

MARK 2/3/4
PERIPHERALS INTERFACE BOARD
MUX DIAGNOSTIC
VERSION 1.3

PRELIMINARY DOCUMENTATION

Revision 04

3-10-86

Document Order Number: HTP0042

COPYRIGHT 1985, 1986 POINT 4 Data Corporation

CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1	INTRODUCTION TO MARK 2/3/4 MUX DIAGNOSTIC	1-1
1.1	GENERAL DESCRIPTION	1-1
1.2	HARDWARE CONFIGURATION	1-2
1.3	RESTRICTIONS	1-2
1.4	TERMINAL COMMANDS	1-3
2	OPERATING PROCEDURES AND PROGRESS MESSAGES	2-1
2.1	LOADING THE DIAGNOSTIC	2-1
2.1.1	Loading from the System Diagnostic Tape	2-1
2.1.2	Loading from the IRIS Operating System	2-3
2.2	SELECTING THE MASTER PORT	2-4
2.3	SELECTING THE PORTS TO BE TESTED	2-5
2.4	MARK 4 TEST OPTION	2-8
2.5	INSTALLING THE TEST CABLES	2-8
2.6	ERROR RECOVERY OPTIONS	2-9
3	MARK 2/3/4 MUX DIAGNOSTIC TEST DESCRIPTIONS	3-1
3.1	FIRMWARE TEST	3-1
3.2	PROGRAMMED I/O MODE TEST	3-2
3.3	AUTOMATIC BUFFER MODE TEST	3-5
3.4	SINGLE CHARACTER MODE TEST	3-9
3.5	REAL TIME CLOCK TEST	3-11
APPENDICES		
A	MUX CABLING DIAGRAMS	A-1

Section 1

INTRODUCTION TO MARK 2/3/4 MUX DIAGNOSTIC

1.1 GENERAL DESCRIPTION

POINT 4 Data Corporation provides a diagnostic program for the MARK 2, MARK 3, or MARK 4 Computer System that verifies the operation of the Mux logic. The program may be provided on disk with the IRIS Operating System or supplied on the stand-alone MARK 2/3/4 System Diagnostics streamer tape cartridge.

The standard MARK 2/3/4 Mux Diagnostic program provides fast and comprehensive testing of the Mux control logic and is a powerful tool for troubleshooting new or malfunctioning units. The diagnostic can be used to verify that the Peripherals Interface Board (PIB) is operational. The short loop tests can be used to isolate problems on suspect boards. Options are provided to stop when an error condition is detected, to display an error message and continue operating, or to enter a tight loop on the operation that generated the failure.

On a MARK 2/3 Computer, all tests are performed in port-to-port mode and once on each pass. Ports are tested in pairs and must be connected by test cables. Characters output on one port are expected to be received on the partner port.

On a MARK 4 Computer, the tests are performed in loopback and optionally in port-to-port mode. The loopback feature of the MARK 4 allows the communications modes to be tested internally without the use of test cables. Characters output on one port are used internally as input on the same port. The port-to-port mode provides a more comprehensive level of testing than the loopback mode. The programs described in Sections 3.2 through 3.4 (Programmed I/O, Automatic Buffer, and Single Character tests) are performed twice automatically; once in loopback and once in port-to-port mode. When the diagnostic is first loaded, DEBUG is relocated to 60000 (octal).

1.2 HARDWARE CONFIGURATION

The hardware configuration required for the operation of the MARK 2/3/4 Mux Diagnostic depends on the computer system to be tested.

1. One of the following configurations is required:
 - a. POINT 4 MARK 3 CPU with MARK 2 Firmware and MARK 2 PIB (optionally with MARK 2 expansion PIB)
 - b. POINT 4 MARK 3 CPU with MARK 3 Firmware and MARK 3 PIB (optionally with MARK 3 expansion PIB)
 - c. POINT 4 MARK 4 CPU with MARK 4 Firmware and MARK 4 PIB (optionally with MARK 4 expansion PIB)
2. Display Terminal
3. Streaming Tape Unit
4. Sets of test cables for MARK 2/3 systems; also required for MARK 4 systems when using port-to-port mode

1.3 RESTRICTIONS

1. Help messages are not available. The prompt messages identify all valid responses.
2. There is no menu option available to enter DEBUG. It may be entered by pressing RESET on the front panel; then enter

J60000

3. The loop-on-error process cannot be interrupted from the terminal. Press the RESET button on the front panel of the computer to stop a looping operation.
4. The new type mux cables must be used for this diagnostic. (See Appendix A for cabling diagrams.)

