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CONTROL DATA CORPORATION

SMALL COMPUTER MAINTENANCE MONITOR REFERENCE MANUAL

CONTROL DATA®
1700 COMPUTER SYSTEMS

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FIGURES

INTRODUCTION 1

The Small Computer Maintenance Monitor (SCMM) provides a means, within the MSOS Version 4 Operating System, of testing the I/O peripherals in an on-line, real-time mode. This means that while a user's process is executing, the operation of specific I/O devices can be tested to obtain useful information about the general operability of system devices.

SCMM consists of the main program (the Executive) and a test program for each I/O device to be tested. The monitor and tests execute under control of the 1700 MSOS Version 4 Operating System; the devices under test are accessed via the MSOS drivers.

Two means of error detection are employed:

- The error code generated by the MSOS driver
- The device's status word

Most tests make use of both detection schemes.

All tests will execute concurrently with other foreground (protected) applications and background (unprotected) jobs. The tests run at some priority above background jobs but at the lowest foreground priority. Therefore, the test time of execution and the response time will vary according to system loading.

GENERAL INFORMATION 2

The SCMM release materials contain the following:

Program Name	Device Tested
SCMEXC	SCMM Executive or Monitor
SCMTTY	Teletypewriter or CRT
SCMCRD	1728/430 or 1729 Card Reader
SCM405	1726/405 Card Reader
SCMCD1	Cartridge Disk
SCMCD2	Cartridge Disk
SCMDK1	853/854 Disk
SCMDK2	853/854 Disk
SCMDVP	853/854 Disk
SCMPRT	Line Printer
SCMMTT	Magnetic Tape
SCMDRM	1752 Drum
SCMDM1	1751 Drum
SCMPTR	Paper Tape Reader
SCMPTP	Paper Tape Punch
SCMAD1	1536 Relay Analog MUX Controller
SCMAD2	1501 Analog Input MUX Controller
SCMLLV	1553/1544 Digital Output/Input Unit (local/remote)
SCMRLY	1555/1544 Relay Output Unit/Digital Input Unit (local/remote)
SCMSTU	1572-1 Sample Timing Unit (local)
SCMCTR	1547 Events Counter Unit (local)

A punched card deck is also included for use with the card reader tests (SCMCRD and SCM405) when a card punch is not part of the system to be tested.

All SCMM programs are coded run-anywhere using CDC 1700 Assembly language. The SCMM Executive is loaded in the operating system as a system ordinal, and the tests are loaded in the program library as absolute files. The method of installing the SCMM package in an MSOS Version 4

Operating System is detailed in Appendix B. The requirements that must be satisfied when designing and coding an SCMM test for a new device are detailed in Section 4.

Tests should be run one at a time to avoid locking out applications programs for long periods. However, it is possible for the user to set up to 16 tests into operation, assuming that enough allocatable core is available.

Numerical values that are input or output are in decimal form, except for disk sector numbers or file addresses, which are in hexadecimal.

All tests may be set into an infinite loop which requires operator intervention for termination. This is discussed in Section 5.

All devices are accessed by their MSOS diagnostic logical unit number. The test verifies that the logical unit requested by the operator is, in fact, one of the devices that the test may operate. If a non-compatible device was specified, the test will recycle so the requester can try again. After the third re-try, the test terminates and must be requested again.

NOTE

Before initiation of the SCMM tests for 1500 peripherals, the user is responsible for reconnecting the tested device to its required test equipment. Test equipments are defined in Appendix D.

The SCMM tests for the 1572-1 Sample Timing Unit and the 1547 Events Counter Unit require exclusive use of the sample timing unit for proper operation. Therefore, these tests should be run only when the sample timing unit is not required for other system functions.

SCMM EXECUTIVE 3

The on-line version of the SCMM Executive (SCMM17) is a mass memory program defined as a system ordinal. The Executive may be set into operation after the operator has caused a manual interrupt.

NOTE

In all instances, a carriage return is entered at the end of SCMM input. Examples of dialog do not indicate these carriage returns.

Operator Input	SCMM Reply
Press Manual Interrupt	MI
SCMM	SCMM IN MM/DD/YY HHMM CONTROL, TEST ID

The SCMM Executive is in and has requested operation parameters.

In response to this request, the following inputs will be recognized:

LST	Provides a printout on the standard list device of all the routines in the SCMM library with their mnemonic name, disk sector address, program length, and core address (if presently executing).
SRT,xxx†	Schedules execution of test xxx if it is in the library and not presently running.
STP,xxx	Terminates execution of test xxx if it is in execution.
PRM,xxx	Halts execution of test xxx and returns to the test's parameter input sequence.
XIT	Terminates all tests in execution and outputs the message SCMM OUT.
NPT,xxx	Sets a flag to suppress error printout by test xxx if it is in execution.
PRT,xxx	Clears a flag to allow error printout by test xxx if it is in execution.
CLR	Terminates operator/monitor communication without terminating tests that are in execution.

†xxx corresponds to TEST ID

NOTE

The above requests can be entered only after the operator has recalled SCMM via manual interrupt.

The three-letter test mnemonics used as test IDs in the above description are:

Test ID	Equipment Type
TTY	Teletypewriter and CRT
CRD	1728/430 Card Reader/Punch and Card Reader
405	1726/405 Card Reader
CD1 CD2	Cartridge Disk
DK1 DK2	853-854 Disk
DVP	853-854 Disk
PRT	Line Printer
MTT	Magnetic Tapes
DRM	1752 Drum
DM1	1751 Drum
PTR	Paper Tape Reader
PR1	Paper Tape Reader
PTP	Paper Tape Punch
PP1	Paper Tape Punch
AD1	1536 Analog Digital Converter
AD2	1501 Analog Digital Converter
LLV	1553/1544 Digital Input/Output Unit
RLY	1555 Power Driver and Relay Output Units and 1544 Digital Input Unit
STU	1572-1 Sample Timing Unit
CTR	1547 Events Counter
HFP	Hardware Floating Point Unit
DAC	1566 Analog Output
SAU	1576 Stall Alarm

Additional messages that may occur during operator/executive interface are as follows:

PROGRAM SCHEDULED	The program requested by the operator is already in operation.
CONTROL ERROR	An illegal control statement was entered by the operator.
NOT IN LIBRARY	The test requested is not in the program library.

PROGRAM NOT SCHEDULED	The operator requested a control statement (STP, PRM, NPT, or PRT) for a test that had not been set in execution.
PROGRAM STACK FULL	No new test may be requested until one or more of the current tests have completed.
DISK ERROR	A disk error occurred during the transfer of a test from mass storage to core.
SPACE ALLOCATION ERROR	MSOS operating system cannot find the required amount of core. This would indicate that the MSOS system has been configured incorrectly or has been overwritten.

All messages from SCMM and the tests are processed by a common message handler within the Executive. The I/O request and message are built in a small portion of allocatable core and are then scheduled by the Executive. If the system is heavily loaded, the messages may stack or queue up.

Necessary parameter retrieval and number conversion routines are part of the SCMM Executive. Descriptions and use of these routines are contained in Appendix C.

EXAMPLE

A typical operator/SCMM conversation is depicted in the following example. The purpose of the sequence outlined is to have simultaneous operation of the magnetic tape, the line printer, and the disk test. The example also depicts a test set into execution which will terminate only by operator request. Two methods of terminating a test prior to normal termination are included.

Operator Entry † / SCMM Reply	Comments
Press manual interrupt	
MI	
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1035 CONTROL, TEST ID	Executive is in operation and requests control and test parameters.
SRT,MTT	Request magnetic tape test.
BEGIN MAG TAPE TEST SECTIONS,NO.OF RECDS,RUNS	Test is in operation and requests operational parameters.
2,500,8000	Operator requests test section 1, 500 records, and infinite execution time.
DLU,DENSITY	Test requests additional information.
6,556 7,800 FFFF	Operator enters MSOS diagnostic logical units 6 and 7 with desired densities. List of logical units is terminated with the FFFF. The mag tape test is now in execution.

†All operator entries except manual interrupt must terminate with a carriage return.

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	
SCMM	Request SCMM.
CONTROL,TEST ID	Executive requests control and test parameters.
SRT,PRT	Request 1742x line printer test.
BEGIN LINE PRINTER TEST DLU,SECTIONS,RUNS	Test is in operation and requests operational parameters.
14,3E,1	Request diagnostic logical unit 14, all test sections, and one pass.
Press manual interrupt	
MI	
SCMM	Request SCMM
CONTROL, TEST ID	Executive requests control and test parameters.
SRT,DK1	Request 1738/1733-1 disk test.
BEGIN DISK 1 TEST BEWARE OF SCRATCH CONFLICT. $C1=xxxx LU,SECTIONS,BEG SEC,END SEC,RUNS	Test is in execution and requests operational parameters.
26,7E,6000,7000,2	Request logical unit 26, all test sections, sectors 6000 to 7000 inclusive, and two passes.
END PRINTER TEST	Line printer test completed.
Press manual interrupt	
MI	
SCMM	Request SCMM.
CONTROL, TEST ID	Executive requests control and test parameters.
STP,MTT	Request termination of magnetic tape test.
END MAG TAPE TEST, 0000 RUNS TAPE UNIT 06, 0000 ERRORS TAPE UNIT 07, 0000 ERRORS	Magnetic tape test terminates
Press manual interrupt	
MI	
SCMM	Request SCMM.
CONTROL, TEST ID	Executive requests control and test parameters.

Operator Entry	SCMM Reply	Comments
XIT		Request termination of all tests and release SCMM Executive.
	END DISK 1 TEST, 0000 RUNS, 0000 ERRORS	Disk test terminates.
	SCMM OUT 12/01/73 1048	SCMM Executive releases allocated core and exits.

TEST/EXECUTIVE INTERFACE 4

This section describes the interface requirements of all test routines running under the control of the diagnostic Executive (SCMEXC) and using the standard routines contained within the Executive. A general description will also be given of the class of diagnostics run under the diagnostic Executive and the basic layout of those diagnostics.

ENTRY REQUIREMENTS

The first 13 words of all diagnostic programs must be set up as follows:

Word	Description
0,1,2	Six-digit ASCII mnemonic name
3	Length of program
4	PSR level of test
5	Flag word used by diagnostic supervisor
6	Address of INFOIN routine:
7	Address of GETFLD routine
8	Address of RHXASC routine
9	Address of ROCDEC routine
10	Address of RDECHX routine
11	Address of CLRSTK routine
12	Address of MESAGE routine

These words define the diagnostic communication region. It is suggested that they be coded as follows:

```
START   ALF  3,TSTNAM
        ADC  END-START
*
        NUM $78   PSR LEVEL
```

```
*
FLAG    NUM 0
*
INFOIN  NUM 0
GETFLD  NUM 0
RHXASC  NUM 0
ROCDEC  NUM 0
RDECHX  NUM 0
CLRSTK  NUM 0
MESAGE  NUM 0
```

At execution time words 6 through 12 are patched by the diagnostic Executive with the addresses of the specified routines. The test program is set in execution by the diagnostic Executive via a scheduler request to the fourteenth word of the program.

A detailed breakdown of the first 13 words follows:

Word	Description
0,1,2	These words contain the ASCII mnemonic ID of the test routine. This is not necessarily the program name, and only the last three characters are used to identify the test. The operator will use these three characters to request the test.
3	This word contains the true length of the program. This is calculated at assembly time by the ADC END-START if an EQU END(*) card is placed just before the END card of the test program.
4	This word contains the PSR level number. The number must be ASCII code for two decimal digits (e.g., $3738 indicates level 78).
5	This is the flag word. It is used by the diagnostic Executive to communicate control functions to the test program. Three bits are currently used: 0 — If set, it indicates to the test that the operator has requested the stop function (STP control word). 6 — If set and bit 0 set, the operator has requested a change in the test's operational parameters (PRM control word). 7 — If not set, then error printout is desired. If set, the operator has requested no error printout (NPT control word). PRT control word clears bit 7.
6	This word contains the core address of the INFOIN routine.
7	This word contains the core address of the GETFLD routine.
8	This word contains the core address of the RHXASC routine.
9	This word contains the core address of the ROCDEC routine.
10	This word contains the core address of the RDECHX routine.

*Equivalent to 2 decimal digits.

Word	Description
11	This word contains the core address of the CLRSTK routine.
12	This word contains the core address of the MESAGE routine.

Detailed descriptions of the routines associated with words 6 through 12 may be found in Appendix C.

ADDITIONAL LIMITATIONS AND REQUIREMENTS

Certain limitations are imposed on the test programs. They may not do the following:

- Inhibit interrupts (except when driver routines are included as part of the diagnostic)
- Use priority levels other than 3 or 4 (except for interrupt response routines), without careful planning
- Communicate with hardware directly when a standard driver exists (except to input level 2 status when the standard driver has detected an error)

In addition, the test program must be programmed run-anywhere and relocatable.

DESIRABLE PROGRAM ORGANIZATION

It is desirable that any test program that is to be part of the SCMM package be laid out as follows:

- Program description
- Test equivalences
- Communications region
- Parameter input
- Test sequence
- I/O routines
- Check for hardware errors
- Check for data errors
- Termination sequence
- Message buffers
- Large I/O buffers

A sample program that illustrates these features is included as Appendix A.

PROGRAM DESCRIPTION

The program description should identify all of the parameters required by the test and each of the distinct test sections. It should specify the type of driver used to communicate with the hardware and any special test boxes required by the test.

TEST EQUIVALENCES

This section should contain the standard test equivalences, the specific test equivalences, and externals.

COMMUNICATIONS REGION

The communications region has been described in Entry Requirements.

PARAMETER INPUT

This section should first output the message:

BEGIN xxxx TEST

and a line denoting the required format of the input parameters; for example:

DLU,SECTIONS,RUNS

If one of the parameters was the logical unit of the hardware device being tested, a check should be made to see that the logical unit is one for that type of hardware. This is done by checking word 8 of the physical device table for the logical unit input against the known value of the word. Only bits 4 through 13 should be checked. If a parameter call does not contain a legality check, then a check should be made to see if the standard input comment device I/O request was completed without error. In both cases the parameter entry request should be made again. Input request for parameters is made via the INFOIN and GETFLD routines.

TEST SEQUENCE

The repertoire of tests provided by a particular diagnostic routine should be sufficient to exercise and check the operability of all the functions and features of the hardware device being tested. Because the diagnostic must communicate with the hardware device via the standard MSOS driver which operates the device, this goal is seldom attained. Accordingly, these test routines can exercise only those functions of a device which are operated by the driver. Nevertheless, the test routine should be designed in such a way that it is expandable, so additions can be made to a driver's capabilities. For example, the 1738 disk driver does not allow the use of the read-compare command, hence, the 1738

test routine is unable to test that function. Should the driver be expanded to accept that command, then the diagnostic should allow for the addition of a read-compare command test sequence.

Where possible a hierarchy of tests should be provided to assist in the diagnosis of a malfunctioning device, i.e., a range of tests, from multiple-function to single-function, should be provided. As a result, the cause of the malfunction should be more easily located.

I/O ROUTINES

Where possible, the I/O portion of the diagnostics should be separated from the test sequence. Therefore when the interface to the MSOS monitor must be modified it can be done without disturbing the function of the test sequence.

CHECK FOR HARDWARE ERRORS

Hardware error information can be obtained from two sources. The first is the hardware status saved by the driver in word 12 of the physical device table. The second is the alternate device handler error code information when saved by the driver in some word of the physical device table. This error code can be used to determine rejects, lost interrupts, and certain types of data errors (i.e., checksum errors, sequence errors, and parity errors when the hardware device does not do this check). Unfortunately, many drivers do not save this error code. For most diagnostics the hardware status is all that is available. Once the error is determined, an error message should be output with the following information:

- Diagnostic mnemonic name (first three words of the communication region)
- Current pass through the test
- Description of the error

For example: TSTTTY SEC1 RUN 0001 INT REJ

If more than one error condition can exist at one time, then an error message should be output for each error condition. Before an error message is output, a check should be made to see if bit 7 of the flag word (word 5 of the communications region) is set. If so, the message should not be output. All error messages should be output via the MESAGE routine.

CHECK FOR DATA ERRORS

For devices that allow data error checking or closed-loop tests, a routine should be provided to verify the data. When a discrepancy occurs, the routine should output a data compare error message. This message should include the following information:

- Diagnostic mnemonic name
- Section currently being executed

- Current pass through the diagnostic
- Hardware address (if applicable)
- Sector number (if applicable)
- Original data
- Actual data

An example would be:

```
TSTDK1 TEST 6 RUN 0001 COMP ERR H/W ADR 0038 SECTOR 3B
       WORD 0020 WAS B5A2 IS B5A1
```

Before the compare error message is output, a check should be made to see if bit 7 of the flag word is set. If it is, the message should not be output. The data compare message should be output via the MESAGE routine.

TERMINATION SEQUENCE

At the end of each pass of the diagnostic routine a check should be made to see if one of the following conditions apply:

- Stop flag set
- Zero runs requested
- Number of runs requested is complete
- Indefinite runs requested

The first three conditions should cause the diagnostic to complete the termination sequence. The fourth condition allows the diagnostic to run until the Stop flag is set by the monitor. If the diagnostic is terminating, it should output an end message via the MESAGE routine as shown below:

```
END xxxx TEST, xxxx RUNS, xxxx ERRORS
```

MESSAGE BUFFERS

The message buffers are normally put at the end of the diagnostic to compress the executable part of the diagnostic as much as possible to reduce the number of two-word relative-addressed statements and to maintain the continuity of the coding.

LARGE I/O BUFFERS

Where possible, large I/O buffers should be placed at the end of the diagnostic, for the same reasons that the message buffers are put at the end.

OPERATOR/TEST INTERFACE 5

This section includes a detailed description of each test and an example of the operator/test dialog. The test description is broken down as follows:

- Devices tested
- Types of tests
- Error detection and reporting
- o Detailed descriptions of input parameters
- Example of operator/test dialog

In all instances, a carriage return is entered at the completion of a line of SCMM input. Examples of dialog do not indicate these carriage returns.

Any test may be exited during parameter entry if the operator inputs a ? as an input value. This will not terminate the tests already in execution.

In some cases, the direction of transfer is included in error messages as either x-C XFER or C-x XFER, where C always indicates core and x is the initial indicating the device being tested. Therefore D-C XFER, if generated by a disk test, would indicate that the error occurred on the disk-to-core transfer portion of the test. If generated by a drum test, D would indicate the drum.

All I/O sequences to the device under test are via unformatted (normal) read/writes, unless otherwise noted.

TELETYPEWRITER TEST (TTY)

DEVICES TESTED

This test will diagnose the following devices:

1711-1 through 1711-5
1713-1 through 1713-5
713-10/711-100/713-120
1743-2
1595

TYPES OF TESTS

Three test sections may be requested, but only one may be executed per entry to this test:

1. Legal character test — Outputs a sliding alpha pattern where each line contains all legal characters.
2. Echo test — Outputs, one time, a string of characters that were specified by the operator.
3. Specified character test — Outputs, as many lines as requested, a string of characters that were specified by the operator.

ERROR DETECTION AND REPORTING

Hardware error reporting is based on the error code returned by the MSOS driver. Actual device status is not considered in this test. The five types of errors recognized by the MSOS driver and the test are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
PARITY	MSOS error 3
INT REJ	MSOS error 5
EXT REJ	MSOS error 6
LINE BREAK	MSOS error 33

An I/O request which causes one of the above errors will be repeated until it is completed without error or until the test is terminated by the operator. The actual error message will be as follows:

```
TSTTTY   TIME OUT
         ALARM
         PARITY
         INT REJ
         EXT REJ
         LINE BK
```

INPUT PARAMETERS

The possible input values for the test's operational parameters (DLU, SECTIONS, LINES) are:

DLU — MSOS diagnostic logical unit in decimal

SECTIONS

2 — Prints a sliding alpha pattern containing all legal characters

4 — An echo test; the operator inputs up to one full line of characters and the test repeats those characters on the next line. This section operates on one line at a time but recycles for operator input for as many lines of input as specified in the LINES parameter.

8 — The operator inputs up to one full line of characters and the test repeats that sequence of characters for as many lines as specified in the LINES parameter.

NOTE: The test will execute only one section at a time. It will not sequence through a request of multiple sections.

