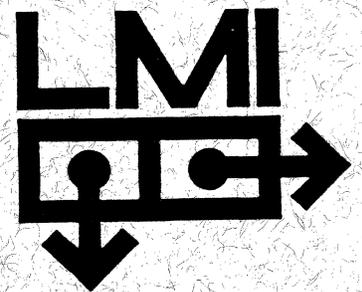


**THE LMI LAMBDA
FIELD SERVICE MANUAL**



The LMI Lambda Field Service Manual

This manual is current for "UNIX 2.10 + LMI", "LMI 12/5/83 Root" and "lboot 64". It will be updated as necessary to accommodate revised software.

To ensure your satisfaction with the LMI Lambda, LMI maintains a Customer Service Help Line, open Monday through Friday, 9 AM-5 PM (Eastern time). This service is free and open to all LMI customers. Call the Help Line, 617-876-6819, if you have bug reports or questions.

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Information in this document is under development, and so may change without notice.

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EMERGENCY POWER DOWN

IMMEDIATELY:

- Turn off (down) the main power switch on the back of the LMI Lambda, or
- Unplug the LMI Lambda's main power cord.

Important: Flipping the switch is faster, since the power cord has a twist-lock plug.

In case of an emergency, such as smoke, fire, or exposure to water, this procedure will minimize the chances of damaging your machine.

Once you have done this, call LMI.

Chapter 1

SOME DOCUMENTATION BASICS

1.1 Conventions in Documentation

By convention, phrases such as "type to (or at) the SDU" refer to operations that must be done using the Zenith Z29 terminal or equivalent, before either LISP or UNIX is booted.

Unless otherwise stated, each command is followed by a <RETURN>. In multiple commands, each end-of-line signals a <RETURN>.

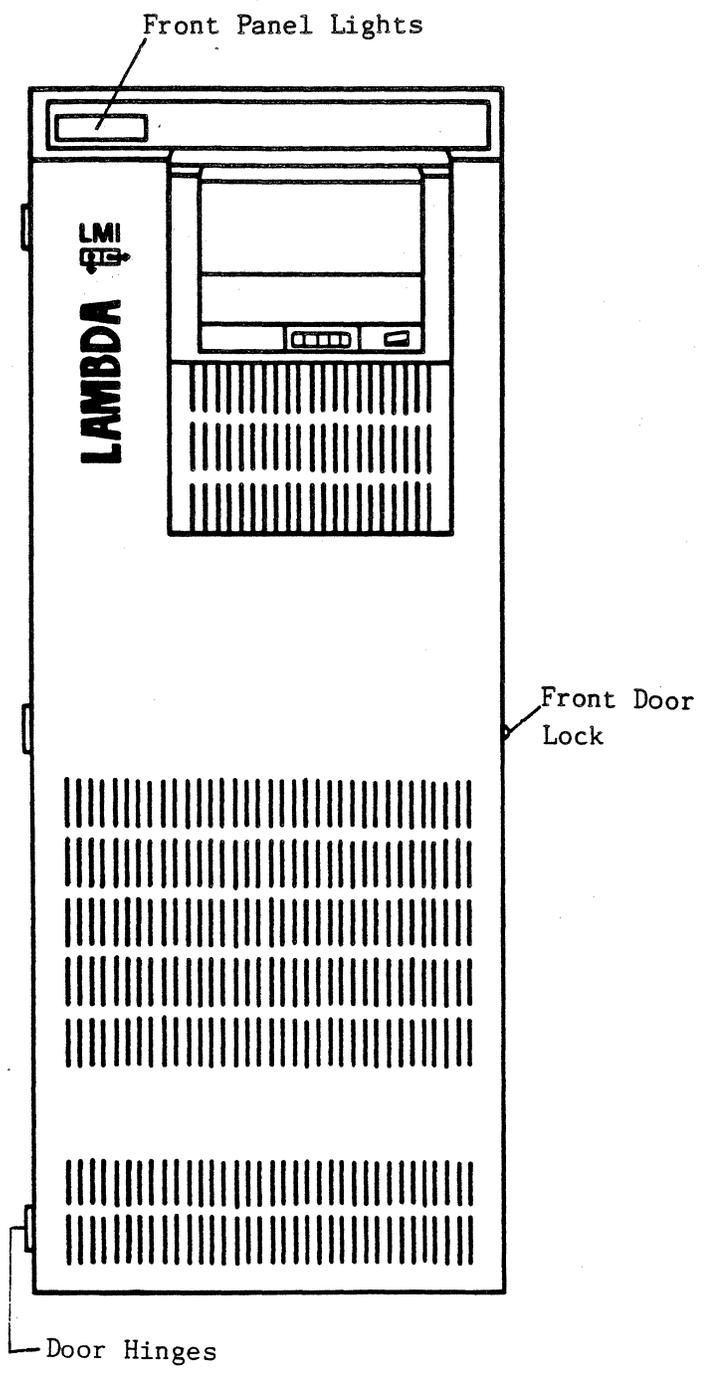
1.2 LMI Policy on Software Updates

LMI documentation is updated by revisions and expansions of hardcopy documentation, by continuing updates of online documentation, and by the LMI PROGRAMMERS' NEWSLETTER, sent free to all LMI Lambda and CADR owners.

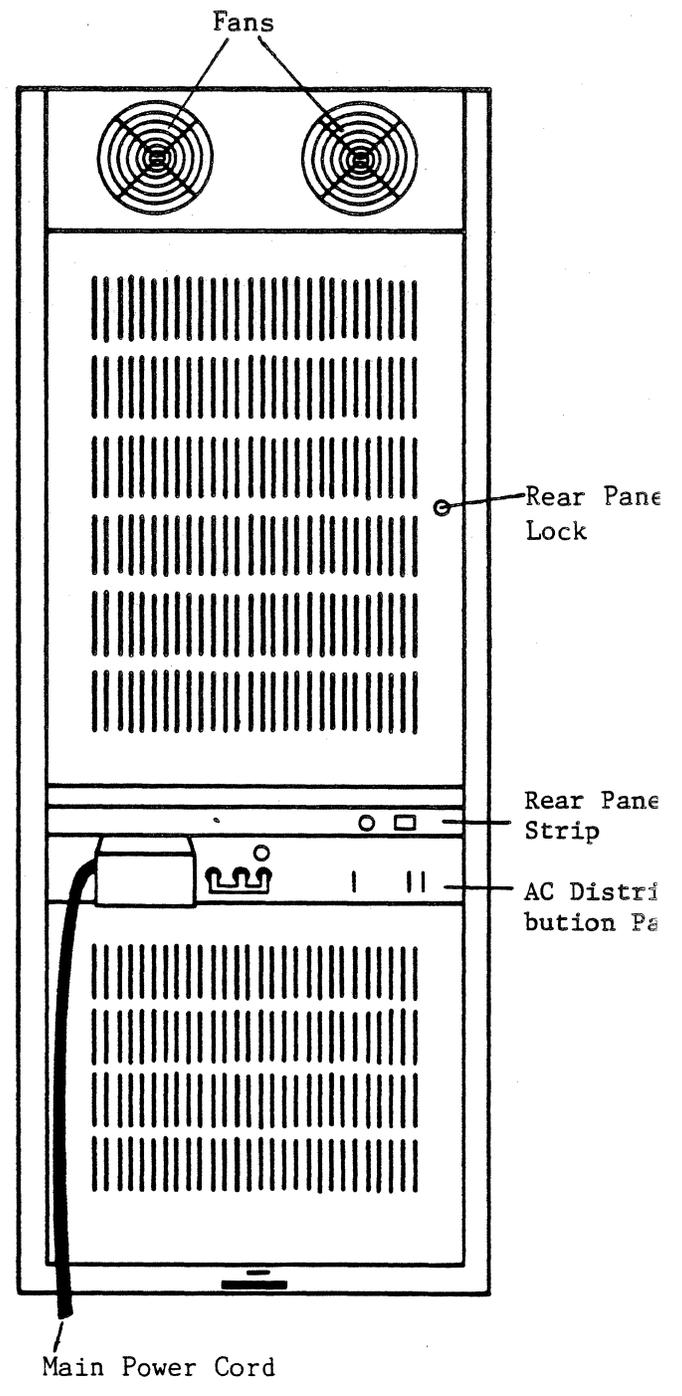
This manual covers features that we anticipate will be changed in the next few months, particularly after the next release of the UNIX system. To keep up with current software changes, free updates of this manual are provided promptly to all customers.

Please feel free to call LMI's Customer Service Help Line, 617-876-6819, to get answers to your questions about the system.

FRONT VIEW OF LMI LAMBDA
WITH CIPHER 1/2" TAPE DRIVE



REAR VIEW OF LMI LAMBDA



Chapter 2

INTRODUCTION

The LMI Lambda is a modular system with a standard hardware configuration consisting of a system cabinet, high-resolution display terminal, console terminal, and connecting cables.

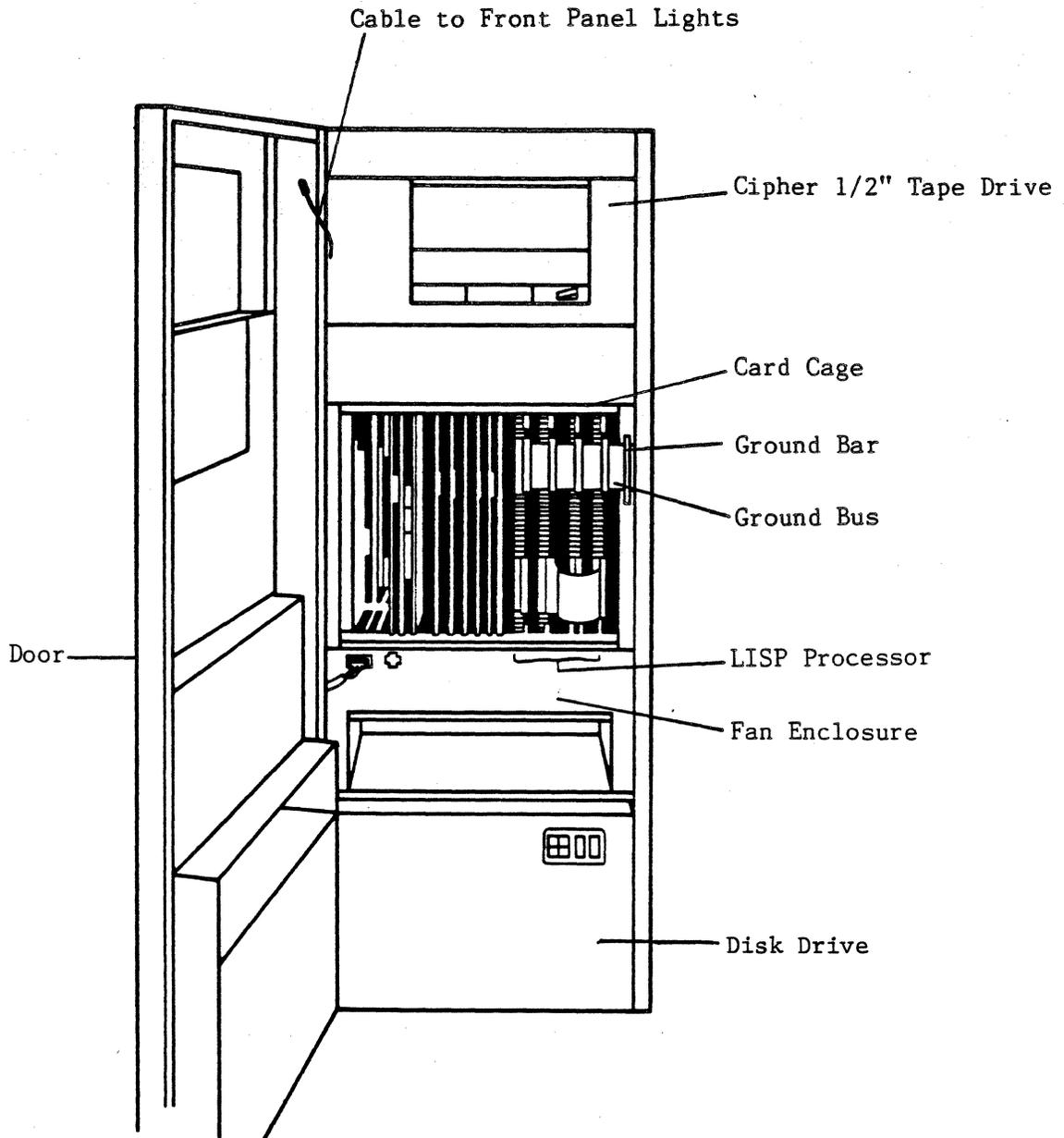
System installation should be performed by LMI personnel only. All installation instructions contained in this manual are solely for customer reference.

This manual provides customers with site preparation instructions, which must be followed before a system can be installed, and with procedures customers may use for troubleshooting problems.

To facilitate its use, this manual has been divided into six sections, as follows:

- LMI Lambda System Components
- Site Preparation
- Installation
- System Operation
- Troubleshooting
- Preventive Maintenance

FRONT VIEW OF LMI LAMBDA WITH CIPHER 1/2" TAPE DRIVE, DOOR OPEN



Chapter 3

LMI LAMBDA SYSTEM COMPONENTS

3.1 Major Components

The LMI Lambda System consists of a main cabinet, high-resolution monitor, and console monitor.

3.1.1 Main Cabinet

In addition to filters, fans and cabling, the main cabinet contains the following:

- AC Distribution Panel
- Rear Panel
- Disk Drive
- Card Cage
- Tape Drive

The monitors, keyboards, and mouse are attached to the main box by cabling.

3.1.1.1 AC Distribution Panel

This unit contains a main power rocker switch, main power cable, 10 Edison-style plugs, 3 remote control jacks, and a 250V, 1/8 A slow-blow fuse.

3.1.1.2 Rear Panel

This unit, directly above the AC Distribution Panel, holds the rotary switch and LMI Lambda RESET button.

3.1.1.3 Power Supplies

The two power supplies are plugged into the AC distribution panel. The smaller supply produces +/-12V DC power to the card cage and the larger one supplies the card cage with +/-5V DC. "DC OK" and "AC OK" signals are also produced by the supplies to protect the SDU's CMOS RAM against power loss.

3.1.1.4 Disk Drive

The Fujitsu Eagle Winchester M2351A Mini-Disk Drive plugs into the AC power distribution panel. Since it contains its own DC power supply, it does not draw power from the card cage power supplies.

3.1.1.5 Card Cage

Slots in the card cage are numbered from 0 at the right to 20 at the left, as viewed from the front of the machine. The card cage contains two busses, the industry-standard Intel Multibus and the NuBus. The Multibus, slots 13-20, has standard 16-bit data and 20-bit address space, and is used for connecting standard peripherals. The NuBus includes slots 0-15 on the backplane. To maximize user flexibility, slots 13-15 can be used for either the Multibus or the NuBus.

IMPORTANT: The private backplane for the LMI Lambda LISP processor occupies slots 0-7 on the backplane. To avoid damage to the system, insert only LMI Lambda boards in these slots.

3.1.1.6 System Diagnostic Unit--SDU

This board, which occupies slot 15 of the card cage, is the source of the NuBus clock and is the bus connector between the NuBus and the Multibus. Features include the following:

- Intel 8088 microprocessor chip
- PROMs and monitor to run diagnostics, boot LISP or UNIX, and control the system's 1/4" cartridge tape streamer interface
- CMOS RAM and rechargeable battery
- Analog to digital converter
- Two RS232 ports

- Bus converter

3.1.1.7 LMI Lambda LISP Processor

The LISP processor consists of four boards, referred to as the RG, MI, CM and DP boards.

Together they form an independent processor for LISP, comparable to the 68000 processor board for UNIX. More information on the LMI Lambda LISP processor is available in the LMI Lambda Technical Summary.

3.1.1.8 Memory Board

The Memory Board contains a 1/2-megabyte memory bank as well as error correction circuitry (ECC), which corrects single-bit memory errors and detects 2-bit memory errors. The memory is capable of 2-, 4-, 8-, or 16-word transfers.

3.1.1.9 Multibus Boards

Multibus boards, which are mounted on triple-high Eurocards ("carrier cards") for standard size and ease of insertion, include the following:

Disk controller board

The LMI Lambda uses Interphase Corporation's SMD 2181 disk controller. It runs the Fujitsu Eagle disk drive and plugs directly into the Multibus, serving as a bus master during data transfer.

The board contains several dip switches and jumpers, which have been preset and should not be altered. Information on the dip-switch settings and jumpers is contained in Appendix C for reference only; users are requested to call LMI rather than reset dip switches or jumpers themselves.

Resetting of dip switches should be necessary only during the installation of an additional disk controller, when a system is expanded to more than four disk drives.

Tape controller board

Manufactured by Computer Products Corporation, the CPC Tapemaster 1/2" magnetic tape drive controller is Multibus-compatible and controls up to eight 1/2", formatted, start-stop or streaming tapes. It functions with 16-, 20-, or 24-bit

addressing, single or multiprocessor.

Ethernet controller board

Manufactured by 3-Com, it conforms to DEC, Intel, and Xerox 1.0 specifications.

3.1.1.10 Optional Boards

There are many optional boards. The following are among those that may be used in a typical configuration:

- The 68000 UNIX processor board, which occupies slot 11, contains one 68000 chip and a 4K word cache.
- Additional optional memory is also available. Present memory boards have a capacity of 1/2 megabyte (128K words) of storage; 1- and 2-megabyte memory boards are under development.
- The Multibus carrier card for user-supplied peripherals, occupying one slot in the card cage for each designated peripheral. In most systems, Multibus carrier cards for the disk drive, tape drive, and Ethernet occupy three of the Multibus slots.

The Multibus is designed to accommodate a wide variety of user-supplied peripherals. However, LMI cannot guarantee proper function of peripherals not installed by its representatives. We suggest contacting LMI before installing peripherals.

The NuBus is also designed to accommodate user-supplied peripherals. At this time their production and distribution is limited to LMI and Texas Instruments; we welcome your interest in developing or interfacing user-supplied peripherals for the NuBus.

3.1.1.11 Tape Drive

The tape drive, Cipher Data Products Model F880 1/2" magnetic tape streamer unit (MTSU), is a dual-speed, 1600-bpi tape transport. The unit features dual-gap head and read-after-write capacity, with read/write, control, and formatting electronics incorporated in one printed circuit board (PCB).

