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Magnetic Tape Operations on the Sound Laboratory Data Acquisition System: A Programmer's Reference Manual

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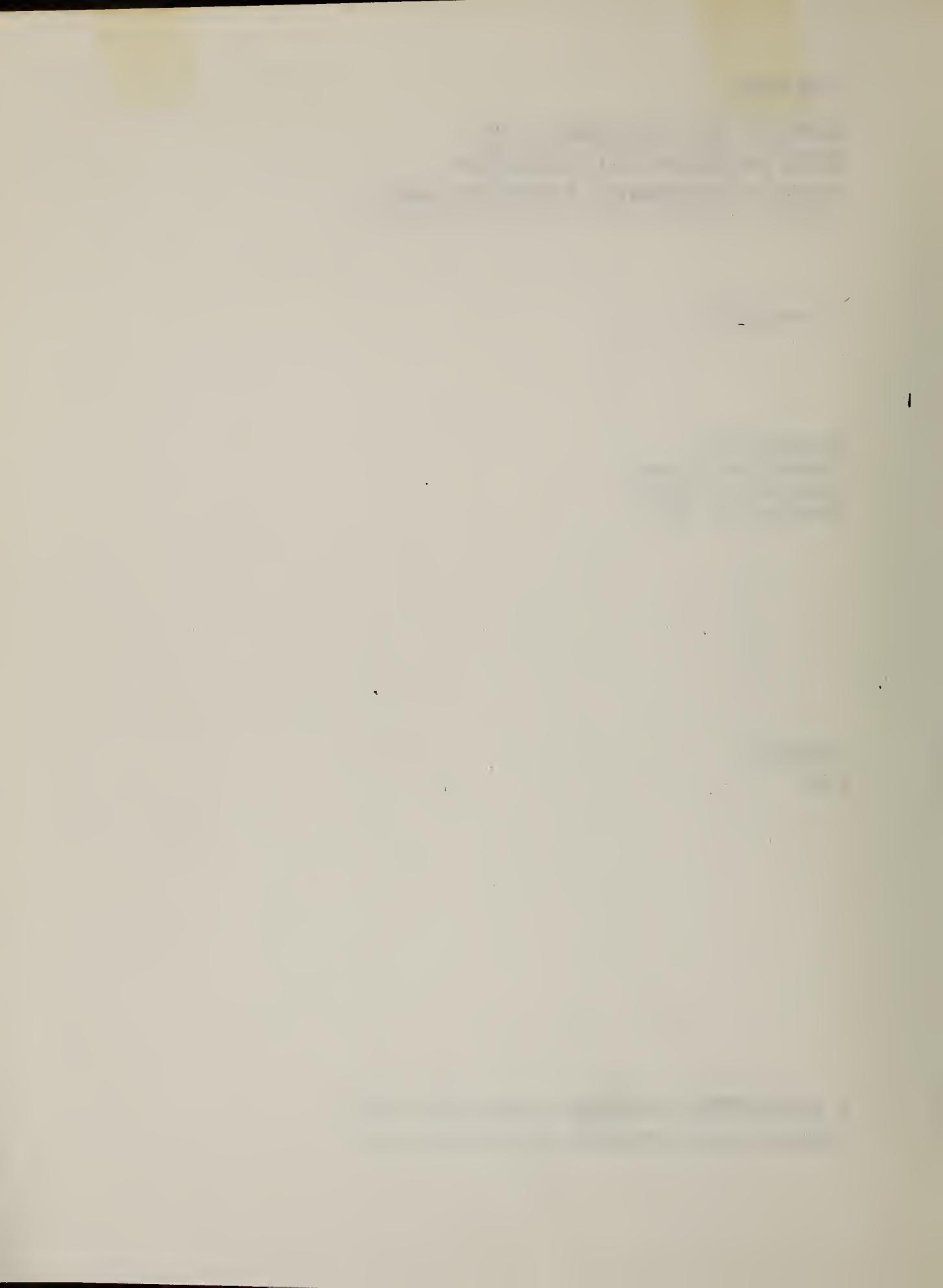
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1. INTRODUCTION

The key subsystem of the Sound Laboratory Data Acquisition System is an Interdata Model 70 minicomputer. Interfaced to the Interdata Model 70 is a Kennedy 8000 magnetic tape system. This report is a systems programmer reference manual for magnetic tape operations on the Interdata Model 70 system.

The basic plan of the report is the following: The features of the magnetic tape system are summarized in a brief discussion of the hardware and of the programming techniques of the system. With this as a background, the next three chapters present a background for magnetic tape operations in three distinct environments. First a loader for inputting relocatable and absolute programs from magnetic tape in a stand-alone environment is described. Next magnetic tape operations under the Interdata Real Time Operating System (RTOS) are described, followed by a description of magnetic tape operations under the Interdata Basic Operating System (BOSS).

This report assumes the reader already has a great deal of programming experience. The reader should be thoroughly familiar with Interdata assembly language and have a good understanding of the Interdata operating systems.

2. THE KENNEDY 8000 MAGNETIC TAPE SYSTEM

Introduction

The Kennedy 8000 magnetic tape system is designed to operate with the Interdata Models 70, 74, or 80 processors. This tape system includes the Kennedy 8108 tape transport, the Kennedy 8208 format control unit, and the Xebec Systems Inc. XTC 8000 controller. The XTC 8000 controller is designed to function as an independent DMA port or to operate on the Interdata selector channel. This report assumes the XTC 8000 controller to be interfaced to the selector channel.

2A. General Specifications

1. Tape Format: 9-track 800 CPI, NRZ1 (ANSI X3.22-1973 Compatible)
2. Tape Speed: 25 inches per second
3. Transfer Rate: 20 KHz
4. Rewind Speed: 150 inches per second
5. Character Format: 8 bits data, 1 bit parity
6. Error Checking: Read-After-Write, VPC, LRC, and CRC checks
7. 1 X 4 Controller: The Kennedy 8208 format control unit can support up to four 7-track or 9-track tape transports.

2B. Operating Controls and Indicators

1. Address Switch. A rotary thumbswitch used to select the transport address. Positions 1 through 4 are active for the System 8000. Position 0 is off and prevents selection.

2. Address Indicator. Illuminated when the tape transport is selected.

3. Write Enable Indicator. Illuminated whenever power is on and a tape reel with a write enable ring is mounted on the transport.

4. Read Status Indicator. Illuminated whenever the tape transport is on line, selected, and read selected.

5. Write Status Indicator. Illuminated whenever the tape transport is on line, selected, and write selected.

6. On Line Switch. A momentary switch/indicator which is enabled after an initial Load or Rewind sequence. Depressing and releasing the switch after an initial Load or Rewind sequence is initiated puts the transport in the On-Line mode. In this condition, the transport can accept remote commands, provided it is also ready and selected. When the On Line switch is activated a second time, it puts the transport in the Off-Line mode.

7. Load Switch. A momentary action switch/indicator. When the Load
    switch is depressed after power is applied, the tape is positioned
    at Load Point which is indicated by a BOT mark on the tape. The
    Load switch is disabled once the first Load or Rewind command has
    been given after the power-on and can only be re-enabled by a loss
    of tape tension or restoration of power after the power has been off.

8. Rewind Switch. A momentary action switch/indicator which is enabled
    only in the Off Line mode. Depressing and releasing the switch causes
    the tape to rewind. On reaching the BOT marker, the Rewind
    ceases and the Load sequence is automatically entered. The BOT tab
    overshoots the photo-sensor, moves forward, and stops at the load
    point. If the Rewind switch is depressed when the tape is at the
    Load Point, the tape rewinds off the take-up reel and tension is lost.

C. Magnetic Tape Loading and Unloading

Refer to the System 8000 Digital Magnetic Tape Recorder Operation and
Maintenance Manual, Kennedy Co. Publication No. 193-8000-001.

2D. Preventive Maintenance

It is recommended that the heads and capstan be cleaned after every
eight hours of operation. It is also recommended that a READ and WRITE skew
alignment test be performed after each month of operation. For specific
procedures, refer to the System 8000 Digital Magnetic Tape Recorder Operation
and Maintenance Manual, Kennedy Co. Publication No. 193-8000-001.

E. Programming Specifications

The XTC 8000 controller is designed to oversee all functions
of the tape transport, including data transfers and control functions. Data
transfers are performed using the Interdata selector channel. All control
functions are transferred via the Interdata multiplexor bus.

All functions of the controller are initiated using the standard Interdata
instruction set. A brief description of how the processor I/O instructions may
be used follows. The reader may refer to the Magnetic Tape Controller I/O
Specifications, Xebec Systems Publication No. 300901, and the Interdata 02-232
Selector Channel Programming Specifications.

Commands. The Xebec XTC 8000 controller is a register oriented device.
Functional units of the controller are addressed as registers.
These registers are selected by executing an OUTPUT COMMAND instruction.
Table 2.1 shows the bit assignments for the Xebec controller command byte.

Table 2.1 Command Byte Coding

Command Byte Value	Function
0	Data Transfer
1	Memory Address
2	
3	Controller Status
4	Interrupt Control
5	Command Word
6	
7	Word Count

The processor controls the operation of the tape unit by issuing commands encoded into a command word. The command word is transferred to the Xebec controller by executing an OUTPUT COMMAND instruction with a command byte of value 5, followed by execution of a WRITE HALFWORD instruction. Table 2.2 details the bit assignments for the Xebec controller command word.

Table 2.2 Command Halfword

0	1	2	3	4 5 6 7	8	9-10	11	12	13	14	15
⊠	⊠	⊠	⊠	OP	⊠	DN	PK	PR	⊠	UN	
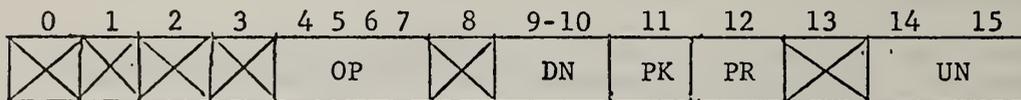
Bits 0 - 3	Ignored
Bits 4 - 7	OP - Operation Code
0	No Operation
1	Read Record
2	Space File Forward
3	Space File Reverse
4	Space Record Forward
5	Space Record Reverse
6	Write Record
7	Write End of File
8	Erase 4 Inches of Tape
9	Rewind
A	Set Unit Off Line
B-F	Illegal
Bit 8	Ignored
Bits 9-10	DN - Density
	9 Track - 11-800 bpi
	01-1600 bpi
Bit 11	PK - Packing Mode
Bit 12	PR - Parity
Bit 13	Ignored
Bits 14-15	UN - Unit Selected
	00 - Unit 1
	01 - Unit 2
	10 - Unit 3
	11 - Unit 4

2. Tape Controller Status. The Xebec magnetic tape controller returns a status byte to the processor as the result of a SENSE STATUS instruction

Table 2.3 Status Byte Coding

Bit Number	0	1	2	3	4	5	6	7
Status	0	0	WLR	BDB	DNR	0	0	FNB

Bits 0 - 1	Read as Zeros
Bit 2	WLR - Wrong Length Record
Bit 3	BDB - Bad Data Block
Bit 4	DNR - Data Not Ready
Bits 5 - 6	Read as Zeros
Bit 7	FNB - Formatter Not Busy

The tape transport status word is read into the processor by first executing an OUTPUT COMMAND with a command byte of value 3. The controller status is then read into the processor by executing a READ HALFWORD instruction. Table 2.4 shows the bit assignments for the tape transport status word.

Table 2.4 Status Word

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	DMA	BDB	PKE	EOF	BOT	EOT	FBR	MUE	NOL	REW	TBY	FBY

Bits 0 - 3	Read as 0
Bit 4	DMA - DMA Timing Error
Bit 5	BDB - Bad Data Block
Bit 6	PKE - Packing Error
Bit 7	EOF - End-of-File
Bit 8	BOT - Beginning of Tape
Bit 9	EOT - End-of-Tape
Bit 10	FBR - Write Protected
Bit 11	MUE - Multiple Unit Error
Bit 12	NOL - Not on Line
Bit 13	REW - Rewinding
Bit 14	TBY - Tape Unit Busy
Bit 15	FBY - Formatter Busy

Interrupts. An external interrupt is generated whenever the status bit formatter-not-busy sets. The formatter-not-busy is the logical NOR of the tape-unit-busy status and the formatter busy status.

Interrupts can be enabled, disabled, armed, or disarmed using an OUTPUT COMMAND instruction. Table 2.5 shows the bit assignments for the controller command byte.

Table 2.5 Interrupt Command Byte

0	1	2	3	4	5	6	7
DAB	DAR	✕	✕	0	1	0	0

Bit 0   DAB-Disable. When set, interrupts are queued.

Bit 1   DAR-Disarm. When set, prevents interrupts from being queued.

Bit 2-3   Ignored

Bit 4-7   4 (Select interrupt control register)

3. KENNEDY MAGNETIC TAPE SYSTEM GENERAL LOADER

Introduction

The Mag Tape General Loader is a stand-alone program occupying about 1500 bytes, and is similar to the Interdata General Loader. It is, itself, loaded by the Interdata Relocating of General Loaders (R01 versions). It is operated from the processor control panel, input 9-track magnetic tape, and logs messages on the teletype. It provides program relocating, ENTRY and EXTRN handling, and allows forward references within programs.

This program loads 108-byte fixed-length object data records from 9-track magnetic tape. The Kennedy 8000 magnetic tape system, device address X'85', is assumed to be the input device. The records must be in standard Interdata non-zoned loader format without the leading X'FØ' character found on M16/17 paper tape formats. For example, object records output under BOSS or RTOS with a binary write SVC are loadable by this loader. No tape positioning is available.

On parity error, four rereads are attempted resulting in a "READ ERROR" message if receipt of the parity error status bit persists. The message "EOF READ" results from an EOM status returned, and the "DEV END" message results from an EOT.

3A. Loader Operation

The Mag Tape General Loader is a relocatable object tape; that is, it can be loaded at a memory location specified at load time. It is loaded using either the Interdata Relocating Loader or the General Loader.

