Part Number 800-1147-01
Revision: 50 of 7 January 1985

Moniterm Monitor (P/N 360-1000-02)

Service Manual

for the

Sun-2 Family of Workstations

Sun Microsystems, Inc.,
2550 Garcia Avenue,
Mountain View,
California 94043
(415) 960-1300

Credits and trademarks

Sun Workstation, **Sun-1**, **Sun-2**,
SunStation, and **Sun Microsystems** are
trademarks of Sun Microsystems, Incorporated.

UNIX is a registered trademark of Bell Laboratories.

Revision History

Revision	Date	Comments
50	7 January 1985	First release of this Service Manual.

Contents

Tables

Figures

Introduction

This manual is meant to help you understand how to troubleshoot, repair, and adjust the Sun-2 Moniterm monitor.

Summary of Contents

This manual has four major sections.

Chapter 1 — is a block-level description of the Moniterm monitor's circuitry.

Chapter 2 — describes the troubleshooting procedures.

Chapter 3 — describes the adjustment procedures.

Chapter 4 — describes the test procedures.

Appendix A — contains an illustrated parts' breakdown of the monitor subassemblies, and the Neck and Deflection board schematics and component locations.

Finally, to help us maintain the currency and accuracy of this material we have supplied a reader comment sheet at the end of this guide. Please use the comment sheet to list errors and omissions. Your responses will help a great deal in our efforts to keep our documentation up to date.

Table 1: Additional Documentation

Part Number	*Description*
950-0001	Engineering Specification for the 19 inch Monochrome Monitor

Chapter 1

Sun-2 Moniterm Monitor

1.1. Goals and Objectives

The purpose of this manual is to present a theory of operations, a troubleshooting guide, and an alignment procedure for repair of the Sun-2 Moniterm monitor.

1.2. Safety Precautions

Warning

To avoid electric shock and/or a fire hazard, DO NOT REMOVE COVERS. Refer all servicing to qualified service personnel.

1.3. Monitor Description

Caution!

There are extremely high voltages present in some of this circuitry, particularly the output of the high voltage supply and the anode connection to the CRT. Make certain all power to the monitor is OFF before attempting any repairs.

The Sun-2 Moniterm monitor is a non-interlaced raster display which in its standard configuration has a 1152 (horizontal) by 900 (vertical) display, with a 100 MHz video pixel rate. An alternate configuration is the 1K x 1K (1024 by 1024) display. For convenience, these two configurations will be known as "A" and "B" (see the table below).

Table 1-1: Two Configurations of the Moniterm Monitor Display

Configuration Name	*Configuration Size*
A	1152 by 900 pixels
B	1024 by 1024 pixels

The monitor has separate low active TTL-level horizontal and vertical sync signals. Frame rates are listed in the timing specification table, below.

The actual number of visible lines (that time when information is being painted on the screen) and invisible lines (that time when information is blanked during retrace) in the standard and optional configurations are given in the two tables below. For instance Configuration A has a total of 1600 horizontal lines, of which 1152 are visible. This means that 448 lines are blanked during retrace time.

Table 1-2: Visible and Invisible Lines in Configuration A

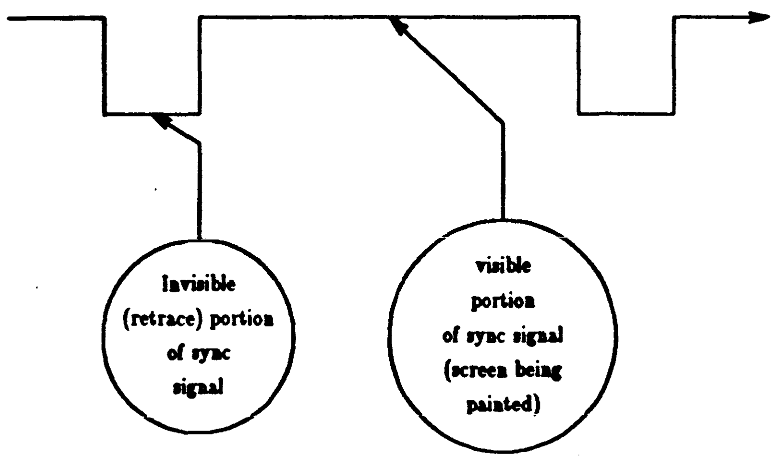
	Total Lines	**Invisible Lines**	**Visible Lines**
Horizontal trace	1600	448	1152
Vertical trace	937	37	900

Table 1-3: Visible and Invisible Lines in Configuration B

	Total Lines	**Invisible Lines**	**Visible Lines**
Horizontal trace	1600	576	1024
Vertical trace	1061	37	1024

Below is a **general** diagram of the portions of the sync waveform which determine the visible and invisible (blanked) lines of the display. By "general" we mean that no timing relationships should be inferred from this diagram.

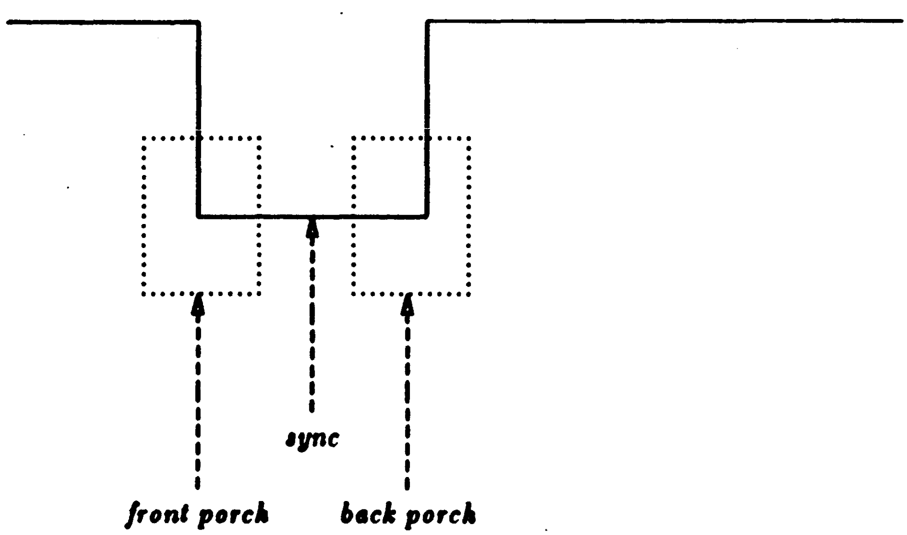
Figure 1-1: The Sync Signals: Visible and Invisible Parts of Waveform



The figure below depicts three parts of the blanking portion of the sync waveform:

- front porch
- sync
- back porch

Figure 1-2: Front Porch, Back Porch and Sync Portions of the Blanking Signal



The table below gives the timing specifications for the two display configurations.

Table 1-4: Timing Specifications for Display A and Display B Video Images

Parameter	Configuration A	Configuration B
Video clock	100.00 MHz	100.00 MHz
Horizontal frequency	62.50 kHz	62.50 kHz
Horizontal sync		
hcycle	16.00 μs	16.00 μs
visible	11.52 μs	10.24 μs
hblanking	4.48 μs	5.76 μs
front porch	0.00 μs	0.64 μs
hsynch	1.28 μs	1.28 μs
back porch	3.20 μs	3.84 μs
Vertical sync		
vcycle	14992.00 μs	16976.00 μs
visible	14400.00 μs	16384.00 μs
vblanking	592.00 μs	592.00 μs
front porch	00.00 μs	00.00 μs
vsync	128.00 μs	128.00 μs
back porch	432.00 μs	432.00 μs
Vertical frequency	66.70 Hz	58.91 Hz

1.3.1. Horizontal Sync Signal

The horizontal sync signals of both configurations have a frequency of 62.5 kHz, which is a period of 16 μs. Each 16 μs period consists of visible (that time when information is being painted on the screen) and invisible (the time when the signal is in retrace) parts of the cycle. For instance, the visible portion of the horizontal sync signal for Configuration B lasts for 10.24 μs; the invisible 5.76 μs. These two added together make up the 16 μs period of the horizontal sync signal.

1.3.2. Vertical Sync Signal

Configuration A's vertical sync signal has a frequency of 66.7 Hz, which is a period of 14.992 ms. Configuration B's vertical sync signal has a frequency of 58.91 Hz, which is a period of 16.976 ms. Both have visible and invisible portions, on the same principle as the horizontal sync signal.

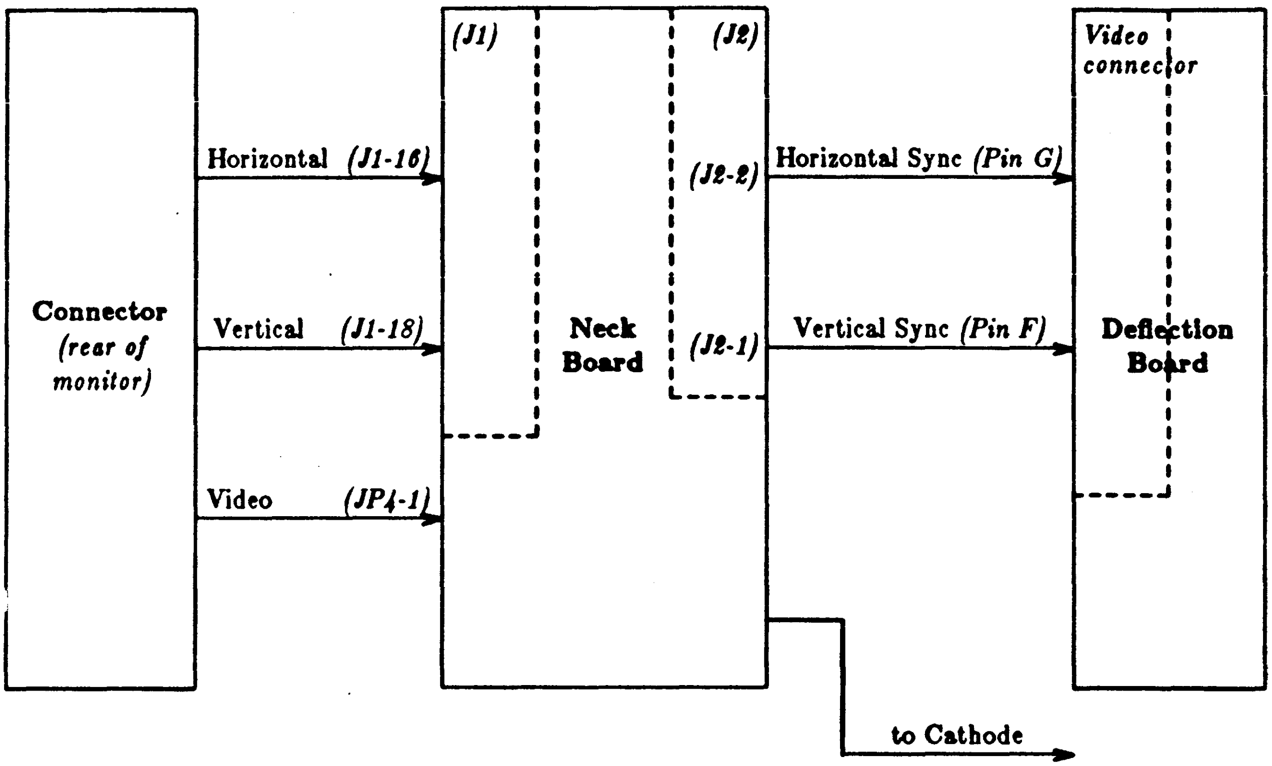
1.4. Monitor Signals

A block diagram of the signal flow is given below — for further detail, refer to schematics of the Neck and Deflection boards in the Appendix.

Basically, three signals come in on the video connector at the rear of the monitor chassis

- video
- horizontal sync
- vertical sync

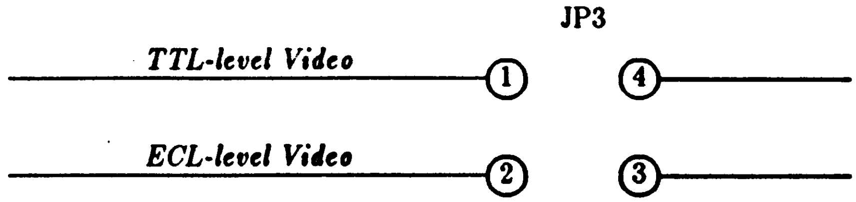
Figure 1-3: Monitor Block Diagram, Part 1



These three signals pass onto the Neck board through J1. The **horizontal** and **vertical** sync signals pass through inverters and are taken off the board at J2. The **video** signal passes through various circuitry (depending upon whether the signal is TTL or ECL) and is taken off the board at P1-7 to the cathode of the CRT. The diagram below illustrates the jumpering of JP3, the TTL/ECL Video Jumper, in which:

- connecting pins 1 and 4 will give you TTL video
- connecting pins 2 and 3 will give you ECL video.

Figure 1-4: TTL/ECL Video Jumper



Voltage level requirements for TTL and ECL signals are listed in the table below.

Table 1-5: Voltage Levels for ECL and TTL Video Logic

Input Signal	*Logic 0*	*Logic 1*
TTL Video	≤0.4 VDC	≥2.4 VDC
Horizontal Sync	≤0.4 VDC	≥2.4 VDC
Vertical Sync	≤0.4 VDC	≥2.4 VDC
ECL Video	differential >0.5 VDC	

The two sync signals are passed to the Deflection board through pin G (horizontal sync) and pin F (vertical sync) of the Video connector — see the schematic for the Deflection board in the Appendix. These deflection signals pass through their respective deflection yokes.

Figure 1-5: Horizontal and Vertical Sync Signals on the Deflection Board

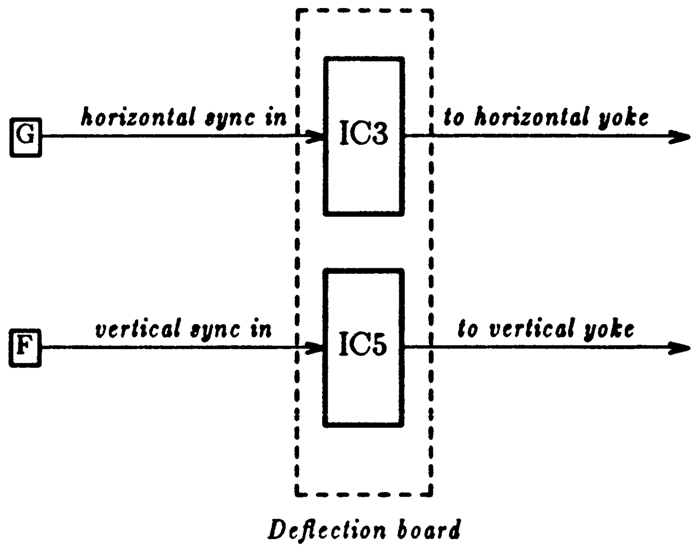
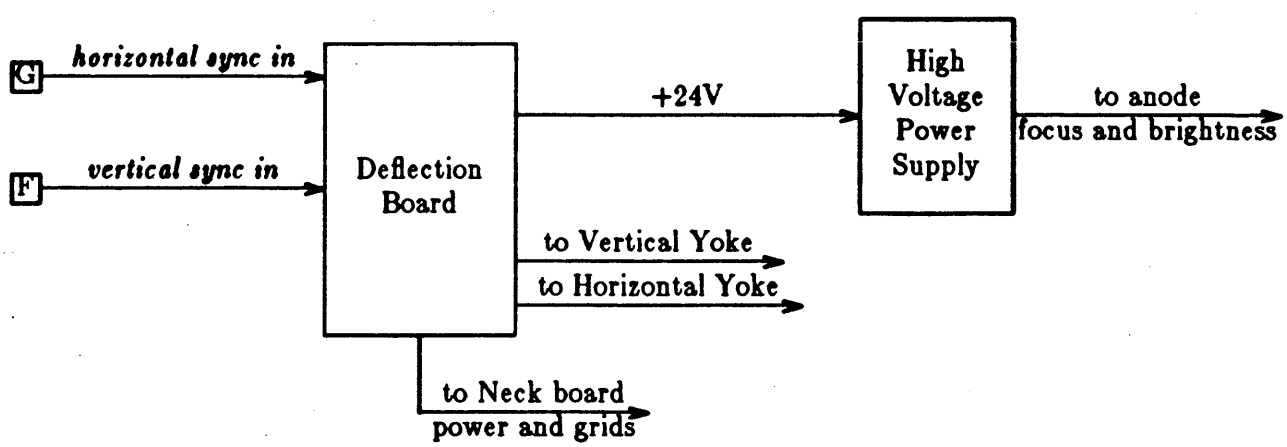
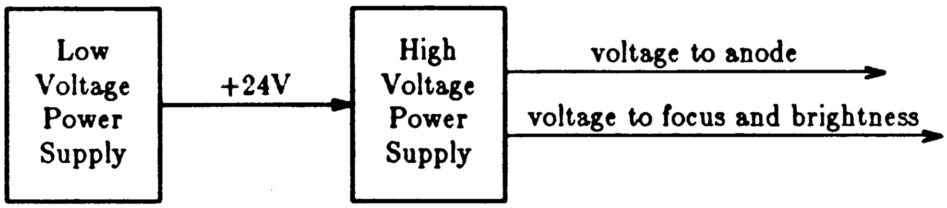


Figure 1-6: Monitor Block Diagram, Part 2



Also included in the Deflection board circuitry are potentiometers P1 through P11, the low voltage power supply, and the high voltage power supply.

