ESI Service Manual – Table of Contents	
File	**Content**
ESI Service Manual Part1	Introduction ESI Overview Basic Operations Mechanical Procedures Diagnostics Theory of Operation
ESI Service Manual Part2	ESI-4000 Schematic
ESI Service Manual Part3	ESI-33 Schematic
ESI Service Manual Part4	ESI-32 Schematic
ESI Service Manual Part5	FX/SPDIF/OUTPUTS (Calamari) Option Schematic
ESI Service Manual Part6	ESI-32 Front Panel Schematic SPDIF Option Schematic
ESI Service Manual Part7	Signal Name Definitions SCSI Option Card Signals SPDIF Option Card Signals Turbo Option Card Signals ESI Parts / PCB Layouts
ESI Service Manual Part8	ESI-4000 Main PCB Assembly Drawing ESI-33 Main PCB Assembly Drawing ESI-32 Main PCB Assembly Drawing Front Panel PCB Assembly Drawing SPDIF Option Assembly Drawing FX/SPDIF/OUTS (Calamari) Option Assembly Drawing Assembly Drawing
ESI Service Manual Part9	Ordering ESI-4000 Parts
ESI Service Manual Part10	Ordering ESI-33 Parts
ESI Service Manual Part11	Ordering ESI-32 Parts

This Manual covers the ESI-4000, ESI-2000 and ESI-32 product range. Note that the ES-2000 is named ESI-33 in this manual.

Text pages were scanned using 100 dpi resolution.
Text pages containing drawings were scanned using 150 dpi resolution.
Schematic pages were scanned using 400 dpi resolution.

The printing quality of the original pages, especially the schematics pages was already poor. Using a higher scanning resolution than 400 dpi would only result in larger files but not better readability.

Page numbering is sometimes weird in the original document. For example in Part 1 there is page 15 in front and page 17 on the back of the same sheet of paper. Page 16 is non existent, like some other pages. However the original document was scanned complete. Schematic pages have no numbering. Numbering continues later in the document.

The original paper format is Letter (similar DIN A4) for text pages and most schematics, and Legal (similar DIN A3) for some schematics and assembly drawings.

The scanning was done using a Canon CanoScan 3000 model. The Legal pages were scanned in two passes. The pages were stored in jpg or gif graphics format and mounted into document parts using Open Office 3.1. The PDF documents were created using the Open Office PDF export function.

ESI DIGITAL SAMPLERS

TECHNICAL REFERENCE MANUAL

#19

E-MU SYSTEMS

ESI Digital Samplers
Technical Reference Manual

FI621 Rev. A

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Important Notice:
In order to obtain warranty service on an ESI unit, the serial number sticker on the bottom panel must be intact and the customer must have a sales receipt or other proof of purchase. If there is no serial number sticker on the ESI unit, please contact E-mu Systems at once.

Table of Contents

Introduction 1

ESI Overview 3

About the ESI 3
Audio Connections 5
Connection Diagram 7
Sample Inputs 8
MIDI Connection 8
110V / 220V Operation 8
Digital I/O (Turbo option) 8
SCSI 8
How the ESI Organizes Sounds 9
Additional Definitions 12
The Current Sample 12
Modules 12
Saving 13
Default 13
The Cursor 13
Data Entry Control & Increment/Decrement Buttons 13
The Big Re-Cap. 13

Basic Operations 15

Power Up 15
Power Switch 15
Volume Control 15
Master/Global Module Button 16
Preset Menu Selection Buttons 16
Arrow Keys/Cursor Control 16
Inc/Dec Buttons 16
Enter Button 16
Escape Button 16
Numeric Keypad 17
Data Entry Control 17
Multi Mode 17

Transpose 18
Drive Select 19
Load 19
Save 20
Audition 20
Trigger Mode 21
Cursor / Page 21
MIDI Activity LED 21
Floppy Disk Drive 21
The Basics. 22
Loading a Bank from Floppy Disks 22
Saving Data to a Floppy Disk 22
Using an External Hard Disk 23
Saving Data to a Hard Disk 24
Loading a Bank from a Hard Disk 24
Selecting Different Presets 24
Selecting Zones 25

Mechanical Procedures 27
Precautions. 27
A Word About Soldered Parts 27
Gaining Access to the ESI Interior 28
Removing the Top Panel 28
Removing the Front Panel Circuit Boards 29
Removing the Main Circuit Board 30
Installing Additional Memory 31
Memory Requirements 31
Upgrading Memory 32

Diagnostics 33
BOOTPROM Diagnostics 34
Special Diagnostics. 35
ESI Functional Test Procedure 39
Equipment 39
Quick Test 39
Accessing the On-Board Diagnostics 40
Panel Tests 40
Auto Tests 41
SCSI Test 41
Calibration 42
Contrast Adjust 42
MIDI Test 42
Jack Detect 43
Effects Test 43
S/PDIF Test 43
Output Test 44

Output Frequency Voltage Peak to Peak 45
Finnish Testing 45
Final Test Inspection 46
Calibrations 46
Calibrating the Volume Control 46
Specifications 47
Power Supply Specifications 48
ESI Software History 49
Version 1.4 49
Version 2.0 49
Version 2.1 49
Version 2.12 50
Version 3.00 50
Surface Mount Transistors 51
Troubleshooting Guide 52
Other Troubleshooting Tips 54

Theory of Operation 55
ESI Circuit Boards 56
Circuit Descriptions 56
Circuit Board Flow Diagrams 63

Schematics 67
Signal Name Definitions 119
ESI-32 Connectors 119
ESI-33, ESI-4000 Connectors 119
Signals 120
SCSI Option Card 127
S/PDIF Option Card 128
Turbo Option Card 129

ESI Parts 131
ESI 4000 Main PCB Layout 132
ESI-33 Main PCB Layout 133
ESI-32 Main PCB Layout 134
ESI Turbo Option PCB Layout 135
ESI SCSI Option PCB Layout 135
ESI S/PDIF Option PCB Layout 136
G-Chip Pinout 137
H-Chip Pinout 138
Assembly Drawings 139
Ordering ESI 4000 Parts 147
Main PCB 147
Front Panel 156
Turbo Option 159

Final Assembly 163
Ordering ESI-33 Parts 165
Main PCB 165
Front Panel 174
SCSI Option 178
S/PDIF Digital I/O Option 180
Final Assembly 182
Ordering ESI-32 Parts 184
Main PCB 184
Additional Part Numbers and Locations 193

Introduction

The information contained in this manual is proprietary to E-mu Systems, Inc. The entire manual is protected under copyright and none of it may be reproduced by any means without written permission from E-mu. Please consider all of the data in this manual proprietary. Use it to service the ESI-32 and ESI 4000 only.

The ESI-32 and ESI 4000 are products that make extensive use of VLSI technology. This technology has several benefits including increased performance, increased reliability and reduced cost to the consumer.

Most of the components are surface mounted, which can be a problem if you are not familiar with them or do not have the proper tools. Please do not attempt to remove and replace surface-mounted components if you are unsure about your skill. It is very easy to cause serious damage to the circuit board which will not be covered under warranty.

To service the ESI-32 or ESI 4000, you should be familiar with digital logic, DAC's, and op-amps, as well as microprocessor troubleshooting techniques. Before attempting to service or repair an ESI unit, you should have on hand (at least) the following equipment: a digital multimeter, a 100 MHz dual trace oscilloscope, and basic technician hand tools.

We feel obliged to remind you that any modification of the ESI other than as specified by a factory authorized E-mu Change Order (ECO) voids the warranty of the instrument.

Please read this manual thoroughly before attempting to service the ESI. If you have any questions about the instrument, contact our Service Department at (408) 438-1921 between the hours of 9:00 - 5:00 PST, Monday through Friday.

ESI Overview

About the ESI

This section presents some background information and describes the basic architecture of the ESI. ESI is the very latest in the long line of high quality and affordable E-mu sampling products. ESI features 22.05 kHz and 44.1 kHz sampling rates and 16-bit resolution for CD quality sound. Sampling can be performed in either mono or true stereo. With 64 channels of polyphony on the ESI 4000 and 32 channels on the ESI-32, you can stack sounds or create lush sequences without fear of channel "ripoff." The user-upgradable memory can be expanded to a maximum of 128 Mbytes on the ESI 4000 and 32MB on the ESI-32 using standard SIMM modules.

The ESI has full access to the huge library of sounds available from E-mu and other sources. It is fully compatible with the legendary EIII and EIIIX libraries, and can import Emax II and Akai S1000/S1100 banks. In many cases, the ESI can import and convert programs faster than the source unit!

The advanced features of the ESI make sampling easy. Samples can be truncated, normalized and placed on the keyboard automatically as the sample is taken. ESI also contains advanced tools such as Auto Correlation, Loop Compression and Crossfade Looping which allow even the most difficult sounds to be looped easily.

Samples can be digitally spliced and mixed with other samples and controlled dynamically from the keyboard using velocity and positional crossfading and switching functions. Advanced digital processing features such as Sample Rate Conversion, Compressor, Digital Parametric Equalizer and Digital Tuning allow you to shape raw samples faster and with greater precision than computer based systems.

The ESI 4000 and ESI-32 (with EOS 3.02 software upgrade) each contain 19 different filter types for each of its channels. The digital filters are very "analog sounding" and implement the following filter types:

- 12, 24, or 36 dB/octave lowpass filters with resonance
- 2nd & 4th order highpass filters with resonance
- 2nd & 4th order bandpass filters with resonance
- Contrary bandpass filter
- Three types of Swept EQ filters

- Three Phasers and one Flanger filter with resonance
- Two morphing Vocal Formant filters
- Bottom Feeder
- Original ESI 24 dB/octave lowpass filter

Modulation sources include three AHDSR envelope generators, a multi-wave low frequency oscillator (LFO) per channel and full MIDI modulation control over virtually every parameter. The ESI's unique Trigger Mode allows you to trigger up to ten different samples from the front panel without connecting a keyboard making it an ideal tool for DJs.

The ESI is 16 part multi-timbral which means you can create complex sequences and sound effects. Four polyphonic audio outputs with integral submix returns let you process sounds separately then return them to the main outputs without using up precious mixer channels. The Turbo Option adds four additional submix outputs plus an Effects main output.

The ESI accesses up to 999 samples per bank arranged in up to 256 presets. The integral 3.5" floppy disk drive provides a convenient means of storing and loading banks. A built-in SCSI interface provides easy access to external high density media such as hard disks, magneto-optical disks or CD ROMs.

A digital interface, available with the Turbo Option, facilitates transfering stereo digital audio between digital recorders, mixers, etc. The Turbo option card contains two stereo 24-bit digital effects processors which add Reverb, Delay, Flanging and Distortion effects to the ESI. Included are over 70 effects which can be applied on a per MIDI channel basis or by keyboard "Zone." Each preset can have its own effect program when ESI is in Omni or Poly mode.

In developing ESI, we retained the logical and easy-to-use interface of the industry-proven EIIIX and enhanced it with our state-of-the-art G-chip and H-chip hardware. The G-chip provides smooth sample transposition over a wide range while the H-chips retain the warm character of analog filters.

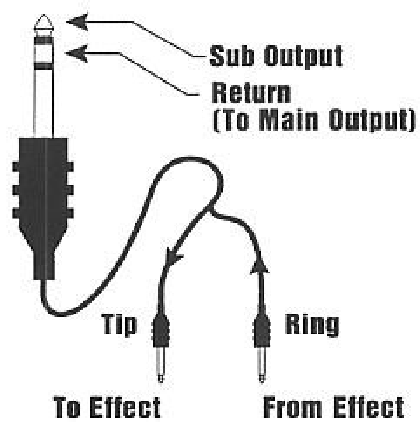
Audio Connections

Main Outputs: The ESI provides a variety of output connection schemes. The most common hookup is using the main stereo outputs. Output level is -10 dBm (approximately 1-2 volts RMS). Output impedance is 1K ohm.