The steps required to load and operate the Mag Tape General Loader are summarized below:

1. Manually enter the 50 sequence into memory.

2. Execute the 50 sequence to load the Relocating or General Loader.

3. Place the Mag Tape General Loader into the high speed paper tape reader. If the Mag Tape General Loader is not to be loaded at the current bias value, X' 80', enter the bias value (MTORG) at ORG + X'A', and execute the Relocating or General Loader at ORG + X'8'.

4. Place the magnetic tape to be loaded onto the tape transport, device address X' 85'. The tape should be in the 'LOAD' position (LOAD POINT). If the program is not to be loaded at the current bias value, X' 80', enter the Program Bias at MTORG + X'A' and execute the Mag Tape General Loader at MTORG + X'8'.

   Note: Absolute programs are always stored at the absolute location specified on the tape being read.

5. If an error occurs during the load, the tape stops, and an error message is typed on the teletype (see Section 2.C).

6. When the load is complete, the tape stops. If no undefined symbols occurred, the message 'NORMAL END' is typed on the teletype.

See Figure 3.1 for an example of a Loader Memory Map.

Figure 3.1 Loader Memory Map
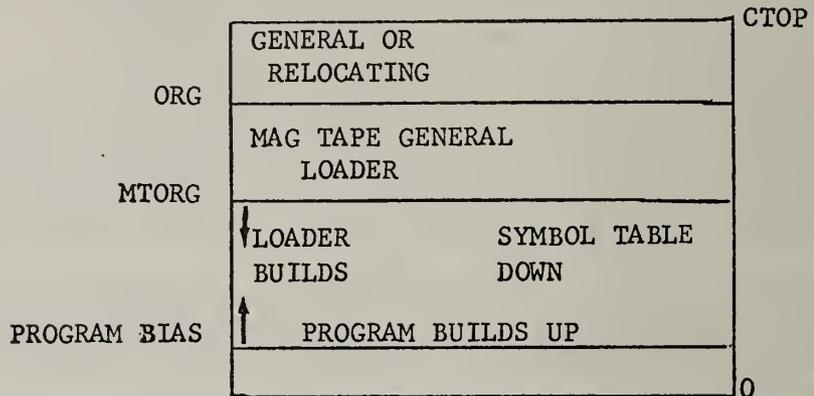
3B. Loader Features

1. Bias Printout

At the start of every load operation, the loader types the current value of the bias pointer on the teletype. This printout occurs prior to reading the first record of a new program, and the message is of the form

BIAS = XXXX

where the XXXX represents the current bias value in hexadecimal form.

2. Messages

Error messages which are typed on the teletype are described in Section 2.C.

3. ENTRY/EXTRN Handling

Programs generated by the assembler can use ENTRYs or EXTRNs to achieve cross referencing and linkage with external programs. In this case, the object tape for these programs contains the symbolic names declared as ENTRYs or EXTRNs. The Mag Tape General Loader uses a symbol table to remember these names when a program is loaded. This symbol table builds downward in memory from the origin (MTORG) of the Mag Tape General Loader. Each entry in the loader symbol table requires 8 bytes of memory.

Since the loader symbol table is building downward into memory and the programs being loaded are building upward into memory, the loader checks to see that the loading program does not over-write the symbol table. If the loading program requires data stored above the current bottom of the symbol table, a MEMORY FULL message is generated and the loader halts.

When the loader is executed at its start location (MTORG) or its bias redefinition location (MTORG + 8), the symbol table is cleared of all names. Executing the Mag Tape General Loader at its continue location (MTORG + 26) does not change the state of the symbol table.

At the end of each program load, the symbol table is scanned for undefined symbols. Any undefined symbols are typed in the form

                         U XXXXXX

where XXXXXX is the symbol name. All such undefined names are printed preceding the NORMAL END message. An undefined symbol results from the fact that the symbol was declared and referenced as an EXTRN in some program, and no program yet loaded has declared and defined that same symbol as an ENTRY. As soon as some loading program declares and defines that symbol as an ENTRY, the symbol becomes defined. If more than one program declares and defines a symbol as ENTRY, the message:

                         M XXXXXX

where XXXXXX is the symbol name, is typed at the time the multiple definition occurs. In this case, the first value defined remains in the symbol table, and the second definition value is ignored.

At the end of each program load, the loader transfers immediately to the program that has been loaded only if a transfer address is specified on the tape and if the symbol table contains no undefined symbols. If any symbols in the table are undefined at the end of a load, those symbols are listed, NORMAL END is printed, and the loader halts, waiting to load the next program.

4. Label Handling

The program label can be up to 6 characters. The first character must be a letter; subsequent characters can be letters or digits. When the loader detects a program label, the label is typed in the form

                    LABEL = ABCDEF

5. Forward Reference Definitions

    Program object tapes generated by one-pass assemblies or load modules
    from the OS Library Loader involve forward references to symbols
    which are defined later in the program. The loader uses a chaining
    procedure for satisfying any forward references at the time the
    symbol definition is encountered.

3C. Loader Error Messages

	Message	Meaning
1.	CKSM ERR	A checksum error was detected after reading the previous record.
2.	SEQ-ERR	A sequence number error was detected after reading the previous error.
3.	MEM-FULL	This message is caused by a conflict between the Mag Tape General Loader and the loading program. The program being loaded has not been loaded to conclusion. The alternatives are the following: a. Load fewer programs. b. Make absolute paper tapes of the programs to be loaded and then use the REL Loader which requires less memory. c. Eliminate some EXTRNs and ENTRYs to reduce size of symbol table. Note that the Mag Tape General Loader cannot load programs above itself in memory.
4.	NORMAL END	This case occurs when a program has successfully loaded and no END transfer address has been specified or if undefined external references remain. All undefined external references are listed on the teletype preceded by a U prior to printing the NORMAL END message. If a transfer address is specified and no undefined symbols remain, the loader transfers directly to the address specified, and no NORMAL END message occurs.
5.	LOAD ERR	This message results if an illegal control item is detected during load. Depress EXECUTE to ignore the control item and attempt to proceed with the load.

6. REF-LOOP   This message results if an endless forward reference or
                external reference chain is encountered. It indicates
                that the input tape was generated incorrectly.

7. READ ERROR This message results if receipt of the parity error status
                persists. Four retries are attempted following receipt
                of a parity error. If the error persists, the tape
                is halted following the record containing the error.

8. EOF READ   An end-of-file mark was encountered after reading
                the previous record.

9. DEV END   The end-of-tape mark was encountered after reading
                the previous record.

4. RTOS KENNEDY 9-TRACK MAGNETIC TAPE DRIVER AND DCB

Introduction

The RTOS Kennedy 9-track Magnetic Tape Driver and DCB, when incorporated into the Interdata Real Time Operating System, support magnetic tape operations on the NBS Sound Laboratory Data Acquisition System. Read, write, and wait and control operations are allowed. Read and write operations may specify wait, proceed, or unconditional proceed. The ASCII or binary option has no significance, and sequential operations are always assumed.

READ requests cause 8-bit data to be read from the tape directly into the user's buffer. The transfer stops when the buffer is full or when the hardware senses an end of record condition. If the buffer length is less than the record length, overflow data is lost. If a parity error occurs, the system attempts to reread the record 4 times before giving up. At the end of the reread operation, the tape is positioned in the inter record gap following the defective record.

WRITE requests cause 8-bit data to be written from the user's buffer to the tape. The operation terminates when the buffer limit is reached. If the tape is positioned at the beginning of tape marker when a WRITE request is received, the system generates 4 inches of blank tape before starting the WRITE operation. This ensures that the BOT is passed prior to starting the WRITE operation.

Note: The buffer limits specified for magnetic tape transfer must start on an even byte boundary and end on an odd byte boundary.

All control commands are accepted. Rewind causes the tape to be positioned at the BOT marker. Backspacing one record moves the tape backward over one record and leaves it positioned in the previous inter record gap. Forward spacing one record positions the tape in the next inter record gap. Skip forward to file mark causes the tape to skip as many records as necessary to get it to the next file mark. The tape is positioned in the inter record gap just beyond the file mark. Skip backward to file mark causes the tape to move backward until it reaches a file mark. It goes past the file mark and stops in the preceding gap.

4A. Detailed Driver Description

In common with Interdata RTOS driver conventions the Kennedy 9-track Magnetic Tape driver is divided into two logically distinct phases. The Initialization phase is entered as a subroutine to SVC 1, with registers set up by SVC 1 to contain all the pertinent information about the SVC block. This phase runs with the external interrupts enabled. The second phase, the Interrupt Service Routine, is entered and re-entered on all subsequent interrupts from the magnetic tape controller and the selector channel controller as a subroutine of the Device Control Block (DCB). This phase runs with external interrupts disabled.

Parameter Set-up

Entry Point

MTDVR (SVC)

Contents of Registers on Entry

R1 -- Address magnetic tape DCB
R2 -- Caller pointer
R3 -- Address user parameter block
R4 -- Function code
R6 -- Physical device number
R7 -- Logical status (contains X'0000')
R8 -- Retry counter
RA -- Function code
RC -- Physical device number of selector
RD -- Physical device number of magnetic tape
RE -- Address of magnetic tape DCB

Functions

1. An output command stop is issued to the selector channel.

2. The status of the magnetic tape is checked for the device
    unavailable status. If the device unavailable status is returned
    from the magnetic tape, R7 is loaded with X'A000' (device unavail-
    able status) and the driver exits to the system (IOEXIT).

3. If the function code specifies a magnetic tape command, the
    driver branches to the command processor (COMAND).

4. If the operation specifies a READ or a WRITE then: R8 = X'0004'
    (four retires on a parity failure), followed by a branch and link
    (R0 as the return register) to IOPTST to determine if the buffer
    limits are correct (starting address must be even and ending
    address must be odd) and the buffer is within the user's allocated
    memory area. If these conditions are not meet R7 is loaded with
    X'C000' (illegal function status) and the driver exits to the
    system (IOEXIT).

5. The physical device number of the selector channel is doubled and
    then added to X'D0' (the start of the ISP table). The driver
    branches to the operation processor specified by the operation
    code (WRITE or READ).

2. Simulate Interrupt Service Routine For READ

Entry Point: READ

Contents of Registers on Entry

    R8 -- Retry counter
    RA -- Function code
    RC -- Physical device number of the selector channel
    RD -- Physical device number of the magnetic tape
    RE -- Address of the magnetic tape DCB

Functions:

    1. An output command stop is issued to the selector channel.

    2. The number of words to be transferred is output to the tape controller.

    3. The starting and ending address of the user buffer is output to the selector channel.

    4. The status of the magnetic tape is checked for the device unavailable status. If this status is returned, R7 is loaded with X'A000' (device unavailable) and the driver exits to the system (IOEXIT).

    5. RF is loaded with the address of the correct interrupt service routine (RDINT). RA is loaded with X'0001' to indicate a READ operation.

    6. R2 through RF are saved in the appropriate place in the DCB.

    7. A simulate interrupt (SINT), using the physical device of the magnetic tape is issued. Following the SINT instruction is an unconditional branch to the system (IOTWAT).

3. Simulate Interrupt Service Routine for WRITE

Entry Point: WRITE

Contents of Registers on Entry

    R8 -- Retry counter
    RA -- Function code
    RC -- Physical device number of the selector channel
    RD -- Physical device number of the magnetic tape
    RE -- Address of the magnetic tape DCB

Functions:

1. The status of the magnetic tape is checked for the
    WRITE protect status. If this bit is set, R7 is loaded
    with X'8400' (unrecoverable error
    exits to the system (IOEXIT).

2. An output command stop is issued to the selector channel.

3. The number of words to be transferred is output to the tape
    controller.

4. The starting and ending address of the user buffer are output
    to the selector channel.

5. The status of the magnetic tape is checked for
    device unavailable status. If this status is returned, R7
    is loaded with X'A000' (device unavailable status) and the
    driver exits to the system (IOEXIT).

6. RF is loaded with the address of the correct interrupt service
    routine (WRTINT). RA is loaded with X'FFFF' to indicate a
    WRITE operation.

7. R2 through RF are saved in the appropriate place in the DCB.

8. A simulate interrupt, SINT, using the physical device number of
    the magnetic tape is issued. Following the SINR instruction
    is an unconditional branch to the system (IOTWAT).

Service Routine for Magnetic Tape Commands

Entry Point:

    COMMAND

Contents of Registers on Entry

    RA -- Function code
    RC -- Physical device number of the selector channel
    RD -- Physical device number of the magnetic tape
    RE -- Address of the magnetic tape DCB

Functions:

1. If a WRITE EOF operation is specified, the status of
    the magnetic tape is tested for the write protect status. If
    write protect status is set, R7 is loaded with X'8400'
    (unrecoverable error) and the driver exits to the system (IOEXIT).

2. If a BACKSPACE RECORD or a BACKSPACE FILE operation is specified, the status of the magnetic tape is tested for the beginning of tape status (BOT). If this bit is set, R7 is loaded with X'9000' (end-of-medium status) and the driver exits to the system (IOEXIT).

3. If a SPACE FORWARD RECORD or a SPACE FORWARD FILE operation is specified, the physical status of the magnetic tape is tested for the end-of-tape status. If this bit is set, R7 is loaded with X'9000' (end-of-medium status) and the driver exits to the system (IOEXIT).

4. A pointer to the location of the correct operation command in the command table stored in the DCB is calculated and loaded in RA.

5. RF is loaded with the address of the correct interrupt service routine (CKSTAT). RA is loaded with X'0000' to indicate a magnetic tape command operation.

6. R2 through RF are saved in the appropriate place in the DCB.

7. The appropriate magnetic tape command is issued by performing an OUTPUT COMMAND followed by a WRITE HALFWORD to the magnetic tape. Following the Write instruction is an unconditional branch to the system (IOTWAT).