LINES — Any decimal value up to 8000. If 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	MI
SCMM	CONTROL, TEST ID
STP, TTY	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 0900 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT,TTY	Request teletypewriter test.
BEGIN TTY TEST DLU,SECTIONS,LINES	Test is in operation and requests operational parameters.
4,2,10	Operator requests logical unit 4, test section 1, and 10 lines of output. The test begins exercising at this point.
END TTY TEST 0010 RUNS, 0000 ERRORS	Test has completed 10 lines of printout and has released allocatable core.
SCMM OUT 12/01/73 0905	SCMM Executive has determined that there are no other tests in execution, so it terminates and releases core.

LINE PRINTER TEST (PRT)

DEVICES TESTED

This test will diagnose the following devices:

1740/501
1742-1
1742-30 and -120

TYPES OF TESTS

Six test sections may be requested:

1. Variable buffer — Outputs lines of varying length
2. Ripple pattern — Outputs 137 lines where successive lines are shifted left one character
3. Full line of same character — Outputs one line on each character between 20_{16} and $5F_{16}$.
4. Alternate even and odd hammer — Outputs one line of As using even hammers, then one line of Bs using the odd hammers. A total of 40 lines are printed.
5. Line spacing — Performs eight single spaces followed by eight double spaces. The operations are flagged by an appropriate message
6. 6 line/8 line per inch — Prints 24 lines at 6 lines per inch and then prints 24 lines at 8 lines per inch

ERROR DETECTION AND REPORTING

Hardware error reporting is based primarily on the error code returned by the MSOS driver. The actual device status is interrogated only for controller ready/not ready. The type of errors recognized by the MSOS driver and the test are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
PARITY ERROR	MSOS error 3
INT REJ	MSOS error 5
EXT REJ	MSOS error 6

The actual error message will be as follows:

TSTPRT SECTION xx TIME OUT {CNTRL NOT READY / CNTRL READY}
ALARM
INT REJ
EXT REJ

After the error message, the test continues with the I/O sequence that was in progress.

INPUT PARAMETERS

The possible input values for the test's operational parameters (DLU,SECTIONS,RUNS) are:

DLU — MSOS diagnostic logical unit in decimal.

SECTIONS

2 — Variable length buffer test

4 — Ripple pattern test

8 — Full line of same character test

10_{16} — Alternate even and odd hammer test

20_{16} — Single and double line spacing test

40_{16} — 6/8 line per inch test (designed for the 1742-1 only)

NOTE: Any combination of the above sections may be requested.

RUNS — Any decimal number up to 8000. If 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL,TEST ID
STP,PRT	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 0910 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT,PRT	Request line printer test.
BEGIN LINE PRINTER TEST DLU,SECTIONS,RUNS	Test is in operation and requests operational parameters.
14,3E,2	Operator requests sections 1 through 5 and two passes on DLU 14. The test begins exercising the device at this point.
END PRINTER TEST	Test has completed the requested test sections and number of passes. It has also released allocatable core.
SCMM OUT 12/01/73 0920	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

MAGNETIC TAPE TEST (MTT)

DEVICES TESTED

This test will diagnose the following devices:

1731/601
1732-2/615-73 and 615-93
1732/608 and 609
1732/608 and 609/1706
1732-3/616-72, 616-92 and 616-95

TYPES OF TESTS

Four test sections may be requested.

1. Worst case pattern — Writes a specified number of records of one of the four worst patterns (6969_{16}, 9696_{16}, $5A5A_{16}$, or $A5A5_{16}$) to tape with a record size of 192 words. The tape is rewound and then as each record is read the incoming data is verified for correctness. This sequence is repeated for each of the worst pattern values.
2. User input pattern — The same as section 1, but uses the pattern specified by the operator to construct the records.
3. Advance and backspace records — Uses worst pattern 6969_{16} to build a record. Writes 499 records, followed by one record that contains worst pattern $5A5A_{16}$. Writes an additional 499 records (pattern 6969_{16}) followed by the special record (pattern $5A5A_{16}$). Next, backspaces 999, advances 700, backspaces 300, and advances 99 records. Reads the next record, which should be the special record (pattern $5A5A_{16}$).
4. Advance and backspace files — This section is the same as section 3, except each record is separated by a file mark and the tape motion is based on files instead of records. This test will take a greater amount of time to execute than the tests mentioned above.

ERROR DETECTION AND REPORTING

Error reporting for this test takes two forms: data errors and hardware errors. Data errors occur as the data is being read back from tape. If this data does not compare with the data that was written out then the following message appears on the standard list device:

TSTMTT SEC xx RUN yy TAPE UNIT ww COMP ERR RECORD zzzz WORD aaaa WAS bbbb IS cccc

After all the words in the record have been checked, and if some data errors did occur, the following error message is also output, indicating the total number of errors:

TSTMTT TAPE UNIT xx COMP ERR TOTAL yyyy

NOTE

When several errors are detected in a record (such as comparing tape against core and words do not match) the error total is for all errors detected.

Hardware errors for this test are detected via the device status word which is saved by the MSOS driver. Errors flagged by the test are:

NOT RDY
LOST DATA
PARITY
NO WRITE RING
END OF TAPE
CORRECTED DROPOUT (615 only)
WRONG POSTAMBLE (615 only)
NO ID (616, 615)
ILLEGAL DENSITY SELECTED (615, 616)
PE WARNING (616)
PE LOST DATA (616)

These errors have the following output format:

TSTMTT SEC xx RUN yy TAPE UNIT ww (one of the above messages) {T-C XFER / C-T XFER}
RECORD zzzz additional error messages

Additional error messages

TSTMTT SHORT XFER
TSTMTT UNEXPECTED END-OF-FILE

are also detected via the device status word.

INPUT PARAMETERS

Possible input values for the test's operational parameters (SECTIONS, NO. OF RECDS, RUNS and DLU, DENSITY) are:

SECTION	2	— Worst case pattern
	4	— User-supplied pattern; for this section the message SPECIAL PATTERN FOR SECTION 2 is output. The operator's reply is a four-digit hexadecimal number followed by a carriage return. This pattern is used as data when the section is executed.
	8	— Advance and backspace records
	10_{16}	— Advance and backspace files
	NOTE: Any combination of the above sections may be requested.	
NO. OF RECDS	Decimal value through 9999	
RUNS	Any decimal number up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following.	

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP,MTT	

DLU MSOS diagnostic logical unit in decimal

DENSITY 200, 556, 800, or 1600 bits per inch.

In response to the DLU,DENSITY request for parameters, the operator may enter up to eight response lines, terminating each with a carriage return. He may terminate the list after any entry by making the next entry FFFF (see the example).

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 0925 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT,MTT	Request magnetic tape test.
BEGIN MAG TAPE TEST SECTIONS,NO.OF RECDS,RUNS	Test is in operation and requests operational parameters.
1E,100,2	Operator requests all sections, 100 records per write/read, and two passes.
DLU,DENSITY	Test requests additional information.
6,556 7,800 FFFF	Operator requests diagnostic logical unit 6 at 556 bpi and 7 at 800 bpi. FFFF terminates the logical unit list. A total of eight logical units may be specified. The test begins exercising the device(s) at this point.
END MAG TAPE TEST, 0002 RUNS TAPE LU 0006, 0000 ERRORS TAPE LU 0007, 0000 ERRORS	Test has completed requested test sections and number of passes, logged the number of errors encountered, and released allocatable core.
SCMM OUT 12/01/73 0925	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

CARD READER/PUNCH TEST (CRD)

DEVICES TESTED

This test will diagnose errors on the following devices:

1728/430
1729-2
1729-3
1725-1

TYPES OF TESTS

Eight test sections are available:

1. Punch random data — Uses a pseudo random number generator to produce the data punched in the card. Card is generated via formatted write.
2. Punch $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ pattern — Use the three words to punch a full card of data.
3. Punch user input pattern — Allows the user to input a one-word pattern which is used to punch a full card of data.
4. Punch sync check — Punches all rows in column 1 and column 80. If bit 15 of the SECTIONS parameter is set, then all rows in columns 40 and 41 are punched.
5. Read random data — Reads the data cards punched in test section 1 and verifies the data.
6. Read $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ pattern — Reads data cards punched in test section 2 and verifies the data.
7. Read user pattern — Reads data cards punched in test section 3 and verifies the data.
8. Read sync check — Reads data cards punched in test section 4 and verifies the data.

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the two status words of the device. MSOS driver errors are:

TIME OUT	MSOS error 0
CKSUM ERROR	MSOS error 4
INT REJECT	MSOS error 5
EXT REJECT	MSOS error 6
NO 7-9 PUNCH	MSOS error 8
NON-NEG RCD LENGTH	MSOS error 10
DATA INT AFTER COL 80	MSOS error 34
EOP INT BEFORE COL 80	MSOS error 35

The error message that is output has the following format:

TSTCRD SEC xx CARD yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

NOT RDY
BUSY
LOST DATA
DATA ERROR COL xxxx
MOTION FAILURE
CHIP BOX FULL

Errors recognized for level 2 status are:

HOPPER EMPTY
STACKER FULL
FEED FAILURE
READER AREA JAM
PUNCH AREA JAM
STACKER AREA JAM
PRE-READ ERROR
PUNCH ERROR
MANUAL
INHIBIT SW SET
INTERLOCK

The message format for these errors is the same as that of the MSOS-driver-detected errors.

One other error message is output if a data error is detected when performing the data verification for the read sections. Its format is:

TSTCRD DATA ERROR COL xx ACTUAL yyyy EXPECTED zzzz

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test will continue.

NOTE

When several errors are detected in a record (such as comparing tape against core and words do not match) the error total is for all errors detected.

INPUT PARAMETERS

The possible input values for the test's operational parameters (DLU, SECTIONS, CARDS) are:

DLU — MSOS diagnostic logical unit in decimal.

SECTIONS

- 2 — Punch random data via a formatted write request
- 4 — Punch $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ pattern via a normal write request
- 8 — Punch user input pattern via a normal write request
- 10_{16} — Punch read sync data via a normal write request
- 20_{16} — Read random data via a formatted read request
- 40_{16} — Read $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ data pattern via a normal read request
- 80_{16} — Read user data pattern via a normal read request
- 100_{16} — Read the read sync data cards via a normal read request

NOTE: This test will execute only one section at a time. It will not sequence through multiple sections.

CARDS — Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Input	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, CRD	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 0950 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT,CRD	Request card reader/punch test.
BEGIN CARD R/P TEST DLU,SECTIONS,CARDS	Test is in operation and requests operation parameters.
24,20,500	Operator requests logical unit 24, section 5 (read random data), and 500 cards.
END CARD R/P TEST, 0500 CARDS 0000 ERRORS	Test has completed the requested test section and read 500 cards. Allocatable core has been released.
SCMM OUT 12/01/73 0958	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

100 TPI 200 TPI

CARTRIDGE DISK TEST (CD1 OR CD2)

DEVICES TESTED

This test will diagnose the following devices:

1739-1
1733-2/856-2
1733-2/856-4

TYPES OF TESTS

Six test sections may be requested by the operator:

1. Worst case pattern — this section uses the four words 9555_{16}, $6AAA_{16}$, $5A5A_{16}$, and $A5A5_{16}$ for its worst patterns. The words are used one at a time in succession to fill the designated test area of disk. When the area is full the data is read back and verified.
2. All ones — The test area on disk is filled with ones and then read back for data verification.
3. Random data — Pseudo random bit patterns are generated to fill the disk test area. The data is then read back and verified.
4. Random data, random block length — The same as test section 3 except the number of words per transfer is random.
5. Zeros written over ones — The test area on disk is filled with ones. Zeros are then written into the area and the data is read back to verify that it is all zeros.
6. Random sector addresses — Generates a pseudo random sector address within the disk test area. Writes 2,048 words of data (word pattern 9555_{16}) starting at that address. Reads the data back and verifies it. A total of 160 addresses are generated.

ERROR DETECTION AND REPORTING

Error checking consists of data compares and device status bits. The message format for data compare errors is:

```
TSTCD1 SEC xx RUN yyyy COMP ERR H/W ADDR zzzz SECTOR ssss
       WORD wwww WAS aaaa IS bbbb
```

The following message also occurs after the entire data transfer block has been verified and errors have occurred:

```
TSTCD1 COMP ERR TOTAL xxxx
```

Hardware status errors that are recognized are:

NOT READY
NO COMP
CHKWRD ERR
LOST DATA
CONTROLLER SEEK ERR
ADDRESS ERR
DRIVE SEEK ERROR
PARITY
PROTECT ERR

The message format for these errors is as follows:

TSTCD1 SEC xx RUN yy (one of the above messages) {D-C XFER / C-D XFER} H/W ADDR zzzz SECTOR aaaa

One other error message:

TSTCD1 SEC ADDR ERR

may appear if the operator requests a disk test area that infringes on the system area of disk or is larger than the maximum number of sectors on the disk ($5BFD_{16}$ for the 856-2 and 1739, $B8DD_{16}$ for the 856-4).

INPUT PARAMETERS

The possible input values for the test's operational parameters (LU, SECTIONS, BEG SEC, END SEC, RUNS) are:

LU — MSOS logical unit number in decimal

SECTIONS
- 1 — NONE
- 2 — Word case data pattern
- 4 — All ones data pattern
- 8 — Random data pattern
- 10_{16} — Random data pattern with random block length
- 20_{16} — Zeros written over ones
- 40_{16} — Random sector addressing

NOTE: Any combination of the above sections may be requested.

BEG SEC — Any hexadecimal value less than the maximum disk sector.

NOTE: If the test is to be run on the system pack, BEG SEC must be larger than the value stored at core address $C1_{16}$.

CD1 = SINGLE DENSITY (100 TPI)
CD2 = DOUBLE DENSITY (200 TPI)

END SEC — Any hexadecimal value less than the maximum disk sector ($5BFD_{16}$ for the 856-2 and 1739, $B8DD_{16}$ for the 856-4) but greater than the value entered for BEG SEC.

RUNS — Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP,CD1	

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1010 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT,CD1	Request cartridge disk test.
BEGIN CDD 1 TEST BEWARE OF SCRATCH CONFLICT, $C1=xxxx LU,SECTIONS,BEG SEC,END SEC,RUNS	Test is in operation and requests operational parameters.
30,2,6000,8000,2	Operator requests MSOS logical unit 30, section 1, beginning sector of 6000, ending sector of 8000, and two passes.
END CDD 1 TEST, xxxx RUNS, yyyy ERRORS	Test has completed requested test sections and number of passes. It has also released allocatable core.
SCMM OUT 12/01/73 1030	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

DISK TEST (DK1 OR DK2)

DEVICES TESTED

This test will diagnose the following devices:

1738/853 and 854
1733-1/853 and 854

TYPES OF TESTS

Six test sections may be requested by the operator:

1. Worst case pattern — This section uses the four words 9555_{16}, $6AAA_{16}$, $5A5A_{16}$, and $A5A5_{16}$ for its worst patterns. The words are used one at a time to fill the designated test area of disk. When the area is full, the data is read back and verified.
2. All ones — The test area on disk is filled with ones and then read back for data verification.
3. Random data — Pseudo random bit patterns are generated to fill the disk test area. The data is then read back and verified.
4. Random data, random block length — The same as test section 3 except the number of words per transfer is random.
5. Zeros written over ones — The test area on disk is filled with ones. Zeros are then written into the area and the data is read back to verify that it is all zeros.
6. Random sector addresses — Generates a pseudo random sector address within the disk test area. Writes 2,048 words of data (word pattern 9555_{16}), starting at that address. Reads the data back and verifies it. A total of 160 addresses are generated.

ERROR DETECTION AND REPORTING

Error checking consists of data compares and device status bits. The message format for data compare errors is:

```
TSTDK1 SEC xx RUN yyyy COMP ERR SECTOR bbbb H/W ADDR zzzz
       WORD wwww WAS aaaa IS bbbb
```

The following message also occurs after the entire data transfer block has been verified and errors have occurred:

```
TSTDK1 COMP ERR TOTAL xxxx
```

Hardware status errors that are recognized are:

NOT READY
NO COMP
CHKWRD ERR
LOST DATA
SEEK ERR
ADR ERR
DEF TRK
PARITY
PROTECT ERR

The message format for these errors is as follows:

TSTDK1 SEC xx RUN yy (one of the above messages) $\left\{\begin{matrix}\text{D-C XFER}\\\text{C-D XFER}\end{matrix}\right\}$ SECTOR bbbb H/W ADDR zzzz

One other error message:

TSTDK1 SEC ADDR ERR

may appear if the operator requests a disk test area that infringes on the system area of disk or is larger than the maximum number of sectors on the disk ($3E7F_{16}$ for the 853, $7EDF_{16}$ for the 854).

INPUT PARAMETERS

The possible input values for the test's operational parameters (LU,SECTIONS,BEG SEC,END DEC, RUNS) are:

LU	MSOS logical unit number in decimal
SECTIONS	2 — Worst case data pattern
	4 — All ones data pattern
	8 — Random data pattern
	10_{16} — Random data pattern of random length data blocks
	20_{16} — Zeros written over ones
	40_{16} — Random sector addressing
	NOTE: Any combination of the section numbers may be requested.
BEG SEC	Any hexadecimal value less than the maximum disk sector.
	NOTE: If the test is to run on the system pack, BEG SEC must be larger than the value stored at core address $C1_{16}$.

END SEC — Any hexadecimal value less than the maximum sector number of the disk ($3E7F_{16}$ for the 853, $7EDF_{16}$ for the 854) but greater than the value entered for BEG SEC.

RUNS — Any decimal number up to 8000. If an 8000 is entered, the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, DK1	

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1035 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, DK1	Request disk test.
BEGIN DISK 1 TEST BEWARE OF SCRATCH CONFLICT, $C1=xxxx LU, SECTIONS, BEG SEC, END SEC, RUNS	Test is in operation and requests operational parameters.
8, 7E, 6000, 7000, 2	Operator requests MSOS logical unit 8, all test sections, beginning sector of 6000, end sector of 7000, and two passes.
END DISK 1 TEST, xxxx RUNS, yyyy ERRORS	Test has completed requested test sections and number of passes. All allocatable core has been released.
SCMM OUT 12/01/73 1115	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

1752 DRUM TEST (DRM)

DEVICES TESTED

This test will diagnose the 1752 drum.

TYPES OF TESTS

Seven test sections may be requested by the operator:

1. Worst case pattern — This section uses the four words 9555_{16}, $6AAA_{16}$, $5A5A_{16}$, and $A5A5_{16}$ for its worst patterns. The words are used one at a time in succession to fill the designated test area of drum. When the area is full the data is read back and verified.
2. All ones — The test area on drum is filled with ones and then read back for data verification.
3. Random data — Generates pseudo random bit patterns which are used to fill the drum test area. The data is then read back and verified.
4. Random data, random block length — The same as test section 3, except the number of words per transfer is random.
5. Zeros written over ones — The test area on drum is filled with ones. Zeros are then written into the area and the data is read back to verify that it is all zeros.
6. Random sector addresses — Generates a pseudo random sector address within the drum test area. Writes 2,048 words of data (word pattern 9555_{16}) starting at that address. Reads the data back and verifies it. A total of 160 addresses are generated.
7. Write sector number — Uses the sector address as data to be written into the specific sector. After the test area on drum is filled, the data is read back and each sector is checked to verify that it contains the sector's address as data.

ERROR DETECTION AND REPORTING

Error checking consists of data compares and device status bits. The message format for data compare error is:

TSTDRM SEC xx RUN yyyy COMP ERR SECTOR zzzz WORD wwww WAS aaaa IS bbbb

The following message also occurs after the entire data transfer block has been verified and errors have occurred:

TSTDRM COMP ERR TOTAL xxxx

Hardware status errors that are recognized are:

NOT READY
LOST DATA
CHKWRD ERR
PROTECT FAULT
TIMING TRACK ERROR
POWER FAILURE
GUARDED ADDRESS ERROR
SECTOR OVERRANGE ERROR

The message format for these errors is as follows:

TSTDRM SEC xx RUN yy (one of the above messages) {D-C XFER / C-D XFER} SECTOR wwww
H/W ADDR zzzz

One other error message

TSTDRM SEC ADR ERR

may appear if the operator requests a drum test area that infringes on the system area of drum or is larger than the maximum number of sectors on the drum.

INPUT PARAMETERS

Possible input values for the test's operational parameters (LU, SECTIONS, BEG SEC, END SEC, RUNS) are:

LU	MSOS logical unit number in decimal	
SECTIONS	2	— Worst case data pattern
	4	— All ones data pattern
	8	— Random data pattern
	10_{16}	— Random data pattern of random block length
	20_{16}	— Zeros written over ones
	40_{16}	— Random sector addressing
	80_{16}	— Write sector number as sector data pattern
	NOTE: Any combination of the above sections may be requested by the operator.	
BEG SEC	Any hexadecimal value less than the maximum drum sector	
	NOTE: If the drum is the system mass storage device then this value must be greater than the sector number stored at core address $C1_{16}$.	

