To: Rick Meyers

Date: June 22, 1983

From: George Cossey

Subject: Evaluation of diagnostic's hardware driver requirements.

Hardware Interface for Lisa 1.75

The following interfaces are needed, for the diagnostics, from the hardware interface in the Lisa 1.75 ROM.

Overall, all routines that interface to the hardware must have safety timeouts in them to prevent endless hangs. The timeout error must also be reported to the caller.

All data area used by the Hardware interface, for a scratch pad or to contain data, must reside in the Video memory. This makes it able to handle a system without any memory boards and improves diagnostic capability. The drivers must be able to run entirely in video memory, without ever using the main memory.

There should be a way to reset the hardware interface software/hardware. Unknown changes may occur during a diagnostic, and to return to a known state a reset may be necessary.

The timer chip.

Timer #0 and #1 can be assumed to be working, this is one of the first tests done by the Boot ROM.

Timer #0 - Need a handler for this timer, allows multiple timeouts to be set. Allows a previously set timeout to be queryed for remaining time and possibly deletion from the timer queue. Need a way to notify user program that timeout has expired, flag resides in user program and he passes you it's address?

Timer #1 - For Floppy driver.

Timer #2 - For Speaker driver.

Standard way to talk to the COPS. This means a way to send data and receive data

with a timeout option, to get around a hang condition. Should be a way to talk to the COPS in a non-structured way, i.e. not expect or send data in only specific formats.

A structured way to talk to the COPS should also be available. A change to the current method would be to have a timeout on multiple byte data streams. This will allow getting out if only part of a mouse stream comes in, a timeout error should occur. This would also handle if multiple data is being sent, as in a date, and the COPS stops accepting data.

Should be able to use the COPS in a polled mode or an interrupt mode.

Need a handler for Speaker values, volume and frequency. This latch requires a "shadow" to be kept in memory.

Need a handler for Contrast values. This latch requires a "shadow" to be kept in memory.

A standard floppy driver, capable of handling either the 871 or the Sony, using the IWM chip. Primitive commands must be allowed, with error trapping. High level commands should be available with error trapping.

A built-in hard disk driver. The special diagnostic commands in the disk drive must be accessiable. This driver must allow low level and high level commands.

A Profile hard disk driver, driving out of a parallel interface card. This driver must allow low level and high level commands.

Standard MMU register routines, for reading and for writing.

Checksums in all ROMs must be in a standard place in the ROM for use during bootup. The same calculation method that is in the Boot ROM must be used to generate this checksum number.

Driver for each of the RS232 ports.

If errors from the drivers are to be logged by a special error handler, then that handler must have numerous features for resetting, reading information, etc.

All error returns from the drivers must be addressed as to what the caller should do next. This especially applies to the Monitor and O.S., the diagnostics will be written to handle all errors.

Suggested Video memory layout:

1st screen - Main user screen.
2nd screen - Alternate screen, used by diagnostics for service mode.
3ed screen - Graphics scratch pad.
4th screen - Data area and scratch pad for Boot ROM programs, also contain enough area for exception vectors and a small stack.

Graphics required.

Standard drawing features must be available. These include:
Line drawing, including different size lines.
Filling an area with a pattern.
Inverting an area.
And others as needed.

Full keyboard and Mouse control, cursors and input handlers.

Simple pulldown tabs, must work with either keyboard or mouse inputs.

Buttons, must work with either keyboard or mouse inputs.

Making a desktop.

All graphics should work on both the standard and the alternate screen. This also means that it should be easy to switch between the two without having to redraw and resetup the screen.

Alerts must be available, must work with either keyboard or mouse inputs.

Icons, the special ones for diagnostics, must be allowed. Only simple drawing, hiliting, and moving is necessary. It must be easy to add icons, an ideal way is to allow the user program to add icons to the standard ones used.

1.75 Meetings

June 30th meeting.

Two video modes:
1. Lisa mode has 720 x 364.
2. Mac mode has 720 x 546.

New code name is "Whopper".

Floppy drive. Sony will be the only floppy, there will not be a 871 in the system. NOTE: Ann is designing an expansion card that will connect to a Sony, an 871, or an Apple II disk. Undecided if single or double sided Sony.

Widget is the built-in hard disk. A profile thru a two-port card is a safety option if the Widget doesn't work.

150ns RAMS will be used in the video, possibly in the rest of the system.

The 68010 processor will be used, 99% for sure. The 68000 is a backup.

There are currently 8 chips assigned for the Boot ROMS. This may go down to 4 chips and then down to 2 chips.

There will have to be a MAC/sound equivalent.

A new two-port card, to be designed, will work in 1.75 and 1.0

Next meeting is Thursday, July 14th at 1:30 PM.

July 14th meeting.

Only one (1) video screen, instead of the previous four.

A sound generator, of sorts, has been added.

Unused video memory should be written to black.

Video memory contains an area for sound and floppy speed.

WORD	SOUND	SPEED
	BYTE	BYTE

A NMI button will be on the CPU board, must get at it by using some kind of a stick thru a vent hole.

A special slot, four (4), for memory boards and co-processors.

There will be a light on the Widget.

No light or button on the Sony.

July 28th meeting.

Apple Computer Inc. Inter-Office Memorandum

To: Distribution 07/18/83

From: George Cossey

Subject: Lisa 1.75 (Whopper) Boot ROM Requirements, revision 1.

This reflects all the changes brought up at the meeting on Monday, July 18 in the Sitting Bull conference room. If there are any questions or changes then please contact me and I will generate a new and improved document.

LISA 1.75 Boot ROM Requirements

This document should be considered as a basic set of requirements for the new boot ROM in the Lisa 1.75 system. Detailed information will be made available in a Program Reference Specification document to be distributed later (there will be a meeting called for that document also).

The Lisa 1.75 Boot ROM should be considered as a totally new ROM and not as an adapted version of the Lisa 1.0 system. This means that any requirements for special operation, such as manufacturing burn-in, must be brought to the diagnostic groups attention as soon as possible.

Display format.

There must be a customer mode with minimal screen display and interaction, similar but not identical to that on the Lisa 1.0 Boot ROM.