Submix Outputs/Mix In: The Submix Outputs are stereo jacks with -10 dBm outputs on the tip of the jack. Output impedance is 1K ohm. The ring of each submix jack is a return input to the main outputs. By using a special cable shown in Figure 1, specific presets or MIDI channels can be externally processed and then returned to the main mix.

In addition to the main stereo outputs, the ESI has an additional pair of submix outputs. Submix Oututs can be used when individual processing on specific instruments is desired. Any combination of channels, keyboard zones and MIDI channels can be programmed to appear at the submix output pair. Use the Output Channel function in the Dynamic Processing module to program keyboard zones. Use the Multimode Mix function in the Master/Global module to program MIDI channels for the Submix Outputs.

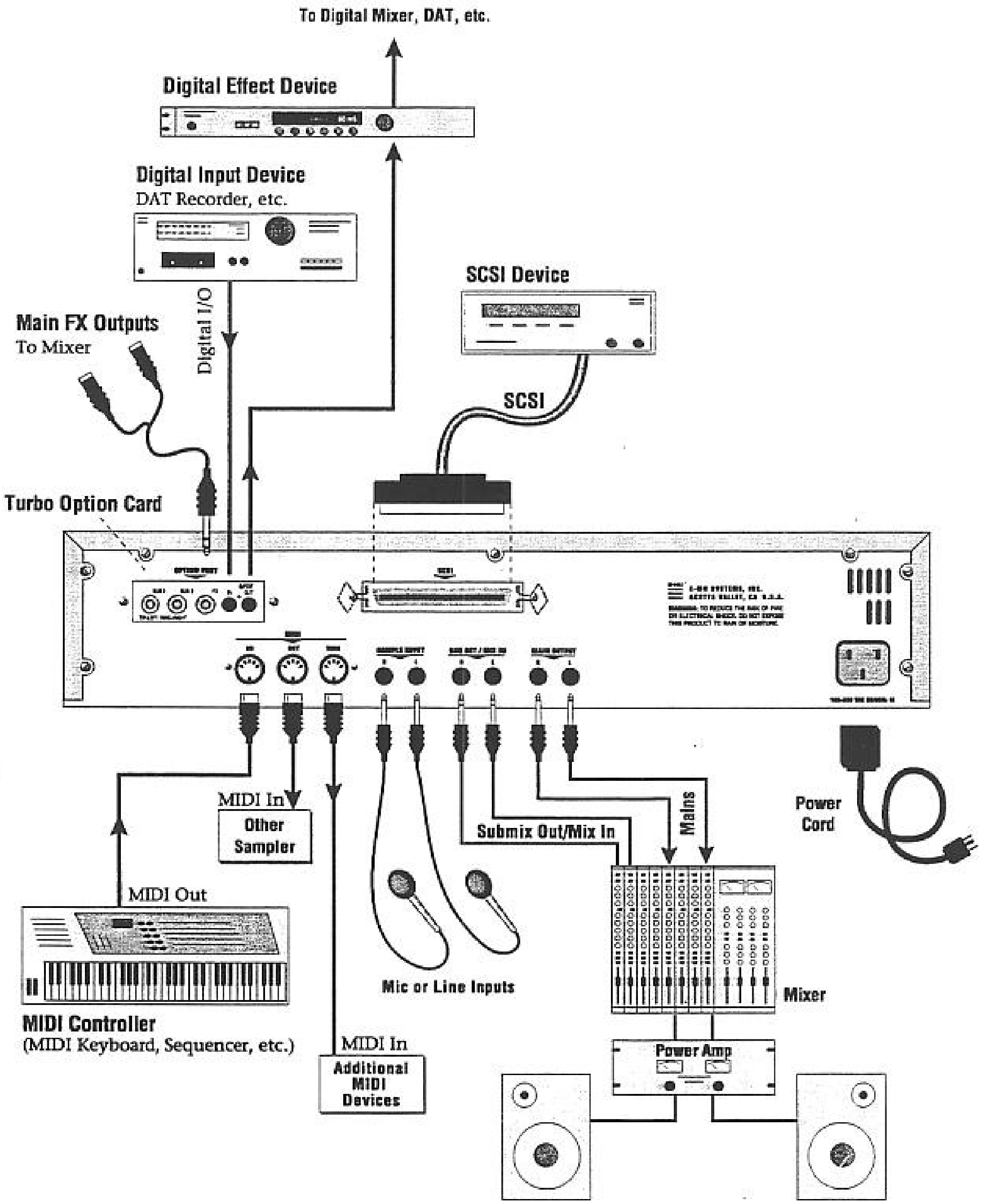
Send/Return Cables



Stereo Headphone Output: The headphone output is located on the left side of the front panel and is capable of driving all types of stereo headphones. The output level is controlled by the master volume control.

Turbo Option Outputs: The optional Turbo card contains three additional output channel pairs: FX, Sub 2 and Sub 3. The stereo outputs are accessed using a stereo plug adapter cable. The FX output is a duplicate of the main outputs run through the effects processors. When MIDI channels or Zones are programmed to "Main," they appear at both the FX and Main outputs. Submix outputs 2 and 3 incorporate "plug sensing"

Connection Diagram



Sample Inputs

The two sampe input jacks accept any low to high level input (microphone to line level). Input impedance is 10K Ohms. The gain of the sample input preamplifier is controlled from the setup screen in the Sample Management module. When in the Sample Management module, the sample inputs can be monitored from the main outputs or the headphone jack.

MIDI Connection

ESI provides a MIDI IN, a MIDI OUT and a MIDI THRU port.

- The MIDI IN port connects to the MIDI OUT port of an external MIDI controller which could be a keyboard, a sequencer, MIDI drum kit or whatever. The ESI responds only to information that the controller transmits. If a MIDI keyboard does not have velocity and pressure sensitivity, the ESI will not respond to velocity and pressure.
- MIDI OUT can be connected to another MIDI instrument or computer. The MIDI OUT jack is used to transmit MIDI sample dump information (transfers sample data).
- MIDI THRU simply re-transmits any information received at the MIDI IN port. Use cords that have been designed specifically for MIDI. While regular 5 pin DIN cords may work, they are not shielded correctly for MIDI use and may cause ground loops between equipment.

110V / 220V Operation

The ESI may be used in either 110 volt or 220 volt environments at either 50 Hz or 60 Hz. No change of voltage settings is required. ESI automatically switches itself for 110 or 220 volt operation.

Digital I/O (Turbo option)

The optional S/PDIF card or ESI-32 or Turbo card for ESI 4000 each contain a digital interface which allows ESI to transfer digital audio back and forth with other digital devices equipped with S/PDIF digital I/O.

The digital input allows sampling directly from a DAT recorder or other digital device. The digital output reflects the data at the stereo outputs of the ESI.

SCSI

The SCSI connector is a high-speed parallel interface used to connect the ESI with internal or external mass storage devices such as hard disks or magneto-optical discs. The SCSI port can link the ESI to an external computer for extremely fast file transfers. The ESI also supports SMDI (SCSI Musical Data Interchange protocol) which allows transfer of samples over SCSI.

How the ESI Organizes Sounds

You can think of the ESI as resembling a collection of sound-organizing modules, all contained within an the ESI bank. Pathways indicate how information flows within the ESI. Let's take a closer look at what makes up this information, and how it is transferred from one section of the instrument to another. We'll start with individual samples, then work our way through the system.

The Sample

Loading in any sound in mono or stereo creates a sample. A sample is the raw material with which the ESI works. The total available sampling time can be divided up any way you like—one long sample, lots of short samples, a few medium samples, or any combination thereof.

The term sample commonly means two different things:

1. A digital recording of a complete sound, or
2. Each snapshot of the sound that makes up the complete sample. Confusing? You bet! In this manual, we'll assume sample means the complete recorded sound unless indicated otherwise.

You can modify a raw sample in several ways:

Transposition: A sample can be transposed up or down in pitch to cover a particular range of the keyboard. By doing this, it is not necessary to record a sample for every key.

Digital Processing: In the ESI, Digital Processing might consist of Looping a sample (allowing even short samples to play indefinitely), Truncating (cutting off unneeded parts of a sample, thus saving memory), or any of a number of digital processes that actually change the raw sample data.

Dynamic Processing: Just as synthesizers include signal processors (filter, voltage-controlled amplifier, envelope generators, LFO, and so on) to modify the sounds produced by the synth's oscillators, the ESI includes similar modules for modifying the sound of samples or combinations of samples.

The Preset

As mentioned earlier, a sample can be assigned to a single note on the keyboard, or transposed polyphonically to cover a wider keyboard range. A preset is one entire keyboard setup. The process of assigning, and optionally transposing, samples to specific ranges of the keyboard is called making a preset. Making a preset is a three-step process:

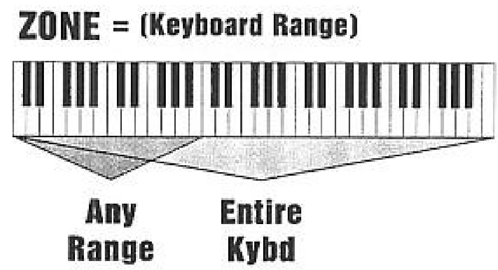
1. Create the preset and give it a number and name. The bank can hold up to 256 Presets (000-255).

2. Place samples to different keyboard ranges. For example, with five samples you could assign each sample to cover one octave of a five octave keyboard. A sample can be assigned more than once within a given preset, and assigned to more than one preset.
3. Choose from a number of available options that further define the preset. Some examples are: assigning samples to partially or fully overlap other samples, thus producing doubling effects, or assigning dynamic control to individual samples in a preset. You can modify zone parameters, and set up MIDI and dynamic processing parameters.

The Zone

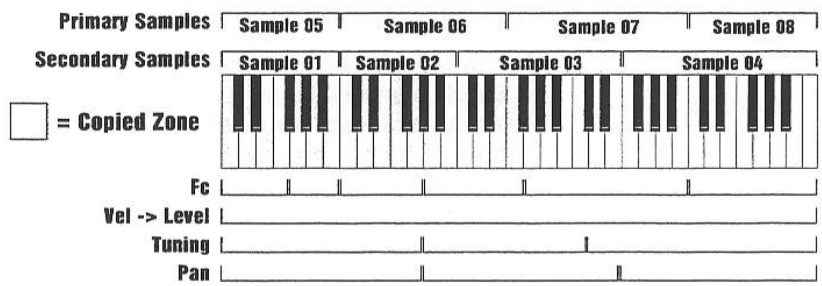
A particular range of the keyboard is called a zone. This zone can include one or more samples and the zone's boundaries need not be the same as the boundaries of the samples contained in the zone. Zones free you from having to think about where the actual samples are assigned. You just select a range of keyboard (a zone) and go!

Keyboard Zones



As an example, suppose you want to set the velocity response for the entire keyboard. You first select the zone range by playing the lowest and highest keys when prompted by the ESI. Next you set the velocity response (in the Dynamic Processing module). Done.

Another View of Zones



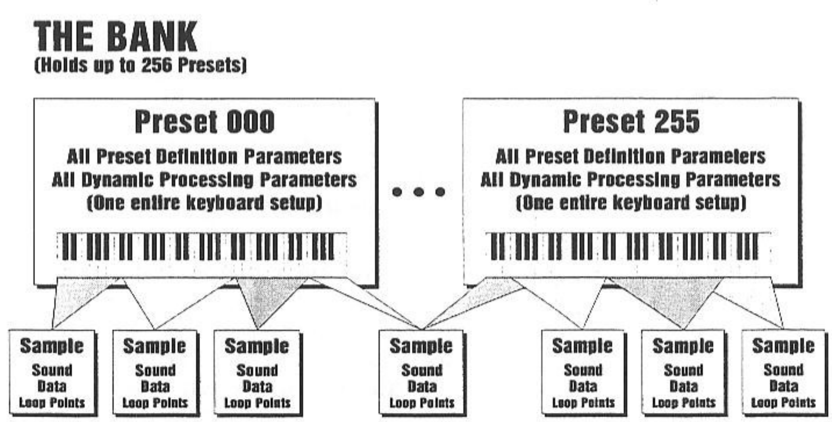
Now, suppose you want just the lower half of the keyboard to have increased velocity response. You simply select a zone for the lower half of the keyboard, then change the velocity settings as desired.

