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## SCSI EXTERNAL SPECIFICATION

*SCSI*, the diagnostic, demonstrates correct functionality of the SCSI board, provides troubleshooting tools as debug features, and easy to use.

The following documents are useful in both understanding the diagnostic and the SCSI board: *Sun SCSI Programmers' Manual*, W. M. Bradley *Sun SCSI Board Theory of Operation*, W. M. Bradley *Introduction to the SASI/SCSI Interface and the Adaptec Controller*, 5/23/83, Bill Stanley, Adaptec Inc. *Adaptec ACB 4000 and 5000 Series Disk Controllers OEM Manual*, 5/16/83, Adaptec Inc. *Controller/System Interface Specification*, 8/7/82 Adaptec Inc. *At this time the above specifications have not yet had assigned part numbers.*

The SCSI diagnostic is a boot only diagnostic. It is designed to specifically test the Sun 2 multibus or VME SCSI board. It is menu driven to provide a friendly user interface environment.

The SCSI diagnostic tests the following: Interface control register. DMA counter register. DMA address register. Device initial selection sequence. Device ready. DMA transfer. Interrupt vector. Data integrity. Timer. SCC (serial ports). It also provides a complete set of tools for debugging the board.

The following hardware is required for testing the SCSI multibus boards: A test station containing:

- \* a card-cage (PN: 340-0332),
- \* a power supply (PN: 300-0135-03),
- \* a Sun 2 processor board (PN: 501-1007-01),
- \* one megabyte of memory (PN: 501-1013-01),
- \* a means of booting the SCSI diagnostic, and
- \* a monitor. The monitor may either be a "dumb terminal" or a Sun monitor, video board, and keyboard. A known good disk drive. A power cable for the disk (PN: 530-xxxx-x). A known good Adaptec board (PN: 370-1010-01). A power cable for the Adaptec board (PN: 530-xxxx-x). The internal cable running from the SCSI board to the Adaptec board (PN: 530-1023-01).

Upon receiving an error indication, the test will immediately terminate and call the Error Handler routine. The Error Handler decodes the error log structure into meaningful and useful information such as the name of the test that failed, the condition under which error occurred, the expected and actual results of the operation.

Tools are provided for debugging purposes and are available only when an error condition is detected. They are menu driven for ease of use. Each test has its own tool.

The whole SCSI diagnostic will take about 2 minutes to run on a bug-free board. Upon completion, it will ask the user whether to run again and for how many passes.

Configure the workstation as described above. Immediately before loading the SCSI diagnostic, give the following PROM monitor command:

>k1

This will reset the workstations memory management unit and allow the test to do its own mapping to the serial ports on the SCSI board. enter the following PROM monitor command:

>bec(,nn)/stand/scsi.diag

where nn is the ethernet server id in hexadecimal. The diagnostic will display the following messages:

SUN xxx SCSI Board Diagnostic Rev. y.y  
Default to run on Micropolis 1340 disk.

Enter A for automatic or M for manual:

where xxx is either "Multibus" or "VME," depending on the type of workstation being used and y.y is the revision number. The diagnostic assumes that the workstation is using a Micropolis 1340 disk. "Automatic" mode means that the diagnostic will run all tests once and give results. "Manual" means that the diagnostic will ask the user to choose from the menu below.

TESTS MENU:

- 1\_ Test Interface Control Register
- 2\_ Test DMA Counter Register
- 3\_ Test DMA Address Register (VME only)
- 4\_ Test Initial Selection Sequence
- 5\_ Test Device Ready
- 6\_ Test Bus Transfer
- 7\_ Test DMA Transfer
- 8\_ Test Status Interrupt
- 9\_ Test DMA Overrun
- 10\_ Test Data integrity
- 11\_ Test Timer (VME only)
- 12\_ Test SCC (Multibus only)
- 13\_ Test all

Select One After you enter one of the selection numbers, the test will ask for the number of times to run. After the test ran the requested number of times, the diagnostic will re-display the above menu. From any menu prompt, you can stop the diagnostic by entering 'x' or 'X'. Once in manual mode, you cannot go to automatic mode (or vice versa) without restarting the diagnostic. If you chose selection 12, the SCC test will display another menu, where you can select which serial port to test, or all ports. Under automatic mode or under "Test all," the SCC test will cover all ports without giving any menu.