1.4 TERMINAL COMMANDS

- <RETURN> Commands are entered at the terminal by typing the appropriate character or string on the keyboard and pressing <RETURN>. This <RETURN> is not shown in the documentation unless it is the only input required or it follows a control character.
- <CTRL-S> Prevents or halts the display of a report or listing.
- <CTRL-Q> Resumes the display of a report or listing.
- <ESC> Can be used to restart an operation under the following conditions:
- At a prompt
 - Just before a listing or report is displayed
 - While a display is in progress

Section 2

OPERATING PROCEDURES AND PROGRESS MESSAGES

2.1 LOADING THE DIAGNOSTIC

2.1.1 LOADING FROM THE SYSTEM DIAGNOSTIC TAPE

The standard MARK 2/3/4 Mux Diagnostic may be loaded from the system diagnostic tape as follows:

1. Insert the system diagnostic tape into the streamer tape unit.
2. On the front panel, press RESET.
3. Type H or H46 depending on the format of the system diagnostic tape. This loads the System Executive and the following messages are displayed:

```
*** POINT 4 DATA CORPORATION ***
15442 DEL AMO AVENUE, TUSTIN, CA.
PHONE NO. (714) 838-2225
*** MARK 2/3/4 SYSTEM DIAGNOSTICS - VERSION n.n ***
```

```
NUMERIC INPUT AND OUTPUT IS OCTAL
ENTER DESIRED NUMBER OF PASSES (DEFAULT = 1)
```

where

n.n - current program revision

Press <RETURN> and the following menu is displayed:

```
*** THE MAXIMUM NUMBER OF PROGRAM SELECTIONS IS 5 ***
*** SYSTEM DIAGNOSTICS ***
1 = TAPE (MARK 2/4)
2 = DISK/DISKETTE (MARK 2/4)
3 = MUX (MARK 2/3/4)
4 = MAP AND MEMORY (MARK 4)
5 = TAPE (MARK 3)
6 = DISK (MARK 3)
*** STANDARD DIAGNOSTICS ***
7 = DISK/DISKETTE/TAPE (MARK 2/4)
10 = MUX (MARK 2/3/4)
11 = MAP AND MEMORY (MARK 4)
12 = TAPE (MARK 3)
13 = DISK (MARK 3)
PRESS RETURN TO EXIT SELECTIONS
```

4. Enter selection 10 and the following message is displayed:

READING DATA

This indicates that the MARK 2/3/4 Mux Diagnostic is being loaded.

After the diagnostic is loaded, the following messages are displayed:

```
*** POINT 4 DATA CORPORATION ***  
*** 15442 DEL AMO AVENUE, TUSTIN, CA.  
*** PHONE NO. (714) 838-2225 ***  
MARK 2/3/4 MUX DIAGNOSTIC - VERSION n.n
```

```
NUMERIC INPUT AND OUTPUT IS OCTAL  
ENTER LAST PORT NUMBER ON YOUR SYSTEM
```

where

n.n - current program revision

Enter your selection for this query and proceed to Section 2.2.

2.1.2 LOADING FROM THE IRIS OPERATING SYSTEM

The standard MARK 2/3/4 Mux Diagnostic program and DEBUG can be loaded from the IRIS Operating System by shutting down the system from the Manager's account as follows:

```
SHUTDOWN <CTRL-E>key<CTRL-E>DI.M234MX.n.n,@40000
```

where

key - password assigned to the SHUTDOWN command by the system manager (the default is X)

n.n - current program revision

A line of information is then displayed on the screen.

To enter DEBUG, enter

```
J40000
```

Once the diagnostic is executed, DEBUG will reside at 60000 instead of 40000.

To execute the diagnostic program, enter

```
J2
```

The POINT 4 messages are then displayed. Proceed to Section 2.2.

