DPE00960
                                 98  *            SLAD=SELCH ADDRESS                                                 DPE00970
                                 99  *            DCAD=DISC CONTROLLER ADDRESS                                       DPE00980
                                100  *            R0=ZERO UPON ENTRY TO ROUTINE                                      DPE00990
                                101  * REGISTERS DESTROYED=NONE                                                      DPE01000
                                102  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED                   DPE01010
```

APPENDIX 2 SENSE STATUS SEEK

```
                                    103  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED                DPEU1020
 0030R  4500 044CR                  104  WDFT1   CLH   R0,TRKDEN    TRACK DENSITY=0                             DPEU1030
*0034R  2669                        105          BE    WDFT1A      YES- ASSUME 2.5 DRIVE GO TO WDFT1A          DPEU1040
 0036R  C5B0 0100                   106          CLHI  TRACK,256   CYLINDER NUMBER= OR > 256                     DPEU1050
*003AR  2686                        107          BNL   WDFT1A      YES- SET MSB IN CONTROLLER AT WDFT0         DPEU1060
 003CR  DA50 044ER                  108          WD    FUT,ZERO    OTHERWISE INSURE IT IS ZERO                 DPEU1070
 0040R  2603                        109          BS    WDFT1A                                                  DPEU1080
 0042R  DA50 044FR                  110  WDFT0   WD    FUT,ONE     IF THE DESIRED DRIVE IS A 10 MB TOP         DPEU1090
 0046R  9A5B                        111  WDFT1A  WDR   FUT,TRACK   OR BOTTOM AND THE DESIRED SEEK IS TO       DPEU1100
 0048R  030E                        112          BR    RETN2       A CYLINDER > 256 THEN A HALFWORD            DPEU1110
                                    113  *                         MUST BE WRITTEN TO THE DRIVE TO             DPEU1120
                                    114  *                         INSURE THAT THE CORRECT CYLINDER            DPEU1130
                                    115  *                         NUMBER IS WRITTEN TO THE FILE               DPEU1140
```

APPENDIX 2 SENSE STATUS DISC READ/WRITE OPERATION

```
                                  115  * SUBROUTINE: READ/WRITE(SENSE STATUS CONTROL)                          DPEU1170
                                  119  * FUNCTION: PERFORMS SENSE STATUS READ/WRITE OPERATION TO DISC          DPEU1180
                                  120  * CALLING SEQUENCE FOR READ: BAL RETN,READS                            DPEU1190
                                  121  * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITS                           DPEU1200
                                  122  * INPUT                                                                DPEU1210
                                  123  * REGISTERS: FUT=FILE ADDRESS                                          DPEU1220
                                  124  *            DCAD= DISC CONTROLLER ADDRESS                             DPEU1230
                                  125  *            SLAD= SELCH ADDRESS                                       DPEU1240
                                  126  *            TRACK=CYLINDER ADDRESS                                    DPEU1250
                                  127  *            SECT= DESIRED SECTOR                                      DPEU1260
                                  128  * MEMORY LOCATIONS: HEAD=DESIRED HEAD                                   DPEU1270
                                  129  *                   SA= STARTING BUFFER ADDRESS                        DPEU1280
                                  130  *                   FA= ENDING BUFFER ADDRESS                          DPEU1290
                                  131  * REGISTERS DESTROYED: WK1,WK2,WK3                                      DPEU1300
0048R  0370 040AR                 132  READS    LB     WK1,RCMD          DISC READ COMMAND                    DPEU1310
004ER  C880 0030                  133           LHI    WK2,X'30'         SELCH READ/GO COMMAND                DPEU1320
0052R  2305                       134           BS     RWCOM                                                  DPEU1330
0054R  0370 040BR                 135  WRITS    LB     WK1,WCMD          DISC WRITE COMMAND                   DPEU1340
0058R  C880 0010                  136           LHI    WK2,X'10'         SELCH WRITE COMMAND                  DPEU1350
005CR  DE40 040CR                 137  RWCOM    OC     SLAD,STOP         STOP THE SELCH- SELCH STAT IDLE      DPEU1360
0060R  0840 045CR                 138           WH     SLAD,SA           WRITE STARTING ADDRESS TO SELCH      DPEU1370
0064R  0840 045ER                 139           WH     SLAD,FA           WRITE FINAL ADDRESS TO SELCH         DPEU1380
0068R  41E0 0030R                 140           BAL    RETN2,WOFT1       WRITE THE CYLINDER NUMBER TO FILE    DPEU1390
006CR  4890 040ER                 141           LH     WK3,HEAD          WRITE FORMATTED HEADER TO DISC       DPEU1400
0070R  9195                       142           SLLS   WK3,5                                                  DPEU1410
0072R  080C                       143           LHR    R0,SECT                                                DPEU1420
0074R  0609                       144           OHR    R0,WK3                                                 DPEU1430
0076R  9AA0                       145           WDR    DCAD,R0           WRITE HEADER TO CONTROLLER           DPEU1440
0078R  9EA7                       146           OCR    DCAD,WK1          OUTPUT COMMAND TO DISC CONTROLLER    DPEU1450
007AR  9E48                       147           OCR    SLAD,WK2          START THE SELCH                      DPEU1460
007CR  9D4D                       148  DXTL     SSR    SLAD,STAT         SENSE SELCH STATUS                   DPEU1470
*007ER 2081                       149           BTC    SLCHBSY,DXTL      WAIT FOR SELCH TO COMPLETE           DPEU1480
0080R  DE40 040CR                 150           OC     SLAD,STOP         STOP THE SELCH- SELCH IDLE           DPEU1490
0084R  9DAD                       151  DXTL1    SSR    DCAD,STAT         SENSE CONTROLLER STATUS              DPEU1500
*0086R 2221                       152           BFC    CONTIDLE,DXTL1    WAIT FOR CONTROLLER TO GO IDLE       DPEU1510
0088R  4250 03C0R                 153           BTC    CNTUNREC,ERRSTOP  BRANCH IF CONTROLLER ERROR           DPEU1520
008CR  0940 0460R                 154           RH     SLAD,SELAD        GET THE SELCH TERMINATION ADDRESS    DPEU1530
0090R  4860 0460R                 155           LH     WK0,SELAD         COMPARE SELCH TERMINAL ADDRESS       DPEU1540
0094R  4560 045ER                 156           CLH    WK0,FA            WITH THE FINAL BUFFER ADDRESS        DPEU1550
0098R  4230 03C0R                 157           BNE    ERRSTOP                                                DPEU1560
009CR  030F                       158           BR     RETN                                                   DPEU1570
```

APPENDIX 2 INTERRUPT DRIVEN READ/WRITE OPERATION

