SPERRY UNIVAC

MAINTAIN III
Peripheral Equipment Test Programs
User Guide

Mini-Computer Operations

2722 Michelson Drive
P.O. Box C-19504
Irvine, California 92713

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MAINTAIN III
PERIPHERAL EQUIPMENT TEST PROGRAMS
User Guide

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All the technical changes are denoted by an arrow (→) in the margin. A downward pointing arrow (↓) next to a line indicates that technical changes begin at this line and continue until an upward pointing arrow (↑) is found. A horizontal arrow (→) pointing to a line indicates a technical change in only that line. A horizontal arrow located between two consecutive lines indicates technical changes in both lines or deletions.

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Change Designation	Issue Date	Change Description
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Update A	10-80	Added SU39 Channel Interface Test (used in 0777 Printer Systems).
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When changes are made to this manual, updated pages are issued. These updated pages **are either added to this manual** or used to replace obsolete pages. The specific **pages affected by each change** are identified on the PAGE STATUS SUMMARY page.

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Section 1
INTRODUCTION

1.1 GENERAL

This manual describes the MAINTAIN III Test Program System for verifying the correct operation and the detection and isolation of malfunctions in SPERRY UNIVAC peripheral equipment and controllers.

The user should be familiar with the instruction set of the equipment on which these programs are used and should also have some knowledge of assembly-language programming. The user who executes these tests should also know the operating procedures for the computer control panel and the peripheral devices on the system under test.

1.2 SCOPE

The organization of this manual is based on the organization of the MAINTAIN III Test Program System. The first section presents an overview of the test system. The following sections present the components (tests) of the system. For a specific component in any given section, the user finds an overview in more detail and a description of the minimum hardware necessary for using the component. The user also finds a description of the test design and its structure, followed by the information needed to use the test in the order needed: first the preliminary procedures such as loading the media and setting sense switches, then the execution procedures, followed by an explanation of any error indication that may occur during execution or cause termination, and finally examples of the program input and output.

As new systems are developed, the existing test system is expanded to include the new systems. In those cases where tests are applicable to more than one system, reference is made to those systems.

1.3 DESCRIPTION OF MAINTAIN III

MAINTAIN III Test Programs system is a systematic approach to testing and maintaining Sperry Univac V70-series computers, communication equipment, and controllers. MAINTAIN III tests provide an interface between the equipment under test, the computer, and the user.

Test programs in this manual cover only the peripheral equipment and controllers. The programs are to be used in conjunction with appropriate servicing manuals which include theory of operation, installation, and maintenance information.

MAINTAIN III test programs are designed to verify correct system operation. Malfunctions can be isolated to a specific area of the system and corrected.

The MAINTAIN III test programs object file directory is contained in the current edition of the Usage Description bulletin 92W0106-013.

1.3.1 STRUCTURE

The MAINTAIN III system consists of the components illustrated in Figure 1-1.

The test executive program, which includes the preliminary instruction test, preliminary memory test, binary loader, and test executive, has the following capabilities:

- Loads test programs.
- Accepts control directives and parameters from the user.
- Executes test programs.
- Contains a utility package comprising aids for debugging, for program maintenance, and for hardware troubleshooting.
- Includes standard test program subroutines, i.e., Teletypewriter (TTY) input/output (I/O), time delay, memory size determination, SENSE switch option, etc.

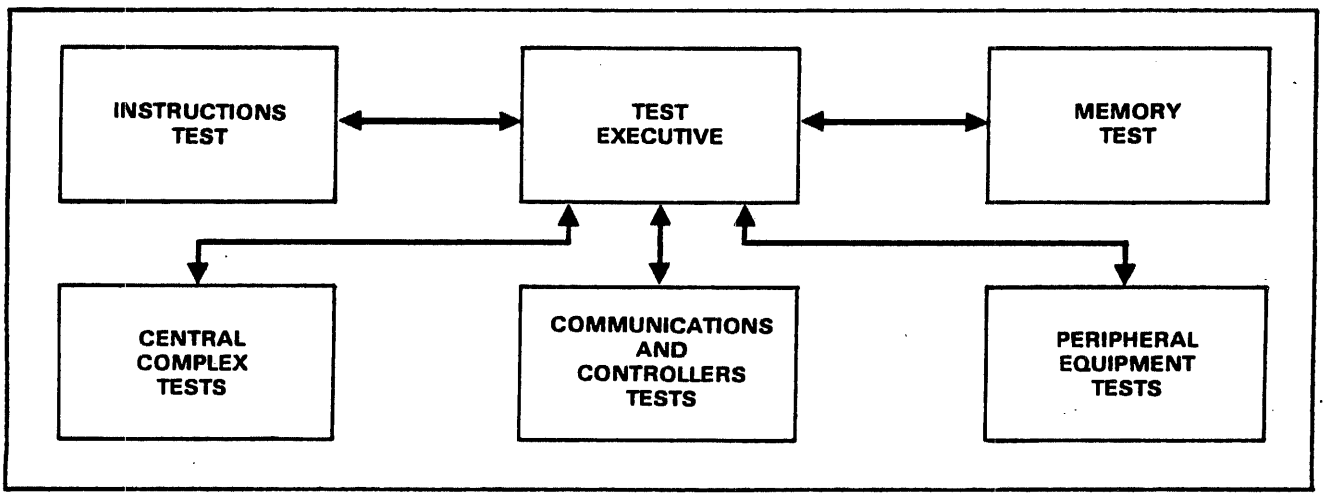

Figure 1-1. MAINTAIN III System Block Diagram

The preliminary instructions test portion of the executive test program validates basic CPU operation. The preliminary memory test checks basic functions of the first 8K memory module. The binary loader reads binary data and stores it in memory.

Test programs are available for the V77 central complex, communications equipment and controllers, and peripheral equipment (refer to Section 1.6 for related documentation).

The central complex test programs test the central processor (instruction test), main memory, and computer options.

The communications and controllers test programs verify correct operation of communications devices (such as terminals, DCM, and line adapters) and controllers that are not associated with specific peripheral equipment.

The peripheral equipment test programs verify correct operation of system peripherals, i.e., line printer, disk, paper tape system, etc. Associated controllers are tested along with the peripherals.

1.3.2 MAINTENANCE CONCEPTS

MAINTAIN III minimizes system maintenance time for the V70-series computers. Test programs are executed when the computer is offline and not transferring data or performing control functions.

Test programs are normally on punched paper tape; other media, such as object card decks, magnetic tape, or disk are also available.

The programs exercise the central complex, communications equipment, peripheral equipment, and associated controllers with sequences of instructions. If an instruction is improperly executed, the sequence is halted and an error message is output to indicate the failing instruction or operation. The user can then repeat, continue, or halt the program until the fault is isolated and corrected.

The recommended procedure for correcting hardware malfunctions is:

1. Isolate the fault to a functional area, such as memory, control, arithmetic/logic, operations register, I/O, communications device or peripheral equipment.

2. Execute, repeat, or modify the applicable test program for the area of the suspected fault.

3. Correct the fault by replacing the faulty component or printed circuit board and restore the system to normal operation.

4. Verify system operation by rerunning the test program.

Servicing manuals appropriate to the user's system contain a description of the major components of the computer's central complex, communications devices, and peripheral equipment.

Specific operating procedures for MAINTAIN III test programs are given in the following sections, which also include descriptions of error conditions and error messages.

1.4 CONVENTIONS USED

In the following procedures, responses to be initiated by the operator are designated by an underscored R (R). The R indicates that a response is to be made before the program continues. Responses generated by the computer program are not underscored.

Unless a specific computer model is called out, the term V70 refers to V72, V73, V75, V76, and V77 series. The term V77 refers to all V77 series computers such as V77-200, V77-400, V77-600, and V77-800.

1.5 TEST PROGRAM LOADING

For paper tape systems, the procedure for loading the test program is as follows:

1. Place the test program tape in the paper tape reader.

2. Position the tape within the leader area between the test part number and the start of the program.

3. Enter an L. on the virtual console.

Magnetic tape systems require the use of file numbers. The procedure for loading the test program is as follows:

1. Consult the MAINTAIN III Usage Description Bulletin for the file number of the test program to be used.

2. Position tape reel on transport.

3. Position tape to test program file number by using MAINTAIN III tape commands (subsection 2.2.2.1).

4. Load the test program by using magnetic tape commands.

1.6 RELATED DOCUMENTATION

Documentation containing information associated with the operation of MAINTAIN III tests are listed in Table 1-1.

Table 1-1. Reference Documents

Document and Part Number	Document Title	Use
UP-8672 98A 9952 07x	MAINTAIN III Test Programs User Manual	Contains procedures for use of V77 central complex test programs.
UP-8876 98A 9952 940	MAINTAIN III Communications Equipment and Controllers Test Programs User Guide	Contains procedures for use of test programs for V77 communications equipment and controllers.
UP-8634 98A 9906 00x	V70 Series Architecture Reference Manual	Contains description of of the V70 series instruction set, data and instruction formats, and addressing modes.
UP-9028 98A 9906 70x	V77-800 Operations Manual	Contains program loading procedures as well as operating procedures for the computer control panel and virtual console.

Section 2
TEST EXECUTIVE PROGRAM

2.1 GENERAL

The test executive program is the program that controls the execution of other programs in the MAINTAIN III test program system. In addition to loading, executing, and monitoring the other MAINTAIN III test programs, the test executive program:

- Provides utility aids for debugging, program maintenance, and hardware troubleshooting.
- Includes standard subroutines for use by associated test programs, i.e., teletypewriter (TTY), input/output (I/O), time-delay/time-out, memory size determination, power-failure/restart protection, SENSE switch options, etc.

2.2 HARDWARE REQUIREMENTS

The test executive program minimum hardware configuration is as follows:

- V70-series computer with 8K of memory (maximum of 32K)
- Teletypewriter or keyboard-display terminal
- A program loading device for the object test media.

2.3 DESCRIPTION OF TEST COMPONENTS

The test executive program comprises:

- Preliminary instructions test
- Preliminary memory test
- Binary loader
- Test executive

Figure 2-1 illustrates the operation of the test executive.

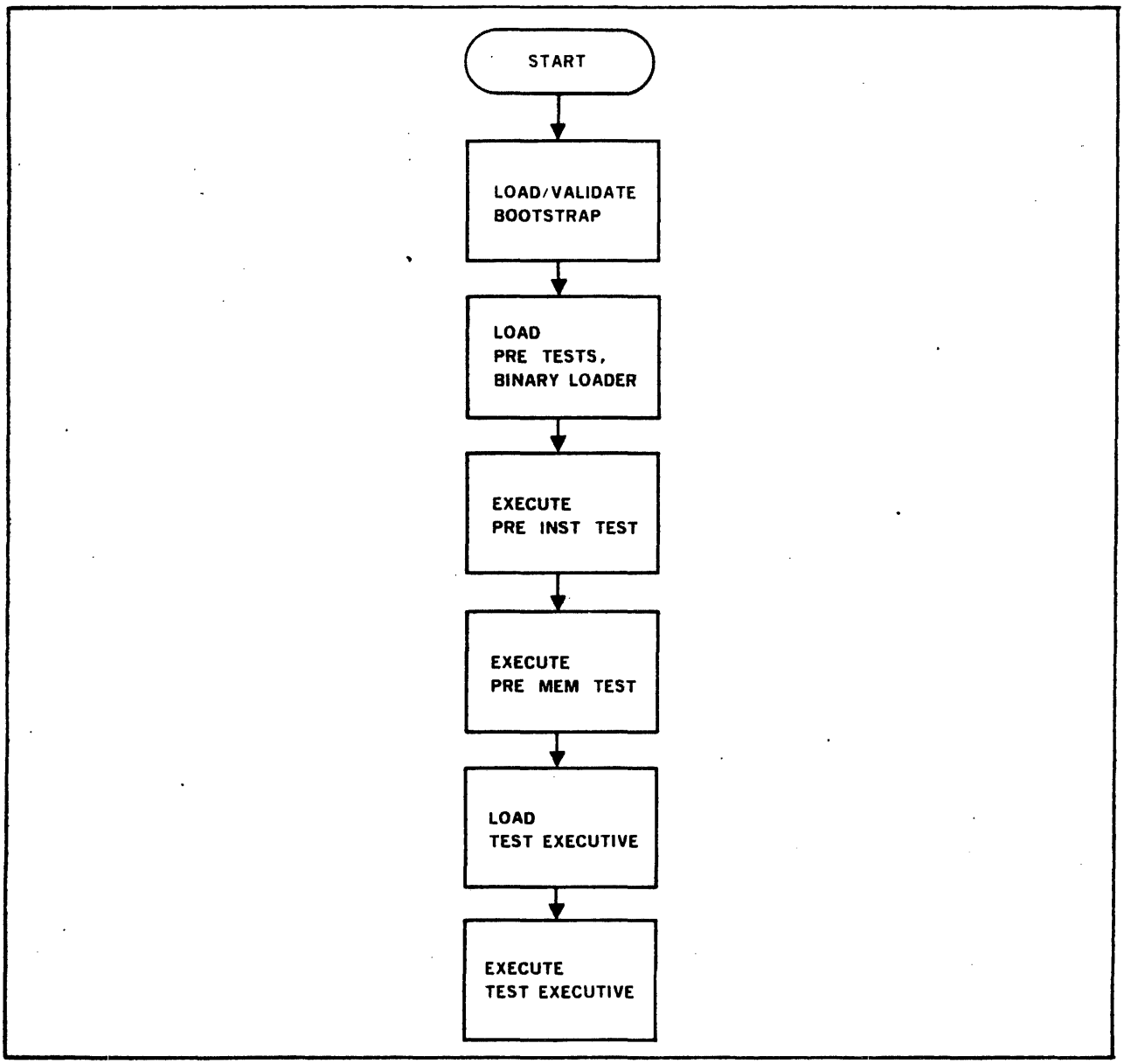

Figure 2-1. Test Executive Block Diagram

2.3.1 BINARY LOADER

The binary loader loads formatted object data into computer memory, computes the checksum, and transfers program control as directed.

2.3.2 PRELIMINARY INSTRUCTIONS TEST

The preliminary instructions test validates central processing unit (CPU) operation by testing the machine instructions listed in Table 2-1. Successful execution of this test indicates that MAINTAIN III test programs can be loaded correctly if loading procedures are followed.

Table 2-1. Preliminary Instructions Test Summary

Mnemonic	Description
ADD	Add memory to A register
ADDI	Add immediate
ANAI	AND immediate
DAR	Decrement A register
DBR	Decrement B register
DECR 02	Set B register to -1
DXR	Decrement X register
ERA	Exclusive-OR memory and A register
ERAI	Exclusive-OR immediate
IAR	Increment A register
IBR	Increment B register
INCR 03	Set A and B reigsters to +1
IXR	Increment X register
JAN	Jump if A register negative
JAP	Jump if A register positive
JAZ	Jump if A register zero
JBZ	Jump if B register zero
JIF 011	Jump if A register - 0 and OVFL is set
JMP	Jump (unconditional)
JMPM	Jump and mark (unconditional)
JMP*	Jump indirect
JOF	Jump if overflow indicator set
JXZ	Jump if X register zero
LDA	Load A register
LDAI	Load A register immediate
LDB	Load B register
LDBI	Load B register immediate
LDX	Load X register
LDXI	Load X register immediate
LLRL	Load logical rotation left
LLSR	Load logical rotation right
LRLA	Logical rotation left A register
LSRA	Logical shift right A register
MERG 032	Transfer ORed A and B registers to B register
NOP	No operation
ORAI	Inclusive-OR immediate
ROF	Reset overflow indicator
STA	Store A register
STAI	Store A register immediate
STB	Store B register
STX	Store X register
SUB	Subtract memory from A register
TBA	Transfer B register to A register

Table 2-1. Preliminary Instructions Test Summary (Continued)

Mnemonic	Description
TBX	Transfer B register to X register
TXA	Transfer X register to A register
TZA	Transfer zero to A register
TZB	Transfer zero to B register
TZX	Transfer zero to X register
XAZ	Execute if A register zero
XBZ	Execute if B register zero
XIF 022	Execute if B register = 0 and A register = $\geq$0

2.3.3 PRELIMINARY MEMORY TEST

The preliminary memory test verifies correct operation of the first 8K of memory. Memory addresses 000044 thru 017777 are tested in two passes. The first pass checks each address with a pattern of 052525; the second pass, 0125252. The original contents of memory are saved and restored by the program.

2.3.4 TEST EXECUTIVE

The test executive is integral to the MAINTAIN III test program system. In addition to providing test control and user interface, it contains standard subroutines commonly required by the associated test programs, i.e., TTY, I/O routines, SENSE switch routines, etc.

The test executive program utility package comprises aids for debugging, program maintenance, and hardware troubleshooting. The capabilities are:

- CPU registers and memory can be displayed or altered.
- The user can specify memory data pattern searches.
- Areas of memory can be set to specified data patterns.
- Object code can be punched or written.
- During execution, test programs can be trapped.

Utility routines are summarized in Table 2-2; standard executive data items in Table 2-3; and standard I/O routines in Table 2-4. Refer to the listing supplied with the program for the entry addresses of the entry addresses of these routines.

Table 2-2. Test Executive Utility Routines

Mnemonic	Description
EARG	Print/change the contents of the pseudo-A register
EBPN	Punch a tape on the TTY (binary)
EBRG	Print/change the contents of the pseudo-B register
ECNG	Print/change the contents of memory
EDUM	Dump (print) the contents of memory on the Teletype printer
EGOT	Transfer to the specified address
EPUN	Punch a tape on the TTY (object)
ESRC	Search memory
ETRP	Trap to the specified address
EXRG	Print/change the contents of the pseudo-X register
INIT	Initialize memory

Table 2-3. Standard Executive Data Items

Mnemonic	Description
$CON	Control panel/TTY mode flag
$DCT	Digit counter for I/O routine INPG
$FLG	Loop on error flag
$LWE	Lowest address used by test executive
$MEM	Highest available memory address
MSG3	Memory size message
$TTY	TTY device address

Table 2-4. Test Executive Standard I/O Routines

Mnemonic	Description
ESZC	Determine memory size
INPA	Input one character
INPB	Input and print one character
INPC	Input one edited character
INPD	Input one alphabetic character
INPE	Input two alphabetic characters
INPF	Input terminating control character
INPG	Input octal number

Table 2-4. Test Executive Standard I/O Routines (Continued)

Mnemonic	Description
INPH	SENSE TTY buffer ready
INPI	Initialize TTY (clear input buffer)
OUTA	Output one character
OUTB	Output two characters
OUTC	Output carriage return and line feed
OUTD	Output message
OUTE	Output octal word
OUTF	Output octal address
OUTG	Output typing error message
OUTH	Output control character
SSWT	Standard SENSE switch routine
TDLY	Time delay
TOUT	Time out

2.4 OPERATING PROCEDURES

A variety of program loading devices are available for use with Sperry Univac computers. When using the following general procedures, the operator must determine what equipment is in use and then follow the detailed procedures described in the appropriate manual.

2.4.1 PRELIMINARY PROCEDURES

After bringing up computer system power:

1. Enter step mode.

2. Reset SENSE switches 1, 2, and 3.

3. Initialize the computer control circuits by activating RESET. If using a virtual console, enter an A to reset the system.

4. Load the object program. Use the applicable following procedure.

   If using the high-speed paper tape (HSPT) reader, set the LOAD/RUN switch to LOAD. Position the tape in the reader with the first nonblank binary frame at the read station. Set the LOAD/RUN switch to RUN.

When using the high-speed paper tape reader-punch, open the cover of the read head and insert tape. Position the tape in the reader with the first nonblank binary frame at the read station. Close the cover of the read head.

NOTE

The Sperry Univac part number is punched in the leader portion of the object tape, e.g., 92U0106-013x in the test executive tape, where x indicates the revision level. Position tape in the reader past this area.

If the computer is equipped with TTY or HSPT automatic bootstrap loader (ABL), initiate RESET. Place the computer in run mode and press BOOT.

To use a card reader, place the test executive object card deck in the card reader hopper. Place the card reader in the ready status and refer to step 5.

If using magnetic tape, place the MAINTAIN III test object tape on the appropriate tape drive unit at proper density. Then:

a. Manually load the magnetic tape bootstrap routine listed in Table 2-5 or 2-6. Refer to the appropriate equipment operations manual for loading procedures.

b. Place the MAINTAIN III magnetic tape in the tape unit and position the tape to the load point.

c. Enter 000 212 into the P register, 07000 into the X register (register R2 on the virtual console), and zero in the A and B registers (R0 and R1 on the virtual console).

d. Set STEP/RUN to RUN on control panel or press key R on the virtual console to enter the test executive into memory.

If the TTY is used, initialize the TTY by setting control to LOCAL (off-line). Type CONTROL D, T, and Q. Return control to LINE (on-line). Position test program tape in the reader with the first nonblank binary frame at the reading station. Set the reader control switch to STOP.

5. If a magnetic tape unit is not used, enter the test executive program into memory by using one of the following procedures.

   To enter the program via the computer control panel, momentarily place the load switch to the LOAD position. The high-speed tape reader (reader-punch) is selected when the load switch is activated.

   If the virtual console is used:

   a. Select the desired program loader routine from the following listing. Reference tables are listed in the event that the routine must be loaded manually.

Program Loader Routine	Loader Code	Reference Table
Teletypewriter paper tape reader	000000	2-7
High-speed paper tape reader	000001	2-8
F3094-0x/F3096-0x disk memory	000002	2-9, 2-10
2842-0x and 2826-0x disk memory	000003	

   b. Enter the program loader code into register R0 by pressing key 0 on the virtual console and typing the desired code. Press key 0 again to verify the contents of register R0.

   c. Press key B on the virtual console to load the program loader and object program. When the tape stops, press R on the virtual console or set STEP/RUN switch to RUN on the control console.

When using a card reader, the program loader routine must be manually loaded. Use the listing in Table 2-11 and the procedures outlined for the magnetic tape unit.

If the TTY is used, set the reader control switch to START/RUN.

After the preliminary tests and binary loader are read into memory, the bootstrap routine jumps to address 007000. The paper-tape reader is turned off, and the preliminary instructions test is automatically executed, starting at address 007002.

Table 2-5. Magnetic Tape Bootstrap Routine

Address	Instructions Code		Symbolic Coding		
		1 *	MAGNETIC TAPE BOOTSTRAP		
		2 *			
*	0000ZZ	3 MT	SET	ZZ	
*	00000Y	4 TU	SET	Y	
000200		5	ORG	0200	
*000200	1012ZZ	6 MTS	SEN	0200+MT,07002	SENSE IF DONE
000201	007002				
*000202	1011ZZ	7	SEN	0100+MT,MTST	SENSE IF DATA IN
000203	000206				
000204	001000	8	JMP	MTS	SENSE DATA IN
000205	000200				
*000206	1025ZZ	9 MTST	CIA	MT	GET WORD
000207	055000	10	STA	0,1	STORE WORD
000210	001000	11	JMP	MTSA	
000211	000214				
		12 *			
		13 *	START HERE WITH X=07000		
		14 *			
*000212	104YZZ	15 ENTR	EXC2	(TU*64)+MT	SELECT UNIT
000213	1000ZZ	16	EXC	MT	READ ONE RECORD BINARY
000214	005144	17 MTSA	IXR		STEP INDEX
000215	001000	18	JMP	MTS	LOOP
000216	000200				

* -where:

Y

Is drive number 1, 2, 3 or 4.

Z

Is device address (normally 010).