The Quarterback 1/4" cartridge tape drive is a low-cost, high-performance option. The interface for this tape is included on the SDU board; thus an additional tape controller board is not required. Each tape drive provides up to 20 megabytes of user data storage and can record and read in streaming mode at 8,000 bpi.

3.1.1.12 Cabling

The following cabling, supplied with the LMI Lambda System, must be checked before installation for proper placement.

The MAIN POWER CABLE is a 30A twistlock.

The AC DISTRIBUTION PANEL has the following cabling:

- Two coaxial cables connect the AC distribution panel to the backplane.
- Power cables connect the AC distribution panel with the power supplies, fans, disk drive, and tape drive.

The BACKPLANE is cabled as follows:

- Regulated DC cable runs to the backplane from the power supplies. The power supplies plug into the AC distribution panel.
- A transceiver cable connects the Ethernet transceiver to the Ethernet controller port at the back of the machine.
- Two gray ribbon cables connect the tape drive to the tape controller, at the back of slot 17.
- Two ribbon cables, one gray and one multicolored, connect the disk drive to the disk controller, at the back of slot 16.

Four cables are attached to the SDU paddlecard in the bottom connector at the back of slot 15. Each is keyed so that it cannot be plugged in upside-down. Still, it is fairly easy to skew these cables when inserting them, so check carefully. The cables go:

1. From the power supply sensors to the "P/S" plug on the SDU paddlecard.
2. From the front panel lights to the "Front Panel" plug on the SDU paddlecard.
3. From the rotary switch and the RESET button at the back of the machine to the "Rear Panel" plug on the SDU paddlecard.
4. From SDU ports A and B to the "Serial I/O" plug on the SDU paddlecard.

3.1.2 High-Resolution Terminal (RSD)

A Moniterm black-and-white, high-resolution monitor (800x1024 pixels), provided with the LMI Lambda System, consists of the following:

- Three-pronged power cord connector
- Connector for specially-configured cabling
- Keyboard port
- Port for mouse.

A standard AI keyboard and cable, and an optical mouse, are also provided.

Chapter 4

SITE PREPARATION

General site requirements include cleanliness, uninterrupted air flow, sufficient space for access front and back, and suitable power. To maintain air cleanliness, designation of the installation site as a NO SMOKING area is highly recommended. The computer room should have "clean" power and good grounding to avoid crashes and system malfunctions. Air-conditioning should be sufficient to maintain the machine room at or below 75 degrees Fahrenheit.

To prevent line noise, the length of cabling from the high-resolution monitor to the main cabinet should not exceed 150 feet.

4.1 System Dimensions and Weight

Uncrated, the LMI Lambda System main cabinet stands 60" high, 35" long and 22" wide. Crated dimensions are 70" x 44" x 36". Weight is approximately 500 lbs. crated, including the tape and disk drives. Uncrated, the monitor dimensions are 16" high, 13 1/2" long, and 11 7/8" wide. Crated dimensions are 24" x 20" x 20".

4.2 Ambient Requirements

4.2.1 Temperature

The LMI Lambda should be operated at between 13-33 degrees C (55-85 degrees F); temperature changes should not exceed 10 degrees C (18 degrees F) per hour.

4.2.2 Relative Humidity

Relative humidity should be 20-80%, noncondensing.

4.2.3 Power Requirements

Line filtering and an uninterruptible power source should be used to prevent poor performance due to voltage irregularities. A dedicated line is preferable.

For the following equipment,

- Cipher 1/2" F880-2 tape drive
- Cipher 1/4" F420-90 tape drive
- Fujitsu (474-megabyte) Eagle disk drive, M2351A
- Main cabinet
- Card cage boards

the following power requirements apply specifically:

Input voltage 110 VAC, +10%, -5%, 47-63 Hz, single-phase.

Input current

30 Amp. maximum. (Actual operating current is less than 20A.)

Power Dissipation

6400 BTU/hr maximum (1870 W).

Plug type

Hubbel 2611 30A., 125V twistlock.

Chapter 5

INSTALLATION

IMPORTANT: Your LMI Lambda will be fully installed by LMI personnel. The following information is supplied for your reference only. Additional disk drive installation information, including drawings of the machine and cabling, can be found in the Texas Instruments NuMachine Installation and User's Manual.

Note: Parts of the NuMachine Installation and User's Manual do not apply to LMI Lambda installation procedures. In all disagreements, use this manual as the definitive word on LMI Lambda installation.

5.1 General Installation

Unpack the LMI Lambda from its shipping crate. Save all shipping boxes, if possible, since that will facilitate returns in case of shipping damage or malfunction. Check for external damage in shipping, for instance dents or any other indication that the system has been dropped or roughly handled.

Open the front panel door and inspect for internal damage:

- Devices snapped from their mounts
- Broken boards
- Cables improperly attached.

5.2 Disk Drive Installation

For shipments within the United States, the Fujitsu Eagle Disk Drive is mounted in the rack. For shipments overseas, it is packaged separately. Please disregard the section on "Rack-Mounting the Disk Drive" if it is already mounted.

Detailed information about the Fujitsu Eagle and diagrams of it are in its manual, which you have received as part of your LMI Documentation Package. Please refer to it as necessary.

5.2.1 Rack-Mounting the Disk Drive

Installing the Fujitsu disk drive in its rack requires two or even three people. This is the recommended procedure:

1. Remove the disk drive from its shipping container.
2. The lower portion of the main cabinet contains slides on both sides. Pull these out until the latch mechanism activates.
3. Mount the disk drive onto these slides and push the slides toward the rear of the cabinet. Verify correct operation of the slide mechanism by pulling the drive in and out of the cabinet. CAUTION: Do not extend the disk drive and tape drive units simultaneously or the machine may fall forward.

5.2.2 Checking the Disk Drive for Shipping Damage

1. Remove the cover of the disk drive and inspect the inside.
2. Check for shipping damage, such as loose or missing parts or foreign matter.
3. Make sure that the printed circuit boards in the unit are properly seated and in the correct positions.

5.2.3 Installing the Disk Drive

1. If the disk was shipped in the machine, just move the machine to its final place. Remove the hardware bolting the disk back to the machine cabinet. Don't lose the bolting hardware; you will need it if the machine ever needs relocation. This allows the disk to be slid forward until it is fully extended in front of the machine. Make sure the cable restraints on the left rear of the disk are loose, so that the disk has enough slack in the cables to allow it to slide forward. Slide disk out until fully extended, remove the black cover (3 screws), and use an 8" Phillips head screwdriver to unlock the disk head. The disk manual explains how to unlock the disk (see "Rotary Actuator Unlocking/Locking," p. 2-4 of that manual).
2. Remove any foam blocks around the disk.

3. Plug in the two disk cables (one wide, one narrow) as shown in this manual. The narrow grey cable goes on the left rear connector on the disk, with the red stripe on the right. The wide multicolored cable goes on the connector just to the right of the narrow cable. The tan and brown twisted pair of wires goes on the right.
4. Plug the disk into the AC distribution panel at the back of the machine.
5. Attach the ground cable shorting plate to the terminals labelled "SG" and "FG2".
6. Replace the disk drive cover and reinsert its securing screws, as described in step 1.
7. Slide the disk drive back into the cabinet.

5.3 Installing Cards and Cables

All cards should be in the machine when it arrives; so should all cables. However, they should be checked for accurate placement and seating.

The four boards of the LMI Lambda processor go in slots 0-7. The RG board goes in slot 0. The other three boards do not need to be in specific slots, but to avoid confusion we have adopted the following standard:

Slot	Board
0	RG
2	MI
4	CM
8	DP

The H-bus goes from the bottom connector on the front of the RG board to the bottom connector on the front of the CM board. The ground bus connects the top connectors of all four LMI Lambda boards and bolts to the right of the card cage.

All four boards should be pushed carefully into their connectors. These boards tend to warp a bit, so you may have to fiddle with them to push them in.

As with all boards, the component side is on the right.

Each LMI Lambda board has its name, number, and version written on it with a white pen.

The rest of the boards are likewise inserted with the component side on the right.

<u>Slot</u>	<u>Board</u>	<u>Distinguishing Features</u>
8	VCMEM	Metal bar on front. 3 PROMs together at top
9	Memory 2	Says "Memory" on front edge
10	Memory 3	Says "Memory" on front edge
11	CPU	Only if UNIX system ordered. Metal bar on front; one 68000 microprocessor chip
12	Memory 1	Says "Memory" on front edge
13	Memory 4	Says "Memory" on front edge
14	Memory 5	Says "Memory" on front edge
15	SDU	Has battery in corner
16	Disk controller	On disk carrier card. One wide, 1 or 2 narrow cables
17	Tape controller	On tape carrier card. Two wide cables
18	Unused	
19	Unused	
20	3-Com Ethernet	On carrier card. Very narrow flat cable

5.4 Installing Paddlecards and Terminators

The left NuBus terminator goes in the top connector in slot 0 at the back of the machine. The right NuBus terminator goes in the top connector in slot 15 at the back of the machine. The only difference between the left and right NuBus terminators is that the left has at its bottom discrete resistors that are absent from the right terminator. Be sure not to confuse these two terminators; although doing so will not damage the equipment, it will make the LMI Lambda function improperly.

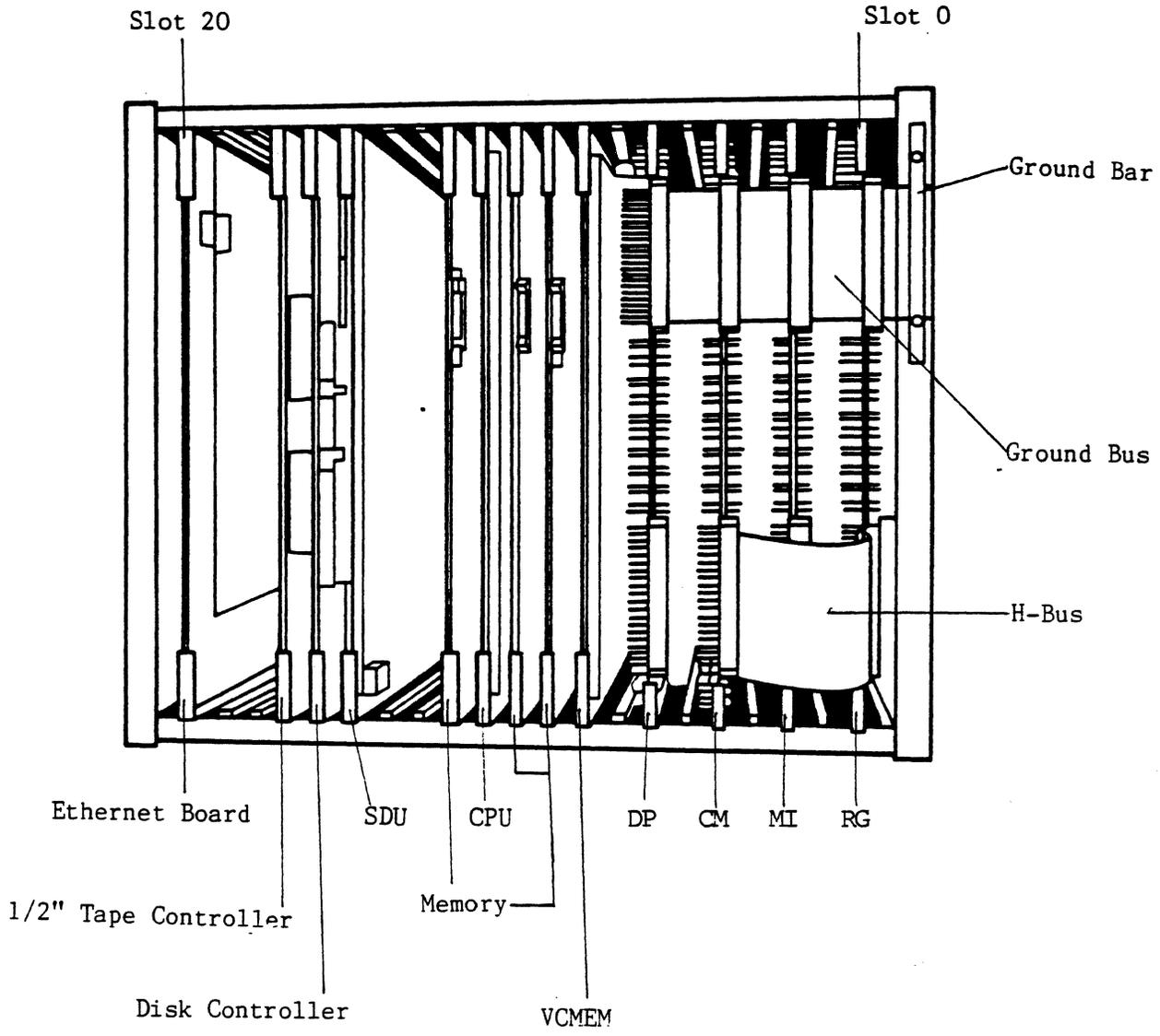
The Multibus terminator goes in the middle connector of slot 20, at the back of the machine.

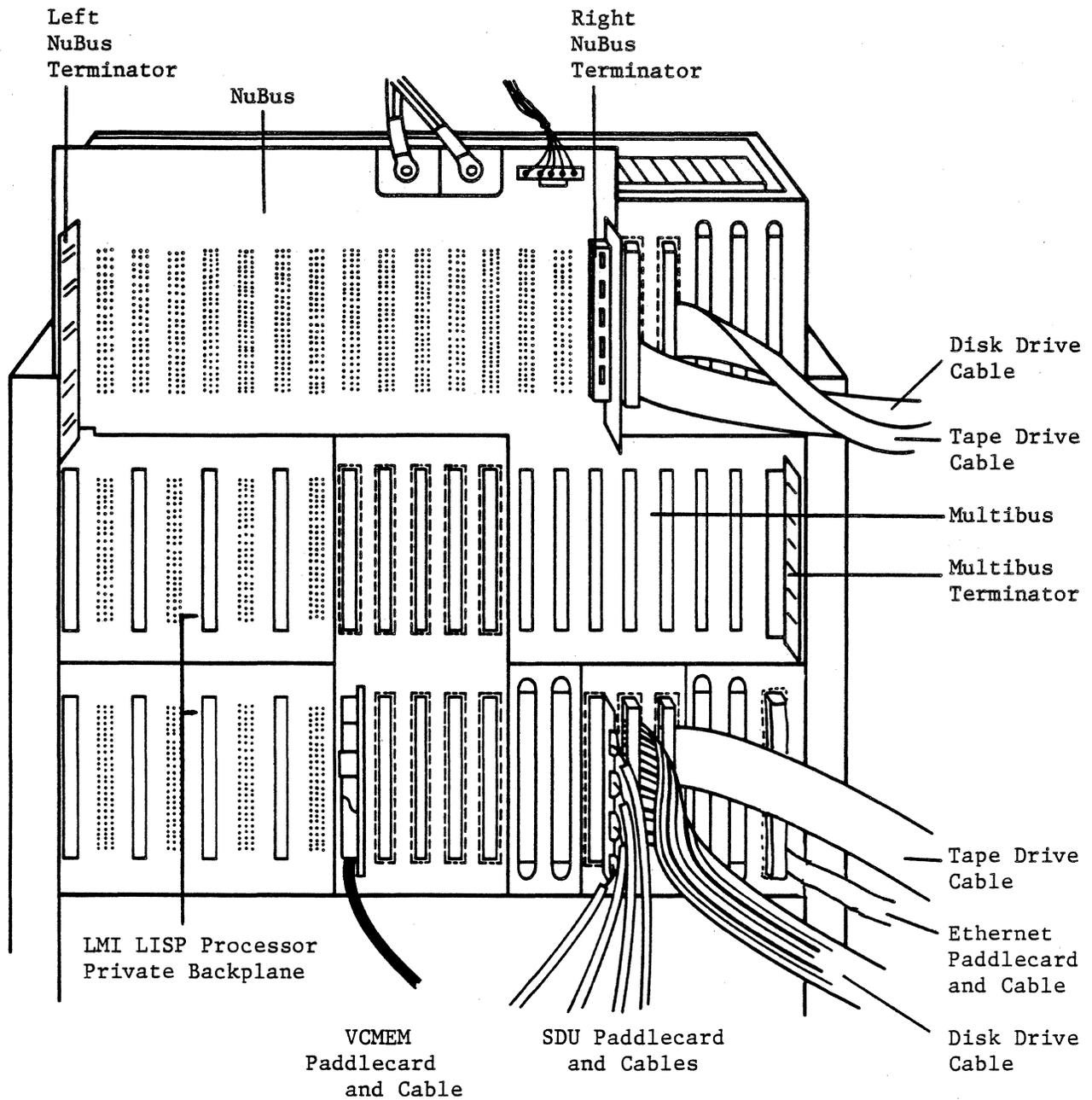
The VCMEM paddlecard goes in the bottom connector in slot 8, at the back of the machine. Two round cables run together from here to the high-resolution monitor cable connector.