Figure 1-7: Low and High Voltage Power Supplies



The 11 potentiometers on the Deflection board are:

- P1 — Horizontal Width
- P2 — Horizontal hold
- P3 — Vertical hold
- P4 — Vertical size
- P5 — Vertical top/bottom linearity
- P6 — Vertical linearity
- P7 — DC focus
- P8 — Brightness
- P9 — Vertical DC centering
- P10 — Vertical dynamic focus
- P11 — Horizontal dynamic focus

For location of these potentiometers, see Chapter 3.

1.5. Picture Tube

The picture tube consists of these various elements:

- Cathode
- G1 — grid which controls the brightness and intensity of the screen
- G2 — grid which sets the biasing point for G1 (tube operating point)
- G3 — suppressor grid; narrows the electron beam and reduces secondary reflection
- G4 — focus grid
- Anode — places a charge on the inside surface of the tube (cf. ***aquadag***, below.)
- Deflection yoke — deflects the electron beam to the correct area of screen
- Aquadag — coating on the inside of the tube which stores a charge like a capacitor.

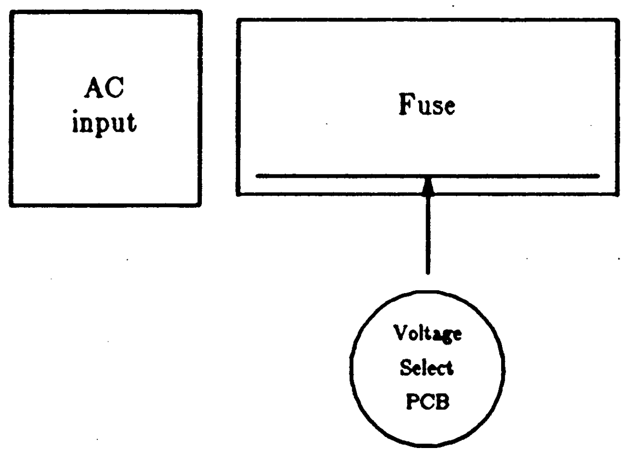
The G2 and G4 grids act like a fine mesh screen, through which electrons pass. The greater the bias voltage which is applied to a grid, the finer the mesh appears, reducing electron flow.

The Moniterm monitor uses both vertical and horizontal dynamic focusing to move the electron beam anywhere on the screen. Dynamic focusing keeps the beam appearing circular, and is adjustable through P10 and P11 on the Deflection board, as described in Chapter 3.

1.6. Setting for the Correct Input Voltage

Voltage selection is done by setting a small PCB in one direction or another inside the "Fuse" section of the AC input receptacle. The diagram below shows the location of the voltage select PCB.

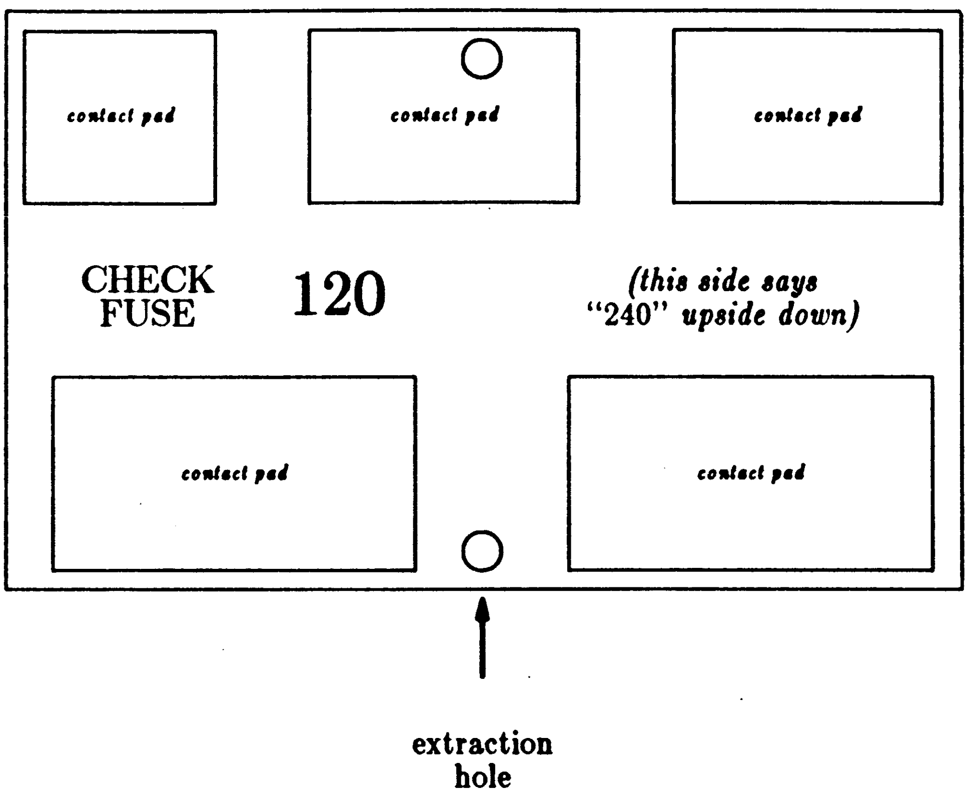
Figure 1-8: AC Power, Voltage Select, and Fuse



1.6.1. 120/240 VAC Operation

Below is a diagram of the 120/240 VAC side of the voltage select PCB. For 120 VAC operation, slide this side up (with the legend **CHECK FUSE 120** on the left-hand side and facing out towards you) into the fuse case.

Figure 1-9: 120/240 VAC Select

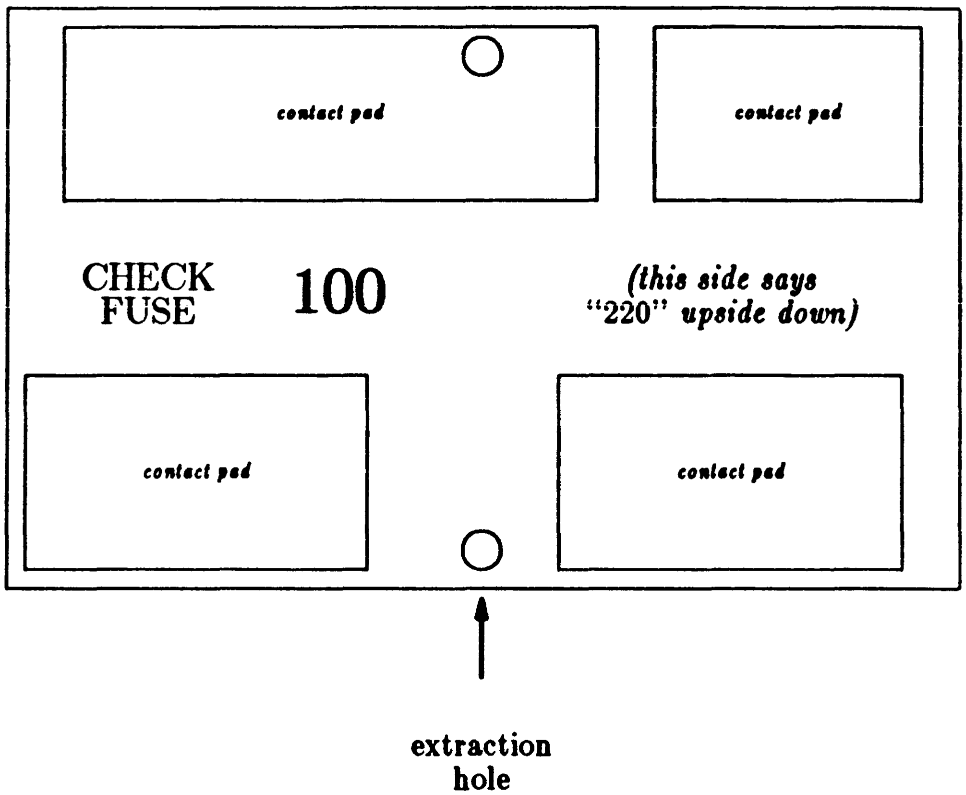


For 240 VAC operation take the PCB out and, keeping this same side up, rotate the PCB 180 degrees so that the legend "240" is on the left-hand side and faces out towards you. Slide the PCB into the fuse case in this position.

1.6.2. 100/220 VAC Operation

For 100/220 VAC operation, flip the card over. It looks something like this:

Figure 1-10: 100/220 VAC Select



For 100 VAC operation, position the card up so the legend **CHECK FUSE 100** is on the left-hand side and facing out towards you. Slide the PCB into the fuse case in this position.

For 220 VAC operation, take the PCB out and, keeping this same side up, rotate the PCB 180 degrees so that the "220" is on the left hand side, facing you. Slide the PCB into the fuse case in that position.

1.7. AC Input Ratings

The tables below list the **absolute maximum ratings** for the four AC input ranges. When the unit is operated at the maximum limits, performance will meet all specifications.

Table 1-6: Maximum Ratings for AC Supply Voltage

AC Supply Voltage *(nominal)*	**Minimum** *(AC Voltage)*	**Maximum** *(AC Voltage)*
100V	90V	110V
120V	108V	132V
220V	198V	242V
240V	216V	264V

1.8. Fuse Rating

The standard fuse to be used with the Moniterm monitor is 1.5A Slo-Blow for all voltages.

1.9. Operating Specifications

Nominal input power for the monitor is 75 watts (255.9 BTUs); maximum power is 95 watts (324.2 BTUs).

Chapter 2

Troubleshooting the Sun-2 Moniterm Monitor

On the following pages is a **basic** troubleshooting chart for the Moniterm monitor.

Caution!

There are extremely high voltages present in some of this circuitry, particularly the output of the high voltage supply and the anode connection to the CRT. The bleed time of the high voltage circuitry is 10 minutes; wait at least that long after turning off the power and removing the AC power cord before attempting any repairs.

- **Inspect the CRT carefully for cracks, especially around the neck and yoke — if any are visible DO NOT turn the power on. Instead, ship the monitor back to the repair center or factory for the tube to be replaced.**
- **Whenever making any repairs or adjustments to the monitor while the power is still on, make certain that the hand you are NOT using is completely clear of the circuitry so that you do not create a closed-circuit to ground with your body.**
- **Whenever possible, use only non-metallic tools for adjustments.**

> ***Note***
>
> ***Before starting this troubleshooting procedure, make certain all boards and cables are securely seated.***

2.1. Explanation of the Troubleshooting Flowchart

On the following pages is a flowchart for troubleshooting the Moniterm monitor. The way to use the troubleshooting flowchart is to start at the beginning, box 1 ("*N1: Is the proper rev. Neck board in the monitor?"), and go on down the left hand side of the page(s) until you come to the box which describes the symptom you have. Note that N1 has an asterisk; going to the bottom of the page, you will see that this means you are to see the "Notes to Troubleshooting" at the end of the flowchart. Adjustments mentioned in the flowchart are described in Chapter 3.

Several symbols are used in the troubleshooting flowchart:

2.1.1. Node and Off-Page Connectors

Circles with a "N" number (N3, in this example), are telling you to go to the step labelled "N3."

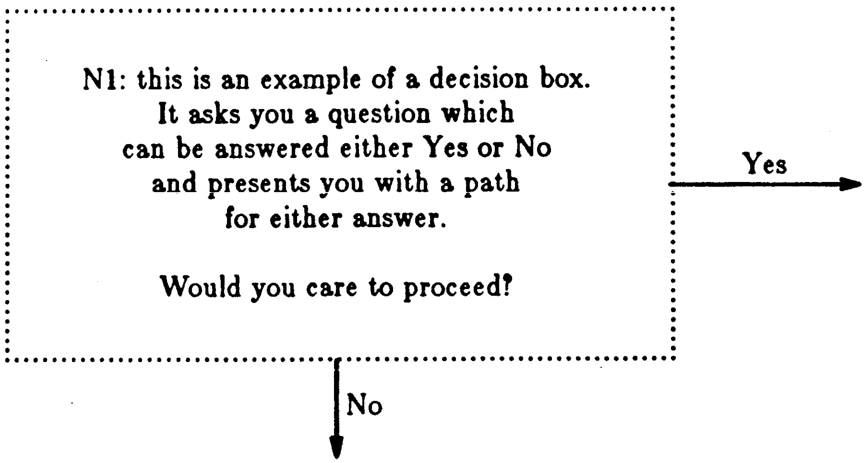
N3

A circle with just a number (no "N" preceding it) means "go to the circle in the flow chart which has the same number." In this instance, circle "3" instructs you to go through the flowchart until you find the other circle with a "3" in it.

3

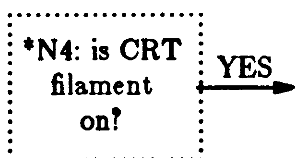
2.1.2. Decision Boxes

Decision boxes are dotted boxes within which a question is asked and two alternatives, in the form of "YES" and "NO" arrows, are presented.



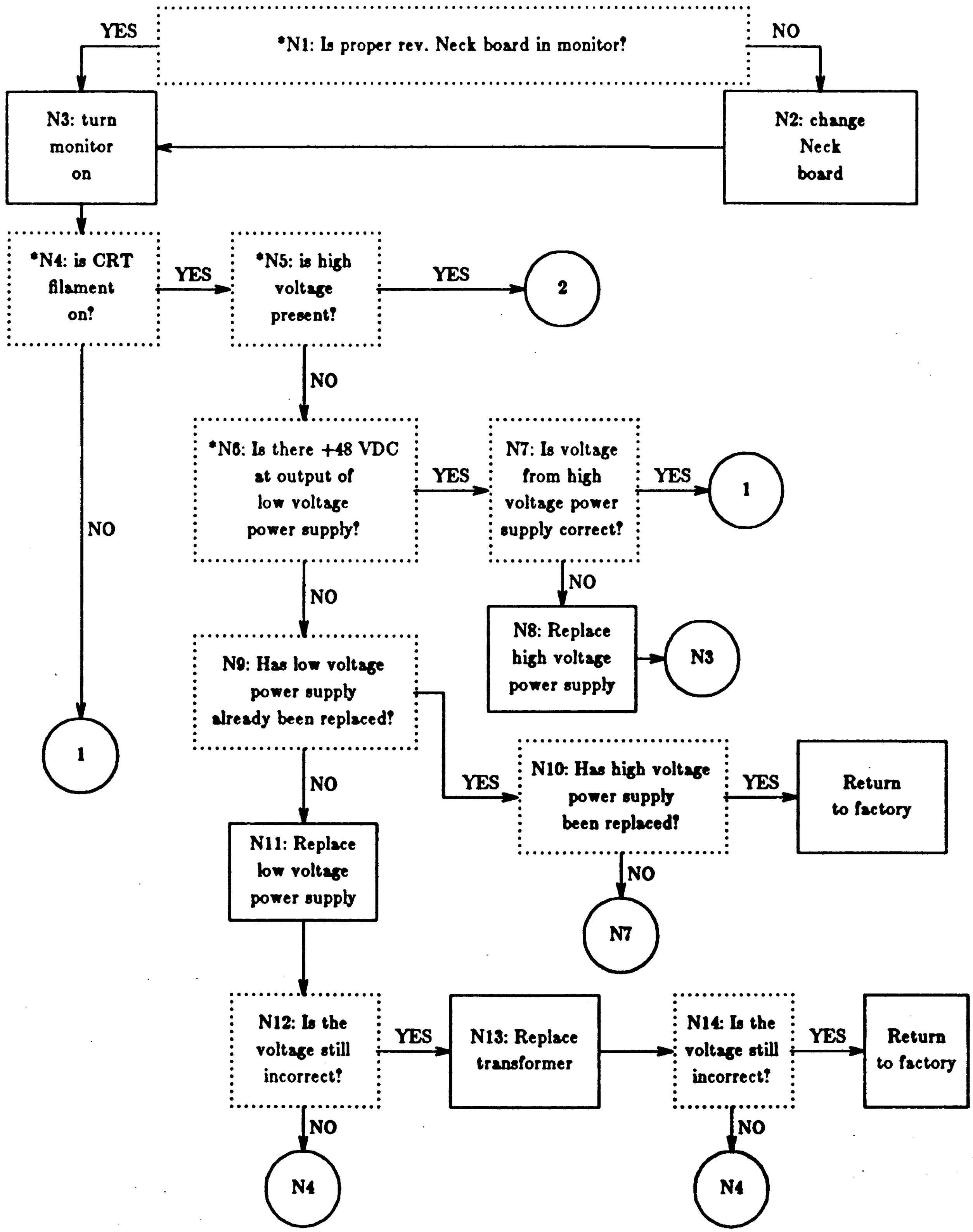
2.1.3. Asterisks

If a node (in this example, N4) has an asterisk preceding its label, go to the section titled "Notes to Troubleshooting" which follows the flowchart for a further explanation of the node's contents.