Table 2-6. Magnetic Tape Bootstrap Routine (F3093-0x, F3062-00, 0870-99, and 0870-35 Tape Units)

Address	Instructions Code		Symbolic Coding		
000200	1031WW	BOOT	OAR	BIC	SET INITIAL ADDRESS
000201	005301		DECR	1	A=0177777 FOR LAST ADDRESS
000202	1031XX		OAR	BIC+1	SET FINAL ADDRESS
000203	1000WW		EXC	BIC	ACTIVATE BIC
000204	1000ZZ		EXC	MT	READ ONE RECORD FROM MAG TAPE
000205	1012ZZ	WAIT	SEN	0200+MT,07002	TO START IF MAG TAPE READY
000206	007002				
000207	005000		NDP		
000210	001000		JMP	WAIT	LOOP UNTIL READY
000211	000205				
		*			
		*		START AT 0212	
		*		WITH X=07000	
000212	1000XX	START	EXC	BIC+1	INITIALIZE BIC
000213	104YZZ		EXC2	(TU*0100)+MT	SELECT MAG TAPE UNIT
000214	005141		INCR	041	SET A+07001 (START ADDRESS)
000215	001000		JMP	BOOT	START BIC
000216	000200				

where:

WW
Is even BIC device address.

XX
Is odd BIC device address.

Y
Is drive number 1, 2, 3, or 4.

ZZ
Is MT device address.

Table 2-7. Teletype Paper-Tape Bootstrap Routine

Address	Instruction Code		Symbolic Coding		
		1 *	TELETYPE PAPER TAPE BOOTSTRAP		
		2 *			
*	0000ZZ	3 TY	SET	ZZ	
000200		4	ORG	0200	
*000200	1026ZZ	5 READ	CIB	TY	8 BITS TO B
000201	004011	6	ASLB	9	SAVE LS6
000202	004041	7	LRLB	1	
000203	004446	8	LLRL	6	MERGE INTO A
000204	001020	9	JBZ	SEL	MORE IF B ZERO
000205	000214				
000206	055000	10	STA	0,1	
000207	001010	11	JAZ	07000	EXIT IF ZERO
000210	007000				
000211	005144	12	IXR		STEP INDEX
		13 *			
		14 *	START HERE WITH X=07000		
		15 *			
000212	005101	16 ENTR	INCR	1	SET A BIT 0
*000213	1026ZZ	17 SEL	CIB	TY	CLEAR TTY BUFFER
*000214	1012ZZ	18	SEN	0200+TY,READ	SENSE READ READY
000215	000200				
000216	001000	19	JMP	*-2	LOOP
000217	000214				

* -where:

Z

Is device address (normally 01).

Table 2-8. High-Speed Paper-Tape Bootstrap Routine

Address	Instruction Code		Symbolic Coding			
		1	*	HIGH-SPEED PAPER TAPE BOOTSTRAP		
		2	*			
*	0000ZZ	3	PT	SET	ZZ	
000200		4		ORG	0200	
*000200	1026ZZ	5	READ	CIB	PT	8 BITS TO B
000201	004011	6		ASLB	9	SAVE LS6
000202	004041	7		LRLB	1	
000203	004446	8		LLRL	6	MERGE INTO A
000204	001020	9		JBZ	SEL	MORE IF ZERO
000205	000214					
000206	055000	10		STA	0,1	STORE WORD
000207	001010	11		JAZ	07000	EXIT IF ZERO
000210	007000					
000211	005144	12		IXR		STEP INDEX
		13	*			
		14	*	START HERE WITH X=07000		
		15	*			
000212	005101	16	ENTR	INCR	1	SET A BIT 0
*000213	1005ZZ	17	SEL	EXC	0500+PT	READ A FRAME
*000214	1015ZZ	18		SEN	0500+PT,READ	SENSE READ READY
000215	000200					
000216	001000	19		JMP	*-2	LOOP
000217	000214					

* - where:

Z

Is device address (normally 037).

Table 2-9. Disk Bootstrap Routine (F3094-0x and F3096-0x RMD)

Address	Instructions Code		Symbolic Coding			
001130	1004ZZ	START	EXC	0400+DISK		INITIALIZE DISK
001131	011167		LDA	DBUNT		POSITION TO CYLINDER
001132	1002ZZ		EXC	0200+DISK		
001133	1031ZZ		OAR	DISK		
001134	101XZZ	SLP	SEN	(UNIT*01000)+DISK		GO SEEK COMPLETE?
001135	001140					
001136	001000		JMP	SLP		NO, LOOP
001137	001134					
001140	1025ZZ	GO	CIA	DISK		CHECK STATUS
001141	151166		ANA	DBSTS		
001142	001010		JAZ	GOOD		I.O ERROR
001143	001145					
001144	000000		HLT			
001145	011167	GOOD	LDA	DBUNT		POSITION TO SECTOR
001146	1003ZZ		EXC	0300+DISK		
001147	1031ZZ		OAR	DISK		
001150	1000WW		EXC	BIC+1		INITIALIZE BIC
001151	011170		LDA	DBSRT		SET START
001152	1031VV		OAR	BIC		
001153	011171		LDA	DBEND		SET END
001154	1031WW		OAR	BIC+1		
001155	1000VV		EXC	BIC		ACTIVATE BIC
001156	1000ZZ		EXC	DISK		READ FROM DISK
001157	1014ZZ	BLP	SEN	0400+DISK,BLP		BUSY?
001160	001157					
001161	1025ZZ		CIA	DISK		CHECK STATUS
001162	151166		ANA	DBSTS		
001163	001010		JAZ	0600		START PROGRAM
001164	000600					
001165	000000		MLT			
001166	005760	DBSTS	DATA	05760		STATUS BITS
001167	0Y0000	DBUN	DATA	(UNIT*020000)		
001170	000000	DBSRT	DATA	0		START LOAD
001171	001130	DBEND	DATA	01130		END LOAD

where:

W
: Is even BIC device address.

WW
: Is odd BIC device address.

X
: Is unit number 0, 1, 2, or 3.

Y
: Is unit number times 2.

ZZ
: Is disk device address.

Table 2-10. Disk Bootstrap Routine (70-7606, F3094-0x, F3310-xx, and F3096-0x RMD's)

Address	Instructions Code		Symbolic Coding		
001130	1004ZZ	START	EXC	0400+DISC	INITIALIZE DISK
001131	011167		LDA	DBUNT	POSITION TO CYLINDER
001132	1031ZZ		OAR	DISK	
001133	1002ZZ		EXC	0200+DISK	
001134	101XZZ	SLP	SEN	((UNIT/2)*100)+DISK,	GO SEEK COMPLETE?
001135	001140				
001136	001000		JMP	SLP	NO, LOOP
001137	001134				
001140	1025ZZ	GO	CIA	DISK	CHECK STATUS
001141	151166		ANA	DBSTS	
001142	001010		JAZ	GOOD	NO ERROR
001143	001145				
001144	000000		HLT		
001145	011167	GOOD	LDA	DBUNT	POSITION TO SECTOR
001146	1031ZZ		OAR	DISK	
001147	1003ZZ		EXC	0300+DISK	
001150	1000WW	EXC	BIC+1	INITIALIZE BIC	
001151	011170		LDA	DBSRT	SET START
001152	1031VV		OAR	BIC	
001153	011171		LDA	DBEND	SET END
001154	1031WW		OAR	BIC+1	
001155	1000VV		EXC	BIC	ACTIVATE BIC
001156	1000ZZ		EXC	DISK	READ FROM DISK
001157	1014ZZ	BLP	SEN	0400+DISK,BLP	BUSY?
001160	001157				
001161	1025ZZ		CIA	DISK	CHECK STATUS
001162	151166		ANA	DBSTS	
001163	001010		JAZ	0600	START PROGRAM
001164	000600				
001165	000000		HLT		
001166	173760	DBSTS	DATA	0173760	STATUS BITS
001167	0Y0000	DBUNT	DATA	UNIT*020000	SETUP WORD
001170	000000	DBSRT	DATA	0	START LOAD
001171	001130	DBEND	DATA	01130	END LOAD

where:

W

Is even BIC device address.

WW

Is odd BIC device address.

X

Is integer of Unit/2.

Y

Is unit number times 2.

ZZ

Is disk device number.

Table 2-11. Card Bootstrap Routine

Address	Instruction Code		Symbolic Coding			
		1	*	CARD	BOOTSTRAP	
		2	*		ZZ	
*	0000ZZ	3	CR	SET		
000200		4		ORG	0200	
*000200	1025ZZ	5	BOOR	CIA	CR	INPUT ODD COLUMN
000201	004250	6		LRLA	8	MOVE TO HIGH ORDER
*000202	1011ZZ	7		SEN	0100+CR,BOOS	SENSE CHARACTER READY
000203	000221					
000204	001000	8		JMP	*-2	LOOP
000205	000202					
000206	001010	9	BOOT	JAZ	07000	END OF PRELIM
000207	007000					
000210	001000	10		JMP	ENTR	
000211	000212					
		11	*			
		12	*		START HERE WITH X=07000	
		13	*			
*000212	1002ZZ	14	ENTR	EXC	0200+CR	READ A CARD
*000213	1011ZZ	15	BOOU	SEN	0100+CR,BOOR	SENSE CHARACTER READY
000214	000200					
*000215	1016ZZ	16		SEN	0600+CR,BOOT	SENSE END OF CARD
000216	000206					
000217	001000	17		JMP	*-4	LOOP
000220	000213					
*000221	1021ZZ	18	BOOS	INA	CR	MERGE EVEN COLUMN INTO A
000222	055000	19		STA	0,1	STORE WORD
000223	005144	20		IXR		STEP INDEX
000224	001000	21		JMP	BOOU	MORE ON CARD
000225	000213					

where:

* = Z

Is device address (normally 030).

Following successful execution of the instructions test, the program automatically executes the preliminary memory test. The program then jumps to the binary loader, which loads the test executive. Setting SENSE switch 3 during their execution causes the program to loop on the combined preliminary instructions and memory tests.

Preliminary test error conditions are described in subsection 2.5.

2.4.2 OPERATING THE TEST EXECUTIVE

This program can be executed using the systems teletypewriter.

For TTY operation when the test executive program is loaded and halts with 000000 in the instruction register, press START or RUN to begin execution. This procedure assumes that the TTY device address is 01; if it is not, load the device address in the A register and press START or RUN.

To start the test executive program manually:

1. Clear the instruction register to zero.
2. Load 014000 in the P register.
3. Press RESET, and, in run mode, press START or RUN.
4. Load the desired device address (if the TTY device address is other than 01) in the A register, and press START or RUN.

The program begins execution with the output of the message:

```
THIS IS THE V70/620 TEST EXECUTIVE
MEMORY SIZE IS nK
```

For a V75/V77 system the message is:

```
THIS IS THE V75 TEST EXECUTIVE
MEMORY SIZE IS nK
```

where:

n
: Indicates memory size (for example, 8, 12, or multiples of 4).

This message is for information only and requires no operator action. At this time, cache memory (if included in the system) is disabled.

The test executive program then waits for a control statement input (Table 2-12).

The test executive can be restarted at any time by initializing the computer and entering RUN from location 0 or by pressing the console interrupt (INT) switch.

Table 2-12. Test Executive Utility Routine Commands

Control Command	Description
A	Print/change the contents of the pseudo-A register.*
B	Print/Change the contents of the pseudo-B register.*
Cx.	Print/change the contents of memory address x.
Dx.	Dump (list) memory on the TTY printer beginning at memory address x.
Gx.	Load the contents of the pseudo-registers into the respective A, B, and X registers, and transfer to memory address x.
Ix,y,z.	Initialize memory addresses x through y with the value of z.
L.	Load a test program (object) and transfer control to the loaded program.
Px,y,z.	Generate in object format on associated peripherals. x is the address of the first word; y is the address of the last word; and z is the execution address. For noncontiguous areas of memory, set z at minus one except for the final area to be copied.
Rn	Print/change the contents of the pseudo-n register* (n is any number 0 through 7).
Sx,y,z,m.	Search memory addresses x through y for the z value. m represents a search mask for comparison.
Ty,x	Trap to memory address y, starting at address x.
X	Print/change the contents of the pseudo-X register.*

Table 2-12. Test Executive Utility Routine Commands (Continued)

Control Command	Description
\	Terminate the control statement and return to the beginning of the test executive supervisor routine. Must be typed prior to inputting the period of the control statement.
←	Delete the last octal digit and substitute the digit following the backarrow.
Carriage Return	Output a carriage return on the TTY printer.
Line Feed	Output a line feed on the TTY printer.
. (period)	Execute the control statement.
, (comma)	Print/change sequential memory addresses.
* The pseudo registers are memory cells used for storing and saving the contents of the respective operations registers.	

2.4.2.1 Magnetic Tape Commands

If the magnetic-tape version is being used, the following additional commands may be used:

Edc.	Write EOF on drive d, controller c.
Fn,dc.	Position to file n on drive d, controller c.
Ldc(,bic)	Load and execute program on drive d, controller c (using BIC bic).
Px,y,z,dc (,bic)	(see P control)

where:

d
: Is 0 for master drive.

d
: Is 1 for first slave, etc.

c
: Is 0 for magnetic-tape unit device address 010, etc.

c
: Is 1 for magnetic-tape unit device address 011, etc.

A feature that appears in the magnetic tape version only is a directory of available programs. The directory can be called up after the test executive identification message is displayed. Do not position the tape prior to loading the directory. Type:

```
Ldc(,bic).
```

Position the tape.

2.4.2.2 Disk Commands

If the disk revision is being used, the following additional commands may be used:

Fn.	Position to file N.
Ln, or Ln.	Load to file N. If the terminator is a period, the program is loaded and the start address is displayed, control is then returned to MAINTAIN III. If the terminator is a comma, then the program is loaded and executed.

2.4.2.3 Writing Disk Files

When writing a file from memory to disk:

- Ensure the disk drive is write-enabled.
- Select an output file by using F command.
- Write out the object modules by using the P command.

- Close the file after all the object modules are written. Use the E command to close the file.

The current output file is closed when either an L or a second F command is issued. If the selected file is a system file, the following message is displayed.

SYSTEM FILE OK?

Enter a Y if the request was intentional or enter an N if unintentional.

All MAINTAIN III system files are two cylinders long and all non-system (scratch) files are four cylinders long. Capacity is approximately 4K words per cylinder. Programs over 16K words will use at least two scratch files.

2.4.2.4 Test Programs

Detailed descriptions of loading and execution procedures of other MAINTAIN III test programs under test executive control are contained in the applicable test section.

Briefly, to load a test program:

1. Select the desired test program.
2. Type L. on the TTY keyboard.
3. The program is loaded and a test identifier message typed on the TTY printer.

Return to the beginning of a test program is normally controlled by a SENSE switch option, or after the execution of a specified number of cycles.

To return to the test executive from a test program, follow the restarting procedure described in subsection 2.4. Pressing the INT switch on the computer also returns control to the test executive; however, since some programs dynamically alter memory, refer to the applicable section of this manual regarding restrictions on interrupting a test in progress.

In general if a test is operating under interrupt control, the program should be terminated via SENSE switch 3, then use the INT switch. This precludes leaving an interrupt hanging that may cause subsequent problems.

To return to a just-executed test program from the test executive, type:

Gx.

where:

x
Is the starting address of the test program.

Refer to the program listing supplied with the software and to the test section for starting addresses.

2.5 ERROR MESSAGES

After the preliminary tests and binary loader are loaded, the preliminary instructions test is automatically executed beginning at address 007002. If an error is detected, the program halts with the error code (Table 2-13) in the instruction register.

To continue program execution after an error halt, press START or RUN. To loop on the subtest in error:

1. Set SENSE switch 2.
2. Refer to the program listing for the jump address specified by the preceding JSS2 instruction, and set the P register to that address.
3. Press START or RUN.

Refer to the program listing for the significance of the A, B, and X registers after an error halt, and to the applicable maintenance manual for correction procedures.

If an error is detected in the preliminary memory test, the program halts with 000077 in the instruction register, the address of the faulty cell in the X register, and the bits in error in the A register. To continue the test, press START or RUN. To loop on an error:

1. Set SENSE switch 2.
2. Press START or RUN.

Table 2-13. Preliminary Instructions Test Error Codes

Error Code	Instruction Subtest
000001	TZA/DAR/JAZ/JAN
000002	LDA/IAR/STA
000003	LDB/JBZ/TZB
000004	IBR/DBR
000005	LDX/JXZ/TZX
000006	IXR/DXR
000007	LDAI/JAN
000010	LDAI/ERA/JAN
000011	ERAI/JAP
000012	LDBI/TBA
000013	LDXI/TXA
000014	LDB/TBX
000015	LDA/ERA
000016	LDA/STA
000017	LDB/STB
000020	LDX/STX
000021	XAZ
000022	XBZ
000023	ROF/SOF/JOF
000024	ROF/JOF/JMP
000025	JMPM/(JMP)
000027	LRLA
000030	LLSR
000031	LLSR
000032	LLRL
000033	LLRL
000034	ADD
000035	ADDI/ORAI
000036	SUB
000037	NOP
000040	INCR 03 (005103)
000041	DECR 02 (005302)
000042	MERG 032 (005032)
000043	LSRA
000044	LDA
000045	STA
000046	ANAI
000047	STAI
000050	XIF 022 (003022)
000051	JIF 011 (001011)

The binary loader computes the checksum of each record of a test program (object) as it is loaded and compares the result with the expected value in the checksum frames at the end of each record.

If a checksum error is detected during program loading, the program stops and the test executive outputs the message:

```
CHECKSUM ERROR X = xxxxxx
```

where:

xxxxxx
: Is the error address in the X register.

To restart the program after a checksum error halt:

1. Position the program tape in the reader at the previous record mark (three all-holes frames).

2. Press START or RUN.

If the record does not cause a halt on restarting, an intermittent fault probably exists in the reader. If a halt again occurs, visually examine the tape and compare it to the illustration of object tape format in the programming section of the applicable system reference namual. If the tape is correct and the reader is operating correctly, refer to the program listing for the address of CKSM and display it on the control panel. Analyzing the ones in the checksum can indicate the location of the fault.

On a non-V75/V77 system, if the test executive does not print:

```
THIS IS THE V70/620 TEST EXECUTIVE
MEMORY SIZE IS nK
```

where:

n
: Is 8 to 32. Only the value of memory up to 32K is detected.

or, if on a V75/V77 system, the test executive does not print:

```
THIS IS THE V75 TEST EXECUTIVE
MEMORY SIZE IS nK
```

the TTY or its controller is not operating properly, the program halts with 000077 in the instruction register, and the TTY output routine goes into a time-out mode.

Refer to the applicable maintenance manual for troubleshooting and correction procedures.

If an illegal control statement is input, the test executive outputs the message:

```
INVALID
```

Enter the correct control statement.

During TTY input activity or while the TTY is waiting for input, setting SENSE switch 3 terminates the input. This internal test executive routine also applies to test programs calling the test executive I/O routines.

If the system includes the power failure/restart (PF/R) option, the test executive PF/R routine permits automatic recovery of operating conditions after a prime power failure and recovery.

2.6 TEST EXECUTIVE EXAMPLES

This section contains examples of the test executive messages and operator actions.

2.6.1 TEST EXAMPLE

The heading message for the V70/620 system is:

```
THIS IS THE V70/620 TEST EXECUTIVE
MEMORY SIZE IS 16K
```

The heading message for the V75/V77 system is:

```
THIS IS THE V75 TEST EXECUTIVE
MEMORY SIZE IS 16K
```

2.6.2 OPERATOR ACTIONS

In the following examples, operator inputs are represented in bold type. Other entries are program responses output to the TTY printer. Operator entry definitions are contained in Table 2-12.

Display the contents of a pseudo register:

```
A    142340.
B    001000.
X    006003.
```

Display the contents of a pseudo register on a V75 system:

```
R0   143240.
R1   001000.
R2   013421.
R3   000000.
R4   000000.
R5   000000.
R6   000000.
R7   000000.
```

Display and change the contents of a pseudo register and return to the test executive:

```
A    010454    10406.
B    006016    10406.
X    007413    10406.
```

Display and change the contents of a pseudo register on a V75 system:

```
R0   010454    10406.
R1   006016    10406.
R2   007413    10406.
R3   006234    10406.
R4   013457    10406.
R5   013341    10406.
R6   000000    10406.
R7   000000    10406.
```

Display the contents of memory address 002050 and return to the test executive:

```
C02050. = 102401.
```

Display and change the contents of memory address 002050, then display the next two addresses:

```
C02050. = 102401 103402,
( 002051 ) = 000067,
( 002052 ) = 177777.
```

Dump (display) memory starting at address 006000:

```
D6000.
( 006000 )     010454     002000 . . .
( 006010 )     005145     004543 . . .
( 006020 )     005041     001000 . . .
( 006030 )     006217     001000 . . .
```

Eight columns of data actually follow the reference memory starting address in the first row. Space limitations prohibit a full representation herein.

Terminate the dump by typing RUBOUT or set SENSE switch 3. The program then completes the current print line before terminating.

Initialize memory addresses 000200 through 000210 to 177777 and return to the test executive:

```
1200,210,177777.
```

Search memory addresses 000200 through 000240 for the contents of 106213; display addresses that compare and return to the test executive:

```
S$200,240,106213,177777.
( 000220 ) = 106213
( 000235 ) = 106213
```

Trap to memory address 000204 starting at address 000100. Display the trap address, contents of the overflow indicator, and contents of the A, B, and X register.

```
T204,100.
( 00204 )  142340  002000  010405  1
```

For a V75 system the trap command maintains the same format; however, eight registers (R0 through R7) will be displayed along with the overflow indicator.

Load and execute a test program:

```
L.
(TEST IDENTIFIER)
```

Transfer to and execute a test program located at address 000500:

```
G500.
(TEST IDENTIFIER)
```

Punch or write in object format beginning at address 000001 through 000006, after initializing the addresses to the desired values:

```
I0,7,0.
I1,6,1.
I2,5,2.
I3,4,3.
P1,6,7.
```

In the preceding example the initialize memory control statement has been used to establish a specified pattern in memory for validation of the format of the resultant operation.

Terminate an erroneous control statement:

```
P1,6
```

Cancel an octal digit and replace with the following digit:

```
I0,6- 7.
```

The following examples illustrate correct operator inputs, cancelling an operator input, and the results of invalid operator inputs. Refer to Table 2-12 for descriptions of the control commands.