When you copy a zone, the appropriate samples are picked up along with the Dynamic Processing parameters.

The Bank

The memory bank contains samples, zones and presets. Everything. Consider the bank as the central storehouse for all of the ESI's data. Although the memory is volatile, meaning that the data disappears when you turn off power, all bank data can be saved permanently to the hard disk drive or other media to keep a record of your work.

The Bank



All data loaded into the ESI is called the Bank. Each individual keyboard setup is called a Preset. Individual Samples can be shared among presets.

Additional Definitions

Primary and Secondary Layers

An ESI key provides for two channels. These contain the primary and secondary layers. For example, the primary layer might be a sample of a guitar note and the secondary layer a detuned version of the same guitar note. When played together, you hear chorusing. A preset contains information about how the keyboard dynamics affect the primary and secondary layers. As an example, the primary layer could be a sample of a drum hit played softly, and the secondary of a drum hit played loudly. Thus, playing the keyboard softly would play the primary layer, and playing the keyboard more forcefully would play the secondary layer.

The Current Preset

When you load a bank the display shows the preset number of the preset ready to play. This is the current preset. If you select another preset, or create a preset, that becomes the current preset.

The Current Sample

The first time you load a bank, the current sample defaults to Sample 001. Whenever you record, load, or select a sample, it becomes the current sample. Subsequently, when you load a bank, the default sample is the sample that was current the last time you saved that bank. For example, if sample 029 was the current sample the last time you saved the bank, then the next time you load the bank the current sample defaults to sample 029. You can always hear the current sample by pressing the audition button or entering the Digital Processing module.

Modules

A module controls a particular set of functions in the ESI. There are six main modules: Master/Global, Preset Management, Preset Definition, Sample Management, Digital Processing and Dynamic Processing.

- **Activating a Module and the Module Identifier:** To work with a module, you must first activate it. Press the button associated with the desired module. The display will then show the Module Identifier and invite you to select a submodule.
- **Submodule:** Each module contains several numbered submodules that set controls for additional functions. There are two ways to select a submodule within the module. You can move the Data Entry Control until the display shows the desired submodule, then press ENTER. As you work with the ESI, though, you will start to memorize the submodule numbers and will probably find it faster to simply key in the appropriate submodule number using the numeric keypad. When using the keypad, it is not necessary to press ENTER. Pressing either the module button or the Escape button returns you to the preset selection screen.

Saving

The bank retains data for as long as the ESI is plugged in and turned on. Of course, we don't expect you to leave the thing on all the time, which brings us to the subject of saving data.

Pressing the SAVE button on the Control Panel shuttles all the bank data (samples and presets) to the drive of your choice. A hard disk permanently stores data so that even after turning off the ESI, the disk will contain a record of your work.

IF YOU DO NOT SAVE A BANK, ALL BANK DATA WILL BE LOST WHEN YOU TURN OFF THE MACHINE.

Default

A default setting is what we've determined to be a useful initial setting. Default settings remain in effect until you change it. For example, if you create a new preset, the initial portamento default value is 0 seconds (off). Had the default been set to some higher value, all new presets would have portamento applied.

The Cursor

The cursor is that small flashing line on the display. It sits under the number or letter that will be altered if you enter data. Entering a new value overwrites the number or letter above the cursor. If the ESI is expecting a two or three-digit number, in most cases you must enter all the required digits.

Data Entry Control & Increment/ Decrement Buttons

In virtually all instances where the Data Entry Control selects options, the Increment (INC/YES) and Decrement (DEC/NO) switches duplicate the Data Entry Control. Press INC/YES to increase a value, or DEC/NO to decrease.

The Big Re-Cap

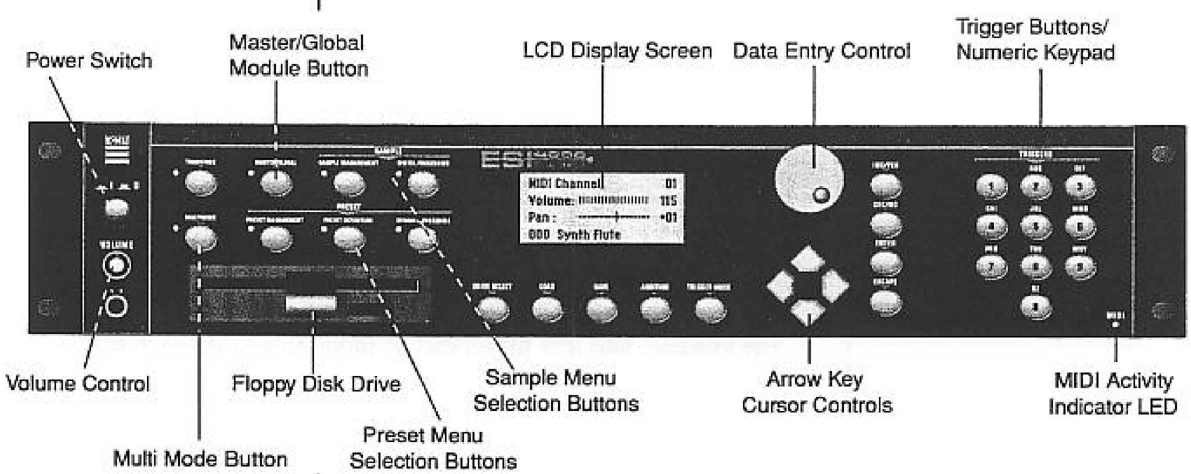
- A sample is a raw sound that is loaded into the bank.
- To create a new preset, make sure you have all the samples required for the preset in the bank, number and name a preset, then assign combinations of samples from the bank to specific sections of the keyboard. By specifying one or more of these samples (or portions thereof) as a zone, the zone may then be processed by the ESI's dynamic signal processors.
- After arranging a bank, it can be saved to one or more drives.
- Since loading from a hard disk fills the bank with samples and presets, you can group these samples into new presets, process the samples contained in particular zones, or alter existing presets.

Basic Operations

Power Up

The power switch is located on the left side of the front panel. When power is applied, the liquid crystal display lights indicating that the unit is operating. You may have noticed that there is no 110/220 Volt power selector switch on ESI 4000 or ESI-32. ESIs have automatic switching for 110 or 220 Volt operation.

The ESI Front Panel Interface



Power Switch

Switches AC power to the unit On and Off.

Volume Control

The Master Volume Knob controls the volume of every audio output on the ESI including the submix and headphone outputs. The master volume knob is a digital control. For maximum dynamic range it should be kept near the maximum position.

Numeric Keypad

The Ten Key Pad is used to enter data in precise amounts. For instance, if you wanted to jump to preset 10, enter 010 on the ten key pad and the new preset number is selected instantly, eliminating the process of finding the number with the Data Entry Control and then pressing Enter.

Data Entry Control

Using the Data Entry Control is the most common way to change parameter values on the ESI. Moving the control changes either the data over the flashing cursor or scrolls through options in the display.

Multi Mode

The Multimode Button puts the ESI into Multimode, where it can receive up to 16 MIDI channels at once. Multimode is used for multi-timbral sequencing and when using a keyboard that can transmit on more than one MIDI channel at a time. The Multimode screen is where you assign presets to MIDI channels for multi-timbral sequencing. You can also set the volume and stereo pan position for each channel's preset.

To Use Multimode

1. Press Multimode. The display shows:

```
MIDI CHANNEL:     01
Volume:          127
Pan-:            +00
000      Synth Flute
```

2. Use the cursor buttons to select one of the following parameters to edit. The volume, pan and preset can be programmed for each of the 16 MIDI channels. Use the Data Entry Control or INC/DEC buttons to change the MIDI channel, Volume or Pan setting. If you do not want the ESI to respond to certain MIDI channels, set the preset for those channels to "Unassigned" which is located just below preset 000.

Setting the preset to "Unassigned" also blocks incoming preset changes on that channel.

```
MIDI CHANNEL:     02
Volume:          116
Pan-:            -01
     Unassigned
```

5. To cancel the transposition, press and hold Transpose and press C2. Line three on the display goes blank. Release Transpose and the LED should turn off.

Drive Select

Use the Drive Select Button to select which storage device to use when loading or saving. The ESI may have an internal hard disk and/or several external SCSI devices connected.

☞ To Select a Drive

1. Press Drive Select. The display shows:

```
     DRIVE SELECT
D1 Sony        SMO-C501

    Select a Drive
```

All SCSI devices are listed in the drive select screen, such as a computer or another sampler on the SCSI bus. Please note that only SCSI storage devices can be selected.

2. Use the Data Entry Control or 10 Key Pad to select the desired drive, then press ENTER. Any subsequent Load or Save operations will now use the selected drive.

Load

The Load function loads presets and samples into the ESI's memory bank from the floppy disk, hard disk or other external SCSI device.

☞ To Load a Bank

1. Press Load.
2. If necessary, select the drive containing the bank to be loaded. The ESI defaults to the current drive. If you want to choose a different drive, place the cursor under the drive number in line two, select the appropriate drive and press ENTER.

```
  LOAD BANK from
D1       Internal HD

   Select a Bank
```


Trigger Mode

When Trigger Mode is activated, the buttons of the ten key pad become sound trigger buttons which can access any ten notes in the current preset. This allows the ESI to be used as a stand-alone sample playback unit.In Trigger Mode, the LED next to the trigger button illuminates and all ESI functions operate normally, except that the ten key pad is now used exclusively for triggering sounds.

The Trigger Buttons are programmed in the Master/Global module, Special (8), Trigger Buttons (7).

Cursor / Page

The Cursor is a small flashing line that appears in the display window under the data that is currently being edited. The Cursor/Page buttons are used to move the cursor around in the display. The buttons are shaped like arrows which point in the direction of movement. In many cases a particular function will have more options than will fit on a single page of the display. In this case the right and left arrow buttons become the page selects, allowing you to move through the various pages of the display.

MIDI Activity LED

Flashes during MIDI activity.

Floppy Disk Drive

A floppy disk is a convenient method of saving and transferring presets. Insert the floppy firmly into the slot on the front panel with the label facing up. Press the eject button to release the disk.

☞ To Save Data to a Floppy Disk:

1. Press the Save button.
2. Position the cursor under the drive number in line two. Select the floppy drive using the Data Entry Control.
3. Insert a floppy disk and press ENTER. The display will say, "Saving Bank".

   If the save requires multiple disks, the display prompts you to insert the next disk. Once the save operation is completed, the display returns to the main screen. If the save required multiple disks, make sure to label them numerically.

Using an External Hard Disk

You can connect an external hard disk to the ESI external SCSI port for loading and saving data.

☞ To Connect an External Hard Disk Drive

1. Turn off all power to the ESI and the external drive.
2. Connect the external drive to the ESI using the proper type of SCSI cable.
3. Turn on the external SCSI device BEFORE the ESI.
4. Turn on the ESI.

☞ To Format a Hard Disk Drive

Like a floppy disk, a hard disk must also be formatted before it can be used to store information.

1. Activate the Master/Global module.
2. Select Disk Utilities (7), Format Disk (6).
3. Select the hard disk using the Data Entry Control and press ENTER. Your hard disk should appear in the list of available drives. If the hard disk is not listed, use Disk Utilities, 1 to Mount Drive then select the Format Disk option after the drive is mounted.
4. Consider the consequences of your action. Formatting the hard disk will erase everything on that disk. The display will inquire if you want to do this.
5. Press Yes to continue the formatting procedure or No to cancel the operation and return to the Module Identifier. Formatting a hard disk can take quite some time, depending on the size of the disk. Take a break.

Selecting Zones

The ESI has two modules dedicated exclusively to processing samples within a preset: Sample Management and Digital Processing. Each sample stored in a bank can be processed by the Digital processing module independently. Therefore, we need a way to specify the current sample which is the individual sample to be processed.

The concept of the curent sample is important. To process one sample out of a preset, select a sample to be the *current* sample and process it.