```
                                  161  * SUBROUTINE: READ/WRITE (INTERRUPT CONTROL)                                  DPE01600
                                  162  * FUNCTION: PERFORMS INTERRUPT READ/WRITE OPERATION TO DISC)                  DPE01610
                                  163  * CALLING SEQUENCE FOR READ: BAL RETN,READX                                   DPE01620
                                  164  * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITX                                  DPE01630
                                  165  * INPUT                                                                       DPE01640
                                  166  * REGISTERS: FUT=FILE ADDRESS                                                 DPE01650
                                  167  *            DCAD=DISC CONTROLLER ADDRESS                                     DPE01660
                                  168  *            SLAD=SELCH ADDRESS                                               DPE01670
                                  169  *            TRACK=CYLINDER ADDRESS                                           DPE01680
                                  170  *            SECT= DESIRED SECTOR                                             DPE01690
                                  171  *            WK0= ADDRESS OF PARAMETER BLOCK DESCRIBED IN MULTI-DISC           DPE01700
                                  172  *              FLOWCHART- ROUTINE WILL EXTRACT STARTING BUFFER ADDRESS         DPE01710
                                  173  *                 AND END ADDRESS FROM PARAMETER BLOCK                        DPE01720
                                  174  * REGISTERS DESTROYED: NONE                                                   DPE01730
009ER  40F0 0042                  175  READX    STH   RETN,OLDPSWLC       SET RETURN ADDRESS FOR NON-INT RETRN     DPE01740
00A2R  C860 4000                  176           LHI   WK0,X'4000'          SET NEW PSW STATUS FOR INT RETRN         DPE01750
00A6R  4060 0040                  177           STH   WK0,OLDPSWST                                                  DPE01760
                                  178  * THIS IS DONE TO INSURE RETURN TO POINT OF SUBROUTINE CALL.                 DPE01770
                                  179  * PROGRAM AT LOCATION READINT WILL EXECUTE AN LPSWR R0                       DPE01780
00AAR  41E0 0106R                 180           BAL   RETN2,LOCORE1        SET UP LOW CORE                          DPE01790
00AER  4300 02A2R                 181           B     READINT              GO TO SELCH AND DISC SETUP ROUTINE       DPE01800
00B2R  40F0 0042                  182  WRITX    STH   RETN,OLDPSWLC       SET RETURN ADDR FOR NON-INT RETURN       DPE01810
00B6R  C860 4000                  183           LHI   WK0,X'4000'          SET NEW PSW LOC FOR NON-INT RETRN        DPE01820
00BAR  4060 0040                  184           STH   WK0,OLDPSWST                                                  DPE01830
00BER  C8E0 4000                  185           LHI   RETN2,X'4000'        SET OLDPSWST FOR NON-INT RETURN          DPE01840
00C2R  40E0 0040                  186           STH   RETN2,OLDPSWST                                                DPE01850
                                  187  * SEE NOTE ABOVE IN READX ROUTINE                                            DPE01860
00C6R  41E0 0106R                 188           BAL   RETN2,LOCORE1                                                 DPE01870
00CAR  4300 0298R                 189           B     WRITINT              GO TO SELCH AND DISC SETUP ROUTINE       DPE01880
                                  190  *SELCH INTERRUPT ENTERS BELOW:                                               DPE01890
00CER  DF60 0410R                 191  SELCHNT1 ACK   WK0,DEVSTAT          ACKNOWLEDGE THE INTERRUPT                DPE01900
00D2R  056A                       192           CLHR  WK0,DCAD             CONTROLLER INTERRUPTING?                 DPE01910
*  00D4R  235E                    193           BE    CNTRLINT             IF YES GO SERVICE IT                     DPE01920
00D6R  0564                       194           CLHR  WK0,SLAD             IF SELCH SERVICE IT                      DPE01930
00D8R  4230 03C0R                 195           BNE   ERRSTOP              IF NEITHER STOP IN ERROR                 DPE01940
00DCR  DE40 040CR                 196           OC    SLAD,STOP            STOP THE SELCH- SELCH IDLE               DPE01950
00E0R  D940 0462R                 197           RH    SLAD,FADR            READ FINAL SELCH ADDRESS                 DPE01960
00E4R  9DAD                       198           SSR   DCAD,STAT            SENSE CONTROLLER STATUS                  DPE01970
00E6R  C300 0080                  199           TH1   STAT,OVERRUN         IF CONTROLLER OVERRUN STATUS IS SET      DPE01980
*  00EAR  2133                    200           BNZ   CNTRLINT             DO NOT EXPECT CONTROLLER INTERRUPT       DPE01990
00ECR  C200 0040                  201           LPSW  OLDPSWST                                                      DPE02000
00F0R  4860 0462R                 202  CNTRLINT LH    WK0,FADR            GET THE FINAL ADDRESS                    DPE02010
00F4R  4560 0464R                 203           CLH   WK0,BUFEND           COMPARE IT TO FINAL BUFFER ADDR          DPE02020
00F8R  4230 03C0R                 204           BNE   ERRSTOP                                                       DPE02030
00FCR  9DAD                       205           SSR   DCAD,STAT            SENSE CONTROLLER STATUS                  DPE02040
00FER  4250 03C0R                 206           BTC   CNTUNREC,ERRSTOP     IF OK EXIT OTHERWISE                     DPE02050
0102R  C200 0040                  207           LPSW  OLDPSWST                                                      DPE02060
                                  208  * SUBROUTINE: LOCORE1                                                        DPE02070
                                  209  * FUNCTION: SETS LOW CORE TO PROCESS                                         DPE02080
                                  210  *           INTERRUPT HANDLING IN THEIS EXAMPLE                              DPE02090
                                  211  * CALLING SEQUENCE: BAL RETN2,LOCORE1                                         DPE02100
                                  212  * INPUT                                                                       DPE02110
                                  213  * REGISTERS:                                                                  DPE02120
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                        214  *        SLAD= SELCH ADDRESS                                          DPE02130
                        215  *        DCAD= DISC CONTROLLER ADDRESS                                DPE02140
                        216  * REGISTERS DESTROYED:                                              DPE02150
                        217  *                WK0,WK1                                            DPE02160
                        218  *                                                                   DPE02170
0106R  0766             219  LOCORE1  XHR   WK0,WK0          ZERO WORK REGISTER FOR PSW         DPE02180
0108R  4060 0044        220           STH   WK0,NEWPSWST      ZERO NEW PSW STATUS                DPE02190
010CR  C860 00CER       221           LHI   WK0,SELCHNT1      GET THE INTERRUPT HANDLING ADDR    DPE02200
0110R  4060 0046        222           STH   WK0,NEWPSWLC      STORE IT IN THE NEW PSWLOC         DPE02210
0114R  030E             223           BR    RETN2             RETURN                             DPE02220
```

APPENDIX 2 MULTI-DISC PROGRAMMING

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                                    226  * THE FOLLOWING PROGRAM DEMONSTRATES THE USE OF A MULTI-DISC DRIVER        DPE02250
                                    227  * ROUTINE THAT CAN BE USED BY AN OPERATING SYSTEM TO SUPPORT UP TO        DPE02260
                                    228  * 4 DISC FILES ON ONE DISC CONTROLLER.THE DRIVER IS CALLED FOR A SEEK/    DPE02270
                                    229  * READ OR SEEK/WRITE OPERATION AND TRANSFERS ONE DISC SECTOR TO OR         DPE02280
                                    230  * FROM DISC.THE DRIVER IS CALLED WITH THE ADDRESS OF THE PARAMETER         DPE02290
                                    231  * BLOCK AS SHOWN IN THE MULTI-DISC FLOWCHART (APPENDIX 2) AN I/O COMPL-    DPE02300
                                                                                                                     DPE02310
                                    232  * ETE FLAG IS SET WHEN                                                     DPE02320
                                    233  * THE DESIRED SEEK/READ OR SEEK/WRITE OPERATION IS COMPLETE. THE MULTI-    DPE02330
                                    234  * DISK DRIVER DEMONSTRATES THE SEQUENCING NECESSARY TO SUPPORT             DPE02340
                                    235  * SIMULTANEOUS SEEK AND OVERLAPPING SEEK/DATA TRANSFER OPERATION.          DPE02350
0116R  C660 0468R                   236          LHI   WK0,PMBK1          LOAD WORK REGISTER WITH PARAMETER         DPE02360
011AR  4840 0452R                   237          LH    SLAD,SELAD1        BLOCK ADDRESS,LOAD SELCH, CONTROLLER      DPE02370
011ER  48A0 0414R                   238          LH    DCAD,DISCONAD      ADDRESSES                                 DPE02380
0122R  41F0 0132R                   239          BAL   RETN,MULDSC        CALL TO MULTI-DISC                        DPE02390
0126R  C860 047AR                   240          LHI   WK0,PMBK2          GET PARAMETER BLOCK ADDRESS               DPE02400
012AR  41F0 0132R                   241          BAL   RETN,MULDSC                                                  DPE02410
012ER  C200 068CR                   242          LPSW  INTWAIT            WAIT WITH INTERRUPTS ENABLED              DPE02420
                                    243  * SUBROUTINE: MULTI-DISC DRIVER                                            DPE02430
                                    244  * FUNCTION: CALLED ONCE FOR A SEEK/READ OR SEEK/WRITE OPERATION.          DPE02440
                                    245  *           THE DRIVER WILL SUPPORT SIMULTANEOUS SEEK OPERATIONS          DPE02450
                                    246  *           AND OVERLAPPED SEEK/DATA TRANSFER TYPE OPERATIONS ON          DPE02460
                                    247  *           THE 4 DISC DRIVES ASSOCIATED WITH DISC CONTROLLER             DPE02470
                                    248  * CALLING SEQUENCE: BAL RETN,MULDSC                                         DPE02480
                                    249  * INPUT                                                                     DPE02490
                                    250  * REGISTERS:  SLAD= SELCH ADDRESS                                          DPE02500
                                    251  *             DCAD= DISC CONTROLLER ADDRESS                               DPE02510
                                    252  *             WK0= PARAMETER BLOCK ADDRESS (SEE FLOWCHART 5.2.4)          DPE02520
                                    253  * REGISTERS DESTROYED: NONE                                                 DPE02530
                                    254  *                                                                           DPE02540
                                    255  *                                                                           DPE02550
0132R  D000 0690R                   256  MULDSC   STM   R0,REGSAVE        SAVE ALL REGISTERS                        DPE02560
0136R  0788                         257          XHR   WK2,WK2            ZERO WORK REGISTER 2                      DPE02570
0138R  9578                         258          EPSR  WK1,WK2            DISABLE PROCESSOR INTERRUPTS              DPE02580
013AR  4060 0458R                   259          STH   WK0,PARMBLK        STORE PARAMETER BLOCK ADDRESS             DPE02590
013ER  41E0 03CCR                   260          BAL   RETN2,LOCORE       SETUP LOCORE FOR INTERRUPT HANDLING       DPE02600
0142R  41EC 03DCR                   261          BAL   RETN2,QUEUEREQ     QUEUE THE REQUEST                         DPE02610
                                    262  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                               DPE02620
                                    263  ************************************************************************  DPE02630
0146R  904D                         264  STATCK   SSR   SLAD,STAT        SENSE THE SELCH STATUS                *   DPE02640
0148R  4280 0176R                   265          BTC   SLCHBSY,RTN1       IF THE SELCH IS BUSY QUEUE REQUEST    *   DPE02650
014CR  DE40 040CR                   266          OC    SLAD,STOP          OTHERWISE STOP THE SELCH              *   DPE02660
0150R  90AD                         267          SSR   DCAD,STAT          SENSE CONTROLLER STATUS               *   DPE02670
0152R  4320 0176R                   268          BFC   CONTIDLE,RTN1      IF THE CONTROLR IS BUSY QUEUE RQST    *   DPE02680
0156R  4860 0458R                   269          LH    WK0,PARMBLK        RELOAD THE PARAMETER BLOCK ADD        *   DPE02690
015AR  0376 0010                    270          LB    WK1,LOGFILE(WK0)   LOAD LOGICAL FILE# FRM PARAMETR BLK   *   DPE02700
015ER  9171                         271          SLLS  WK1,1              MULTIPLY IT BY 2 TO INDEX INTO TBL    *   DPE02710
0160R  4857 041CR                   272          LH    FUT,FILE1(WK1)     GET THE FILE ADDRESS FROM TABLE       *   DPE02720
0164R  905D                         273          SSR   FUT,STAT           SENSE FILE STATUS                     *   DPE02730
0166R  C300 0043                    274          TMI   STAT,FLUNRECV      IF FILE STATUS UNRECOVERABLE          *   DPE02740
016AR  4230 03C0R                   275          BNZ   ERRSTOP            ERROR ABORT THE OPERATION             *   DPE02750
016ER  C300 0008                    276          TMI   STAT,RSRWT         IF RSRWT=1 QUEUE REQUEST AND EXIT     *   DPE02760
*  0172R  2152                      277          BNZ   RTN1               *                                     *   DPE02770
*  0174R  230B                      278          B     ENTER1             *                                     *   DPE02780
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                                279  *                                                                      *  DPEU2780
0176R  C8E0 4000                280  RTN1     LHI   RETN2,X'4000'      ENABLE PROCESSOR INTERRUPTS FOR     *  DPEU2790
0178R  40E0 0040                281           STH   RETN2,OLDPSWST     INTERRUPTS ENABLED                  *  DPEU2800
017ER  40F0 0042                282           STH   RETN,OLDPSWLC      STORE RETN ADDR FOR NON-INT RTN     *  DPEU2810
0182R  0100 0690R               283           LM    R0,REGSAVE         RESTORE THE USERS REGISTERS         *  DPEU2820
0186R  C200 0040                284           LPSW  OLDPSWST           *                                   *  DPEU2830
                                285  ************************************************************************  DPEU2840
                                286  *                                                                         DPEU2850
0188R  C8E0 4000                287  ENTER1   LHI   RETN2,X'4000'      ENABLE PROCESSOR INTERRUPTS FOR        DPEU2860
018ER  40E0 0040                288           STH   RETN2,OLDPSWST     RETURN TO USER                         DPEU2870
0192R  40F0 0042                289           STH   RETN,OLDPSWLC      SET UP RETURN FOR NON-INTERRUPT EXIT   DPEU2880
0196R  4300 023ER               290           B     COMETRY            BRANCH TO COMMON ENTRY ROUTINE         DPEU2890
                                291  *                                                                         DPEU2900
                                292  * EXTERNAL INTERRUPTS ENTER HERE AND ARE                                 DPEU2910
                                293  * VECTORED TO THE APPROPRIATE DEVICE HANDLER                             DPEU2920
                                294  * AS CALLED BY THE LABELS:                                               DPEU2930
                                295  * SELCHINT = ENTRY POINT FOR SELCH INTERRUPT PROCESSING                  DPEU2940
                                296  * CONTINT = ENTRY POINT FOR CONTROLLER INTERRUPT PROCESSING              DPEU2950
                                297  * FILE1INT = ENTRY POINT FOR FILE1 INTERRUPT PROCESSING                  DPEU2960
                                298  * FILE2INT = ENTRY POINT FOR FILE2 INTERRUPT PROCESSING                  DPEU2970
                                299  * FILE3INT = ENTRY POINT FOR FILE3 INTERRUPT PROCESSING                  DPEU2980
                                300  * FILE4INT = ENTRY POINT FOR FILE4 INTERRUPT PROCESSING                  DPEU2990
                                301  *                                                                         DPEU3000
                                302  *                                                                         DPEU3010
019AR  0000 0690R               303  EXTINT   STM   R0,REGSAVE                                              DPEU3020
019ER  DF60 0410R               304           ACK   WK0,DEVSTAT        ACKNOWLEDGE THE INTERRUPT              DPEU3030
01A2R  4840 0452R               305           LH    SLAD,SELAD1        RESTORE SELCH ADDRESS REGISTER         DPEU3040
01A6R  48A0 0414R               306           LH    DCAD,DISCONAD      RESTORE DISC CONTROLLER ADDR REGISTR   DPEU3050
01AAR  0564                     307           CLHR  WK0,SLAD           IS IT AN EXTERNAL SELCH INTERRUPT      DPEU3060
01ACR  4330 01DAR               308           BE    SELCHINT           IF YES- GO TO SELCH INTERRUPT HANDLR   DPEU3070
01B0R  056A                     309           CLHR  WK0,DCAD           OTHERWISE,IS IT A CONTROLLER INTERPT   DPEU3080
01B2R  4330 01F6R               310           BE    CONTINT            IF IT IS GO TO CONTINT ENTRY POINT     DPEU3090
01B6R  4360 041CR               311           CLH   WK0,FILE1          IF FILE1 IS INTERRUPTING GO TO FILE1   DPEU3100
01BAR  4330 02F8R               312           BE    FILE1INT           ENTRY ROUTINE AND SIMILIARLY CHECK     DPEU3110
01BER  4360 041ER               313           CLH   WK0,FILE2          THE OTHER THREE FILES FOR INTERRUPT    DPEU3120
01C2R  4330 02FER               314           BE    FILE2INT           SERVICING                              DPEU3130
01C6R  4360 0420R               315           CLH   WK0,FILE3                                               DPEU3140
01CAR  4330 0304R               316           BE    FILE3INT                                                 DPEU3150
01CER  4360 0422R               317           CLH   WK0,FILE4                                               DPEU3160
01D2R  4330 030AR               318           BE    FILE4INT                                                 DPEU3170
01D6R  4300 03C0R               319           B     ERRSTOP                                                  DPEU3180
                                320  * SELCH INTERRUPTS ENTER HERE PROCESSOR INTERRUPTS ARE                  DPEU3190
                                321  * DISABLED THE SELCH IS STOPPED AND ERROR CHECKING IS                   DPEU3200
                                322  * PERFORMED                                                             DPEU3210
                                323  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                            DPEU3220
                                324  ************************************************************************  DPEU3230
01DAR  0E40 040CR               325  SELCHINT OC    SLAD,STOP          STOP THE SELCH                      *  DPEU3240
01DER  0940 0462R               326           RH    SLAD,FADR          READ SLCH TERMINATION ADDRESS       *  DPEU3250
01E2R  0E40 040CR               327           OC    SLAD,STOP          STOP THE SELCH AND SENSE            *  DPEU3260
01E6R  9DAD                     328           SSR   DCAD,STAT          CONTROLLER STATUS                   *  DPEU3270
01E8R  C300 0080                329           THI   STAT,OVERRUN       TEST FOR CONTROLLER OVERRUN STATUS  *  DPEU3280
*  01ECR  2135                  330           BNZ   CONTINT            IF OVERRUN=1 DO NOT EXPECT CONT INT*  DPEU3290
01EER  0100 0690R               331           LM    R0,REGSAVE         RESTORE THE USERS REGISTERS         *  DPEU3300
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01F2R  C200 0040          532          LPSW  OLDPSWST            RETURN TO THE USER                  *  DPEU3310
                          533  ***********************************************************************  DPEU3320
                          534  *                                                                        DPEU3330
                          535  *                                                                        DPEU3340
                          536  * CONTROLLER INTERRUPTS ENTER HERE                                       DPEU3350
01F6R  0766               537  CONTINT  XHR   WK0,WK0                                                 DPEU3360
01F8R  4060 041AR         538           STH   WK0,INTFLG           ZERO THE INTERNAL CONTR BUSY FLG    DPEU3370
                          539  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                            DPEU3380
                          540  ***********************************************************************  DPEU3390
01FCR  4860 0462R         541  CONTRLIT LH    WK0,FADR             GET THE SELCH TERMINATION ADDRESS  *  DPEU3400
0200R  4560 0464R         542           CLH   WK0,BUFEND           COMPARE TERMINAL ADDRESS WITH BUFEED  DPEU3410
0204R  4230 0336R         543           BNE   ERROR                *                                   *  DPEU3420
0208R  90AD               544           SSR   DCAD,STAT            SENSE CONTROLLER STATUS             *  DPEU3430
020AR  4250 0336R         545           BTC   CNTUNREC,ERROR       IF CONT ERROR UNRECOVERABLE-ABORT IO  DPEU3440
                          546  ***********************************************************************  DPEU3450
                          547  *                                                                        DPEU3460
                          548  *                                                                        DPEU3470
020ER  4860 0456R         549           LH    WK0,FILEIO           OTHERWISE GET THE PARAMETER         DPEU3480
0212R  2471               550           LIS   WK1,1                BLOCK OF OPERATION IN PROGRESS.     DPEU3490
0214R  0276 000F          551           STB   WK1,IOCOMPLT(WK0)    SET THE I/O COMPLETED FLAG IN PARM  DPEU3500
0218R  0777               552           XHR   WK1,WK1              BLOCK                               DPEU3510
021AR  0276 0000          553           STB   WK1,DATATRNS(WK0)    ZERO THE READ/WRITE Q FLAG IN PARM  DPEU3520
                          554  *                                                                        DPEU3530
021ER  0376 0010          555  QMANG    LB    WK1,LOGFILE(WK0)     LOAD THE LOGICAL FILE NUMBER        DPEU3540
0222R  9171               556           SLLS  WK1,1                SHIFT FOR TABLE INDEXING            DPEU3550
0224R  4877 0424R         557           LH    WK1,BLKAD(WK1)       GET THE FILE QUEUE ADDRESS          DPEU3560
0228R  4887 0002          558           LH    WK2,QENTRY2(WK1)     GET THE SECOND QUEUE ENTRY          DPEU3570
022CR  4087 0000          559           STH   WK2,0(WK1)           MOVE IT TO THE TOP OF THE QUEUE     DPEU3580
0230R  4887 0004          560           LH    WK2,QENTRY3(WK1)     GET THE THIRD QUEUE ENTRY           DPEU3590
0234R  4087 0002          561           STH   WK2,QENTRY2(WK1)     MOVE IT TO THE SECOND QUEUE ENTRY   DPEU3600
0238R  0788               562           XHR   WK2,WK2              ZERO THE THIRD QUEUE ENTRY SO THE   DPEU3610
023AR  4087 0004          563           STH   WK2,QENTRY3(WK1)     QUEUE WILL EMPTY ITSELF             DPEU3620
023ER  41E0 0352R         564  COMETRY  BAL   RETN2,STRTSK          START ALL QUEUED SEEK OPERATIONS    DPEU3630
0242R  0766               565  STRTIO   XHR   WK0,WK0              GO START FIRST AVAILABLE I/O TRANSFR DPEU3640
0244R  9161               566  STRTIO1  SLLS  WK0,1                WHEN CONTROLLER IS IDLE             DPEU3650
0246R  4856 041CR         567           LH    FUT,FILE1(WK0)       GET THE MAIN FILE ADDRESS           DPEU3660
024AR  4876 0424R         568           LH    WK1,BLKAD(WK0)       GET THE FILEQ ADDRESS               DPEU3670
024ER  4877 0000          569           LH    WK1,0(WK1)           GET THE FILEQ ENTRY BLOCK ADDRESS   DPEU3680
*  0252R  2355            570           BZ    STRTIO2              IF ITS ZERO NO NEED TO GO CHECK BLK DPEU3690
0254R  0397 000C          571           LB    WK3,SEEKQFLG(WK1)    GET THE SEEKQ FLAG AND SET          DPEU3700
0258R  0899               572           LHR   WK3,WK3              AND SET THE CONDITION CODE          DPEU3710
*  025AR  2359            573           BZ    CHKIO                IF ITS ZERO GO CHECK DATA TRNSFR Q  DPEU3720
025CR  9061               574  STRTIO2  SRLS  WK0,1                FLAG OTHERWISE ADD 1 TO THE LOGICAL DPEU3730
025ER  2661               575           AIS   WK0,1                FILE# AND CHECK NEXT FILEQ. WHEN ALL DPEU3740
0260R  C960 0003          576           CHI   WK0,3                ARE DONE EXIT.                      DPEU3750
0264R  4220 02F0R         577           BP    EXIT2                                                    DPEU3760
0268R  4300 0244R         578           B     STRTIO1                                                  DPEU3770
026CR  0397 000D          579  CHKIO    LB    WK3,DATATRNS(WK1)    GET THE DATA TRANSFER Q FLAG        DPEU3780
0270R  0899               580           LHR   WK3,WK3              AND SET THE CONDITION CODE          DPEU3790
*  0272R  225B            581           BZ    STRTIO2              IF Q FLAG IS ZERO NO DATA TRANSFER  DPEU3800
0274R  90D0               582           SSR   FUT,STAT             SENSE THE FILE STATUS               DPEU3810
0276R  C300 0043          583           THI   STAT,FLUNRECV        TEST FOR UNRECOV RRABLE ERROR       DPEU3820
027AR  4250 03C0R         584           BNZ   ERRSTOP              IF NON ZERO HALT IN ERROR           DPEU3830
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027EH  4070 0456R          385            STH   WK1,FILEIO          OTHERWISE START DATA TRANSFER BY      DPEU3840
0282R  4070 041AR          386            STH   WK1,INTFLG          FIRST STORING PARAMETER BLOCK ADDR.   DPEU3850
0286R  4867 0004           387            LH    WK0,BUFENDAD(WK1)   AS ADDR OF I/O IN PROGRESS AND SET  DPEU3860
028AR  4060 0464R          388            STH   WK0,BUFEND          INTERNAL CONTROLLER BUSY FLAG         DPEU3870
028EH  0867                389            LHR   WK0,WK1                                                   DPEU3880
0290R  0397 000E           390            LB    WK3,RDWRTFLG(WK1)   CHECK READ/WRT FLAG IN PARAM BLOCK    DPEU3890
0294R  0899                391            LHR   WK3,WK3             SET THE CONDITION CODE                DPEU3900
*  0296R  2336              392            BZ    READINT             IF ITS ZERO GO AHEAD AND READ         DPEU3910
                           393  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                               DPEU3920
                           394  ************************************************************************** DPEU3930
0298R  0370 040BR          395  WRITINT  LB    WK1,WCMD            OTHERWISE ITS A WRITE OPERATION    *  DPEU3940
029CR  C880 0010           396            LHI   WK2,X'10'           SELCH WRITE COMMAND                *  DPEU3950
02A0R  2305                397            BS    RWCOM1              *                                  *  DPEU3960
02A2R  0370 040AR          398  READINT  LB    WK1,RCMD            READ OPERATION                     *  DPEU3970