There must be a Service mode which produces extensive test results for failure evaluation and the debug tools necessary to look at the problem. This will allow better debugging capabilitys on exact test state and failure information.

Test controls.

The basic flow must be diagnostics, followed by hardware initialization, followed by the bootup of the selected device.

There must be a service mode which allows for overriding any safety checks placed in there for customer mode.

Service mode must also have access to a simple debugger and have more extensive error logging on failures. This debugger must contain at least the features of the debugger in the current ROM, if possible then this debugger should be a subset of LisaBug and linked to it in some manner.

If the system is doing a cold start and booting is taking place from the built-in hard disk then the diagnostics should take advantage of this extra time to run extended memory tests.

If the system is doing a warm start then there should be only very fast diagnostics done and the user should have a minimal wait time.

A special 'fast' bootup command should be added for booting from the floppy disk. This is for debugger's use only and is restricted to the floppy. This restriction is to prevent this from becoming the new 'standard' way of booting.

Very long memory tests along with other interactive or long tests should be available if space permits, these will be called from service mode only.

Bootable devices must include:

a) Built-in hard disk.
b) Built-in floppy disk, Sony.
c) Expansion slots.
d) Serial port B using AppleBus, if AppleBus software is ready.
e) Serial port B using TALK.
f) Automatic burn-in of CPU board, using a signal bit from an edge connector pin.
g) Automatic bootup, described in Manufacturing requirements.

Option selection.

Selection of any user options must allow for both Mouse and Keyboard entry in the customer mode, this means that all of Customer mode must work using only the mouse or only the keyboard or a combination of both. Keyboard entry is required in the Service mode debugger.

Diagnostic test requirements.

Diagnostics must include the following:

a) Checksum tests for all ROMs and boot blocks.
b) Video and main memory tests.
c) Basic video circuit tests.
d) Extensive timer tests.
e) Basic COPS functional tests, keyboard and mouse reset test along with a basic clock test.
f) IWM controller chip tests.
g) RS232 port tests.
h) MMU memory and functional tests.
i) Parity circuit tests.
j) Hard disk port tests.

Optional diagnostics available from Service mode.

a) Extensive memory test.
b) Keyboard test, (only is space permits).
c) Mouse test, (only if space permits).

Details on diagnostics will be the subject of a later meeting.

Extra bug patch space should be designed into the plan for the ROM.

Manufacturing requirements.

The automatic boot special cases must be in the new ROM. These are:

a) If there is a test card (whose I.D. is within a special range) and an Applenet card installed, then the default boot device will be changed to the Applenet card.

b) If there is a bootable test card (whose I.D. is within a special range), and no Applenet card, then the bootable test card will be the default boot device.

Must support the crosshatch video pattern for both video modes, also grey patterns as must be available.

CPU board burn-in will be automatically done if the special line provided in hardware is set. Additional test requirements are to be provided by manufacturing.

Field Service requirements.

All requirements are covered in other areas in this document. Additional test requirements to be provided by Field Service.

A Power-Cycling mode must be provided, details will be provided by Field Service and Manufacturing.

Error codes will remain the same as Lisa 1.0 for the same failures. Additional error codes will be added for new tests and new features. Some error codes used in Lisa 1.0 are not used in Lisa 1.75.

Special debug commands must be available for floppy debugging.

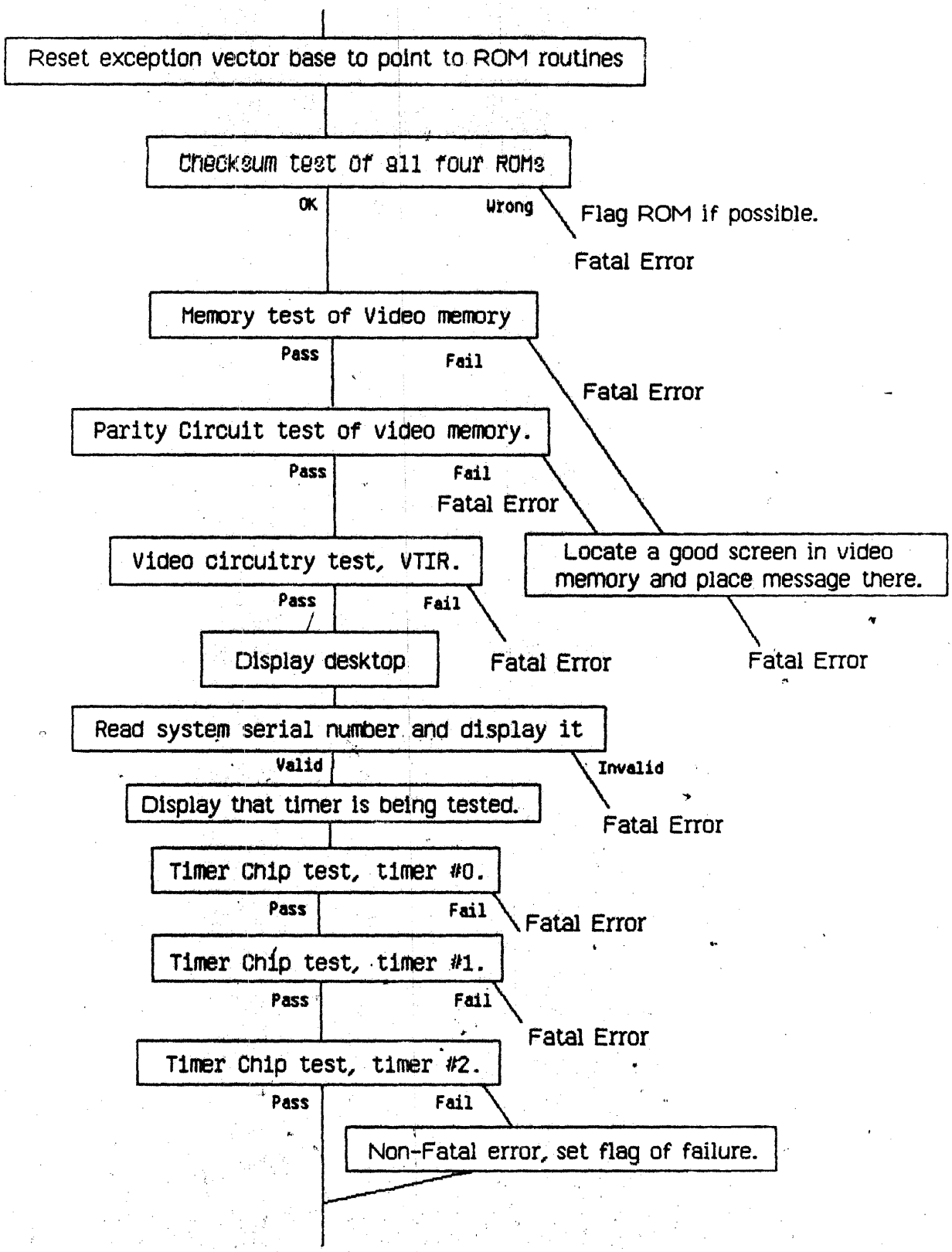
Office Systems requirements.