☞ To Identify Which Keyboard Keys Belong to Which Sample:

1. Activate the Preset Definition module.
2. Select Edit Assignment (2).
3. Play a key on the keyboard.

   Line two shows the preset number and the last key pressed. Line three shows the primary sample assigned to the key, and the fourth line shows the secondary sample, if any, assigned to the key. As you run your fingers up and down the keyboard, the primary and/or secondary sample numbers change indicating the keyboard range of those samples. You can also move the Data Entry Control knob to show you the sample boundaries.
4. Choose a zone and press ENTER.

   The display now whows the range of the current zone on the upper line of the display. Don't play any keys but press ENTER again. Now the display shows something like the following, where XX is the name of the key (such as D2).

```
EDIT ASSIGNMENT

Zone:  XX to XX
Select High Key
```

Mechanical Procedures

Precautions

Always observe the following precautions when working on the ESI:

- Always turn off the power to the unit and touch a grounded object before connecting or disconnecting any circuitry or removing or installing any PCBs.
- Do not bend or strain the PCBs. This may cause tiny breaks in the printed circuit traces which are extremely difficult to locate.

A Word About Soldered Parts

Many of the components in the ESI are "surface mounted" meaning they are soldered directly to the PCB. Use extreme caution and work slowly and carefully when removing soldered components. If you are unsure about your desoldering skills it may be best to "clip out" the component, then desolder the leads rather than risk damaging the circuit board traces.

☞ To Replace a Soldered Component

1. Switch off the power to the unit.
2. Remove the PCB with the affected component from the instrument.
3. Desolder the component from both sides using a desoldering vacuum or solder wick.
4. Solder the new IC into place.

Gaining Access to the ESI Interior

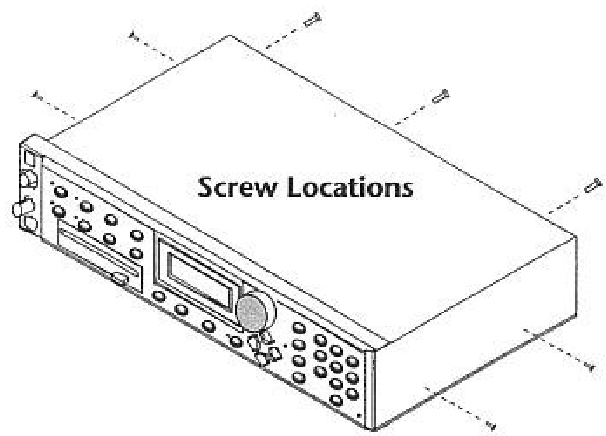
Before taking the ESI apart, find a stable, soft, well lit workplace. A carpeted or rubber covered workbench is ideal. Place the ESI on the bench with the front panel facing you. It is also a good idea to have a MIDI keyboard nearby so you can test the ESI.

Removing the Top Panel

You must remove the top panel of the ESI to gain access to the interior.

☞ To Remove the Top Panel

1. Remove the seven (7) screws securing the top panel to the main chassis as shown in the following illustration.



2. Slide the metal top toward the rear of the unit and lift off the main chassis.

Removing the top panel exposes the ESI main circuit board where most troubleshooting can be done.

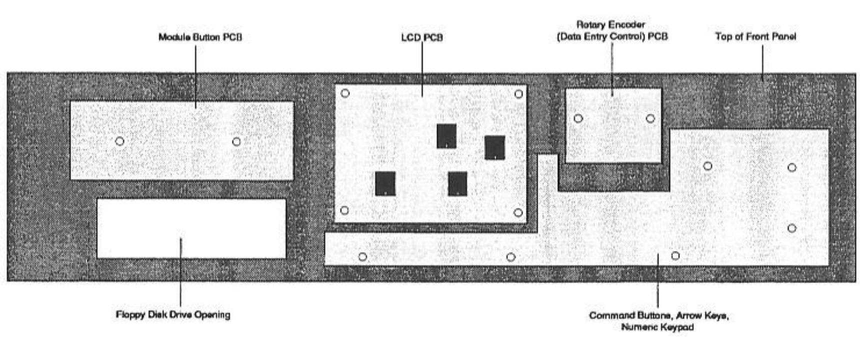
Removing the Front Panel Circuit Boards

You may need to remove the front panel circuit board in order to clean or replace the front panel buttons or to replace the rotary encoder (Data Entry Control) or to replace the LCD circuit board.

☞ To Access the Front Panel Circuit Boards

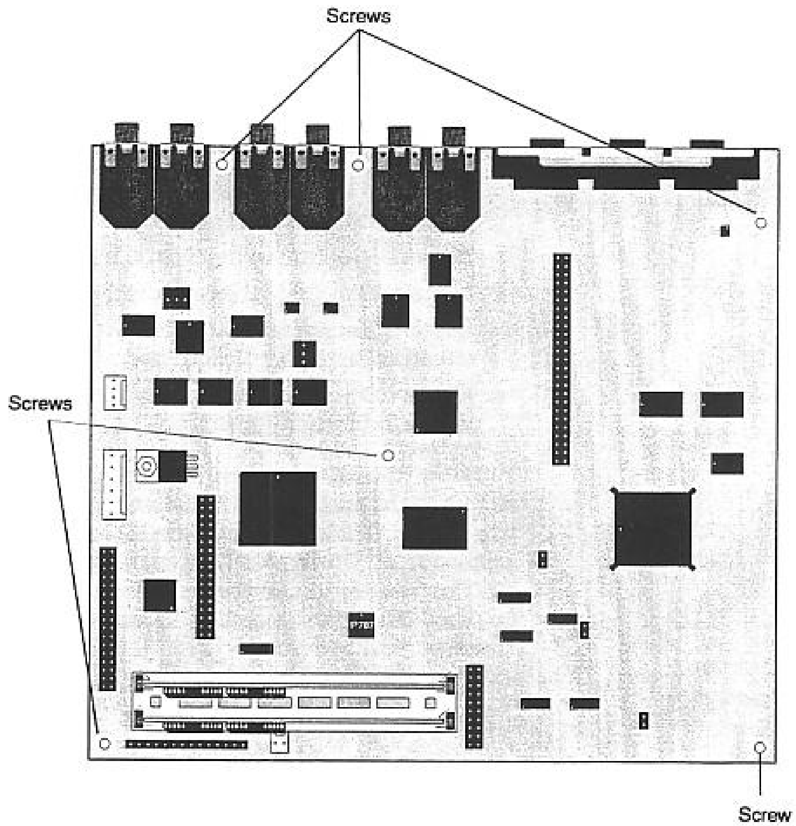
1. Disconnect the cables coming from the front panel from the main circuit board in the unit. Make sure to note the connections for later when you want to put it back together.
2. Remove the four (4) screws with attached lock washers located on the outside of the box securing the front panel to the main chassis as shown in the following illustration.
3. Remove the front panel from the main chassis.
4. Remove the eight screws securing the inside cover to the front panel.
5. Remove the screw securing the headphone jack and volume control circuit board to the inside cover of the front panel.
6. Remove the inside cover from the panel, carefully lifting it up and off without damaging the circuit boards inside.

You now have access to the front panel circuit boards. The front panel circuit board containing the data encoder is attached to the front panel by two screws. The LCD circuit board is attached with four small screws (one at each corner). The large PCB in the front panel contains the numeric keypad buttons, the command buttons below the LCD screen, and the arrow key buttons. The rotary encoder PCB and the module button PCB are each attached with two screws. Refer to the following illustration for screw location details.



Removing the Main Circuit Board

The main circuit board is attacted directly to the chassis standoffs by six (6) screws. The following illustration shows the locations of the screws securing the main PCB when looking into the chassis with the front of the unit facing you.



Installing Additional Memory

The memory of ESI is expandable up to 128 MB using one or two SIMM RAM memory modules. The requirements for the SIMM modules are as follows:

- 72-pin low profile SIMM (4 MB, 16 MB or 64MB)
- 8 or 9 bits (Mac or IBM)
- 70 nS or faster
- No 8 MB or 32 MB SIMMs are allowed in ESI!

Memory Requirements

The charts below show the allowable combinations of SIMMs. The standard ESI comes with (1) 4 MB SIMM installed. ~~Either~~ socket ~~can be~~ used when only one SIMM is installed.

Total	Rear	Front
4 MB	4 MB	Empty
8 MB	4 MB	4 MB
16 MB	16 MB	Empty
18 MB	16 MB	4 MB
32 MB	16 MB	16 MB
64 MB	64 MB	Empty
72 MB	64 MB	16 MB
128 MB	64 MB	64 MB

If the SIMMs are of different size, the smaller SIMM will be divided in half. That is, you will get only half of the memory of the smaller SIMM. You MUST install the larger SIMM in the slot towards the rear of the unit.

Determine the proper locations of the SIMMs you plan to install BEFORE YOU BEGIN.

Refer to the instructions for gaining access to the interior of the ESI beginning on page 28

Upgrading Memory

Remove the Old Memory SIMMs (if necessary). The memory SIMMs are located near the front panel. The front of ESI should be facing you.

☞ Remove the Old SIMM:

1. Ground yourself by touching a grounded object.
2. On each end of the SIMM socket, facing toward the rear, there is a little plastic tab. Use a screwdriver or a ball point pen to squeeze the tabs toward the outside of the socket while gently pushing the SIMM toward the rear of the unit. The old SIMM should "hinge" backward and can now be removed.

☞ Install the New Memory SIMMs

1. Ground yourself by touching a grounded object, then remove the memory SIMM modules from the static protected packaging they came in.
2. Gently set the SIMM deep into the SIMM socket at a 45° angle. One end of the SIMM is notched. This notched end should be on the same side as the RAM 1 and RAM 2 labels. Without forcing the insertion, let the board rest in the socket as deep as it will go. See the diagram below.
3. While applying a slight downward pressure on the top of the SIMM to keep it from popping out of the socket, tilt the SIMM board into a vertical position. You should hear an audible click. Make sure both sides of the plastic tabs have latched.

☞ Reassemble the Unit

1. Tilt the rear of the top cover up a little and slide the front of the top panel under the front panel lip. Lower the rear of the top panel into place.
2. Replace the seven screws. The screws are all identical.

☞ Test It

At this point, the installation is almost finished. Plug in the power cord and turn on power to ESI. If the display boots up showing the new memory size, everything is probably OK. If the unit comes up without showing the proper memory size, you may have installed the SIMMs incorrectly.

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 controller 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
0	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.
3	Jack Detection Test	Tests the submix output jack.
4	Effects Ram Test	If the Turbo option is intalled, tests the Effects RAM.
5	EEprom Tests 0) Verify EEprom 1) Initialize EEprom	 Writes to, then reads from the EEPROM, then initializes it. 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.

☞ To 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.

WARNING: The Sinewave Test destroys sample memory.

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.

WARNING: THIS TEST DESTROYS ALL DATA ON THE HARD DISK!!!

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.

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 is performed on every ESI before it leaves the factory. Use this test to verify that a problem exists or as a final test to verify that the unit is working perfectly before returning it to the customer.

CAUTION: PLEASE USE PROPER PROTECTION AND PROPER PRECAUTIONS WHEN LISTENING TO UNTESTED EQUIPMENT. IF YOU DON'T FOLLOW THE CORRECT PROCEDURE YOU COULD POSSIBLY DAMAGE YOUR EARS.

Equipment

- Oscilloscope, 10 MHz or greater with automatic triggering. DSO preferred.
- Compressor/headphone amp
- Headphones
- External hard drive
- 1/4 inch phone shorting plug (male)
- MIDI thru led tester
- MIDI cable
- Signal generator or microphone

Quick Test

Boot up test

1. Attach AC power cable and power on.
2. Check that the softwatre version is the most current. See Software Chart. The LCD should also indicate the correct amount of sound memory and configuration.
3. After boot up is completed, the following LED's should NOT be on:

LED ON	INDICATES
Transpose LED	CPU RAM bad
Master/Global LED & LCD not normaL	LCD problem
Sample Management LED	G-chip register problem
Digital Signal Processing LED	G-chip memory bad
Multi Moe LED	H-chip bad
Preset Management LED	Timer bad
Preset Definition LED	UART bad
Dynamic LED	Floppy drive/controller problem
Trigger Mode LED	SCSI device problem

If any of the above LED's remain on or the LCD indicates the wrong memory size there is a problem with the computer or one of its peripherals.

