

TITLE : SUN\_2 COLOR BOARD DIAGNOSTIC USER'S MANUAL

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## 1. INTRODUCTION

### 1.1. Purpose

The purpose of this document is to describe the Sun\_2 Color Video board diagnostic program (*scdiag*). This diagnostic serves as the primary tool in determining the functionality of Sun\_2's Color Video Board.

### 1.2. Applicable Documents

For further information on the Sun\_2 Color Video Board hardware please refer to:

*Sun\_2 Color Video Board  
Engineering Manual  
PM: xxx-xxxx*

*Sun\_2 Color Video Board  
User's Manual  
PM: xxx-xxxx*

### 1.3. General Description

*Scdiag* is a standalone diagnostic program dedicated totally for testing the Sun\_2 Color Video Board and capable of performing diagnostics on a maximum of four boards.

This diagnostic is a bootable program only; therefore, it requires some means of booting. The diagnostic user is required to be familiar with booting diagnostics and noting messages appearing upon the screen. Sections 3 and 4 cover the detailed information of each diagnostic test.

## 2. SCDIAG USER INTERFACE

This section describes how to boot and run *scdiag*. Redirect input and output to an auxillary terminal so that the user communication is not obstructed by the video display. The prom monitor command *u a* redirects the I/O. To boot *scdiag* from disk issue the following prom monitor command:

b stand/*scdiag*

The **Cpu Prom Monitor** manual contains directions for booting from other devices.

Upon booting, *scdiag* attempts to locate all color boards configured in the system. Each board's base address is displayed, and if there are any differences between this address and switch setting then follow the procedure below:

power down system  
check jumpers  
reinsert board  
power up  
again boot *scdiag*

If there is still a problem set aside board in question for further test and component replacement.

*Scdiag* next requests whether to proceed with an automatic or manual test of the configured board(s). Respond with an **a** to select the automatic diagnostics or **m** to choose the manual/interactive mode. Refer to section 3 and 4 for descriptions of automatic and manual diagnostics.

### 3. AUTOMATIC MODE

*Scdiag* performs extensive tests on the Sun\_2 Color Board(s). The following sections include test descriptions and possible test error messages(s) that are generated during the automatic testing. The automatic diagnostic repeats until halted.

#### 3.1. Digital-to-Analog Converter Verification

After each DAC Verification test any key may be struck to continue the next test. The following tests are executed:

- Check Red ramp monotonicity
- Check Green ramp monotonicity
- Check Blue ramp monotonicity
- Check White ramp monotonicity
- Adjust -5.2 precision voltage to remove DAC glitches
- Verify that DAC output is a stable gray pattern
- Verify that all screen borders are visible

#### 3.2. Test On-board Registers

The registers below are tested:

- Status register
- Per\_plane mask register
- Word pan register
- Line Offset and zoom register
- Pixel Pan register
- Variable Zoom Register

An error occurring during this test appears as follows:

**Device #d @ x Wrote valu1 Read valu2**

d - specifies the board address causing the error, x is the register address, valu1 and valu2 are the hex values written and read respectively.

#### 3.3. Test Interrupts

Interrupts are disabled and all possible values are written to and read from the status register. An error occurring during this test appears as follows:

**Device #d Retrace bit in Status Register never toggles.**  
**Device #d No Interrupt when expected.**

d - specifies the board address causing the error.

#### 3.4. Test Color Map

First a checker board pattern is written to video memory. The following ten different color maps are loaded and verified automatically:

- Test 1: red = 0xAA, grn = 0x55, blu = 0xCC
- Test 2: red = 0x00, grn = 0xFF, blu = 0xC3
- Test 3: red = 0xC3, grn = 0x28, blu = 0xB7
- Test 4: red ramp
- Test 5: grn ramp
- Test 6: blu ramp
- Test 7: monochrome ramp
- Test 8: color map loaded with checker board pattern set 1
- Test 9: color map loaded with checker board pattern set 2

An error occurring during this test appears as follow:

**Entry #n BLU Read #value compare w/ #n1 XOR #n2**

Entry #n RED Read #value compare w/ #n1 XOR #n2  
 Entry #n GRN Read #value compare w/ #n1 XOR #n2

value - is data read, n1 is data written and n2 is XOR of value and n1.

### 3.5. Frame Buffer Tests Word mode and Pixel mode

The Frame Buffer diagnostic include:

- Test 1-6 : A constant data test is performed six times, and the data used are 0x0000000, 0FFFFFF00, 0xFFFFFFFF, 0X00AACCC33, 0X00FF3355 and 0xAA33CCFF.
- Test 7 : The address test fills each long integer with its address, then reads and compares with the data written.
- Test 8 : Check the frame buffer with the random data test.
- Test 9-A : Checker tests find the stuck\_at\_0 and stuck\_at\_1 via filling the memory with a checker board patterns of increasing size.

If an error occurs the following message will be displayed:

Device #d Test #n

- n is the number of errors occurred.

