6. Maintenance

6.1 Introduction

This section contains information necessary to disassemble, assemble, maintain, calibrate and troubleshoot the LeCroy LC684D, LC684DM, LC684DL and LC684DXL digital storage oscilloscopes.

6.1.1 Safety Precautions

The symbol used in this manual indicates dangers that could result in personal injury.

The symbol used in this manual identify conditions or practices that could damage the instrument.

The following servicing instructions are for use by qualified personnel only. Do not perform any servicing other than contained in service instructions. Refer to procedures prior to performing any service.

Exercise extreme safety when testing high energy power circuits. Always turn the power OFF, disconnect the power cord, discharge the cathode ray tube and all capacitors before disassembling the instrument.

6.1.2 Antistatic Precautions

Any static charge that builds on your person or clothing may be sufficient to destroy CMOS components, integrated circuits, Gate array's.....etc.

In order to avoid possible damage, the usual precautions against static electricity are required.

- Handle the boards in antistatic boxes or containers with foam specially designed to prevent static build-up.
- Ground yourself with a suitable wrist strap.
- Disassemble the instrument at a properly grounded work station equipped with antistatic mat.
- When handling the boards, do not touch the pins.
- Stock the boards in antistatic bags.

6.2 Disassembly and Assembly Procedure

The disassembly and assembly procedures detailed below refer to the views of figures shown in section 8.

6.2.1 Disassembly Procedure

Please study the figures in section 8 before attempting disassembly. Before removing any parts from the LeCroy LC684D, be sure to read carefully the instructions referring to those parts, noting any precautions needed to avoid problems.

Extreme caution should be taken in protecting the LCD face from damage (e.g. scratch marks, fingerprints, dust etc.) when handling, in particular when inserting or removing from the instrument.

a. Removal of the Front Bezel

The front bezel disassembly procedure refers to the view of figure 8-1.

The display is very easily damaged by fingerprints and dust once the front bezel is removed. Extra care must be exercised to protect the LCD face from getting dust or fingerprints. It may be impossible to clean completely if it is touched.

- Before removing front bezel make sure work area is as dust free as possible.
- Cover hands with powder free vinyl gloves.
- Remove three M3X6 screws underneath the plastic bezel.
- Pivot up the plastic bezel and remove it from the front frame by disengaging the hooks on the top of the bezel from the corresponding front frame lugs.
- Place bezel in plastic bag to protect glass from dust and fingerprints.
- Immediately cover LCD face with fresh piece of plastic wrap - secure to frame of unit if nessesary with tape.

b. Removal of the Upper Cover Assembly

The upper cover disassembly procedure refers to the view of figure 8-1.

- Remove the front bezel (6.2.1.a)
- Remove the seven M3X6 screws (three M3X6 on top, two M3X6 on left and two M3X6 on right).
- Remove the two upper feet ruber (see 11 on figure 8-3).
- Remove the two M5 screws that secure the two upper feet to the upper cover and rear panel.
- Carefully slide the upper cover off the unit (disconnect optional Internal printer cables from power supply and processor board).

c. Removal of the Front Frame Assembly with Color LCD Display

The front frame disassembly procedure refers to the view of figure 8-2 and 8-12.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove two M3X6 screws that secure the front frame on both side of the lower cover.
- With a long hex screwdriver unlock four M3X6 screws that secure the front frame on the main board upper shield.
- Disconnect the monitor cable from the F9615-21 card connector J1
- Disconnect the floppy cable from the processor board connector J1.
- Disconnect the front panel cable from the processor board connector J2

The front frame assembly with LCD display, front panel and floppy disk drive can with care be removed forward from the unit.

d. Removal of the Processor Board

The processor board disassembly procedure refers to the view of figure 8-1 & 8-18.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove the front frame assembly (6.2.1.c)
- Disconnect the processor cable J10 from the F9601-2 card connector J4.
- Disconnect the processor cable J9 from the F9301-4 RS232 & GPIB interface. and optional F9300-8 hard disk interface.

The processor can now be removed vertically from the main board connector J1.

e. Removal of the Power Supply Assembly

The power supply disassembly procedure refers to the view of figure 8-3.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove the front frame assembly (6.2.1.c)
- Remove the processor board (6.2.1.d)

If the instrument is equipped with hard disk option, remove the F9300-8 interface from the rear panel, by removing two M3X6 screws that secure it to the rear panel.

- Remove two M3x6 screws that secure the fan shroud to the rear panel.
- Remove one M3x6 screw which secures the fan shroud to the top of the power supply.

- Remove two M3X6 screws that secure the power supply on the main board upper shield.
- Remove two M3X6 screws that secure the power supply on the rear panel.
- Disconnect the power supply cable from the F9601-8 board connector J2
- Disconnect the fan power cable from the power supply connector J6

The power supply can now be removed vertically from the oscilloscope.

f. Removal of the Upper Shield Assembly

The upper shield disassembly procedure refers to the view of figure 8-2, 8-3 & 8-4.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove the front frame assembly (6.2.1.c)
- Remove the processor board (6.2.1.d)
- Remove the power supply assembly (6.2.1.e)
- Remove the two M3x5 that secure the fan shroud to the rear panel.
- Remove twelve M3x20 screws that secure the shield to the lower cover.
- Remove six M3X5 screws on both side of the lower cover.
- Remove six M2.5x6 screws that secure the upper shield to the main board front panel.
- Remove three M3X6 screws that secure the upper shield to the rear panel.
- Disconnect the power cable from the F9601-8 board connector J1.

The upper shield can now be removed from the oscilloscope.

g. Removal of the Rear Panel Assembly

The rear panel disassembly procedure refers to the view of figure 8-3 & 8-8.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove the front frame assembly (6.2.1.c)
- Remove the processor board (6.2.1.d)
- Remove the power supply (6.2.1.e)
- Remove the upper shield (6.2.1.f)
- Remove the two lower feet rubber (see 5 on figure 8-4)
- Remove two M5 screws that secure the two lower feet to the rear panel and lower cover.

The rear panel assembly can now be removed from the oscilloscope.

h. Removal of the Main Board Assembly

The main board disassembly procedure refers to the view of figure 8-5 & 8-10.

- Remove the front bezel (6.2.1.a)
- Remove the upper cover assembly (6.2.1.b)
- Remove the front frame assembly (6.2.1.c)
- Remove the processor board (6.2.1.d)
- Remove the power supply (6.2.1.e)
- Remove the upper shield (6.2.1.f)
- Remove three M3x6 screws that secure the main board to the lower cover.
- Remove twelve M3X6 screws that secure the main board to the lower cover

The main board can now be removed from the oscilloscope.

6.2.2 Assembly Procedure

Reassemble the unit in the reverse order, check that all screws shown on the drawings in section 8 are used and properly torqued.
Verify that all cables are correctly connected.

Assembly Note :

- **Bezel :** The plastic bezel should be in contact with the CRT all around the screen area. The bezel should not be deformed. When reassembling unit, if glass on inside of bezel must be cleaned use lint free wipes and while again wearing a lab coat and gloves try to polish off any marks, as a last resort use glass cleaner. If any fingerprints are present on LCD display, it may be possible to clean with alcohol and a lint free wipe, however sometimes it is impossible to clean it completely. If dust is present it may be possible to blow it off using particle free compressed air however this may cause more dust to be drawn to the LCD face.

- **LCD Display**: Being careful not to damage the LCD face. Fingerprints may be impossible to clean off.

- **Fan** : Check the fan cable direction. Note the air flow, the fan extracts air from the unit and expels it.

- **Feet** : Check that the lower feet and rear feet are aligned and properly tightened before re-assembly.

- **Filter** : Check that the earth wire is correctly installed and tightened.