END SEC — Any hexadecimal value less than the maximum sector of the drum (800_{16} for Model 1, 1800_{16} for Model 2, 3000_{16} for Model 3, and 4000_{16} for Model 4).

RUNS — Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, DRM	

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1120 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, DRM	Request drum test.
BEGIN DRUM TEST LU, SECTIONS, BEG SEC, END SEC, RUNS	Test is in operation and requests operational parameters.
24, 2, 1000, 2000, 1	Operator requests MSOS logical unit 24, test section 1, beginning sector of 1000, end sector of 2000, and one pass.
END DRUM TEST, xxxx RUNS, yyyy ERRORS	Test has completed requested test section and number of passes. Allocatable core has been released.
SCMM OUT 12/01/73 1128	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

PAPER TAPE READER TEST (PR1)

DEVICES TESTED

This test diagnoses errors on the following devices:

1720-1

TYPES OF TESTS

The test sections that are available are as follows:

1. Read random data — Reads the tape punched by section 1 of the paper tape punch test and verifies the data.
2. Read $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ pattern — Reads tape punched in section 2 of the paper tape punch test and verifies the data pattern.
3. Read user pattern — Reads tape punched in section 3 of the paper tape punch test and verifies the data pattern.
4. Read sync check — Reads the tape punched in section 4 of the paper tape punch test and verified the sync patterns.

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the status word of the device. MSOS driver errors are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
PARITY ERROR	MSOS error 3
CHECKSUM ERROR	MSOS error 4
INTERNAL REJECT	MSOS error 5
EXTERNAL REJECT	MSOS error 6
NOT READY	MSOS error 14

The error message that is output has the following format:

TSTPR1 SECTION xx RECS yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

BUSY
BACKWARD MOTION
PARITY ERROR

The message format for these errors is the same as that of the MSOS-driver-detected errors.

One other error message is output if a data error is detected when performing the data verification. Its format is:

TSTPTR DATA ERROR FRAME xx ACTUAL yyyy EXPECTED zzzz

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test continues.

INPUT PARAMETERS

The possible input values for the test's operational parameters (DLU, SECTIONS,RECDS) are:

DLU — MSOS diagnostic logical unit number in decimal

SECTIONS
- 2 — Read random data pattern
- 4 — Read $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ data pattern
- 8 — Read user-specified pattern
- 10_{16} — Read sync check data pattern

RECDS — Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, PR1	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 10/01/75 1130 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, PR1	Request paper tape reader test.
BEGIN PAPER TAPE READER TEST DLU, SECTIONS, RECDS	Test is in operation and requests operational parameters.
2,4,500	Operator requests MSOS logical unit 2, section 2 (random data) and 500 records.
END PAPER TAPE READER TEST, xxxx RECS yyyy ERRORS	Test has completed requested test sections and number of records. Allocatable core has been released.
SCMM OUT 10/01/75 1135	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

PAPER TAPE READER TEST (PTR)

DEVICES TESTED

This test will diagnose errors on the following devices:

1713
1721
1723
1777

TYPES OF TESTS

The test sections that are available are as follows:

1. Read random data — Reads the tape punched by section 1 of the paper tape punch test and verifies the data.
2. Read $AA55_{16}$ pattern — Reads tape punched in section 2 of the paper tape punch test and verifies the data pattern.
3. Read user pattern — Reads tape punched in section 3 of the paper tape punch test and verifies the data pattern.
4. Read sync check — Reads the tape punched in section 4 of the paper tape punch test and verifies the sync patterns.

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the status word of the device. MSOS driver errors are:

TIME OUT	MSOS error 0
LOST DATA	MSOS error 1
ALARM	MSOS error 2
PARITY ERROR	MSOS error 3
CHECKSUM ERROR	MSOS error 4
INTERNAL REJECT	MSOS error 5
EXTERNAL REJECT	MSOS error 6

The error message that is output has the following format:

TSTPTR SECTION xx RECS yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

NOT READY
BUSY
MOTION FAILURE
POWER FAILURE
EXISTENCE CODE

The message format for these errors is the same as that of the MSOS-driver-detected errors.

One other error message is output if a data error is detected when performing the data verification. Its format is:

TSTPTR DATA ERROR FRAME xx ACTUAL yyyy EXPECTED zzzz

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test will continue.

INPUT PARAMETERS

The possible input values for the test's operational parameters (DLU, SECTIONS, RECDS) are:

DLU — MSOS diagnostic logical unit number in decimal

SECTIONS
- 2 — Read random data pattern
- 4 — Read $AA55_{16}$ data pattern
- 8 — Read user-specified pattern
- 10_{16} — Read sync check data pattern

RECDS — Any decimal value up to 8000. If an 8000 is entered, the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, PTR	

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1130 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, PTR	Request paper tape reader test.
BEGIN PAPER TAPE READER TEST DLU, SECTIONS, RECDS	Test is in operation and requests operational parameters.
2, 4, 5000	Operator requests MSOS logical unit 2, section 2 (random data), and 500 records.
END PAPER TAPE READER TEST, xxxx RECS yyyy ERRORS	Test has completed requested test sections and number of records. Allocatable core has been released.
SCMM OUT 12/01/73 1135	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

PAPER TAPE PUNCH TEST (PP1)

DEVICES TESTED

This test diagnoses errors on the following devices:

1720-1

TYPES OF TESTS

The test sections that are available are as follows:

1. Punch random data — Uses a pseudo random number generator to produce the data punched in the record (40 words).
2. Punch $AA55_{16}$ pattern — Uses the one word to punch a full record of data.
3. Punch user input pattern — Allows the user to input a one-word pattern which is used to punch a full record of data.
4. Punch sync check — Punches all channels at the beginning and end of a record. If bit 15 of the SECTIONS parameter is set then all channels in the last half of frame 40 and the first half of frame 41 are punched.

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the status word of the device. MSOS driver errors are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
PARITY ERROR	MSOS error 3
INTERNAL REJECT	MSOS error 5
EXTERNAL REJECT	MSOS error 6
INVALID DEVICE MSG STATUS	MSOS error 27
VALIDATION/ECHO ERROR	MSOS error 30
TAPE SUPPLY	MSOS error 32

The error message that is output has the following format:

TSTPP1 SECTION xx RECS yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

NOT RDY
BUSY

The message format for these errors is the same as that of the MSOS-driver-detected errors.

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test continues.

INPUT PARAMETERS

Possible input values for the test's operational parameters (DLU, SECTIONS, RECDS) are:

DLU — MSOS diagnostic logical unit number in decimal

SECTIONS
- 2 — Punch random data pattern
- 4 — Punch $AA55_{16}$ data pattern
- 8 — Punch user-specified data (one word) pattern
- 10_{16} — Punch sync check data pattern

RECDS — Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, PP1	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 10/01/75 1140 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, PP1	Request paper tape punch test.
BEGIN PAPER TAPE PUNCH TEST DLU,SECTIONS,RECS	Test is in operation and requests operational parameters.
3,10,500	Operator requests MSOS logical unit 3, section 4 (read sync), and 500 records.
END PAPER TAPE PUNCH TEST xxxx RECS yyyy ERRORS	Test has completed requested test sections and number of records. Allocatable core has been released.
SCMM OUT 10/01/75 1145	SCMM Executive has determined that no other tests are in execution so it terminates and releases core.

PAPER TAPE PUNCH TEST (PTP)

DEVICES TESTED

This test will diagnose errors on the following devices:

1713
1722
1724
1778

TYPES OF TESTS

The test sections that are available are as follows:

1. Punch random data — Uses a pseudo random number generator to produce the data punched in the record (40 words).

2. Punch $AA55_{16}$ pattern — Uses the one word to punch a full record of data.

3. Punch user input pattern — Allows the user to input a one-word pattern which is used to punch a full record of data.

4. Punch sync check — Punches all channels at the beginning and end of a record. If bit 15 of the SECTIONS parameter is set, then all channels in the last half of frame 40 and the first half of frame 41 are punched.

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the status word of the device. MSOS driver errors are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
PARITY ERROR	MSOS error 3
INTERNAL REJECT	MSOS error 5
EXTERNAL REJECT	MSOS error 6
VALIDATION ERROR	MSOS error 30

The error message that is output has the following format:

TSTPTP SECTION xx RECS yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

NOT RDY
BUSY
EXISTENCE CODE
POWER FAILURE
TAPE SUPPLY LOW

The message format for these errors is the same as that of the MSOS-driver-detected errors.

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test will continue.

INPUT PARAMETERS

Possible input values for the test's operational parameters (DLU, SECTIONS, RECDS) are:

DLU	MSOS diagnostic logical number in decimal
SECTIONS	2 — Punch random data pattern
	4 — Punch $AA55_{16}$ data pattern
	8 — Punch user-specified data (one word) pattern
	10_{16} — Punch sync check data pattern
RECDS	Any decimal value up to 8000. If an 8000 is entered, the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, PTP	

EXAMPLE

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1140 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, PTP	Request paper tape punch test.
BEGIN PAPER TAPE PUNCH TEST DLU, SECTIONS, RECS	Test is in operation and requests operational parameters.
3, 10, 500	Operator requests MSOS logical unit 3, section 4 (read sync), and 500 records.
END PAPER TAPE PUNCH TEST xxxx RECS yyyy ERRORS	Test has completed requested test sections and number of records. Allocatable core has been released.
SCMM OUT 12/01/73 1145	SCMM Executive has determined that no other tests are in execution so it terminates and releases core.

405 CARD READER TEST (405)

DEVICES TESTED

This test will diagnose errors on the following device:

1726/405 Card Reader

TYPES OF TESTS

The test sections that are available are as follows:

1. Read Random Data — Reads the data cards punched by section 1 of the card reader/punch test and verifies the data.
2. Read $AAA5_{16}$, $55AA_{16}$, $A555_{16}$ Pattern — Reads the data cards punched by section 2 of the card reader/punch test and verifies the data.
3. Read User Pattern — Reads the data cards punched by section 3 of the card reader/punch test and verifies the data.
4. Read Sync Check — Reads the data cards punched by section 4 of the card reader/punch test and verifies the data. The data cards used in this test are part of the MSOS 4.1 installation material.

   NOTE: Input cards for this test must be punched by the punch sections of the card reader/punch test (CRD).

ERROR DETECTION AND REPORTING

Two types of reporting are used in the test: errors flagged by the MSOS driver and errors specified in the status word of the device.

MSOS driver errors are:

TIME OUT	MSOS error 0
ALARM	MSOS error 2
CKSUM ERROR	MSOS error 4
INT REJECT	MSOS error 5
EXT REJECT	MSOS error 6
PRE-READ ERROR	MSOS error 7
ILLEGAL ASCII	MSOS error 8
SEQ ERROR	MSOS error 9
NON-NEG RCD LENGTH	MSOS error 10
NO 7-9 PUNCH	MSOS error 12
INPUT EMPTY	MSOS error 23
1706 ADDRESS ERROR	MSOS error 37

The error message that is output has the following format:

TST405 SEC xx CARDS yyyy (one of the above messages)

Hardware errors recognized for level 1 status are:

READER NOT READY
READER BUSY
FEED FAIL
STACKER FULL/JAM
INPUT HOPPER EMPTY

The message format for these errors is the same as that of the MSOS-driver-detected errors.

One other error message is output if a data error is detected when performing the data verification for the read sections. Its format is:

TST405 DATA ERROR COL xxxx ACTUAL yyyy EXPECTED zzzz

The test logic assumes that all errors flagged in the device status words are fatal errors and therefore terminates the test. Those errors detected by the MSOS driver are considered recoverable and the test will continue.

INPUT PARAMETERS

Possible input values for the test's operational parameters (DLU,SECTIONS,CARDS) are:

DLU — MSOS diagnostic logical unit in decimal

SECTIONS
- 2 — Read random data pattern
- 4 — Read $AAA5_{16}$, $55AA_{16}$, A555 data pattern
- 8 — Read user specified data pattern
- 10_{16} — Read sync check data pattern

NOTE: Data cards read by this test must be those that were punched by the punch sections of test CRD. Only one of the sections will be executed per call even though all sections were requested.

CARDS — Any decimal value up to 8000. If an 8000 is entered then the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP,405	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1150 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT,405	Request 405 Card Reader test.
BEGIN 405 CARD READER TEST DLU,SECTIONS,CARDS	Test is in operation and requests operational parameters.
16,4,500	Operator requests MSOS logical unit 16, section 2, and 500 cards.
END 405 CARD READER TEST, xxxx CARDS yyyy ERRORS	Test has completed requested test sections and read 500 cards. Allocatable core has been released.
SCMM OUT 12/01/73 1200	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

1751 DRUM TEST (DM1)

DEVICES TESTED

This test will diagnose the following device:

1751 Drum

TYPES OF TESTS

Eight test sections may be requested by the operator:

1. Worst case pattern — Uses the four words 9555_{16}, $6AAA_{16}$, $5A5A_{16}$, and $A5A5_{16}$ for its worst patterns. The words are used one at a time in succession to fill the designated test area of drum. When the area is full the data is read back and verified.
2. All ones — The test area on drum is filled with ones and then read back for data verification.
3. Random data — Generates pseudo random bit patterns which are used to fill the drum test area. The data is then read back and verified.
4. Random data, random block length — The same as test section 3, except the number of words per transfer is random.
5. Zeros written over ones — The test area on drum is filled with ones. Zeros are then written into the area and the data is read back to verify that it is all zeros.
6. Random sector addresses — Generates a pseudo random sector address within the drum test area. Writes 2,048 words of data (word pattern 9555_{16}) starting at that address. Reads the data back and verifies it. A total of 160 addresses are generated.
7. Track switching test — Two cells are set to ones and transferred to the drum so that the first word is allocated to the last sector of a track; therefore, the second word should be placed in the first sector of the next track. The contents of the two sectors are read and checked for proper track switching. This procedure is repeated for all tracks in the drum test area.
8. Write sector number — Uses the sector address as data to be written into the specific sector. After the test data on drum is filled, the data is read back and each sector is checked to verify that it contains the sector's address as data.

ERROR DETECTION AND REPORTING

Error checking consists of data compares and device status bits. The message format for a data compare error is:

TSTDM1 SECTION xx RUN yyyy COMP ERR TRACK zzzz WORD wwww WAS aaaa IS bbbb

The following message also occurs after the entire data transfer block has been verified and errors have occurred:

TSTDM1 COMP ERR TOTAL xxxx

Hardware status errors that are recognized are:

NOT READY
LOST DATA
CHKWRD ERR
PROTECT FAULT
TIMING TRACK ERROR
POWER FAILURE
GUARDED ADDRESS ERROR
SECTOR OVERRANGE ERROR

The message format for these errors are as follows:

TSTDM1 SECTION xx RUN yy (one of the above messages) $\left\{\begin{matrix}\text{D-C XFER}\\ \text{C-D XFER}\end{matrix}\right\}$

One other error message:

TSTDM1 TRACK ADR ERR

may appear if the operator requests a drum test area which infringes on the system area of drum or is larger than the maximum number of sectors on the drum.

INPUT PARAMETERS

Possible input values for the test's operational parameters (LU, SECTIONS, BEG TRK, END TRK, RUNS) are:

LU	MSOS logical unit number in decimal	
SECTIONS	2	— Worst case data pattern
	4	— All ones data pattern
	8	— Random data pattern
	10_{16}	— Random data pattern of random block length
	20_{16}	— Zeros written over ones
	40_{16}	— Random sector addressing
	80_{16}	— Track switching test
	100_{16}	— Write sector number
	NOTE: Any combination of the above sections may be requested by the operator.	
BEG TRK	Any hexadecimal value less than the maximum drum sector	
	NOTE: If the drum is the system mass storage device then this value must be greater than the sector number stored at core address $C1_{16}$.	

END TRK	Any hexadecimal value less than the maximum sector of the drum.
RUNS	Any decimal value up to 8000. If an 8000 is entered the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP,DM1	

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1120 CONTROL, TEST ID	SCMM Executive in and requests control information.
SRT, DM1	Request drum test.
BEGIN 1751 TEST DLU,SECTIONS,BEG TRK,END TRK,RUNS	Test is in operation and requests operational parameters.
24,2,1000,2000,1	Operator requests MSOS logical unit 24, test section 1, beginning sector of 1000, end sector of 2000, and one pass.
END 1751 TEST, xxxx RUNS, yyyy ERRORS	Test has completed requested test section and number of passes. Allocatable core has been released.
SCMM OUT 12/01/73 1128	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

DISK VARIABLE POSITION TEST (DVP)

DEVICES TESTED

This test will diagnose the following devices:

1738/853-854
1733-1/853-854

TYPES OF TESTS

Two test sections may be requested by the operator:

1. Variable positioning — This section, using the cylinder limits entered by the operator, seeks to the highest address and writes or reads one sector of data, seeks to the lowest address and writes or reads one sector of data, decrements the highest cylinder address, increments the lowest cylinder address, and then repeats the high/low seek sequence. This process is repeated until the lowest cylinder address is equal to the END CYL value entered by the operator. If the operator requests a write/read sequence, then on the read the data is verified against the data written.
2. Two-position seek — Seeks to the highest cylinder address and writes or reads one sector of data, seeks to the lowest cylinder address and writes or reads one sector of data, and then checks if the requested number of passes has been completed. Again, if the write/read sequence has been requested the data read is verified against the data written.

ERROR DETECTION AND REPORTING

Error checking consists of data compares and device status bits. The message format for data compare errors is:

TSTDVP SEC xx RUN yyyy COMP ERR H/W ADDR zzzz WORD wwww WAS aaaa IS bbbb

The following message also occurs after the entire data transfer block has been verified and errors have occurred:

TSTDVP COMP ERR TOTAL xxxx

Hardware status errors that are recognized are:

NOT READY
NO COMP
CHKWRD ERR
LOST DATA
SEEK ERR
ADR ERR
DEF TRK
PARITY
PROTECT ERR

The message format for these errors is as follows:

TSTDVP SEC xx RUN yy (one of the above messages) $\left\{\begin{matrix}\text{D-C XFER}\\\text{C-D XFER}\end{matrix}\right\}$ H/W ADDR zzzz

Other messages that may appear due to operator input errors are:

LU ERROR	Illegal logical unit requested
CYL ADR ERR	Requested cylinder address is either in the system area of the disk or larger than the disk's maximum cylinder (maximum 100 for the 853, 203 for the 854).
HEAD NO. ERR	Requested head number is greater than the disk's maximum number (maximum is 10).

INPUT PARAMETERS

The possible input values for the test's operational parameters (LU, SECTIONS, RUNS, BEG CYL, END CYL, HEAD, TYPE (I/O), DATA PATTERN) are:

LU — MSOS logical unit number in decimal

SECTIONS
2 — Variable-position seek
4 — Two-position seek

NOTE: Only one section at a time may be requested.

RUNS — Any decimal number up to 8000. If an 8000 is entered, the test will execute indefinitely until the operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	MI
SCMM	CONTROL, TEST ID
STP, DVP	

BEG CYL	Any decimal value less than the maximum cylinder number but greater than the highest cylinder used by the system.
END CYL	Any decimal value less than the maximum cylinder number.
HEAD	Any decimal number less than or equal to 10.
TYPE I/O	0 — Read only mode
	2 — Write/read mode
	4 — Write only mode
	8000 — Read only with data compare
DATA PATTERN	Any four-digit hexadecimal number

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/01/73 1310 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT,DVP	Request disk variable positioning test.
BEGIN DISK POSITION TEST BEWARE OF SCRATCH CONFLICT, $C1=xxxx LU,SECTIONS,RUNS	Test is in operation and requests operational parameters.
8,2,2	Operator requests MSOS logical unit 8, section 1, and two passes.
BEG CYL,END CYL,HEAD	Test requests additional information.
50,60,5	Operator requests lowest cylinder used as 50, highest cylinder used as 60, and head 5.
TYPE (I/O), DATA PATTERN	Test requests additional information.
2,A5A5	Operator requests write/read sequence with each data word being an $A5A5_{16}$.
END DISK POSITIONING TEST xxxx RUNS. yyyy ERRORS	Test has completed requested test section and number of passes. Allocatable core has been released.
SCMM OUT 12/01/73 1320	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

LOW-SPEED ANALOG INPUT TEST (AD1)

DEVICES TESTED

This test will diagnose the following devices:

1536/1502-80/1525-3 (local or remote)

TYPES OF TESTS

This routine obtains inputs from a sequence of one to eight channel sets, reports a specified number of times, compares the actual to the expected counts, and generates a double-precision histogram (see Figure 5-1) which allows a maximum count of 9,999,999 for each error counter.