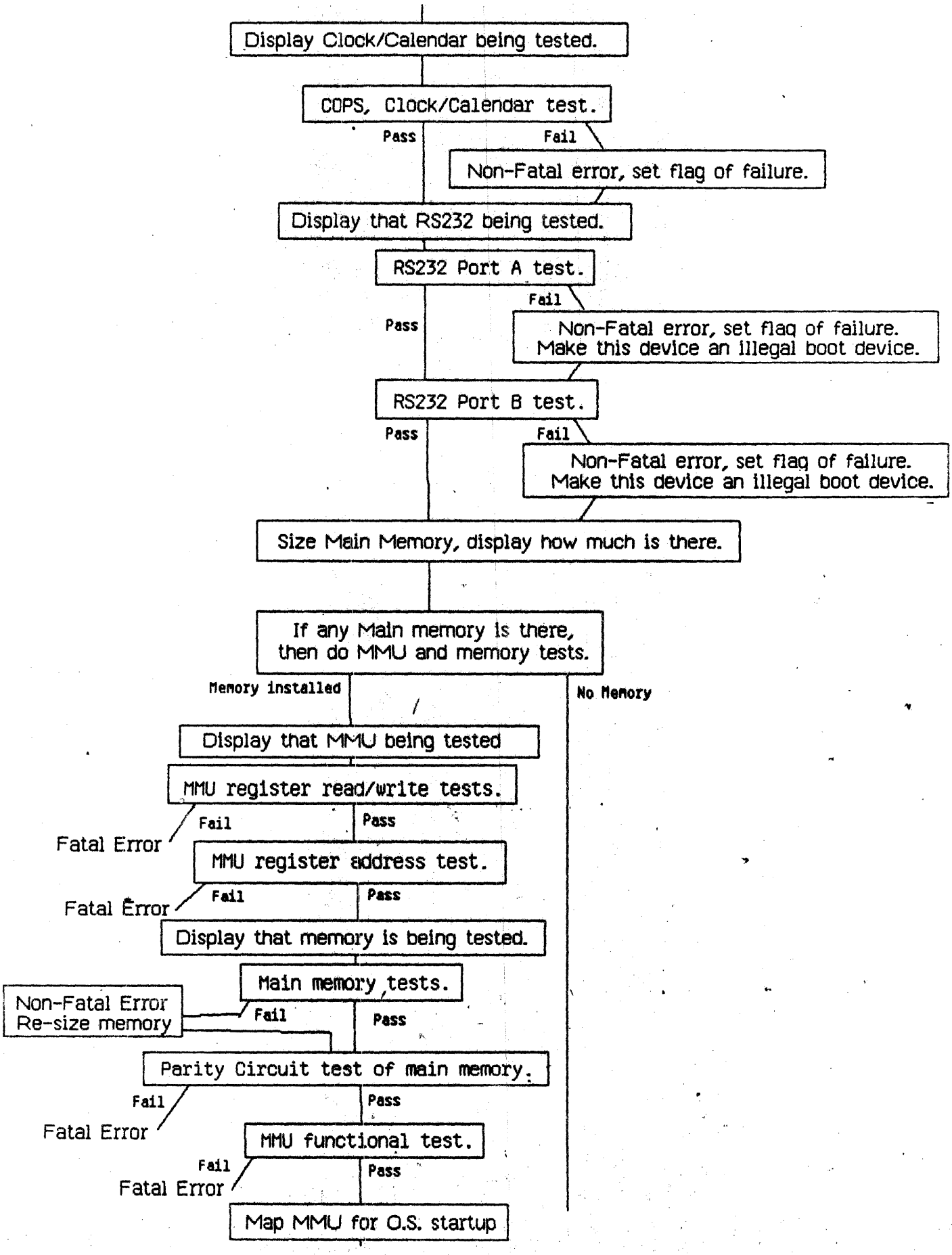
The boot process must be very fast and not take much longer than the current boot ROM, if possible then be faster than the current process. The LISA 1.0 boot process, for the boot ROM, takes about 30 seconds. The new boot ROM will be targeted for 15 seconds. Additional test requirements to be provided by the O.S. group.

