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16-BIT EXTENDED SELECTOR CHANNEL (ESELCH) PROGRAMMING MANUAL

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FOREWORD

This manual explains how the Extended Selector Channel (ESELCH) and a 16-bit processor generate an 18-bit address to access expanded memory. The ESELCH can access up to four 64KB blocks of memory for a total of 256KB of memory. It can also operate with only one 64KB block of memory. Programming instructions and three sample programs are provided for the user.

Table of Contents

APPENDICES

ILLUSTRATIONS

TABLES

1. INTRODUCTION

The 16-Bit Extended Selector Channel (ESELCH) operates in a 16-bit system and controls data transfers between I/O devices and memory at rates up to two megabytes per second. A maximum of 16 I/O devices can be connected to the ESELCH, but only one device at a time can transfer data.

The advantage of using an ESELCH is that other program processing can occur simultaneously with the transfer of data between the I/O device and memory. This is accomplished by allowing the ESELCH and the processor to access memory on a cycle-stealing basis. In some instances, the execution times of the program in process are affected; while in others, the effect is negligible. This depends upon the INTERDATA Processor being used and the rate at which both the ESELCH and the processor compete for memory access.

Figure 1 shows the ESELCH incorporated into the INTERDATA peripheral system.

The Appendices contain three programming examples showing use of the ESELCH.

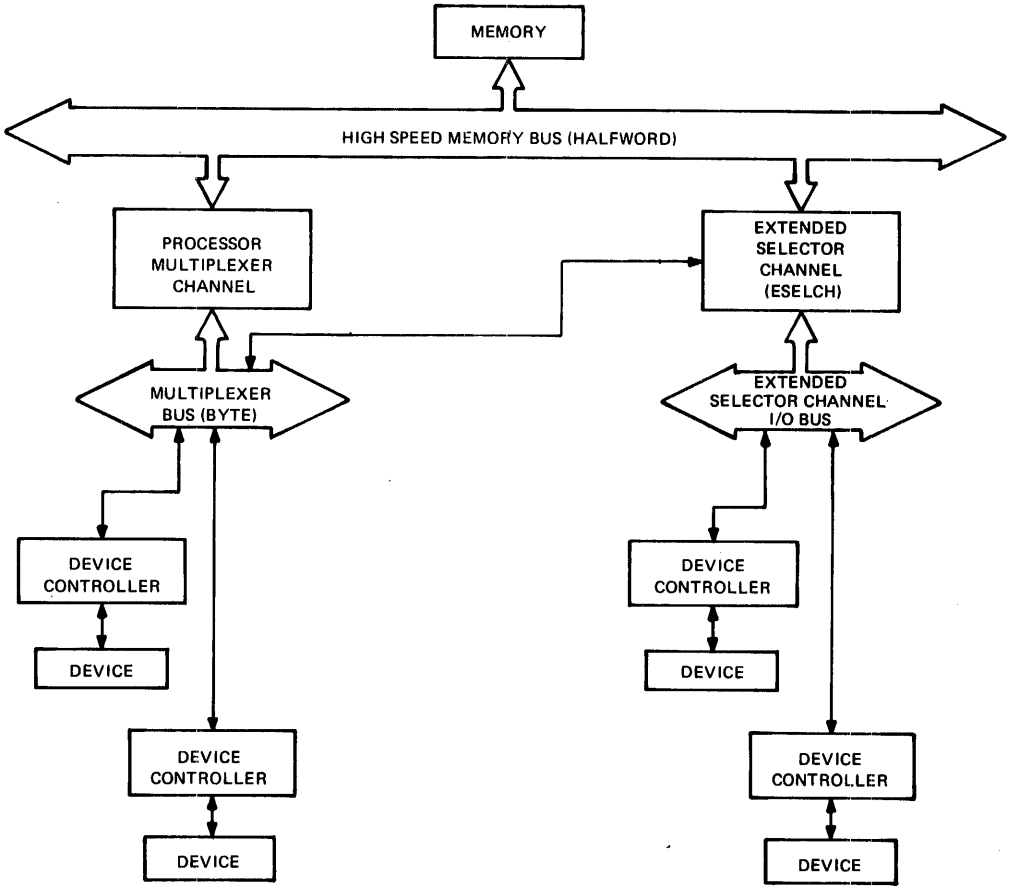


Figure 1. System Interface Block Diagram

2. CONFIGURATION

The Extended Selector Channel (ESELCH) and a 16-bit series processor, which can accommodate the 18-bit address required to access extended memory (e.g., 8/16E Processor), are used in a 16-bit extended memory system containing up to 256KB (Kilo Bytes) of memory. The ESELCH can be used with a 16-bit series processor as a non-extended memory system containing up to 64KB of memory. Refer to the appropriate processor maintenance manual for configuration details.

3. PROGRAMMING INSTRUCTIONS

A Sense Status (SS or SSR) instruction transfers the ESELCH status byte to the processor. Refer to Section 5 for status and command byte information. This instruction should not be used under interrupt control because it could cause the ESELCH to become idle and the interrupt condition to reset.

The Output Command (OC or OCR) instruction causes a command byte to be sent to the ESELCH.

The Write Data (WD or WDR) or Write Halfword (WH or WHR) instructions send the starting and final addresses to the ESELCH.

The Read Data (RD or RDR) or Read Halfword (RH or RHR) instructions obtain the last processor memory location either written into or read from memory.

4. MEMORY

A 16-bit system can have an extended memory containing up to 256KB of memory or a non-extended memory containing up to 64KB of memory.

4.1 Extended Memory System

An extended memory system is composed of one to four memory segments. Each segment contains 64KB of memory with the exception of the last segment which may contain only 32KB of memory.

The extended memory requires an 18-bit address. The Extended Selector Channel generates the 18-bit address in two parts. The two most significant bits of the address (XMA140 and XMA150) which define a particular memory segment are specified in the Output Command instruction. The remaining 16-bits are specified in the Write (byte or halfword) instruction and address memory within the segment.

An extended memory system requires a processor which can accommodate the 18-bit address required to access the extended memory; however, the processor may address memory differently than the Extended Selector Channel (ESELCH). Refer to the appropriate processor maintenance manual for details (e.g., 8/16E Processor Maintenance Manual, Publication Number 29-618).

4.2 Non-Extended Memory System

The Extended Selector Channel (ESELCH) can be used with a non-extended memory by maintaining the value of the two most significant bits (XMA140 and XMA150) of the 18-bit address at zero. In this condition, the ESELCH operates identically to the 16-bit Selector Channel (SELCH).

5. STATUS AND COMMAND BYTE INFORMATION

Table 1 shows ESELCH Status and Command Byte Data.

TABLE 1. ESELCH STATUS AND COMMAND BYTE

BIT NUMBER	0	1	2	3	4	5	6	7
STATUS BYTE					BSY			
COMMAND BYTE			READ	GO	STOP		XMA 140	XMA 150

64KB Address Segment

BSY — This bit is set when the ESELCH is in the process of transferring data. It is reset when the ESELCH terminates or is stopped by an Output Command.

READ — This command changes the mode of the ESELCH from Write to Read. The data is then transmitted from the active device on the private ESELCH I/O Bus and written into memory. When a data transmission has been completed, the ESELCH is placed in the Write mode. Each time a Read operation is required, an Output Command must be issued with the READ and GO bits set.

GO — This command initiates a data transmission and can be issued at the same time the Read/Write mode is established.

STOP — This command halts any data transmission in process and initializes the ESELCH for starting a new operation. It is given when the ESELCH terminates.

XMA140
XMA150 — These bits are the two most significant bits of the 18-bit address. They define the memory segment where the Write or Read operation is to occur. See Table 2.

TABLE 2. XMA 140:150 - MEMORY SEGMENT AND ADDRESS

XMA 140	XMA 150	MEMORY SEGMENT	MEMORY ADDRESS
0	0	0	X`00000' to X`0FFFF'
0	1	1	X`10000' to X`1FFFF'
1	0	2	X`20000' to X`2FFFF'
1	1	3	X`30000' to X`3FFFF'

XMA140 and XMA150 must be specified in the same command byte that commands the ESELCH to perform a Write or Read and GO operation.

XMA140 and XMA150 must be reset when a STOP command (Bit 4 set) is issued to the ESELCH.

6. PROGRAMMING SEQUENCES

Programming a device on the ESELCH consists of setting up the ESELCH, setting up the device, and sending a GO command to the ESELCH as explained in Section 5. Setting up or initiating a device on the ESELCH is device dependent and the user should refer to the appropriate device programming manual for specifics. If the ESELCH is Busy, I/O instructions should not be issued; but the STOP command can be issued. The ESELCH has its own unique device number and is affected by an Output Command, if the correct device address is used. If an I/O instruction is directed to a device on the private ESELCH I/O Bus while the ESELCH is Busy, a False SYNC is indicated by the Condition Code (CVGL = 0100) and the command is ignored.

The ESELCH is idle (not Busy) after Initialize (see Section 7.6), after a STOP command is issued to the ESELCH, or when transfers are complete. Prior to starting an I/O operation with the ESELCH or any device on the private ESELCH I/O Bus, the program must do one of the following:

1. Wait until the ESELCH completes an I/O transfer (Busy resets); then issue a STOP command to the ESELCH.

2. Issue a STOP command to the ESELCH.

The ESELCH operates within one 64KB memory segment at a time. Programming the ESELCH to access memory requires defining the memory segment through the Output Command. Writing to the device or reading from the device via the ESELCH can occur only within the defined memory segment; therefore, transmitting the start and final addresses to the ESELCH or reading the terminating address from the ESELCH must be done relative to the defined memory segment. The memory segment bits cannot be read out of the ESELCH.

To perform a Read or Write operation on a device using an ESELCH, the following steps are required:

1. Wait for the ESELCH to become not Busy or issue a STOP Command. The STOP Command stops any transfer in progress and should be used wisely.

2. Send the starting and ending addresses to the ESELCH.

3. Set up the device on the ESELCH by issuing the appropriate I/O commands.

4. Send an Output Command to the ESELCH with the GO bit set. The READ bit should be set for a Read operation and reset for a Write operation. In this command byte, the two most significant bits (XMA140 and XMA150) must be specified to define the memory segment of the starting and terminating addresses.

NOTE

No I/O instruction can be issued to any other device during the execution of the program instructions in Steps 2 through 4. When the GO command is issued, the ESELCH does the following:

1. Transfers data to the last device addressed by the processor (i.e., by the user program or by the microprogram) if that device is connected to the ESELCH.

2. Because the ESELCH does not react to false sync if no device attached to the ESELCH has been addressed by the processor since initialization, the ESELCH hangs up attempting to communicate with a non-existant device. See Section 7.6. For this reason, the program instructions in Steps 2 through 4 must be executed with processor I/O interrupts disabled. Otherwise, it is possible to detect an external interrupt and the interrupt driver in the user program (or the microprogram in the case of an immediate interrupt) can address any other device. Also, the single cycle mode of the display may not be used since the microcode addresses the display panel after each instruction execution.

Transmission of Starting and Final Addresses

A STOP Output Command is issued prior to starting any operation on the ESELCH. Four successive bytes are required to specify the start and final addresses. The Write Data (WD or WDR) or Write Halfword (WH or WHR) instructions send the start and final addresses to the ESELCH Controller. Figure 2 illustrates the meaning of four bytes used for addressing.

	0←HIGH→7	8←LOW→15
START ADDRESS	1	2
FINAL ADDRESS	3	4

1. START ADDRESS HIGH (BITS 0-7)
2. START ADDRESS LOW (BITS 8-15)
3. FINAL ADDRESS HIGH (BITS 0-7)
4. FINAL ADDRESS LOW (BITS 8-15)

Figure 2. Memory of Data Bytes for Start and Final Addresses

For example, if the start address is X`0ABC' and the ending address is X`CFAB', the following addressing sequences are correct:

```
1.  WD (or WDR) SELCH, START    (0A)
    WD (or WDR) SELCH, START+1  (BC)
    WD (or WDR) SELCH, END      (CF)
    WD (or WDR) SELCH, END+1    (AB)

2.  WH (or WHR) SELCH, START    (0ABC)
    WH (or WHR) SELCH, END      (CFAB)
```

7. PROGRAMMING NOTES

The ESELCH has a 16-bit incrementing Address Register (AR) and a 16-bit Final Address Register (FAR). XMA14 and XMA15 are not part of the AR or FAR. The user program loads the starting memory address into the incrementing Address Register (AR) and the final memory address into the Final Address Register (FAR). Transfer is completed when the incrementing Address Register (AR) matches the Final Address Register (FAR). The address limits are expressed inclusively; transfers begin and end on the addresses placed in the start and final address registers.

Memories in INTERDATA processors are addressed on halfword boundaries; that is, each time memory is accessed, two bytes (a halfword) are obtained. Therefore, Bit 15 of the 16-bit incrementing Address Register (AR) is used to determine the bytes desired. See Figure 3.

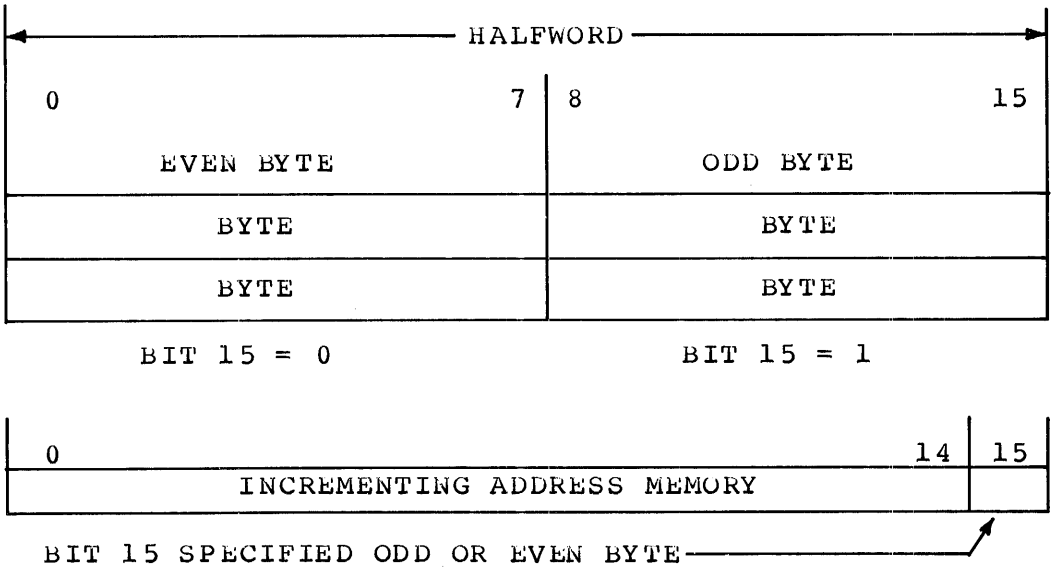


Figure 3. Memory Addressing

Each time the ESELCH accesses memory, two bytes (a halfword) are transmitted. It is mandatory for data transfers to begin on a halfword boundary, but it is not mandatory for them to end on a halfword boundary. The following results if data transfers are ended on byte boundaries:

1. Write mode (Memory to Device) - End on byte boundary (Bit 15 = 0) with no effect.

2. Read mode (Device to Memory) - End on byte boundary (Bit 15 = 0). The previous content of the last odd byte in memory is written into the current odd byte. See Figure 4.