In order to conduct the test, the user must provide an analog signal for each channel being tested. This is most conveniently accomplished using the analog input test box,† which provides variable dc inputs to each channel of a sequence of eight-channel sets. With the test box, the user can apply the desired voltage to each of the channels; then, when requested by the test routine, he can enter the reading in percentage of full scale expected for each channel. This information is converted by the program to expected counts. The expected counts are compared to actual counts to produce a histogram of deviations.

After each input, checks are made for any error indications returned by the driver. Any errors indicated result in the output of diagnostic messages.

ERROR DETECTION AND REPORTING

Hardware error reporting is based primarily on the error code returned by the MSOS driver. The types of errors recognized by the MSOS driver and the test are:

TIME OUT	Local and remote
MUX REJECT	
ADC REJECT	
INT REJECT	Remote
EXT REJECT	Remote

The actual error message will be as follows:

```
TSTAD1 CHNL  xxxx  TIME OUT
                   MUX REJECT
                   ADC REJECT
                   INT REJECT
                   EXT REJECT
```

After the error message, the test continues with the I/O sequence that was in progress.

---

†IOM analog test box, Part No. 88970700

Additional error messages are:

CHNL xxxx CK RELAY VALUE READ xxxx
LU ERROR
ADR ERROR
CHNL xxxx VALUE TOO +
CHNL xxxx VALUE TOO -

TSTAD1 HISTOGRAM OF RESULTS
SCALE FACTOR 0001 ADDR 0000- 0015 NUM READ 00000010

POINT	1	2	3	4	5	6	7	8
EX CNTS	7CF0	7CF0	7CF0	7CF0	7CF0	7CF0	7CF0	7CF0
GAIN	0000	0000	0000	0000	0000	0000	0000	0000
GT	0	0	0	0	0	0	0	0
+7	0	0	0	0	0	0	0	0
+6	0	0	0	0	0	0	0	0
+5	0	0	0	0	0	0	0	0
+4	0	0	0	0	0	0	0	0
+3	0	0	0	0	0	0	0	0
+2	0	0	0	0	0	0	0	0
+1	1	0	0	0	0	0	0	0
0	19	20	20	20	20	20	20	20
-1	0	0	0	0	0	0	0	0
-2	0	0	0	0	0	0	0	0
-3	0	0	0	0	0	0	0	0
-4	0	0	0	0	0	0	0	0
-5	0	0	0	0	0	0	0	0
-6	0	0	0	0	0	0	0	0
-7	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0

Figure 5-1. Sample Histogram (AD1)

INPUT PARAMETERS

The possible input values for the test's operational parameters are:

LU	MSOS logical unit in decimal
BGN ADR	Start point (channel) that is to be tested in decimal
END ADR	End point (channel) in decimal. It must not be less than BGN ADR. The maximum number of points of END ADR is 1024.
READINGS PER RUN	Number of times a point is to be read per run (in decimal)
RUNS	Any decimal value up to 8000. If an 8000 is entered, the test will execute indefinitely until the operator uses the SCMM Executive STP command.
SCALE	One to four hexadecimal digits representing the histogram scale factor. The expected counts are subtracted from the actual counts and the result is divided by a non-zero scale factor to produce the scaled conversion error recorded in the histogram. A zero scale factor is treated as a one.
CK RELAY	1 — Causes the following message to output whenever the scale's deviation is greater than +7 or less than -7 CHK RELAY NO. x hhhh VALUE READ yyyy Where: hhhh = Hexadecimal channel address yyyy = Value actually read in hexadecimal 0 — Message is bypassed
ADC BIT TYPE	0 — 1536 Analog Digital Converter low speed analog input is 12-bit and left-justified. 1 — 1536 Analog Digital Converter low speed analog input is 14-bit and left-justified.
0% FS COUNTS/ 100% FS COUNTS	Enter analog digital converter reading for an input of 0% full scale (typically 0000_{16}). Enter analog digital converter reading for an input of 100% full scale (typically $7D00_{16}$).
% FS/GAIN POINT x	% FS — Integer percent of full scale in decimal expected for point x. (If 8000 is entered for %, the test will take the first reading and use it for expected counts.)

GAIN — Gain applied to input

0 — Gain of 1
1 — Gain of 10
2 — Gain of 100
3 — Gain of 1000

Example: If 0.5v is used as an input but 100% of full scale ($7D00_{16}$) is expected, specify a gain of 1 to increase the input by a factor of 10. (5v is considered full scale in this example).

x — Point number (channel)

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 10/02/74 0800 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, AD1	Request 1536 Low Speed Analog Input Test.
BEGIN ADC NO. 1 1536 TEST LU, BGN ADR, END ADR READINGS PER RUN, RUNS	Test is in operation and requests operational parameters.
21, 0, 15, 10, 10	Operator specifies logical unit 21. The beginning point is 0, and the ending point is 15. There are 10 readings for each point per run and 10 runs.
SCALE, CK RELAY, TYPE BIT ADC	
1, 1, 0	Operator specifies scale factor of 1, ±7 channel error message, and 12-bit ADC.
% FS COUNTS/100% FS COUNTS	
0000, 7D00	Operator specifies the 0% and 100% FS counts.
%FS, GAIN POINT 0000	
8000	Operator specifies that the first reading of the run will be used as a compare value.

Operator Entry SCMM Reply	Comments
POINT 0001	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0002	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0003	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0004	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0005	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0006	
8000	Operator specifies that the first reading of the run will be used as a compare value.
POINT 0007	
8000	Operator specifies that the first reading of the run will be used as a compare value. Points 8 through 15 are set up to mirror points 0 through 7. The histogram does the first eight points and then does points 8 through 15, but treats them as points 0 through 7. For example, on the histogram, points 0 and 8 will be mirror images.

The operator can now check the analog digital converter for a variety of analog voltages. The test will take the first reading of a run and use that as a compare value for the current run. The operator can consult the histogram and make adjustments, if necessary, until the desired readings are received. The operator can now input a different analog signal through the analog digital converter. There may be some errors, because the test is still expecting an analog voltage that it received at the start of that run. These can be inhibited by the SCMM Executive by using NPT, AD1. When the test starts the next run, the test will accept a new compare value and the operator can then enable error printout by using the SCMM Executive PRT, AD1 command.

HIGH-SPEED ANALOG INPUT TEST (AD2)

DEVICES TESTED

This test will diagnose the following devices:

1501-x/1525-3 (local or remote)

TYPES OF TESTS

This routine obtains inputs from a sequence of one to eight channel sets, reports a specified number of times, compares the actual to the expected counts, and generates a double-precision histogram (see Figure 5-2) which allows a maximum count of 9,999,999 for each error counter.

In order to conduct the test, the user must provide an analog signal for each channel being tested. This is most conveniently accomplished using the analog input test box,† which provides variable dc inputs to each channel of a sequence of eight-channel sets. With the test box, the user can apply the desired voltage to each of the channels; then, when requested by the test routine, he can enter the reading in percentage of full scale expected for each channel. This information is converted by the program to expected counts. The expected counts are compared to actual counts to produce a histogram of deviations.

After each input, checks are made for any error indications returned by the driver. Any errors indicated result in the output of diagnostic messages.

ERROR DETECTION AND REPORTING

Hardware error reporting is based primarily on the error code returned by the MSOS driver. The types of errors recognized by the MSOS driver and the test are:

TIME OUT	
INT REJECT	
EXT REJECT	
BAD INDEX	Local
REJECT	Local

The actual error message will be as follows:

```
TSTAD2 CHNL xxxx TIME OUT
                INT REJECT
                EXT REJECT
                BAD INDEX
                REJECT
```

†IOM analog test box, Part No. 89870700

After the error message, the test continues with the I/O sequence that was in progress.

Additional error messages are:

```
CHNL xx CK RELAY VALUE READ xxxx
LU ERROR
ADR ERROR
CHNL xxxx VALUE TOO +
CHNL xxxx VALUE TOO -
```

```
TSTAD2 HISTOGRAM OF RESULTS
SCALE FACTOR  0000 ADDR 0010 - 0012  NUM READ  00000010
POINT          1          2          3
EX CNTS     0000       7D00       7D00
GT             0          0          0
+7             0          0          0
+6             0          0          0
+5             0          0          0
+4             0          0          0
+3             0          0          0
+2             0          0          0
+1             0          0          0
 0            10         10         10
-1             0          0          0
-2             0          0          0
-3             0          0          0
-4             0          0          0
-5             0          0          0
-6             0          0          0
-7             0          0          0
LT             0          0          0
```

Figure 5-2. Sample Histogram (AD2)

INPUT PARAMETERS

The possible input values for the test's operatinal parameters are:

LU — MSOS logical unit in decimal for remote analog digital converter

0 — Local 1501 Analog Digital Converter

READINGS PER RUN — Number of readings for each point per run

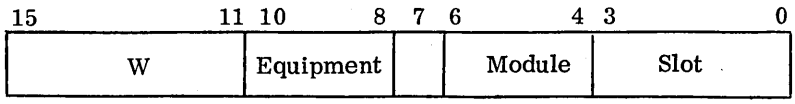
RUNS — Any decimal number up to 8000. If 8000 is entered, the test will execute indefinitely until the operator uses the SCMM Executive STP command.

BGN ADR — Start point (channel) that is to be tested in decimal

END ADR — End point (channel) in decimal. It must not be less than BEG ADR.

ADC WEMS — The WEMS for the analog digital converter

MUX WEMS — The WEMS for the 1501 Analog Input MUX Controller



SCALE — One to four hexadecimal digits representing the histogram scale factor. Expected counts are subtracted from actual counts and the result is divided by a non-zero scale factor to produce the scaled conversion error recorded in the histogram. A zero scale factor is treated as a one.

CK RELAY — 1 — Causes the following message to output whenever the deviation is greater than +7 or less than -7

CHK RELAY NO. x hhhh VALUE READ yyyy

Where: hhhh = Hexadecimal channel address
yyyy = Value actually read in hexadecimal

0 — Message is bypassed

ADC BIT TYPE — 0 — High speed analog input is 12-bit and left-justified.

1 — High speed analog input is 14-bit and left-justified.

0% FS COUNTS/ 100% FS COUNTS	Enter analog-to-digital converter reading for an input of 0% full scale (typically 0000_{16}). Enter analog-to-digital converter reading for an input of 100% full scale (typically $7D00_{16}$).	
% FS/POINT x	% FS	— Integer percent of full scale in decimal expected for point x. (If 8000 is entered for %, the test will take the first reading and use it for expected counts.)

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 09/05/74 0800 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, AD2	Request high speed analog input test.
BEGIN ADC NO. 2 1501 TEST LU, READINGS PER RUN, RUNS	Test is in operation and requests operational parameters.
20, 10, 1	Operator requests logical unit 20, 10 readings per run, and one run.
BEG ADR, END ADR	
10, 12	Operator requests that points 10 through 12 be tested.
SCALE, CK RELAY, ADC BIT TYPE	
0, 1, 0	Operator requests zero scale, ±7 channel error message, and 12-bit ADC.
% FS COUNTS/100% FS COUNTS	
0000, 7D00	Operator specifies the 0% and 100% FS counts.
% FS POINT 0010	
0	Operator specifies 0% of full scale.

Operator Entry	SCMM Reply	Comments
	POINT 0011	
100		Operator specifies 100% of full scale.
	POINT 0012	
100		Operator specifies 100% of full scale.
	END ADC NO. 2 TEST xxxx ERRORS	Tests are completed with xxxx errors.
	SCMM OUT 09/05/74 0805	SCMM Executive has determined that there are no other tests in execution, so it terminates and releases core.

LOGICAL LEVEL DIGITAL INPUT/OUTPUT TEST (LLV)

DEVICES TESTED

This test will diagnose the following devices:

1553-x/1544-x

TYPES OF TESTS

This routine tests the operation of a 1553 Digital Output Unit and a 1544 Digital Input Unit. It will test either a local or remote IOM system. Operation of the test requires that each digital output channel to be tested be connected to a digital input channel by a backplane jumper cable.†

Various bit patterns are output on the digital output unit and input on the digital input unit, and the digital inputs are compared with the output images. Five types of bit configurations are output to the digital output unit:

1. All output channels are zeroed. The image $FFFF_{16}$ is output to a channel. Digital inputs are read from all channels, and the inputs are compared to the output images. This procedure is repeated for all channels specified.

2. All output channels are set to $FFFF_{16}$. A channel is zeroed. Digital inputs are read on all channels, and the inputs are compared to the output images. This procedure is repeated for all channels specified.

3. All output channels are zeroed. The teletypewriter is enabled to receive input, whereupon the user can enter any desired four-digit hexadecimal number. This pattern is output on each channel as in Test 1.

4. All output channels are zeroed. Taking each channel in turn, a bit is left-shifted sequentially from positions 0 through 15. The image is output to the digital input unit after each shift of the bit, digital inputs are read on all channels, and the inputs are compared to the output images. Each channel is again zeroed once bit 15 has been set and output/input accomplished. This procedure is repeated for each channel specified.

   All outputs are set to $FFFF_{16}$, and the above procedure is repeated with a zero bit being shifted and each channel reset to $FFFF_{16}$ when it is completed.

5. This test is identical to Test 4 with the exception that all channels are set to $FFFF_{16}$. Taking each channel in turn, a zero bit is left-shifted sequentially from positions 0 through 15.

   All outputs are set to 0000_{16}, and the above procedure is repeated with a one bit being shifted and each channel completed.

†Backplane jumper cable, part No. 88968700

ERROR DETECTION AND REPORTING

After each I/O operation, the hardware is checked for errors. If any errors occurred, a message is output. After the completion of the input operation, a data compare check is done if no hardware errors occurred. A message is output for each data error. At the end of each test sequence, an error detected by the test produces the following message:

SCMLLV TEST (1) RUN (2) 15xx CHNL (3) STATUS ERROR (4)

A data error produces the following message:

SCMLLV TEST (1) RUN (2) OUT CHNL (5) IS (6) IN CHNL (7) IS (8)

Where: 1 is the decimal number of the test currently being executed.

2 is the hexadecimal number of the current pass.

3 is the channel index if local, or channel address if remote.

4 is the printout of status (explained below).

5 is the digital output unit channel index if local, or channel address if remote.

6 is the image output.

7 is the digital input unit channel index if local, or channel address if remote.

8 is the digital input.

xx is 44 or 53 to designate equipment.

Status 4 has the following meanings:

Local IOM system

8000 — Bad index

8001 — Internal or external reject

Remote IOM system

7FFF — External or internal reject on local unit

Bit 13 — Receive error on local control unit

Bit 12 — Receive error on remote control input unit

Bit 10 — Internal reject on remote control unit

Bit 9 — External reject on remote control unit

INPUT PARAMETERS

The possible input values for the test's operational parameters are:

OUT LU — MSOS logical unit of remote digital output unit

0 — Local digital output unit

IN LU

MSOS logical unit of remote digital input unit

0 — Local digital input unit

NOTE: The digital output unit also has to be local.

TESTS

One to four hexadecimal digits represent 16 bits with the following assignment:

Bit 1 = 1	DO Test 1
Bit 2 = 1	DO Test 2
Bit 3 = 1	DO Test 3
Bit 4 = 1	DO Test 4
Bit 5 = 1	DO Test 5

SWITCH

0 — For testing contacts that are normally open

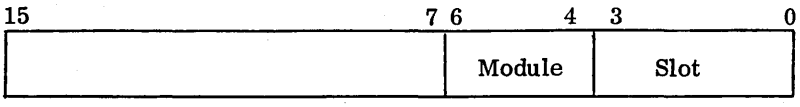
1 — For testing contacts that are normally closed

RUNS

One to four decimal digits representing the number of times the test sequence is to be run before exiting. If 8000 is set, the test will repeat until halted by the user.

OUT CHANL-MOD-SLOT

Two-digit hexadecimal number for the module and slot of the digital output unit



IN CHANL-MOD-SLOT

Two-digit hexadecimal number for the module and slot of the digital input unit

The user inputs $FFFF_{16}$ when all channel combinations are specified. Channel combinations are limited to 16 or less.

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 10/24/74 0800 CONTROL, TEST ID	SCMM Executive is in and requests control information.

Operator Entry / SCMM Reply	Comments
SRT, LLV	Request logical level digital input/output test.
BEGIN 1553/1544 TEST OUT LU, IN LU, TESTS, RUNS, SWITCH	Test is in operation and requests operational parameters.
0, 0, 2, 200, 0	Operator requests local digital output unit and local digital input unit, Test 2, normally open contacts, and 200 runs.
OUT CHANL MOD-SLOT, IN CHANL MOD-SLOT	
OD, OD OE, OE FFFF	Operator specifies two pairs of connected channel address. The first pair includes module 0 and slot 13 for the digital output unit and slot 13 for the digital input unit. The second pair also includes module 0 and slot 14 for the digital output unit and slot 14 for the digital input unit. FFFF terminates channel specification.
END 1553/1544 TEST 200 RUNS, 0000 ERRORS	Test has completed the requested number of passes, logged the number of errors encountered, and released allocatable core.
SCMM OUT	

RELAY INPUT/OUTPUT DIGITAL TEST (RLY)

DEVICES TESTED

This test will diagnose the following devices:

1555/1544 (local or remote)

TYPES OF TESTS

This routine tests the performance of a 1555 Power Driver and Relay Output Units and a 1544 Digital Input Interface. It will test either a local or remote IOM system. Operation of the test requires that each relay output channel to be tested be connected to a digital input channel by a backplane jumper cable.†

Various bit patterns are output on the relay output unit and input on the digital input unit, and the digital inputs are compared with the output images. Five types of bit configurations are output to the relay output unit:

1. All output relays are zeroed. The image FF_{16} is output to a channel. Digital inputs are read from all channels, and the inputs are compared to the output images. This procedure is repeated for all channels specified.

2. All output relays are set at FF_{16}. A channel is zeroed. Digital inputs are read on all channels, and the inputs are compared to the output images. This procedure is repeated for all channels specified.

3. All output relays are zeroed. The teletypewriter is enabled to receive input, whereupon the user can enter any desired two-digit hexadecimal number. This pattern is output on each channel as in Test 1.

4. All output relays are zeroed. Taking each channel in turn, a bit is left-shifted sequentially from positions 0 through 7. The image is output to the digital input unit after each shift of the bit, digital inputs are read on all channels, and the inputs are compared to the output images. Each channel is again zeroed once bit 7 has been set and output/input accomplished. This procedure is repeated for each channel specified.

   All outputs are set to FF_{16}, and the above procedure is repeated with a zero bit being shifted and each channel reset to FF_{16} when it is completed.

5. This test is identical to Test 4 with the exception that all channels are set to FF_{16}. Taking each channel in turn, a zero bit is left-shifted sequentially from positions 0 through 7.

   All outputs are set to 00_{16} and the above procedure is repeated with a one bit being shifted and each channel reset to 00_{16} when it is completed.

---

†Backplane jumper cable, part No. 88830200

ERROR DETECTION AND REPORTING

After each I/O operation, the hardware is checked for errors. If errors occurred, a message is output. After the completion of the input operation, a data compare check is done if no hardware errors occurred. A message is output for each data error.

An error detected by the test produces the following message:

SCMRLY TEST (1) RUN (2) 15xx CHL (3) STATUS ERROR (4)

A data error produces the following message:

SCMRLY TEST (1) RUN (2) OUT CHNL (5) IS (6) IN CHNL (7) IS (8)

Where: 1 is the decimal number of the test being currently executed.

2 is the hexadecimal number of the current pass.

3 is the channel index if local, or channel address if remote.

4 is the printout of status (explained below).

5 is the relay output unit channel index if local, or channel address if remote.

6 is the image output.

7 is the digital input unit channel index if local, or channel address if remote.

8 is the digital input.

xx is 44 or 55 to designate equipment.

Status 4 has the following meanings:

Direct IOM system

8001 — Internal or external reject

Remote IOM system

7FFF — External or internal reject on local unit

Bit 13 — Receive error on local control unit

Bit 12 — Receive error on remote control input unit

Bit 10 — Internal reject on remote control unit

Bit 9 — External reject on remote control unit

INPUT PARAMETERS

The possible input values for the test's operational parameters are:

OUT LU	MSOS logical unit of remote relay output unit
	0 — Local relay output unit

IN LU

MSOS logical unit of remote digital input unit

0 — Local digital input unit. The relay output unit also has to be local.