5. READ Interrupt Service Routine

    Entry Point: RDINT

    Contents of Registers on Entry

        R8 -- Retry counter
        RA -- X'0001'
        RC -- Physical device number of the selector channel
        RD -- Physical device number of the magnetic tape
        RE -- Address of the magnetic tape DCB
        RF -- Address of the interrupt service routine

    Functions:

    1. The status of the magnetic tape is tested for the not-on-line status. If this bit is set, R7 is loaded with X'8400' (unrecoverable error). R8 through RF are stored in the DCB. The address of the DCB plus one is added to the Queue Termination List. The driver then exits to the DCB where RF is saved. An entry to the system is made via a LPSW instruction.

2. The status of the magnetic tape is tested for the
    transport busy status. If this bit is set, the driver exits
    through the DCB as described in step 1, waiting for transport
    busy to reset.

3. RF is loaded with the address of the appropriate interrupt service
    routine (CKSTAT). R2 through RF are stored in the DCB.

4. A read command is issued to the tape transport and a go read
    command is issued to the selector channel.

5. The driver executes an unconditional branch to the system (IOTWAT).

WRITE Interrupt Service Routine

Entry Point

   WRTINT

Contents of Registers on Entry

   R8 -- Retry counter
   RA -- X'FFFF'
   RC -- Physical device number of the selector channel
   RD -- Physical device number of the magnetic tape
   RE -- Address of the magnetic tape DCB
   RF -- Address of the interrupt service routine

Functions:

1. The status of the magnetic tape is tested for the
    not-on-line status. If this bit is set, R7 is loaded with
    X'8400' (unrecoverable error). R8 through RF are stored in
    the DCB. The address of the DCB plus one is added to the
    Queue Termination List. The driver then exits to the DCB where
    RF is saved. An entry to the system is made via a LPSW
    instruction.

2. The status of the magnetic tape is tested for the
    transport busy status. If this bit is set, the driver exits
    through the DCB as described in step 1, waiting for transport
    busy to reset.

3. RF is loaded with the address of the appropriate interrupt
    service routine (CKSTAT). R2 through RF are stored in the DCB.

4. A Write command is issued to the tape transport and a go
    Write command is issued to the selector channel.

5. The driver executes an unconditional branch to the system
    (IOTWAT).

7. Magnetic Tape Termination Interrupt Service Routine

Entry Point

    CKSTAT

Contents of Registers on Entry

    R8 -- Retry counter
    RA -- Operation pointer
    RC -- Physical device number of the selector channel
    RD -- Physical device number of the magnetic tape
    RE -- Address of the magnetic tape DCB
    RF -- Address of the interrupt service routine

Functions:

1. The status of the magnetic tape is tested for a
    parity error. If a parity error occurred the driver branches to
    RETRY where the retry counter is decremented by one. If the
    retry counter is now greater than zero, RF is loaded with
    the address of the appropriate interrupt service routine
    (RDINT or WRTINT). R2 through RF are stored in the DCB and a
    BACKSPACE RECORD is issued. The driver then exits to the
    system (IOTWAT).

2. If on a parity error in step 1, the retry counter is decremented
    to zero, R7 is loaded with X'8400' (unrecoverable error). R8
    through RF are stored in the DCB. The address of the DCB plus
    one is added to the Queue Termination List. The driver then
    exits to the DCB where RF is saved. An entry to the system is
    made via a LPSW instruction.

3. The status of the magnetic tape is tested for the end-
    of-file status. If this bit is set, the status is also tested
    for the end-of-tape status. If both bits are set R7 is loaded
    with X'9800' and the driver exits to the system (IOEXIT).
    If only the end-of-file status is set, RF is loaded with
    X'8800' and the driver exits to the system (IOEXIT).

4. If the end-of-file status is not set, see step 3., the physical device status is tested for the end-of-tape status. If this bit is set, R7 is loaded with X'9000' and the driver exits to the system (IOEXIT).

5. If no error status bit is set, R7 is loaded with X'0000'. The address of the DCB plus one is loaded on the Queue Termination List and the driver exits to the DCB. An entry to the system is made via a LPSW instruction.

4B. Error Status Code

The following are the error conditions that the driver checks for; if any of these conditions are encountered the status is returned to the user's parameter block.

1. Illegal Function (X'C085')

A READ or WRITE operation was specified and the starting address of the buffer is odd or the ending address is even, or the starting address is greater than the ending buffer address. No data transferred. A control operation was specified, but there was no valid function command. A WRITE operation was attempted on a Write Protected tape. No data transferred.

2. Device Unavailable (X'AØ85')

The tape transport is not on line. Either the tape transport or the format control unit is not available to accept commands.

3. End-of-Tape (X'9Ø85')

An end-of-tape (EOT) condition was detected. This can occur on a READ, a WRITE, a SKIP FILE FORWARD, or a SPACE RECORD FORWARD. The end-of-tape status is also returned when the beginning-of-tape marker is encountered on SKIP FILE REVERSE or a SPACE RECORD REVERSE command.

4. End-of-File (X'8885')

The end-of-file status is returned if the end-of-file record was detected during a READ operation.

5. Parity Failure (X'8485')

READ: The parity failure status bit was detected and after four(4) rereads the error condition still existed. The tape is positioned after the erroneous record.

WRITE: The parity failure status was detected and after four(4) rewrites the error condition still existed. The tape is positioned after the erroneous record.

4C. System Generation Parameters

     The Kennedy 9-track Magnetic Tape driver has only one SYSGEN parameter:

     SELCH -- The physical address of the selector channel.

     The SYSGEN parameters for the Kennedy 9-track Magnetic Tape DCB include the following:

     TOC85 -- Time out count
     MT85 -- Physical device address of the magnetic tape controller
     SCF0 -- Physical address of the selector channel
     KMDTAB -- Table of magnetic tape controller command halfwords
          (See Section 1.E)

5. BOSS KENNEDY 9-TRACK MAGNETIC TAPE DRIVER

Introduction

When incorporated into the Interdata Basic Operating System (BOSS), Program No. 03-019, this driver supports magnetic tape operations on the NBS Sound Laboratory Data Acquisition System. Read, write, and wait and control operations are allowed. In agreement with BOSS driver conventions read and write operations may specify wait, proceed, or unconditional proceed. However, under BOSS all I/O operations are wait. The ASCII or binary option has no significance and sequential operations are always assumed.

READ requests cause eight bit data to be read from the tape directly into the user's buffer. The transfer stops when the buffer is full or when the hardware senses an end of record condition. If the buffer length is less than the record length, overflow data is lost. If a parity error occurs, the system attempts to reread the record four times before giving up. At the end of the reread operation, the tape is positioned in the inter record gap following the defective record.

WRITE requests cause eight bit data to be written from core to the tape. The operation terminates when the buffer limit is reached. If the tape is positioned at the beginning of tape marker when a WRITE request is received, the system generates 4 inches of blank tape before starting the WRITE operation. This insures that the BOT is passed prior to starting the WRITE operation.

5A. Detailed Driver Description

1. Parameter Set-up

    Entry Point: MTDVR

    Contents of Registers on Entry:

        R3 -- Address of termination routine within Exec (DVRTN) that
              is entered to indicate normal termination
        R4 -- Physical address of magnetic tape
        R5 -- Address of termination routine within Exec that is entered
              to indicate device unavailable (ABTRM)
        R7 -- Address of the SVC parameter block
        R8 -- Function code and logical unit number
        R9 -- Address of the beginning of the user buffer
        RA -- X'0001'
        RB -- Address of the end of the user buffer

    Functions:

        1. R0 is loaded with the address of the selector channel.

        2. An output command stop is sent to the selector channel.

3. The Function Code is tested for a magnetic tape command and a branch is executed to the proper routine (COMAND).

4. R6 is loaded with the number of retries permitted on a parity failure (X'0004').

5. The number of halfwords to be transferred is loaded in RA.

6. The status of the magnetic tape is tested for the unavailable status. If this status is set, the driver exits to the system (ABTRM).

7. The function code is tested for a READ or WRITE function and a branch is executed to MTR or MTW respectively.

2. Write Service Routine

Entry Point: MTW

Contents of Registers on Entry:

RO -- Address of the selector channel
R3 -- Address of termination routine within the EXEC that is entered to indicate normal termination (DVRTN)
R4 -- Physical device address of the magnetic tape
R6 -- Retry counter
R7 -- Address of the SVC parameter block
R8 -- Function code and logical unit number
R9 -- Address of the start of the user buffer
RA -- Number of halfwords to be transferred
RB -- Address of the end of the user buffer

Functions:

1. The status of the magnetic tape is tested for the write protected status. If this bit is set the driver exits to the system (UNRTRM).

2. The status of the magnetic tape is tested for the end-of-tape status. If this bit is set the driver exits to the system (ABTRM).

3. The status of the magnetic tape is tested for the beginning-of-tape status. If this bit is set, four inches of tape are erased before proceeding with the WRITE operation.

4. The number of words to be transferred is sent to the magnetic tape controller and the starting and ending addresses of the user buffer are sent to the selector channel.

5. The driver sends a Write command to the magnetic tape controller and a Go-Write command to the selector channel.

6. The driver loads R1 with a parity failure retry pointer and branches to the termination routine (CS).

Read Service Routine

Entry Point: MTR

Contents of Registers on Entry:

    R0 -- Address of the selector channel
    R3 -- Address of termination routine with the Exec that is entered
           to indicate a normal termination (DVRTN)
    R4 -- Physical device address of the magnetic tape
    R6 -- Retry counter
    R7 -- Address of the SVC parameter block
    R8 -- Function code and logical unit number
    R9 -- Address of the start of the user buffer
    RA -- Number of halfwords to be transferred
    RB -- Address of the end of the user buffer

Functions:

1. The status of the magnetic tape is tested for the end-of-tape status. If this bit is set, the driver exits to the system (ABTRM).

2. The number of halfwords to be transferred is sent to the magnetic tape controller and the starting and ending addresses of the user buffer are sent to the selector channel.

3. The driver sends a Read command to the magnetic tape controller and a Go-Read command to the selector channel.

4. The driver loads R1 with a parity failure retry pointer and branches to the termination routine (CS).

4. Command Service Routine

    Entry Point: COMAND

    Contents of Registers on Entry:

        R0 -- Address of the selector channel
        R3 -- Address of termination routine within Exec that is
              entered to indicate a normal termination (DVRTN)
        R4 -- Physical address of magnetic tape
        R5 -- Address of termination routine within the Exec that is
              entered to indicate device unavailable (ABTRM)
        R7 -- Address of SVC parameter block
        R8 -- Function code and logical unit number
        R9 -- Address of the start of the user buffer
        RA -- X'0001'
        RB -- Address of the end of the user buffer

Functions:

    1. The function code is tested for a. WRITE END-OF-FILE command.
        If this operation is specified, the status of the
        magnetic tape is tested for the write protect status. If
        this bit is set, the driver exits to the system (UNRTRM).

    2. The function code is tested for the BACKSPACE FILE or the
        BACKSPACE RECORD command. If either of these commands is
        specified, the status of the magnetic tape is tested
        for the beginning-of-tape status. If this bit is set the
        driver exits to the system (EOMTRM).

    3. The function code is tested for the SPACE FORWARD FILE of the
        SPACE FORWARD RECORD command. If either of these commands
        is specified, the status of the magnetic tape is
        tested for the end-of-tape status. If this bit is set, the
        driver exits to the system (EOMTRM).

    4. The function code is translated into an index value for the
        command table, and the magnetic tape command is output to the
        tape controller.

    5. The driver branches to the termination routine (CS).

Termination Routine

Entry Point: CS

Contents of the Registers on Entry:

    R0 -- Physical address of the selector channel
    R1 -- Address of parity failure retry routine
    R3 -- Address of the termination routine within the Exec that
          is entered to indicate a normal termination (DVRTN)
    R4 -- Physical address of the magnetic tape
    R5 -- Address of the termination routine within the Exec that is
          entered to indicate device unavailable (ABTRM)
    R7 -- Address of the SVC parameter block
    R8 -- Function code and logical unit number
    R9 -- Address of the beginning of the user buffer
    RA -- Retry counter
    RB -- Address of the end of the user buffer

Functions:

    1. The status of the magnetic tape is tested for a parity
        failure. If a parity failure occurred, the retry counter is
        decremented by one. If the retry counter is greater than zero
        a BACKSPACE RECORD command is sent to the magnetic tape and
        the driver branches to address specified by R1. If the retry
        counter is equal to zero the driver exits to the system (UNRTRM).

    2. The status of the magnetic tape is tested for the
        end-of-file status. If this bit is set, the status is also
        tested for the end-of-tape status. If only the end-of-file
        status the driver exits to the system (EOFTRM). If both bits
        are set the driver exits to the system (ZZZZ).

    3. If the end-of-file status is not set, the status of
        the magnetic tape is tested for the end-of-tape status. If
        this bit is set the driver exits to the system (EOMTRM).

    4. If no error status bit is set, the driver exits to the system
        through R3.

5B. Error Status Code

The following are the error conditions that the driver checks for; if any of these conditions are encountered the appropriate status is returned in the user's parameter block.

1. Illegal Function (X'C085')

A control operation was specified, but there was no valid function command. A WRITE operation was attempted on a write protected tape. No data transferred.

2. Device Unavailabe (X'A∅85')

The tape transport is not on line. Either the tape transport or the format control unit is not available to accept commands.

3. End-of-Tape (X'9∅85')

An end-of-tape (EOT) condition was detected. This can occur on a READ, a WRITE, a SKIP FILE FORWARD, or a SPACE RECORD FORWARD. The end-of-tape status is also returned when the beginning-of-tape marker is encountered on SKIP FILE REVERSE or a SPACE RECORD REVERSE command.

4. End-of-File (X'8885')

The end-of-file status is returned if the end-of-file marker is detected during a READ operation.

5. Parity Failure (X'8485')

READ: The parity failure status bit was detected and after four(4) rereads the error condition still existed. The tape is positioned after the erroneous record.

WRITE: The parity failure status was detected and after four(4) rewrites the error condition still existed. The tape is positioned after the erroneous record.