Correct control statement A input:

```
A 000000 2.
A 000002 1,
A 000001 .
A 000001 ,
```

Cancelling control statement A input:

```
A 000001
A 000001 2
A 000001 .
```

Invalid control statement A input:

```
A 000001 X INVALID
A 000001 2X INVALID
A 000001 .
```

Correct control statement B input:

```
B 000000 2.
B 000002 1,
B 000001 .
B 000001 ,
```

Cancelling control statement B input:

```
B 000001
B 000001 2
```

Invalid control statement B input:

```
B 000001 X INVALID
B 000001 2X INVALID
B 000001 .
```

Correct control statement C input:

```
C10.=000000 1.
C10.=000001 .
C10,=000001 2.
C10,=000002 .

C10.=000002 1,
( 000011 ) =000000 2.
C10.=000001 ,
( 000011 ) =000002 .
C10.=000001 ,
( 000011  ) =000002 ,
( 000012  ) =000000 3.
C10.=000001 ,
( 000011 ) =000002 ,
( 000012 ) =000003 .
```

Cancelling control statement C input:

```
C10.=000002
C10.=000002 3
C10,=000002
C10,=000002 3
C10.=000002 .

C10,=000001 ,
( 000011 ) =000002
C10,=000001 ,
( 000011 ) =000002 3
C10,=000001 ,
( 000011 ) =000002 ,
( 000012 ) =000003 4

C10.=000001 ,
( 000011 ) =000002
C10.=000001 ,
( 000011 ) =000002 3
C10.=000001 ,
( 000011 ) =000002 ,
( 000012 ) =000003 4
C12.=000003 .
```

Invalid control statement C input:

```
C10.=000002 3X INVALID
C10,=000002 3X INVALID
C10.=000002 .
C1X  INVALID

C10,=000001 ,
( 000011 ) =000002 X INVALID
C10,=000001 ,
( 000011 ) =000002 3X INVALID
C10,=000001 ,
( 000011 ) =000002 ,
( 000012 ) =000003 X INVALID
C12.=000003 .
```

Correct control statement D input:

```
D0.
( 000000 ) 000000 000001 000002 000003 000004 000005
           000006 000007
( 000010 ) 000010 000011 000012 000013 000014 000015
           000016 000017
( 000020 )

D0,
( 000000 ) 000000 000001 000002 000003 000004 000005
           000006 000007
( 000010 ) 000010 000011 000012 000013 000014 000015
           000016 000017

D4.
( 000004 ) 000004 000005 000006 000007
( 000010 ) 000010 000011 000012 000013 000014 000015
           000016 000017

D4,
( 000004 ) 000004 000005 000006 000007
( 000010 ) 000010 000011 000012 000013 000014 000015
           000016 000017
```

Cancelling control statement D input:

```
D
D4
```

Invalid control statement D input:

```
DX INVALID
D4X INVALID
```

Correct control statement E input:

```
I0,7,0.
I1,6,1.
I2,5,2.
I3,4,3.
```

Correct control statement I input:

```
I0,7,0.
I1,6,1.
I2,5,2.
I3,4,3.
D0.
( 000000 ) 000000 000001 000002 000003 000003 000002
           000001 000000
```

Cancelling control statement I input:

```
I
I0
I0,
I0,7
I0,7,
I0,7,0
I,
I,7
I,7,
I,7,0
I,,
I,,0
```

Invalid control statement I input:

```
IX INVALID
I0X INVALID
I0,X INVALID
I0,7X INVALID
I0,7,X INVALID
I0,7,0X INVALID
I7,0,0. INVALID
```

Correct control statement L input:

```
L.
```

Cancelling control statement L input:

```
L
```

Invalid control statement L input:

```
LX INVALID
L0 INVALID
```

Control statement L input with forced checksum error:

```
I0,7,0.
L.CHECKSUM ERROR X = 000001
D0.
( 000000 ) 000000 000001 000002 000003 000003 000006
           000001 000000
```

Correct control statement P input:

```
I0,7,0.
I1,6,1.
I2,5,2.
I3,4,3.
P1,6,7.@@F@@A@@A@@B@@C@@C@@B@@A@@G@@@@@G@@G

P1,6,777777.@@F@@A@@A@@B@@C@@C@@B@@A@@B@@A@@G
```

Cancelling control statement P input:

```
P
P1
P1,
P1,6
P1,6,
P1,6,0
P,
P,6
P,6,
P,6,0
P,,
P,,0
```

Invalid control statement P input:

```
PX INVALID
P1X INVALID
P1,X INVALID
P1,6X INVALID
P1,6,X INVALID
P1,6,0X INVALID
```

Correct control statement R input:

```
R0  000000 2.
R1  000000 1.
R2  000000.
R3  000000.
R4  000000.
R5  000000 4.
R6  000000.
R7  000000.
```

Cancelling control statement R input:

```
R0  000001
R1  000000
R2  000300 2
R3  010000 3
R4  000000 4
R5  000003 5
R6  040000 6
R7  050000 7
```

Invalid control statement R input:

```
R0  000001  X   INVALID
R1  000001  2X  INVALID
R2  000001  2X  INVALID
R3  000001  X   INVALID
R4  000001  X   INVALID
R5  000001  X   INVALID
R6  000001  A   INVALID
R7  000001  B   INVALID
```

Correct control statement S input:

```
D0,
( 000000 ) 000000 000001 000002 000003 000004 000005
           000006 000007

S0,6,0,7777.
( 000000 ) =000000

S1,7,7,7777.
( 000007 ) =000007

S1,6,0,7777.
S1,6,7,7777.

S0,7,35,7.
( 000005 ) =000005
S1,5,1,1.
( 000001 ) =000001
( 000003 ) =000003
( 000005 ) =000005
S1,2,77,0.
( 000001 ) =000001
( 000002 ) =000002
```

Cancelling control statement S input:

```
S
S0
S0,
S0,7
S0,7,
S0,7,5
S0,7,5,
S0,7,5,7
S,
S,7
S,7,
S,7,5
S,7,5,
S,7,5,7
S,,
S,,5
S,,5,
S,,5,7
S,,,
S,,,7
```

Invalid control statement S input:

```
SX INVALID
S0X INVALID
S0,X INVALID
S0,7X INVALID
S0,7,X INVALID
S0,7,5X INVALID
S0,7,5,X INVALID
S0,7,5,7X INVALID
```

Correct control statement X input:

```
X 000000 2.
X 000002 1,
X 000001 .
X 000001 ,
```

Cancelling control statement X input:

```
X 000001 . .
X 000001 2
```

Invalid control statement X input:

```
X 000001 X INVALID
X 000001 2X INVALID
X 000001 .
```

3.1 GENERAL

This section describes the MAINTAIN III test programs for V77 card equipment subsystems.

3.2 2812 CARD READER AND CONTROLLER TEST

The card reader and controller test verifies the capability of the 2812 Card Reader/Controller to correctly read card characters. The card reader test program is available as an object paper tape, magnetic tape file, card deck, or as a disk object file.

The test program allows the operator to speed up the test by configuring a buffer interlace controller (BIC) or priority interrupt module (PIM) as needed through the input of the proper response to test prompts. The BIC transfers data directly to memory and the PIM alarms the processor that the data is in memory. The card reader test has the capability of running an initialization test with the option of PIM control. An initialize command resets card control lines and runs all the mechanical procedures necessary to initialize the card reader to the ready state.

During the test, if options are specified, the user configures the system according to the following criteria:

- Input/output operations using BIC.
- Input/output operations using BIC and PIM.
- Input/output operations not using BIC or PIM.
- Input/output oprations using PIM.

If options are not specified, the operator has the option of using the PIM Reader Ready Interrupt during the initialization test.

During the test, each card-columns bit configuration is tested. If a card's data is correct, the program reads the next data card. If an error is detected, the program will print an error message. Each column of every input card is verified for valid input.

3.2.1 RELATED PUBLICATIOINS

The 2812 Card Reader is described in the M-200 Card Reader Manual (Documation, document number 7845). The card reader controller is described in SPERRY UNIVAC Engineering Description 98A0945.

3.2.2 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 3-1 lists the sense switch settings.

Table 3-1. Sense Switch Settings

Sense Switch	Set	Reset
1	(Not used)	(Not used)
2	Program halts on data error.	Errors are counted and the program continues.
3	Program returns to start of test.	Program continues testing.

3.2.3 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the 2812 Card Reader/Controller test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in subsection 1.5.

When the test program is loaded, automatic transfer to the start of the program takes place (address 0500) and the program prints the following:

V70/620. CARD READER TEST OPTIONS?

The user responds with a Y for Yes or N for No. If no options are requested, the parameters remain unchanged and the initialization test will be performed. If options are requested, the following message is output:

```
CARD READER DA =
```

The card reader device address is found in the system memo. The user responds with the octal device address of the card reader and a period or comma. Subsections 3.2.3.1 through 3.2.3.5 describe the remaining operating sequences.

3.2.3.1 Initialization Test

After the device address has been specified, the program generates the following message:

```
PERFORM INITIALIZATION TEST?
```

The user then responds with a Y for Yes or N for No (no period or comma is used). If Y is input, the following is typed:

```
READER READY INTERRUPT TO BE USED?
```

The user responds with a Y for Yes or N for No. If N is input, the following messages are skipped; otherwise the following is typed:

```
PIM DA=
TRAP LOCATION=
INTERRUPT MASK=
```

Answers to the prompts for the PIM DA, TRAP LOCATION, and INTERRUPT MASK are found in the system memo.

The user must respond with the corresponding octal values followed by a period or comma.

3.2.3.2 Card Reader Ready Condition

After the trap locations, interrupt masks, and device address have been specified, the program outputs the message:

```
EMPTY HOPPER OF CARD READER AND THEN RESTORE CARDS
DO NOT MAKE CARD READER READY
```

The program then halts with the Instruction Register (IR) equal to 1 to allow the user to comply with this request. The user then manually restarts the program.

The program then senses for a reader ready condition. A reader ready when sensed indicates a malfunction of the reader ready sense line. If that occurs, the following is printed:

```
READER READY SENSED
IT SHOULD NOT HAVE BEEN
```

If no options were specified, the test program tries to read a card. If options were specified, the rest of the parameters are then input.

If 'Reader Ready' is not sensed, the test program executes a card reader initializing command. After a delay, to allow the reader to be mechanically initialized by this command, the reader ready sense is then initialized again. If the reader is not ready, the following message is printed and a halt occurs with IR equal to 2.

```
INITIALIZATION ERROR
```

Depress SYSTEM RESET and RUN on the computer control panel to continue with the test. If the reader is ready, the initialization was satisfactorily performed. In either case, if options were not specified, the program attempts to read a card using the sense mode.

3.2.3.3 Specification of Inputs

If options were specified, the program prints:

```
I/O MODE=
```

The valid responses to the I/O MODE= command are BIC, BAP, SEN and PIM (no period or comma is included). The responses are defined as follows:

- BIC - Input/output operations using BIC
- BAP - Input/output oprations using BIC and PIM
- SEN - Input/output operations over sense line (not using BIC or PIM)
- PIM - Input/output operations using PIM

If the operator enters a different response, the program types INVALID and waits for a correct entry.

If the operator types SEN or PIM, the following message is skipped, otherwise the output device types:

```
BIC DA=
```

The BIC device address is identified in the system memo.

The user enters the octal device address of the BIC followed by a period or comma.

If the operator types BIC or SEN, the following messages are skipped; otherwise the output device types:

```
PIM DA=
TRAP LOCATION=
INTERRUPT MASK=
```

The 'PIM DA', 'TRAP LOCATION', and 'INTERRUPT MASK' are determined from the system memo. The user enters the corresponding octal value followed by a period or comma after each '='.

3.2.3.4 Reader Ready Operations

If the 'READY' condition is not true on the card reader, the program will type:

```
READER NOT READY
```

and subsequently hold with IR equal to 3, unless sense switch 3 is set, in which case the summary message will be typed. If no reader error is detected, each of the 80 characters will be stored in memory.

If a card reader error is sensed and the hopper is not empty, the program will type the following:

```
CARD READER ERROR
```

This will be followed by a halt with IR equal to 4.

If a card reader error is sensed and the hopper is empty, the following message will be typed followed by the summary message:

```
HOPPER EMPTY
```

Other abnormal conditions which would prevent the reading of a card are indicated by the following error messages:

Message	Halt
CHARACTER READY TIME-OUT	IR=5
BIC BUSY (prior to initialization of BIC)	IR=6
BIC ABNORMAL STOP	IR=7
INTERRUPT TIME-OUT	IR=010
BIC BUSY TIME-OUT (after initialization of BIC)	IR=011

After any such error halt, depress 'RUN' to resume the attempt to read a card.

3.2.3.5 Reading of Cards

Each card column is tested for a preset bit configuration, and if the data is correct, the next card is read. If any data is incorrect, and sense switch 2 is reset, the error count is incremented and the program continues. If sense switch 2 is set, the program will halt at IR=0100 with the X, B, and A registers containing the column, the expected value in the card column, and the actual value in that card column. Depress 'RUN' to continue.

Each column of each card is tested. If sense switch 3 is set at any time during the read operation or if a hopper empty condition is sensed, the program types the following summary message:

```
END OF TEST, NUMBER OF CARDS READ IS XXXXXX
TOTAL  NUMBER OF ERRORS IS YYYYYY
```

The test then prints 'OPTIONS?' to restart the test program.

The following messages may be printed as detected:

```
CARD IN READ STATION STATUS IR=012
PREMATURE END OF CARD STATUS IR=012
```

3.2.4 PROGRAM EXAMPLE

```
THIS IS THE V75 TEST EXECUTIVE
MEMORY SIZE IS 32K
L.
V70/620 CARD READER TEST

OPTIONS?
Y
CARD READER DA=30,
PERFORM INITIALIZATION TEST?
N
I/O MODE =SEN
CARD   COLUMN EXP'D  ACTUAL
000010 000001 004000 000000
000010 000015 004400 000400
000010 000016 004200 000200
000010 000017 004100 000100
000010 000020 004040 000040
000010 000021 004020 000020
000010 000022 004010 000010
000010 000023 004004 000004
000010 000024 004002 000002
000010 000025 004001 000001
000010 000050 004000 000000
000010 000051 006000 002000
000010 000052 007000 003000
000010 000053 007400 003400
000010 000054 007600 003600
000010 000055 007700 003700
000010 000056 007740 003740
000010 000057 007760 003760
000010 000060 007770 003770
000010 000061 007774 003774
000010 000062 007776 003776
000010 000063 007777 003777
000010 000077 005252 001552
000010 000102 004001 000001
END OF TEST, NUMBER OF CARDS READ IS 000027
TOTAL NUMBER OFERRORS IS 000024
```

3.2.5 ERROR MESSAGES

Error Messages and their causes are listed in Table 3-2.

Table 3-2. Error Messages

Message	Cause
INVALID	Invalid input.
CHARACTER READY TIME-OUT	PIM mode. Did not receive character ready.
CARD READER ERROR	BIC failure or card reader empty.
BIC ABNORMAL STOP	BIC did not read character.
READER NOT READY	Sensed any time reader is not ready.
BIC BUSY	Wiring error.
HOPPER EMPTY	Card hopper empty.
INITIALIZATION ERROR	During the initialization test the card reader is not ready.
INTERRUPT TIME-OUT	Waiting for PIM to be ready; have not received PIM ready signal.
BIC BUSY TIME-OUT	Waiting for BIC to be ready; have not received PIM ready signal.
CARD IN READ STATION STATUS	Card never left read station.
PREMATURE END OF CARD STATUS	Card shorter than 80 characters
READER READY WHILE READING	BIC busy, reader not busy.
CARD COLUMN EXPECTED ACTUAL	Data compare error.

3.3 2813 CARD PUNCH TEST AND F3081 CONTROLLER TEST

The card punch test verifies the ability of the 2813 Card Punch controller to transfer user given data to the 2813 Card Punch. The test allows the user to define the number of cards to be punched, the data to be punched, and the output mode. One of these output modes can be selected: the sense mode reads data into memory through the instruction registers, the priority interrupt module (PIM) mode alarms memory when data is ready to

be transferred, and the buffer interlace controller (BIC) mode reads data directly into memory. The 2813 Card Punch Test program is available as an object paper tape, magnetic tape file, card deck, or as a disk object file.

The test consists of the following:

1. Reading a data card with the 2812, 2844-02 or F3080-00 Card Reader to determine the data pattern to be punched.

2. Output of the given data pattern to a specified number of cards with the 2813 Card Punch for any one of three output modes: sense, PIM, or BIC.

3.3.1 RELATED PUBLICATIONS

The type 2813 Card Punch Unit is described in the Card Punch (Type 1701/1710) Servicing Manual (HB-1571). The card punch controller is described in Sperry Univac Engineering Description 98A0672.

3.3.2 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 3-2 lists the sense switch settings.

Table 3-3. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Errors are counted and the program continues
3	Program returns to start of test	Program continues testing

3.3.3 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the 2813 Card Punch Test Program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in subsection 1.5.

When the test program is loaded, automatic transfer to the start of the program takes place (address 0500). A data card must be available with the data patterns to be tested punched on it. A punched card can be used which has enough different punches on it to satisfy the user. The punched card should be followed by a blank card and inserted in the input hopper of the card reader. The card reader is then turned on and started. A stack of cards adequate for the test, is then placed in the back input hopper of the 2813 Card Punch. If no card is present in the visible station of the card punch, a card should be placed in the front input slot. The card punch is then turned on. The test is now ready for execution.

3.3.3.1 Reading the Card

This section describes the procedures for reading a data card.

The test types:

```
CARD PUNCH TEST (620-27)
```

The test also types:

```
CARD READER DA=
```

The user must then enter the octal device address of the card reader followed by a period or comma.

The test then types:

```
CARD PUNCH DA=
```

The user then enters the octal device address of the card punch followed by a period or comma.

The last initial request is:

```
NO. OF CARDS TO BE PUNCHED=
```

The user then enters the octal number of cards to be punched followed by a period or comma.

An attempt is then made to read the data card. If the attempt is successful,

DATA CARD READ

is typed. Otherwise, an appropriate message is output (see Table 3-4), a halt occurs, and the card reader must be fixed by the user. 'SYSTEM RESET' and 'RUN' are then depressed to try again to read the data card.

3.3.3.2 Input/Output Operations

This section describes sense, PIM and BIC operations.

The test then types:

I/O MODE=

The user types 'SE', 'PI', or 'BI' for the sense, PIM, or BIC mode. If the choice of mode is PIM or BIC, the user must input more parameters.

The test types:

PIM DA=

The user then inputs the PIM device address followed by a period or comma.

Device Addresses, Trap Locations, and Interrupt Masks are found in the systems memo.

The test types:

TRAP LOCATION=

The user then inputs the trap location followed by a period or a comma.

The program then types:

INTERRUPT MASK=

The interrupt mask is calculated from a table like the following:

Level	Address	Interrupt Mask
0	Even 0	376
1	Even 2	375
2	Even 4	373
3	Even 6	367
4	Odd 0	357
5	Odd 2	337
6	Odd 4	277
7	Odd 6	177

Even 0 specifies an even octal number with a zero on the end.

Odd 0 specifies an odd octal number with a zero on the end.

The user must then input the interrupt mask followed by a period or comma. The interrupt mask is an octal number which represents the status of the trap location.

In the BIC mode, the test types:

```
BIC DA=
```

The user then inputs the BIC device address followed by a period or a comma.

3.3.3.3 Card Punching

This section describes the procedure for punching cards.

After the input of the output mode information, the test requests the user to check the visible station of the 2813 Card Punch to see if a card is present by typing the following message:

```
IF A CARD IS PRESENT IN THE VISIBLE STATION, INPUT
"0."; OTHERWISE INPUT "1."
```

The user then complies with the test by typing "0." or "1.". If the visible station is empty, a card must be positioned in the front feed slot to avoid a punch error condition. An attempt is subsequently made to punch the indicated number of cards with the given data pattern. If the attempt is successful, the following message will be typed:

```
PUNCHING COMPLETE, MOVE CARDS TO CARD READER
```

The test then halts at 01013 to allow the user to move the cards.

If the punching attempt is not satisfactory, an appropriate diagnostic message is typed (see Table 3-4) and a halt occurs. The user then corrects the malfunction in the hardware, and

depresses 'SYSTEM RESET' and then 'RUN' and it is again attempted to punch the current card.

3.3.3.4 Card Punch Verification

This section describes the verification of the punched cards.

After the user has moved the cards to the card reader and has placed a blank card on top, the user depresses 'RUN'.

An attempt is then made to read the indicated number of punched cards. If the attempt is successful, each card will be read and checked for errors. If sense switch 2 is set, the test will halt on the first data error at 02651, with the card number in the instruction register (not more than 0777 cards can be punched), the column number in the X-register, the expected data in the A-register, and the actual data in the B-register. The user may restart the test by depressing 'RUN'.

3.3.4 ERROR MESSAGES

This section provides a description and interpretation of those error messages associated with the test program.

Table 3-4. Error Messages

Message	Significance
CARD READER ERROR	An error condition sensed at card reader
CARD READER READY TIME-OUT	Card reader is not ready
CARD READER CHARACTER READY TIME-OUT ERROR	During or prior to input of data from a card, buffer ready stayed off
CARD PUNCH PROBLEM	An error condition sensed at card punch
BUFFER READY TIME-OUT	During or prior to output of data to a card, buffer ready stayed off

Table 3-4. Error Messages (Continued)

Message	Significance
BUFFER.READY INTERRUPT TIME-OUT	A card punch interrupt for buffer ready not received during output of data
BIC BUSY	BIC busy when BIC card punch output routine entered
BIC ABNORMAL STOP	BIC abnormal stop after initialization for data transfer to card punch
BIC BUSY TIME-OUT	BIC did not finish data transmission to card punch
DATA ERROR(S)	Data errors created by the card punch were recognized

CARD	COLUMN	EXPECTED	ACTUAL
AB	CDEF	GHIJ	KLMN
OP	QRST	UVWX	YZAB

(The above letters represent octal numbers with the given output format and associated headers above them.)

Section 4
Printer Equipment

4.1 GENERAL

This section describes the MAINTAIN III test program for the V77 Line Printers.

4.2 2820, 2819, 0786, AND 0789 LINE PRINTER TESTS

The line printer test verifies the capability of the line printer to correctly print data patterns. The line printer test program is available as an object paper tape, magnetic tape file, card deck, or as a disc object file. The test program allows the operator to speed up the test by configuring a buffer interlace controller (BIC) or priority interrupt module (PIM). In the BIC mode, a line is stored in a memory buffer, and then printed under BIC control. The BIC option is only exercised for the spiral or fixed patterns. The line printer test has the capability of running the test over a sense line or with the option of PIM control. The PIM alarms memory when the printer is ready for a character. During the test, each print position can be tested to determine if it functions correctly when a print command is issued. Spiral, fixed, pyramid and VFU pattern tests are provided.

The decimal equivalent of the octal number specified in the response to the CYCLES prompt determines the number of times that a test is repeated. The spiral data pattern continuously prints a specified ASCII character set. The fixed data pattern prints one specified ASCII character. The pyramid prints a pyramid of the letter P starting with print position 1 and ending with print position one hundred and thirty-two. The VFU test outputs one line each of sequentially specified characters.

4.2.1 RELATED PUBLICATIONS

The type 2820-00, 300 line-per-minute printer is described in the Model 2230 Line Printer Manual (Dataproducts document number DPC 241735). The line printer controller is described in Sperry Univac Engineering Description 98A1095.

The type 2820-04, 600 line-per-minute printer is described in the Model 2260 Line Printer Manual (Dataproducts document number DPC 239541). The line printer controller is described in Sperry Univac Engineering Description 98A1095.

The type 2819 printer is described in the Model 101 Printer Manual (Centronics). The line printer controller is described in Sperry Univac Engineering Description 98A1095.

The type 0786 line printer is described in the Sperry Univac Printer Type 0786 Servicing Manual (Handbook 2340). The line printer controller is described in Sperry Univac Engineering Description 98A1298.

4.2.2 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 4-1 lists the sense switch settings.

Table 4-1. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Errors are counted and the program continues
3	Program returns to start of test	Program continues testing

If sense switch 3 is set and then reset to terminate test cycling, a G500 must be input at the teletypewriter to return control to the beginning of the program.

4.2.3 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the line printer test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the

test program using the procedures outlined in subsection 1.5. When loading of the test program is complete, there is automatic transfer to the start of the test program (address 0500). If an error is made in the input of command data, a backslash ( ) cancels that command.

4.2.3.1 Printer and Cycles Specifications

This section contains instructions for specifying the printer used and test cycles.

The program prints the following:

```
620 LINE PRINTER TEST
PRINTER DA
```

The operator responds with the octal device address of the line printer which is found in the systems memo.

The program then prints the following:

```
(8/16)
```

The answer to this prompt is normally N for no, because parallel 8/16 lines are usually not connected to V77 computer printers. The program then prompts:

```
PRINTER TYPE
```

The operator responds with a 1 for a 2820 printer, a 2 for a 2819 printer, a 7 for a 0786 printer, or a 10 for a 0789 printer. The numbers 1, 2, 7, and 10 represent the printer types. Their parameters are given in Table 4-2.

When a type 10 line printer is tested, the operator is prompted with the following message

```
BAND DASH NUMBER
```

Enter a two-digit decimal number that corresponds to the dash number of the band feature number. Terminate the entry with a period.

After the Printer Type is entered, the program prompts:

```
CYCLES
```

The operator responds with an octal number, the decimal equivalent of which represents the number of times that a test output is repeated.

Table 4-2. Printer Parameters

Printer Type	Description
1	132 print positions Space (1-7) and skip (1-7) on VFU Character set 0240-0337
2	132 print positions Vert tab, Form, SO, SI on VFU Character set 0240-0336
7	132 print positions Vert tab, Form, SO, SI on VFU Character set 0240-0376
→ 10	T0789 Printer

4.2.3.2 Output Patterns and Test Configurations

This section describes the control of the output pattern and configurations of the BIC and PIM.