- **Floppy** : Adjust the floppy position to obtain the front face tangential to face of the front panel. Check that the door is moving freely and shuts correctly.
  Insert a floppy and eject it to check the mechanism.

- **Front Panel** : Check that knobs rotate freely, are the right size and in the right place.

- **Main Board** :The main card must be parallel and tacked against the bend of the lower cover. Being careful not to bend the board or damage components underneath.

- **Rear Panel** : Check the CD9610 trimming adjustments align with holes in the rear panel.

- **Processor** : Check that the memory card insertion guide is correctly inserted in the front panel.

- **Printer** : If the graphic printer is used, before closing don't forget to plug input cable to the option and the driver cable to the processor card.

6.3 Software Update Procedure

6.3.1 Firmware upgrades are available from the Internet via http://www.lecroy.com or CDROM using the LeCroy software utility Scope Explorer.

The following methods are available for upgrading scope firmware:

1) GPIB **2) RS-232** **3) Floppy disk (No connection)**

Each method is described below.

a) GPIB:

Scope requirements:
- IEEE 488.2 GPIB cable connected to the PC.
- From the utilities menu; select the GPIB/RS232 menu.
- Now select a GPIB address and ignore the rest of the menu.
- Put the scope in stop mode by depressing STOP on the front panel.

PC requirements:
- National Instruments TNT type GPIB card.
- Windows 95, 98, or NT operating system.
- LeCroy Scope Explorer utility.

Connecting to PC
1) Open Scope Explorer, then select Scope-finder from the scope pull-down menu. (see fig. #1)
2) From the Scope-finder window select find.
3) If more than one device appears in the window, select the correct device.
4) Using the scope pull-down menu select upgrade DSO from internet/CD and follow the upgrade wizard. (see fig. #2)
5) After following the instructions, the firmware will be automatically upgraded via the Internet.

6) Cycle the power when prompted.

b) RS232:

Scope requirements:

- 9-pin serial null modem cable connected to the PC.
- From the scope utilities menu; select the GPIB/RS232 menu.
- Select RS232; 8 bits; parity none; stop bits 1; max baud rate 19.2K; and ignore the GPIB address.
- Place scope in stop mode by depressing STOP on the front panel.

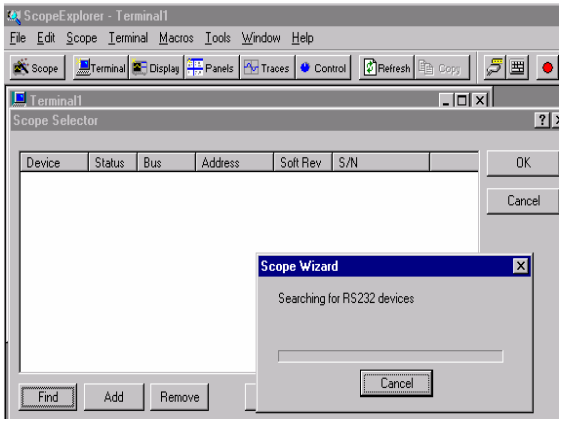


Figure 1: scope find window

PC requirements:

- Windows 95, 98, or NT operating system
- LeCroy Scope Explorer utility.
- Two 1.44 M byte formatted floppy disks

Connecting to PC

1) Open Scope Explorer, then select Scope-finder from the scope pull-down menu (see fig. #1)
2) From the Scope-finder window select find.
3) If more than one device appears in the window, select the correct device.
4) Using the scope pull-down menu select upgrade DSO from internet/CD and follow the upgrade wizard (see fig. #2)
5) The scope cannot be upgraded directly through RS232, but will download the firmware to 1.44 Mbyte floppy disks.
6) After the software is loaded to the floppy disks, put floppy # 1 into the scope drive.
7) Push the utilities button and select special modes from the on screen menu.
8) Now select firmware update, and update from floppy.
9) From the on screen menu choose update flash.
10) Remove floppy # 1 and insert floppy # 2 into scope when prompted on scope display.
11) Cycle the power when prompted.

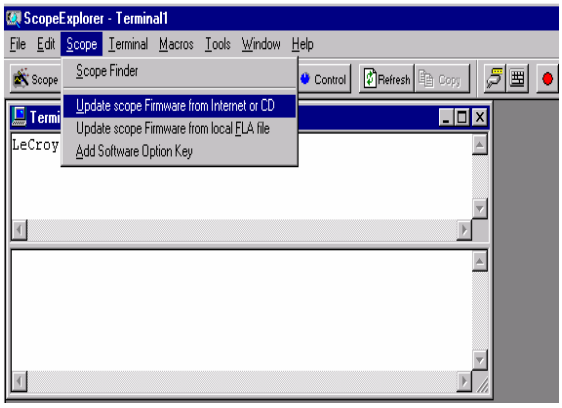


Figure 2: firmware upgrade window

c) No Connection (floppy disk)

Scope requirements:
- Put the scope in stop mode by depressing STOP on the front panel.

PC requirements:
- Windows 95, 98, or NT operating system.
- LeCroy Scope Explorer utility.
- Two 1.44 Mbytes formatted floppy disks.

Without a connection:
1) Open Scope Explorer
2) Using the scope pull-down menu select upgrade DSO from internet/CD and follow the upgrade wizard
3) You must have the scope model number, the firmware version, and the scope serial number.
4) To find the scope information, push the show status button on the scope.
5) In the status box, highlight system by pressing the second on screen menu button and the text screen will contain the necessary information.
6) Because the scope cannot upgrade directly Scope Explorer will download the firmware to 1.44 Mbytes floppy disks.
7) Now follow the same directions as RS232 connection step # 6

6.3.2 Software Options

The following software options are available:

- WP01 Advanced Math Firmware
- WP02 Basic FFT Firmware
- WP03 Parameter Distribution Analysis Firmware
- DDM Disk Drive Measurements
- PRML Partial Response Maximum Likelihood
- ORM Optical Recording Measurement
- DDFA Disk Drive Failure Analysis
- MC01 PCMCIA Memory Card
- JTA Jitter and Timing Analysis
- PMT Power Measurement Tools
- MT01/02 Automatic Mask Tester
- MT03 OC3/OC12 Optical Signal Test Solution
- PMSK Polymask Mask Testing Software
- JPRO JitterPro
- CCTM Clock Certification and Test Module

6.3.2.1 Changing Software Option Key

a. Scope ID, Scope Serial Number

The scope ID and scope s/n: are used to request a Software Option Key

- Enter the scope's Software Options menu (located under the **STATUS**, **SYSTEM** menu).
- Note the **SCOPEID**, i.e: 59258A-31 and **Scope s/n**: LC684DL30104 that are found on that menu.

b. Entering Option Key in the DSO

- Enter the scope's Software Options menu (**STATUS**, **SYSTEM** menu).
- Enter the **ADD OPTION KEY** menu on the DSO
- Enter the new option key using the dymo-editor, i.e: **C4B5-F4A9-4464-E7ED**
- Click on **ENTER THIS OPTION KEY** to add the key
- Reboot the scope and verify that the options added correctly.

6.3.3 Processor Board Exchange Procedure

The serial number of the LC684D oscilloscope is loaded in the real time clock memory which is battery backed up. If it becomes necessary to replace the processor board, the serial number must be loaded in the memory of the new board by using LeCroy program " LeCalsoft " under GPIB remote control.
To run " LeCalsoft " type SKP.exe, in the main menu type S, and follow the instructions, use five digits to enter the serial number (i.e. 30104).
Then check in the system summary, by using the show status button on the front panel, the scope serial number.

6.4 Equipment and Spare Parts Recommended for Service

6.4.1 Test Equipment Required

See Table 5-1 in section 5.2.