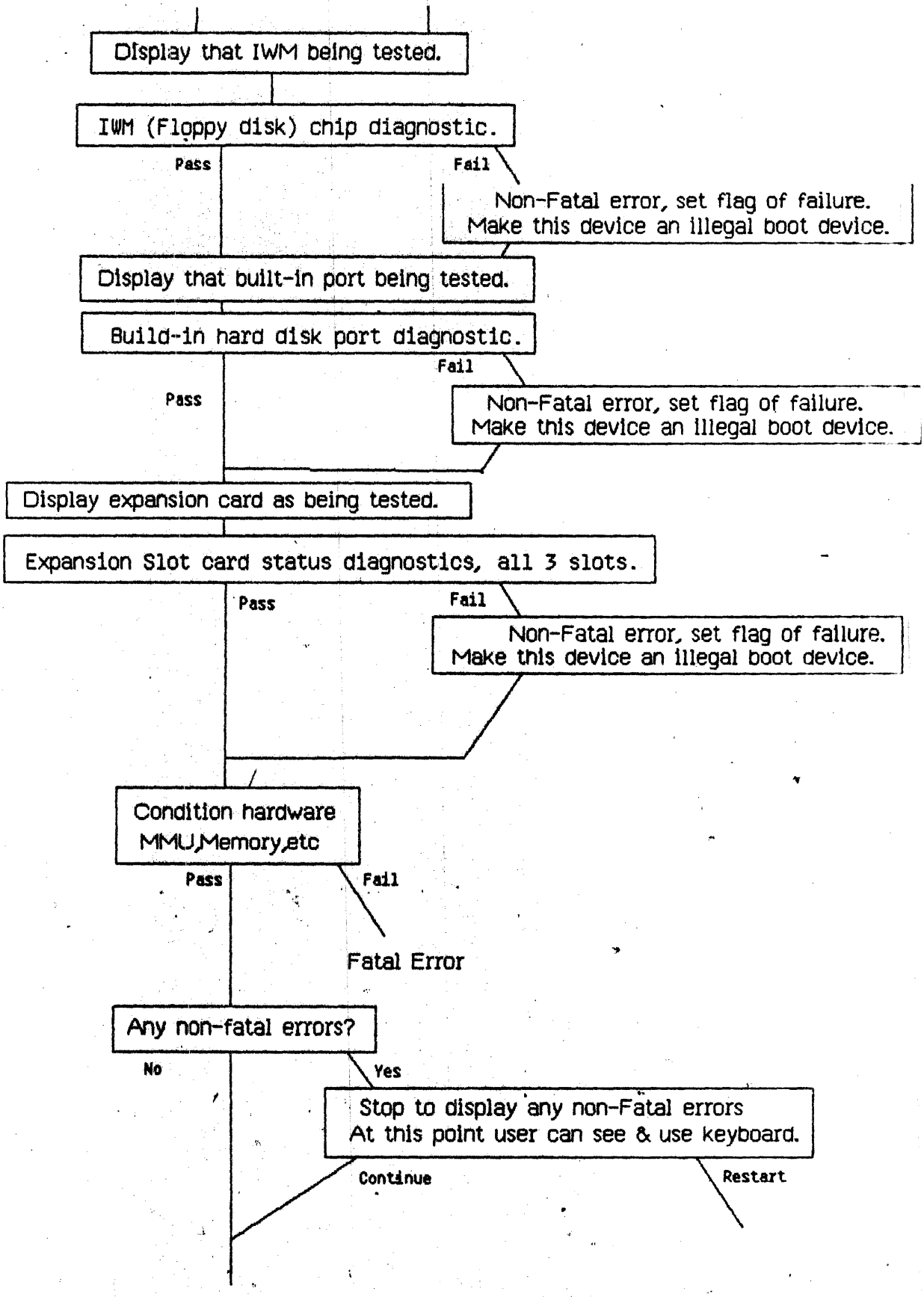
Compatability requirements.

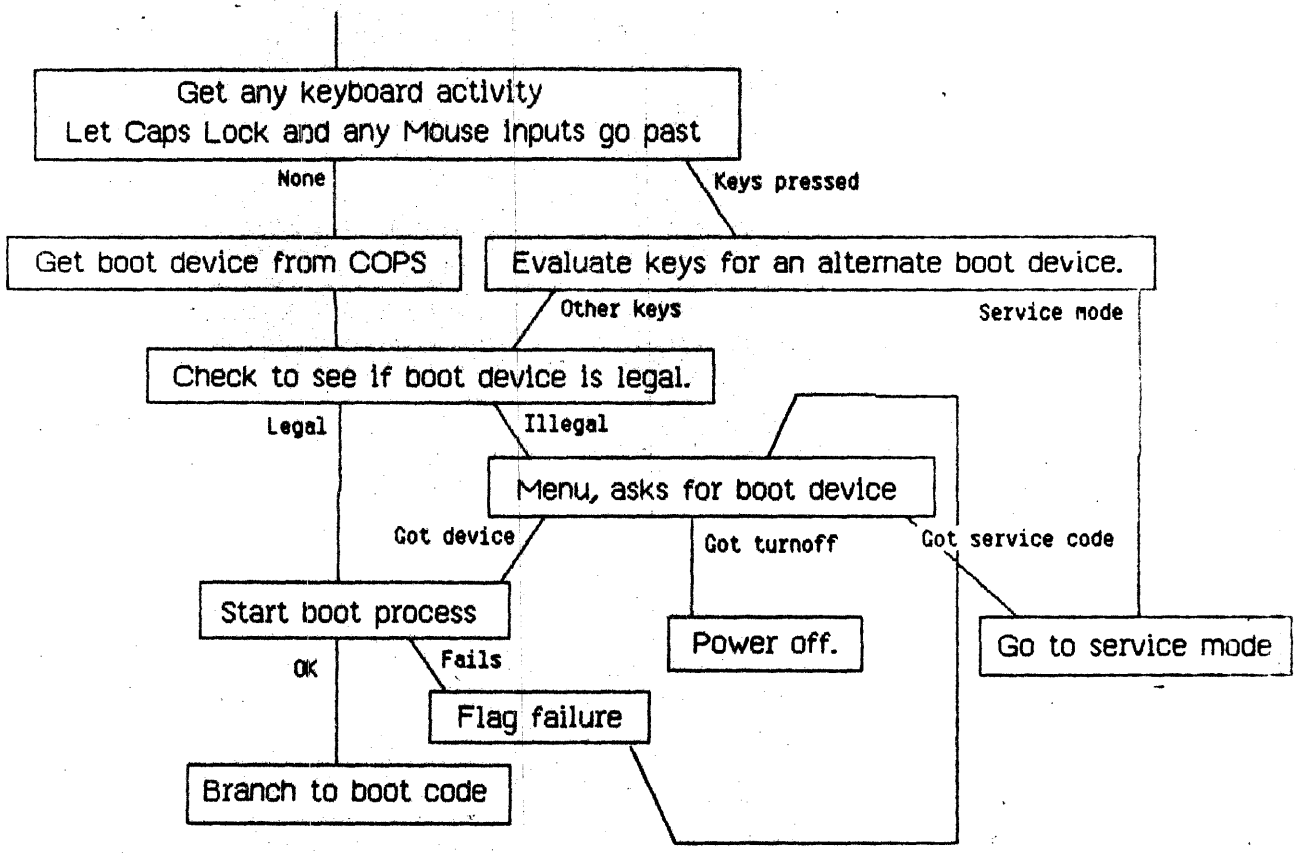
Must supply the same interface to expansion cards, so that current expansion card ROMs will work without modification.