The program then prompts:

Pattern

The operator responds with S for spiral, F for fixed, P for pyramid, and V for VFU. A description of these parameters is contained in subsection 4.2. Table 4-3 lists the VFU commands.

The program then prompts the following:

PIM used

The operator responds with a Y for yes or N for no. If a Y is typed and the following information has not already been supplied, the program will prompt:

PIM DA

The operator responds with the octal device address.

The program then prompts:

Interrupt Cell

The operator responds with the interrupt location.

The program then prompts:

Mask

The operator then responds with the interrupt mask. The PIM DA, Interrupt Cell and Mask are found in the systems memo.

The program then prompts:

BIC used

The operator responds with a Y for yes or an N for no. If a Y is typed in and the following information has not been already supplied, the program will prompt:

BIC DA

The operator responds with the octal device address found in the systems memo. At the conclusion of the questions, the test will begin.

Figure 4-1 is an example of the spiral data pattern and Figure 4-2 is an example of the pyramid data pattern.

When using Table 4-1 for the 0789 printer, the output varies according to the band used. ←

Table 4-3. VFU Commands

Character Printed	VFU Command Executed at End of Print Line
K	013
L	014
M	015
N	016
O	017
@	0100

Table 4-3. VFU Commands (Continued)

Character Printed	VFU Command Executed at End of Print Line
A	0101
B	0102
C	0103
D	0104
E	0105
F	0106
G	0107
P	0120
Q	0121
R	0122
S	0123
T	0124
U	0125
V	0126
W	0127
X	0130
Y	0131
Z	0132
[	0133
	0134
]	0135
	0136
	0137

4.2.4 PROGRAM EXAMPLES

The following are examples of program output.

```
620 Line Printer Test

Printer DA          35.
8/16 Option         N.
Printer Type        2.
Patterns            S.
PIM used            N.
BIC used            Y.
BIC DA              20.
CYCLES              100.
Pattern             S.
PIM used            N.
BIC used            Y.
```

4.2.5 ERROR MESSAGES

Table 4-4. Error Messages

Message	Significance
WRITE ALERT	The printer has reported a write alert malfunction
PRINTER NOT READY	The printer controller reported that the printer is not ready
CONTROLLER NOT READY	The printer controller has failed to respond to a command
BUFFER SIZE ERROR	The BIC reported that not all data has been transferred
BIC ABNORMAL	The BIC reported an abnormal disconnect

The following error messages are applicable to the type 10 printer, the messages are self explanatory.

ACTUATOR ERROR
BAND ERROR
DATA PARITY ERROR
PARITY ERROR
PAPER FEED MOTION ERROR
FORMS JAM
FORMS RUNAWAY
INVALID TRANSFER
PAPER CHECK
PAPER LOSS
SLEW ERROR*
STACKER FULL
TEMPERATURE ERROR
VFU ERROR

* The vertical format test forces a slew error condtion. This error appears once for each time that the 'V' test is run.

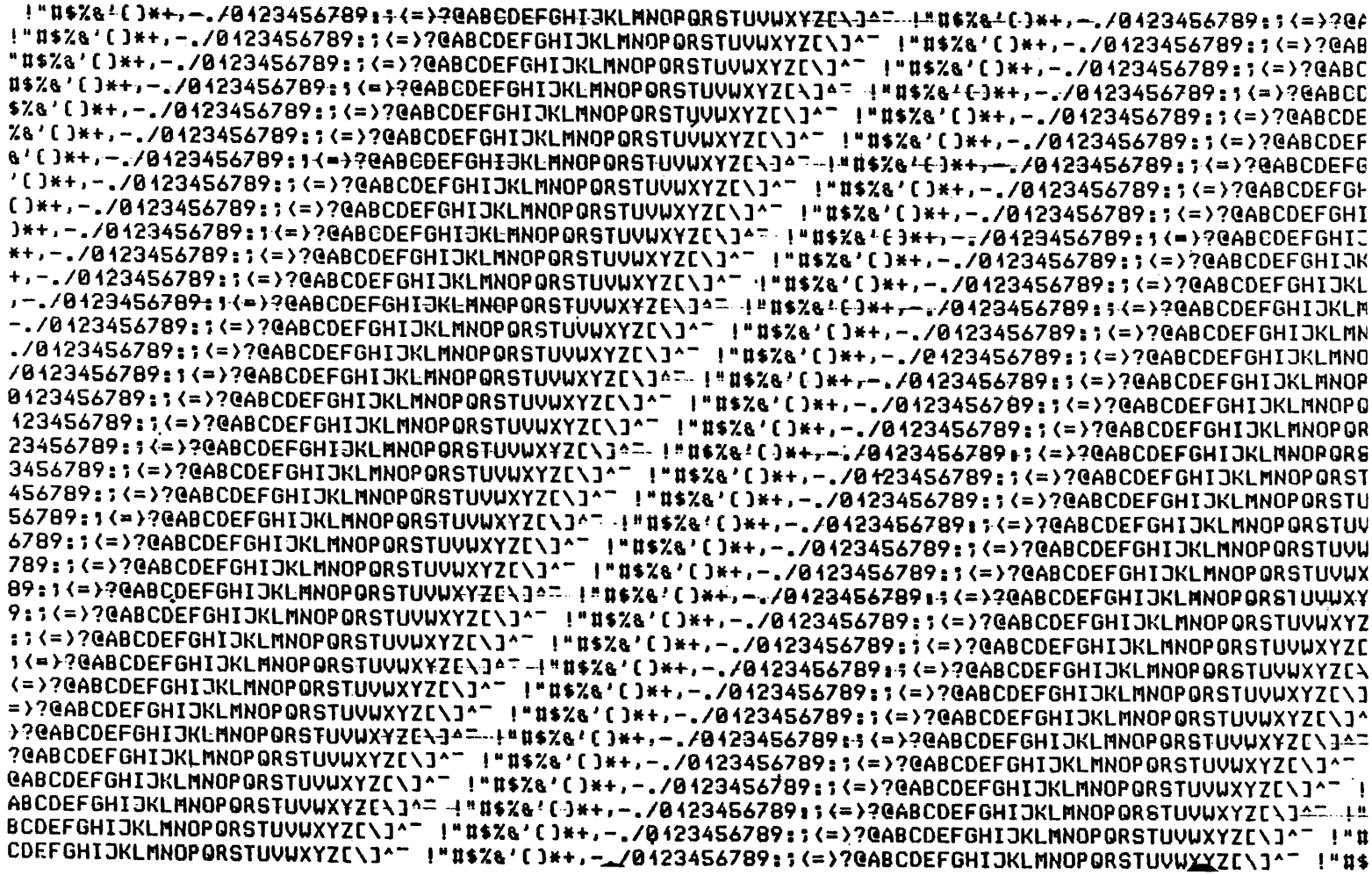

Figure 4-1. Spiral Data Pattern

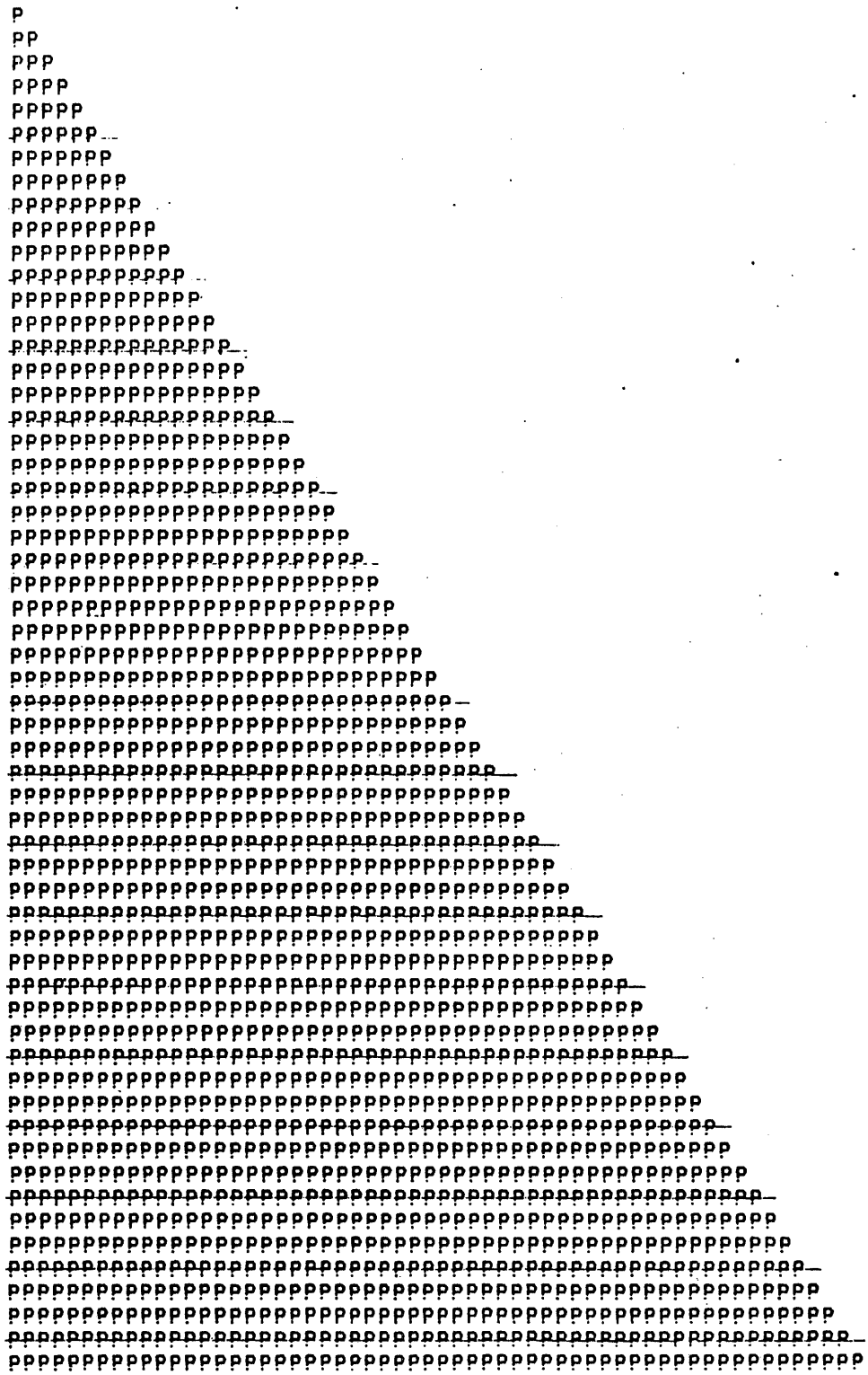

Figure 4-2. Pyramid Data Pattern

4.3 SU39 CHANNEL INTERFACE TEST

The SU39 Channel Interface Diagnostic Program tests the operational status of the SPERRY UNIVAC Channel Interface (F3068-00) and SPERRY UNIVAC 0777 Printer Subsystem. The SU39 Channel Interface (Channel) is used to provide an interface between a SPERRY UNIVAC V77 Series Computer and the 0777 Printer.

This test is designed to operate with the MAINTAIN III test executive. The test uses the console interface, SENSE switch routines, I/O routines, timing routines, and system constants contained in the test executive.

In using this test, either a 0777 Printer Subsystem or an E4751B Channel Tester can be interfaced with the channel. In this test description, the printer and tester are referred to as the control unit.

An initialization dialog routine allows the user to enter certain hardware dependent parameters. Parameters are entered prior to testing the system. They describe the system to be tested and are used to modify the program. Program modification ensures that the correct device addresses are entered in the I/O instruction address fields.

A test selection phase follows initialization. During this phase, the user specifies the test sequence and the number of test cycles to be performed. The test sequence consists of one or more of the subtests that are in the test program.

Test routines are divided into routines that test the channel (channel tests) and routines that exercise the printer (printer tests). In addition, there are three specialized tests:

- A test that causes all channel interface tests to be performed.
- A test that causes the channel to be initialized and a system clear to be issued to the control unit.
- A test that causes control to be transferred to the MAINTAIN III test executive.

When a tester is connected to the channel, only channel tests can be selected. When a printer is connected, any test can be selected.

Utility routines, to aid in fault isolation, are available as test executive routines.

Available documentation is as follows:

Document Number	Title
UP-8672	MAINTAIN III Test Program Users Manual
UP-9079	Channel Interface Functional Analysis and Servicing Manual
92( )0114-002	SU39 Channel Diagnostic for F3068-00 Channel

4.3.1 HARDWARE REQUIREMENTS

The minimum hardware requirements are as follows:

- One V77-600 Computer with:
  - 16K words of memory
  - F3021-00 Processor Linkage
  - F3024-01 Priority Interrupt Module (PIM)
  - F3068-00 Channel Interface
- One 0777 Printer Subsystem or E4751B Channel Tester
- One operator Console

4.3.2 DESCRIPTION OF TEST COMPONENTS

This section contains a brief description of the test components. Error messages are described in Section 4.3.5.

4.3.2.1 Test 0

Test 0 is used to perform tests 050 through 075 in sequence.

4.3.2.2 Test 01

Test 01 verifies that an unsolicited (asynchronous) status request from the control unit is properly handled. When the channel is connected to the printer, a status request occurs as a result of the printer transition from the STOP to RUN mode. When a tester is connected to the channel, this test must be performed in the tester station. The tester then simulates the STOP to RUN mode transition.

The following user messages are displayed:

```
STEP PRINTER FROM STOP TO RUN MODE

HIT PERIOD WHEN DONE
```

Error messages 01, 02, 03, and 04 are called for by this test.

4.3.2.3 Test 02

Test 02 is used to set up the printer table and initiates the printer for printing. The user enters the diskette font identification (0 through 016) from which character generators 0 and 1 are loaded. The vertical format table is loaded for 88 lines (eight lines per inch) and translate table 0 is selected and loaded.

The following user message is displayed:

```
ENTER FONT ID (0-016)
```

Error messages 01, 02, and 07 are called by this test.

4.3.2.4 Test 03

Test 03 is used to generate the mark form command to the printer. If the printer is loaded with the commands from test 02 and the font is GOTHIC 10, the mark form character is  .

Error messages 01 and 02 are called by this test.

4.3.2.5 Test 04

Test 04 generates one print line of 204 characters via a print advance command with a space of one. If the font is GOTHIC 10, the line printed is:

The message is followed by dashes (-) and each printable character in the font. This print buffer is used by several of the tests in this diagnostic.

Error messages 01 and 02 are called by this test.

4.3.2.6 Test 05

Test 05 transmits an end-of-transmission command to the printer. This allows a partial page in the printer page buffer to be printed.

Error messages 01 and 02 are called by this test.

4.3.2.7 Test 06

Test 06 verifies that each invalid printer command is rejected. This action sets the unit check bit of the status byte and the command reject bit of sense byte 0.

Error messages 01, 02, and 013 are called by this test.

4.3.2.8 Test 07

Test 07 verifies that the load-copy modification command is functioning properly. The user specifies:

- the number of copies of a page that are to be printed,
- the copy number,
- the line number, and
- the position, within the line, to be modified.

The specified copy is replaced with 101 consecutive characters starting at the specified position on the appropriate line. Commands issued to the printer are:

- Print advance
- Load copy number

- Load copy modification
- End of transmission
- No operation (No-op)

The No-op command is used at the end of a command chain to avoid an asynchronous status condition.

The following user messages are displayed:

ENTER NUMBER OF COPIES (1-0377)

COPY MODIFICATION REQUEST

ENTER COPY NUMBER, LINE NUMBER, COLUMN NUMBER

Error messages 01, 02, and 07 are called by this test.

4.3.2.9 Test 010

Test 010 verifies that the load-copy-number is functioning properly. The user specifies the number of copies of a page that are to be printed. Commands issued to the printer are:

- Print advance
- Load copy number
- End of transmission
- No-op

The following user message is displayed:

ENTER NUMBER OF COPIES (1-0377)

Error messages 01 and 02 are called by this test.

4.3.2.10 Test 011

Test 011 generates a sense command for the printer. The 18 printer sense bytes (Table 1) are then displayed on the operator console as an octal value.

Error messages 01 and 02 are called by this test.

Table 4-1. Printer Sense Bytes

SENSE BYTES			BIT POSITIONS							
			0	1	2	3	4	5	6	7
	SUMMARY INFORMATION	0	COMMAND REJECT	INTERVENTION REQUIRED	BUS OUT CHECK	EQUIPMENT CHECK	DATA CHECK	PROGRAM ALERT	BUFFER LOAD CHECK	INVALID SEQUENCE
	PROGRAMMING	1	INVALID CHARACTER GENERATOR	INHIBIT DATA CHECK	INHIBIT STATUS IN	NEED IPL	PRINT INTEGRITY	INTERFACE DISC OR SELECTIVE RESET	INVALID VFB	INVALID (SELECTED) TRANSLATE TABLE
		2	INVALID MEMORY ADDRESS	INVALID DATA LENGTH	INVALID FONE ID	(UNASSIGNED)	COPY ADVANCE	INVALID ADVANCE	ERROR LOG OVERFLOW	ERROR LOG ENTRY
		3	DATA IN PAGE BUFFER	INVALID FLASH NUMBER	INVALID COPY MODIFICATION	PAGE BFR OVERFLOW	PRINTING ACTIVE	(UNASSIGNED)		
	ERROR RECOVERY PAGE NUMBER	4								
		5								
	ELECTRICAL	6	PROCESSOR COMPARE ERROR: A BITS 0-3	B BITS 4-7	C BITS 8-11	D BITS 12-15	E ALU STATUS	BUS-IN PARITY ERROR	TRANSLATE CHECK	IF MAIN MEMORY READ PARITY ERROR
		7	CHARACTER GENERATOR PARITY ERROR	INVALID CHARACTER GEN. EOC	(UNASSIGNED)	INPUT BUS PAR. ERROR SCRATCH PAD	INPUT BUS PAR. ERROR MAIN MEMORY	INPUT BUS PAR. ERROR EXPANDED BUS	PROCESSOR MEM. INPUT BUS PARITY ERROR	IF MAIN MEMORY INPUT BUS PARITY ERROR
		8	(UNASSIGNED)			MECHANISM OUTPUT REGISTER PARITY ERROR	MODULE TEMPERATURE EARLY WARNING	UNCORRECTABLE MAIN MEMORY PAGE BUFFER ERROR	UNCORRECTABLE MAIN MEMORY OUTPUT LINE BFR ERROR	UNCORRECTABLE MAIN MEMORY INPUT LINE BFR ERROR
	DISKETTE	9	(UNASSIGNED)				DISKETTE NOT READY	TRACK MISMATCH	SECTOR NOT FOUND	DISKETTE CRC ERROR
		10	DEVICE POWER CHECK	POWER ON DELAY	FOLD ERROR	CORONA OFF	TONER EMPTY	CATCHBOX FULL	END OF OIL FELT	TONER DUST DETECTOR
		11	TRANSFER ST. OR PREHEAT PL OPEN	END OF PAPER	PAPER CHECK	DEVELOPER STATION OPEN	TONERMARK ERROR	AIR PRESSURE ERROR	MISSING CLOCK PAPER STEP	REGENERATION LAMP
		12	MECH. FON SEQUENCER PARITY ERROR	NO PAPER MOTION	FUSER OVERTEMPERATURE	PAPER STEP ERROR	FUSER POSITION ERROR	TRANSFER ST. POSITION ERROR	GLASSRAR ERROR	NO LASER BEAM
		13	LASER SAFETY SWITCH	LOOP ERROR	FUSER TEMPERATURE TOO LOW	PAPER BRAKE	FUSER OIL EMPTY	CLEANING CYCLE FAILURE	CHANGE FLEECE	CLEANING CYCLE
		14	OVERLAY OUT OF SYNC	OVERLAY LAMP FAILED	OVERLAY NOT INSTALLED	OVERLAY STATION SWITCH	CHANGE FILTER	PRESSURE ROLLER JAM	STACKER FULL	WIPER MOTOR FAILURE
		15	(UNASSIGNED)					TEMPERATURE SENSOR FAILURE	HEATER FAILURE	MOTOR OVER-TEMPERATURE
	ADDITIONAL DEVICE (BTS)	16	(UNASSIGNED)				BTS OFF-LINE	BTS STOP	BTS STACKER FULL	BTS ABNORMAL
	FEATURES	17	(UNASSIGNED)	SPLICING STATION FEATURE	FORMS OVERLAY FEATURE	ADDITIONAL CHARACTER STORAGE MEMORY FEATURE	BURSTER TRIMMER STACKER FEATURE	(UNASSIGNED)		

4.3.2.11 Test 012

Test 012 verifies that the optional forms-overlay feature of the printer and the corresponding load-flash-number command are functioning properly. The user specifies the number of copies to be printed and the flash number.

Commands issued to the printer are the same as those for test 010 plus the load-flash-command.

The following user messages are displayed:

ENTER NUMBER OF COPIES (1-0377)

ENTER FLASH NUMBER (0-COPY NUMBER)

4.3.2.12 Test 013

Test 013 verifies that the load graphic-character-modification (GCM) command and the read graphic-character-generator (GCG) command are operating properly.

A character (□) with no EOC byte is loaded into character generator position 64. A second character (⌐) containing an EOC byte is loaded into character generator position 65. A line, containing the two character, is then printed. A third load GCM command is issued to move the character generator to position 64. The subsequent read GCG command reads 81 bytes from that position.

Error messages 01, 02, 05, and 07 are called by this test.

4.3.2.13 Test 014

Test 014 verifies that the following commands are functioning properly:

- Load page number
- Inhibit data check
- Allow data check
- Set inhibit status
- Rreset inhibit status
- Initialize printer

- Clear printer
- Clear input line buffer

Following execution of this test, the printer is in an initialized state. The printer tables must be loaded for printing.

Error messages 01, 02, 03, and 016 are called by this test.

4.3.2.14 Test 015

Test 015 verifies that the advance-print command is functioning properly. The user specifies the space value or skip code.

The following user message is displayed:

ENTER SPACE COUNT (0-017) OR SKIP CODE (020-037)

Error messages 01 and 02 are called by this test.

4.3.2.15 Test 016

Test 016 verifies that the advance-only command is functioning properly. The user specifies the space count or skip code.

This test uses the same user and error messages as test 015.

4.3.2.16 Test 017

Test 017 verifies that the print-advance command is functioning properly. The user specifies the space count or skip code.

This test uses the same user and error messages as test 015.

4.3.2.17 Test 020

Test 020 allows the user to select and load any translate table/character generator pair. The user enters the translate table/character generator to be loaded and the font that is to be read from the printer diskette.

The following user messages are displayed:

ENTER TRANSLATE TABLE/CHARACTER GENERATOR NUMBER (0-3)

ENTER FONT ID (0-016)

Error messages 01, 02, and 016 are called by this test.

4.3.2.18 Test 021

Test 021 generates a load-vertical-format-buffer command with variable lines/inch and skip codes specified. Subsequent print-advance, advance-print, or advance-only commands can be issued to validate the settings. The vertical format buffer is loaded with the following data:

Lines	LPI	Skip Code	Lines	LPI	Skip Code
1-4	8		34-36	12	
5	8	1	37	12	A
6-8	8		38	12	
9	6	2	39-40	6	
10-12	6		41	6	B
13	6	3	42-44	6	
14	6		45	8	D
15-16	12		46-48	8	
17	12	4	49	8	E
18-20	12		50-52	8	
21	12	5	53	12	F
22-24	12		54-56	12	
25	12	6	57-60	6	
26-28	12		61-64	8	
29	12	7	65	8	C
30-32	12		66-91	8	
33	12	8	92	8	9

Error messages 01 and 02 are called by this test.

4.3.2.19 Test 022

Test 022 verifies that the overprint logic of the printer is functioning properly. Five sequences of commands are generated and transmitted to the printer.