02A6R  C880 0030           399            LHI   WK2,X'30'           SELCH READ AND GO COMMAND          *  DPEU3980
02AAR  DE40 040CR          400  RWCOM1   OC    SLAD,STOP           STOP THE SELCH                     *  DPEU3990
02AER  0846 0000           401            WH    SLAD,BUFSTRT(WK0)   WRITE STARTING BUFFER ADDR TO SELCH*  DPEU4000
02B2R  0846 0004           402            WH    SLAD,BUFENDAD(WK0)  WRITE BUFFER ENDING ADDRESS TO SLCH*  DPEU4010
02B6R  4886 0008           403            LH    TRACK,CYLINDER(WK0) WRITE CYLINDER NUMBER TO THE FILE  *  DPEU4020
02BAR  4890 044CR          404            LH    WK3,TRKDEN          GET THE TRACK DENSITY OPTION       *  DPEU4030
02BER  C590 0000           405            CLHI  WK3,0               IS THIS OPTION ZERO                *  DPEU4040
*  02C2R  2339              406            BE    WDFT1B              IF IT IS ITS A 2.5 MEGABYTE DRIVE  *  DPEU4050
02C4R  C580 0100           407            CLHI  TRACK,256           OTHERWISE 10 MEGABYTE DRIVE IS ASSMD  DPEU4060
*  02C8R  2304              408            BNL   WDFT10A             IS TRACK= OF > 256 IF YES SET MSB  *  DPEU4070
02CAR  DA50 044ER          409            WD    FUT,ZERO            IN CONTROLLER OTHERWISE ZERO IT    *  DPEU4080
02CER  2303                410            BS    WDFT1B              *                                  *  DPEU4090
02D0R  DA50 044FR          411  WDFT10A  WD    FUT,ONE             SET MSB IN DISC CONTROLLER         *  DPEU4100
02D4R  9A5B                412  WDFT1B   WDR   FUT,TRACK           WRITE THE CYLINDER # TO THE FILE   *  DPEU4110
02D6R  0396 000A           413            LB    WK3,HEADNO(WK0)     GET THE HEAD NUMBER FRM PRMTR BLK  *  DPEU4120
02DAR  9195                414            SLLS  WK3,5               SHIFT IT FOR FORMATTING THE HEADER *  DPEU4130
02DCR  4080 045AR          415            STH   WK2,WK2SVE          *                                  *  DPEU4140
02E0R  0386 0008           416            LB    WK2,SECTOR(WK0)     GET THE SECTOR FROM THE PARAMETER  *  DPEU4150
02E4R  0689                417            OHR   WK2,WK3             BLOCK AND FORMAT THE HEADER        *  DPEU4160
02E6R  9AA8                418            WDR   DCAD,WK2            WRITE THE HEADER TO THE CONTROLLER *  DPEU4170
02E8R  4880 045AR          419            LH    WK2,WK2SVE          *                                  *  DPEU4180
02ECR  9EA7                420            OCR   DCAD,WK1            OUTPUT CONTROLLER COMMAND          *  DPEU4190
02EER  9E48                421            OCR   SLAD,WK2            OUTPUT SELCH COMMAND               *  DPEU4200
02F0R  0100 0690R          422  EXIT2    LM    R0,REGSAVE          RESTORE THE USERS REGISTERS        *  DPEU4210
02F4R  C200 0040           423            LPSW  OLDPSWST            *                                  *  DPEU4220
                           424  ************************************************************************** DPEU4230
                           425  *                                                                          DPEU4240
                           426  *                                                                          DPEU4250
                           427  * FILE INTERRUPTS PROCESSED BELOW:                                        DPEU4260
02F8R  C860 042CR          428  FILE1INT LHI   WK0,FILE1Q          LOAD FILEQ ADDRESS FOR MAIN DRIVE     DPEU4270
02FCR  2309                429            BS    FILCOM              BRANCH TO FILECOMMON ROUTINE       DPEU4280
02FER  C860 0434R          430  FILE2INT LHI   WK0,FILE2Q          LOAD FILEQ ADDRESS FOR 1 EXP DISC     DPEU4290
0302R  2306                431            BS    FILCOM                                                 DPEU4300
0304R  C860 043CR          432  FILE3INT LHI   WK0,FILE3Q          LOAD FILEQ ADDRESS FOR 2ND EXP DISC   DPEU4310
0308R  2303                433            BS    FILCOM                                                 DPEU4320
030AR  C860 0444R          434  FILE4INT LHI   WK0,FILE4Q          LOAD FILE4Q ADDRESS FOR 3RD EXP DSC   DPEU4330
030ER  0777                435  FILCOM   XHR   WK1,WK1                                                 DPEU4340
0310R  4866 0000           436            LH    WK0,0(WK0)          GET THE Q-ENTRY FROM THE APPROPRIATE  DPEU4350
0314R  D276 000C           437            STB   WK1,SEEKQFLG(WK0)   FILE QUEUE AND ZERO THE SEEK Q-FLAG   DPEU4360
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APPENDIX 2 16 BIT PROGRAMMING EXAMPLES                PAGE  11  21:46:19  09/28/78

APPENDIX 2 MULTI-DISC PROGRAMMING
                          *                                IN THE PARAMETER BLOCK              DPE04370
                          *                                                                    DPE04380
                          * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                         DPE04390
                          ******************************************************************** DPE04400
  0318R  4860 041AR       FILINT   LH    WK0,INTFLG        IF THE INTERNAL CONTROLLER BUSY FLG* DPE04410
* 031CR  2139                      BNZ   EXIT              IS SET EXIT AND WAIT FOR CONT INT. * DPE04420
  031ER  4860 0410R                LH    WK0,DEVSTAT       CHECK THE DEVICE STATUS            * DPE04430
  0322R  C360 0008                 THI   WK0,RSRWT         FOR FILE READY                     * DPE04440
  0326R  4230 03C0R                BNZ   ERRSTOP           IF FILE IS NOT READY (RSRWT=1) ABORT DPE04450
  032AR  4300 023ER                B     COMETRY           BRANCH TO COMMON ENTRY ROUTINE     * DPE04460
                          ******************************************************************** DPE04470
                          *                                                                    DPE04480
                          *                                                                    DPE04490
  032ER  0100 0690R       EXIT     LM    R0,REGSAVE        RESTORE USERS REGISTERS             DPE04500
  0332R  C200 0040                 LPSW  OLDPSWST                                              DPE04510
                          *                                                                    DPE04520
                          * THE ERROR ROUTINE WILL PROCESS THE APPROPRIATE FLAGS IN THE PARAMETER DPE04530
                          * BLOCK AND TERMINATE THE PRESENT I/O OPERATION                     DPE04540
  0336R  4860 0456R       ERROR    LH    WK0,FILEIO        GET THE PARAMETER BLOCK ADDRESS OF  DPE04550
  033AR  2471                      LIS   WK1,1             THE CURRENT I/O OPERATION IN PROG   DPE04560
  033CR  D276 000F                 STB   WK1,IOCOMPLT(WK0) SET I/O COMPLETE FLG IN PARAM BLK   DPE04570
  0340R  D370 0410R                LB    WK1,DEVSTAT       GET DEVICE ERROR STATUS             DPE04580
  0344R  D276 0011                 STB   WK1,ERRSTA(WK0)   STORE IT IN THE PARAMETER BLOCK     DPE04590
  0348R  0777                      XHR   WK1,WK1                                               DPE04600
  034AR  D276 000D                 STB   WK1,DATATRNS(WK0) ZERO THE DATA TRANSFER Q FLAG IN THE DPE04610
  034ER  4300 021ER                B     QMANG             BRANCH TO Q HANDLING CODE           DPE04620
                          *                                                                    DPE04630
                          * SUBROUTINE: START SEEK                                             DPE04640
                          * FUNCTION: TAKES THE TOP ENTRY IN EACH FILEQ AND CHECKS             DPE04650
                          *          IF SEEKQ FLAG IS SET. IF SET, SEEK OPERATION IS           DPE04660
                          *          INITIATED. WHEN THE CONTROLLER IS IDLE, THE NEXT FILEQ    DPE04670
                          *          IS CHECKED UNTIL ALL REQUIRED SEEKS ARE INITIATED.        DPE04680
                          *                                                                    DPE04690
                          * CALLING SEQUENCE: BAL   RETN2,STRTSK                               DPE04700
                          *                                                                    DPE04710
                          *                                                                    DPE04720
  0352R  0766             STRTSK   XHR   WK0,WK0                                               DPE04730
  0354R  9161             STRTSK1  SLLS  WK0,1                                                 DPE04740
  0356R  4856 041CR                LH    FUT,FILE1(WK0)    GET THE FIRST FILE ADDR             DPE04750
  035AR  4876 0424R                LH    WK1,BLKAD(WK0)    GET THE FIRST FILEQ ADDRESS         DPE04760
  035ER  4877 0000                 LH    WK1,0(WK1)        GET PRM BLK ADDRESS FRM THE QUEUE   DPE04770
  0362R  4330 03B0R                BZ    SEEKIT1           IF ZERO, NO NEED TO CHECK FURTHER   DPE04780
  0366R  D397 000C                 LB    WK3,SEEKQFLG(WK1) GET THE SEEKQ FLG FRM PARM BLOCK    DPE04790
  036AR  0899                      LHR   WK3,WK3           SET THE CONDITION CODE              DPE04800
  036CR  4330 03B0R                BZ    SEEKIT1           IF ZERO SEEK NOT REQUIRED           DPE04810
                          *                                                                    DPE04820
                          * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                         DPE04830
                          ******************************************************************** DPE04840
  0370R  9050             INTSK1   SSR   FUT,STAT          OTHERWISE START SEEK SEQUENCE     * DPE04850
  0372R  C300 0010                 THI   STAT,ADRINTLK     IF ADR INTLK=1 WAIT FOR           * DPE04860
* 0376R  2033                      BNZ   INTSK1            IT TO GO TO ZERO                  * DPE04870
  0378R  C300 0043                 THI   STAT,FLUNRECV     IF FILE IN UNRECOVERABLE ERROR    * DPE04880
  037CR  4230 03C0R                BNZ   ERRSTOP           ABORT OTHERWISE                   * DPE04890
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03B0R  C3D0 0008          491           THI   STAT,RSRWT          WAIT FOR RSRWT=0                    *  DPEU4900
03B4R  4230 03B0R         492           BNZ   SEEKIT1              *                                   *  DPEU4910
03B8R  4887 0008          493           LH    TRACK,CYLINDER(WK1) EXTRACT CYLINDER NUMBER FROM BLOCK*  DPEU4920
03BCR  4890 044CR         494           LH    WK3,TRKDEN          GET THE TRACK DENSITY OPTION        *  DPEU4930
03C0R  C590 0000          495           CLHI  WK3,0               IS THIS OPTION ZERO                 *  DPEU4940
*      03C4R  2339        496           BE    WDFT1C              IF IT IS A 2.5 MEGABYTE DRIVE       *  DPEU4950
03C6R  C580 0100          497           CLHI  TRACK,256           OTHERWISE 10 MEGABYTE DRIVE IS ASSMD  DPEU4960
*      03CAR  2304        498           BNL   WDFT10B             IS TRACK= OR > 256 IF YES SET MSB   *  DPEU4970
03CCR  DA50 044ER         499           WD    FUT,ZERO            IN CONTOLLER OTHERWISE ZERO IT      *  DPEU4980
03D0R  2303               500           BS    WDFT1C              *                                   *  DPEU4990
03D2R  DA50 044FR         501  WDFT10B  WD    FUT,ONE             SEE SUBROUTINE WDFT1 FOR COMMENT ON*  DPEU5000
03D6R  9A5B               502  WDFT1C   WDR   FUT,TRACK           DISC TRACK DENSITY ALGORITHM (PG.3)*  DPEU5010
03D8R  DE50 0408R         503           OC    FUT,ISKC1D          OUTPUT SEEK COMMAND INTERRUPTS ARMED  DPEU5020
03DCR  9DAD               504  INTSK2   SSR   DCAD,STAT           SENSE CONTROLLER STATUS             *  DPEU5030
*      03DER  2221        505           BFC   CONTIDLE,INTSK2     *                                   *  DPEU5040
                          506  ********************************************************************** DPEU5050
                          507  *                                                                       DPEU5060
                          508  *                                                                       DPEU5070
03E0R  9061               509  SEEKIT1  SRLS  WK0,1               ADD 1 TO THE LOGICAL FILE NUMBER    DPEU5080
03E2R  2661               510           AIS   WK0,1                                                   DPEU5090
03E4R  C960 0003          511           CHI   WK0,3               HAVE ALL FILE QUEUES BEEN CHECKED   DPEU5100
*      03E8R  2123        512           BP    RETN2A              YES, RETURN                         DPEU5110
03EAR  4300 0354R         513           B     STRTSK1             NO GO CHECK NEXT Q AND BLOCK ENTRY  DPEU5120
03EER  030E               514  RETN2A   BR    RETN2                                                   DPEU5130
                          515  * ERROR STOP CODE HALTS THE MACHINE WITH THE TERMINAL LOC INDICATING    DPEU5140
                          516  * THE POINT AT WHICH THE ERROR OCURRED                                  DPEU5150
03C0R  C8E0 8000          517  ERRSTOP  LHI   RETN2,X'8000'      MACHINE STATUS WAIT STATE           DPEU5160
03C4R  40E0 0040          518           STH   RETN2,OLDPSWST      AND HALT                            DPEU5170
03C8R  C200 0040          519           LPSW  OLDPSWST                                                DPEU5180
                          520  * SUBROUTINE: LOCORE                                                   DPEU5190
                          521  * CALLING SEQUENCE: BAL RETN2,LOCORE                                   DPEU5200
                          522  * FUNCTION: SETS UP INTERRUPT SERVICE POINTER TABLE FOR INTERRUPT       DPEU5210
                          523  *           HANDLING                                                    DPEU5220
03CCR  C860 019AR         524  LOCORE   LHI   WK0,EXTINT         GET ADDR OF EXTERNAL INT HANDLER    DPEU5230
03D0R  4060 0046          525           STH   WK0,NEWPSWLC                                            DPEU5240
03D4R  0766               526           XHR   WK0,WK0                                                 DPEU5250
03D6R  4060 0044          527           STH   WK0,NEWPSWST                                            DPEU5260
03DAR  030E               528           BR    RETN2                                                   DPEU5270
                          529  * SUBROUTINE:  QUEUE SUBROUTINE CALL                                   DPEU5280
                          530  * FUNCTION: LOOKS FOR THE FIRST ZERO ENTRY IN THE APPROPRIATE          DPEU5290
                          531  *           FILE Q AND STORES THE PARAMETER BLOCK ADDRESS IN THE QUEUE   DPEU5300
                          532  * CALLING SEQUENCE: BAL RETN2,QUEUEREQ                                  DPEU5310
                          533  *                                                                       DPEU5320
03DCR  4860 0458R         534  QUEUEREQ LH    WK0,PARMBLK         GET THE PARAMETER BLOCK ADDRESS     DPEU5330
03E0R  0366 0010          535           LB    WK0,LOGFILE(WK0)    GET THE LOGICAL FILE UNIT FROM BLOCK  DPEU5340
03E4R  9161               536           SLLS  WK0,1               SHIFT FOR INDEXING INTO TABLE       DPEU5350
03E6R  4866 0424R         537           LH    WK0,BLKAD(WK0)      GET THE CORRECT FILEQ ADDRESS       DPEU5360
03EAR  4876 0000          538  QCOM     LH    WK1,0(WK0)          GET THE FIRST Q ENTRY               DPEU5370
*      03EER  2336        539           BZ    QCOM1               IF ITS ZERO, GO STORE P.BLOCK ADDR  DPEU5380
03F0R  C570 4FFF          540           CLHI  WK1,X'4FFF'         HAVE WE EXHAUSTED ALL Q ENTRIES?    DPEU5390
*      03F4R  2338        541           BE    QFULL               YES-Q IS FULL -ABORT REQUEST        DPEU5400
03F6R  2662               542           AIS   WK0,2               BUMP THE Q ADDRESS                  DPEU5410
*      03F8R  2207        543           B     QCOM                CHECK THE NEXT Q ENTRY              DPEU5420
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APPENDIX 2 MULTI-DISC PROGRAMMING

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03FAR  4870 0456R      544  QCOM1    LH     WK1,PARMBLK     GET THE PARAMETER BLOCK ADDRESS          DPEU5430
03FER  4076 0000       545             STH    WK1,0(WK0)      STORE IT IN THE FILE QUEUE               DPEU5440
0402R  030E            546             BR     RETN2           RETURN                                   DPEU5450
0404R  4300 03C0R      547  QFULL    B      ERRSTOP         QUEUE IS FULL ABORT IN ERROR             DPEU5460
0408R                  548             ALIGN  4                                                        DPEU5470
0408R  42              549  ISKCMD   DB     X'42'           INTERRUPT SEEK COMMAND                   DPEU5480
0409R  C2              550  SEEKC    DB     X'C2'           SEEK COMMAND                             DPEU5490
040AR  01              551  RCMD     DB     X'01'           DISC READ COMMAND                        DPEU5500
040BR  02              552  WCMD     DB     X'02'           WRITE COMMAND                            DPEU5510
040CR  08              553  STOP     DB     X'08'           SELCH STOP COMMAND                       DPEU5520
040ER  0000            554  HEAD     DC     X'0'                                                     DPEU5530
0410R  0000            555  DEVSTAT  DC     X'0'            DEVICE ERROR STATUS SAVE                 DPEU5540
0412R  0000            556  DEVADR   DC     X'0'                                                     DPEU5550
0414R  00B6            557  DISCONAD DC     X'B6'           DISC CONTROLLER ADDR.                    DPEU5560
0416R  0000            558  RETNSV   DC     X'0'                                                     DPEU5570
0418R  0000            559  RETNSV1  DC     X'0'                                                     DPEU5580
041AR  0000            560  INTFLG   DC     X'0'            INTERNAL CONTROLLER BUSY FLAG            DPEU5590
041CR  00C6            561  FILE1    DC     X'C6'           FILE 1 ADDRESS                           DPEU5600
041ER  00D6            562  FILE2    DC     X'D6'           FILE 2 ADDRESS                           DPEU5610
0420R  00E6            563  FILE3    DC     X'E6'           FILE 3 ADDRESS                           DPEU5620
0422R  00F6            564  FILE4    DC     X'F6'           FILE 4 ADDRESS                           DPEU5630
0424R  042CR           565  BLKAD    DC     Z(FILE1Q)       FILE 1 Q ADDRESS                         DPEU5640
0426R  0434R           566             DC     Z(FILE2Q)       FILE 2 Q ADDRESS                         DPEU5650
0428R  043CR           567             DC     Z(FILE3Q)       FILE 3 Q ADDRESS                         DPEU5660
042AR  0444R           568             DC     Z(FILE4Q)       FILE 4 Q ADDRESS                         DPEU5670
042CR  0000            569  FILE1Q   DC     X'0'            FILE 1 Q WHERE                           DPEU5680
042ER  0000            570             DC     X'0'            PARAMETER BLOCK ADDRESSES                DPEU5690
0430R  0000            571             DC     X'0'            ARE QUEUED                               DPEU5700
0432R  4FFF            572             DC     X'4FFF'         FILE 1 Q DELIMITER                       DPEU5710
0434R  0000            573  FILE2Q   DC     X'0'            FILE 2 Q                                 DPEU5720
0436R  0000            574             DC     X'0'                                                     DPEU5730
0438R  0000            575             DC     X'0'                                                     DPEU5740
043AR  4FFF            576             DC     X'4FFF'         FILE 2 Q DELIMITER                       DPEU5750
043CR  0000            577  FILE3Q   DC     X'0'            FILE 3 Q                                 DPEU5760
043ER  0000            578             DC     X'0'                                                     DPEU5770
0440R  0000            579             DC     X'0'                                                     DPEU5780
0442R  4FFF            580             DC     X'4FFF'         FILE 3 Q DELIMITER                       DPEU5790
0444R  0000            581  FILE4Q   DC     X'0'            FILE 4 Q                                 DPEU5800
0446R  0000            582             DC     X'0'                                                     DPEU5810
0448R  0000            583             DC     X'0'                                                     DPEU5820
044AR  4FFF            584             DC     X'4FFF'         FILE 4 Q DELIMITER                       DPEU5830
044CR  0000            585  TRKDEN   DC     X'0'            TRACK DENSITY USED IN SENSE ST SK        DPEU5840
044ER  00              586  ZERO     DB     0               ZERO CONSTANT                            DPEU5850
044FR  01              587  ONE      DB     1               ONE CONSTANT                             DPEU5860
0450R  0000            588  RETN2SV  DC     X'0'                                                     DPEU5870
0452R  00F0            589  SELAD1   DC     X'F0'           SELCH ADDRESS                            DPEU5880
0454R  0000            590  RWSAVE   DC     X'0'                                                     DPEU5890
0456R  0000            591  FILEIO   DC     X'0'            PARM. BLK ADDR OF FILE I/O IN PROG       DPEU5900
0458R  0000            592  PARMBLK  DC     X'0'            PARAMETER BLOCK ADDRESS SAVE             DPEU5910
                       593  *                                                                        DPEU5920
045AR  0000            594  WK2SVE   DC     X'0'                                                     DPEU5930
045CR  0000            595  SA       DC     X'0'            WORK REGISTER SAVE AREA                  DPEU5940
045ER  0000            596  FA       DC     X'0'            STARTING ADDRESS OF BUFFER               DPEU5950
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APPENDIX 2 MULTI-DISC PROGRAMMING

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0460R  0000                597  SELAD    DC    X'0'          FINAL SELCH TERMINATION ADDRESS          DPEU5960
0462R  0000                598  FADR     DC    X'0'          FINAL BUFFER ADDRESS                     DPEU5970
                           599  *                                                                    DPEU5980
0464R  0000 0000           600  BUFEND   DC    Y'0'          FINAL BUFFER ADDR. EX. 5.4               DPEU5990
0468R  046CR               601  PMBK1    DC    A(BUF1)       PARAMETER BLOCK 1 STRT BFR AD            DPEU6000
046AR  0000                602           DC    X'0'          FILLER USED TO MAINTAIN COMMON BLK       DPEU6010
046CR  058BR               603           DC    A(BUF1+255)   ENDING BUFFER ADDRESS                    DPEU6020
046ER  0000                604           DC    X'0'          FILLER USED TO MAINTAIN COMMON BLK       DPEU6030
0470R  0197                605           DC    X'197'        CYLINDER                                 DPEU6040
0472R  00                  606           DB    X'0'          HEAD                                     DPEU6050
0473R  10                  607           DB    X'10'         SECTOR                                   DPEU6060
0474R  01                  608           DB    X'01'         SEEK Q FLAG                              DPEU6070
0475R  01                  609           DB    X'01'         READ/WRITE Q FLAG                        DPEU6080
0476R  00                  610           DB    X'00'         READ/WRT IDENT.                          DPEU6090
0477R  00                  611           DB    X'0'          I/O COMPLETE FLAG                        DPEU6100
0478R  00                  612           DB    X'0'          LOGICAL FILE IDENT.                      DPEU6110
0479R  00                  613           DB    X'0'          ERROR STATUS SAVE AREA                   DPEU6120
047AR  058CR               614  PMBK2    DC    A(BUF2)       PARAMETER BLOCK 2 STRT BFR AD            DPEU6130
047CR  0000                615           DC    X'0'          FILLER USED TO MAINTAIN COMMON BLK       DPEU6140
047ER  068BR               616           DC    A(BUF2+255)   ENDING BUFFER ADDR                       DPEU6150
0480R  0000                617           DC    X'0'          FILLER USED TO MAINTAIN COMMON BLK       DPEU6160
0482R  0197                618           DC    X'197'        CYLINDER                                 DPEU6170
0484R  00                  619           DB    X'0'          HEAD                                     DPEU6180
0485R  10                  620           DB    X'10'         SECTOR                                   DPEU6190
0486R  01                  621           DB    X'01'         SEEK Q FLG.                              DPEU6200
0487R  01                  622           DB    X'01'         READ/WRITE Q FLG.                        DPEU6210
0488R  00                  623           DB    0             READ/WRITE IDENT.                        DPEU6220
0489R  00                  624           DB    0             I/O COMPLETE FLG.                        DPEU6230
048AR  01                  625           DB    X'01'         LOGICAL FILE IDENT.                      DPEU6240
048BR  00                  626           DB    X'0'          ERROR STATUS SAVE AREA                   DPEU6250
048CR                      627  BUF1     DS    256           BUFFER - PARAM. BLK 1                    DPEU6260
058CR                      628  BUF2     DS    256           BUFFER - PARAM. BLK 2                    DPEU6270
068CR                      629           ALIGN 2                                                      DPEU6280
068CR  C000                630  INITWAIT DC    X'C000'       WAIT STATE WITH INTERRUPTS               DPEU6290
068ER  0192R               631           DC    A(MULDSC)     ENABLED- LOC=MULDSC                      DPEU6300
0690R                      632  REGSAVE  DSH   16            REG SAVE AREA FOR REG SET                DPEU6310
06B0R                      633           END                                                          DPEU6320
```

```
   APPENDIX 2 16 BIT PROGRAMMING EXAMPLES                    PAGE  15  21:46:19  09/28/78

   APPENDIX 2 MULTI-DISC PROGRAMMING

ASSEMBLED BY CAL 03-066R05-00   (32-BIT)

START OPTIONS:  *NONE*

   NO CAL ERRORS
   NO CAL WARNINGS
    6 PASSES

 ABSTOP     0000 0000
 ADC        0000 0002
 ADRINTLK   0000 0010      28*    81    487
 BLKAD      0000 0424R    357    368    477    537    565*
 BUF1       0000 048CR    601    603    627*
 BUF2       0000 058CR    614    616    628*
 BUFEND     0000 0464R    203    342    588    600*
 BUFENDAD   0000 0004      34*    387    402
 BUFSTRT    0000 0000      35*    401
 CHKIO      0000 026CR    373    379*
 CNTRLINT   0000 00F0R    193    200    202*
 CNTUNREC   0000 0005      31*    153    206    345
 COMETRY    0000 023ER    290    364*   447
 CONTIDLE   0000 0002      27*    79     152    268    505
 CONTINT    0000 01F6R    310    330    337*
 CONTRLIT   0000 01FCR    341*
 CYLINDER   0000 0008      36*    403    493
 DATATRNS   0000 000D      40*    353    379    462
 DCAD       0000 000A      24*    78     145    146    151    192    198    205    238    267    306    309    328
                           344    418    420    504
 DEVADR     0000 0412R    556*
 DEVSTAT    0000 0410R    191    304    444    459    555*
 DISCONAD   0000 0414R    258    306    557*
 DXTL       0000 007CR    148*   149
 DXTL1      0000 0084R    151*   152
 ENTER1     0000 018AR    278    287*
 ERROR      0000 0336R    343    345    456*
 ERRSTA     0000 0011      44*   460
 ERRSTOP    0000 03C0R     84    153    157    195    204    206    275    319    384    446    490    517*   547
 EXIT       0000 032ER    443    451*
 EXIT2      0000 02F0R    377    422*
 EXTINT     0000 019AR    303*   524
 FA         0000 045ER    139    156    596*
 FADR       0000 0462R    197    202    326    341    598*
 FILCOM     0000 030ER    429    431    433    435*
 FILE1      0000 041CR    272    311    367    476    561*
 FILE1INT   0000 02F8R    312    428*
 FILE1Q     0000 042CR    428    565    569*
 FILE2      0000 041ER    313    562*
 FILE2INT   0000 02FER    314    430*
 FILE2Q     0000 0434R    430    566    573*
 FILE3      0000 0420R    315    563*
 FILE3INT   0000 0304R    316    432*
 FILE3Q     0000 043CR    432    567    577*
 FILE4      0000 0422R    317    564*
```