5.5 Installing Monitors

To hook up an SDU console terminal, connect the top connector at the back of the Z29 to "SDU Port A", the male RS232 connector labeled on the back of the machine, using a standard, straight-through RS232 cable. Make sure the rotary switch on the

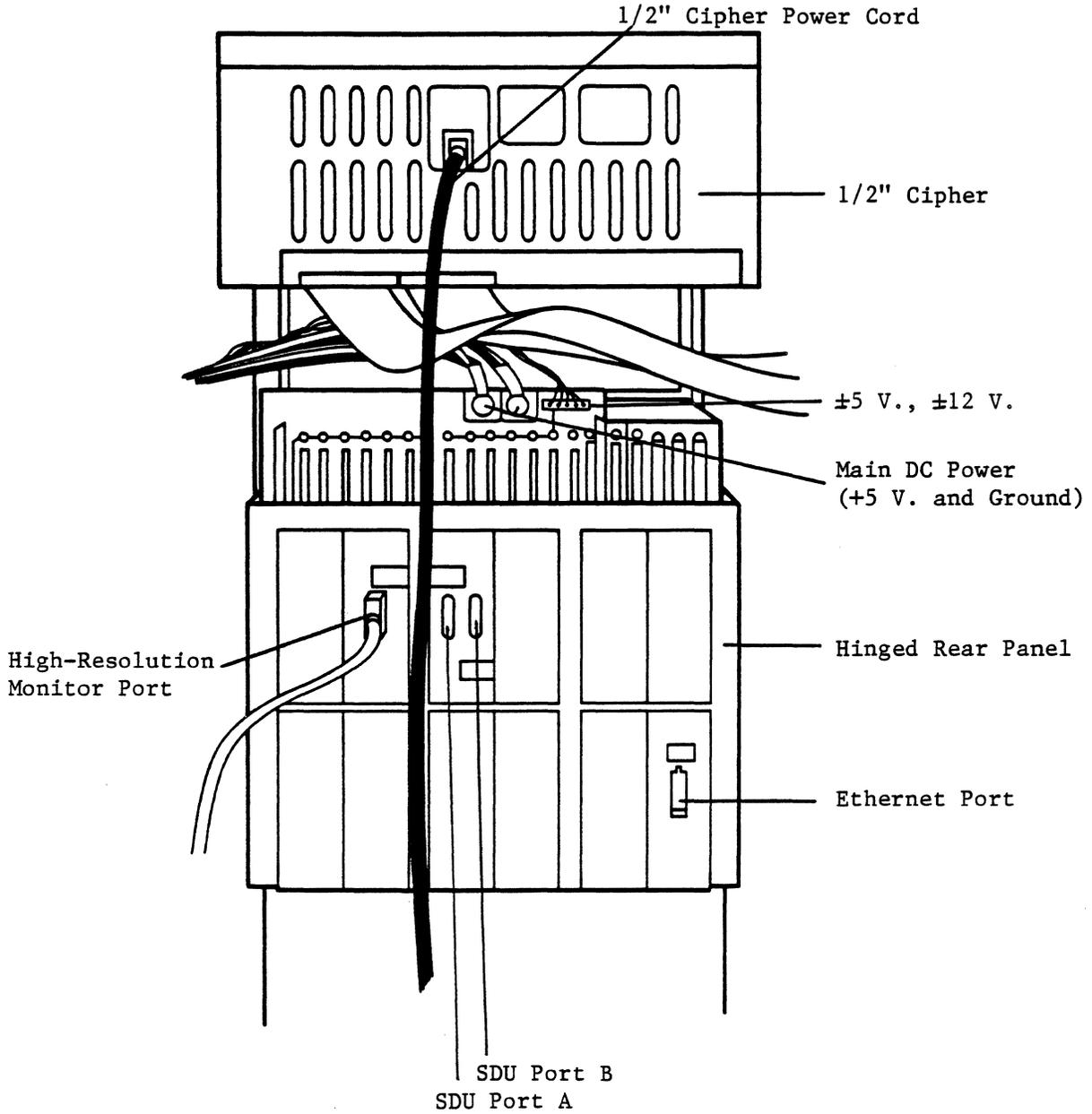
LAMBDA CARD CAGE

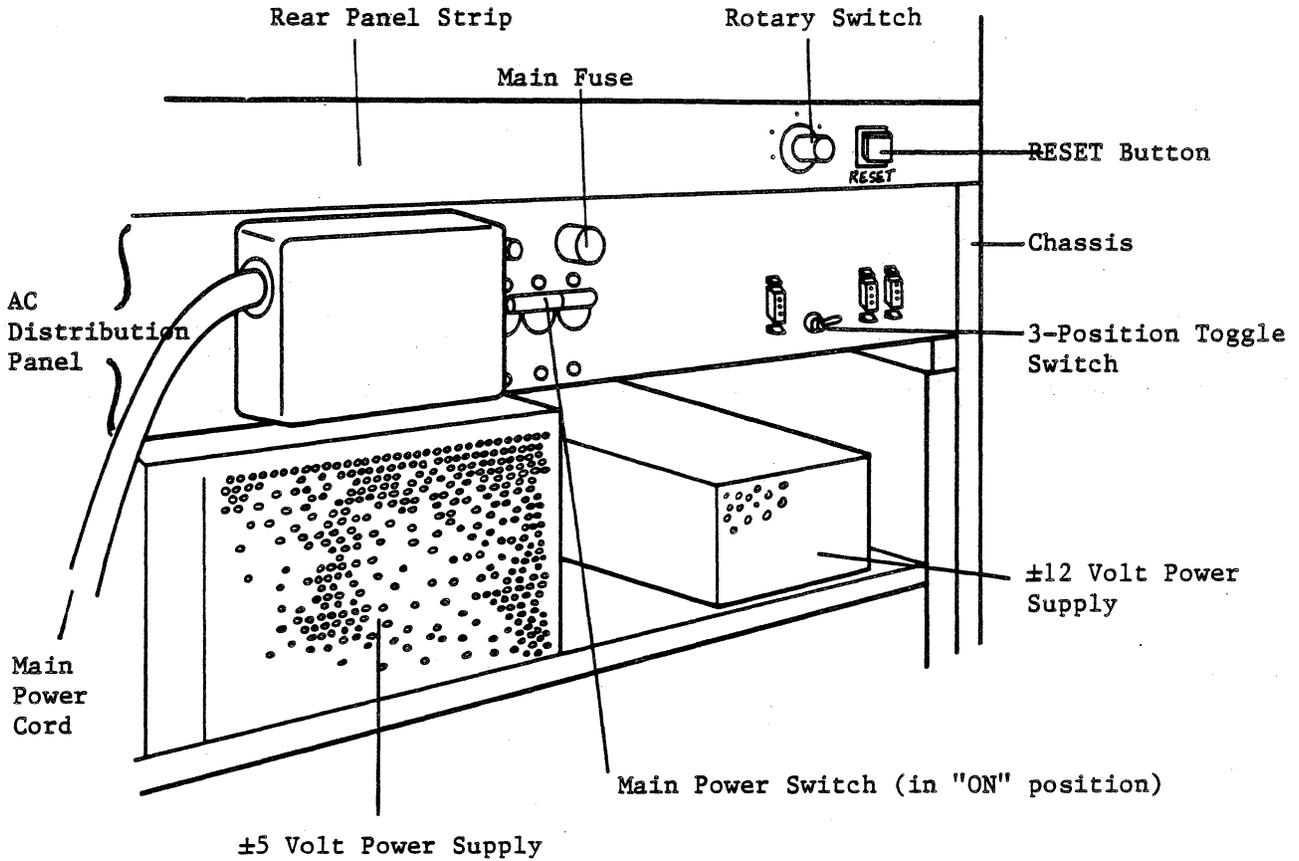




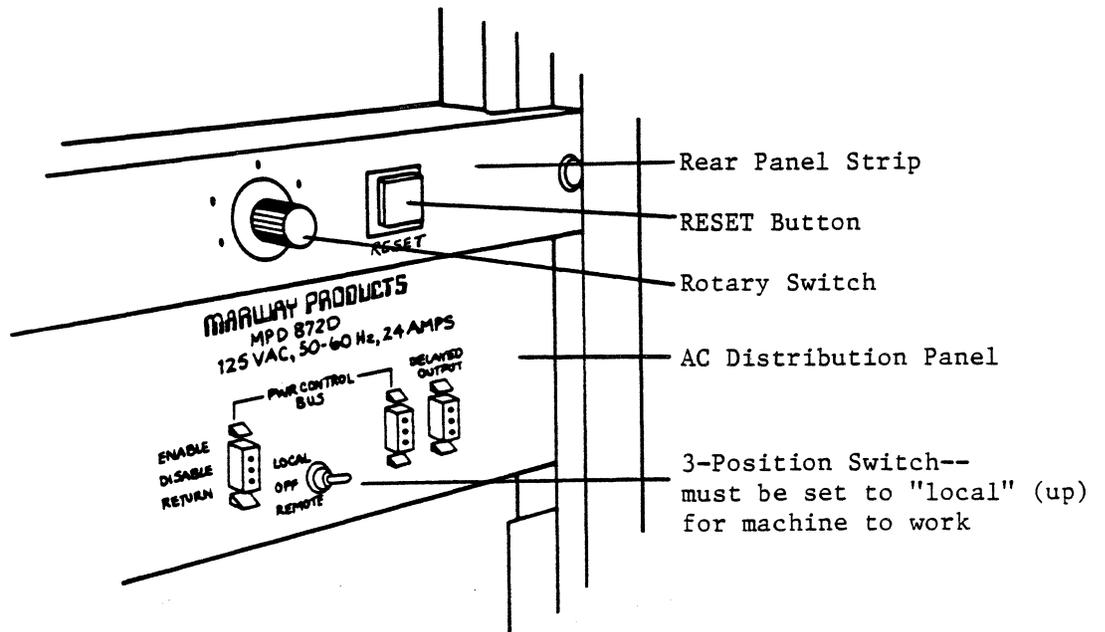
TI BACKPLANE (NUBUS AND MULTIBUS) AND LMI PRIVATE BACKPLANE

REAR VIEW OF LAMBDA WITH REAR PANEL REMOVED





REAR PANEL STRIP AND AC DISTRIBUTION PANEL--DETAIL



back of the machine (just above the back of the power distribution panel, toward the right) is set to 1. The Z29 should be set up in Auxiliary mode at 9600 baud.

Connect the high-resolution monitor to the labeled "Hi Res" port to the left of SDU Port A.

Another terminal (normal resolution and not a console) can be hooked up to SDU Port B. If it is another Z29, it should be SETUP as a Normal mode port at 9600 baud. The cable to this second Z29 should plug from the bottom connector located on the back of the terminal to SDU Port B, the female RS232 connector next to SDU Port A.

5.6 The AC Distribution Panel

The AC distribution panel contains 10 Edison-style sockets.

The power cables from the card cage power supply, disk drive, and tape drive all plug into the AC distribution panel.

The three-position toggle switch on the right of the panel must be set to "Local". If it is set to "Off" or "Remote", it will cut power to the machine.

5.7 The Rear Panel

The rotary switch should be set to "1" to use SDU Port A as the 9600 baud console.

The LMI Lambda RESET button is the square button at the right of the panel.

5.8 Installing the Tape Drive

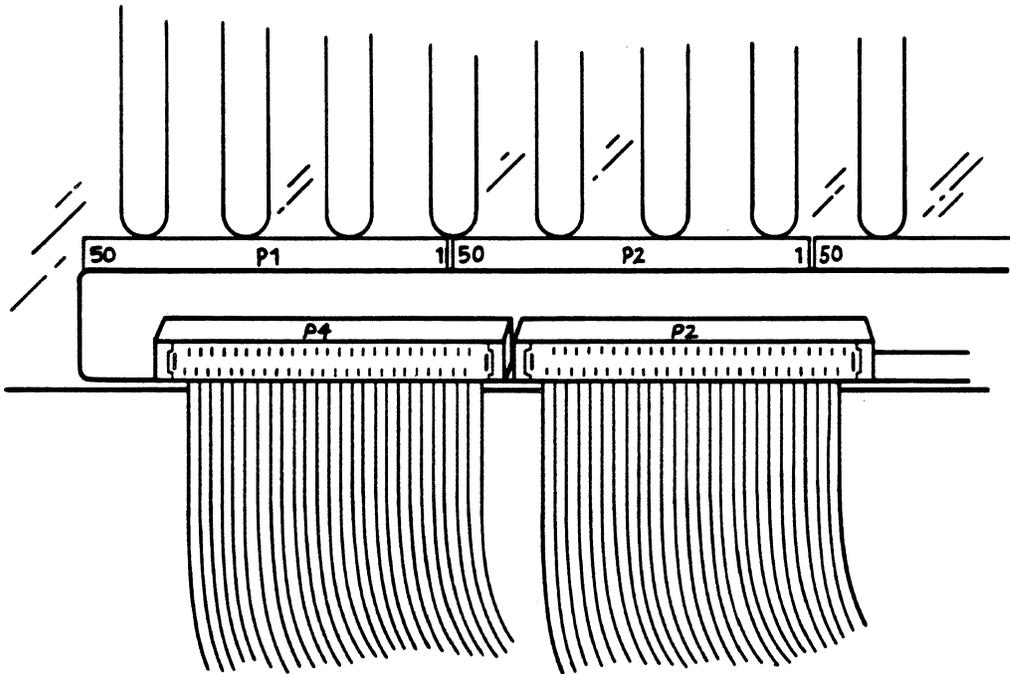
First, make sure the tape controller and the cables are firmly plugged in.

5.8.1 Installing the Cipher Tape Drive

On a 1/2" Cipher tape drive, one cable (part number 2338206) goes from P1 on the left rear of the tape drive to the bottom connector on the tape controller. The red line on the cable is on the bottom and the cable is flush against the top of the connector. The other cable, part number 2338207, goes from P2 on the left rear of the drive to the top connector on the tape controller. The red line is still on the bottom; the cable is flush against the bottom of the connector.

The Cipher Tape Drive is mounted in the main cabinet when the system is delivered. To install it, the following procedure must be followed:

1. Remove the tape that holds the top covers and front door in place. Open the top cover by lifting the sides directly behind the front panel.
2. Remove the retaining pin from the cover stay, lift the two black Ny-Latch fasteners, and raise the cover. A slot is provided to hold the stay.
3. Pull the tachometer away from the hub and remove and discard the foam cushion. Carefully replace the tachometer assembly on the takeup hub.
4. Inspect visually for damage, especially for dents or any parts that have obviously been broken off or bent. Examine the tape path, reel hub, tachometer, and other parts for foreign matter.
5. The voltage is preset for standard US or optional European requirements according to the order. No voltage adjustment should be necessary. For reference, instructions on adjusting the voltage are provided in Appendix F.
6. The power cord supplied is for a 110V outlet. Plug it into the AC distribution panel.
7. If necessary, clean the tape path using 1,1,1 trichloroethane. For details on cleaning, see "Preventive Maintenance", Appendix A.
8. Power up the unit and verify that the UNLOAD indicator lights up. Allow for a two-second delay while front panel lights flash, indicating the performance of a self-diagnostic.
9. Open the front-panel door by pressing down gently on the center top of the door. Observe that both the top cover



CLOSEUP OF BACK OF 1/2" CIPHER TAPE DRIVE (NOTE "P4" AND "P2" LABELS)

and the front-panel door lock automatically during all tape-loaded functions.

10. Insert the tape into the front panel of the unit with the write-enable ring side down.
11. Close the front-panel door.
12. Actuate the LOAD/REWIND switch, which locks the access doors. The LOAD/REWIND indicator blinks while operating and remains lit after the LOAD sequence is completed.
13. Depress the ON-LINE switch several times and verify that it is alternately lit and extinguished.

For further details on the operation of the tape drive, see the Cipher Tape Drive Manual.

5.8.2 Installing the Optional Kennedy Tape Drive

On the Kennedy reel-to-reel tape drive, the cable (#2338207) from the top connector on the tape controller goes to J1 at the top of the Kennedy's formatter board. The cable (#2338206) from the bottom connector on the tape controller goes to J5 at the bottom of the Kennedy's formatter board.

The drive must be set to 25 inches per second (ips) instead of 75 ips. Set DIP switches 1-3 on the right DIP switch box on the Kennedy formatter card to 25 ips:

speed	$\frac{1}{2}$	1	$\frac{1}{2}$	2	$\frac{1}{2}$	3
-----+	-----+	-----+	-----+	-----+	-----+	-----+
25 ips	$\frac{1}{2}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	0
-----+	-----+	-----+	-----+	-----+	-----+	-----+
75 ips	$\frac{1}{2}$	0	$\frac{1}{2}$	1	$\frac{1}{2}$	1

The switch on the front left of the drive must be set for 1600 bpi.

5.9 Inspecting the Card Cage

Inspect for damage, such as broken cards, loose cables, or any signs that brackets have been twisted or stressed.

5.10 Possible Backplane Problem

Due to redesign of the LMI Lambda backplane, some machines do not (yet) have protective black covers over the backplane pins. If yours does not, avoid damage by BEING CAREFUL when you open and close the hinged back panel of the LMI Lambda (the panel into which the high-resolution and console panels are plugged). The VCMEM bulkhead cable, which goes from the back of slot 8 to the high-resolution port, tends to twist to the left and bend pins on the back of the LMI Lambda backplane. This may cause problems including corruption of data, failure to boot, and repeated crashes.

To avoid damaging your LMI Lambda boards,

- Always turn the machine off before you open and close this panel.
- Gently move the VCMEM cable out of the way to the right as you close the panel.

If you suspect that the cable is pushing on the backplanes or that there are bent pins on your backplanes, power down your machine and call LMI.

5.11 The Optical Mouse

Your new LMI Lambda is equipped with an optical mouse manufactured by Mouse Systems Inc. Setting up the mouse for operation is a bit different than it was with the mechanical mice some of you may be familiar with from CADRs. The mouse box should contain a mouse with a MODULAR-JACK (RJ-11C) connector, a mouse pad, and a technical manual from Mouse Systems. The box may have empty spaces for other equipment; these are for accessories not needed for your LMI Lambda.

The metal object with blue and green lines printed on it is your MOUSE PAD. The mouse runs on it and will not work correctly unless it is on the pad. Put the pad on your desk in a comfortable position, vertically oriented like a sheet of paper.