5C. System Generation Procedure

The BOSS Kennedy 9-track Magnetic Tape driver source tape should be inserted in the BOSS source tape prior to the END statement. The BOSS Kennedy 9-track Magnetic Tape driver source tape should start with the statement IF KNNEDY and should end with a PAUSE STATEMENT.

The statement KNNEDY EQU'85' should be inserted in the BOSS OPTION module.

The SYSGEN parameters for the driver include the following:

    SELCH -- Physical address of the selector channel
    KMDTAB -- Table of magnetic tape controller halfwords
            (See Section 1.E)

REFERENCES

1. User's Manual, Publication Number 29-261R01 Interdata, Inc. 1971

2. Real Time Operating System Reference Manual, Interdata Publication Number 29-240R06. Interdata, Inc. 1970

3. 16-Bit Loader Descriptions Manual, Interdata Publication Number B29-231R06. Interdata, Inc. 1970

4. Basic Operating System (BOSS) Reference Manual, Interdata Publication Number 29-292R01. Interdata, Inc. 1972

5. Selector Channel Programming Specifications, Interdata Publication Number 02-232R01.

6. System 8000 Digital Magnetic Tape Recorder Operation and Maintenance Manual, Kennedy Co. Publication Number 193-8000-001.

7. System 8000 Model 8208 NRZ1 Format Control Unit Operation and Maintenance Manual, Kennedy Co. Publication Number 193-8208-001.

8. Magnetic Tape Controller I/O Specifications, Xebec Systems Inc. Publication Number 300901. 1972

Appendix A.   Transporting Magnetic Tapes Between the Sound Lab Data
              Acquisition System and the NBS UNIVAC 1108

   One important use of magnetic tapes is to transport programs and data
between the Sound Lab system and the NBS UNIVAC 1108. The recording format
on the Interdata system is based on Interdata's use of the 8-bit byte
as the basic unit of memory. The UNIVAC 1108, which is a 36-bit word
length machine, uses a 9-bit data format. Hence there is a problem of
compatibility between tapes written on the Sound Laboratory Data Acquisition
System and tapes written on the UNIVAC 1108. Two programs are available
for use on the UNIVAC 1108 which handle this problem as follows:

   A.   RDBIN:

       RDBIN is a FORTRAN callable subroutine which allows the user to
read a 9-track binary tape and reformat the input into signed integers
numbers. The tape is considered a string of binary digits which the program
groups as 4, 8, 12, 16, 20, 24, 28, 30, 32, 36 bit integers. These integers
are then sign extended into 36-bit 1's complement format in the UNIVAC
1108 memory.

   B.   UTIL* COPY-TO-9 TRK

       UTIL* COPY-TO-9 TRK. This routine allows the user to copy a
symbolic element from a program file on mass storage and output it as
unit record images on 9-track magnetic tape. Each 6-bit field data character
is translated into its equivalent 8-bit ASCII character. Each record is
81 frames/characters long.

       Write-ups for these two programs are available from the Computer
Services Division.