APPENDIX 2 MULTI-DISC PROGRAMMING

		379	385	386	387	389	390	395	398	420	435	435	457	457
		458	459	460	461	461	462	477	478	478	480	493	538	540
		544	545											
WK2	0000 0008	16*	135	136	147	257	257	258	358	359	360	361	362	362
		363	396	399	415	416	417	418	419	421				
WK2SVE	0000 045AR	415	419	594*										
WK3	0000 0009	17*	141	142	144	371	372	372	379	380	380	390	391	391
		404	405	413	414	417	480	481	481	494	495			
WRITINT	0000 0298R	189	395*											
WRITS	0000 0054R	135*												
WRITX	0000 00B2R	182*												
ZERO	0000 044ER	108	409	499	586*									

PROG= *NONE* ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

```
                                1          SCRAT
                                2          PROG  APPENDIX 3 32 BIT PROCESSOR DISC EXAMPLES
                                3          SQUEZ
                                4          SQCHK
                                5          CROSS
                                6          TARGT 32
                                7          WIDTH 120
                                8          NORX3
0000 0000                       9  R0      EQU   0          REGISTER 0-3
0000 0001                      10  R1      EQU   1          RESERVED FOR INTERRUPT USE
0000 0002                      11  R2      EQU   2
0000 0003                      12  R3      EQU   3
0000 0004                      13  SLAD    EQU   4          SELCH ADDRESS
0000 0005                      14  FUT     EQU   5          FILE ADDRESS
0000 0006                      15  WK0     EQU   6          WORK REGISTER 0
0000 0007                      16  WK1     EQU   7          WORK REGISTER 1
0000 0008                      17  WK2     EQU   8          WORK REGISTER 2
0000 0009                      18  WK3     EQU   9          WORK REGISTER 3
0000 0002                      19  QENTRY2 EQU   2
0000 0004                      20  QENTRY3 EQU   4
0000 000B                      21  TRACK   EQU   11
0000 000D                      22  STAT    EQU   13         DEVICE STATUS
0000 000E                      23  RETN2   EQU   14         RETURN REGISTER 2
0000 000F                      24  RETN    EQU   15         RETURN REGISTER 1
0000 000A                      25  DCAD    EQU   10         DISC CONTROLLER ADDRESS
0000 000C                      26  SECT    EQU   12         DISC SECTOR NUMBER
0000 0008                      27  SLCHBSY EQU   8          SELCH BUSY STATUS
0000 0002                      28  CONTIDLE EQU  2          DISC CONTROLLER IDLE
0000 0010                      29  ADRINTLK EQU  X'10'      FILE ADDR INTLK STATUS
0000 0043                      30  FLUNRECV EQU  X'43'      WRTCHK+SEEKINC+DISCNTRDY (FILE STAT)
0000 0008                      31  RSRWT   EQU   8          FILE READY TO SEEK,READ,OR WRITE
0000 0005                      32  CNTUNREL EQU  5          EX+DATATRNSFRERR (CONT STAT)
0000 0080                      33  OVERRUN EQU   X'80'      CONTROLLER OVERRUN STATUS
0000 00FF                      34  FLABORT EQU   X'FF'      AABORT OPERATION FILE STATUS
0000 0006                      35  BUFENDAD EQU  6          PARAMETER BLOCK BUFFER END ADR
0000 0008                      36  CYLINDER EQU  8          PARAMETER BLOCK CYLINDER ENTRY
0000 000A                      37  HEADNO  EQU   10         PARAMETER BLOCK HEAD ENTRY
0000 000B                      38  SECTOR  EQU   11         PARAMETER BLOCK SECTOR ENTRY
0000 000C                      39  SEEKQFLG EQU  12         PARAMETER BLOCK SEEK QUEUE FLAG
0000 000D                      40  DATATRNS EQU  13         PARAMETER BLOCK DATA TRANSFER Q FLG
0000 000E                      41  RDWRTFLG EQU  14         PARAMETER BLOCK READ/WRITE OP IDENT
0000 000F                      42  IOCOMPLT EQU  15         PARAMETER BLOCK I/O COMPLETED FLAG
0000 0010                      43  LOGFILE EQU   16         PARAMETER BLOCK LOGICAL FILE IDENT
0000 0011                      44  ERRSTA  EQU   17         PARAMETER BLOCK ERROR STATUS
```

DPE00010 DPE00030 DPE00040 DPE00041 DPE00050 DPE00060 DPE00070 DPE00080 DPE00090 DPE00100 DPE00110 DPE00120 DPE00130 DPE00140 DPE00150 DPE00160 DPE00170 DPE00180 DPE00190 DPE00200 DPE00210 DPE00220 DPE00230 DPE00240 DPE00250 DPE00260 DPE00270 DPE00280 DPE00290 DPE00300 DPE00310 DPE00320 DPE00330 DPE00340 DPE00350 DPE00360 DPE00370 DPE00380 DPE00390 DPE00400 DPE00410 DPE00420 DPE00430 DPE00440

