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MAGNETIC TAPE PROGRAMMING MANUAL

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MAGNETIC TAPE PROGRAMMING MANUAL

1. INTRODUCTION

This manual describes the functional characteristics and programming aspects of the INTERDATA 45 IPS 1600 character per inch (CPI), 45 IPS 800 CPI, 75 IPS 800 CPI (vacuum column), and 75 IPS Dual Density (vacuum column) Read-After-Write Magnetic Tape Systems.

For information about INTERDATA programming, refer to the following:

Model 7/32 Processor User's Manual, Publication Number 29-405
Model 8/32 Processor User's Manual, Publication Number 29-428
16-Bit Processor User's Manual, Publication Number 29-509
SELCH Programming Manual, Publication Number 29-567
ESELCH Programming Manual, Publication Number 29-529.

The appendices of this manual contain various sample programs.

2. CONFIGURATION

These Magnetic Tape systems can be used with most INTERDATA Series 16, Series 32 or compatible processors.

These Magnetic Tape systems are normally operated in conjunction with a Selector Channel, although the Selector Channel is not a mandatory prerequisite for operation of the 45 IPS 800 CPI NRZI and 45 IPS 1600 CPI Magnetic Tape systems. This manual deals primarily with the programming considerations of the Selector Channel.

The following is the relationship between Product Numbers and Part Numbers for different configurations of Magnetic Tape systems.

Mag Tape Interface	Mag Tape	Transport
M46-475, M46-512	1600 CPI PE (45 IPS)	M46-465 M46-466
M46-470, M46-500	800 CPI NRZI (45 IPS)	M46-460 M46-461
M46-490	800 CPI NRZI (75 IPS Vac. Col.)	M46-492
M46-494	800/1600 NRZI/PE (75 IPS Vac. Col.)	M46-496

Table 1 gives various characteristics of each Magnetic Tape system.

TABLE 1. CHARACTERISTICS OF MAGNETIC TAPE SYSTEMS

	PE 1600 CPI	NRZI 800 CPI	NRZI 800 CPI (VAC. COL.)	PE/NRZI DUAL DENSITY (V.C.)
INTERFACE PRODUCT NO.	M46-475 M46-512	M46-470 M46-500	M46-490	M46-494
TAPE SPEED	45 IPS	45 IPS	75 IPS	75 IPS
RECORDING FORMAT	9 TRACK P.E. ANSI AND IBM COMPATIBLE	9 TRACK NRZI IBM COMPAT-IBLE	9 TRACK P.E. ANSI AND IBM COMPATIBLE	9 TRACK PE/NRZI ANSI AND IBM COMPATIBLE
TAPE CAPACITY	2400 FEET	2400 FEET	2400 FEET	2400 FEET
INTER-RECORD GAP	.6 INCH	.75 INCH	.6 INCH	.6 INCH
TRANSFER RATE	72K BYTES/ SEC	36K BYTES/ SEC	60K BYTES/ SEC	120K BYTES/SEC (READ), 240K BYTES/SEC (WRITE)
ERROR CHECKS	1. VERTICAL PARITY CHECKS (READ-AFTER-WRITE) 2. FALSE PRE-AMBLE AND POSTAMBLE DETECTION	1. VERTICAL PAR-ITY CHECKS (READ AND READ-AFTER WRITE) 2. LRC CHECK (READ AND READ-AFTER-WRITE) 3. CRC CHECKS (READ ONLY)	1. VERTICAL PARITY CHECKS (READ-AFTER WRITE) 2. LCR CHECK (READ AND READ-AFTER WRITE) 3. CRC EHCKS (READ ONLY)	1. VERTICAL PAR-ITY CHECKS (READ AND READ-AFTER WRITE) 2. LRC CHECK (READ AND READ-AFTER-WRITE) 3. CRC CHECKS (READ ONLY) 4. FALSE PRE-AMBLE AND POST-AMBLE DETECTION
MIN. NO. CHAR.	4	4	4	4

3. OPERATING CONTROLS AND INDICATORS

Figure 1 illustrates the operating controls and indicators for the 1600 CPI, 800 CPI, and Dual Density Magnetic Tape drives.

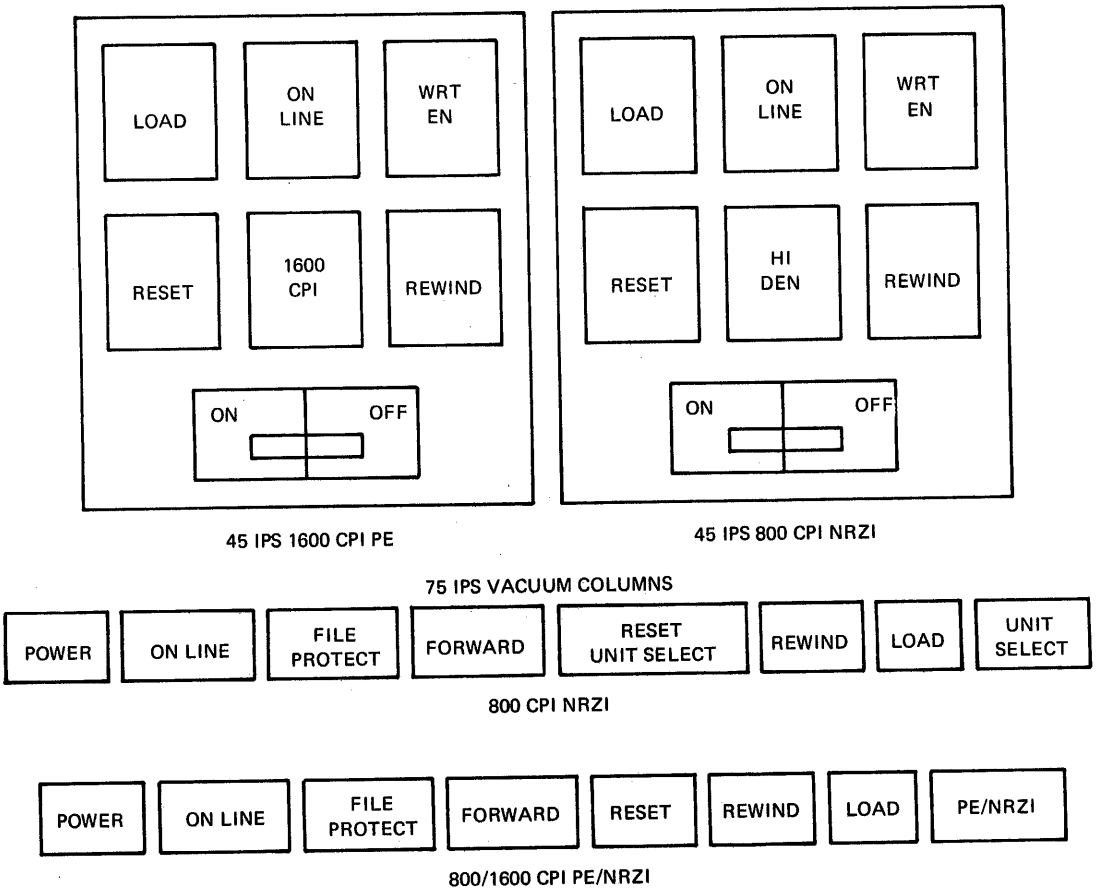
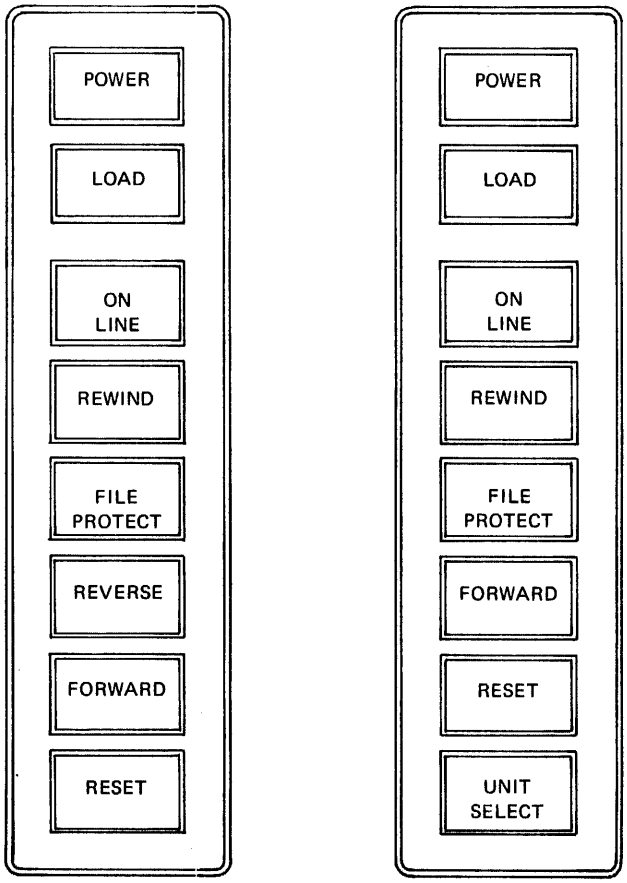


Figure 1. Controls and Indicators of Tape Drivers



PE (STANDARD)
45 IPS 1600 CPI

DUAL DENSITY (UNIT SELECT OPTION;
REMOTE MODE SELECTION)
NRZI 45 IPS 800 CPI

Figure 1. (Continued)

3.1 Switches and Indicators

The switches and indicators for the 45 IPS 800 CPI NRZI and 1600 CPI PE are:

ON/OFF	The ON/OFF control is an alternate action switch/indicator which connects line voltage to the unit.
LOAD	The LOAD control is a momentary action switch/indicator. When LOAD is momentarily depressed for the first time after power is applied, and a tape is mounted, the tension arms move to to the load position. When the LOAD control is depressed for the second time, after power is applied, the tape is positioned at the load point which is indicated by a reflector on the tape. The LOAD switch is disabled once the first LOAD or manual Rewind command has been given following the power-on and can only be re-enabled by loss of tape tension or restoration of power after power has been off.
1600 CPI	The 1600 CPI control is an alternate action switch/indicator. It indicates that power is applied to the transport. As a switch, it is not operational.
HI DEN (High Density)	The HIGH DEN control is an alternate action switch/indicator. It indicates that power is applied to the transport. As a switch, it is not operational.

REWIND	The REWIND control is a momentary action switch/indicator which is enabled only in the Off-Line Mode. Depressing and releasing the control causes the tape to rewind at the specified speed. On reaching the BOT reflector, the rewind drive ceases and the Load sequence is automatically entered. The BOT tab overshoots the photo-tab sensor, moves forward and stops at the Load Point. If the REWIND control is depressed and released while the tape is positioned at BOT, the tape rewinds until it is unloaded from the take-up reel and tension in the tape is lost.
ON-LINE	The ON-LINE control is a momentary switch/indicator which is enabled after a Load or Rewind sequence has been initiated. Depressing and releasing the switch puts the transport On-Line and turns on the indicator lamp. In this condition, the transport can accept external commands, provided it is also Ready and Selected.
WRT EN (Write Enable)	WRT EN is an indicator lamp which is turned on whenever the Power switch is in the ON position and a reel of tape, with a Write Enable ring installed, is mounted on the transport (tape tension established).
RESET	RESET is a momentary action switch/indicator which stops all manual commands when the switch is depressed. Depressing the RESET switch when the transport is ON-LINE removes the unit from On-Line operation.
FORMATTER POWER SWITCH	The formatter power control is an alternate action switch/indicator which applies AC power to the formatter. It is located on the front panel of the formatter (on 1600 CPI Drives only).

3.2 Switches and Indicators for the Vacuum Column Tape Systems

POWER	This is a combination pushbutton switch and indicator. The indicator lamp is on when power has been supplied to the tape system. For the convenience of the maintenance or customer engineer, a power switch is provided on the power supply chassis at the inside rear of the machine. It is accessible only when the tape unit is swung open for service.
LOAD	After threading of the tape, this button is pressed to complete the tape loading operation. Tape is automatically advanced to the load point and then the tape system goes ON-LINE. The LOAD and ON-LINE lamps are on when the action is completed. After this sequence of operations is completed, the switch becomes functionally disabled and can only be re-enabled by loss of vacuum in the chambers. The LOAD lamp goes out when the tape is advanced from load point or rewound. The LOAD lamp is on anytime that the tape is positioned at load point.
FORWARD	This button functions only when the machine is off-line. If the ON-LINE indicator is on, pressing the FORWARD button has no effect. If the ON-LINE indicator is off and the FORWARD button is pressed, the indicator is turned on and the transport moves the tape in the forward direction at the normal tape speed. To stop the machine when it is running in this mode, the RESET button should be pressed.
RESET/UNIT SELECT	All tape motion (except UNLOAD), regardless of the command that established it, stops when RESET is pressed. Pressing RESET clears all read, write, and control functions and also removes the tape unit from on-line operation. The ON-LINE indicator is turned off. The RESET switch also houses the Unit Select indicator on NRZI only units. This indicator is turned on if the unit has been selected. Dual Density units do not have this indicator.
ON-LINE	This is a combination switch and indicator. If this indicator is on the system is under processor control. If the system is off-line and control is to be turned over to the processor, ON-LINE must be pressed. The system is returned to the OFF-LINE mode if the system interlocks are lost, or the RESET pushbutton is depressed.
FILE PROTECT	This indicator is on when a write enable ring is *not* installed on the file reel. When a file or supply reel is put on the machine with the write enable ring in place in the slot at the back of the reel, the FILE PROTECT light is off. This indicates that data may be written on the tape. Without the ring, protective circuits in the tape system prevent data from being recorded or erased.

REWIND	Pressing this button results in rewind of the tape, with high speed reverse operation. The operator can stop this reverse motion by pressing the RESET switch. If Reset is not pressed, the tape goes beyond the beginning-of-tape marker, stops, and then automatically returns to the load point. If the REWIND button is then again pressed, the tape rewinds until tension is lost and vacuum shuts off. Since tape still remains in the chambers, it is drawn out of the tape path and the unload sequence completes. If the REWIND button is again pressed, the file reel moves slowly in the rewind direction to take up the remaining tape, as long as the button is held in. This switch is disabled if the system is ON-LINE.
UNIT SELECT SWITCH	This switch is not functional.
PE/NRZI	This switch is used only on PE/NRZI Dual Density units. It is a combination alternate action switch and indicator. This switch conditions the system to operate in PE mode when the indicator is on. To operate in NRZI mode, the switch must be in the alternate state corresponding to the indicator being turned off. This switch is not installed if the PE SELECT input line is used. See the *Vendor's Operating and Service Manual* Publication Number under Section 3.4.

3.3 Preventive Maintenance

It is recommended that the heads and capstan be cleaned after every eight hours of operation. Refer to the vendor's Operating and Service Manual (Publication Number under Section 3.4).

3.4 Magnetic Tape Loading and Unloading

Refer to the *Vendor's Operating and Service Manual,* Publication Number 29-321 (1600 BPI), 29-296 (800 BPI), and 29-557 (vac. col.).

4. DATA FORMAT

4.1 1600 CPI

Data is written on the 1600 CPI Read-After-Write Magnetic Tape system in the standard 1600 CPI phase-encoded format. This consists of a preamble, a variable length binary record with eight bits per character and one vertical parity bit, followed by a postamble. The minimum record size for data transfer is four bytes. See Figures 2, 3, and 4.

4.2 800 CPI

Data is written on the 800 CPI Read-After-Write Magnetic Tape in the standard nine track NRZI format. This consists of variable length binary records with eight bits per character and one bit of vertical parity check (VPC). A Cyclic Redundance Check Character (CRCC) and Longitudinal Record Check Character (LRCC) are inserted at the end of each record. An Inter-Record Gap separates one record from another. Note that the CRCC checking is optional to the interface. The minimum record size for data transfer is four bytes. See Figures 2, 3, and 4.

4.3 System Tape Format

Figure 2 shows the INTERDATA system tape format. Records are separated by Inter-Record Gaps (IRG), and a number of records are separated by a File Mark (EOF). When generating a tape (writing) from the beginning of tape (Load point), a File Mark (EOF) must be written on tape for compatibility purposes.

Figure 3 shows an example of the appearance of data on magnetic tape.

Figure 4 shows the spacing of track locations on magnetic tape.

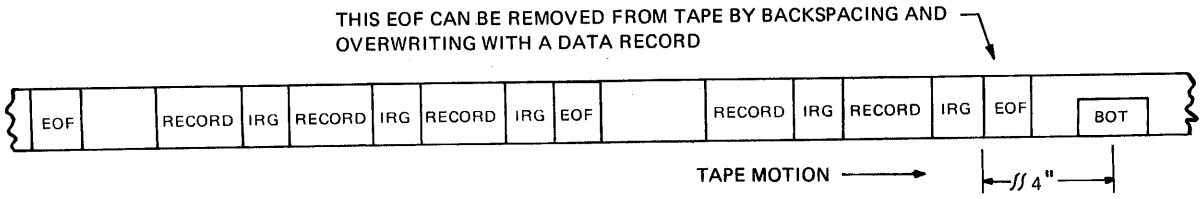


Figure 2. Tape Format

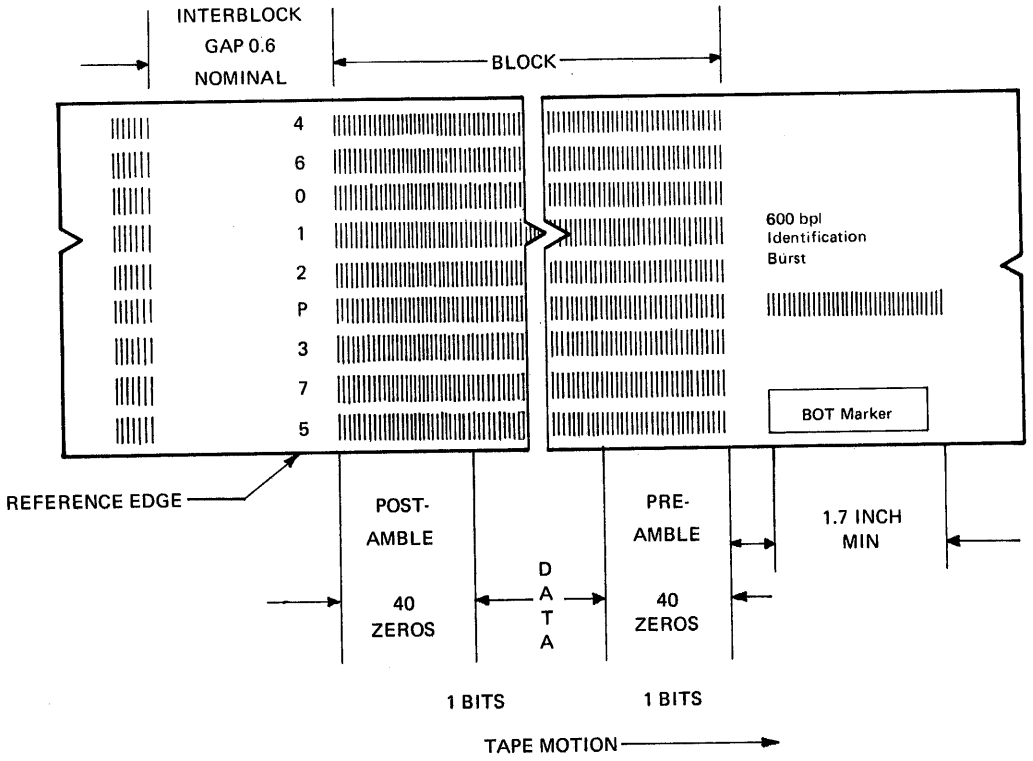


Figure 3. Data Format

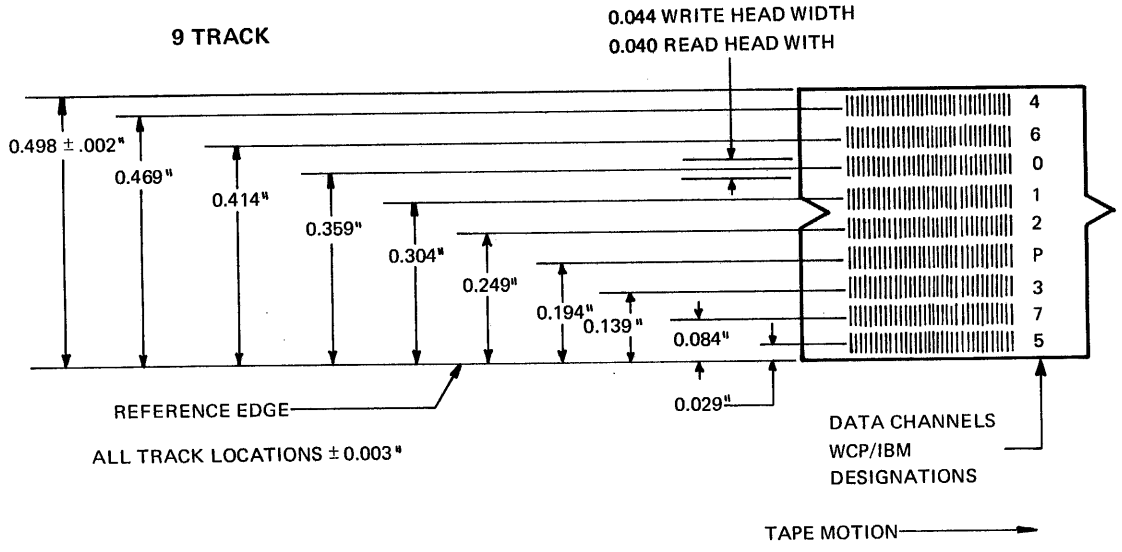


Figure 4. Track Locations and Spacing

5. PROGRAMMING INSTRUCTIONS

There are several methods of programming the Read-After-Write Magnetic Tape System. The choice of the method depends upon the application and the system configuration; that is, through the Selector Channel or directly on the Multiplexor Bus. The information on Status and Command bytes applies regardless of the programming method used. Later paragraphs discuss the Selector Channel programming.

5.1 Instructions

Output Command (OC or OCR)	This instruction is used to send a command byte to the Magnetic Tape Interface.
Sense Status (SS or SSR)	This instruction reads the status byte of the Magnetic Tape Interface.
Read Data (RD or RDR) * Write Data (WD or WDR)	This instruction is used to input/output a data byte between the Magnetic Tape Interface and the processor, if operating on the multiplexor bus.
Acknowledge Interrupt (AI or AIR)	This instruction allows the user to examine the device address and status byte when the Interface generates an interrupt. It is valid on 16-bit Processors only.
Write Block, Read Block ** (WB, RB)	This instruction is used to input/output a block of data between the Magnetic Tape Interface and the Processor if operating on the multiplexor channel.
Autoload **	The Autoload instruction can be used initially to input data into the processor. However, when used in this manner, there should be no leading filemark on the tape, as Autoload terminates. See Section 6.1.

5.2 Status and Command Byte Data

The INTERDATA System Controller returns a status byte to the processor as a result of a Sense Status Instruction. Table 2 shows the bit assignments for the Magnetic Tape System Status Byte and Command Byte.

TABLE 2. STATUS AND COMMAND BYTE CODING

BIT NUMBER	0	1	2	3	4	5	6	7
STATUS	ERR	EOF	ET	NMTN	BSY	EX	EOM	DU
COMMAND	DISABLE	ENABLE	SEE TABLE 3 FOR LEGAL COMMANDS					

NOTES

The ERR bit is deferred until EOM sets (EOM=1).

The status byte reflects the current status of the selected tape transport (last transport addressed).

Each transport has its own individual device address. If an operation on the transport is in progress, any instruction which addresses the other transports causes the operation in progress to be aborted. An exception to this rule is the Rewind operation. See Section 6.9 for details.

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*Because of the speed of the Magnetic Tape and the possible loss of data with this instruction, it is advisable to use the Write Block or Read Block instruction when transferring data without the SELCH.

**This instruction is not useable on 75 IPS drives.

Status

ERR. The Error bit (Bit 0) is set on the following conditions:

1. Write Overflow – if a data byte is not supplied in time, the controller assumes end of record and any attempt to write to the device while generating the postamble, and the Inter-Record GAP (IRG) (generated after postamble), sets this bit.

2. Read Overflow – Processor fails to read characters in time.

3. Read Error – (1600 BPI) – vertical parity failure, false preamble and postamble detection.

4. Read Error on Read or Write – (800 BPI) – Longitudinal Record Check (LRC) incorrect on transfer or vertical parity (VPC) on a Write.

5. Write Error – vertical parity failure, false preamble and postamble, and error corrections made on data read (1600 BPI only).

6. VPC, CRCC, or LRC error on a Read (800 BPI only) – The error bit may be set on either a Read or Write operation because of the Read-After-Write feature of the magnetic tape transport.

EOF The end of File bit (Bit 1) is set when a file mark has been detected during Write, Read, Backspace, or Skip operation.

ET The End of Tape (Bit 2) is set on:

1. BOT (Beginning of Tape) – Physical reflector marker on the tape.
2. EOT (End of Tape) – Physical reflector marker at the end of the tape. It remains set until Rewind, Clear, or Initialize.

NMTN The No Motion bit (Bit 3) is set when the tape motion has stopped and the Controller is in the idle state (ready to accept any valid command). All output commands given when NMTN is reset are ignored.

BSY The Busy bit (Bit 4) is set when data is not available in the Read or Write Mode. It is reset in the Idle state or when EOM is set.

EX The Examine bit (Bit 5) is set to indicate that one or more of the high order bits (ERR, EOF, NMTN) have set.

EOM The End of Medium bit (Bit 6) is set upon the termination of any of the following operations: Read, Write, Backspace, WEOF, or Skip (operations).