	0 7	8 15
NEXT TO LAST HALFWORD	EVEN BYTE*	ODD BYTE**
LAST HALFWORD	BYTE*	BYTE**

* LAST BYTE SPECIFIED
**BOTH BYTES HAVE SAME VALUE

Figure 4. Memory Configuration End on Byte Boundary

7.1 Termination

Data transmission between the ESELCH and the device presently connected to it is halted when any of the following conditions occur:

1. The start incrementing address matches the final address. This denotes normal termination.

2. The start incrementing address changes from all ones to all zeros (maximum count). In this case, a match has not occurred and is considered an abnormal termination.

3. Bit 5, 6, or 7 is set in the status byte of the device presently connected to the ESELCH. This may be an abnormal termination, depending on the application.

4. A STOP command is sent to the ESELCH by a user program.

5. The processor is initialized or a power failure is detected. Memory cycle in process is completed.

The termination condition is determined in one of two ways: by a status scan or by the interrupt method. The methods are described in the following paragraphs. A STOP Output Command is issued to the ESELCH following its termination.

7.2 Status Scan

The status of the ESELCH may be examined by issuing a Sense Status (SS or SSR) instruction. The BUSY bit (Bit 4) is set while transmission is in progress and reset when transmission is terminated. One method of testing for termination is to continually or periodically test the BUSY bit of the ESELCH. The change from set to reset indicates the termination of a data transfer. In the status scan method of programming, it is possible for the BUSY bit to change from set to reset during a Sense Status instruction without returning the ESELCH to idle. To guarantee the idle mode after BUSY resets on a Sense Status instruction, a STOP Command must be sent to the ESELCH.

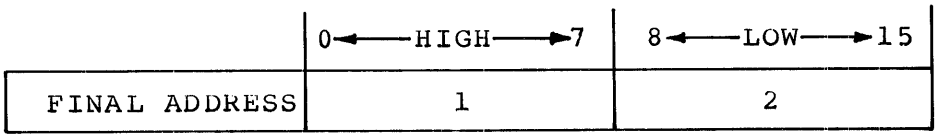
7.3 Interrupt Method

When data transmission is initiated on the ESELCH, the interrupt is effectively enabled. If external device interrupts are permitted (Bit 1 of the PSW set) to enter the processor at termination, the processor is interrupted. The interrupt handler address must be stored in the proper dedicated memory location. The Acknowledge Interrupt (ACK or ACKR) instruction causes the device number of the ESELCH (normally X'F0') and the status of the peripheral device to be brought into the processor and it also clears the interrupt condition. The BUSY bit is treated in the manner previously described for the Status Scan.

7.4 Reading the Final Address

The last processor memory location either written into or read by the ESELCH (incrementing Address Register) may be obtained by executing a pair of Read Data (RD or RDR) instructions or a Read Halfword (RH or RHR) instruction. This information permits a user program to verify a successful data transmission or determine the address termination occurred. If the ending address returned by the ESELCH is not equal to the ending address written to the ESELCH, then the ESELCH terminated early with all of the specified memory not written or read. See Section 7.1.

Figure 5 shows the order in which data is read into the processor.



1. FINAL ADDRESS HIGH (BITS 0-7)
2. FINAL ADDRESS LOW (BITS 8-15)

Figure 5. Execution Order for Read Data Instructions

7.5 Device Number

The ESELCH is normally assigned device number X'F0' but may easily be changed on the ESELCH Device Controller board. Refer to the ESELCH Installation and Maintenance Manual, Publication Number 29-619, for details.

7.6 Initialization

Whenever the Initialize switch (INT) on the display panel is depressed, or a STOP command is issued, the following action occurs:

1. Any data transmission in process is halted and the Stop mode is affected.
2. The ESELCH is placed in the Write mode.
3. The ESELCH is made idle.
4. The ESELCH interrupt is reset.

8. SAMPLE PROGRAMS

The Appendices contain three sample programs for demonstrating the use of the 16-Bit ESELCH. The first two programs involve the use of the INTERDATA 1600 BPI and 800 BPI Read-After-Write Magnetic Tape Systems. The third program involves the INTERDATA 2.5 and 10-Megabyte Removable Cartridge Disc. For further information pertaining to programming the Magnetic Tape System or Cartridge Disc, refer to the following INTERDATA manuals:

1. Magnetic Tape Programming Manual, Publication Number 29-530.
2. 2.5 and 10 Megabyte Removable Cartridge Disc Programming Manual, Publication Number 29-454.

Descriptions of the sample programs are given below.

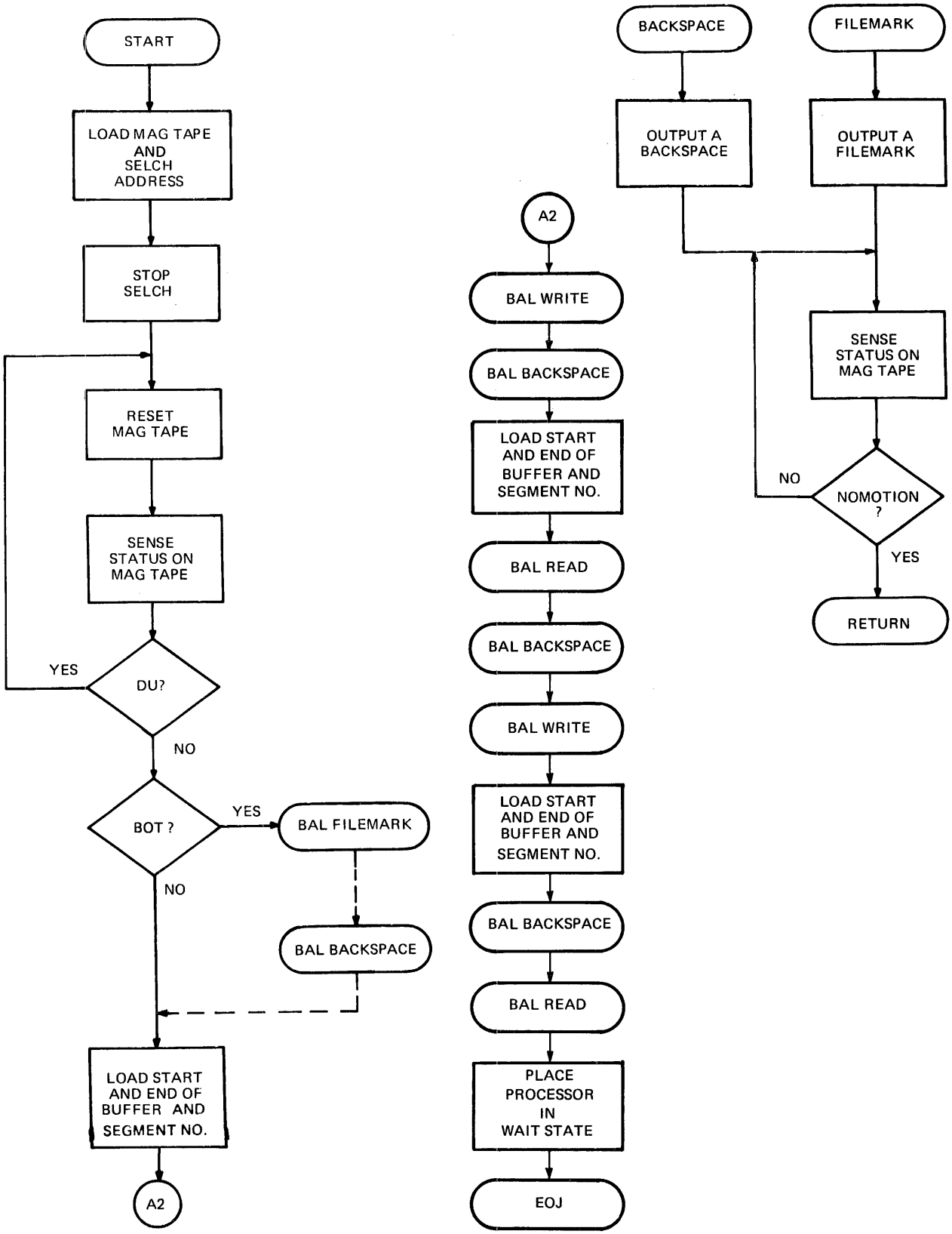
8.1 Magnetic Tape System with ESELCH

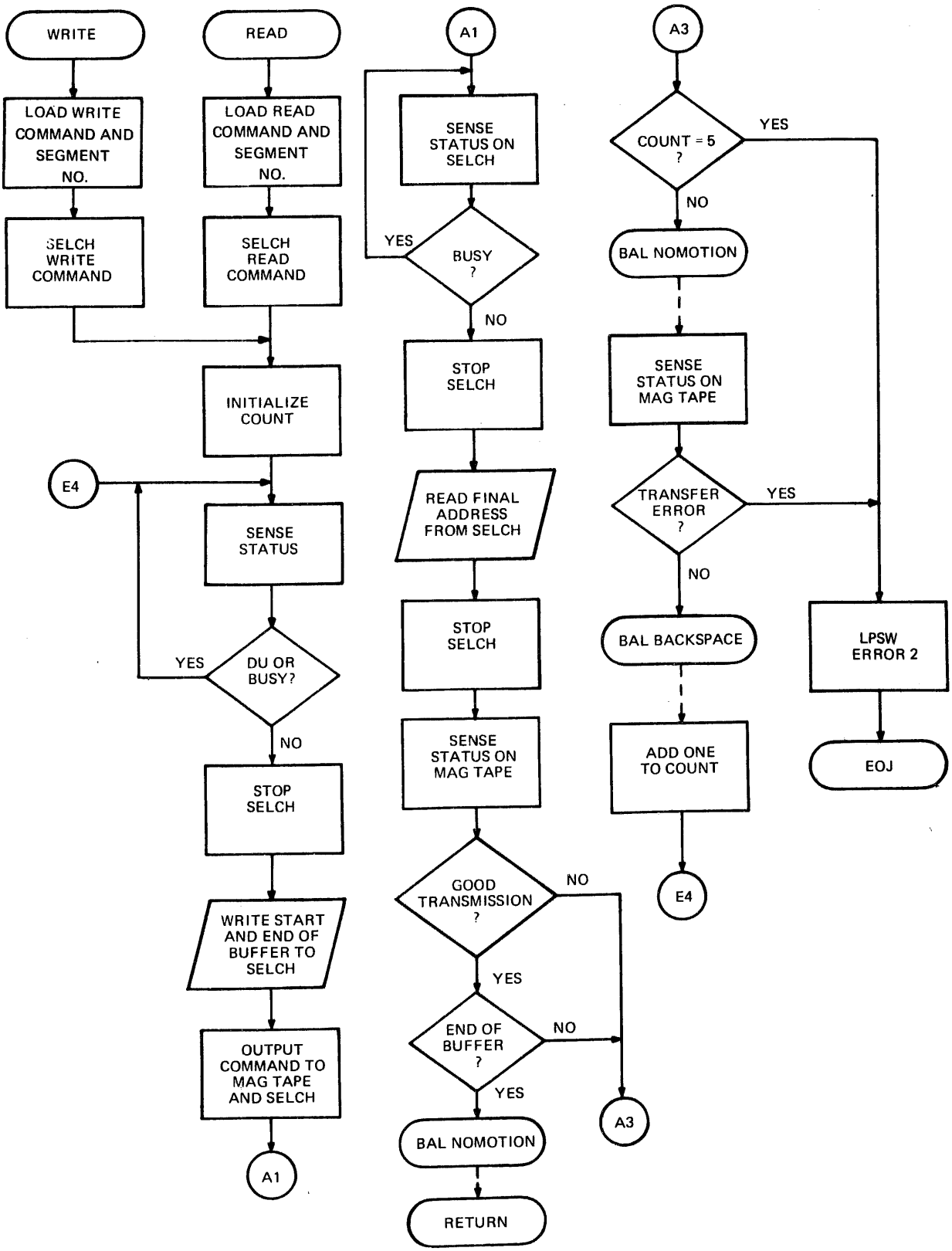
The first program uses the ESELCH and Sense Status Loops to read and write on magnetic tape. The second program uses the ESELCH and External Interrupts to read and write on magnetic tape.

8.2 Cartridge Disc with ESELCH

The first part of this program uses the ESELCH and Sense Status Loops to read and write on the disc. The second part of the program uses the ESELCH and External Interrupts to read and write on the disc.