6.4.2 LC684D/DM/DL & DXL Spare Parts

LeCroy P/N	Assembly	Adjustments	Performance Tests
F9601-11-16	Power PC, 2X8MB DRAM for LC684D & DM	None	None
F9601-11-64	Power PC,2X32MB DRAM for LC684DL	None	None
F9602-1-64	Power PC 200MHz, 2X32MB DRAM for LC684DXL	None	None
F9601-2	Internal + External VGA Centronics Interface	None	None
F9615-3	Acquisition Card 4 GS/s	None	See Chapter 5
F9301-4	GPIB Interface RS232 Interface	None	None
F9615-5	Keyboard Assy	None	None
S9615-21	Buffer Board	None	None
F9601-6	Floppy Disk Drive Assy	None	None
F9300-7	Printer Interface	None	None
F9300-8	Hard Disk Interface	None	None
F9601-9	NMB Variofan	None	None
S9601-9	NMB Speed Control	None	None
258104001	TFT Color LCD Module, 10.4 inch	None	None
PS9611	Power Supply	6.5.1	None

The other parts are not on the above list because the probability of failure is very low. See chapter 7, 8 & 9 for mechanical and electrical replaceable parts.

6.5 Calibration Procedures

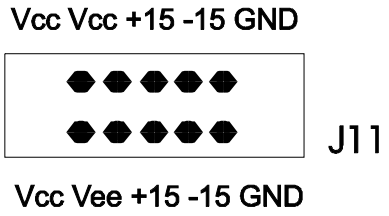
The following section includes the manual adjustments of the power, but does not contain any instructions or descriptions about the acquisition board calibration. The acquisition board adjustments required complex test set-up and calibration Software. For information on the availability of the tester and software, contact your nearest LeCroy service center.

6.5.1 Power Supply Calibration Procedure

- Remove the front bezel (see 6.2.1.a)
- Remove the upper cover assembly (see 6.2.1.b)

- To ensure adequate main board cooling, it is necessary to control the air flow by installing a **temporary closure plate** which fully encloses the air space behind the monitor.

- Turn on the power, set the scope to **Auto Trigger**, and perform the adjustments to get on processor board connector J11:



Vcc : **+ 5.00V** (Min = + 4.9 V, Max = + 5.10 V)
Vee : **- 5.1 V** (Min = - 5.05 V, Max = - 5.15 V)
+15 : **+14.95 V** (Min = +14.90 V, Max = +15.05V)
- 15 : **- 14.95 V** (Min = -14.90 V, Max = -15.05 V)

- The four potentiometers are accessible from the top through holes in the PS9611 power supply chassis.

- Turn the potentiometer clockwise to increase the voltage or counterclockwise to decrease the voltage.

- When the adjustment is done, stop the acquisition by depressing the stop trigger push button, and verify that there is no large difference on the + 5.00 V, typically less than 80 mV.

6.6 Troubleshooting and Flow Charts

6.6.1 Introduction

The troubleshooting information contained in this section is intended for use by qualified personnel having a basic understanding of electronics (analog and digital). In order to simplify servicing and minimise downtime, the following list of possible symptoms, likely causes, and troubleshooting steps have been prepared. The first step in troubleshooting is to check for obvious items like blown fuses. The power supply is the next item to check before proceeding to more detailed troubleshooting, since noise or low power supply voltages can cause a variety of digital and analog problems.

6.6.2 Line Fuses Replacement

The power supply of the oscilloscope is protected against short circuits and overload by means of two T6.3A / 250 V fuses located above the main plugs.

Turn off the power and disconnect the line cord from the instrument Disconnect the instrument from other equipment.

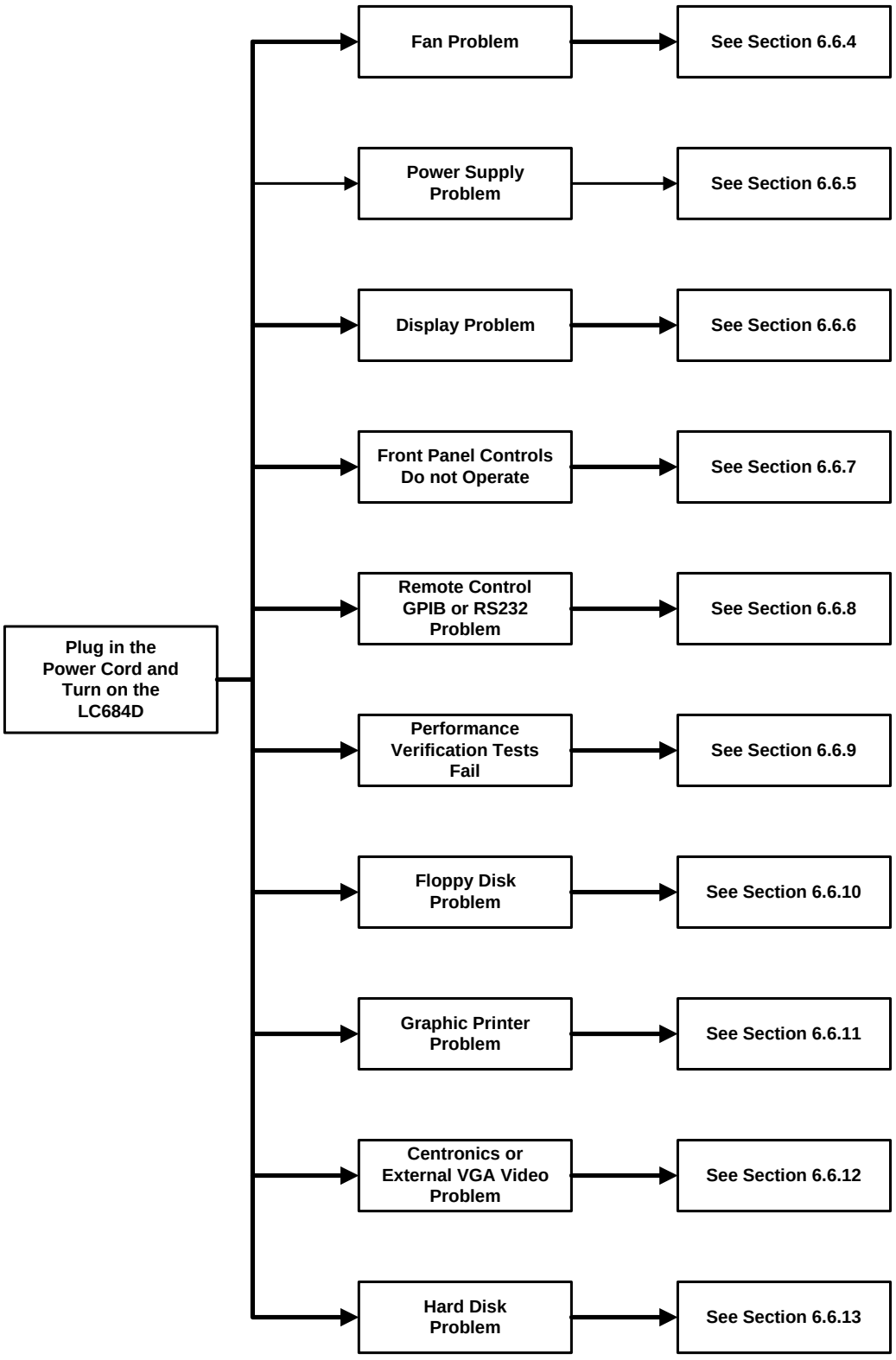
To replace line fuses, proceed as follow:

- Open the fuse box by inserting a small flat screwdriver under the plastic cover and remove the fuse carrier from the holder
- Remove the fuse and replace it with the proper type: T6.3 A / 250 V, LeCroy part number: **433 162 630**