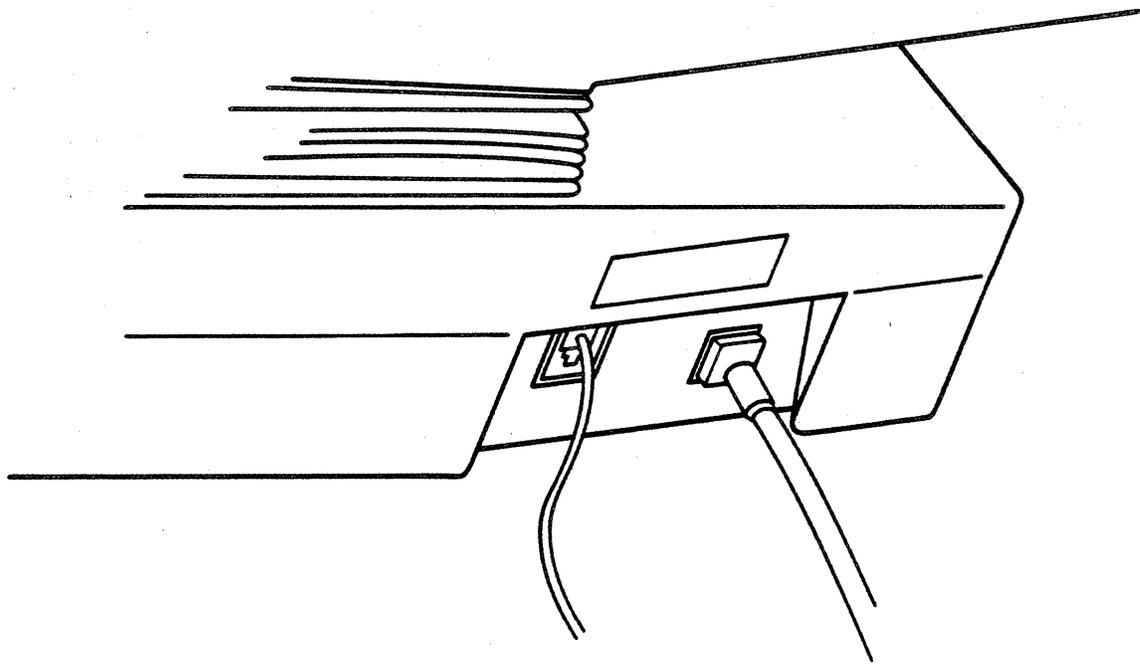
The connector on the mouse should be inserted into the matching socket on the right side of the monitor. There is only one appropriate socket.

The mouse receives its power from the monitor and loses power each time the monitor is turned off, or when it is disconnected from the monitor. Each time the mouse is powered up, it must be calibrated--that is, must adjust to the sensitivity of its sensors to the mouse pad in use. To calibrate the mouse, move it around in large circles at a comfortable speed until the mouse cursor starts moving, then click any mouse button once.

If you have a problem with the mouse, first make sure the LMI Lambda software has not crashed. Then try power-cycling the mouse by pulling its connector out of the monitor for a few seconds and recalibrating. This will usually clear up any problems. If trouble persists, turn the mouse over and look at the LEDs that shine through holes there. Normally only one of the two LEDs will be on and will glow continuously. If no LEDs are lit, try pushing any of the buttons on the front of the mouse. If both LEDs light the mouse is not calibrated; try the calibration process again. If no LEDs are lit the mouse probably is not receiving power. If one or both LEDs are flashing, there is some sort of error detected by the internal mouse processor. The Mouse Systems technical manual describes how you can correct most of these. If this doesn't succeed, contact LMI for a replacement mouse.

If you have a black mouse, two of the DIP switches inside the mouse are changed from their standard settings. Switch 4 is turned off; this sets the pad orientation to suit our screen shape. Switch 6 is turned on. Beige mice contain no DIP switches.

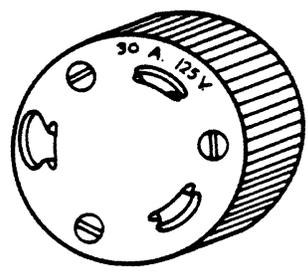
KEYBOARD AND MOUSE CONNECTIONS TO BACK OF MONITOR



Keyboard

Mouse

HUBBEL 30A 125V TWISTLOCK PLUG, #2611



Chapter 6

SYSTEM OPERATION

6.1 Powering Up

Before connecting power, make sure that all switches are off.

1. Insert the main power cable into a twist-lock female connector (Hubbel 2613) on its own 30 Amp. circuit and twist it clockwise. If it does not catch, pull it out, turn it one-third and reinsert.
2. Make sure the rotary switch is set to position 1.
3. All cards and cables should already be installed. Make sure that the main circuit breaker on the machine is off, the circuit breaker on the right rear of the disk is on, the disk drive, power supplies and any fan and tape plugs are plugged in, and the Start switch on the disk front panel is off.
4. An additional terminal currently is necessary to boot the LMI Lambda. Almost any RS232 full duplex terminal that can be used as a DCE device can be used. LMI supplies a Zenith Z29 terminal for this purpose. The Z29 terminal should be SETUP as a 9600 baud, Auxiliary mode port and plugged into SDU port A, the male RS232 port on the back of the Lambda.
5. Verify that the orange indicator light on the AC power distribution panel is on. Also, make sure the 3-position toggle switch on the right center of the power distribution panel is up (in the "Local" position). Important: If this switch is turned to "Off" or "Remote", it will turn off power to the LMI Lambda.
6. Turn on the disk drive circuit breaker. It is located on the back right of the disk drive.
7. Turn on the main rocker switch to power the card cage. "On" is the up position.

8. Check to make sure the fans are operating and that there are lights on the front panel and on some of the cards.
9. As a precautionary measure, check for any crackling sound or smell of smoke. In case of either, turn off the machine IMMEDIATELY by turning off the main circuit breaker or pulling out the plug; then call LMI.
10. Turn on the tape drive using the switch on the right front of the drive.

Within a few seconds after you power up the LMI Lambda, the message "Monitor Version 7" will appear on the SDU console screen, followed by a SDU prompt (>>). The power light on the disk front panel will be on. (If not, make sure that the disk is plugged in and its circuit breaker is on.) Turn on the Start switch on the disk front panel. The START light will go on. In forty seconds the READY light on the disk front panel will go on. Make sure the Protect (write protect) switch on the disk front panel is off.

Once all three lights--POWER, START, and READY--are on, the disk is "spun up" and ready for use.

If the red SETUP light on the LMI Lambda front panel comes on and stays on, you need to set up the CMOS RAM. See the section on "SDU Operations" in chapter 9, "Troubleshooting", for instructions.

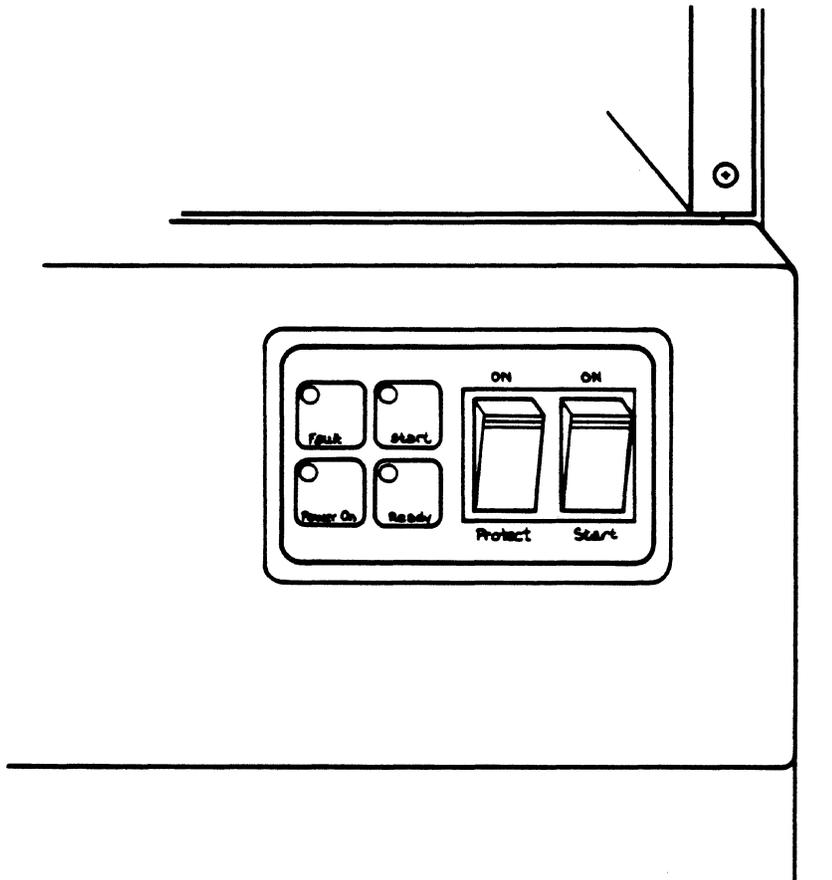
Anytime you power up the machine or press the square RESET button on the back of the machine, you will have to type the following command on the console:

```
init
```

Whenever this command is running, the lights on the front panel will go on in the following sequence:

1. Initially the red ATTN and SETUP lights will go on.
2. The ATTN light will go off.
3. If the CMOS RAM on the SDU is valid, the SETUP light will next go off.
4. The green RUN light will come on, indicating that the system is ready for use.

The "init" command enables the NuBus and Multibus. If you forget to type "init", the next command you type will probably return a "NuBus and Multibus timeout" error message. If that happens, just type "init" and start again.



FUJITSU EAGLE DISK DRIVE FRONT PANEL

It is also necessary to type "init" after various errors. If you get an error message from the SDU or if you return to the SDU by typing CTRL-C to exit a program, it is a good idea to type "init".

6.2 Booting LISP

Note: The LISP boot procedure and related functions documented here are still being improved, and therefore are subject to change. These instructions are current for "UNIX 2.10+ LMI", "LMI 12/5/83 Root", and "lboot 64." Check with LMI if you have questions.

After powering up the machine (see POWERING UP), type at the SDU console

```
lboot
```

This boot program will run for about 5 minutes, printing many things on the screen. If no errors occur, it will finish printing out information and will print a line saying that the "dribble file" is complete. It will then display

```
Debug Level 2>
```

on the screen.

At this time you should see "run bars" flashing on the high-resolution monitor screen. These bars show that the LISP processor is cold-booting. They appear about four inches above the lower right corner of the screen.

NOTE: While LISP is booting, do not type on the keyboard, move the mouse, or detach the mouse or keyboard. Neither type on nor detach the console keyboard. If you do, the machine will probably crash.

After a few minutes of run bar motion the screen should be cleared, and soon afterwards the LMI Lambda will finish booting. Again, make sure that there is no keyboard or mouse input from anywhere while the machine is booting.

After LISP has finished booting, the word "keyboard" will be displayed at the bottom center of the high-resolution monitor screen and it is safe to type on the keyboard. It is also safe to detach the Z29 from SDU port A; this terminal will not be necessary again until the next time you are out of LISP.

If you will be using tapes on the LISP machine, you must first initialize the tape controller. Type in LISP

```
(fs:tapemaster-initialize)
```

to do so.

Since this needs to be done only once each time LISP is booted, it is a good idea to do it just after booting LISP so it will already have been done by the time someone needs to use tape.

Note: Nothing will be harmed if the tape controller is initialized more than once; it is just unnecessary.

As a precautionary measure: Every two weeks, and whenever LISP has been halted with files open, type to the LISP Listener after LISP is booted

```
(fs:lm-salvage)
```

This will take ten minutes or less, and will make sure the LISP file system is consistent.

6.2.1 Possible Problems While Booting

The first time you try to boot the machine after power-up, the memories might not be initialized. The machine might stop booting and print "COMPARE ERROR" or "NuBus timeout" on the SDU monitor. If this happens, type "init" and "lboot" again. If the problem recurs three or four times (for instance, if the machine consistently stops at the same point, or at random times during the boot procedure), call LMI.

If LISP crashes during booting, you will be able to tell by the lack of activity on the screen. The run bars will stop moving and not start again. A crash after LISP is already up will cause the cursor to stop flashing and the time, in the lower left-hand corner, to stop updating. Call LMI if LISP continually crashes.

If booting stops repeatedly with a "timeout" (NuBus or Multibus), memory boards may not be in the correct slots (specified by the "/disk/monitor/memsetup" command) or boards may be seated poorly. Check, then call LMI. If booting stops immediately after the high-resolution screen is cleared, there may be a problem with the Ethernet board. Call LMI.

6.3 Booting UNIX

Type on the console

```
init
```

```
uboot
```

UNIX should boot. It will print a line or two of text, then will prompt with a number sign (#). Next type CTRL-D to boot UNIX the rest of the way. (Now it will be able to connect to other terminals besides the console.)

The first thing UNIX will do after the CTRL-D is to run the program "/etc/fsck" to make sure the file system is consistent. It will then display the date and put a login prompt on all terminals that are connected and enabled in the "/etc/ttys" file.

(For an explanation of "/etc/fsck", see CRASHES IN UNIX.)

If nothing happens for about 30 seconds after you type "uboot", type CTRL-C. The message "Command exited with value 1" should appear on the console, followed by an SDU prompt. Type

```
init
```

```
uboot
```

to try it again.

If you get UNIX booted most of the way--if it prints a line or two, but it won't print the prompt #--wait about 10-15 seconds, then type CTRL-C and try again, using "init" and "uboot".

If, while trying to boot UNIX, you get one of the messages, "Command exited with value 647," "NuBus timeout," "Multibus timeout," or "Command got both NuBus and Multibus timeout," type "init" on the console and try again. (Remember which error you got.) If you get the same error again, call LMI--some of your cards may be in the wrong slots. Don't change them yourself; call the LMI help line.

6.4 Setting Terminal Type in UNIX

To tell UNIX what type of terminal you have, type while in multiuser UNIX, using the "C shell" (see CREATING NEW UNIX DIRECTORIES):

```
setenv TERM h19
```

on a Z29, or

```
setenv TERM rsd
```

on a high-resolution monitor.

Then, on either terminal, type

```
stty newcrt
```

Important: If you type the "setenv" command (or "stty") in singleuser instead of multiuser UNIX, the system will crash.

6.5 Switching from LISP to UNIX and from UNIX to LISP

Currently you must explicitly leave one process and enter the other. This feature will be changed to an interface after a bit of software development. Meanwhile, our apologies.

6.6 Logging In

To log into LISP, type the LISP function

```
(login "name")
```

where "name" is your username. You will then be in a LISP Listener, from which you can access any part of the system.

To log in to UNIX, type your username at the prompt "login:". UNIX will prompt you with "password:". Type your password at the system. With the UNIX set up as shipped from LMI, you can log in as "root", with no password, if you don't have a login ID for

UNIX.

6.7 Creating New LISP User Directories

Make a directory for a user ("naha," for example) by typing in LISP

```
(fs:create-directory "naha;")
```

Once the directory is created the user can use ZMACS to create an init file (called "lisp.init") in that directory.

6.8 Creating New UNIX User Directories

"/etc/passwd" describes users to the system. Each user is described by a line consisting of seven fields: a login name; an encrypted password; a user ID; a group ID; a field containing information for accounting purposes; the full pathname of the user's login directory; and a program name. If the last is null, /bin/sh is invoked; those who prefer the "C shell" should use /bin/csh. (You must use /bin/csh for terminal type setting to work.)

Login as root, then edit the file /etc/passwd to add an entry for the user being added. A typical entry for a privileged user would be

```
gjc:mypwd:1:7:George J. Carrette:/usr/gjc:/bin/csh
```

Next, make the directory by typing

```
mkdir /usr/gjc
```

and change its owner from Root to the user by

```
chown gjc /usr/gjc
```

If a password is desired, set it with the "passwd" program. This can be done by the user himself or by the superuser:

```
passwd gjc
```

The user will be prompted for the old password and then twice for the new password. The password is stored in "/etc/passwd" in an encrypted form.

For more information, consult the UNIX Programmer's Manual, volume I.

6.9 Installing LISP Sources

Use the LMI Lambda distribution tape. Type to LISP (if necessary)

```
(fs:tapemaster-initialize)
```

Put in the desired tape and type

```
(fs:restore-magtape ':query nil)
```

This will take a bit over an hour. When it is done, the bottom of the screen will say "keyboard", and you can rewind the tape by typing

```
(fs:mt-rewind)
```

or by "manually" rewinding it from the tape drive's front panel.

6.10 Backing up LISP Directories

To backup a LISP directory onto tape (e.g., the LISP directory for the user "mwt"), mount a blank tape (with a write ring) and type while in LISP

```
(fs:copy-directory "mwt;" "mt:" ':query nil)
```

This should be done, as often as makes you comfortable, for each directory that has been modified. More than one directory can be put on the same tape, merely by repeating the above command, substituting the next directory name in place of "mwt".

When you finish writing directories onto the tape, type

```
(fs:mt-write-eof)
```

to write an end-of-file mark onto the tape. (If you forget this, the tape will work fine except that you'll get an error at the end, when the machine doesn't see an eof mark.) Take out the write ring and put the tape somewhere safe. When you want to restore it, you can put it in the drive and make sure it is at the beginning of the tape (i.e., the LOAD light is on). Then you

can type

```
(fs:restore-magtape ':query nil)
```

and then

```
(fs:mt-rewind)
```

6.11 Backing up UNIX Directories

To backup a UNIX directory onto tape (e.g., the UNIX directory for the user "mwt"), mount a blank tape (with a write ring) and type while in multiuser UNIX

```
cd /usr
```

then

```
tar cvfb /dev/rmt1 10 mwt
```

Take out the write ring and put the tape somewhere safe. You cannot append files to the end of the tape--if you try, the files at the beginning of the tape will be written over, and the only accessible files will be the new ones you just wrote. To put more than one directory onto the tape, issue the directory names (e.g., "mwt" and "zrm") in the same command line

```
tar cvfb /dev/rmt1 10 mwt zrm
```

If you need to continue onto another line with directory names, either set your terminal for "line wrap" and keep typing, or type a backslash (\) before typing the carriage return and then continue the command line:

```
tar cvfb /dev/rmt1 10 mwt zrm \  
jqr
```

(A backslash turns off the special meaning of whatever character follows it.)

NOTE: Keep in mind that since UNIX doesn't have version numbers, any files extracted from tape will write over files with the same names, already on the disk. To prevent this, you should rename files on the disk before extracting the tape. For example, if "foo" and "bar" are the two files in the directory "mwt", you should type in multiuser UNIX

```
cd /usr/mwt
```

```
cp foo foo.old
```

```
cp bar bar.old
```

It is now safe to extract the tape, since "foo" has been copied into "foo.old" and "bar" to "bar.old". Type

```
cd /usr
```

```
tar xpvf /dev/rmt1
```

You can rename disk files at any time with the "mv" or "cp" command if you wish. The "cp" command preserves all the links to the file, and so is probably more useful than "mv". (See the UNIX Manual, Vol. 1, for more information.)

Periodically you may want to dump the entire user file system. To do so, load a tape and type in multiuser UNIX

```
cd /usr
```

```
tar cvfb /dev/rmt1 10 *
```

and proceed as before. The commands to use in restoring this tape onto the disk are, in multiuser UNIX,

```
cd /usr
```

```
tar xpvf /dev/rmt1
```

6.12 Making a LISP Microcode and Band Tape

LMI's standard format for band tapes is two microcode bands followed by one LISP band. Load a blank tape (with a write ring) and type, assuming "lmcl" is a good microcode band,

```
(si:copy-disk-partition 0 "lmcl" "mt" "")
```

Note that here there is no colon after the letters "mt"; it is not "mt:".