TESTS

One to four hexadecimal digits representing 16 bits with the following assignments:

Bit 1 = 1	DO Test 1
Bit 2 = 1	DO Test 2
Bit 3 = 1	DO Test 3
Bit 4 = 1	DO Test 4
Bit 5 = 1	DO Test 5

SWITCH

0 — For testing normally open contacts

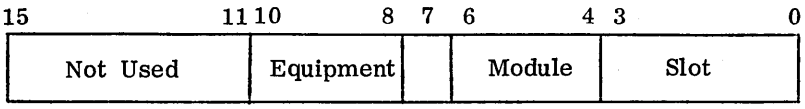
1 — For testing normally closed contacts

RUNS

One to four decimal digits representing the number of times the test sequence is to be run before exiting. If 8000 is set, the test will repeat until halted by the user.

OUT CHANL EQUIP-MOD-SLOT

Three-digit hexadecimal number for the equipment, module, and slot of the relay output unit. For remote, only module and slot are needed.



IN CHANL EQUIP-MOD-SLOT

Three-digit hexadecimal number for the equipment, module, and slot of the digital input unit. For remote, only module and slot are needed.

The user inputs $FFFF_{16}$ when all channel combinations are specified. Channel combinations are limited to 16 or less.

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processore is in core.
SCMM	Request SCMM Executive.
SCMM IN 10/24/74 0800 CONTROL, TEST ID	SCMM Executive in and requests control information.

Operator Entry / SCMM Reply	Comments
SRT, RLY	Request relay output test.
BEGIN 1555/1544 TEST OUT LU, IN LU, TESTS, SWITCH, RUNS	Test is in operation and requests operational parameters.
0,0,2,0,200	Operator requests local relay output unit and local digital input unit, Test 2, normally open contacts, and 200 runs.
OUT CHANL EQUIP-MOD-SLOT, IN CHANL EQUIP-MOD-SLOT	
606,605 609,608 FFFF	Operator specifies two pairs of connected channel address. The first pair includes module 0 and slot 6 for the relay output unit and slot 5 for the digital input unit. The second pair also includes module 0 and slot 9 for the relay output unit and slot 8 for the digital input unit. FFFF terminates channel specification.
END 1555/1544 TEST 200 RUNS, 0000 ERRORS	Test has completed requested number of passes, logged the number of errors encountered, and released allocatable core.
SCMM OUT 10/24/74 0800	

SAMPLE TIMING UNIT TEST (STU)

DEVICE TESTED

This test will diagnose the following device in an off-line mode:

1572-1

TYPES OF TESTS

Four test sections may be requested by the operator:

1. This test exercises all function/status/data capabilities of the LST and the SRG. Interrupts are enabled and disabled and a check is made on the control of interrupts. Diagnostic messages are output if errors are detected. All functions are left-disabled at the end of the test section.
2. Data is transferred to the multiplier register and from the counter of the SRG. The countdown of the individual bits of the counter is verified for the upper 12 bits and the count to zero is verified for the lower bits. Differences of less than eight counts are not detected as errors. All functions are left-disabled at the end of the test section.
3. Using the parameters specified before the start of the test sequence, the test will count interrupts from the LST and from the SRG and will type out the results if bit 15 of the sync parameter is not set. Input parameters are LST INT CNT, MULT, and SYNC.
4. Each time this test section is entered, the user is requested to input parameters as described in Section 3. The execution of the test section is the same as in Section 3.

ERROR DETECTION AND REPORTING

Error reporting is done in conjunction with the device status word and in test comparisons. The error messages will be as follows:

NO INT RCVD
ILLEGAL INT
INT REJECT
MULTIPLIER AND COUNTER OF SRG DON'T AGREE

INPUT PARAMETERS

The possible input values for the test's operational parameters are:

TESTS

2 — Enable/disable interrupts

4 — Multiplier register and counter register comparison (SRG)

8 — Interrupt counts from LST, SRG

10 — Interrupt counts from LST, SRG. Operator controlled.

RUNS

Number of runs. If an 8000 is entered, the test will execute indefinitely until the operator enters the following:

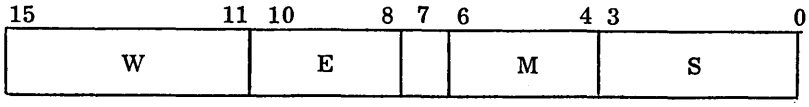
Operator Entry	SCMM Reply
Press manual interrupt	
	MI
SCMM	
	CONTROL, TEST ID
STP, STU	

INTERRUPT LINE

The decimal interrupt line number for the sample timing unit must be in the range of 2 to 15.

WEMS CODE FOR TIMER

One to four hexadecimal digits representing the 16 bits that are loaded into the Q register to address the sample timing unit



Where: W is the converter code, which is zero.

E is the equipment number of the computer interface unit.

M is the module number holding the STU.

S is the slot number of the sample timing unit within the module.

COMPUTER TYPE

0 — 1784-2 Computer

1 — 1784-1 Computer

2 — 1704-14 Computer

3 — 1774-SC Computer

LST INT CNT

One to four decimal digits representing the number of LST interrupts that will be used to establish the overall time interval for the test

MULT

One to four hexidecimal digits representing the data that will be loaded into the SRG multiplier register. (This will determine the number of interrupts from the SRG during the time interval established by field 1.) The number of interrupts expected can be calculated with the following equations:

$$\text{SRG Interrupt Counts} = \frac{\text{LST INT CNT}}{\text{Interrupts}} \quad (1,\ 2,\ 4,\ 8,\ \text{or } 16) \times 60 \times \frac{\text{Precision Time Base (1, 10, 100 or 1000 kHz)}}{\text{MULT}}$$

SYNC	One to four hexidecimal digits representing 16 bits with the following assignments: Bit 1 = 1 Enable Sync 1 LST Bit 2 = 1 Enable Sync 2 SRG Bit 15 = 1 Disable typeout of results

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 09/02/74 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, STU	Request sample timing unit test.
BEGIN 1572-1 STU OFF-LINE TEST TESTS, RUNS	Test is in operation and requests operational parameters.
A,1	Operator requests Test Sections 1 and 3 with one run.
INTERRUPT LINE, WEMS CODE FOR TIMER, COMPUTER TYPE	
8,060F,1	Operator specifies that the timer is on interrupt line 8, WEMS code is 060F, and the computer type is 1784-1.
LST INT CNT, MULT, SYNC	
300,10,6	Operator specifies that the LST interrupt count will be 300, the SRG multiplier register will be loaded with a 10, and the SYNC is enabled.
END 1572-1 STU TEST, xxxx RUNS, yyyy ERRORS, AUTOLOAD SYSTEM TO ASSURE CORRECT OPERATION	Test has completed last test section and allocatable core has been released.
SCMM OUT 09/02/74 0805	SCMM Executive has determined that no other tests are in execution, so it terminates and releases core.

EVENTS COUNTER TEST (CTR)

DEVICE TESTED

This test will diagnose the following device in an off-line mode:

1547 (local or remote)

TYPES OF TESTS

This routine tests the operation of up to four 1547 Events Counters in 8- or 16-bit operation, in the local mode. The test tailors itself to the nut/bolt/washer configuration as specified in the jumper parameter for each card.

Operation of the test requires that each events counter be connected to a digital output unit (1553 Digital Output Unit or 1555 Relay Output Unit) by a backplane jumper cable.† If Section 2 is requested, a 1572-1 Sample Timing Unit must be available in the MSOS system. If the sample timing unit is not present, various subsections of Section 2 will be bypassed.

It should be noted that the diagnostic may detect occasional spurious count and status errors, which are caused by the non-synchronous operation of the system timer and the diagnostic. These spurious errors should be ignored.

Two test sections may be requested by the operator:

1. The status, functions test will check the status, function, and data read/write operations.
2. This section tests counting, interrupts, and events per unit time capabilities.

ERROR DETECTION AND REPORTING

The hardware is checked for errors. If errors occurred, a message is output. Error messages will be as follows:

TSTCTR TEST xx RUN STATUS ERR xxxx ACTUAL xxxx EXPECTED xxxx CTRWEMS hhhh
COUNT ERR
NO READ CLEAR
READ CLEAR

TSTCTR TEST xx RUN xxxx CTR WEMS hhhh {INT REJECT / EXT REJECT} Q=xxxx A=xxxx X=xxxx

Additional error messages are as follows:

INTERRUPT ASSIGNMENT ERROR
OUTPUT TYPE ERROR

†Backplane jumper cable, Part No. 88968700

DASH NO. ERROR
NO INTERRUPT
1572-1 SYN. NOT SYSTEM TIMER

INPUT PARAMETERS

The possible input values for the test's operational parameters are:

TESTS — One to four hexadecimal digits representing 16 bits with the following assignments:

Bit 1 = 1	DO Test 1
Bit 2 = 1	DO Test 2

RUNS — One to four decimal digits representing the number of times the test sequence is to be run before exiting. If 8000 is set, the test will repeat until halted by the user.

1547 INT. LINE — Interrupt line (2-15) of the events counter. If the interrupt is not used, enter a zero.

COMPUTER TYPE

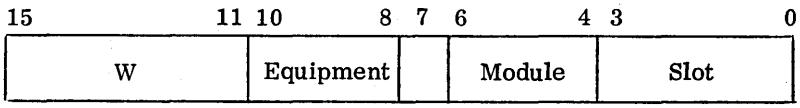
0 — 1784-2 Computer

1 — 1784-1 Computer

2 — 1714, 1704 Computer

3 — 1774 Computer

1547-WEMS — Event counter's equipment, module, and slot number.



DASH-NO — Events counter's dash number (1 or 2)

JUMPER — Jumper word, nut/bolt/washer configuration on card

Bit	Jumper	Description
15	Read clear	— 0 Clear on data read — 1 Master clear
14	8/16 bit	— 0 8-bit counter — 1 16-bit counter
13	Not used	
12	Enable rate Select interrupt (ERS INT)	— 0 Interrupt off — 1 Interrupt off

Bit	Jumper	Description
11	Sync 2 or external sync (SYN2/EX SYN)	— 0 Sync 2 — 1 External Sync
10	S2/External polarity	— 0 High-going low signal — 1 Low-going high signal
09	Lower counter overflow interrupt (LOW INT)	— 0 On — 1 Off
08	Lower counter EPUT measurement enable (LCS2)	— 0 Off — 1 On
07	LCEX/LCS	— 0 Select external input for lower events counter — 1 Select SYNC 1 input for lower events counter
06	Lower counter B input (LCB)	— 0 Select high-going low input — 1 Select low-going high input
05	Lower counter A input (LCA)	— 0 Select high-going low input — 1 Select low-going high input
04	Upper counter overflow interrupt (UP INT)	— 0 On — 1 Off
03	Upper counter EPUT measurement enable (UCS2)	— 0 Off — 1 On
02	UCEX/UCS1	— 0 Select external input for upper events counter — 1 Select SYNC 1 input for upper events counter
01	Upper counter B input (UCB)	— 0 Select high-going low input — 1 Select low-going high input
00	Upper counter A input (UCA)	— 0 Select high to low input — 1 Select low to high input

D/OUT WEMS — Digital output WEMS (relay output unit or digital output unit)

TYPE D/OUT — Digital output type (1-10)

1-6 — Digital output unit

7-10 — Relay output unit †

Enter FFFF if less than four counters are being tested.

† The 7-10 is derived by taking the maximum digital output unit and adding it to the relay dash type, which may be 1 through 4.

EXAMPLE

Operator Entry SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 12/12/74 0800 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, CTR	Request events counter test.
BEGIN IOM 1547-1/2 OFF-LINE TEST TESTS, RUNS, 1547 INT LINE, COMPUTER TYPE	Test is in operation and requests operational parameters.
2, 2, 0, 1	Operator specifies Test 2, two runs, 1547 interrupt line 0, and computer type 1784-1.
ENTER — H/W TEST CONFIGURATION INFO 1547 EVENT COUNTER OUTPUT UNIT 1547-WEMS, DASH-NO., JUMPER D/OUT WEMS, TYPE D/OUT	
#01 040A, 1, 065C, 0408, 1	Operator specifies that the 1547-WEMS is 040A, the dash number is 1, the jumper word is $065C_{16}$, the digital output unit WEMS is 0408_{16}, and the type is 1.
#02 FFFF	Operator enters $FFFF_{16}$ to terminate parameter input.
END IOM 1547 TEST, 0002 RUNS, 0000 ERRORS	Test has completed two runs with zero errors.
SCMM OUT 12/12/74 0802	SCMM Executive has determined that no other tests are in execution, so it terminates and releases core.

HARDWARE FLOATING POINT TEST (HFP)

DEVICE TESTED

This test diagnoses the following device:

1781-1 Hardware Floating Point Unit

TYPE OF TEST

The 1781-1 is tested by first checking the registers FSR, CCR, IR, FPAC1, FPAC2, and FPAC3. In normal use, each register is tested with sliding one and sliding zero patterns. Upon command from the operator, the register test may be repeated until stopped by the operator. The test continues by generating a random sequence of commands (termed calling sequence or CSQ) and then executing the commands on both the 1781-1 and a software package which simulates the operation of the 1781-1. Results of the two operations should be identical. The test continues generating random calling sequences until a specified pass count is satisfied, but executes the register check only once immediately following the entry of parameters.

In normal use, the diagnostic determines each of the following parameters in a random manner:

1. Mode of operation (single or double precision)
2. Number of commands in calling sequence
3. Order of commands in calling sequence
4. Location of operands relative to calling sequence
5. Operand values

Under operator control, it is possible to force the diagnostic to operate in only one mode and/or to use only calling sequences of a fixed length. It is also possible to repeat a failing calling sequence and to disable parts of the error printouts.

ERROR DETECTION AND REPORTING

Error detection is based upon a compare of the final state of the 1781-1 registers and data buffer area to the results of a software simulation of the 1781-1 within the diagnostic. In the register check section, the test patterns are written and then read from the registers before comparison is made. All data is compared bit for bit and all errors are counted.

When an error in results is detected, the diagnostic outputs a message on the system standard list device.

The message of a register check error consists of two parts. Both may be disabled by means of the 'NPT' request to the SCMM monitor.

1. Header line

   TSTHFP REGISTER ERROR

2. Error printout (one or more of the following may be printed)

FSR	0010	0018
CCR	1000	1010
IR	0040	0000
FPAC1	FFFE	FFFD
FPAC2	BFFF	BFFC
FPAC3	0200	0300

Leftmost column: Register name

Center column: Value output to register

Rightmost column: Error value returned from register

NOTE

The two FSR printouts may differ without an error occuring since the state of bits 15, 5, and 0 are not significant to the test.

The floating point check error message consists of four parts, three of which may be suppressed by setting the appropriate bit in 'Flags' of the test's operational or restart parameters.

The four parts of the message are as follows:

1. Header Line

   TSTHFP ERROR, RUN xxxx, RESTART VALUES xxxx xxxx xxxx xxxx

   This printout can only be disabled by means of the 'NPT' request to the SCMM monitor.

2. Calling Sequence

2A54	BA54	(FLDD FDIV FEND FEND)
2A55	2A1C	(6CE6 4EF1 E98E)
2A56	2A1F	(3C72 47E4 0B75)

Leftmost column: Core location

Center column: Contents of the core location (command word or operand address)

Entries enclosed in parenthesis: Command mnemonics or operand values (Note that if the location is used by a 'FLST', 'STRI' or 'FLOF' instruction or is used as an address for a branch instruction, this column is blank)

NOTE

The operand value printed is 1, 2, or 3 words depending upon type of operand — integer, single precision, or double precision. If the address points to a location used by FLST, STRI, or FLOF, no operand value is printed.

This printout may be suppressed by setting bit 11 in 'Flags' of the test's operational or restart parameters.

3. End Register Status

	S	H	
FSR	OCCO	OCDO	(SEE NOTE)
CCR	4BA5	4BA5	
IR	0000	0000	
PCR	2AF7	2AF7	
FPAC1	F7BE	F7BE	
FPAC2	F9AF	F9AF	
FPAC3	1DA4	1DA5	<

Leftmost column: Register designation

Center column: Software simulated value (expected value)

Righthand column: Hardware result (actual value)

Any register disagreement is flagged by an < . If minimum error printout is selected, only the register which disagrees is printed.

The end register status printout may be disabled by setting bit 12 in 'Flags' of the test's operational or restart parameters.

NOTE

The hardware and software FSR printouts may differ without an error occuring since the state of bits 15, 8, and 5 through zero are not significant to the test.

4. Data Buffers

ADDR	S	H
287A	72C6	72C6
287B	78EB	78EB
287C	3756	3756
287D	AE08	AE08
287E	DC80	DC80
287F	C43D	C43D
2880	63C0	63C0
2881	BB8A	BB8A
2882	CB99	CB99

```
2883        9390        9390
2884        FF15        14F5    <
2885        4D6B        E838    <
2886        3EEC        3EEC
2887        E800        E800
```

Leftmost column: Core address

Center column: Software simulated result (expected value)

Rightmost column: Hardware result (actual value)

The data buffer location(s) in disagreement is flagged by an < . If minimum error printout is selected, only the location(s) which disagrees is printed.

This printout may be disabled by setting bit 10 in 'Flags' of the test's operational or restart parameters.

INPUT PARAMETERS

The possible input values for the test's operational parameters (flags, runs, CSQ length, mode) are:

FLAGS Bit

0	Perform test in single precision mode only. †
1	Perform test in double precision mode only. †
2	If bit 2 is set, wait for 1781-1 completion by reading FSR status and checking for active status bit to clear. If bit 2 is not set, 1781-1 completion is signaled by a reply to an input of address status with Q=xxx3 (single precision) or Q=xxx4 (double precision).
3	If bit 3 is set, the register check section repeats until a manual interrupt is performed. A monitor command may then be entered.
4-5	Not used
6	Minimum error printout. Only the register status and data buffer words in error are printed.
7	Test illegal operation codes (SPEC followed by $A through $F). These codes should be treated as FEND instructions.
8	Issue a PROGRAM MASTER CLEAR prior to the start of each calling sequence.
9	Request operator action after detecting an error.
10	Suppress printout of data buffers on error.
11	Suppress printout of calling sequence on error.
12	Suppress printout of register status on error.
13	Suppress all error printouts, except header line.
14	If bit 14 is set, the diagnostic generates one calling sequence and executes it repeatedly until stopped.
15	Restart at failing calling sequence.

† If neither bit 0 nor bit 1 is set, the test randomly selects single or double precision for each calling sequence.

RUNS — Any decimal number up to 8000. If 8000 is entered, the test executes indefinitely until operator enters the following:

Operator Entry	SCMM Reply
Press manual interrupt	MI
SCMM	CONTROL, TEST ID
STP, HFP	

A run consists of executing 10,000 calling sequences.

CSQ LENGTH — Any decimal number up to 200. If zero is specified, the CSQ length is determined randomly.

MODE

0 Operate 1781-1 in block mode
1 Operate 1781-1 in hog mode
2 Operate 1781-1 in word mode

The possible input values for the test's request for operator action after error (TSTHFP error • Action?) are:

0 Stop the test and exit
1 Ignore the error and continue the test
2 Retry the same calling sequence on the hardware
3 Request a new set of parameters from the operator
4 Loop on hardware execution of the failing calling sequence until redirected †
5 Request entry of restart parameters

The possible input values for the test's request for restart values (enter restart values/flags, R1, R2, R3, R4) are:

FLAGS — Same as flags described under operational parameters except that bits 0, 1, and 7 are ignored if set.

R1, R2, R3, R4 — The values printed as part of the header line of the error output of the failing sequence to be restarted.

EXAMPLE

A. Initiating Test

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 07/29/75 1510 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, HFP	Request 1781-1 test.

† While looping on the hardware execution of the failing calling sequence, the skip switch may be set to inhibit error checking of the results.

Operator Entry	SCMM Reply	Comments
	1781-1 HARDWARE FLOATING POINT UNIT TEST FLAGS, RUNS, CSQ LENGTH, MODE	Test is in operation and requests operational parameters
0, 1, 0, 0		Operator requests 1 pass of random length, random precision calling sequences in block mode. Test begins executing.
	END 1781-1 TEST, 0001 RUNS, 0000 ERRORS	Test has completed execution and released core
SCMM OUT 07/29/75 1525		SCMM executive has determined that there are no other tests in execution so it terminates and releases core

B. Responding to a request for action after an error (Bit 9 of FLAGS set)

Operator Entry	SCMM Reply	Comments
	TSTHFP ERROR•ACTION?	Test has detected an error and outputs all its messages. It now requests operator action.
2		Operator requests repeat of the sequence which caused error.
	TSTHFP ERROR•ACTION?	Test again detects error.
	Set selective skip switch on	Operator sets selective skip to inhibit error checking.
4		Operator requests test to loop on execution of the failing sequence.
Press manual interrupt		Operator presses manual interrupt.
	MI	Manual interrupt processor requests command.
SCMM		Operator requests SCMM Executive.
	CONTROL, TEST ID	SCMM Executive requests control information.
STP, HFP		Operator requests that 1781-1 test be stopped.
END 1781-1 TEST, 0001 RUNS, 0002 ERRORS		Test exits.