APPENDIX 2 SENSE STATUS SEEK

```
                                      46  * SUBROUTINE: SENSE STATUS SEEK                                                  DPE00450
                                      47  * FUNCTION:PERFORMS SENSE STATUS SEEK OPERATIONS                                 DPE00460
                                      48  * CALLING SEQUENCE: BAL RETN,SKSR                                               DPE00470
                                      49  * INPUT                                                                         DPE00480
                                      50  * REGISTERS: TRACK= DESIRED CYLINDER NUMBER                                     DPE00490
                                      51  *            FUT= FILE ADDRESS                                                  DPE00500
                                      52  *            SLAD= SELCH ADDRESS                                                DPE00510
                                      53  *            DCAD= DISC CONTROLLER ADDRESS                                      DPE00520
                                      54  * REGISTERS DESTROYED: SECT,RETN2,STAT                                          DPE00530
                                      55  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED                   DPE00540
                                      56  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED                   DPE00550
0000001  07CC                        57  SKSR     XR    SECT,SECT          REGISTER SECT IS DESTROYED                    DPE00560
0000021  41E0 800E =0000141          58           BAL   RETN2,FRSSR        FILE READY TO SEEK,READ,WRITE SEQ             DPE00570
0000061  41E0 8026 =0000301          59           BAL   RETN2,WDFT1        WRITE CYLINDER NUMBER TO FILE                 DPE00580
00000A1  0E50 365F =0003ED1          60           OC    FUT,SEEKC          OUTPUT SEEK COMMAND (INIPTS DISARMD)          DPE00590
00000E1  41E0 8002 =0000141          61           BAL   RETN2,FRSSR        WAIT FOR SEEK COMPLETE W/ GOOD STAT           DPE00600
0000121  03UF                        62           BR    RETN               RETURN TO USER                                DPE00610
                                      63  *                                                                              DPE00620
                                      64  *                                                                              DPE00630
                                      65  *SUBROUTINE: FILE READY TO SEEK,READ OR WRITE                                  DPE00640
                                      66  *FUNCTION: PERFORMS NECESSARY STATUS CHECK ON CONTROLLER AND FILE TO            DPE00650
                                      67  *          INSURE CORRECT FILE OPERATION                                       DPE00660
                                      68  * CALLING SEQUENCE: BAL RETN2,FRSSR                                            DPE00670
                                      69  * INPUT                                                                        DPE00680
                                      70  * REGISTERS: FUT= FILE ADDRESS                                                 DPE00690
                                      71  *            SLAD= SELCH ADDRESS                                               DPE00700
                                      72  *            DCAD= CONTROLLER ADDRESS                                          DPE00710
                                      73  * REGISTERS DESTROYED: NONE                                                    DPE00720
0000141  9DAD                        74  FRSSR    SSR   DCAD,STAT          SENSE DISC CONTROLLER STATUS                  DPE00730
*0000161  2221                       75           BFC   CONTIDLE,FRSSR     IF CONTROLLER NOT IDLE WAIT                   DPE00740
0000181  9D5D                        76           SSR   FUT,STAT           SENSE FILE STATUS                             DPE00750
00001A1  C3D0 0010                   77           TMI   STAT,ADRINTLK      TEST FILE STATUS FOR ADRINTLK=0               DPE00760
*00001E1  2035                       78           BNZ   FRSSR              ADRINTLK=1 WAIT FOR IT TO GO TO ZERO          DPE00770
0000201  C3D0 0043                   79           TMI   STAT,FLUNRECV      UNRECOVERABLE FILE ERROR                      DPE00780
0000241  4250 853C =0003641          80           BNZ   ERRSTOP            ABORT THE OPERATION                           DPE00790
                                      81  * AT THIS POINT USER COULD ATTEMPT TO CORRECT SEEK INCOMPLETE STATUS          DPE00800
                                      82  * BY ISSUING A RESTORE COMMAND AND REPEATING THE DESIRED SEEK                 DPE00810
0000281  C3D0 0008                   83  FRSSR1   TMI   STAT,RSRWT          FILE RSRWT=1                                  DPE00820
*00002C1  2032                       84           BNZ   FRSSR1             IF YES WAIT FOR RSRWT=0                       DPE00830
00002E1  03UE                        85           BR    RETN2              RETURN                                        DPE00840
                                      86  *                                                                              DPE00850
                                      87  *                                                                              DPE00860
                                      88  * SUBROUTINE: WRITE CYLINDER NUMBER TO THE FILE                               DPE00870
                                      89  * FUNCTION: WRITE CYLINDER # TO THE DISC FILE                                 DPE00880
                                      90  * CALLING SEQUENCE: BAL RETN2,WDFT1                                           DPE00890
                                      91  * INPUT                                                                       DPE00900
                                      92  * REGISTERS: TRACK=DESIRED CYLINDER NUMBER                                    DPE00910
                                      93  *            FUT=FILE ADDRESS                                                  DPE00920
                                      94  *            SLAD=SELCH ADDRESS                                                DPE00930
                                      95  *            DCAD=DISC CONTROLLER ADDRESS                                      DPE00940
                                      96  * REGISTERS DESTROYED=NONE                                                     DPE00950
                                      97  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED                  DPE00960
                                      98  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED                   DPE00970
```

APPENDIX 2 SENSE STATUS SEEK

```
0000301  4500 83FC =0004301     99  WDFT1    CLH   R0,TRKDEN       TRACK DENSITY=0                                  DPE00980
*0000341 2369                   100           BE    WDFT1A          YES- ASSUME 2.5 DRIVE GO TO WDFT1A               DPE00990
 0000361 C5B0 0100              101           CLHI  TRACK,256       CYLINDER NUMBER= OR > 256                        DPE01000
*0000341 2386                   102           BNL   WDFT1A          YES- SET MSB IN CONTROLLER AT WDFT0              DPE01010
 00003C1 DA50 83F2 =0004321     103           WD    FUT,ZERO        OTHERWISE INSURE IT IS ZERO                      DPE01020
 0000401 2303                   104           BS    WDFT1A                                                           DPE01030
 0000421 DA50 83ED =0004331     105  WDFT0    WD    FUT,ONE         SET MSB IN DISC CONTROLLER                       DPE01040
 0000461 9A5B                   106  WDFT1A   WDR   FUT,TRACK       WRITE THE CYLINDER # TO THE FILE                 DPE01050
 0000481 030E                   107           BR    RETN2                                                            DPE01060
```

APPENDIX 3 SENSE STATUS DISC READ/WRITE OPERATION

```
                                    110  * SUBROUTINE: READ/WRITE(SENSE STATUS CONTROL)                                  DPEU1090
                                    111  * FUNCTION: PERFORMS SENSE STATUS READ/WRITE OPERATION TO DISC                  DPEU1100
                                    112  * CALLING SEQUENCE FOR READ: BAL RETN,READS                                     DPEU1110
                                    113  * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITS                                    DPEU1120
                                    114  * INPUT                                                                         DPEU1130
                                    115  * REGISTERS: FUT=FILE ADDRESS                                                   DPEU1140
                                    116  *            DCAD= DISC CONTROLLER ADDRESS                                      DPEU1150
                                    117  *            SLAD= SELCH ADDRESS                                                DPEU1160
                                    118  *            TRACK=CYLINDER ADDRESS                                             DPEU1170
                                    119  *            SECT= DESIRED SECTOR                                               DPEU1180
                                    120  * MEMORY LOCATIONS: HEAD=DESIRED HEAD                                           DPEU1190
                                    121  *                   SA= STARTING BUFFER ADDRESS                               DPEU1200
                                    122  *                   FA= ENDING BUFFER ADDRESS                                 DPEU1210
                                    123  * REGISTERS DESTROYED: WK1,WK2,WK3                                              DPEU1220
00004A1  0370 83A0 =0003EE1         124  READS    LB     WK1,RCMD          DISC READ COMMAND                          DPEU1230
00004E1  C860 0070                  125           LHI    WK2,X'70'         EXTENDED SELCH READ COMMAND                DPEU1240
0000521  2305                      126           BS     RWCOM                                                        DPEU1250
0000541  0370 8397 =0003EF1         127  WRITS    LB     WK1,WCMD          DISC WRITE COMMAND                         DPEU1260
0000581  C860 0050                  128           LHI    WK2,X'50'         EXTENDED SELCH WRITE COMMAND               DPEU1270
00005C1  DE40 8390 =0003F01         129  RWCOM    OC     SLAD,ESTOP        STOP THE SELCH- SELCH STAT IDLE            DPEU1280
0000601  DA40 83E1 =0004451         130           WD     SLAD,SA+1         WRITE EXTENDED STARTING ADDRESS            DPEU1290
0000641  0840 83DE =0004461         131           WH     SLAD,SA+2                                                    DPEU1300
0000681  DA40 83D0 =0004491         132           WD     SLAD,FA+1         WRITE EXTENDED FINAL ADDRESS TO            DPEU1310
00006C1  0840 83DA =00044A1         133           WH     SLAD,FA+2                                                    DPEU1320
0000701  41E0 FFBC =000030I         134           BAL    RETN2,WDFT1       WRITE THE CYLINDER NUMBER TO FILE          DPEU1330
0000741  7390 837A =0003F2I         135           LHL    WK3,HEAD                                                     DPEU1340
0000781  1195                      136           SLLS   WK3,5                                                        DPEU1350
00007A1  086C                      137           LR     R0,SECT                                                       DPEU1360
00007C1  0609                      138           OR     R0,WK3                                                        DPEU1370
00007E1  9AA0                      139           WDR    DCAD,R0           WRITE HEADER TO CONTROLLER                 DPEU1380
0000801  9EA7                      140           OCR    DCAD,WK1          OUTPUT COMMAND TO DISC CONTROLLER          DPEU1390
0000821  9E48                      141           OCR    SLAD,WK2          START THE SELCH                            DPEU1400
0000841  9D4D                      142  DXTL     SSR    SLAD,STAT         SENSE SELCH STATUS                         DPEU1410
*0000861 2081                      143           BTC    SLCHBSY,DXTL      WAIT FOR SELCH TO COMPLETE                 DPEU1420
0000881  DE40 8364 =0003F0I         144           OC     SLAD,ESTOP        STOP THE SELCH -SELCH IDLE                 DPEU1430
00008C1  9DAD                      145  DXTL1    SSR    DCAD,STAT         SENSE CONTROLLER STATUS                    DPEU1440
*00008E1 2221                      146           BFC    CONTIDLE,DXTL1    WAIT FOR CONTROLLER TO GO IDLE             DPEU1450
0000901  4250 82D0 =000364I         147           BTC    CNTUNREC,ERRSTOP  BRANCH IF CONTROLLER ERROR                 DPEU1460
0000941  0B40 83B5 =00044D1         148           RD     SLAD,SELAD+1      GET FINAL ADDRESS FROM                     DPEU1470
0000981  0940 83B2 =00044EI         149           RH     SLAD,SELAD+2                                                 DPEU1480
00009C1  5860 83AC =00044C1         150           L      WK0,SELAD         COMPARE SELCH TERMINAL ADDRESS             DPEU1490
0000A01  5560 83A4 =0004481         151           CL     WK0,FA                                                       DPEU1500
0000A41  4230 82BC =000364I         152           BNE    ERRSTOP                                                      DPEU1510
0000A81  030F                      153           BR     RETN                                                         DPEU1520
```

APPENDIX 3 INTERRUPT DRIVEN READ/WRITE OPERATION

```
                                    * SUBROUTINE: READ/WRITE (INTERRUPT CONTROL)                                    DPEU1550
                                    * FUNCTION: PERFORMS INTERRUPT READ/WRITE OPERATION TO DISC)                    DPEU1560
                                    * CALLING SEQUENCE FOR READ: BAL RETN,READX                                     DPEU1570
                                    * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITX                                    DPEU1580
                                    * INPUT                                                                         DPEU1590
                                    * REGISTERS: FUT=FILE ADDRESS                                                   DPEU1600
                                    *            DCAD=DISC CONTROLLER ADDRESS                                       DPEU1610
                                    *            SLAD=SELCH ADDRESS                                                 DPEU1620
                                    *            TRACK=CYLINDER ADDRESS                                             DPEU1630
                                    *            SECT= DESIRED SECTOR                                               DPEU1640
                                    *            WK0= ADDRESS OF PARAMETER BLOCK DESCRIBED IN MULTI-DISC            DPEU1650
                                    *              FLOWCHART- ROUTINE WILL EXTRACT STARTING BUFFER ADDRESS          DPEU1660
                                    *              AND ENDING BUFFER ADDRESS FROM THE PARAMETER BLOCK               DPEU1670
                                    * REGISTERS DESTROYED: R0,R1,WK0,WK1,WK2,WK3                                     DPEU1680
0000AA1  081F                       READX    LR     R1,RETN              SET RETURN ADDRESS FOR NON-INT RETRN    DPEU1690
0000AC1  C800 4000                           LHI    R0,X'4000'           ENABLE INTERRUPTS IN NON INT RETN       DPEU1700
                                    * THIS IS DONE TO INSURE RETURN TO POINT OF SUBROUTINE CALL.                    DPEU1710
                                    * PROGRAM AT LOCATION READINT WILL EXECUTE AN LPSWR R0                          DPEU1720
0000B01  41E0 8040 =0000F41                  BAL    RETN2,LOCORE1        SET UP LOW CORE                         DPEU1730
0000B41  4300 8192 =000024A1                 B      READINT              GO TO SELCH AND DISC SETUP ROUTINE      DPEU1740
0000B81  081F                       WRITX    LR     R1,RETN              SET RETURN ADDRESS FOR NON-INT RETRN    DPEU1750
0000BA1  C800 4000                           LHI    R0,X'4000'                                                   DPEU1760
                                    * SEE NOTE ABOVE IN READX ROUTINE                                               DPEU1770
0000BE1  41E0 8032 =0000F41                  BAL    RETN2,LOCORE1                                                DPEU1780
0000C21  4300 817A =000024U1                 B      WRITINT              GO TO SELCH AND DISC SETUP ROUTINE      DPEU1790
                                    *SELCH INTERRUPT ENTERS BELOW:                                                  DPEU1800
                                                                                                                    DPEU1810
0000C61  0E40 8326 =0003FU1  SELCHNT1 OC    SLAD,ESTOP                                                          DPEU1820
0000CA1  0B40 8383 =0004511          RD     SLAD,FADR+1          READ FINAL ADDRESS                             DPEU1830
0000CE1  0940 8380 =0004521          RH     SLAD,FADR+2                                                         DPEU1840
0000D21  0E40 831A =0003FU1          OC     SLAD,ESTOP                                                          DPEU1850
0000D61  9UAD                        SSR    DCAD,STAT            SENSE CONTROLLER STATUS                        DPEU1860
0000D81  C300 0080                   THI    STAT,OVERRUN         IF CONTROLLER OVERRUN STATUS IS SET            DPEU1870
*0000DC1  2152                       BNZ    CNTRLINT             DO NOT EXPECT CONTROLLER INTERRUPT              DPEU1880
0000DE1  1800                        LPSWR  R0                                                                   DPEU1890
0000E01  5860 836C =000450I  CNTRLINT L      WK0,FADR                                                            DPEU1900
0000E41  5560 836C =000454I          CL     WK0,BUFEND                                                          DPEU1910
0000E81  4250 8278 =0003641          BNE    ERRSTOP                                                             DPEU1920
0000EC1  9UAD                        SSR    DCAD,STAT            SENSE CONTROLLER STATUS                        DPEU1930
0000EE1  4250 8272 =0003641          BTC    CNTUNREC,ERRSTOP     IF UNRECOVERABLE ERROR ABORT                   DPEU1940
0000F21  1800                        LPSWR  R0                   OTHERWISE EXIT                                 DPEU1950
                                    * SUBROUTINE: LOCORE1                                                           DPEU1960
                                    * FUNCTION: SETS UP LOW CORE TO PROCESS                                         DPEU1970
                                    *           INTERRUPT HANDLING IN THIS EXAMPLE                                  DPEU1980
                                    * CALLING SEQUENCE: BAL RETN2,LOCORE1                                          DPEU1990
                                    * INPUT                                                                         DPEU2000
                                    * REGISTERS:                                                                    DPEU2010
                                    *        SLAD= SELCH ADDRESS                                                    DPEU2020
                                    *        DCAD= DISC CONTROLLER ADDRESS                                          DPEU2030
                                    * REGISTERS DESTROYED:                                                         DPEU2040
                                    *              WK0,WK1                                                          DPEU2050
                                    *                                                                             DPEU2060
0000F41  0864                       LOCORE1  LR     WK0,SLAD             GET THE SELCH ADDR                     DPEU2070
0000F61  1161                                SLLS   WK0,1                MULTIPLY BY 2
```