### 3.6. Digital-to-Analog Converter Tests

- Display Red
- Display Green
- Display Blue
- Display White
- Display rbgw-hramp
- Stability
- Verify that DAC output is a stable gray pattern.
- Verify that all screen border is visible.
- Display outline of frame buffer
- Display RGB simultaneously

### 3.7. Zoom and Pan Tests

First a checker board pattern is displayed then, for each zoom factor the origin pans down and up, to lower-right and back, to right and left to original starting point. Next a check is done for the n lower lines zoom disable function.

### 3.8. ROPC Tests

The ROPC tests include;

- Register tests : Dst, Src1, Src2, Pattern, Mask1, Mask2, Shift, Function, Width, Op\_count and Flag.
- Random Data Tests : Src1, Src2, Dst, Pattern, Function.
- Implicit word mode Tests : For each bit plane:
  - Test Dst Mode 0,2,4,6
  - Test Src Mode 0,2,4,6
- Mask Test : Test opcount and Mask1 and Mask2
- Pixel mode test : Dst Mode 1, Src mode 1 (Note, modes 3,5 and 7 are not tested.)

### 3.9. Per-plane Mask and Per\_plane loading of ROPC tests

Test mask register for all bit combinations in pixel mode. For each mask combination an alternating zero and one pattern is written to each bit plane.

#### 4. MANUAL/INTERACTIVE MODE

This diagnostic includes all the functions of the Automatic tests. In addition, the following features are provided: add a device to device list, select a device for manual operation and write continuously to board. The manual tests are listed in section 4.1.

##### 4.1.1. Add a Device to Device List

This menu adds a device to the device list, and requests for monitor type (1152x900) or (1024x1024) and device address. Up to four devices can be added to the device list. Device selection is explained in the following section.

##### 4.1.2. Select a Device for Manual Test

If multiple Color Boards are included in the device list, then an individual Color Board must be selected for diagnostic testing. Also if the device address of the board is different than the one *scdiag* found, the device address should be entered.

##### 4.1.3. Access Board Continuously

Test continuously Word\_Pan register by writing and reading 0x00AAAAAA. This is a minimum test of Color Board's VME bus interface. The VME bus interface can also be tested by the Control Register Tests.

##### 4.1.4. Test Control Registers

The following registers are tested via read once, read continuously, write once, write continuously, write-read once, write-read continuously, write-read-compare and increment by 1, write-read and increment continuously, write-read-compare, write-read-compare and increment data by n, and write-read alternating data:

- Status Register
- Per\_plane Mask Register
- Word Pan Register
- Pixel Pan Register
- Line Offset and Zoom Register
- Variable Zoom Register
- Interrupt Vector Register

If a test fails a corresponding error message will be displayed on the monitor (i.e. the values written and read to the register are shown.)

##### 4.1.5. Interrupts Tests

The following tests check the interrupt part of VME Color Board interface. If interrupts are failing then a usefull test is "Enable, trap and Reset interrupts. Repeat forever".

- Enable interrupts on CPU
- Disable interrupts on CPU
- Enable, trap and Reset interrupts. Repeat 50 times
- Enable, trap and Reset interrupts. Repeat forever
- Set User Interrupt vector
- Set All User Interrupt vectors

##### 4.1.6. Color Map Tests

To display the image in the Sun\_2 color frame buffer memory, each 8 bit pixel is used as an index into a 256 element color lookup table. Each element of the table is 24 bits, 8 bits drive the red DAC, 8 drive the green, and 8 for the blue. The color lookup tables consist of a high speed ECL lookup table used during video display, and a TTL shadow color lookup table that can be access at any time. The TTL shadow color lookup table is



loaded into ECL lookup table during vertical blanking.

Acquire access to TTL CMAP -- enable shadow color map modifications.  
 Relinquish access to TTL cmap -- disable shadow color map modifications.  
 Load TTL to ECL cmap once -- load content of shadow color map into ECL color map.  
 Load cmap with default arrays -- load checker board pattern into color map.  
 Verify cmap with default arrays -- verify that color map has been loaded correctly with the default arrays.  
 Load cmap with solid value -- load color map with a constant value.  
 Verify cmap with solid value -- verify that color map has been loaded with the constant value.  
 Set 0-255 red, 256-511 green, 512-767 blue --  
 Test single location --  
 Auto test --  
 Continuous auto test --  
 Load cmap with ramp -- loads shadow color map with monochrome ramp  
 Verify cmap with ramp -- verify that shadow color map is loaded with a monochrome map.

NOTE: to activate the shadow map it must be loaded into ECL map (i.e. third menu choice).

**4.1.7. Frame Buffer Tests** The Frame Buffer Memory Tests allow reading/writing to/from frame buffer memory. These tests are useful for checking word or pixel mode addressing and frame buffer data or address line stuck\_at conditions. The frame buffer tests are self explanatory.