The first sequence verifies that a non-space, non-underscore character replaces a space character. An advance-print command is generated with a buffer of 132 space characters. This is followed by a print-advance command with the standard print buffer. These commands are followed by an end of transmission command and a no-op command.

The second sequence verifies that a space character does not replace any character. This sequence is identicial to the first sequence except that the standard print buffer is output first with an advance-print command. The space character buffer is output with a print-advance command.

The third and fourth sequences verify that an underscore and any other character are merged. Each sequence is identical to the first two sequences except that an underscore character buffer is used in place of the space character buffer.

The fifth sequence verifies that a non-space, non-underscore character does not replace a non-space, non-underscore character. A unit-check-error status is verified.

A print line resides in the print page buffer. The use of any other related test, that prints a page, also prints this line.

Error messages 01, 02, and 07 are called by this test.

4.3.2.20 Test 023

Test 023 verifies that the sense-error-log command is functioning properly. The command is transmitted to the printer. The error log is displayed on the operator console.

The following user message is displayed:

ERROR LOG DATA

Error messages 01 and 02 are called by this test.

4.3.2.21 Test 024

Test 024 verifies that the clear-error-log command is operating properly. The command, with a no-op command, is transmitted to the printer.

Error messages 01 and 02 are called by this test.

4.3.2.22 Test 025

Test 025 verifies that a generated load-character-generator command, when data is present in the page buffer, is rejected. A print-advance command, followed by the load-character-generator command, is transmitted to the printer.

Error messages 01 and 02 are called by this test.

4.3.2.23 Test 050

Test 050 verifies a no-op command with a completion status of 06000.

Error messages 01 and 02 are called by this test.

4.3.2.24 Test 051

Test 051 verifies a test-I/O command with a completion status of 000000.

Error messages 01 and 02 are called by this test.

4.3.2.25 Test 052

Test 052 verifies a sense (SEN) command with a completion status of 06000. This is the only test that uses the SEN instruction to validate channel completion. All other tests depend on an interrupt for channel completion.

Error messages 01 and 02 are called by this test.

4.3.2.26 Test 053

Test 053 verifies that a write-page-buffer command signals a completion status of 06000. The command transmits 254 bytes to the control unit. The first two bytes specify a page buffer address of 010000. A data pattern of 0101 is used.

Error messages 01 and 02 are called by this test.

4.3.2.27 Test 054

Test 054 verifies that a write-page-buffer command with a two-byte buffer address signals a completion status of 06000. A buffer address of 010000 is used.

Error messages 01 and 02 are called by this test.

4.3.2.28 Test 055

Test 055 verifies that the read-page-buffer command to the control unit is functioning properly. A total of 252 bytes in the page buffer are read and the output is verified. Test 053 and 054 must be performed prior to this test.

Error messages 01, 02, and 05 are called by this test.

4.3.2.29 Test 056

Test 056 verifies that command chaining is functioning properly. A write-page-buffer command of 254 bytes is generated. A data pattern of 01777 starting at page buffer location 011000 is used. The first command is chained to a second write-page-buffer command. Two bytes, containing the page buffer address 011000, are generated. The second command is chained to a read-page-buffer command.

The test verifies:

- A normal completion status
- The 252 data bytes match the output
- Correct byte transfer
- Correct channel program table pointer

Error messages 01, 02, 05, 06, and 07 are called by this test.

4.3.2.30 Test 057

Test 057 verifies that the chaining interrupt status and normal completion are functioning properly. The chaining-interrupt-control bit of the channel is set and an interrupt results.

A command chained sequence, identical to the test 056, is generated. The chaining-interrupt-control bit is set for the first write-page-buffer command. A data pattern of 0707, starting at location 010000, is loaded into the page buffer.

Error messages 01, 02, 05, 06, 07, and 010 are called by this test.

4.3.2.31 Test 060

Test 060 verifies that command chaining is broken and an interrupt is generated when an error (unit check) status is received from the control unit. The basic sequence of test 056 is used for this test. The byte count of the second write-page-buffer command is changed, from two to one, to cause the error status.

Error messages 01, 02, 07, and 011 are called by this test.

4.3.2.32 Test 061

Test 061 verifies that the halt-channel-program instruction is functioning properly. A chained command sequence similar to test 056 is used. However, after a delay of approximately 300 usec., a halt-channel-program instruction is transmitted to the channel. The resulting interrupt and channel status is validated.

Error messages 01 and 02 are called by this test.

4.3.2.33 Test 062

Test 062 verifies that the suspend- and continue-channel-program instructions are functioning properly. A sequence similar to test 061 is used. However, a suspend-channel-program instruction is generated after 300 usec. The resulting interrupt causes the continue-channel-program instruction to be generated. The next interrupt validates the successful completion of the sequence.

Error messages 01, 02, 05, 06, and 07 are called by this test.

4.3.2.34 Test 063

Test 063 verifies that the reset-channel-program instruction is functioning properly. A sequence similar to test 061 is used.

However, a reset-channel-program instruction is issued after 300 usec. The resulting interrupt and halt channel status is validated.

Error messages 01 and 02 are called by this program.

4.3.2.35 Test 064

Test 064 verifies that a command to a non-existent device is properly handled. A no-op command is transmitted to a non-existent control unit. An interrupt with a channel status of no-unit-response is verified as the correct response.

Error messages 01 and 02 are called by this program.

4.3.2.36 Test 065

Test 065 verifies that a buffer-size error occurs when a control unit has more bytes to send than the channel is set up for. A sequence similar to test 056 is used. However, the byte count for the read-page-buffer command is changed from 252 to 4. The resulting interrupt indicates a channel status of buffer-size-error and the received byte count is 4.

Error messages 01, 02, 06, and 07 are called by this test.

4.3.2.37 Test 066

Test 066 verifies that the use of an alternate channel program table (CPT) is functioning properly. The expected status is set to an incorrect value. The retry count is set to two. A no-op command, chained to an alternate CPT is sent to the control unit. The resulting interrupt is validated for a retry-count-exhausted channel status and the retry count set to zero.

Error messages 01, 02, 07, and 012 are called by this test.

4.3.2.38 Test 067

Test 067 is identical to test 066 except that the mask is set to an incorrect value.

Error messages 01, 07, and 012 are called by this test.

4.3.2.39 Test 070

Test 070 verifies that the match path of an alternate channel program table (CPT) is functioning properly. The correct mask and expected status are set with the match CPT set to point to the sense CPT. The resulting interrupt is validated for correct completion.

Error messages 01, 02, and 07 are called by this test.

4.3.2.40 Test 071

Test 071 verifies that data chaining on the output is functioning properly. Four levels of data chaining are established by utilizing a write-page-buffer command. The page buffer address (010000) and the data pattern (01777) are transmitted. Each level transmits the number of bytes as follows: 40, 100, 10, and 104. A read-page-buffer command is then command chained.

Error messages 01, 02, 05, 06, and 07 are called by this test.

4.3.2.41 Test 072

Test 072 verifies that the transfer-in-channel control bit setting is functioning properly. A sequence similar to test 056 is used. However, the TIC control bit is set for the read-page-buffer command. The resulting interrupt is validated for no data transferred to the input buffer. Data is sent to the page buffer but, on input, no data is placed in memory.

Error messages 01, 02, 05, 06, and 07 are called by this test.

4.3.2.42 Test 073

Test 073 verifies that a channel-control-table (CCT) error is generated when a CPT crosses a map boundary.

Error messages 01, and 02 are called by this test.

4.3.2.43 Test 074

Test 074 verifies that a CPT error is generated by chaining to a CPT crossing a map boundary.

Error messages 01, and 02 are called by this test.

4.3.2.44 Test 075

Test 075 verifies that data chaining on input is functioning properly. Four levels of chaining are established by utilizing a read-page-buffer command. A write-page-buffer command is command chained to the read-buffer-page command. The read-buffer-page command specifies a page buffer location (010000) and 126 words of a data pattern (0101). Each level inputs the number of bytes as follows: 40, 100, 10, and 102.

Error messages 01, 02, 05, and 07 are called by this test.

4.3.2.45 Test 0100

Test 0100 transmits the initialize-controller instructions to the channel. This results in a system clear signal to the control unit.

No error messages are called by this test.

4.3.2.46 Test 0101

Test 0101 causes program control to be transferred to the MAINTAIN III test executive.

No error messages are called by this test.

4.3.3 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded and operational before the diagnostic program can be loaded. Loading procedures for the test executive are outlined in Section 2.

Equipment to be used during the test must be on line.

4.3.3.1 Program Loading

The diagnostic program is normally loaded via commands entered in the operator console. The various tests are also executed via operator console commands.

Magnetic tape systems require the use of file numbers. The procedure for loading the test program is as follows:

1. The same tape that was used to load the test executive is used to load the diagnostic program.

2. Consult the current revision of the MAINTAIN III Software Release Description for the file number of the diagnostic program.

3. Position the tape to the required diagnostic program file by entering:

   FR,.

   on the operator console.

4. Load the diagnostic program, into memory, by entering:

   L,22.

   on the operator console.

4.3.3.2 Execution

The setting of the computer operator panel SENSE switches determines the execution modes of the test program. Settings can alter the test program as follows:

Sense Switch	Set Position	Reset Position
1	Suppress error message	Print error message
2*	Before error halt:	Before error halt:
	Halt on error	Do not halt on error
		Print error and continue
	After error halt:	After error halt:
	Continue testing	Loop on error

Sense Switch	Set Position	Reset Position
3	Terminate test and Return to test selection	Continue testing

*SENSE switch 2 can be used to continue the test following an error halt or to loop on the error:

a. To continue to the next error halt, leave the SENSE switch SET and depress the START switch on the computer.

b. To loop on the error, RESET the SENSE switch and depress the START switch on the computer control panel. Looping will continue until the switch is SET, the program then continues in the "halt on error" mode until the next error halt. If the error condition clears, looping continues until SENSE switch is set.

4.3.3.2.1 Program Identification. When the test program is loaded, execution begins. The following two messages are displayed:

```
SU39 CHANNEL (F3068) TEST

CCT IS LOCATED AT 0200
```

The messages serve to identify the diagnostic program and to give the location of the channel control table (CCT).

4.3.3.2.2 Initialization. Initialization consists of entering addresses. The addresses configure the diagnostic program to the particular system under test.

The channel device address is requested when the following message is displayed:

```
ENTER DEVICE ADDRESS = 7.
```

Enter 7 for the channel device address.

The PIM device address is requested when the following message is displayed:

ENTER PIM DEVICE ADDRESS = 40.

Enter 40 for the PIM device address.

The interrupt address is requested when the following message is displayed:

ENTER INTERRUPT ADDRESS = 100.

Enter 100 for the interrupt address.

The control unit (printer or tester) address is requested when the following message is displayed:

ENTER CONTROL UNIT NUMBER = 13.

Enter 13 for the control unit number.

After all of the required addresses have been entered, the initialization process is complete and the test selection phase is entered.

4.3.3.2.3 Test Selection. The test selection phase consists of selecting a test sequence and the number of test cycles.

The following operational guidelines must be observed:

- Several of the printer tests request an operator input of specified parameters. If an invalid parameter is entered, the sequence is aborted and the request is initiated again.
- When the Channel Tester (E4751B) is installed, tests 0, 01, and 0100 are required.
- Test 02 must be run at least once prior to running any test which causes forms advance or printing to occur. This test loads the printer tables and character generators. Perform this test prior to performing tests 03 through 05, 07, 010, 012, 013, 015 through 017, 022, and 025.
- Test 02 must be run after tests 20, 21, or 100 in order to restore the printer tables.

- Test 05 must be run after any test which results in a printout. The printer is a page printer and the test printouts are only a few lines. Thus, test 05 must be run in order to print the results.

Test 011 is used after a printer error. The test displays the sense data.

Test 014 is a series of subtests.

Test 021 loads the vertical format buffer (VFU) with each skip code that is to be used. Subsequent use of print and advance tests (015, 016, or 017) can be utilized to validate appropriate responses spacing or skipping. The same tests are also used to test error responses when spacing beyond codes 9 or C.

The test sequence is requested when the following message is displayed:

ENTER TEST NUMBER(S) = R.

Enter the test sequence. The test sequence can consist of one or more tests. If the test sequence consists of more than one test, each test-number entry is separated with a comma. The test selection sequence is terminated with a period.

Available tests are:

- Channel tests; test numbers 01 and 50 through 75
- Printer tests; test numbers 02 through 25.
- Special tests; test numbers 0, 0100, and 0101.

Test descriptions are contained in Section 4.3.2.

After the test sequence has been entered, the number of test cycles to be performed is requested.

The following message is displayed:

ENTER TEST NUMBER OF TEST CYCLES = R.

Enter the number of cycles that the test sequence is to be performed.

Use of a period or 0. in lieu of a specific number for the number of cycles results in a continuously running test. In order to abort the test cycle, set SS3.

4.3.3.2.4 Test Termination. At the end of the specified number of test cycles the following message is displayed:

```
TESTING COMPLETE.
```

The diagnostic program then loops back to the test selection phase (Section 4.3.3.2.3) and waits for further operator action.

The test sequence can be terminated by setting SS3. The following messages are displayed:

```
SENSE SWITCH 3 SET

TEST ABORTED

RESET SENSE SWITCH 3
```

When the operator resets SS3, the program loops back to the test selection phase. The program then waits for further operator action.

Following a test abort via SS3, use Test 0100 to reset and clear the channel interface and control unit.

The user can return control to the initialization phase by entering G500. Control is returned to the test selection phase by entering G600.

4.3.3.2.5 Program Examples. The following printouts are examples of program diagnostics in which no errors are encountered.

```
SU 39 CHANNEL (F3068) TEST
CCT IS LOCATED AT 0200
ENTER DEVICE ADDRESS = 7.
ENTER PIM DEVICE ADDRESS = 40.
ENTER INTERRUPT ADDRESS = 100.
ENTER CONTROL UNIT NUMBER = 13.
ENTER TEST NUMBER(S) = 100.
ENTER NUMBER OF TEST CYCLES = 1.
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 0.
ENTER NUMBER OF TEST CYCLES = 1.
TESTING COMPLETE.
```

```
ENTER TEST NUMBER(S) = 0.
ENTER NUMBER OF TEST CYCLES = 1.
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 100.
ENTER NUMBER OF TEST CYCLES = 1.
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 0.
ENTER NUMBER OF TEST CYCLES = 1.
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 1.
ENTER NUMBER OF TEST CYCLES = 1.
STEP PRINTER FROM STOP TO RUN MODE
HIT PERIOD WHEN DONE
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 2.
ENTER NUMBER OF TEST CYCLES = 1.
ENTER FONT ID (0-016) 1.
TESTING COMPLETE.


ENTER TEST NUMBER(S) = 4,4,4,4,4,5.
ENTER NUMBER OF TEST CYCLES = 7.
TESTING COMPLETE.
(Note:  This results in 7 pages printed; 5 lines per page.)
```

4.3.4 ERRORS

The failure of any test does not prevent completion of the test sequence.

When an error condition is detected by the program, an error message is displayed. The basic format of the error message is:

ER XX-YY NNNNNN { Failed Command and Channel Control Bits / or / MMMMMM }

where:

XX
Is the octal test number of the test that failed.

YY
Is the octal error number as follows:

- 01 Timeout on status interrupt
- 02 Invalid controller/channel status
- 03 Invalid polling unit status
- 04 Invalid polling unit numbers
- 05 Mismatch between output and input data
- 06 Incorrect input byte transfer count
- 07 Incorrect current CPT pointer
- 010 Timeout after chaining interrupt
- 011 Invalid data length
- 012 Invalid ACPT retry count
- 013 Command was not rejected
- 014 Channel memory error
- 015 Channel memory parity error
- 016 Invalid sense data

NNNNNN
Is the octal value of the last received channel/control unit status word. For further explanation, see text that follows:

MMMMMM

Is the octal value of the failed CPT.

FAILED COMMAND AND CHANNEL CONTROL BITS

Are the English text command that failed the test, and the associated channel control bits.

The channel/control unit status word (NNNNNN) consists of two bytes:

- left byte which contains the printer status word, and
- right byte which contains the channel interface status word.

One or more bits can be set to make up the printer status word. Bits 8 through 15 (left byte), when set, have the following meanings:

Bit	Definition
8	Unit exception
9	Unit check
10	Device end
11	Channel end
12	Busy
13	Control unit end
14	Status modifier
15	Attention

An octal value is used to make up the channel interface status word. Bits 0 through 7 (right byte) combine to form an octal value with the following meanings:

Value	Definition
00	Normal completion
01	Halt channel

Value	Definition
02	Suspend function
03	Check control unit status
04	Chaining interrupt
05	No unit response
06	Control unit timed out
07	Retry count exhausted
10	Control unit requested service
11	Parity error detected
12	Buffer size error
13	Control unit issued disconnect
14	CPT error detected
15	CCT error detected
16	Control unit terminated write

If the program can identify the command in error, the command name and associated channel control bits from the failed channel program table (CPT) are displayed. Certain valid commands have various bit configurations. The program is designed to identify only one configuration. The recognized control bits are:

Bit	Definition
AL	Alternate CPT format enabled
CC	Command chaining enabled
CI	Chaining interrupt enabled
DC	Data chaining enabled
TC	Disable memory data transfer on input
TH	Thread CPT

If the command cannot be identified, MMMMMM is generated, this word contains the command and associated channel control bits of word 0 of the failed CPT. Detailed information is contained in UP-9079.

The following printout is an example of a program diagnostic in which errors are encountered.

On the ER70 message, the program does not identify the command in error. Word 0 of the failed CPT is printed.

```
SU 39 CHANNEL (F3068)
CCT IS LOCATED AT 0200
ENTER DEVICE ADDRESS = 7.
ENTER PIM DEVICE ADDRESS = 40.
ENTER INTERRUPT ADDRESS = 100.
ENTER CONTROL UNIT NUMBER 13.
ENTER TEST NUMBER(S) = 0.
ENTER NUMBER OF TEST CYCLES = 1.


ER50-02 000005 NOP
ER51-02 000005 000000
ER52-02 000005 SENSE
ER53-02 000005 WRITE PAGE BUFFER
ER54-02 000005 WRITE PAGE BUFFER
ER55-02 000005 READ PAGE BUFFER
ER55-02 000005 WRITE PAGE BUFFER CC TH
ER57-02 000005 WRITE PAGE BUFFER CC CI TH
ER60-02 000005 WRITE PAGE BUFFER CC TH
ER62-02 000005 WRITE PAGE BUFFER CC TH
ER65-02 000005 WRITE PAGE BUFFER CC TH
ER70-02 000005 100240
ER71-02 000005 WRITE PAGE BUFFER CC TH
ER72-06 000005 WRITE PAGE BUFFER CC TH
ER75-02 000005 WRITE PAGE BUFFER CC TH


TESTING COMPLETE.
```

Section 5
PAPER TAPE EQUIPMENT

5.1 GENERAL

This section describes the MAINTAIN III test program for V77 paper tape systems.

5.2 PAPER TAPE SYSTEM TEST: TAPE READER (F3082), TAPE PUNCH (F3083), TAPE READER (F3084), BIC (F3024)

The paper tape system and BIC test determines the correct operation of the high-speed paper tape system and buffer interlace controller (BIC). The paper tape punch and paper tape reader can be tested with the same controller or with separate controllers. The test program tests the punch, step-read and continuous-read modes of the paper tape system using the data set last used or a new data set. The BIC is tested in a special BIC subtest but can also be utilized during the punch and continuous read tests. The BIC reads data directly into memory. The PIM alarms memory when data is ready to be processed. The paper tape and BIC test program is available as an object paper tape, magnetic tape file, card deck, or as a disk object file.

The test program allows the user to indicate whether he wishes to test the BIC or the paper tape system. If he desires to test the paper tape system, he may do the following.

- Test the punch process in the sense, PIM or BIC mode.
- Test the step-read process in the sense or PIM mode.
- Test the continuous-read process in the sense, PIM or BIC mode.

The BIC can be tested with or without a BIC-through interrupt. All device addresses, trap locations, and interrupt masks are input by the user. Data patterns are set by the user in the paper tape section of the test. The BIC section of the test checks all critical address ranges for the initial and final BIC registers.

5.2.1 RELATED PUBLICATIONS

The paper tape system is described in the Ex-Cell-O Technical Manual, Tape Reader/Perforator System, Models RAB6375BDX and RAF6375BDX (Ex-Cell-O document number 112670-059E). The paper tape system controller is described in Sperry Univac Engineering Description 98A1091.

5.2.2 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 5-1 lists the sense switch settings.

Table 5-1. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Errors are counted and the program continues
3	Program returns to start of test	Program continues testing

5.2.3 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the paper tape test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in subsection 1.5. When the test program is loaded, automatic transfer to the start of the program takes place (address 0500). If an error is made in the input of command data, a backslash ( ) results in the command being repeated.

5.2.3.1 BIC and PIM Specifications

This section lists the instructions for defining BIC or PIM utilization.

The program prints the following:

```
620 PAPER TAPE AND BIC TEST
PT PUNCH DA=
```

The user inputs the octal device address of the paper tape punch followed by a period or comma. Octal device addresses are found in the systems memo.

The program then prints:

```
PT READER DA=
```

The user then enters the octal device address of the high-speed paper tape reader followed by a period or comma.

The program then prints:

```
BIC TEST REQUESTED?
```

The user then responds with a Y or an N for yes or no (no period or comma is input). If Y is input, see subsection 5.2.3.3. If N is input, the test types:

```
BIC USED?
```

The user then responds with a Y or an N (no period or comma is input). If the answer was Y, the test types:

```
BIC DA=
```

The user then inputs the octal device address of the BIC followed by a period or comma. The test then continues at subsection 5.2.3.2.

If the answer was N to BIC USED?, the test types:

```
PIM USED?
```

The user then responds with a Y or an N (no period or comma is input).

If the answer was N, the test continues at subsection 5.2.3.2. If the answer was Y, the test types:

```
PIM DA=
```

The user then inputs the octal device address of the PIM followed by a period or comma.

The test then types:

TRAP LOCATION=

The user then inputs the octal address of the trap branch for the interrupt line being used followed by a period or comma.

The test then types:

INTERRUPT MASK=

The user then inputs the interrupt mask which masks out all interrupts but the one being used followed by a period or comma. The PIM DA, TRAP LOCATION and INTERRUPT MASK are found in the systems memo.

5.2.3.2 PIM Not Used

If the PIM is not used, the following input information is requested:

INPUT TEST TYPE

The user then inputs 'P', 'R', or 'H' for punch, step-read, or continuous-read. If the user desires to use the data set last used (or on the first pass, the assembler default), he then inputs a period (.). Otherwise, he inputs a comma (,), and the test types:

INPUT LOWER LIMIT, UPPER DATA LIMIT, AND DATA BLOCK SIZE

The user then inputs 3 corresponding octal values, each followed by a comma or period. When using the BIC to input or output data, a maximum of 0400 is allowed for the data block size parameter because of the provided buffer length.

The test then types:

CYCLES

The user then inputs the number of cycles in octal or 0 for continuous, followed by a period or comma. If the R parameter was entered for the test type, the test types:

TIME DELAY=

The user then inputs a positive number which produces a time delay of thirteen times that number times the processor cycle time. This delay is executed prior to executing the step-read command after the buffer ready is sensed. If the user inputs a negative number, a random number generator is invoked to give successive random wait periods to be executed. The value input must be followed by a period or comma.

The test is now performed according to the input parameters. An error condition produces a descriptive message as given in subsection 5.2.4. When the test is done, the following is printed:

BIC TEST REQUESTED?

The process is then restarted. If sense switch 3 is set or the test restarted at 0500, the device addresses, trap locations, and interrupt masks will have to be input once again. If sense switch 3 is not set or the program is not restarted at 0500, the device addresses, trap locations, and interrupt masks do not have to be reinitialized.