APPENDIX 3 INTERRUPT DRIVEN READ/WRITE OPERATION

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0000F81  E670 FFCA =0000C6I     209          LA     WK1,SELCHNT1       GET THE SELCH INTERRUPT HANDLER      DPEV2080
0000FC1  4076 0000              210          STH    WK1,X'00'(WK0)     STORE IT IN THE LOCORE SERVICE       DPEV2090
0001001  086A                   211          LR     WK0,DCAD           TABLE AND PERFORM SIMILAR            DPEV2100
0001021  1161                   212          SLLS   WK0,1              SETUP FOR CONTROLLER INTERRUPT       DPEV2110
0001041  E670 FFD8 =0000E0I     213          LA     WK1,CNTRLINT       HANDLING                             DPEV2120
0001081  4076 0000              214          STH    WK1,X'00'(WK0)                                          DPEV2130
00010C1  030E                   215          BR     RETN2                                                   DPEV2140
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                                    * THE FOLLOWING PROGRAM DEMONSTRATES THE USE OF A MULTI-DISC DRIVER      DPEU2170
                                    * ROUTINE THAT CAN BE USED BY AN OPERATING SYSTEM TO SUPPORT UP TO      DPEU2180
                                    * 4 DISC FILES ON ONE DISC CONTROLLER.THE DRIVER IS CALLED FOR A SEEK/  DPEU2190
                                    * READ OR SEEK/WRITE OPERATION AND TRANSFERS ONE DISC SECTOR TO OR      DPEU2200
                                    * FROM DISC.THE DRIVER IS CALLED WITH THE ADDRESS OF THE PARAMETER      DPEU2210
                                    * BLOCK AS SHOWN IN THE MULTI-DISC FLOWCHART (APPENDIX 2) AN I/O COMPL- DPEU2220
                                    * ETE FLAG IS SET WHEN                                                  DPEU2230
                                    * THE DESIRED SEEK/READ OR SEEK/WRITE OPERATION IS COMPLETE. THE MULTI- DPEU2240
                                    * DISK DRIVER DEMONSTRATES THE SEQUENCING NECESSARY TO SUPPORT          DPEU2250
                                    * SIMULTANEOUS SEEK AND OVERLAPPING SEEK/DATA TRANSFER OPERATION.       DPEU2260
00010E1  E660 8346 =000458I     228         LA    WK0,PMBK1          LOAD WORK REGISTER WITH PARAMETER      DPEU2270
0001121  4840 8320 =0004361     229         LH    SLAD,SELAD1        BLOCK ADDRESS,LOAD SELCH, CONTROLLER   DPEU2280
0001161  48A0 82DE =0003F8I     230         LH    DCAD,DISCONAD      ADDRESSES                              DPEU2290
00011A1  41F0 800C =00012A1     231         BAL   RETN,MULDSC        CALL TO MULTI-DISC                     DPEU2300
00011E1  E660 834A =00046CI     232         LA    WK0,PMBK2          GET PARAMETER BLOCK ADDRESS            DPEU2310
0001221  41F0 8004 =00012AI     233         BAL   RETN,MULDSC                                               DPEU2320
0001261  C200 8556 =00068UI     234         LPSW  INTWAIT            PLACE MACHINE IN WAIT STATE            DPEU2330
                                    * WITH EXTERNAL INTERRUPTS ENABLED                                      DPEU2340
                                    * SUBROUTINE: MULTI-DISC DRIVER                                         DPEU2350
                                    * FUNCTION: CALLED ONCE FOR A SEEK/READ OR SEEK/WRITE OPERATION.        DPEU2360
                                    *           THE DRIVER WILL SUPPORT SIMULTANEOUS SEEK OPERATIONS        DPEU2370
                                    *           AND OVERLAPPED SEEK/DATA TRANSFER TYPE OPERATIONS ON        DPEU2380
                                    *           THE 4 DISC DRIVES ASSOCIATED WITH DISC CONTROLLER           DPEU2390
                                    * CALLING SEQUENCE: BAL RETN,MULDSC                                      DPEU2400
                                    * INPUT                                                                  DPEU2410
                                    * REGISTERS:  SLAD= SELCH ADDRESS                                        DPEU2420
                                    *             DCAD= DISC CONTROLLER ADDRESS                             DPEU2430
                                    *             WK0= PARAMETER BLOCK ADDRESS (SEE FLOWCHART 5.2.4)        DPEU2440
                                    * REGISTERS DESTROYED: NONE                                              DPEU2450
                                    *                                                                       DPEU2460
                                    *                                                                       DPEU2470
                                    *                                                                       DPEU2480
00012A1  0768                   249 MULDSC  XR    WK2,WK2            ZERO WORK REGISTER 2                   DPEU2490
00012C1  9578                   250         EPSR  WK1,WK2            DISABLE PROCESSOR INTERRUPTS           DPEU2500
00012E1  4060 834A =00043CI     251         STH   WK0,PARMBLK        STORE PARAMETER BLOCK ADDRESS          DPEU2510
0001321  41E0 8234 =00036AI     252         BAL   RETN2,LOCORE       SETUP LOCORE FOR INTERRUPT HANDLING    DPEU2520
0001361  41E0 8286 =0003C0I     253         BAL   RETN2,QUEUEREQ      QUEUE THE REQUEST                      DPEU2530
                                    * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                            DPEU2540
                                    ************************************************************************DPEU2550
00013A1  9D4D                   256 STATCK  SSR   SLAD,STAT          SENSE THE SELCH STATUS                 *DPEU2560
00013C1  4280 802A =00016AI     257         BTC   SLCHBSY,RTN1       IF THE SELCH IS BUSY QUEUE REQUEST     *DPEU2570
0001401  DE40 82AC =0003FUI     258         OC    SLAD,ESTOP         OTHERWISE STOP THE SELCH               *DPEU2580
0001441  9DAD                   259         SSR   DCAD,STAT          SENSE CONTROLLER STATUS                *DPEU2590
0001461  4320 8020 =00016AI     260         BFC   CONTIDLE,RTN1      IF THE CONTROLLER IS BUSY QUEUE RQST   DPEU2600
00014A1  7360 82EE =00043CI     261         LHL   WK0,PARMBLK        RELOAD THE PARAMETER BLK ADDRESS       *DPEU2610
00014E1  0376 0010              262         LB    WK1,LOGFILE(WK0)   LOAD LOGICAL FILE# FRM PARAMETER BLK   DPEU2620
0001521  1171                   263         SLLS  WK1,1              MULTIPLY IT BY 2 TO INDEX INTO TABLE   DPEU2630
0001541  4857 82A8 =0004001     264         LH    FUT,FILE1(WK1)     GET THE FILE ADDRESS FROM TABLE        *DPEU2640
0001581  9D5D                   265         SSR   FUT,STAT          SENSE FILE STATUS                      *DPEU2650
00015A1  C3D0 0043              266         TBI   STAT,FLUNRECV      IF FILE STATUS UNRECOVERABLE           *DPEU2660
00015E1  4230 8202 =0003641     267         BNZ   ERRSTOP            ERROR ABORT THE OPERATION              *DPEU2670
0001621  C3D0 0008              268         TBI   STAT,RSRWT         IF RSRWT=1 QUEUE REQUEST AND EXIT      *DPEU2680
*0001661  2132                  269         BNZ   RTN1               *                                      *DPEU2690
*0001681  2304                  270         B     ENTER1             *                                      *
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00016A1  C8E0 4000            271  RTN1     LHI   RETN2,X'4000'       EXIT WITH PROCESSOR INTERRUPTS     *  DPEU2700
00016E1  18UE                 272           LPSWR RETN2               ENABLED                            *  DPEU2710
                              273  ************************************************************************  DPEU2720
000170I  081F                 274  ENTER1   LR    R1,RETN             SET UP RETURN ADDRESS FOR NON-INTP     DPEU2730
000172I  C8E0 4000            275           LHI   RETN2,X'4000'       ENABLE PROCESSOR INTERRUPTS NON-INT    DPEU2740
0001761  08UE                 276           LR    R0,RETN2                                                 DPEU2750
0001781  4300 806A =0001E61   277           B     COMETRY             BRANCH TO COMMON ROUTINE               DPEU2760
                              278  * SELCH INTERRUPTS ENTER HERE PROCESSOR INTERRUPTS ARE                   DPEU2770
                              279  * DISABLED THE SELCH IS STOPPED AND ERROR CHECKING IS                    DPEU2780
                              280  * PERFORMED                                                              DPEU2790
                              281  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                             DPEU2800
                              282  ************************************************************************  DPEU2810
00017CI  4840 8286 =0004561   283  SELCHINT LH    SLAD,SELAD1         LOAD SELCH ADDRESS                 *  DPEU2820
0001801  48A0 8274 =0003F81   284           LH    DCAD,DISCONAD       LOAD THE CONTROLLER ADDRESS        *  DPEU2830
0001841  0E40 8268 =0003F01   285           OC    SLAD,ESTOP          STOP THE SELCH                     *  DPEU2840
0001881  0840 82C5 =0004511   286           RD    SLAD,FADR+1         READ SELCH TERMINATION             *  DPEU2850
00018C1  0940 82C2 =0004521   287           RH    SLAD,FADR+2         ADDRESS                            *  DPEU2860
0001901  0E40 825C =0003F01   288           OC    SLAD,ESTOP          STOP THE SELCH AND SENSE           *  DPEU2870
0001941  9DAD                 289           SSR   DCAD,STAT           CONTROLLER STATUS                  *  DPEU2880
0001961  C3D0 0080            290           THI   STAT,OVERRUN        TEST FOR CONTROLLER OVERRUN STATUS *  DPEU2890
*00019AI 2132                 291           BNZ   CONTINT             IF OVERRUN=1 DO NOT EXPECT CONT INT*  DPEU2900
00019C1  1800                 292           LPSWR R0                  *                                  *  DPEU2910
                              293  ************************************************************************  DPEU2920
                              294  *                                                                       DPEU2930
                              295  *                                                                       DPEU2940
                              296  * CONTROLLER INTERRUPTS ENTER HERE                                       DPEU2950
00019EI  0766                 297  CONTINT  XR    WK0,WK0                                                  DPEU2960
0001A0I  4060 825A =0003FE1   298           STH   WK0,INTFLG          ZERO THE INTERNAL CONTR BUSY FLG       DPEU2970
                              299  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                             DPEU2980
                              300  ************************************************************************  DPEU2990
0001A41  5860 82A8 =0004501   301  CONTRLIT  L     WK0,FADR            GET THE SELCH TERMINATION ADDRESS  *  DPEU3000
0001A81  5560 82A8 =0004541   302           CL    WK0,BUFEND          COMPARE TERMINAL ADDRESS WITH BUFEND   DPEU3010
0001AC1  4230 812A =0002DA1   303           BNE   ERROR               *                                  *  DPEU3020
0001B01  9DAD                 304           SSR   DCAD,STAT           SENSE CONTROLLER STATUS            *  DPEU3030
0001B21  4250 8124 =0002DAI   305           BTC   CNTUNREC,ERROR      IF CONT ERROR UNRECOVERABLE-ABORT IO   DPEU3040
                              306  ************************************************************************  DPEU3050
                              307  *                                                                       DPEU3060
                              308  *                                                                       DPEU3070
0001B61  4860 8280 =00043A1   309           LH    WK0,FILEIO          OTHERWISE GET THE PARAMETER            DPEU3080
0001BA1  2471                 310           LIS   WK1,1               BLOCK OF OPERATION IN PROGRESS.        DPEU3090
0001BC1  D276 000F            311           STB   WK1,IOCOMPLT(WK0)   SET THE I/O COMPLETED FLAG IN PARM     DPEU3100
0001C01  0777                 312           XR    WK1,WK1             BLOCK                                  DPEU3110
0001C21  D276 000D            313           STB   WK1,DATATRNS(WK0)   ZERO THE READ/WRITE Q FLAG IN PARM     DPEU3120
                              314  *                                                                       DPEU3130
0001C61  D376 0010            315  QMANG    LB    WK1,LOGFILE(WK0)    LOAD THE LOGICAL FILE NUMBER           DPEU3140
0001CA1  1171                 316           SLLS  WK1,1               SHIFT FOR TABLE INDEXING               DPEU3150
0001CC1  4877 8238 =0004081   317           LH    WK1,BLKAD(WK1)      GET THE FILE QUEUE ADDRESS             DPEU3160
0001D01  4867 0002            318           LH    WK2,QENTRY2(WK1)    GET THE SECOND QUEUE ENTRY             DPEU3170
0001D41  4067 0000            319           STH   WK2,0(WK1)          MOVE IT TO THE TOP OF THE QUEUE        DPEU3180
0001D81  4867 0004            320           LH    WK2,QENTRY3(WK1)    GET THE THIRD QUEUE ENTRY              DPEU3190
0001DC1  4067 0002            321           STH   WK2,QENTRY2(WK1)    MOVE IT TO THE SECOND QUEUE ENTRY      DPEU3200
0001E01  0788                 322           XR    WK2,WK2             ZERO THE THIRD QUEUE ENTRY SO THE      DPEU3210
0001E21  4067 0004            323           STH   WK2,QENTRY3(WK1)    QUEUE WILL EMPTY ITSELF                DPEU3220
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APPENDIX 3 MULTI-DISC PROGRAMMING

