# **Diagnostics**

Before working on ESI, we suggest you first perform a functional test on the unit. Many times a complete functional test reveals important clues to the problem that may have otherwise been overlooked. Try to isolate the problem as much as possible through the operational controls, then go in with your instruments to nail it down. A high quality amplifier and speaker system is also necessary to pick out subtle problems that would otherwise be missed.

Although the microprocessor and output sections should not give you much trouble, certain sections of ESI can be more difficult to troubleshoot. If you have isolated the problem to a surface mount chip, a board swap may be in order. Simply call the E-mu Customer Service department to arrange for a board swap.

## BOOTPROM Diagnostics

The bootprom diagnostic tests automatically occur each time you power up the ESI. On power-up, all front panel LEDs are initially turned on. As each bootprom diagnostic is completed and passed, the LED goes out. With this in mind, a completely dead CPU will likely have all LEDs lit. If the LEDs don't light when power is turned on, the problem is likely hardware. If a test fails, the corresponding LED does not turn off and the ESI continues with subsequent tests and attempts to boot. The following table lists the LEDs, the test performed, and a brief description of the test.

LED	Test	Description
Transpose	RAM	Tests CPU RAM. No use of RAM is made until after this test is done.
Master/Global	LCD	Writes to the LCD.
Sample Management	G-Chip Register	Tests the G-Chip register. Passes if G-Chip can be written to and read.
Digital Processing	G-Chip Memory	Passes if G-Chip can be written to, read, AND if there is working memory installed.
Multi Mode	H-Chip	Passes if H-Chip can be written to and read.
Preset Management	Timer	Passes if the Timer can be written to or read.
Preset Definition	UART	Passes if the UART can be written to or read.
Dynamic Processing	Floppy Drive	Passes if the floppy control- ler seeks to track 00.
Trigger Mode	SCSI	Passes if the SCSI device can be written to or read.

# Special Diagnostics

ESI contains a number of on-board diagnostic tests. These can be accessed or read from the front panel without even opening the unit! This section provides a description of these diagnostic tests. For step-by-step instructions on how to do these tests, refer to the next section, "ESI Functional Test Procedures."

ESI's on-board diagnostic tests are divided into submodules. The following table provides a brief description of each.

#	Test Name	Description
	Panel/Kybd Test	Tests the LCD pixels, and button LEDs.
1	Ram Test	Tests CPU RAM (cRAM) and Sound RAM (gRAM).
2	Serial Test	Tests the MIDI /serial ports.
	Jack Detection Test	Tests the submix output jack.
	Effects Ram Test	If the Turbo option is intalled, tests the Effects RAM.
5	EEprom Tests 0) Verify EEprom	Writes to, then reads from the EEPROM, then initializes it.
	1) Initialize EEprom	Initializes the EEProm with the factory defaults.
6	Init Digital I/O	Resets S/PDIF and Turbo cards (if installed).
7	Sinewave Test	Emits a 1 kHz or 19 kHz sine wave to check outputs for distortion or noise.
8	AutoTest	Cyclically tests CPU RAM, G-chip cound RAM and the SCSI disk (if installed).
		WARNING: Designed for in-house burn-in, this test destroys any and all data on the hard disk
9	Disk Diagnostics 0) Disk Utilities 0) Create Checksum 1) Verify Checksum 1) HD Select Drive 2) HD Read Only 3) HD Read/Reassign 4) HD Write/Rd/Reass. 5) HD Error Correct 6) HD Result 7) HD Media Defects 8) Floppy Read Only 9) Floppy Write/Ver	Performs various tests and utilities on the hard or floppy disk.

#### 0. Panel/Kybd Test

The Panel/Kybd test first tests all the pixels on the LCD. The pixels are flashed three times. Make sure there are now lines or bad pixels. Then press each of the buttons on the front panel to display the corresponding operation or button name in the display. Finally, check the Data Entry Control (encoder knob). Turn the knob to display the values from 0 to 36 (one full turn). Press the Enter button twice to exit the test.

#### 1. Ram Test

The RAM test checks and verifies the CPU RAM and the SoundRAM. This diagnostic performs three different tests.

**CPU RAM.** The CPU RAM test displays the amount o CPU RAM installed (512K, 1MB), and does a pattern Write/Read comb of the installed RAM. Any errors are displayed in line 3 of the LCD. The test continues to cycle through the CPU RAM until you initiate the next test. Let this test go through at least 10 cycles before going on to the next one. Press the Enter button to advance to the gRAM tests.