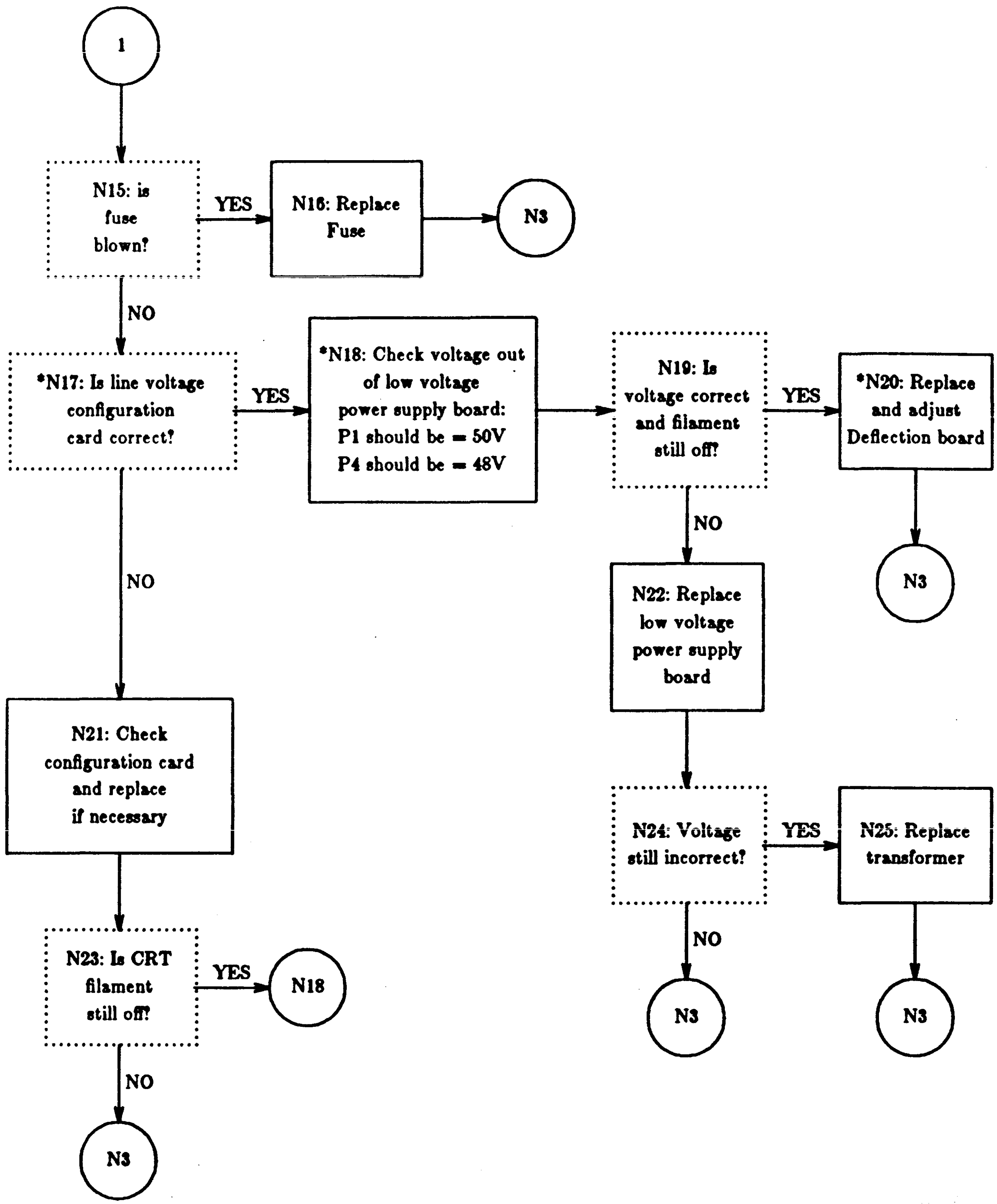


2.1.4. Checking Line Voltage

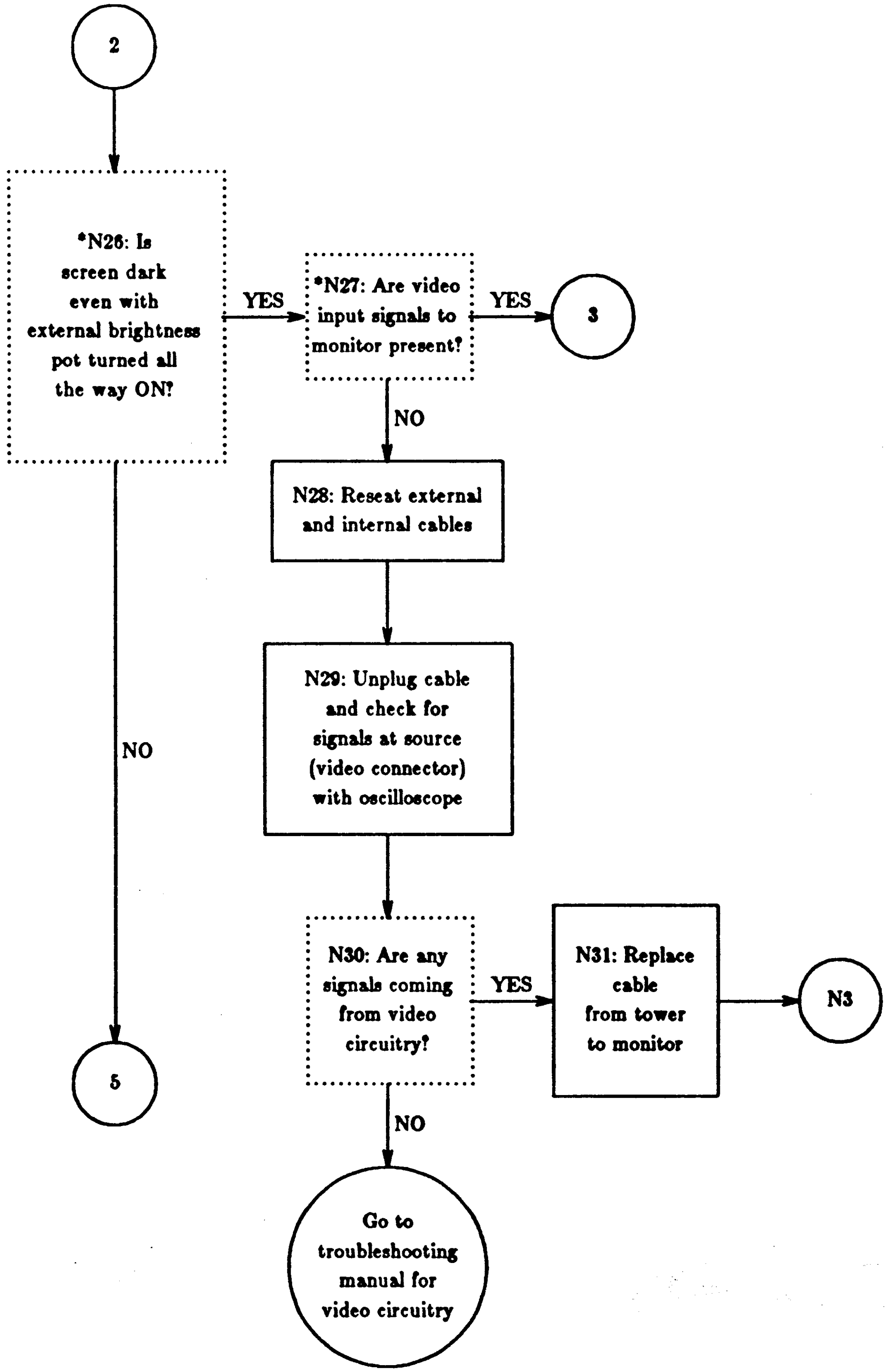
Finally, if you are having problems with your Sun-2/50 which you suspect are voltage related, use a voltmeter to make certain that the line voltage supplied from the AC outlet is within the applicable range. Ranges are specified in the "AC Input Ratings" section of Chapter 1.



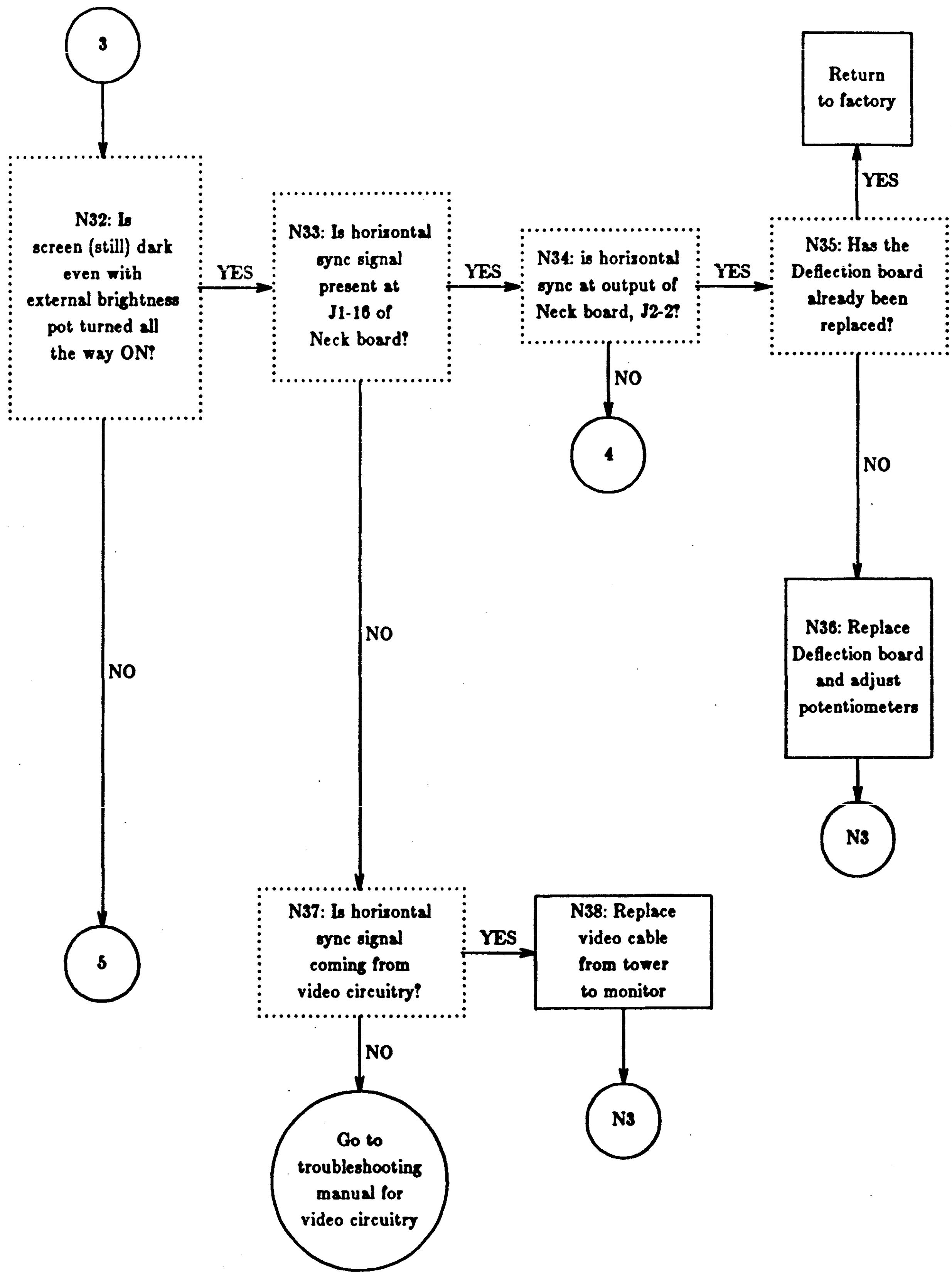
*See "Notes to Troubleshooting" following this flowchart.

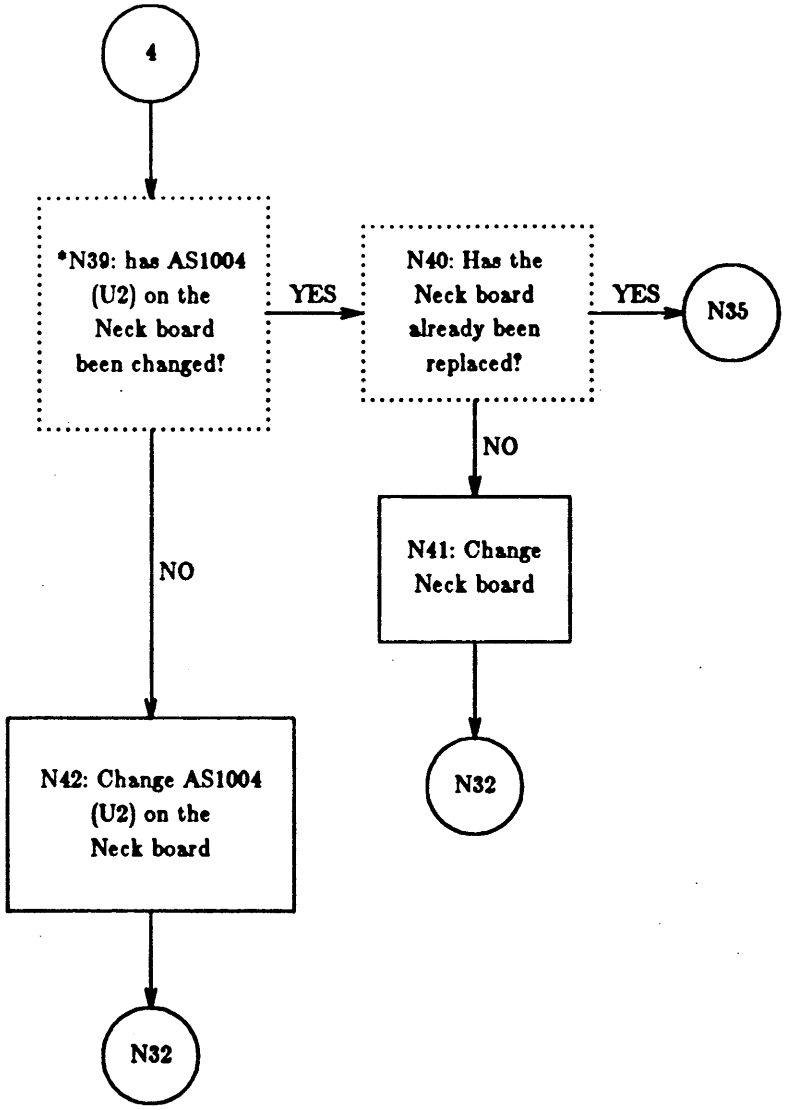


*See "Notes to Troubleshooting" following this flowchart.

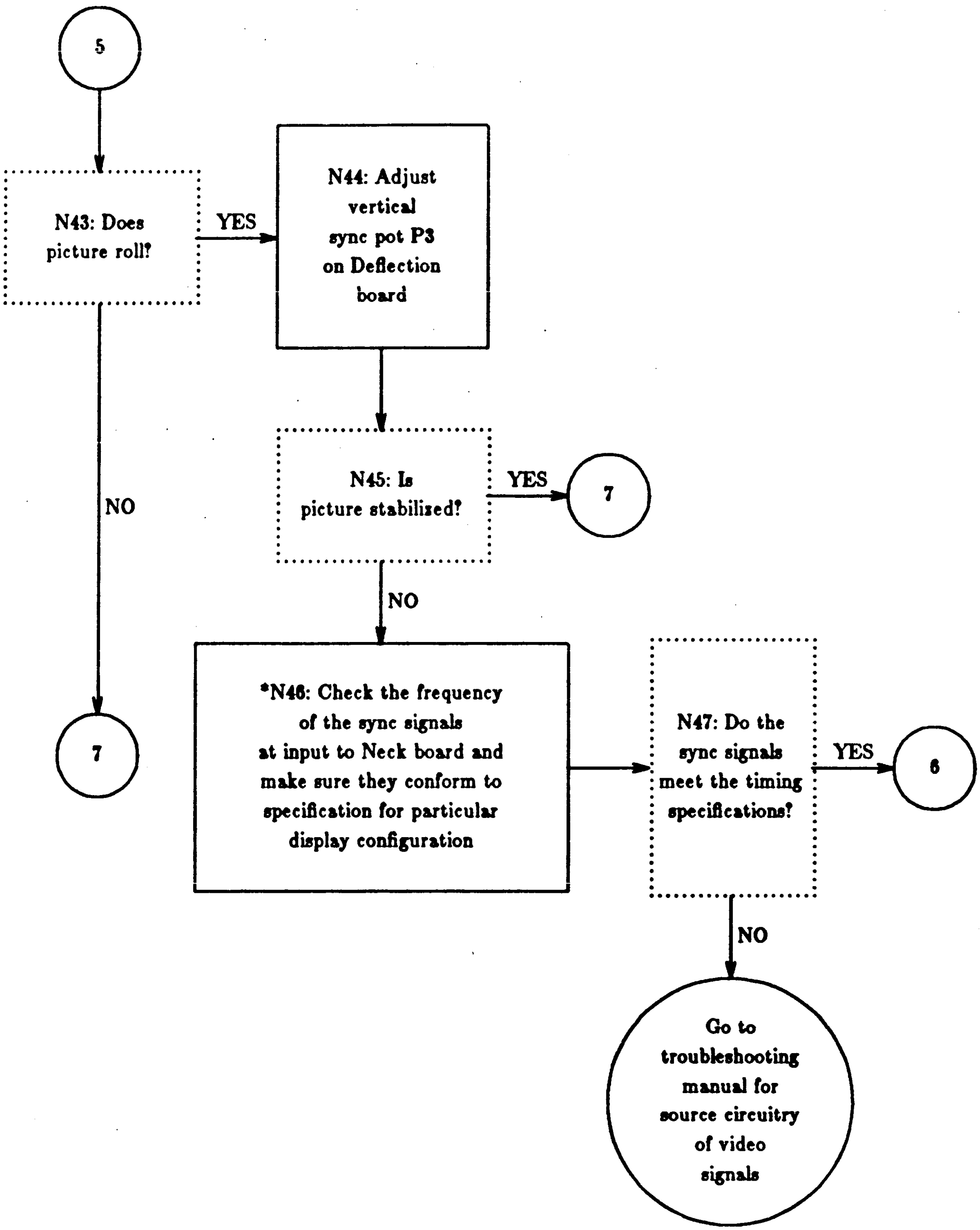


*See "Notes to Troubleshooting" following this flowchart.