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0001E6I  41E0 810C =0002F6I    524  COMETRY  BAL   RETN2,STRTSK        START ALL QUEUED SEEK OPERATIONS        DPEU3230
0001EAI  0766                  525  STRTIO   XR    WK0,WK0             GO START FIRST AVAILABLE I/O TRANSFR    DPEU3240
0001ECI  1161                  526  STRTIO1  SLLS  WK0,1               WHEN CONTROLLER IS IDLE                 DPEU3250
0001EEI  4856 820E =0004001    527           LH    FUT,FILE1(WK0)      GET THE MAIN FILE ADDRESS               DPEU3260
0001F2I  4876 8212 =0004081    528           LH    WK1,BLKAD(WK0)      GET THE FILEQ ADDRESS                   DPEU3270
0001F6I  4877 0000             529           LH    WK1,0(WK1)          GET THE FILEQ ENTRY BLOCK ADDRESS       DPEU3280
*0001FAI 2365                  530           BZ    STRTIO2             IF ITS ZERO NO NEED TO GO CHECK BLK     DPEU3290
0001FCI  D397 000C             531           LB    WK3,SEEKQFLG(WK1)   GET THE SEEKQ FLAG AND SET             DPEU3300
0002001  0899                  532           LR    WK3,WK3             THE CONDITION CODE                      DPEU3310
*0002021 2339                  533           BZ    CHKIO               IF ITS ZERO GO CHECK DATA TRNSFR Q      DPEU3320
0002041  1061                  534  STRTIO2  SRLS  WK0,1               FLAG OTHERWISE ADD 1 TO THE LOGICAL     DPEU3330
0002061  2661                  535           AIS   WK0,1               FILE# AND CHECK NEXT FILEQ. WHEN ALL    DPEU3340
0002081  C960 0003             536           CHI   WK0,3               ARE DONE EXIT.                          DPEU3350
00020CI  4220 8090 =0002A0I    537           BP    EXIT2                                                       DPEU3360
0002101  4300 FFD8 =0001ECI    538           B     STRTIO1                                                     DPEU3370
0002141  D397 000D             539  CHKIO    LB    WK3,DATATRNS(WK1)   GET THE DATA TRANSFER Q FLAG            DPEU3380
0002181  0899                  540           LR    WK3,WK3             AND SET THE CONDITION CODE              DPEU3390
*00021AI 223B                  541           BZ    STRTIO2             IF Q FLAG IS ZERO NO DATA TRANSFER      DPEU3400
00021CI  9D5D                  542           SSR   FUT,STAT            SENSE THE FILE STATUS                   DPEU3410
00021EI  C3D0 0043             543           THI   STAT,FLGUNRECV      TEST FOR UNRECOVERRABLE ERROR           DPEU3420
0002221  4230 813E =0003641    544           BNZ   ERRSTOP             IF NON ZERO HALT IN ERROR               DPEU3430
0002261  4070 8210 =00043AI    545           STH   WK1,FILEIO          OTHERWISE START DATA TRANSFER BY        DPEU3440
00022AI  4070 81D0 =0003FEI    546           STH   WK1,INTFLG          FIRST STORING PARAMETER BLOCK ADDR.     DPEU3450
00022EI  5867 0004             547           L     WK0,4(WK1)          AS ADDR OF I/O IN PROGRESS AND SET      DPEU3460
0002321  5060 821E =0004541    548           ST    WK0,BUFEND          INTERNAL CONTROLLER BUSY FLAG           DPEU3470
0002361  0867                  549           LR    WK0,WK1                                                     DPEU3480
0002381  D397 000E             550           LB    WK3,RDWRTFLG(WK1)   CHECK READ/WRT FLAG IN PARAM BLOCK      DPEU3490
00023CI  0899                  551           LR    WK3,WK3             SET CONDITION CODE                      DPEU3500
*00023EI 2336                  552           BZ    READINT             IF ITS ZERO GO AHEAD AND READ           DPEU3510
                               553  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                               DPEU3520
                               554  ********************************************************************      DPEU3530
0002401  D370 81A8 =0003EFI    555  WRITINT  LB    WK1,WCMD            OTHERWISE ITS A WRITE OPERATION    *    DPEU3540
0002441  C880 0050             556           LHI   WK2,X'50'           SELCH WRITE COMMAND EXTENDED MEMORY*    DPEU3550
0002481  2305                  557           BS    RWCOM1              *                                  *    DPEU3560
00024AI  D370 81A0 =0003EEI    558  READINT  LB    WK1,RCMD            READ OPERATION                     *    DPEU3570
00024EI  C880 0070             559           LHI   WK2,X'70'           SELCH READ AND GO EXTENDED MEMORY  *    DPEU3580
0002521  0E40 819A =0003F01    560  RWCOM1   OC    SLAD,ESTOP          STOP THE SELCH                     *    DPEU3590
0002561  DA46 0001             561           WD    SLAD,1(WK0)         WRITE STARTING BUFFER ADDRESS      *    DPEU3600
00025AI  D846 0002             562           WH    SLAD,2(WK0)         TO THE SELCH                       *    DPEU3610
00025EI  DA46 0005             563           WD    SLAD,5(WK0)         WRITE ENDING BUFFER ADDRESS        *    DPEU3620
0002621  D846 0006             564           WH    SLAD,BUFENDAD(WK0)  TO THE SELCH                       *    DPEU3630
0002661  7386 0008             565           LHL   TRACK,CYLINDER(WK0) WRITE CYLINDER NUMBER TO THE FILE *    DPEU3640
00026AI  4890 81C2 =0004301    566           LH    WK3,TRKDEN          GET THE TRACK DENSITY OPTION       *    DPEU3650
00026EI  C590 0000             567           CLHI  WK3,0               IS THIS OPTION ZERO                *    DPEU3660
*0002721 2369                  568           BE    WDFT1B              IF IT IS ITS A 2.5 MEGABYTE DRIVE  *    DPEU3670
0002741  C5B0 0100             569           CLHI  TRACK,256           OTHERWISE 10 MEGABYTE DRIVE IS ASSMD    DPEU3680
*0002781 2384                  570           BNL   WDFT10A             IS TRACK= OF > 256 IF YES SET MSB  *    DPEU3690
00027AI  DA50 81B4 =0004321    571           WD    FUT,ZERO            IN CONTROLLER OTHERWISE ZERO IT    *    DPEU3700
00027EI  2303                  572           BS    WDFT1B              *                                  *    DPEU3710
0002801  DA50 81AF =0004331    573  WDFT10A  WD    FUT,ONE             SET MSB IN DISC CONTROLLER         *    DPEU3720
0002841  9A5B                  574  WDFT1B   WDR   FUT,TRACK           WRITE THE CYLINDER # TO THE FILE   *    DPEU3730
0002861  D396 000A             575           LB    WK3,HEADNO(WK0)     GET THE HEAD NUMBER FRM PRMTR BLK  *    DPEU3740
00028AI  1195                  576           SLLS  WK3,5               SHIFT IT FOR FORMATTING THE HEADER *    DPEU3750
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00028C1  5080 81B0 =0004401   377           ST    WK2,WK2SVE          *                                   *  DPEU3760
0002901  0386 0008            378           LB    WK2,SECTOR(WK0)     GET THE SECTOR FROM THE PARAMETER   *  DPEU3770
0002941  0689                 379           OR    WK2,WK3             BLOCK AND FORMAT THE HEADER         *  DPEU3780
0002961  9AA8                 380           WDR   DCAD,WK2            WRITE THE HEADER TO THE CONTROLLER  *  DPEU3790
0002981  5880 81A4 =0004401   381           L     WK2,WK2SVE          *                                   *  DPEU3800
00029C1  9EA7                 382           OCR   DCAD,WK1            OUTPUT CONTROLLER COMMAND           *  DPEU3810
00029E1  9E48                 383           OCR   SLAD,WK2            OUTPUT SELCH COMMAND                *  DPEU3820
0002A01  1800                 384  EXIT2    LPSWR R0                  *                                   *  DPEU3830
                              385  ************************************************************************  DPEU3840
                              386  *                                                                        DPEU3850
                              387  *                                                                        DPEU3860
                              388  * FILE INTERRUPTS PROCESSED BELOW:                                       DPEU3870
0002A21  C860 041DI           389  FILE1INT LHI   WK0,FILE1Q          LOAD FILEQ ADDRESS FOR MAIN DRIVE   DPEU3880
0002A61  2309                 390           BS    FILCOM              BRANCH TO FILECOMMON ROUTINE        DPEU3890
0002A81  C860 0418I           391  FILE2INT LHI   WK0,FILE2Q          LOAD FILEQ ADDRESS FOR 1 EXP DISC   DPEU3900
0002AC1  2306                 392           BS    FILCOM                                                  DPEU3910
0002AE1  C860 0420I           393  FILE3INT LHI   WK0,FILE3Q          LOAD FILEQ ADDRESS FOR 2ND EXP DISC DPEU3920
0002B21  2303                 394           BS    FILCOM                                                  DPEU3930
0002B41  C860 0428I           395  FILE4INT LHI   WK0,FILE4Q          LOAD FILE4Q ADDRESS FOR 3RD EXP DSC DPEU3940
0002B81  4030 8138 =0003F41   396  FILCOM   STH   R3,DEVSTAT                                              DPEU3950
0002BC1  0777                 397           XR    WK1,WK1                                                 DPEU3960
0002BE1  4866 0000            398           LH    WK0,0(WK0)          GET THE Q-ENTRY FROM THE APPROPRIATE DPEU3970
0002C21  D276 000C            399           STB   WK1,SEEKQFLG(WK0)   FILE QUEUE AND ZERO THE SEEK Q-FLAG  DPEU3980
                              400  *                                  IN THE PARAMETER BLOCK              DPEU3990
                              401  *                                                                        DPEU4000
                              402  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                             DPEU4010
                              403  ************************************************************************  DPEU4020
0002C61  4860 8134 =0003FE1   404  FILINT   LH    WK0,INTFLG          IF THE INTERNAL CONTROLLER BUSY FLG* DPEU4030
*0002CA1  2137                405           BNZ   EXIT                IS SET EXIT AND WAIT FOR CONT INT. * DPEU4040
*0002CC1  C330 0008            406           TI    R3,RSRWT            CHECK DEVICE STATUS FOR FILE READY * DPEU4050
0002D01  4250 8090 =0003641   407           BNZ   ERRSTOP             IF FILE IS NOT READY (RSRWT=1) ABORT DPEU4060
0002D41  4300 FF0E =0001E61   408           B     COMETRY             OTHERWISE BRANCH TO COMMON ENTRY    * DPEU4070
                              409  ************************************************************************  DPEU4080
                              410  *                                                                        DPEU4090
                              411  *                                                                        DPEU4100
0002D81  1800                 412  EXIT     LPSWR R0                  RESTORE OLDPSW WAIT FOR CONTROLR INT DPEU4110
                              413  *                                                                        DPEU4120
                              414  * THE ERROR ROUTINE WILL PROCESS THE APPROPRIATE FLAGS IN THE PARAMETER  DPEU4130
                              415  * BLOCK AND TERMINATE THE PRESENT I/O OPERATION                          DPEU4140
0002DA1  4860 815C =00043A1   416  ERROR    LH    WK0,FILEIO          GET THE PARAMETER BLOCK ADDRESS OF   DPEU4150
0002DE1  2471                 417           LIS   WK1,1               THE CURRENT I/O OPERATION IN PROG    DPEU4160
0002E01  D276 000F            418           STB   WK1,IOCOMPLT(WK0)   SET I/O COMPLETE FLG IN PARAM BLK    DPEU4170
0002E41  D370 810C =0003F41   419           LB    WK1,DEVSTAT         GET DEVICE ERROR STATUS              DPEU4180
0002E81  D276 0011            420           STB   WK1,ERRSTA(WK0)     STORE IT IN THE PARAMETER BLOCK      DPEU4190
0002EC1  0777                 421           XR    WK1,WK1                                                 DPEU4200
0002EE1  D276 0000            422           STB   WK1,DATATRNS(WK0)   ZERO THE DATA TRANSFER Q FLAG IN THE DPEU4210
0002F21  4300 FED0 =0001C61   423           B     QMANG               BRANCH TO Q HANDLING CODE            DPEU4220
                              424  *                                                                        DPEU4230
                              425  * SUBROUTINE: START SEEK                                                 DPEU4240
                              426  * FUNCTION: TAKES THE TOP ENTRY IN EACH FILEQ AND CHECKS                 DPEU4250
                              427  *           IF SEEKQ FLAG IS SET. IF SET, SEEK OPERATION IS              DPEU4260
                              428  *           INITIATED. WHEN THE CONTROLLER IS IDLE, THE NEXT FILEQ       DPEU4270
                              429  *           IS CHECKED UNTIL ALL REQUIRED SEEKS ARE INITIATED.           DPEU4280
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                                    430  *                                                                    DPE04290
                                    431  * CALLING SEQUENCE: BAL  RETN2,STRTSK                                DPE04300
                                    432  *                                                                    DPE04310
                                    433  *                                                                    DPE04320
0002F6I  0766                       434  STRTSK   XR    WK0,WK0                                               DPE04330
0002F8I  1161                       435  STRTSK1  SLLS  WK0,1                                                 DPE04340
0002FAI  4856 8102 =0004001         436           LH    FUT,FILE1(WK0)      GET THE FIRST FILE ADDR          DPE04350
0002FEI  4876 8106 =0004081         437           LH    WK1,BLKAD(WK0)      GET THE FIRST FILEQ ADDRESS      DPE04360
0003021  4817 0000                  438           LH    WK1,0(WK1)          GET PRM BLK ADDRESS FRM THE QUEUE DPE04370
0003061  4330 804A =0003541         439           BZ    SEEKIT1             IF ZERO, NO NEED TO CHECK FURTHER DPE04380
00030A1  0397 000C                  440           LB    WK3,SEEKQFLG(WK1)   GET THE SEEKQ FLG FRM PARM BLOCK DPE04390
00030E1  0899                       441           LR    WK3,WK3             SET THE CONDITION CODE           DPE04400
0003101  4330 8040 =0003541         442           BZ    SEEKIT1             IF ZERO SEEK NOT REQUIRED        DPE04410
                                    443  *                                                                    DPE04420
                                    444  * REFERENCE: MULTI-DISC FLOWCHART APPENDIX 2                         DPE04430
                                    445  ********************************************************************* DPE04440
0003141  9D5D                       446  INTSK1   SSR   FUT,STAT           OTHERWISE START SEEK SEQUENCE    * DPE04450
0003161  C3D0 0010                  447           THI   STAT,ADRINTLK      IF ADR INTLK=1 WAIT FOR          * DPE04460
*00031A1  2063                      448           BNZ   INTSK1             IT TO GO TO ZERO                 * DPE04470
00031C1  C3D0 0043                  449           THI   STAT,FLUNRECV      IF FILE IN UNRECOVERABLE ERROR   * DPE04480
0003201  4230 8040 =0003641         450           BNZ   ERRSTOP            ABORT OTHERWISE                  * DPE04490
0003241  C3D0 0008                  451           THI   STAT,RSRWT         WAIT FOR RSRWT=0                 * DPE04500
0003281  4230 8028 =0003541         452           BNZ   SEEKIT1            *                                * DPE04510
00032C1  7387 0008                  453           LHL   TRACK,CYLINDER(WK1) EXTRACT CYLINDER NUMBER FROM BLOCK* DPE04520
0003301  4890 80FC =0004301         454           LH    WK3,TRKDEN         GET THE TRACK DENSITY OPTION     * DPE04530
0003341  C590 0000                  455           CLHI  WK3,0              IS THIS OPTION ZERO              * DPE04540
*0003381  2369                      456           BE    WDFT1C             IF IT IS A 2.5 MEGABYTE DRIVE    * DPE04550
00033AI  C5B0 0100                  457           CLHI  TRACK,256          OTHERWISE 10 MEGABYTE DRIVE IS ASSMD DPE04560
*00033E1  2364                      458           BNL   WDFT10B            IS TRACK= OR > 256 IF YES SET MSB  * DPE04570
0003401  DA50 80EE =0004321         459           WD    FUT,ZERO           IN CONTOLLER OTHERWISE ZERO IT   * DPE04580
0003441  2303                      460           BS    WDFT1C             *                                * DPE04590
0003461  DA50 80E9 =0004331         461  WDFT10B  WD    FUT,ONE            SET MSB IN DISC CONTROLLER       * DPE04600
00034A1  9A5B                       462  WDFT1C   WDR   FUT,TRACK          WRITE THE CYLINDER # TO THE FILE * DPE04610
00034C1  DE50 809C =0003EC1         463           OC    FUT,ISKCMD         OUTPUT SEEK COMMAND INTERRUPTS ARMED DPE04620
0003501  9DAD                       464  INTSK2   SSR   DCAD,STAT          SENSE CONTROLLER STATUS          * DPE04630
*0003521  2221                      465           BFC   CONTIDLE,INTSK2    *                                * DPE04640
                                    466  ********************************************************************* DPE04650
                                    467  *                                                                    DPE04660
                                    468  *                                                                    DPE04670
0003541  2661                       469  SEEKIT1  AIS   WK0,1               ADD 1 TO THE LOGICAL FILE NUMBER DPE04680
0003561  C560 0003                  470           CLHI  WK0,3              HAVE ALL FILE QUEUES BEEN CHECKED DPE04690
0003581  4330 FF9A =0002F81         471           BE    STRTSK1                                             DPE04700
00035E1  036E                       472           BNLR  RETN2              YES, RETURN                      DPE04710
0003601  4300 FF94 =0002F81         473           B     STRTSK1            NO, GO CHECK NEXT Q AND BLOCK ENTRY DPE04720
                                    474  * ERROR STOP CODE HALTS THE MACHINE WITH THE TERMINAL LOC INDICATING DPE04730
                                    475  * THE POINT AT WHICH THE ERROR OCURRED                               DPE04740
0003641  C8E0 8000                  476  ERRSTOP  LHI   RETN2,X'8000'       MACHINE STATUS-WAIT STATE        DPE04750
0003681  18VE                       477           LPSWR RETN2              ERRSTOP EXECUTED ON ABORTING AN OPE- DPE04760
                                    478  *                                  RATION                           DPE04770
                                    479  * SUBROUTINE: LOCORE                                                DPE04780
                                    480  * CALLING SEQUENCE: BAL RETN2,LOCORE                                 DPE04790
                                    481  * FUNCTION: SETS UP INTERRUPT SERVICE POINTER TABLE FOR INTERRUPT    DPE04800
                                    482  *           HANDLING                                                 DPE04810
```