**Sound Ram Fixed Test.** The Fixed Sound RAM test (gRAM) displays the amount of Sound RAM installed in the unit and does a pattern Write/Read comb of the RAM. This test cycles with a different pattern each time. Let this test cycle through at least 4 passes. Press the Enter button to advance to the next test.

Sound Ram Random Test. This is a very thorough test designed to find errors between adjacent memory cells. The display shows the amount of SoundRAM installed, then the test does a random pattern Write/Read comb of the entire installed RAM. On each successive cycle, a different random pattern seed number is used. Each test cycle takes approximately ten to 15 minutes to complete. Once finished, the LCD displays the number of errors, and tells you it's done. Press the Enter button to return to the Diagnostics menu screen.

#### So Find a Bad Memory SIMM:

**Caution:** If diagnosing an ESI 4000 and using a single RAM SIMM for sound memory, the SIMM must be located in slot B. The unit will fail the sound RAM memory check if one SIMM is used in RAM slot A.

Since there are only two memory SIMMs in the ESI, you can easily test for a bad SIMM by removing one of the SIMMs and replacing it with a known good SIMM, then run a memory test. If the test passes, remove that SIMM and replace the one you took out first. Repeat the memory test. Verify the SIMM is bad by repeating the memory test.

#### 2. Serial Test

This test writes and reads an AA and then a 55 to the MIDI port. The test waits a reasonable length of time for each response. If there is no response, it records a failure. In order for the test to work, MIDI Out must be connected to MIDI In.

#### 3. Jack DetectionTest

The Jack Detection test checks the submix output jack detection circuitry. When a phone plug is inserted into each submix jack, the display shows a "Y" next to the jack name. If the jack is not detected, the screen displays an "n" next to the jack name. Press ENTER to stop the test and return to the Diagnostics screen.

#### 4. Effects Ram Test

The Effects RAM test writes, then reads from all Effects RAM locations.

#### 5. EEprom Tests

There are two options in the EEprom Test menu; Verify EEprom and Initialize EEprom.

The first diagnostic, Verify EEprom, writes, then reads from the EEPROM. Once the write/read operation is completed, the test initializes and verifies the EEPROM. Press ENTER when complete to exit the test.

The second diagnostic, Initialize EEprom, initializes the EEPROM with the factory default settings.

#### 6. Init Digital I/O

This test resets the S/PDIF card or Turbo card if installed. The CPU does not get a response from this test.

#### 7. Sinewave Test

The Sine wave test emits a 1 kHz or 19 kHz sine wave. Use this sine wave to check the outputs. Be careful when listening to untested equipment and take precautions to prevent ear damage.

#### 8. AutoTest

This test was designed for E-mu in-house burn-in. Auto Test cycles continuously between testing CPU RAM, G-chip sound RAM and the SCSI disk (if installed). The floppy disk is not checked.

#### 9 Disk Diagnostics

The Disk Diagnostics menu provides several tests and utilities related to the hard disk and floppy disk in the unit. There are ten different disk diagnostic submodules as described below.

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WARNING: The Sinewave Test destroys sample memory.

WARNING: THIS TEST DESTROYS ALL DATA ON THE HARD DISK!!! **0.** Disk Utilities. The disk utilities submodule contains two utilities. One creates the checksum, the other verifies it.

**0.** Create Checksum - A checksum is calculated by using all the data and passing it through an algorithm to generate a value (the checksum) which is saved.

1. Verify Checksum - The checksum is recalculated and compared to the saved value.

1. HD Select Drive. Selects any currently mounted drive.

**2. HD Read Only.** Non-destructive. Exercises (reads) the entire HD media for data read errors. Run continuously. Press and hold ENTER to quit. Exiting the drive in this manner sets the drive error correction to "ON."

**3. HD Read/Reassign.** Potentially destructive. Same as Read Only, but first turns error correction off and re-assigns bad blocks using the drive block assignment.

**4.** HD Write/Rd/Reass. This diagnostic destroys all data! Exercises the entire hard disk media by writing a test pattern, reading it back, and comparing the two. The drive must be reformatted after this test with the ESI format disk utility.