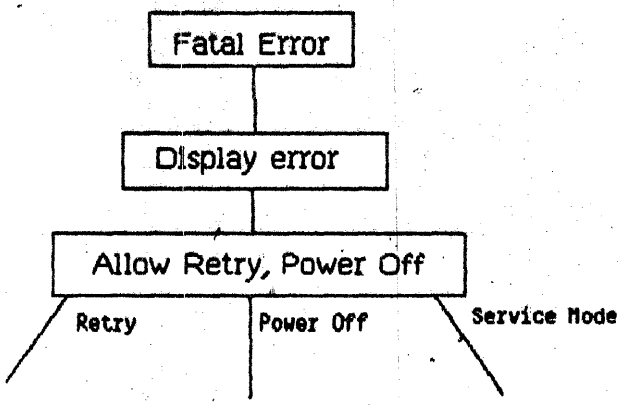
Boot ROM Flow



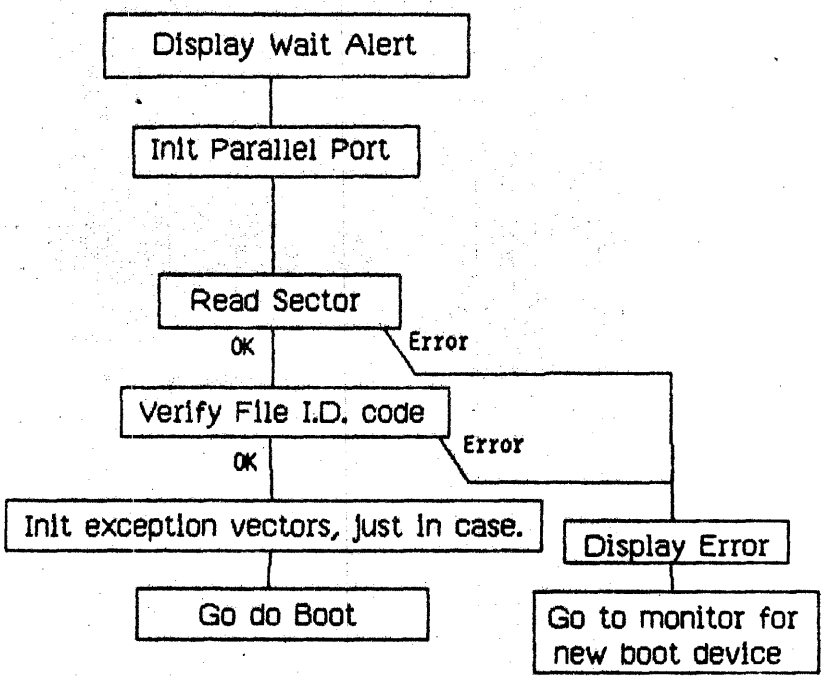

Display Clock/Calendar being tested.
COPS, Clock/Calendar test.
Pass
Fail
Non-Fatal error, set flag of failure.
Display that RS232 being tested.
RS232 Port A test.
Fail
Pass
Non-Fatal error, set flag of failure.
Make this device an illegal boot device.
RS232 Port B test.
Pass
Fail
Non-Fatal error, set flag of failure.
Make this device an illegal boot device.
Size Main Memory, display how much is there.
If any Main memory is there,
then do MMU and memory tests.
Memory installed
No Memory
Display that MMU being tested
MMU register read/write tests.
Fail
Pass
Fatal Error
MMU register address test.
Fail
Pass
Fatal Error
Display that memory is being tested.
Main memory tests.
Non-Fatal Error
Re-size memory
Fail
Pass
Parity Circuit test of main memory.
Fail
Pass
Fatal Error
MMU functional test.
Fail
Pass
Fatal Error
Map MMU for O.S. startup


Display that IWM being tested.
IWM (Floppy disk) chip diagnostic.
Pass
Fail
Non-Fatal error, set flag of failure.
Make this device an illegal boot device.
Display that built-in port being tested.
Build-in hard disk port diagnostic.
Fail
Pass
Non-Fatal error, set flag of failure.
Make this device an illegal boot device.
Display expansion card as being tested.
Expansion Slot card status diagnostics, all 3 slots.
Pass
Fail
Non-Fatal error, set flag of failure.
Make this device an illegal boot device.
Condition hardware
MMU,Memory,etc
Pass
Fail
Fatal Error
Any non-fatal errors?
No
Yes
Stop to display any non-Fatal errors
At this point user can see & use keyboard.
Continue
Restart

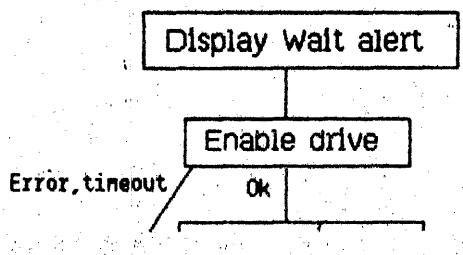

Get any keyboard activity
Let Caps Lock and any Mouse inputs go past
None
Keys pressed
Get boot device from COPS
Evaluate keys for an alternate boot device.
Other keys
Service mode
Check to see if boot device is legal.
Legal
Illegal
Menu, asks for boot device
Got device
Got turnoff
Got service code
Start boot process
Power off.
Go to service mode
OK
Fails
Flag failure
Branch to boot code