Repeat this, maybe using a different microcode band (e.g., lmc2 in place of lmcl). Next, do it again but with a LISP band (e.g., lod1) instead of a microcode band. When all this is done, write a few extra eof's on the tape by typing

```
(fs:mt-write-eof)
```

three or four times. As always, take out the write ring and put

the tape somewhere safe.

If the tape is for loading outside of LISP in a system with no UNIX CPU, the tape will need to be written with short records instead of long ones. In this case, before doing the copy-disk-partition command, type

```
(setq si:*default-record-size* 1024.)
```

and proceed as before. A short record tape takes much longer to load than a long record one, so it is preferable to use long records and load with UNIX. (The problem here is that the SDU cannot read long records.)

It is not possible to make a short record band tape for bands with a second system number larger than 44 (e.g., "1.47"), because the band is too big to fit on one short record tape. The SDU software is being modified to accept long record tapes, but this is not yet implemented.

6.13 Making a Root Image Tape (at the SDU)

A "Root Image" contains all the information necessary to boot either LISP or UNIX. If you want a copy of it on tape, type at the SDU

```
copy $disk tape 8500
```

IMPORTANT: Be very careful not to confuse the order of "\$disk" and "tape". If you do, random garbage will be written all over what used to be the root image on the disk.

6.14 Restoring a Root Image Tape (at the SDU)

To restore the root image onto the disk, type at the SDU

```
copy tape $disk
```

Notice that no length--e.g. "8500"--is necessary.

Restoring the root image is a destructive procedure. It replaces the current root image on the disk.

6.15 Logging Out of LISP

In the LISP Listener, use the function

```
(logout)
```

If another user logs in, you will automatically be logged out.

6.16 Logging Out of UNIX

You can log out of UNIX by typing "logout" (when you are in multiuser UNIX) or typing CTRL-D at the "%" prompt.

6.17 Leaving LISP Gracefully

To leave the LISP environment, first save any work you have done and logout using the (logout) function. Make sure no one else is reading or writing files over the network from another machine. You can tell that someone is doing so if there is a file name in the bottom right corner of the screen.) Warn other networked users that you are about to halt the machine and wait for them to finish using any files they have open. If you cannot find the person who has the file open (or if the other machine "forgot" and left the file open), type in the LISP Listener

```
(chaos:reset)
```

and then

```
(fs:close-all-files)
```

and finally halt the machine by

```
(si:%halt)
```

This will cause the LISP processor to halt. If you want to return to the SDU monitor, you can press the SDU RESET button on the back of the machine. Or, if there is a "Debug Level 2>" prompt on the SDU console, you can simply type CTRL-Z. You might have to type CTRL-Z twice before you get the SDU prompt (>>). To

make sure that the machine is in a known state, type at the SDU

```
init
```

before trying any other operations.

6.18 Leaving UNIX Gracefully

If you are in single-user UNIX, you can leave by merely typing

```
sync
```

```
sync
```

and then pressing the RESET button. After you get a prompt from the SDU, type

```
init
```

If you are in multiuser UNIX, make sure the other users have saved their work and know you are about to stop UNIX. Login as "root" or become a superuser by typing

```
su
```

You will get a different prompt (#) than you had as a multiuser. Type

```
sync
```

```
sync
```

```
kill -2 1
```

You will immediately get a prompt. Wait about 20 seconds. If you get another prompt, type

```
sync
```

```
sync
```

then press the RESET button. When you get a SDU prompt, type

```
init
```

If you don't have a prompt, or don't get one even after you type <RETURN>, it means that even the superuser's UNIX has stopped. In this case, just press the RESET button, then type

init

when you get a SDU prompt.

6.19 RESET Button

Whenever you want to leave UNIX or LISP when the machine "hangs" and you are unable to regain control, you must use the RESET button. It is the square black button on the right rear of the machine, mounted on the panel above the AC distribution panel. Pressing RESET momentarily grounds the machine's reset line, causing the SDU to regain control. Since this also resets the NuBus and Multibus, you must always type "init" to the SDU after you reset the machine.

This is not a preferred method for exiting LISP or UNIX, since it will forcibly halt processes in mid-operation. Whenever possible, you should leave LISP or UNIX gracefully. Still, there are times when no other option is feasible. Call LMI if you are concerned.

6.20 Restoring Disk from Tape

IMPORTANT: This is a destructive procedure, to be used only when absolutely necessary (on LMI's instructions). In most situations you will want to use only the "Installing LISP Microcode and Band" instructions.

Use the LMI Root Image tape. After powering up the machine and typing "init", type at the SDU console

```
copy tape $disk
```

NOTE: Don't mix up the order of "tape" and "\$disk" or the SDU will attempt to write the contents of the entire disk onto the tape, which will take a long time and create garbage.

After about 20 minutes you will get a prompt.

6.20.1 Case 1: If You Do Not Have UNIX

NOTE: Only tapes written with short records can be read by the SDU.

Load the LISP microcode and band tape (short records) and type at the SDU

```
/disk/lambda/load
```

You will get a prompt that says, "Disk loader>". You should then type

```
initlabel
```

If you get an error message instead of a prompt, it means that the minilabel wasn't initialized on your root image tape (our mistake, not yours). If so, type

```
initmini
```

and then

```
initlabel
```

Next, type

```
load
```

to get into the booting program. The program will tell you what type of file is first on the tape and will prompt you for the name of the partition to load it into. The LISP microcode should be first (probably referred to as "ulambda"). It should have a version number, e.g. "88". In this case, type

```
lmcl
```

The LISP software band should be next. It should have a version number, e.g. "1.44". Type

```
lodl
```

and it will load for about an hour.

When it finishes, you will again get a prompt. Type

```
printlabel
```

and make sure the disk label says that the current microcode band is "lmcl" and the current LISP band is "lodl". If not, type

```
setmload lmcl
```

```
setband lodl
```

Type CTRL-C to get back to the SDU.

6.20.2 Case 2: If You Do Have UNIX

Load the LISP microcode and band tape and boot UNIX singleuser.
Type

```
/lambda/load68
```

You will get a prompt that says, "Disk loader>". You should then type

```
initlabel
```

If you get an error message instead of a prompt, it means that the minilabel wasn't initialized on your root image tape (our mistake, not yours). If so, type

```
initmini
```

and then

```
initlabel
```

Next, type

```
load
```

to get into the booting program. The program will tell you what type of file is first on the tape and will prompt you for the name of the partition to load it into. The LISP microcode should be first (it is probably referred to as "ulambda"). It should have a version number, e.g. "88". In this case, type

```
lmcl
```

Another copy of the microcode band should be next. When prompted, specify

```
lmc2
```

instead of "lmcl" this time.

The LISP software band should be third. It should have a version number, e.g. "1.44". Type

```
lodl
```

and it will load for about an hour.

When it finishes, you will again get a prompt. Type

printlabel

and make sure the disk label says that the current microcode band is "lmcl" and the current LISP band is "lodl". If not, type

setmload lmcl

setband lodl

Type CTRL-C so that you leave the disk loader program and get a UNIX prompt. Leave UNIX the usual way, by typing

sync

sync

then pressing the RESET button. Type

init

on the SDU console after you get a prompt.

6.20.3 For Both LISP and UNIX

Type

/disk/lambda/memsetup

to the SDU.

This runs a program through which you can enter the slot numbers for the memory boards.

After running memsetup, type

/disk/lambda/setspeed

This runs a program through which you can adjust the speed of the LISP processor. The program will prompt you for two numbers, from 1-1 to 3-3 (3 being the slowest speed), which will determine the durations of the "source" and "execute" cycles of the LISP processor.

Some sets of boards cannot be run faster than a certain speed before they crash frequently or fail to boot. Check with LMI as to how fast your boards can run reliably. If you are unsure, it is safest to set the speeds to 3 and 3. (LMI refers to this speed as "triple-triple" and to the "2 and 2" version as "double-double".)

Now you are ready to boot LISP. Type CTRL-C to get back to the SDU. As always, do this by typing

lboot

Now make a copy of the microcode and band partitions. Copy the microcode from lmc1 to lmc3, for example, by typing

```
(si:copy-disk-partition 0 "lmc1" 0 "lmc3")
```

(Partitions lmc1 to lmc8 exist.)

Copy the band to somewhere far away from UNIX on the disk, perhaps lod3, just to be safe. (lod1 through lod5 exist.)

```
(si:copy-disk-partition 0 "lod1" 0 "lod3")
```

This won't take nearly as long as loading the band from tape.

Since this is the first time LISP has been booted since being reloaded from tape, the file system must be initialized if there are no important files already on the disk (call LMI if you are concerned). To do so, type

```
(fs:initialize-file-system)
```

and say "yes" when it asks. This wipes out all files that are in the file system, so never do it unless you are certain you are supposed to. Call LMI first to confirm.

If the machine asks you to log in during installation, type

```
(login "lisp" "lm" t)
```

Next, type

```
(si:set-sys-host "lm")
```

When you first boot LISP (during installation or if you have just reloaded the LISP band from tape), you will have to set the disk pack. Choose a name (e.g., "Mysite 1"), then type in LISP

```
(si:set-pack-name "Mysite 1")
```

After this, type

```
(fs:tapemaster-initialize)
```

Load the LISP Sources tape and type

```
(fs:restore-magtape ':query nil)
```

This will take a bit over an hour. Then rewind the tape with

```
(fs:mt-rewind)
```

The LISP world is now completely restored. If you have any further directories to add (for example, from backed-up files), you can again use

```
(fs:restore-magtape ':query nil)
```

and

```
(fs:mt-rewind) .
```

6.21 Restoring UNIX from Tape (for systems using the Fujitsu Eagle 474 Mbyte disk drive)

Do this before loading LISP.

UNIX is on the LMI Root Image, so UNIX exists as soon as you finish the "copy tape \$disk" command. The multiuser system ("/usr file system") has not been created yet, though, so you must do so.

Boot UNIX. Make sure the Root filesystem is consistent by typing

```
/etc/fsck -y /dev/dk0a
```

This will make sure everything is ready to make the user filesystem. If fsck finds damage, leave UNIX, reboot, and try fsck again. If something is still wrong, reload the root tape ("copy tape \$disk") and try again.

When you get a prompt, type

```
/etc/mkfs /dev/rdk0e 23436 4 500
```

It will print

```
isize=14992
```

```
m/n 4 500
```

and in about ten seconds you will get a prompt. Type CTRL-D to bring up multiuser UNIX, at which point the machine will automatically run fsck. If you get any error messages at this point, call LMI.

After doing this, you can create UNIX directories, restore other tapes of user or other files, or anything else, since UNIX now works.

6.22 Restoring UNIX User Files (assuming the user filesystem exists)

Use the UNIX distribution tape. Load it and put the tape drive online. Log in as "root" to multiuser UNIX.

There are some files at the beginning of the tape that you must skip over before getting to the user files. Type

```
dd if=/dev/rmt of=/dev/null bs=1k files=3
```

Note that the input file device is "/dev/rmt". This is to reference the tape but not rewind it when done. The output file is the null device, which means that this command line just skips over the first three files on the tape, not using the data at all. This takes about twenty minutes.

Get into the usr directory by typing

```
cd /usr
```

and then extract (i.e., copy from tape to disk) all the files on the tape by typing

```
tar xvfp /dev/rmt1
```

Note that the device used this time is "/dev/rmt1". This causes the tape to rewind when done. (To see what other options can be used with "tar", check the UNIX Programmer's Manual, volume 1.) If you know the exact names of the files you want, you can extract just those. Always, files extracted from the usr tape will write over files with the same name that are currently on the disk, so you should rename any files that you have already extracted into the user file system and wish to preserve.

6.23 Warm Booting LISP

This procedure works only with lboot64 or higher lboot version numbers.

If your machine crashes while running LISP, you should try to warm boot it. Go to the SDU console and type at the "Debug Level 2>" prompt

:warm

NOTE: Don't forget the colon (:) at the beginning of the command. When it asks, "Are you sure? (y/n)" type

y

and the machine will warm boot.

When you type the first character to the "Debug Level 2>" prompt, it may print something like "Process had NuBus timeout." If this happens or if ":warm" doesn't work the first time, type CTRL-C twice to get back to a SDU prompt. (If that doesn't work, press RESET.) Then type

init

lboot -n

NOTE: Don't forget the "-n" argument to lboot, or the machine will cold boot and you will lose its state.

This will immediately put you at the "Debug Level 2>" prompt, from which you can again try ":warm" and answer "y".

A warm booted machine may have corrupted internal data structures. It will probably halt when it accesses one of these, so you should consider the machine to be in a very delicate state. Try not to run any more programs than the minimum needed to save your files. Get out of LISP and cold boot in the usual way, with lboot.

If you are brave you can keep using the machine, but be careful, and be especially wary of a sudden crash.

6.24 Installing LISP Microcode and Band

When LMI sends you an updated microcode and band tape, or if you wish to install a new LISP microcode and band on your machine, you will not want to destroy information already on the disk. Likewise, you may wish to solve LISP software problems by reloading software, but without resorting to the drastic measures outlined in the "Restoring Disk from Tape" section of this manual. Whenever possible, you should avoid destructive commands such as the SDU "copy tape \$disk" and especially the commands "initmini", "initlabel" and "(fs:initialize-file-system)".

The following procedures should be your first recourse when the microcode and band need reloading. The first procedure outlined

is for use in UNIX; the second, for use in LISP.

6.24.1 In UNIX

If LISP won't boot or run reliably, you will have to use UNIX. Boot UNIX, load the tape containing the desired microcode and band, then type in UNIX

```
/lambda/load68
```

When you get the "Disk Loader>" prompt, type

```
printlabel
```

Look at the disk label and see where there are unused microcode and band partitions (with nothing in their comment fields). If none of the appropriate partitions are free, decide which are unnecessary and can be loaded over. When you have this information, type

```
load
```

The program will read the tape and will tell you which type of partition it is, microcode ("ulambda") or band (e.g., "1.52"). If it is a microcode partition and you know from the disk label that it should go on the partition "LMC4", type when prompted

```
lmc4
```

Similarly, if it is a band you want to put on LOD3, type

```
lod3
```

Continue in this way for whichever partitions in the tape you want.

To switch to this new software (so that it will be used when LISP is next booted), set the current microcode and band to these partitions (see "Setting Current Microcode and Band in UNIX").

6.24.2 In LISP

Once LISP is booted, load the LISP microcode and band tape and issue the (fs:tapemaster-initialize) command if necessary. Type

```
(print-disk-label)
```

Look at the disk label and see where there are unused microcode and band partitions (with nothing in their comment fields). If none of the appropriate partitions are free, decide which are unnecessary and can be loaded over.

Suppose you have a tape containing microcode you want loaded onto microcode partition LMC4, followed by a LISP band you want loaded onto band partition LOD3. Type

```
(si:copy-disk-partition "mt" "" 0 "lod3")
```

To switch to this new software, set the current band and microcode to these partitions and reload the partitions. (See "Setting Current Microcode and Band in LISP".)

6.25 Setting Current Microcode and Band in UNIX

You can set the current microcode and band for LISP by using the UNIX band loading program. Type in UNIX

```
/lambda/load68
```

To see what microcode and band partitions are currently in use, type at the "Disk Loader>" prompt

```
printlabel
```

to look at the disk label. The third line of text says which partitions are the current microcode ("microload") and band. There is also an asterisk to the left of the current microcode and band partitions on the disk label.

To change to the band on LOD3, type at the "Disk Loader>" prompt (still in the /lambda/load68 program)

```
setband lod3
```

and to change the current microcode partition to LMC4, type

```
setmload lmc4
```

The next time LISP boots, it will do so using the microcode in LMC4 and the LISP band on LOD3.

6.26 Setting Current Microload and Band in LISP

To see what microcode and band partitions are currently in use, type

(print-disk-label)

to look at the disk label. The third line of text says which partitions are the current microcode ("microload") and band. There is also an asterisk to the left of the current microcode and band partitions on the disk label.

To change to the band on LOD3, type

(set-current-band 3)

To change the current microcode partition to LMC4, type

(set-current-microload 4)

These commands set up the environment so that the next time LISP cold boots it will do so on the partitions just set.

If you changed the current band partition but not the current microcode partition, you can start using the new band, with the old microcode, without rebooting LISP. Before doing so, take all the precautions usually taken before halting LISP: save all your work, make sure no one is using your machine as a fileserver, and warn anyone who might decide to start using it. Then type the command

(disk-restore)

The machine will ask you if you really want to reload the partition; you should say "yes". A "disk restore" is like a cold boot except that it does not reload the microcode. When you again see the "keyboard" prompt at the bottom of the screen (as usual, when booting completes), the machine will be booted on the partition you just set.

6.27 Setting Up UNIX Memory Boards

The UNIX file "monitor/conf/std" tells in which slots UNIX expects memory boards. If this file says that there is a memory board in a slot where no memory board is physically present, UNIX will fail to boot and will give a "NuBus timeout" error message when it tries to access that memory board while trying to boot.

You should need to change this file only if you add more memory boards to your system, or if for some reason you must remove memory boards. If you do not edit the file before leaving UNIX and removing the memory board, you will not be able to boot UNIX the next time you try. Adding more memory boards is not "dangerous" in this way; additional memory boards that are not

listed in this file merely will be ignored by UNIX.

To edit this file, login as "root" and either delete the lines for the memory boards you plan to remove or insert additional lines, in the same format as those already there, for memory boards you plan to add.

A typical monitor/conf/std file might look like this:

```
cpu:    FB000000
vcmem:  F8000000
ram:    F9000000      200
ram:    FA000000      200
ram:    FC000000      200
port:   FF000014     FFFDFDFC
disk:   0      3     7C1800      7D000
disk:   0      3     9C4000      84D000
disk:   0      3     19A28000     0
disk:   0      3     0              0
disk:   0      3     16E3000     1212000
disk:   0      3     0              0
disk:   0      3     0              0
disk:   0      3     0              0
logport: 0
logchannel: 1
```

If you plan to take the memory board out of slot 10, edit this file and delete the line:

```
ram: FA000000 200
```

and save the file. The next time you boot UNIX, it will need memory boards only in slots 9 and 12.