APPENDIX 1
16 BIT EXTENDED SELCH (MAG TAPE WITH SENSE STATUS)




WRITE
READ
A1
A3
LOAD WRITE COMMAND AND SEGMENT NO.
LOAD READ COMMAND AND SEGMENT NO.
SENSE STATUS ON SELCH
COUNT = 5 ?
YES
NO
SELCH WRITE COMMAND
SELCH READ COMMAND
YES
BUSY ?
NO
BAL NOMOTION
INITIALIZE COUNT
STOP SELCH
SENSE STATUS ON MAG TAPE
E4
READ FINAL ADDRESS FROM SELCH
TRANSFER ERROR ?
YES
SENSE STATUS
STOP SELCH
NO
YES
DU OR BUSY?
BAL BACKSPACE
LPSW ERROR 2
NO
SENSE STATUS ON MAG TAPE
ADD ONE TO COUNT
EOJ
STOP SELCH
GOOD TRANSMISSION ?
NO
E4
WRITE START AND END OF BUFFER TO SELCH
YES
END OF BUFFER ?
NO
OUTPUT COMMAND TO MAG TAPE AND SELCH
YES
A3
BAL NOMOTION
A1
RETURN

```
      16 BIT EXTENDED SELCH (MAG TAPE WITH SENSE STATUS)       PAGE   1

PROG= ESELMG      ASSEMBLED BY CAL 03-066R04-01 (16-BIT)

                                    1          SCRAT                                                    MAG00020
                                    2          WIDTH  120                                               MAG00030
                                    3          CROSS                                                    MAG00040
                                    4          TARGT  16                                                MAG00050
                                    5  *                                                                MAG00060
                                    6  *  THIS PROGRAM USES THE 16 BIT EXT SELCH &  SENSE STATUS       MAG00070
                                    7  *  LOOPS TO:                                                    MAG00080
                                    8  * (1) WRITE A BUFFER FROM MEMORY SEGMENT ZERO (0)               MAG00090
                                    9  * TO MAG TAPE.                                                  MAG00100
                                   10  * (2) READ FROM MAG TAPE TO A BUFFER IN MEMORY                   MAG00110
                                   11  * SEGMENT ONE (1).                                              MAG00120
                                   12  * (3) WRITE THIS BUFFER TO MAG TAPE.                            MAG00130
                                   13  * (4) READ THE DATA FROM MAG TAPE BACK TO THE                   MAG00140
                                   14  * ORIGINAL BUFFER IN SEGMENT ZERO (0).                          MAG00150
                                   15  *                                                               MAG00160
                                   16  *  16-BIT PROCESSORS                                           MAG00170
                                   17  *                                                               MAG00180
                                   18  *  REGISTER ASSIGNMENTS:                                       MAG00190
                                   19  *                                                               MAG00200
          0000 0001                20  R1       EQU    1              START OF BUFFER REGISTER         MAG00210
          0000 0001                21  DU       EQU    1              DEVICE UNAVAILABLE               MAG00220
          0000 0002                22  R2       EQU    2              END OF BUFFER REGISTER           MAG00230
          0000 0003                23  R3       EQU    3              DEVICE ADDRESS REGISTER          MAG00240
          0000 0004                24  R4       EQU    4              STATUS                           MAG00250
          0000 0005                25  R5       EQU    5              RETURN REGISTER                  MAG00260
          0000 0006                26  R6       EQU    6              MOST SIG 2 BITS OF MEMORY        MAG00270
          0000 0007                27  R7       EQU    7              COUNTER                          MAG00280
          0000 0008                28  BSY      EQU    8              BUSY                             MAG00290
          0000 0008                29  R8       EQU    8              COMMAND BYTE STORE               MAG00300
          0000 0009                30  R9       EQU    9              SELCH ADDRESS REGISTER           MAG00310
          0000 000A                31  R10      EQU    10             SELCH COMMAND HOLD REGISTER      MAG00320
          0000 000B                32  R11      EQU    11             WORK REGISTER                    MAG00330
          0000 000C                33  R12      EQU    12             RETURN REGISTER                  MAG00340
          0000 0010                34  TEST     EQU    X'10'          TEST=NOMOTION BIT                MAG00350
          0000 0020                35  BOT      EQU    X'20'          TEST FOR BOT                     MAG00360
          0000 00C0                36  TERM     EQU    X'C0'          TERMINATION STATUS=X'C0'         MAG00370
0000R     4830 013AR               37           LH     R3,MTADR       LOAD MAG TAPE ADDRESS            MAG00380
0004R     4890 0138R               38           LH     R9,SELCH       LOAD SELCH ADDRESS               MAG00390
0008R     DE90 013ER               39           OC     R9,STOP        STOP SELCH                       MAG00400
000CR     DE30 013FR               40  DUTEST   OC     R3,RESET       OUTPUT RESET                     MAG00410
0010R     9D34                     41           SSR    R3,R4          SENSE STATUS ON MAG TAPE         MAG00420
0012R     4210 000CR               42           BTC    DU,DUTEST      IS MAG TAPE UNAVAILABLE          MAG00430
0016R     C340 0020                43           THI    R4,BOT         TEST FOR BOT                     MAG00440
001AR     2335                     44           BZS    WRT            BRANCH TO WRITE                  MAG00450
001CR     4150 0068R               45           BAL    R5,FLMK        FILEMARK ROUTINE                 MAG00460
0020R     4150 0062R               46           BAL    R5,BAKSP       BACKSPACE TAPE ROUTINE           MAG00470
0024R     C810 00F8R               47  WRT      LHI    R1,BUFSRT      LOAD START OF BUFFER             MAG00480
0028R     C820 012FR               48           LHI    R2,BUFEND      LOAD END OF BUFFER               MAG00490
002CR     0766                     49           XHR    R6,R6          LOAD 2 MOST SIG BITS OF MEM (0)  MAG00500
002ER     41C0 0076R               50           BAL    R12,WRITE      WRITE TO DEVICE                  MAG00510
                                   51  *                                                                MAG00520
0032R     4150 0062R               52           BAL    R5,BAKSP       BACK SPACE                       MAG00530
0036R     0711                     53           XHR    R1,R1          LOAD START OF BUFFER (0)         MAG00540
0038R     C820 0037                54           LHI    R2,BUFEND-BUFSRT LOAD END OF BUFFER             MAG00550
```

```
003CR  D360 0145R          55          LB     R6,MEMSEG          LOAD 2 MOST SIG BITS OF MEM          MAG00560
0040R  41C0 008AR          56          BAL    R12,READ           READ FOR DEVICE                      MAG00570
                           57  *                                                                       MAG00580
0044R  4150 0062R          58          BAL    R5,BAKSP           BACKSPACE                            MAG00590
0048R  41C0 0076R          59          BAL    R12,WRITE          WRITE TO DEVICE                      MAG00600
                           60  *                                                                       MAG00610
004CR  C810 00F8R          61          LHI    R1,BUFSRT          LOAD START OF BUFFER                 MAG00620
0050R  C820 012FR          62          LHI    R2,BUFEND          LOAD END OF BUFFER                   MAG00630
0054R  0766                63          XHR    R6,R6              LOAD 2 MOST SIG BITS OF MEM (0)      MAG00640
0056R  4150 0062R          64          BAL    R5,BAKSP           BACKSPACE                            MAG00650
005AR  41C0 008AR          65          BAL    R12,READ           READ FROM DEVICE                     MAG00660
                           66  *                                                                       MAG00670
005ER  C200 0134R          67  END1    LPSW   END                                                      MAG00680
                           68  ******************************************************                 MAG00690
                           69  * SUBROUTINE: BAKSP                                                    MAG00700
                           70  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                         MAG00710
                           71  *       SEE CALLING SEQUENCE BELOW.                                    MAG00720
                           72  *                                                                       MAG00730
                           73  *  SUBROUTINE: FLMK                                                    MAG00740
                           74  *       THIS SUBROUTINE WRITES A FILEMARK                              MAG00750
                           75  *       SEE CALLING SEQUENCE BELOW.                                    MAG00760
                           76  *                                                                       MAG00770
                           77  *                                                                       MAG00780
                           78  ******************************************************                 MAG00790
                           79  *                                                                       MAG00800
                           80  *  SUBROUTINE: NOMOT                                                   MAG00810
                           81  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                      MAG00820
                           82  *       STOP MOVING.                                                   MAG00830
                           83  *                                                                       MAG00840
                           84  *       CALLING SEQUENCE:     BAL R5,BAKSP                             MAG00850
                           85  *       ----------------      BAL R5,FLMK                              MAG00860
                           86  *                             BAL R5,NOMOT                             MAG00870
                           87  *       R3=DEVICE ADDRESS REGISTER                                     MAG00880
                           88  *       R5=RETURN REGISTER                                             MAG00890
                           89  *                                                                       MAG00900
                           90  *       WORK REGISTERS:                                                MAG00910
                           91  *       -------------                                                  MAG00920
                           92  *       R4=DEVICE STATUS REGISTER                                      MAG00930
                           93  *                                                                       MAG00940
                           94  ******************************************************                 MAG00950
                           95  *                                                                       MAG00960
0062R  DE30 0141R          96  BAKSP   OC     R3,BKSP            OUTPUT BACKSPACE                     MAG00970
0066R  2303                97          BS     NOMOT              BRANCH TO NOMOTION                   MAG00980
0068R  DE30 0140R          98  FLMK    OC     R3,FILMRK          OUTPUT FILEMARK                      MAG00990
006CR  9D34                99  NOMOT   SSR    R3,R4              SENSE STATUS ON MAG TAPE             MAG01000
006ER  C340 0010          100          THI    R4,TEST            TEST FOR NO MOTION                   MAG01010
0072R  2233               101          BZS    NOMOT              SENSE AGAIN                          MAG01020
0074R  0305               102          BR     R5                 RETURN                               MAG01030
                          103  ******************************************************                 MAG01040
                          104  *  SUBROUTINE: WRITE                                                   MAG01050
                          105  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE                 MAG01060
                          106  *       MAG TAPE.                                                      MAG01070
                          107  *       SEE CALLING SEQUENCE BELOW                                     MAG01080
                          108  *  SUBROUTINE READ                                                     MAG01090
                          109  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE                 MAG01100
                          110  *       MAG TAPE.                                                      MAG01110
```

```
                                111  *                                                                    MAG01120
                                112  *       CALLING SEQUENCE:     BAL R12,WRITE                        MAG01130
                                113  *       ----------------      BAL R12,READ                         MAG01140
                                114  *       R1=START OF BUFFER                                         MAG01150
                                115  *       R2=END OF BUFFER                                           MAG01160
                                116  *       R3=DEVICE ADDRESS REIGSTER                                 MAG01170
                                117  *       R9=SELCH ADDRESS REGISTER                                  MAG01180
                                118  *       R12=RETURN REGISTER                                        MAG01190
                                119  *                                                                  MAG01200
                                120  *       WORK REGISTERS:                                            MAG01210
                                121  *       ---------------                                            MAG01220
                                122  *       R4=STATUS REGISTER                                         MAG01230
                                123  *       R5=NOMOTION RETURN REGISTER                                MAG01240
                                124  *       R7=RETRY COUNT                                             MAG01250
                                125  *       R8=COMMAND REGISTER                                        MAG01260
                                126  *       R10=SELCH COMMAND REGISTER                                 MAG01270
                                127  *       R11=WORK REGISTER                                          MAG01280
                                128  ***************************************************                MAG01290
0076R  D380 0143R               129  WRITE    LB     R8,WRTCMD          LOAD WRITE COMMAND             MAG01300
007AR  D3A0 013DR               130           LB     R10,SELWRT         LOAD SELCH WRITE               MAG01310
007ER  C4A0 00FC                131           NHI    R10,X'FC'          BIT 0-5 OF COMMAND             MAG01320
0082R  C460 0003                132           NHI    R6,X'03'           BITS 6-7 OF COMMAND            MAG01330
0086R  06A6                     133           OHR    R10,R6             COMPOSE SELCH COMMAND          MAG01340
0088R  230A                     134           BS     RETRY              BRANCH TO RETRY                MAG01350
008AR  D380 0144R               135  READ     LB     R8,RDCMD           LOAD READ COMMAND              MAG01360
008ER  D3A0 013CR               136           LB     R10,SELRD          LOAD SELCH READ                MAG01370
0092R  C4A0 00FC                137           NHI    R10,X'FC'          BITS 0-5 OF COMMAND            MAG01380
0096R  C460 0003                138           NHI    R6,X'03'           BITS 6-7 OF COMMAND            MAG01390
009AR  06A6                     139           OHR    R10,R6             COMPOSE SELCH COMMAND          MAG01400
009CR  0777                     140  RETRY    XHR    R7,R7              ZERO OUT COUNT                 MAG01410
009ER  9D34                     141  SENSE1   SSR    R3,R4              SENSE STATUS ON MAG TAPE       MAG01420
00A0R  2091                     142           BTBS   DU+BSY,SENSE1      TEST FOR BUSY+DEVICE UNAVAILABLE MAG01430
00A2R  DE90 013ER               143           OC     R9,STOP            STOP SELCH                     MAG01440
00A6R  9891                     144           WHR    R9,R1              WRITE START OF BUFFER TO SELCH MAG01450
00A8R  9892                     145           WHR    R9,R2              WRITE END OF BUFFER TO SELCH   MAG01460
00AAR  9E38                     146           OCR    R3,R8              OUTPUT COMMAND TO MT           MAG01470
00ACR  9E9A                     147           OCR    R9,R10             OUTPUT COMMAND TO SELCH        MAG01480
00AER  9D94                     148           SSR    R9,R4              SENSE STATUS ON SELCH          MAG01490
00B0R  2081                     149           BTBS   BSY,1              TEST FOR BUSY                  MAG01500
00B2R  DE90 013ER               150           OC     R9,STOP            STOP THE SELCH                 MAG01510
00B6R  999B                     151           RHR    R9,R11             READ FINAL ADR. FROM SELCH     MAG01520
00B8R  DE90 013ER               152           OC     R9,STOP            STOP THE SELCH                 MAG01530
00BCR  9D34                     153           SSR    R3,R4              SENSE STATUS ON THE MAG TAPE   MAG01540
00BER  C340 00C0                154           THI    R4,TERM            TEST FOR GOOD TERMINATION      MAG01550
00C2R  4230 00D2R               155           BNZ    ERROR              BRANCH TO TRY AGAIN            MAG01560
00C6R  05B2                     156           CLHR   R11,R2             TEST END OF BUFFER             MAG01570
00C8R  4230 00D2R               157           BNE    ERROR                                             MAG01580
00CCR  4150 006CR               158           BAL    R5,NOMOT           WAIT FOR TAPE TO STOP          MAG01590
00D0R  030C                     159           BR     R12                RETURN                         MAG01600
                                160  *                                                                  MAG01610
                                161  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS MAG01620
                                162  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS     MAG01630
                                163  *   BEFORE TERMINATING.                                            MAG01640
                                164  *                                                                  MAG01650
00D2R  C570 0005                165  ERROR    CLHI   R7,5               TEST FOR 5 TRIES               MAG01660
00D6R  4330 00F2R               166           BE     ERROR1             BRANCH TO ERROR1               MAG01670
```