DU The Device Unavailable bit (Bit 7) is set if the tape drive power switch is in the OFF position, the ON-LINE switch is reset, or the Magnetic Tape is not properly readied for Processor control (and the power switch on the formatter is in the OFF position).

5.3 Command Byte

The Processor controls the operation of the Magnetic Tape System by issuing commands encoded into a Command byte. The command Byte Enables, Disables, and Disarms interrupts, sets the mode to Read or Write, and controls the Rewind, Backspace, Skip, and Write EOF operations. Table 3 shows the bit assignments for the Command Byte.

TABLE 3. COMMAND BYTE

	COMMAND	HEX COMMAND EQUIVALENT	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
**	DISABLE INTERRUPTS	X'80'	1	0	0	0	0	0	0	0
**	ENABLE INTERRUPTS	X'40'	0	1	0	0	0	0	0	0
**	DISARM INTERRUPTS	X'C0'	1	1	0	0	0	0	0	0
	READ	X'21'	0	0	1	0	0	0	0	1
	WRITE	X'22'	0	0	1	0	0	0	1	0
	WRITE FILE MARK (EOF)	X'30'	0	0	1	1	0	0	0	0
	REWIND	X'38'	0	0	1	1	1	0	0	0
	SKIP FILE FORWARD	X'23'	0	0	1	0	0	0	1	1
	SKIP FILE REVERSE	X'13'	0	0	0	1	0	0	1	1
*	CLEAR	X'20'	0	0	1	0	0	0	0	0
	BACKSPACE	X'11'	0	0	0	1	0	0	0	1

* BITS 0 AND 1 MUST BE ZEROS ON A CLEAR COMMAND.

** THESE COMMANDS CAN BE COMBINED WITH THE FUNCTION COMMANDS TO PROVIDE BOTH SETS OF INFORMATION WITH A SINGLE COMMAND.

NOTE

Any bit configurations that do not conform to the above table are invalid and are ignored to the interface.

5.4 Commands

DISABLE — When this command bit is set and the ENABLE bit is reset, the Controller generates interrupt signals to the Processor. If an interrupt condition occurs, the interrupt signal is queued and remains queued until Disarmed or Enabled by the Processor.

ENABLE — When this command bit is set and the DISABLE bit is reset, the controller sends interrupt signals to the Processor as they occur.

DISARM — When both the DISABLE and ENABLE bits are set in any output command, the controller inhibits the generation and queueing of interrupts, and clears any previously queued interrupts.

NO CHANGE — If DISABLE and ENABLE are both reset in an output command, the controller maintaines its existing Interrupt state, initiated by a previous command, Power Up, or an Initialize sequence.

READ — The Read command sets the Controller to the Read Mode and starts the tape moving forward.

WRITE — The Write command sets the Controller to Write Mode and starts the tape moving forward.

WRITE FILE MARK (EOF) — The Write File Mark command causes the Controller to write a hardware generated file mark (EOF).

BACKSPACE — This command moves the tape backward from the current position to the previous Inter-Record Gap.

SKIP FILE — This command causes the tape to move backwards until a file mark is encountered and then to stop in the next gap.

REWIND — This command moves the tape backward from the current position to beginning of the tape (BOT).

CLEAR — This command initializes the Controller and resets the interface, leaving the interface addressed (same as System Clear except the Address flip-flop is not reset). This command may be issued at any time. However, if the tape is rewinding at the time of the command, tape motion does not stop until the Rewind operation is complete. (This command places the Interrupt circuit of the Controller in the disarm state, 1600 CPI only).

NOTE

Interrupts are generated only by the selected tape transport.

6. PROGRAMMING SEQUENCES

The following section gives a number of conventions and comments concerning the Magnetic Tape System programming. Some, or all, of the comments may apply, depending on how the Magnetic Tape System is to be used.

6.1 File Mark at BOT

To conform to IBM as well as INTERDATA tape formats, it is necessary to write a file mark when the tape is positioned at the Beginning of Tape (BOT). This is accomplished with a Write EOF command. Once the Write EOF operation terminates (NMTN set), the normal write record processing may be executed. Also, the EOF mark may be overwritten if desired by a "Backspace, Write" sequence. (See Appendix for special uses of Filemarks in an operating system.)

6.2 Skip File Forward from BOT

Since a Skip Forward command can be issued while the tape is positioned at the beginning of Tape (BOT status set), a general procedure for Skipping File Marks from BOT is as follows:

1. Command Skip File Forward, which moves the tape past the first EOF mark, if not overwritten.
2. A Read or Write command may be issued to process the remaining records of the file.

6.3 Error Recovery

Like any magnetic tape device, the Read-After-Write Magnetic Tape is subject to errors from dirt on the tape or from oxide worn thin. When writing or reading from a magnetic tape, proper error tests and error recovery routines should be used. In general, during the reading operations, if EOM occurs before four characters have been transferred, the EOM indication may be due to dirt or noise on the tape. In this case, the "short record" should be ignored, and re-read as outlined below. If the ERR status occurs after reading a record of normal length, a Read error may have resulted. In this case, it is proper to Backspace and re-read the record five times before considering the error unrecoverable. In the case of a Write error, it is proper to Backspace and attempt to re-write the record five times before considering it an unrecoverable error.

NOTE

Following an unrecoverable error, either the program should backspace and overwrite the bad record with record gaps and resume, or the write process on that magnetic tape should be aborted.

The procedure for filling a bad record with record gaps is as follows:

1. Write a File Mark.
2. Backspace.
3. Write a File Mark.
4. Backspace.
5. Write.

6.4 Skip File Forward

The Skip File Forward operation is achieved by the use of the Skip command. That is, once an Output command to skip is issued, the tape advances to the next Inter-Record Gap (IRG) beyond the EOF mark.

6.5 Long Records

For normal use, there should be sufficient buffer space in memory to allow reading the longest record on the magnetic tape. In case the program waits for EOM status and ignores the trailing extra data characters, then ERR status results due to data input "overflow." The program cannot then distinguish between "long records" and an actual read error condition. To avoid this ambiguity, it is mandatory that the program read all data characters from the tape, and disregard those characters in the program that do not fit into the buffer space available.

6.6 Short Records

If short records are written, a large amount of space may be wasted on the tape by the many Inter-Record Gaps that occur.

6.7 End of File Marks

The Write End of File Mark (WEOF) command causes the tape unit to generate a special hardware character. When reading in the EOF mark, the special character is recognized by the hardware and the EOF bit is set in the status.

File marks are used by the Magnetic Tape Controller for Skip operations. For this reason, extraneous EOFs on a tape should be avoided. If a tape terminates its last file with a file mark, care should be taken in extending that file. The procedure to extend the last file, terminated by a file mark, is:

1. Skip Forward the last file mark at end of last file.
2. Backspace one record.
3. Write new record as desired. (Overwriting the File Mark)
4. Write a new file mark at the end.

6.8 End of Tape (EOT) Status

The EOT status bit is set whenever the magnetic tape sensors detect the reflective markers at the beginning or end of the tape. Once the End of Tape (EOT) is encountered, the EOT bit remains set until a Clear command is given, system initialization occurs, or a Rewind operation is performed. The Examine (EX) bit does not set when EOT sets, unlike the other status bits (EOF, ERR and NMTN). Thus, it is necessary that the programmer test the upper half of the status byte to ascertain the EOT or BOT condition. It is permissable to write beyond the End of Tape (EOT). (Note that care must be taken to insure the tape length is not exceeded.) The EOT bit remains set until one of the previously mentioned operations in this paragraph is performed.

If the Processor issued a Write or Write File Mark command to a magnetic tape that does not have a Write ring present, (1) the command is ignored, (2) the No Motion (NMTN) status bit remains set, and (3) the BUSY (BSY) status bit remains reset.

6.9 Read Operation at BOT

The Read block and Autoload instructions can be used to read from the BOT (except on 75 IPS tape drives). If the first record on the tape is an EOF mark, then it is necessary that two Read operations must be performed to read the tape. The first Read operation moves the tape past the EOF and the second Read loads the first data record.

6.10 Multi-Transport Operations

Each transport on a controller can be issued a Rewind command and all transports rewound. If Transport 0 is Busy (NMTN=0) and Transport 1 is addressed, the operation (if other than Rewind) is terminated on Transport 0. The following is a recommended sequence for switching tape transport operations:

1. Wait for NMTN=1 on Transport 0.
2. Issue Rewind command to Transport 0.
3. Wait for NMTN=1 on Transport 1.
4. Perform operations on Transport 1.

It is not mandatory that a program adhere to this sequence, but as a general rule, only the Rewind command to all transports can allow motion of all transports at the same time.

As a general rule, no transport accepts a command unless NMTN=1. This means that No Motion (NMTN=1) must be set on one transport before any other can be used. It is not necessary to write until NMTN is set before ending an operation, but it is necessary to wait for NMTN to set before starting an operation on the same transport or to any other transport.

6.11 Data Transfer

Due to the high data transfer rate of the Magnetic Tape System the Selector Channel is the preferred method of implementation, however, Multiplexer Bus programming can be used in certain situations. The 75 IPS 800 CPI and Dual Density 75 IPS tape drives can only transfer data with the Selector Channel due to their extremely high transfer rate. Multiplexer Bus programming can be used for the 45 IPS transports, but must be done with knowledge of data transfer rates and the throughput rate of the controlling software.

6.12 Programming Modes

The Magnetic Tape System may be programmed using Sense Status loops, Immediate Interrupts, or Auto Driver Channel. The choice of mode depends on the application and the drives involved. (See Appendix 2 for programming examples of various modes.)

7. INTERRUPTS

The Tape System produces interrupts when:

1. DU sets or resets
2. BUSY resets (interface is ready to receive or transmit data).
3. EX sets.
4. NMTN sets.
5. EOM sets.

The program must respond to these interrupts (i.e., read or write data) to avoid loss of data (or overflow), which set the ERR bit, within the specified times as shown below:

13 micro-seconds for 800 CPI (75 IPS)

6.5 Micro-seconds for 1600 CPI (75 IPS)

25 micro-seconds for 800 CPI (45 IPS)

If, because of extraordinary circumstances, the program attempts to write to the magnetic tape after the time period that the particular drive allows for response to an interrupt, the data byte is not written. However, the status byte on the next interrupt indicates ERR, EX, and EOM.

NOTE

The End of Medium interrupt occurs as described above, and at the end of all normal operations. Another interrupt occurs after End of Medium (NTMN is set) after the following time periods:

10 milliseconds for 45 IPS
5.3 milliseconds for 75 IPS

Only the addressed transport may generate interrupts.

8. INITIALIZATION

Manual initialization of the Processor puts the Magnetic Tape Controller in the idle state, with interrupts DISARMED, ready to accept any valid command. The configuration of the status byte is: ERR bit reset, ET bit set if at BOT or EOT, NMTN is set, BSY bit is reset, EX bit set, EOM bit reset, and DU bit set or reset, depending on the state of the device. See Figure 5.

	ERR	EOF	ET	NMTN	BSY	EX	EOM	DU
STATUS	0	0	X	1	0	1	0	Y

WHERE: X DEPENDS ON POSITION OF TAPE

Y DEPENDS ON STATE OF THE DEVICE

Figure 5. Status of Magnetic Tape Controller after Initialization.

9. DEVICE NUMBERS

The preferred Device Numbers assigned to the Magnetic Tape System are:

	1600 CPI 45 IPS PE	1600/800 CPI 75 IPS PE/NRZI	800 CPI 45 IPS also 75 IPS NRZI
1st Transport	X'C5'	X'C5'	X'85'
2nd Transport	X'D5'	X'D5'	X'95'
3rd Transport	X'E5'	X'E5'	X'A5'
4th Transport	X'F5'	X'F5'	X'B5'

1600 CPI and 800 CPI Programming Differences

The differences between the INTERDATA 1600 CPI Magnetic Tape System (M46-475) and the INTERDATA 800 CPI NRZI (M46-470) are as follows:

1. When reading a file mark on the 1600 CPI Magnetic Tape System, no data is transferred to memory. On an 800 CPI drive, a file mark transfers two bytes of X'13' to memory.

2. If a Write command is given to the Controller and no data is presented to the Controller by the Processor before the end of the preamble, a one character record is written onto tape and the Error bit is set.

These differences in no way affect the Software compatibility with existing INTERDATA Magnetic Tape Software.

NOTE

Compatibility is not possible between the 800 CPI NRZI and 1600 CPI Phase Encoded Tapes.

10. SAMPLE PROGRAMS

Appendix 2 contains 3 programs and flowcharts for the 16-bit Processors (Model 7/16 or equivalent).

The first program uses Sense Status loops to write a pre-defined buffer of data onto magnetic tape and then reads it back into memory. Read Block/Write Block instructions are used.

The second program uses Sense Status loops and a SELCH to write a predefined buffer of data onto magnetic tape and then reads it back into memory.

The third program uses Immediate Interrupts and a SELCH to write a predefined buffer of data onto magnetic tape and reads it back into memory.

Appendix 3 contains three programs and flowcharts for the 32-Bit Processors (Model 7/32, 8/32, or equivalent). The first program uses Immediate Interrupts and an ESELCH to write a predefined buffer of data onto magnetic tape and reads it back into memory. The second program uses the Auto Driver Channel and an ESELCH to write a buffer of data onto magnetic tape and reads it back into memory. The third program uses Immediate Interrupts and an ESELCH to write a buffer of data onto magnetic tape and then copies it onto another magnetic tape.

APPENDIX 1
SPECIAL CONDITIONS FOR FILEMARKS UNDER AN INTERDATA OPERATING SYSTEM

Certain utility programs use "filemarks" for one purpose or another. The use of filemarks, however, can make a program unnecessarily device dependent. If filemarks are to be used in a device-independent program, the following rules should be observed:

1. Never use more than one filemark on the same medium. This immediately restricts the medium to be magnetic tape, cassette, and some types of disc files. That is:

   no double filemark to indicate EOM

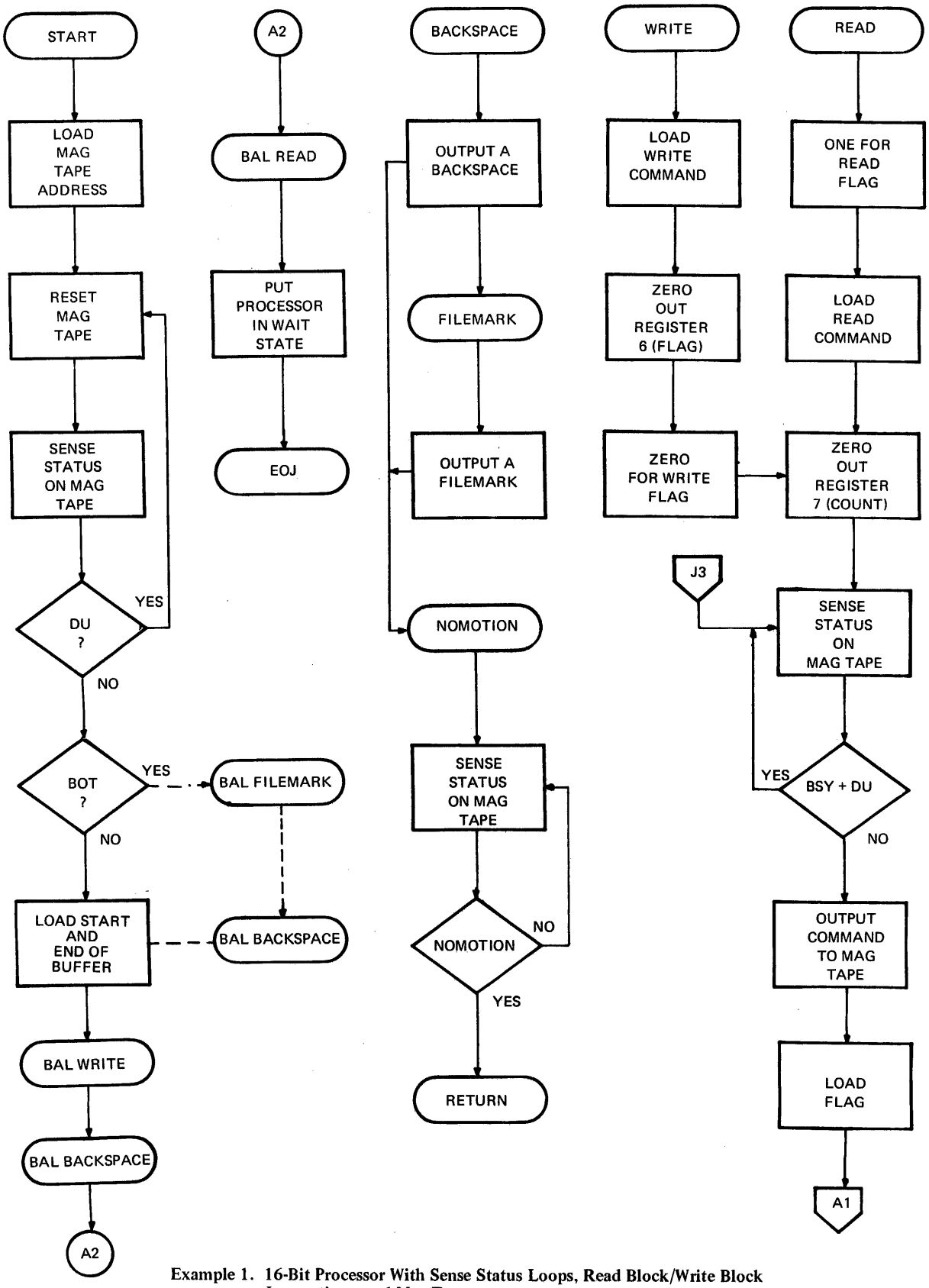
   no "subfiles" separated by filemarks

2. Chained and Indexed files do not support filemarks. To append to a chained or indexed file, the file should be positioned at the end of file by issuing a Forward File (FF) Command.

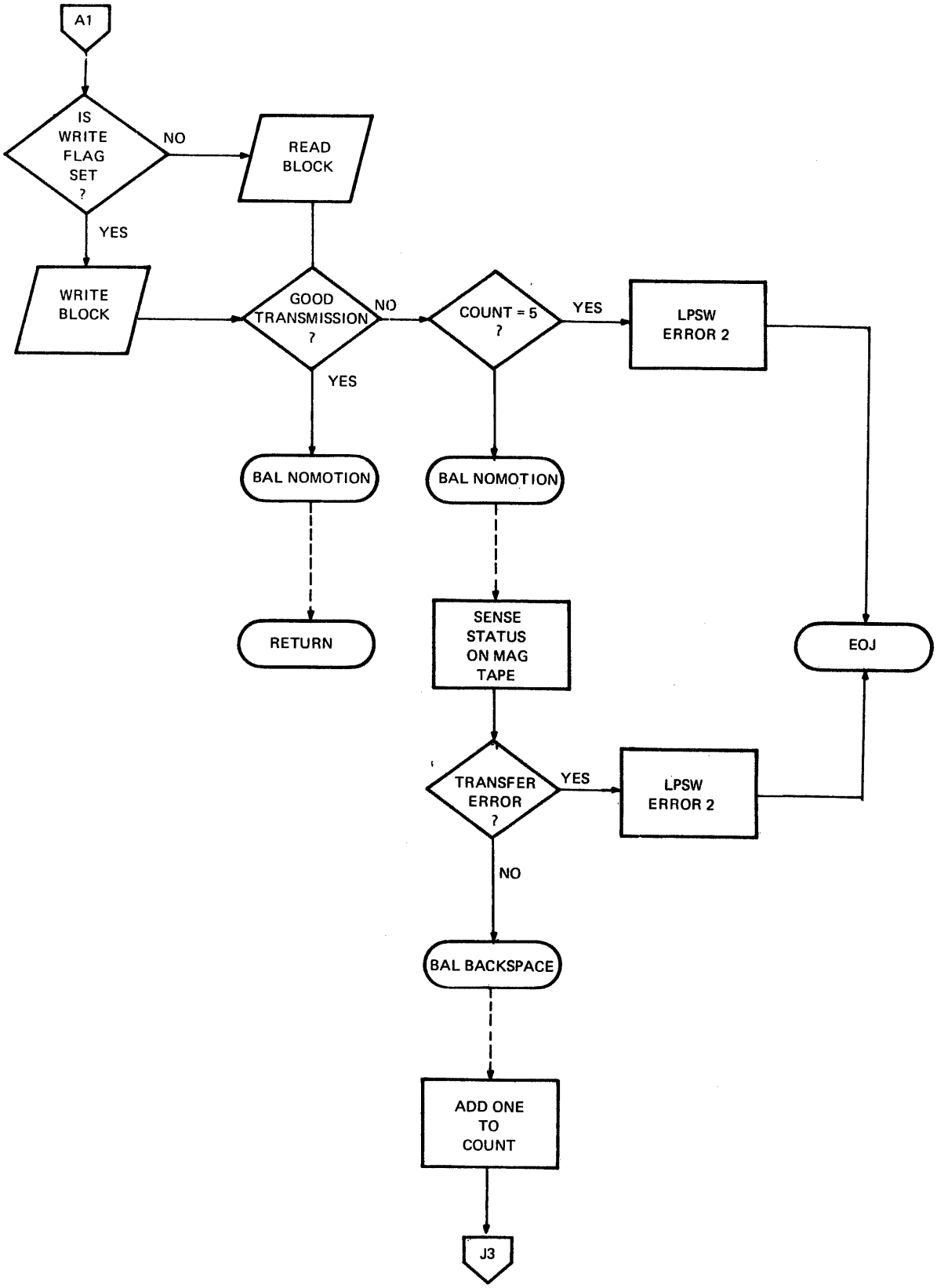
3. It is always permissible to write a filemark when it is used to indicate EOF, or more precisely, LEOM (Logical End of Medium). This implies that no data should be written following the filemark.

4. Programs taking special action upon detection of error status should treat EOF and EOM status identically, when sensed on a Read operation.

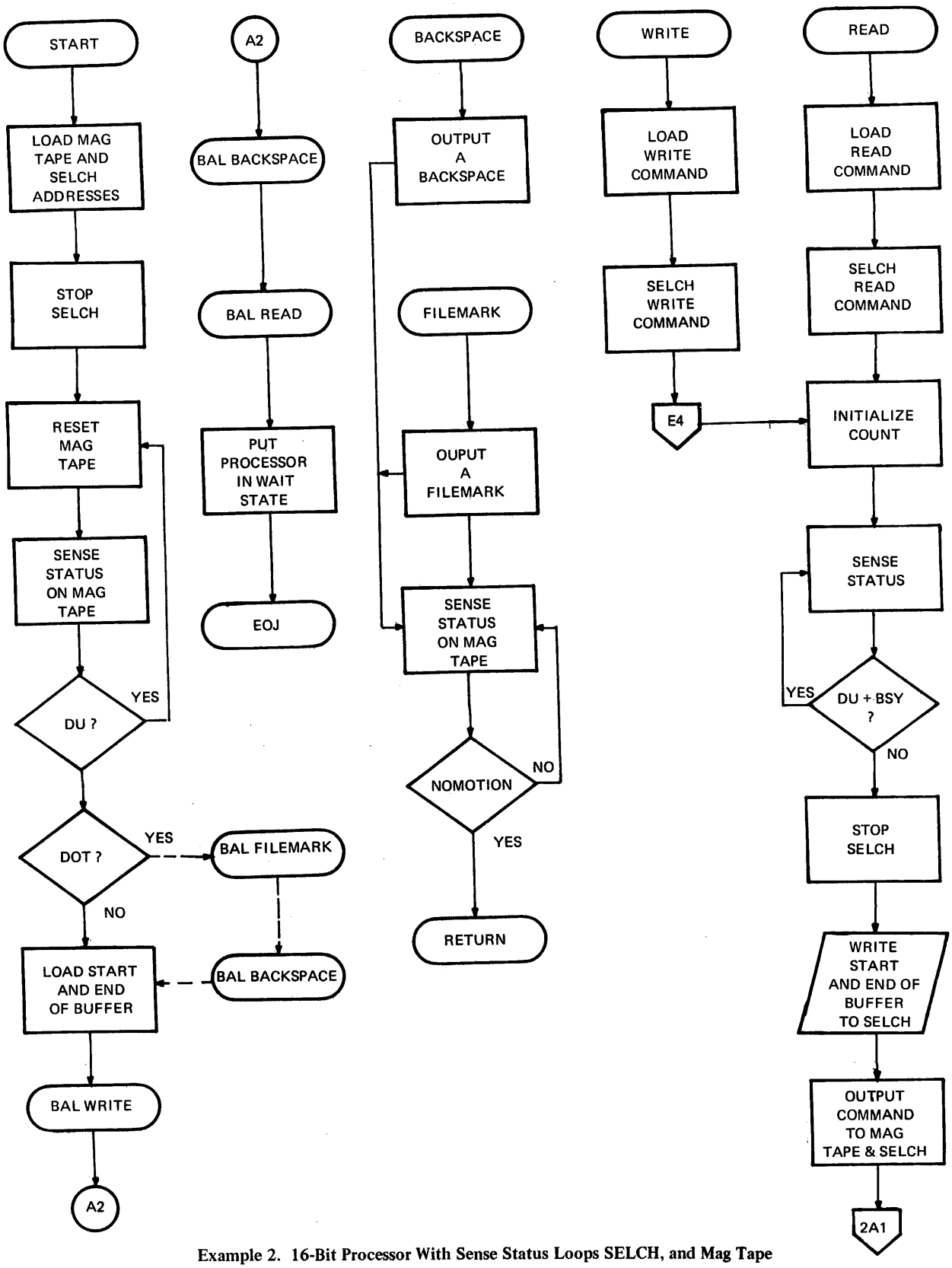
Any program strictly follows the above rules will be device-independent under all presently-existing operating systems.