If you plan to insert a memory board in slot 13, edit the file and insert the line:

```
ram: FD000000 200
```

The white space separating the fields can be either spaces or tabs; tabs are usually used. To keep things looking orderly, it would be a good idea to insert this line right after the line for the slot 12 memory board. Save the file, and the next time UNIX is booted it will reference the slot 13 memory board.

NOTE: Do not physically remove the memory board in slot 12. If you do, LISP will not be able to boot. Also remember that if you physically remove a memory board, you will have to use the "memsetup" program to let LISP know about the change, in addition to telling UNIX via the /monitor/conf/std file.

It is a very good idea to make a version of this file that can work with fewer memory boards than are physically in your

system. One way to do this is to make another copy of this file and call it "std.lmem", for example, and edit it to contain only one memory board. Do this (in UNIX) logging in as "root" and typing

```
cp /monitor/conf/std /monitor/conf/std.lmem
```

and then edit /monitor/conf/std.lmem so that the only "ram" entry it contains is one for slot 12 ("ram: FC000000 200") and save it. This will be useful for debugging, in case UNIX ever seems to fail because of a faulty memory board. If you boot UNIX by typing

```
uboot -C /monitor/conf/std.lmem
```

it will need a memory board in slot 12 only. This means you can isolate the memory problem by swapping memory boards until you have the bad one in slot 12, at which point UNIX will fail.

6.28 Setting LISP Processor Speed

To set the speed of the LISP Processor, type at the SDU

```
/disk/lambda/setspeed
```

This runs a program through which you can adjust the speed of the LISP processor. The program will prompt you for two numbers, from 1-1 to 3-3 (3 being the slowest speed), which will determine the duration of the "source" and "execute" cycles of the LISP processor.

Some sets of boards cannot be run faster than a certain speed before they crash frequently or fail to boot. Check with LMI about the speed at which your boards can reliably run. If you are unsure, it is safest to set the speeds to 3 and 3. (LMI calls this speed "triple-triple"; 2-2 is "double-double" and 1-1, "single-single".)

If at some time you just want to see what speed the processor is set to and do not want to change it, you can either use the above command line and type a <RETURN> instead of a number when it prompts you for a new speed, or else you can type at the SDU

```
/disk/lambda/speed
```

The file will contain only the numbers "21" if the processor is set at "double-single", "33" if it is at "triple-triple", etc.

6.29 Setting up LISP Memory Boards

Type

```
/disk/lambda/memsetup
```

to the SDU.

This runs a program through which you can enter the slot numbers for the memory boards.

To see which slots the Lambda thinks have memory boards for LISP, type

```
cat /disk/lambda/memories
```

The numbers in this file are the hexadecimal (base 16) slot numbers of the memory boards, as set by the memsetup command. For example, if there are memory boards set up in slots 9, 10, 12, and 13, this file will contain "9acd".

6.30 Installing a New Root Image Tape

If your LMI Lambda already has software loaded on it and you need to change its root image, you can do so without losing the UNIX user file, LISP microcode, band, and file information already on the disk. To be safe, though, backup your user files before installing a new Root image. (It is always a good practice to do a backup before making any major changes to the disk.)

To install the new Root image, load the tape and type at the SDU

```
copy tape $disk
```

This will take about 20 minutes, then will say how many bytes were copied and you will get a prompt. At this point, you can boot either LISP or UNIX as before.

IMPORTANT: Do NOT type either "initmini" or "initlabel" in the SDU or UNIX load program (which is what you would do if reloading the disk completely from tape). If you type these commands, the information about what LISP software is on the disk will be removed from the disk label and you will have to edit the disk label in LISP to restore that information.

6.31 Powering Down the Machine

Leave LISP or UNIX gracefully (see the sections on LEAVING LISP GRACEFULLY and LEAVING UNIX GRACEFULLY). Spin down the disk by turning the Start switch to off. (Off is the down position.) Wait about two seconds. Turn off the main rocker switch on the AC distribution panel (this is the main circuit breaker).

Keep in mind that any peripherals plugged into the AC distribution panel will also get powered down when you turn off the main circuit breaker. In particular, make sure that you have rewound and unloaded any tape in the tape drive. If you power down a loaded tape, it will read "unloaded" but will really be locked into the drive when you next power on the drive. If this happens, press "unload" and the tape will unload normally.

Turn off the SDU console and the high-resolution monitor.

If desired, unplug the console monitor and LMI Lambda.

6.32 Emergency Power Down

In case of an emergency, such as smoke, fire, or exposure to water, the following procedure will minimize the chances of damaging your machine.

IMMEDIATELY:

- Turn off (down) the main circuit breaker on the back of the LMI Lambda, or
- Unplug the LMI Lambda's main power cord.

Note: The main power cord has a twist-lock plug to prevent accidental power loss, so will NOT pull straight out of the wall. Flipping the switch is faster.

Once you have done this, call LMI.

6.33 Running Diagnostics

Diagnostics stored on the disk can be run on the various cards. This is done at the SDU (after typing "init" if necessary) by typing any of the following commands, followed by a <RETURN>.

CARD	COMMAND
Memory slot 9	/disk/monitor/diag/ram -tvs -S 9
Memory slot 10	/disk/monitor/diag/ram -tvs -S 10
Memory slot 11	/disk/monitor/diag/ram -tvs -S 11
Memory slot 12	/disk/monitor/diag/ram -tvs -S 12
Memory slot 13	/disk/monitor/diag/ram -tvs -S 13
Memory slot 14	/disk/monitor/diag/ram -tvs -S 14
VCMEM	/disk/monitor/diag/vcmem -tvs
CPU	/disk/monitor/diag/cpu -tvs
Tape controller	/disk/monitor/diag/tape -tvs
Disk	/disk/monitor/diag/2181 -tvs

Bugs: Memory and VCMEM tests take around an hour to run. However, you can type CTRL-C at any time to stop the test. This way you can at least know how the first several tests come out (they go quickly).

Second, the CPU diagnostic is extremely memory-intensive. If you do not have a full complement of memory boards, it may not be possible to run the CPU diagnostic. You can tell that this is the difficulty when an attempt to run the CPU diagnostic yields an "out of memory, can't run CPU" error.

You can also run a diagnostic for the disk by using the "tar" diagnostic tape. Load it and put it on line, then type to the SDU:

```
/tar/2181 -tvs
```

It will take about 30 minutes. This diagnostic tape can also run diagnostics on the other items as above. Replace "/disk/monitor/diag" in each of the command lines above with "/tar" (as you did with "/tar/2181") to use diagnostics from the tape.



Chapter 7

Troubleshooting by Area

The following sections summarize some symptoms of malfunctions that may appear in your LMI Lambda, and ways in which these can be quickly corrected.

This manual divides troubleshooting problems into two chapters. Use the first if you are reasonably sure where the problem lies. The second chapter details problems for which you may be unsure of the cause, or which may have several causes.

In all cases, the manual details the simplest debugging procedures first. Try these before going on to more complex ones.

When in doubt, or when these procedures don't work, please call us. LMI's Customer Service Help Line is open to serve you from (9-5 (Eastern Time), Monday through Friday, at (617)876-6819. This service is free to all LMI customers.

7.1 SDU Operations

Symptom: Nothing lights on the front panel when you power up the machine.

Response: Either the front panel lights or the SDU are unplugged. Reconnect whichever is appropriate, and call LMI with any questions.

Symptom: The red SETUP light on the front panel goes on and stays on when you power up the machine.

Response: The battery that backs up the CMOS RAM has run down. (Since the CMOS RAM on the SDU contains essential configuration information, the SDU will not operate correctly without it.) The CMOS RAM needs to be set up. At this point, your machine is set to have the console on SDU Port A at 300 baud, so you must set your console terminal to

300 baud before continuing.

Use the LMI "tar" diagnostic tape. Load it and put it online, then type at the SDU (after typing "init", if necessary)

```
/tar/setup clear eagle sp shell
```

In a minute or two, you will get a prompt. Type

```
init
```

When you type "init", both red lights will come on; then they will go off and the green RUN light will go on. The console will now be set up for the usual 9600 baud, so you must change the console terminal to 9600 baud to see the prompt. Everything should now be back to normal.

If something does go wrong (for instance, a multibus timeout occurs even though "init" has been typed), type

```
/tar/setup
```

This will print out the contents of the CMOS RAM. If everything is zero, try again typing

```
/tar/setup clear eagle sp shell
```

```
init
```

and look at /tar/setup again. It should have numbers other than 0, and should have entries for the disk. If not, something more serious is wrong. Call LMI.

The battery recharges itself whenever the power is on, so you need not worry about replacing it.

Symptom: Nothing happens when the machine is powered up.

Response: Plug in the machine, and plug into the AC distribution panel all power cords inside the machine.

Make sure the main circuit breaker is on and the machine is plugged into a socket that has power. Make sure the 3 position switch to the right of the main breaker is on "local".

If there is still no response, check the fuse in the power distribution box.

Symptom: Nothing appears on the console screen once the machine is powered up.

Response: Make sure the console monitor is plugged in and turned on, and check its fuse.

Symptom: A cursor is flashing on the console screen, but no SDU message or prompt appears on the screen. The green RUN light is lit on the machine's front panel.

Response: Make sure the SDU is plugged into Slot 15 of the card cage and the machine is powered up. Make sure the console cable is connected to SDU Port A. Make sure the rotary switch on the back panel is set to position 1. If it is not, switch it to 1 and hit the RESET button. If your console is a Z29, make sure the console cable is attached to the top port at the back of the console, and the console is setup to 9600 baud and "Auxiliary Mode". If you still have no luck, try changing your Z29 setup to 300 baud. Power cycle the console, then the machine.

If that doesn't fix it, one of the boards may be wedging the bus. Power down the machine, remove all boards except the SDU, power up the machine and see if a prompt appears. If it does, try to determine which board is at fault by using the following procedure:

Since it is very unlikely that the memory boards cause this sort of problem, power down the machine, put the memory boards back where they belong, power up the machine, and see if there is a prompt. If not, power cycle the machine, removing one memory board at a time, until the bad one is isolated.

If there is a prompt, continue power cycling the machine, inserting one additional board from those belonging in slots 8-20 each time, until the prompt fails to appear. Whichever board stops the prompt is the culprit. If the prompt appears when all boards in slots 8-20 are in place, the trouble is with the LISP processor. Power down the machine, insert the RG, CM and DP boards (i.e., all the LISP processor boards except the MI), power up the machine and verify that there is a prompt. The MI board is the only

one of the LISP boards that can be a bus master, so it is the only one that should be able to wedge the bus. When a prompt appears, power down, insert the MI board, power up, and verify that the MI board causes no prompt to appear.

In the unlikely case that one of the RG, CM, or DP boards is the problem, power down the machine and remove all four LISP boards. Insert the RG board, power up, and look for a prompt. If there is none, the RG board is bad. If there is one, power down, insert the CM or DP board, power up, and try again. If this does not isolate the bad board, power down, insert whichever board (CM or DP) was not inserted last time, power up, and try again. Verify that this last board causes the problem.

Symptom: The "ls" command from the SDU does not list the name of a file that "ls" in UNIX shows.

Response: This is a bug in the software for the SDU "ls" command. Although annoying, it is harmless. If you are concerned that a UNIX file seems to be missing, boot UNIX to look for it instead of relying on the SDU.

7.2 Problems in the SDU/UNIX Environment

If the system gets so wedged that typing CTRL-C on the console doesn't cause a prompt, press the RESET button. It is the square button just to the right of the rotary switch on the back of the machine. RESET should cause a prompt from the SDU.

If the console seems unable to communicate with the SDU, check whether it is plugged in and is on, then check the SETUP mode. The console should be in "Auxiliary Mode" and set at 9600 baud, the monitor should be off, and it should be on line.

7.3 Disk Drive Operations

Symptom: The ON light on the disk drive does not come on, although there is power to other parts of the machine (fans, card cage).

Response: Turn off the main circuit breaker. Make sure the disk drive is plugged in and the circuit breaker on the lower right rear of the drive is on. Next, check the fuse on the disk drive.

Symptom: The FAULT light comes on.

Response: Reseat the 1" wide multicolored ribbon cable on the right rear of the drive near the drive's main circuit breaker. If the FALT light remains lit, a cable under the disk enclosure needs reseating. Call LMI.

Symptom: The ON light is on, but the READY light doesn't come on when you press the START switch to spin up the disk.

Response: Turn the READY switch off and try again. Next, make sure that the two-position toggle switch on the right rear of the disk drive is switched to "Local". If not, switch it and the drive should spin up.

Symptom: The ON light on the disk drive is on, but as soon as you turn on the START switch, the circuit breaker on the back of the disk drive shuts off.

Response: Almost certainly a large power surge has burned out some power transistors on the disk drive power amplifier board. The board will need to be sent back to Fujitsu for repairs. Call LMI.

Symptom: The disk drive is working (the READY and ON lights are on), but a "can't access disk" error message appears when you start the SDU.

Response: First make sure that the PROTECT switch is not on. (The PROTECT switch is located on the front panel next to the START switch.) Next, open the front panel and check visually to make sure that the disk controller board is in the correct slot in the card cage (Slot 16). You do not need to power down to do this.

If the board is in the wrong slot, power down the machine and remove and reinsert the board.

Check to make sure that the two ribbon cables (60-pin and 26-pin) that connect the disk controller to the disk drive are firmly connected at each end--at the left rear of the disk drive and at the top and bottom connectors at the back of Slot 16.

Next, check at the back of the card cage to see if the pins of the DIN connectors have been bent or are touching each other in any way.

If none of the above items is the source of the problem, call LMI.

The SDU will notify you of disk drive problems by printing a terse error message. It will function, but will not be able to access the disk drive.

7.3.1 Reformatting the Disk

This is a destructive procedure that will indiscriminately destroy all information on the disk--the Root image, UNIX, LISP, and all of the user files. Although LMI has backup copies of the Root, UNIX, and LISP, only you have tape backup copies of your files. ONLY FILES THAT HAVE BEEN MANUALLY BACKED UP ON TAPE WILL EXIST AFTER THE DISK IS REFORMATTED.

Before reformatting the disk, re-setup the CMOS RAM using the LMI diagnostic tape and the command `"/tar/setup4"`. Note that `"setup4"` is used instead of the usual `"setup"`. This is in order that the disk will be formatted with an interleave of four. If `"setup"` is used, the formatting program will subsequently format the disk incorrectly, with an interleave of three.

Type at the SDU

```
/tar/setup4 clear eagle sp shell
```

followed by

```
init
```

to setup the CMOS RAM correctly.

Reformat the disk (it will take about an hour) with the command

```
/tar/2181 -tvsFD
```

To be safe, run the disk diagnostic after this is done. Sometimes the disk controller (or formatting program, or something) doesn't manage to format some tracks. Type

```
/tar/2181 -tvs
```

At the end of the diagnostic, any bad tracks will be printed. Reformat these tracks. If only one track is bad (for instance, track 1234), type a range of tracks around that one:

```
/tar/2181 -tvsFD -A 1232-1236
```

If several tracks in a range are bad, reformat that range (for instance, tracks from 3000 to 3025) with

```
/tar/2181 -tvsFD -A 3000-3025
```

(All track numbers are decimal, as the SDU expects.)

Run the diagnostic again for just those reformatted tracks:

```
/tar/2181 -tvs -A 1234
```

```
/tar/2181 -tvs -A 3000-3025
```

7.3.2 Running Memory Tests

In cases where it seems memory boards cannot be accessed, try using the SDU to do writes and reads to the boards in question.

The writes and reads on the SDU work only with memory boards that are listed in the configuration file. Boards that are not in this file will get timeouts. To see which boards are in the file, type at the SDU

```
cat /disk/monitor/conf/std
```

Each memory board in the file will have a line like:

```
ram FC000000 200
```

where FC000000 is the slot number, in hexadecimal (so this example is the slot 12 memory board).

If this file shows memory boards for only "FC000000" and "FA000000", only SDU writes and reads to slots 12 and 9 will work; boards in slots 10, 11, 13 and 14 will get timeouts.

The SDU Manual explains about write and read commands. Briefly, to write a word containing the number 400 (decimal) to the zeroth location of the memory board in slot 12, type at the SDU

```
w -w FC000000 400
```

and to read that word, type

```
r -w FC000000
```

Note: You must always do a write before the read in this test.

7.4 Tape Drive Operations

The SDU console can test the tape. You will be most likely to encounter tape drive problems in the form of an error message from the SDU, or from UNIX or LISP when you try to use the tape with one of these processors.

NOTE: In LISP you must type

```
(fs:tapemaster-initialize)
```

before using the tape.

First, make sure the tape controller and the cables are firmly plugged in. The tape controller should be in slot 17, the slot to the left of the disk controller.

On a 1/2" Cipher tape drive, one cable (part number 2338206) goes from P1 at the left rear of the drive to the bottom connector on the tape controller. At P1, the red line on the cable should be on the right. At the tape controller, the red line on the cable is on the bottom and the cable is flush against the top of the connector. The other cable, part number 2338207, goes from P2 at the left of the drive to the top connector on the tape controller. At P2, the red line on the cable is again on the right. At the controller, the red line is still on the bottom; the cable is flush against the bottom of the connector.

On the Kennedy reel-to-reel tape drive the bottom connector on the tape controller plugs into J5 on the drive and the top connector plugs into J1 on the drive. The red line on the cable should be on the LEFT on both J1 and J5 on the Kennedy. (Note that this differs from the orientation on the Cipher.) Note also that the drive must be set to 25 ips (see "Installing the Optional Kennedy Tape Drive" earlier in this manual).

After you've checked that everything is plugged in, see if the tape works from the SDU. Insert the diagnostic tape and say

```
/tar/2181
```

This will start a disk diagnostic, which will tell you whether the tape works. You don't have to keep running the diagnostic; stop it by typing CTRL-C when you've seen as much as you want.

Next, type at the SDU

init

Then type

```
/disk/monitor/diag/tape -tvs
```

Write down any error messages you get and what was being done when you got them, and call us at LMI to describe the problem.