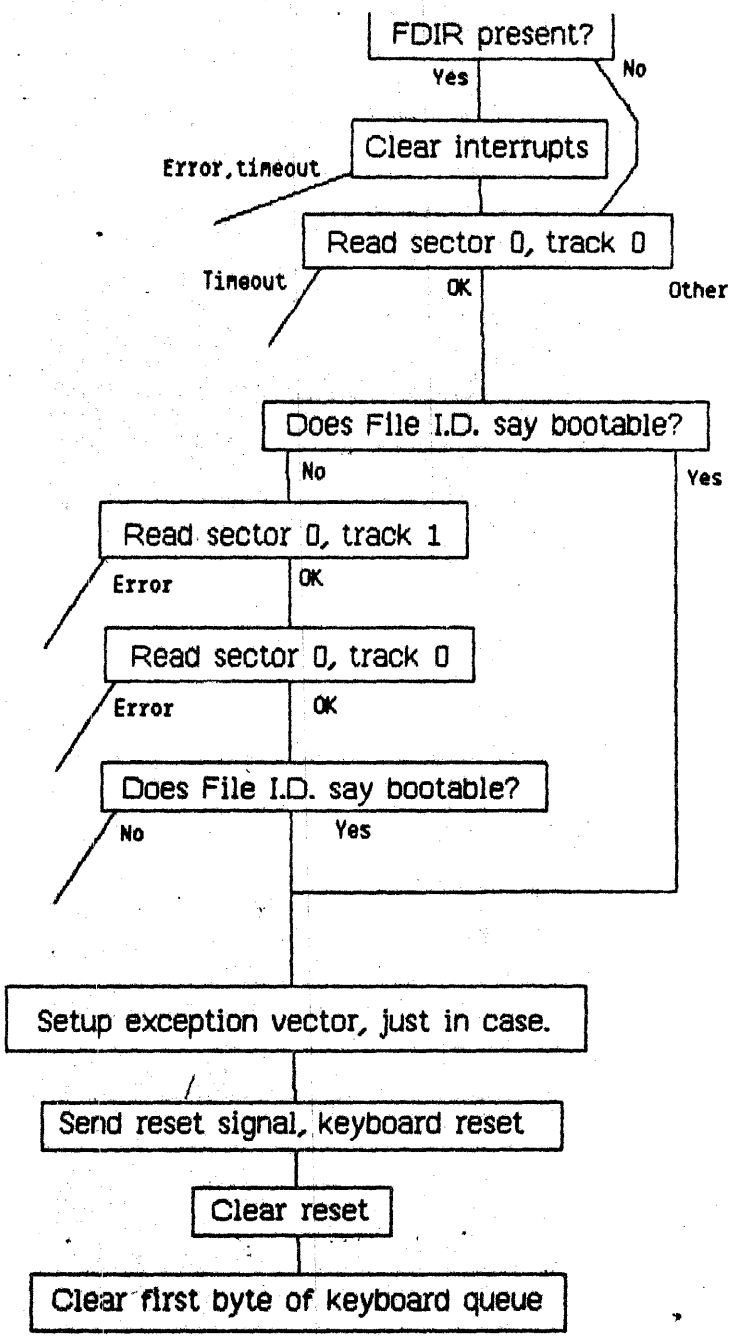

Fatal Error
Display error
Allow Retry, Power Off
Retry
Power Off
Service Mode

Boot from Profile

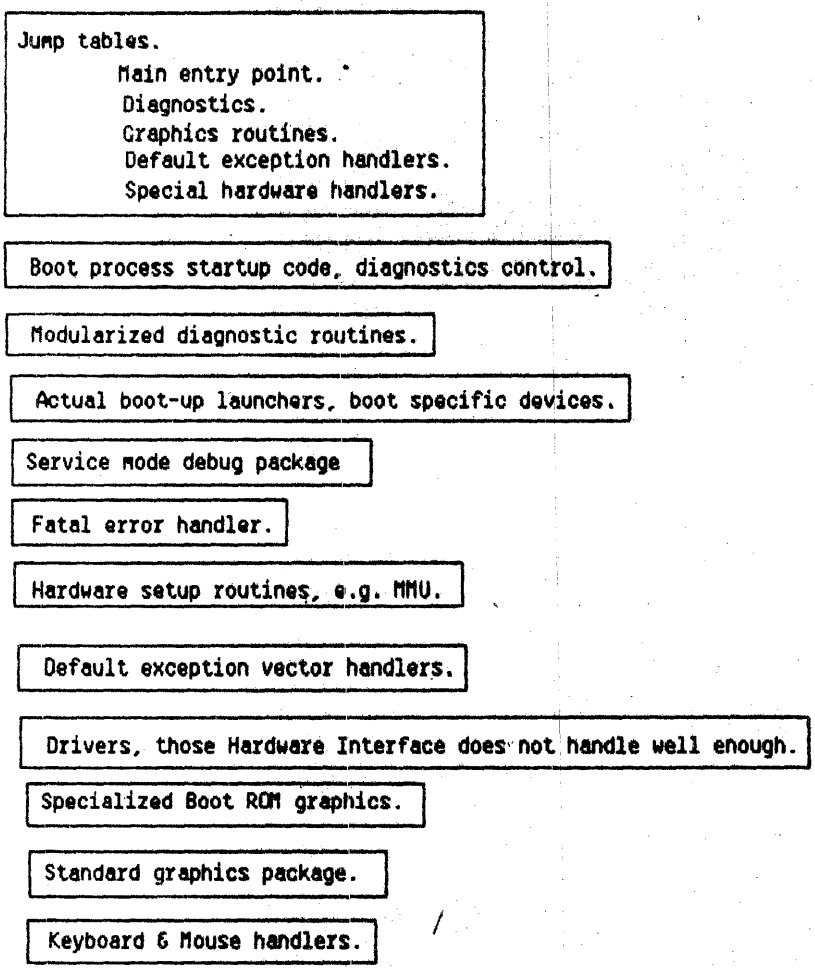


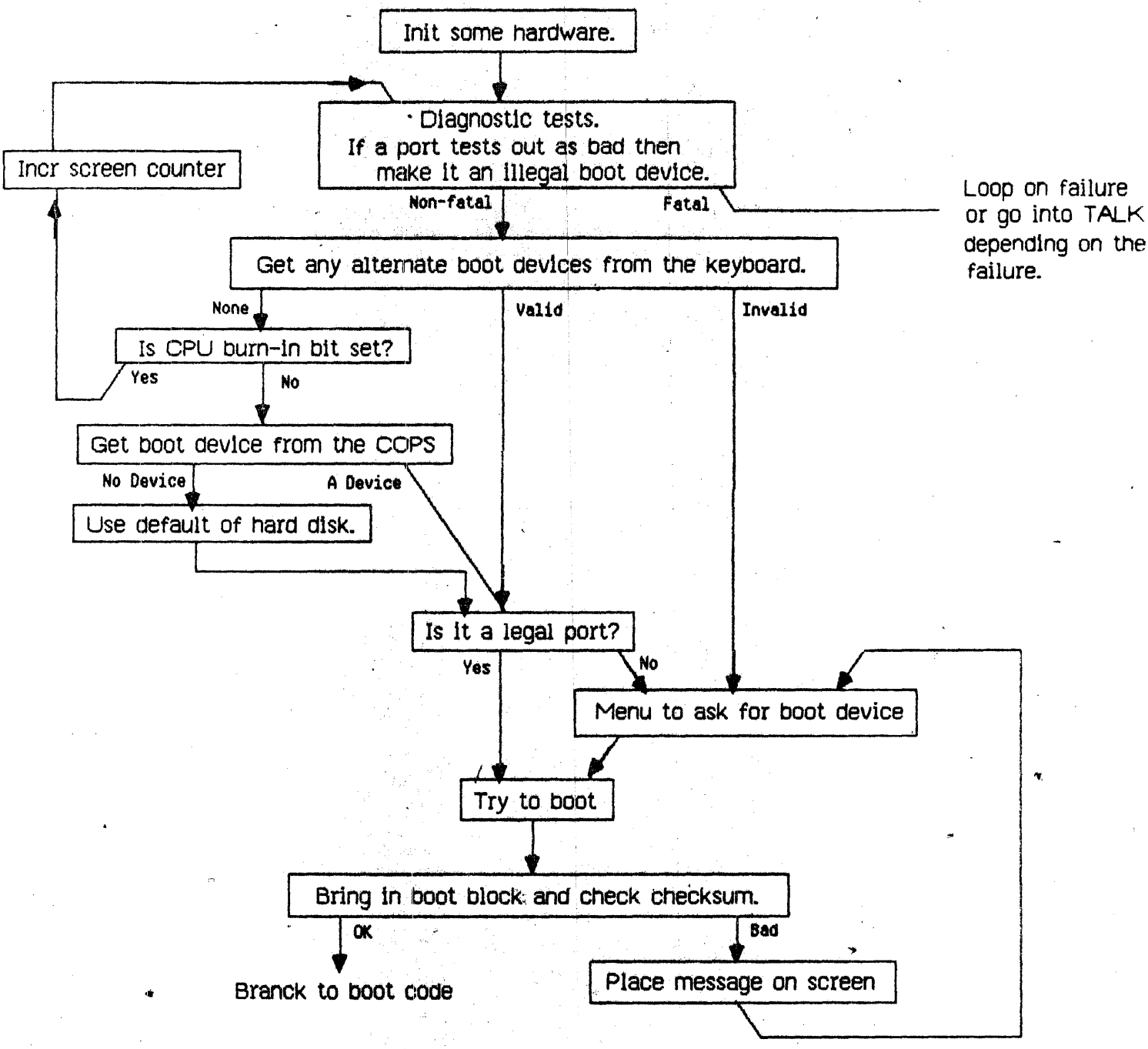
Floppy disk Boot

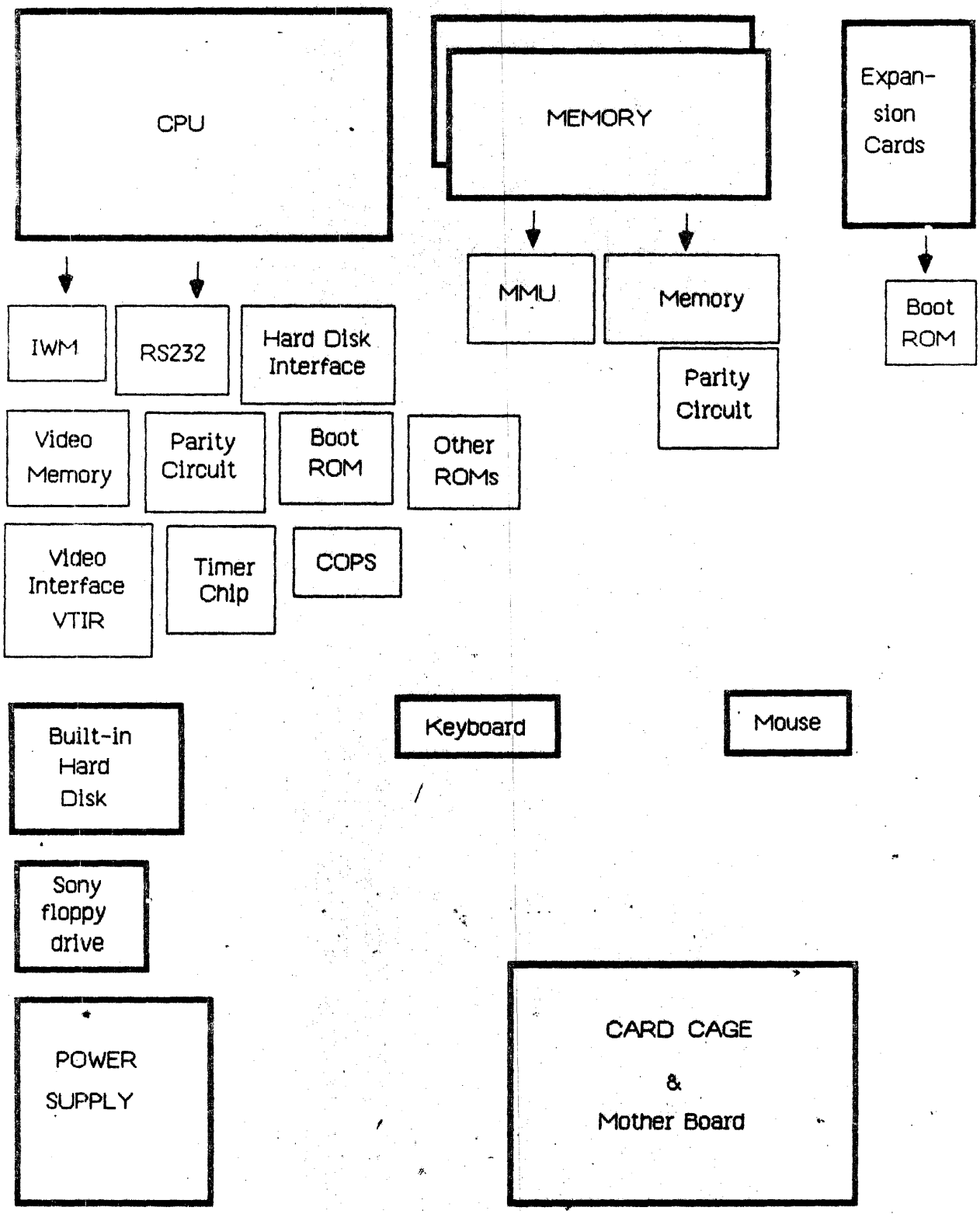



FDIR present?
Yes
No
Clear interrupts
Error,timeout
Read sector 0, track 0
Timeout
OK
Other
Does File I.D. say bootable?
No
Yes
Read sector 0, track 1
Error
OK
Read sector 0, track 0
Error
OK
Does File I.D. say bootable?
No
Yes
Setup exception vector, just in case.
Send reset signal, keyboard reset
Clear reset
Clear first byte of keyboard queue

Lisa 1.75 Boot ROM Layout




Init some hardware.
Diagnostic tests.
If a port tests out as bad then
make it an illegal boot device.
Incr screen counter
Non-fatal
Fatal
Loop on failure
or go into TALK
depending on the
failure.
Get any alternate boot devices from the keyboard.
None
Valid
Invalid
Is CPU burn-in bit set?
Yes
No
Get boot device from the COPS
No Device
A Device
Use default of hard disk.
Is it a legal port?
Yes
No
Menu to ask for boot device
Try to boot
Bring in boot block and check checksum.
OK
Bad
Branck to boot code
Place message on screen


CPU
MEMORY
Expan-
sion
Cards
MMU
Memory
Boot
ROM