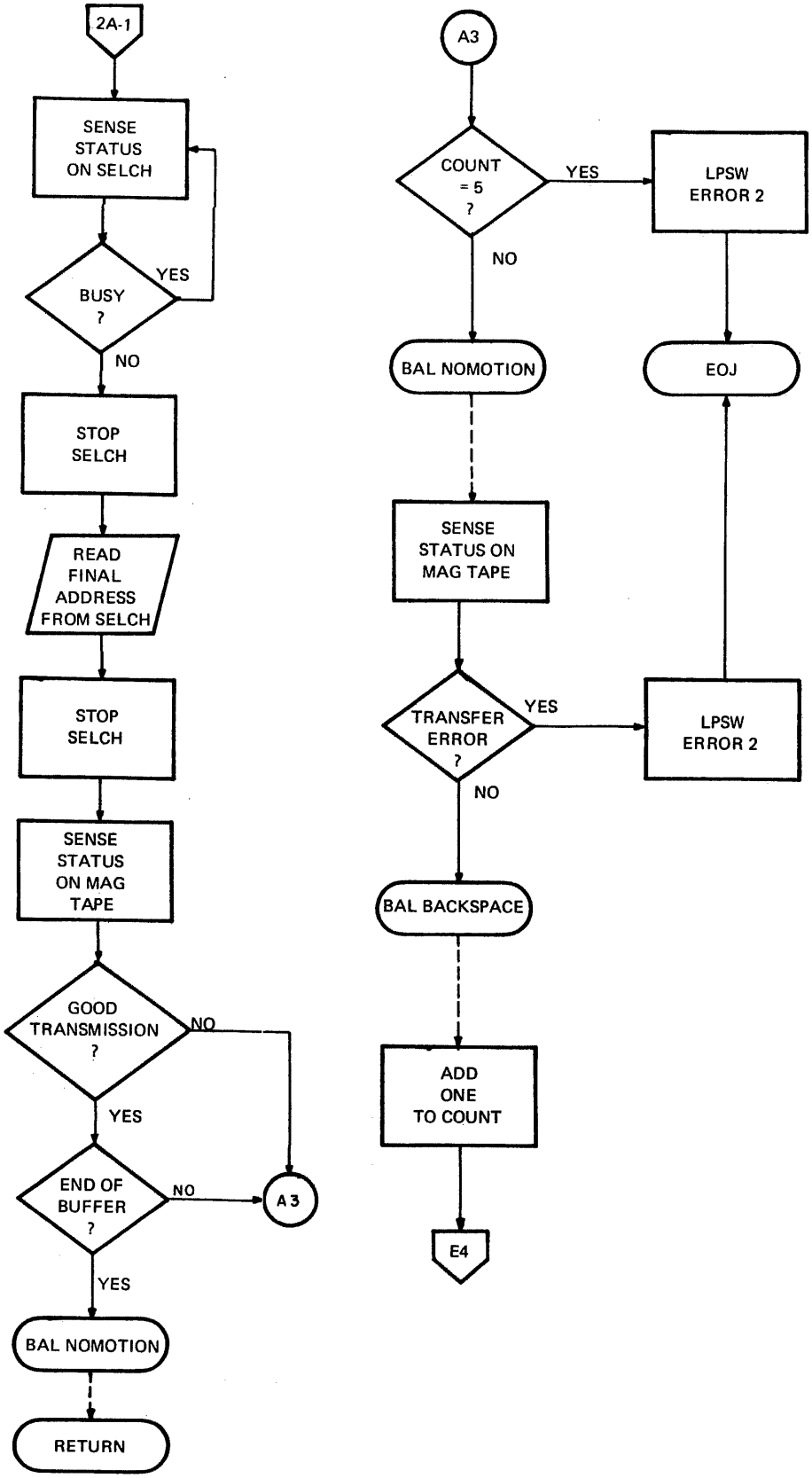
Example 1. 16-Bit Processor With Sense Status Loops, Read Block/Write Block Instructions, and Mag Tape



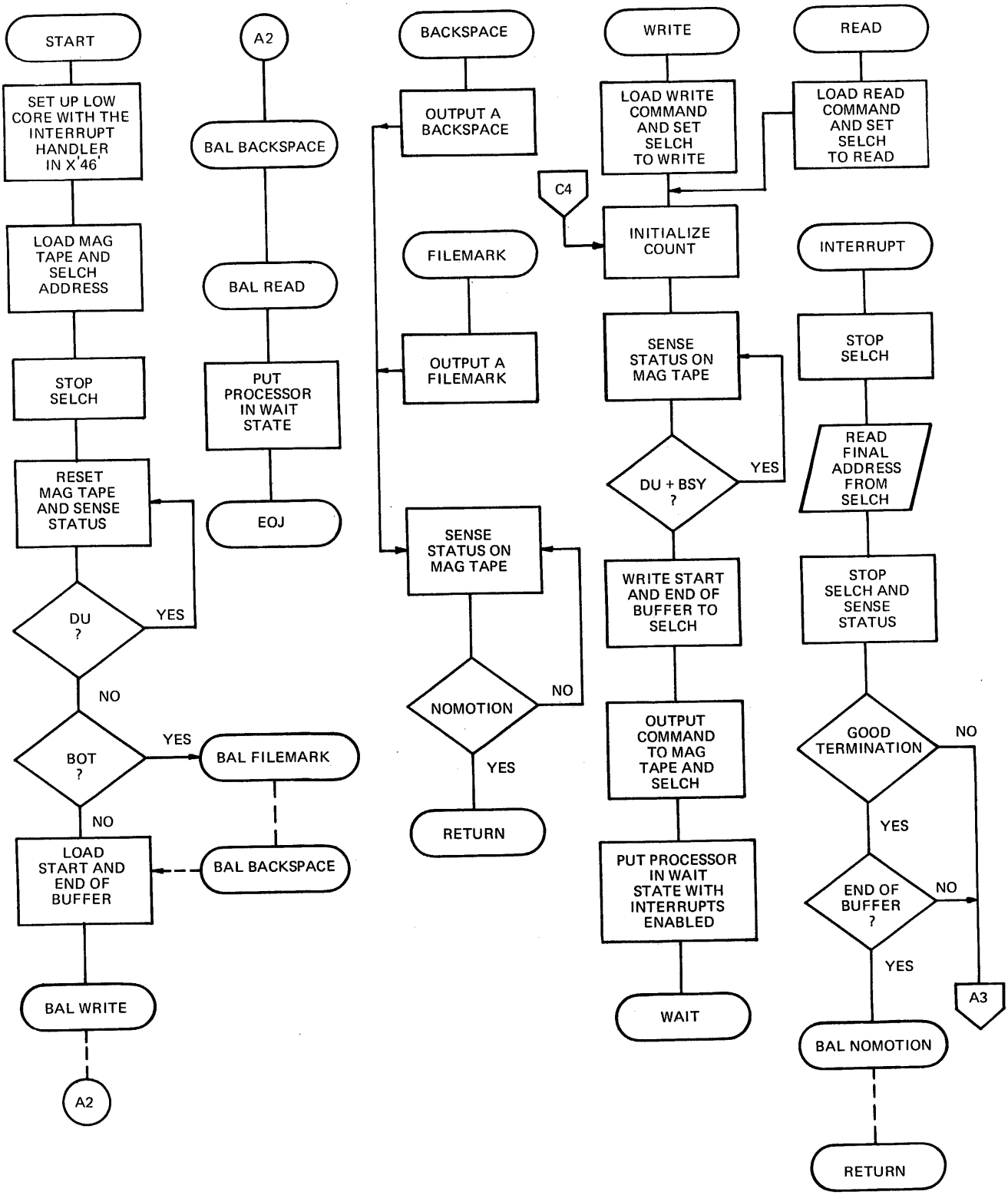
Example 1. (Continued)



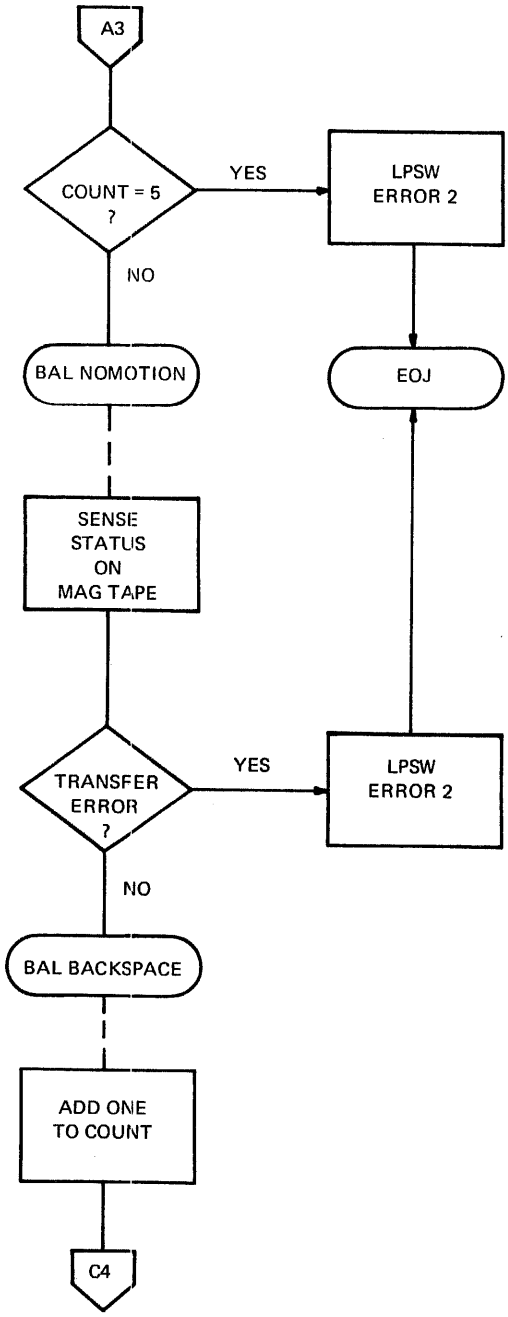
Example 2. 16-Bit Processor With Sense Status Loops SELCH, and Mag Tape



Example 2. (Continued)



Example 3. 16-Bit Processor With SELCH, Immediate Interrupts, And Mag Tape



Example 3. (Continued)

```
      16-BIT     RB/WB,NO SELCH,SENSE STATUS                PAGE   1  22:59:00  09/11/79

PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

                                    1  MAGTP    PROG  16-BIT     RB/WB,NO SELCH,SENSE STATUS          MAG00010
                                    2           SCRAT                                               MAG00020
                                    3           WIDTH 120                                           MAG00030
                                    4           TARGT 16                                            MAG00040
                                    5           CROSS                                               MAG00050
                                    6           SQUEZ 2                                             MAG00060
                                    7  *                                                            MAG00070
                                    8  *  THIS PROGRAM USES THE WRITE BLOCK READ BLOCK              MAG00080
                                    9  *  INSTRUCTIONS, SENSE STATUS LOOPS, AND NO SELCH,           MAG00090
                                   10  *  TO WRITE A BUFFER ONTO MAG TAPE AND THEN                  MAG00100
                                   11  *  READ BACK FROM THAT SAME MAG TAPE INTO MEMORY             MAG00110
                                   12  *                                                            MAG00120
                                   13  *  16-BIT PROCESSORS                                        MAG00130
                                   14  *                                                            MAG00140
                                   15  *  REGISTER ASSIGNMENTS:                                    MAG00150
          0000 0001                16  R1       EQU   1                START OF BUFFER REGISTER     MAG00160
          0000 0001                17  DU       EQU   1                DEVICE UNAVAILABLE           MAG00170
          0000 0002                18  R2       EQU   2                END OF BUFFER REGISTER       MAG00180
          0000 0003                19  R3       EQU   3                DEVICE ADDRESS REGISTER      MAG00190
          0000 0004                20  R4       EQU   4                STATUS REGISTER              MAG00200
          0000 0005                21  R5       EQU   5                RETURN REGISTER              MAG00210
          0000 0006                22  R6       EQU   6                WORK REGISTER                MAG00220
          0000 0007                23  R7       EQU   7                COUNTER                      MAG00230
          0000 0008                24  R8       EQU   8                COMMAND STORAGE REGISTER     MAG00240
          0000 0008                25  BSY      EQU   8                BUSY                         MAG00250
          0000 000C                26  R12      EQU   12               RETURN REGISTER              MAG00260
          0000 000F                27  TRANS    EQU   15               TRANSFER STATUS=15           MAG00270
          0000 0010                28  TEST     EQU   X'10'            TEST=NOMOTION BIT            MAG00280
          0000 0020                29  BOT      EQU   X'20'            TEST FOR BOT                 MAG00290
          0000 00C0                30  TERM     EQU   X'C0'            TERMINATION STATUS=X'C0'     MAG00300
0000R     4830 00E4R               31           LH    R3,MTADR         LOAD MAG TAPE ADDRESS        MAG00310
0004R     DE30 00E8R               32  OUTEST   OC    R3,RESET         OUTPUT RESET                 MAG00320
0008R     9D34                     33           SSR   R3,R4            SENSE STATUS ON MAG TAPE     MAG00330
*   000AR 2013                     34           BTC   DU,OUTEST        IS MAG TAPE UNAVAILABLE      MAG00340
000CR     C340 0020                35           THI   R4,BOT           TEST FOR BOT                 MAG00350
0010R     2335                     36           BZS   WRT              BRANCH TO  WRITE             MAG00360
0012R     4150 0038R               37           BAL   R5,FLMK         FILEMARK ROUTINE             MAG00370
0016R     4150 0032R               38           BAL   R5,BAKSP        BACKSPACE ROUTINE            MAG00380
                                   39  *                                                            MAG00390
001AR     C810 009CR               40  WRT      LHI   R1,BUFSRT        LOAD START OF BUFFER         MAG00400
001ER     C820 00DBR               41           LHI   R2,BUFEND        LOAD END OF BUFFER           MAG00410
0022R     41C0 0046R               42           BAL   R12,WRITE        GO WRITE                     MAG00420
                                   43  *                                                            MAG00430
0026R     4150 0032R               44           BAL   R5,BAKSP         BACKSPACE TAPE ROUTINE       MAG00440
002AR     41C0 0052R               45           BAL   R12,RFAD         DO READ ROUTINE              MAG00450
                                   46  *                                                            MAG00460
002ER     C200 00E0R               47  END1     LPSW  END                                           MAG00470
                                   48  *                                                            MAG00480
                                   49  ********************************************************    MAG00490
                                   50  * SUBROUTINE: BAKSP                                         MAG00500
                                   51  *       THIS SUBROUTINE BACKSPACES ONE RECORD.              MAG00510
                                   52  *       SEE CALLING SEQUENCE BELOW.                         MAG00520
                                   53  *                                                           MAG00530
```

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16-BIT      RB/WB,NO SELCH,SENSE STATUS                PAGE   2  22:59:00  09/11/79

                                54  *  SUBROUTINE: FLMK                                          MAG00540
                                55  *       THIS SUBROUTINE WRITES A FILEMARK                   MAG00550
                                56  *       SEE CALLING SEQUENCE BELOW.                         MAG00560
                                57  *                                                           MAG00570
                                58  ************************************************************ MAG00580
                                59  *                                                           MAG00590
                                60  *  SUBROUTINE: NOMOT                                        MAG00600
                                61  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO           MAG00610
                                62  *       STOP MOVING.                                        MAG00620
                                63  *                                                           MAG00630
                                64  *       CALLING SEQUENCE:     BAL R5,BAKSP                  MAG00640
                                65  *       ----------------      BAL R5,FLMK                   MAG00650
                                66  *                             BAL R5,NOMOT                  MAG00660
                                67  *       R3=DEVICE ADDRESS REGISTER                          MAG00670
                                68  *       R5=RETURN REGISTER                                  MAG00680
                                69  *                                                           MAG00690
                                70  *       WORK REGISTERS:                                     MAG00700
                                71  *       ---------------                                     MAG00710
                                72  *       R4=DEVICE STATUS REGISTER                           MAG00720
                                73  *                                                           MAG00730
                                74  ************************************************************ MAG00740
                                75  *                                                           MAG00750
0032R  DE30 00EAR               76  BAKSP    OC    R3,BKSP           OUTPUT BACKSPACE          MAG00760
0036R  2303                     77           BS    NOMOT             BRANCH TO NOMOTION        MAG00770
0038R  DE30 00E9R               78  FLMK     OC    R3,FILMRK         OUTPUT A FILE MARK        MAG00780
003CR  9D34                     79  NOMOT    SSR   R3,R4            SENSE STATUS ON MAG TAPE  MAG00790
003ER  C340 0010                80           THI   R4,TEST           TEST FOR NO MOTION        MAG00800
0042R  2233                     81           BZS   NOMOT             SENSE AGAIN               MAG00810
0044R  0305                     82           BR    R5                RETURN                    MAG00820
                                83  ************************************************************ MAG00830
                                84  *                                                           MAG00840
                                85  *  SUBROUTINE: WRITE                                        MAG00850
                                86  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE     MAG00860
                                87  *       MAG TAPE.                                           MAG00870
                                88  *       SEE CALLING SEQUENCE BELOW                          MAG00880
                                89  *                                                           MAG00890
                                90  *  SUBROUTINE READ                                          MAG00900
                                91  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE      MAG00910
                                92  *       MAG TAPE.                                           MAG00920
                                93  *                                                           MAG00930
                                94  *       ----------------      BAL R12,READ                  MAG00940
                                95  *       CALLING SEQUENCE:     BAL R12,WRITE                 MAG00950
                                96  *       R1=START OF BUFFER                                  MAG00960
                                97  *       R2=END OF BUFFER                                    MAG00970
                                98  *       R3=DEVICE ADDRESS REGISTER                          MAG00980
                                99  *       R12=RETURN REGISTER                                 MAG00990
                               100  *                                                           MAG01000
                               101  *       WORK REGISTERS:                                     MAG01010
                               102  *       ---------------                                     MAG01020
                               103  *       R4=STATUS REGISTER                                  MAG01030
                               104  *       R5=NOMOTION RETURN REGISTER                         MAG01040
                               105  *       R6=FLAG REGISTER                                    MAG01050
                               106  *       R7=RETRY COUNT                                      MAG01060
                               107  *       R8=COMMAND REGISTER                                 MAG01070
                               108  *                                                           MAG01080
```