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16 BIT EXTENDED SELCH (MAG TAPE WITH SENSE STATUS)       PAGE   4

00DAR  4150 006CR          167            BAL     R5,NOMOT          STOP MOTION OF TAPE                    MAG01680
00DER  9D34                168            SSR     R3,R4             SENSE STATUS ON MAG TAPE               MAG01690
00E0R  C340 00C0           169            THI     R4,TERM           TEST FOR GOOD TERMINATION              MAG01700
00E4R  4330 00F2R          170            BZ      ERROR1            BRANCH TO ERROR1                       MAG01710
00E8R  4150 0062R          171            BAL     R5,BAKSP          BACKSPACE ROUTINE                      MAG01720
00ECR  2671                172            AIS     R7,1              ADD ONE TO COUNT                       MAG01730
00EER  4300 009ER          173            B       SENSE1            BRANCH TO SENSE1                       MAG01740
                           174  *                                                                            MAG01750
00F2R  C200 0130R          175  ERROR1    LPSW    ERROR2                                                   MAG01760
                           176  *                                                                            MAG01770
                           177  *   BUFFER                                                                   MAG01780
                           178  *                                                                            MAG01790
00F8R                      179            ALIGN   4                 ALIGN START OF BUFFER                  MAG01800
                           180  *                                    ON HALFWORD BOUNDARY                   MAG01810
00F8R  0123                181  BUFSRT    DC      X'0123',X'4567'                                          MAG01820
00FAR  4567
00FCR  89AB                182            DC      X'89AB',X'CDEF'                                          MAG01830
00FER  CDEF
0100R  0123                183            DC      X'0123',X'4567'                                          MAG01840
0102R  4567
0104R  89AB                184            DC      X'89AB',X'CDEF'                                          MAG01850
0106R  CDEF
0108R  0123                185            DC      X'0123',X'4567'                                          MAG01860
010AR  4567
010CR  89AB                186            DC      X'89AB',X'CDEF'                                          MAG01870
010ER  CDEF
0110R  0123                187            DC      X'0123',X'4567'                                          MAG01880
0112R  4567
0114R  89AB                188            DC      X'89AB',X'CDEF'                                          MAG01890
0116R  CDEF
0118R  0123                189            DC      X'0123',X'4567'                                          MAG01900
011AR  4567
011CR  89AB                190            DC      X'89AB',X'CDEF'                                          MAG01910
011ER  CDEF
0120R  0123                191            DC      X'0123',X'4567'                                          MAG01920
0122R  4567
0124R  89AB                192            DC      X'89AB',X'CDEF'                                          MAG01930
0126R  CDEF
0128R  0123                193            DC      X'0123',X'4567'                                          MAG01940
012AR  4567
012CR  89AB                194            DC      X'89AB',X'CDEF'                                          MAG01950
012ER  CDEF
       0000 012FR          195  BUFEND    EQU     *-1                                                      MAG01960
0130R  8000                196  ERROR2    DC      X'8000',A(ERROR1)                                        MAG01970
0132R  00F2R
0134R  8000                197  END       DC      X'8000'                                                  MAG01980
0136R  005ER               198            DC      A(END1)                                                  MAG01990
0138R  00F0                199  SELCH     DC      X'F0'             SELECTOR CHANNEL ADDRESS               MAG02000
013AR  0085                200  MTADR     DC      X'85'             MAG TAPE ADDRESS                       MAG02010
013CR  30                  201  SELRD     DB      X'30'             SELCH READ COMMAND                     MAG02020
013DR  10                  202  SELWRT    DB      X'10'             SELCH WRITE COMMAND                    MAG02030
013ER  08                  203  STOP      DB      X'08'             SELCH STOP COMMAND                     MAG02040
013FR  E0                  204  RESET     DB      X'E0'             RESET COMMAND                          MAG02050
0140R  30                  205  FILMRK    DB      X'30'             FILEMARK COMMAND                       MAG02060
0141R  11                  206  BKSP      DB      X'11'             BACKSPACE COMMAND                      MAG02070
0142R  38                  207  REWIND    DB      X'38'             REWIND COMMAND                         MAG02080
```

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0143R  22                  208  WRTCMD   DB     X'22'          WRITE COMMAND FOR MAG TAPE          MAG02090
0144R  21                  209  RDCMD    DB     X'21'          READ COMMAND FOR MAG TAPE           MAG02100
0145R  01                  210  MEMSEG   DB     X'01'          MEMORY SEGMENT 1                    MAG02110
0146R                      211           END                                                       MAG02120
```

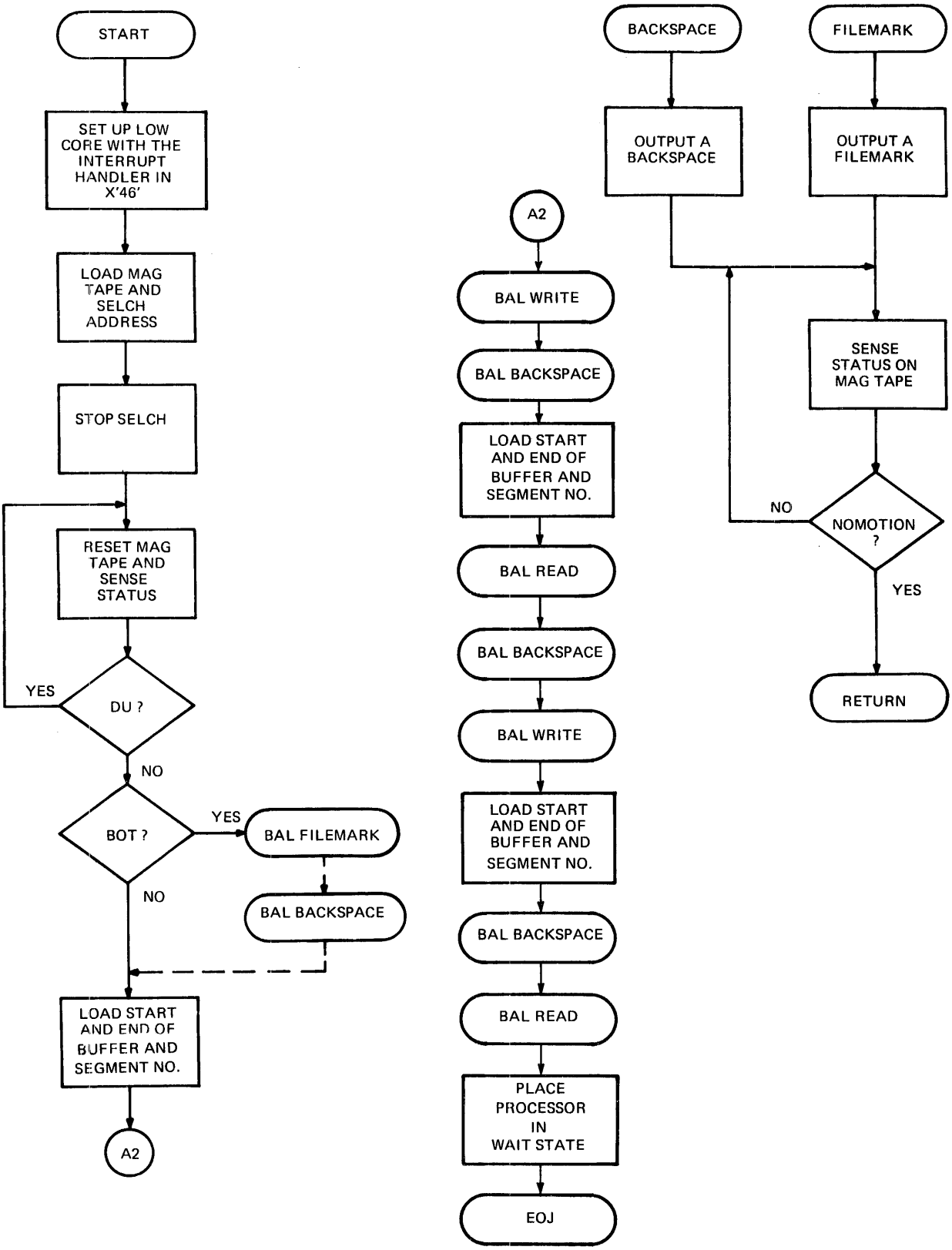
16 BIT EXTENDED SELCH (MAG TAPE WITH SENSE STATUS) PAGE 6

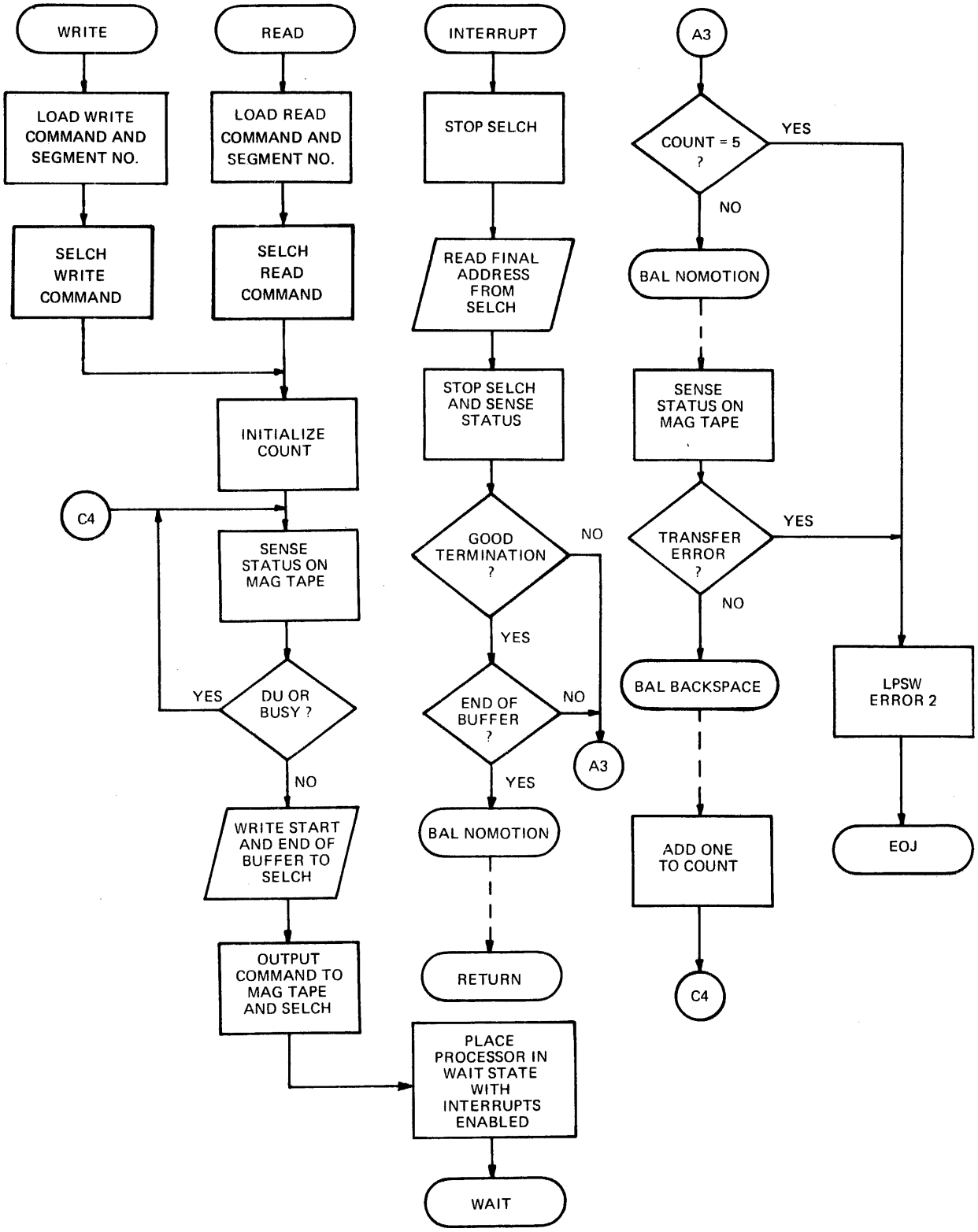
NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	0000										
ADC	0002										
BAKSP	0062R	46	52	58	64	171					
BKSP	0141R	96									
BOT	0020	43									
BSY	0008	142	149								
BUFEND	012FR	48	54	62							
BUFSRT	00F8R	47	54	61							
DU	0001	42	142								
DUTEST	000CR	42									
END	0134R	67									
END1	005ER	198									
ERROR	00D2R	155	157								
ERROR1	00F2R	166	170	196							
ERROR2	0130R	175									
FILMRK	0140R	98									
FLMK	0068R	45									
IMPTOP	0146R										
LADC	0001										
MEMSEG	0145R	55									
MTADR	013AR	37									
NOMOT	006CR	97	101	158	167						
PURETOP	0000R										
R1	0001	47	53	53	61	144					
R10	000A	130	131	133	136	137	139	147			
R11	000B	151	156								
R12	000C	50	56	59	65	159					
R2	0002	48	54	62	145	156					
R3	0003	37	40	41	96	98	99	141	146	153	168
R4	0004	41	43	99	100	141	148	153	154	168	169
R5	0005	45	46	52	58	64	102	158	167	171	
R6	0006	49	49	55	63	63	132	133	138	139	
R7	0007	140	140	165	172						
R8	0008	129	135	146							
R9	0009	38	39	143	144	145	147	148	150	151	152
RDCMD	0144R	135									
READ	008AR	56	65								
RESET	013FR	40									
RETRY	009CR	134									
REWIND	0142R										
SELCH	0138R	38									
SELRD	013CR	136									
SELWRT	013DR	130									
SENSE1	009ER	142	173								
STOP	013ER	39	143	150	152						
TERM	00C0	154	169								
TEST	0010	100									
WRITE	0076R	50	59								
WRT	0024R	44									
WRTCMD	0143R	129									

APPENDIX 2
16 BIT EXTENDED SELCH (MAG TAPE & EXT INTERRUPTS)