2.2 SELECTING THE MASTER PORT

The master port on all POINT 4 systems is designated as port 0. Any port specified as a master port is used as the operator interface and cannot be tested by the diagnostic. To allow all ports on a system to be tested, the program permits the operator to select any valid port to function as the master port. Valid ports include the following:

<u>Port Numbers</u>	<u>Type of System</u>
0-3	Standard MARK 2/3 System
0-6	MARK 2/3 System with Port Expansion Board
0-7	Standard MARK 4 System
0-17	MARK 4 System with Port Expansion Board

Master port selection is initiated by the following prompt:

CONNECT MASTER CRT TO DESIRED PORT AND PRESS RETURN

Proceed as follows:

1. Connect the CRT to any valid port.
2. Press <RETURN> on the keyboard.

The program displays the following message:

MASTER CRT IS ON PORT n
OK (Y/N)? >

3. Enter Y if the CRT is connected to the desired port; enter N if the terminal is connected to the wrong port. The first prompt is then redisplayed and the operator can reconnect the terminal.

2.3 SELECTING THE PORTS TO BE TESTED

The diagnostic tests the communications on ports selected by the operator. Selection of the ports to be tested is initiated by a menu displayed in the following format:

SELECT PORTS TO BE TESTED:

xxx
xxx
xxx

>

where

xxx - port selection options valid for the particular system and the designated master port

The operator can select the following options by entering the numerical code:

- For a MARK 2/3 with master port 0
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 2 AND 3
 3. PORTS 3 THROUGH 6
 4. PORTS 1 THROUGH 6
- For a MARK 2/3 with master port 1
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 2 AND 3
 3. PORTS 3 THROUGH 6
- For a MARK 2/3 with master port 2
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 0 AND 1
 3. PORTS 3 THROUGH 6
- For a MARK 2/3 with master port 3
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 0 AND 1
- For a MARK 2/3 with master port 4, 5, or 6
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 0 THROUGH 3

- For a MARK 4 with master port 0 or 1
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 2 THROUGH 7
 3. PORTS 10 THROUGH 17 (OCTAL)
 4. PORTS 2 THROUGH 17 (OCTAL)

- For a MARK 4 with master port 2 through 7
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 0 AND 1
 3. PORTS 10 THROUGH 17 (OCTAL)

- For a MARK 4 with master port 10 through 17 (octal)
 1. OPERATOR SPECIFIED PAIR
 2. PORTS 0 THROUGH 7

Options 3 and 4 display port selections for systems equipped with a port expansion port. Ports 4-6 on a MARK 2/3 and ports 8-17 on a MARK 4 are not actually available on systems without a port expansion board. It is recommended that only those ports actually on the system be specified because the diagnostic will attempt to test all the ports selected.

If option 1 is selected, the following prompt is displayed twice:

ENTER PORT NUMBER (OCTAL) >

Enter the number of the first (lowest) port to be tested the first time the prompt is displayed; enter the number of the last port the second time the prompt is displayed.

If the number entered exceeds the number of ports on the system, the following message is displayed:

MUST BE BETWEEN 0 AND p

where

p - maximum port number for the host machine

If the number of the master port is selected, the following message is displayed:

CANNOT TEST MASTER CRT PORT

If the operator enters the same port number on both prompts, the following message is displayed:

THIS PORT ALREADY SELECTED

After any of these error messages, the program displays the ENTER PORT NUMBER (OCTAL) prompt.

When port selection has been completed, the program displays the selected ports for the operator's approval in the following format:

```
TEST PORTS (OCTAL): p1 p2 p3 . . . pn
OK (Y/N)? >
```

where

p1, p2, p3, pn - selected port numbers

Enter Y if the selection is correct; enter N to restart the selection process.

2.4 MARK 4 TEST OPTION

On a MARK 4 system, the tests can be run in port-to-port or loopback mode. The operator can choose the mode of testing at the following prompt:

```
DO PORT TO PORT TESTS (Y/N)? >
```

Enter **Y** to run port-to-port tests. Enter **N** to run the tests in loopback mode.

2.5 INSTALLING THE TEST CABLES

If the system is a MARK 2/3 or port-to-port tests were selected for a MARK 4 system, the program requests that test cables be installed with the following messages:

```
INSTALL TEST CABLES ON THE FOLLOWING PAIRS OF PORTS,  
THEN PRESS RETURN  
(OCTAL) p1-p2 p3-p4 . . . pm-pn  
>
```

where

p1-p2, p3-p4, pm-pn - ports that should be connected

Press <RETURN> after the cables have been installed.