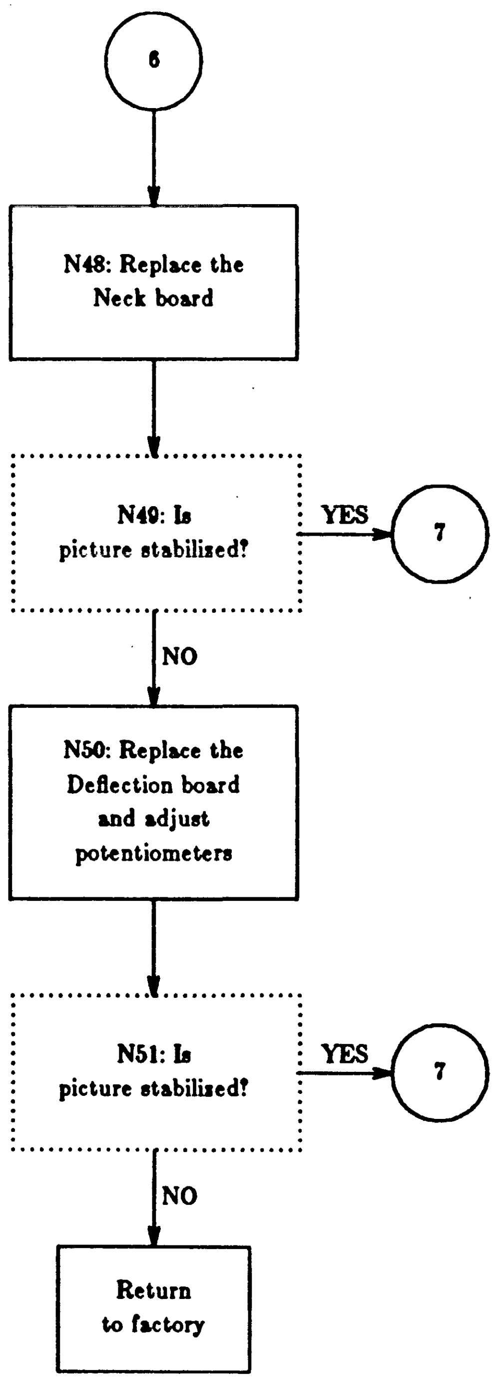

3
N32: Is screen (still) dark even with external brightness pot turned all the way ON?
YES
NO
5
N33: Is horisontal sync signal present at J1-16 of Neck board?
YES
NO
N34: is horisontal sync at output of Neck board, J2-2?
YES
NO
4
N35: Has the Deflection board already been replaced?
YES
Return to factory
NO
N36: Replace Deflection board and adjust potentiometers
N3
N37: Is horisontal sync signal coming from video circuitry?
YES
N38: Replace video cable from tower to monitor
N3
NO
Go to troubleshooting manual for video circuitry

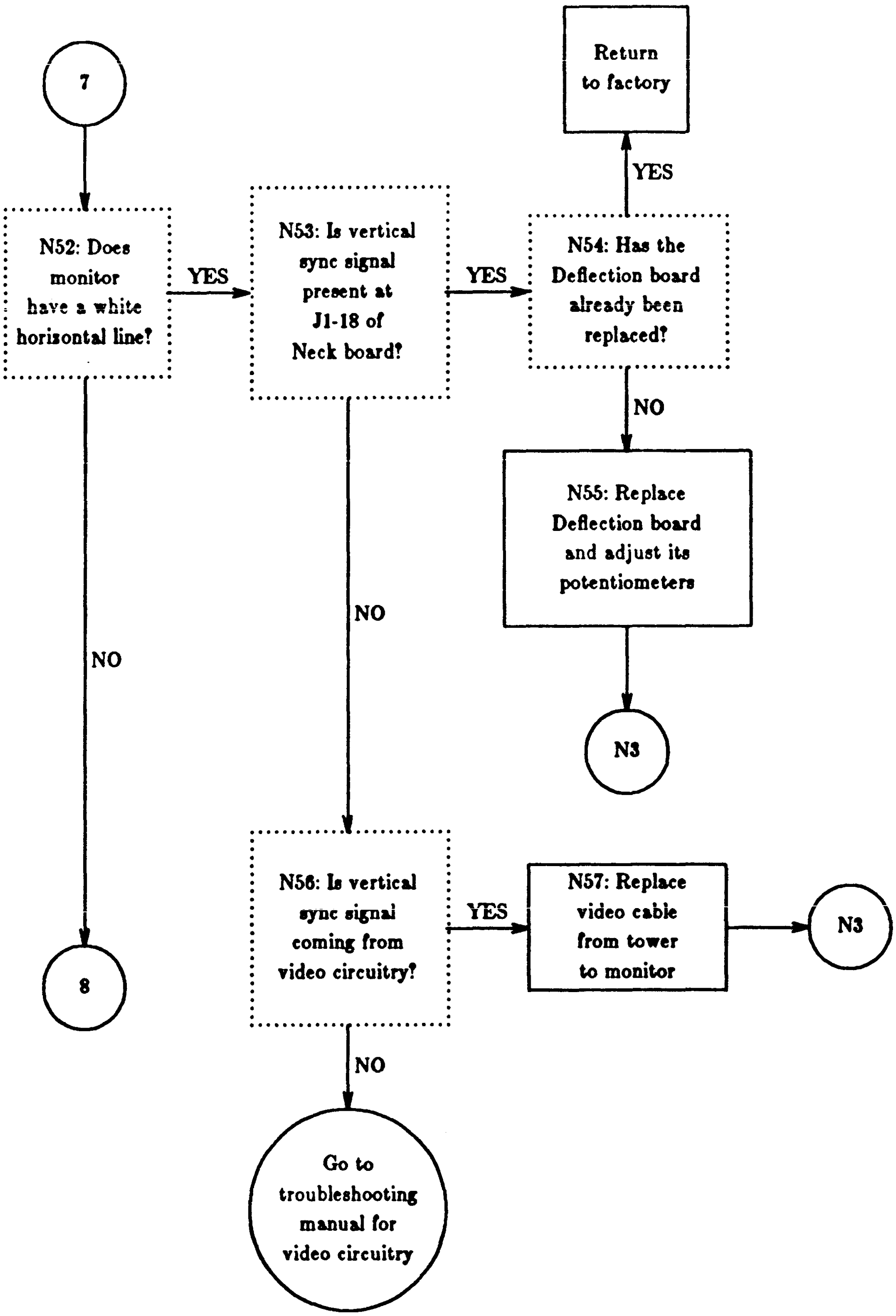


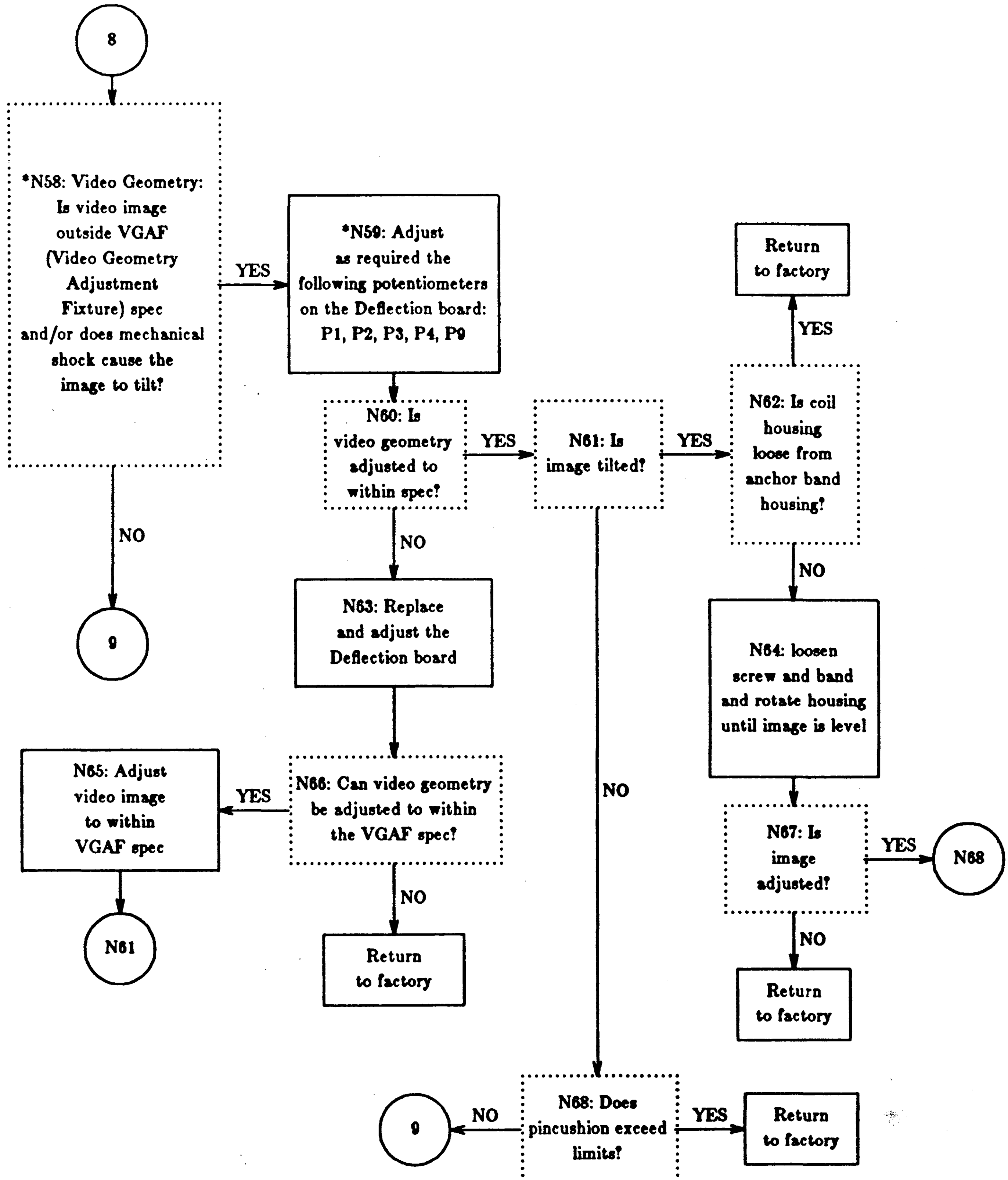
*See "Notes to Troubleshooting" following this flowchart.



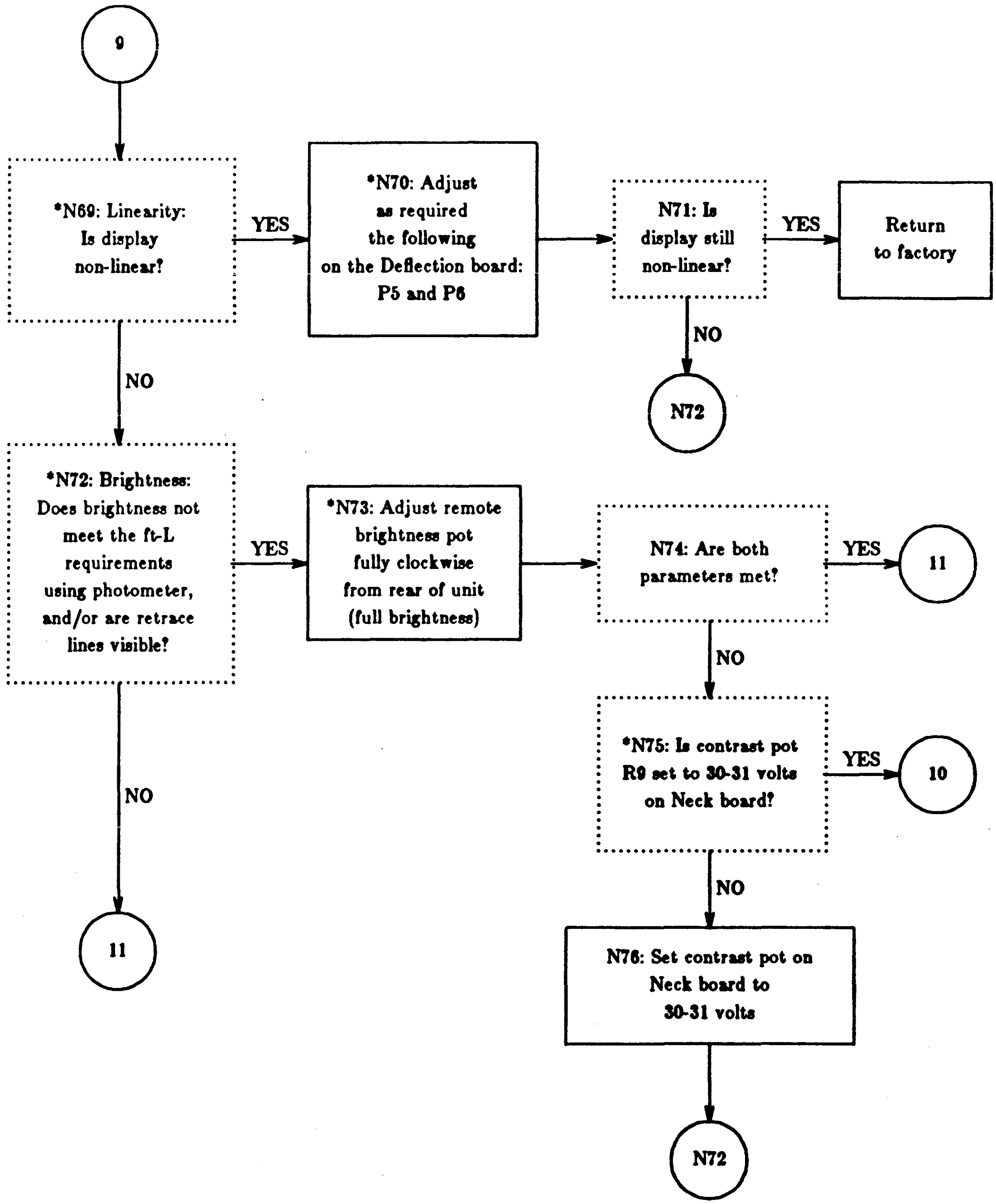
*See "Notes to Troubleshooting" following this flowchart.