WRITE
LOAD WRITE COMMAND AND SEGMENT NO.
SELCH WRITE COMMAND
READ
LOAD READ COMMAND AND SEGMENT NO.
SELCH READ COMMAND
INITIALIZE COUNT
C4
SENSE STATUS ON MAG TAPE
YES
DU OR BUSY ?
NO
WRITE START AND END OF BUFFER TO SELCH
OUTPUT COMMAND TO MAG TAPE AND SELCH
INTERRUPT
STOP SELCH
READ FINAL ADDRESS FROM SELCH
STOP SELCH AND SENSE STATUS
GOOD TERMINATION ?
NO
YES
END OF BUFFER ?
NO
YES
A3
BAL NOMOTION
RETURN
PLACE PROCESSOR IN WAIT STATE WITH INTERRUPTS ENABLED
WAIT
A3
COUNT = 5 ?
YES
NO
BAL NOMOTION
SENSE STATUS ON MAG TAPE
TRANSFER ERROR ?
YES
NO
BAL BACKSPACE
ADD ONE TO COUNT
C4
LPSW ERROR 2
EOJ

```
      16 BIT EXTENDED SELCH (MAG TAPE & EXT INTERRUPTS)        PAGE   1

PROG= ESELME      ASSEMBLED BY CAL 03-066R04-01 (16-BIT)

                                    1          SCRAT                                                    MAG00020
                                    2          WIDTH  120                                               MAG00030
                                    3          CROSS                                                    MAG00040
                                    4          TARGT  16                                                MAG00050
                                    5  *                                                                MAG00060
                                    6  * THIS PROGRAM USES THE 16 BIT EXTENDED SELCH & EXTERNAL         MAG00070
                                    7  * INTERRUPTS TO:                                                 MAG00080
                                    8  * (1) WRITE A BUFFER FROM MEMORY SEGMENT ZERO (0)                MAG00090
                                    9  * TO THE MAG TAPE.                                              MAG00100
                                   10  * (2) READ FROM THE MAG TAPE TO A BUFFER IN MEMORY               MAG00110
                                   11  * SEGMENT ONE (1).                                              MAG00120
                                   12  * (3) WRITE THE DATA BACK TO THE MAG TAPE.                       MAG00130
                                   13  * (4) READ THE DATA FROM THE MAG TAPE BACK TO                    MAG00140
                                   14  * THE ORIGINAL BUFFER IN MEMORY SEGMENT ZERO (0).                MAG00150
                                   15  *                                                               MAG00160
                                   16  *  16-BIT PROCESSORS                                            MAG00170
                                   17  *                                                               MAG00180
                                   18  *  REGISTER ASSIGNMENTS:                                        MAG00190
                                   19  *                                                               MAG00200
          0000 0001                20  R1       EQU    1              START OF BUFFER REGISTER          MAG00210
          0000 0001                21  DU       EQU    1              DEVICE UNAVAILABLE                MAG00220
          0000 0002                22  R2       EQU    2              END OF BUFFER REGISTER            MAG00230
          0000 0003                23  R3       EQU    3              DEVICE ADDRESS REGISTER           MAG00240
          0000 0004                24  R4       EQU    4              STATUS                            MAG00250
          0000 0005                25  R5       EQU    5              RETURN REGISTER                   MAG00260
          0000 0006                26  R6       EQU    6              MOST SIG 2 BITS OF MEMMORY ADDRESS MAG00270
          0000 0007                27  R7       EQU    7              COUNTER                           MAG00280
          0000 0008                28  BSY      EQU    8              BUSY                              MAG00290
          0000 0008                29  R8       EQU    8              COMMAND BYTE STORE                MAG00300
          0000 0009                30  R9       EQU    9              SELCH ADDRESS REGISTER            MAG00310
          0000 000A                31  R10      EQU    10             SELCH COMMAND HOLD REGISTER       MAG00320
          0000 000B                32  R11      EQU    11             WORK REGISTER                     MAG00330
          0000 000C                33  R12      EQU    12             RETURN REGISTER                   MAG00340
          0000 000D                34  R13      EQU    13             INTERRUPT DEVICE REGISTER         MAG00350
          0000 000E                35  R14      EQU    14             INTERRUPT STATUS REGISTER         MAG00360
          0000 000F                36  R15      EQU    15             WORK REGISTER                     MAG00370
          0000 0010                37  TEST     EQU    X'10'          TEST=NOMOTION BIT                 MAG00380
          0000 0020                38  BOT      EQU    X'20'          TEST FOR BOT                      MAG00390
          0000 00C0                39  TERM     EQU    X'C0'          TERMINATION STATUS=X'C0'          MAG00400
0000R     07FF                     40          XHR    R15,R15        ZERO OUT REGISTER 15              MAG00410
0002R     40F0 0044                41          STH    R15,X'44'      ZERO OUT NEW PSW                  MAG00420
0006R     C8F0 00C2R               42          LHI    R15,MTINT      LOAD INTERRUPT HANDLER            MAG00430
000AR     40F0 0046                43          STH    R15,X'46'      STORE INTERRUPT HANDLER IN NEW LOC MAG00440
000ER     4830 0142R               44          LH     R3,MTADR       LOAD MAG TAPE ADDRESS             MAG00450
0012R     4890 0140R               45          LH     R9,SELCH       LOAD SELCH ADDRESS                MAG00460
0016R     DE90 014AR               46          OC     R9,STOP        STOP SELCH                        MAG00470
001AR     DE30 014BR               47  DUTEST  OC     R3,RESET       OUTPUT RESET TO MAG TAPE          MAG00480
001ER     9D34                     48          SSR    R3,R4          SENSE STATUS ON MAG TAPE          MAG00490
0020R     4210 001AR               49          BTC    DU,DUTEST      IS MAG TAPE UNAVAILABLE           MAG00500
0024R     C340 0020                50          THI    R4,BOT         TEST FOR BOT                      MAG00510
0028R     2335                     51          BZS    WRT            BRANCH TO WRITE                   MAG00520
002AR     4150 0076R               52          BAL    R5,FLMK        FILEMARK ROUTINE                  MAG00530
002ER     4150 0070R               53          BAL    R5,BAKSP       BACKSPACE ROUTINE                 MAG00540
0032R     C810 0100R               54  WRT     LHI    R1,BUFSRT      LOAD START OF BUFFER              MAG00550
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0036R  C820 0137R          55          LHI    R2,BUFEND          LOAD END OF BUFFER                          MAG00560
003AR  0766                56          XHR    R6,R6              LOAD 2 MOST SIG BITS OF MEM (0)             MAG00570
003CR  41C0 0084R          57          BAL    R12,WRITE          WRITE TO DEVICE                             MAG00580
                           58  *                                                                              MAG00590
0040R  4150 0070R          59          BAL    R5,BAKSP           BACKSPACE                                   MAG00600
0044R  0711                60          XHR    R1,R1              LOAD START OF BUFFER (0)                    MAG00610
0046R  C820 0037           61          LHI    R2,BUFEND-BUFSRT   LOAD END OF BUFFER                          MAG00620
004AR  D360 0151R          62          LB     R6,MEMSEG          LOAD 2 MOST SIG BITS OF MEM                 MAG00630
004ER  41C0 009AR          63          BAL    R12,READ           READ FROM DEVICE                            MAG00640
                           64  *                                                                              MAG00650
0052R  4150 0070R          65          BAL    R5,BAKSP           BACKSPACE                                   MAG00660
0056R  41C0 0084R          66          BAL    R12,WRITE          WRITE TO DEVICE                             MAG00670
                           67  *                                                                              MAG00680
005AR  C810 0100R          68          LHI    R1,BUFSRT          LOAD  TART OF BUFFER                        MAG00690
005ER  C820 0137R          69          LHI    R2,BUFEND          LOAD END OF BUFFER                          MAG00700
0062R  0766                70          XHR    R6,R6              LOAD 2 MOST SIG BITS OF ADR                 MAG00710
0064R  4150 0070R          71          BAL    R5,BAKSP           BACKSPACE                                   MAG00720
0068R  41C0 009AR          72          BAL    R12,READ           READ FROM DEVICE                            MAG00730
                           73  *                                                                              MAG00740
006CR  C200 013CR          74  END1    LPSW   END                                                            MAG00750
                           75  ******************************************************                        MAG00760
                           76  * SUBROUTINE: BAKSP                                                          MAG00770
                           77  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                                MAG00780
                           78  *       SEE CALLING SEQUENCE BELOW.                                           MAG00790
                           79  *                                                                             MAG00800
                           80  *  SUBROUTINE: FLMK                                                         MAG00810
                           81  *       THIS SUBROUTINE WRITES A FILEMARK                                     MAG00820
                           82  *       SEE CALLING SEQUENCE BELOW.                                           MAG00830
                           83  *                                                                             MAG00840
                           84  *                                                                             MAG00850
                           85  ******************************************************                        MAG00860
                           86  *                                                                             MAG00870
                           87  *  SUBROUTINE: NOMOT                                                        MAG00880
                           88  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                             MAG00890
                           89  *       STOP MOVING.                                                          MAG00900
                           90  *                                                                             MAG00910
                           91  *       CALLING SEQUENCE:     BAL R5,BAKSP                                    MAG00920
                           92  *       ----------------      BAL R5,FLMK                                     MAG00930
                           93  *                             BAL R5,NOMOT                                    MAG00940
                           94  *       R3=DEVICE ADDRESS REGISTER                                            MAG00950
                           95  *       R5=RETURN REGISTER                                                    MAG00960
                           96  *                                                                             MAG00970
                           97  *       WORK REGISTERS:                                                       MAG00980
                           98  *       -------------                                                         MAG00990
                           99  *       R4=DEVICE STATUS REGISTER                                             MAG01000
                          100  *                                                                             MAG01010
                          101  ******************************************************                        MAG01020
                          102  *                                                                             MAG01030
0070R  DE30 014DR         103  BAKSP   OC     R3,BKSP            OUTPUT A BACKSPACE                          MAG01040
0074R  2303               104          BS     NOMOT              BRANCH TO NOMOTION                          MAG01050
0076R  DE30 014CR         105  FLMK    OC     R3,FILMRK          OUTPUT A FILEMARK                           MAG01060
007AR  9D34               106  NOMOT   SSR    R3,R4              SENSE STATUS                                MAG01070
007CR  C340 0010          107          THI    R4,TEST            TEST FOR NO MOTION                          MAG01080
0080R  2233               108          BZS    NOMOT              SENSE AGAIN                                 MAG01090
0082R  0305               109          BR     R5                 RETURN                                      MAG01100
                          110  ******************************************************                        MAG01110
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                                    111  *                                                                    MAG01120
                                    112  *  SUBROUTINE: WRITE                                                 MAG01130
                                    113  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE              MAG01140
                                    114  *       MAG TAPE.                                                   MAG01150
                                    115  *       SEE CALLING SEQUENCE BELOW                                  MAG01160
                                    116  *                                                                   MAG01170
                                    117  *  SUBROUTINE READ                                                  MAG01180
                                    118  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE              MAG01190
                                    119  *       MAG TAPE.                                                   MAG01200
                                    120  *                                                                   MAG01210
                                    121  *       CALLING SEQUENCE:     BAL R12,WRITE                         MAG01220
                                    122  *       ----------------      BAL R12,READ                          MAG01230
                                    123  *       R1=START OF BUFFER                                          MAG01240
                                    124  *       R2=END OF BUFFER                                            MAG01250
                                    125  *       R3=DEVICE ADDRESS REIGSTER                                  MAG01260
                                    126  *       R9=SELCH ADDRESS REGISTER                                   MAG01270
                                    127  *       R12=RETURN REGISTER                                         MAG01280
                                    128  *                                                                   MAG01290
                                    129  *       WORK REGISTERS:                                             MAG01300
                                    130  *       -------------                                               MAG01310
                                    131  *       R4=STATUS REGISTER                                          MAG01320
                                    132  *       R5=NOMOTION RETURN REGISTER                                 MAG01330
                                    133  *       R7=RETRY COUNT                                              MAG01340
                                    134  *       R8=COMMAND REGISTER                                         MAG01350
                                    135  *       R10=SELCH COMMAND REGISTER                                  MAG01360
                                    136  *       R11=WORK REGISTER                                           MAG01370
                                    137  *       R13=INTERRUPT DEVICE REGISTER                               MAG01380
                                    138  *       R14=INTERRUPT STATUS REGISTER                               MAG01390
                                    139  ******************************************************              MAG01400
0084R  D380 014FR                   140  WRITE    LB     R8,WRTCMD          LOAD WRITE COMMAND              MAG01410
0088R  D3A0 0149R                   141           LB     R10,SELWRT         LOAD SELCH WRITE                MAG01420
008CR  C4A0 00FC                    142           NHI    R10,X'FC'          BITS 0-5 OF COMMAND             MAG01430
0090R  C460 0003                    143           NHI    R6,X'03'           BITS 6-7 OF COMMAND             MAG01440
0094R  06A6                         144           OHR    R10,R6             COMPOSE SELCH COMMAND           MAG01450
0096R  4300 00ACR                   145           B      RETRY              BRANCH TO RETRY                 MAG01460
                                    146  *                                                                   MAG01470
009AR  D380 0150R                   147  READ     LB     R8,RDCMD           LOAD READ COMMAND               MAG01480
009ER  D3A0 0148R                   148           LB     R10,SELRD          LOAD SELCH READ                 MAG01490
00A2R  C4A0 00FC                    149           NHI    R10,X'FC'          BITS 0-5 OF COMMAND             MAG01500
00A6R  C460 0003                    150           NHI    R6,X'03'           BITS 6-7 OF COMMAND             MAG01510
00AAR  06A6                         151           OHR    R10,R6             COMPOSE SELCH COMMAND           MAG01520
00ACR  0777                         152  RETRY    XHR    R7,R7              ZERO OUT COUNT                  MAG01530
00AER  9D34                         153  SENSE1   SSR    R3,R4              SENSE STATUS                    MAG01540
00B0R  2091                         154           BTBS   DU+BSY,SENSE1      TEST FOR BUSY+DEVICE UNAVAILABLE MAG01550
00B2R  DE90 014AR                   155           OC     R9,STOP            STOP SELCH                      MAG01560
00B6R  9891                         156           WHR    R9,R1              WRITE START OF BUFFER TO SELCH  MAG01570
00B8R  9892                         157           WHR    R9,R2              WRITE END OF BUFFER TO SELCH    MAG01580
00BAR  9E38                         158           OCR    R3,R8              OUTPUT COMMAND TO MT            MAG01590
00BCR  9E9A                         159           OCR    R9,R10             OUTPUT COMMAND TO SELCH         MAG01600
00BER  C200 0144R                   160  WAIT1    LPSW   WAIT                                               MAG01610
00C2R  9FDE                         161  MTINT    AIR    R13,R14                                            MAG01620
00C4R  DE90 014AR                   162           OC     R9,STOP            STOP THE SELCH                  MAG01630
00C8R  999B                         163           RHR    R9,R11             READ FINAL ADR. FROM SELCH      MAG01640
00CAR  DE90 014AR                   164           OC     R9,STOP            STOP THE SELCH                  MAG01650
00CER  9D34                         165           SSR    R3,R4              SENSE STATUS OF MAG TAPE        MAG01660
00D0R  C340 00C0                    166           THI    R4,TERM            TEST FOR GOOD TERMINATION       MAG01670
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 16 BIT EXTENDED SELCH (MAG TAPE & EXT INTERRUPTS)        PAGE    4

00D4R  4230 00E4R          167            BNZ     ERROR              BRANCH TO TRY AGAIN.                    MAG01680
00D8R  05B2                168            CLHR    R11,R2             TEST FOR END OF BUFFER                  MAG01690
00DAR  4230 00E4R          169            BNE     ERROR                                                      MAG01700
00DER  4150 007AR          170            BAL     R5,NOMOT           WAIT FOR TAPE TO STOP                   MAG01710
00E2R  030C                171            BR      R12                RETURN                                  MAG01720
                           172  *                                                                            MAG01730
                           173  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS          MAG01740
                           174  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS               MAG01750
                           175  *   BEFORE TERMINATING.                                                      MAG01760
                           176  *                                                                            MAG01770
00E4R  C570 0005           177  ERROR     CLHI    R7,5               TEST FOR 5 TRIES                        MAG01780
00E8R  4330 00FAR          178            BE      ERROR1             BRANCH TO ERROR1                        MAG01790
00ECR  4150 007AR          179            BAL     R5,NOMOT           WAIT FOR TAPE TO STOP                   MAG01800
00F0R  4150 0070R          180            BAL     R5,BAKSP           OUTPUT A BACKSPACE                      MAG01810
00F4R  2671                181            AIS     R7,1               ADD ONE TO COUNT                        MAG01820
00F6R  4300 00AER          182            B       SENSE1             BRANCH TO SENSE1                        MAG01830
00FAR  C200 0138R          183  ERROR1    LPSW    ERROR2                                                     MAG01840
0100R                      184            ALIGN   4                  ALIGN START OF BUFFER                   MAG01850
                           185  *                                     ON HALFWORD BOUNDARY                    MAG01860
0100R  0123                186  BUFSRT    DC      X'0123',X'4567'                                            MAG01870
0102R  4567
0104R  89AB                187            DC      X'89AB',X'CDEF'                                            MAG01880
0106R  CDEF
0108R  0123                188            DC      X'0123',X'4567'                                            MAG01890
010AR  4567
010CR  89AB                189            DC      X'89AB',X'CDEF'                                            MAG01900
010ER  CDEF
0110R  0123                190            DC      X'0123',X'4567'                                            MAG01910
0112R  4567
0114R  89AB                191            DC      X'89AB',X'CDEF'                                            MAG01920
0116R  CDEF
0118R  0123                192            DC      X'0123',X'4567'                                            MAG01930
011AR  4567
011CR  89AB                193            DC      X'89AB',X'CDEF'                                            MAG01940
011ER  CDEF
0120R  0123                194            DC      X'0123',X'4567'                                            MAG01950
0122R  4567
0124R  89AB                195            DC      X'89AB',X'CDEF'                                            MAG01960
0126R  CDEF
0128R  0123                196            DC      X'0123',X'4567'                                            MAG01970
012AR  4567
012CR  89AB                197            DC      X'89AB',X'CDEF'                                            MAG01980
012ER  CDEF
0130R  0123                198            DC      X'0123',X'4567'                                            MAG01990
0132R  4567
0134R  89AB                199            DC      X'89AB',X'CDEF'                                            MAG02000
0136R  CDEF
       0000 0137R          200  BUFEND    EQU     *-1                                                        MAG02010
0138R  8000                201  ERROR2    DC      X'8000',A(ERROR1)                                          MAG02020
013AR  00FAR
013CR  8000                202  END       DC      X'8000'                                                    MAG02030
013ER  006CR               203            DC      A(END1)                                                    MAG02040
0140R  00F0                204  SELCH     DC      X'F0'              SELECTOR CHANNEL ADDRESS                MAG02050
0142R  0085                205  MTADR     DC      X'85'              MAG TAPE ADDRESS                        MAG02060
0144R  C000                206  WAIT      DC      X'C000'            PUT PROCESSOR IN WAIT STATE             MAG02070
0146R  00BER               207            DC      WAIT1              WITH EXTERNAL INTERRUPTS ENABLED        MAG02080
```