```
16-BIT     RB/WB,NO SELCH,SENSE STATUS                    PAGE   3  22:59:00  09/11/79

                     109 *******************************************************   MAG01090
  0046R 0380 00ECR   110 WRITE    LB    R8,WRTCMD           LOAD WRITE COMMAND     MAG01100
  004AR 0766         111          XHR   R6,R6               ZERO OUT R6            MAG01110
  004CR 4060 00E6R   112          STH   R6,FLAG             STORE ZERO IN FLAG     MAG01120
  0050R 2306         113          BS    RETRY               BRANCH TO RETRY        MAG01130
                     114 *                                                         MAG01140
  0052R 2461         115 READ     LIS   R6,1                LOAD ONE IN R6         MAG01150
  0054R 4060 00E6R   116          STH   R6,FLAG             SET READ FLAG          MAG01160
  0058R 0380 00EDR   117          LB    R8,RDCMD            LOAD READ COMMAND      MAG01170
  005CR 0777         118 RETRY    XHR   R7,R7               ZERO OUT R7            MAG01180
  005ER 9D34         119 SENSE1   SSR   R3,R4               SENSE STATUS ON MAG TAPE  MAG01190
  0060R 2091         120          BTBS  DU+BSY,SENSE1       TEST FOR BUSY + DEVICE UNAVAILABLE  MAG01200
  0062R 9E38         121          OCR   R3,R8               OUTPUT APPROPRIATE I/O COMMAND  MAG01210
  0064R 4860 00E6R   122          LH    R6,FLAG             LOAD FLAG              MAG01220
* 0068R 2334         123          BZ    WRTBLK              BRANCH ON WRITE FLAG   MAG01230
  006AR 9731         124          RBR   R3,R1               READ BLOCK             MAG01240
* 006CR 21F7         125          BTC   TRANS,ERROR         TRANSFER AGAIN IF NO GOOD  MAG01250
  006ER 2303         126          BS    TEST1               BRANCH TO TEST1        MAG01260
  0070R 9631         127 WRTBLK   WBR   R3,R1               WRITE BLOCK            MAG01270
* 0072R 21F4         128          BTC   TRANS,ERROR         TRANSFER AGAIN IF NO GOOD  MAG01280
  0074R 4150 003CR   129 TEST1    BAL   R5,NOMOT            WAIT FOR TAPE TO STOP  MAG01290
  0078R 030C         130          BR    R12                 RETURN                 MAG01300
                     131 *                                                         MAG01310
                     132 *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS  MAG01320
                     133 *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS      MAG01330
                     134 *   BEFORE TERMINATING.                                   MAG01340
                     135 *                                                         MAG01350
  007AR C570 0005    136 ERROR    CLHI  R7,5                TEST FOR 5 TRIES       MAG01360
  007ER 4330 0098R   137          BE    ERROR1              BRANCH TO ERROR1       MAG01370
  0082R 4150 003CR   138          BAL   R5,NOMOT            WAIT FOR TAPE TO STOP  MAG01380
  0086R 9D34         139          SSR   R3,R4               SENSE STATUS ON MAG TAPE  MAG01390
  0088R C340 00C0    140          THI   R4,TERM             TEST FOR GOOD TERMINATION  MAG01400
* 008CR 2336         141          BZ    ERROR1              TRY AGAIN              MAG01410
  008ER 4150 0032R   142          BAL   R5,BAKSP            BACKSPACE ROUTINE      MAG01420
  0092R 2671         143          AIS   R7,1                ADD ONE TO COUNT       MAG01430
  0094R 4300 005ER   144          B     SENSE1              BRANCH TO SENSE1       MAG01440
  0098R C200 00DCR   145 ERROR1   LPSW  ERROR2                                     MAG01450
  009CR              146          ALIGN 4                   ALIGN START OF BUFFER  MAG01460
                                                            ON HALFWORD BOUNDARY   MAG01470
                     147 *                                                         MAG01480
                     148 *                                                         MAG01490
                     149 *   BUFFER                                                MAG01500
                     150 *                                                         MAG01510
  009CR 0123         151 BUFSRT   DCX   0123,4567
  009ER 4567                                                                       MAG01520
  00A0R 89AB         152          DCX   89AB,CDEF
  00A2R CDEF                                                                       MAG01530
  00A4R 0123         153          DCX   0123,4567
  00A6R 4567                                                                       MAG01540
  00A8R 89AB         154          DCX   89AB,CDEF
  00AAR CDEF                                                                       MAG01550
  00ACR 0123         155          DCX   0123,4567
  00AER 4567                                                                       MAG01560
  00B0R 89AB         156          DCX   89AB,CDEF
  00B2R CDEF                                                                       MAG01570
  00B4R 0123         157          DCX   0123,4567
```

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   16-BIT     RB/WB,NO SELCH,SENSE STATUS                    PAGE   4  22:59:00  09/11/79

00B6R  4567
00B8R  89AB                  158            DCX   89AB,CDEF                                  MAG01580
00BAR  CDEF
00BCR  0123                  159            DCX   0123,4567                                 MAG01590
00BER  4567
00C0R  89AB                  160            DCX   89AB,CDEF                                  MAG01600
00C2R  CDEF
00C4R  0123                  161            DCX   0123,4567                                 MAG01610
00C6R  4567
00C8R  89AB                  162            DCX   89AB,CDEF                                  MAG01620
00CAR  CDEF
00CCR  0123                  163            DCX   0123,4567                                 MAG01630
00CER  4567
00D0R  89AB                  164            DCX   89AB,CDEF                                  MAG01640
00D2R  CDEF
00D4R  0123                  165            DCX   0123,4567                                 MAG01650
00D6R  4567
00D8R  89AB                  166            DCX   89AB,CDEF                                  MAG01660
00DAR  CDEF
       0000 00DBR            167  BUFEND     EQU   *-1                                        MAG01670
00DCR  8000                  168  ERROR2     DC    X'8000',A(ERROR1)                          MAG01680
00DER  0098R
00E0R  8000                  169  END        DC    X'8000'          WAIT STATE                MAG01690
00E2R  002ER                 170             DC    A(END1)                                    MAG01700
00E4R  0085                  171  MTADR      DC    X'85'            MAG TAPE ADDRESS          MAG01710
00E6R  0000                  172  FLAG       DC    0                READ/WRITE FLAG           MAG01720
00E8R  E0                    173  RESET      DB    X'E0'            RESET COMMAND             MAG01730
00E9R  30                    174  FILMRK     DB    X'30'            FILEMARK COMMAND          MAG01740
00EAR  11                    175  BKSP       DB    X'11'            BACKSPACE COMMAND         MAG01750
00EBR  38                    176  REWIND     DB    X'38'            REWIND COMMAND            MAG01760
00ECR  22                    177  WRTCMD     DB    X'22'            WRITE COMMAND FOR MAG TAPE MAG01770
00EDR  21                    178  RDCMD      DB    X'21'            READ COMMAND FOR MAG TAPE MAG01780
00EER                        179             END                                              MAG01790
```

```
   16-BIT     RB/WB,NO SELCH,SENSE STATUS                PAGE   5  22:59:00  09/11/79

ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

   NO CAL ERRORS
   NO CAL WARNINGS
    3 PASSES

ABSTOP    0000 0000
ADC       0000 0002
BAKSP     0000 0032R      38     44     76*    142
BKSP      0000 00EAR      76    175*
BOT       0000 0020       29*    35
BSY       0000 0008       25*   120
BUFEND    0000 00DBR      41    167*
BUFSRT    0000 009CR      40    151*
DU        0000 0001       17*    34    120
DUTEST    0000 0004R      32*    34
END       0000 00E0R      47    169*
END1      0000 002ER      47*   170
ERROR     0000 007AR     125    128    136*
ERROR1    0000 0098R     137    141    145*   168
ERROR2    0000 00DCR     145    168*
FILMRK    0000 00E9R      78    174*
FLAG      0000 00E6R     112    116    122    172*
FLMK      0000 0038R      37     78*
IMPTOP    0000 00EER
LADC      0000 0001
MTADR     0000 00E4R      31    171*
NOMOT     0000 003CR      77     79*    81    129    138
PURETOP   0000 0000R
R1        0000 0001       16*    40    124    127
R12       0000 000C       26*    42     45    130
R2        0000 0002       18*    41
R3        0000 0003       19*    31     32     33     76     78     79    119    121    124    127    139
R4        0000 0004       20*    33     35     79     80    119    139    140
R5        0000 0005       21*    37     38     44     82    129    138    142
R6        0000 0006       22*   111    111    112    115    116    122
R7        0000 0007       23*   118    118    136    143
R8        0000 0008       24*   110    117    121
RDCMD     0000 00EDR     117    178*
READ      0000 0052R      45    115*
RESET     0000 00E8R      32    173*
RETRY     0000 005CR     113    118*
REWIND    0000 00EBR     176*
SENSE1    0000 005ER     119*   120    144
TERM      0000 00C0       30*   140
TEST      0000 0010       28*    80
TEST1     0000 0074R     126    129*
TRANS     0000 000F       27*   125    128
WRITE     0000 0046R      42    110*
WRT       0000 001AR      36     40*
WRTBLK    0000 0070R     123    127*
WRTCMD    0000 00ECR     110    177*
```

```
      16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS       PAGE   1  22:57:19  09/11/79

PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

                                      1  MAGTP    PROG  16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS
                                      2           SCRAT                                                    MAG00020
                                      3           WIDTH 120                                                MAG00030
                                      4           CROSS                                                    MAG00040
                                      5           TARGT 16                                                 MAG00050
                                      6  *                                                                 MAG00070
                                      7  *  THIS PROGRAM USES THE SELCH AND SENSE STATUS                  MAG00080
                                      8  *  LOOPS TO WRITE A BUFFER TO THE MAG                            MAG00090
                                      9  *  TAPE AND THEN READ IT BACK INTO MEMORY.                       MAG00100
                                     10  *                                                                 MAG00110
                                     11  *  16-BIT PROCESSORS                                             MAG00120
                                     12  *                                                                 MAG00130
                                     13  *  REGISTER ASSIGNMENTS:                                         MAG00140
                                     14  *                                                                 MAG00150
          0000 0001                  15  R1       EQU   1                 START OF BUFFER REGISTER        MAG00160
          0000 0001                  16  DU       EQU   1                 DEVICE UNAVAILABLE              MAG00170
          0000 0002                  17  R2       EQU   2                 END OF BUFFER REGISTER          MAG00180
          0000 0003                  18  R3       EQU   3                 DEVICE ADDRESS REGISTER         MAG00190
          0000 0004                  19  R4       EQU   4                 STATUS                          MAG00200
          0000 0005                  20  R5       EQU   5                 RETURN REGISTER                 MAG00210
          0000 0007                  21  R7       EQU   7                 COUNTER                         MAG00220
          0000 0008                  22  BSY      EQU   8                 BUSY                            MAG00230
          0000 0008                  23  R8       EQU   8                 COMMAND BYTE STORE              MAG00240
          0000 0009                  24  R9       EQU   9                 SELCH ADDRESS REGISTER          MAG00250
          0000 000A                  25  R10      EQU   10                SELCH COMMAND HOLD REGISTER     MAG00260
          0000 000B                  26  R11      EQU   11                WORK REGISTER                   MAG00270
          0000 000C                  27  R12      EQU   12                RETURN REGISTER                 MAG00280
          0000 0010                  28  TEST     EQU   X'10'             TEST=NOMOTION BIT               MAG00290
          0000 0020                  29  BOT      EQU   X'20'             TEST FOR BOT                    MAG00300
          0000 00C0                  30  TERM     EQU   X'C0'             TERMINATION STATUS=X'C0'        MAG00310
0000R     4830 00FER                 31           LH    R3,MTADR          LOAD MAG TAPE ADDRESS           MAG00320
0004R     4890 00FCR                 32           LH    R9,SELCH          LOAD SELCH ADDRESS              MAG00330
0008R     DE90 0102R                 33           OC    R9,STOP           STOP SELCH                      MAG00340
000CR     DE30 0103R                 34  OUTEST   OC    R3,RESET          OUTPUT RESET                    MAG00350
0010R     9D34                       35           SSR   R3,R4             SENSE STATUS ON MAG TAPE        MAG00360
0012R     4210 000CR                 36           BTC   DU,OUTEST         IS MAG TAPE UNAVAILABLE         MAG00370
0016R     C340 0020                  37           THI   R4,BOT            TEST FOR BOT                    MAG00380
001AR     2335                       38           BZS   WRT              BRANCH TO WRITE                 MAG00390
001CR     4150 0042R                 39           BAL   R5,FLMK           FILEMARK ROUTINE                MAG00400
0020R     4150 003CR                 40           BAL   R5,BAKSP          BACKSPACE TAPE ROUTINE          MAG00410
0024R     C810 003CR                 41  WRT      LHI   R1,BUFSRT         LOAD START OF BUFFER            MAG00420
0028R     C820 00F3R                 42           LHI   R2,BUFEND         LOAD END OF BUFFER              MAG00430
002CR     41C0 0050R                 43           BAL   R12,WRITE         DO WRITE                        MAG00440
                                     44  *                                                                 MAG00450
0030R     4150 003CR                 45           BAL   R5,BAKSP          BACKSPACE TAPE ROUTINE          MAG00460
0034R     41C0 005AR                 46           BAL   R12,READ          DO READ                         MAG00470
0038R     C200 00F8R                 47  END1     LPSW  END                                               MAG00480
                                     48  ******************************************************           MAG00490
                                     49  * SUBROUTINE: BAKSP                                             MAG00500
                                     50  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                  MAG00510
                                     51  *       SEE CALLING SEQUENCE BELOW.                             MAG00520
                                     52  *                                                                 MAG00530
                                     53  *  SUBROUTINE: FLMK                                              MAG00540
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16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS       PAGE   2  22:57:19  09/11/79

                                54  *       THIS SUBROUTINE WRITES A FILEMARK                          MAG00550
                                55  *       SEE CALLING SEQUENCE BELOW.                                MAG00560
                                56  *                                                                  MAG00570
                                57  *                                                                  MAG00580
                                58  ******************************************************            MAG00590
                                59  *                                                                  MAG00600
                                60  *  SUBROUTINE: NOMOT                                               MAG00610
                                61  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                  MAG00620
                                62  *       STOP MOVING.                                               MAG00630
                                63  *                                                                  MAG00640
                                64  *       CALLING SEQUENCE:      BAL R5,BAKSP                        MAG00650
                                65  *       ----------------       BAL R5,FLMK                         MAG00660
                                66  *                              BAL R5,NOMOT                        MAG00670
                                67  *       R3=DEVICE ADDRESS REGISTER                                 MAG00680
                                68  *       R5=RETURN REGISTER                                         MAG00690
                                69  *                                                                  MAG00700
                                70  *       WORK REGISTERS:                                            MAG00710
                                71  *       ---------------                                            MAG00720
                                72  *       R4=DEVICE STATUS REGISTER                                  MAG00730
                                73  *                                                                  MAG00740
                                74  ******************************************************            MAG00750
                                75  *                                                                  MAG00760
003CR  DE30 0105R               76  BAKSP    OC     R3,BKSP             OUTPUT BACKSPACE               MAG00770
0040R  2303                     77           BS     NOMOT               BRANCH TO NOMOTION             MAG00780
0042R  DE30 0104R               78  FLMK     OC     R3,FILMRK           OUTPUT FILEMARK                MAG00790
0046R  9034                     79  NOMOT    SSR    R3,R4               SENSE STATUS ON MAG TAPE       MAG00800
0048R  C340 0010                80           THI    R4,TEST             TEST FOR NO MOTION             MAG00810
004CR  2233                     81           BZS    NOMOT               SENSE AGAIN                    MAG00820
004ER  0305                     82           BR     R5                  RETURN                         MAG00830
                                83  ******************************************************            MAG00840
                                84  *  SUBROUTINE: WRITE                                               MAG00850
                                85  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE            MAG00860
                                86  *       MAG TAPE.                                                  MAG00870
                                87  *       SEE CALLING SEQUENCE BELOW                                 MAG00880
                                88  *  SUBROUTINE READ                                                 MAG00890
                                89  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE             MAG00900
                                90  *       MAG TAPE.                                                  MAG00910
                                91  *                                                                  MAG00920
                                92  *       CALLING SEQUENCE:      BAL R12,WRITE                       MAG00930
                                93  *       -----------------      BAL R12,READ                        MAG00940
                                94  *       R1=START OF BUFFER                                         MAG00950
                                95  *       R2=END OF BUFFER                                           MAG00960
                                96  *       R3=DEVICE ADDRESS REIGSTER                                 MAG00970
                                97  *       R9=SELCH ADDRESS REGISTER                                  MAG00980
                                98  *       R12=RETURN REGISTER                                        MAG00990
                                99  *                                                                  MAG01000
                               100  *       WORK REGISTERS:                                            MAG01010
                               101  *       ---------------                                            MAG01020
                               102  *       R4=STATUS REGISTER                                         MAG01030
                               103  *       R5=NOMOTION RETURN REGISTER                                MAG01040
                               104  *       R7=RETRY COUNT                                             MAG01050
                               105  *       R8=COMMAND REGISTER                                        MAG01060
                               106  *       R10=SELCH COMMAND REGISTER                                 MAG01070
                               107  *       R11=WORK REGISTER                                          MAG01080
                               108  ******************************************************            MAG01090
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16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS       PAGE   3  22:57:19  09/11/79

0050R  D380 0107R          109  WRITE    LB     R8,WRTCMD          LOAD WRITE COMMAND                  MAG01100
0054R  D3A0 0101R          110           LB     R10,SFLWRT         LOAD SELCH WRITE                    MAG01110
0058R  2305                111           BS     RETRY              BRANCH TO RETRY                     MAG01120
005AR  D380 0108R          112  READ     LB     R8,RDCMD           LOAD READ COMMAND                   MAG01130
005ER  D3A0 0100R          113           LB     R10,SFLRD          LOAD SELCH READ                     MAG01140
0062R  0777                114  RETRY    XHR    R7,R7              ZERO OUT COUNT                      MAG01150
0064R  9D34                115  SENSE1   SSR    R3,R4              SENSE STATUS ON MAG TAPE            MAG01160
0066R  2091                116           BTBS   OU+BSY,SENSE1      TEST FOR BUSY+DEVICE UNAVAILABLE    MAG01170
0068R  DE90 0102R          117           OC     R9,STOP            STOP SELCH                          MAG01180
006CR  9891                118           WHR    R9,R1              WRITE START OF BUFFER TO SELCH      MAG01190
006ER  9892                119           WHR    R9,R2              WRITE END OF BUFFER TO SELCH        MAG01200
0070R  9E38                120           OCR    R3,R8              OUTPUT COMMAND TO MT                MAG01210
0072R  9E9A                121           OCR    R9,R10             OUTPUT COMMAND TO SELCH             MAG01220
0074R  9D94                122           SSR    R9,R4              SENSE STATUS ON SELCH               MAG01230
0076R  2081                123           BTBS   BSY,1              TEST FOR BUSY                       MAG01240
0078R  DE90 0102R          124           OC     R9,STOP            STOP THE SELCH                      MAG01250
007CR  999B                125           RHR    R9,R11             READ FINAL ADR. FROM SELCH          MAG01260
007ER  DE90 0102R          126           OC     R9,STOP            STOP THE SELCH                      MAG01270
0082R  9D34                127           SSR    R3,R4              SENSE STATUS ON THE MAG TAPE        MAG01280
0084R  C340 00C0           128           THI    R4,TERM            TEST FOR GOOD TERMINATION           MAG01290
0088R  4230 0098R          129           BNZ    ERROR              BRANCH TO TRY AGAIN                 MAG01300
008CR  05B2                130           CLHR   R11,R2             TEST END OF BUFFER                  MAG01310
008ER  4230 0098R          131           BNE    ERROR                                                  MAG01320
0092R  4150 0046R          132           BAL    R5,NOMOT           WAIT FOR TAPE TO STOP               MAG01330
0096R  030C                133           BR     R12                RETURN                              MAG01340
                           134  *                                                                      MAG01350
                           135  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS    MAG01360
                           136  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS         MAG01370
                           137  *   BEFORE TERMINATING.                                                MAG01380
                           138  *                                                                      MAG01390
0098R  C570 0005           139  ERROR    CLHI   R7,5               TEST FOR 5 TRIES                    MAG01400
009CR  4330 00B8R          140           BE     ERROR1             BRANCH TO ERROR1                    MAG01410
00A0R  4150 0046R          141           BAL    R5,NOMOT           STOP MOTION OF TAPE                 MAG01420
00A4R  9D34                142           SSR    R3,R4              SENSE STATUS ON MAG TAPE            MAG01430
00A6R  C340 00C0           143           THI    R4,TERM            TEST FOR GOOD TERMINATION           MAG01440
00AAR  4330 00B8R          144           BZ     ERROR1             BRANCH TO ERROR1                    MAG01450
00AER  4150 003CR          145           BAL    R5,BAKSP           BACKSPACE ROUTINE                   MAG01460
00B2R  2671                146           AIS    R7,1               ADD ONE TO COUNT                    MAG01470
00B4R  4300 0064R          147           B      SENSE1             BRANCH TO SENSE1                    MAG01480
                           148  *                                                                      MAG01490
00B8R  C200 00F4R          149  ERROR1   LPSW   ERROR2                                                 MAG01500
                           150  *                                                                      MAG01510
                           151  *   BUFFER                                                             MAG01520
                           152  *                                                                      MAG01530
00BCR                      153           ALIGN  4                  ALIGN START OF BUFFER               MAG01540
                           154  *                                  ON HALFWORD BOUNDARY                MAG01550
00BCR  0123                155  BUFSRT   DC     X'0123',X'4567'                                        MAG01560
00BER  4567
00C0R  89AB                156           DC     X'89AB',X'CDEF'                                       MAG01570
00C2R  CDEF
00C4R  0123                157           DC     X'0123',X'4567'                                       MAG01580
00C6R  4567
00C8R  89AB                158           DC     X'89AB',X'CDEF'                                       MAG01590
00CAR  CDEF
00CCR  0123                159           DC     X'0123',X'4567'                                       MAG01600
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16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS       PAGE   4  22:57:19  09/11/79

00CER  4567
00D0R  89AB                    160            DC    X'89AB',X'CDEF'                                  MAG01610
00D2R  CDEF
00D4R  0123                    161            DC    X'0123',X'4567'                                  MAG01620
00D6R  4567
00D8R  89AB                    162            DC    X'89AB',X'CDEF'                                  MAG01630
00DAR  CDEF
00DCR  0123                    163            DC    X'0123',X'4567'                                  MAG01640
00DER  4567
00E0R  89AB                    164            DC    X'89AB',X'CDEF'                                  MAG01650
00E2R  CDEF
00E4R  0123                    165            DC    X'0123',X'4567'                                  MAG01660
00E6R  4567
00E8R  89AB                    166            DC    X'89AB',X'CDEF'                                  MAG01670
00EAR  CDEF
00ECR  0123                    167            DC    X'0123',X'4567'                                  MAG01680
00EER  4567
00F0R  89AB                    168            DC    X'89AB',X'CDEF'                                  MAG01690
00F2R  CDEF
       0000 00F3R              169  BUFEND    EQU   *-1                                              MAG01700
00F4R  8000                    170  ERROR2    DC    X'8000',A(ERROR1)                                MAG01710
00F6R  00B8R
00F8R  8000                    171  END       DC    X'8000'                                          MAG01720
00FAR  0038R                   172            DC    A(END1)                                          MAG01730
00FCR  00F0                    173  SELCH     DC    X'F0'          SELECTOR CHANNEL ADDRESS          MAG01740
00FER  0085                    174  MTADR     DC    X'85'          MAG TAPE ADDRESS                  MAG01750
0100R  30                      175  SELRD     DB    X'30'          SELCH READ COMMAND                MAG01760
0101R  10                      176  SELWRT    DB    X'10'          SELCH WRITE COMMAND               MAG01770
0102R  08                      177  STOP      DB    X'08'          SELCH STOP COMMAND                MAG01780
0103R  E0                      178  RESET     DB    X'E0'          RESET COMMAND                     MAG01790
0104R  30                      179  FILMRK    DB    X'30'          FILEMARK COMMAND                  MAG01800
0105R  11                      180  BKSP      DB    X'11'          BACKSPACE COMMAND                 MAG01810
0106R  38                      181  REWIND    DB    X'38'          REWIND COMMAND                    MAG01820
0107R  22                      182  WRTCMD    DB    X'22'          WRITE COMMAND FOR MAG TAPE        MAG01830
0108R  21                      183  RDCMD     DB    X'21'          READ COMMAND FOR MAG TAPE         MAG01840
010AR                          184            END                                                    MAG01850
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    16-BIT SELCH WITH MAG TAPE USING SENSE STATUS LOOPS       PAGE   5  22:57:19  09/11/79

ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

   NO CAL ERRORS
   NO CAL WARNINGS
    2 PASSES

 ABSTOP    0000 0000
 ADC       0000 0002
 BAKSP     0000 003CR       40     45     76*    145
 BKSP      0000 0105R       76    180*
 BOT       0000 0020        29*    37
 BSY       0000 0008        22*   116    123
 BUFEND    0000 00F3R       42    169*
 BUFSRT    0000 00BCR       41    155*
 DU        0000 0001        16*    36    116
 DUTEST    0000 000CR       34*    36
 END       0000 00F8R       47    171*
 END1      0000 0038R       47*   172
 ERROR     0000 0098R      129    131    139*
 ERROR1    0000 00B8R      140    144    149*   170
 ERROR2    0000 00F4R      149    170*
 FILMRK    0000 0104R       78    179*
 FLMK      0000 0042R       39     78*
 IMPTOP    0000 010AR
 LADC      0000 0001
 MTADR     0000 00FER       31    174*
 NOMOT     0000 0046R       77     79*    81    132    141
 PURETOP   0000 0000R
 R1        0000 0001        15*    41    118
 R10       0000 000A        25*   110    113    121
 R11       0000 000B        26*   125    130
 R12       0000 000C        27*    43     46    133
 R2        0000 0002        17*    42    119    130
 R3        0000 0003        18*    31     34     35     76     78     79    115    120    127    142
 R4        0000 0004        19*    35     37     79     80    115    122    127    128    142    143
 R5        0000 0005        20*    39     40     45     82    132    141    145
 R7        0000 0007        21*   114    114    139    146
 R8        0000 0008        23*   109    112    120
 R9        0000 0009        24*    32     33    117    118    119    121    122    124    125    126
 RDCMD     0000 0108R      112    183*
 READ      0000 005AR       46    112*
 RESET     0000 0103R       34    178*
 RETRY     0000 0062R      111    114*
 REWIND    0000 0106R      181*
 SELCH     0000 00FCR       32    173*
 SELRD     0000 0100R      113    175*
 SELWRT    0000 0101R      110    176*
 SENSE1    0000 0064R      115*   116    147
 STOP      0000 0102R       33    117    124    126    177*
 TERM      0000 00C0        30*   128    143
 TEST      0000 0010        28*    80
 WRITE     0000 0050R       43    109*
 WRT       0000 0024R       38     41*
 WRTCMD    0000 0107R      109    182*
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      16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS     PAGE   1  22:54:17  09/11/79

PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)
                                    1  MAGTP    PROG  16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS

                                    1  MAGTP    PROG  16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS
                                    2           SCRAT                                                          MAG00020
                                    3           WIDTH 120                                                      MAG00030
                                    4           CROSS                                                          MAG00040
                                    5           TARGT 16                                                       MAG00050
                                    6  *                                                                       MAG00070
                                    7  *  THIS PROGRAM USES THE SELCH AND IMMEDIATE                           MAG00080
                                    8  *  INTERRUPTS TO WRITE A BUFFER TO THE                                  MAG00090
                                    9  *  MAG TAPE AND THEN READ IT BACK                                       MAG00100
                                   10  *  INTO MEMORY.                                                        MAG00110
                                   11  *                                                                       MAG00120
                                   12  *  16-BIT PROCESSORS                                                   MAG00130
                                   13  *                                                                       MAG00140
                                   14  *  REGISTER ASSIGNMENTS:                                               MAG00150
                                   15  *                                                                       MAG00160
          0000 0001                16  R1       EQU   1              START OF BUFFER REGISTER                 MAG00170
          0000 0001                17  DU       EQU   1              DEVICE UNAVAILABLE                      MAG00180
          0000 0002                18  R2       EQU   2              END OF BUFFER REGISTER                  MAG00190
          0000 0003                19  R3       EQU   3              DEVICE ADDRESS REGISTER                 MAG00200
          0000 0004                20  R4       EQU   4              STATUS                                  MAG00210
          0000 0005                21  R5       EQU   5              RETURN REGISTER                         MAG00220
          0000 0007                22  R7       EQU   7              COUNTER                                 MAG00230
          0000 0008                23  BSY      EQU   8              BUSY                                    MAG00240
          0000 0008                24  R8       EQU   8              COMMAND BYTE STORE                      MAG00250
          0000 0009                25  R9       EQU   9              SELCH ADDRESS REGISTER                  MAG00260
          0000 000A                26  R10      EQU   10             SELCH COMMAND HOLD REGISTER             MAG00270
          0000 000B                27  R11      EQU   11             WORK REGISTER                           MAG00280
          0000 000C                28  R12      EQU   12             RETURN REGISTER                         MAG00290
          0000 000D                29  R13      EQU   13             INTERRUPT DEVICE REGISTER               MAG00300
          0000 000E                30  R14      EQU   14             INTERRUPT STATUS REGISTER               MAG00310
          0000 000F                31  R15      EQU   15             WORK REGISTER                           MAG00320
          0000 0010                32  TEST     EQU   X'10'          TEST=NOMOTION BIT                       MAG00330
          0000 0020                33  BOT      EQU   X'20'          TEST FOR BOT                            MAG00340
          0000 00C0                34  TERM     EQU   X'C0'          TERMINATION STATUS=X'C0'                MAG00350
0000R     07FF                     35           XHR   R15,R15        ZERO OUT REGISTER 15                    MAG00360
0002R     40F0 0044                36           STH   R15,X'44'      ZERO OUT NEW PSW                        MAG00370
0006R     C8F0 0098R               37           LHI   R15,MTINT      LOAD INTERRUPT HANDLER                  MAG00380
000AR     40F0 0046                38           STH   R15,X'46'      STORE INTERRUPT HANDLER IN NEW LOC      MAG00390
000ER     4830 0106R               39           LH    R3,MTADR       LOAD MAG TAPE ADDRESS                   MAG00400
0012R     4890 0104R               40           LH    R9,SELCH       LOAD SELCH ADDRESS                      MAG00410
0016R     DE90 010ER               41           OC    R9,STOP        STOP SELCH                              MAG00420
001AR     DE30 010FR               42  OUTEST   OC    R3,RESET       OUTPUT RESET TO MAG TAPE                MAG00430
001ER     9D34                     43           SSR   R3,R4          SENSE STATUS ON MAG TAPE                MAG00440
0020R     4210 001AR               44           BTC   DU,OUTEST      IS MAG TAPE UNAVAILABLE                 MAG00450
0024R     C340 0020                45           THI   R4,BOT         TEST FOR BOT                            MAG00460
0028R     2335                     46           BZS   WRT           BRANCH TO WRITE                         MAG00470
002AR     4150 0050R               47           BAL   R5,FLMK        FILEMARK ROUTINE                        MAG00480
002ER     4150 004AR               48           BAL   R5,BAKSP       BACKSPACE ROUTINE                       MAG00490
0032R     C810 00C4R               49  WRT      LHI   R1,BUFSRT      LOAD START OF BUFFER                    MAG00500
0036R     C820 00FBR               50           LHI   R2,BUFEND      LOAD END OF BUFFER                      MAG00510
003AR     41C0 005ER               51           BAL   R12,WRITE      DO WRITE                                MAG00520
                                   52  *                                                                       MAG00530
003ER     4150 004AR               53           BAL   R5,BAKSP       BACKSPACE TAPE ROUTINE                  MAG00540
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16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS     PAGE   2  22:54:17  09/11/79

0042R  41C0 006AR          54            BAL   R12,READ            DO READ                                  MAG00550
0046R  C200 0100R          55  END1      LPSW  END                                                          MAG00560
                           56  ********************************************************                   MAG00570
                           57  * SUBROUTINE: BAKSP                                                        MAG00580
                           58  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                             MAG00590
                           59  *       SEE CALLING SEQUENCE BELOW.                                        MAG00600
                           60  *                                                                          MAG00610
                           61  *  SUBROUTINE: FLMK                                                        MAG00620
                           62  *       THIS SUBROUTINE WRITES A FILEMARK                                  MAG00630
                           63  *       SEE CALLING SEQUENCE BELOW.                                        MAG00640
                           64  *                                                                          MAG00650
                           65  *                                                                          MAG00660
                           66  ********************************************************                   MAG00670
                           67  *                                                                          MAG00680
                           68  *  SUBROUTINE: NOMOT                                                       MAG00690
                           69  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                          MAG00700
                           70  *       STOP MOVING.                                                       MAG00710
                           71  *                                                                          MAG00720
                           72  *       CALLING SEQUENCE:     BAL R5,BAKSP                                 MAG00730
                           73  *       ----------------      BAL R5,FLMK                                  MAG00740
                           74  *                             BAL R5,NOMOT                                 MAG00750
                           75  *       R3=DEVICE ADDRESS REGISTER                                         MAG00760
                           76  *       R5=RETURN REGISTER                                                 MAG00770
                           77  *                                                                          MAG00780
                           78  *       WORK REGISTERS:                                                    MAG00790
                           79  *       ---------------                                                    MAG00800
                           80  *       R4=DEVICE STATUS REGISTER                                          MAG00810
                           81  *                                                                          MAG00820
                           82  ********************************************************                   MAG00830
                           83  *                                                                          MAG00840
004AR  DE30 0111R          84  BAKSP     OC    R3,BKSP             OUTPUT A BACKSPACE                   MAG00850
004ER  2303                85            BS    NOMOT               BRANCH TO NOMOTION                   MAG00860
0050R  DE30 0110R          86  FLMK      OC    R3,FILMRK           OUTPUT A FILEMARK                    MAG00870
0054R  9D34                87  NOMOT     SSR   R3,R4               SENSE STATUS                         MAG00880
0056R  C340 0010           88            TMI   R4,TEST             TEST FOR NO MOTION                   MAG00890
005AR  2233                89            BZS   NOMOT              SENSE AGAIN                          MAG00900
005CR  0305                90            BR    R5                  RETURN                               MAG00910
                           91  ********************************************************                   MAG00920
                           92  *                                                                          MAG00930
                           93  *  SUBROUTINE: WRITE                                                       MAG00940
                           94  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE                    MAG00950
                           95  *       MAG TAPE.                                                          MAG00960
                           96  *       SEE CALLING SEQUENCE BELOW                                         MAG00970
                           97  *                                                                          MAG00980
                           98  *  SUBROUTINE READ                                                         MAG00990
                           99  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE                     MAG01000
                          100  *       MAG TAPE.                                                          MAG01010
                          101  *                                                                          MAG01020
                          102  *       CALLING SEQUENCE:     BAL R12,WRITE                                MAG01030
                          103  *       ----------------      BAL R12,READ                                 MAG01040
                          104  *       R1=START OF BUFFER                                                 MAG01050
                          105  *       R2=END OF BUFFER                                                   MAG01060
                          106  *       R3=DEVICE ADDRESS REIGSTER                                         MAG01070
                          107  *       R9=SELCH ADDRESS REGISTER                                          MAG01080
                          108  *       R12=RETURN REGISTER                                                MAG01090
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16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS     PAGE   3  22:54:17  09/11/79

                                  109  *                                                                    MAG01100
                                  110  *       WORK REGISTERS:                                              MAG01110
                                  111  *       -------------                                                MAG01120
                                  112  *       R4=STATUS REGISTER                                           MAG01130
                                  113  *       R5=NOMOTION RETURN REGISTER                                  MAG01140
                                  114  *       R7=RETRY COUNT                                               MAG01150
                                  115  *       R8=COMMAND REGISTER                                          MAG01160
                                  116  *       R10=SELCH COMMAND REGISTER                                   MAG01170
                                  117  *       R11=WORK REGISTER                                            MAG01180
                                  118  *       R13=INTERRUPT DEVICE REGISTER                                MAG01190
                                  119  *       R14=INTERRUPT STATUS REGISTER                                MAG01200
                                  120  ***************************************************                  MAG01210
005ER  D380 0113R                 121  WRITE    LB    R8,WRTCMD          LOAD WRITE COMMAND               MAG01220
0062R  D3A0 010DR                 122           LB    R10,SELWRT         LOAD SELCH WRITE                 MAG01230
0066R  4300 0072R                 123           B     RETRY              BRANCH TO RETRY                  MAG01240
                                  124  *                                                                    MAG01250
006AR  D380 0114R                 125  READ     LB    R8,RDCMD           LOAD READ COMMAND                MAG01260
006ER  D3A0 010CR                 126           LB    R10,SELRD          LOAD SELCH READ                  MAG01270
0072R  0777                       127  RETRY    XHR   R7,R7              ZERO OUT COUNT                   MAG01280
0074R  9D34                       128  SENSE1   SSR   R3,R4              SENSE STATUS                     MAG01290
0076R  2091                       129           BTBS  DU+BSY,SENSE1      TEST FOR BUSY+DEVICE UNAVAILABLE MAG01300
0078R  DE90 010ER                 130           OC    R9,STOP            STOP SELCH                       MAG01310
007CR  9891                       131           WHR   R9,R1              WRITE START OF BUFFER TO SELCH   MAG01320
007ER  9892                       132           WHR   R9,R2              WRITE END OF BUFFER TO SELCH     MAG01330
0080R  9E38                       133           OCR   R3,R8              OUTPUT COMMAND TO MT             MAG01340
0082R  9E9A                       134           OCR   R9,R10             OUTPUT COMMAND TO SELCH          MAG01350
0084R  C200 0108R                 135  WAIT1    LPSW  WAIT                                                MAG01360
0088R  9FDE                       136  MTINT    AIR   R13,R14                                              MAG01370
008AR  DE90 010ER                 137           OC    R9,STOP            STOP THE SELCH                   MAG01380
008ER  999B                       138           RHR   R9,R11             READ FINAL ADR. FROM SELCH       MAG01390
0090R  DE90 010ER                 139           OC    R9,STOP            STOP THE SELCH                   MAG01400
0094R  9D34                       140           SSR   R3,R4              SENSE STATUS OF MAG TAPE         MAG01410
0096R  C340 00C0                  141           THI   R4,TERM            TEST FOR GOOD TERMINATION        MAG01420
009AR  4230 00AAR                 142           BNZ   ERROR             BRANCH TO TRY AGAIN.             MAG01430
009ER  0582                       143           CLHR  R11,R2             TEST FOR END OF BUFFER           MAG01440
00A0R  4230 00AAR                 144           BNE   ERROR                                               MAG01450
00A4R  4150 0054R                 145           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP            MAG01460
00A8R  030C                       146           BR    R12                RETURN                           MAG01470
                                  147  *                                                                    MAG01480
                                  148  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS  MAG01490
                                  149  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS       MAG01500
                                  150  *   BEFORE TERMINATING.                                              MAG01510
                                  151  *                                                                    MAG01520
00AAR  C570 0005                  152  ERROR    CLHI  R7,5               TEST FOR 5 TRIES                 MAG01530
00AER  4330 00C0R                 153           BE    ERROR1             BRANCH TO ERROR1                 MAG01540
00B2R  4150 0054R                 154           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP            MAG01550
00B6R  4150 004AR                 155           BAL   R5,BAKSP           OUTPUT A BACKSPACE               MAG01560
00BAR  2671                       156           AIS   R7,1               ADD ONE TO COUNT                 MAG01570
00BCR  4300 0074R                 157           B     SENSE1             BRANCH TO SENSE1                 MAG01580
00C0R  C200 00FCR                 158  ERROR1   LPSW  ERROR2                                              MAG01590
00C4R                             159           ALIGN 4                  ALIGN START OF BUFFER            MAG01600
                                  160  *                                 ON HALFWORD BOUNDARY             MAG01610
00C4R  0123                       161  BUFSRT   DC    X'0123',X'4567'                                     MAG01620
00C6R  4567
00C8R  89AB                       162           DC    X'89AB',X'CDEF'                                     MAG01630
```