6
N48: Replace the Neck board
N49: Is picture stabilized?
YES
7
NO
N50: Replace the Deflection board and adjust potentiometers
N51: Is picture stabilized?
YES
7
NO
Return to factory

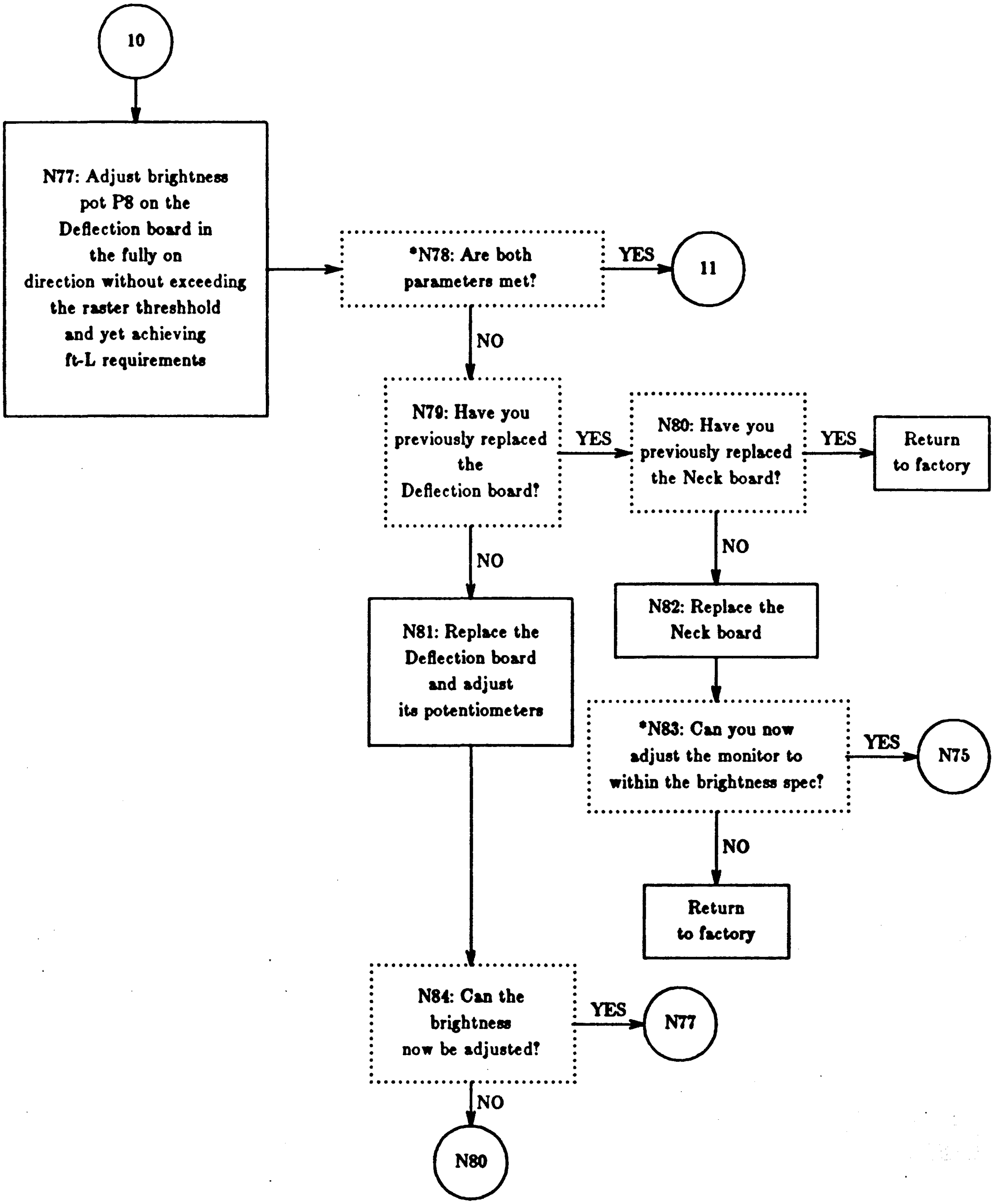

7
N52: Does monitor have a white horisontal line?
YES
N53: Is vertical sync signal present at J1-18 of Neck board?
YES
N54: Has the Deflection board already been replaced?
YES
Return to factory
NO
N55: Replace Deflection board and adjust its potentiometers
N3
NO
N56: Is vertical sync signal coming from video circuitry?
YES
N57: Replace video cable from tower to monitor
N3
NO
Go to troubleshooting manual for video circuitry
NO
8



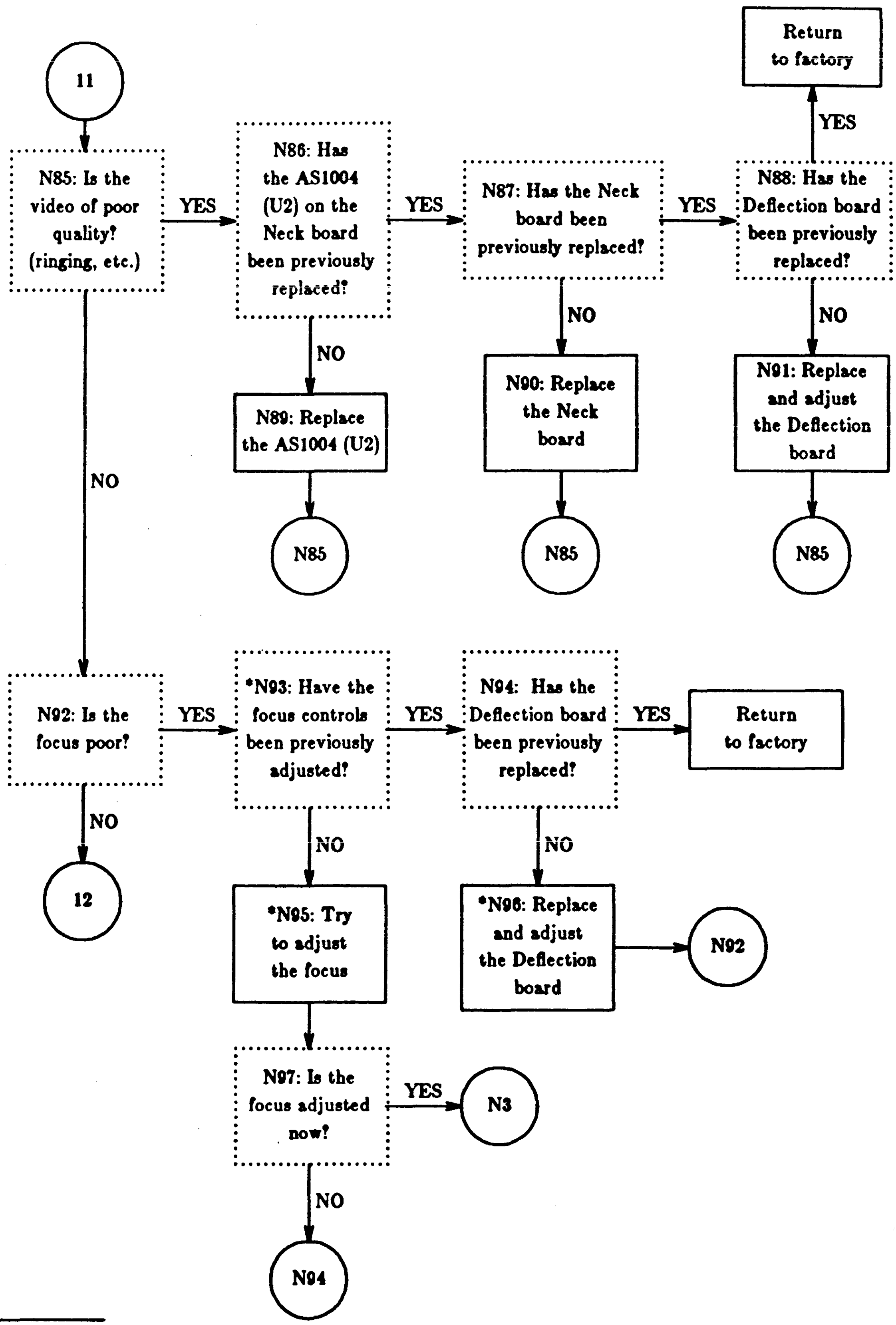
*See "Notes to Troubleshooting" following this flowchart.



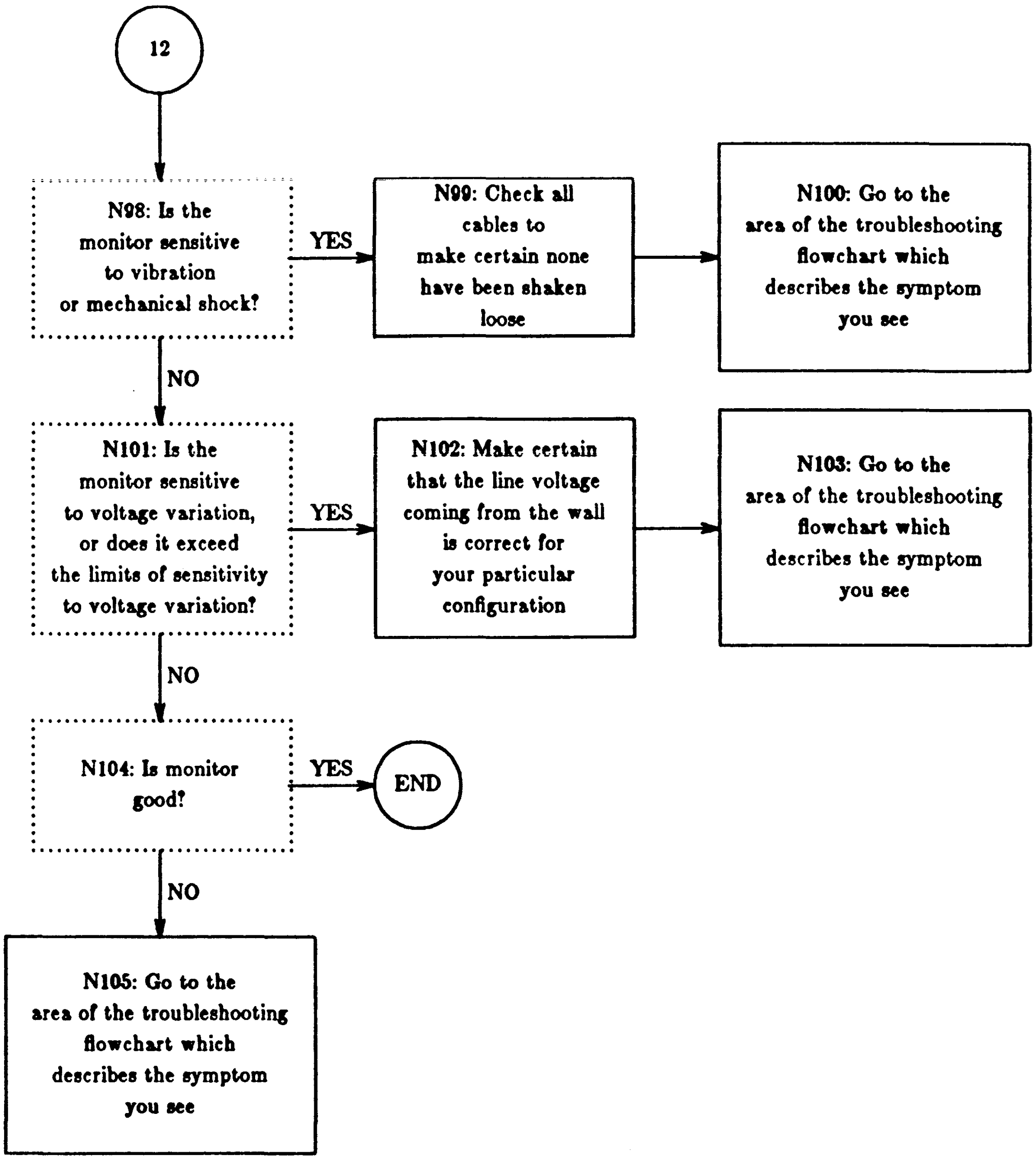
*See "Notes to Troubleshooting" following this flowchart.



*See "Notes to Troubleshooting" following this flowchart.



*See "Notes to Troubleshooting" following this flowchart.


12
N98: Is the monitor sensitive to vibration or mechanical shock?
YES
N99: Check all cables to make certain none have been shaken loose
N100: Go to the area of the troubleshooting flowchart which describes the symptom you see
NO
N101: Is the monitor sensitive to voltage variation, or does it exceed the limits of sensitivity to voltage variation?
YES
N102: Make certain that the line voltage coming from the wall is correct for your particular configuration
N103: Go to the area of the troubleshooting flowchart which describes the symptom you see
NO
N104: Is monitor good?
YES
END
NO
N105: Go to the area of the troubleshooting flowchart which describes the symptom you see

2.2. Notes to Troubleshooting

> *Note*
>
> *Make certain that all DVM and oscilloscope ground connections are made to the sheetmetal enclosure.*

N1: — make certain the PROMs on the video board in the tower are at least REV-04. Video board is the board with the thick round cord coming from it.

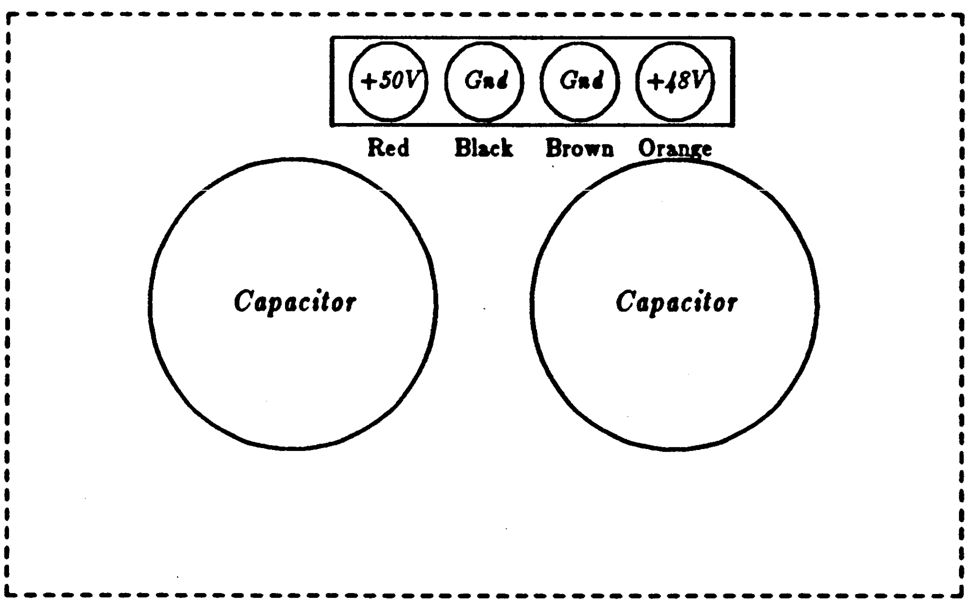
N4: — you may have to provide some sort of shade to be able to see the red glow of the filaments. Look at the cathode end of the tube: the part closest to the Neck board.

N5: — check output to the anode for 16.8 kV, ±100V, with the high voltage probe properly grounded to metal chassis.

> **Caution!**
>
> **This is an extremely high voltage; make this measurement and adjustment with extreme care.**

N6: — check at output of low voltage power supply for +48V (orange wire).

Figure 2-1: Connector, Low Voltage Power Supply



Low Voltage Power Supply board
(not to scale)

N17: — the line voltage configuration card slides into the bottom of the fuse case on the rear of the monitor. Positioning of the voltage configuration card is described in Chapter 1.

N18: — P1 (red wire) should be 50 VDC, and P4 (orange wire) should be 48 VDC. See figure above.

N20: — see Chapters 3 and 4 for a description of Deflection board adjustments.

N26: — turn remote brightness pot all the way clockwise (maximum brightness) and see if screen stays dark.

N27: — check for video at JP4-1 of Neck board, horizontal sync at J1-16, vertical sync at J1-18.

N39: — if either of the sync signals are bad on the board, the most likely cause is U1 74LS14. Check for signal at J1-16 (horizontal synch onto board) and J2-2 (horizontal synch off board), J1-18 (vertical synch onto board) and J2-1 (vertical synch off board). If it looks like the Neck board has had extensive ECO rework, are all the solder connections still good? Check for opens and broken wires in the following circuitry:

1. between J1-18 and J2-1, for vertical sync
2. between J1-16 and J2-2, for horizontal sync
3. at JP4-1, for video.

N46: — check the signals (horizontal sync at J1-16 and vertical sync at J1-18 on Neck board) and compare with the table listing timing specifications in Chapter 1.

N58, N59: — see the sections in Chapters 3 and 4 which describe the video geometry adjustment procedure.

N69, N70: — see the sections in Chapters 3 and 4 which describe the linearity adjustment procedure.

N72, N73, N78: — see the sections in Chapters 3 and 4 which describe the brightness adjustment procedure.

N75: — check remote brightness control, then check the output of IC2 on the Neck board at R8-IC2 junction. Adjust R9 so voltage at R8-IC2 junction is between +30 and +31 volts. Make certain you use a non-metallic adjustment tool when adjusting R9 on the Neck board.

N83: — see the sections in Chapters 3 and 4 which describe the brightness adjustment procedure.

N93: — adjust P5, P6, P7 on the Deflection board as needed. (See "Adjustment Potentiometers on the Deflection Board," in Chapter 3.)

N95: — see the sections in Chapters 3 and 4 which describe the focus adjustment procedure.

N96 : — see N93, and adjust the Deflection board as needed.

Chapter 3

How to Adjust the Moniterm Monitor

3.1. Tools Needed for Adjusting/Repairing the Monitor

For basic repair (including removing the external cover and RF screen), the following are required:

- 10 inch #2 point Phillips
- 6 to 8 inch #1 point Phillips screwdriver
- #1 point stubby Phillips
- 5/16 inch by 6 inch blade screwdriver
- 1/4 inch by 6 inch blade screwdriver
- 3/16 inch by 6 inch blade screwdriver
- 1/8 inch by 6 inch non-metallic blade screwdriver, for adjusting the high voltage power supply.
- 9/16 inch nut driver
- 5/16 inch nut driver
- 1/4 inch nut driver
- 3/16 inch nut driver
- 3/16 inch stubby nut driver, such as Xcelite PS-120.
- 6 inch metal rule
- Digital Voltmeter, Fluke model 75, with Fluke 80K-40 (or equivalent) high voltage probe
- Oscilloscope — Tektronix model 2215, or equivalent, having 150 MHz and 100 volts/division (or better), together with 10-to-1 probe
- Photometer, UDT S351F, or equivalent, with an aperture angle of ***at least*** 15°
- Sun-2/120 with test pattern ROMs, or if available, Sun Monochrome Pattern Generator with Test Pattern ROMs
- Video Geometry Alignment Fixture (VGAF) — plexiglass overlay for aligning the video, part number Sun-VGAF-19-Mono

- GC Electronics (or equivalent) insulated alignment tool — cut off about 1 inch from the recessed end, (used for adjusting R9 on early versions of the Neck board).
- GC Electronics (or equivalent) insulated alignment tool, standard length.

3.2. Getting Inside the Monitor

Caution!

There are extremely high voltages present in some of this circuitry, particularly the output of the high voltage supply and the anode connection to the CRT. Make certain all power to the monitor is OFF before disassembling the monitor to attempt repairs.

Four Phillips screws hold the cover onto the CRT chassis: two at the top and two on the bottom (see "Removing the Chassis Cover"). They are accessible from the back of the monitor. Remove them and pull the cover off.

The perforated metal cover on top of the metal CRT chassis is held on by six Phillips screws (see "Removing the Perforated Metal Cover"). Remove these screws and take the perforated metal cover off.