2.6 ERROR RECOVERY OPTIONS

The program allows the operator to choose an error recovery option only when an error is detected. If an error is detected, the program provides the operator with a choice of error recovery routines.

ON ERROR:

1. CONTINUE
2. LOOP
3. STOP

>

OPTION 1 - Error messages describing the failure are displayed. The diagnostic continues with the test in progress. Subsequent failures are also reported and the program continues execution.

OPTION 2 - Error messages describing the first failure are displayed. The diagnostic goes into a tight loop by repeatedly performing the operation that caused the failure. No additional messages are displayed. Operator input is ignored. The loop can be interrupted by pressing RESET on the computer's front panel.

OPTION 3 - Error messages describing the failure are displayed. The program halts after displaying the following prompt:

ENTER 1 (CONTINUE), 2 (LOOP), OR 3 (RESTART DIAGNOSTIC) >

where

- 1 - The diagnostic continues testing until another failure is detected. Error messages and the option prompt are then displayed.
- 2 - The diagnostic performs the tight loop test.
- 3 - The diagnostic exits the test mode and starts at the beginning by displaying the welcome message described in Section 2.1.1.

Enter the numeric code (1, 2, or 3) to specify the desired error recovery routine.

Section 3

MARK 2/3/4 MUX DIAGNOSTIC TEST DESCRIPTIONS

3.1 FIRMWARE TEST

At the beginning of each pass of the Mux Diagnostic, the operation of the firmware is tested. The address of the port 0 input/output control block (IOCB) is in accumulator 0. The following instruction sequence is executed:

```
DOBS 0,CPU
DIBS 1,CPU
```

The test completes successfully if the values in accumulators 0 and 1 correspond and no message is displayed.

If the value received by the DIBS instruction does not match that sent by the DOBS instruction, one of the following two messages is displayed:

```
*** FIRMWARE ERROR - FAILURE TO CLEAR MUX INTERRUPT ***
```

```
*** FIRMWARE ERROR - MUX IOCB POINTER MISMATCH ***
```

The first message indicates that the interrupt pending bit received from the controller is set to 1 (it should be 0). The second message indicates that the controller did not return the correct value for the IOCB memory address.

3.2 PROGRAMMED I/O MODE TEST

The diagnostic performs the following steps to test the programmed I/O mode:

1. Selects the word length, parity, and number of stop bits for each test port. In loopback mode, eight different combinations of parameter values are tested, with all ports programmed identically on each pass. In port-to-port mode, pairs of ports are tested in 24 different combinations of parameter values.
2. Verifies a master reset operation on all ports, and programs each port with the selected port parameters.
3. Selects the test data value. All 7-bit or 8-bit values (depending on the word length parameter) are tested.
4. Checks each port for transmitter timeout, and outputs the current data value if not timed out.
5. Checks each port for receiver timeout. If not timed out, checks the port status bits, inputs a character, and verifies its value against the current test value.
6. If all data values have not been transmitted, returns to Step 3.
7. If all port parameter combinations have not been tested, returns to Step 1.

If the test completes successfully, the Automatic Buffer Mode test is performed.

If an error occurs, the following message is displayed:

```
*** eeeee ON PORT p ***
```

where

```
eeeee - error message  
p      - port number
```

Possible errors include the following:

NONZERO STATUS AFTER RESET - The master reset command that was sent to the port did not generate the expected port status value of 0.

TRANSMITTER TIMEOUT - The port's Transmit Data Register Empty bit did not become set in the allotted time period after the port parameters were programmed.

RECEIVER TIMEOUT - The character that was transmitted to this port was not received in the allotted time period.

STATUS ERROR - One or more of the port's status bits had an unexpected value after a character was received. The incorrect bit(s) will be identified in the next line by one or more of the following:

- PARITY ERROR - An unexpected parity error condition resulted.
- MISSING PARITY ERROR - An expected parity error did not occur.
- RECEIVER OVERRUN - A receiver overrun condition resulted.
- FRAMING ERROR - A framing error occurred.

BAD DATA RECEIVED - The value received on the port did not match the current test data value. The value received is identified in the following message:

RECV DATA: xxxxxx

where

xxxxxx - data received

Except for BAD DATA, the identifying error message is followed by a description of the port's status.