C. Restarting test to repeat a failing calling sequence

Operator Entry	SCMM Reply	Comments
	MI	
SCMM		
	CONTROL, TEST ID	
SRT, HFP		
	1781-1 HARDWARE FLOATING POINT UNIT TEST FLAGS, RUNS, CSQ LENGTH, MODE	

Operator Entry / SCMM Reply	Comments
8000, 0, 0, 0	Operator requests entry to restart routine.
ENTER RESTART VALUES/FLAGS, R1, R2, R3, R4	
6000, 0, F, 3328, 510F	Operator requests restart of previous failing sequence and looping with error printouts suppressed.
Set selective skip switch	Skip switch set to inhibit printout of restart message on error.

D. Register check looping

Operator Entry / SCMM Reply	Comments
Press manual interrupt	
MI	Manual interrupt processor is in core.
SCMM	Request SCMM Executive.
SCMM IN 07/29/75 1510 CONTROL, TEST ID	SCMM Executive is in and requests control information.
SRT, HFP	Request 1781-1 test.
1781-1 HARDWARE FLOATING POINT UNIT TEST FLAGS, RUNS, CSQ LENGTH, MODE	Test is in operation and requests operational parameters.
8, 0, 0, 0	Operator requests repeating of the register check section. Execution of the register test begins.
	Test loops in the register test section.
Press manual interrupt	Operator presses manual interrupt.
MI	Manual interrupt processor requests command.
SCMM	Operator requests SCMM Executive.
CONTROL, TEST ID	SCMM Executive requests control information.
PRM, HFP	Operator requests re-entry of parameters.
1781-1 HARDWARE FLOATING POINT UNIT TEST FLAGS, RUNS, CSQ LENGTH, MODE	Test is in operation and requests operational parameters.
0, 1, 0, 0	Operator requests 1 pass of random length, random precision calling sequence in block mode. Test begins executing.
END 1781-1 TEST, 0001 RUNS, 0000 ERRORS	Test has completed execution and released core.
SCMM OUT 07/29/75 1525	SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

1576 STALL ALARM TEST (SAU)

DEVICE TESTED

This test diagnoses the following device in an off-line mode:

1576 Stall Alarm Unit

TYPES OF TEST

Four test sections may be requested by the operator:

1. This test checks device status in response to the following function outputs:
   a. Clear and Enable Stall Reset
   b. Enable Stall Counter 1
   c. Disable Stall Counter 1
   d. Enable Stall Counter 2
   e. Disable Stall Counter 2
   f. Enable Stall Counter 3
   g. Disable Stall Counter 3
   h. Enable Stall Counter 4
   i. Disable Stall Counter 4
   j. Set Computer Stall and Enable Stall Reset
   k. Clear and Enable Stall Reset
2. This test checks the overflow time of each counter and its ability to cause a stall interrupt on overflow.
3. This test checks the ability of the stall alarm to generate an interrupt on AC line power failure.
4. This test checks the ability of the stall alarm to generate an interrupt upon closure of a field stall contact.

SPECIAL CONFIGURATION

In order for the test to function, it is necessary that the stall alarm interrupt be connected to an interrupt line not normally used by the system.

ERROR DETECTION AND REPORTING

Error messages output by the test are as follows:

INTERRUPT ASSIGNMENT ERROR

Interrupt line specified not within legal range of 2 to 15.

CPU TYPE ERROR

CPU type specified not within legal range of 0 to 5.

TEST 1 RUN xxxx FUNCTION xxxx STATUS

ERROR ACTUAL xxxx EXPECTED xxxx

NO STALL INTERRUPT

TEST 2 COUNTER xx COUNT ERROR xxxx
ACTUAL xxxx EXPECTED xxxx
INT REJECT Q=xxxx A=xxxx X=xxxx
EXT REJECT Q=xxxx A=xxxx X=xxxx

NO POWER FAIL STATUS

Did not get interrupt from interruption of AC line. Status shows AC line still up.

NO POWER FAIL INTERRUPT
NO FIELD STALL STATUS

Did not get interrupt from field stall. Status shows no field stall received.

NO FIELD STALL INTERRUPT

INPUT PARAMETERS

Input parameters entered are as follows:

TEST, RUNS, CPU TYPE

TESTS	BIT 1=1	Test 1
	BIT 2=1	Test 2
	BIT 3=1	Test 3
	BIT 4=1	Test 4
RUNS	Non-terminating if entered as 8000.	
CPU TYPE	0 = 1704, 1714	
	1 = 1774	
	2 = 1784-1	
	3 = 1784-2	
	4 = MP17	

INT LINE, WEMS, JUMPER

INT LINE	2 through 15
WEMS	Equipment Code, Module, and Station Address for 1576
JUMPER	0 = OUT 1 = IN

EXAMPLE

Operator Entry SCMM Reply	Comments
Manual Interrupt MI	
SCMM SCMM IN 08/21/75 1305 CONTROL, TEST ID	
SRT, SAU BEGIN 1576-x STALL ALARM OFF LINE TEST TESTS, RUNS, CPU TYPE	
1E, 5, 0 INT LINE, WEMS, JUMPER	All tests, 5 runs, 1704 CPU
2, 406, 0	Interrupt line 2 Equipment code = 8 Module = 0 Station = 6 Jumper Out
END 1576-x STALL ALARM TEST, xxxx RUNS, xxxx ERRORS	
SCMM OUT 08/21/75 1320	

ANALOG OUTPUT TEST (DAC)

DEVICES TESTED

This test diagnoses the following devices:

1566-20 ±10 volts dc output
1566-21 0 to 5 milliamperes dc output
1566-22 0 to 20 milliamperes dc output
1566-23 0 to 50 milliamperes dc output

HARDWARE CONFIGURATION

Any of the following hardware configurations may be tested:

DAC installed in local 1750

DAC installed in remote 1590

DAC connected to external DVM or equivalent

DAC connected to 1536/1525/1501-80 relay analog input multiplexer

DAC connected to 1501/1525 solid-state multiplexer

DAC operated in current mode

DAC operated in voltage mode

When the DAC is tested in current mode and connected to an analog input channel (Echo) the test expects the full scale voltage developed across the shunt resistor to be 5.00 vdc for the 1536 relay multiplexer and either 5.00 vdc or 10.00 vdc for the 1501/1525 solid-state multiplexer.

TYPES OF TESTS

Three test sections may be selected:

Section 1 — Section 1 outputs to all selected DACS in the following sequences:

1536/Voltage Mode

$0000	0 PC FS =	0 vdc
$0080	+25 PC FS =	2.5 vdc
$0100	+50 PC FS =	5.0 vdc

1536-1501/Current Mode

$0066	+20 PC FS =	10 ma
$0132	+60 PC FS =	30 ma
$10FF	+100 PC FS =	50 ma

1501/Voltage Mode 5.0-volt ADC

$0000	0 PC FS =	0 vdc
$0100	+50 PC FS =	+5 vdc
$0300	-50 PC FS =	-5 vdc

1501/Voltage Mode 10.00-volt ADC

$0000	0 PC FS =	0 vdc
$01FF	+100 PC FS =	+10 vdc
$0200	-100 PC FS =	-10 vdc

Open Loop/Voltage

$0000	0 PC FS =	0 vdc
$01FF	+100 PC FS =	+10 vdc
$0200	-100 PC FS =	-10 vdc

Open Loop/Current

$0066	+20 PC FS =	10 ma
$0132	+60 PC FS =	30 ma
$01FF	+100 PC FS =	50 ma

If closed loop and no output errors were detected, the corresponding analog inputs are read and the expected data compared to actual.

Section 2 — Section 2 outputs to all selected DACs in the following sequence:

DAC Value

$0001 Start one-bit left shift
$0002
$0004
-
-
$0100 If echo specified:
1. stop here if 1536
2. skip to (A) if 5.00-volt ADC or 1501 solid-state multiplexer
$0200
$0200 Start one-bit right shift sign extended
$0300 (A)
$03C0
-
-
$03F8
$03FC
$03FE

If closed loop and no output errors were detected, the corresponding analog channels are input and the expected data compared to actual.

Section 3 — Section three outputs to all selected DACs in the following sequence.

If voltage output DACs are tested in echo mode with a 5-volt ADC, the full scale output is set at 50 percent DAC output.

Negative values are omitted if echo mode and a 1536 is specified or if output is current.

```
  0 PC FS
+10 PC FS
-10 PC FS
+20 PC FS
-20 PC FS
   -
   -
+90 PC FS
-100 PC FS
```

ERROR DETECTION AND REPORTING

The following errors are detected and reported by the test:

```
DAC INTERNAL REJECT
DAC EXTERNAL REJECT
AI INTERNAL REJECT
AI EXTERNAL REJECT
AI TIMEOUT
1590 STATUS = xxxx, LOCAL RECEIVE ERROR
1590 STATUS = xxxx, REMOTE RECEIVE ERROR
1590 STATUS = xxxx, 1590 REJECT
1590 STATUS = xxxx, 1590 TIMEOUT
1590 STATUS = xxxx, DAC INTERNAL REJECT
1590 STATUS = xxxx, DAC EXTERNAL REJECT
1590 STATUS = xxxx, AI INTERNAL REJECT
1590 STATUS = xxxx, AI EXTERNAL REJECT
ECHO ERROR EXPTD = xxxx, ACTUAL = xxxx
```

All of the above error messages are preceded by:

```
TSTDAC, SECTION N, RUN NNNN,
```

INPUT PARAMETERS

Operator input parameters:

SECTIONS, RUNS, MODE, LOCATION, ECHO

SECTIONS

BIT 1=1 Test 1, 0, 50, and 100 PC FS output

BIT 2=1 Test 2, Bit weight test

BIT 3=1 Test 3, Increment 10 PC FS test

RUNS IN DECIMAL

Non-terminating if entered as 8000

MODE

0 = Current mode DAC

1 = Voltage mode DAC

LOCATION

0 = Connected to local CIU

1 = Connected to remote CIU (1590)

ECHO

0 = Open loop

1 = DAC connected to analog inputs

ANALOG INPUT TYPE

Requested if closed loop test

0 = 1536 relay multiplexer

1 = 1501 solid-state multiplexer

ANALOG INPUT LU IN DECIMAL

Requested if closed loop test and (1536 or remote location)

ADC RANGE

Requested if closed loop

0 = 5.00 vdc

1 = 10.00 vdc

DAC LU IN DECIMAL

Requested if remote location

DAC WEMS, DAC CHANNEL, AI CHANNEL, ALLOWABLE DAC ERROR

DAC WEMS

Module-station address of the 1566

DAC CHANNEL

DAC channel number (0-3)

AI CHANNEL

Requested if closed loop

Channel number (0-N) of associated AI channel

ALLOWABLE DAC ERROR IN ADC BITS

Requested if closed loop

Repeat inquiry until FFFF entered for DAC W-E-M-S or until 16 channels specified.

EXAMPLE

Operator Entry	SCMM Reply
Press Manual Interrupt	
	MI
SCMM	
	SCMM IN 08/03/75 1130 CONTROL, TEST ID
SRT, DAC	
	BEGIN 1566 DAC TEST SECTIONS, RUNS, MODE, LOCATION, ECHO
E, 4, 1, 1, 1	
	AI TYPE =
0	
	AI LU =
49	
	AI RANGE =
0	
	DAC LU =
54	
	DAC WEMS, DAC CHANNEL, AI CHANNEL, DAC ERROR
3, 0, 0, 2	
	DAC WEMS, DAC CHANNEL, AI CHANNEL, DAC ERROR
3, 1, 1, 2	
	DAC WEMS, DAC CHANNEL, AI CHANNEL, DAC ERROR
FFFF	
	END 1566 DAC TEST, nnnn RUNS, xxxx ERRORS

GLOSSARY

Absolute address	1. An address that is permanently assigned by the machine designer to a storage location. 2. A pattern of characters that identifies a unique storage location without further modification. 3. Synonymous with machine address. Specific address.
Absolute file	A file on mass storage that is identified by a program name and which contains the program's code in machine language.
Address	1. An identification, as represented by a name, label, or number, for a register, location in storage, or any other data source or destination such as the location of a station in a communication network. 2. Loosely, any part of an instruction which specifies the location of an operand for the instruction.
Allocatable core	A portion of main memory within which the operating system allocates blocks of words according to a priority scheme.
Allocate	To reserve an amount of a resource in a computing system for a specific purpose.
Applications program	A task or group of tasks which perform a defined function under the control of an executive system.
ASCII	American National Standard Code for Information Interchange. The standard code, using a coded character set consisting of seven-bit coded characters (eight bits including parity check), used for information interchange among data processing systems, communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters.
Autoload	To place the resident routines of the operating system in core storage.
Background	See Unprotected.
Binary	A characteristic, property, or condition having two alternatives; a numbering system based on two rather than ten.

Buffer	1. A routine or storage used to compensate for a difference in rate of flow of data or time of occurrence of events, when transmitting data from one device to another. 2. An isolating circuit used to prevent a driven circuit from influencing the driving circuit.
Cathode ray tube (CRT)	An electronic vacuum tube containing a screen on which output data may be displayed in graphic form or by character representation.
Central memory (CM)	The directly addressable core storage of computers.
Core resident (CMR)	The part of the operating system which resides permanently in central memory. It contains code, various system tables, special buffers, etc., and begins at absolute location zero in core memory.
Diagnostic	1. The detection and isolation of a malfunction or mistake. 2. A message printed when an assembler, compiler, or monitor detects a program error.
Diagnostic communication region	A block of words in each SCMM diagnostic program that is used for communication between the diagnostic executive and the program.
Diagnostic logical unit	A logical unit number that indicates the following to the MSOS driver: upon completion of a request with error, the return is to the user without going through the alternate device handler.
Diagnostic test	A program or routine designed to locate and explain errors in a computer routine or malfunctions of a hardware component.
Driver	A program whose main function is to perform a physical I/O transfer of data between one storage medium and another (e.g., between CM and mass storage or between CM and magnetic tape).
Error	Any deviation of a computed or a measured quantity from the theoretically correct value.
Error code	A code (usually a number) used as an index to a list of errors published in a manual or handbook.
Execute	To carry out an instruction or perform a routine.
Execution	The process whereby the instructions contained in a program direct the activities of the central processing unit.
External interrupt	An interrupt occurring as a result of conditions within peripheral devices or their immediate interfaces. Interrrupts occurring as a result of conditions within a data channel are classified as external or internal in keeping with specifications set forth in individual hardware system reference manuals.

Fatal errors	Errors indicating that the device will not continue to operate in a manner that can be predetermined.
Fault	A physical condition that causes a device, component, or element to fail to perform in a required manner. Examples of faults are short circuits, broken wires, and intermittent connections.
Flag	1. Any of various types of indicators used for the duration of a job. 2. A character or bit that signals the occurrence of some condition, such as the end of a word. 3. A frequently used indicator (program- or hardware-initiated) that tells some later part of a program that some condition occurred earlier. 4. To generate a flag.
Foreground	See Protected.
Initialize	To set counters, switches, and addresses to zero or some other starting value at the beginning of a program or at prescribed points in a program.
Input/output	The bidirectional transmission of information between computer memory and peripheral devices.
Internal interrupt	An interrupt occurring as a result of conditions within the computer mainframe or immediate interfaces.
Interrupt	1. To stop a process in such a way that it can be resumed at a later time. 2. A break in the normal flow of a system or routine so that the flow can be resumed from that point at a later time. An interrupt is usually caused by a hardware-generated signal.
Interruptable process	A process that is composed of an interruptable processor and interterruptable data. This process may be interrupted, the processor taken away and applied to another process, and later reinstated and run to completion without ill effects from the interrupt.
Library	An organized collection of standard, checked-out programs, routines, and subroutines which may be used to solve many types of problems.
Logical unit number	A number that can be equated to any one of a variety of peripheral units.
Mass storage device	A disk or drum capable of storing large quantities of information than can be randomly accessed.

Mass storage resident	That part of the system that resides on mass storage but is brought into core when needed by the system.
Monitor	The supervisory routine in an operating system which coordinates and controls the operation of user and system programs.
On-line mode	The situation in which several application programs are concurrently in execution.
Operarating system	Software which controls the execution of computer programs and which may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.
Operational parameters	Input parameters required by a program that define the mode and method of execution.
Parameter	1. A variable that is given a constant value for a specific purpose or process. 2. A quantity in a routine which specifies a machine configuration, subroutines to be called, or other operating conditions.
Priority	A scheme for determining that one routine or job is to be executed before another. In MSOS, priority distinctions are applicable in multiprogramming. In multiprogramming, the priority program may gain control of the processor from the batch program through interrupts, and the batch program receives control of the processor only when the priority program relinquishes control.
Priority level	All programs are assigned a priority level, and the use of the central processor is determined by priority level. The highest program priority is 15; the lowest is -1.
Program library	A mass memory data file containing programs that can be accessed via the operating system (not via a scheduler call).
Protected	A defined area of core storage in which each word of that area can only be accessed by words in that area, thus providing memory protection.
PSR level	A number identifying the last Programming System Report that affected the program.
Read	To transfer information from an external device to internal storage.
Real time	Pertaining to a program for which time requirements are particularly stringent.