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16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS     PAGE    4  22:54:17  09/11/79

00CAR  CDEF
00CCR  0123                    163            DC    X'0123',X'4567'                                  MAG01640
00CER  4567
00D0R  89AB                    164            DC    X'89AB',X'CDEF'                                  MAG01650
00D2R  CDEF
00D4R  0123                    165            DC    X'0123',X'4567'                                  MAG01660
00D6R  4567
00D8R  89AB                    166            DC    X'89AB',X'CDEF'                                  MAG01670
00DAR  CDEF
00DCR  0123                    167            DC    X'0123',X'4567'                                  MAG01680
00DER  4567
00E0R  89AB                    168            DC    X'89AB',X'CDEF'                                  MAG01690
00E2R  CDEF
00E4R  0123                    169            DC    X'0123',X'4567'                                  MAG01700
00E6R  4567
00E8R  89AB                    170            DC    X'89AB',X'CDEF'                                  MAG01710
00EAR  CDEF
00ECR  0123                    171            DC    X'0123',X'4567'                                  MAG01720
00EER  4567
00F0R  89AB                    172            DC    X'89AB',X'CDEF'                                  MAG01730
00F2R  CDEF
00F4R  0123                    173            DC    X'0123',X'4567'                                  MAG01740
00F6R  4567
00F8R  89AB                    174            DC    X'89AB',X'CDEF'                                  MAG01750
00FAR  CDEF
       0000 00FBR              175  BUFEND    EQU   *-1                                              MAG01760
00FCR  8000                    176  ERROR2    DC    X'8000',A(ERROR1)                                MAG01770
00FER  00C0R
0100R  8000                    177  END       DC    X'8000'                                          MAG01780
0102R  0046R                   178            DC    A(END1)                                          MAG01790
0104R  00F0                    179  SELCH     DC    X'F0'       SELECTOR CHANNEL ADDRESS             MAG01800
0106R  0085                    180  MTADR     DC    X'85'       MAG TAPE ADDRESS                     MAG01810
0108R  C000                    181  WAIT      DC    X'C000'     PUT PROCESSOR IN WAIT STATE          MAG01820
010AR  0084R                   182            DC    WAIT1       WITH EXTERNAL INTERRUPTS ENABLED     MAG01830
010CR  30                      183  SELRD     DB    X'30'       SELCH READ COMMAND                   MAG01840
010DR  10                      184  SELWRT    DB    X'10'       SELCH WRITE COMMAND                  MAG01850
010ER  08                      185  STOP      DB    X'08'       SELCH STOP COMMAND                   MAG01860
010FR  E0                      186  RESET     DB    X'E0'       RESET COMMAND                        MAG01870
0110R  30                      187  FILMRK    DB    X'30'       FILEMARK COMMAND                     MAG01880
0111R  11                      188  BKSP      DB    X'11'       BACKSPACE COMMAND                    MAG01890
0112R  38                      189  REWIND    DB    X'38'       REWIND COMMAND                       MAG01900
0113R  22                      190  WRTCMD    DB    X'22'       WRITE COMMAND FOR MAG TAPE           MAG01910
0114R  21                      191  RDCMD     DB    X'21'       READ COMMAND FOR MAG TAPE            MAG01920
0116R                          192            END                                                    MAG01930
```

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   16-BIT SELCH WITH MAG TAPE USING IMMEDIATE INTERRUPTS     PAGE   5  22:54:17  09/11/79

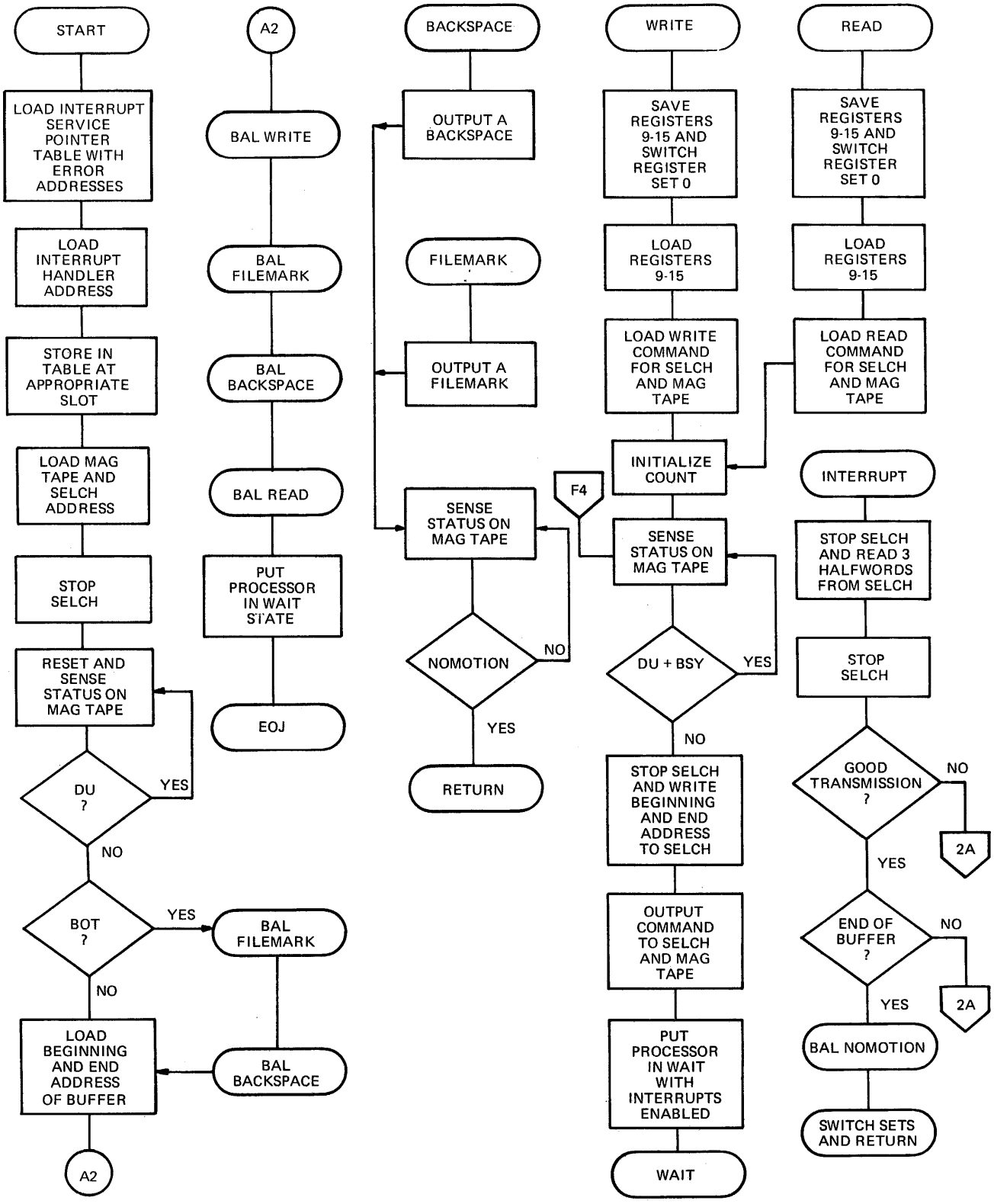
ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

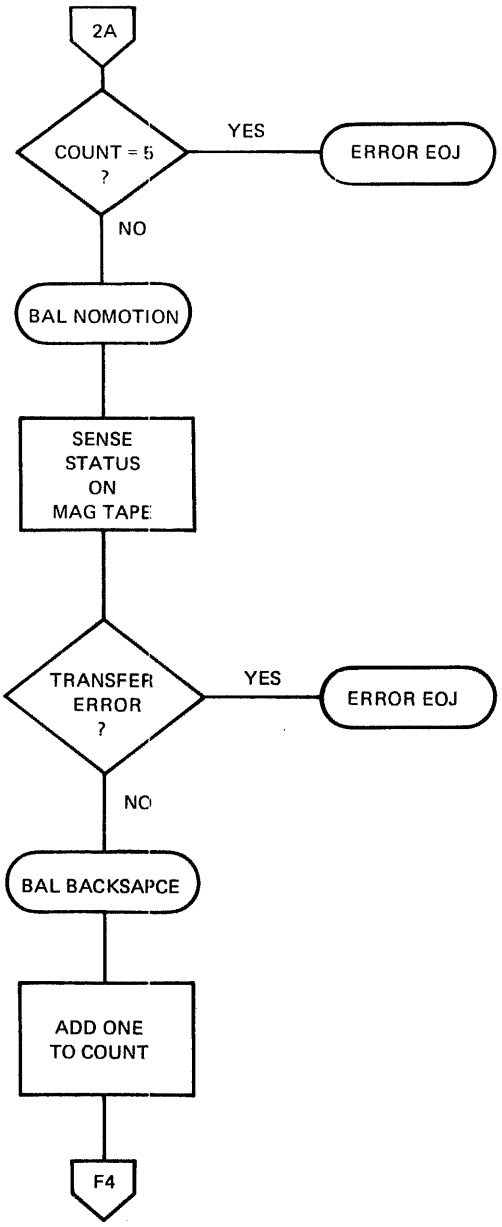
   NO CAL ERRORS
   NO CAL WARNINGS
    2 PASSES

ABSTOP    0000 0000
ADC       0000 0002
BAKSP     0000 004AR        48     53     84*   155
BKSP      0000 0111R        84    188*
BOT       0000 0020         33*    45
BSY       0000 0008         23*   129
BUFEND    0000 00FBR        50    175*
BUFSRT    0000 00C4R        49    161*
DU        0000 0001         17*    44    129
DUTEST    0000 001AR        42*    44
END       0000 0100R        55    177*
END1      0000 0046R        55*   178
ERROR     0000 00AAR       142    144    152*
ERROR1    0000 00C0R       153    158*   176
ERROR2    0000 00FCR       158    176*
FILMRK    0000 0110R        86    187*
FLMK      0000 0050R        47     86*
IMPTOP    0000 0116R
LADC      0000 0001
MTADR     0000 0106R        39    180*
MTINT     0000 0088R        37    136*
NOMOT     0000 0054R        85     87*    89    145    154
PURETOP   0000 0000R
R1        0000 0001         16*    49    131
R10       0000 000A         26*   122    126    134
R11       0000 000B         27*   138    143
R12       0000 000C         28*    51     54    146
R13       0000 000D         29*   136
R14       0000 000E         30*   136
R15       0000 000F         31*    35     35     36     37     38
R2        0000 0002         18*    50    132    143
R3        0000 0003         19*    39     42     43     84     86     87    128    133    140
R4        0000 0004         20*    43     45     87     88    128    140    141
R5        0000 0005         21*    47     48     53     90    145    154    155
R7        0000 0007         22*   127    127    152    156
R8        0000 0008         24*   121    125    133
R9        0000 0009         25*    40     41    130    131    132    134    137    138    139
RDCMD     0000 0114R       125    191*
READ      0000 006AR        54    125*
RESET     0000 010FR        42    186*
RETRY     0000 0072R       123    127*
REWIND    0000 0112R       189*
SELCH     0000 0104R        40    179*
SELRD     0000 010CR       126    183*
SELWRT    0000 010DR       122    184*
SENSE1    0000 0074R       128*   129    157
STOP      0000 010ER        41    130    137    139    185*
```

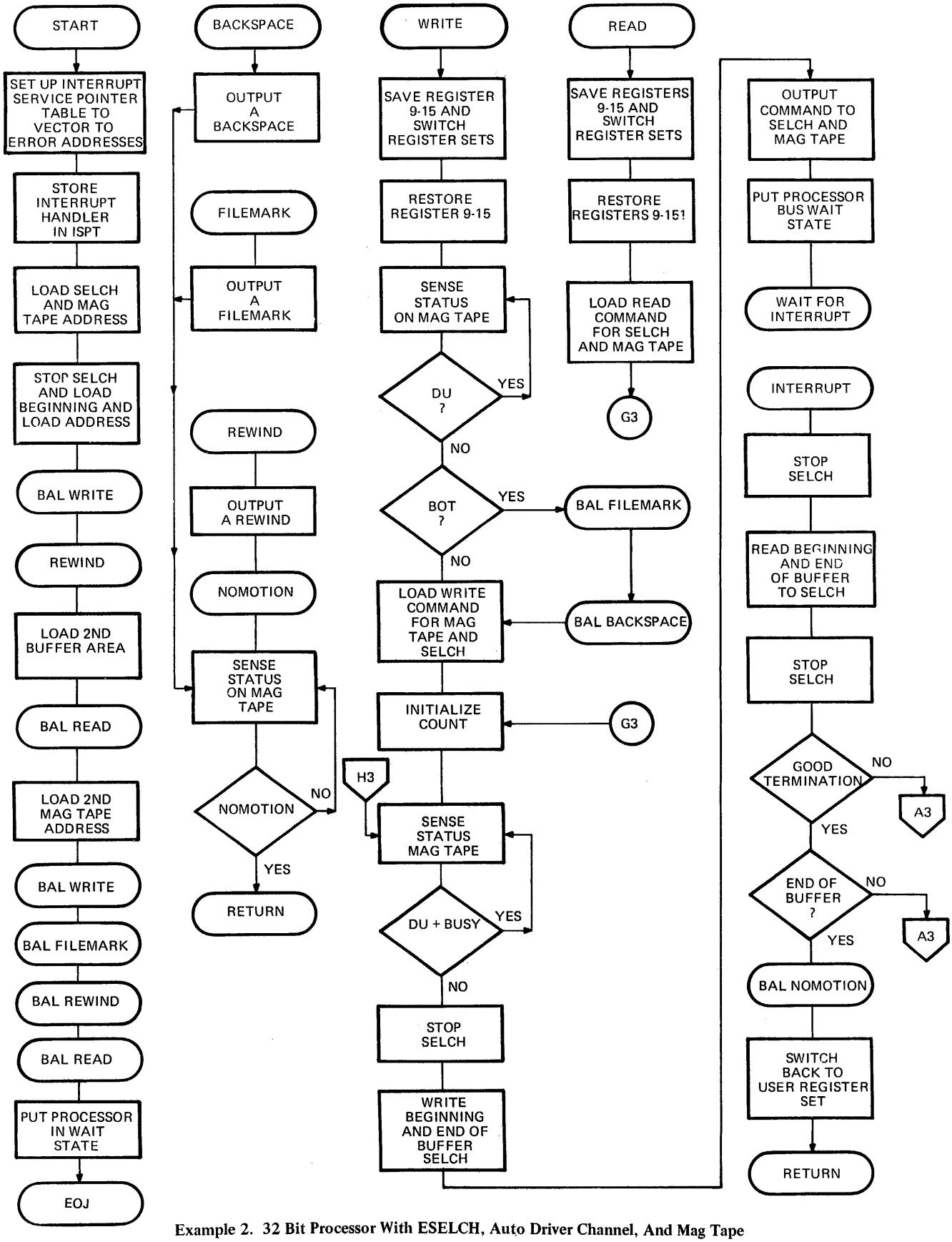
```
TERM      0000 00C0        34*   141
TEST      0000 0010        32*    88
WAIT      0000 0108R      135    181*
WAIT1     0000 0084R      135*   182
WRITE     0000 005ER       51    121*
WRT       0000 0032R       46     49*
WRTCMD    0000 0113R      121    190*
```



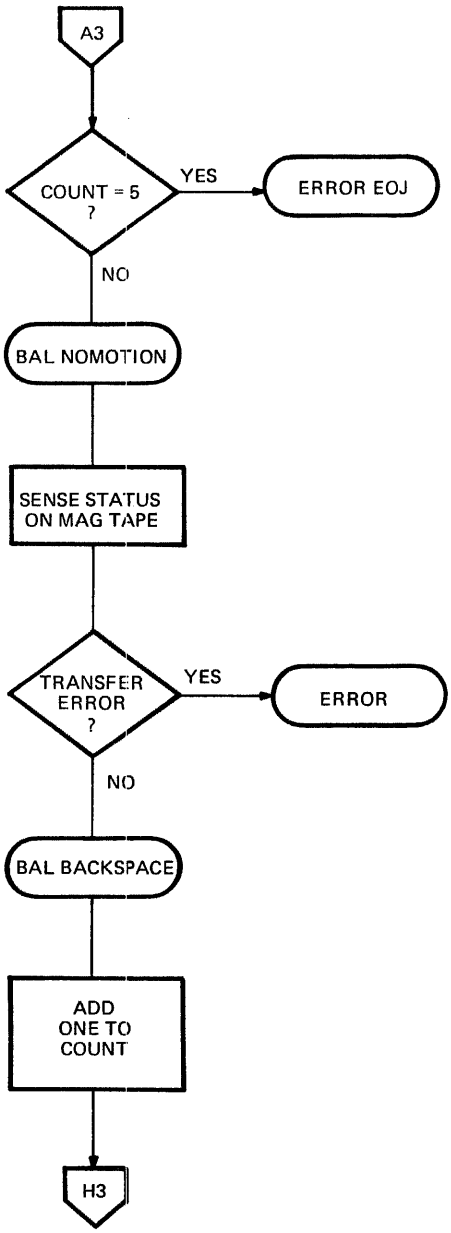
Example 1. 32 Bit Processor With Immediate Interrupts, And Mag Tape