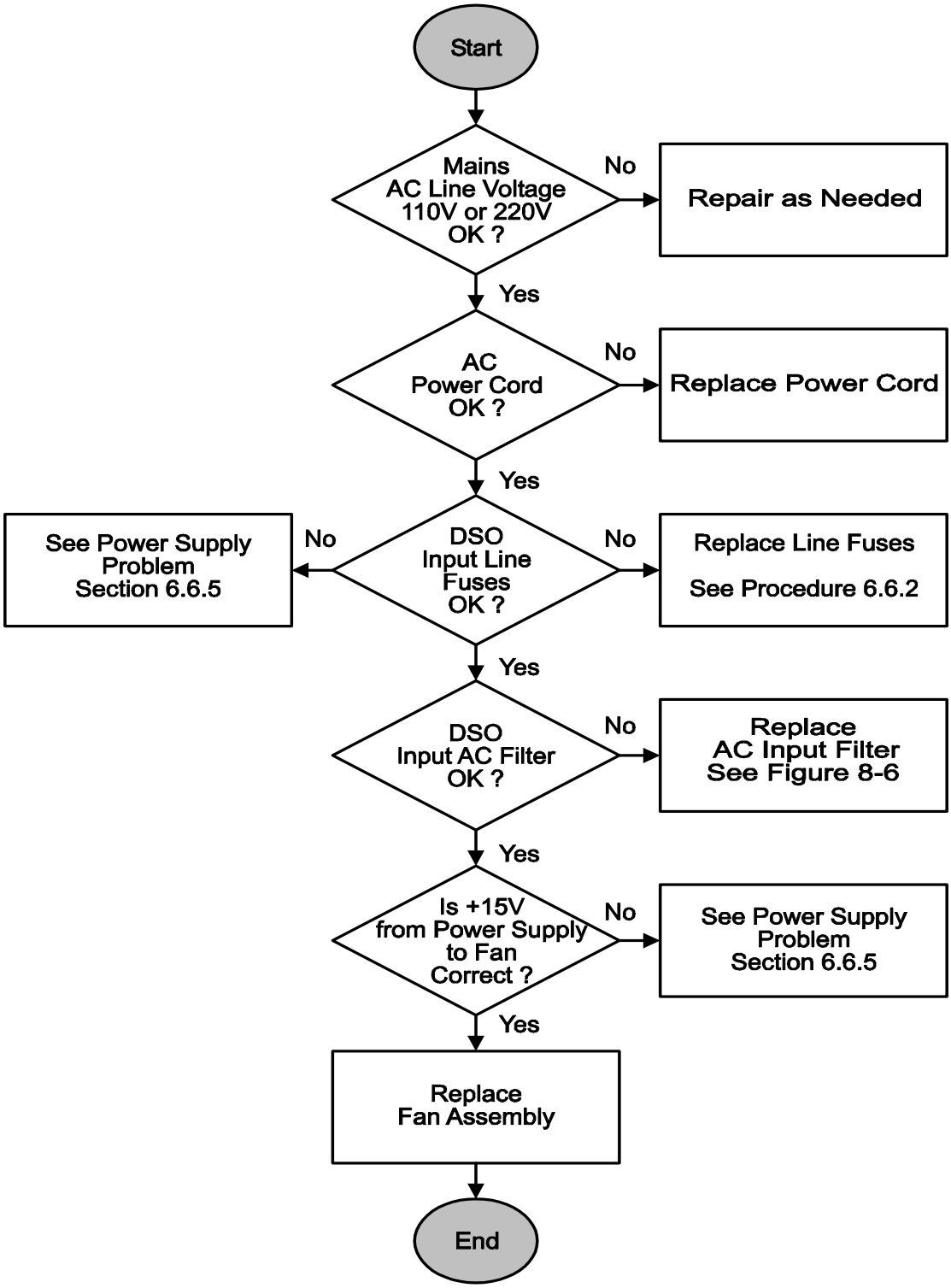
6.6.3 Initial Troubleshooting Chart

Most procedures in this section will allow troubleshooting down to the **BOARD LEVEL.**

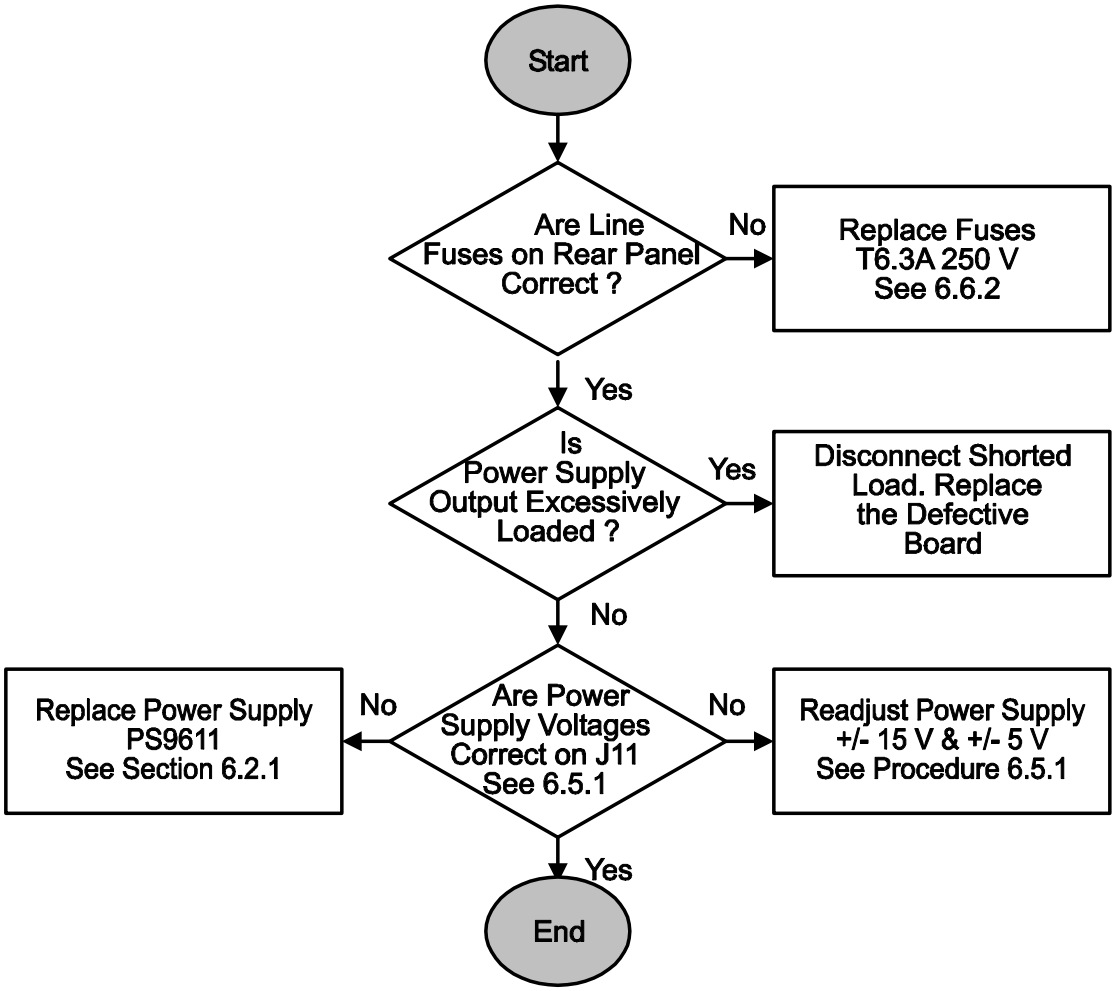
Defective circuit boards will be repaired or exchanged by the regional LeCroy service office or the local representative (see section 2.2).