When any test discovers an error condition, it gives an error message and gives the user the following message:

Do you wish to use debug tools?

Enter 'Y' or 'y' to access the tools. The diagnostic will select the appropriate tools for debugging the failed part, and display a menu of options.

Every effort was made to make SCSI diagnostics easy to use. User interface is done with menus and simple prompts for the inputs required. A set of commands is available, allowing you to examine readable registers, reset the SCSI bus, display scb, alter cdb, ...etc. If you entered a string starting with a character, the diagnostic will search a command list for that string. If the command exists, the diagnostic will execute it. Otherwise it will give a message indicating that it was an invalid command and ask the user to enter "help" or "?" for the command list. If you entered a number, it will check to see if the number is within the range of the menu. If so, it will execute the corresponding item. Otherwise it will give a message saying that the number is not in the menu.

Following sections describe all tests provided by the diagnostics:

Interface control register is tested by writing test patterns from 0x00 to 0x3F and the results are read back and compared with the expected results. It also checks for time out on read and write accesses to ICR. This test covers the read/write part of the interface control register, the data path to ICR, and verifies that read and write accesses do not cause time out. When an error is detected, an error message will be displayed indicating the condition under which the error occurred, the expected and actual results. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

DMA counter register is tested by writing test pattern from 0x0000 to 0xFFFF and the results are read back and compared with the expected results. This test verifies that the counter register can be accessed. However it does not test for counter operations. This is done on test DMA transfers. Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

If system is a SUN2 multibus, this test will be skipped and testing of DMA address register is then done on test DMA transfers. DMA address register is tested by writing test pattern from 0x0000 to 0xFFFFFFFF and the results are read back and compared with the expected results. This test verifies that the address register can be access. However it does not test for counter operations. This is done on test DMA transfer. Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools. And the test menu is displayed again.

Initial selection sequence is tested by setting select bit of interface control register and expecting the controller response with busy signal. The test verifies the paths of select and busy bits in ICR between SCSI and the controller. Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

Test device ready is done by issuing the **test unit ready** command to the controller, getting status and message back from the device. Then the test will issue the **request sense** command to the device. An evaluation on sense information is done. All bus transfers of commands, data, status, and messages are done using program I/O. This test covers the following SCSI board hardware:

- \* REQ/ACK handshaking mechanism for asynchronous transfer of command, status, and data on the SCSI bus.

- \* Control lines on ICR, such as REQ, MSG, CMD, and I/O.

- \* Command/Status register.

- \* Data register. If error is detected, error message will be displayed. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

Write and read operations on one block of data (512 bytes) to and from disk are performed using DMA transfers. After DMA transfers are completed, the status completion block is checked for any error indication. The DMA counter register is checked for correct functionality. The DMA address and data register are checked by comparing the expected data and the actual data. This test covers the DMA circuitry which includes:

- DMA address register,

- DMA counter register,

- DMA control circuitries,

- byte packaging mechanism. If error is detected, error message will be displayed. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

This test is divided into two parts: The first part writes test patterns from 0x00 to 0x0F to the interrupt vector register and the results are read back and compared with the expected results. When complete, interrupt vector is then set to 26 before going to the next part of the test. This part of the test is executed only if the SCSI board under test is a VME SCSI board. The second part verifies the occurrence of correct level of interrupt. This is done by enabling interrupts, doing a DMA transfer and expecting an interrupt to occur. This test covers the interrupt vector register (if board under test is a VME SCSI board), and the interrupt

circuitry.