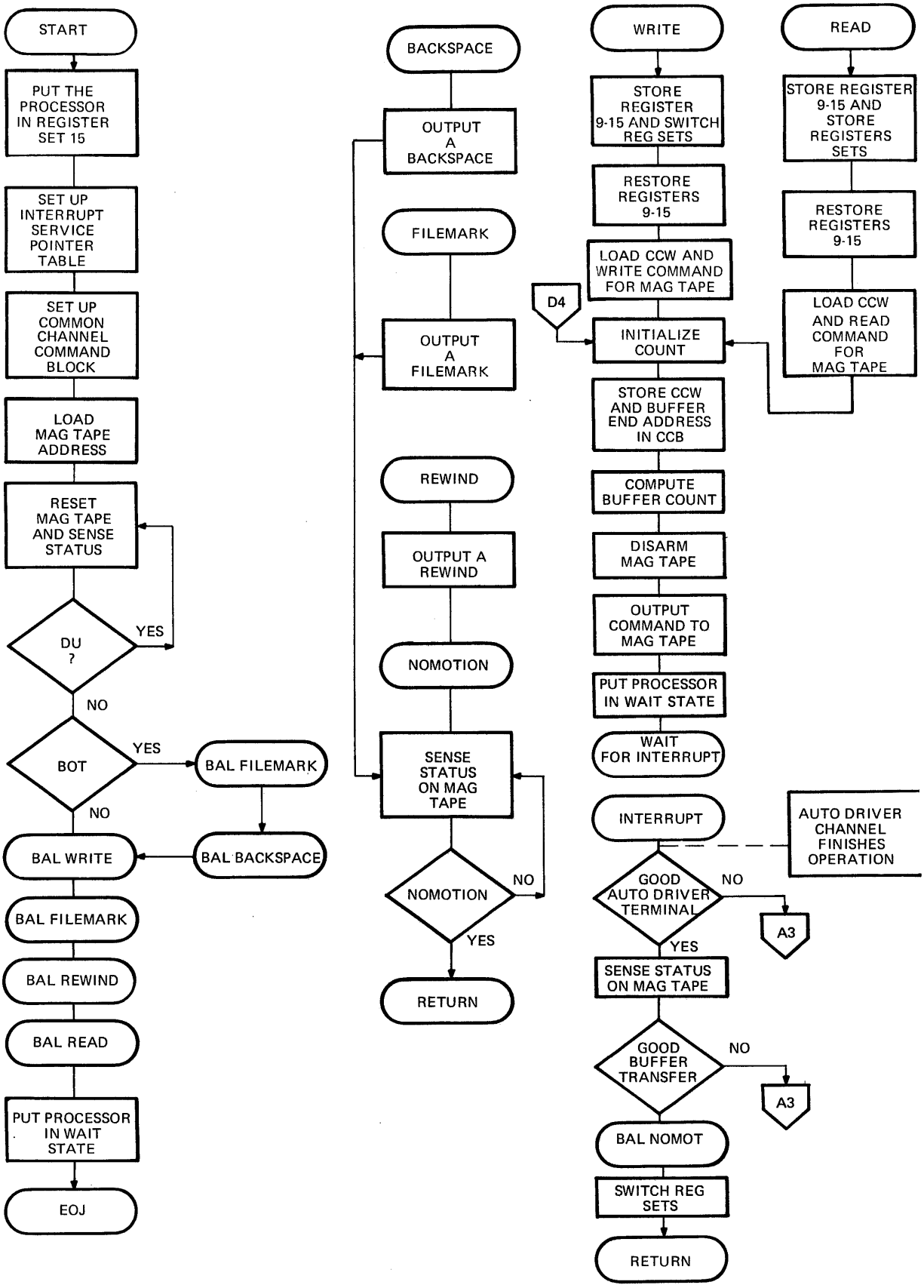
Example 1. (Continued)



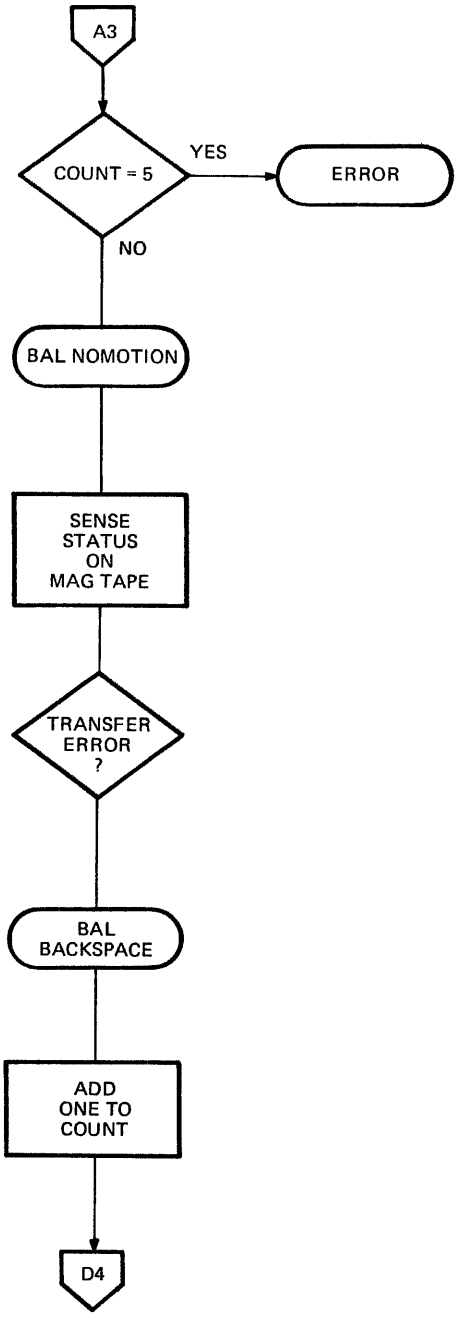
Example 2. 32 Bit Processor With ESELCH, Auto Driver Channel, And Mag Tape



Example 2. (Continued)



Example 3. 32 Bit Processor With Immediate Interrupts, ESELCH, And Two Mag Tapes



Example 3. (Continued)

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      32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   1  23:05:51  09/11/79

PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

                                  1  MAGTP    PROG  32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS   MAG00010
                                  2           SCRAT                                                           MAG00020
                                  3           WIDTH 120                                                       MAG00030
                                  4           CROSS                                                           MAG00040
                                  5           NORX3                                                           MAG00050
                                  6           TARGT 32                                                        MAG00060
                                  7  *                                                                        MAG00070
                                  8  *  THIS PROGRAM USES THE E-SELCH AND IMMEDIATE                          MAG00080
                                  9  *  INTERRUPTS TO WRITE A BUFFER TO THE                                   MAG00090
                                 10  *   MAG TAPE,READ IT BACK INTO A SECOND BUFFER AREA AND                  MAG00100
                                 11  *   COPY IT ONTO ANOTHER MAG TAPE.                                       MAG00110
                                 12  *                                                                        MAG00120
                                 13  *  32-BIT PROCESSORS                                                    MAG00130
                                 14  *                                                                        MAG00140
                                 15  *  NOTE:  THE INTERRUPT SERVICE POINTER TABLE IS SET                    MAG00150
                                 16  *         UP TO VECTOR TO ERROR ROUTINES (EOJ) EXCEPT                   MAG00160
                                 17  *         FOR THE SELCH INTERRUPT HANDLER                               MAG00170
                                 18  *                                                                        MAG00180
                                 19  *  REGISTER ASSIGNMENTS:                                                MAG00190
                                 20  *                                                                        MAG00200
      0000 0000                  21  R0       EQU   0                 WORK REGISTER                         MAG00210
      0000 0001                  22  R1       EQU   1                 WORK REGISTER                         MAG00220
      0000 0001                  23  DU       EQU   1                 DEVICE UNAVAILABLE                    MAG00230
      0000 0003                  24  R3       EQU   3                 STATUS REGISTER                       MAG00240
      0000 0004                  25  R4       EQU   4                 STATUS                                MAG00250
      0000 0005                  26  R5       EQU   5                 RETURN REGISTER                       MAG00260
      0000 0007                  27  R7       EQU   7                 COUNTER                               MAG00270
      0000 0008                  28  BSY      EQU   8                 BUSY                                  MAG00280
      0000 0008                  29  R8       EQU   8                 COMMAND BYTE STORE                    MAG00290
      0000 0009                  30  R9       EQU   9                 SELCH ADDRESS REGISTER                MAG00300
      0000 000A                  31  R10      EQU   10                SELCH COMMAND HOLD REGISTER           MAG00310
      0000 000C                  32  R12      EQU   12                MAG TAPE ADDRESS REGISTER             MAG00320
      0000 000D                  33  R13      EQU   13                BUFFER START ADDRESS REGISTER         MAG00330
      0000 000E                  34  R14      EQU   14                BUFFER END ADDRESS REGISTER           MAG00340
      0000 000F                  35  R15      EQU   15                RETURN REGISTER                       MAG00350
      0000 0010                  36  TEST     EQU   X'10'             TEST=NOMOTION BIT                     MAG00360
      0000 0020                  37  BOT      EQU   X'20'             TEST FOR BOT                          MAG00370
      0000 00C0                  38  TERM     EQU   X'C0'             TERMINATION STATUS=X'C0'              MAG00380
                                 39  *                                                                        MAG00390
                                 40  *   SWITCH INTO REGISTER SET 0                                           MAG00400
                                 41  *                                                                        MAG00410
000000I  C8F0 00F0               42           LHI   R15,X'00F0'       LOAD REGISTER SET 15                  MAG00420
000004I  959F                    43           EPSR  R9,R15            ACTIVATE                              MAG00430
                                 44  *                                                                        MAG00440
                                 45  *   SET UP INTERRUPT SERVICE                                             MAG00450
                                 46  *   POINTER TABLE                                                        MAG00460
                                 47  *                                                                        MAG00470
000006I  07FF                    48           XR    R15,R15           ZERO OUT WORK REGISTER                MAG00480
000008I  C8C0 0064I              49           LHI   R12,ERROR1        LOAD ERROR ROUTINE ADDRESS            MAG00490
00000CI  40CF 00D0               50  LOAGAIN  STH   R12,X'D0'(R15)    INTO FIRST SLOT OF ISPT               MAG00500
000010I  26F2                    51           AIS   R15,2             BUMP COUNTER BY 2                     MAG00510
000012I  C5F0 0200               52           CLHI  R15,X'200'        COMPARE TO LIMIT                      MAG00520
000016I  4280 FFF2 =00000CI      53           BL    LOAGAIN           COMPLETE TABLE                        MAG00530
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      32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   2  23:05:51  09/11/79

00001AI  4890 81DA =0001F8I      54            LH    R9,SELCH            LOAD SELCH ADDRESS                  MAG00540
00001EI  1191                    55            SLLS  R9,1                MULTIPLY BY 2                       MAG00550
000020I  C8F0 00EAI              56            LHI   R15,STNTR           LOAD INTERRUPT HANDLER              MAG00560
000024I  40F9 0000               57            STH   R15,X'00'(R9)       PLACE IN TABLE AT PROPER SLOT       MAG00570
                                 58  *                                                                       MAG00580
                                 59  *   SET UP SELCH AND MAG TAPE                                           MAG00590
                                 60  *                                                                       MAG00600
000028I  4890 81CC =0001F8I      61            LH    R9,SELCH            LOAD SELCH ADDRESS                  MAG00610
00002CI  DE90 81D0 =000200I      62            OC    R9,STOP             STOP SELCH                          MAG00620
000030I  48C0 81C6 =0001FAI      63            LH    R12,MTADR           LOAD MAG TAPE ADDRESS               MAG00630
000034I  E6D0 8188 =0001C0I      64            LA    R13,BUFSRT          LOAD START OF BUFFER ADDRESS        MAG00640
000038I  E6E0 818B =0001F7I      65            LA    R14,BUFEND          LOAD END OF BUFFER                  MAG00650
00003CI  41F0 8042 =000082I      66            BAL   R15,WRITE           DO WRITE                            MAG00660
000040I  4150 8030 =000074I      67            BAL   R5,REWND            REWIND ROUTINE                      MAG00670
000044I  E6D0 8140 =000188I      68            LA    R13,BUFST2          LOAD START OF SECOND BUFFER         MAG00680
000048I  E6E0 8172 =0001BEI      69            LA    R14,BUFEND2         LOAD END OF SECOND BUFFER           MAG00690
00004CI  41F0 8060 =000080I      70            BAL   R15,READ            DO READ                             MAG00700
000050I  48C0 81A8 =0001FCI      71            LH    R12,MTADR2          LOAD ADDRESS OF SECOND MAG TAPE     MAG00710
000054I  41F0 802A =000082I      72            BAL   R15,WRITE           DO WRITE ROUTINE                    MAG00720
000058I  4150 8012 =00006EI      73            BAL   R5,FLMK             FILEMARK ROUTINE                    MAG00730
00005CI  4150 8014 =000074I      74            BAL   R5,REWND            REWIND ROUTINE                      MAG00740
000060I  41F0 804C =000080I      75            BAL   R15,READ            DO READ ROUTINE                     MAG00750
000064I  C200 80C8 =000130I      76  END1      LPSW  END                                                     MAG00760
                                 77  *                                                                       MAG00770
                                 78  *********************************************************             MAG00780
                                 79  * SUBROUTINE: BAKSP                                                   MAG00790
                                 80  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                        MAG00800
                                 81  *       SEE CALLING SEQUENCE BELOW.                                   MAG00810
                                 82  *                                                                     MAG00820
                                 83  *  SUBROUTINE: FLMK                                                   MAG00830
                                 84  *       THIS SUBROUTINE WRITES A FILEMARK                             MAG00840
                                 85  *       SEE CALLING SEQUENCE BELOW.                                   MAG00850
                                 86  *                                                                     MAG00860
                                 87  *  SUBROUTINE: REWIND                                                 MAG00870
                                 88  *       THIS SUBROUTINE REWINDS THE MAG TAPE.                         MAG00880
                                 89  *       SEE CALLING SEQUENCE BELOW                                    MAG00890
                                 90  *                                                                     MAG00900
                                 91  *********************************************************             MAG00910
                                 92  *                                                                     MAG00920
                                 93  *  SUBROUTINE: NOMOT                                                  MAG00930
                                 94  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                     MAG00940
                                 95  *       STOP MOVING.                                                  MAG00950
                                 96  *                                                                     MAG00960
                                 97  *       CALLING SEQUENCE:     BAL R5,BAKSP                            MAG00970
                                 98  *       -----------------     BAL R5,FLMK                             MAG00980
                                 99  *                             BAL R5,REWIND                           MAG00990
                                100  *                             BAL R5,NOMOT                            MAG01000
                                101  *       R12=DEVICE ADDRESS REGISTER                                   MAG01010
                                102  *       R5=RETURN REGISTER                                            MAG01020
                                103  *                                                                     MAG01030
                                104  *       WORK REGISTERS:                                               MAG01040
                                105  *       ---------------                                               MAG01050
                                106  *       R4=DEVICE STATUS REGISTER                                     MAG01060
                                107  *                                                                     MAG01070
                                108  *********************************************************             MAG01080
```

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     32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   3  23:05:51  09/11/79

                                    109  *                                                                    MAG01090
000068I  DEC0 8197 =000203I        110  BAKSP    OC     R12,BKSP            OUTPUT A BACKSPACE               MAG01100
00006CI  2306                      111           BS     NOMOT               BRANCH TO NOMOTION               MAG01110
00006EI  DEC0 8190 =000202I        112  FLMK     OC     R12,FILMRK          OUTPUT A FILEMARK                MAG01120
000072I  2303                      113           BS     NOMOT               BRANCH TO NOMOTION               MAG01130
000074I  DEC0 818C =000204I        114  REWND    OC     R12,RFWIND          OUTPUT A REWIND                  MAG01140
000078I  9DC4                      115  NOMOT    SSR    R12,R4              SENSE STATUS ON MAG TAPE         MAG01150
00007AI  C340 0010                 116           THI    R4,TEST             TEST FOR NO MOTION               MAG01160
00007EI  2233                      117           BZS    NOMOT               SENSE AGAIN                      MAG01170
000080I  0305                      118           BR     R5                  RETURN                           MAG01180
                                   119  ******************************************************               MAG01190
                                   120  *                                                                    MAG01200
                                   121  *  SUBROUTINE: WRITE                                                 MAG01210
                                   122  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE              MAG01220
                                   123  *       MAG TAPE.                                                    MAG01230
                                   124  *       SEE CALLING SEQUENCE BELOW                                   MAG01240
                                   125  *                                                                    MAG01250
                                   126  *  SUBROUTINE READ                                                   MAG01260
                                   127  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE               MAG01270
                                   128  *       MAG TAPE.                                                    MAG01280
                                   129  *                                                                    MAG01290
                                   130  *       CALLING SEQUENCE:     BAL R12,WRITE                          MAG01300
                                   131  *       -----------.---       BAL R12,READ                           MAG01310
                                   132  *       R9 =SELCH ADDRESS REGISTER                                   MAG01320
                                   133  *       R12=MAG TAPE ADDRESS REGISTER                                MAG01330
                                   134  *       R13=BUFFER START REGISTER                                    MAG01340
                                   135  *       R14=BUFFER END REGISTER                                      MAG01350
                                   136  *       R15=RETURN REGISTER                                          MAG01360
                                   137  *                                                                    MAG01370
                                   138  *       WORK REGISTERS:                                              MAG01380
                                   139  *       ------------                                                 MAG01390
                                   140  *                                                                    MAG01400
                                   141  *   REGISTER SET 0 IS USED TO PERFORM THE READ/WRITE ROUTINES         MAG01410
                                   142  *                                                                    MAG01420
                                   143  ******************************************************               MAG01430
000082I  D090 80CA =000150I        144  WRITE    STM    R9,REGSAV           STORE R9-R15 IN SAVE AREA        MAG01440
000086I  C200 80AE =000138I        145           LPSW   SWITCH1             SWITCH TO REGISTER SET 0         MAG01450
00008AI  D190 80C2 =000150I        146  WRITE1   LM     R9,REGSAV           RESTORE REGISTERS 9-15           MAG01460
00008EI  9DC4                      147  SENS     SSR    R12,R4              SENSE STATUS ON MAG TAPE         MAG01470
000090I  4210 FFFA =00008EI        148           BTC    DU,SENS             IS MAG TAPE UNAVAILABLE          MAG01480
000094I  C340 0020                 149           THI    R4,BOT              TEST FOR BOT                     MAG01490
000098I  4330 8008 =0000A4I        150           BZ     WRT                 BRANCH TO WRT                    MAG01500
00009CI  4150 FFCE =00006EI        151           BAL    R5,FLMK             FILEMARK ROUTINE                 MAG01510
0000A0I  4150 FFC4 =000068I        152           BAL    R5,BAKSP            BACKSPACE ROUTINE                MAG01520
0000A4I  D380 815D =000205I        153  WRT      LB     R8,WRTCMD           LOAD WRITE COMMAND FOR SELCH     MAG01530
0000A8I  D3A0 8153 =0001FFI        154           LB     R10,SFLWRT          LOAD SELCH WRITE                 MAG01540
0000ACI  4300 8014 =0000C4I        155           B      RETRY               BRANCH TO RETRY                  MAG01550
                                   156  *                                                                    MAG01560
0000B0I  D090 809C =000150I        157  READ     STM    R9,REGSAV           STORE R9-R15 IN SAVE AREA        MAG01570
0000B4I  C200 8088 =000140I        158           LPSW   SWITCH2             SWITCH TO REGISTER SET 0         MAG01580
0000B8I  D190 8094 =000150I        159  READ1    LM     R9,REGSAV           RESTORE REGISTERS 9-15           MAG01590
0000BCI  D380 8146 =000206I        160           LB     R8,RDCMD            LOAD READ COMMAND FOR MAG TAPE   MAG01600
0000C0I  D3A0 813A =0001FEI        161           LB     R10,SFLRD           LOAD SELCH READ                  MAG01610
0000C4I  0777                      162  RETRY    XR     R7,R7               ZERO OUT COUNT                   MAG01620
0000C6I  9DC4                      163  SENSE1   SSR    R12,R4              SENSE STATUS ON MAG TAPE         MAG01630
```

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      32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   4  23:05:51  09/11/79

0000C8I  2091                    164            BTBS   DU+BSY,SENSE1       TEST FOR BUSY+DEVICE UNAVAILABLE      MAG01640
0000CAI  DE90 8132 =000200I      165            OC     R9,STOP             STOP SELCH                            MAG01650
0000CEI  084D                    166            LR     R4,R13              LOAD START OF BUFFER IN WORK AREA     MAG01660
0000D0I  EC40 0010               167            SRL    R4,16               SHIFT OVER 16 PLACES                  MAG01670
0000D4I  9A94                    168            WDR    R9,R4               WRITE UPPER BYTE                      MAG01680
0000D6I  989D                    169            WHR    R9,R13              WRITE LOWER HALFWORD                  MAG01690
0000D8I  084E                    170            LR     R4,R14              LOAD END OF BUFFER IN WORK AREA       MAG01700
0000DAI  EC40 0010               171            SRL    R4,16               SHIFT OVER TO WRITE HIGH ORDER BITS   MAG01710
0000DEI  9A94                    172            WDR    R9,R4               WRITE UPPER BYTE                      MAG01720
0000E0I  989E                    173            WHR    R9,R14              WRITE LOWER HALFWORD                  MAG01730
0000E2I  9EC8                    174            OCR    R12,R8              OUTPUT COMMAND TO MAG TAPE            MAG01740
0000E4I  9E9A                    175            OCR    R9,R10              OUTPUT COMMAND TO SELCH               MAG01750
0000E6I  C200 805E =000148I      176  WAIT1     LPSW   WAIT                WAIT FOR INTERRUPTS                   MAG01760
0000EAI  DE90 8112 =000200I      177  SINTR     OC     R9,STOP             STOP SELCH                            MAG01770
0000EEI  9B94                    178            RDR    R9,R4               READ UPPER BYTE                       MAG01780
0000F0I  ED40 0010               179            SLL    R4,16               SHIFT OVER TO ACCESS LOW ORDER BITS   MAG01790
0000F4I  9994                    180            RHR    R9,R4               READ LOWER BYTE                       MAG01800
0000F6I  DE90 8106 =000200I      181            OC     R9,STOP             STOP THE SELCH                        MAG01810
0000FAI  C330 00C0               182            THI    R3,TERM             TEST FOR GOOD TRANSMISSION            MAG01820
0000FEI  4230 8012 =000114I      183            BNZ    ERROR               BRANCH TO TRY AGAIN.                  MAG01830
000102I  05E4                    184            CLR    R14,R4              TEST FOR END OF BUFFER                MAG01840
000104I  4230 800C =000114I      185            BNE    ERROR               BRANCH TO ERROR                       MAG01850
000108I  4150 FF6C =000078I      186            BAL    R5,NOWOT            WAIT FOR TAPE TO STOP                 MAG01860
00010CI  C800 00F0               187            LHI    R0,X'00F0'          CHANGE TO REGISTER SET F              MAG01870
000110I  9510                    188            EPSR   R1,R0               ACTIVATE NEW REGISTER SET             MAG01880
000112I  030F                    189            BR     R15                 RETURN                                MAG01890
                                 190  *    THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS    MAG01900
                                 191  *    AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS         MAG01910
                                 192  *    BEFORE TERMINATING.                                                MAG01920
                                 193  *                                                                       MAG01930
000114I  C570 0005               194  ERROR     CLHI   R7,5                TEST FOR 5 TRIES                      MAG01940
000118I  4330 FF48 =000064I      195            BE     ERROR1              BRANCH TO ERROR1                      MAG01950
00011CI  4150 FF58 =000078I      196            BAL    R5,NOWOT            WAIT FOR TAPE TO STOP                 MAG01960
000120I  4150 FF44 =000068I      197            BAL    R5,BAKSP            OUTPUT A BACKSPACE                    MAG01970
000124I  2671                    198            AIS    R7,1                ADD ONE TO COUNT                      MAG01980
000126I  4300 FF9C =0000C6I      199            B      SENSE1              BRANCH TO SENSE1                      MAG01990
         0000 0064I              200  ERROR1    EQU    END1                BRANCH TO END1                        MAG02000
000130I                          201            ALIGN  8                                                         MAG02010
000130I  0000 8000               202  END       DC     Y'8000'             PUT PROCESSOR IN WAIT STATE           MAG02020
000134I  0000 0064I              203            DC     A(END1)                                                   MAG02030
000138I  0000 0000               204  SWITCH1   DC     Y'0000'             REGISTER SET ZERO                     MAG02040
00013CI  0000 008AI              205            DC     A(WRITE1)                                                 MAG02050
000140I  0000 0000               206  SWITCH2   DC     Y'0000'             REGISTER SET ZERO                     MAG02060
000144I  0000 00B8I              207            DC     A(READ1)                                                  MAG02070
000148I  0000 C000               208  WAIT      DC     Y'C000'             PUT PROCESSOR IN WAIT STATE INT ENAB  MAG02080
00014CI  0000 00E6I              209            DC     WAIT1               WITH EXTERNAL INTERRUPTS ENABLED      MAG02090
000150I                          210  REGSAV    DS     56                  STORAGE FOR REGISTER                  MAG02100
000188I                          211  BUFST2    DS     56                  START BUFFER 2 STORAGE AREA           MAG02110
         0000 018EI              212  BUFEND2   EQU    *-2                 END BUFFER 2 STORAGE AREA             MAG02120
0001C0I  0123                    213  BUFSRT    DC     X'0123',X'4567'                                           MAG02130
0001C2I  4567
0001C4I  89AB                    214            DC     X'89AB',X'CDEF'                                           MAG02140
0001C6I  CDEF
0001C8I  0123                    215            DC     X'0123',X'4567'                                           MAG02150
0001CAI  4567
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     32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   5  23:05:51  09/11/79