5.2.3.3 BIC Test

If Y is entered to BIC TEST REQUESTED?, the user places the test tape (92110107-045A) in the reader positioned any place on the initial blank leader. The test types the following:

BIC DA=

The user then types the BIC device address in octal, followed by a period or comma.

The test then types:

PIM USED?

The user responds through the input of a Y or N (no period or comma is input). If N is input, the input parameters are skipped. If Y is input, the test types:

PIM DA=

The user then inputs the octal value of the PIM device address followed by a period or a comma. The test then types:

TRAP LOCATION=

The user then inputs the address for the trap branch for the interrupt line to be used. This is followed by a period or a comma.

The test then types:

INTERRUPT MASK=

The user then inputs the interrupt mask which masks out the interrupt lines not used, followed by a period or comma. The PIM DA, TRAP LOCATION, and INTERRUPT MASK, are found in the systems memo.

The test then types:

CYCLES=

The user then inputs the number of cycles in octal or 0 for continuous followed by a period or comma.

The BIC test is then performed. Error messages are tabulated in subsection 5.2.4. When the test is through, the test types:

BIC TEST REQUESTED?

The process is then restarted, with the difference that device addresses, trap locations, and interrupt masks are input only once, unless sense switch 3 is set or the test is restarted at 0500.

5.2.4 ERROR MESSAGES

Table 5-1 is a listing of the paper tape system and BIC test error messages.

Table 5-2. Error Messages

Message	Significance
Buffer Ready Time-Out	During or prior to output of data, buffer ready stayed off.
BIC Busy Time-Out	BIC did not finish data transmission to Paper Tape System.
BIC Abnormal Stop	BIC abnormal stop after initialization for data transfer to Paper Tape System.
BIC-Through Interrupt when BIC Busy	BIC reported via PIM that it is finished but BIC is still busy.
No BIC-Through Interrupt	BIC finished but data never came through PIM.
SECTION EXPECTED ACTUAL X AAAAAA YYYYYY	Error data referencing section of BIC chip.
CHIP EXPECTED ACTUAL XXXXXX AAAAAA YYYYYY	Error data referencing BIC chip.

6.1 GENERAL

This section describes the MAINTAIN III test programs for V77 Magnetic Tape Systems.

6.2 TEST PROGRAM FOR F3093 AND 0870 MAGNETIC TAPE UNITS

The magnetic tape test program is utilized with V77 series computers and designed to operate with the MAINTAIN III test executive program. The test program tests the magnetic tape controller and its associated tape drive units and reports any errors. The test program may be used on any of the product tape systems (70-7104/05/06/07). The test program consists of the initialization routine and the test routines. The initialization routine allows the user to enter run-time parameters describing the system to be tested. The user can select the appropriate subtest he wishes to run by entering the appropriate commands through the teletypewriter.

The initialization routine allows the user to specify the magnetic tape control unit and the BIC device addresses. The occurrence of motion and data transfer complete events is determined in either the sense or interrupt mode. If the occurrence of these events is to be determined in the interrupt mode, the interrupt mask, trap location and device address for the priority interrupt module (PIM) associated with the interrupts is specified. The magnetic tape control unit may control up to four tape drive units and the test program will test up to four identical drives.

6.2.1 RELATED PUBLICATIONS

The F3093 and 0870 Magnetic Tape is described in the MOD 12 PE only or MOD12 PE/NRZI Auto-Load Tape Unit Operation and Maintenance Manual (WANGCO document number 202056-001).

6.2.2 DESCRIPTION OF TEST COMPONENTS

The magnetic tape test program consists of the following 12 components (subtests):

- Write Test
- Read Test
- Echo Test
- Motion Test
- Growing Record Test
- Compatibility Test
- Data Transfer Test
- Multiple Unit Test
- Random Function Test
- Burn-In Test
- Debugging Tools
- Reinitialize

This section identifies and describes the test components (subtests) that are used in the test. Refer to subsection 6.2.4.3 for command definitions of the various tests.

6.2.2.1 Write Test

The Write Test will write a block of data of a given length and data patterns onto the specified unit. When the operation is complete, the device status is checked against the status mask. Any bits set that are masked on will result in an error printout. If the continuous mode is specified, the operation will be repeatedly executed. If the mode is not continuous, control is returned to the test monitor.

6.2.2.2 Read Test

The Read Test will read a block of data. When the operation is complete, the device status is checked. The block of data read is compared against the contents of the write buffer and any differences noted.

6.2.2.3 Echo Test

The Echo Test will write a block of data and backspace over the data just written. The data is then read and verified. The device status is checked at the completion of both the write and the read operations. The test is essentially a combination of the write and read tests.

6.2.2.4 Motion Test

The Motion Test will rewind the selected unit, write a file mark, rewind, read, and check the status for a filemark detect. The test also checks for drive creep from load point and for gap erasure by writing and backspacing repeatedly.

6.2.2.5 Growing Record Test

The Growing Record Test writes the record counts followed by known data in a growing record on the tape until the tape is completely written. The test then rewinds the tape, reads each record, and verifies the data.

6.2.2.6 Compatibility Test

This test is essentially the read portion of the growing record test and provides a means of checking the interchangeability of tapes among units. The growing record test must be run on one tape, the tape moved to another unit and the compatibility test run on the second unit to verify the data could be recovered.

6.2.2.7 Data Transfer Test

During one execution of the test, it will make five hundred and twelve passes of the following operations: the writing of a block of random data length, the backspacing over and reading the

data record, then verification of the block of data. Any errors are noted.

6.2.2.8 Multiple Unit Test

The Multiple Unit Test verifies that concurrent tape drive operations can be performed. While the program is transferring data on one tape drive unit, the other units will be backspacing, rewinding or idle. The test makes five hundred and twelve write/read/verify passes each time it is selected.

6.2.2.9 Random Function Test

The test will write five hundred and twelve records randomly on a tape. The records will be either filemark, short block data, or long block data. The test then reads these records and validates the data.

6.2.2.10 Burn-In Test

During one execution of the test, it will make five hundred and twelve passes of the following operations: the writing of a block of random data of random size, backspacing over the block, and the reading and verification of the block with up to 5 errors listed.

NOTE

In the above tests, status errors that occur on data transfer operations or any data compare errors will cause the record to be reread and possibly rewritten based on the retry parameters.

6.2.2.11 Debugging Tools

The debugging tools will perform the indicated function without checking the status response. The end or the beginning of the tape will terminate continuous operations.

6.2.2.12 Reinitializing

The reinitializing command is used to reenter the initialization section of the program to correct or change parameters.

6.2.3 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 6-1 lists the sense switch settings.

Table 6-1. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Program will not halt on an error
3	Program will terminate test	Program will continue test

6.2.4 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the magnetic tape test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in subsection 1.5. When the test program is loaded, automatic transfer to the start of the program takes place (address 0500). If an error is made in the input of command data, a backslash ( ) cancels that command.

6.2.4.1 Initialization Dialogue

This initialization dialogue is used to configure the magnetic tape system for the test. The initialization dialogue begins with the program typing the following:

```
MAGNETIC TAPE TEST
CONTROLLER TYPE
```

The user responds with a 1. for a type 0870 system or a 0. for a type F3093 system. The program then types:

UNIT TYPE

The user responds with a 0. to denote a non-phase encoded drive (or one selected to non-phase encoded), or 1. for a phase encoded drive. The program then types:

TAPE CONTROLLER DA

The response is an octal number, found in the sytems memo. THe program then types:

BIC DA

The response is an octal number, found in the systems memo. The program then types:

INTERRUPTS? (Y/N)

If interrupts are to be used, the user responds with a Y. If interrupts are not going to be used, the user responds with an N. The program then types:

TRANSFER COMPLETE TRAP INFORMATION

The user defines the transfer complete interrupt with the systems memo. That includes the PIM device address, the interrupt location and the PIM mask to be used. The program then types:

MOTION COMPLETE TRAP INFORMATION

The user then responds with the information about the motion complete interrupt which is found in the systems memo. The program then types:

READ RETRY COUNT

The user responds with an octal value followed by a period. When all read retrys have been attempted, a write retry is performed. The program then types:

WRITE RETRY COUNT

The user responds with an octal value followed by a period. The initialization dialogue may be restarted by toggling sense switch 3. The test then types:

**

This is a notice to the user from the test monitor that it is awaiting a command string, identifying the test to be run.

Some of the fields of the command string are validated, while others are not checked so that error conditions may be produced. If, in the fields that are checked, an invalid parameter is specified, the program will print a question mark (?), carriage return, line feed, and prompt. The entire line must be reentered correcting the invalid parameter. Each command string is terminated by a period.

6.2.4.2 Command String Parameters and Status Mask Definition

The following is an explanation of the command string parameters and status mask.

unit = address of the tape drive unit ($1 \leq$ unit ≤ 4).

length = size of the data block in words (decimal field).

status mask = status mask word (in octal).

This mask specifies which bits are examined when the status word is checked. pattern = (octal field) denotes that this fixed pattern will be used for all data transfers. If omitted, random data patterns will be used.

C= if entered, the test will be run continuously until terminated by sense switch 3. If omitted, the test will be run one time.

The status mask is constructed from the following:

BIT 15 - RATE ERROR
BIT 14 - LRC ERROR (NRZI) OR MULTIPLE DEAD TRACKS (PE)
BIT 13 - DEAD TRACK ERROR
BIT 12 - FORMATTER FATAL ERROR
BIT 11 - FALSE POSTAMBLE ERROR (PE) OR CRC ERROR (NRZI)
BUT 10 - CHARACTER PARITY ERROR
BIT 9 - HIGH DENSITY

BIT 8 - SPARE
BIT 7 - REWINDING
BIT 6 - BOT
BIT 5 - EOT
BIT 4 - ODD LENGTH
BIT 3 - FILE MARK
BIT 2 - TRANSPORT NOT READY
BIT 1 - WRITE ENABLE
BIT 0 - TAPE ERROR

6.2.4.3 Command Definitions and Examples

This section provides definitions of the command strings along with examples of command usage. The operator enters the entire command string beginning with the identifying letter and ending with a period.

6.2.4.3.1 Write Test Command The write command format consists of the following:

W unit, length, status mask [,[pattern],[C]].

Examples of the use of the write format are the following:

W3,120,2040,,C.

A 120-word block of random data will be continuously written on unit 3. In the status word the error bits parity error and end of tape will be checked. If either of those bits is set, an error condition will occur.

W2,64,176043,125252

A 64-word block of data of the fixed pattern 125252 will be written on unit 2. With the F3093, error bits (see status mask), end of tape and write enable will be checked. In this example an error printout will occur on F3093 units because the write enable will be true if a write ring is installed.

6.2.4.3.2 Read Test Command The read command format consists of the following:

R unit, length, status mask [,[pattern],[C]].

Examples of the use of the read format are the following:

```
R4,240,2040,0,C.
```

A 240-word block will be continuously read from unit 4. The block of data read will be compared against a block of zeros, which will be inserted in the write buffer.

```
R1,26,2040.
```

A single block of 26 words will be read from unit 1. The block of data will be compared against the current contents of the write buffer.

6.2.4.3.3 Echo Test Command The echo command format consists of the following:

```
E unit, length, status mask [,[pattern],[C]].
```

An example of the use of the echo test is the following:

```
E3,128,2040,,C.
```

A 128-word block of random data is written on unit 3. The data is then read and verified. The test is run continuously. The random block of data is only generated once.

6.2.4.3.4 Motion Test Command The motion test command format consists of the following:

```
T unit[,C].
```

Examples of the use of the motion test are the following:

```
T 1.
```

The motion test will run one pass on unit 1.

```
T 2,C.
```

The motion test will run continuously on unit 2, rewinding at the end of each pass.

6.2.4.3.5 Growing Record Test Command The growing record test command format consists of the following:

```
G unit[,C].
```

An example of the use of the growing record test is the following:

```
G 1.
```

The growing record test will run one pass on unit 1.

6.2.4.3.6 Compatibility Test Command The compatibility test command format consists of the following:

```
C unit[,C].
```

An example of the use of the compatibility test is the following:

```
C 3,C.
```

The compatibility test is run continuously on unit 3.

6.2.4.3.7 Data Transfer Test Command The data transfer test command format consists of the following:

```
D unit[,C].
```

An example of the use of the data transfer test is the following:

```
D 4,C
```

The data transfer test is run continuously on unit 4. End of tape will cause the unit to be rewound, and the test will continue.

6.2.4.3.8 Multiple Unit Test Command The multiple unit test command format consists of the following:

```
M unit [,unit][,unit][,C].
```

An example of the use of the multiple unit test is the following:

```
M 2,4.
```

The test will be executed one time (512 passes) on units 2 and 4.

6.2.4.3.9 Random Function Test Command The random function test consists of the following:

```
F unit[,C].
```

An example of the use of the random function test is the following:

```
F 1,C.
```

The random function test will run continuously on unit 1.

6.2.4.3.10 Burn-In Test Command The burn-in test command format consists of the following:

```
B unit[,unit][,unit][,unit].
```

An example of the use of the burn-in test is the following:

```
B 3.
```

The burn-in test is run continuously on unit 3.

NOTE

In the preceding magnetic tape unit tests, status errors that occur on data transfer operations as any data compare errors will cause the record to be reread and possibly rewritten based on the retry parameters.

6.2.4.3.11 Debugging Tools Command The debugging tools command format consists of the following:

```
P unit.
```

The debug commands, input after the operator inputs the command format parameters, are listed in Table 6-2.

Table 6-2. Debug Commands

L = rewind [C]B = backspace [C]F = write filemark [C]G = forward one record [C]R = read [C]W = write (120 words) X = exit [C] prefacing a command means continuous.

An example of the use of the debug mode is the following:

```
P 1.

# #
```

The debug mode for unit 1 is entered. The debug prompt is # #.

6.2.4.3.12 Reinitializing Command The reinitializing command format consists of the following:

```
I
```

An example of the use of the reinitializing command is the following:

```
I
```

The program reenters the initialization section.

6.2.5 PROGRAM EXAMPLE

```
THIS IS THE 73/620 MAGNETIC TAPE TEST
UNIT TYPE=
        MAGNETIC TAPE TEST

CONTROLLER TYPE  1.
UNIT TYPE 1.
TAPE CONTROLLER  DA 10.
BIC  DA 20.
INTERRUPTS? (Y/N)    N
READ RETRY COUNT  1.
WRITE RETRY COUNT 1.
**W 1,10,0,177777.
```

```
**L 1.

**R 1,10,0,166666.
DATA COMPARE ERROR  001 001002 0010 RB
 HIGH DENSITY
 WRITE ENABLE
       READ           WRITE
047777 177777 020000 166666
050000 177777 020001 166666
050001 177777 020002 166666
050002 17777 7 020003 166666
050003 177777 020004 166666
050004 177777 020005 166666
050005 177777 020006 166666
050006 17777 7 020007 166666
050007 177777 020010 166666
050010 17777 7 020011 166666

**L 1.

**W 1,10,0,166666.

**L 1.

**R 1,10,0,177777.
DATA COMPARE ERROR  001 000002 0010 RB
 WRITE ENABLE
       READ           WRITE
047777 166666 020000 177777
050000 166666 020001 177777
050001 166666 020002 177777
050002 166666 020003 177777
050003 166666 020004 177777
050004 166666 020005 177777
050005 166666 020006 177777
050006 166666 020007 177777
050007 166666 020010 177777
050010 166666 020011 177777

**G 1.

**F 1.

**B 1.

G500.
**L 1.
```

```
**T 1.
WRITE FILEMARK ERROR  001 000012 0000 WF
 FILE MARK
 WRITE ENABLE

**T 1,C.
WRITE FILEMARK ERROR  001 000012 0000 WF
 FILE MARK
 WRITE ENABLE

**E 1,128,2040.

**T 1,,?
**T 1,C,?
**T 1,C.
WRITE FILEMARK ERROR  001 000012 0000 WF
 FILE MARK
 WRITE ENABLE

**D 1.

**
  ?
**
  ?
**
```

6.2.6 ERROR MESSAGES

END OF TAPE uuu ssssss ff

An end of tape indication has been detected. The unit is rewound and the test continues.

TIMEOUT uuu 111111 ff

A timeout of operation ff has occurred at location 111111.

STATUS ERROR uuu ssssss rrrr ff

A status error has occurred. The test continues.

DATA COMPARE ERROR uuu ssssss rrrr ff

A data compare error has occurred. This typeout is followed by the data written and the data read. The test continues.

aaaaaa bbbbbb cccccc dddddd

This is the typeout of the data compare error.

WRITE FILEMARK ERROR uuu ssssss ff

This error is from the T test; it indicates that an error occurred during a write filemark command.

REWINDING ERROR uuu ssssss ff

This error indicates either the unit showed loadpoint immediately after a REWIND command or failed to show load point after rewinding.

LOAD POINT ERROR uuu ssssss ff

This error indicates the unit moved off of load point after a delay.

READ FILEMARK ERROR uuu ssssss ff

This error indicates that a read of a known filemark did not give the proper status response.

PROBABLE READ ERROR

This error message occurs when a reread has brought in valid data.

PROBABLE WRITE ERROR

This error message occurs when a rewrite and read has brought in valid data.

PROBABLE BAD SPOT

This error message occurs when all retrys of write and read have been exhausted and valid data has not been brought in.

POWER FAILURE DETECTED

This message occurs after a power failure and power is restored.

where:

aaaaaa
: Is read location.

bbbbbb
: Is read data.

cccccc
: Is write location.

dddddd
: Is write data.

ff
: Is function performed.

llllll
: Is location where timeout occurred.

ssssss
: Is latest status.

uuu
: Is unit number.

The following messages are output as an aid in decoding the status response.

```
RATE ERROR
LRC ERROR
MULTIPLE DEAD TRACKS
DEAD TRACK ERROR
FORMATTER FATAL ERROR
CRC ERROR
FALSE POSTAMBLE ERROR
CHARACTER PARITY ERROR
HIGH DENSITY
REWIND
BOT
EOT
ODD LENGTH
FILE MARK
TRANSPORT NOT READY
WRITE ENABLE
TAPE ERROR
```

7.1 GENERAL

This section describes the MAINTAIN III test programs for V77 disk memory systems.

7.2 3094 AND 3096 MOVING HEAD DISK TEST

The moving head disk test program tests the disk controller and its associated disk storage units and reports any errors. The test programs consists of a series of subtests. The subtests provide a means of comprehensively testing the disk system and provide an aid in isolating known faults. The user can select the subtests which he desires to perform by entering the appropriate commands through a cathode ray tube or teletypewriter. Prior to testing, an initialization dialogue enables the program to modify itself to conform to most system configurations.

The disk control unit may control up to four disk storage units. In the multiple unit test, the test program provides concurrent testing of up to four units.

The 3094 and 3096 moving head disk test program is available as an object paper tape, magnetic tape file, or card deck.

7.2.1 RELATED PUBLICATIONS

The 3094 and 3096 Moving Head Disk is described in the Control Data Cartridge Disk Drive Manual, Model 9427H (Magnetic Peripherals document number 77834675). The description for the controller is in Sperry Univac Engineering Description 98A 1150.

7.2.2 DESCRIPTION OF TEST COMPONENTS

The 3094 and 3096 moving head disk test program consists of the following eleven subtests:

- Write Test
- Real Test
- Echo Test
- Seek Test
- Unique Address Test
- Compatability Test
- Data Transfer Test
- Multiple Unit Test
- Sense/Status Test
- Burn-In Test
- Format
- Reinitialize

This section identifies and describes the test components (subtests) that are used in the test. Refer to Section 7.2.4.3 for command definitions of the various tests.

7.2.2.1 Write Test

The write test allows the user to write a block of data of specified length, at a specified sector, on the specified disk storage unit. When the operation is complete, the device status is checked. The user also specifies whether a fixed or random data pattern is to be used. If the continuous mode is specified, the operation will be executed repeatedly. If the continuous mode is not specified, control is returned to the test monitor.

7.2.2.2 Read Test

The read test allows the user to read and verify a block of data of specified length, at a specified sector, on the specified disk storage unit. The user may also specify which status bits are to be checked.

7.2.2.3 Echo Test

The echo test will write a block of data beginning at the specified sector. The data is then read and verified. The device status is checked at the completion of both the write and read operations. The test is essentially a combination of the write and read tests.

7.2.2.4 Seek Test

The seek test will seek to track 0 via the recalibrate, then to the specified track on the designated unit. The device status will be checked at the completion of each seek.

7.2.2.5 Unique Address Test

The unique address test writes a one sector block of data in each sector on the specified unit. The first word of the block contains the track address, the second word contains the sector address and the remainder a random data pattern. After the entire disk storage unit has been written, each sector is read and the track address, sector address and random data verified. Any errors are noted. The writing and reading of sectors is interfaced to reduce the execution time of the test.

7.2.2.6 Compatability Test

The compatability test is essentially the read portion of the Unique Address test and provides a means of checking the interchangeability of packs among units. The unique address test must be run on one unit, the disk pack moved to a second unit and the compatability test run on the second unit to verify that the data could be recovered.

7.2.2.7 Data Transfer Test

The data transfer test seeks to a random track on the specified disk storage unit and writes a block of random data, of random length, at a random sector address. The test then reads and verifies the block, reporting any errors. The test makes five hundred and twelve seek/write/read passes each time it is selected. If the unique address test has been run immediately prior to this test, the track address will be verified during the data transfer test. When moving from one unit to another in testing, always execute a unique address test on the new unit prior to running the data transfer test.

7.2.2.8 Multiple Unit Test

The multiple unit test may be used to test concurrent operation of two disk drive units on the model number 7603 system but not two disks on the same drive unit. This test verifies that concurrent disk operations can be performed. While the program is transferring data on one disk storage unit, the other units will be seeking or will be idle, having completed a previous seek. The test uses random track and sector addresses, and a fixed data pattern. The test makes five hundred and twelve write/read/verify passes each time it is selected.

7.2.2.9 Sense/Status Test

The sense/status test performs a series of disk operations on the specified disk, producing those error conditions that can be programmably generated, and verifying that the error conditions are correctly reported. It also verifies that the sense conditions and the equivalent status bits agree.

7.2.2.10 Burn-In Test

The burn-in test seeks to a random track on the specified disk storage unit and writes a block of random data, of random length, at a random sector address. The test then reads and verifies the block, reporting up to five errors per pass. The test makes five hundred and twelve seek/write/read passes each time it is selected. If the unique address test has been run immediately prior to this test, the track address will be verified during the burn-in test.

7.2.2.11 Format

The format command will select the unit to format starting at cylinder 0, sector 0. At the end of this operation the complete platter will be formatted.

7.2.2.12 Reinitializing

The reinitializing command re-enters the initialization section of the program to enable the correction of parameters.

7.2.3 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 7-1 lists the sense switch settings.

Table 7-1. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Program will not halt on an error
3	Program will terminate test	Program will continue test

7.2.4 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the moving head disk test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in Section 1.5. When the test program is loaded, automatic transfer to the start of the program takes place (address 0500). If an error is made in the input of command data, a back slash (\ ) results in the command being repeated.