If the tape works from the SDU, try it with LISP ("lboot"). In LISP,

```
(fs:tapemaster-initialize)
```

should cause the following information to be printed on the screen:

```
Now configuring ...
Command: Configure
Tape Select 0, Bank Select 0, Forward Mode.
Interrupt type: non-vectored.
Interrupts off, Link Bit off, Bus unlocked.
Speed (Density): low (high), with non-continuous
movement.
Bus Width: 16.
Return count: 4000 (2048.)
Buffer size: 0 (0.)
Records/Overrun: 0 (0.)
Buffer Address: 0
Write ring is not there [or is there, if that's so or
if there's no tape in the drive]
Formatter is busy.
The selected drive is ready and online.
Command complete.
Command received by controller.
T
```

Exercise the system by loading a tape that you know works and restoring it with

```
(fs:restore-magtape °:query nil)
```

If it still doesn't work, the problem is likely to be a hardware failure; try replacing the tape controller, cables, or tape drive.

A common way for tape drives to fail is for the machine to think the drive is offline although it is actually online. If this appears to be the case, run the tape diagnostic at the SDU to see if the problem shows up there. If so, make sure the cables are plugged in solidly. If the problem persists, there is a problem with either the tape controller or the Cipher tape drive (probably with its interface board). Try swapping the controller

first, then call LMI to arrange for the replacement or repair of the drive.

If the drive passes the SDU diagnostic, try it with UNIX and with LISP to see if it fails with either or both. Call LMI and report.

Although the tape controller and the SDU are the two boards that most commonly cause tape problems, such problems can also be caused by the UNIX or LISP processor or the disk controller. Historically, most problems have been failures with the cables, tape controllers, and tape drives.

7.5 Cabling Operations

Four types of cabling problems generally occur.

Symptom: The piece of equipment in question won't function.

Response: The cabling is improperly seated or not plugged in. Plug in the cable.

Symptom: Cabling is plugged in, but piece of equipment still won't function.

Response: Cabling is plugged in upside down, or is defective. Most cabling for the LMI Lambda is keyed to prevent improper insertion. However, the ribbon cables for the disk drive and tape drive could come loose or be inserted upside down. Turn off the machine, leave it off, and call LMI if you suspect problems. Cables plugged in upside down can conceivably damage the machine, although this is unlikely.

Symptom: Equipment does not work, or works but gives incorrect responses.

Response: Cabling is plugged into wrong slot, or is defective. This can cause shorts, resulting in possibly severe damage to the machine. If any cabling is disconnected, i.e. in shipping, avoid problems by playing it safe: DO NOT POWER UP THE MACHINE until you have spoken with LMI.

Symptom: Cable is frayed or pinched.

Response: Cable may be shorted or broken. Check all cables carefully before powering up the machine. Send any suspicious ones back to LMI for replacement rather than risking a short that could seriously damage the equipment.

7.6 Monitor, Keyboard and Mouse Operations

Symptom: The monitor display is comprehensible but distorted; i.e., everything is shifted to right, out of proportion, etc., or screen has funny lines in background or contrast problems, but screen still contains recognizable data.

Response: The VCMEM board may be bad. Call LMI for a replacement VCMEM board first, unless the problem is obviously with the monitor.

The monitor may be out of adjustment. See the monitor manual for monitor adjustment. Monitor adjustment should be attempted by skilled personnel only.

DANGER: The monitor contains extremely high voltages. Plastic tools should be used to protect both you and the equipment.

Symptom: The monitor doesn't light up after you plug it in and turn it on.

Response: Check fuses.

Check cabling. All external monitor cabling is keyed to prevent improper insertion.

If possible, attempt to use the monitor with a different monitor cable and the cable with a different monitor, to determine which part causes the problem.

Symptom: The monitor works but the keyboard does not.

Response: Wait about one minute and try again. Next, press the keyboard's RESET button and wait again. Some of the keyboards may contain defective microprocessors, which take too long to warm up. LMI will replace any such keyboard.

If there continues to be no response from the keyboard, there may be a problem with the VCMEM board, cable or monitor. Call LMI.

Symptom: The screen is suddenly full of garbage while the machine is in operation.

Response: The probable cause is a voltage surge or brownout (accompanied by dimming of the lights).

First press the CLEAR SCREEN key. If the screen clears but does not refresh, try CTRL-L to renew the display.

If the CLEAR SCREEN key and CTRL-L do not work, check the monitor. If it is at fault, you can disconnect it and reconnect another monitor to a live keyboard. If there is still a problem, the VCMEM board may be defective; call LMI for a replacement.

Symptom: Mouse doesn't function.

Response: First check mouse cabling to make sure that it is plugged in. (Mouse cabling is keyed, so improper insertion should not be an issue.)

If the mouse cabling is properly plugged into the monitor, there may be a problem with the mouse, the VCMEM board or cables, or the internal monitor cabling. Call LMI.

7.7 LISP Operations

LISP boots by using a script called a "dribble file" that initializes the boards for LISP. The "lboot" program causes the machine to boot, comparing what initialization it does in real time (displayed in inverse video on the screen during "lboot") with what it is supposed to do (stored in the dribble file). In this way, the LMI Lambda knows when the boot process has occurred incorrectly. The program stops and displays a "compare error" message at the current offset into the dribble file, or else the program hangs. You must press the RESET button, then type "init" before continuing.

This procedure is being reworked for greater speed and ease of use. In the meantime, however, there are a few important items to keep in mind.

The first time after power-up, "lboot" might get a timeout after printing two or three lines of the alphanumeric dribble file data. This is because the memory did not get initialized correctly. If this happens, type "init" and "lboot" again.

If the message "iwrite failed" appears, make sure the boards are seated well. Seating problems also account for one of many conditions that cause compare errors at random places throughout the dribble file.

If, after the dribble file has printed the message "Doing the MOBY GO", the first inverse video number is 36017, the disk label is bad.

7.8 Crashes in LISP

Whenever LISP has been halted with files open, type to the LISP Listener after LISP is booted

```
(fs:lm-salvage)
```

This will take ten minutes or less, and will make sure the file system is consistent.

This should also be done every two weeks, as a precautionary measure. (See in Chapter 6 the section "Booting LISP.")

7.9 Crashes in UNIX

This procedure is also useful the first time UNIX is brought up after power on.

Do "uboot" in the usual way. While still in single-user mode (before typing CTRL-D), type

```
/etc/fsck -y
```

This runs the "file system consistency check" program. With the "-y" option, it will automatically do any appropriate cleaning up, if necessary, to restore for you a consistent UNIX file system.

If you do not use the "-y" option, if UNIX finds an inconsistency it will ask you whether it should clean it up. Generally it is safe to say yes. If you are concerned about whether to answer

yes, call the LMI help line. Information about what happened to make the file system inconsistent (accidental powerdown, crash, etc.) will help us understand the problem.

If "fsck" finds no errors, you will simply get a prompt. Type CTRL-D to bring up multiuser UNIX. Automatically, "/etc/fsck" is run after you type CTRL-D.

If "fsck" does some cleaning up, it may say "BOOT UNIX--NO SYNC" when it is done. Press the RESET button on the back of the machine to leave UNIX in this case. (Don't type "sync" before pressing RESET.) Once you are back at the SDU, type "init" and boot UNIX in the usual way. This will give you a consistent file system.

Chapter 8

Troubleshooting by Symptoms

Symptom: You have just powered up the machine, but don't get any ">>" prompt on the Z29 console.

Possible Causes:

- Terminal is set at wrong baud rate.
- Rotary switch on back of machine is in wrong position.
- Terminal RS232 cable isn't plugged into right port (male port A in machine to female "DCE" port on Zenith).
- SDU paddle card, cable, or backplane is malfunctioning.
- SDU is bad.

What to Do: Check the cables and connections. Set the baud rate to 300 and the rotary switch to position 0. Hit the RESET button on the back of the machine. If you still don't get a prompt, then probably the SDU paddle card, cable, or backplane has a loose connection. Try wiggling and tightening all connections. This will take some patience, and you should not give up until you have tried for at least five minutes.

If you still have no luck, type

```
init
```

to the terminal. If the two red lights on the front door go on, then you can be sure that the problem is a loose connection, since the machine is receiving input from the terminal, but isn't able to send output successfully.

If you have extras, replace the SDU paddlec card and its cables. Try swapping with another

machine's SDU.

Supposedly rotary switch positions 3 and 4 allow the high-resolution monitor and port B to be used as the system consoles, instead of port A. This feature has never actually been seen to work.

Symptom: You are able to talk to the SDU monitor at 9600 baud and "init" works. However, when you type "ls /disk", an error message appears.

Possible Causes:

- The SDU has lost its CMOS RAM information.
- The disk is not spun up.
- The disk has not been formatted.
- There is no Root file system on the disk.
- The "Disk protect" switch is on or the disk heads are locked.
- You have a bad SDU.

What to Do: First make sure the disk drive is on and spun up.

If the red SETUP light on the front panel is on, reload the CMOS RAM (with /tar/setup) and that will fix the problem.

Try typing CTRL-C and then "init".

If you suspect that the disk needs to be formatted, check by loading the diagnostic tape and running "/tar/2181 -tvs -A 0-100", which will check the format of the first 100 tracks on the disk.

More likely, though, the Root file system has not been copied to disk. Call LMI.

Symptom: "ls /disk" works when typed to the SDU monitor, but "uboot" doesn't work (for instance, it returns a "NuBus/Multibus timeout error").

Possible Causes:

- The UNIX configuration file (/monitor/conf/std) is inconsistent with the placement of the memory boards in the

NuMachine slots.

- The 68000 board is bad.
- The configuration file, or one of the other files needed by UNIX (/etc/rc, /etc/fstab, /etc/checklist) is missing.
- The Root file system may have been damaged.
- You forgot to type "init".

What to Do: Type "init" and try "uboot" again.

List the contents of the /disk/monitor/bin directory, and make sure there is a file named "uboot" there.

Look at the configuration file, /disk/monitor/conf/std. To print it on the terminal, type

```
cat /disk/monitor/conf/std
```

Make sure that you actually have memory boards in the appropriate slots according to this file, removing the LMI Lambda boards if necessary.

If the other files (/etc/rc, /etc/fstab, /etc/checklist) are missing, then you will have to reload the Root file system. This is a destructive procedure, so call LMI first to see if anything else can be done. If not, put the LMI Root tape in and type

```
copy tape $disk
```

It takes about 20 minutes.

If there happens to be another configuration file on the disk (this file is sometimes named /disk/monitor/conf/std.old), you can have "uboot" use this file instead of the standard one by typing

```
uboot -C /disk/monitor/conf/std.old
```

instead of just "uboot".

Try swapping 68000 boards.

Symptom: "uboot" seems to be working--it printed out a welcome message and version number--but it never

prints out a "#" prompt or accepts terminal input.

Possible Causes:

This is a random software bug, which happens on rare occasions. It is not destructive, just inconvenient.

What to Do: Hit the back panel RESET button, type "init", and "uboot" again.

Symptom: You get flaky, unreliable, and inconsistent behavior of the SDU monitor or UNIX. (The system hangs or crashes while running innocuous programs, or when you are typing at the keyboard; when you run disk diagnostics you get many random errors; programs behave inconsistently and illogically.)

Possible Causes:

- Loose or bad cable connections.
- Bad SDU board or 68000 board.

What to Do: Try running the NuMachine diagnostics from the SDU to see which board, if any, is bad.

Check cabling.

Swap SDU or 68000 boards.

Symptom: You get "bad track" errors when formatting the disk.

Possible Causes:

Nothing is really wrong; bad tracks are common (although usually there are fewer than §20). If you seem to be getting substantially more, make sure the disk and tape cables are securely connected.

What to Do: Reformat the bad tracks. It is usually best to reformat some of the surrounding tracks also. Thus to reformat track 1012, type

```
/tar/2181 -tvsDF -A 1010-1014
```

If this fails, then try again; sometimes it takes two or three tries before a good track is found.

When you have finished formatting the bad sectors, it is a good idea to check the entire

disk again by typing

/tar/2181 -tvs

Symptom: You have problems booting UNIX.

Possible Causes:

A disk or cable problem, or a software problem.

What to Do: Try booting LISP to see if it works. In most cases, if LISP boots it is a UNIX software problem instead of a disk problem. The LMI Root Image will need reloading. This operation requires the reloading of all UNIX files and of the entire LISP system, so be sure to make a tape backup of all LISP user files before reloading the root.

Symptom: The AI keyboard works in the LISP world but not in multiuser UNIX.

Possible Causes:

Defective VCMEM board.

What to Do: Replace the VCMEM board.

Symptom: LISP doesn't boot. Typing "lboot" results in an error message; "lboot" gets an error while executing the dribble file; or the run bars have appeared on the high-resolution monitor, but the system crashes before it finishes.

Possible Causes:

- You forgot to type "init" after power-up and before running "lboot".
- The "lboot" program isn't on the disk, or it hasn't been linked to the file /disk/monitor/bin/lboot, or it is damaged.
- The memory board positions haven't been specified properly via the "memsetup" command.
- The processor speed hasn't been set via the "setspeed" command.
- The current band and microcode haven't been loaded or set.
- The boards are being run too fast.

- One of the LMI Lambda boards has some sort of a hardware problem (for instance, bent pins or a wiring problem).

What to Do:

Type "init" and try "lboot" again.

If "lboot" doesn't seem to exist, try typing "/disk/lambda/lboot". If this works, the file is not linked. In UNIX, link "/lambda/lboot" to "/monitor/bin/lboot", or call LMI.

Set the processor speed to "triple-triple", using the "setspeed" command, and do "lboot" again.

Make sure the memory configuration is correct by running the "memsetup" command.

In case you forgot to load the microcode and LISP bands, try running "/lambda/load68" in UNIX and type "printlabel" to the program. This should print out the contents of the disk. If incorrect, reload the microcode and band.

Try swapping boards, if possible, or reseating them.

NOTE: Don't type on the keyboard or move the mouse while LISP is booting, as this may cause it to crash.

Symptom: You have trouble booting LISP but not UNIX.

Possible causes: Disk problem, LISP processor, or LISP backplane.

What to Do: It has been demonstrated that some disk problems will let UNIX boot when LISP cannot. Booting UNIX will give you this information, but not much else. Try swapping LISP processors, the LISP backplane.

Symptom: The LISP function (fs:tapemaster-initialize) doesn't work.

Possible Causes:

- The tape drive is broken.
- Something is wrong with the NuMachine tapemaster board or tape cables.

What to Do:

Unload the tape drive, turn it off, turn it on again, try (fs:tapemaster-initialize) again.

Check the J1 and J2 cables and the tapemaster board (in Slot 17).

Reboot the machine, type "init" and "lboot", and try again.

Try running the tapemaster board diagnostics at SDU level:

```
/disk/monitor/diag/tape -tvs -S
```

See the SDU Monitor Manual, chapter 6, and the NuMachine Installation Manual for more information about this diagnostic program.

Try swapping tapemaster boards.

Symptom: When you boot UNIX in multiuser mode and run /etc/fsck, you get error messages.

Possible Causes:

- The system crashed or was powered down while UNIX was writing to disk.
- LISP has damaged the UNIX part of the disk. (This would occur only if LISP were malfunctioning, for instance crashing frequently.)
- For some other reason the UNIX file system is inconsistent.

What to Do: Whenever /etc/fsck gets an error, it asks you if it should try to correct the problem. Always answer "yes".

If it gets many errors (more than 6), consult a UNIX expert.

If LISP has recently crashed, it is possible (although rather unlikely) that the UNIX part of the disk software was damaged. You may have to reload UNIX. Call LMI.

If you ever reboot the LMI Lambda while running UNIX, but don't type "sync" first, don't be surprised if /etc/fsck finds errors the next time

you run it. Answer "yes" to all /etc/fsck questions. There should be only a few. If there are more than six, call LMI.

Appendix A

Preventive Maintenance

The Lambda LISP Machine is designed to require hardly any maintenance. The card cage and boards, power supply, power controller, and fans do not require preventive maintenance.

A.1 Filters

The filter is located on a sliding tray under the fan. To clean it, simply slide out the tray. The filter (Fujitsu part number is B90L-0400-0303A) should be replaced as needed.

A.2 Cipher Tape Drive

Preventive Maintenance Schedule

<u>Maintenance Operation</u>	<u>Frequency</u>
Clean head	daily [if in frequent use]
Clean guides	daily [if in frequent use]
Clean tachometer roller	daily [if in frequent use]
Clean tape cleaner	daily [if in frequent use]
Clean reel-hub pads	daily [if in frequent use]
Replace reel motors	when worn [at least 5,000 hrs.]
Clean filter	1,000 hrs.

Cleaning of Tape Path Components

Clean the tape path using 1,1,1 trichloroethane. Use a moistened cotton swab to wipe the tachometer roller and guides, head, and tape scraper blades and housing. When cleaning tape cleaner, be careful to avoid damaging the sharp edges of the tape cleaner blades.

IMPORTANT: Do not use alcohol or other solvents. Do not allow solvent to come into contact with the tachometer disk, located in the tachometer housing. Permanent damage to the tachometer assembly may result.

Housing

Clean the dust door and control panel with Miller Stephenson Chemical Co. MS-260, Windex, or an equivalent, commercial-grade plastic cleaner.

Reel Hub Pads

Wipe away any debris clinging to the reel hub pads with a cotton swab moistened with tape path cleaner (trichlorofluoroethane).

Tape Drive Filter

1. Disconnect the transport from AC power source.
2. Place the drive in access position:
 1. Release the rack retaining mechanism located on the lower left-hand side of the front panel.
 2. Hold the front panel firmly and withdraw the drive on its slides until the first lock engages.
 3. Holding each side of the front cover, raise the cover to its locked, retained position.
3. Slide the air duct tube forward by depressing the side of the tube near the front panel and disengaging the retaining tab.
4. Release the Ny-Latch fastener securing the filter adapter to the front of the power supply assembly and remove the filter adapter.
5. Remove the filter from the filter adapter.
6. Blow off loose dirt with compressed air.
7. Replace air filter in filter adapter and replace filter adapter to the front of power supply assembly and replace

the air duct tube.

Appendix B

Disk Controller Switches and Jumpers

B.1 SMD 2181 Dip Switch Settings

The factory set positions and functions of the two 10-pole dip switches S1 and S2 are as follows:

Pole	S2	S1
	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
Closed, ON, 1:	. . . . .	. 0
Open, OFF, 0:	0 0 0 0 0 0 0 0 0 0	0 . 0 0 0 0 0 0 0 0
Function:	X * F E D C B A 9 8	7 6 5 4 3 2 1 0 X X

X: Reserved

*: 8/16 bit I/O Addressing (ON-16, OFF-8)

0-F: I/O Address, Positive Logic (On-1, OFF-0)

The I/O Base Address of the disk controller is 100 octal.