0001CCI  89AB                  216            DC    X'89AB',X'CDEF'                                  MAG02160
0001CEI  CDEF
0001D0I  0123                  217            DC    X'0123',X'4567'                                  MAG02170
0001D2I  4567
0001D4I  89AB                  218            DC    X'89AB',X'CDEF'                                  MAG02180
0001D6I  CDEF
0001D8I  0123                  219            DC    X'0123',X'4567'                                  MAG02190
0001DAI  4567
0001DCI  89AB                  220            DC    X'89AB',X'CDEF'                                  MAG02200
0001DEI  CDEF
0001E0I  0123                  221            DC    X'0123',X'4567'                                  MAG02210
0001E2I  4567
0001E4I  89AB                  222            DC    X'89AB',X'CDEF'                                  MAG02220
0001E6I  CDEF
0001E8I  0123                  223            DC    X'0123',X'4567'                                  MAG02230
0001EAI  4567
0001ECI  89AB                  224            DC    X'89AB',X'CDEF'                                  MAG02240
0001EEI  CDEF
0001F0I  0123                  225            DC    X'0123',X'4567'                                  MAG02250
0001F2I  4567
0001F4I  89AB                  226            DC    X'89AB',X'CDEF'                                  MAG02260
0001F6I  CDEF
         0000 01F7I            227  BUFEND    EQU   *-1                                              MAG02270
0001F8I  00F0                  228  SELCH     DC    X'F0'          SELECTOR CHANNEL ADDRESS          MAG02280
0001FAI  0085                  229  MTADR     DC    X'85'          MAG TAPE ADDRESS                  MAG02290
0001FCI  00C5                  230  MTADR2    DC    X'C5'          SECOND MAG TAPE ADDRESS           MAG02300
0001FEI  70                    231  SELRD     DB    X'70'          READ,EXT ADD                      MAG02310
0001FFI  50                    232  SELWRT    DB    X'50'          WRITE,EXT ADD                     MAG02320
000200I  48                    233  STOP      DB    X'48'          STOP,EXT ADD                      MAG02330
000201I  E0                    234  RESET     DB    X'E0'          RESET COMMAND                     MAG02340
000202I  30                    235  FILMRK    DB    X'30'          FILEMARK COMMAND                  MAG02350
000203I  11                    236  BKSP      DB    X'11'          BACKSPACE COMMAND                 MAG02360
000204I  38                    237  REWIND    DB    X'38'          REWIND COMMAND                    MAG02370
000205I  22                    238  WRTCMD    DB    X'22'          WRITE COMMAND FOR MAG TAPE        MAG02380
000206I  21                    239  RDCMD     DB    X'21'          READ COMMAND FOR MAG TAPE         MAG02390
000208I                        240            END                                                    MAG02400
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   32-BIT     R/W,MULTI-DEVICE,E-SELCH,IMMEDIATE INTERRUPTS  PAGE   6  23:05:51  09/11/79

ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

   NO CAL ERRORS
   NO CAL WARNINGS
    2 PASSES

 ABSTOP    0000 0000
 ADC       0000 0004
 BAKSP     0000 0068I       110*   152    197
 BKSP      0000 0203I       110    236*
 BOT       0000 0020         37*   149
 BSY       0000 0008         28*   164
 BUFEND    0000 01F7I        65    227*
 BUFEND2   0000 01BEI        69    212*
 BUFSRT    0000 01C0I        64    213*
 BUFST2    0000 0188I        68    211*
 DU        0000 0001         23*   148    164
 END       0000 0130I        76    202*
 END1      0000 0064I        76*   200    203
 ERROR     0000 0114I       183    185    194*
 ERROR1    0000 0064I        49    195    200*
 FILMRK    0000 0202I       112    235*
 FLMK      0000 006EI        73    112*   151
 IMPTOP    0000 0208I
 LADC      0000 0002
 LDAGAIN   0000 000CI        50*    53
 MTADR     0000 01FAI        63    229*
 MTADR2    0000 01FCI        71    230*
 NOMOT     0000 0078I       111    113    115*   117    186    196
 PURETOP   0000 0000P
 R0        0000 0000         21*   187    188
 R1        0000 0001         22*   188
 R10       0000 000A         31*   154    161    175
 R12       0000 000C         32*    49     50     63     71    110    112    114    115    147    163    174
 R13       0000 000D         33*    64     68    166    169
 R14       0000 000E         34*    65     69    170    173    184
 R15       0000 000F         35*    42     43     48     48     50     51     52     56     57     66     70     72
                             75    189
 R3        0000 0003         24*   182
 R4        0000 0004         25*   115    116    147    149    163    166    167    168    170    171    172    178
                            179    180    184
 R5        0000 0005         26*    67     73     74    118    151    152    186    196    197
 R7        0000 0007         27*   162    162    194    198
 R8        0000 0008         29*   153    160    174
 R9        0000 0009         30*    43     54     55     57     61     62    144    146    157    159    165    168
                            169    172    173    175    177    178    180    181
 RDCMD     0000 0206I       160    239*
 READ      0000 00B0I        70     75    157*
 READ1     0000 0088I       159*   207
 REGSAV    0000 0150I       144    146    157    159    210*
 RESET     0000 0201I       234*
 RETRY     0000 00C4I       155    162*
 REWIND    0000 0204I       114    237*
```

REWND	0000 0074I	67	74	114*			
SELCH	0000 01F8I	54	61	228*			
SELRD	0000 01FEI	161	231*				
SELWRT	0000 01FFI	154	232*				
SENS	0000 008EI	147*	148				
SENSE1	0000 00C6I	163*	164	199			
SINTR	0000 00EAI	56	177*				
STOP	0000 0200I	62	165	177	181	233*	
SWITCH1	0000 0138I	145	204*				
SWITCH2	0000 0140I	158	206*				
TERM	0000 00C0	38*	182				
TEST	0000 0010	36*	116				
WAIT	0000 0148I	176	208*				
WAIT1	0000 00E6I	176*	209				
WRITE	0000 0082I	66	72	144*			
WRITE1	0000 008AI	146*	205				
WRT	0000 00A4I	150	153*				
WRTCMD	0000 0205I	153	238*				

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      32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS                PAGE   1  23:04:16  09/11/79
PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

                                    1  MAGTP    PROG  32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS   MAG00010
                                    2           SCRAT                                              MAG00020
                                    3           WIDTH 120                                          MAG00030
                                    4           CROSS                                              MAG00040
                                    5           NORX3                                              MAG00050
                                    6           TARGT 32                                           MAG00060
                                    7           SQUEZ 2                                            MAG00070
                                    8  *                                                           MAG00080
                                    9  *  THIS PROGRAM USES THE E-SELCH AND IMMEDIATE             MAG00090
                                   10  *  INTERRUPTS TO WRITE A BUFFER TO THE                      MAG00100
                                   11  *  MAG TAPE AND THEN READ IT BACK                           MAG00110
                                   12  *  INTO MEMORY.                                            MAG00120
                                   13  *                                                           MAG00130
                                   14  *  32-BIT PROCESSORS                                       MAG00140
                                   15  *                                                           MAG00150
                                   16  *  NOTE:  THE INTERRUPT SERVICE POINTER TABLE IS SET       MAG00160
                                   17  *         UP TO VECTOR TO ERROR ROUTINES (EOJ) EXCEPT      MAG00170
                                   18  *         FOR THE SELCH INTERRUPT HANDLER                  MAG00180
                                   19  *                                                           MAG00190
                                   20  *  REGISTER ASSIGNMENTS:                                   MAG00200
                                   21  *                                                           MAG00210
0000 0000                          22  R0       EQU   0              WORK REGISTER               MAG00220
0000 0001                          23  R1       EQU   1              WORK REGISTER               MAG00230
0000 0001                          24  DU       EQU   1              DEVICE UNAVAILABLE          MAG00240
0000 0002                          25  R2       EQU   2              END OF BUFFER REGISTER      MAG00250
0000 0003                          26  R3       EQU   3              STATUS REGISTER             MAG00260
0000 0004                          27  R4       EQU   4              WORK REGISTER               MAG00270
0000 0005                          28  R5       EQU   5              RETURN REGISTER             MAG00280
0000 0007                          29  R7       EQU   7              COUNTER                     MAG00290
0000 0008                          30  BSY      EQU   8              BUSY                        MAG00300
0000 0008                          31  R8       EQU   8              COMMAND BYTE STORE          MAG00310
0000 0009                          32  R9       EQU   9              SELCH ADDRESS REGISTER      MAG00320
0000 000A                          33  R10      EQU   10             SELCH COMMAND HOLD REGISTER MAG00330
0000 000C                          34  R12      EQU   12             MAG TAPE ADDRESS REGISTER   MAG00340
0000 000D                          35  R13      EQU   13             START OF BUFFER REGISTER    MAG00350
0000 000E                          36  R14      EQU   14             END OF BUFFER REGISTER      MAG00360
0000 000F                          37  R15      EQU   15             RETURN REGISTER             MAG00370
0000 0010                          38  TEST     EQU   X'10'          TEST=NOMOTION BIT           MAG00380
0000 0020                          39  BOT      EQU   X'20'          TEST FOR BOT                MAG00390
0000 00C0                          40  TERM     EQU   X'C0'          TERMINATION STATUS=X'C0'    MAG00400
                                   41  *                                                          MAG00410
                                   42  *   SET UP INTERRUPT                                       MAG00420
                                   43  *   SERVICE POINTER                                        MAG00430
                                   44  *   TABLE                                                  MAG00440
                                   45  *                                                          MAG00450
000000I  C8F0 00F0                 46           LHI   R15,X'00F0'    LOAD REGISTER SET 15        MAG00460
000004I  959F                      47           EPSR  R9,R15         ACTIVATE                    MAG00470
000006I  07FF                      48           XR    R15,R15        ZERO OUT WORK REGISTER      MAG00480
000008I  C8C0 005CI                49           LHI   R12,ERROR1     LOAD ERROR ROUTINE ADDRESS  MAG00490
00000CI  40CF 00D0                 50  LDAGAIN  STH   R12,X'D0'(R15) INTO FIRST SLOT OF ISPT    MAG00500
000010I  26F2                      51           AIS   R15,2          BUMP COUNTER BY 2           MAG00510
000012I  C5F0 0200                 52           CLHI  R15,X'200'     COMPARE TO LIMIT            MAG00520
*000016I 2085                      53           BL    LDAGAIN        COMPLETE TABLE              MAG00530
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      32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS              PAGE   2  23:04:16  09/11/79

000018I  4890 8174 =000190I     54            LH    R9,SELCH            LOAD SELCH ADDRESS                MAG00540
00001CI  1191                   55            SLLS  R9,1                MULTIPLY BY 2                     MAG00550
00001EI  C8F0 00C4I             56            LHI   R15,SYNTR           LOAD INTERRUPT HANDLER            MAG00560
000022I  40F9 0000              57            STH   R15,X'D0'(R9)       PLACE IN TABLE AT PROPER SLOT     MAG00570
000026I  48C0 8168 =000192I     58            LH    R12,MTADR           LOAD MAG TAPE ADDRESS             MAG00580
00002AI  4890 8162 =000190I     59            LH    R9,SELCH            LOAD SELCH ADDRESS                MAG00590
00002EI  DE90 8164 =000196I     60            OC    R9,STOP             STOP SELCH                        MAG00600
000032I  DEC0 8161 =000197I     61  DUTEST     OC    R12,RESET           OUTPUT RESET TO MAG TAPE          MAG00610
000036I  9DC4                   62            SSR   R12,R4              SENSE STATUS ON MAG TAPE          MAG00620
*000038I 2013                   63            BTC   DU,DUTEST           IS MAG TAPE UNAVAILABLE           MAG00630
00003AI  C340 0020              64            THI   R4,BOT              TEST FOR BOT                      MAG00640
00003EI  2335                   65            BZS   WRT                 BRANCH TO WRITE                   MAG00650
000040I  4150 8022 =000066I     66            BAL   R5,FLMK             FILEMARK ROUTINE                  MAG00660
000044I  4150 8018 =000060I     67            BAL   R5,BAKSP            BACKSPACE ROUTINE                 MAG00670
                                68  *                                                                      MAG00680
000048I  E6D0 810C =000158I     69  WRT       LA    R13,BUFSRT          LOAD START OF BUFFER              MAG00690
00004CI  E6E0 813F =00018FI     70            LA    R14,BUFEND          LOAD END OF BUFFER                MAG00700
000050I  41F0 8020 =000074I     71            BAL   R15,WRITE           DO WRITE                          MAG00710
                                72  *                                                                      MAG00720
000054I  4150 8008 =000060I     73            BAL   R5,BAKSP            BACKSPACE ROUTINE                 MAG00730
000058I  41F0 802E =00008AI     74            BAL   R15,READ            DO READ                           MAG00740
00005CI  C200 80A0 =000100I     75  END1      LPSW  END                                                   MAG00750
                                76  ****************************************************                MAG00760
                                77  * SUBROUTINE: BAKSP                                                 MAG00770
                                78  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                       MAG00780
                                79  *       SEE CALLING SEQUENCE BELOW.                                  MAG00790
                                80  *                                                                    MAG00800
                                81  *  SUBROUTINE: FLMK                                                  MAG00810
                                82  *       THIS SUBROUTINE WRITES A FILEMARK                            MAG00820
                                83  *       SEE CALLING SEQUENCE BELOW.                                  MAG00830
                                84  *                                                                    MAG00840
                                85  *                                                                    MAG00850
                                86  ****************************************************                MAG00860
                                87  *                                                                    MAG00870
                                88  *  SUBROUTINE: NOMOT                                                 MAG00880
                                89  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                    MAG00890
                                90  *       STOP MOVING.                                                 MAG00900
                                91  *                                                                    MAG00910
                                92  *       CALLING SEQUENCE:     BAL R5,BAKSP                           MAG00920
                                93  *       -----------------     BAL R5,FLMK                            MAG00930
                                94  *                             BAL R5,NOMOT                           MAG00940
                                95  *       R12=DEVICE ADDRESS REGISTER                                  MAG00950
                                96  *       R5=RETURN REGISTER                                           MAG00960
                                97  *                                                                    MAG00970
                                98  *       WORK REGISTERS:                                              MAG00980
                                99  *       ---------------                                              MAG00990
                               100  *       R4=DEVICE STATUS REGISTER                                    MAG01000
                               101  *                                                                    MAG01010
                               102  ****************************************************                MAG01020
                               103  *                                                                    MAG01030
000060I  DEC0 8135 =000199I    104  BAKSP     OC    R12,BKSP            OUTPUT A BACKSPACE                MAG01040
000064I  2303                  105            BS    NOMOT               BRANCH TO NOMOTION                MAG01050
000066I  DEC0 812E =000198I    106  FLMK      OC    R12,FILMRK          OUTPUT A FILEMARK                 MAG01060
00006AI  9DC4                  107  NOMOT     SSR   R12,R4              SENSE STATUS ON MAG TAPE          MAG01070
00006CI  C340 0010             108            THI   R4,TEST             TEST FOR NO MOTION                MAG01080
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32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS          PAGE   3  23:04:16  09/11/79

000070I  2233                109          BZS   NOMOT              SENSE AGAIN          MAG01090
000072I  0305                110          BR    R5                 RETURN               MAG01100
                             111  ********************************************************MAG01110
                             112  *                                                       MAG01120
                             113  *  SUBROUTINE: WRITE                                    MAG01130
                             114  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE MAG01140
                             115  *       MAG TAPE.                                       MAG01150
                             116  *       SEE CALLING SEQUENCE BELOW                      MAG01160
                             117  *                                                       MAG01170
                             118  *  SUBROUTINE READ                                      MAG01180
                             119  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE MAG01190
                             120  *       MAG TAPE.                                       MAG01200
                             121  *                                                       MAG01210
                             122  *       CALLING SEQUENCE:     BAL R12,WRITE             MAG01220
                             123  *       ----------------      BAL R12,READ              MAG01230
                             124  *       R9 =SELCH ADDRESS REGISTER                      MAG01240
                             125  *       R12=MAG TAPE ADDRESS REGISTER                   MAG01250
                             126  *       R13=BUFFER START REGISTER                       MAG01260
                             127  *       R14=BUFFER END REGISTER                         MAG01270
                             128  *       R15=RETURN REGISTER                             MAG01280
                             129  *                                                       MAG01290
                             130  *       WORK REGISTERS:                                 MAG01300
                             131  *       ---------------                                 MAG01310
                             132  *                                                       MAG01320
                             133  *   REGISTER SET 0 IS USED TO PERFORM THE READ/WRITE ROUTINES MAG01330
                             134  *                                                       MAG01340
                             135  ********************************************************MAG01350
000074I  D090 80A8 =000120I  136  WRITE    STM   R9,REGSAV          STORE R9-R15 IN SAVE AREA MAG01360
000078I  C200 808C =000108I  137            LPSW  SWITCH1          SWITCH TO REGISTER SET 0  MAG01370
00007CI  D190 80A0 =000120I  138  WRITE1   LM    R9,REGSAV        RESTORE REGISTERS 9-15    MAG01380
000080I  D380 8117 =00019BI  139            LB    R8,WRTCMD        LOAD MAG TAPE WRITE       MAG01390
000084I  D3A0 810D =000195I  140            LB    R10,SELWRT       LOAD SELCH WRITE          MAG01400
*000088I 230B                141            B     RETRY            BRANCH TO RETRY           MAG01410
                             142  *                                                       MAG01420
00008AI  D090 8092 =000120I  143  READ     STM   R9,REGSAV          STORE R9-R15 IN SAVE AREA MAG01430
00008EI  C200 807E =000110I  144            LPSW  SWITCH2          SWITCH TO REGISTER SET 0  MAG01440
000092I  D190 808A =000120I  145  READ1    LM    R9,REGSAV        RESTORE REGISTERS 9-15    MAG01450
000096I  D380 8102 =00019CI  146            LB    R8,RDCMD         LOAD MAG TAPE READ        MAG01460
00009AI  D3A0 80F6 =000194I  147            LB    R10,SELRD        LOAD SELCH READ           MAG01470
00009EI  0777                148  RETRY    XR    R7,R7            ZERO OUT COUNT            MAG01480
0000A0I  9DC4                149  SENSE1   SSR   R12,R4           SENSE STATUS ON MAG TAPE  MAG01490
0000A2I  2091                150            BTBS  DU+BSY,SENSE1    TEST FOR BUSY+DEVICE UNAVAILABLE MAG01500
0000A4I  DE90 80EE =000196I  151            OC    R9,STOP          STOP SELCH                MAG01510
0000A8I  084D                152            LR    R4,R13           LOAD START OF BUFFER IN WORK AREA MAG01520
0000AAI  EC40 0010           153            SRL   R4,16            SHIFT OVER FOR HIGH ORDER BITS MAG01530
0000AEI  9A94                154            WDR   R9,R4            WRITE UPPER BYTE          MAG01540
0000B0I  989D                155            WHR   R9,R13           WRITE LOWER HALFWORD      MAG01550
0000B2I  084E                156            LR    R4,R14           LOAD END OF BUFFER IN WORK AREA MAG01560
0000B4I  EC40 0010           157            SRL   R4,16            SHIFT OVER FOR HIGH ORDER BITS MAG01570
0000B8I  9A94                158            WDR   R9,R4            WRITE UPPER BYTE          MAG01580
0000BAI  989E                159            WHR   R9,R14           WRITE LOWER HALFWORD      MAG01590
0000BCI  9EC8                160            OCR   R12,R8           OUTPUT COMMAND TO MAG TAPE MAG01600
0000BEI  9E9A                161            OCR   R9,R10           OUTPUT COMMAND TO SELCH   MAG01610
000C0I   C200 8054 =000118I  162  WAIT1    LPSW  WAIT                                       MAG01620
0000C4I  DE90 80CE =000196I  163  SINTR    OC    R9,STOP          STOP SELCH                MAG01630
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      32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS              PAGE   4  23:04:16  09/11/79

0000C8I  9894                    164           RDR   R9,R4              READ UPPER BYTE                    MAG01640
0000CAI  ED40 0010               165           SLL   R4,16              SHIFT OVER FOR HIGH ORDER BITS     MAG01650
0000CEI  9994                    166           RHR   R9,R4              READ LOWER BYTE                    MAG01660
0000D0I  DE90 80C2 =000196I      167           OC    R9,STOP            STOP THE SELCH                     MAG01670
0000D4I  C330 00C0               168           THI   R3,TERM            TEST FOR GOOD TRANSMISSION         MAG01680
*0000D8I 2139                    169           BNZ   ERROR              BRANCH TO TRY AGAIN.               MAG01690
0000DAI  05E4                    170           CLR   R14,R4             TEST FOR CORRECT BUFFER END        MAG01700
*0000DCI 2137                    171           BNE   ERROR              BRANCH TO ERROR                    MAG01710
0000DEI  4150 FF88 =00006AI      172           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP              MAG01720
*0000E2I C800 00F0               173           LI    R0,X'00F0'         SWITCH REGISTER SETS               MAG01730
0000E6I  9510                    174           EPSR  R1,R0                                                 MAG01740
0000E8I  030F                    175           BR    R15                RETURN                             MAG01750
                                 176  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS MAG01760
                                 177  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS      MAG01770
                                 178  *   BEFORE TERMINATING.                                             MAG01780
                                 179  *                                                                   MAG01790
0000EAI  C570 0005               180  ERROR    CLHI  R7,5               TEST FOR 5 TRIES                   MAG01800
0000EEI  4330 FF6A =00005CI      181           BE    ERROR1             BRANCH TO ERROR1                   MAG01810
0000F2I  4150 FF74 =00006AI      182           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP              MAG01820
0000F6I  4150 FF66 =000060I      183           BAL   R5,BACKSP          OUTPUT A BACKSPACE                 MAG01830
0000FAI  2671                    184           AIS   R7,1               ADD ONE TO COUNT                   MAG01840
0000FCI  4300 FFA0 =0000A0I      185           B     SENSE1             BRANCH TO SENSE1                   MAG01850
                                 186  *                                                                   MAG01860
         0000 005CI              187  ERROR1   EQU   END1               BRANCH TO END1                     MAG01870
000100I                          188           ALIGN 8                                                     MAG01880
000100I  0000 8000               189  END      DC    Y'8000'                                               MAG01890
000104I  0000 005CI              190           DC    A(END1)                                               MAG01900
000108I  0000 0000               191  SWITCH1  DC    Y'0000'            REGISTER SET 0                     MAG01910
00010CI  0000 007CI              192           DC    A(WRITE1)                                             MAG01920
000110I  0000 0000               193  SWITCH2  DC    Y'0000'            REGISTER SET 0                     MAG01930
000114I  0000 0092I              194           DC    A(READ1)                                              MAG01940
000118I  0000 C000               195  WAIT     DC    Y'C000'            PUT PROCESSOR IN WAIT STATE INT ENAB MAG01950
00011CI  0000 00C0I              196           DC    WAIT1              WITH EXTERNAL INTERRUPTS ENABLED   MAG01960
000120I                          197  REGSAV   DS    56                 STORAGE AREA FOR REGISTERS         MAG01970
000158I  0123                    198  BUFSRT   DC    X'0123',X'4567'                                       MAG01980
00015AI  4567
00015CI  89AB                    199           DC    X'89AB',X'CDEF'                                      MAG01990
00015EI  CDEF
000160I  0123                    200           DC    X'0123',X'4567'                                      MAG02000
000162I  4567
000164I  89AB                    201           DC    X'89AB',X'CDEF'                                      MAG02010
000166I  CDEF
000168I  0123                    202           DC    X'0123',X'4567'                                      MAG02020
00016AI  4567
00016CI  89AB                    203           DC    X'89AB',X'CDEF'                                      MAG02030
00016EI  CDEF
000170I  0123                    204           DC    X'0123',X'4567'                                      MAG02040
000172I  4567
000174I  89AB                    205           DC    X'89AB',X'CDEF'                                      MAG02050
000176I  CDEF
000178I  0123                    206           DC    X'0123',X'4567'                                      MAG02060
00017AI  4567
00017CI  89AB                    207           DC    X'89AB',X'CDEF'                                      MAG02070
00017EI  CDEF
000180I  0123                    208           DC    X'0123',X'4567'                                      MAG02080
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      32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS              PAGE   5  23:04:16  09/11/79

000182I  4567
000184I  89AB                209            DC    X'89AB',X'CDEF'                              MAG02090
000186I  CDEF
000188I  0123                210            DC    X'0123',X'4567'                              MAG02100
00018AI  4567
00018CI  89AB                211            DC    X'89AB',X'CDEF'                              MAG02110
00018EI  CDEF
         0000 018FI          212  BUFEND    EQU   *-1                                          MAG02120
000190I  00F0                213  SELCH     DC    X'F0'          SELECTOR CHANNEL ADDRESS      MAG02130
000192I  0085                214  MTADR     DC    X'85'          MAG TAPE ADDRESS              MAG02140
000194I  70                  215  SELRD     DB    X'70'          READ,EXT ADD                  MAG02150
000195I  50                  216  SELWRT    DB    X'50'          WRITE,EXT ADD                 MAG02160
000196I  48                  217  STOP      DB    X'48'          STOP,EXT ADD                  MAG02170
000197I  E0                  218  RESET     DB    X'E0'          RESET COMMAND                 MAG02180
000198I  30                  219  FILMRK    DB    X'30'          FILEMARK COMMAND              MAG02190
000199I  11                  220  BKSP      DB    X'11'          BACKSPACE COMMAND             MAG02200
00019AI  38                  221  REWIND    DB    X'38'          REWIND COMMAND                MAG02210
00019BI  22                  222  WRTCMD    DB    X'22'          WRITE COMMAND FOR MAG TAPE    MAG02220
00019CI  21                  223  RDCMD     DB    X'21'          READ COMMAND FOR MAG TAPE     MAG02230
00019EI                      224            END                                                MAG02240
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    32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS              PAGE   6  23:04:16  09/11/79

ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

   NO CAL ERRORS
   NO CAL WARNINGS
    3 PASSES

 ABSTOP     0000 0000
 ADC        0000 0004
 BAKSP      0000 0060I        67     73    104*   183
 BKSP       0000 0199I       104    220*
 BOT        0000 0020         39*    64
 BSY        0000 0008         30*   150
 BUFEND     0000 018FI        70    212*
 BUFSRT     0000 0158I        69    198*
 DU         0000 0001         24*    63    150
 DUTEST     0000 0032I        61*    63
 END        0000 0100I        75    189*
 END1       0000 005CI        75*   187    190
 ERROR      0000 00EAI       169    171    180*
 ERROR1     0000 005CI        49    181    187*
 FILMRK     0000 0198I       106    219*
 FLMK       0000 0066I        66    106*
 IMPTOP     0000 019EI
 LADC       0000 0002
 LDAGAIN    0000 000CI        50*    53
 MTADR      0000 0192I        58    214*
 NOMOT      0000 006AI       105    107*   109    172    182
 PURETOP    0000 0000P
 R0         0000 0000         22*   173    174
 R1         0000 0001         23*   174
 R10        0000 000A         33*   140    147    161
 R12        0000 000C         34*    49     50     58     61     62    104    106    107    149    160
 R13        0000 000D         35*    69    152    155
 R14        0000 000E         36*    70    156    159    170
 R15        0000 000F         37*    46     47     48     48     50     51     52     56     57     71     74    175
 R2         0000 0002         25*
 R3         0000 0003         26*   168
 R4         0000 0004         27*    62     64    107    108    149    152    153    154    156    157    158    164
                              165    166    170
 R5         0000 0005         28*    66     67     73    110    172    182    183
 R7         0000 0007         29*   148    148    180    184
 R8         0000 0008         31*   139    146    160
 R9         0000 0009         32*    47     54     55     57     59     60    136    138    143    145    151    154
                              155    158    159    161    163    164    166    167
 RDCMD      0000 019CI       146    223*
 READ       0000 008AI        74    143*
 READ1      0000 0092I       145*   194
 REGSAV     0000 0120I       136    138    143    145    197*
 RESET      0000 0197I        61    218*
 RETRY      0000 009EI       141    148*
 REWIND     0000 019AI       221*
 SELCH      0000 0190I        54     59    213*
 SELRD      0000 0194I       147    215*
```