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16 BIT EXTENDED SELCH (MAG TAPE & EXT INTERRUPTS)        PAGE    5

0148R  30                208  SELRD    DB      X'30'          SELCH READ COMMAND                  MAG02090
0149R  10                209  SELWRT   DB      X'10'          SELCH WRITE COMMAND                 MAG02100
014AR  08                210  STOP     DB      X'08'          SELCH STOP COMMAND                  MAG02110
014BR  E0                211  RESET    DB      X'E0'          RESET COMMAND                       MAG02120
014CR  30                212  FILMRK   DB      X'30'          FILEMARK COMMAND                    MAG02130
014DR  11                213  BKSP     DB      X'11'          BACKSPACE COMMAND                   MAG02140
014ER  38                214  REWIND   DB      X'38'          REWIND COMMAND                      MAG02150
014FR  22                215  WRTCMD   DB      X'22'          WRITE COMMAND FOR MAG TAPE          MAG02160
0150R  21                216  RDCMD    DB      X'21'          READ COMMAND FOR MAG TAPE           MAG02170
0151R  01                217  MEMSEG   DB      X'01'          MEMORY SEGMENT 1                    MAG02180
0152R                    218           END                                                        MAG02190
```

16 BIT EXTENDED SELCH (MAG TAPE & EXT INTERRUPTS) PAGE 6

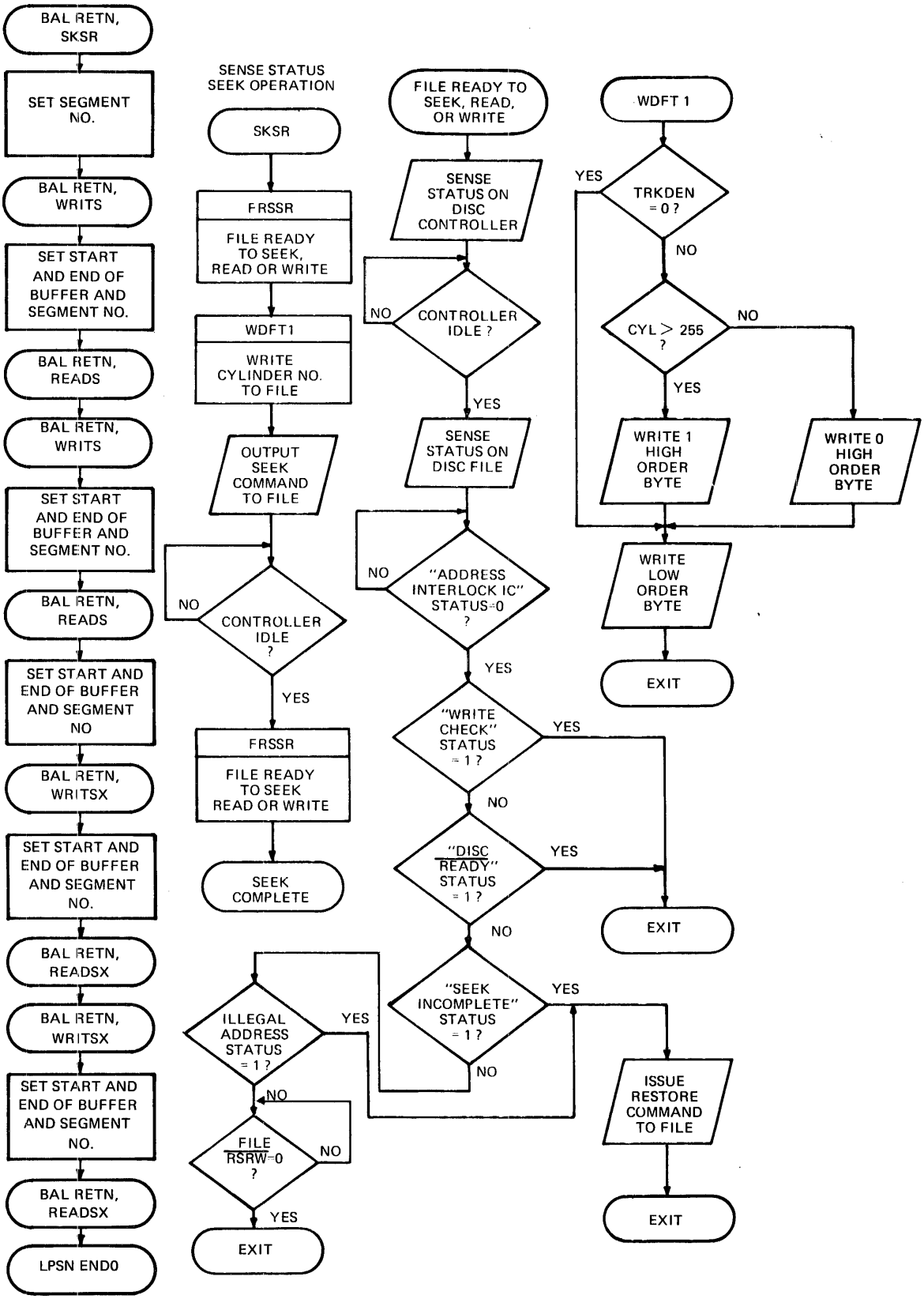
NO ERRORS 0 SQUEZ PASSES

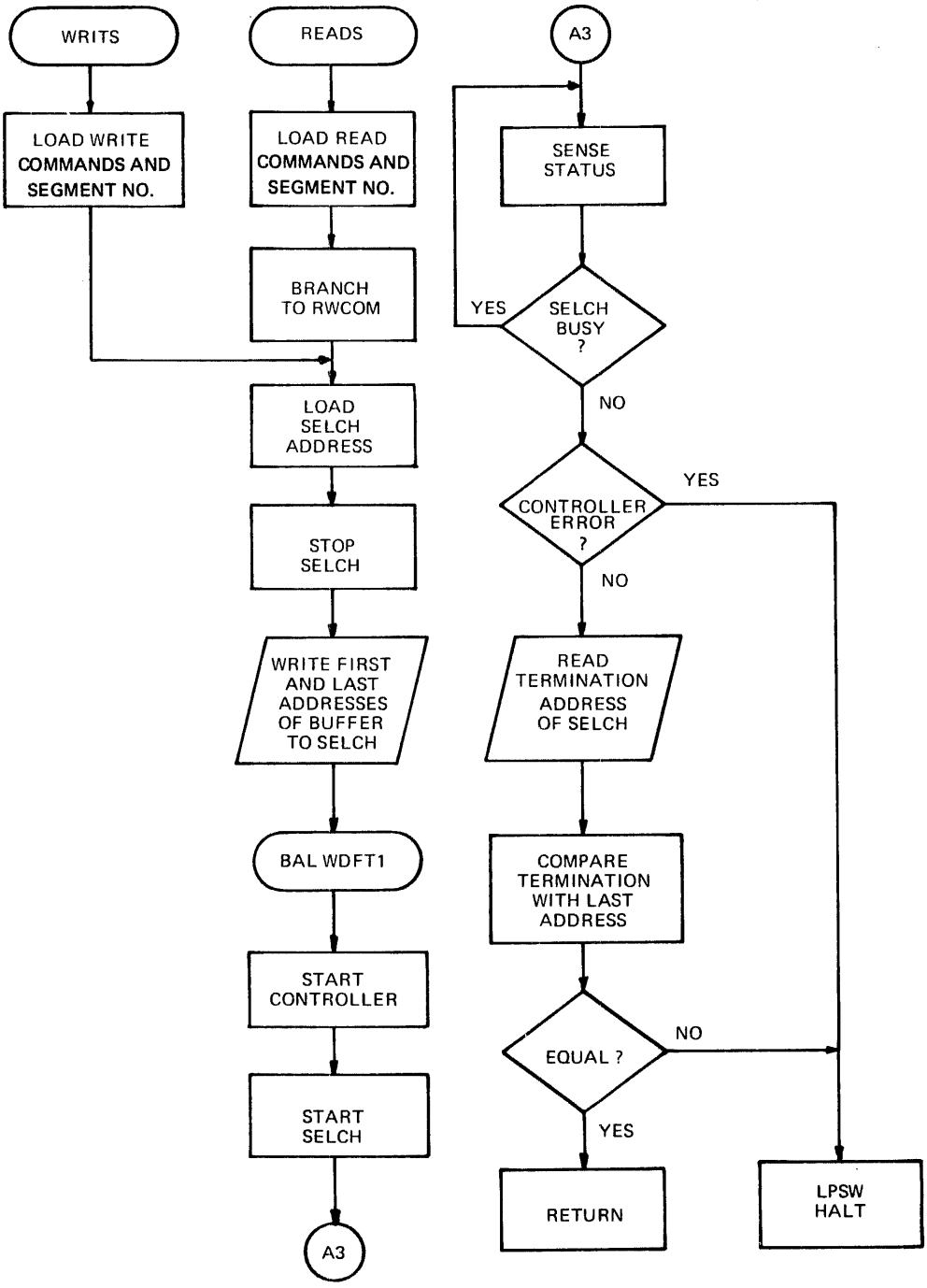
CAL 04-01

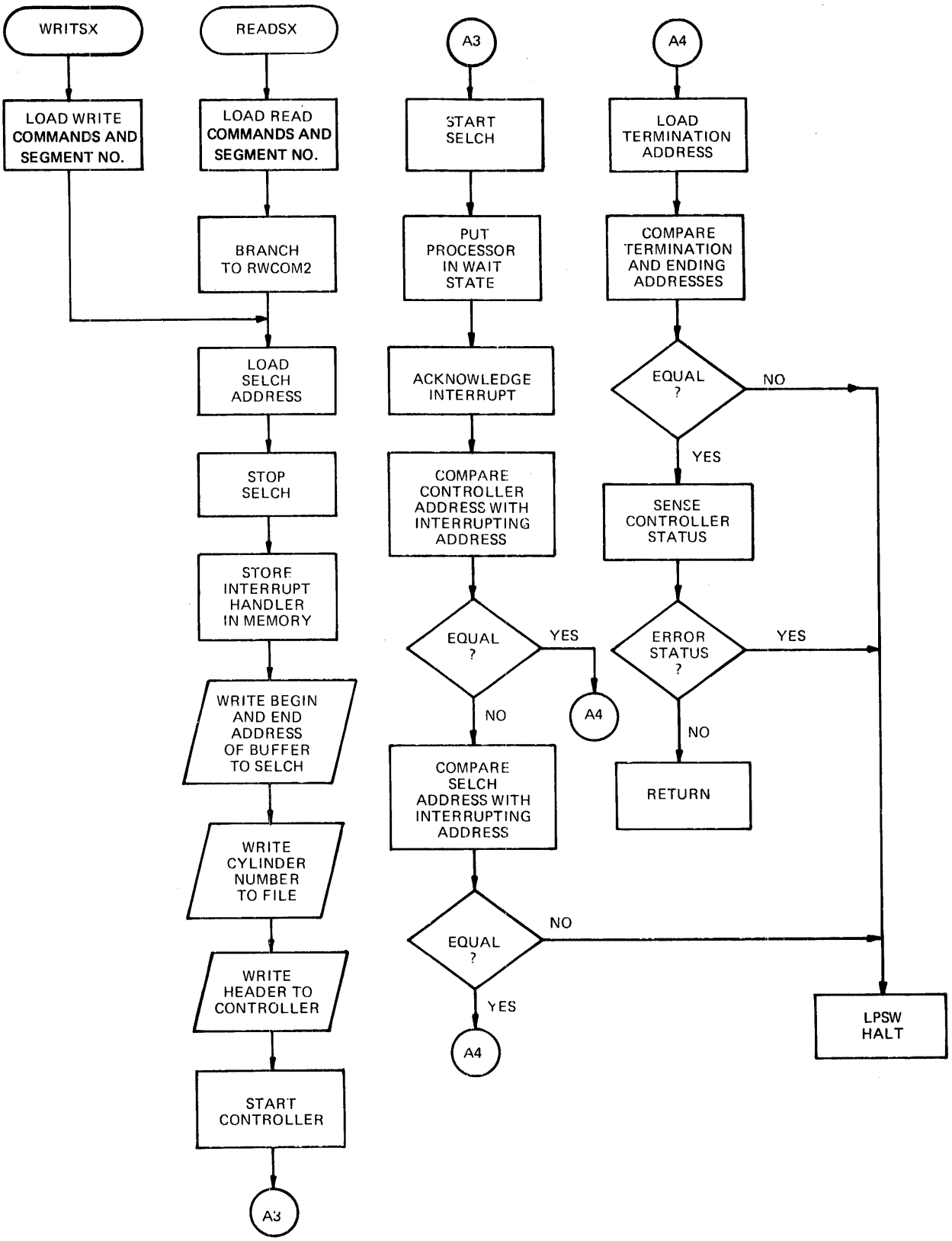
ABSTOP	0000									
ADC	0002									
BAKSP	0070R	53	59	65	71	180				
BKSP	014DR	103								
BOT	0020	50								
BSY	0008	154								
BUFEND	0137R	55	61	69						
BUFSRT	0100R	54	61	68						
DU	0001	49	154							
DUTEST	001AR	49								
END	013CR	74								
END1	006CR	203								
ERROR	00E4R	167	169							
ERROR1	00FAR	178	201							
ERROR2	0138R	183								
FILMRK	014CR	105								
FLMK	0076R	52								
IMPTOP	0152R									
LADC	0001									
MEMSEG	0151R	62								
MTADR	0142R	44								
MTINT	00C2R	42								
NOMOT	007AR	104	108	170	179					
PURETOP	0000R									
R1	0001	54	60	60	68	156				
R10	000A	141	142	144	148	149	151	159		
R11	000B	163	168							
R12	000C	57	63	66	72	171				
R13	000D	161								
R14	000E	161								
R15	000F	40	40	41	42	43				
R2	0002	55	61	69	157	168				
R3	0003	44	47	48	103	105	106	153	158	165
R4	0004	48	50	106	107	153	165	166		
R5	0005	52	53	59	65	71	109	170	179	180
R6	0006	56	56	62	70	70	143	144	150	151
R7	0007	152	152	177	181					
R8	0008	140	147	158						
R9	0009	45	46	155	156	157	159	162	163	164
RDCMD	0150R	147								
READ	009AR	63	72							
RESET	014BR	47								
RETRY	00ACR	145								
REWIND	014ER									
SELCH	0140R	45								
SELRD	0148R	148								
SELWRT	0149R	141								
SENSE1	00AER	154	182							
STOP	014AR	46	155	162	164					
TERM	00C0	166								
TEST	0010	107								
WAIT	0144R	160								

WAIT1	00BER	207	
WRITE	0084R	57	66
WRT	0032R	51	
WRTCMD	014FR	140	

APPENDIX 3
16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT)




WRITS
READS
A3
LOAD WRITE COMMANDS AND SEGMENT NO.
LOAD READ COMMANDS AND SEGMENT NO.
SENSE STATUS
BRANCH TO RWCOM
YES
SELCH BUSY ?
NO
LOAD SELCH ADDRESS
CONTROLLER ERROR ?
YES
STOP SELCH
NO
WRITE FIRST AND LAST ADDRESSES OF BUFFER TO SELCH
READ TERMINATION ADDRESS OF SELCH
BAL WDFT1
COMPARE TERMINATION WITH LAST ADDRESS
START CONTROLLER
EQUAL ?
NO
START SELCH
YES
RETURN
LPSW HALT
A3


WRITSX
READSX
A3
A4
LOAD WRITE COMMANDS AND SEGMENT NO.
LOAD READ COMMANDS AND SEGMENT NO.
START SELCH
LOAD TERMINATION ADDRESS
BRANCH TO RWCOM2
PUT PROCESSOR IN WAIT STATE
COMPARE TERMINATION AND ENDING ADDRESSES
LOAD SELCH ADDRESS
ACKNOWLEDGE INTERRUPT
EQUAL ?
NO
YES
STOP SELCH
COMPARE CONTROLLER ADDRESS WITH INTERRUPTING ADDRESS
SENSE CONTROLLER STATUS
STORE INTERRUPT HANDLER IN MEMORY
EQUAL ?
YES
ERROR STATUS ?
YES
A4
NO
NO
WRITE BEGIN AND END ADDRESS OF BUFFER TO SELCH
COMPARE SELCH ADDRESS WITH INTERRUPTING ADDRESS
RETURN
WRITE CYLINDER NUMBER TO FILE
EQUAL ?
NO
WRITE HEADER TO CONTROLLER
YES
LPSW HALT
START CONTROLLER
A4
A3