Figure 3-1: Removing the Chassis Cover

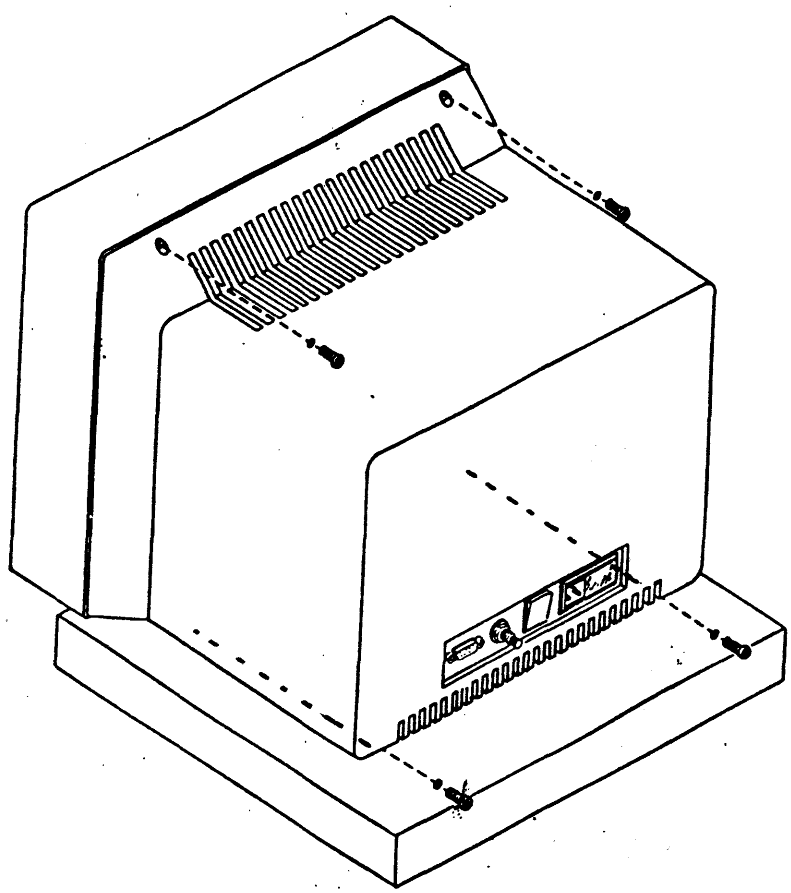
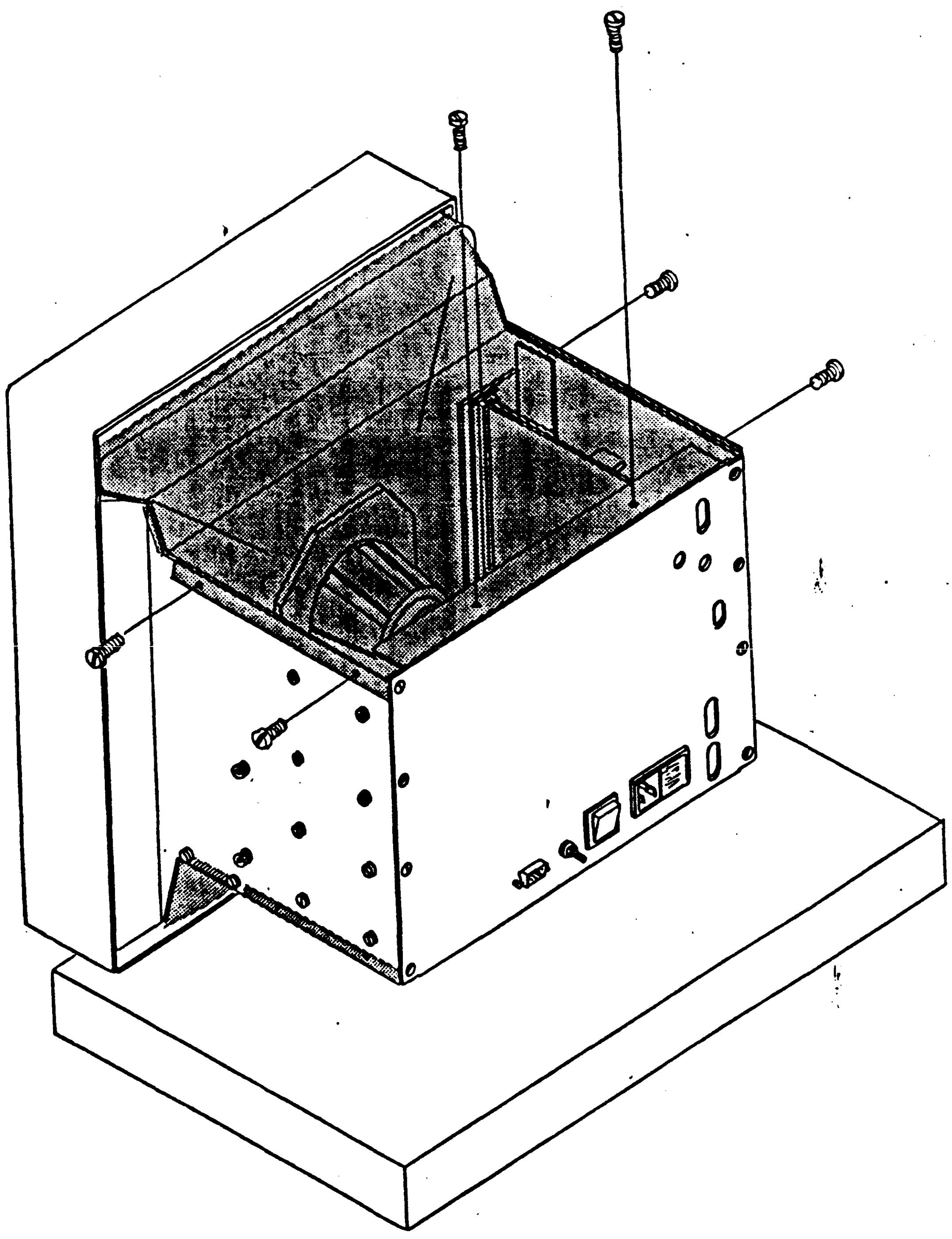


Figure 3-2: Removing the Perforated Metal Cover

Warning

If any of the screws retaining the perforated metal cover are missing, the unit will no longer comply with the RFI requirements of the FCC. Therefore, make certain all screws are replaced!



3.3. Removing the Deflection Board

This section tells you how to remove the Deflection board, should you need to.

> **Warning**
>
> **After turning power to the monitor off, allow the high voltage power supply 10 minutes to discharge before attempting to remove or replace any of the boards.**

See the figure entitled, "Major Subassemblies of the Monitor" for location of the Deflection board.

To remove the Deflection board you will need a #1 point stubby screwdriver, and either a #1 point 6 inch Phillips, or a 3/16 inch by 6 inch blade screwdriver, depending upon the type of screw which holds the Deflection board to the side casing.

To remove the Deflection board, unscrew the bracket which is attached to the metal chassis of the CRT (see "Grounding Strap Locations: Deflection and Neck Boards" for location). Make certain you carefully note the location of each connector before removing (label them, if necessary) in order to be able to replace them correctly, then,

- disconnect the connector running to the power supply board
- disconnect the ground strap (if present) which is attached to the CRT chassis (see "Grounding Strap Locations: Deflection and Neck Boards")
- disconnect P1, which runs to the power supply board
- disconnect the Molex connector at the high voltage supply
- disconnect the two connectors from the Neck board
- disconnect the plug on the Deflection board which runs to the CRT yoke.

Now, unscrew the three screws (two on the side of the chassis, one on the bottom of the chassis) and remove the Deflection board.

3.4. Removing the Neck Board

This section tells you how to remove the Neck board, should you need to.

To remove the Neck board,

- disconnect the video connector and P1, the plug at the edge of the Neck board which runs to the D connector on the back of the chassis
- unscrew the metal grounding strap (see "Grounding Strap Locations: Deflection and Neck Boards," Detail B) from the chassis
- carefully tug the Neck board from the CRT and set it aside.

3.5. Removing the Video Cable

This section tells you how to remove the video cable, should you need to. The video cable runs from the 9-pin D connector (inside the rear of the chassis) to the Neck board.

- The video cable and its 9-pin D connector can be removed by using the 3/16 inch nut driver (for the jackscrews outside the chassis) and 3/16 inch stubby nutdriver (for the nuts inside the chassis).

3.6. Removing the Remote Brightness Potentiometer

This section tells you how to remove the remote brightness potentiometer, should you need to.

- The remote brightness potentiometer (see "Major Subassemblies of the Monitor") can be removed by using either a 9/16 inch nut driver, deep socket, open-end wrench, or box wrench.

3.7. Putting the Monitor Back Together

To put the monitor back together, simply reverse the process:

- replace the remote brightness pot
- replace the video cable
- replace the Neck board

Warning

If lockwashers are not reinstalled as shown in Detail B of "Grounding Strap Locations: Deflection and Neck Boards," safe operation of the monitor is not guaranteed!

- replace the Deflection board

Note

Early units may have three mounting screws. Reinstallation of the screw that mounts through the bottom casework is no longer necessary.

Important

Make certain that the low voltage power supply is connected to the Deflection board before turning power on!

- replace the perforated metal cover

Warning

If any of the screws holding the perforated metal cover are missing, the unit will no longer comply with the RFI requirements of the FCC. Therefore, make certain all screws are replaced!

- replace the chassis cover.

3.8. Adjustments to the Moniterm Monitor

There are 11 adjustment potentiometers (P1-P11) and an adjustable inductor (L1) on the Deflection board, however the inductor can only be adjusted at the factory. There is also a potentiometer which controls contrast (R9) on the Neck board and another (remote brightness control) on the back of the monitor. Finally, there is an adjustment pot on the high voltage power supply. Please be careful to remember that whenever you are making voltage adjustments, you must connect the ground lead to the sheetmetal chassis.

3.8.1. Neck Board Adjustment

Warning

All adjustments to the Neck board must be done using the insulated alignment tool. Do NOT use a metal screwdriver because you could shock yourself or damage the equipment.

Contrast pot R9 on the Neck board works in conjunction with the remote brightness control located on the rear of the monitor chassis and P8 brightness pot on the Deflection board. Set the value for R9 first, as described below.

3.8.1.1. Brightness Adjustment: Pot R9

R9 on the Neck board controls the contrast of the CRT. The voltage coming out of IC2 regulator (see the Neck board schematic in the Appendix) should be between +30 to +31 volts. Place your DVM probe at the junction between R8 and IC2 and adjust R9 so the output of IC2 is within the range of +30 to +31 VDC.

3.8.2. Adjustment Potentiometers on the Deflection Board

Below is a description of the 11 Deflection board pots (see the following figure for location of these potentiometers). Also included — where it applies — is a description of the effect which turning the pot clockwise (CW) and counter-clockwise (CCW) has on the video image. All adjustments are done **facing the rear of the monitor chassis**, where the OFF/ON switch is (see "Major Subassemblies of the Monitor " for OFF/ON switch location), so the easiest way to make these adjustments is to set a mirror in front of the display in order to be able to see the effect of your adjustment as you are making it. Use the video geometry alignment fixture for horizontal and vertical alignments.

Video adjustments on the Deflection board are:

- P1 — Horizontal Width

  This controls the horizontal (left-right) width of the visible display upon the screen. Turning the adjustment screw CW expands the video frame, turning CCW reduces the size of the video frame.

- P2 — Horizontal Hold

  This controls the horizontal (left-right) movement of the video frame upon the CRT screen. Turning this adjustment screw CW moves the screen image to your left across the screen (when you are facing the front of the CRT); turning it CCW moves the screen image to your right.

- P3 — Vertical Hold

  This controls the vertical (top-bottom) movement of the video frame upon the CRT screen. To use this adjustment,

  1) turn the P3 adjustment screw in one direction until the picture starts to go out of synchronization. Loss of synchronization makes the picture roll either up or down on the screen.
  2) Keeping track of the number of turns you make, turn the P3 adjustment screw ***in the opposite direction*** until the picture synchronizes, then starts to roll again.
  3) Halve the number of turns you made from no-sync to no-sync. For instance, if you made fifteen full turns between loss of synchronization at one extreme and loss at the other extreme, divide this number in half — seven and a half turns.

> *Note*
>
> *If you make* **less than five full turns** *between losses of synchronization, check the picture size with the VGAF adjustment tool to make certain picture size is within tolerance. If picture is within tolerance, replace the Deflection board. Five full turns is minimum adjustment necessary for the Vertical Hold.*

  4) Turn the P3 adjustment screw back this half number of turns. (In our example, this would be seven and a half turns — in your case you will have to determine this number for yourself). This centers the adjustment between the two extremes of vertical synchronization.

- P4 — Vertical Size

  This controls the vertical (top-bottom) size of the video frame upon the CRT screen. Turning this adjusting screw CW expands the size of the video frame; turning it CCW shrinks the video frame.

- P5 — Vertical Top-Bottom Linearity

  This controls the size of the image at the top and bottom of the screen in comparison with the image in the middle of the screen. Turning this adjustment screw CW makes the top and bottom edge images **larger** in relation to the image in the middle of the screen. Turning the adjustment screw CCW makes the top and bottom edge images **smaller** in relation to the image in the middle of the screen.

- P6 — Vertical Linearity

  This controls the relative size of image over the entire display area. Turning this adjustment screw CW moves the top and bottom edges away from the center of the screen. Turning the adjustment screw CCW moves the top and bottom edges toward the center of the screen.

- P7 — DC Focus

  This controls the crispness and sharpness of the image over the entire screen. Generally the sharpest image will be somewhere around the mid-range of this pot. Displaying Test Pattern #7, coarse hatch, turn the pot back and forth until the image appears sharpest.

- P8 — Brightness

  This controls the brightness of the screen. Use this control together with the remote brightness pot on the back of the monitor and the photometer.

  1) Turn the remote brightness pot on the back of the monitor completely CW — maximum contrast.

  2) Adjust the P8 brightness pot until you can see retrace lines — these are white slanting lines that cross the screen.

  3) Readjust P8 until the retrace lines are no longer visible. A good place to check for them is the black area surrounding the video image. There should be no white retrace lines in this black area.

  4) Type the "clear" command to the executive to get a bright display. After making sure the remote brightness pot on the back of the monitor is turned completely CW (maximum brightness) use the photometer's footlambert scale to measure the light intensity coming from the **center** of the screen.

  5) Adjust P8 until the reading from the photometer is between 27 and 33 footlamberts (23 and 27 footlamberts with anti-glare coating). With the CRT adjusted to this level, make certain that no retrace lines are visible in the black areas around the outside of the screen. If retrace lines *are* visible, return the unit to the factory.

- P9 — Vertical DC Centering

  This controls the vertical (up-down) position of the video frame upon the CRT screen. Turning this CW moves the image down, turning it CCW moves the image up the face of the screen.

- P10 — Vertical Dynamic Focus, and

- P11 — Horizontal Dynamic Focus

  These two pots are set at the factory to a specific voltage level and should not be adjusted in the field. A symptom of the loss of dynamic focus would be bleeding of characters. However this can sometimes be remedied by adjusting P7, DC Focus.

Figure 3-3: Video Geometry Alignment Fixture (VGAF)

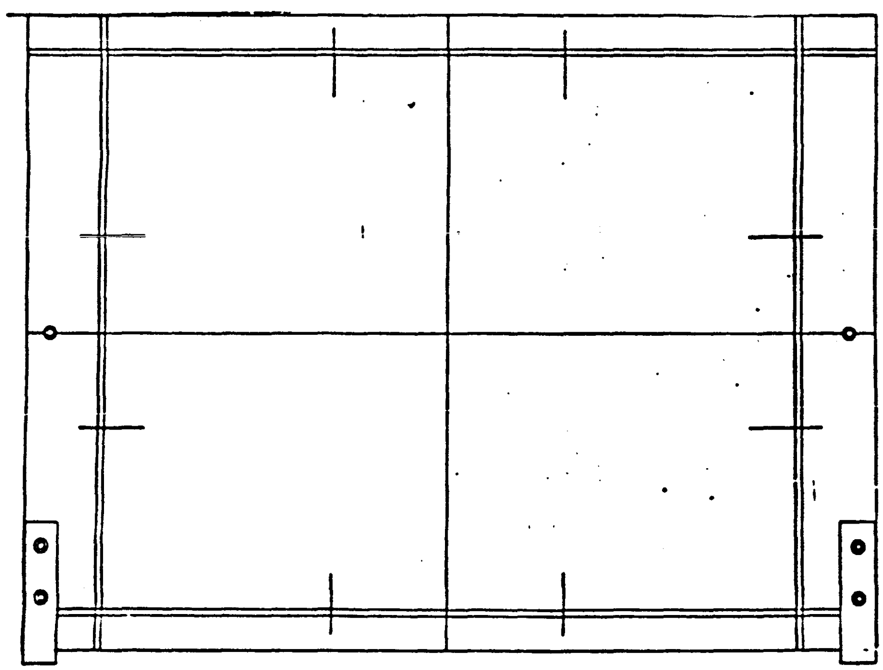
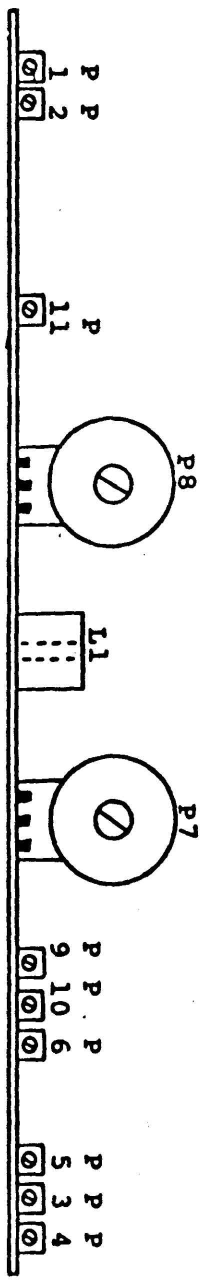


Figure 3-4: Adjustment Potentiometers on the Deflection Board



P1	Horizontal width
P2	Horizontal hold
P3	Vertical hold
P4	Vertical size
P5	Vertical top/bottom linearity
P6	Vertical linearity
P7	DC focus
P8	Brightness
P9	Vertical DC centering
P10	Vertical dynamic focus (factory adjustment only)
P11	Horizontal dynamic focus (factory adjustment only)

Chapter 4

Test Procedure for the Moniterm Monitor

This chapter defines the test procedure and initial set-up for the Moniterm monitor. All adjustments must be made in the order presented here; for instance, if you try to do the geometry adjustment before the high voltage adjustment, you will find you have to go back and readjust the geometry after the high voltage is adjusted.