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    32-BIT     R/W,E-SELCH,IMMEDIATE INTERRUPTS                PAGE   7  23:04:16  09/11/79

SELWRT      0000 0195I       140    216*
SENSE1      0000 00A0I       149*   150     185
SINTR       0000 00C4I        56    163*
STOP        0000 0196I        60    151     163     167     217*
SWITCH1     0000 0108I       137    191*
SWITCH2     0000 0110I       144    193*
TERM        0000 00C0         40*   168
TEST        0000 0010         38*   108
WAIT        0000 0118I       162    195*
WAIT1       0000 00C0I       162*   196
WRITE       0000 0074I        71    136*
WRITE1      0000 007CI       138*   192
WRT         0000 0048I        65     69*
WRTCMD      0000 019BI       139    222*
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      32-BIT     R/W,AUTO DRIVER CHANNEL                    PAGE   1  23:10:12  09/11/79

PROG= MAGTP      ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

                                    1  MAGTP    PROG  32-BIT     R/W,AUTO DRIVER CHANNEL                MAG00010
                                    2           SCRAT                                                  MAG00020
                                    3           WIDTH 120                                              MAG00030
                                    4           CROSS                                                  MAG00040
                                    5           NORX3                                                  MAG00050
                                    6           TARGT 32                                               MAG00060
                                    7           SQUEZ 2                                                MAG00070
                                    8  *                                                               MAG00080
                                    9  *  THIS PROGRAM USES THE AUTO DRIVER CHANNEL TO WRITE          MAG00090
                                   10  *  A BUFFER OF DATA FROM MEMORY TO MAG TAPE                     MAG00100
                                   11  *  AND THEN READ IT BACK FROM THAT MAG TAPE.                    MAG00110
                                   12  *                                                               MAG00120
                                   13  *  32-BIT PROCESSORS                                           MAG00130
                                   14  *                                                               MAG00140
                                   15  *  NOTE:  THE INTERRUPT SERVICE POINTER TABLE IS SET           MAG00150
                                   16  *         UP TO VECTOR TO ERROR ROUTINES (EOJ) EXCEPT          MAG00160
                                   17  *         FOR THE SELCH INTERRUPT HANDLER                      MAG00170
                                   18  *                                                               MAG00180
                                   19  *  REGISTER ASSIGNMENTS:                                       MAG00190
                                   20  *                                                               MAG00200
          0000 0000                21  R0       EQU   0              WORK REGISTER                    MAG00210
          0000 0001                22  R1       EQU   1              WORK REGISTER                    MAG00220
          0000 0001                23  DU       EQU   1              DEVICE UNAVAILABLE               MAG00230
          0000 0004                24  R4       EQU   4              STATUS                           MAG00240
          0000 0005                25  R5       EQU   5              RETURN REGISTER                  MAG00250
          0000 0007                26  R7       EQU   7              COUNTER                          MAG00260
          0000 0008                27  R8       EQU   8              COMMAND BYTE STORE               MAG00270
          0000 0009                28  R9       EQU   9              SELCH ADDRESS REGISTER           MAG00280
          0000 000C                29  R12      EQU   12             MAG TAPE ADDRESS REGISTER        MAG00290
          0000 000D                30  R13      EQU   13             START OF BUFFER ADDRESS REGISTER MAG00300
          0000 000E                31  R14      EQU   14             END OF BUFFER ADDRESS REGISTER   MAG00310
          0000 000F                32  R15      EQU   15             WORK AND RETURN REGISTER         MAG00320
          0000 0010                33  TEST     EQU   X'10'          TEST=NOMOTION BIT                MAG00330
          0000 0020                34  BOT      EQU   X'20'          TEST FOR BOT                     MAG00340
          0000 00C0                35  TERM     EQU   X'C0'          TERMINATION STATUS=X'C0'         MAG00350
 000000I  C8F0 00F0                36           LHI   R15,X'00F0'    LOAD REGISTER SET 15             MAG00360
 000004I  959F                     37           EPSR  R9,R15         ACTIVATE                         MAG00370
 000006I  07FF                     38           XR    R15,R15        ZERO OUT WORK REGISTER           MAG00380
 000008I  C8C0 00EAI               39           LHI   R12,ERROR1     LOAD ERROR ROUTINE ADDRESS       MAG00390
 00000CI  40CF 00D0                40  LDAGAIN  STH   R12,X'D0'(R15) INTO FIRST SLOT OF ISPT         MAG00400
 000010I  26F2                     41           AIS   R15,2          BUMP COUNTER BY 2                MAG00410
 000012I  C5F0 02D0                42           CLHI  R15,X'2D0'     COMPARE TO LIMIT                 MAG00420
*000016I  2085                     43           BL    LDAGAIN        COMPLETE TABLE                   MAG00430
 000018I  C800 018DI               44           LHI   R0,CCW+1       LOAD ODD ADDRESS INTO A REGISTER MAG00440
 00001CI  4890 8186 =0001A6I       45           LH    R9,MTADR       LOAD MAG TAPE ADDRESS            MAG00450
 000020I  1191                     46           SLLS  R9,1           MULTIPLY BY 2                    MAG00460
 000022I  4009 00D0                47           STH   R0,X'D0'(R9)   STORE AT INDICATED ADDRESS      MAG00470
 000026I  C8F0 003CI               48           LHI   R15,SINTR      LOAD INTERRUPT HANDLER           MAG00480
 00002AI  40F0 8172 =0001A0I       49           STH   R15,SIBADR     STORE EXIT ROUT. ADDRESS INTO CCB MAG00490
 00002EI  E6D0 8122 =000154I       50           LA    R13,BUFSRT     LOAD START OF BUFFER             MAG00500
 000032I  E6E0 8155 =00018BI       51           LA    R14,BUFEND     LOAD END OF BUFFER               MAG00510
 000036I  48C0 816C =0001A6I       52           LH    R12,MTADR      LOAD MAG TAPE ADDRESS            MAG00520
 00003AI  0EC0 816C =0001AAI       53  OUTEST   OC    R12,RESET      OUTPUT RESET TO MAG TAPE         MAG00530
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      32-BIT     R/W,AUTO DRIVER CHANNEL                    PAGE   2  23:10:12  09/11/79

 00003EI  9DC4                    54           SSR   R12,R4              SENSE STATUS ON MAG TAPE      MAG00540
*000040I  2013                    55           BTC   DU,DUTEST           IS MAG TAPE UNAVAILABLE       MAG00550
 000042I  C340 0020               56           THI   R4,BOT              TEST FOR BOT                  MAG00560
 000046I  2335                    57           BZS   WRT                 BRANCH TO WRITE               MAG00570
 000048I  4150 801A =000066I      58           BAL   R5,FLMK             FILEMARK ROUTINE              MAG00580
 00004CI  4150 8010 =000060I      59           BAL   R5,BAKSP            BACKSPACE ROUTINE             MAG00590
                                  60  *                                                                MAG00600
 000050I  41F0 8020 =000074I      61  WRT      BAL   R15,WRITE           DO WRITE ROUTINE              MAG00610
                                  62  *                                                                MAG00620
 000054I  4150 8008 =000060I      63           BAL   R5,BAKSP            BACKSPACE ROUTINE             MAG00630
 000058I  41F0 802E =00008AI      64           BAL   R15,RFAD            DO READ                       MAG00640
 00005CI  C200 8090 =0000F0I      65  END1     LPSW  END                 EOJ                           MAG00650
                                  66  ***************************************************              MAG00660
                                  67  * SUBROUTINE: BAKSP                                             MAG00670
                                  68  *       THIS SUBROUTINE BACKSPACES ONE RECORD.                   MAG00680
                                  69  *       SEE CALLING SEQUENCE BELOW.                              MAG00690
                                  70  *                                                                MAG00700
                                  71  *  SUBROUTINE: FLMK                                            MAG00710
                                  72  *       THIS SUBROUTINE WRITES A FILEMARK                        MAG00720
                                  73  *       SEE CALLING SEQUENCE BELOW.                              MAG00730
                                  74  *                                                                MAG00740
                                  75  *                                                                MAG00750
                                  76  ***************************************************              MAG00760
                                  77  *                                                                MAG00770
                                  78  *  SUBROUTINE: NOMOT                                           MAG00780
                                  79  *       THIS SUBROUTINE WAITS FOR THE MAG TAPE TO                MAG00790
                                  80  *       STOP MOVING.                                             MAG00800
                                  81  *                                                                MAG00810
                                  82  *       CALLING SEQUENCE:     BAL R5,BAKSP                       MAG00820
                                  83  *       -----------------     BAL R5,FLMK                        MAG00830
                                  84  *                             BAL R5,NOMOT                       MAG00840
                                  85  *       R12=DEVICE ADDRESS REGISTER                              MAG00850
                                  86  *       R5=RETURN REGISTER                                       MAG00860
                                  87  *                                                                MAG00870
                                  88  *       WORK REGISTERS:                                          MAG00880
                                  89  *       ---------------                                          MAG00890
                                  90  *       R4=DEVICE STATUS REGISTER                                MAG00900
                                  91  *                                                                MAG00910
                                  92  ***************************************************              MAG00920
                                  93  *                                                                MAG00930
 000060I  DEC0 8148 =0001ACI      94  BAKSP    OC    R12,BKSP            OUTPUT A BACKSPACE            MAG00940
 000064I  2303                    95           BS    NOMOT               BRANCH TO NOMOTION            MAG00950
 000066I  DEC0 8141 =0001ABI      96  FLMK     OC    R12,FILMRK          OUTPUT A FILEMARK             MAG00960
 00006AI  9DC4                    97  NOMOT    SSR   R12,R4              SENSE STATUS ON MAG TAPE      MAG00970
 00006CI  C340 0010               98           THI   R4,TEST             TEST FOR NO MOTION            MAG00980
 000070I  2233                    99           BZS   NOMOT               SENSE AGAIN                   MAG00990
 000072I  0305                   100           BR    R5                  RETURN                        MAG01000
                                 101  ***************************************************              MAG01010
                                 102  *  SUBROUTINE: WRITE                                           MAG01020
                                 103  *       THIS SUBROUTINE WRITES ONE BLOCK OF DATA TO THE          MAG01030
                                 104  *       MAG TAPE.                                                MAG01040
                                 105  *       SEE CALLING SEQUENCE BELOW                               MAG01050
                                 106  *  SUBROUTINE READ                                             MAG01060
                                 107  *       THIS SUBROUTINE READS A BLOCK OF DATA FROM THE           MAG01070
                                 108  *       MAG TAPE.                                                MAG01080
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                                109  *                                                                  MAG01090
                                110  *       CALLING SEQUENCE:     BAL R12,WRITE                      MAG01100
                                111  *       ----------------      BAL R12,READ                       MAG01110
                                112  *       R12=MAG TAPE ADDRESS REGISTER                            MAG01120
                                113  *       R13=START OF BUFFER ADDRESS REGISTER                     MAG01130
                                114  *       R14=END OF BUFFER ADDRESS REGISTER                       MAG01140
                                115  *       R15=RETURN ADDRESS REGISTER                              MAG01150
                                116  *       R9=CHANNEL COMMAND WORD REGISTER                         MAG01160
                                117  *       WORK REGISTERS:                                          MAG01170
                                118  *       ---------------                                          MAG01180
                                119  *                                                                MAG01190
                                120  *   REGISTER SET 0 IS USED TO PERFORM THE READ/WRITE ROUTINES     MAG01200
                                121  *                                                                MAG01210
                                122  ************************************************************    MAG01220
 000074I  D090 80A4 =00011CI    123  WRITE    STM   R9,REGSAV          STORE R9-R15 IN SAVE AREA     MAG01230
 000078I  C200 8084 =000100I    124           LPSW  SWITCH1           SWITCH TO REGISTER SET 0      MAG01240
 00007CI  D190 809C =00011CI    125  WRITE1   LM    R9,REGSAV          RESTORE REGISTERS 9-15        MAG01250
 000080I  4890 811E =0001A2I    126           LH    R9,CHCMW           LOAD CHANNEL COMMAND WRITE    MAG01260
 000084I  D380 8126 =0001AEI    127           LB    R8,WRTCMD          LOAD WRITE COMMAND FOR MAG TAPE MAG01270
*000088I  230B                  128           B     BRANC              BRANCH TO BRANC               MAG01280
                                129  *                                                                MAG01290
 00008AI  D090 80BE =00011CI    130  READ     STM   R9,REGSAV          STORE R9-R15 IN SAVE AREA     MAG01300
 00008EI  C200 8076 =000108I    131           LPSW  SWITCH2           SWITCH TO REG SET 0           MAG01310
 000092I  D190 8086 =00011CI    132  READ1    LM    R9,REGSAV          RESTORE REGISTERS 9-15        MAG01320
 000096I  4890 810A =0001A4I    133           LH    R9,CHCMR           LOAD CHANNEL COMMAND WORD READ MAG01330
 00009AI  D380 8111 =0001AFI    134           LB    R8,RDCMD           LOAD READ COMMAND FOR MAG TAPE MAG01340
 00009EI  0777                  135  BRANC    XR    R7,R7              INITIALIZE COUNT              MAG01350
 0000A0I  4090 80E8 =00018CI    136  RETRY    STH   R9,CCW             STORE CHANNEL COMMAND WORD    MAG01360
 0000A4I  50D0 8070 =000118I    137           ST    R13,SAVE           SAVE REGISTER 13              MAG01370
 0000A8I  50E0 80E4 =000190I    138           ST    R14,BUFEND0        STORE END OF BUFFER IN CCW    MAG01380
 0000ACI  0BDE                  139           SR    R13,R14            COMPUTE NEGATIVE BUFFER COUNT MAG01390
 0000AEI  40D0 80DC =00018EI    140           STH   R13,BUFCOUNT       STORE BUFFER COUNT IN CCW     MAG01400
 0000B2I  DEC0 80F2 =0001A8I    141           OC    R12,DISARM         PREVENT QUEUED INTERRUPTS     MAG01410
 0000B6I  9EC8                  142           OCR   R12,R8             SEND OUTPUT COMMAND TO MAG TAPE MAG01420
 0000B8I  C200 8054 =000110I    143  WAIT1    LPSW  WAIT               WAIT FOR INTERRUPT            MAG01430
*0000BCI  232B                  144  SINTR    BFC   2,ERROR            TEST FOR GOOD AUTO DRIVER STATUS MAG01440
 0000BEI  9DC4                  145           SSR   R12,R4             SENSE STATUS ON MAG TAPE      MAG01450
 0000C0I  C340 00C0             146           THI   R4,TERM            TEST FOR GOOD TERMINATION     MAG01460
*0000C4I  2137                  147           BNZ   ERROR              BRANCH TO TRY AGAIN.          MAG01470
 0000C6I  4150 FFA0 =00006AI    148           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP         MAG01480
 0000CAI  C800 00F0             149           LHI   R0,X'00F0'         CHANGE TO REG SET F           MAG01490
 0000CEI  9510                  150           EPSR  R1,R0              ACTIVATE                      MAG01500
 0000D0I  030F                  151           BR    R15                RETURN                        MAG01510
                                152  *   THIS ROUTINE ABORTS THE PROGRAM ON NON-RECOVERABLE STATUS ERRORS MAG01520
                                153  *   AND TRIES 5 TIMES TO RECOVER ON DATA TRANSFER STATUS ERRORS   MAG01530
                                154  *   BEFORE TERMINATING.                                          MAG01540
                                155  *                                                                MAG01550
 0000D2I  C570 0005             156  ERROR    CLHI  R7,5               TEST FOR 5 TRIES              MAG01560
 0000D6I  E6D0 803E =000118I    157           LA    R13,SAVE           RESTORE REGISTER 13           MAG01570
*0000DAI  2338                  158           BE    ERROR1             BRANCH TO ERROR1              MAG01580
 0000DCI  4150 FF8A =00006AI    159           BAL   R5,NOMOT           WAIT FOR TAPE TO STOP         MAG01590
 0000E0I  4150 FF7C =000060I    160           BAL   R5,BAKSP           OUTPUT A BACKSPACE            MAG01600
 0000E4I  2671                  161           AIS   R7,1               ADD ONE TO COUNT              MAG01610
 0000E6I  4300 FFB6 =0000A0I    162           B     RETRY              BRANCH TO RETRY               MAG01620
 0000EAI  C200 800A =0000F8I    163  ERROR1   LPSW  ERROR2                                           MAG01630
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0000F0I                          164            ALIGN 8                                                    MAG01640
0000F0I  0000 8000               165  END       DC    Y'8000'          PUT PROCESSOR IN WAIT STATE       MAG01650
0000F4I  0000 005CI              166            DC    A(END1)                                            MAG01660
0000F8I  0000 8000               167  ERROR2    DC    Y'8000',A(ERROR1)                                  MAG01670
0000FCI  0000 00EAI
000100I  0000 0000               168  SWITCH1   DC    Y'0000'          REG SET 0                         MAG01680
000104I  0000 007CI              169            DC    A(WRITE1)                                          MAG01690
000108I  0000 0000               170  SWITCH2   DC    Y'0000'          REG SET 0                         MAG01700
00010CI  0000 0092I              171            DC    A(READ1)                                           MAG01710
000110I  0000 C000               172  WAIT      DC    Y'C000'          PUT PROCESSOR IN WAIT STATE INT ENAB MAG01720
000114I  0000 0088I              173            DC    WAIT1            WITH EXTERNAL INTERRUPTS ENABLED  MAG01730
000118I  0000 0000               174  SAVE      DC    Y'0000'          SAVE AREA FOR REGISTER 13         MAG01740
00011CI                          175  REGSAV    DS    56               REGISTER SAVE AREA                MAG01750
000154I  0123                    176  BUFSRT    DC    X'0123',X'4567'                                    MAG01760
000156I  4567
000158I  89AB                    177            DC    X'89AB',X'CDEF'                                    MAG01770
00015AI  CDEF
00015CI  0123                    178            DC    X'0123',X'4567'                                    MAG01780
00015EI  4567
000160I  89AB                    179            DC    X'89AB',X'CDEF'                                    MAG01790
000162I  CDEF
000164I  0123                    180            DC    X'0123',X'4567'                                    MAG01800
000166I  4567
000168I  89AB                    181            DC    X'89AB',X'CDEF'                                    MAG01810
00016AI  CDEF
00016CI  0123                    182            DC    X'0123',X'4567'                                    MAG01820
00016EI  4567
000170I  89AB                    183            DC    X'89AB',X'CDEF'                                    MAG01830
000172I  CDEF
000174I  0123                    184            DC    X'0123',X'4567'                                    MAG01840
000176I  4567
000178I  89AB                    185            DC    X'89AB',X'CDEF'                                    MAG01850
00017AI  CDEF
00017CI  0123                    186            DC    X'0123',X'4567'                                    MAG01860
00017EI  4567
000180I  89AB                    187            DC    X'89AB',X'CDEF'                                    MAG01870
000182I  CDEF
000184I  0123                    188            DC    X'0123',X'4567'                                    MAG01880
000186I  4567
000188I  89AB                    189            DC    X'89AB',X'CDEF'                                    MAG01890
00018AI  CDEF
         0000 018BI              190  BUFEND    EQU   *-1                                                MAG01900
00018CI  0000                    191  CCW       DC    H'0'             * CHANNEL COMMAND WORD            MAG01910
00018EI  0000                    192  BUFCOUNT  DC    H'0'             * BUFFER COUNT                    MAG01920
000190I  0000 0000               193  BUFEND0   DC    F'0'             * BUFFER END ADDRESS              MAG01930
000194I  0000                    194            DC    H'0'             * CHECK WORD (NOT USED IN THIS EX.) MAG01940
000196I  0000                    195            DC    H'0'             * BUF 1 COUNT NOT USED IN THIS EX.) MAG01950
000198I  0000 0000               196            DC    F'0'             * BUF 1 END AD (NOT USED IN THIS EX) MAG01960
00019CI  0000 0000               197            DC    F'0'             * TRAN TAB ADR (NOT USED IN THIS EX) MAG01970
0001A0I  0000                    198  SUBADR    DC    H'0'             * SUBROUTINE ADDRESS              MAG01980
0001A2I  F784                    199  CHCMW     DC    X'F784'          CHANNEL COMMAND WORD,WRITE        MAG01990
0001A4I  F780                    200  CHCMR     DC    X'F780'          CHANNEL COMMAND WORD,READ         MAG02000
0001A6I  0085                    201  MTADR     DC    X'85'            MAG TAPE ADDRESS                  MAG02010
0001A8I  C000                    202  DISARM    DC    X'C000'          DISARM MAG TAPE                   MAG02020
0001AAI  E0                      203  RESET     DB    X'E0'            RESET COMMAND                     MAG02030
```

```
0001ABI  30                    204  FILMRK   DB    X'30'      FILEMARK COMMAND          MAG02040
0001ACI  11                    205  BKSP     DB    X'11'      BACKSPACE COMMAND         MAG02050
0001ADI  38                    206  REWIND   DB    X'38'      REWIND COMMAND            MAG02060
0001AEI  62                    207  WRTCMD   DB    X'62'                                MAG02070
0001AFI  61                    208  RDCMD    DB    X'61'                                MAG02080
0001B0I                        209             END                                       MAG02090
```

```
    32-BIT     R/W,AUTO DRIVER CHANNEL                    PAGE   6  23:10:12  09/11/79

ASSEMBLED BY CAL 03-066R05-01   (32-BIT)

START OPTIONS:  SCR,CRO

   NO CAL ERRORS
   NO CAL WARNINGS
    3 PASSES

 ABSTOP     0000 0000
 ADC        0000 0004
 BAKSP      0000 0060I        59     63     94*    160
 BKSP       0000 01ACI        94    205*
 BOT        0000 0020         34*    56
 BRANC      0000 009EI       128    135*
 BUFCOUNT   0000 018EI       140    192*
 BUFEND     0000 018BI        51    190*
 BUFEND0    0000 0190I       138    193*
 BUFSRT     0000 0154I        50    176*
 CCW        0000 018CI        44    136    191*
 CHCMR      0000 01A4I       133    200*
 CHCMW      0000 01A2I       126    199*
 DISARM     0000 01A8I       141    202*
 DU         0000 0001         23*    55
 DUTEST     0000 003AI        53*    55
 END        0000 00F0I        65    165*
 END1       0000 005CI        65*   166
 ERROR      0000 00D2I       144    147    156*
 ERROR1     0000 00EAI        39    158    163*   167
 ERROR2     0000 00F8I       163    167*
 FILMRK     0000 01ABI        96    204*
 FLMK       0000 0066I        58     96*
 IMPTOP     0000 01B0I
 LADC       0000 0002
 LDAGAIN    0000 000CI        40*    43
 MTADR      0000 01A6I        45     52    201*
 NOMOT      0000 006AI        95     97*    99    148    159
 PURETOP    0000 0000P
 R0         0000 0000         21*    44     47    149    150
 R1         0000 0001         22*   150
 R12        0000 000C         29*    39     40     52     53     54     94     96     97    141    142    145
 R13        0000 000D         30*    50    137    139    140    157
 R14        0000 000E         31*    51    138    139
 R15        0000 000F         32*    36     37     38     38     40     41     42     48     49     61     64    151
 R4         0000 0004         24*    54     56     97     98    145    146
 R5         0000 0005         25*    58     59     63    100    148    159    160
 R7         0000 0007         26*   135    135    156    161
 R8         0000 0008         27*   127    134    142
 R9         0000 0009         28*    37     45     46     47    123    125    126    130    132    133    136
 RDCMD      0000 01AFI       134    208*
 READ       0000 008AI        64    130*
 READ1      0000 0092I       132*   171
 REGSAV     0000 011CI       123    125    130    132    175*
 RESET      0000 01AAI        53    203*
 RETRY      0000 00A0I       136*   162
 REWIND     0000 01ADI       206*
```

```
32-BIT     R/W.AUTO DRIVER CHANNEL                           PAGE   7  23:10:12  09/11/79

SAVE       0000 0118I       137     157     174*
SINTR      0000 00BCI        48     144*
SUBADR     0000 01A0I        49     198*
SWITCH1    0000 0100I       124     168*
SWITCH2    0000 0108I       131     170*
TERM       0000 00C0         35*    146
TEST       0000 0010         33*     98
WAIT       0000 0110I       143     172*
WAIT1      0000 00B8I       143*    173
WRITE      0000 0074I        61     123*
WRITE1     0000 007CI       125*    169
WRT        0000 0050I        57      61*
WRTCMD     0000 01AEI       127     207*
```

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