PORT STATUS: ssssss

where

ssssss - the port status value

The following seven lines show the contents of bits 8 through 15 of the status value:

{NO} PARITY ERROR
{NO} RECEIVER OVERRUN
{NO} FRAMING ERROR
{NOT} CLEAR TO SEND
DATA CARRIER {NOT} PRESENT
TRANSMIT DATA REGISTER {NOT} EMPTY
RECEIVE DATA REGISTER {NOT} FULL

Except for the CLEAR TO SEND and DATA CARRIER PRESENT lines, the bracketed NO or NOT in each line is displayed only if the corresponding bit is set to 0. In the CLEAR TO SEND and DATA CARRIER PRESENT lines, NOT is displayed only if the corresponding bit is set to 1.

For some of these error conditions, the Mux Diagnostic then displays the current test data value in the following format:

XMIT DATA: yyyyyy

where

yyyyyy - test data value

For all errors except NONZERO STATUS, the word-select parameters for the test ports are also displayed.

If the test is being conducted in loopback mode, or the error was a TRANSMITTER TIMEOUT, the following message is displayed:

PORT PARAMS: b BITS, ppp PARITY, s STOP BITS

When two ports are involved, the following messages are displayed:

RECV (PORT p) PARAMS: b BITS, ppp PARITY, s STOP BITS
XMIT (PORT q) PARAMS: b BITS, ppp PARITY, s STOP BITS

where

p - receiving port
q - sending port
b - 7 or 8
ppp - EVEN or ODD
s - 1 or 2

3.3 AUTOMATIC BUFFER MODE TEST

The diagnostic performs the following steps to test the mux in automatic buffer mode:

1. Resets all test ports and programs each port for 7 bits, even parity, and one stop bit.
2. Initializes the I/O control block (IOCB) for each port, setting each input control word (ICW) and output control word (OCW) for automatic buffer mode.
3. Initializes the input buffer for each test port to binary ones.
4. Starts the transmitter and receiver on each test port.
5. Monitors all IOCBs for I/O completion. Reports those operations that time out.
6. Checks each IOCB for correct pointer values and proper input status.
7. Checks all input buffers for correct data values.

If the test completes successfully, the Single Character test is performed.

If an error occurs, an error message is displayed in the following format:

```
*** eeeee ON PORT p ***
```

where

```
eeeee - error message  
p      - port on which the error occurred
```

Possible errors include the following:

OUTPUT OPERATION TIMEOUT - The most significant bit (output operation complete) of the OCW in the port's IOCB was not set in the allotted time period.

INPUT OPERATION TIMEOUT - The most significant bit (input operation complete) of the ICW in the port's IOCB was not set in the allotted time period.

STATUS ERROR - One or more of the status bits in the ICW had an unexpected value after the input operation terminated. The incorrect bit(s) are identified by one or more of the following messages:

```
LOSS OF CARRIER  
FRAMING ERROR  
RECEIVER OVERRUN  
PARITY ERROR
```

BAD DATA RECEIVED - A value mismatch was detected between one of the characters in the port's input buffer and the corresponding character in the output buffer of the port that transmitted to it (which will be the same port if loopback mode is active). The mismatch is identified with the following message:

REC'D DATA: xxxxxx XMIT DATA: yyyyyy BUFFER BYTE OFFSET: zzzzzz

where

xxxxxx - data in input buffer
yyyyyy - data in output buffer
zzzzzz - offset in each buffer of the first pair of bytes that did not match

IOCB ERROR - The port's IOCB contains inconsistent data. The four possibilities are listed below, along with the error line that will be displayed in each case.

- a. The output byte pointer (OBP) does not match the last output byte pointer (LOB):

OUTPUT BYTE PTR: xxxxxx LAST OUTPUT BYTE PTR: yyyyyy

where

xxxxxx - value of OBP
yyyyyy - value of LOB

- b. The character in the low-order byte of OCW does not match the character pointed to by OBP:

LAST OUTPUT CHAR: yyyyyy
LAST OUTPUT CHAR: xxxxxx LAST BUFFER CHAR: yyyyyy

where

xxxxxx - value from OCW
yyyyyy - value pointed to by OBP

- c. The input byte pointer (IBP) does not match the last input byte pointer (LIB):

INPUT BYTE PTR: xxxxxx LAST INPUT BYTE PTR: yyyyyy

where

xxxxxx - value of IBP
yyyyyy - value of LIB

- d. The character in the low-order byte of ICW does not match the character pointed to by IBP:

LAST INPUT CHAR: xxxxxx LAST BUFFER CHAR: yyyyyy

where

xxxxxx - value from ICW
yyyyyy - value pointed to by IBP

The identifying error message is followed by a detailed description of the contents of the IOCB for the port on which the error occurred. If a port-to-port test is in progress, a description of the IOCB for the partner port is also displayed. The IOCB for the port that was doing the output operation (SENDER) is displayed on the left half of the screen; the IOCB for the port that was doing the input operation (RECEIVER) is displayed on the right half of the screen.