Appendix B.   Kennedy Mag Tape General Loader Assembly Listings

```
        KENNEDY MAG TAPE GENERAL LOADER    3/28/74
0000            R0      EQU   0
0001            R1      EQU   1
0002            R2      EQU   2
0003            R3      EQU   3
0004            BYTE    EQU   4
0005            PICK    EQU   5
0006            SEQNUM  EQU   6
0007            ONE     EQU   7
0008            TWO     EQU   8
0009            FOUR    EQU   9
000A            A       EQU   10
000B            B       EQU   11
000C            C       EQU   12
000D            D       EQU   13
000E            E       EQU   14
000F            ABSF    EQU   15
                *
                *SYMBOL TABLE BUILDS DOWNWARD FROM START
                *
                *LOAD IS THE START LOCATION FOR THE LOADER
                *GO TO LOAD FOR RESTART
                *SET LOAD+A AND GO TO LOAD+8 FOR BIAS REDEFINITION *
0000R C8A0      START  LHI  A,X'80'        INITIALIZE LOC, BIAS
      0080
0004R 4300             B    *+8
      000CR
0008R C8A0      REDEF  LHI  A,X'80'        BIAS REDEFINITION
      0080
000CR 40A0             STH  A,LOC
      0518R
0010R 40A0             STH  A,BIAS
      051CR
0014R 40A0             STH  A,PTOP         RESET PTOP TO BIAS
      051ER
0018R 0BAA             SHR  A,A
001AR 40A0      CLEAR  STH  A,LOCX
      0516R
001ER C8A0             LHI  A,START        CLEAR SYMBOL-TABLE
      0000R
0022R 40A0             STH  A,CRNT
      0514R
0026R 0B66      CONT   SHR  SEQNUM,SEQNUM  CLEAR SEQNUM
0028R 0BFF             SHR  ABSF,ABSF      SET REL MODE
002AR C870             LHI  ONE,1          SET CONSTANTS 1,2,4
      0001
002ER C880             LHI  TWO,2
      0002
0032R C890             LHI  FOUR,4
```

```
      KENNEDY MAG TAPE GENERAL LOADER    3/28/74
          0004
0036R C8A0              LHI    A.MCRLF          INITIALIZE CRLF FOR TTY
      0494R
003AR 4120             ·BAL    R2.LIST
      0346R
003ER 48A0              LH     A.BIAS
      051CR
0042R C8C0              LHI    C.-4
      FFFC
0046R 08BA     PBIAS    LHR    B.A              UNPACK BIAS
0048R CCB0              SRHL   B.12             FOR PRINTING
      000C
004CR C6B0              OHI    B.X'30'
      0030
0050R C5B0              CLHI   B.X'3A'
      003A
0054R 4280              BL     *+8
      005CR
0058R CAB0              AHI    B.7
      0007
005CR D2BC              STB    B.MBIAS+11(C)
      04D8R
0060R CDA0              SLHL   A.4
      0004
0064R 0AC7              AHR    C.ONE
0066R 4210              BM     PBIAS
      0046R
006AR C8A0              LHI    A.MBIAS          PRINT BIAS = BBBB
      04D0R
006ER 4120              BAL    R2.LIST
      0345R
0072R 0B67     NEXT     SHR    SEQNUM.ONE       DECR SEQ COUNT
0074R 4120              BAL    R2.INPUT         INPUT ONE RECORD
      03D8R
0078R C8A0              LHI    A.106            COMPUTE CHECKSUM
      006A
007CR 07CC              XHR    C.C
007ER 47CA     CKIT     XH     C.BUFF(A)        BY XH OF EVERY HW OF BUFR
      0520R
0082R 0BA8              SHR    A.TWO            AND WHEN DONE
0084R 4310             ·BNM    CKIT
      007ER
0088R C7C0              XHI    C.-1             WITH FFFF. RESULT SHOULD
      FFFF
008CR 4230              BNZ    CERR             BE ZERO
      00ECR
0090R 4560              CLH    SEQNUM.BUFF      COMPARE TO SEQ NUM
      0520R
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
0094R 4230         BNE     SERR
      00F4R
0096R C850         LHI     PICK,BUFF+4       ADJUST PICK,BYTE
      0524R
009CR C840         LHI     BYTE,12,
      000C
      *
00A0R C550   LOOP  CLHI    PICK,BUFF+108     TEST IF RECORD DONE
      058CR
00A4R 4380         BNL     NEXT
      0072R
00A8R 48A5         LH      A,0(PICK)         EXTRACT NEXT COMMAND
      0000
00ACR 4110         BAL     R1,EXTR
      03C2R
00B0R 0AAA         AHR     A,A
00B2R 48BA         LH      B,JUMP(A)         GO TO COMMAND ROUTINE
      00B3R
00B6R 030B         BR      B
      *
00B8R 0072R  JUMP  DC      NEXT,END,CHAIN,FLIP
      0120R
      02FAR
      0174R
00C0R 018CR        DC      LDX,LDL,RFIN,DFIN
      0198R
      01F8R
      0204R
00C8R 01B8R        DC      UNAB,UNRL,DUAB,DURL
      01C0R
      01D8R
      01F0R
00D0R 0210R        DC      RBCD,DBCD,EITM,LABEL
      021CR
      00D8R
      031AR
      *
00D8R 4BA5   EITM  SH      A,0(PICK)         FETCH SECOND DIGIT
      0000
00DCR 4110         BAL     R1,EXTR           OF EX CONTROL ITEMS
      03C2R
00E0R 05A9         CLHR    A,FOUR            IF IT'S E4,ZERO SEQ
00E2R 4230         BNE     LERR              OTHERWISE, LOAD:ERR
      010AR
00E6R 0766         XHR     SEQNUM,SEQNUM
00E8R 4300         B       LOOP
      00A0R
00ECR C8A0   CERR  LHI     A,MCSERR          CKSM ERR MESSAGE
```

```
                  KENNEDY MAG. TAPE GENERAL LOADER     3/28/74
                  048AR
00F0R 4300                    B      *+8
      00F8R
00F4R C8A0        SERR        LHI    A.MSNERR        SEQ NUM ERR MESSAGE
      0496R
00F8R 4120                    BAL    R2.LIST
      0346R
00FCR C8A0        ERROR       LHI    A.X'000F'       DISPLAY X'0F' TO
      000F
0100R 9A7A                    WDR    ONE.A           SHOW INPUT ERROR
0102R C200                    LPSW   *+4
      0106R
0106R 8000                    DC     X'8000'.A(NEXT+2)
      0074R
                  *
010AR C8B0        LERR        LHI    B.X'FE'         LOAD ERR IF E1.E2.OR E3
      00FE
010ER C8A0                    LHI    A.MLERR         BYTE IS E
      04BAR
0112R 4120                    BAL    R2.LIST
      0346R
0116R 9A7B                    WDR    ONE.B           DISPLAY FE
0118R C200                    LPSW   *+4
      011CR
011CR 8000                    DC     X'8000'.LOOP
      00A0R
                  *
0120R 0B33        END         SHR    R3.R3           CLEAR R3 FOR UNDEF FLAG
0122R C8C0                    LHI    C.START
      0000R
0126R CBC0        END1        SHI    C.8             ADJUST POINTER TO TABLE
      0008
012AR 45C0                    CLH    C.CRNT
      0514R
012ER 4220                    BTC    2.END5          B IF TABLE ENTRY TO TEST
      0160R
0132R 48B0                    LH     B.PTOP
      051ER
0136R 40B0        END2        STH    B.BIAS          UPDATE BIAS
      051CR
013AR 40B0                    STH    B.LOC           FORCE LOC = BIAS
      0518R
013ER 0833                    LHR    R3.R3           TEST UNDEF FLAG
0140R 4230                    BNZ    END3
      014AR
0144R 48B0                    LH     B.LOCX          GO TO NON-ZERO LOCX
      0516R
0148R 023B                    BTCR   3.B             ONLY IF UNDEF FLAG ZERO
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
0!4AR C8A0    END3    LHI    A,MNEND
      04ACR
014ER 4120    END4    BAL    R2,LIST
      0345R
0152R 4800            LH     R0,BIAS
      051CR
0156R 9A7B            WDR    ONE,B           DISPLAY 00 FOR NORMAL END
0158R C200            LPSW   *+4
      015CR
015CR 8000            DC     X'8000',CONT
      0026R
0160R 488C    END5    LH     B,6(C)          EXAMINE TABLE ENTRY FOR
      0006
0164R 4310            BNM    END1            UNSATISFIED REFS
      0126R
0168R C8A0            LHI    A,C'U'
      0055
016CR 4130            BAL    R3,SHOW         PRINT UNDEFS
      0370R
0170R 4300            B      END1            R3 NON ZERO IS UNDEF FLAG
      0126R
              *
0174R C7F0    FLIP    XHI    ABSF,X'FFFF'    FLIP THE ABS FLAG
      FFFF
0178R 48A0            LH     A,LOC           FLIP LOC COUNTERS
      0518R
017CR 48B0            LH     B,LOC+2
      051AR
0180R 40A0            STH    A,LOC+2
      051AR
0184R 40B0            STH    B,LOC
      0518R
0188R 4300            B      LOOP
      00A0R
              *
018CR 4130    LDX     BAL    R3,GETT         SET EXECUTION ADRS
      039AR
0190R 40D0            STH    D,LOCX
      0516R
0194R 4300            B      LOOP
      00A0R
              *
0198R 4130    LDL     BAL    R3,GETT         SET LOAD LOCATION
      039AR
019CR 45D0    LDL0    CLH    D,CRNT
      0514R
01A0R 4380            BNL    FERR
      0278R
```

```
                 KENNEDY MAG TAPE GENERAL LOADER      3/28/74
      01A4R 40D0              STH    D.LOC
            0518R
      01A8R 45D0      LDL1    CLH    D.PTOP
            051ER
      01ACR 4280              BL     LOOP
            00A0R
      01B0R 40D0              STH    D.PTOP           UP PTOP IF NEC.
            051ER
      01B4R 4300              B      LOOP
            00A0R
                      *
      01B8R 4120      UNAB    BAL    R2.WORD          LOAD 2 BYTES ABS
            03AAR
      01BCR 4300              B      UNRX
            01C8R
      01C0R 4120      UNRL    BAL    R2.WORD          LOAD 2 BYTES REL
            03AAR
      01C4R 4AD0              AH     D.BIAS
            051CR
      01C8R 43C0      UNRX    LH     C.LOC
            0518R
      01CCR 40DC              STH    D.0(C)
            0000
      01D0R 0AC8              AHR    C.TWO            BUMP LOAD LOCATION
      01D2R 08DC              LHR    D.C
      01D4R 4300              B      LDL0
            019CR
                      *
      01D8R C8E0      DUAB    LHI    E.UNAB           LOAD 4 BYTES ABS
            01B8R
      01DCR 4120      DU      BAL    R2.WORD
            03AAR
      01E0R 43C0              LH     C.LOC
            0518R
      01E4R 40DC              STH    D.0(C)
            0000
      01E8R 0AC8              AHR    C.TWO
      01EAR 40C0              STH    C.LOC
            0518R
      01EER 030E              BR     E
                      *
      01F0R C8E0      DURL    LHI    E.UNRL           LOAD 4 BYTES REL
            01C0R
      01F4R 4300              B      DU
            01DCR
                      *
      01F8R 4130      RFIN    BAL    R3.GETT          GET REF VALUE
            039AR
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
01FCR 40D0          STH   D.REF
      0510R
0200R 4300          B     LOOP
      00A0R
             *
0204R 4130   DFIN   BAL   R3.GETT        GET DEF VALUE
      039AR
0208R 40D0          STH   D.DEF
      0512R
020CR 4300          B     LOOP
      00A0R
             *
0210R C800   RBCD   LHI   R0.X'8000'     SET REF FLAG IN REG 0
      8000
0214R 43E0          LH    E.REF          SET REF FLAG IN REG E
      0510R
0218R 4300          B     BCD1
      0222R
021CR 0700   DBCD   XHR   R0.R0          CLR REF FLAG IN REG 0
021ER 43E0          LH    E.DEF          SET DEF VALUE IN REG E
      0512R
0222R 4120   BCD1   BAL   R2.WORD
      03AAR
0226R 40D0          STH   D.BUFF+2       PUT 6 CHAR SYMBOL
      0522R
022AR 4120          BAL   R2.WORD        INTO BUFF(2-7)
      03AAR
022ER 40D0          STH   D.BUFF+4
      0524R
0232R 4120          BAL   R2.WORD
      03AAR
0236R 40D0          STH   D.BUFF+6
      0526R
023AR C8C0          LHI   C.START        SEARCH CURRENT TABLE
      0000R
023ER CBC0   BCD2   SHI   C.8            FOR A MATCH
      0008
0242R 45C0          CLH   C.CRNT
      0514R
0246R 4220          BTC   2.BCD3
      0280R
             *
024AR 40EC          STH   E.0(C)         ENTER NEW SYMBOL
      0000
024ER 43A0          LH    A.BUFF+2
      0522R
0252R 40AC          STH   A.2(C)
      0002
```

```
                KENNEDY MAG TAPE GENERAL LOADER    3/28/74
0256R 48A0              LH    A,BUFF+4
      0524R
025AR 40AC              STH   A,4(C)
      0004
025ER 48A0              LH    A,BUFF+6
      0526R
0262R 06A0              OHR   A,R0            REF/DEF FLAG IN R0
0264R 40AC              STH   A,6(C)
      0006
0268R CBC0              SHI   C,8             ADJUST CRNT TO POINT
      0008
026CR 40C0              STH   C,CRNT          TO NEXT AVAILABLE SLOT
      0514R
0270R 45C0              CLH   C,PTOP
      051ER
0274R 4380              BNL   LOOP
      00A0R
0278R C8A0      FERR    LHI   A,MFULL         MEM FULL ERROR
      04A0R
027CR 4300              B     END4
      014ER
                *
0280R 48AC      BCD3    LH    A,2(C)          COMPARE BCD TO TABLE ENTRY
      0002
0284R 45A0              CLH   A,BUFF+2
      0522R
0288R 4230              BNE   BCD2            RETN TO BCD2 IF NO MATHC
      023ER
028CR 48AC              LH    A,4(C)
      0004
0290R 45A0              CLH   A,BUFF+4
      0524R
0294R 4230              BNE   BCD2
      023ER
0298R 48AC              LH    A,6(C)
      0006
029CR 086A              LHR   B,A             SAVE REF/DEF FLAG IN B
029ER C4A0              NHI   A,X'7FFF'       MASK OUT REF FLAG
      7FFF
02A2R 45A0              CLH   A,BUFF+6
      0526R
02A6R 4230              BNE   BCD2
      023ER
                *
                *POW BAM
                *A MATCH
                *
02AAR 0800              LHR   R0,R0           TEST TAPE VALUE
```

```
          KENNEDY MAG TAPE GENERAL LOADER   3/28/74
02ACR 4210          BM   BCD4            B IF TAPE VALUE IS REF
      02C2R
02B0R 0388          LHR  B,B             TEST TABLE ENTRY
02B2R 4210          BM   BCD7            B IF TABLE ENTRY IS REF
      02EAR
02B6R C8A0          LHI  A,C'M*'         MULTIPLE DEF
      4D2A
02BAR 4130          BAL  R3,SHOW1        KEEP TABLE ENTRY AS IS
      0384R
02BER 4300          B    LOOP
      00A0R
     *
02C2R 48DC   BCD4   LH   D,0(C)          TAPE VALUE IS REF
      0000
02C6R 0388          LHR  B,B             TEST TABLE ENTRY
02C8R 4310          BNM  CH1             B IF TABLE ENTRY ID DEF
      0302R
02CCR 07AA          XHR  A,A             INIT COUNTER
02CER 48CD   BCD5   LH   C,0(D)          REF-REF
      0000
02D2R 4330          BZ   BCD6
      02E2R
02D6R 0AA7          AHR  A,ONE           COUNT LINKS IN REF CHAIN
02DAR 4240          BO   RELP            TOO MANY] REF-LOOP...
      033ER
02DCR 03DC          LHR  D,C             FOLLOW TABLE THREAD
02DER 4300          B    BCD5
      02CER
02E2R 40ED   BCD6   STH  E,0(D)          ATTACH TAPE THREAD
      0000
02E6R 4300          B    LOOP
      00A0R
     *
02EAR 40AC   BCD7   STH  A,6(C)          TAPE DEF,TABLE REF
      0006
02EER 48AC          LH   A,0(C)          CLEAR REF FLAG
      0000
02F2R 40A0          STH  A,REF           SET REF VALUE FROM TABLE
      0510R
02F6R 40EC          STH  E,0(C)          SET DEF VALUE FROM TAPE
      0000
     *
02FAR 48D0   CHAIN  LH   D,DEF           DEF THE REFS
      0512R
02FER 48E0          LH   E,REF
      0510R
0302R 48CE   CH1    LH   C,0(E)          FOLLOW THE REF THREAD
      0000
```

```
          KENNEDY MAG TAPE GENERAL LOADER    3/28/74
0306R 40DE            STH    D.0(E)           AND DEF EVERY LITTLE REF
      0000
030AR 05CD            CLHR   C.D              SEE IF WE'VE BEEN HERE
030CR 4330            BE     RELP             BEFORE. THATS REF-LOOP
      033ER
0310R 08EC            LHR    E.C
0312R 4230            BNZ    CH1
      0302R
0316R 4300            B      LOOP
      00A0R
           *
031AR 4120    LABEL   BAL    R2.WORD          PRINT LABEL = LLLLLL
      03AAR
031ER 40D0            STH    D.MLABEL+8
      04E6R
0322R 4120            BAL    R2.WORD
      03AAR
0326R 40D0            STH    D.MLABEL+10
      04E8R
032AR 4120            BAL    R2.WORD
      03AAR
032ER 40D0            STH    D.MLABEL+12
      04EAR
0332R C8A0            LHI    A.MLABEL
      04DER
0336R 4120    LABI    BAL    R2.LIST
      0346R
033AR 4300            B      LOOP
      00A0R
           *
033ER C8A0    RELP    LHI    A.RELPM
      04C6R
0342R 4300            B      END4
      014ER
0346R C8D0    LIST    LHI    D.2              ASSUME TTY = DEV NO. 2
      0002
034AR DED0            OC     D.TWRT
      0488R
034ER D30A    L1      LB     R0.0(A)          A IS MESSAGE POINTER
      0000
0352R 4110            BAL    R1.L2            OUTPUT CHAR
      0366R
0356R 0AA7            AHR    A.ONE
0358R C500            CLHI   R0,X'0D'         WAS CHAR = CAR RET
      000D
035CR 4230            BNE    L1
      034ER
0360R C800            LHI    R0,X'0A'         OUTPUT LF AFTER CAR RET
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
          000A
0364R 0312          LHR    R1,R2
0366R 9DDE   L2     SSR    D,E              OUTPUT CHAR FROM R0
0368R 4290          BTC    9,L2
      0366R
036CR 9AD0          WDR    D,R0
036ER 0301          BR     R1
             *
0370R 4060   SHOW   STH    B,BUFF+6         PUT SYM NAME INT
      0526R
0374R 48BC          LH     B,4(C)           BUFF(2:7)
      0004
0378R 4060          STH    B,BUFF+4
      0524R
037CR 48BC          LH     B,2(C)
      0002
0380R 4080          STH    B,BUFF+2
      0522R
0384R 40A0   SHOW1  STH    A,BUFF           PUT U OR M INTO BUF
      0520R
9388R C8A0          LHI    A,CRLF
      0D0A
038CR 40A0          STH    A,BUFF+8         PUT CRLF INTO BUFF(8,9)
      0528R
0390R C8A0          LHI    A,BUFF
      0520R
0394R 4120          BAL    R2,LIST          PRINT U OR M SYMBOL
      0346R
0398R 0303          BR     R3
             *
039AR 4120   GETT   BAL    R2,WORD          GET 2 BYTES OF DATA
      03AAR
039ER 03FF          LHR    ABSF,ABSF        AND ADD BIAS TO IT
03A0R 4233          BNZ    0(R3)            IF IN REL MOD
      0000
03A4R 4AD0          AH     D,BIAS
      051CR
03A8R 0303          BR     R3
             *
03AAR 08C9   WORD   LHR    C,FOUR           ASSEMBLE 1 WORD OR
03ACR 48A5   WORD1  LH     A,0(PICK)        TWO BYTES OF DATA
      0000
03B0R 4110          BAL    R1,EXTR          INTO REG D.
      03C2R
03B4R CDD0          SLHL   D,4
      0004
03B8R 06DA          OHR    D,A
03BAR 08C7          SHR    C,ONE
```

```
        KENNEDY MAG TAPE GENERAL LOADER      3/28/74
03BCR 4230            BNZ     WORD1
      03ACR
03C0R 0302            BR      R2
              *
03C2R CCA4    EXTR    SRHL    A,0(BYTE)      EXTRACT ONE FOUR BIT
      0000
03C6R C4A0            NHI     A,X'F'         BYTE FROM THE DATA
      000F
03CAR 0B49            SHR     BYTE,FOUR      IN REG A.
03CCR 4311            BNM     0(R1)
      0000
03D0R C840            LHI     BYTE,12        UPDATE PICK AND BYTE
      000C
03D4R 0A58            AHR     PICK,TWO
03D6R 0301            BR      R1
              *
              * MAG TAPE INPUT ROUTINE
              *
              *READS 108-BYTE BINARY RECORDS FROM MAG TAPE
              *
              * REDEFINE SOME REGISTERS
0002          RTN     EQU     R2             LINK REGISTER
000D          DEV     EQU     D              DEVICE ADDRESS
000A          AC1     EQU     A
0001          DAT     EQU     R1             INPUT DATA & STATUS
000E          CBA     EQU     E              CURRENT BYTE ADRS POINTER
000B          CRB     EQU     11             TEMP STOR FOR BYTE ASMB
              *
              *CALL BAL RTN,INPUT
03D8R 48D0    INPUT   LH      DEV,BINDV      BINARY INPUT DEVICE ADDR
      0592R
03DCR C8E0            LHI     CBA,5          NO. OF RETRIES
      0005
03E0R C8F0            LHI     SLCH,SELADR    GET SELECTOR CHANNEL ADDR.
      00F0
03E4R DEF0            OC      SLCH,SCST      GIVE SELCH STOP
      0598R
03E8R DED0            OC      DEV,CREG
      0590R
03ECR D8D0            WH      DEV,NOOP       SELECT TAPE
      059ER
03F0R 9DD1    S1      SSR     DEV,DAT
03F2R 4310            BFC     1,S1
      03F0R
03F6R DED0            OC      DEV,SREG
      058ER
03FAR 99D1            RHR     DEV,DAT        CHECK DEVICE O.K.
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
03FCR C410          NHI  DAT,X'FF5F'     BOF AND PROTECT STATUS ALL
      FF5F
0400R 4230          BNZ  S1
      03F0R
0404R C810          LHI  DAT,54
      0036
0408R DED0          OC   DEV,WREG        108 BYTES TO WORD COUNT RE
      058FR
040CR 98D1          WHR  DEV,DAT
040ER D8F0          WH   SLCH,BFST       START ADDR. TO SELCH
      0594R
0412R D8F0          WH   SLCH,BFEN       END ADDR. TO SELCH
      0596R
0416R DED0          OC   DEV,CREG        READ RECORD COMMAND TO FOR
      0590R
041AR D8D0          WH   DEV,RDCM
      059AR
041ER DEF0          OC   SLCH,SCMD       START SELCH
      0599R
0422R 9DF1          SSR  SLCH,DAT
0424R 2081          BTBS 8,1             WAIT FOR SELCH TO TERMINAT
0426R DEF0          OC   SLCH,SCST
      0598R
042AR 9DD1          SSR  DEV,DAT         CHECK DEVICE STATUS
042CR 2211          BFBS 1,1
042ER DED0          OC   DEV,SREG        GET STATUS REG
      058ER
0432R 99D1          RHR  DEV,DAT
0434R C310          THI  DAT,X'400'      BAD DATA
      0400
0438R C310          THI  DAT,X'100'      EOF ERROR
      0100
043CR 4230          BNZ  EFER
      0478R
0440R C310          THI  DAT,X'40'       EOT ERROR
      0040
0444R 4230          BNZ  DEER
      0480R
0448R C310          THI  DAT,X'A10'      ANY OTHER ERROR
      0A10
044CR 4230          BNZ  PEMS
      0468R
0450R 0302          BR   RTN
0452R 8BE7    PRER  SHR  CBA,ONE         DECREMENT RETRY COUNT
0454R 4330          BZ   PEMS
      0468R
0458R DED0          OC   DEV,CREG
      0590R
```

```
            KENNEDY MAG TAPE GENERAL LOADER    3/28/74
045CR D8D0                WH    DEV,SPRV          SPACE REVERSE ONE RECORD
      059CR
0460R 9DD1                SSR   DEV,DAT
0462R 2211                BFBS  1,1
0464R 4300                B     S1
      03F0R
0468R C8A0        PEMS    LHI   A,PEMSA
      04EER
046CR 4120        ERHT    BAL   R2,LIST
      0346R
0470R C200                LPSW  *+4
      0474R
0474R 8000                DC    X'8000',CONT
      0026R
0478R C8A0        EFER    LHI   A,EFERA
      04FCR
047CR 4300                B     ERHT
      046CR
0480R C8A0        DEER    LHI   A,DEERA
      0506R
0484R 4300                B     ERHT
      046CR
0488R 98A9        TWRT    DC    X'98A9'
                  *  MESSAGES
                  *
0D0A              CRLF    EQU   X'0D0A'
048AR 2043        MCSERR  DC    C' CKSM ERR'
      4B53
      4D20
      4552
      5220
0494R 0D0A        MCRLF   DC    CRLF
0496R 5345        MSNERR  DC    C'SEQ-ERR',CRLF
      512D
      4552
      5220
      0D0A
04A0R 204D        MFULL   DC    C' MEM-FULL',CRLF
      454D
      2D46
      554C
      4C20
      0D0A
04ACR 204E        MNEND   DC    C' NORMAL END',CRLF
      4F52
      4D41
      4C20
      454E
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
         4420
         0D0A
04BAR 204C    MLERR   DC    C' LOAD ERR',CRLF
         4F41
         4420
         4552
         5220
         0D0A
04C6R 5245    RELPM   DC    C'REF-LOOP',CRLF
         462D
         4C4F
         4F50
         0D0A
04D0R 4249    MBIAS   DC    C'BIAS = BBBB',CRLF
         4153
         203D
         2042
         4242
         4220
         0D0A
04DER 4C41    MLABEL  DC    C'LABEL = LLLLLL',CRLF
         4245
         4C20
         3D20
         4C4C
         4C4C
         4C4C
         0D0A
04EER 2052    PEMSA   DC    C' READ ERROR',CRLF
         4541
         4420
        '4552
         524F
         5220
         0D0A
04FCR 454F    EFERA   DC    C'EOF READ',CRLF
         4620
         5245
         4144
         0D0A
0506R 2044    DEERA   DC    C' DEV END',CRLF
         4556
         2045
         4E44
         0D0A
0510R 0000    REF     DC    0
0512R 0000    DEF     DC    0
0514R FFE0R   CRNT    DC    START-32
```

```
        KENNEDY MAG TAPE GENERAL LOADER    3/28/74
0516R 0000    LOCX    DC      0
0518R 0080    LOC     DC      X'80'
051AR 0000            DC      0
051CR 0080    BIAS    DC      X'80'
051ER 0000    PTOP    DC      0
0520R         BUFF    DS      108
058CR                 DS      2
058ER 0307    SREG    DC      X'0307'
058FR         WREG    EQU     SREG+1
0590R 0500    CREG    DC      X'0500'
000F          SLCH    EQU     15
0592R 0085    BINDV   DC      X'0085'
00F0          SELADR  EQU     X'F0'
0594R 0520R   BFST    DC      BUFF
0596R 05FFR   BFEN    DC      BFST+107
0598R 0830    SCST    DC      X'830'
0599R         SCMD    EQU     SCST+1
059AR 0178    RDCM    DC      X'178'
059CR 0578    SPRV    DC      X'578'
059ER 0078    NOOP    DC      X'078'
              *
05A0R                 END
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74
NO ERRORS