Parity
Circuit
IWM
RS232
Hard Disk
Interface
Video
Memory
Parity
Circuit
Boot
ROM
Other
ROMs
Video
Interface
VTIR
Timer
Chip
COPS
Keyboard
Mouse
Built-in
Hard
Disk
Sony
floppy
drive
POWER
SUPPLY
CARD CAGE
&
Mother Board

MEMORY MAP

Location	Segment	Function
$000000-$007FFF	0,32,64,96	ROM 0, Boot ROM
$020000-$027FFF	1,33,65,97	ROM 1
$040000-$047FFF	2,34,66,98	ROM 2
$060000-$067FFF	3,35,67,99	ROM 3
$000000-$007FFF	30,62,94,126	Screen 0, Data
$008000-$00FFFF	30,62,94,126	Screen 1, Data
$000000-$007FFF	31,63,95,127	Screen 2, Data
$008000-$00FFFF	31,63,95,127	Screen 3, Data
$002001	12,44,76,108	IWM, Phase 0 low
$002003	12,44,76,108	IWM, Phase 0 high
$002005	12,44,76,108	IWM, Phase 1 low
$002007	12,44,76,108	IWM, Phase 1 high
$002009	12,44,76,108	IWM, Phase 2 low
$002008	12,44,76,108	IWM, Phase 2 high
$00200D	12,44,76,108	IWM, Phase 3 low
$00200F	12,44,76,108	IWM, Phase 3 high
$002011	12,44,76,108	IWM, L-Motor-On
$002015	12,44,76,108	IWM, Drive select
$002019	12,44,76,108	IWM, L6
$00201D	12,44,76,108	IWM, L7
$003001	12,44,76,108	Status register
$003003	12,44,76,108	Status register
$003004	12,44,76,108	IWM, Disk motor off
$003005	12,44,76,108	IWM, Disk motor on
$003006	12,44,76,108	Hard disk interrupt mask, disable