Accessing the On-Board Diagnostics

Many of the Functional Test Procedures are accessed through the Special Diagnostics Submodule.

☞ 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

1. 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

1. Press the Master/Global button. Select 8, Special, then select 1, Recalibrate.
2. Turn volume pot fully counter clockwise, then press ENTER.
3. Turn volume pot fully clockwise, then press ENTER.
4. Test volume pot calibration 0-255 and press ENTER.
5. Press the Inc/Yes to save the calibration and return to the Special submenu.

Contrast Adjust

1. Press the Master/Global button. Select 8, Special, then select 2, Contrast.
2. 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.
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:

```
SERIAL TESTS
MIDI test:     Passed

Done, Press Enter
```

3. Remove MIDI cables.
4. Press ENTER to exit test.

Jack Detect

1. Access the Diagnostics submodule as described earlier.
2. Press 3, ENTER.

```
 SUBMIX JACK DETECT
SUB1   Y
SUB2  (not installed)
SUB3  (not installed)
```

The **right** SUB1 plug is inserted.

3. Plug shorting plug into each Sub out and note change on LCD.
4. Verify: Y= inserted, N= not inserted, on all sub outputs.
5. Press ENTER.

Effects Test

Note: Turbo board must be installed.

1. Access the Diagnostics submodule as described earlier.
2. Press 4. After test, screen should indicate, "MEMORY OK".
3. Press ENTER.

```
 EFFECTS RAM TEST
 Testing...

Memory OK. Test Done
```

S/PDIF Test

Note: S/PDIF or Turbo card must be installed.

S/PDIF Out on the ESI mirrors the main outputs. S/PDIF In takes the place of the analog sample inputs.

☞ To test S/PDIF In:

1. Connect a S/PDIF source such a CD or DAT player to S/PDIF In.
2. Press Sample Management, 5. Sample Setup.
3. Press Right Cursor.
4. Set Source to S/PDIF, matching the sample rate of the source.
5. Make sure the source unit is sending S/PDIF and press 8 on ESI to begin sampling.
6. Listen carefully to the sample or measure using test equipment.

☞ 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

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

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.

```
SINEWAVE TEST
WARNING! Destroys
Sample Memory
Proceed? Y/N
```

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

```
SINEWAVE TEST
1K sinewave
Yes=1K          No=19K
Press ENTER to exit
```

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 Voltage Peak to Peak

Main 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)

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

1. Inspect rear panel for:
    - 6 nuts on jacks
    - 2 screws on MIDI jacks
    - 4 screws on plates
    - 1 power supply screw
2. Inspect sides for:
    - 4 bezel screws in and tight
    - 2 power switch screws
3. Inspect inside for:
    - Check ALL cables for offset or not fully inserted.
    - 8 screws on front panel board
    - 2 screws on encoder board
    - 1 screw on headphone jack
    - 6 screws on main board
    - SIMMs inserted correctly
4. Inspect bottom for:
    - 4 Floppy drive screws tightened
    - 4 feet fully inserted
    - Bezel clips fully seated into chassis?

Calibrations

This section describes how to calibrate the volume knob.

Calibrating the Volume Control

1. Press the Master/Global key.
2. Select Submodule 8, Special, then Submodule 1, Recalibrate.
3. Turn the volume knob all the way down, then press ENTER.
4. Turn the volume knob all the way up, then press ENTER.
5. Check the calibration value, press ENTER to continue.
6. Press YES to save the calibration.

Specifications

Specifications:

Number of Voices	ESI 4000: 64 mono, 32 stereo ESI-32: 32 mono, 16 stereo
Memory	ESI 4000: 4 MB standard, 128 MB maximum ESI-32: 2 MB standard, 32 MB maximum
Outputs	4 individual 1/4" unbalanced, polyphonic 6 additional with Turbo Option
Output Level	-10 dbm nominal, max 6 Volts p-p
Output Impedance	1K Ω
Data Encoding	Input: 16 bit Output: 18 bit
Digital I/O (Turbo Opt.)	S/PDIF format, RCA connectors
SCSI	50 pin connector, advanced links
Sample Rates	44.1 kHz, 22.05 kHz
Frequency Response	20 Hz to 20 kHz at 44.1 kHz sample rate
THD + N	Less than 0.05%
THD	Less than 0.03%
Signal/Quiescent Noise	Better than 100 dB
Stereo Phase	Phase Coherent ±1° at 1 kHz
Weight	10 lbs (4.5 kg)
Dimensions	W - 17.125" (43.5cm), H - 3.5" (8.9cm), L - 9.75" (23.7cm)
Power	100-240 VAC, 50/60 Hz, auto-switching supply, less than 30 watts consumption

Power Supply Specifications

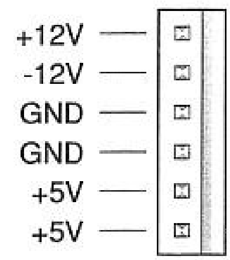
ESIs use a switching power supply. We do not repair these supplies at the factory and do not even have schematics for them. If a supply is defective, contact E-mu customer service at (408) 438-1921, to obtain a new supply.

The power supply automatically switches for 110 or 220 volt operation.

There is one trim pot on the power supply board which simultaneously adjusts +5V and +12V.

Note: Switching supplies will not operate without a load.

Power Supply Header



Specificatons

Chassis Is Ground

On Power Supply DC Connector

Green wires are Ground

Verify +12V on Violet wire

Verify -12V on Orange wire (-11.7 to -12.3)

Verify +5V on Yellow wire (+4.75 to +5.25)

On Floppy Disk DC Connector

Green wire is Ground

Verify +12V on Orange wire

Verify +5V on Yellow wire

±5 Volts to DACs

Verify +5 Volts on Pin 3 of VR2 (+4.75 to +5.25)

Verify -5 Volts on Pin 3 of VR1 (-4.75 to -5.25)

ESI Software History

Version 1.4

Bug Fixes

- Bus Error Crash - Lock Bank & Drive
- Sample feedthrough on powerup causes feedback

Version 2.0

Bug Fixes

- Data encoder accelerator is sticky
- Syquest 270M slow boot
- Various CD-ROM Loading bugs. Unable to access Emax CD ROM.
- Screen change in Digital Processing: Loop

Version 2.1

Bug Fixes

- Loads Preset and Sample from Floppy Disk
- Scrub Wheel for manipulating samples in Digital Processing module
- MIDI Receive Program Change On/Off
- SMDI - SCSI Musical Data Interchange for super-fast file transfers.
- PC Support
- Macintosh Support
- EIIIX Compatibility
- Drive Select screen now shows all devices on the SCSI bus by ID number.
- Load/Save now displays bank size
- Controller 32 causes Pitch Bend

Other Improvements:

- SCSI is now faster and compatible with more types of hard disk
- Audition From Disk volume increased
- Improved Doppler/Pan signal quality
- Improved Digital Tuning signal quality
- Improved Data Encoder resolution
- Akai & Emax II Import process improved - Emax II banks imported and merged correctly. All Akai sample rates now imported correctly.
- ESI-32 SCSI ID is now renamed "ESI-32 (Local) ID".
- Mac on SCSI Bus is now renamed "Avoid Host on ID". This allows you to select the SCSI ID to be avoided. Formerly, this was preset at ID #7.

Version 2.12

- Implements compatibility of new Motorola CPU chips with existing ESI-32 hardware.

Version 3.00

New Features:
- 17 Filter Types
- Assignment Groups
- Sonic Enhancer
- Export Functions
- Velocity Ranges
- Output Boost
- Implementation of the Turbo option card.

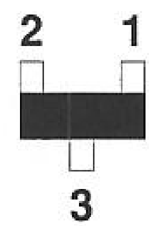
Other Features & Improvements:
- Support for NEC brand CD-ROM drives.
- ESI now supports hard disk drives of up to 4 gigabytes.
- Improved operation with Iomega Jaz drives.
- Improved compatibility with non-512 byte/sector hard disks.
- Improved pitch shifting at extreme transpositions.
- Pitch bend range has been increased to ±12 semitones.
- Dynamic Allocation has been removed and replaced with Assignment Group function.
- New realtime control routing - VCF Note-on Q.
- Filter Q can be controlled by the position of a realtime controller at note-on time.
- Finer Ratio Resolution (1/10 of a percent) in the Digital Processing, Time Compression algorithm.
- Improved stereo phase lock in the Digital Processing, Time Compression algorithm.
- Two additional algorithms have been added to the Time Compression and Pitch Change functions.
- Improved trigger button operation response. Now you can play any two trigger buttons polyphonically.

Bug Fixes:
- H-chip filter popping
- G-chip bandwidth rip-off improved
- Trigger button ghosting
- Thermal drift on volume knob
- ESi-32 typo on SCSI ID page

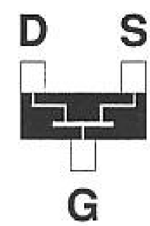
Surface Mount Transistors

Because the surface-mount technology i relatively new, these diagrams may be useful in identifying the proper pins of surface-mount transistors and diodes. Both NPN and PNP transistors use the same convention.

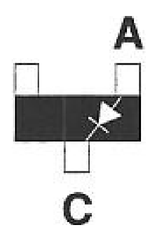
Numerical



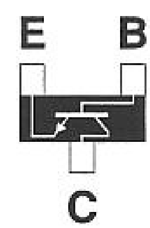
FET



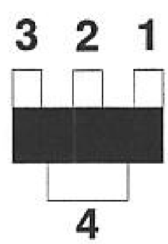
Diode



Bipolar



Power Trans.



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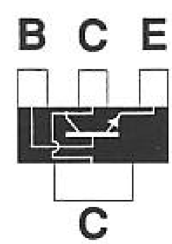

Trouble-shooting Guide

When troubleshooting ESI, common sources of problems are connectors, ribbon cables, the LCD, and broken solder joints. The traces on the ESI boards are very thin. Be extremely careful when desoldering parts. If you are having problems desoldering a component, we suggest that you clip the part out rather than risk damaging the board. Once again, DO NOT attempt to remove and replace a surface-mounted IC if you do not have the experience. Damage to the board resulting from poor soldering is NOT covered under warranty.

Computer

Problem	Cause	Solution
No Lights, No power.	Power supply bad or bad power connector crimp.	Replace supply or repair connector.
No boot. Power OK.	Check front panel diag-nostic LEDs. Do you get any LCD message?	Troubleshoot based on diatnostic LEDs. If HD, try floppy software.
CPU Dead.	Check clock, data bus, etc. Does the CPU start to run, If so, suspect peripheral.	Troubleshoot to the basics. RD/WR, data bus, etc.

Digital Distortion

Problem	Cause	Solution
Bad distortion on one output.	Bad DAC.	Replace bad chip.
Low level on one output.	Bad capacitor.	Replace capacitor.
Single channel plays wrong pitch.	G-chip bad.	Swap board.
No output, single channel.	Posible bad DAC, Capacitor or op-amp.	Determine cause and replace bad component.
Bad Sounds.	Check G-chip, H-chips for unsoldered pins.	Carefully resolder pins, or swap board.

Analog

Problem	Cause	Solution
Noise (hiss) on single output.	Posibly bad op-amp or bad capacitor on output filter	Find and replace bad component.
No output or hum, DC.	Output driver blown.	Replace output driver.

Hard Disk

Problem	Cause	Solution
Hard disk doesn't work.	HD may be damaged.	Try disk diagnostics, reformat or replace the hard disk.
Display reads "Disk Not Formatted."	Hard disk my have crashed.	Disconnect all SCSI devices & reboot. May need to reformat HD.
	External HD cable may be too long or two SCSI devices have the same ID#.	Use short SCSI cable. Check SCSI ID numbers.
Display reads "SCSI Error!"	Two SCSI devices have the same ID or a device is not powered on.	Check power to SCSI devices. Change SCSI ID# and check cables.
ESI doesn't recognize external HD.	External HD was turned on after the ESI.	Mount the drive using the Disk Utilities.