Plug in the Power Cord and Turn on the LC684D
Fan Problem
See Section 6.6.4
Power Supply Problem
See Section 6.6.5
Display Problem
See Section 6.6.6
Front Panel Controls Do not Operate
See Section 6.6.7
Remote Control GPIB or RS232 Problem
See Section 6.6.8
Performance Verification Tests Fail
See Section 6.6.9
Floppy Disk Problem
See Section 6.6.10
Graphic Printer Problem
See Section 6.6.11
Centronics or External VGA Video Problem
See Section 6.6.12
Hard Disk Problem
See Section 6.6.13

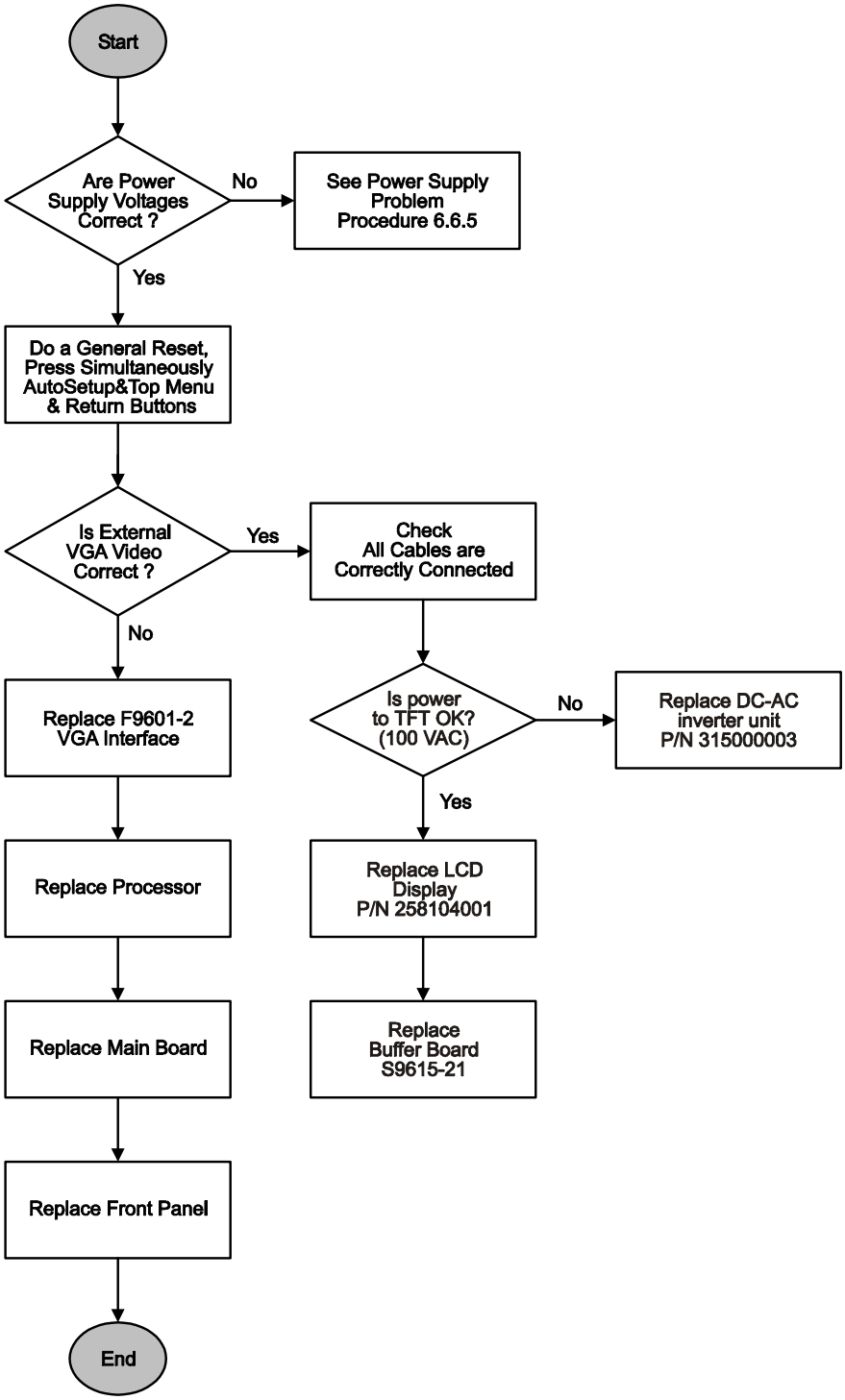
6.6.4 Fan Problem



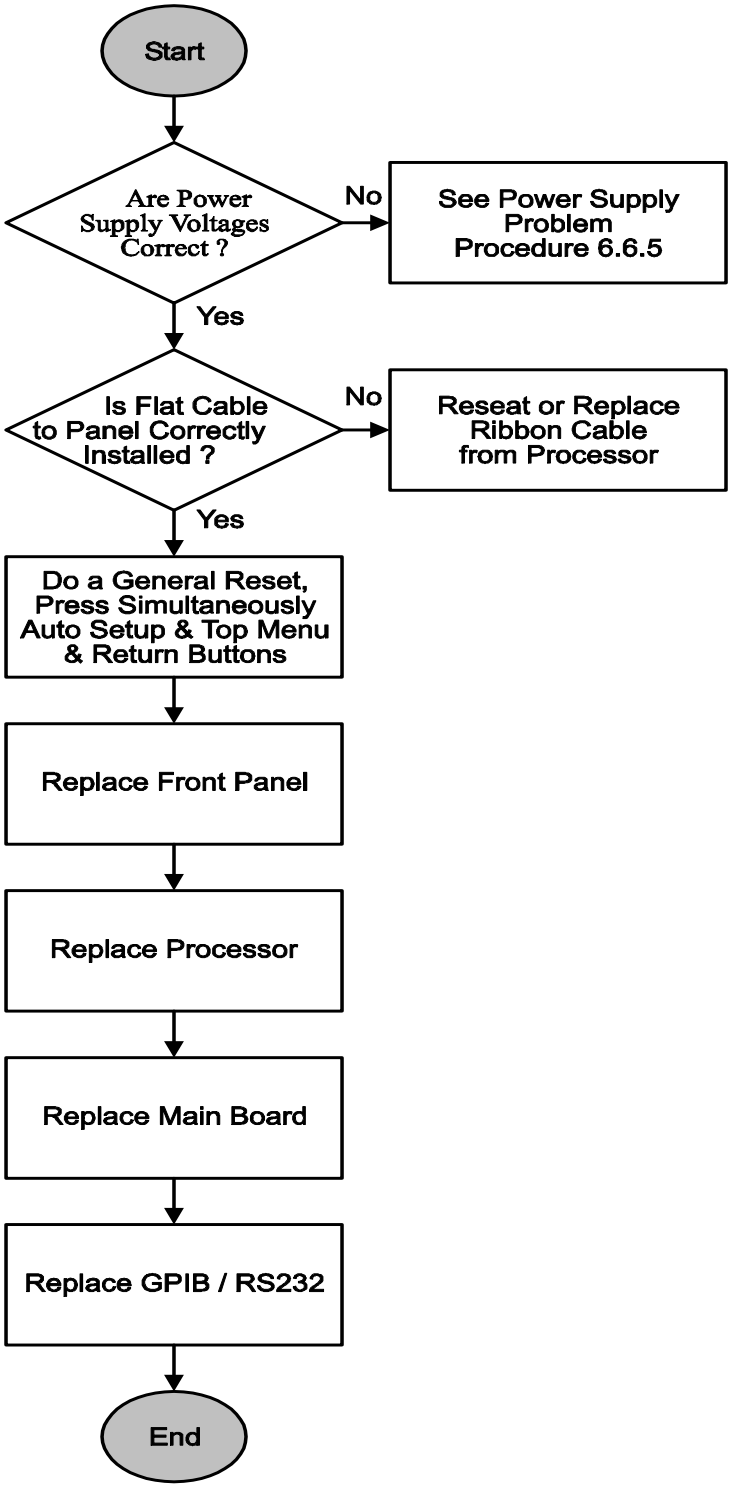
6.6.5 Power Supply Voltages Problem



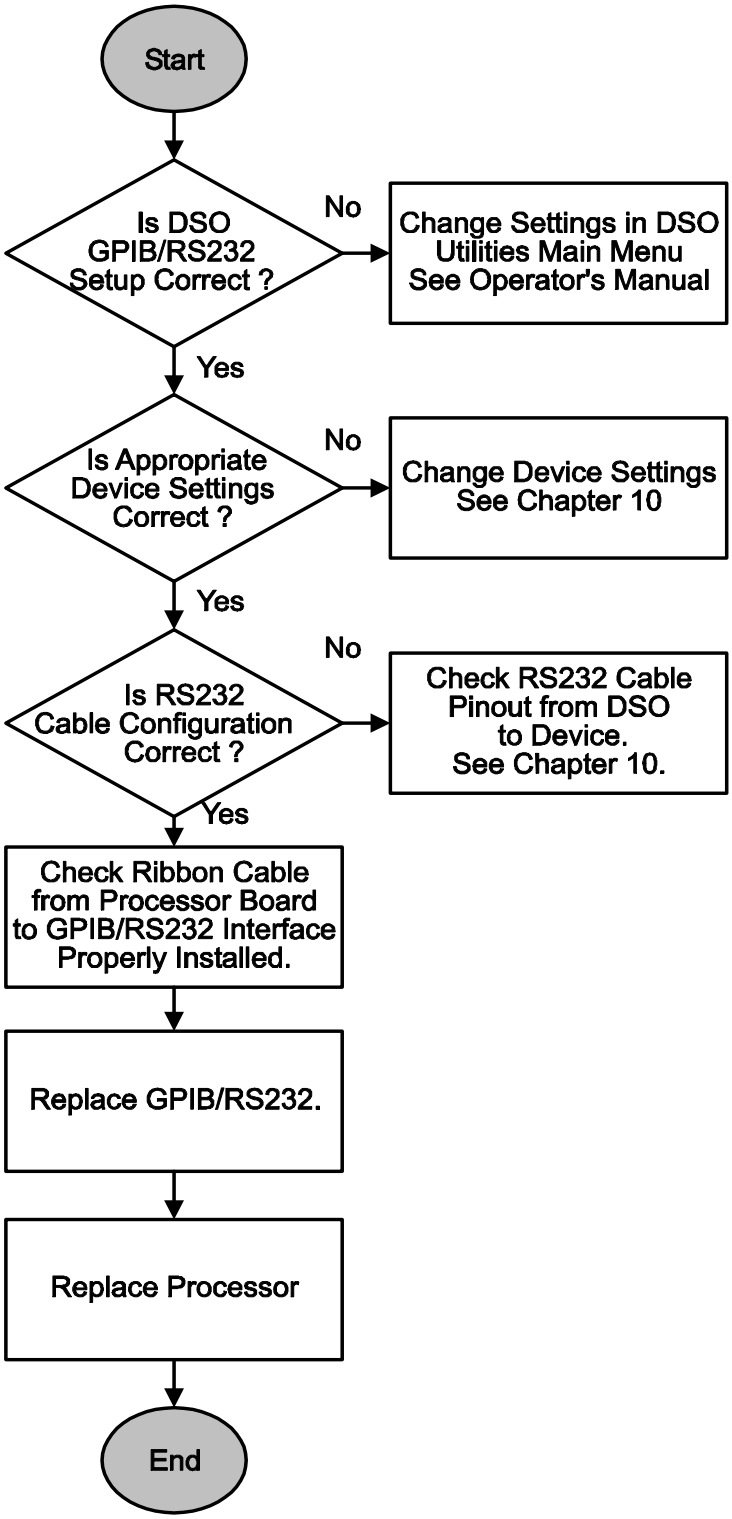
6.6.6 Display Problem



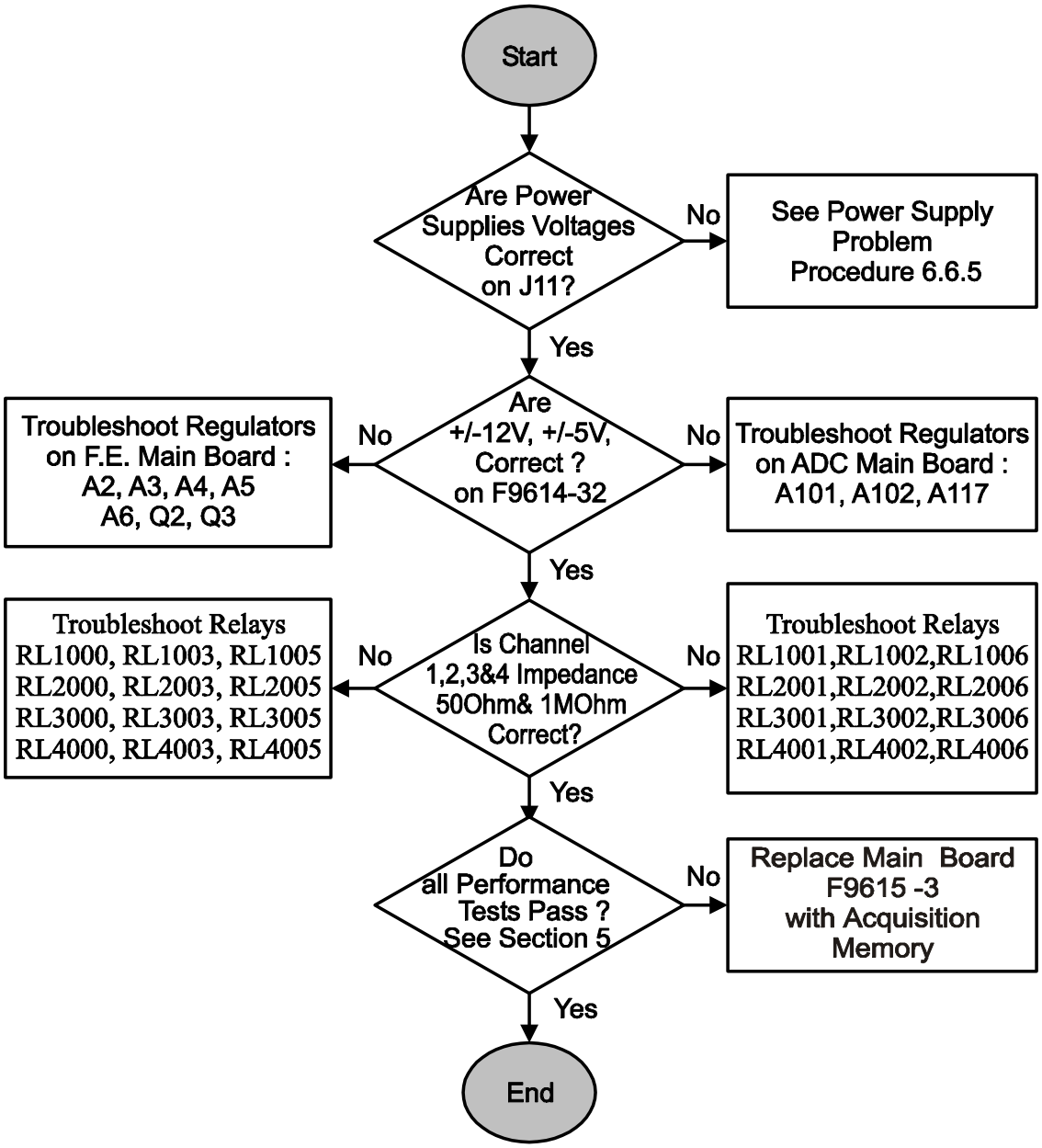
6.6.7 Front Panel Controls Do not Operate