*: Factory settings

S2 Reserved

S2-1

S2 8/16 Bit I/O addressing select

S2-2

ON 16 Bit I/O Addressing

OFF 8 Bit I/O Addressing

S2 Most significant I/O address byte (positive logic)

S2-3,4,5,6,7,8,9,10

ON (1) S2-3 is the MSB and S2-10 is the LSB

OFF (0)

S1 Least significant I/O address byte (positive logic)

S1-1,2,3,4,5,6,7,8

ON (1) S1-1 is the MSB and S1-8 is the LSB

OFF (0) (S1-7 and S1-8 should be OFF)

S1 Reserved

S1-9, 10

B.2 Jumpers

The SMD 2181 contains seventeen jumpers labeled "W1" through "W19".

W1 -5 Volt Source (Located below U5)

*C-1 P1-9 and P1-10 supply -5 volts from the bus.

C-2 The on-board regulator supplies -5 volts.

W4 Interrupt Level Select (Located below U72)

C-0,1...7 Selects the desired interrupt level (connect only one)

*NO CONNECT Status-driven systems should leave all disconnected.

W5 -5 Volt Regulator Source (Located below U74)

C-1 P1-79 and P1-80 supply -12 volts to the regulator.

C-2 P1-77 and P1-78 supply -10 volts to the regulator.

*NO CONNECT If W-1, C-1 is installed, W5 should be disconnected.

W6 Sector Detect + (Located between U3 & U4)
 *C-1 "SECTOR" flags the beginning of a sector
 C-2 "ADDRESS MARK FOUND" flags the beginning of a sector

W7 Sector Detect - (Located between U3 & U4)
 *C-1 "SECTOR" flags the beginning of a sector
 C-2 "ADDRESS MARK FOUND" flags the beginning of a sector

W8 Unit B3 (Located below U3)
 C-1 SMD drive is unit 8 through unit 15
 *C-2 SMD drive is unit 0 through unit 7

W9 Unit B2 (Located below U3)
 C-1 SMD drive is unit 4 through unit 7 or 12 through 15.
 *C-2 SMD drive is unit 0 through unit 3 or 8 through 11.

W10 Priority Out (Located below U35)
 *C-1 SMD 2181 supplies BPRO active low (normal bus)
 C-2 SMD 2181 supplies BPRO active high

W11 BCLK/Origin (Located below U61)
 1-2 SMD 2181 supplies a 10 MHz BCLK/ to the bus
 *NO CONNECT another board supplies BCLK/ to the bus

W12 Reserved

W13 Buffer Page 2 (Located above U31)
 *C-1 2K to 4K buffer, 24 pin RAMS in U31 and U45
 C-2 16K buffer, 28 pin RAMS in U31 and U45

W14 Buffer size (Located above U30)

1-2 4K or greater buffer, 2K or greater RAMS in U31 and U45

*NO CONNECT 2K buffer, 1K RAMS installed in U31 and U45

W15 I/O Address 0 decode (Located below U63)

*C-1 SMD 2181 Normal Mode

C-2 Reserved

W16 I/O Address 1 decode (Located below U63)

*C-1 SMD 2181 Normal Mode

C-2 Reserved

W17 Processor RAM size (Located below U38)

1-2 2K RAM installed in U51

*NO CONNECT 1K RAM installed in U51

W18 EPROM size (Located above U29)

*C-1 4K EPROM 2732 installed in U38 (normal mode)

C-2 2K EPROM 2716 installed in U38

W19 Priority In (Located below U70)

C-1 SMD 2181 is not to be the highest priority device or this is a parallel priority system

*C-2 SMD 2181 is to be the highest priority device in a serial priority system.

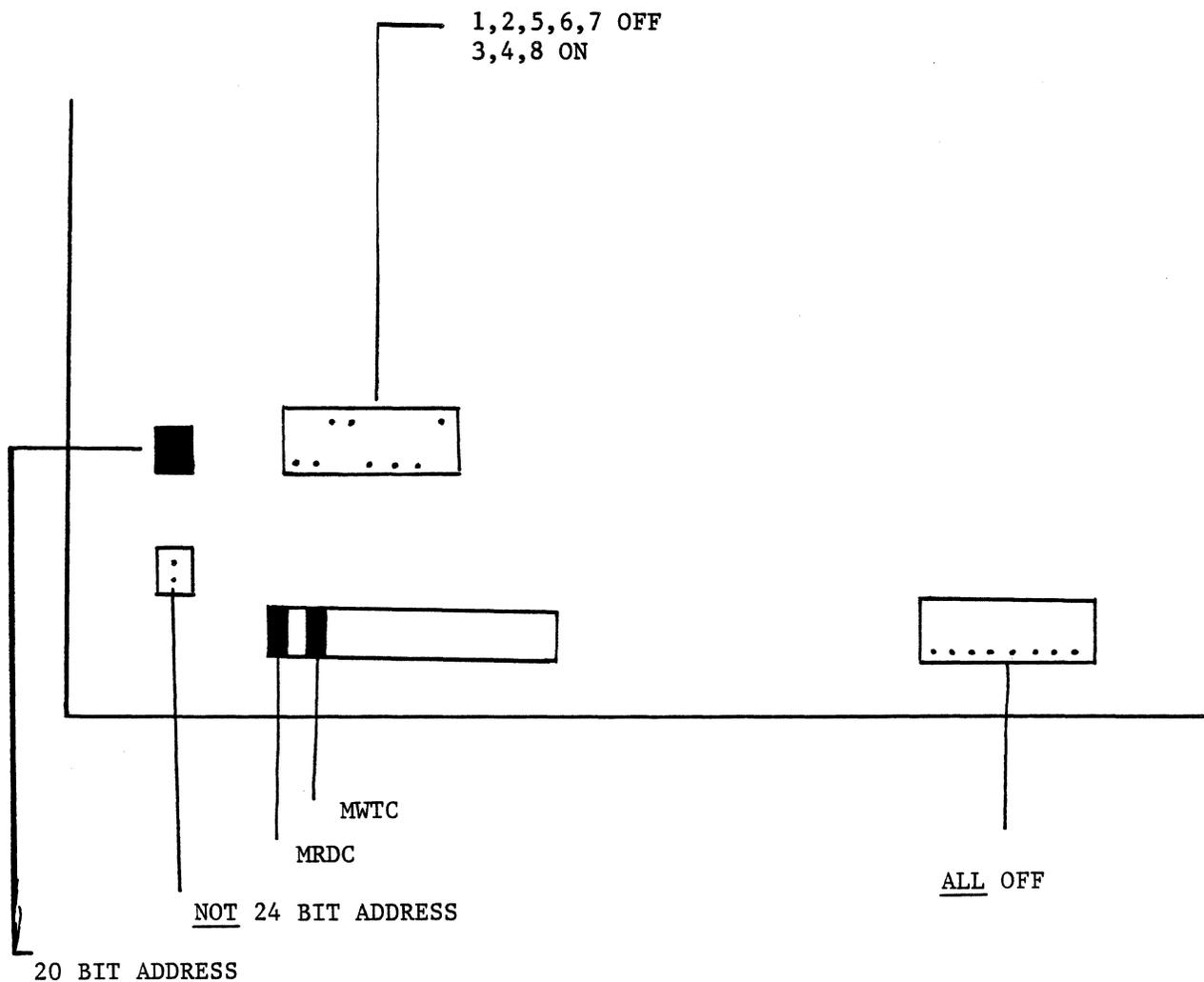
Appendix C

Tape Controller Board Dip Switches and Jumpers

Pole	S2										S1									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Closed, ON, 1:	0	0	0	0	0	0	0	0	0	0	0	.	.	0	0	0	0	0	0	0
Open, OFF, 0:	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	.	.

Appendix D

Jumpers and Switches for 3Com Ethernet Card



Appendix E

Selecting Disk Drive Operating Voltage

The voltage selection panel is labeled TRM1 and is located on the left hand side of the back of the disk drive (see Figure E-1). Change the taps on the terminal according to the desired voltage and frequency of AC input power as follows:

Vac (Hz)	Tap Number	
	(A) - (B)	(C) - (D)
100 (50/60)	2 - 4	6 - 8
120 (60)	1 - 4	6 - 7
220 (50)	2 - 3	5 - 7
240 (50)	1 - 3	5 - 7

(For more information on the disk drive DC power supply unit, refer to the Fujitsu M2351A/AF Mini-Disk Drive CE Manual, pp. 3-1 to 3-3.3).

NOTE: If your exact voltage is not available, ALWAYS set the drive for the slightly higher voltage. For example, disk drives powered with 110 VAC, 115 VAC, or 120 VAC should all be set for 120 VAC--never for 100 VAC. This will protect the drive against voltage spikes and surges. If your drive is more than 10% from one of the drive's settings, use a transformer.

Appendix F

Selecting Tape Drive Operating Voltage

1. Make sure the transport power is OFF and the power disconnected.
2. Release the rack retaining mechanism located on the front panel at the lower left.
3. Hold the front panel firmly and withdraw the transport on its slides until the first lock engages.
4. Hold the front cover by its sides and raise it to its locked, retained position.
5. Release the first lock retainer on the right slide.
6. Withdraw the tape drive firmly on its slides until the second lock engages.
7. Use a screwdriver to loosen the two spring-loaded screws on the top of the top-plate casting.
8. Grasp the two lower corners of the front panel and lift the top plate to its maximum upright position. When the unit is lowered approximately one inch, the latch mechanism will engage automatically.
9. Insert a tool or bolt through the holes provided in both members of the top-plate support to prevent injury due to accidental release of the lock mechanism.
10. Releasing the Ny-Latch fasteners near the printed wiring board (PWB) stiffener, carefully lower the printed wiring board. Grasping it by the sides, lift it carefully out of the slots in the brackets at its rear corners and lower it to the bottom of the chassis assembly.
11. Remove the two 6-32 Phillips' head screws that secure the power supply cover and slide the cover forward to remove it from the assembly. Note the position of the chassis ground cable.

12. Remove the four 6-32 Phillips' head screws at the corners of the power supply printed wiring board and lower the board.
13. The voltage selection card is on J9 on the power supply printed wiring board. Select the correct voltage by repositioning the key in J9 to correspond to the slot on the card as follows:

Voltage	Selection Card	Amperes	Frequency
85-110	100	3.0	50/60 Hz
102-132	120	3.0	50/60 Hz
187-242	220	1.5	50/60 Hz
204-264	240	1.5	50/60 Hz

14. Carefully replace the power supply printed wiring board, routing the cables so as not to interfere with the blower motor.
15. Replace the power supply cover and the Phillips' head screws and replace the printed wiring board in the slots of its brackets, making sure the chassis ground cable is connected to the power supply assembly.
16. Lift the transport to its maximum upright position and lower it smoothly to horizontal position.
17. Reverse Steps 1 through 5.
18. Make sure that all screws and retaining pins are replaced.

Appendix G

Heath-Nu Machine Cable Configuration, RS232C

Nu Machine			Heath		
<u>Male (DCE)</u>			<u>Female (DTE)</u>		
Wire	Signal	Pin	Pin	Signal	Wire
R	(TD)	2	2	(RD)	R
RB	(RD)	3	3	(TD)	RB
W	(RTS)	4	4	(RTS)	W
WB	(CTS)	5	5	(CTS)	WB
G	(SG)	7	7	(SG)	G
GB	(DTR)	20	20	(DTR)	GB

SEE ATTACHED FIGURE.

Appendix H

System Diagnostic Unit RS232 Port Pin and Signal Assignment Table

25-Pin, D-Shell
Male Connector
(Remote Channel)

25-Pin, D-Shell
Female Connector
((Local Channel)

Pin No.	Signal Name	Pin No.	Signal Name
1	Chassis Gnd	1	Chassis Gnd
2	TXD	2	RXD
3	RXD	3	TXD
4	RTS	4	CTS
5	CTS	5	RTS
6	--	6	Pull-Up (+12V)
7	Logic Gnd	7	Logic Gnd
8	DSR	8	DTR
9	--	9	--
10	--	10	--
11	--	11	--
12	--	12	--
13	--	13	--
14	--	14	--
15	--	15	--
16	--	16	--
17	--	17	--
18	--	18	--
19	--	19	--
20	DTR	20	DSR
21	--	21	--
22	--	22	--
23	--	23	--
24	--	24	--
25	--	25	--

Appendix I

Using LISP with No Ethernet Board

Soon there will be a SDU program that can tell the LMI Lambda when it has an Ethernet board. Until then, you have to follow the procedure below:

Put a working Ethernet board in the system and boot it. Then type

```
(login "lisp" t)

(si:set-sys-host "lm")
```

Look at the number beside "Experimental system 1.xx". If the number after the decimal point is 41 or less, you have to load patches; see below. After patches are loaded, continue as follows.

Now remove the board from the system variables:

```
(ethernet:remove-ethernet-board)
```

then type

```
(print-disk-label)
```

to look for a free "lod" band. You should see one with a number between 1 and 5 that has "" in its comment field. (The comment field is at the end of the line.) Type

```
(disk-save N)
```

where N is the number of the "lod" band (e.g., disk-save 2 if "LOD2" is the current band), to write out to the disk a band that doesn't need Ethernet. (disk-save N) will ask you to type a comment; type "no ether". If it says something like "Exp 1.42 no ether" is too long for the comment field, retype the comment as "1.42 no ether".

Now the machine will look as if it is cold-booting. Wait until it comes back, then type

```
(set-current-band N)
```

where N is the same as above. Now turn off the power, remove the Ethernet board, and try booting the system again.

If you run into any problems while doing this, call LMI.

I.1 Loading Patches with No Ethernet Board

Put the "ethernet" patch tape on the tape drive. Type the following:

```
(fs:tapemaster-initialize)
```

```
(fs:restore-magtape 'query nil)
```

and wait for the machine to finish and say "keyboard" at the bottom center of the screen. Then type

```
(disk-restore)
```

The machine will ask "Are you sure you want to do this?" Type yes.

Wait for a cold boot. Now type

```
(login "lisp" t)
```

```
(si:set-sys-host "lm")
```

```
(load-patches 'system)
```

The machine will respond with the patch number and the message "Do you want to load it (Y, N, or P)?" Type "P" and wait.

Now go back to "(ethernet:remove-ethernet-board)" in the previous section and proceed as before.

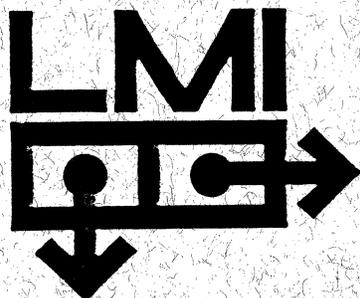
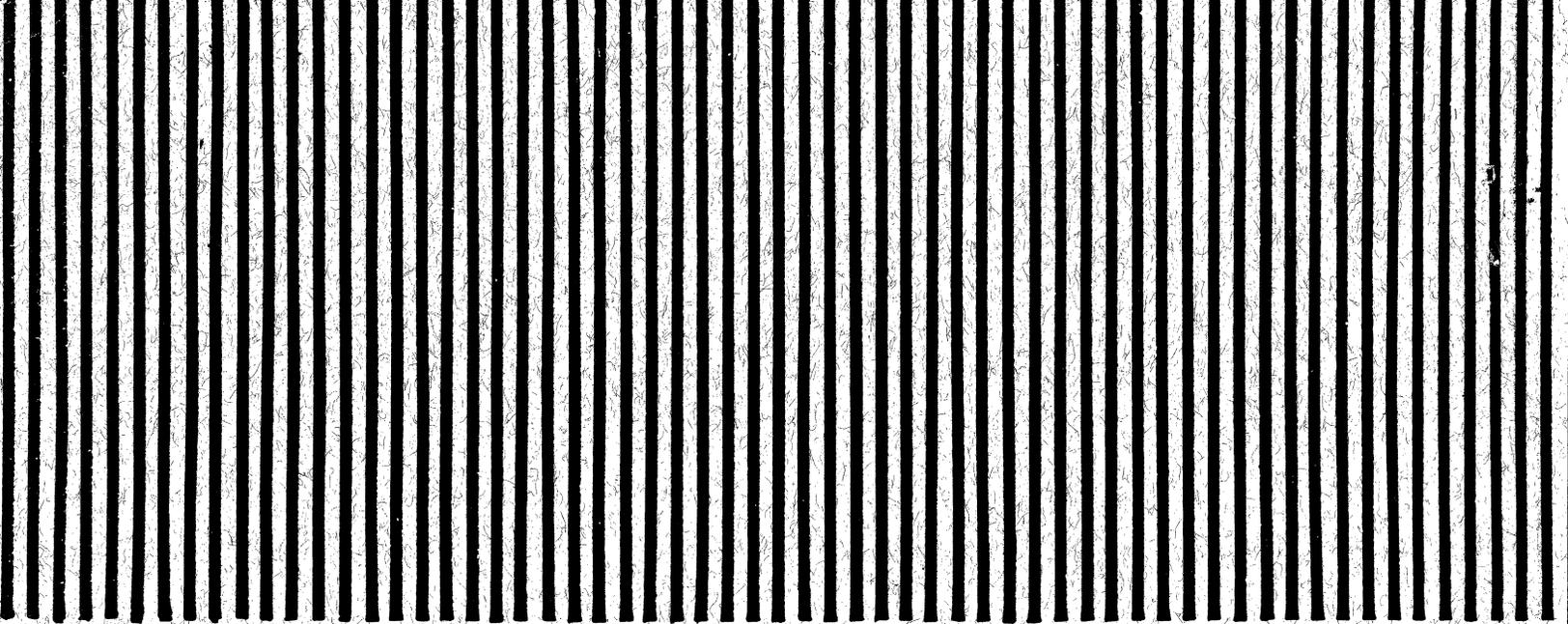
I.2 Reinserting the Ethernet Board

To go back to using the Ethernet board, type in LISP

```
(ethernet:install-ethernet-board)
```

Index

Cipher tape drive maintenance 1
FIGURE 11, 17
Filters maintenance 1
Preventive Maintenance 1
Reel hub pads cleaning 2
Tape path components cleaning 2



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