```
00036A1  7360 80C8 =0004361   483 LOCORE  LHL   WK0,SELAD1          SELCH ADDRESS                          DPE04820
00036E1  1161                 484         SLLS  WK0,1                                                  DPE04830
0003701  E670 FE08 =00017C1   485         LA    WK1,SELCHINT        SELCH INTERRUPT HANDLER                DPE04840
0003741  4076 0000            486         STH   WK1,X'00'(WK0)      STORE ADDRESS IN LOCORE                DPE04850
0003781  7360 807C =0003F81   487         LHL   WK0,DISCONAD        CONTROLLER ADDRESS                     DPE04860
00037C1  1161                 488         SLLS  WK0,1                                                  DPE04870
00037E1  E670 FE1C =00019E1   489         LA    WK1,CONTINT         CONTROLLER INTERRUPT HANDLER           DPE04880
0003821  4076 0000            490         STH   WK1,X'00'(WK0)      STORE ADDRESS IN LOCORE                DPE04890
0003861  7360 8076 =0004001   491         LHL   WK0,FILE1           GET FILE1 ADDRESS                      DPE04900
00038A1  1161                 492         SLLS  WK0,1                                                  DPE04910
00038C1  E670 FF12 =0002A21   493         LA    WK1,FILE1INT        FILE1 INTERRUPT HANDLER                DPE04920
0003901  4076 0000            494         STH   WK1,X'00'(WK0)      STORE ADDRESS IN LOCORE                DPE04930
0003941  7360 806A =0004021   495         LHL   WK0,FILE2           GET FILE2 ADDRESS                      DPE04940
0003981  1161                 496         SLLS  WK0,1                                                  DPE04950
00039A1  E670 FF0A =0002A81   497         LA    WK1,FILE2INT        FILE2 INTERRUPT HANDLER                DPE04960
00039E1  4076 0000            498         STH   WK1,X'00'(WK0)      STORE ADDRESS IN LOCORE                DPE04970
0003A21  7360 805E =0004041   499         LHL   WK0,FILE3           FILE3 ADDRESS                          DPE04980
0003A61  1161                 500         SLLS  WK0,1                                                  DPE04990
0003A81  E670 FEF2 =0002AE1   501         LA    WK1,FILE3INT                                           DPE05000
0003AC1  4076 00D0            502         STH   WK1,X'00'(WK0)                                         DPE05010
0003B01  7360 8052 =0004061   503         LHL   WK0,FILE4           GET FILE4 ADDRESS                      DPE05020
0003B41  1161                 504         SLLS  WK0,1                                                  DPE05030
0003B61  E670 FEFA =0002B41   505         LA    WK1,FILE4INT        FILE4 INTERRUPT HANDLER                DPE05040
0003BA1  4076 00D0            506         STH   WK1,X'00'(WK0)      STORE ADDRESS                          DPE05050
0003BE1  030E                 507         BR    RETN2                                                  DPE05060
                              508 * SUBROUTINE:  QUEUE SUBROUTINE CALL                                   DPE05070
                              509 * FUNCTION: LOOKS FOR THE FIRST ZERO ENTRY IN THE APPROPRIATE          DPE05080
                              510 *           FILE Q AND STORES THE PARAMETER BLOCK ADDRESS IN THE QUEUE  DPE05090
                              511 * CALLING SEQUENCE: BAL RETN2,QUEUEREQ                                 DPE05100
                              512 *                                                                      DPE05110
0003C01  7360 8078 =00043C1   513 QUEUEREQ LHL   WK0,PARMBLK         GET THE PARAMETER BLOCK ADDRESS        DPE05120
0003C41  0366 0010            514         LB    WK0,LOGFILE(WK0)    GET THE LOGICAL FILE UNIT FROM BLOCK   DPE05130
0003C81  1161                 515         SLLS  WK0,1               SHIFT FOR INDEXING INTO TABLE          DPE05140
0003CA1  4866 803A =0004081   516         LH    WK0,BLKAD(WK0)      GET THE CORRECT FILEQ ADDRESS          DPE05150
0003CE1  7376 0000            517 QCOM    LHL   WK1,0(WK0)          GET THE FIRST Q ENTRY                  DPE05160
*0003D21 2636                 518         BZ    QCOM1               IF ITS ZERO, GO STORE P.BLOCK ADDR     DPE05170
 0003D41 C570 4FFF            519         CLHI  WK1,X'4FFF'         HAVE WE EXHAUSTED ALL Q ENTRIES?       DPE05180
*0003D81 2338                 520         BE    QFULL               YES-Q IS FULL -ABORT REQUEST           DPE05190
 0003DA1 2662                 521         AIS   WK0,2               BUMP THE Q ADDRESS                     DPE05200
*0003DC1 2207                 522         B     QCOM                CHECK THE NEXT Q ENTRY                 DPE05210
 0003DE1 7370 805A =00043C1   523 QCOM1   LHL   WK1,PARMBLK         GET THE PARAMETER BLOCK ADDRESS        DPE05220
 0003E21 4076 0000            524         STH   WK1,0(WK0)          STORE IT IN THE FILE QUEUE             DPE05230
 0003E61 030E                 525         BR    RETN2               RETURN                                 DPE05240
 0003E81 4300 FF78 =0003641   526 QFULL   B     ERRSTOP             QUEUE IS FULL ABORT IN ERROR           DPE05250
 0003EC1                      527         ALIGN 4                                                        DPE05260
 0003EC1 42                   528 ISKCMD  DB    X'42'               INTERRUPT SEEK COMMAND                 DPE05270
 0003ED1 C2                   529 SEEKC   DB    X'C2'               SEEK COMMAND                           DPE05280
 0003EE1 01                   530 RCMD    DB    X'01'               DISC READ COMMAND                      DPE05290
 0003EF1 02                   531 WCMD    DB    X'02'               WRITE COMMAND                          DPE05300
 0003F01 48                   532 ESTOP   DB    X'48'               STOP                                   DPE05310
 0003F21 0000                 533 HEAD    DC    X'0'                                                       DPE05320
 0003F41 0000                 534 DEVSTAT DC    X'0'                DEVICE ERROR STATUS SAVE               DPE05330
 0003F61 0000                 535 DEVADR  DC    X'0'                                                       DPE05340
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0003F8I  00B6                    536  DISCONAD DC    X'B6'          DISC CONTROLLER ADDR.                    DPEU5350
0003FAI  0000                    537  RETNSV   DC    X'0'                                                    DPEU5360
0003FCI  0000                    538  RETNSV1  DC    X'0'                                                    DPEU5370
0003FEI  0000                    539  INTFLG   DC    X'0'           INTERNAL CONTROLLER BUSY FLAG            DPEU5380
0004001  00C6                    540  FILE1    DC    X'C6'          FILE 1 ADDRESS                           DPEU5390
0004021  00D6                    541  FILE2    DC    X'D6'          FILE 2 ADDRESS                           DPEU5400
0004041  00E6                    542  FILE3    DC    X'E6'          FILE 3 ADDRESS                           DPEU5410
0004061  00F6                    543  FILE4    DC    X'F6'          FILE 4 ADDRESS                           DPEU5420
0004081  0410I                   544  BLKAD    DC    Z(FILE1Q)      FILE 1 Q ADDRESS                         DPEU5430
00040A1  0418I                   545           DC    Z(FILE2Q)      FILE 2 Q ADDRESS                         DPEU5440
00040C1  0420I                   546           DC    Z(FILE3Q)      FILE 3 Q ADDRESS                         DPEU5450
00040E1  0428I                   547           DC    Z(FILE4Q)      FILE 4 Q ADDRESS                         DPEU5460
0004101  0000                    548  FILE1Q   DC    X'0'           FILE 1 Q WHERE                           DPEU5470
0004121  0000                    549           DC    X'0'           PARAMETER BLOCK ADDRESSES                DPEU5480
0004141  0000                    550           DC    X'0'           ARE QUEUED                               DPEU5490
0004161  4FFF                    551           DC    X'4FFF'        FILE 1 Q DELIMITER                       DPEU5500
0004181  0000                    552  FILE2Q   DC    X'0'           FILE 2 Q                                 DPEU5510
00041A1  0000                    553           DC    X'0'                                                    DPEU5520
00041C1  0000                    554           DC    X'0'                                                    DPEU5530
00041E1  4FFF                    555           DC    X'4FFF'        FILE 2 Q DELIMITER                       DPEU5540
0004201  0000                    556  FILE3Q   DC    X'0'           FILE 3 Q                                 DPEU5550
0004221  0000                    557           DC    X'0'                                                    DPEU5560
0004241  0000                    558           DC    X'0'                                                    DPEU5570
0004261  4FFF                    559           DC    X'4FFF'        FILE 3 Q DELIMITER                       DPEU5580
0004281  0000                    560  FILE4Q   DC    X'0'           FILE 4 Q                                 DPEU5590
00042A1  0000                    561           DC    X'0'                                                    DPEU5600
00042C1  0000                    562           DC    X'0'                                                    DPEU5610
00042E1  4FFF                    563           DC    X'4FFF'        FILE 4 Q DELIMITER                       DPEU5620
0004301  0000                    564  TRKDEN   DC    X'0'           TRACK DENSITY USED IN SENSE ST SK        DPEU5630
0004321  00                      565  ZERO     DB    0              ZERO CONSTANT                            DPEU5640
0004331  01                      566  ONE      DB    1              ONE CONSTANT                             DPEU5650
0004341  0000                    567  RETN2SV  DC    X'0'                                                    DPEU5660
0004361  00F0                    568  SELAD1   DC    X'F0'          SELCH ADDRESS                            DPEU5670
0004381  0000                    569  R#SAVE   DC    X'0'                                                    DPEU5680
00043A1  0000                    570  FILEIO   DC    X'0'           PARM. BLK ADDR OF FILE I/O IN PROG       DPEU5690
00043C1  0000                    571  PARMBLK  DC    X'0'           PARAMETER BLOCK ADDRESS SAVE             DPEU5700
                                 572  *                                                                      DPEU5710
0004401                          573           ALIGN 4                                                        DPEU5720
0004401  0000 0000               574  WK2SVE   DC    Y'0'           WORK REGISTER SAVE AREA                  DPEU5730
0004441  0000 0000               575  SA       DC    Y'0'           STARTING ADDRESS OF BUFFER EX. 3.2       DPEU5740
0004481  0000 0000               576  EA       DC    Y'0'           ENDING ADDR OF BUFFER EX 3.2             DPEU5750
00044C1  0000 0000               577  SELAD    DC    Y'0'           FINAL SELCH ADDR EX. 3.2                 DPEU5760
0004501  0000 0000               578  FADR     DC    Y'0'           FINAL BUFFER ADDR EX. 3.2                DPEU5770
                                 579  *                                                                      DPEU5780
0004541  0000 0000               580  BUFEND   DC    Y'0'           FINAL BUFFER ADDR. EX. 3.4               DPEU5790
0004581  0000 047EI              581  PMBK1    DC    A(BUF1)        PARAMETER BLOCK 1 STRT BFR AD            DPEU5800
00045C1  0000 0578I              582           DC    A(BUF1+255)    ENDING BUFFER ADDRESS                    DPEU5810
00046UI  0197                    583           DC    X'197'         CYLINDER                                 DPEU5820
0004621  00                      584           DB    X'0'           HEAD                                     DPEU5830
0004631  10                      585           DB    X'10'          SECTOR                                   DPEU5840
0004641  01                      586           DB    X'01'          SEEK Q FLAG                              DPEU5850
0004651  01                      587           DB    X'01'          READ/WRITE Q FLAG                        DPEU5860
0004661  00                      588           DB    X'0'                                                    DPEU5870
```

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0004671  00                    589            DB     X'0'          I/O COMPLETE FLAG                          DPEU5880
0004681  00                    590            DB     X'0'          LOGICAL FILE IDENT.                        DPEU5890
0004691  00                    591            DB     X'0'          ERROR STATUS SAVE AREA                     DPEU5900
00046C1                        592            ALIGN  4                                                        DPEU5910
00046C1  0000 057E1            593  PMBK2     DC     A(BUF2)       PARAMETER BLOCK 2 STRT BFR AD              DPEU5920
0004701  0000 067D1            594            DC     A(BUF2+255)   ENDING BUFFER ADDR                         DPEU5930
0004741  0197                  595            DC     X'197'        CYLINDER                                   DPEU5940
0004761  00                    596            DB     X'0'          HEAD                                       DPEU5950
0004771  10                    597            DB     X'10'         SECTOR                                     DPEU5960
0004781  01                    598            DB     X'01'         SEEK Q FLG.                                DPEU5970
0004791  01                    599            DB     X'01'         READ/WRITE Q FLG.                          DPEU5980
00047A1  00                    600            DB     0             READ/WRITE IDENT.                          DPEU5990
00047B1  00                    601            DB     0             I/O COMPLETE FLG.                          DPEU6000
00047C1  01                    602            DB     X'01'         LOGICAL FILE IDENT.                        DPEU6010
00047D1  00                    603            DB     X'0'          ERROR STATUS SAVE AREA                     DPEU6020
00047E1                        604  BUF1      DS     256           BUFFER - PARAM. BLK 1                      DPEU6030
00057E1                        605  BUF2      DS     256           BUFFER - PARAM. BLK 2                      DPEU6040
0006801                        606            ALIGN  8                                                        DPEU6050
0006801  0000 C000             607  INTWAIT   DC     Y'C000'       WAIT STATE WITH INTERRUPTS                 DPEU6060
0006841  0000 012A1            608            DC     A(MULDSC)     ENABLED- LOC=MULDSC                        DPEU6070
0006881                        609            END                                                             DPEU6080
```

ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

START OPTIONS: *NONE*

NO CAL ERRORS
NO CAL WARNINGS
3 PASSES

```
ABSTOP     0000 0000
AUC        0000 0004
ADRINTLK   0000 0010      29*    77    447
BLKAD      0000 0408I    317    328   437    516    544*
BUF1       0000 047EI    581    582   604*
BUF2       0000 057EI    593    594   605*
BUFEND     0000 0454I    191    302   548    580*
BUFENDAD   0000 0006      35*    364
CHKIO      0000 0214I    333    339*
CNTRLINT   0000 00E0I    188    190*  213
CNTUNREC   0000 0005      32*    147   194    305
COMETRY    0000 01E6I    277    324*  408
CONTIDLE   0000 0002      28*    75    146    260    465
CONTINT    0000 019EI    291    297*  489
CONTRLIT   0000 01A4I    301*
CYLINDER   0000 0008      36*    365   453
DATAIRNS   0000 000D      40*    313   339    422
DCAD       0000 000A      25*    74    139    140    145    186    193    211    230    259    284    289    304
                          380    382   464
DEVADR     0000 03F6I    535*
DEVSTAT    0000 03F4I    396    419   534*
DISCONAD   0000 03F8I    230    284   487    536*
DXTL       0000 0084I    142*   143
DXTL1      0000 008CI    145*   146
ENTER1     0000 0170I    270    274*
ERROR      0000 02DAI    303    305   416*
ERRSTA     0000 0011      44*   420
ERRSTOP    0000 0364I     80    147   152    192    194    267    344    407    450    476*   526
ESTOP      0000 03F0I    129    144   182    185    258    285    288    360    532*
EXIT       0000 0208I    405    412*
EXIT2      0000 02A0I    337    384*
FA         0000 0448I    132    133   151    576*
FADR       0000 0450I    183    184   190    286    287    301    578*
FILCOM     0000 02B8I    390    392   394    396*
FILE1      0000 0400I    264    327   436    491    540*
FILE1INT   0000 02A2I    389*   493
FILE1W     0000 0410I    389    544   548*
FILE2      0000 0402I    495    541*
FILE2INT   0000 02A8I    391*   497
FILE2W     0000 0418I    391    545   552*
FILE3      0000 0404I    499    542*
FILE3INT   0000 02AEI    393*   501
FILE3W     0000 0420I    393    546   556*
FILE4      0000 0406I    503    543*
FILE4INT   0000 02B4I    395*   505
```

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FILE4Q      0000 0428I      395    547    560*
FILE10      0000 043AI      309    345    416    570*
FILINT      0000 02C6I      404*
FLABORT     0000 00FF        54*
FLUNRECV    0000 0043        30*    79    266    343    449
FRSSR       0000 0014I       58     61     74*    75     78
FRSSR1      0000 0028I       83*    84
FUT         0000 0005        14*    60     76    103    105    106    264    265    327    342    371    373    374
                             436    446    459    461    462    463
HEAD        0000 03F2I      135    535*
HEADNO      0000 000A        37*    375
IMPTOP      0000 0688I
INTFLG      0000 05FEI      298    346    404    539*
INTSK1      0000 0314I      446*    448
INTSK2      0000 0350I      464*    465
INTWAIT     0000 0680I      234    607*
IOCOMPLT    0000 000F        42*    311    418
ISKCMD      0000 03ECI      463    528*
LADC        0000 0002
LOCORE      0000 056AI      252    483*
LOCORE1     0000 00F4I      174    179    207*
LOGFILE     0000 0010        43*    262    515    514
MULDSC      0000 012AI      231    233    249*    608
ONE         0000 0433I      105    373    461    566*
OVERRUN     0000 0080        33*    187    290
PARMBLK     0000 043CI      251    261    513    523    571*
PMBK1       0000 0458I      226    581*
PMBK2       0000 046CI      232    593*
PURETOP     0000 0000P
QCOM        0000 03CEI      517*    522
QCOM1       0000 03DEI      518    523*
QENTRY2     0000 0002        19*    318    321
QENTRY3     0000 0004        20*    320    323
QFULL       0000 03E8I      520    526*
QMANG       0000 01C6I      315*    423
QUEUEREG    0000 03C0I      253    513*
R0          0000 0000         9*    99    137    138    139    171    177    189    195    276    292    384    412
R1          0000 0001        10*    170    176    274
R2          0000 0002        11*
R3          0000 0003        12*    396    406
RCMD        0000 03EEI      124    358    530*
RDWRTFLG    0000 000E        41*    350
READINT     0000 024AI      175    352    558*
READS       0000 004AI      124*
READX       0000 00AAI      170*
RETN        0000 000F        24*    62    153    170    176    231    233    274
RETN2       0000 000E        23*    58     59     61     85    107    134    174    179    215    252    253    271
                             272    275    276    324    472    476    477    507    525
RETN2SV     0000 0434I      567*
RETNSV      0000 03FAI      537*
RETNSV1     0000 03FCI      538*
RSRWT       0000 0008        31*    83    268    406    451
RTN1        0000 016AI      257    260    269    271*
```

RWCOM	0000 005C	126	129*											
RWCOM1	0000 0252	357	360*											
RWSAVE	0000 0438	569*												
SA	0000 0444	130	131	575*										
SECT	0000 000C	26*	57	57	137									
SECTOR	0000 000B	38*	378											
SEEKC	0000 05ED	60	529*											
SEEKIT1	0000 0354	439	442	452	469*									
SEEKWFLG	0000 000C	59*	331	399	440									
SELAD	0000 044C	148	149	150	577*									
SELAD1	0000 0436	229	283	483	568*									
SELCHINT	0000 017C	283*	485											
SELCHNT1	0000 00C6	182*	209											
SKSR	0000 0000	57*												
SLAD	0000 0004	15*	129	130	131	132	133	141	142	144	148	149	182	183
		184	185	207	229	256	258	283	285	286	287	288	360	361
		362	363	564	583									
SLCHBSY	0000 0008	27*	143	257										
STAT	0000 000D	22*	74	76	77	79	83	142	145	186	187	193	256	259
		265	266	268	289	290	304	342	343	446	447	449	451	464
STATCK	0000 013A	256*												
STRT10	0000 01EA	325*												
STRT101	0000 01EC	326*	338											
STRT102	0000 0204	330	334*	341										
STRTSK	0000 02F6	324	434*											
STRTSK1	0000 02F8	435*	471	473										
TRACK	0000 000B	21*	101	106	365	369	374	453	457	462				
TRKDEN	0000 0430	99	366	454	564*									
WCMD	0000 03EF	127	355	531*										
WDFT0	0000 0042	105*												
WDFT1	0000 0030	59	99*	134										
WDFT10A	0000 0280	370	373*											
WDFT10B	0000 0346	458	461*											
WDFT1A	0000 0046	100	102	104	106*									
WDFT1B	0000 0284	368	372	374*										
WDFT1C	0000 034A	456	460	462*										
WK0	0000 0006	15*	150	151	190	191	207	208	210	211	212	214	228	232
		251	261	262	297	297	298	301	302	309	311	313	315	325
		325	326	327	328	334	335	336	347	348	349	361	362	363
		364	365	375	378	389	391	393	395	398	398	399	404	416
		418	420	422	434	434	435	436	437	469	470	483	484	486
		487	488	490	491	492	494	495	496	498	499	500	502	503
		504	506	513	514	514	515	516	516	517	521	524		
WK1	0000 0007	16*	124	127	140	209	210	213	214	250	262	263	264	310
		311	312	312	313	315	316	317	317	318	319	320	321	326
		328	329	329	331	339	345	346	347	349	350	355	358	382
		397	397	399	417	418	419	420	421	421	422	457	458	458
		440	453	485	486	489	490	493	494	497	498	501	502	505
		506	517	519	523	524								
WK2	0000 0008	17*	125	128	141	249	249	250	318	319	320	321	322	322
		323	356	359	377	378	379	380	381	383				
WK2SVE	0000 0440	377	381	574*										
WK3	0000 0009	18*	135	136	138	331	332	332	339	340	340	350	351	351

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APPENDIX 3 32 BIT PROCESSOR DISC EXAMPLES                  PAGE  18  18:08:22  09/27/78

APPENDIX 3 MULTI-DISC PROGRAMMING

                              366    367    375    376    379    440    441    441    454    455
WRITINT    0000 0240I         180    355*
WRITS      0000 0054I         127*
WRITX      0000 00B8I         176*
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