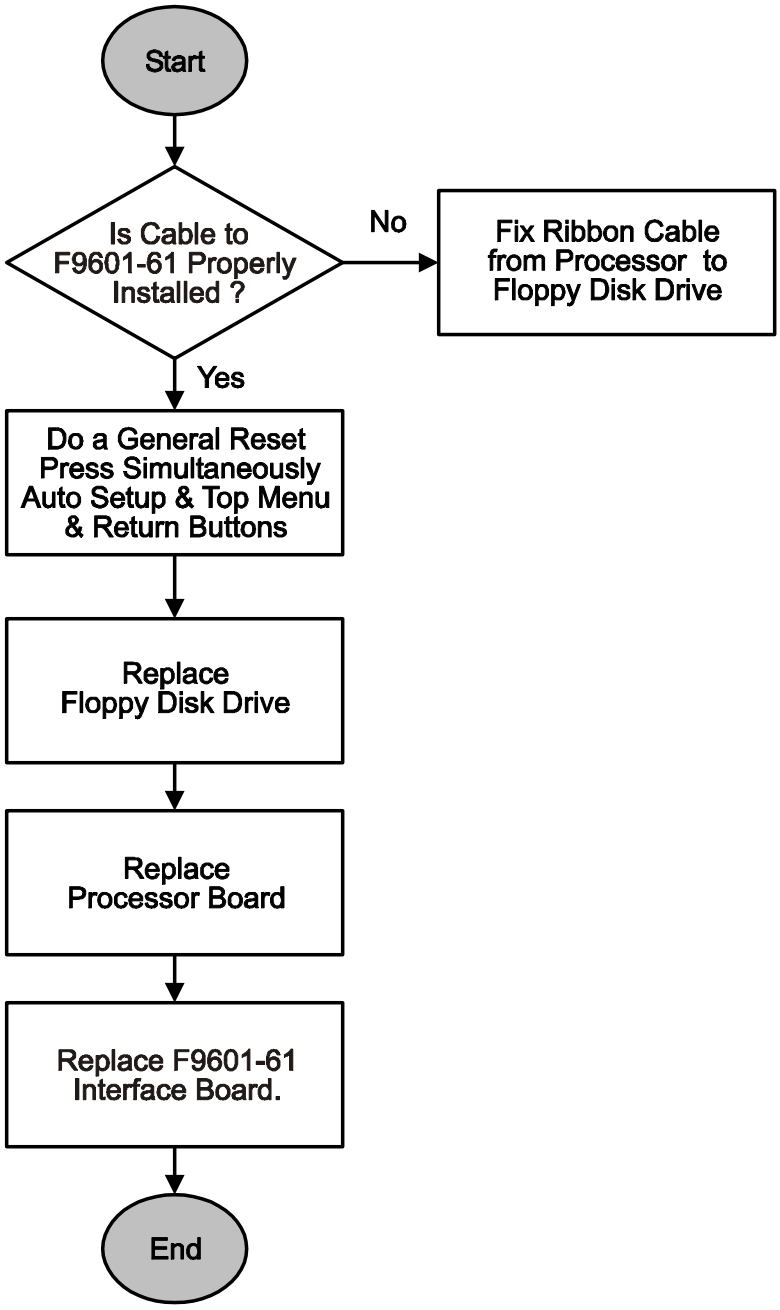
6.6.8 Remote Control GPIB or RS232 Problem