5. HD Error Correct. Allows investigation and change of the drive error correction state. Should be set to ON after the diagnostics are completed.

6. HD Result. SCSI Sense Key and Sense Code, Sector Number and status of last hard disk operation.

7. HD Media Defects. Displays the hard disk's defect list in hex.

**8. Floppy Read Only.** This test continuously reads the entire floppy surface and verifies to a known test pattern. You must use a disk written to previously by the Floppy Write/Verify test. All soft errors are logged according to sector number, byte number and data compared. This test is useful for read exercising and checking drive to drive compatibility (alignment, etc.).

**9. Floppy Write/Verify.** Runs continuously. This test writes a test pattern and reads it back, comparing the data. Errors are logged. The test pattern is an ascending pattern (such as 104, 105, 106...and so on). The first byte in the sector is the sector number mod 256. Each sector has 512 data bytes. There are 10 sectors x 80 tracks x 2 sides = 1600 sectors per track.

ESI Functional Test Procedure	This is part of the functional test which leaves the factory. Use this test to verify test to verify that the unit is working pe customer. CAUTION: PLEASE USE PROPER PROT PRECAUTIONS WHEN LISTENING TO DON'T FOLLOW THE CORRECT PROC DAMAGE YOUR EARS.	is performed on every ESI before it y that a problem exists or as a final erfectly before returning it to the ECTION AND PROPER UNTESTED EQUIPMENT. IF YOU EDURE YOU COULD POSSIBLY
Equipment	<ul> <li>Oscilloscope, 10 MHz or greater with preferred.</li> <li>Compressor/headphone amp</li> <li>Headphones</li> <li>External hard drive</li> <li>1/4 inch phone shorting plug (male)</li> <li>MIDI thru led tester</li> <li>MIDI cable</li> <li>Signal generator or microphone</li> </ul>	h automatic triggering. DSO
Quick Test	<ul> <li>Boot up test</li> <li>Attach AC power cable and power of</li> <li>Check that the softwatre version is Chart. The LCD should also indicate memory and configuration.</li> <li>After boot up is completed, the foll</li> <li>LED ON</li> <li>Transpose LED</li> <li>Master/Global LED &amp; LCD not normal.</li> <li>Sample Management LED</li> <li>Digital Signal Processing LED</li> <li>Multi Moe LED</li> <li>Preset Management LED</li> <li>Preset Definition LED</li> <li>Dynamic LED</li> <li>Trigger Mode LED</li> <li>If any of the above LED's remain on or memory size there is a problem with the</li> </ul>	DD. the most current. See Software te the correct amount of sound owing LED's should NOT be on: INDICATES CPU RAM bad LCD problem G-chip register problem G-chip register problem G-chip memory bad H-chip bad Timer bad UART bad Floppy drive/controller problem SCSI device problem the LCD indicates the wrong e computer or one of its peripherals.

Accessing the On-Many of the Functional Test Procedures are accessed through the Special Diagnostics Submodule. **Board Diagnostics** IF To access the on-board Diagnostic menu 1. Press the Master/Global module button. 2. Select Special (8) from the Master/Global menu. 3. Press 0 (zero) on the numeric keypad to access the Diagnostic menu. DIAGNOSTICS Enter MagicCode: 4. Enter the Magic Code. The diagnostics code is "1358" (the notes in a major chord). DIAGNOSTICS Select a Submodule If you see the above displayed screen, you have successfully accessed the on-board diagnostics. Following are descriptions and instructions for the different diagnostics tests you can do from here. Panel Tests 1. Enter Diagnostics submenu as described earlier. 2. Press 0 for Panel/Kybd Test. The LCD should flash all pixels three times. Look for lines or missing pixels. Once this test completes, the following screen displays. PANEL TEST ENTER twice to exit

Press the Enter button twice to exit the test and return to the diagnostics screen.

- 3. Test each of the buttons on the interface. Each time you press a button on the front panel, the LCD displays the name of the button pressed and the number of times each button is pressed. All buttons toggle their corresponding LED.
- 4. Turn the Data Entry Control (encoder dial), change the value to 0, move to 36 & from 36 back to 0. Check for any skips or jumps.
- 5. Check to be sure the LCD backlight is on.
- 6. Press ENTER to verify LED works. Press ENTER again to exit the test and return to the Diagnostics submenu.