Error is displayed if the expected interrupt did not occur or if interrupt was caused by BUS ERROR. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

This test writes 1k block of data into the disk, using DMA transfer. Then the data are read back and compared with the expected values. This test verifies that data transferred between disk device and main memory. Error evaluation is done base on the error code and sense informations. If error is detected, error message will be displayed. Afterward, the user will be prompted to ask if he/she wants to use debugging tools.

Version 1.8 of the SCSI diagnostic does not have this test. If your version is newer, the following discussion is valid. The SCSI timer is tested by writing a value to it and the result is read back and verified. This test verifies the correct functionality of the timer chip. Error messages are displayed upon error detection. Afterward, the user will be prompted to ask if he/she wants to use debugging tools.

This attempts to verify the correct functionality of both Zilog Z8530 SCC Serial Communications Controllers. It is divided into two parts: The first part verifies the time constant register (WR12/WR13) for both controllers. The second part tests external loop back for all for serial ports in this manner: a to b, b to a, c to d and d to c, at all possible baud rates. Then values of 0x0 through 0xFF are sent through. The value transmitted is then against the expected value. Error messages are displayed upon error detection. The user will be prompted to ask if he/she wants to use debugging tools.

**APPROVAL SECTION**

**EXTERNAL SPECIFICATION  
(User Perspective)**

**TITLE : Multi-Bus Scsi Board Diagnostic External Specification**

**AUTHOR : Hai The Ngo**

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**SCSI EXTERNAL SPECIFICATION**

**1. INTRODUCTION**

**1.1. Purpose**

*SCSI*, the diagnostic,

- (1) demonstrates correct functionality of the SCSI board,
- (2) provides troubleshooting tools as debug features, and
- (3) easy to use.

**1.2. Applicable Documents**

The following documents are useful in both understanding the diagnostic and the SCSI board:

- (1) *Sun SCSI Programmers' Manual*, W. M. Bradley
- (2) *Sun SCSI Board Theory of Operation*, W. M. Bradley
- (3) *Introduction to the SASI/SCSI Interface and the Adaptec Controller*, 5/23/83, Bill Stanley, Adaptec Inc.
- (4) *Adaptec ACB 4000 and 5000 Series Disk Controllers OEM Manual*, 5/16/83, Adaptec Inc.
- (5) *Controller/System Interface Specification*, 8/7/82 Adaptec Inc.

*At this time the above specifications have not yet had assigned part numbers.*

**2. SYSTEM OVERVIEW**

**2.1. General Description**

The SCSI diagnostic is a boot only diagnostic. It is designed to specifically test the Sun 2 multibus or VME SCSI board. It is menu driven to provide a friendly user interface environment.

**2.2. Features**

The SCSI diagnostic tests the following:

- (1) Interface control register.
- (2) DMA counter register.
- (3) DMA address register.
- (4) Device initial selection sequence.
- (5) Device ready.
- (6) DMA transfer.
- (7) Interrupt vector.
- (8) Data integrity.

- (9) Timer.
- (10) SCC (serial ports).

It also provides a complete set of tools for debugging the board.

### **2.3. Required Configuration**

The following hardware is required for testing the SCSI multibus boards:

- (1) A test station containing:
  - \* a card-cage (PN: 340-0332),
  - \* a power supply (PN: 300-0135-03),
  - \* a Sun 2 processor board (PN: 501-1007-01),
  - \* one megabyte of memory (PN: 501-1013-01),
  - \* a means of booting the SCSI diagnostic, and
  - \* a monitor.

The monitor may either be a "dumb terminal" or a Sun monitor, video board, and keyboard.

- (2) A known good disk drive.
- (3) A power cable for the disk (PN: 530-xxxx-x).
- (4) A known good Adaptec board (PN: 370-1010-01).
- (5) A power cable for the Adaptec board (PN: 530-xxxx-x).
- (6) The internal cable running from the SCSI board to the Adaptec board (PN: 530-1023-01).

### **2.4. Error Handler**

Upon receiving an error indication, the test will immediately terminate and call the Error Handler routine. The Error Handler decodes the error log structure into meaningful and useful information such as the name of the test that failed, the condition under which error occurred, the expected and actual results of the operation.