```
      16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT) PAGE   1

PROG= ESELDI      ASSEMBLED BY CAL 03-066R04-01 (16-BIT)

                                    1           SCRAT
                                    2           CROSS
                                    3           TARGT  16
                                    4           WIDTH  120
                                    5  * THE FIRST PART OF THIS PROGRAM PERFORMS WRITE AND READ
                                    6  * OPERATIONS WITH THE SELCH USING SENSE STATUS LOOPS.
                                    7  *
                                    8  * THE SECOND PART OF THIS PROGRAM PERFORMS WRITE AND READ
                                    9  * OPERATIONS WITH THE SELCH USING INTERRUPTS CONTROL.
                                   10  *
                                   11  * IN BOTH CASES, DATA IS TRANSFERRED FROM MEMORY SEGMENT
                                   12  * ZERO (0) TO MEMORY SEGMENT ONE (1) AND BACK AGAIN.
                                   13  *
                0000 0000          14  R0        EQU    0
                0000 0001          15  R1        EQU    1
                0000 0001          16  MEMSEG    EQU    1              MEMORY SEGMENT NO.
                0000 0004          17  SLAD      EQU    4              SELCH ADDRESS
                0000 0005          18  FUT       EQU    5              FILE ADDRESS
                0000 0006          19  WK0       EQU    6              WORK REGISTER 0
                0000 0007          20  WK1       EQU    7              WORK REGISTER 1
                0000 0008          21  WK2       EQU    8              WORK REGISTER 2
                0000 0009          22  WK3       EQU    9              WORK REGISTER 3
                0000 000B          23  TRACK     EQU    11
                0000 000D          24  STAT      EQU    13             DEVICE STATUS
                0000 000E          25  RETN2     EQU    14             RETURN REGISTER 2
                0000 000F          26  RETN      EQU    15             RETURN REGISTER 1
                0000 000F          27  R15       EQU    15
                0000 000A          28  DCAD      EQU    10             DISC CONTROLLER ADDRESS
                0000 000C          29  SECT      EQU    12             DISC SECTOR NUMBER
                0000 0008          30  SLCHBSY   EQU    8              SELCH BUSY STATUS
                0000 0002          31  CONTIDLE  EQU    2              DISC CONTROLLER IDLE
                0000 0010          32  ADRINTLK  EQU    X'10'          FILE ADDR INTLK STATUS
                0000 0043          33  FLUNRECV  EQU    X'43'          WRTCHK+SEEKING+DISCNTRDY (FILE STAT)
                0000 0008          34  RSRWT     EQU    8              FILE READY TO SEEK,READ,OR WRITE
                0000 0005          35  CNTUNREC  EQU    5              EX+DATATRNSERERR (CONT STAT)
                0000 0080          36  OVERRUN   EQU    X'80'          CONTROLLER OVERRUN STATUS
                0000 0044          37  NEWPSWST  EQU    X'44'          EXTERNAL INT. NEW PSW STAT
                0000 0046          38  NEWPSWLC  EQU    X'46'          EXTERNAL INT NEW PSW LOC.
0000R  41F0 0070R                  39          BAL    RETN,SKSR
0004R  0711                        40          XHR    R1,R1          MEMORY SEGMENT 0
0006R  41F0 00E4R                  41          BAL    RETN,WRITS     WRITE TO DEVICE
000AR  07FF                        42          XHR    R15,R15
000CR  40F0 022ER                  43          STH    R15,SA         START ADR 0
0010R  C8F0 0037                   44          LHI    R15,SAFA       GET BUFFER SIZE
0014R  40F0 0230R                  45          STH    R15,FA         FINAL ADR
0018R  2411                        46          LIS    MEMSEG,1       MEMORY SEGMENT 1
001AR  41F0 00D4R                  47          BAL    RETN,READS     READ FROM DEVICE
001ER  41F0 00E4R                  48          BAL    RETN,WRITS     WRITE TO DEVICE
0022R  C8F0 01D4R                  49          LHI    R15,BUFSRT     START ADR
0026R  40F0 022ER                  50          STH    R15,SA
002AR  C8F0 020BR                  51          LHI    R15,BUFEND     END ADR
002ER  40F0 0230R                  52          STH    R15,FA
0032R  0711                        53          XHR    R1,R1          MEMORY SEGMENT 1
0034R  41F0 00D4R                  54          BAL    RETN,READS
```