Auto Tests

The AutoTest procedure checks the memory line then cycles through testing and verifying the CPU RAM (cRAM), Sound RAM (gRAM) and the disk media (hard disk, floppy).

- 1. Access the Diagnostics submodule as described earlier.
- 2. Press 8, to select AutoTest. Confirm the procedure by pressing the Inc/ Yes button. The tests begin.

A "Memory line test OK" flashes on the screen and then the CPU RAM test starts. After the CPU RAM test, the Sound RAM test begins. The test cycles through all of the gRAM installed, then verifies the RAM for errors and checks the drives.

Errors found are displayed on the screen. If no errors are found, the following displays:

Autotest	PASSED

NOTE: If the unit shows one or two floppy hard errors, the disk could be corrupted. Insert another disk and repeat the Automated Test.

### SCSI Test

- Attach MIDI loop & thru cables, SCSI cable & scope cables to main L & R.
- 2. Turn unit on.
- **3.** Press Drive Select, Inc/Yes. LCD should indicate that the external HD is connected.

Calibration	<ol> <li>Press the Master/Global button. Select 8, Special, then select 1, Recalibrate.</li> <li>Turn volume pot fully counter clockwise, then press ENTER.</li> <li>Turn volume pot fully clockwise, then press ENTER.</li> </ol>	
	4. Test volume pot calibration 0-255 and press ENTER.	
	<ol> <li>Press the Inc/Yes to save the calibration and return to the Special submenu.</li> </ol>	
Contrast Adjust	<ol> <li>Press the Master/Global button. Select 8, Special, then select</li> <li>2, Contrast.</li> </ol>	
	<ol> <li>Turn encoder through range of adjustment. (+7 to -8). The LCD contrast should change gradually between settings. Large or no change between settings could indicate missing resistors.</li> </ol>	
	3. Set the viewing angle to (+3) and press ENTER.	
MIDI Test	1. Enter Diagnostics submenu.	
	2. Press 2, to access the Serial Test (check that the MIDI LED located on the bottom, right corner of the front panel Verify MIDI tester led flashes	
	after pressing 2, ENTER. Display will read:	
	SEBIBL TESTS	
	MIDI test: Passed	
	Done, Press Enter	
	3. Remove MIDI cables.	
	4. Press ENTER to exit test.	

Jack Detect	<ol> <li>Access the Diagnostics submodule as described earlier.</li> <li>Press 3, ENTER.</li> </ol>	
	SUBMIX JACK DETECT SUB 1 Y SUB2 (not installed) SUB3 (not installed)	
	The <b>right</b> SUB1 plug is inserted.	
	<ol> <li>Plug shorting plug into each Sub out and note change on LCD.</li> <li>Verify: Y= inserted, N= not inserted, on all sub outputs.</li> <li>Press ENTER.</li> </ol>	
Effects Test	Note: Turbo board must be installed.	
	<ol> <li>Access the Diagnostics submodule as described earlier.</li> <li>Press 4. After test, screen should indicate, "MEMORY OK".</li> <li>Press ENTER.</li> </ol>	
	EFFECTS RAM TEST Testing Memory OK. Test Done	
S/PDIF Test	S/PDIF Out on the ESI mirrors the main outputs. S/PDIF In takes the place of the analog sample inputs.	
Note: S/PDIF or Turbo	IF To test S/PDIF In:	
Cura mast de Histaniea.	<ol> <li>Instanced.</li> <li>Connect a S/PDIF source such a CD or DAT player to S/PDIF In.</li> <li>Press Sample Management, 5. Sample Setup.</li> <li>Press Right Cursor.</li> </ol>	
	<ul><li>4. Set Source to S/PDIF, matching the sample rate of the source.</li><li>5. Make sure the source unit is sending S/PDIF and press 8 on ESI to begin</li></ul>	
	<ul><li>sampling.</li><li>6. Listen carefully to the sample or measure using test equipment.</li></ul>	
	i Copyright © 1998, E-mu Systems, Inc. 43	

#### IS To test S/PDIF Out:

- 1. Connect S/PDIF out to a S/PDIF device such as a DAT recorder.
- 2. Enable recording or monitor through on the external S/PDIF device.
- 3. Load a bank of sounds on ESI and play the unit using a MIDI keyboard or the Audition button.
- 4. Listen carefully to the destination device, listening for pops, hiss or distortion.