4.1. Applicable Documents

- 19-inch Monochrome Monitor Engineering Specification — Part Number 950-0001-06

4.2. Definitions

DVM — digital voltmeter

UUT — unit under test

CW — clockwise

CCW — counter-clockwise

ft-L — footlamberts

4.3. Test Set-up

4.3.1. Test Configuration

With the AC power switch OFF and the AC cord pulled, remove the chassis cover and the perforated metal cover from the monitor. Then,

1) turn the AC power switch on back of the monitor ON.

2) Warm up unit under test (UUT) for 10 minutes with the rear chassis cover installed.

3) Make one or more of the following checks and adjustments as required.

The following checks and adjustments are done using one or more of the following test patterns supplied with the Sun Test Pattern Generator (contact Sun Field Service for part number and operating instructions):

Test Pattern #1 — Grid

Test Pattern #2 — Vertical Hatch

Test Pattern #3 — Targets

Test Pattern #4 — Diagonal Lines

Test Pattern #5 — Black, White, and Grey Vertical Stripes

Test Pattern #6 — Fine Hatch

Test Pattern #7 — Coarse Hatch

Test Pattern #8 — Fine Hatch with Boxes

4.4. Test Procedure

> *Note*
>
> *All Deflection board adjustments are to be done with the insulated adjustment tool unless otherwise noted. Remember also that adjustments must be made in the order presented here; for instance, if you make the contrast adjustment before the high voltage adjustment, you must go back and readjust the contrast after the high voltage is adjusted.*

4.4.1. High Voltage Adjustment

Use the high voltage probe for this adjustment, with the display completely white. To get a white display, type "clear" to the executive.

1) Plug the high voltage probe into the DVM.
2) Set the DVM to measure DC voltage.
3) Attach the high voltage probe's ground lead (the black lead) to any convenient spot on the metal chassis.
4) **Carefully** insert the tip of the high voltage probe under the anode insulation cup and verify that the anode voltage is 16.8 kVDC, ±100 volts.

> **Warning**
>
> **In the following adjustment, make certain you only use a non-metallic screwdriver. Also be careful to keep the hand you are not using clear of the equipment.**

5) If the voltage at the anode is outside this range, adjust it to 16.8 kVDC by turning the potentiometer (screw located on top of the high voltage power supply) with the 1/8 inch by 6 inch non-metallic screwdriver. Note that turning the pot counter-clockwise will INCREASE anode voltage; turning it clockwise will DECREASE anode voltage.
6) If the high voltage power supply's output cannot be adjusted to within specification, it must be replaced.

4.4.2. Contrast Adjustment

1) Set the DVM to measure DC voltage.
2) Connect the standard probes to DVM.
3) Attach the ground probe (black) to metal chassis at any convenient spot.
4) Touch the red probe to the lower side of R1, R2, or R3 (470Ω resistors on the side of the Neck board which faces the Deflection board) and make certain that the voltage is between 30.0 and 31.0 VDC.
5) If the voltage is outside this range, adjust R9 on the Neck board with the modified GC 8276 insulated alignment tool.
6) If R9 cannot be adjusted to within specification, refer to that section of the troubleshooting flowchart which applies to the contrast adjustment.

4.4.3. Geometry Adjustment

This adjustment is to be done with the display completely white. One way of getting a white display is to type "clear" to the executive, which clears the screen of all images. Also, since the adjustments are made from the rear of the monitor, it might be helpful to set a mirror in front of the display so that you don't have to run back and forth to see the effect of your adjustments.

1) Place the plexiglass alignment fixture (Sun-VGAF-19-Mono) over the monitor's bezel.
2) Adjust pots P1 and P2 on the Deflection board (horizontal size and horizontal position) so both the left and right display edges fall within the left and right border margins of the alignment fixture.
3) Adjust pots P4 and P9 on the Deflection board (vertical size and vertical positioning) so both the top and bottom display edges fall within the upper and lower border margins of the alignment fixture.
4) If the horizontal and vertical size and position cannot be correctly adjusted, refer to that section of the troubleshooting flowchart which applies to the geometry adjustment.

4.4.4. Vertical Linearity Adjustment

This adjustment is to be done in SunWindows®, with a clock icon in each of the four corners.

1) Adjust P5 and P6 (vertical linearity pots) on the Deflection board so that clock size and circularity is equal. (For a description of P5 and P6 operation, see the preceding section, "Adjustment Potentiometers on the Deflection Board.")
2) If the clocks are not circular and the vertical linearity cannot be adjusted so that the clocks are circular, refer to that section of the troubleshooting flowchart which applies to the brightness adjustment.
3) When you have finished the vertical linearity adjustment, go back and recheck your geometry adjustments, because these two adjustments are interrelated.

4.4.5. *Brightness Adjustment*

This adjustment is to be done with the display completely white. One way of getting a white display is to type "clear" to the executive, which clears the screen of all images.

1) From the rear of the monitor, turn the external brightness control fully clockwise (CW) to maximum brightness.
2) Using the cleared display, place the photometer on the center of the screen and adjust pot P8 on the Deflection board to give a reading of 27 to 33 footlamberts (for a monitor without the anti-glare screen), 23-27 footlamberts (for a monitor with the anti-glare screen), **without retrace lines being visible**. Retrace lines are slanted white lines visible on the display when contrast or brightness is turned up too high.
3) Measure the display for luminance over the entire face of the display. Luminance variation may not exceed 3 ft-L within 3 inches, within the ranges described in step 2:
   - without the anti-glare screen, 27 to 33 footlamberts, and
   - with the anti-glare screen, 23 to 27 footlamberts.
4) From the rear of the monitor, turn the external brightness control fully CCW, so that the display is completely dark.
5) Measure the luminance at the center of the display.
6) Turn the power off. Measure the luminance again at the center of the screen. Luminance measured in step 5 may not exceed 1 ft-L above the AC power-off reading at the same spot for monitors either with or without the anti-glare screen.
7) If you can't adjust for the correct luminance, refer to that section of the troubleshooting flowchart which applies to the brightness adjustment.

4.4.6. *Pincushion and Barrel Distortion Check*

This check is to be done using the test pattern generator supplied by field service, with test pattern #1, the grid, displayed on the screen. Operating instructions for the test pattern generator are also supplied by Sun field service.

1) Using the VGAF, verify that the edge geometry doesn't vary more than 0.070 inch in any one third of the vertical length (3.7 inches), and no more than 0.100 inch in one third of the horizontal length (4.7 inches).
2) Verify that there are no more than three direction reversals (wavy edges along the border of the display) along any margin.
3) If the display does not fall within these specifications, return to monitor to the factory.

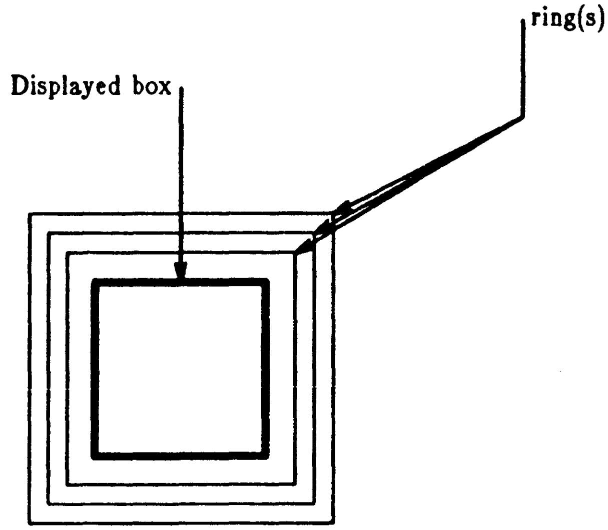
4.4.7. *Ringing Test*

This check is to be done using the test pattern generator supplied by field service. Operating instructions for the test pattern generator are also available from Sun field service.

The ringing test uses test pattern #8, fine hatch with boxes, and pattern #6, fine hatch. Pattern #8 will expose any ringing caused by the Neck board, which will show up near the center of the screen as a faint line or lines around the edges of the boxes. Pattern #6 will expose any

Deflection board ringing, which will show up as a line or lines near the edge of the display.

Figure 4-1: What Ringing Looks Like



Neck board ringing

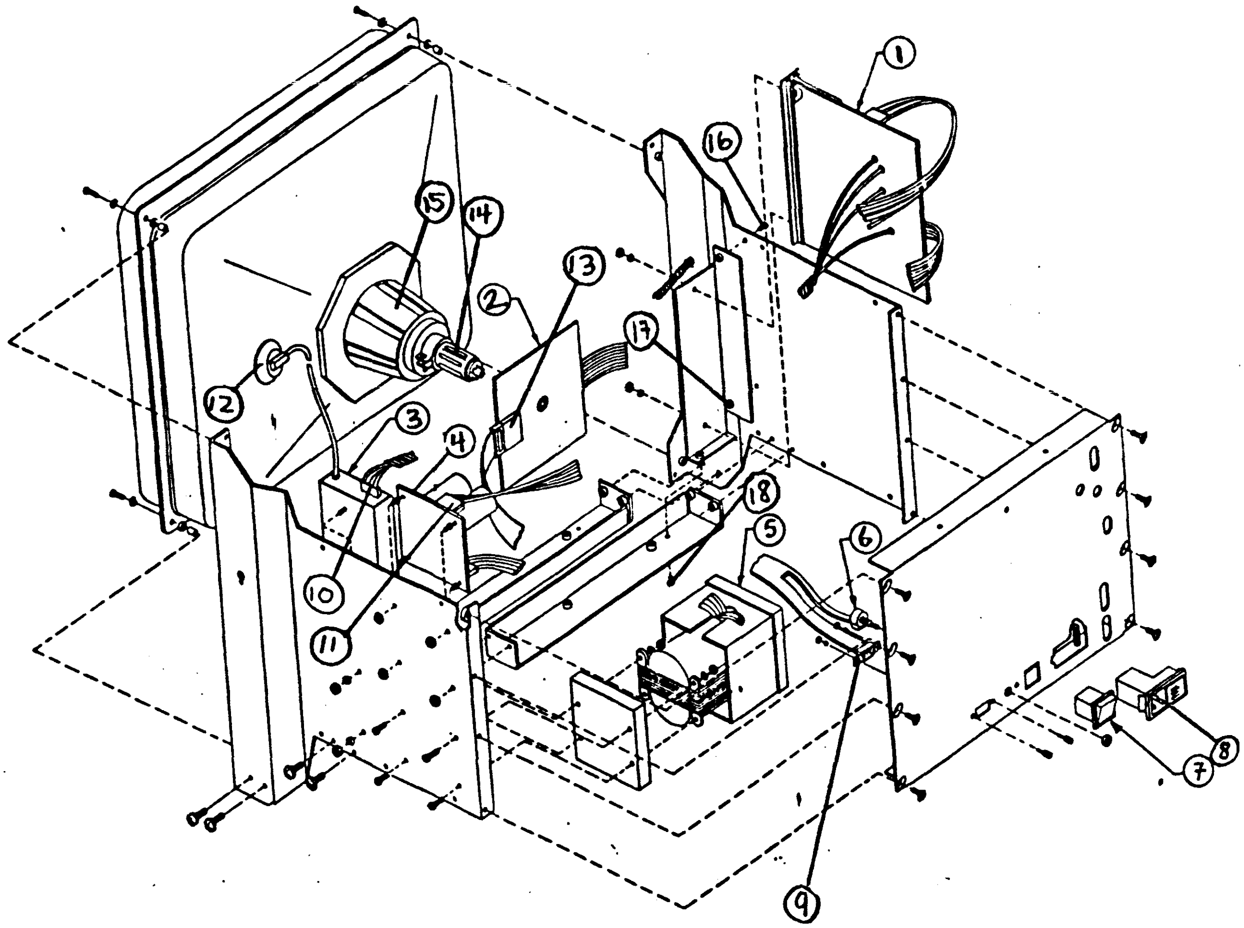
1) Using the test pattern generator supplied by field service, call up test pattern #8, fine hatch with boxes. Neck board ringing is acceptable if there is only one faint ring around the edge of the box. A single heavy ring or multiple faint rings is unacceptable. If ringing is present, refer to the applicable section of the troubleshooting flowchart.

2) Call up test pattern #6, fine hatch. Deflection board ringing is acceptable if there is only one faint ring near the edge of the display. A single heavy ring or multiple faint rings is unacceptable. If ringing is present, refer to the applicable section of troubleshooting flowchart.

Appendix A

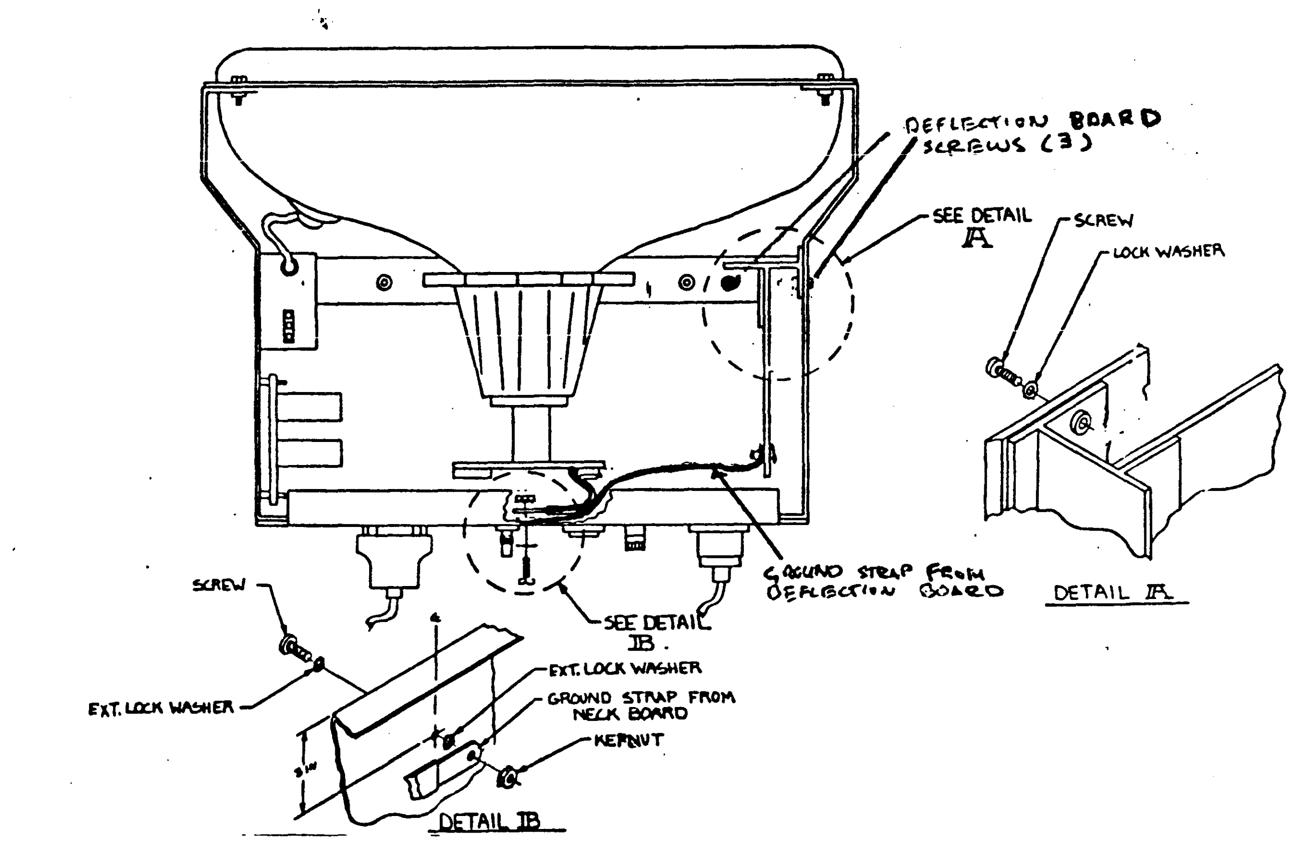
Parts, Schematics and Component Locations

Figure A-1: Major Subassemblies of the Monitor



Index	Description	Index	Description
1	Deflection board	9	Video Input
2	Neck Board	10	High Voltage P. S. connector
3	High Voltage Supply	11	Low voltage power supply connector
4	Low voltage power supply	12	Anode
5	Transformer and enclosure	13	J1, Neck Board
6	Remote Brightness pot	14	Cathode and Grids
7	AC ON/OFF switch	15	Deflection Yoke
8	AC input/Line Filter/ Voltage Selector	16, 17, 18	Deflection board retaining screws

Figure A-2: Grounding Strap Locations: Deflection and Neck Boards



Detail B: location of the grounding strap from Deflection board to chassis is not illustrated, but the Deflection board grounding strap is to be placed between kepnut and Neck board ground strap.