```
A        000A
ABSF     000F
AC1      000A
B        000B
BCD1     0222R
BCD2     023ER
BCD3     0280R
BCD4     02C3R
BCD5     02CER
BCD6     02E2R
BCD7     02E4R
BFEN     059ER
BFST     0594R
BIAS     051CR
BINDV    0592R
BUFF     0520R
BYTE     0004
C        000C
CBA      000E
CERR     00ECR
CH1      0302R
CHAIN    02FAR
CKIT     007ER
CLEAR    001AR
CONT     0026R
CRB      000B
CREG     0590R
CRLF     000A
CRNT     0514R
D        000D
DAT      0001
DECD     021CR
DEER     0490R
DEERA    0506R
DEF      0512R
DEV      000D
DFIN     0204R
DU       01DCR
DUAB     01DER
DURL     01F0R
E        000E
EFER     0478R
EFERA    04FCR
EITM     02D8R
END      0128R
END1     0125R
END2     0136R
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
END3     014AR
END4     014ER
END5     0168R
ERHT     046CR
ERROR    00FCR
EXTR     03C2R
FERR     0278R
FLIP     0174R
FOUR     0009
GETT     039AR
INPUT    03D8R
JUMP     00B8R
L1       034ER
L2       0366R
LAB1     0336R
LABEL    031AR
LDL      0198R
LDL0     019CR
LDL1     01A8R
LDX      018CR
LERR     010AR
LIST     0346R
LOC      0518R
LOCX     0516R
LOOP     00A0R
MBIAS    04D0R
MCRLF    0494R
MCSERR   048AR
MFULL    04A0R
MLABEL   04DER
MLERR    048AR
MNEND    04ACR
MSNERR   0496R
NEXT     0072R
NOOP     059ER
ONE      0007
PBIAS    0048R
PEMS     0468R
PEMSA    04EER
PICK     0005
PRER     0452R
PTOP     051ER
R0       0000
R1       0001
R2       0002
R3       0003
RBCD     0210R
RDCM     059AR
```

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
REDEF     000ER
REF       0510R
RELP      033ER
RELPM     040GR
RFIN      01F8R
RTN       0002
S1        03F8R
SCMD      0599R
SCST      0598R
SFLADR    A0F0
SEONUM    0006
SERR      00F4R
SHOW      0370R
SHOW1     0384R
SLCH      000F
SPRV      059CR
SREG      058ER
START     0000R
TWO       0028
TURT      0488R
UNAB      01B8R
UNRL      01C0R
UNPX      01CBR
WORD      03AAR
WORD1     03ACR
WREG      058FR
```