$003007	12,44,76,108	Hard disk interrupt mask, enable
$00300C	12,44,76,108	TxD A/LED (enable/Off)
$00300D	12,44,76,108	TxD A/LED (Disable/On)
$00300E	12,44,76,108	Hard disk parity mask, disable
$00300F	12,44,76,108	Hard disk parity mask, enable
$003020	12,44,76,108	Memory parity enable
$003030	12,44,76,108	Memory parity disable
$003040	12,44,76,108	IWM, Head select - Side 0
$003050	12,44,76,108	IWM, Head select - Side 1
$003060	12,44,76,108	Hard disk interface CMD line low
$003070	12,44,76,108	Hard disk interface CMD line high
$0030C0	12,44,76,108	Disable Vertical Retrace Interrupt
$0030D0	12,44,76,108	Enable Vertical Retrace Interrupt
$0030AA	12,44,76,108	Set screen to 0, read
$0030AB	12,44,76,108	Set screen to 1, read
$00308A	12,44,76,108	Set screen to 2, read
$0030BB	12,44,76,108	Set screen to 3, read
$004001	12,44,76,108	Read/Load Timer Counter 0
$004003	12,44,76,108	Read/Load Timer Counter 1
$004005	12,44,76,108	Read/Load Timer Counter 2
$004007	12,44,76,108	Write to timer mode register
$006001	12,44,76,108	SCC, Channel B Control
$006003	12,44,76,108	SCC, Channel A Control
$006005	12,44,76,108	SCC, Channel B Data
$006007	12,44,76,108	SCC, Channel A Data
$007000	12,44,76,108	Error address latch
$007001	12,44,76,108	Audio and Contrast latch