Warning

If lockwashers and kepnut are not reinstalled as shown in Detail B, safe operation of the monitor is NOT guaranteed!

Also, if ground strap is missing, or is in the wrong location, the board must be returned to the factory.

Figure A-3: Deflection Board Component Locations

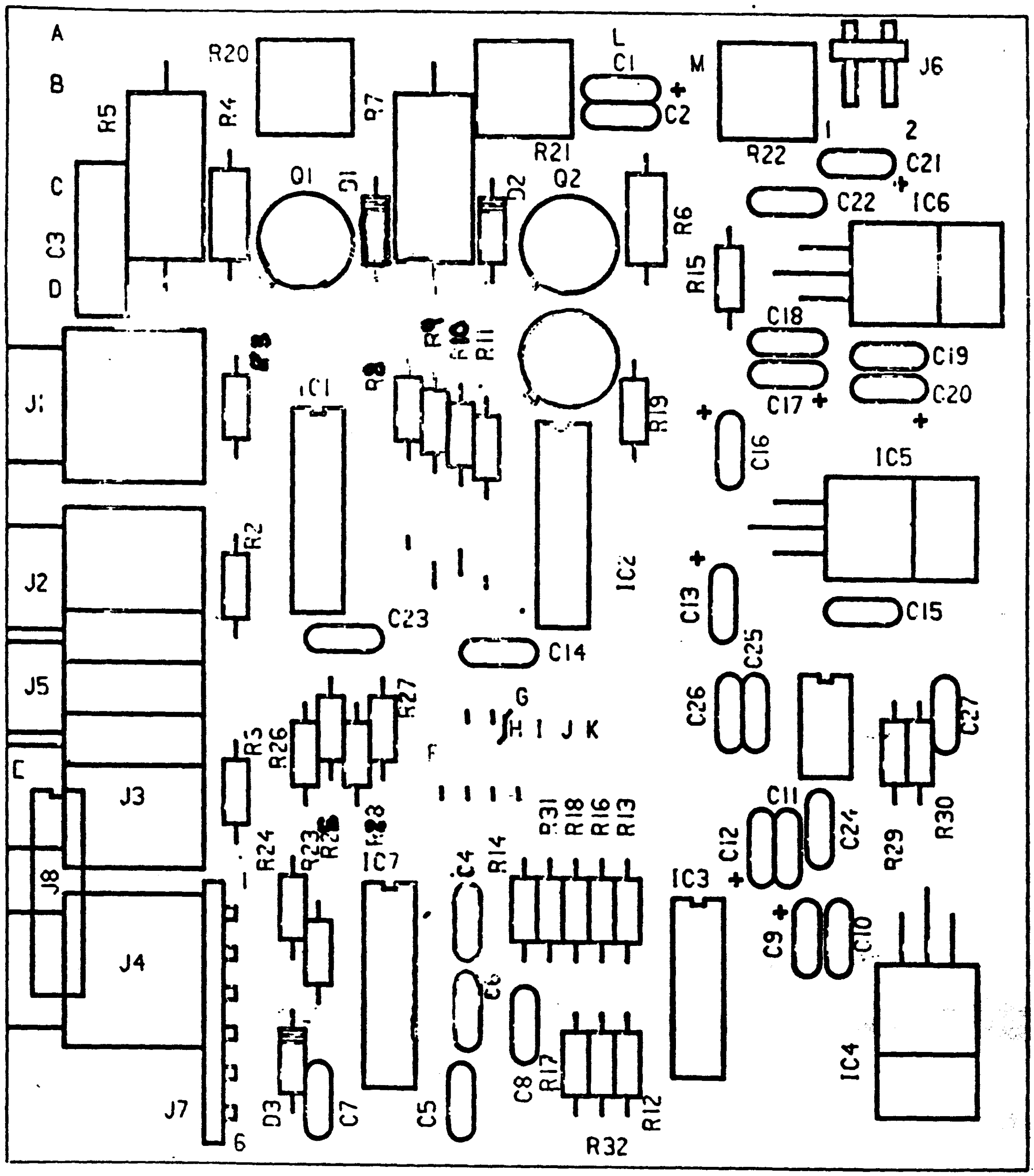
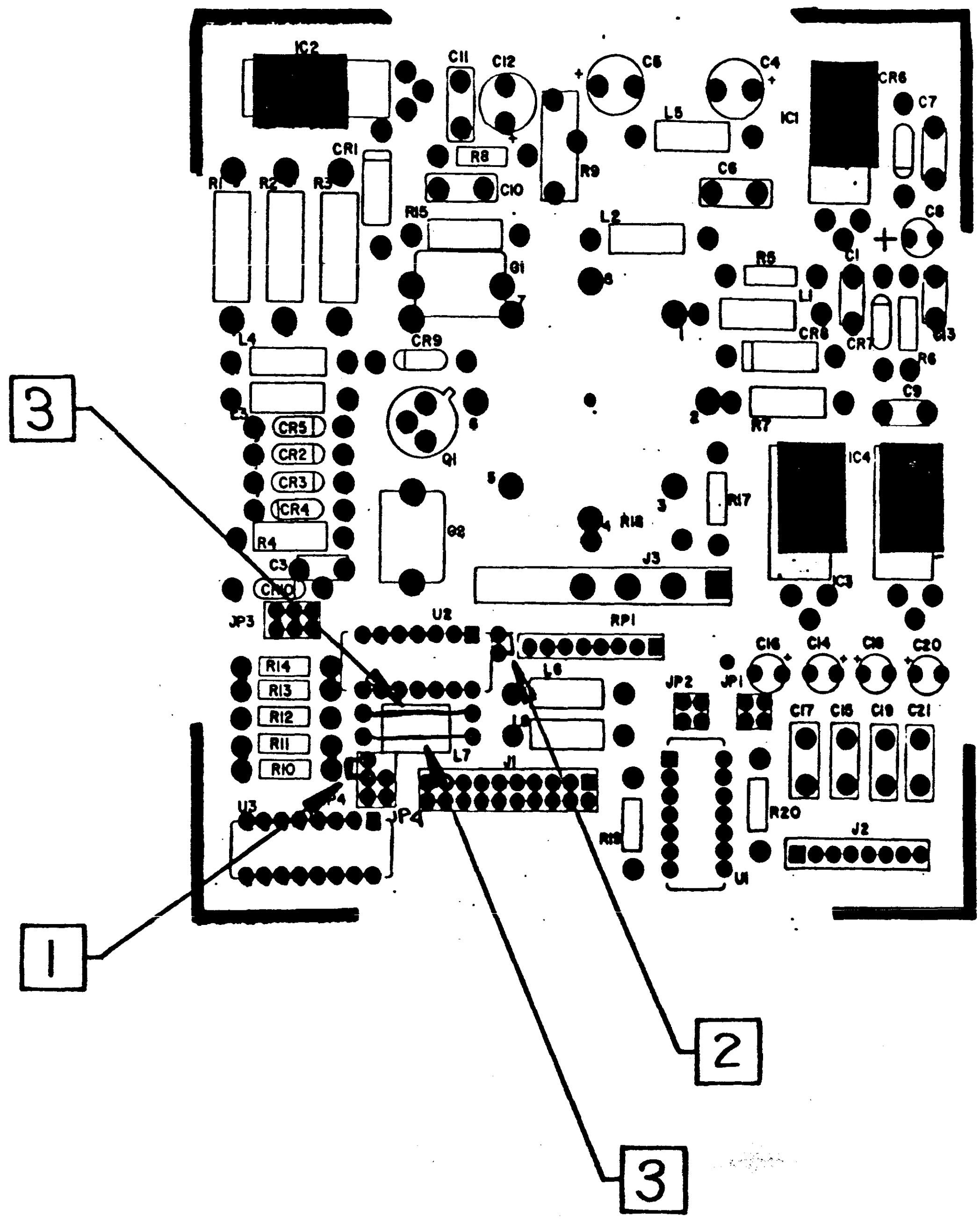


Figure A-4: Neck Board Component Locations



JUMPER WIRES:

1 JUMPER JP4 AS SHOWN.

2 JUMPER PADS ADJACENT TO U2.

3 INSTALL QTY. 2 JUMPERS INTO L7.

Figure A-5: Deflection Board Schematic

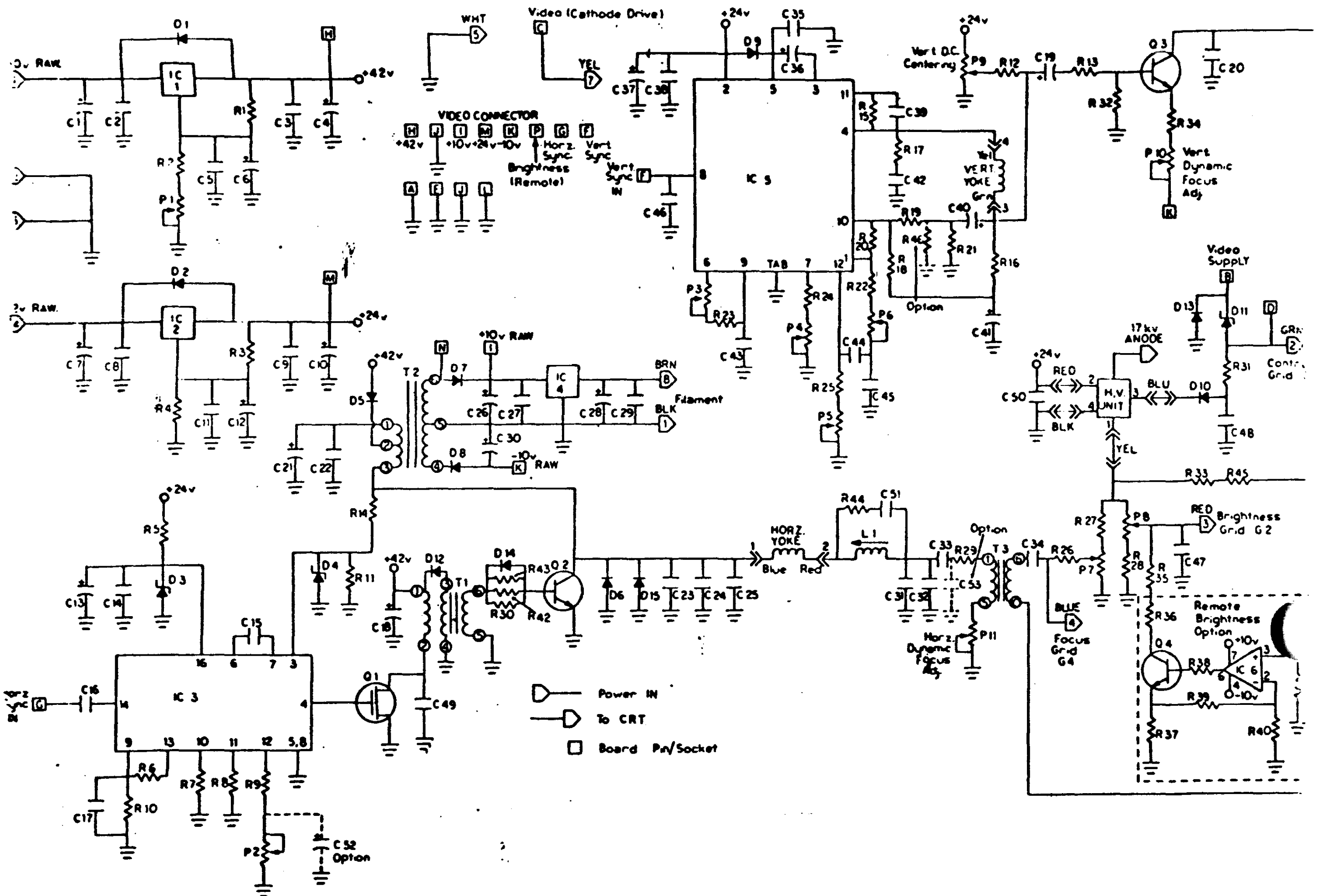
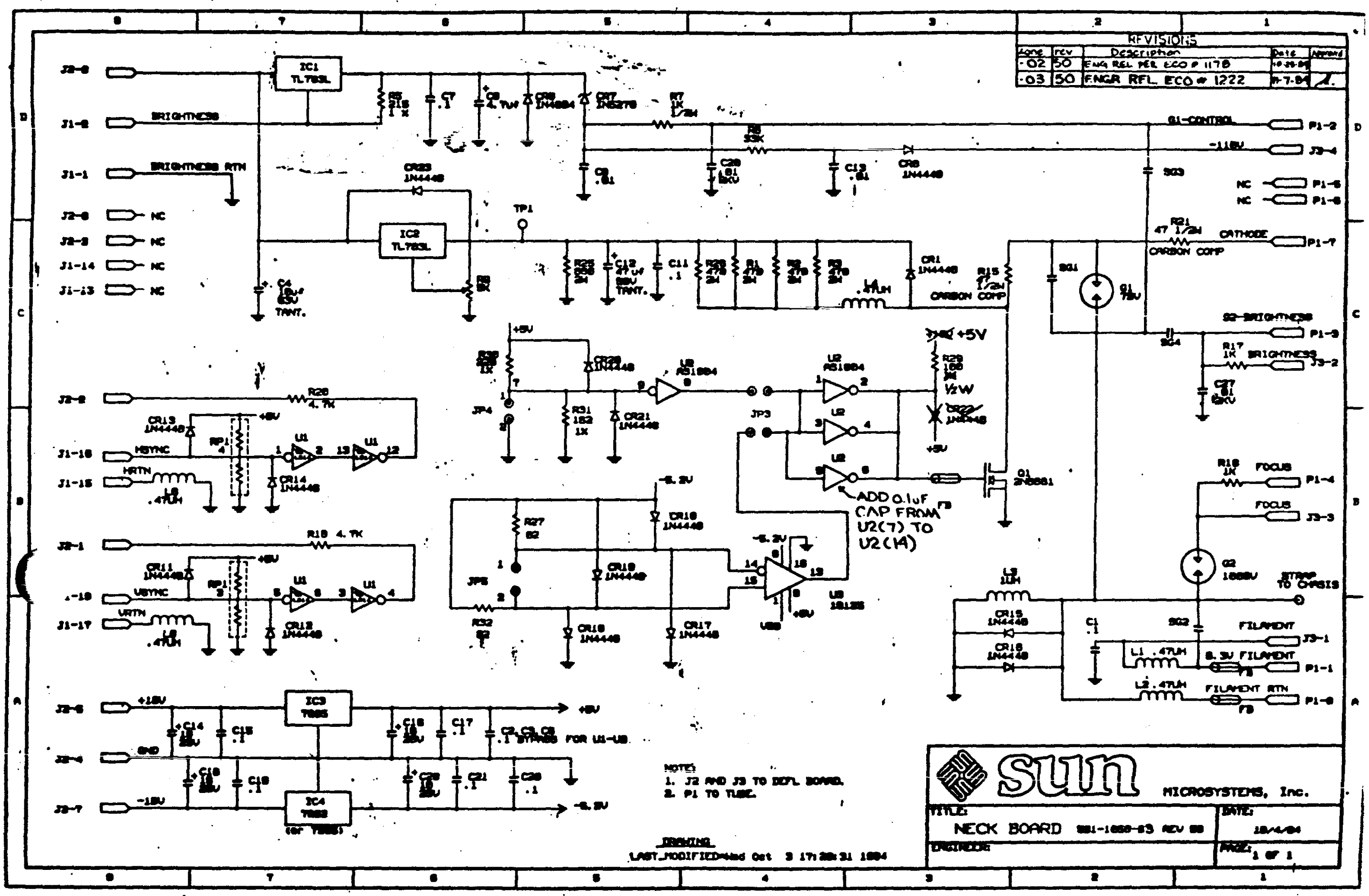


Figure A-6: Neck Board Schematic



READER COMMENT SHEET

Dear Customer,
We who work here at Sun Microsystems wish to provide the best possible documentation for our products. To this end, we solicit your comments on this manual. We would appreciate your telling us about errors in the content of the manual, and about any material which you feel should be there but isn't.

Typographical Errors:
Please list typographical errors by page number and actual text of the error.

Technical Errors:
Please list errors of fact by page number and actual text of the error.

Content:
Please list errors of fact by page number and actual text of the error.

Content:

Did this guide meet your needs? If not, please indicate what you think should be added or deleted in order to do so. Please comment on any material which you feel should be present but is not. Is there material which is in other manuals, but would be more convenient if it were in this manual?

Layout and Style:

Did you find the organization of this guide useful? If not, how would you rearrange things? Do you find the style of this manual pleasing or irritating? What would you like to see different?