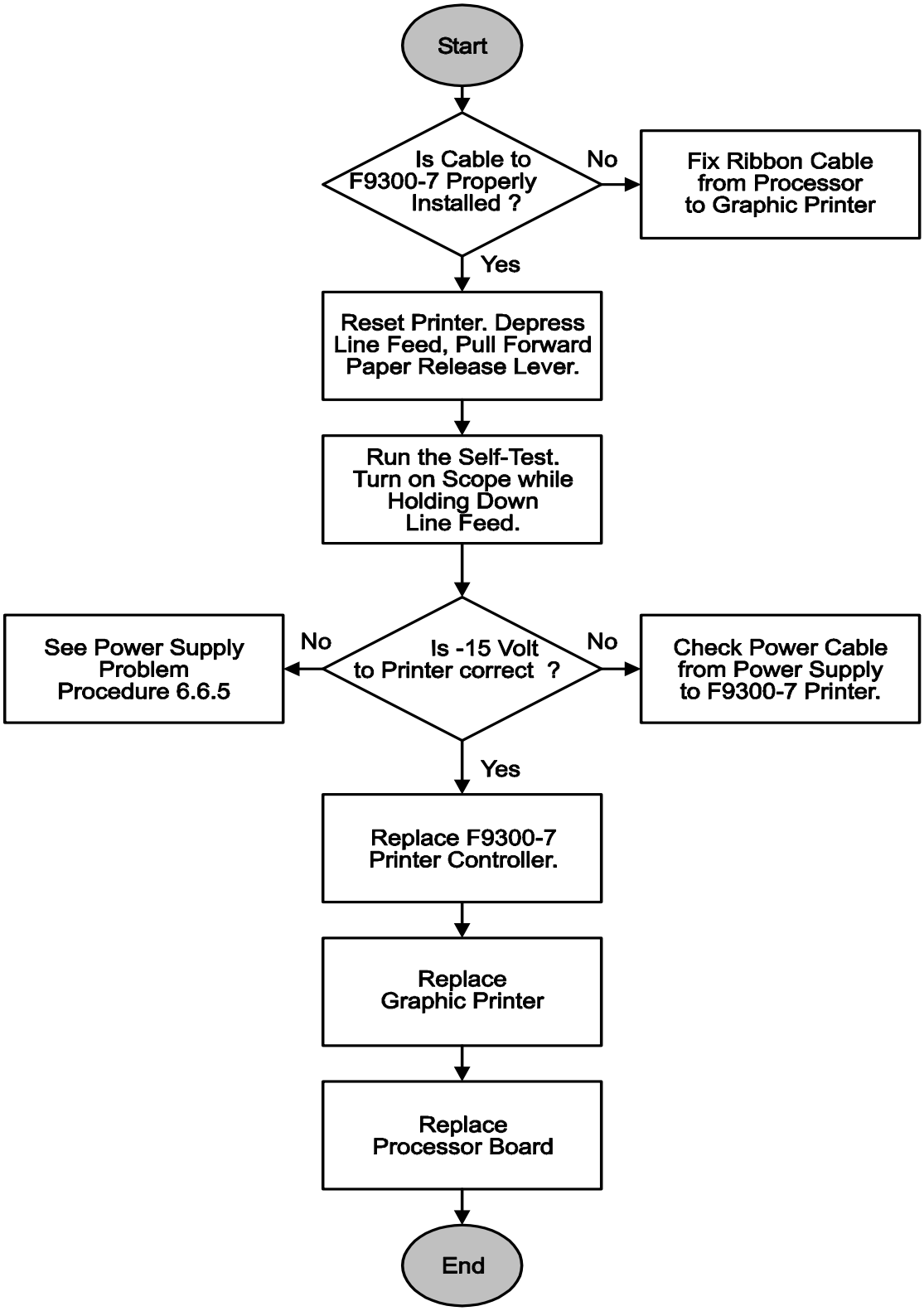
6.6.9 Performance Verification Fails



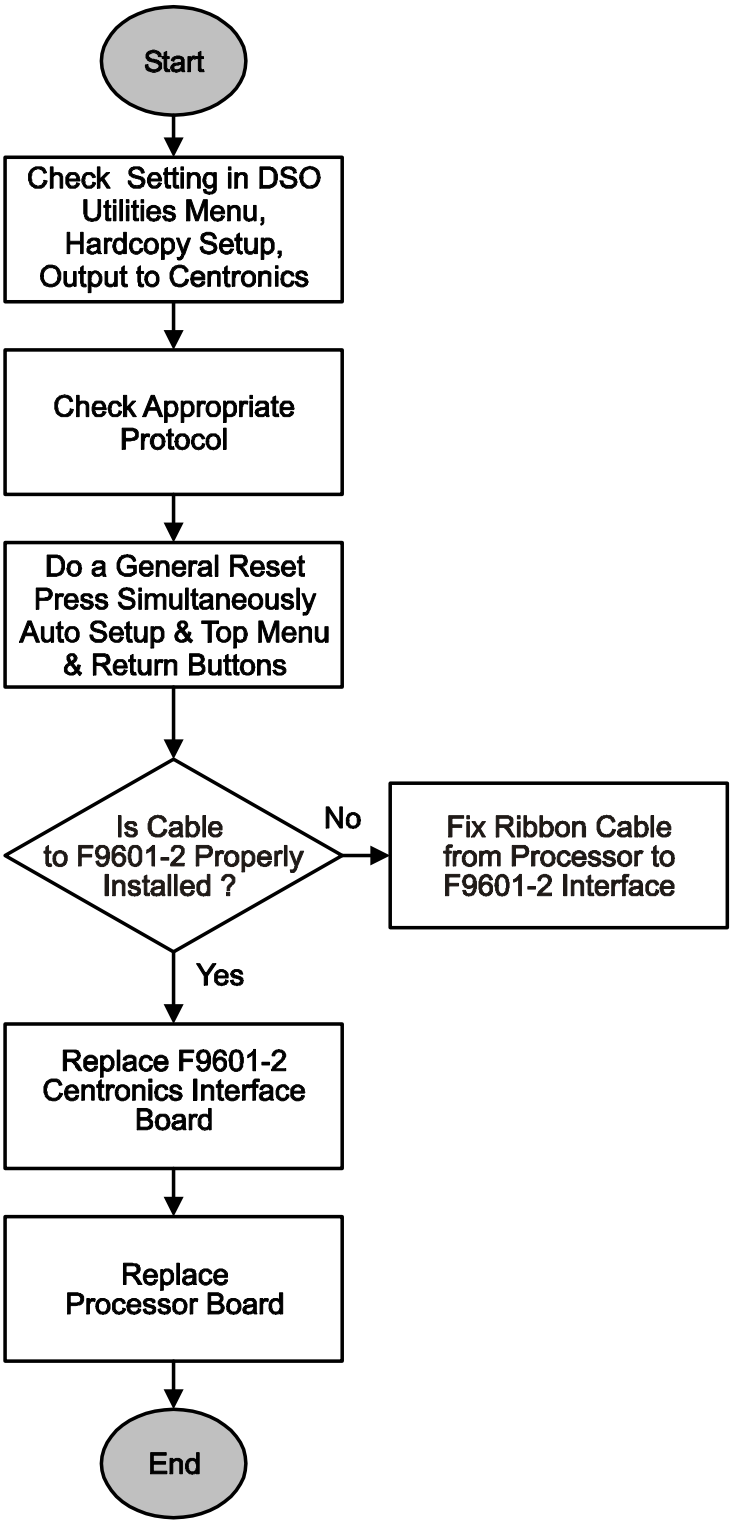
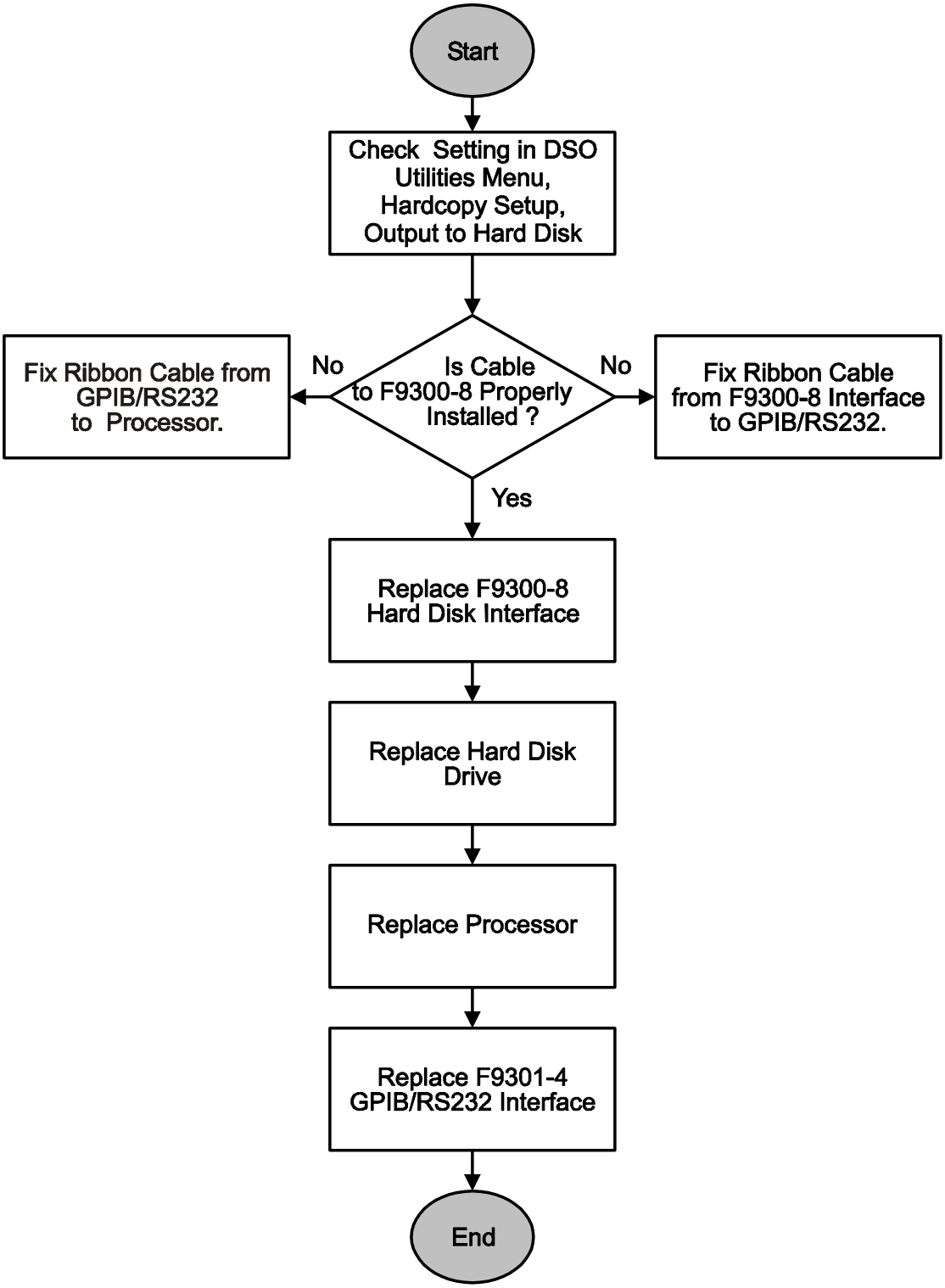
6.6.10 Floppy Disk Drive Problem



6.6.11 Graphic Printer Problem



6.6.12 Centronics Problem



6.6.13 Hard Disk Drive Problem