Floppy Disk

Problem	Cause	Solution
Intermittent or never loads disks.	Drive may be out of alignment.	Have drive realigned or swap drive.
Intermittent loading.	Possible wrong capacitor on power supply.	See E.C.O. section or call factory.

Other

Problem	Cause	Solution
Volume control is out of calibration	ADC temperature shift.	Recalibrate Volume Control after unit has warmed up for 30 mins.
Squealing power supply.	Bad decoupling capacitor.	Isolate to board, then find and replace shorted capacitor.
Intermittent power.	Bad connection at power supply.	Clean contacts and reseat power connector.

Other Troubleshooting Tips

- Sometimes the little legs of the G1.5 chip will become unsoldered from the circuit board. This can result in "bad" sounds and other digital garbage. To find an unsoldered pin, press down on the pins with a pencil eraser while playing the unit. If the unit returns to normal, you've found it!
- Inductor L4, located near the left front board screw on the LCD, tends to break off due to board warping and stress. Symptoms of this occurance is a flickering LCD, a dead backlight, and/or no boot boxes in the display. To determine if the inductor has broken off, flex the PCB to isolate the flicker.

Theory of Operation

The ESI is a computer controlled, digital instrument which records and plays back digitally recorded (sampled) sounds. It can modify sampled sounds in real-time using filtering, pitch and volume modulation. Sampled sounds can also be processed using non real-time DSP functions. Like all of E-mu's instruments, the ESI relies heavily on custom integrated circuits to handle the high speed memory access and signal processing required in a multi-channel instrument.

The ESI family was designed to make use of the advanced Emulator IIIX software (formerly E-mu's top of the line instrument) running on a cost-reduced hardware platform. The ESI has succeeded admirably in it's goals, offering unprecedented power and value or an instrument in its price range.

ESI Circuit Boards

There are three different ESI circuit boards designated ESI-32, ESI-33 and ESI 4000. ESI-33 is an in-house name only and is an ESI-32 circuit board with a built-in SCSI interface. The basic differences between the three boards are listed below.

Model	Identifying Features
ESI-32	PCBoard: PC418. First model introduced. No SCSI interface on-board. SCSI was available as an option card. The clock circuitry was implemented with standard logic.
ESI-33	PCBoard: PC517. This model incorporates several cost saving measures. SCSI was added on-board as a standard feature. The clock divisor circuitry is implemented using a larger PAL which handles multiple functions. A data bus driver (U15) buffering the expansion header was removed to save cost. The LCD was changed to an LED backlight version, eliminating the HV power supply. The metal cage covering the switching power supply was removed to save cost. The unnecessary DSP header was removed.
ESI 4000	PCBoard: PC542. All the changes of ESI-33 plus the following: Another H-chip was added to enable 64 channel operation. Address bus drivers were added between the G-chip and Sound RAM to allow use of up to 128 MB of Sound RAM (2 x 64 MB SIMMs).

Circuit Descriptions

Power Supply (Page 1)
The ESI uses a switching power supply with a 6-pin cable connecting to the main board, supplying +5V and fairly unregulated +12V and -12V. These ±12V supplies are further regulated down to a clean ±5V for use by the DACs and ADC. ESI-32 uses 7805 and 79L05 regulators for the ±5V analog voltage. ESI-33 and ESI 4000 use a 79L05 or the -5V DAC/ADC supply. The DAC and ADC each have their own 78L05 on the ESI-33 and ESI 4000. The Turbo option card uses a +5V regulator and a -5Vregulator on the op amps.

All op amps run off ±12V from the switching supply. Extra filtering capacitors were included on the ±12V lines of the ESI-32, but were removed on the ESI-33 and ESI 4000 because they were found to be unnecessary. A 4-pin connector supplies power from the main board to the floppy disk drive.

ESI-32 Clock Generation (Page 2 of ESI-32 Schematics)
This page shows the clock generation used for sample rates. The G-chip, H-chips and the DSP processor all require a clock 512 times the playback sample rate. All ESIs have a fixed playback rate of 44.1 kHz (512 x 44.1 kHz = 22.579 MHz). The 45 MHz crystal clock is divided in half to get the required 22.579 MHz rate.

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There are 3 possible recording sample rates:

- 44.1 kHz
- 22.05 kHz (44.1 ÷ 2)
- S/PDIF controlled clock rate (variable, supplied by an AES receiver chip on S/PDIF option board)

The HCT153 is a dual multiplexer. One half of the chip selects one of the 3 record sample rate clocks (44.1 kHz, 22.05 kHz, or S/PDIF) and the other half selects the corresponding serial data source (the ADC or the S/PDIF chip).

Two bits under software control (SRSEL1 and SRSEL0) select the recording sample source:

11	22.05 kHz
10	44.1 kHz
01	S/PDIF In
00	none

To reduce extraneous clock noise, unused clocks are disabled when not in use.

- When SRSEL0 = 0 (44.1 kHz), the flip-flop generating the 22.05 kHz master clock (11 MHz ÷ 2) is disabled via the clear pin on the flip-flop.
- When SRSEL1 = 0 (S/PDIF), the flip-flop generating the 44.1 kHz master clock (11 MHz) is disabled which also kills the 11 MHz ÷ 2 clock.

Multiples of the recording sample rate (FS512, FS256, FS128, FS64, FS32, FS16, FS8, FS4, FS2, and FS1) are all available on this page. (FS1 is the main sample rate = 44.1 kHz.) FS2 is required to be inverted (FS2N) for the ADC shift registers so it is also generated here.

ESI-33/ESI 4000 Clock Generation (Page 2 of ESI-33 and ESI 4000 Schematics)

On the ESI-33 and ESI 4000, all the clock divisor and multiplexer circuitry was incorporated into a large PAL (which also handles other functions such as floppy disk control). The same 2-bit control signals (SRSEL1 and SRSEL0) are used and perform the same functions inside the PAL. FS16 from the PAL is further divided by an HCT193 divider chip (U24) to get the FS1 and FS2 clocks. An HCT14 inverting Schmitt trigger inverts FS2 into FS2N for the ADC shift register.

The reset circuitry is also located on this page. It consists of a simple RC circuit coupled to a HCT14 inverting Schmitt trigger to generate the system RESET signal. Another HCT14 turns this into RESETN. A diode across the capacitor insures a slow turn on and a quick turn off.

A circuit at the bottom of the page was originally designed as a "home made" OR gate to sum an interrupt request from the expansion header with the hard disk interrupt request. The interrupt request input from the expansion header was never implemented on any of the option cards and so it is always pulled high with a 1K resistor. The HDIRQ signal is inverted by the circuit.

Microprocessor (Page 3)

All ESI models use the MC68306 processor which has a built-in DRAM controller. The DRAM is composed of a single S0J42 DRAM chip which holds 256K x 16 bits. Two socketed surface-mount ROMs contain the system firmware. The total ROM memory size is 256K x 16 bits.

The processor runs at 16 MHz, generated by an external crystal and distributed to the expansion bus and the floppy control logic.

The MC68306 has two generic I/O ports: port A and port B (PA [7-0] and PB[7-0]). Each pin can be individually programmed as an output or an input. The MC68306 contains an internal UART which is used for the transmission and reception of serial MIDI data. These pins are labeled TXDA and RXDA. An external 3 MHz clock (C3M) entering through "X1" is divided internally to derive the 31.250 kHz MIDI data rate for the UART.

The processor also reads the front panel rotary encoder directly through dedicated input ports 0 and 1 (IP0 & IP1). These inputs are pulled up using external resistors and shorted to ground (using quadrature encoding) when the rotary encoder is turned.

EEPROM, Extra Chip Selects, Expansion Bus (Page 4)

A small 93C46 EEPROM chip (U28) provides nonvolatile storage for the following miscellaneous bits of information:

- Volume Control calibration
- LCD Angle
- Headroom/Boost settings
- Trigger Button settings
- SCSI Setup information
- Lock Bank & Drive settings
- MIDI Global settings
- MIDI Load Bank setting
- MIDI Volume Pedal setting
- MIDI Volume/Pan settings
- Multimode Enable settings

The processor directly interfaces with the clock, data input and chip select of the EEPROM using three pins of a dedicated output port (OP1-3).

The 50-pin expansion bus supports cards using an 8-bit data bus. On the ESI-32 a 74HCT245 transceiver chip is used to buffer the data bus to the expansion card. On the ESI-33 and ESI 4000, the buffer was deemed unnecessary and removed.

The MC68306 has eight dedicated chip select output pins which can be extensively programmed for address range, number of wait states and read/write access. Seven of these selects go directly to a peripheral. The remaining output, CSDTACKN, gets further decoding on this page into seven additional chip selects, all of which generate their own DTACK. This chip select is programmed by the MC68306 to prohibit generation of an automatic DTACK.

The processor's DRAM is mapped at the end of memory:

DRAM f80000-ffffff (256K x 16)

Front Panel Interface (Page 5)

A 20-pin connector connects to the front panel board. The 8 data bus lines are connected through 270 ohm damping resistors. The ground and power pins on this header are chosen so that incorrect insertion of the connector should not be catastrophic. The two data encoder lines (ENCA & ENCB) are also carried by this cable.

Note: There is an unfortunate flaw in both the ESI-33 and the ESI 4000 related to the LCD. Inductor L4, located near the left front board screw tends to break off due to board warping and stress. Symptoms of this problem are a flickering LCD or no boot. Flex the PCB to isolate LCD flicker to this cause.

The backlight transformer generates high voltage for the LCD backlight on the ESI-32 only. The HV is carried on its own twisted pair cable to the LCD. LED driven backlights are used on the ESI-33 and ESI 4000 and so a HV supply is not needed on these products.

The LCD has its own ribbon cable which carries data bus bits 8-15, the LCD enable, +5V, ground and the contrast control voltage for the LCD. The contrast voltage for the LCD is generated using four bits from miscellaneous port B on the MC68306. The values of the four bits have been chosen to create a "cheap DAC" which generates 16 different contrast voltages.

Floppy Disk Interface (Page 6)

An Intel 82078 Floppy Disk Controller chip is used to interface with the floppy. This interfaces to D8-D15 of the data bus and A1-A3 of the address bus. The ESI-32 has its own PAL (described below) which generates the unusual read and write signals that the floppy controller needs. In the ESI-33 and the ESI 4000, the floppy read/write signals are generated in the main PAL on page 2.

A 74HCT393 divider is used to divide the floppy disk's 24 MHz clock down to 3 MHz which is used by the MC68306 to generate the MIDI baud rate.

The ESI-32 PAL has several responsibilities:

- Generates the special read and write signals for the floppy controller
- Generates DTACKN for the floppy controller
- Generates DTACKN for the LCD
- Generates DTACKN when reading the sample latch
- Routes the DSP's DTACKN to an open collector DTACKN
- Converts the expansion card's WAITN to DTACKN
- Inverts the LCD chip select to active high
- Implements a Schmitt trigger for RESET and RESETN

The PAL on the ESI-33 and ESI 4000 implements the first four functions as well as others described in the text.

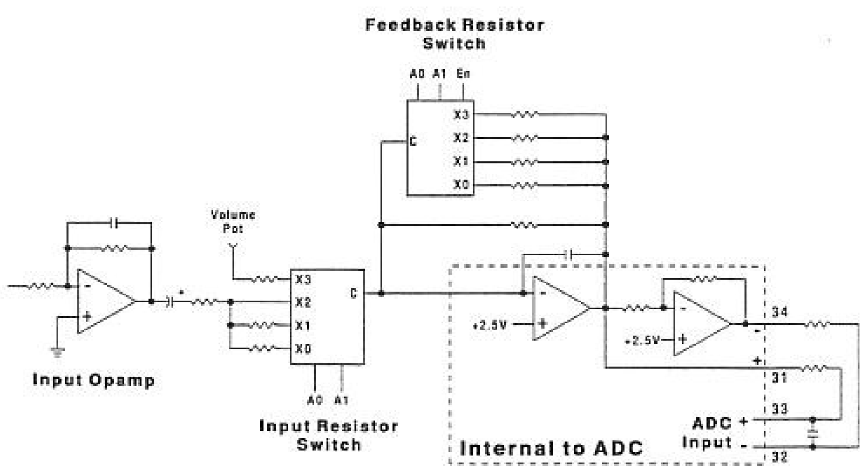
MIDI Interface (Page 7)

This page shows the standard MIDI interface receiver using a PC400 optoisolator and open-collector transistor drivers on MIDI Out and MIDI Thru. MIDI data is transmitted at 31250 baud with a data format of one start bit, eight data bits, and one stop bit with no parity.