### **Output Test**

- The Sine wave test emits a 1 kHz or 19 kHz sine wave allowing you to check the outputs. Be careful when listening to untested equipment and take precautions to prevent ear damage.
  - 1. Connect the scope to audio outputs.
  - 2. Access the Diagnostics submodule as described earlier.
  - 3. Press 7 to access the Sinewave test.

NOTE: LISTEN CAREFULLY TO ALL OUTPUTS FOR POPS, HISS OR DISTORTION.



4. Press the INC/YES button to continue. The following screen appears:



- 5. Press, NO = 19 kHz signal. Observe levels on scope. Press, YES = 1 kHz. signal. Observe levels on scope. A sine wave should be present at main & all sub outputs. All output levels should look and sound consistent. Signals should be in the proper operating range.
- 6. Press ENTER to exit the test.

**Output Frequency** Main outs L & R: 1 kHz 2.6 V P-P (2.5 - 2.8) Voltage Peak to Peak 19 kHz 3.9 V P-P (3.7 - 4.1) Sub outs L & R: 1 kHz 2.6 V P-P (2.5 - 2.8) 19 kHz 3.9 V P-P (3.7 - 4.1) 1. Connect the Y cable to scope, Y cable to headphone jack on unit, test Headphone outputs. Headphones 1 kHz 2.6 V P-P (2.5 - 2.8) • Headphones 19 kHz 3.9 V P-P (3.7 - 4.1) 2. Press ENTER, to exit test. 3. Unplug Y-cable, attach scope cables to mains L & R. 4. Partially insert one Attenuator cable into sub outs L & R until first detent is felt. (Look for indication on scope, verify output changes from left to right). Sample Test 1. Connect signal Source to Sample Inputs. 2. Adjust the ADC gain to +00 dB. 3. Press the Right Cursor and set Length to 4 seconds using the encoder. 4. Verify that the Source is set to 44100. 5. Press 8 to take a sample. 6. Hold down Audition button to LISTEN and observe output. (Rotate volume knob if it's not working). Listen for 4 sec. Listen carefully for pops, hiss or distortion. 7. Press 5, Right Cursor, and move cursor UP, set the source to 22050. using the encoder. 8. Press ENTER. 9. Press 8 to take a sample. 10. Hold down audition button to LISTEN and observe sine wave output. Listen for 4 sec. **Finnish Testing** 0. Take a cold shower after your sauna. 1. Turn power off. 2. Remove option test card if installed. 3. Disconnect all test cables. 4. Install cover with (7) screws (HS386 for ESI-32s with older board, HS474 with ESI-32s with the ESI-33 board and ESI 4000s).

5. Clean if needed.

Final Test Inspection	<ol> <li>Inspect rear panel for:         <ul> <li>6 nuts on jacks</li> <li>2 screws on MIDI jacks</li> <li>4 screws on plates</li> <li>1 power supply screw</li> </ul> </li> <li>Inspect sides for:         <ul> <li>4 bezel screws in and tight</li> <li>2 power switch screws</li> </ul> </li> <li>Inspect inside for:         <ul> <li>Check ALL cables for offset or not fully inserted.</li> <li>8 screws on front panel board</li> <li>2 screws on encoder board</li> <li>1 screw on headphone jack</li> <li>6 screws on main board</li> <li>SIMMs inserted correctly</li> </ul> </li> <li>Inspect bottom for:         <ul> <li>4 Floppy drive screws tightened</li> <li>4 feet fully inserted</li> </ul> </li> </ol>	
	<ul> <li>I screw on headphone jack</li> <li>6 screws on main board</li> <li>SIMMs inserted correctly</li> <li>4. Inspect bottom for: <ul> <li>4 Floppy drive screws tightened</li> <li>4 feet fully inserted</li> <li>Bezel clips fully seated into chassis?</li> </ul> </li> </ul>	
Calibrations	This section describes how to calibrate the volume knob.	
Calibrating the Volume Control	<ol> <li>Press the Master/Global key.</li> <li>Select Submodule 8, Special, then Submodule 1, Recalibrate.</li> <li>Turn the volume knob all the way down, then press ENTER.</li> <li>Turn the volume knob all the way up, then press ENTER.</li> <li>Check the calibration value, press ENTER to continue.</li> <li>Press YES to save the calibration.</li> </ol>	