Appendix C.   RTOS Kennedy 9-Track Magnetic Tape Driver Assembly Listings

```
           KENNEDY 9-TRACK MAG TAPE DRIVER                              PAGE    1
                        *       RTOS COMPATABLE DRIVER
                        *       FOR KENNEDY 8108 TAPE SYSTEM.
                        *       A. J. BAROODY
                        *       JUNE 18,1974
                        *
                        *
                        * EXTRN/ENTRY DECLARATIONS:
           0000R                 ENTRY  MTDVR,MTTRM
           0000R                 EXTRN  IOEXIT,LIOTRM,IOTWAT,IOPTST
                        *
                        * INTERDATA REGISTER ALLOCATIONS
           0000         R0       EQU    0              ADDRESS OF DRIVER
           0001         R1       EQU    1              ADDRESS OF DCB
           0002         R2       EQU    2              CALLER/IOW POINTERS
           0003         R3       EQU    3              POINTER TO PARAMETER BLOCK
           0004         R4       EQU    4              FUNCTION CODE AND LU
           0005         R5       EQU    5              ADDRESS OF BUSY FLAG
           0006         R6       EQU    6              DEVICE ADDRESS
           0007         R7       EQU    7              STATUS REGISTER
           0007         STAT     EQU    7
           0008         R8       EQU    8
           0009         R9       EQU    9
           000A         RA       EQU    10
           000A         AC1      EQU    10
           000B         AC2      EQU    11
           000B         RB       EQU    11
           000C         RC       EQU    12
           000C         SELCH    EQU    12
           000D         RD       EQU    13
           000D         DEV      EQU    13
           000E         RE       EQU    14
           000E         DCB      EQU    14
           000F         RF       EQU    15
           000F         ISR      EQU    15
                        *
                        *
                        *
                        *SYSGEN PARAMETERS
                        *
                        *     SELCH ADDRESS = X'F0'
                        *
                        *    XEBEC CONTROLLER REGISTERS
                        *
           0000R 00     KDATA    DB     0
           0001R 01     KMEM     DB     1
           0002R 03     KSTAT    DB     3
           0003R 04     KINT     DB     4
           0004R 05     KCMD     DB     5
           0005R 07     KWORD    DB     7
                        *
           0006R 08E1   MTDVR    LHR    DCB,R1         GET ADDR OF DCB
           0008R 93D6            LBR    DEV,R6         AND DEV NO.
           000AR C8C0            LHI    SELCH,X'F0'    AND SELCH ADDRESS
                 00F0
           000ER DEC0            OC     SELCH,STOP     STOP SELCH
                 02BER
```

```
                      *
                      *
0012R 4188            BAL    RB,MTCKDU      TEST FOR TAPE AVAILABLE
      029ER
0016R C370            THI    STAT,X'000F'   IS DEVICE ONLINE?
      000F
001AR 4330            BZ     ONLINE
      0026R
001ER C870            LHI    STAT,X'A000'   DEV UNAVAILABLE
      A000
0022R 4300            B      IOEXIT
      0000F
0026R 08A4   ONLINE   LHR    RA,R4          COMMAND OR FUNCTION?
0028R 4210            BM     COMAND
      00F4R
002CR 2484            LIS    RB,4           4 RETRIES ON PARITY FAIL
002ER 4100            BAL    RB,IOPTST      CHECK BUFFER LIMITS
      0000F
0032R 2335            BZS    OK
0034R C870   ILFUNC   LHI    STAT,X'C000'   ILLEGAL FUNCTION
      C000
0038R 4300            B      IOEXIT
      0024R
                      *
                      *POINT SELCH INTERRUPTS TO MAG TAPE DCB
                      *
003CR 08BC   OK       LHR    RB,SELCH
003ER 0ABB            AHR    RB,RB
0040R 40EB            STH    DCB,X'D0'(RB)  STORE ADDR. OF DCB IN ISPTAB
      00D0
                      *
                      *
0044R 0AAA            AHR    RA,RA          TEST FOR READ
0046R 4310            BNM    READ
      0024R
004AR C370   WRITE    THI    STAT,X'0020'   TEST FOR WRITE PROTECT SET
      0020
004ER 4330            BZ     WRT1
      005AR
0052R C870            LHI    R7,X'8400'     UNRECOVERABLE ERROR
      8400
0056R 4300            B      IOEXIT
      003AR
005AR DEC0   WRT1     OC     SELCH,STOP
      020ER
005ER 43AE            LH     AC1,6(DCB)     LOAD  ENDING ADDR.
      0006
0062R 43BE            LH     AC2,4(DCB)     AND STARTING ADDR. INTO REG.
      0004
0066R 0BAB            SHR    AC1,AC2        CALCULATE NO. OF
0068R 26A2            AIS    AC1,2          BYTES TO TRANSFER
006AR 90A1            SRLS   AC1,1          NOW WORD COUNT
006CR DED0            OC     DEV,KWORD
      0005R
0070R 98DA            WHR    DEV,AC1        SEND WORD COUNT TO KENNEDY
0072R D9C3            WH     SELCH,4(R3)    SEND STARTING ADDRESS
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                              PAGE   3
        0004
0076R D8C3            WH      SELCH.6(R3)         AND ENDING ADDRESS
        0006
007AR 9DD7            SSR     DEV.STAT            MAG TAPE DU = 0
007CR 4210           BTC     1.WRTOK
        0088R
0080R C870           LHI     R7.X'A000'          TAPE UNAVAILABLE
        A000
0084R 4300           B       IOEXIT
        0059R
0088R C8F0    WRTOK  LHI     RF.WRTINT
        01B4R
008CR C8A0           LHI     AC1.-1              AC1 NEGATIVE EQUAL WRITE
        FFFF
0090R D02E           STM     R2.28(DCB)
        001C
0094R C370           THI     STAT.X'0080'        TEST FOR BOT
        0080
0098R 4330           BZ      WRT3
        00ACR
009CR DED0    WRT2   OC      DEV.KINT            ENABLE TAPE INTERRUPTS
        0003R
00A0R DED0           OC      DEV.KCMD
        0004R
00A4R D8DE           WH      DEV.72(DCB)         SEND ERASE TAPE COMMAND
        0049
00A8R 4300           B       IOTWAT
        0000F
00ACR E20D    WRT3   SINT    0(DEV)              SIMULATE INTERRUPT AND WAIT
        0000
00B0R 4300           B       IOTWAT
        00AAR
              **
              **
00B4R DEC0    READ   OC      SELCH.STOP
        02BER
00B8R 49AE           LH      AC1.6(DCB)          LOAD FINAL ADDR INTO REG
        0006
00BCR 49AE           LH      AC1.4(DCB)          LOAD STARTING ADDR.
        0004
00C0R 0BA8           SHR     AC1.AC2             NOW CALCULATE
00C2R 26A2           AIS     AC1.2               NO. OF BYTES
00C4R 90A1           SRLS    AC1.1               AND NO. OF WORDS
00C6R DED0           OC      DEV.KWORD
        0005R
00CAR 98DA           WHR     DEV.AC1             SEND WORD COUNT TO KENNEDY
00CCR D8C3           WH      SELCH.4(R3)         SEND STARTING ADDRESS
        0004
00D0R D8C3           WH      SELCH.6(R3)         AND ENDING ADDRESS
        0006
00D4R 9DD7           SSR     DEV.STAT            TEST FOR DEVICE AVAILABLE
00D6R 4210           BTC     1.READ1
        00E2R
00DAR C870           LHI     STAT.X'A000'        TAPE IS NOT AVAILABLE
        A000
00DER 4300           B       IOEXIT
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                          PAGE    4
        0086R
00E2R C9F0      READ1   LHI     RF.RDINT        LOAD ISR TO POINT TO READ INTERRUPT ROUTIN
      0184R
00E6R 24A1              LIS     AC1.1           SET AC1 TO ONE FOR READ
00E8R D02E              STM     R2.28(DCB)
      001C
00ECR E20D              SINT    0(DEV)          SIMULATE INTERRUPT
      0000
00F0R 4300              B       IOTWAT
      0082R
                **
                **
00F4R C4A0      COMAND  NHI     RA.X'7F00'      LEAVE ONLY FUNC. CODE
      7F00
00F8R C3A0              THI     RA.X'0800'      TEST FOR WRITE EOF
      0800
00FCR 4330              BZ      CHK1
      0110R
0100R C370              THI     STAT.X'0020'    TEST FOR WRITE PROTECTED
      0020
0104R 4330              BZ      MTC2
      0140R
0108R C870              LHI     R7.X'8400'      WRITE PROTECTED, UNRECOVERABLE ERROR.
      8400
010CR 4300              B       IOEXIT
      00E0R
0110R C3A0      CHK1    THI     RA.X'2200'      TEST FOR BACKSPACE
      2200
0114R 4330              BZ      CHK2
      0128R
0118R C370              THI     STAT.X'0080'    TEST FOR BOT
      0080
011CR 4330              BZ      MTC2
      0140R
0120R C870              LHI     R7.X'9000'
      9000
0124R 4300              B       IOEXIT
      010ER
0128R C3A0      CHK2    THI     RA.X'1400'      TEST FOR SPACE FORWARD
      1400
012CR 4330              BZ      MTC2
      0140R
0130R C370              THI     STAT.X'0040'    TEST FOR EOT
      0040
0134R 4330              BZ      MTC2
      0140R
0138R C8A0              LHI     RA.X'9000'
      9000
013CR 4300              B       IOEXIT
      0126R
                *
                *NOW CALCULATE POINTER TO COMMAND IN DCB
                * AND LOAD  INTO AC1.
                *
0140R 2470      MTC2    LIS     STAT.0
0142R 91A1      CHK3    SLLS    RA.1
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                          PAGE   5
0144R 4210              BM    MTC3
      015AR
0148R 2672              AIS   STAT,2
014AR C970              CHI   STAT,12         TEST FOR NO COMMAND
      000C
014ER 4230              BNE   CHK3
      0142R
0152R C870              LHI   R7,X'C000'
      C000
0156R 4300              B     IOEXIT
      013ER
015AR 48AE    MTC3      LH    AC1,60(DCB)     LOAD KMDTAB ADDR. IN REGISTER
      003C
015ER 0AA7              AHR   AC1,STAT
0160R 9DD7              SSR   DEV,STAT
0162R 4210              BTC   1,CMDGO
      016ER
0166R C870              LHI   STAT,X'A000'    DEVICE UNAVAILABLE
      A000
016AR 4300              B     IOEXIT
      0158R
016ER C8F0    CMDGO     LHI   RF,CKSTAT
      01E4R
0172R DED0              OC    DEV,KCMD
      0004R
0176R D8DA              WH    DEV,0(AC1)
      0000
017AR 24A0              LIS   AC1,0           SET AC1 FOR COMMAND
017CR D02E              STM   R2,28(DCB)
      001C
0180R 4300              B     IOTWAT
      00F2R
              *
              *   READ INTERRUPT SERVICE
              *
0184R 4180    RDINT     BAL   RS,MTCKDU
      029ER
0188R C370              THI   STAT,X'0008'    IS NOL SET?
      0008
018CR 4330              BFC   3,RDCK
      0194R
0190R 4300              B     UNREC
      0234R
0194R C370    RDCK      THI   STAT,X'0005'    IS DEVICE BUSY?
      0005
0198R 4330              BZ    INPUT           NO, THEN GO READ
      01A0R
019CR 430E              B     16(RE)          YES; THEN WAIT
      0010
01A0R 48F0    INPUT     LH    RF,CKSTAT
      01E4R
01A4R D02E              STM   R2,28(DCB)
      001C
01A8R D8DE              WH    DEV,76(DCB)     SEND READ COMMAND TO KENNEDY
      004C
01ACR DEC0              OC    SELCH,GORD      SELCH READ COMMAND
```

```
         02BCR
018ØR 4300          B     IOTWAT
         0182R
                  *
                  *  WRITE INTERRUPT SERVICE ROUTINE
                  *
01B4R 4190   WRTINT BAL   R8,MTCKDU
         029ER
01B8R C370          THI   STAT,X'0009'     IS NOL SET?
         0009
01BCR 4330          BFC   3,WRCK
         01C4R
01CØR 4300          B     UNREC
         0234R
01C4R C370   WRCK   THI   STAT,X'0005'     IS DEVICE BSY?
         0005
01C8R 4330          BZ    OUTPUT           NO;GO WRITE DATA
         01DØR
01CCR 430E          B     16(RE)           YES; WAIT
         0010
01DØR C8FØ   OUTPUT LHI   RF,CKSTAT
         01E4R
01D4R DØ2E          STM   R2,28(DCB)
         001C
01D8R D8DE          WH    DEV,78(DCB)      SEND WRITE COMMAND TO KENNEDY
         004E
01DCR DECØ          OC    SELCH,GOWRT      SEND SELCH WRITE COMMAND
         02BDR
01EØR 4300          B     IOTWAT
         01B2R
                  *
                  *  CHECK STATUS AFTER OPERATION COMPLETE
                  *
01E4R 4190   CKSTAT BAL   R8,MTCKDU
         029ER
01E8R C370          THI   STAT,X'E00'      TEST FOR PARITY ERROR
         0E00
01ECR 4330          BZ    CS1
         01F8R
01FØR C370          THI   STAT,X'100'      IF PARITY ERROR AND EOF THEN IGNORE
         0100
01F4R 4330          BZ    RETRY
         022ER
01F8R C370   CS1    THI   STAT,X'100'      TEST FOR EOF
         0100
01FCR 4330          BZ    NDEOF
         0218R
02ØØR C370          THI   STAT,X'40'       TEST FOR EOT
         0040
02Ø4R 4330          BZ    EOFTRM
         0210R
02Ø8R C870          LHI   STAT,X'9800'     EOF AND EOT
         9800
02ØCR 4300          B     IOEXIT
         016CR
021ØR C870   EOFTRM LHI   STAT,X'8800'
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                              PAGE   7
        8800
0214R 4300            B     IOEXIT
      020ER
0218R C370   NOEOF    THI   STAT,X'40'      TEST FOR EOT
      0040
021CR 4230            BNZ   EOMTRM
      0226R
0220R 2470   OKAY     LIS   STAT,0
0222R 4300            B     MTTRM
      02B2R
0226R C870   EOMTRM   LHI   STAT,X'9000'
      9000
022AR 4300            B     IOEXIT
      0216R
             *
             *   RETRY FOR PARITY ERROR
             *
022ER 2781   RETRY    SIS   R8,1
0230R 4310            BNM   CONTIN
      0240R
0234R C870   UNREC    LHI   STAT,X'8400'    UNRECOVERABLE ERROR
      8400
0238R 408E   ERRSAV   STH   R8,38(DCB)
      0026
023CR 4300            B     MTTRM
      02B2R
0240R 08AA   CONTIN   LHR   AC1,AC1         TEST FOR READ OR WRITE
0242R 4210            BM    WRT
      0274R
0246R 4330            BZ    UNREC           NOT READ OR WRITE
      0234R
024AR C8F0            LHI   RF,RDINT        POINT ISR TO READ INT. ROUTINE
      0134R
024ER D02E            STM   R2,28(DCB)
      001C
0252R DEC0            OC    SELCH,STOP
      028ER
0256R 9DD7            SSR   DEV,STAT
0258R 4210            BTC   1,RDON
      0264R
025CR C870            LHI   STAT,X'A000'
      A000
0260R 4300            B     IOEXIT
      022CR
0264R DED0   RDON     OC    DEV,KINT        ENABLE TAPE INTERRUPTS
      0003R
0268R DED0            OC    DEV,KCMD
      0004R
026CR D8DE            WH    DEV,62(DCB)     BACKSPACE RECORD AND TRY AGAIN
      003E
0270R 4300            B     IOTWAT
      01E2R
0274R C8F0   WRT      LHI   RF,WRTINT       POINT ISR TO WRITE INTERRUPT ROUTINE
      0184R
0278R D02E            STM   R2,28(DCB)
      001C
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                            PAGE    8
027CR DEC0              OC      SELCH,STOP
      02BER
0280R 9DD7              SSR     DEV,STAT
0282R 4210             BTC     1,WRTON
      028ER
0286R C670             LHI     STAT,X'A000'
      A000
028AR 4300             B       IOEXIT
      0262R
028ER DED0      WRTON   OC      DEV,KINT        ENALBLE TAPE INTERRUPTS
      0003R
0292R DED0              OC      DEV,KCMD
      0004R
0296R D8DE             WH      DEV,62(DCB)      SEND BACKSPACE RECORD COMMAND
      003E
029AR 4300             B       IOTWAT
      0272R
                *
                *COMMON ROUTINE TO RETRIEVE MAGNETIC TAPE STATUS.
                *DEVICE STATUS WORD IS RETURNED IN STAT.
                *
                *TO USE:
                *
                *     BAL R8,MTCKDU
                *
                *
029ER DEC0      MTCKDU  OC      SELCH,STOP
      026ER
02A2R DED0              OC      DEV,KCMD
      0004R
02A6R D8DE             WH      DEV,74(DCB)      SEND NO-OP COMMAND TO TAPE
      004A
02AAR DED0              OC      DEV,KSTAT
      0002R
02AER 99D7             RHR     DEV,STAT
02B0R 0309             BR      R8
                *
                *COMMON TERMINATION ROUTINE: ADDS DCB TO LIOTERM
                *ENTRY AT MTTRM
                *
02B2R C8FE      MTTRM   LHI     ISR,20(DCB)
      0014
02B6R 26E1              AIS     DCB,1            MAKE DCB ADDRESS ODD
02B8R 430E              B       16(DCB)
      0010
02BCR 30        GORD    DB      X'30'
02BDR 10        GOWRT   DB      X'10'
02BER 0300      STOP    DC      X'0300'          STOP COMMAND FOR SELCH
02C0R                   END
```

```
        KENNEDY 9-TRACK MAG TAPE DRIVER                          PAGE   9
   NO ERRORS
      AC1      000A
      AC2      000B
      CHK1     0110R
      CHK2     0128R
      CHK3     0142R
      CKSTAT   01E4R
      CMDGO    016ER
      COMAND   00F4R
      CONTIN   0240R
      CS1      01F8R
      DCB      000E
      DEV      000D
      EOFTRM   0210R
      EOMTRM   0226R
      ERRSAV   0238R
      GORD     028CR
      GOWRT    028DR
      ILFUNC   0034R
      INPUT    01A0R
   *  IOEXIT   028CR
   *  IOPTST   0030R
   *  IOTWAT   029CR
      ISR      000F
      KCMD     0004R
      KDATA    0000R
      KINT     0003R
      KMEM     0001R
      KSTAT    0002R
      KWORD    0005R
   **LIOTRM    0000
      MTC2     0140R
      MTC3     015AR
      MTCKDU   029ER
   *  MTDVR    0006R
   *  MTTRM    02B2R
      NOEOF    0218R
      OK       003CR
      OKAY     0220R
      ONLINE   0026R
      OUTPUT   01D0R
      R0       0000
      R1       0001
      R2       0002
      R3       0003
      R4       0004
      R5       0005
      R6       0006
      R7       0007
      R8       0008
      R9       0009
      RA       000A
      RB       000B
      RC       000C
      RD       000D
      RDCK     0194R
```

KENNEDY 9-TRACK MAG TAPE DRIVER   PAGE   10

```
RDINT    0184R
RDON     0264R
RE       000E
READ     0084R
READ1    00E2R
RETRY    022ER
RF       000F
SELCH    000C
STAT     0007
STOP     025ER
UNREC    0234R
WRCK     01C4R
WRITE    004AR
WRT      0274R
WRT1     005AR
WRT2     009CR
WRT3     00ACR
WRTINT   01B4R
WRTOK    0068R
WRTON    028ER
```

Appendix D. RTOS Kennedy 9-Track Magnetic Tape DCB Assembly Listings

```
      DCB 85--KENNEDY 8103 TAPE SYSTEM                        PAGE    1
                  * LAB = DCB85
                  * A. J. BAROODY
                  * JUNE 20,1974
                  *
                  * ALL DEVICE DEPENDANT COMMANDS ARE STORED IN THE DCB
                  * IN A TABLE LOCATED AT KMDTAB.
                  *
                  * EXTRN/ENTRY DECLARATIONS:
0000R                       EXTRN  SCBSY,MTTRM,MTDVR,IORSAV
0000R                       ENTRY  DCB85,KMDTAB
                  *
                  * REGISTER ALLOCATIONS:
                  *
0008              R8     EQU    8
0009              R9     EQU    9
000F              RF     EQU    15
0085              MT85   EQU    X'85'
00F0              SCF0   EQU    X'F0'          DEVICE NUMBER OF SELCH
0000R 0000F              DC     SCBSY          A(BSY FLAG)
0002R 0000               DC     0              RETURN TO IODONE IF 0
0004R 0000F              DC     MTTRM          A(DRIVER TERMINATION ROUTINE)
0006R 0000        TOC85  DC     0              TIME-OUT COUNT
0008R 0000        FLAG85 DC     0              FLAGS
000AR 0000F              DC     MTDVR          A(DRIVER ENTRY POINT)
000CR 0000        DCB85  DC     0,0            OLD PSW SAVE AREA
      0000
0010R 2000               DC     X'2000'        NEW PSW STAT(MACHINE MALFUNC. SET)
0012R D080               STM    R8,IORSAV      SAVE SYSTEM REGISTERS
      0000F
0016R D190               LM     R9,REG9        GET DRIVER REGISTERS
      0036R
001AR 030F               BR     RF             EXIT TO DRIVER
001CR 40F0               STH    RF,REG15       SAVE RF
      0042R
0020R D180        NOPISR LM     R8,IORSAV      RESTORE SYSTEM REGISTERS
      0014R
0024R C200               LPSW   DCB85          EXIT TO SYSTEM
      000CR
0028R 0000               DC     0              R2 = CALLER/IOW POINTERS
002AR 0000               DC     0              R2=A(PARAMETER BLOCK)
002CR 0000               DC     0              R4=FUNCTION CODE/LU
002ER 0000               DC     0              R5
0030R 0000               DC     0              R6=DEVICE NUMBER
0032R 0000               DC     0              R7=LOGICAL STATUS OF DEVICE
0034R 0000               DC     0              R8
0036R             REG9   EQU    *
0036R 0000               DC     0,0,0,0        R9,RA,RB,RC
      0000
```

```
        DCB 85--KENNEDY 8108 TAPE SYSTEM                        PAGE    2
           0000
           0000 ⌣
    003ER 0000              DC     0               RD=DEVICE NUMBER
    0040R 0000              DC     0               RE=A(DCB)
    0042R          REG15    EQU    *
    0042R 0020R             DC     NOPISR          RF=INTERRUPT SERVICE ROUTINE PTR.
    0044R 00F0              DC     SCF0            DEV NUM OF SELCH
    0046R 0000              DC     0               REREAD COUNT
    0048R          KMDTAB   EQU    *
    0048R 0978     KRWIND   DC     X'978'          REWIND
    004AR 0578     BSPREC   DC     X'578'          BACKSPACE A RECORD
    004CR 0478     FORREC   DC     X'478'          SPACE FORWARD A RECORD
    004ER 0778     WEOF     DC     X'778'          WRITE END OF FILE
    0050R 0278     FWDFIL   DC     X'278'          SPACE FORWARD FILE
    0052R 0378     BSPFIL   DC     X'378'          BACKSPACE A FILE
    0054R 0878     ERASE    DC     X'878'          ERASE 4" OF TAPE
    0056R 0078     NOOP     DC     X'078'          NO-OP
    0058R 0178     KREAD    DC     X'178'          READ A RECORD
    005AR 0678     KWRITE   DC     X'678'          WRITE A RECORD
    01DA                    ORG    X'D0'+MT85+MT85 ISPTAB ENTRY
    01DA 000CR             DC     DCB85
    01DC                    END
```