Record	A collection of related items of data, treated as a unit; for example, one line of an invoice may form a record, and a complete set of such records may form a file.
Re-entrant	Programs that may be interrupted, called by interrupting programs, and resumed at the point of interruption without loss of continuity.
Re-entrant code	A code which does not alter itself during execution. The same body of code may be used concurrently by two or more processors. This feature saves space as does a serially re-usable subroutine. It also saves time because there is no waiting. Re-entrant subroutines rely quite heavily on the use of registers, especially for use in addressing, so that each task will have its own data storage area and all valuable information will be stored if the processor is interrupted.
Release core	The act of returning a block of allocatable core to the operating system's core allocation monitor.
Relocatable program (object deck)	A program which includes control information regarding program name, entries, externals, transfer address, and command sequence storage. It may be loaded anywhere in absolute form by a relocating loader.
Request priority	Priority of a request with respect to other requests. Determines when a request is processed.
Run-anywhere programs	Programs which will execute properly regardless of where they are executed in core memory. All data internal to the program is referenced by relative addressing.
Status	A state or condition of hardware or task; for example, busy or not busy.
Status word	A word containing all of the status bits of a specified device.
System ordinal	A program in an absolute file that can be set into execution via a MSOS scheduler call.
Unformatted read/writes	Reads and writes which cause data to be transferred without regard to the type of device being read from or written to.
Unit	A peripheral device connected to an equipment and capable of storing, receiving, transmitting, or interpreting data.
Unprotected	A defined area of core storage where memory references are restricted to other locations in that area. Memory accesses which reference a protected area will generate an internal fault condition,

	thus providing memory protection. References from a protected area may legally access this area.
Worst case	That which gives maximum stress or consumes maximum time; e.g., the pattern of ones and zeros in storage that creates the greatest noise or the maximum possible time between two significant programming operations.
Write	To transfer information, usually from internal storage, to an output device.

```
0001                    NAM  SCMTTY        SUMMARY LEVEL RE  MSOS 4.1
0002            *
0003            *            ON-LINE TELETYPEWRITER TEST
0004            *
0005            *       1700 MASS STORAGE OPERATING SYSTEM VERSION 4.1
0006            *       SMALL COMPUTER DEVELOPMENT DIVISION, LA JOLLA, CALIFORNIA
0007            *       COPYRIGHT CONTROL DATA CORPORATION 1973


0009            *
0010            *            M A S S   M E M O R Y   R E S I D E N T
0011            *
0012            *       PROGRAM IS RUN ANYWHERE RELOCATABLE

0014            ************************************************************************
0015            *                                                                      *
0016            *                            TEST DESCRIPTION                          *
0017            *                                                                      *
0018            ************************************************************************


0020            *       SCMTTY IS A DIAGNOSTIC EXERCISER FOR THE 713 CRT
0021            *       AND 1711/1713 TELETYPEWRITER.  IT OPERATES UNDER THE CONTROL
0022            *       OF THE DIAGNOSTIC EXECUTIVE SCMEXC AND USES THE M.S.O.S.
0023            *       DRIVERS FOR ALL COMMUNICATION WITH THE TYPER SUBSYSTEM.
0024            *       BEFORE TEST EXECUTION IS STARTED, THE USER IS REQUESTED
0025            *       TO INPUT THE TEST PARAMETERS -- LOGICAL UNIT, TEST SECTION
0026            *       TO BE EXECUTED AND THE NUMBER OF TIMES TO EXECUTE THE TEST
0027            *       SECTION. THE LOGICAL UNIT IS CHECKED FOR VALIDITY AND IF
0028            *       INVALID, THE USER IS REQUESTED TO RE-ENTER THE TEST PARA-
0029            *       METERS. SCMTTY IS DIVIDED INTO THREE SECTIONS (TESTS) AS
0030            *       FOLLOWS:
0031            *            SECTION 1   OUTPUT CHARCTER TEST
0032            *            SECTION 2   ECHO TEST
0033            *            SECTION 3   SELECTABLE OUTPUT CHARACTER TEST
0034            *       SECTION ONE OUTPUTS THE COMPLETE CHARACTER SET AND REPEATS
0035            *       UNTIL CARRIAGE LENGTH IS REACHED. ON COMPLETION OF EACH I/O
0036            *       REQUEST, A CHECK IS MADE FOR HARDWARE ERRORS. IF THE M.S.O.S.
0037            *       DRIVER DETECTED AN ERROR, THE TEST RETRIVES THE ALTERNATE
0038            *       DEVICE HANDLER ERROR CODE TO DETERMINE THE HARDWARE FAIL-
0039            *       URE.THE TEST ALSO PATCHES THE "LOG1" TABLE SUCH THAT WHEN
0040            *       AN ERROR OCCURS CONTROL IS SENT BACK TO THE TEST WITHOUT
0041            *       USER ACTION. THIS IS DONE BY ALTERNATING TO THE SOFTWARE
0042            *       DUMMY. AT THE END OF EACH PASS OF THE TEST SECTION BEING
0043            *       EXECUTED, A PASS COUNTER IS UPDATED AND COMPARED AGAINST
0044            *       THE NUMBER OF TIMES REQUESTED BY THE USER. IF EQUAL, THE
0045            *       TEST IS TERMINATED. THE STOP FLAG IS ALSO CHECKED AND IF
0046            *       SET THE TEST IS TERMINATED. IF $8000 IS ENTERED FOR THE
0047            *       NUMBER OF EXECUTIONS, THE TEST SECTION WILL BE EXECUTED
0048            *       INDEFINITELY.
```

PROGRAM DESCRIPTION

EST QUIVALENCES

```
0050                ********************************************************************************
0051                *                                                                              *
0052                *                                TEST EQUIVALENCES                             *
0053                *                                                                              *
0054                ********************************************************************************


0056        0008            EQU  FREQST(8)      PHYTAB DRIVER REQUEST STATUS LOCATION
0057        00F4            EQU  AMONI($F4)     LOCORE LOCATION OF ADDRESS OF MONITOR
0058        00EA            EQU  ADISP($EA)     LOCORE LOCATION OF ADDRESS OF DISPATCHER
0059        0002            EQU  LPMSK($2)      START OF LOWER BIT MASKS
0060        0023            EQU  ONEBIT($23)    START OF ONE BIT TABLE
0061        0200            EQU  FRC($200)      REQUEST WORD 'REQUEST CODE' LOCATOR
0062        0100            EQU  FX($100)       REQUEST WORD 'F' BIT LOCATOR
0063        0010            EQU  FRP($10)       REQUEST WORD 'REQUEST PRIORTY' LOCATOR
0064        0001            EQU  FCP(1)         REQUEST WORD 'COMPLETION PRIORTY' LOCATOR
0065                *
0066                        EXT  LOG1A          LINK TO LOG1A TABLE
0067                *
0068        000D            EQU  ERCODE(13)     PHYTAB WORD CONTAINING ALTDEV ERROR CODE
0069        000A            EQU  MFF($A)
0070        001A            EQU  MFF00($1A)
0071        0028            EQU  M20($28)
```

OMMUNICATIONS EGION

```
0073                ********************************************************************************
0074                *                                                                              *
0075                *                            COMMUNICATION REGION                              *
0076                *                                                                              *
0077                ********************************************************************************


0079 P0000 5453 START  ALF  $,TSTTTY$
     P0001 5454
     P0002 5459
0080 P0003 0177        ADC  END-START      LENGTH OF PROGRAM
0081                *
0082 P0004 C153        NUM  $C153          REVISION DATE
0083                *
0084 P0005 0000 FLAG   NUM  0              COMMUNICATION WORD WITH MONITOR
0085                *
0086 P0006 0000 INFOIN NUM  0              ADDRESS BUFFER -- FILLED IN AT EXECUTION TIME
0087 P0007 0000 GETFLD NUM  0
0088 P0008 0000 RHXASC NUM  0
0089 P0009 0000 ROCDEC NUM  0
0090 P000A 0000 ROFCHX NUM  0
0091 P000B 0000 CLRSTK NUM  0
0092 P000C 0000 MESAGE NUM  0
```

```
0094                ********************************************************************
0095                *                                                                  *
0096                *                          PARAMETER INPUT                         *
0097                *                                                                  *
0098                ********************************************************************


0100 P000D 0844    ENTER  CLR  A
0101 P000E 683C           STA* INPERR
0102 P000F 5CFC    ENTER1 RTJ* (MESAGE)       OUTPUT INITIAL MSG
0103 P0010 8144    MES1   NUM  $8144
0104 P0011 0103           ADC  MSG1B-MES1
0105 P0012 0011           ADC  MSG1E-MSG1B
0106 P0013 0C00           ENQ  0
0107 P0014 5CF1           RTJ* (INFOIN)      GET TEST PARAMETERS
0108 P0015 5CF1    INI1   RTJ* (GETFLO)
0109 P0016 0162           SQP  FLDOK1
0110 P0017 1800           JMP  ENDMSG        RUBOUT ENTERED--ABANDON TEST
     P0018 008A
0111 P0019 0DFE    FLDOK1 INQ  -1
0112 P001A 6A2C           STA* LU,Q
0113 P001B 0DFD           INQ  -2
0114 P001C 0141           SQZ  INI2-*-1
0115 P001D 18F7           JMP* INI1
0116 P001E C82A    INI2   LDA* LINES          CONVERT
0117 P001F 0131           SAM  INI2A                    (CHECK FOR CONTINOUS EXECUTION)
0118 P0020 5CE9           RTJ* (RDECHX)       NO. OF LINES
0119 P0021 6827    INI2A  STA* LINES
0120 P0022 C824           LDA* LU
0121 P0023 5CE6           RTJ* (RDECHX)      CONVERT LU TO HEX
0122 P0024 6876           STA* SELLU
0123 P0025 0822           TRA  Q
0124 P0026 E600 X         LOQ* LOG1A,Q
     P0027 7FFF X
0125 P0028 4821           STQ* PHYLOC
0126 P0029 C208           LDA- EREQST,Q      CK IF LU LEGAL
0127 P002A A000           AND  =N$3FF0
     P002B 3FF0
0128 P002C 0F44           ARS  4
0129 P002D 9000           SUB  =N$300        1711 TELETYPEWRITER  ($300)
     P002E 0300
0130 P002F 0104           SAZ  GO
0131 P0030 09FB           INA  -4            713 CRT              ($304)
0132 P0031 0102           SAZ  GO
0133 P0032 09E9           INA  -22           1713 TELETYPEWRITER  ($31A)
0134 P0033 0111           SAN  LUER
0135 P0034 180E    GO     JMP* INI3
0136 P0035 D815    LUER   RAO* INPERR
0137 P0036 5CD5           RTJ* (MESAGE)      LOGICAL UNIT ERROR
0138 P0037 8244    MES2   NUM  $8244
0139 P0038 FFC8           ADC  (START-MES2)
0140 P0039 0003           NUM  3
0141 P003A 0101           ADC  MSG4B-MES2
0142 P003B 0005           ADC  MSG4E-MSG4B
0143 P003C C80E           LDA* INPERR        IS THIS THE THIRD L.U. ERROR
0144 P003D 09FC           INA  -3
0145 P003E 0101           SAZ  1
0146 P003F 18CF           JMP* ENTER1
0147 P0040 1800           JMP  ENDMSG        YES, TERMINATE TEST
     P0041 0091
0148 P0042 0844    INI3   CLR  A
0149 P0043 0844           CLR  A
0150 P0044 6850           STA* REPEAT
0151 P0045 1806           JMP* BEGIN
0152                *
0153                *      TEST PARAMETERS
0154                *
0155 P0046 0000    LU     NUM  0
0156 P0047 0000    TEST   NUM  0
0157 P0048 0000    LINES  NUM  0
0158 P0049 0000    PHYLOC NUM  0
0159 P004A 0000    INPERR NUM  0
```

TEST SEQUENCE

```
0161                ********************************************************************************
0162                *                                                                              *
0163                *                    SECTION 1   OUTPUT CHARACTER TEST                         *
0164                *                                                                              *
0165                ********************************************************************************

0167 P004B C8F8   BEGIN  LDA* TEST          CK IF TEST ONE REQUESTED
0168 P004C A024          AND- ONEBIT+1
0169 P004D 0111          SAN  TEST1-*-1
0170 P004E 1806          JMP* T2CK
0171 P004F 5800   TEST1  RTJ  SETBUF        PUT CHARACTER SET IN BUFFER
     P0050 0097
0172 P0051 5844          RTJ* DOIO          OUTPUT CHARACTER BUFFER
0173 P0052 5873          RTJ* ENDTST
0174 P0053 18F8          JMP* TEST1

0176                ********************************************************************************
0177                *                                                                              *
0178                *                          SECTION 2   ECHO TEST                               *
0179                *                                                                              *
0180                ********************************************************************************

0182 P0054 C8F2   T2CK   LDA* TEST          CK IF TEST 2 REQUESTED
0183 P0055 A025          AND- ONEBIT+2
0184 P0056 0111          SAN  TEST2-*-1
0185 P0057 1805          JMP* T3CK
0186 P0058 580C   TEST2  RTJ* INPMSG
0187 P0059 583C          RTJ* DOIO          OUTPUT CHARACTER BUFFER
0188 P005A 5868          RTJ* ENDTST
0189 P005B 18FC          JMP* TEST2

0191                ********************************************************************************
0192                *                                                                              *
0193                *              SECTION 3   SELECTABLE OUTPUT CHARACTER TEST                    *
0194                *                                                                              *
0195                ********************************************************************************

0197 P005C C8EA   T3CK   LDA* TEST          CK IF TEST3 REQUESTED
0198 P005D A026          AND- ONEBIT+3
0199 P005E 0111          SAN  TEST3-*-1
0200 P005F 1873          JMP* ENDMSG
0201 P0060 5804   TEST3  RTJ* INPMSG
0202 P0061 5834          RTJ* DOIO          OUTPUT CHARACTER BUFFER
0203 P0062 5863          RTJ* ENDTST
0204 P0063 18FD          JMP* TEST3+1
```

```
0206                ********************************************************************************
0207                *                                                                              *
0208                *                    REQUEST AND INPUT CHARACTER STRING                        *
0209                *                                                                              *
0210                ********************************************************************************


0212 P0064 0000   INPMSG D     0
0213 P0065 C000          LDA-  0
0214 P0066 0000          ADC   MSG3E-MSG3B
0215 P0067 6834          STA*  SIZE
0216 P0068 C000          LDA-  0
0217 P0069 0094          ADC   MSG33-REF1
0218 P006A 6832          STA*  ADDRES
0219 P006B 582A          RTJ*  DOIO            OUTPUT USER DIRECTIONS
0220 P006C 0A25          ENA   37
0221 P006D 682E          STA*  SIZE
0222 P006E C000          LDA-  0
0223 P006F 0038          ADC   CHAR1A-REF1
0224 P0070 682C          STA*  ADDRES
0225 P0071 0C24          ENQ   36              ZERO
0226 P0072 0A00          ENA   0                OUT
0227 P0073 6A00   S00A1  STA   CHAR1A,Q          THE
     P0074 000E
0228 P0075 00FE          INQ   -1                 INPUT
0229 P0076 0141          SQZ   S00A2               BUFFER
0230 P0077 18F8          JMP*  S00A1
0231 P0078 C826   S00A2  LDA*  READ
0232 P0079 681E          STA*  REF1
0233 P007A 5818          RTJ*  DOIO            INPUT STRING OF CHARACTERS
0234 P007B 0844          CLR   A
0235 P007C 60FF          STA-  I
0236 P007D C900   S000A  LDA   CHAR1A,I        GET WORD FROM BUFFER
     P007E 0004
0237 P007F 0822          TRA   Q               SAVE IT TEMPORARY
0238 P0080 0111          SAN   S000AA          CHECK IF MESSAGE ENDED
0239 P0081 1811          JMP*  S000D            ON AN EVEN CHARACTER
0240 P0082 A00A   S000AA AND-  MFF             NO - CHECK IF
0241 P0083 900A          SUB-  MFF              ENDED ON ODD CHARACTER
0242 P0084 0118          SAN   S000C           NOT END OF MSG - PROCEED
0243 P0085 0814          TRQ   A               STRIP OFF
0244 P0086 A01A          AND-  MFF00            THE FF AND
0245 P0087 8028          ADD-  M20               REPLACE WITH A SPACE
0246 P0088 6900          STA   CHAR1A,I           STORE IT BACK INTO THE BUFFER
     P0089 00C9
0247 P008A D0FF          RAO-  I               BUMP MESSAGE LENGTH
0248 P008B C0FF          LDA-  I               SET THE MSG LENGTH
0249 P008C 680F   S000B  STA*  SIZE             IN THE WRITE REQUEST
0250 P008D C812          LDA*  WRITE           SET TYPE
0251 P008E 6809          STA*  REF1             OF REQUEST
0252 P008F 1C04          JMP*  (INPMSG)
0253 P0090 D0FF   S000C  RAO-  I               BUMP BUFFER INDEX
0254 P0091 18E8          JMP*  S000A           GO GET NEXT WORD
0255 P0092 C0FF   S000D  LDA-  I               MESSAGE ENDED ON EVEN CHARACTER
0256 P0093 18F8          JMP*  S000B
0257 P0094 0000   REPEAT NUM   0
```

I/O ROUTINE

```
0259                ********************************************************************************
0260                *                                                                              *
0261                *                    COMMOM ROUTINE TO DO ALL I/O                              *
0262                *                                                                              *
0263                ********************************************************************************

0265 P0095 0000   DOIO   0     0
0266 P0096 54F4          RTJ-  (AMONI)
0267 P0097 0044   REF1   ADC   6*FRC+FX+4*FRP+4*FCP       FORMAT WRITE CODE
0268 P0098 0009          ADC   COMPLA-REF1
0269 P0099 0000          ADC   0
0270 P009A 0000   SELLU  NUM   0
0271 P009B 0025   SIZE   ADC   SETA-CHAR1A
0272 P009C 008B   ADDRES ADC   CHAR1A-REF1
0273 P009D 14FA          JMP-  (ADISP)
0274 P009E 0944   READ   ADC   4*FRC+FX+4*FRP+4*FCP       FORMAT READ CODE
0275 P009F 0044   WRITE  ADC   6*FRC+FX+4*FRP+4*FCP       FORMAT WRITE CODE
```

CHECK FOR HARDWARE ERRORS

```
0277                ********************************************************************************
0278                *                                                                              *
0279                *                         CHECK FOR HARDWARE ERRORS                            *
0280                *                                                                              *
0281                ********************************************************************************

0283 P00A0 0166   COMPLA SQP   RETURN-*-1
0284 P00A1 E8A7          LDQ*  PHYLOC
0285 P00A2 C20D          LDA-  ERCODE,Q       PICK UP ALTDEV ERROR CODE
0286 P00A3 A006          AND-  LPMSK+4
0287 P00A4 0822          TRA   0
0288 P00A5 00F8          INQ   -7
0289 P00A6 0171          SQM   1
0290 P00A7 1818   RETURN JMP*  FORM5
0291 P00A8 0105          SAZ   OK-*-1
0292 P00A9 0002          INQ   2
0293 P00AA 0171          SQM   1
0294 P00AB 09FE          INA   -1
0295 P00AC 09FE          INA   -1
0296 P00AD 0FC2          ALS   2              MUT BY 4
0297 P00AE E000   OK      LDQ   =XMSG6B-MES3
     P00AF 0086
0298 P00B0 0832          AAQ   0
0299 P00B1 480C          STQ*  MSGPTR
0300 P00B2 C800          LDA   FLAG           CK FOR NO PRINTOUT FLAG
     P00B3 FF51
0301 P00B4 A02A          AND-  ONEBIT+7
0302 P00B5 0119          SAN   FORM5-*-1
0303 P00B6 5C00          RTJ   (MESAGE)       OUTPUT DIAGNOSTIC MESSAGE
     P00B7 FF54
0304 P00B8 8344   MES3   NUM   $8344
0305 P00B9 FF47          ADC   (START-MES3)
0306 P00BA 0003          NUM   3
0307 P00BB 0085          ADC   MSG5B-MES3
0308 P00BC 0001          ADC   MSG5E-MSG5B
0309 P00BD 0086   MSGPTR ADC   MSG6B-MES3
0310 P00BE 0004          ADC   MSG6E-MSG6B
0311 P00BF C800   FORM5  LDA   FLAG           CK FOR STOP FLAG
     P00C0 FF44
0312 P00C1 A023          AND-  ONEBIT
0313 P00C2 0101          SAZ   FORM6-*-1
0314 P00C3 180F          JMP*  ENDMSG
0315 P00C4 1CD0   FORM6  JMP*  (DOIO)
```

This Program Contains No Data Error Checks

```
0317                ********************************************************************************
0318                *                                                                              *
0319                *                              TERMINATION SEQUENCE                            *
0320                *                                                                              *
0321                ********************************************************************************


0323 P00C5 0000   ENDTST 0     0
0324 P00C6 D8CD          PAO*  REPEAT
0325 P00C7 C800          LDA   FLAG            CK FOR STOP FLAG
     P00C8 FF3C
0326 P00C9 A023          AND-  ONEBIT
0327 P00CA 0117          SAN   ENDMSG-*-1
0328 P00CB C800          LDA   LINES
     P00CC FF79
0329 P00CD 0133          SAM   END1-*-1        INFINITE RUNS REQUESTED
0330 P00CE 0103          SAZ   ENDMSG-*-1      ZERO RUNS REQUESTED
0331 P00CF 98C4          SUB*  REPEAT
0332 P00D0 0101          SAZ   ENDMSG-*-1      NUMBER OF RUNS REQUESTED ARE COMPLETE
0333 P00D1 1CF3   END1   JMP*  (ENDTST)
0334                     *
0335 P00D2 5C00   ENDMSG RTJ   (MESAGE)        OUTPUT END MESSAGE
     P00D3 FF38
0336 P00D4 8144   MES4   NUM   $8144
0337 P00D5 0050          ADC   MSG2B-MES4
0338 P00D6 0007          ADC   MSG2E-MSG2B
0339 P00D7 C800          LDA   FLAG            CK FOR STOP TO RE-ENTER PARAMETERS
     P00D8 FF2C
0340 P00D9 A029          AND-  ONEBIT+6
0341 P00DA 0105          SAZ   END2-*-1
0342 P00DB 0844          CLR   A
0343 P00DC 6800          STA   FLAG
     P00DD FF27
0344 P00DE 1800          JMP   ENTER
     P00DF FF2D
0345 P00E0 C800   END2    LDA   START+1        CLEAR TEST NAME FROM PROGRAM STACK
     P00E1 FF1F
0346 P00E2 E800          LDQ   START+2
     P00E3 FF1E
0347 P00E4 5C00          RTJ   (CLRSTK)       CLEAR TEST NAME FROM PGM STACK, RELEASE CORE
     P00E5 FF25
0348 P00E6 FF19          ADC   (START-*)
```