### **2.5. Tools**

Tools are provided for debugging purposes and are available only when an error condition is detected. They are menu driven for ease of use. Each test has its own tool.

### **2.6. General Performance Characteristics**

The whole SCSI diagnostic will take about 2 minutes to run on a bug-free board. Upon completion, it will ask the user whether to run again and for how many passes.

## **3. RUN PROCEDURE**

### **3.1. Pre-Loading**

Configure the workstation as described above. Immediately before loading the SCSI diagnostic, give the following PROM monitor command:

```
>k1
```

This will reset the workstations memory management unit and allow the test to do its own

mapping to the serial ports on the SCSI board.

### **3.2. Starting the Diagnostic**

enter the following PROM monitor command:

```
>bec(,nn)/stand/scsi.diag
```

where nn is the ethernet server id in hexadecimal.

The diagnostic will display the following messages:

```
SUN xxx SCSI Board Diagnostic Rev. y.y  
Default to run on Micropolis 1340 disk.
```

Enter A for automatic or M for manual:

where xxx is either "Multibus" or "VME," depending on the type of workstation being used and y.y is the revision number. The diagnostic assumes that the workstation is using a Micropolis 1340 disk.

"Automatic" mode means that the diagnostic will run all tests once and give results. "Manual" means that the diagnostic will ask the user to choose from the menu below.

#### **TESTS MENU:**

- 1\_ Test Interface Control Register
  - 2\_ Test DMA Counter Register
  - 3\_ Test DMA Address Register (VME only)
  - 4\_ Test Initial Selection Sequence
  - 5\_ Test Device Ready
  - 6\_ Test Bus Transfer
  - 7\_ Test DMA Transfer
  - 8\_ Test Status Interrupt
  - 9\_ Test DMA Overrun
  - 10\_ Test Data integrity
  - 11\_ Test Timer (VME only)
  - 12\_ Test SCC (Multibus only)
  - 13\_ Test all
- Select One

After you enter one of the selection numbers, the test will ask for the number of times to run. After the test ran the requested number of times, the diagnostic will re-display the above menu. From any menu prompt, you can stop the diagnostic by entering 'x' or 'X'.

Once in manual mode, you cannot go to automatic mode (or vice versa) without restarting the diagnostic.

If you chose selection 12, the SCC test will display another menu, where you can select which serial port to test, or all ports. Under automatic mode or under "Test all," the SCC test will cover all ports without giving any menu.

### **4. SCSI DIAGNOSTIC TOOLS**

When any test discovers an error condition, it gives an error message and gives the user the following message:

```
Do you wish to use debug tools?
```

Enter 'Y' or 'y' to access the tools. The diagnostic will select the appropriate tools for debugging the failed part, and display a menu of options.

## **5. SCSI DIAGNOSTIC SPECIFICATION**

### **5.1. USER INTERFACE**

Every effort was made to make SCSI diagnostics easy to use. User interface is done with menus and simple prompts for the inputs required. A set of commands is available, allowing you to examine readable registers, reset the SCSI bus, display scb, alter cdb, ...etc.

If you entered a string starting with a character, the diagnostic will search a command list for that string. If the command exists, the diagnostic will execute it. Otherwise it will give a message indicating that it was an invalid command and ask the user to enter "help" or "?" for the command list.

If you entered a number, it will check to see if the number is within the range of the menu. If so, it will execute the corresponding item. Otherwise it will give a message saying that the number is not in the menu.

### **5.2. TEST DESCRIPTIONS**

Following sections describe all tests provided by the diagnostics:

#### **5.2.1. Test Interface Control Register**

Interface control register is tested by writing test patterns from 0x00 to 0x3F and the results are read back and compared with the expected results. It also checks for time out on read and write accesses to ICR.

This test covers the read/write part of the interface control register, the data path to ICR, and verifies that read and write accesses do not cause time out.

When an error is detected, an error message will be displayed indicating the condition under which the error occurred, the expected and actual results. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### **5.2.2. Test DMA Counter Register**

DMA counter register is tested by writing test pattern from 0x0000 to 0xFFFF and the results are read back and compared with the expected results.