7.2.4.1 Initialization Dialogue

This initialization dialogue is used to configure the 3094 and 3096 moving head disk for the test. The initialization dialogue begins with the program typing the following:

```
        MOVING HEAD DISK TEST
DISK CONTROLLER
```

The user enters the disk controller device address found in the systems memo. The program then types:

```
DISK SIZE (IN MB)
```

The operator responds with a number which represents the disk size in mega bytes (5, 10, or 20). The program then types:

```
BIC
```

The user enters the buffer interlace controller device address found in the system memo. The program then types:

INTERRUPTS? (Y/N)

The user responds as to whether he wants the program run in the interrupt or sense mode. If the sense mode is to be used, the user would have responded with a N and the initialization would then be complete. If a Y is typed, indicating the interrupt mode was to be used, the program would type:

TRANSFER COMPLETE TRAP INFORMATION

The user then enters the device address of the priority interrupt module associated with the disk transfer complete interrupt, the address of the trap location associated with the transfer complete interrupt, (this interrupt may be generated by the BIC complete signal or the controller ready signal), and the PIM mask. The program then types:

BIC COMPLETE USED? (Y/N)

An N response to this prompt would indicate that controller ready rather than the BIC complete signal was used. The program then types:

SEEK COMPLETE TRAP INFORMATION

The user then enters the parameters of the trap location associated with the seek complete interrupts for disk unit 0. The program then types:

SEEK COMPLETE TRAP INFORMATION

The user then enters the parameters of the trap location associated with the seek complete interrupts for disk unit 1. The program then types:

FORMAT ERROR TRAP INFORMATION

The user then enters the parameters of the formatter error interrupt which are found in the systems memo. The program then types:

READ RETRY COUNT

The user responds with an octal value followed by a period. The program then types:

WRITE RETRY COUNT

The user responds with an octal value followed by a period. The initialization dialogue may be restarted by toggling sense switch 3 at any point where input is requested, Before running any test on a unit, the unit must have a pack mounted, and the START/STOP switch must be in the IN position. (When the unit is in the ready condition, the READY light will be illuminated.)

7.2.4.2 Definition of The Command String

The following discussion defines the parameters of the command string and the status word.

The test monitor enables the user to input a command string. The command string selects a particular test for execution and provides a parameter list to be associated with the test. The test monitor prints an asterisk to notify the user that it is awaiting input. The first character of the command string identifies the test to be executed. Some of the fields of the command string are validated and other fields are not checked, therefore, error conditions may be produced. An example of this would be issuing a seek to an illegal track address. If, an invalid parameter is specified in the fields that are checked, the program will print a question mark, carriage return, line feed, asterisk and wait for a new command string to be entered. Each command string is terminated by a period. The following is a list of the parameters used in the command string and their meaning:

- unit - address of the disk storage unit or pack [0≤unit≤7]
- track - track address (decimal field)
- sector - sector address (decimal field)
- length - size of the data block in words (decimal field) [1≤length≤570]
- status mask - status mask word (in octal) specifies which status bits are to be examined when the status word is checked.
- pattern - (octal field) denotes this fixed pattern will be used on data transfers. If omitted, random data patterns will be used.
- C - If entered, the test will be run continuously until terminated by sense switch 3. If C is omitted, the test will be run one time.

The status word is provided by the disk controller in response to the program request for status. The status word, with the exception of the seek complete bits, pertains to the disk currently selected. The status word in the command string specifies which bits are to be included when the status is checked. The meaning of the bits in the status word is defined in the following list. Comments in parenthesis refer to the 3094 disk.

Bit	Meaning if Bit On
0	Unit 0 Seek Complete (Unit 0, Seek Complete)*
1	Unit 1, Seek Complete (Unit 0, Seek Complete)*
2	Unit 2, Seek Complete (Unit 1, Seek Complete)*
3	Unit 3, Seek Complete (Unit 1, Seek Complete)*
4	Selected Unit Illegal Sector **
5	Selected Unit Illegal Address *
6	Selected Unit Malfunction *
7	Selected Unit Timing Error **
8	Selected Unit CRC Search Error **
9	Selected Unit Read CRC Error **
10	Selected End of Track Error **
11	Selected Write Protect *
12	Selected Unit - Unit Not Ready *
13	Selected Unit - Head Compare Error
14	Format Error
15	SYNC Not Found
*	Originate at the disk unit.
**	Reset by Initilize Disk command (after every error is printed out)

7.2.4.3 Command Definitions and Examples

This section provides definitions of the command strings along with examples of command usage. The operator must enter the entire command string which begins with the identifying letter for the test and ends with a period.

7.2.4.3.1 Write Test Command The write test command format consists of the following:

W unit, sector, length, status mask [,[pattern],[C]].

Examples of the use of the write test format are the following:

W 3,28,120,1760,,C.

A 120 word block (one sector) of random data will be continuously written at sector 28 of the current track on unit 3. The error bits of the status word will be checked.

W 0,9,64,3760,125252.

A 64 word block of data of the fixed pattern 125252 will be written at sector 9 of the current track on unit 0. In addition to the error bits, the write protect bit of the status word will be checked.

7.2.4.3.2 Read Test Command The read test command format consists of the following:

R unit, sector, length, status mask, [,[pattern],[C]].

Examples of the use of the read test format are the following:

R 0,23,240,1760,0,C.

A 240 word block (two sectors) will be continuouusly read beginning at sector 23 of the current track on unit 0. A block of data read will be compared against a block of zeros which will be inserted in the write buffer.

R 1,0,26,1760.

A 26 word block of data will be read from sector 0 of the current track on unit 1. The block of data read will be compared against the current contents of the write buffer.

7.2.4.3.3 Echo Test Command The echo test command format consists of the following:

E unit, sector, length, status mask [,[pattern],[C]].

An example of the use of the echo test format is the following:

E 0,12,128,1760,,C.

A 128 word block of random data is written at sector 12 of the current track on unit 0. The data is then read and verified. The test is run continuously. The random block of data is generated once.

7.2.4.3.4 Seek Test Command The seek test command format consists of the following:

S unit, track, status mask [,C].

Examples of the use of the seek test format are the following:

S 1,53,1760.

The test will seek to track 0, then to track 53 on unit 1.

S 2,0,1760.

The test will execute two seeks to track 0 on unit 2. The second seek complete will be immediate because the unit is already on track.

S 0,199,1761.

The test will seek to track 0, then to track 199 on unit 0. In addition to the error bits, the seek complete bit for device 0 will be checked.

7.2.4.3.5 Unique Address Test Command The unique address test command format consists of the following:

A unit [,C].

An example of the use of the unique address test format is the following:

A 1

The unique address test will be executed on unit 1.

7.2.4.3.6 Compatability Test Command The compatability test command format consists of the following:

```
C unit [,C].
```

An example of the use of the compatability test format is the following:

```
C 0,C.
```

The compatability test is run continuously on unit 0.

7.2.4.3.7 Data Transfer Test Command The data transfer test command format consists of the following:

```
D unit [,C].
```

An example of the use of the data transfer test format is the following:

```
D 3,C.
```

The data transfer test will run continuously on unit 3.

7.2.4.3.8 Multiple Unit Test Command The multiple unit test command format consists of the following:

```
M unit [,unit] [,unit] [,C].
```

An example of the use of the multiple unit test format is the following:

```
M 0,2.
```

The multiple unit test will be executed one time (512 passes) on units 0 and 2.

NOTE

The multiple unit test may not be executed if PIM interrupts are used for seek complete.

7.2.4.3.9 Sense/Status Test Command The sense/status test command format consists of the following:

```
T unit[,C].
```

An example of the use of the sense/status test format is the following:

```
T 3.
```

The sense/status test will be run on unit 3.

7.2.4.3.10 Burn-In Test Command The burn-in test command format consists of the following:

```
B unit[,unit][,unit][,unit].
```

An example of the use of the burn-in test format is the following:

```
B 3.
```

The burn-in test is run continuously on unit 3.

7.2.4.3.11 Format The format test command format consists of the following:

```
F unit.
```

An example of the use of the format function is the following:

```
F 1.
```

This command will format unit 1.

7.2.4.3.12 Reinitializing The reinitializing test command format consists of the following:

```
I.
```

An example of the reinitializing test format is the following:

```
I.
```

The program will re-enter the initialization section of the program.

7.2.5 PROGRAM EXAMPLE

```
THIS IS THE V75 TEST EXECUTIVE
MEMORY SIZE IS 32K
LHAWK.
          MOVING HEAD DISK TEST

DISK CONTROLLER    16.
DISK SIZE (IN MB)  10.
BIC   20.
INTERRUPTS? (Y/N)  N
READ RETRY COUNT   1.
WRITE RETRY COUNT  1.
*F-1.
*F 0.
*S 0,100,1760.

*S 1,100,1760.

*E 0,12,128,1760.

*E 1,0,12,128  INVALID
*E 1,12,128,1760.

*W 0,28,120,1760.

*W 1,28,120,1760.

*W 1,37,240,1760.

*R 1,37,240,1760.

*A 0.

*D 0.

*T 0.

*T 0.
02 00 004017 RC
04 00 004017 RC

*T 1.

*T 1.
02 01 004017 RC
04 01 004017 RC

*B 0,1.

*
G500.
*1
```

7.2.6 ERROR MESSAGES

When an error condition is detected by the program, an associated error type number is printed. Most of the error type numbers will be followed by message extension words containing information for determining the specific cause of the error. In the following list of errors, the first three messages may occur in any test, while the remainder occur only in the Sense/Status test.

Error Type Number	Description
1	A disk controller timeout error occurred. The error type number will be followed by the unit address and the location in the program where the timeout occurred. (The remainder of the test will be aborted.)
2	An apparent status error occured. The error type number will be followed by the unit address, the status read, the track address, and, if a data transfer operation, the sector address and size of the data block. (The status word is logically ended with the status word mask, and if the result is non-zero, the status is displayed.)
3	A data comparison error occurred. The error type number will be followed by the unit address, the status, the track address, sector address, and the size of the data block. (Each type 3 message will be followed by one or more typeouts which contain the address in the read buffer where the data error occurred, the read buffer word (was), the address in the write buffer of the corresponding word, and the write buffer word (should be).
4	The status word indicated an error while the sense error instruction did not. The error type number will be followed by the unit address and the last status read.
5	The status word indicated the unit not ready while the sense selected unit not ready instruction did not. The error type number will be followed by the unit address and the last status read.

Error Type Number	Description
6	The status word indicated the unit write protected while the sense selected unit write protected instruction did not. The error type number will be followed by the unit address and the last status read.
7	A seek was performed on the unit but the status word did not indicate a seek in progress. The error type number is followed by the unit address and the last status read.
8	A seek was performed on the unit but the sense seek complete instruction did not indicate a seek in progress. The error type number is followed by the unit address and the last status read.
9	The status word falsely indicated a seek in progress. The error type number is followed by the unit address and the last status read.
10	The sense seek complete instruction falsely indicated a seek in progress. The error type number is followed by the unit address and the last status read.
11	A read was performed on the unit but the sense controller instruction did not indicate a busy condition. The error type number is followed by the unit address and the last read.
12	The sense controller busy instruction falsely indicated a busy condition. The error type number is followed by the unit address and the last status read.
13	A seek to an illegal track address was attempted, but the status word did not indicate this. The error type number is followed by the unit address and the last status read.
14	While the status word indicated on illegal address error the sense error instruction did not indicate an error. The error type number is followed by the unit address and the last status read.

Error Type Number	Description
15	A read was attempted to an illegal sector but the status word did not indicate this. The error type number is followed by the unit address and the last status read.
14	While the status word indicated an illegal sector error the sense error instruction did not indicate an error. The error type number is followed by the unit address and the last status read.
17	A write was performed which should have resulted in an end of track error but the status word did not indicate this. The error type number is followed by the unit address and the last status read.
18	An incorrect header was written, when this sector was read, no error was reported. The error type number is followed by the unit address and the last status read.

Each error message of this type is followed by one or two characters defining the disk I/O operation just performed (R - Read, W - Write, S - Seek, RH - Read Header, WH - Write Header, RC - Recalibrate, S0 - Select Unit Zero, WF - Write Format, and VF - Verify Format).

The following errors are detected by the formatter:

```
FORMAT ERROR
```

An error detected by the controller caused an error interrupt,

```
FORMAT ERROR-S/B  x y z
               WAS  x y z
```

A format error was detected by the test program. The values of x, y, and z are octal numbers for x - cylinder, y - unit/sector, and z - CRC. S/B is the correct values. WAS are the values from the disk.

The following messages are output by test as warning messages only:

POWER FAILURE DETECTED
UNIT POSSIBILY NOT FORMATTED
PROBABLE WRITE ERROR
PROBABLE READ ERROR
PROBABLE BAD SPOT

7.3 2823 AND 2824 MOVING HEAD DISK TEST

The moving head disk test program tests the disk controller and its associated disk storage units and reports any errors. The test program may be used on both the 2823 and 2824 disk memory systems. The 2823 and 2824 disk memory systems each have four hundred and four tracks (0-403) and fourty eight sectors (0-47).

The test program consists of ten subtests that test the disk system, and provide an aid in isolating known faults. The user can select a subtest by entering the appropriate commands through the console teletypewriter. The disk control unit can control up to four disk spindles. The test program provides for the concurrent testing of up to four units in the multiple unit test.

7.3.1 RELATED PUBLICATIONS

The 2823 and 2824 Moving Head Disk is described in the 224/225 Disk Drive Maintenance Manual (California Computer Products, P/N 76037-102). The description for the controller is in Sperry Univac Hardware Performance Specification 98A1110.

7.3.2 DESCRIPTION OF TEST COMPONENTS

The 2823 and 2824 moving head disk test program consists of the following eleven components:

- Write Test
- Read Test
- Echo Test
- Seek Test
- Unique Address Test
- Compatability Test
- Multiple Unit Test
- Sense/Status Test
- Burn-In Test
- Format
- Reinitialize

This section identifies and describes the test components (subtests) that are used in the test. Refer to subsection 7.3.4.3 for command definitions of the various tests.

7.3.2.1 Write Test

The write test allows the user to write a block of data of specified length, at a specified sector, on the specified disk storage unit. The user specifies which status bits are to be checked and whether a fixed or random data pattern is to be used.

7.3.2.2 Read Test

The read test allows the user to read and verify a block of data of specified length, at a specified sector, on the specified disk storage unit. When the operation is complete, the device status is checked. The block of data read is compared against the contents of the write buffer and any differences are noted.

7.3.2.3 Echo Test

The echo test will write a block of data beginning at the specified sector. The data is then read and verified. The device status is checked at the completion of both the write and read operations. The test is essentially a combination of the write and read tests.

7.3.2.4 Seek Test

The seek test allows the user to perform a seek to track 0, then to the designated track on the specified disk storage unit. The user may also specify the status bits to be checked.

7.3.2.5 Unique Address Test

The unique address test writes a one sector block of data in each sector on the specified unit. The first word of the block contains the track address, the second word the head address, the third word the sector address, and the remainder a random data pattern. After the entire disk storage unit is written, each sector is read and the track address, sector address and random data verified.

7.3.2.6 Compatability Test

The compatability test is essentially the read portion of the unique address test and provides a means of checking the interchangeability of packs among units. The unique address test must be run on one unit, the pack moved to a second unit and the compatability test run on the second unit to verify that the data could be recovered.

7.3.2.7 Multiple Unit Test

The multiple unit test checks the capability of the controller and disk storage units of performing concurrent operations. While the program is transferring data to one disk storage unit, the other units will be seeking or will be idle, having completed a previous seek. The routine uses random track and sector addresses, and a fixed data pattern. The test makes 512 passes each time it is selected.

7.3.2.8 Sense/Status Test

The sense/status test performs a series of disk operations on the specified disk, producing those error conditions that can be programmably generated, and verifying that the error conditions are correctly reported.

7.3.2.9 Burn-In Test

During one execution of the test, it will make 512 passes of the following operations: a seek to a random track address, the writing of a block of random data length beginning at a random sector, and the reading and verification of the block. Up to five errors per pass are noted. The test determines if the random sector and length will produce an end-of-track error. If it will produce an end-of-track error another random sector is chosen.

7.3.2.10 Format

The function will command the selected unit to format starting at cylinder 0, head 0, sector 0. At the end of this operation, the unique address test is performed. A C input will cause only the head and track previously input to be formatted continuously until sense switch 3 is set.

7.3.2.11 Reinitialize

Reinitialize will reenter the initialization section of the program to correct or append parameters.

7.3.3 SENSE SWITCH OPERATION

The operator can modify the execution of the test program by activating sense switches on the computer control panel. Table 7-2 lists the sense switch settings.

Table 7-2. Sense Switch Settings

Sense Switch	Set	Reset
1	Program suppresses error printouts	Program prints error messages
2	Program halts on data error	Program will not halt on an error
3	Program will terminate test	Program will continue test

7.3.4 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the moving head disk test program can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program using the procedures outlined in subsection 1.5. When loading of the test program is complete, there is automatic transfer to the start of the test program (address 0500).

7.3.4.1 Initialization Dialogue

This initialization dialogue is used to configure the 2823 and 2824 disk memory system for the test. The initialization dialogue begins with the program typing the following:

```
        MOVING HEAD DISK TEST
DISK CONTROLLER
```

The user enters the disk controller address found in the systems memo. The program then types:

BIC

The user responds with the BIC device address found in the systems memo. The program then types:

INTERRUPTS? (Y/N)

If Y is input, the interrupt mode is to be used. If N is input the user is using the sense mode and the initialization is completed. The program then types:

TRANSFER COMPLETE TRAP INFORMATION

The user then enters the device address of the priority interrupt module associated with the disk transfer complete interrupt, the address of the trap location associated with the transfer complete interrupt (this interrupt may be generated by the BTC complete signal or the controller ready signal), and the PIM mask. The program then types:

BIC COMPLETE USED? (Y/N)

A Y would indicate that the BIC complete signal is to be used, while an N indicates that the controller ready signal is used. The program then types:

SEEK COMPLETE TRAP INFORMATION

The user then enters the parameters of the trap location associated with the seek complete interrupts for the disk units. The program then asks for the timer times out interrupt parameter.

TIMER TIMES OUT TRAP INFORMATION

The user enters the parameters of the timer times out interrupt. The program then types:

READ RETRY COUNT

The user represents the number of read retrys with an octal value followed by a period. The program then types:

WRITE RETRY COUNT

The user represents the number of write retrys with an octal value followed by a period. The program then types:

SAVE BAD TRACK TABLE (Y/N)

The user responds with a Y or N depending on whether or not he desires to save the bad track table. The initialization dialogue may be restarted by toggling sense switch 3 at any point where input is requested. Before running any test on a unit, the unit must have a pack mounted, and the RUN/STOP switch must be in the RUN position. When the unit is in the ready condition, the write enable light will be illuminated.

7.3.4.2 Definition of the Command String

The following discussion defines the parameters of the command string and the status word.

The test monitor enables the user to input a command string which selects a particular test for execution and provides a parameter list to be associated with the test. The test monitor prints an asterisk to notify the user it is awaiting input. The first character of the command string identifies the test to be executed. Some of the fields of the command string are validated, while other fields are not checked. This may produce an error condition. An example of this would be issuing a seek to an illegal track address. If an invalid parameter is specified in the fields that are checked, the program will print a question mark, carriage return, line feed, asterisk and then wait for a new command string to be entered. Each command string is terminated by a period.

The following is a list of parameters used in the command string and their meaning:

- unit - address of the disk storage unit or pack [$0 \leq unit \leq 3$]
- track - track address (decimal field)
- head - head address (decimal field)
- sector - sector address (decimal field)
- length - size of the data block in words (decimal field) [$1 \leq length \leq 5760$]
- pattern - (octal field) denotes this fixed pattern will be used on data transfers. If omitted, random data patterns will be used.

- C - if entered, the test will be run continuously until terminated by sense switch 3. If omitted, the test will be run one time.

The status word is internal to the program. It is not programmed in the command string. The status word, with the exception of the seek complete bits, pertains to the disk currently selected.

Bit	Meaning if Bit On
0	Timing error
1	Track stop (record not found)
2	Format error (record too long)
3	Search error (bad cyclic check)
4	Data error (bad cyclic check)
5	End of cylinder (head no. 19)
6	Unit not on line
7	Disk drive unsafe
8	Seek error (seek incomplete)
9	Read only
10	Unit not selected
11	Head select error
12	Bad track flag set
13	Disk reserved
14	Not used
15	Not used

7.3.4.3 Command Definitions and Examples

This section provides definitions of the command strings along with examples of command usage. The operator enters the entire command string beginning with the identifying letter and ending with a period.

7.3.4.3.1 Write Test Command The write test command format consists of the following:

W unit, head, sector, length [,[pattern],[C]].

Examples of the use of the write test format are the following:

W 3,12,28,120,,C.

A 120 word block (one sector) of random data will be continuously written at sector 28 of head 12 of the current track on unit 3. The error bits of the status word will be checked. The test will be run continuously until terminated by sense switch 3.

W 0,6,9,64,125252.

A 64 word block of data of the fixed pattern 125252 will be written at sector 9 of head 6 of the current track on unit 0. In addition to the error bits, the write protect bit of the status word will be checked. The bad track table may be over written.

7.3.4.3.2 Read Test Command The read test command format consists of the following:

R unit, head, sector, length [,[pattern],[C]].

Examples of the use of the read test format are the following:

R 0, 19, 23, 240,0,C.

A 240 word block (two sectors) will be continuously read beginning at sector 23 of head 19 of the current track on unit 0. A block of data read will be compared against a block of zeros which will be inserted in the write buffer.

R 1,0,0,26

A 26 word block of data will be read from sector 0 of head 0 of the current track on unit 1. The block of data read will be compared against the current contents of the write buffer.

7.3.4.3.3 Echo Test Command The echo test command format consists of the following:

E unit, head, sector, length[,[pattern],[C]].

An example of the use of the echo test format is the following:

```
E 0,1,12,128,,C.
```

A 128 word block of random data is written at sector 12 of head 1 of the current track on unit 0. The data is then read and verified. The test is run continuously. The random block of data is only generated once. The bad track table may be over written.

7.3.4.3.4 Seek Test Command The seek test command format consists of the following:

```
S unit, track,[,C].
```

Examples of the use of the seek test format are the following:

```
S 1,53,C.
```

The test will seek to track 0, then to track 53 on unit 1.

```
S 2,0.
```

The test will execute two seeks to track 0 on unit 2. The second seek complete will be immediate because the unit is already on track.

```
S 0,199.
```

The test will seek to track 0, then to track 199 on unit 0.

7.3.4.3.5 Unique Address Test Command The unique address test command format consists of the following:

```
A unit[,C[.
```

An example of the use of the unique address test format is the following:

```
A 1.
```

The unique address test will be executed on unit 1.

7.3.4.3.6 Compatability Test Command The compatability test command format consists of the following:

```
C unit[,C[.
```

An example of the use of the compatability test format is the following:

```
C 0,C.
```

The test is run continuously on unit 0.

7.3.4.3.7 Multiple Unit Test Command The multiple unit test command format consists of the following:

```
M unit [,unit] [,unit] [,unit] [,C].
```

An example of the use of the multiple unit test format is the following:

```
M 0,2.
```

The test will be executed one time (512 passes) on units 0 and 2.

NOTE

The multiple unit test may not be executed if PIM interrupts are used for seek complete.

7.3.4.3.8 Sense/Status Test Command The sense/status test command format consists of the following:

```
T unit[,C].
```

An example of the use of the sense/status test format is the following:

```
T 3.
```

The test will be run on unit 3.

7.3.4.3.9 Burn-In Test Command The burn-in test command format consists of the following:

B unit[,unit][,unit][,unit].

An example of the use of the burn-in test format is the following:

B 3.

The test is run continuously on unit 3.

7.3.4.3.10 Format The format test command format consists of the following:

F unit ,{0 / C} .

7.3.4.3.11 Reinitializing The reinitializing command format consists of the following:

I.

The example of the use of the reinitializing format is the following:

I.

This input will cause the program to reenter the initialization section.

7.3.5 ERROR MESSAGES

When an error condition is detected by the program, an associated error type number is printed. Most of the error type numbers will be followed by message extension words containing information for determining the specific cause of the error. The first three messages may occur in any test, while the remainder occur only in the Sense/Status Test.