Write checkerboard -- write a series of rectangular regions with different gray level values.  
 Write a vertical line -- a vertical line with a given gray value is written into frame buffer.  
 Write a Horizontal Line -- a horizontal line with a given gray value is written into frame buffer.  
 Verify a Vertical line -- read and compare vertical line previously written.  
 Verify a Horizontal Line -- read and compare horizontal line previously written  
 Fill a Region with constant -- fill a frame buffer rectangle with a gray value.  
 Print all Vertical Lines -- lists all pixel values for all vertical lines.  
 Print all Horizontal Lines -- lists all pixel values for all horizontal lines.  
 Test Single Location -- read or write from a word location.  
 Auto test  
 Continuous Auto Test  
 Fill Frame Buffer in Word-Mode -- fill planes 0-7 with constant data.  
 Fill one Ram -- ram is specified by entering plane and column, pattern choices are all zeros, all ones alternating zeros and ones.  
 Write Horizontal line in Word Mode -- write a constant horizontal line in a given plane and row.  
 Write even vertical lines in frame buffer -- test even byte frame buffer addressing.  
 Write odd vertical lines in frame buffer -- test odd byte frame buffer addressing.  
 Access word-mode location 0. Trap Bus error -- used for checking basic VME bus interface to frame buffer.  
 Pound alternating word location with data -- read, write or read/write words to the two chosen word addresses.

Scan word mode memory for a value -- searches planes 0-8 for a given bit pattern.

Fill frame buffer with addresses -- writes to each frame buffer word address the 16 least significant bits of its

Verify frame buffer with addresses -- verifies that data from previous test was written correctly.

**4.1.8. ROPC Tests** There is a ROPC for each bit plane in the frame buffer. Since the data paths connecting and coordinating there per\_plane RasterOp units are somewhat complex refer to Sun-2 Color Board Engineering manual for detailed information.

Select ROPC (Default = 0) -- used for ROPC (bit plane) selection.

Register Tests -- The following registers are tested via read once, read continuously, write once, write continuously, write-read once, write-read continuously, write-read-compare and increment by 1, write-read and increment continuously, write-read-compare, write-read-compare and increment data by n, and write-read alternating data:

Destination Register  
 Source 1 Register  
 Source 2 Register  
 Pattern Register  
 Mask1 Register  
 Mask2 Register  
 Shift Value Register  
 Function Register  
 Width Register  
 Op Count Register  
 Function Output Register  
 Manual Load Destination Register  
 Manual Load Souce Register  
 Flag Register

Auto Register Tests -- This test automatically writes and reads bit patterns to each of the following registers.

Destination Register  
 Source 1 Register  
 Source 2 Register  
 Pattern Register  
 Mask1 Register  
 Mask2 Register  
 Shift Value Register  
 Function Register  
 Width Register  
 Op Count Register  
 Function Output Register  
 Flag Register

Auto Function unit test -- Writes/reads/compares random patterns to/from source1, source2, destination, pattern, and function registers.

Auto Destination Register Tests -- for a chosen addressing mode (0-9) the destination register is tested.

Auto Source Register Tests -- for a chosen addressing mode (0-9) the source register is tested.

**Auto Mask Tests -- Test proper decrement and reload of Opcounter .**  
 At each step read diagnostic function output and write to frame buffer. Verify that right and left makes are enabled at the proper time.

**Continuous Auto Tests --**

**Continuous Auto Function Unit Tests --**

**Test Per\_Plane Mask Register -- Loads the plane mask register with all possible values (0-255) in both pixel and word modes.**

#### **4.1.9. Zoom and Pan Tests**

The use of hardware zoom and pan does not change the addressing of the color frame buffer; it alters the region of the frame buffer that is actually displayed. Thus a frame buffer memory scan line is not necessarily equivalent to a displayed scan line. The Sun-2 Color Board supports pixel pan and zoom in integer magnification of zero to 8.

**Alter Zoom -- change the magnification factor.**

**Alter Origin (Absolute) -- set frame buffer coordinates for center of region to be displayed while zooming.**

**Alter Origin (Relative) -- add a relative offset to the current origin.**

**Set No Zoom Line Number -- set line number below which zoom is disabled.**

**Excercise Pan -- this test automatically moves the zoom origin around the frame buffer.**

**Auto Test -- draw a checker board pattern first and then repeats exercise pan test for zoom factors 0 to 7.**

**Toggle Origin -- toggles between two zoom origins forever.**

#### **4.1.10. DAC and Monitor Tests**

The following tests load various ramps and patterns to the frame buffer, and thus are usefull for debugging the video DAC and monitor.

Write a Horizontal Red Ramp

Write a Horizontal Green Ramp

Write a Horizontal Blue Ramp

Write a Horizontal White Ram

Write a vertical Red Ramp

Write a Vertical Green Ramp

Write a Vertical Blue Ramp

Write a Veritcal White Ram

Write Simultaneous RGBW horizontal Ramps

Write Screen Borders x=(0:1152) y=(0:899)

Write alternating bars of color to test DAC glitches

Continuous Auto Tests

Test Screen Stability

#### **4.1.11. Brief monitor Tests**

Brief monitor Tests are mainly visual diagnostics and help identify the screen purity, convergence, ringing and bleeding monitor problems. Once in the menu use <cr> to continue to next test.

#### **4.1.12. Perform Auto Test**

refer to section 3.1