Analog Inputs (Page 8)

The input gain scaling stage is a little hard to decipher as drawn in the schematic. Each input goes into an inverting buffer op amp with 10K ohm input impedance and an ESD protection zener. The RC in the feedback loop provides the single-pole anti-aliasing lowpass filter required by the ADC.

Simplified Schematic of Input Gain Scaling



The Phillips SAA7360 has two op amps built in, both inverting and both with their non-inverting inputs internally tied to VREF (2.5V). The first op amp has both its inverting input and output brought out to pins. This op amp will be used for gain scaling. The second op amp is hard-wired to simply invert the output of the first op amp. The outputs of these op amps get internally connected to the final differential input of the ADC.

The input (after the first external op amp), goes through a 1 of 4 analog switch (1/2 4052) into the input of the ADC's first op amp. In the feedback loop, is another 1 of 4 switch. By switching in different resistors to the input and feedback, the gain is varied. There are 3 switches for the input resistor and four switches for the feedback resistor which would seem to yield 12 possible input gain values. The 4052 in the feedback loop can be entirely switched out leaving a large (330K) resistor in the feedback. This trick gives us 3 x 5 =15 different gain values. The resistors are precisely scaled to provide 4dB steps from -16dB to +40dB.

When not sampling, the ADC reads the volume pot voltage, which is brought into X3 of the 4053.

The ADC runs on a sample rate clock which is 64 times the actual sample rate. It outputs 32 bits per sample to the 16-bit shift register form using 2 74HCT299s (U17 & U19). Only the first 16 bits (MSB first) from the shift register are valid data. The FS2N signal is a square wave at twice the sample rate going high on the first 16 valid bits and low on the last 16 invalid bits. This signal is used to halt the 299 shift registers from shifting the invalid bits. The CSSAMPLEN, FS1 and FS2 are decoded by the PAL to hold off DTACK until the 16 valid bits have been loaded into the shift register.

G-Chip (Page 9)

The G-chip 2.0 controls up to 64 channels of sound ROM addressing, volume shaping and pitch shifting. Only 32 channels are used in the ESI-32 and ESI-33. The ESI 4000 uses all 64 channels of the G-Chip.

The G-Chip is interfaced directly to the main CPU's address and data bus. The G-Chip controls all sound memory writes, RAS/CAS addressing and refresh for up to 128 Mbytes of dynamic RAM. It also generates its own DTACKN signal back to the MC68306. Referring to the block diagram, you can see that the Sound RAM is connected only to the G-Chip. The main CPU can read and write Sound RAM but must request the G-chip to do so. The G-Chip runs on a 22579200 Hz clock which is 512 times the sample rate (FS512).

The ESI-32 and ESI-33 can address up to 32 MB of Sample RAM using 12 address lines plus RAS and CAS. The ESI 4000 can address up to 128 MB of Sample RAM using 12 address lines and 4 RAS and 4 CAS lines. All the G-Chip address lines on the ESI 4000 are buffered through 74ACT244s and damped with 22 ohm resistors. The address buffering compensates for the extra loading of certain types of DRAM.

Sound data is output from the G-Chip via two serial interface lines (SRCD0 & SRCD1) which handle the even and odd channels respectively. The ESI-32 and ESI-33 use only the odd channel line SRCD1. The ESI 4000 uses both lines. A serial data clock (GSYNC) synchronizes the output data with the H-Chip(s).

H-Chip (Page 10)

The H-Chip is a multichannel filter chip capable of implementing up to (32) 6-pole lowpass filters with resonance or a myriad of other filter algorithms. They also have bus mixing and volume contouring capabilities.

The ESI-32 and ESI-33 use a single H1.5-Chip and the ESI 4000 uses two H1.5-Chips to implement 64 filter channels (one H-chip each for the even and odd channels).

Like the G-chip, the H-chips interface directly to the address and data buses and run on the FS512 clock. It generates it own DTACKN signal to the MC68306. Sound data is input to the SRCD input. In the ESI 4000, the H-chips are linked via a data cascade line (CSCD0). DAC data is output from pin 57 (DACD).

On the ESI-32 the DAC data signal is called DSPINDATA and is connected to the expansion header where it connects to DACDATA via a jumper. This DSP connector, which is only found on the ESI-32, was never utilized.

The H1.5-chips have a built in DAC interface system and supplies three signals to the DACs. These signals are resistor damped to reduce ringing and line noise.

DACDATA - which is sent to all the DACs. On the ESI-33 and ESI 4000, the DACDATA signal is resistor damped to form the signals EXPDATA and DACDATA (expansion header and DACs)

DCLK - The DAC Clock. On the ESI-32 this signal is resistor damped into the following signal names: MAINLCLK, DACCLK, SUBRCLK, SUBLCLK, MAINRCLK. On the ESI-33 and ESI 4000, DCLK is resistor damped into: MAINCLK, DACCLK and SUBCLK.

LEN: Each DAC has its own Data Latch Enable which is generated by strobe outputs 0, 1, 2, 7 on the final H1.5-Chip. These go low to latch the proper 18-bit data word into each DAC.

DACS & Output (Page 11 & 12)

The output sections are identical for all ESI models. The Analog Devices 18-bit DACS are powered by ±5V supplied by 78L05 and 79L05 100 mA regulators (7805 in the ESI-32). The regulators run on ±12V from the switching supply. The DACs have a serial input and do not require the use of a sample/hold deglitcher on their output.

The output of the DACs go into an op amp reconstruction filter, which is a sharp lowpass cutoff filter with sin(x)/sin correction. The cutoff frequency of the filter is 19.5 kHz. The purpose of the reconstruction filter, as you probably already know, is to remove the "stairsteps" in the signal which are generated as a result of the D/A conversion process.

Both halves of a 4052 dual analog switch are used to feed the analog signal from the sample inputs to the output op amps during sampling so the sample inputs can be monitored through the main outputs.

The output amplifiers, which use the second half of the op amp, are class AB. The transistors on the output provide drive when the current requirements exceeds 13 mA. The 13 mA current through the 270 ohm resistor causes a 0.6V base-emitter voltage, turning on the NPN 2N3904 (PNP 2N3906) transistor when the current is flowing positively (negatively) to the outputs. The output on these drivers are fed back to the op amp as a negative feedback error signal to maintain a very low distortion. Note that the transistor drivers are supplied from the unregulated ±12V DC power.

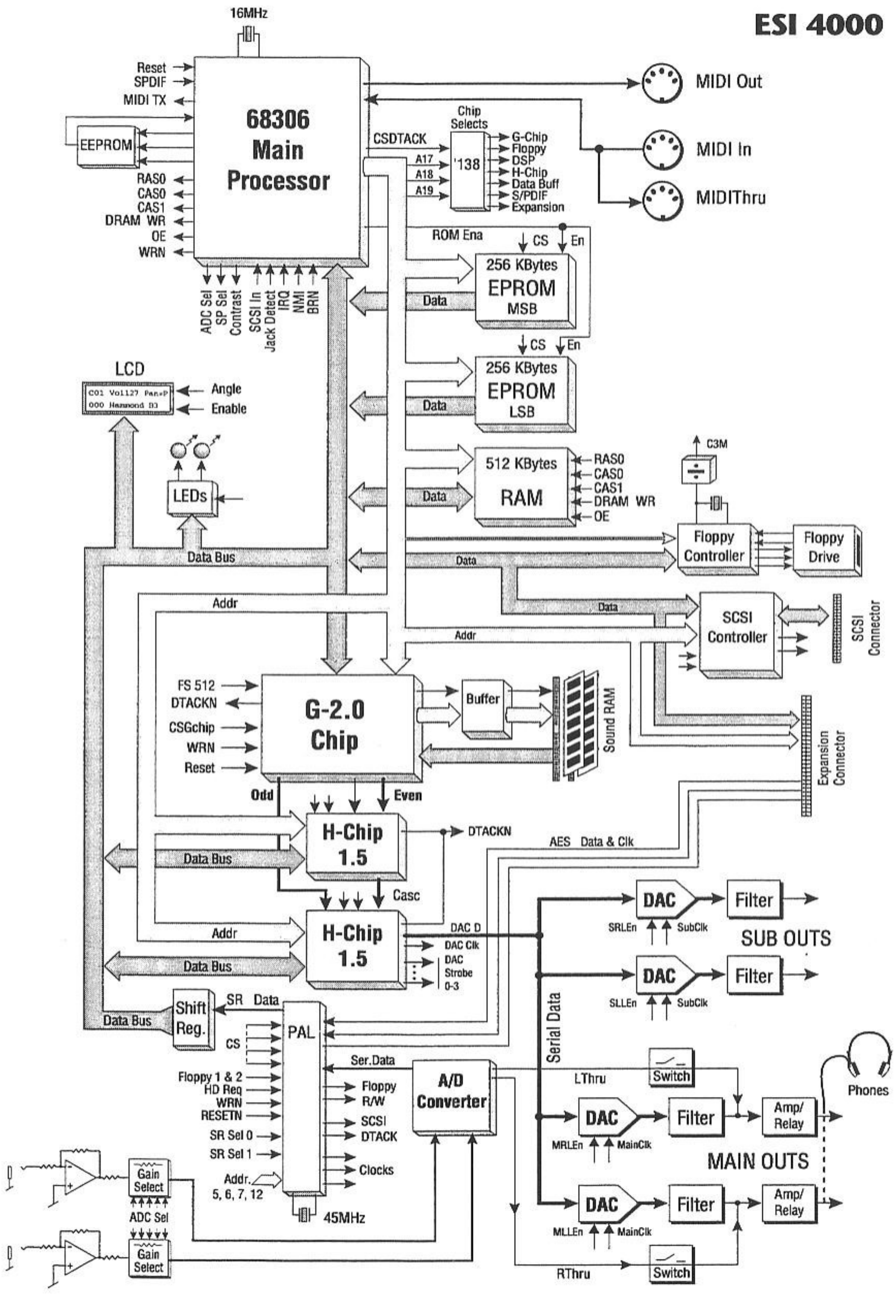
The main outputs incorporate a clever scheme using switched stereo jacks which allows them to function as separate left and right outputs when both plugs are inserted, left + right (mono) when just the right plug is inserted, or left + right (stereo) when a stereo plug is inserted into the left jack only.

The headphone jack is tapped off before the main outputs. A 1/2 Watt, 22 ohm output resistor maintains a similar output power for 60 or 8 ohm headphones and provides short circuit protection.