Error Type Number	Description
1	A disk controller timeout error occurred. The error type number will be followed by the unit address and the location in the program where the timeout occurred. (The remainder of the test will be aborted.)
2	An apparent status error occurred. The error type number will be followed by the unit address, the status read, the track address, and if a data transfer operation, the sector address and size of the data block. (The status word is logically ended with the status word mask, and if the result is nonzero, the status is displayed.)
3	A data comparison error occurred. The error type number will be followed by the unit address, the status, the track address, sector address, and the size of the data block. (Each type 3 message will be followed by one or more typeouts which contain the address in the read buffer where the data error occurred, the read buffer word (was), the address in the write buffer of the corresponding word, and the write buffer word (should be).
8	A seek was performed on the unit but the sense seek complete instruction did not indicate a seek in progress. The error type number if followed by the unit address and the last status read.
10	The sense seek complete instruction falsely indicated a seek in progress. The error type number is followed by the unit address and the last status read.
11	A read was performed on the unit but the sense controller instruction did not indicate a busy condition. The error type number is followed by the unit address and the last read.
12	The sense controller busy instruction falsely indicated a busy condition. The error type number is followed by the unit address and the last status read.

Error Type Number	Description
13	A seek to an illegal track address was attempted but the status word did not indicate this. The error type number is followed by the unit address and the last status read.
17	A write was performed which should have resulted in an end-of-track error but the status word did not indicate this. The error type number is followed by the unit address and the last status read.

Each error message of this type is followed by one or two characters defining the disk I/O operation just performed (I - initialize, S - select cyclinder, RA - read address, WF - write track format, RW - read/write, RC - recalibrate, RE - restore cylinder register, D - deselect unit.)

The following messages are output by test as warning messages only:

POWER FAILURE DETECTED	The hardware power fail/restart a power failure.
UNIT POSSIBLY NOT FORMATTED	The selected unit has not been formatted by the test and the bad track table was not saved.
RECOVERABLE READ ERROR	The unit read the correct data after one or more rereads.
RECOVERABLE WRITE ERROR	The unit read the correct data after one or more rewrites.
NONRECOVERABLE ERROR	The unit could not read the correct data after all read retrys and write retrys were exhausted.
TIMER DISABLED	If interrupts are used, the unit is commanded to recalibrate. After a time delay, the timer times out; interrupt did not occur.
TIMER ENABLED	If interrupts are used, the unit is commanded to recalibrate. After a time delay, the timer times out; interrupt occurred.

7.4 F3012 DIRECT MEMORY DISK CONTROLLER (DMDC) AND 2825, 2826, 2842, and 2843 DISK DRIVES

7.4.1 TEST COMPONENTS

The items that are tested are the F3012 direct memory disk controller and the 2825, 2826, 2842, and 2843 disk drives. The DMDC and disk drives test consists of a series of specialized test directives, general tests, and test control directives.

The specialized tests consist of various subtests which will test and verify proper operation of the following:

- Mechanical positioning of disk drives.
- Read function of the respective disks.
- Write function of the respective disks.
- Simulated system operation (Read/Write data transfers utilizing main memory available).
- Dual access capability.
- Random seek, write and read capabilities.

The general tests consist of tests which, by definition, are longer than an execution of a specialized test. The test control directives are used to control the data pattern selected, the number of times a test is executed, and may abort commands or return to the MAINTAIN III executive. This test program is available as an object paper tape, magnetic tape file, or card deck.

7.4.2 RELATED PUBLICATIONS

The F3012 Direct Memory Disk Controller is described in Sperry Univac manual 98A 9906-510 (Model 70-7540/70-7541 Direct Memory Disk Controller Operation and Service (For 70-755X Disk Units)).

The 2825, 2826, 2842, and 2843 Disk Drives are described in the Control Data Corporation Disk Drive 9760 Manuals (P/N 83322150, P/N 83322240, P/N 83322200, and P/N 83322440).

7.4.3 DIRECTIVES

This section identifies and describes the test components (subtests) that are used in the test. Refer to subsection 7.4.5.2 for command definitions of the various tests.

The function primitive directives are the following:

- RESTORE Directive
- RELEASE Directive
- SEEK Directive
- DEMAND Directive
- RESET Directive
- FORMAT Directive
- WRITE, DATA Directive
- WRITE, HEADER Directive
- READ, DATA Directive
- READ, HEADER Directive
- VERIFY Directive
- ENABLE Directive
- DISABLE Directive
- STROBE Directive
- SPINDLE Directive
- GET Directive
- TEST Directive
- DEVICE Directive
- UNIT Directive
- SUS Directive
- TUF Directive
- RESERVE Directive

- RESREL Directive
- OVERLAP Directive
- WRITE, CRC Directive
- READ, CRC Directive
- BURN-IN Directive
- MAP Directive

7.4.3.1 DEVICE Directive

The DEVICE directive specifies the disk controller to be tested. The DEVICE directive, along with the UNIT directive is required for test execution.

7.4.3.2 UNIT DIRECTIVE

The UNIT directive specifies the disk unit to be tested. The UNIT directive along with the DEVICE directive is required for test execution.

7.4.3.3 GO Directive

The purpose of the GO directive is to execute a specified test sequence a number of times. This directive must be entered in order to begin execution of a test sequence or function. The numerical limits of the GO directive are ($0 \leq n \leq 77777_8$) as shown in Table 7-3.

7.4.3.4 TEST Directive

The TEST directive is used to select an entire sequence of test components or any one test component. The test component will consist of a test which will initiate and verify the proper operation of the following disk system functions:

Table 7-3. Test Directive Test Definitions

Test Number	Test Component
0	Static Test - Interrogate controller and verify status information. Basic Read Test - Will verify headers on the selected unit under user control to verify basic reading capability without data transfer.
1	Position Test - Will seek to all operational positions of driver under test, then pseudo-randomly exercise the mechanical positioning of the drive.
2	Write/Read Test - Will write complete sectors with a default pattern and then read and verify. A test to verify the operation of the retry feature will be included.
3	Exercisor Test - Will generate all patterns on the disk and utilize all memory available for the read/write buffer.
4	Unique Address Test - Will write complete sectors of all ones followed by fractional sector to verify zero fill in. The capability of writing and reading fractional sectors will be tested.

Table 7-4 gives approximate times for the various tests. The times were taken on a V77-600 using a disk with 120 words per sector.

Table 7-4. Test Directive Times

Test	40 MB	80 MB	150 MB	300 MB
0	1 min.	2.5 min	5 min.	10 min.
1	15 sec.	30 sec.	45 sec.	1 min.
2	6.5 min.	13 min.	25 min.	50 min.
3	1 hr.	2 hrs.	4 hrs.	8 hrs.
4	1 hr.	2.5 hrs.	4.5 hrs.	9 hrs.

7.4.3.5 FORMAT Directive

The FORMAT directive is used to format all or a portion of the entire disk.

NOTE

Every parameter or parameter string that is input must be followed with a GO directive.

7.4.3.6 SEEK Directive

The SEEK directive is used to determine if a seek to a cylinder, track, and sector can be executed.

7.4.3.7 RESET Directive

The RESET directive is used to reset the unit or reset the device. If reset device is used, the program will respond with octal numbers for the number of cylinders, tracks, sectors and words per sector. If reset unit is used the status word will be returned.

Configuration information, printed in response to reset device as shown in Table 7-5.

Table 7-5. Disk Configuration Table

(all values are in octal)

	120 Words Per Sector			
	2825 40 MB	2842 80 MB	2826 150 MB	2843 300 MB
Cylinders	633	1467	633	1467
Tracks	5	5	23	23
Sectors	76	76	76	76
Sector Size	170	170	170	170

Table 7-5. Disk Configuration Table (Continued)

	240 Words Per Sector			
	2825 40 MB	2842 80 MB	2826 150 MB	2843 300 MB
Cylinders	633	1467	633	1467
Tracks	5	5	23	23
Sectors	43	43	43	43
Sector Size	360	360	360	360

7.4.3.8 WRITE Directive

After seeking to a cylinder, track and sector, one may want to write data to that cylinder, track and sector or from that cylinder, track and sector to another cylinder, track and sector. The WRITE directive writes from a cylinder, track and sector to a cylinder track and sector.

7.4.3.9 READ Directive

The READ directive is identical to the write directive, the only difference being that it will read instead of write. As in the case of all other directives, when the directive sequence is complete, the directives must be executed with a GO command. Any real directive using track 0 will include, after all data has been real, a transfer in channel of 120 words.

7.4.3.10 PATTERN Directive

Ten choices of pattern can be made for writing data onto the disk as shown in Table 7-6.

Table 7-6. Pattern-Descriptions

n	Pattern-Description
0	No data comparison after read.
1	Random data - This pattern will use the test default and will be used to test the disk system in the most general way with pseudo random data.

Table 7-6. Pattern-Descriptions (Continued)

2	Alternate ones and zeros - Will utilize a 052525 and a 0125252 pattern to assure that the dynamic transitions of all data bits will be tested.
3	Floating zero - Will be used to test each bit's vulnerability to cross-talk conditions as only one bit will be the complement (zero) of all other bits in the word (ones).
4	Floating one - The complement of the floating zero test.
5	Ones and zeros - Will generate a constant pattern of 0125252 for the purpose of troubleshooting a failing condition. The constant pattern will be easier to use with a real-time display device; such as an oscilloscope.
6	Zeros and ones - The complement of pattern number 5. For the same reason the pattern will be 052525.
7	All ones - Used to test the logic one condition of all bits and to isolate noise caused failures.
8	All zeros - The complement of pattern number 7, but used to test the logic zero condition of all bits and their related noise problems.
9	User selected - Use pattern submitted by user via 'CHANGE' directive.

7.4.3.11 CHANGE Directive

The CHANGE directive is used to submit a user selected data pattern to be used in testing the disk(s).

7.4.3.12 INTER Directive

The INTER directive is used to set the DMDC interrupt location to respond where using interrupts.

7.4.3.13 PRINT Directive

The PRINT directive enables printing of all data errors.

7.4.3.14 VERIFY Directive

The VERIFY directive is used to verify the data just written at a cylinder, track and sector or to verify a cylinder and track starting at the specified sector and continuing to the end of the track.

7.4.3.15 READ, HEADER Directive

There is a header preamble before each cylinder, track and sector. It is written there by the format command. To read and display the header before a cylinder, track and sector input that specific cylinder, track and sector with the READ, HEADER directive.

7.4.3.16 WRITE, HEADER Directive

If one desires to write a different header he may use the WRITE, HEADER directive.

7.4.3.17 READ, CRC Directive

This directive is used to read and output the CRC character from a cylinder, track and sector.

7.4.3.18 WRITE, CRC Directive

This directive is used to write a specified CRC character at a cylinder, track and sector.

7.4.3.19 ABORT Directive

The ABORT directive is used to cancel the input of a current chain of directives. It will not cancel the change, inter, exec or print directives.

7.4.3.20 EXEC Directive

This directive returns the user to MAINTAIN III. The entrance to the DMDC test is 500. After an exec command is executed, a G500 will return to the DMDC test. Then the DEVICE number, UNIT number, and GO directives have to be input again.

7.4.3.21 GET Directive

The GET directive will display the condition or the status.

7.4.3.22 SUS Directive

The SUS directive selects and displays the unit status. Thus, the unit status word can be displayed by the SUS, RESET and GET directives.

7.4.3.23 TUF Directive

The TUF directive terminates any operation in a sequential order, displays the unit status, and returns to the DMDC test.

7.4.3.24 RESTORE Directive

The RESTORE directive restores the disk drive back to its cylinder.

7.4.3.25 ENABLE Directive

The ENABLE directive is used to enable all interrupts or enabling device interface interrupts. PIM's are masked to not allow any interrupts.

7.4.3.26 DISABLE Directive

The DISABLE directive is used to disable interrupts by enable device interface interrupts or it is used to disable all interrupts.

7.4.3.27 DEMAND Directive

The DEMAND directive will cause the other processor, now using the disk drive, to release that disk drive to the demanding processor.

7.4.3.28 RELEASE Directive

If a demand command has been issued a release command must be issued to release the demanded unit.

7.4.3.29 RESERVE Directive

The RESERVE directive reserves the disk drive.

7.4.3.30 RESREL Directive

The RESREL directive executes a reserved release command.

7.4.3.31 OVERLAP Directive

The OVERLAP directive is used to demonstrate the seek/data transfer overlap capabilities. This test runs in the interrupt mode only. It also requires two units attached to the same controller.

7.4.3.32 SPINDLE Directive

The SPINDLE directive is used to set the disk drive spindle.

7.4.3.33 STROBE Directive

The STROBE directive is used to set the disk drive strobe.

7.4.3.34 BURN-IN Directive

This is a random burn-in test. The disk is positioned to a random location (cylinder, track, sector) and a random length block of data is written and read back. Any errors are reported. A cycle count is monitored and printed about every six minutes.

7.4.3.35 MAP Directive

The MAP directive is a test used to verify that the DMDC can transfer data to and from all of the system memory modules. The test is invoked by typing MAP. The test identifies itself and then asks for the map type, and memory size. As each 32k module is tested a message is output to indicate whether the test paused or failed.

7.4.4 SENSE SWITCH OPERATIONS

The sense switches are not used on this test.

7.4.5 OPERATING PROCEDURES

The MAINTAIN III test executive must be loaded before the DMDC and disk drive test programs can be loaded. Load the test executive in accordance with the procedures outlined in Section 2. Load the test program, using the procedures outlined in subsection 1.5. When the test program is loaded, automatic transfer to the start of the program takes place (address 0500).

7.4.5.1 Operational Dialogue

There is virtually no initialization dialogue used for this test. When the test is loaded the test prints

```
          DMDC TEST PROGRAM

DEVICE          STARTING UNIT
Device Number   000000
```

The operator must then input the DEVICE number and UNIT number followed by a GO command. After that, the directives may be entered. If an input directive is accepted by the program, a DE is returned by the program.

7.4.5.2 Directive Usage

This section lists the command formats used to control the execution of the tests. Definition of the command formats are in subsection 7.4.3.

7.4.5.2.1 DEVICE Directive The DEVICE directive has the following format:

```
DEVICE,n
```

where:

n
Represents the disk controller to be tested.

7.4.5.2.2 UNIT Directive The UNIT directive has the following format:

```
UNIT,n
```

where:

n
Is the unit number of the disk unit to be tested.

7.4.5.2.3 GO Directive The GO directive has the following format:

```
GO,n
```

where:

n
Determines the number of times that the test is executed. ($0 \leq n \leq 77777_8$)

7.4.5.2.4 TEST Directive The TEST directive has the following format:

```
TEST,  n1,n2...nn
       n
       .
```

where:

n
Represents the test or tests desired.

7.4.5.2.5 FORMAT Directive The FORMAT directive has the following format:

```
          {ALL}
FORMAT,   {ONE}   ,c,t.
```

where:

c
Is the cylinder address.

t
Is the track address.

7.4.5.2.6 SEEK Directive The SEEK directive has the following format:

```
SEEK,DATA,c,t,s.
```

where:

c
Is the cylinder to seek.

t
Is the track to seek.

s
Is the sector to seek.

7.4.5.2.7 RESET Directive The RESET directive has the following format:

```
          UNIT
RESET,    DEVICE
```

where:

UNIT
Will return the status word.

DEVICE
Will output configuration information.

7.4.5.2.8 WRITE Directive

The WRITE directive has the following format:

WRITE,DATA,c_1,c_2,t_1,t_2,s_1,s_2.

where:

c_1,c_2,t_1,t_2,s_1,s_2.
Writing on the disk starts at sector s_1, and cylinder c_1, on track t_1, and ends at sector s_2, cylinder c_2 of track t_2.

7.4.5.2.9 READ Directive The READ directive has the following format:

READ,DATA,c_1,c_2,t_1,t_2,s_1,s_2.

where:

c_1,c_2,t_1,t_2,s_1,s_2.
Reading from the disk starts at sector s_1, and cylinder c_1, on track t_1, and ends at sector s_2, cylinder c_2 of track t_2.

7.4.5.2.10 PATTERN Directive The PATTERN directive has the following format:

PATTERN,n

where:

n
Is $0 \leq n \leq 9$.

7.4.5.2.11 CHANGE Directive The CHANGE directive has the following format:

CHANGE, octal number

where:

octal number
Is a selected data pattern to be used in testing the disks(s).

7.4.5.2.12 INTER Directive The INTER directive has the following format:

```
INTER,n.
```

where:

n
Is used to set the DMDC interrupt location to respond where using interrupts.

7.4.5.2.13 PRINT Directive The PRINT directive has the following format:

```
PRINT.
```

This enables printing of all data errors.

7.4.5.2.14 VERIFY Directive The VERIFY directive has the following format:

```
VERIFY, {DATA  } ,c,t,s.
        {TRACK }
```

where:

c,t,s.
The program is used to verify the data just written at cyclinder c, track t, sector s or to verify the track t of cylinder c starting at sector s and continuing to the end of the track.

7:4.5.2.15 READ, HEADER Directive The READ, HEADER directive has the following format:

```
READ, HEADER,c,t,s.
```

where:

c,t,s.
The header is read at cylinder c, track t, and sector s. The following header is typed out:

```
READ HEADER RESPONSE
WORD 1  WORD 2  WORD 3
```

7.4.5.2.16 WRITE, HEADER Directive The WRITE, HEADER directive has the following format:

```
WRITE,HEADER,c,t,s,h.
```

where:

c,t,s,h.
Header h is written at cylinder c, track t, and sector s.

7.4.5.2.17 READ, CRC Directive The READ, CRC directive has the following format:

```
READ,CRC,c,t,s.
```

where:

c,t,s.
The CRC character is read and output from cylinder c, track t, and sector s.

7.4.5.2.18 WRITE, CRC Directive The WRITE, CRC directive has the following format:

```
WRITE,CRC,c,t,s,n.
```

where:

c,t,s,n.
The CRC character n is written at cylinder c, track t, and sector s.

7.4.5.2.19 ABORT Directive The ABORT directive has the following format:

```
ABORT.
```

where:

ABORT.
All function primitive directives input are deleted.

7.4.5.2.20 EXEC Directive The EXEC directive has the following format:

```
EXEC.
```

where:

EXEC.
The program will return to the MAINTAIN III test executive.

7.4.5.2.21 GET Directive The GET directive has the following format:

```
GET, {COND  }
     {STATUS}  .
```

where:

COND
The conditions will be displayed.

STATUS
The status buffer will be displayed.

7.4.5.2.22 SUS Directive The SUS directive has the following format:

```
SUS.
```

where:

SUS.
The unit status is selected and displayed.

7.4.5.2.23 TUF Directive The TUF directive has the following format:

```
TUF.
```

where:

TUF.
A terminate unit function is executed and the unit status is displayed.

7.4.5.2.24 RESTORE Directive The RESTORE directive has the following format:

```
RESTORE.
```

where:

RESTORE.
The disk drive is restored back to its cylinder.

7.4.5.2.25 ENABLE Directive The ENABLE directive has the following format:

```
ENABLE, {DEVICE}
        {ALL   } .
```

where:

DEVICE.
Interrupts are enabled by enable device interface interrupt. PIM's are masked to not allow any interrupts.

ALL.
All interrupts are enabled. PIMs are masked to not allow any interrupts.

7.4.5.2.26 DISABLE Directive The DISABLE directive has the following format:

```
DISABLE, {DEVICE}
         {ALL   } .
```

where:

DEVICE.
Interrupts are disabled by enable device interface interrupt.

all.
Interrupts are disabled by disabling all interrupts.

7.4.5.2.27 DEMAND Directive The DEMAND directive has the following format:

```
DEMAND.
```

where:

DEMAND.
The demanded unit is released to the demanding processor.

7.4.5.2.28 RELEASE Directive The RELEASE directive has the following format:

```
RELEASE.
```

where:

RELEASE.
The unit demanded is released.

7.4.5.2.29 RESERVE Directive The RESERVE directive has the following format:

```
RESERVE.
```

where:

RESERVE.
The disk drive is reserved.

7.4.5.2.30 RESREL Directive The RESREL directive has the following format:

```
RESREL.
```

where:

RESREL.
A reserve release is executed.

7.4.5.2.31 OVERLAP Directive The OVERLAP directive has the following format:

```
OVERLAP,n1,n2.
```

where:

nl,n2
The number of the two disk units attached to the same controller.

7.4.5.2.32 SPINDLE Directive The SPINDLE directive has the following format:

SPINDLE, { NORMAL / AWAY / TOWARD } .

where:

NORMAL.
The spindle is set in its NORMAL position.

AWAY.
The spindle is set in the AWAY position.

TOWARD.
The spindle is set in the TOWARD position.

7.4.5.2.33 STROBE Directive The STROBE directive has the following format:

STROBE, { EARLY / LATE / NORMAL } .

where:

EARLY.
The strobe is set EARLY.

LATE.
The strobe is set LATE.

NORMAL.
The strobe is set NORMAL.

7.4.5.2.34 BURN-IN Directive The BURN-IN directive has the following format:

BURNIN.

where:

BURNIN.
The test is a random burn-in test.

7.4.5.2.35 MAP Directive The MAP directive has the following format:

MAP.

where:

MAP.
This is a test to verify that the DMDC can transfer data to and from all of the system memory modules.

7.4.5.2.36 Down Directive The Down directive has the following format:

DOWN, (C), (T), (S).

where:

C
Is cylinder.

T
Is track.

S
Is sector

This places an entry into the table. Before an entry can be made, the device and unit numbers must be set. The program checks the Cylinder (C), Track (T), and Sector (S) for proper range. The sector is saved, but is not used by the program; the entire track is "not operational" and not used. If the track is already flagged, the message "ALREADY IN TABLE" is printed. If the table is full, the message "TABLE FULL" is printed (there is room for 255 entries). Test 0, 1, 2, 3, 4, and BURNIN have been changed to skip over any track that is in the table. Note that the key-in commands such as WRITE, DATA READ, DATA FORMAT, etc. can still use the track.

7.4.5.2.37 Up Directive The directive has the following format:

UP,(C), (T), (S).

where:

C
Is cylinder.

T
Is track.

S
Is sector.

This command deletes an entry from the table, thereby allowing the track to be tested. If the track was not flagged, then the message "NOT IN TABLE" is printed.

7.4.5.2.38 Clear Directive The CLEAR directive has the following format:

CLEAR.

This will clear all entries in the table. Note that the table is initialized when the program is loaded, but not when the program is restarted at location 0500.

7.4.5.2.39 List Directive The LIST directive has the following format:

LIST

This command will list all the entries in the table. The form of the printout is:

DEVICE UNIT CYLINDER TRACK SECTOR

If there were no entries in the table, the message "TABLE EMPTY" is printed.

It should be noted that the BTF table is only kept in memory and will be lost when another program is loaded. It is suggested an

external copy be made of the bad tracks, so they may be re-entered when the test is run again.

7.4.6 PROGRAM EXAMPLE

The following is a program example:

```
DMDC TEST PROGRAM

DEVICE    STARTING UNIT
000013     000000

**DEVICE,13.  DE
**UNIT,0.  DE
**GO,1.
**TEST,0.  DE
**GO,1.
STATIC TEST
SENSE     IOACTIVE   TRUE

STATUS  000000
**TEST,1.  DE
**GO,1.
**TEST,2.  DE
**GO,1.
**TEST,3.  DE
**GO,1.
**TEST,.  DE
**GO,4.
STATIC TEST
SENSE     IOACTIVE   TRUE
```

```
   STATIC TEST
SENSE   IOACTIVE  true/false
STATUS   status
READ HEADER RESPONSE
 Word 1
 Word 2
 Word 3
READ RETRY WITH SEEK  retry
INVALID INTERRUPT
CONFIGURATION FOR UNIT   unit
CYLINDERS              cylinders
TRACKS                 tracks
SECTORS                sectors
SECTOR SIZE            sector size

DEVICE (device)        UNIT (unit)
CYLINDER (cylinder)    TRACK (track)   SECTOR (sector)
CRC CHARACTER =
```

MAP TEST MESSAGES

```
DMDC MEMORY/MAP TEST
INPUT MAP TYPE
(0 - NONE, 1 = 256K, 2 = MEGA MAP, 3 = V77-400
INPUT MEMORY SIZE IN DECIMAL K
MODULE TESTED OK
CANNOT RUN THIS TEST
MEMORY MAP TIME OUT
```