This test verifies that the counter register can be accessed. However it does not test for counter operations. This is done on test DMA transfers.

Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### **5.2.3. Test DMA Address Register (VME only)**

If system is a SUN2 multibus, this test will be skipped and testing of DMA address register is then done on test DMA transfers.

DMA address register is tested by writing test pattern from 0x0000 to 0FFFFFFF and the results are read back and compared with the expected results.

This test verifies that the address register can be access. However it does not test for counter operations. This is done on test DMA transfer.

Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools. And the test menu is displayed

again.

#### 5.2.4. Test Initial Selection Sequence

Initial selection sequence is tested by setting select bit of interface control register and expecting the controller response with busy signal.

The test verifies the paths of select and busy bits in ICR between SCSI and the controller.

Error messages are displayed upon error detection. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### 5.2.5. Test Device Ready

Test device ready is done by issuing the **test unit ready** command to the controller, getting status and message back from the device. Then the test will issue the **request sense** command to the device. An evaluation on sense information is done. All bus transfers of commands, data, status, and messages are done using program I/O.

This test covers the following SCSI board hardware:

- \* **REQ/ACK** handshaking mechanism for asynchronous transfer of command, status, and data on the SCSI bus.
- \* Control lines on ICR, such as REQ, MSG, CMD, and I/O.
- \* Command/Status register.
- \* Data register.

If error is detected, error message will be displayed. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### 5.2.6. Test DMA Transfer

**Write** and **read** operations on one block of data (512 bytes) to and from disk are performed using DMA transfers. After DMA transfers are completed, the status completion block is checked for any error indication. The DMA counter register is checked for correct functionality. The DMA address and data register are checked by comparing the expected data and the actual data.

This test covers the DMA circuitry which includes:

DMA address register,  
DMA counter register,  
DMA control circuitries,  
byte packaging mechanism.

If error is detected, error message will be displayed. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### 5.2.7. Test Interrupt Vector

This test is divided into two parts:

The first part writes test patterns from 0x00 to 0x0F to the interrupt vector register and the results are read back and compared with the expected results. When complete, interrupt vector is then set to 26 before going to the next part of the test. This part of the test is executed only if the SCSI board under test is a VME SCSI board.

The second part verifies the occurrence of correct level of interrupt. This is done by enabling interrupts, doing a DMA transfer and expecting an interrupt to occur.

This test covers the interrupt vector register (if board under test is a VME SCSI board), and the interrupt circuitry.

Error is displayed if the expected interrupt did not occur or if interrupt was caused by BUS ERROR. At this point, the user will be prompted to ask if he/she wants to use debugging tools.

#### **5.2.8. Test Data Integrity**

This test writes 1k block of data into the disk, using DMA transfer. Then the data are read back and compared with the expected values.

This test verifies that data transferred between disk device and main memory.

Error evaluation is done base on the error code and sense informations. If error is detected, error message will be displayed. Afterward, the user will be prompted to ask if he/she wants to use debugging tools.

#### **5.2.9. Test Timer**

Version 1.8 of the SCSI diagnostic does not have this test. If your version is newer, the following discussion is valid.

The SCSI timer is tested by writing a value to it and the result is read back and verified.

This test verifies the correct functionality of the timer chip.

Error messages are displayed upon error detection. Afterward, the user will be prompted to ask if he/she wants to use debugging tools.

#### **5.2.10. Test SCC**

This attempts to verify the correct functionality of both Zilog Z8530 SCC Serial Communications Controllers.

It is divided into two parts:

The first part verifies the time constant register (WR12/WR13) for both controllers.

The second part tests external loop back for all for serial ports in this manner: a to b, b to a, c to d and d to c, at all possible baud rates. Then values of 0x0 through 0xFF are sent through. The value transmitted is then against the expected value.

Error messages are displayed upon error detection. The user will be prompted to ask if he/she wants to use debugging tools.