Subroutine For Test Sequence*

```
0350                ********************************************************************************
0351                *                                                                              *
0352                *                              RESET CHARACTER BUFFER                          *
0353                *                                                                              *
0354                ********************************************************************************

0356 P00E7 0000   SETBUF NUM  0
0357 P00E8 0828          RAO* CHAR1          INCREMENT STARTING CHARACTER
0358 P00E9 C827          LDA* CHAR1          CHECK IF CHARACTER
0359 P00EA 9828          SUB* SIXTY           IS ILLEGAL
0360 P00EB 0132          SAM  S0001          NO - GO FILL BUFFER
0361 P00EC 0A20          ENA  $20            YES - RESET STARTING
0362 P00ED 6823          STA* CHAR1           CHARACTER
0363 P00EF C822   S0001  LDA* CHAR1          SET UP
0364 P00EF 6822          STA* CHAR            TO FILL BUFFER
0365 P00F0 0842          CLR  0                WITH LEGAL CHARACTERS
0366 P00F1 C820   S0002  LDA* CHAR           GET UPPER
0367 P00F2 0FC8          ALS  8               8 BITS
0368 P00F3 60FF          STA- I                SAVE TEMPORARILY
0369 P00F4 C81D          LDA* CHAR           CHECK IF NEXT
0370 P00F5 9000          SUB  =N$5F           NEXT CHARACTER
     P00F6 005F
0371 P00F7 0132          SAM  S0003            WILL BE LEGAL
0372 P00F8 0A1F          ENA  $1F            NO - RESET
0373 P00F9 6818          STA* CHAR            CHARACTER
0374 P00FA C0FF   S0003  LDA- I
0375 P00FB 8816          ADD* CHAR           COMBINE LOWER
0376 P00FC 0901          INA  1               8 BITS - INCREASE BY 1
0377 P00FD 6A55          STA* CHAR1A,Q         AND STORE IN BUFFER
0378 P00FE 0D01          INQ  1              INCREMENT BUFFER INDEX
0379 P00FF 0814          TRQ  A              CHECK IF
0380 P0100 9000          SUB  =N36            BUFFER IS FULL
     P0101 0024
0381 P0102 0108          SAZ  FINISH         YES - GO PRINT BUFFER
0382 P0103 C80E          LDA* CHAR           SET UP
0383 P0104 0902          INA  2               NEXT
0384 P0105 680C          STA* CHAR             CHARACTER
0385 P0106 980C          SUB* SIXTY          CHECK IF
0386 P0107 0132          SAM  S0004           IT IS LEGAL
0387 P0108 0A20          ENA  $20            NO - RESTORE
0388 P0109 6808          STA* CHAR            CHARACTER
0389 P010A 18E6   S0004  JMP* S0002          GO FILL  NEXT WORD
0390 P010B C000   FINISH LDA  =N$D00          STORE CARRIAGE RETURN
     P010C 0D00
0391 P010D 6A45          STA* CHAR1A,Q        IN OUTPUT BUFFER
0392 P010E 488C          STQ* SIZE           STORE NO. OF WORDS IN I/O REQUEST
0393 P010F 1CD7          JMP* (SETBUF)       GO PRINT BUFFER
0394 P0110 001F   CHAR1  NUM  $1F
0395 P0111 001F   CHAR   NUM  $1F
0396 P0112 0060   SIXTY  NUM  $60
```

*Located here to save core space.

```
0398                ********************************************************************************
0399                *                                                                              *
0400                *                              MESSAGE BUFFERS                                 *
0401                *                                                                              *
0402                ********************************************************************************

0404 P0113 4245     MSG1B   ALF   $,BEGIN TTY TEST$
     P0114 4749
     P0115 4E20
     P0116 5454
     P0117 5920
     P0118 5445
     P0119 5354
0405 P011A 0000             NUM   $000
0406 P011B 444C             ALF   *,DLU,SECTIONS,LINES*
     P011C 552C
     P011D 5345
     P011E 4354
     P011F 494F
     P0120 4E53
     P0121 2C4C
     P0122 494E
     P0123 4553
0407        0124 P          EQU   MSG1E(*)
0408 P0124 454E     MSG2B   ALF   $,END TTY TEST $
     P0125 4420
     P0126 5454
     P0127 5920
     P0128 5445
     P0129 5354
     P012A 2020
0409        012B P          EQU   MSG2E(*)
0410 P012B 1200     MSG3B   NUM   $1200
0411 P012C 494E             ALF   11,INPUT CHARACTER STRING
     P012D 5055
     P012E 5420
     P012F 4348
     P0130 4152
     P0131 4143
     P0132 5445
     P0133 5220
     P0134 5354
     P0135 5249
     P0136 4E47
0412 P0137 000A             NUM   $00A
0413        0138 P          EQU   MSG3E(*)
0414 P0138 2044     MSG4B   ALF   *, DLU ERROR*
     P0139 4C55
     P013A 2045
     P013B 5252
     P013C 4F52
0415        013D P          EQU   MSG4E(*)
0416 P013D 2020     MSG5B   ALF   1,
0417        013E P          EQU   MSG5E(*)
0418 P013E 5449     MSG6B   ALF   4,TIME OUT
     P013F 4D45
     P0140 204F
     P0141 5554
0419        0142 P          EQU   MSG6E(*)
0420 P0142 414C             ALF   4,ALARM
     P0143 4152
     P0144 4D20
     P0145 2020
0421 P0146 5041             ALF   4,PARITY
     P0147 5249
     P0148 5459
     P0149 2020
0422 P014A 494E             ALF   4,INT REJ
     P014B 5420
     P014C 5245
     P014D 4A20
0423 P014E 4558             ALF   4,EXT REJ
     P014F 5420
     P0150 5245
     P0151 4A20
```

LARGE I/O BUFFER

```
0425                ********************************************************************************
0426                *                                                                              *
0427                *                                    I/O BUFFER                                *
0428                *                                                                              *
0429                ********************************************************************************

0431 P0152 0000    CHAR1A NUM  0
0432 P0153 0024           BZS  (36)          CHARACTER BUFFER
0433       0177 P         EQU  SETA(*)
0434       0177 P         EQU  END(*)
0435                      END
```

INSTALLATION OF SCMM B

Ideally, SCMM is installed during system build. However, if a system ordinal labeled SCMM has been defined, SCMM may be installed at any time.

Installing SCMM at system build time requires that the following cards and decks be inserted in the build tape or decks:

Cards and Decks	Comments
*YM, SCMM17, 27	Insert with other *YM cards.
*M SCMM	Insert as the 27th *M in the build deck.
Binary deck for SCMEXC	

The following control cards will cause the decks to be loaded into the program library as absolute files.

NOTE

All file names must begin with the letters SCM.

*JOB	
*K, I10, P8	Assign input as card reader, punch unit as disk.
*LIBEDT	
*P, F	LIBEDT creates an absolute file of binary deck.
Binary deck for test SCMTTY	
*T	End of this absolute file.
*K, I8	Assign input as disk.
*N, SCMTTY, , , B	Transfer file to program library under the name SCMTTY.
*K, I10	Change input back to card reader.
*P, F	
Binary deck for test SCMCRD	
*T	
*K, I8	
*N, SCMCRD, , , B	
*K, I10	
*P, F	

Cards and Decks	Comments

Binary deck for test SCM405

```
*T
*K,I8
*N,SCM405,,,B
*K,I10
*P,F
```

Binary deck for SCMCD1

```
*T
*K,I8
*N,SCMCD1,,,B
*K,I10
*P,F
```

Binary deck for SCMCD2

```
*T
*K,I8
*N,SCMCD2,,,B
*K,I10
*P,F
```

Binary deck for SCMDK1

```
*T
*K,I8
*N,SCMDK1,,,B
*K,I10
*P,F
```

Binary deck for SCMDK2

```
*T
*K,I8
*N,SCMDK2,,,B
*K,I10
*P,F
```

Binary deck for SCMDVP

```
*T
*K,I8
*N,SCMDVP,,,B
*K,I10
*P,F
```

Binary deck for SCMPRT

```
*T
*K,I8
*N,SCMPRT,,,B
*K,I10
*P,F
```

Cards and Decks	Comments

Binary deck for SCMMTT

```
*T
*K,I8
*N,SCMMTT,,,B
*K,I10
*P,F
```

Binary deck for SCMDRM

```
*T
*K,I8
*N,SCMDRM,,,B
*K,I10
*P,F
```

Binary deck for SCMDM1

```
*T
*K,I8
*N,SCMDM1,,,B
*K,I10
*P,F
```

Binary deck for SCMPTP

```
*T
*K,I8
*N,SCMPTP,,,B
*K,I10,P10
*Z
```

Binary deck for SCMPTR

```
*T
*K,I8
*N,SCMPTR,,,B
*K,I10
*P,F
```

Binary deck for SCMSTU

```
*T
*K,I8
*N,SCMSTU,,,B
*K,I10
*P,F
```

Binary deck for SCMLLV, CNTTBL, D1544A, D1553A

```
*T
*K,I8
*N,SCMLLV,,,B
*K,I10
*P,F
```

Cards and Decks	Comments
Binary deck for SCMRLY	
*T *K,I8 *N,SCMRLY,,,B *K,I10 *P,F	
Binary deck for SCMAD1	
*T *K,I8 *N,SCMAD1,,,B *K,I10 *P,F	
Binary deck for SCMAD2, CNTTBL, D1501A	
*T *K,I8 *N,SCMAD2,,,B *K,I10 *P,F	
Binary deck for SCMCTR	
*T *K,I8 *N,SCMCTR,,,B *K,I10 *P	
Binary deck for SCMHFP,SFLOAT	
*T *K,I8 *N,SCMHFP,,,B *K,I10 *P,F	Change input and punch back to normal devices. Terminates LIBEDT

Installation of SCMM after a system has been built will require the same control cards and decks as described above, with one exception. The exception is the ordinal SCMM which will be loaded under LIBEDT as follows:

*JOB
*LIBEDT
*M,027,,,M

Binary deck for SCMEXC

*T

This can be followed by the control cards and decks for each of the SCMM tests if the entire SCMM package is to be loaded.

When replacing a test with an updated version, the control cards are identical to those used during system build. For example, to replace the magnetic tape test MT1:

```
*JOB
*K,I10,P8
*LIB EDT
*P,F
Binary deck for TSTMT1
*T
*K,I8
*N,SCMMTT,,,B
*K,P10
*U
```

As noted in Section 2 only one copy of a test may be set in execution at any given time. This means that if a system configuration contains duplicate hardware devices (such as two disks), both devices cannot be exercised simultaneously unless the following occurs (the 1738/853-854 is used as an example):

1. Duplicate the source deck for SCMM test SCMDK1.
2. Change the NAM card to NAM SCMDK2.
3. Change the card START ALF $,TSTDK1$ to START ALF $,TSTDK2$.
4. Change all messages to reflect that the test is now DK2.
5. Assemble the new deck and install it in the program library as outlined above.

This allows the testing of two disk drives or the simulation of two users accessing the same drive.

COMMON SUBROUTINES C

The following subroutines are available to aid in SCMM test development. The user is reminded that the integrity of the A, Q, and I registers is not maintained upon return from these subroutines.

INFOIN

This routine is used to input 40 characters from the standard input comment device. The caller must execute an indirect return jump to this routine. On entry, if the Q register is zero, a request is made to the standard comment device for a carriage return, line feed. If the Q register is non-zero, no request is made. This allows the operator to input characters on the same line as the previous message. Following the completion of the input request, control is returned to the caller with the driver error status in the upper three bits of the Q register. If bit 15 is set, an error was detected by the driver during the input operation. The caller then determines if another try should be made to input the character buffer. Each entry to the routine resets the buffer pointer and field counter for the GETFLD routine.

If no error occurred during the execution of INFOIN, the caller should execute a series of indirect return jumps to the GETFLD to pick up the data.

The calling sequence to input from the standard comment device is:

```
INFOIN    NUM    0          Word 6 of the caller's program. Address
                            of the routine is inserted by the SCMM
                            Executive when the caller's program is
                            loaded.
          ENQ    0
          RTJ    (INFOIN)
```

GETFLD

This routine searches the 20-word buffer, which received the input from INFOIN, for fields of data delimited by commas or carriage returns, and returns with the last four hexadecimal digits of a field in the A register and the number of the field (left to right) in the Q register. Checks for input errors are the responsibility of the caller. GETFLD sets the Q register negative when the operator enters a question mark. A test for Q positive must be inserted immediately after each RTJ to GETFLD to assure proper routing.

The calling sequence is:

```
GETFLD    NUM    0          Word 7 of the caller's program. Address
                            of the routine is inserted by SCMM
                            Executive when the caller's program is
                            loaded.
```

```
INI1    RTJ   (GETFLD)
        SQP   FLGOK1     If positive, continue; if question mark,
        JMP   ENDMSG     discontinue test.
FLGOK1  INQ   -1         Use Q as a storage index.
        STA   PRAM,Q     Check if three values have been
        INQ   -2         retrieved.
        SQZ   INI2
        JMP*  INI1       No go; get next value.
```

RHXASC This routine converts the value in the A register to four ASCII characters. The caller must execute an indirect return jump to this routine. The contents of the return address must contain a relative address from the return address to a two-word buffer where the routine will store the four ASCII characters. This relative address must always have bit 15 set. The Q register is not affected by this routine. RHXASC is re-entrant.

The calling sequence is:

```
RHXASC  NUM   0          Word 8 of the caller's program. Address
                         of the routine is inserted by SCMM
                         Executive when the caller's program is
                         loaded.
        LDA   HEXNUM
        RTJ   (RHXASC)
        ADC   (BUF-*)    Generates relative address to two-word
                         buffer.
BUF     BZS   BUF(2)     Buffer to receive converted value.
```

ROCDEC This routine converts the hexadecimal value in the A register to a decimal number and returns the value in the A register. The caller must execute an indirect return jump to this routine. The return address and the next two locations are used as temporary storage by the routine.

The routine returns to the location following these three words of temporary storage. The Q register is not maintained during this routine, and contains the sign of the value. The routine is re-entrant. The largest value to be handled is 9,999.

The calling sequence is:

```
ROCDEC  NUM   0          Word 9 of the caller's program. Address
                         of the routine is inserted by SCMM
                         Executive when the caller's program is
                         loaded.
        LDA   OCNUM      Number to be converted.
        RTJ   (ROCDEC)
        NUM   0          Scratch
        NUM   0          Pad
        NUM   0          Cells
        STA   DECNUM     Save converted value.
```

RDECHX This routine converts the decimal value in the A register to a hexadecimal value and returns it in the A register. The decimal value is assumed to be positive and may have a maximum value of 9,999.

The Q register is not affected by this routine and the routine is re-entrant.

The calling sequence is:

```
RDECHX   NUM   0          Word 10 of the caller's program.
                           Address of the routine is inserted by
                           SCMM Executive when the caller's
                           program is loaded.
         LDA   DECNUM      Decimal value to be converted.
         RTJ   (RDECHX)
         STA   HEXNUM      Save hexadecimal value.
```

CLRSTK This routine clears the caller's test name from the program stack used by the SCMM Executive. The routine also releases core allocated to the caller's program. The caller must execute an indirect return jump to this routine with the A register containing the third and fourth characters of the test mnemonic name and the Q register containing the fifth and sixth characters. The contents of the return address must be a relative address to the first word of the test. The routine never returns to the caller.

The calling sequence is:

```
START    ALF   $,TSTxxx$  Test ID mnemonic; word 0 of the caller's
                           program.
CLRSTK   NUM   0          Word 11 of caller's program. Address
                           of routine is inserted by SCMM Executive
                           when the caller's program is loaded.
         LDA   START+1     Test name
         LDQ   START+2     Mnemonic
         RTJ   (CLRSTK)
         ADC   (START-*)   Relative address to the first address of
                           the test.
```

MESAGE This routine is used by the caller to output messages. When messages have several segments, the routine combines all segments before the message is output. A formatted I/O request, a scheduler request to return to the caller, and a release core request are moved to allocatable core along with all message segments. The routine then makes a scheduler call to the beginning of the allocatable region where the above parts are stored. The routine then exists.

When the I/O request in allocatable core is complete, the caller is scheduled at the address following the end of the parameter list. The routine must execute an indirect

return jump to the routine. The contents of the return address must contain a control word defined as follows:

Bits 0-3	Completion priority for I/O request
Bits 4-7	Request priority for I/O request
Bits 8-11	Number of message segments
Bits 12-14	Not used
Bit 15	0 = Output message on the standard list device 1 = Output message on the standard output comment device

For each message segment specified in bits 8 through 11, there are two words in the parameter list, which starts with the word following the control word. The first word is a relative address from the control word to the message segment. This relative address is a signed value (i.e., for backward addressing bit 15 must be set). The second word is the length of the usage segment. If the length is zero, the routine ignores the message segment and continues with the next segment.

When output, the message is preceded by a carriage return, line feed because a formatted I/O request is used. There is no need to end the message with a line feed, carriage return.

Bits 0 through 3, completion priority for the I/O request, are also needed as the schedule priority for the scheduler request to return to the caller.

The calling sequence is:

```
MESAGE   NUM   0                    Word 12 of the caller's
                                    program. Address of the
                                    routine is inserted by the
                                    SCMM Executive when the
                                    caller's program is loaded.
         RTJ   (MESAGE)
MES1     NUM   $8144
         ADC   MSG1B-MES1           Relative address to start of
                                    message.
         ADC   MSG1E-MSG1B          Message length.
MSG1B    ALF   $,BEGIN TTY TEST$
         NUM   $D00
         ALF   $,DLU,SECTIONS,LINES$
         EQU   MSG1E(*)
```

The value entered as MES1 denotes the following:

- 8 — Output on standard comment device
- 1 — Number of message segments
- 44 — Request and completion priority of 4

SCMM DIAGNOSTICS IOM PARTS LIST

D

Equipment No.	Product No.	Description	Test Equipment	Part No.
EL101-A	1750-1	Computer Interface Unit	Front Edge Jumper Cable	88823500
EL102-A	1750-2	Computer Interface Expander	1544-x Digital Input Unit 1553-x Digital Output Unit or 1555-x Relay Output Unit	39842200 39842500
DA101-A/B	1544-1/2	Digital Input Unit (LL)	Backplane Jumper Cable 1553-x Digital Output Unit	88968700 39842500
DA401-A/B	1544-3/4	Digital Input Unit (CC)	Backplane Jumper Cable 1553-x Digital Output Unit	88968700 39842502
DA502-E/F	1553-1/2	Digital Output Unit (LL)	Backplane Jumper Cable	88968700
DA502-J/K	1553-5/6	Digital Output Unit (Driver)	1544-x Digital Input Unit	39842200
DA502-G/H	1553-3/4	Digital Output Unit (CC)	Backplane Jumper Cable 1544-x Digital Input Unit	88968700 39842202
DK605-A/B	1595-10/20	Serial I/O Interface	Backplane Jumper Plug	88968800
DF3A1-A/D	1555-1/2/3/4	Relay Output Unit	Backplane Jumper Cable 1544-x Digital Input Unit	88830200 39842202
FV4A3-A	1576-1	Stall Alarm Unit	None Required	
FV498-A	1576-2	Stall Alarm Panel	Clip Lead Jumper	N/A
GA128-A	1572-1	Sample Timing Unit	None Required	
FT1A1-A/B	1547-1/2	Events Counter	Backplane Jumper Cable 1553-x Digital Output or 1555-x Relay Output Unit	88968700 39842500
EB3A1-A	1566-20/21	D/A Conversion Unit (four channels, ± 10v)	Digital Voltmeter with 0.05% accuracy† or IOM Analog Test Box	 88970700
EG801-A/B/C	1566-22/23	D/A Conversion Unit (four channels, 5/20/50 ma)	Digital Voltmeter with 0.05% accuracy† or IOM Analog Test Box Zoor 1/4w 0.01% Register/ Ch.	 88970700
EA309-A	1525-3	Analog-to-Digital Converter	DC Voltage Standard with 0.01% accuracy or IOM Analog Test Box	 88970700

†Special cable required

Equipment No.	Product No.	Description	Test Equipment	Part No.
ED105-A ED106-A	1501-10 1501-11	Analog Input MUX/Control Analog Input Expander	Analog Test Box with Digital Voltmeter with 0.05% accuracy† or DC Voltage Standard with 0.01% accuracy or	39007700
			IOM Analog Test Box	88970700
FL1A1-A ED4A1-A/B/C	1536-2 1502-8X	Relay Analog MUX Controller Relay Analog MUX Module (eight channels)	Analog Test Box with Digital Voltmeter with 0.05% accuracy† or DC Voltage Standard with 0.01% accuracy† or	39007700
			IOM Analog Test Box	88970700
			NOTE A minimum of one IOM type card extender is required for trouble shooting purposes.	39844100

†Special cable required

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COMMENT SHEET

MANUAL TITLE 1700 Computer Systems Small Computer Maintenance Monitor

Reference Manual

PUBLICATION NO. 39520200 REVISION C

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