Messages are displayed identifying the port, showing the value in ICW, and decoding the ICW value as follows:

```
PORT p IOCB
ICW: iiiiii
INPUT OPERATION {NOT} COMPLETE
AUTOMATIC INPUT
SPECIAL CHAR INT {NOT} ENABLED
{NO} PARITY ERROR
{NO} RECEIVER OVERRUN
{NO} FRAMING ERROR
DATA CARRIER {NOT} PRESENT
INPUT CHARACTER: xxxxxx
OCW: oooooo
OUTPUT OPERATION {NOT} COMPLETE
AUTOMATIC BUFFER OUTPUT
SPECIAL CHAR INT {NOT} ENABLED
OUTPUT CHARACTER: yyyyyy
IBP: zzzzzz hOBP: zzzzzz h
LIB: zzzzzz hLOB: zzzzzz h
```

where

```
p - port number
iiiiii - value in ICW
xxxxxx - input character value in the low-order byte
of ICW
oooooo - value in OCW
yyyyyy - output character value in the low-order byte
of OCW excluding bits 4-7
zzzzzz - word address in bits 0-14
h - L (left half) if bit 15 is set to 0
- R (right half) if bit 15 is set to 1
```

Except in the DATA CARRIER PRESENT line, each bracketed NO or NOT is displayed only if the corresponding bit is set to 0. In the DATA CARRIER PRESENT line, NOT is displayed if the corresponding bit set to 1.

The second line of each decoding shows the value of the mode field in bits 1 and 2 of the corresponding control word.

The values displayed in the decoding lines are the expected values. Other possible values for the ICW mode field are

SINGLE CHARACTER INPUT
ILLEGAL INPUT MODE
AUTOMATIC INPUT WITH ECHO

Other possible values for the OCW mode field are

IDLE
SINGLE CHARACTER OUTPUT
ILLEGAL OUTPUT MODE

3.4 SINGLE CHARACTER MODE TEST

The diagnostic performs the following steps to test the mux in single character mode:

1. Resets all test ports and programs each port for 7 bits, even parity, and one stop bit.
2. Selects the test data value. All 7-bit values are tested.
3. Initializes the IOCB for each port by setting each ICW and OCW for single character mode and inserting the current test data value into the OCW.
4. Starts the transmitter and receiver on each test port.
5. Monitors all IOCBs for I/O completion and reports those operations that time out.
6. Checks each IOCB for proper input status and that the data value in the ICW matches the current test value.
7. If all data values have not been transmitted, returns to Step 2.

If the test completes successfully, the Real Time Clock test is performed.

If an error occurs, the Mux Diagnostic program displays the following message:

```
*** eeeee ON PORT p ***
```

where

```
eeeee - error message  
p      - port number
```

Possible error messages include the following:

OUTPUT OPERATION TIMEOUT - The most significant bit (output operation complete) of the OCW in the port's IOCB was not set in the allotted time period.

INPUT OPERATION TIMEOUT - The most significant bit (input operation complete) of the ICW in the port's IOCB was not set in the allotted time period.