```
                                55  *
                                56  * INTERRUPT CONTROL
                                57  *
0038R  0711                     58          XHR     R1,R1               MEMORY MODULE 0
003AR  41F0 014ER               59          BAL     RETN,WRITSX         WRITE TO DEVICE
003ER  07FF                     60          XHR     R15,R15
0040R  40F0 022ER               61          STH     R15,SA              START ADR 0
0044R  C8F0 0037                62          LHI     R15,SAFA            GET BUFFER SIZE
0048R  40F0 0230R               63          STH     R15,FA              FINAL ADR
004CR  2411                     64          LIS     MEMSEG,1            MEMORY SEGMENT 1
004ER  41F0 013CR               65          BAL     RETN,READSX         READ FROM DEVICE
0052R  41F0 014ER               66          BAL     RETN,WRITSX         WRITE TO DEVICE
0056R  C8F0 01D4R               67          LHI     R15,BUFSRT          START AADR
005AR  40F0 022ER               68          STH     R15,SA
005ER  C8F0 020BR               69          LHI     R15,BUFEND          END ADR
0062R  40F0 0230R               70          STH     R15,FA
0066R  0711                     71          XHR     R1,R1               MEMORY MODULE 0
0068R  41F0 013CR               72          BAL     RETN,READSX         READ FROM DEVICE
006CR  C200 020CR               73  EOP     LPSW    ENDO
                                74  * SUBROUTINE: SENSE STATUS SEEK
                                75  * FUNCTION:PERFORMS SENSE STATUS SEEK OPERATIONS
                                76  * CALLING SEQUENCE: BAL REIN,SKSR
                                77  * INPUT
                                78  * REGISTERS: TRACK= DESTRED CYLINDER NUMBER
                                79  *            FUT= FILE ADDRESS
                                80  *            SLAD= SELCH ADDRESS
                                81  *            DCAD= DISC CONTROLLER ADDRESS
                                82  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED
                                83  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED
0070R  07CC                     84  SKSR    XHR     SECT,SECT           REGISTER SECT IS DESTROYED
0072R  41E0 0084R               85          BAL     RETN2,FRSSR         FILE READY TO SEEK,READ,WRITE SEQ
0076R  41E0 00AER               86          BAL     RETN2,WDFT1         WRITE CYLINDER NUMBER TO FILE
007AR  DE50 0210R               87          OC      FUT,SEEKC           OUTPUT SEEK COMMAND (INPTS DISARMD)
007ER  41E0 0084R               88          BAL     RETN2,FRSSR         WAIT FOR SEEK COMPLETE W/ GOOD STAT
0082R  030F                     89          BR      RETN                RETURN TO USER
                                90  *
                                91  *
                                92  *SUBROUTINE: FILE READY TO SEEK,READ OR WRITE
                                93  *FUNCTION: PERFORMS NECESSARY STATUS CHECK ON CONTROLLER AND FILE TO
                                94  *          INSURE CORRECT FILE OPERATION
                                95  * CALLING SEQUENCE: BAL RETN2,FRSSR
                                96  * INPUT
                                97  * REGISTERS: FUT= FILE ADDRESS
                                98  *            SLAD= SELCH ADDRESS
                                99  *            DCAD= CONTROLLER ADDRESS
0084R  48A0 0222R              100  FRSSR   LH      DCAD,DISCONAD
0088R  9DAD                    101          SSR     DCAD,STAT
008AR  4320 0084R              102          BFC     CONTIDLE,FRSSR      IF CONTROLLER NOT IDLE WAIT
008ER  4850 0224R              103          LH      FUT,FOT
0092R  9D5D                    104          SSR     FUT,STAT            SENSE FILE STATUS
0094R  C3D0 0010               105          THI     STAT,ADRINTLK       TEST FILE STATUS FOR ADRINTLK=0
0098R  4230 0084R              106          BNZ     FRSSR               ADRINTLK=1 WAIT FOR IT TO GO TO ZERO
009CR  C3D0 0043               107          THI     STAT,FLUNRECV       UNRECOVERABLE FILE ERROR
00A0R  4230 01CER              108          BNZ     ERRSTOP             ABORT THE OPERATION
                               109  * AT THIS POINT USER COULD ATTEMPT TO CORRECT SEEK INCOMPLETE STATUS
                               110  * BY ISSUING A RESTORE COMMAND AND REPEATING THE DESIRED SEEK
```

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16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT) PAGE   3

00A4R  C3D0 0008          111  FRSSR1   THI    STAT,RSRWT        FILE RSWRT=1
00A8R  4230 00A4R         112           BNZ    FRSSR1            IF YES WAIT FOR RSRWT=0
00ACR  030E               113           BR     RETN2             RETURN
                          114  *
                          115  *
                          116  * SUBROUTINE: WRITE CYLINDER NUMBER TO THE FILE
                          117  * FUNCTION: WRITE CYLINDER # TO THE DISC FILE
                          118  * CALLING SEQUENCE: BAL RETN2,WDFT1
                          119  * INPUT
                          120  * REGISTERS: TRACK=DESIRED BYLINDER NUMBER
                          121  *            FUT=FILE ADDRESS
                          122  *            SLAD=SELCH ADDRESS
                          123  *            DCAD=DISC CONTROLLER ADDRESS
                          124  *            R0=ZERO UPON ENTRY TO ROUTINE
                          125  * NOTE: IF LOCATION TRKDEN=0, A 2.5 MEGABYTE DRIVE IS ASSUMED
                          126  *       IF LOCATION TRKDEN=1, A 10 MEGABYTE DRIVE IS ASSUMED
00AER  4500 0228R         127  WDFT1    CLH    R0,TRKDEN         TRACK DENSITY=0
00B2R  4330 00D0R         128           BE     WDFT1A            YES- ASSUME 2.5 DRIVE GO TO WDFT1A
00B6R  C5B0 0100          129           CLHI   TRACK,256         CYLINDER NUMBER= OR > 256
00BAR  4380 00D0R         130           BNL    WDFT1A            YES- SET MSB IN CONTROLLER AT WDFT0
00BER  48B0 0226R         131           LH     TRACK,TROCK
00C2R  4850 0224R         132           LH     FUT,FOT
00C6R  DA50 022AR         133           WD     FUT,ZERO
00CAR  2303               134           BS     WDFT1A
00CCR  DA50 022BR         135  WDFT0    WD     FUT,ONE           IF THE DESIRED DRIVE IS A 10 MB TOP
00D0R  9A5B               136  WDFT1A   WDR    FUT,TRACK         OR BOTTOM AND THE DESIRED SEEK IS TO
00D2R  030E               137           BR     RETN2             A CYLINDER > 256 THEN A HALFWORD
                          138  *                                 MUST BE WRITTEN TO THE DRIVE TO
                          139  *                                 INSURE THAT THE CORRECT CYLINDER
                          140  *                                 NUMBER IS WRITTEN TO THE FILE
                          141  * SUBROUTINE: READ/WRITE(SENSE STATUS CONTROL)
                          142  * FUNCTION: PERFORMS SENSE STATUS READ/WRITE OPERATION TO DISC
                          143  * CALLING SEQUENCE FOR READ: BAL RETN,READS
                          144  * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITS
                          145  * INPUT
                          146  * REGISTERS: FUT=FILE ADDRESS
                          147  *            DCADE= DISC CONTROLLER ADDRESS
                          148  *            SLADE= SELCH ADDRESS
                          149  *            TRACK=CYLINDER ADDRESS
                          150  *            SECT= DESIRED SECTOR
                          151  * MEMORY LOCATIONS: HEAD=DESIRED HEAD
                          152  *                   SA= STARTING BUFFER ADDRESS
                          153  *                   FA= ENDING BUFFER ADDRESS
00D4R  D370 0211R         154  READS    LB     WK1,RCMD          DISC READ COMMAND
00D8R  C880 0030          155           LHI    WK2,X'30'         SELCH READ/GO COMMAND
00DCR  C410 0003          156           NHI    MEMSEG,X'03'      BITS 6,7 ONLY
00E0R  0681               157           OHR    WK2,MEMSEG        ADD MEMORY SEGMENT
00E2R  2308               158           BS     RWCOM
00E4R  D370 0212R         159  WRITS    LB     WK1,WCMD          DISC WRITE COMMAND
00E8R  C880 0010          160           LHI    WK2,X'10'         SELCH WRITE COMMAND
00ECR  C410 0003          161           NHI    MEMSEG,X'03'      BITS 6,7 ONLY
00F0R  0681               162           OHR    WK2,MEMSEG        ADD MEMORY SEGMENT.
00F2R  4840 022CR         163  RWCOM    LH     SLAD,SELAD1       LOAD SELCH ADDRESS
00F6R  DE40 021AR         164           OC     SLAD,STOP         STOP SELCH, IDLE
00FAR  D840 022ER         165           W4     SLAD,SA           WRITE BEGINNING ADDRESS TO SELCH
00FER  D840 0230R         166           WH     SLAD,FA           WRITE ENDING ADDRESS TO SELCH
```

```
0102R  41E0 00AER        167           BAL    RETN2,WDFT1       WRITE THE CYLINDER NUMBER TO FILE
0106R  4890 021CR        168           LH     WK3,HEAD
010AR  9195              169           SLLS   WK3,5
010CR  080C              170           LHR    R0,SECT
010ER  0609              171           OHR    R0,WK3
0110R  9AA0              172           WDR    DCAD,R0           WRITE HEADER TO CONTROLLER
0112R  9EA7              173           OCR    DCAD,WK1          START CONTROLLER
0114R  9E48              174           OCR    SLAD,WK2          START THE SELCH
0116R  9D4D              175  DXTL     SSR    SLAD,STAT         SENSE SELCH STATUS
0118R  4280 0116R        176           BTC    SLCHBSY,DXTL      WAIT FOR SELCH TO COMPLETE
011CR  DE40 021AR        177           OC     SLAD,STOP         STOP THE SELCH- SELCH IDLE
0120R  9DAD              178  DXTL1    SSR    DCAD,STAT         SENSE CONTROLLER STATUS
0122R  4320 0120R        179           BFC    CONTIDLE,DXTL1    WAIT FOR CONTROLLER TO GO IDLE
0126R  4250 01CER        180           BTC    CNTUNREC,ERRSTOP  BRANCH IF CONTROLLER ERROR
012AR  D940 0232R        181           RH     SLAD,SELAD        GET THE SELCH TERMINATION ADDRESS
012ER  4860 0232R        182           LH     WK0,SELAD         COMPARE SELCH TERMINAL ADDRESS
0132R  4560 0230R        183           CLH    WK0,FA            TO SELCH ENDING ADDRESS
0136R  4230 01CER        184           BNE    ERRSTOP           IF NOT EQUAL, GO TO ERRSTOP
013AR  030F              185           BR     RETN              RETURN TO NEXT BAL STATEMENT
                         186  * SUBROUTINE: READ/WRITE (INTERRUPT CONTROL)
                         187  * FUNCTION: PERFORMS INTERRUPT READ/WRITE OPERATION TO DISC)
                         188  * CALLING SEQUENCE FOR READ: BAL RETN,READX
                         189  * CALLING SEQUENCE FOR WRITE: BAL RETN,WRITX
                         190  * INPUT
                         191  * REGISTERS: FUT=FILE ADDRESS
                         192  *            DCAD=DISC CONTROLLER ADDRESS
                         193  *            SLAD=SELCH ADDRESS
                         194  *            TRACK=CYLINDER ADDRESS
                         195  *         SECT= DESIRED SECTOR
                         196  * REGISTERS DESTROYED: NONE
013CR  D370 0213R        197  READSX   LB     WK1,RCMDX         LOAD CONTROLLER READ COMMAND
0140R  C880 0030         198           LHI    WK2,X'30'         SELCH READ/GO COMMAND
0144R  C410 0003         199           NHI    MEMSEG,X'03'      BITS 6,7 ONLY
0148R  0681              200           OHR    WK2,MEMSEG        ADD MEMORY SEGMENT
014AR  4300 015CR        201           B      RWCOM2
014ER  D370 0214R        202  WRITSX   LB     WK1,WCMDX         LOAD CONTROLLER WRITE COMMAND
0152R  C880 0010         203           LHI    WK2,X'10'         SELCH WRITE COMMAND
0156R  C410 0003         204           NHI    MEMSEG,X'03'      BITS 6,7 ONLY
015AR  0681              205           OHR    WK2,MEMSEG        ADD MEMORY SEGMENT
015CR  4840 022CR        206  RWCOM2   LH     SLAD,SELAD1       LOAD SELCH ADDRESS
0160R  DE40 021AR        207           OC     SLAD,STOP         STOP SELCH, SELCH IDLE
0164R  0766              208           XHR    WK0,WK0           CLEAR WORK REGISTER
0166R  4060 0044         209           STH    WK0,NEWPSWST      ZERO NEW PSW STATUS
016AR  C860 0192R        210           LHI    WK0,SELCHNT1      GET THE INTERRUPT HANDLING ADDR
016ER  4060 0046         211           STH    WK0,NEWPSWLC      STORE IT IN THE NEW PSWLOC
0172R  D840 022ER        212           WH     SLAD,SA           WRITE BEGINNING ADDRESS TO SELCH
0176R  D840 0230R        213           WH     SLAD,FA           WRITE ENDING ADDRESS TO SELCH
017AR  41E0 00AER        214           BAL    RETN2,WDFT1       WRITE THE CYLINDER NUMBER TO FILE
017ER  4890 021CR        215           LH     WK3,HEAD
0182R  9195              216           SLLS   WK3,5
0184R  080C              217           LHR    R0,SECT
0186R  0609              218           OHR    R0,WK3
0188R  9AA0              219           WDR    DCAD,R0           WRITE HEADER TO CONTROLLER
018AR  9EA7              220           OCR    DCAD,WK1          START CONTROLLER
018CR  9E48              221           OCR    SLAD,WK2          START SELCH
018ER  C200 021ER        222  WAIT     LPSW   WAIT1             WAIT FOR INTERRUPT
```

```
0192R  9F6D
0194R  056A
0196R  4330 01BAR
019AR  0564
019CR  4230 01CER
01A0R  DE40 021AR
01A4R  D940 0234R
01A8R  DE40 021AR
01ACR  9DAD
01AER  C3D0 0080
01B2R  4230 01BAR
01B6R  4300 018ER
01BAR  4860 0234R
01BER  4560 0230R
01C2R  4230 01CER
01C6R  9DAD
01C8R  4250 01CER
01CCR  030F
01CER  C200 0216R
01D4R

01D4R  0123
01D6R  4567
01D8R  89AB
01DAR  CDEF
01DCR  0123
01DER  4567
01E0R  89AB
01E2R  CDEF
01E4R  0123
01E6R  4567
01E8R  89AB
01EAR  CDEF
01ECR  0123
01EER  4567
01F0R  89AB
01F2R  CDEF
01F4R  0123
01F6R  4567
01F8R  89AB
01FAR  CDEF
01FCR  0123
01FER  4567
0200R  89AB
0202R  CDEF
0204R  0123
0206R  4567
0208R  89AB
020AR  CDEF
       0000 020BR
       0000 0037
020CR  8000
020ER  006CR
0210R  C2
0211R  01
```

```
223  *SELCH INTERRUPT ENTERS BELOW:
224  SELCHNT1 ACKR   WK0,STAT     ACKNOWLEDGE INTERRUPT
225           CLHR   WK0,DCAD     CONTROLLER INTERRUPTING?
226           BE     CNTRLINT     IF YES GO SERVICE IT
227           CLHR   WK0,SLAD     IF SELCH SERVICE IT
228           BNE    ERRSTOP      IF NEITHER STOP IN ERROR
229           OC     SLAD,STOP    STOP THE SELCH- SELCH IDLE
230           RH     SLAD,FADR    READ FINAL SELCH ADDRESS
231           OC     SLAD,STOP
232           SSR    DCAD,STAT    SENSE CONTROLLER STATUS
233           THI    STAT,OVERRUN IF CONTROLLER OVERRUN STATUS IS SET
234           BNZ    CNTRLINT     DO NOT EXPECT CONTROLLER INTERRUPT
235           B      WAIT         BRA TO WAIT FOR CONTROLLER INTERRUPT
236  CNTRLINT LH     WK0,FADR     GET THE FINAL ADDRESS
237           CLH    WK0,FA       COMPARE EXPECTED FINAL WITH THE LAST    ADDRESS
238           BNE    ERRSTOP      IF NOT EQUAL GO TO ERROR
239           SSR    DCAD,STAT    SENSE CONTROLLER STATUS
240           BTC    CNTUNREC,ERRSTOP IF OK EXIT OTHERWISE
241           BR     RETN         RETURN TO NEXT BAL STATEMENT OR EOP
242  ERRSTOP  LPSW   HALT         IF ERROR, THEN HALT PROCESSOR
243           ALIGN  4            ALIGN START OF BUFFER
244  *                           ON HALFWORD BOUNDARY
245  BUFSRT   DC     X'0123',X'4567'
246           DC     X'89AB',X'CDEF'
247           DC     X'0123',X'4567'
248           DC     X'89AB',X'CDEF'
249           DC     X'0123',X'4567'
250           DC     X'89AB',X'CDEF'
251           DC     X'0123',X'4567'
252           DC     X'89AB',X'CDEF'
253           DC     X'0123',X'4567'
254           DC     X'89AB',X'CDEF'
255           DC     X'0123',X'4567'
256           DC     X'89AB',X'CDEF'
257           DC     X'0123',X'4567'
258           DC     X'89AB',X'CDEF'
259  BUFEND   EQU    *-1
260  SAFA     EQU    BUFEND-BUFSRT
261  ENDO     DC     X'8000'
262           DC     Z(EOP)
263  SEEKC    DB     X'C2'        SEEK COMMAND
264  RCMD     DB     X'01'
```

```
16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT) PAGE   6

0212R  02                265  WCMD      DB      X'02'
0213R  41                266  RCMDX     DB      X'41'
0214R  42                267  WCMDX     DB      X'42'
0216R  8000              268  HALT      DC      X'8000'
0218R  01CER             269            DC      Z(ERRSTOP)
021AR  08                270  STOP      DB      X'08'            SELCH STOP COMMAND
021CR  0000              271  HEAD      DC      X'0'
021ER  C000              272  WAIT1     DC      X'C000'
0220R  018ER             273            DC      Z(WAIT)
0222R  00B6              274  DISCONAD  DC      X'B6'            DISC CONTROLLER ADDR.
0224R  00C6              275  FOT       DC      X'C6'
0226R  0004              276  TROCK     DC      X'04'
0228R  0000              277  TRKDEN    DC      X'0'             TRACK DENSITY USED IN SENSE ST SK
022AR  00                278  ZERO      DB      0                ZERO CONSTANT
022BR  01                279  ONE       DB      1                ONE CONSTANT
022CR  00F0              280  SELAD1    DC      X'F0'            SELCH ADDRESS
                         281  *
022ER  01D4R             282  SA        DC      A(BUFSRT)
0230R  020BR             283  FA        DC      A(BUFEND)
0232R  0000              284  SELAD     DC      X'0'             FINAL SELCH TERMINATION ADDRESS
0234R  0000              285  FADR      DC      X'0'             FINAL BUFFER ADDRESS
                         286  *
0236R                    287            ALIGN   2
0236R                    288  REGSAVE   DSH     16               REG SAVE AREA FOR REG SET
0256R                    289            END
```

16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT) PAGE 7

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	0000												
ADC	0002												
ADRINTLK	0010	105											
BUFEND	020BR	51	69	260	283								
BUFSRT	01D4R	49	67	260	282								
CNTRLINT	01BAR	226	234										
CNTUNREC	0005	180	240										
CONTIDLE	0002	102	179										
DCAD	000A	100	101	172	173	178	219	220	225	232	239		
DISCONAD	0222R	100											
DXTL	0116R	176											
DXTL1	0120R	179											
ENDO	020CR	73											
EOP	006CR	262											
ERRSTOP	01CER	108	180	184	228	238	240	269					
FA	0230R	45	52	63	70	166	183	213	237				
FADR	0234R	230	236										
FLUNRECV	0043	107											
FOT	0224R	103	132										
FRSSR	0084R	85	88	102	106								
FRSSR1	00A4R	112											
FUT	0005	87	103	104	132	133	135	136					
HALT	0216R	242											
HEAD	021CR	168	215										
IMPTOP	0256R												
LADC	0001												
MEMSEG	0001	46	64	156	157	161	162	199	200	204	205		
NEWPSWLC	0046	211											
NEWPSWST	0044	209											
ONE	022BR	135											
OVERRUN	0080	233											
PURETOP	0000R												
R0	0000	127	170	171	172	217	218	219					
R1	0001	40	40	53	53	58	58	71	71				
R15	000F	42	42	43	44	45	49	50	51	52	60	60	61 62
		63	67	68	69	70							
RCMD	0211R	154											
RCMDX	0213R	197											
READS	00D4R	47	54										
READSX	013CR	65	72										
REGSAVE	0236R												
RETN	000F	39	41	47	48	54	59	65	66	72	89	185	241
RETN2	000E	85	86	88	113	137	167	214					
RSRWT	0008	111											
RWCOM	00F2R	158											
RWCOM2	015CR	201											
SA	022ER	43	50	61	68	165	212						
SAFA	0037	44	62										
SECT	000C	84	84	170	217								
SEEKC	0210R	87											
SELAD	0232R	181	182										
SELAD1	022CR	163	206										

16 BIT EXTENDED SELCH (DISC WITH SENSE STATUS & EXT INT) PAGE 8

SELCHNT1	0192R	210											
SKSR	0070R	39											
SLAD	0004	163	164	165	166	174	175	177	181	206	207	212	213	221
		227	229	230	231									
SLCHBSY	0008	176												
STAT	000D	101	104	105	107	111	175	178	224	232	233	239		
STOP	021AR	164	177	207	229	231								
TRACK	000B	129	131	136										
TRKDEN	0228R	127												
TROCK	0226R	131												
WAIT	018ER	235	273											
WAIT1	021ER	222												
WCMD	0212R	159												
WCMDX	0214R	202												
WDFT0	00CCR													
WDFT1	00AER	86	167	214										
WDFT1A	00D0R	128	130	134										
WK0	0006	182	183	208	208	209	210	211	224	225	227	236	237	
WK1	0007	154	159	173	197	202	220							
WK2	0008	155	157	160	162	174	198	200	203	205	221			
WK3	0009	168	169	171	215	216	218							
WRITS	00E4R	41	48											
WRITSX	014ER	59	66											
ZERO	022AR	133												

INDEX

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