DC8 85--KENNEDY 8108 TAPE SYSTEM   PAGE   3

NO ERRORS
   BSPFIL   0052R
   BSPREC   004AR
* DCB35   000CR
   ERASE   0054R
   FLAG85   0008R
   FORREC   004CR
   FWDFIL   0050R
* IORSAV   0022R
* KMDTAB   0048R
   KREAD   0058R
   KRWIND   0048R
   KWRITE   005AR
   MT85   0085
* MTDVR   000AR
* MTTRM   0004R
   NOOP   0056R
   NOPISR   0020R
   R8   0008
   R9   0009
   REG15   0042R
   REG9   0036R
   RF   000F
* SCBSY   0000R
   SCF0   00F0
   TOC85   0006R
   WEOF   004ER

KENNEDY MAG TAPE GENERAL LOADER   3/28/74

```
REDEF    0008R
REF      0510R
RELP     033ER
RELPM    04C6R
RFIN     01F8R
RTN      0002
S1       03F8R
SCMD     0599R
SCST     0598R
SELADR   00F0
SEQNUM   0006
SERR     00F4R
SHOW     0370R
SHOW1    0384R
SLCH     000F
SPRV     059CR
SREG     058ER
START    0000R
TWO      0008
TWRT     0488R
UNAB     01B8R
UNRL     01C0R
UNRX     01C8R
WORD     03AAR
WORD1    03ACR
WREG     058FR
```

Appendix E.   BOSS Kennedy 9-Track Magnetic Tape Driver Assembly Listings

```
                    *
                    *
                    *
                    *clckclckclckclckclckclckclckclckclckclckclckclckclckck
                    *                                                    *
                    *                                                    *
                    *       MAGNETIC TAPE DRIVER                         *
                    *       KENNEDY 8108                                 *
                    *       JIM BAROODY -- 03/28/74                      *
                    *       SET-UP FOR 800 BPI, 9-TRACK                  *
                    *       AND ODD PARITY                               *
                    *                                                    *
                    *                                                    *
                    *clckclckclckclckclckclckclckclckclckclckclckclckck
                    *
                    *
103C  0000          DC    0
0000        SELCH   EQU   0
0000        WAIT    EQU   0
0001        RTN1    EQU   1
0002        STAT    EQU   2
0003        DVRTN   EQU   3
0004        DEV     EQU   4
0005        ABTRM   EQU   5
0006        CTRL    EQU   6
0007        AX2     EQU   7
0008        FCN     EQU   8
0009        CBA     EQU   9
000A        ONE     EQU   10
000B        FBA     EQU   11
000C        AC0     EQU   12
000D        AC1     EQU   13
            *     XEBEC CONTROLLER REGISTERS
103E  00    KDATA   DB    0           DATA TRANSFER
103F  01    KMEM    DB    1           MEMORY ADDRESS REG.
1040  03    KSTAT   DB    3           DEVICE STATUS
1041  04    KINT    DB    4           INTERRUPT CONTROL
1042  05    KCMD    DB    5           COMMAND REG.
1043  07    KWORD   DB    7           WORD COUNT
            *
1044  C800  MTDVR   LHI   SELCH,X'F0'
      00F0
1048  DE00          OC    SELCH,SLSTOP
      11B6
104C  9D02          SSR   SELCH,STAT
104E  2031          BTBS  8,1
1050  0888  REREAD  LHR   FCN,FCN     COMMAND?
1052  4210          BM    COMAND
```

```
         112A
1056     2465          LIS    CTRL,5          RETRIES = 5
1058     09AB          LHR    ONE,FBA
105A     0BA9          SHR    ONE,CBA
105C     26A2          AIS    ONE,2           BYTE COUNT
105E     90A1          SRLS   ONE,1           WORD COUNT
1060     4110          BAL    RTN1,MTCKDU     SELECT DEVICE
         119A
1064     0A58          AHR    FCN,FCN         TEST FOR READ
1066     4210          BM     MTR
         10B2
106A     C320   MTW    THI    STAT,X'0020'    TEST WRITE PROTECT
         0020
106E     4230          BNZ    UNRTRM
         07B8
1072     C320   TEST1  THI    STAT,X'0040'    TEST FOR EOT
         0040
1076     0235          BNZR   ABTRM
1078     C320          THI    STAT,X'0080'    TEST FOR BOT
         0080
107C     4330          BZ     WRITE
         108C
1080     DE40          OC     DEV,KCMD
         1042
1084     D840          WH     DEV,ERASE       ERASE FOUR INCHES OF TAPE
         11AC
1088     9D42   WAIT1  SSR    DEV,STAT
108A     2211          BFBS   1,1
108C     DE40   WRITE  OC     DEV,KWORD       SEND WORD COUNT
         1043
1090     984A          WHR    DEV,ONE
1092     980B          WHR    SELCH,CBA       SEND SELCH START ADDRESS
1094     980B          WHR    SELCH,FBA       AND ENDING ADDRESS
1096     DE40          OC     DEV,KCMD
         1042
109A     D840          WH     DEV,KWRITE      START KENNEDY
         11B2
109E     DE00          OC     SELCH,GOWRT     AND SELCH
         11B5
10A2     9D02          SSR    SELCH,STAT      WAIT FOR SELCH TERMINATION
10A4     2081          BTBS   8,1
10A6     DE00          OC     SELCH,SLSTOP
         11B6
10AA     C810          LHI    RTN1,WAIT1      SET UP RETURN
         1088
10AE     4300          B      CS
         10DE
10B2     C320   MTR    THI    STAT,X'0040'    TEST FOR EOT
```

```
        BOSS            MODULE 8* -- MAG TAPE DRIVER              PAGE  70
        0040
 10B6   0235            BNZR    ABTRM
 10B8   9D42    WAIT2   SSR     DEV.STAT
 10BA   2211            BFBS    1,1
 10BC   DE40    READ    OC      DEV.KWORD        OUTPUT WORD COUNT
        1043
 10C0   984A            WHR     DEV.ONE
 10C2   9809            WHR     SELCH.CBA        SEND SELCH STARTING
 10C4   980B            WHR     SELCH.FBA        AND ENDING ADDRESS
 10C6   DE40            OC      DEV.KCMD         START KENNEDY
        1042
 10CA   D840            WH      DEV.KREAD
        11B0
 10CE   DE00            OC      SELCH.GORD
        11B4
 10D2   9D02            SSR     SELCH.STAT       WAIT FOR SELCH TERMINATION
 10D4   2081            BTBS    8,1
 10D6   DE00            OC      SELCH.SLSTOP
        11B6
 10DA   C810            LHI     RTN1,WAIT2       SET UP RETURN
        10B8
 10DE   9D42    CS      SSR     DEV.STAT
 10E0   2211            BFBS    1,1
 10E2   DE40            OC      DEV.KSTAT
        1040
 10E6   9942            RHR     DEV.STAT
 10E8   C320            THI     STAT,X'E00'      TEST FOR PARITY ERROR
        0E00
 10EC   4330            BZ      CS1
        10F8
 10F0   C320            THI     STAT,X'100'      IF PARITY ERROR AND EOF IGNORE PARITY
        0100
 10F4   4330            BZ      RETRY            NO EOF, RETRY
        111A
 10F8   C320    CS1     THI     STAT,X'100'      TEST FOR EOF
        0100
 10FC   4330            BZ      NOEOF
        1110
 1100   C320            THI     STAT,X'40'       TEST FOR EOT
        0040
 1104   4330            BZ      EOFTRM           EOF ONLY, TERMINATE
        07B2
 1108   C820            LHI     STAT,X'9800'     EOF AND EOT
        9800
 110C   4300            B       ZZZZ
        07A0
 1110   C320    NOEOF   THI     STAT,X'40'       TEST FOR EOT
        0040
```

```
       DOSS          MODULE SW -- MAG TAPE DRIVER              PAGE 71
1114   0333          BZR    DVRTN            NORMAL EXIT IF NOT EOT EITHER
1116   4300          B      EOMTRM
       0796
111A   2761   RETRY  SIS    CTRL,1
111C   4210          BM     UNRTRM
       0789
1120   DE48          OC     DEV,KCMD
       1042
1124   D848          LH     DEV,BSPREC
       11A2
1128   0301          BR     RTN1
112A   4110   COMAND BAL    RTN1,MTCKDU      CHECK FOR DEVICE AVAILABLE
       118A
112E   C430          NHI    FCN,X'7F00'      LEAVE ONLY FUNCTION CODE
       7F00
1132   C330          THI    FCN,X'0800'      TEST FOR WRITE EOF
       0800
1136   4330          BZ     CHK1
       1145
113A   C320          THI    STAT,X'0020'     TEST FOR WRITE PROTECT
       0020
113E   4230          BNZ    UNRTRM
       0769
1142   4320          B      MTC2
       115A
1145   C330   CHK1   THI    FCN,X'2200'      TEST FOR BACKSPACE
       2200
1149   4330          BZ     CHK2
       115A
114E   C320          THI    STAT,X'0080'     TEST FOR BOT
       0080
1152   4230          BNZ    EOMTRM
       0796
1156   4300          B      MTC2
       115A
115A   C330   CHK2   THI    FCN,X'1400'      TEST FOR SPACE FORWARD
       1400
115E   4330          BZ     MTC2
       116A
1162   C320          THI    STAT,X'0040'     TEST FOR EOT
       0040
1166   4230          BNZ    EOMTRM
       0796
116A   2400   MTC2   LIS    AC0,0
116C   9151   CHK3   SLLS   FCN,1
116E   4210          BM     MTC3
       117E
1172   2602          AIS    AC0,2
```

```
     BOSS                MODULE 8* -- MAG TAPE DRIVER              PAGE  72
1174  C9C0              CHI    AC0,12          TEST FOR NO COMMAND
      000C
1178  0335              BER    ABTRM
117A  4300              B      CHK3
      116C
117E  DE40     MTC3     OC     DEV,KCMD
      1042
1182  D84C              WH     DEV,KMDTAB(AC8)
      11A8
1186  4300              B      CS
      10DE
           *MTCKDU - CHECK FOR DEVICE AVAILABLE
           *
           *CALL SEQUENCE
           *
           *     BAL RTN1,MTCKDU
           *
           *     DEVICE STATUS RETURNED IN STAT
           *
118A  DE40     MTCKDU   OC     DEV,KCMD        SEND NO-OP COMMAND
      1042
118E  D840              WH     DEV,NOOP
      11AE
1192  DE40              OC     DEV,KSTAT
      1040
1196  9942              RHR    DEV,STAT
1198  C320              THI    STAT,X'000F'    TEST FOR UNAVAILABLE
      000F
119C  0331              BZR    RTN1
119E  0305              BR     ABTRM
11A0           KMDTAB   EQU    *
11A0  0978     KRWIND   DC     X'978'
11A2  0578     BSPREC   DC     X'578'
11A4  0478     FORREC   DC     X'478'
11A6  0778     WEOF     DC     X'778'
11A8  0278     KFWDFL   DC     X'278'
11AA  0378     BSPFIL   DC     X'378'
11AC  0878     ERASE    DC     X'878'
11AE  0078     NOOP     DC     X'078'
11B0  2178     KREAD    DC     X'178'
11B2  0678     KWRITE   DC     X'678'
11B8  38       GORD     DB     X'38'
11B5  10       GOWRT    DB     X'18'
11B6  08       SLSTOP   DB     X'08'
11B7  00                DB     0
11B8           SUPTOP   END    SYSGO
```

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15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

   This report is a systems programmer reference manual for magnetic tape operations on the Sound Laboratory Data Acquisition system. The hardware features of the system are summarized, followed by a brief discussion of programming techniques. Magnetic tape operations are discussed in three distinct environments as follows: a stand-alone loader, a driver compatible with the Interdata Basic Operating System, and a driver compatible with the Interdata Real Time Operating System.

17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)

Magnetic Tape; driver; Interdata Basic Operating System; Interdata Real Time Operating System; stand-alone loader

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