STATUS ERROR - One or more of the status bits in the ICW had an unexpected value after the input operation terminated. The incorrect bit(s) is identified in the next line by one or more of the following:

```
LOSS OF CARRIER  
FRAMING ERROR  
RECEIVER OVERRUN  
PARITY ERROR
```

BAD DATA RECEIVED - The character extracted from the ICW in the port's IOCB did not match the current test data value. The mismatch is identified in the next line with the message

```
RECV DATA: xxxxxx   XMIT DATA: yyyyyy
RECV DATA: xxxxxx   XMIT DATA: yyyyyy
```

where

```
xxxxxx - expected data
yyyyyy - current data
```

The identifying error message is followed by a detailed description of the contents of the IOCB for the port on which the error occurred. If a port-to-port test is in progress, the IOCB for the partner port is also decoded. The descriptions are displayed in the following format:

```
PORT p IOCB
ICW: iiiiii
INPUT OPERATION {NOT} COMPLETE
AUTOMATIC INPUT
SPECIAL CHAR INT {NOT} ENABLED
{NO} PARITY ERROR
{NO} RECEIVER OVERRUN
{NO} FRAMING ERROR
DATA CARRIER {NOT} PRESENT
INPUT CHARACTER: xxxxxx
OCW: oooooo
OUTPUT OPERATION {NOT} COMPLETE
AUTOMATIC BUFFER OUTPUT
SPECIAL CHAR INT {NOT} ENABLED
OUTPUT CHARACTER : yyyyyy
IBP: zzzzzz hOBP: zzzzzz h
LIB: zzzzzz hLOB: zzzzzz h
```

where

```
p          - port number
iiiiiii   - value in ICW
xxxxxxx   - input character value in the low-order byte of
            ICW
ooooooo   - value in OCW
yyyyyyy   - output character value in the low-order byte of
            OCW excluding bits 4-7
zzzzzz   - word address in bits 0-14
h         - L (left half) if bit 15 is set to 0
            - R (right half) if bit 15 is set to 1
```

Values displayed for IBP, LIB, OBP, and LOB are not meaningful in single-character test mode.

3.5 REAL TIME CLOCK TEST

The last test for each pass of the Mux Diagnostic verifies that the Real Time Clock on the PIB is operational and makes a rough determination of the accuracy of the clock.

The frequency of the Real Time Clock is always 100 hz on a MARK 2/3 Computer. The MARK 4 PIB can be jumpered to set the frequency to 10 hz instead of the standard 100 hz.

After starting the Real Time Clock and disabling all DMA activity, the program counts the number of times that a short loop can be executed between two ticks of the clock. The test completes successfully if the loop count falls within an acceptable range.

The diagnostic program displays a message indicating which frequency it has used to determine the acceptable number of loops.

Two types of errors can occur in the Real Time Clock test; the clock interrupt bit is not set or the number of loops that were executed were not within the acceptable range.

If the clock interrupt pending bit is not set within a given time period after the clock is started, the following error message is displayed:

*** ERROR IN REAL TIME CLOCK TEST - NO CLOCK TICK DETECTED ***

If clock ticks are detected at a rate that is not within approximately five percent of a standard value, error messages appropriate to the computer are displayed.

If the computer is a MARK 4, the following messages are displayed:

*** ERROR IN REAL TIME CLOCK TEST - LOOP COUNT WAS xxxxxx
EXPECTED APPROXIMATELY 004714 (100 HZ) OR 061272 (10 HZ) ***

If the computer is a MARK 2/3, the following messages are displayed:

*** ERROR IN REAL TIME CLOCK TEST - LOOP COUNT WAS xxxxxx
EXPECTED APPROXIMATELY 003232 (MK 2) OR 003314 (MK 3) ***

where

xxxxxx - number of loops executed

The number of loops executed should be compared with the appropriate number displayed in the second message line.

If the computer is a MARK 4 and the loop count does not appear to be appropriate, the operator should check that the PIB is jumpered for the proper frequency.

Appendix A
MUX CABLING DIAGRAMS

**MARK 2/3 MUX DIAGNOSTIC CABLE (FOR MK 2/3/4 DIAG)
(MK 4 IF MOLEX CONNECTORS ARE USED)**

<u>PIN</u>	<u>PIN</u>	
1	— 4	PIN 1 IS TRANSMIT DATA
4	— 1	PIN 4 IS RECEIVE DATA

MARK 4 MUX DIAGNOSTIC CABLE WHEN USING DB-25 CONNECTORS

<u>PIN</u>	<u>PIN</u>	
3	— 2	PIN 3 IS TRANSMIT DATA
2	— 3	PIN 2 IS RECEIVE DATA

MOLEX 6-PIN CONNECTOR
POINT 4 P/N 500106
MOLEX P/N 09-50-3061
PINS, CRIMP-TYPE FOR MOLEX CONNECTOR
POINT 4 P/N 724005
MOLEX P/N 08-50-0106

080-19