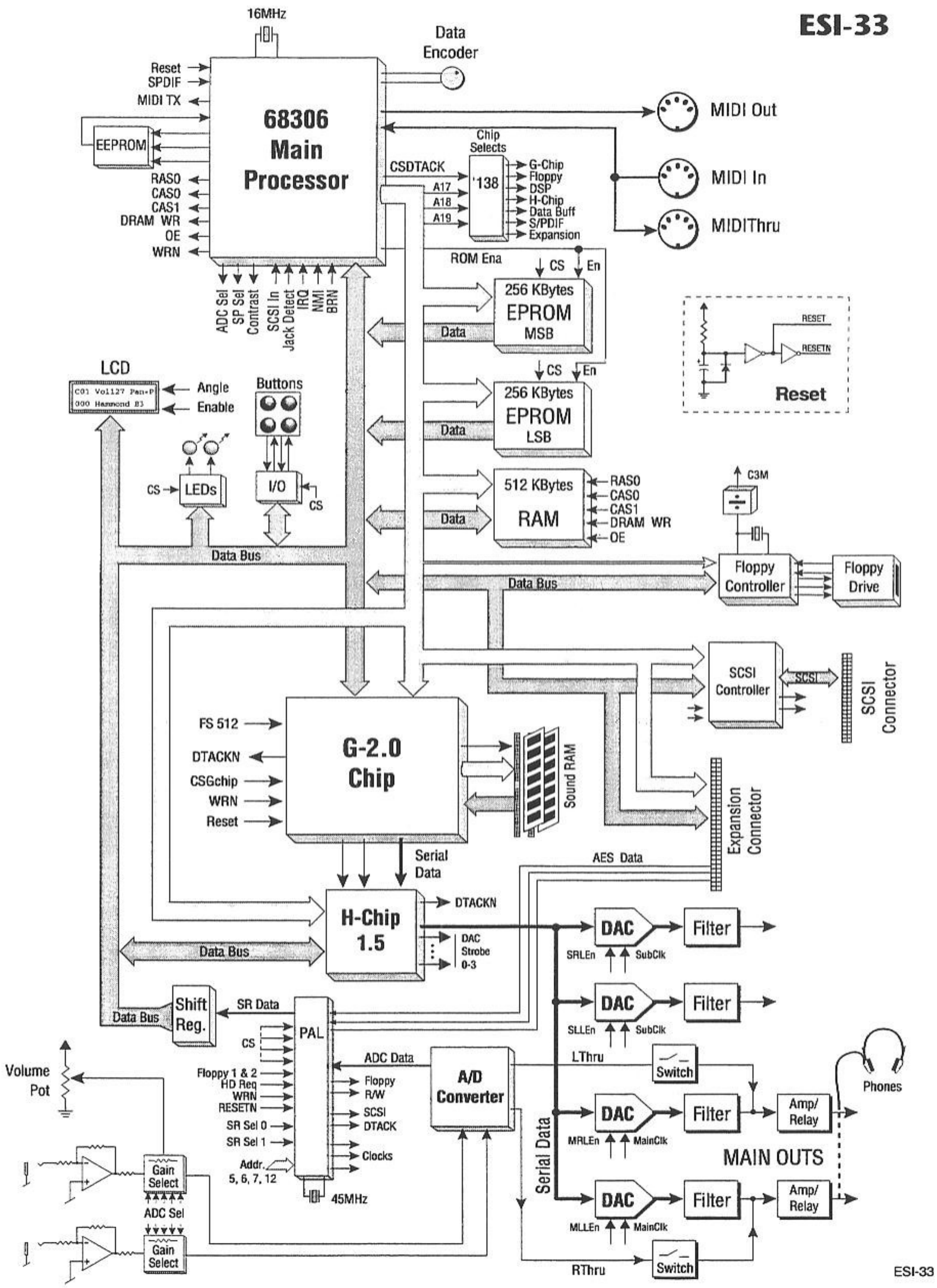
3904 NPN transistors are used to short each output to ground during power up and power down cycles to reduce voltage spikes on the outputs. A special reset circuit on page 11 is designed to turn the transistors on slowly during power up and turn them off quickly on power down.

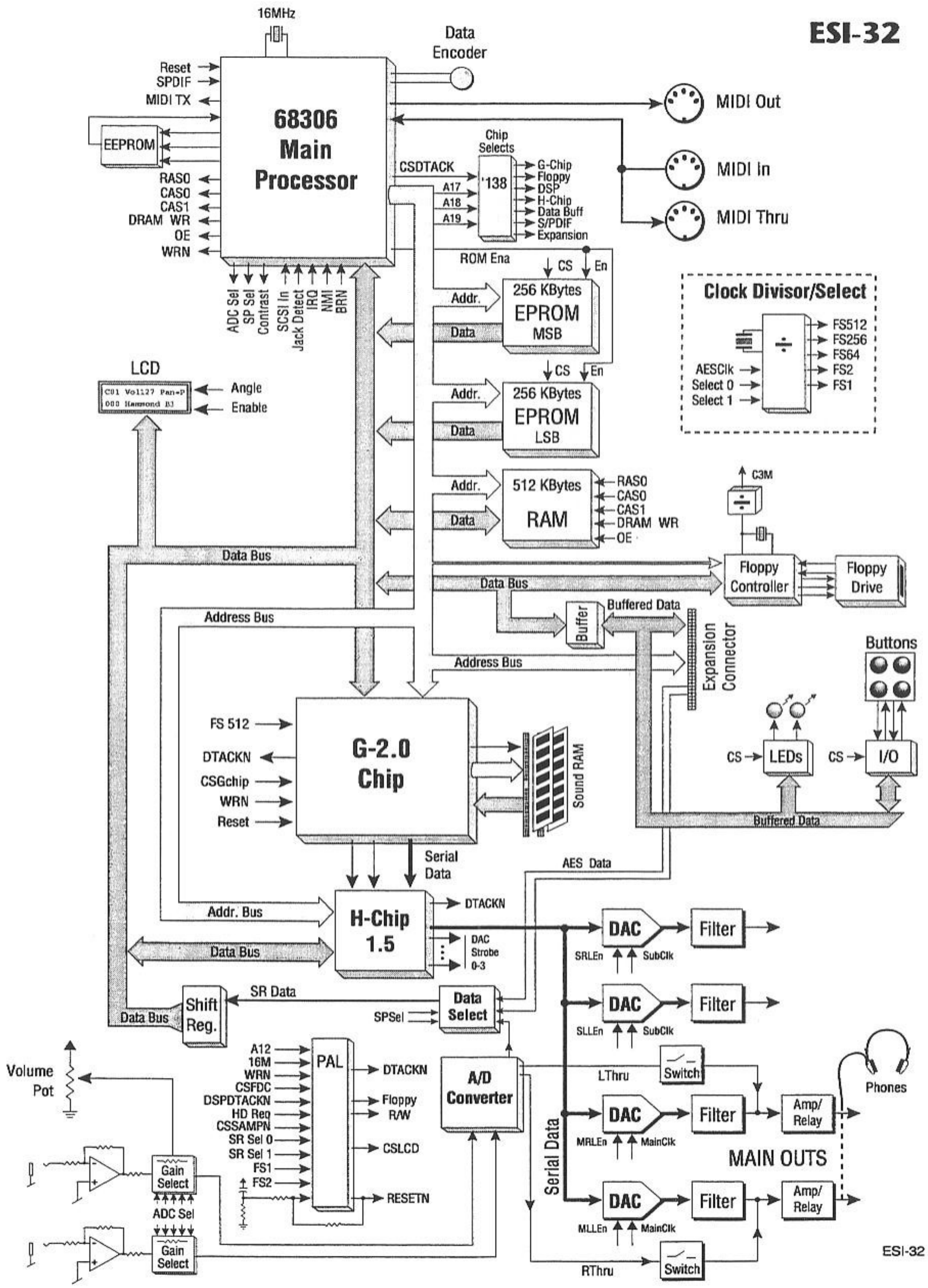
Circuit Board Flow Diagrams

The following three pages show the circuitry flow of the three ESI models. For detailed circuitry information, see the schematics in the last section of this book.


ESI 4000
16MHz
68306
Main
Processor
Reset
SPDIF
MIDI TX
EEPROM
RAS0
CAS0
CAS1
DRAM WR
OE
WRN
ADC Sel
SP Sel
Contrast
SCSI In
Jack Detect
IRQ
NMI
BRN
CSDTACK
Chip
Selects
A17
A18
A19
'138
G-Chip
Floppy
DSP
H-Chip
Data Buff
S/PDIF
Expansion
MIDI Out
MIDI In
MIDIThru
ROM Ena
CS
En
256 KBytes
EPROM
MSB
Data
256 KBytes
EPROM
LSB
512 KBytes
RAM
LCD
Angle
Enable
LEDs
C3M
Floppy
Controller
Floppy
Drive
Data Bus
Addr
SCSI
Controller
SCSI
Connector
FS 512
DTACKN
CSGchip
WRN
Reset
G-2.0
Chip
Buffer
Sound RAM
Expansion
Connector
Odd
Even
H-Chip
1.5
DTACKN
AES Data & Clk
Casc
DAC D
DAC Clk
DAC
Strobe
0-3
DAC
Filter
SRLEn
SubClk
SUB OUTS
SLLEn
Shift
Reg.
SR Data
PAL
CS
Ser.Data
Serial Data
A/D
Converter
LThru
Switch
Phones
Floppy 1 & 2
HD Req
WRN
RESETN
SR Sel 0
SR Sel 1
Addr.
5, 6, 7, 12
Floppy
R/W
SCSI
DTACK
Clocks
45MHz
Amp/
Relay
MRLEn
MainClk
MAIN OUTS
MLLEn
Gain
Select
ADC Sel
RThru

ESI-33


16MHz
Data Encoder
Reset
SPDIF
MIDI TX
EEPROM
68306 Main Processor
RAS0
CAS0
CAS1
DRAM WR
OE
WRN
ADC Sel
SP Sel
Contrast
SCSI In
Jack Detect
IRQ
NMI
BRN
MIDI Out
MIDI In
MIDIThru
Chip Selects
CSDTACK
A17
A18
A19
'138
G-Chip
Floppy
DSP
H-Chip
Data Buff
S/PDIF
Expansion
ROM Ena
CS
En
256 KBytes EPROM MSB
256 KBytes EPROM LSB
Data
512 KBytes RAM
RESET
RESETN
Reset
LCD
Angle
Enable
Buttons
LEDs
I/O
Data Bus
C3M
Floppy Controller
Floppy Drive
SCSI Controller
SCSI
SCSI Connector
FS 512
DTACKN
CSGchip
Reset
G-2.0 Chip
Sound RAM
Expansion Connector
Serial Data
AES Data
H-Chip 1.5
DAC Strobe 0-3
DAC
Filter
SRLEn
SubClk
SLLEn
Shift Reg.
SR Data
PAL
Floppy 1 & 2
HD Req
RESETN
SR Sel 0
SR Sel 1
Addr. 5, 6, 7, 12
45MHz
Floppy R/W
DTACK
Clocks
ADC Data
A/D Converter
LThru
Switch
Amp/ Relay
Phones
MRLEn
MainClk
MAIN OUTS
MLLEn
RThru
Volume Pot
Gain Select
ADC Sel
ESI-33


ESI-32
16MHz
Data Encoder
Reset
SPDIF
MIDI TX
EEPROM
68306 Main Processor
RAS0
CAS0
CAS1
DRAM WR
OE
WRN
ADC Sel
SP Sel
Contrast
SCSI In
Jack Detect
IRQ
NMI
BRN
CSDTACK
A17
A18
A19
Chip Selects
'138
G-Chip
Floppy
DSP
H-Chip
Data Buff
S/PDIF
Expansion
MIDI Out
MIDI In
MIDI Thru
ROM Ena
CS
En
Addr.
Data
256 KBytes EPROM MSB
256 KBytes EPROM LSB
512 KBytes RAM
Clock Divisor/Select
FS512
FS256
FS64
FS2
FS1
AESClk
Select 0
Select 1
LCD
Angle
Enable
C3M
Floppy Controller
Floppy Drive
Data Bus
Address Bus
Buffer
Buffered Data
Expansion Connector
Buttons
LEDs
I/O
FS 512
DTACKN
CSGchip
Reset
G-2.0 Chip
Sound RAM
Serial Data
AES Data
Addr. Bus
H-Chip 1.5
DAC Strobe 0-3
DAC
Filter
SRLEn
SubClk
SLLEn
MRLEn
MainClk
MLLEn
SR Data
Shift Reg.
SPSel
Data Select
A12
16M
CSFDC
DSPDTACKN
HD Req
CSSAMPN
SR Sel 0
SR Sel 1
FS1
FS2
PAL
Floppy R/W
CSLCD
RESETN
A/D Converter
LThru
RThru
Switch
Amp/ Relay
Phones
MAIN OUTS
Volume Pot
Gain Select
ADC Sel
ESI-32

Schematics

