

# Inside of a LCD Monitor



Team Number: 8838E


Team Name: Egg

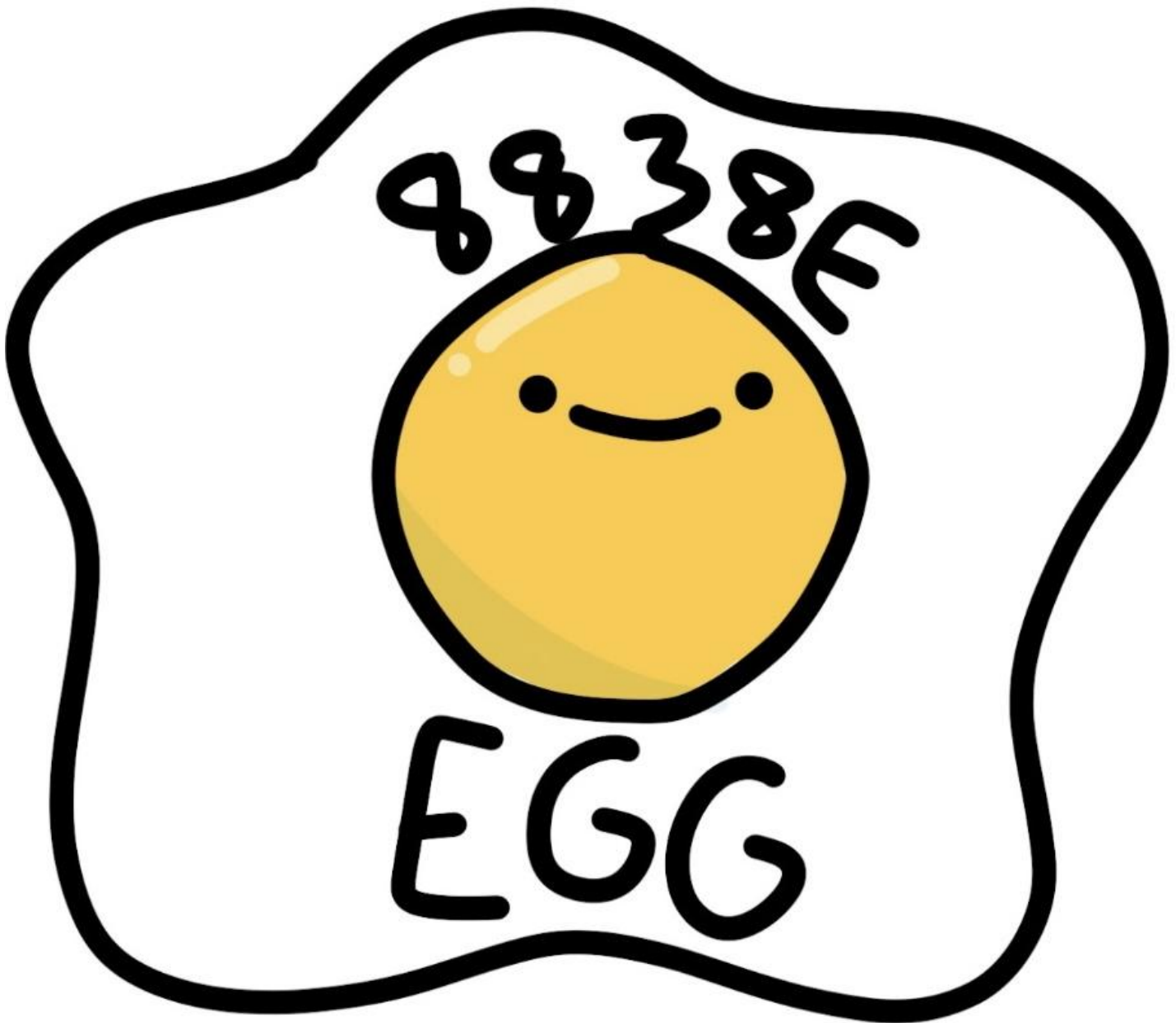
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# Reverse Engineering Device Approval Document

Written By Team 8838E, Egg

I, coach , approve the following deconstruction and documentation of the 1996 ACER LCD (Liquid Crystal Display) Monitor for educational and competition purposes including that of the VEX Robotics Competition.]



# Table of Contents

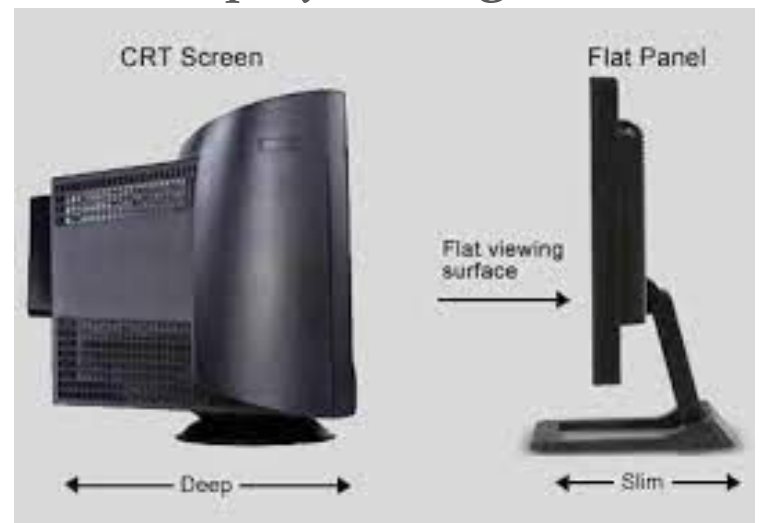
Introduction.....	1
Approval Document.....	2
Process.....	3
Safety Precautions.....	4
Steps.....	5
Cover Removal.....	6
Frame Removal.....	7
Port Removal.....	8
Part Separation.....	9
Wire Connectivity.....	10
Board Breakdown.....	11
Power Board Breakdown.....	12
Board Breakdown p2.....	13
LCD Screen Breakdown.....	14
Component Function.....	15
Conclusion.....	16
Summary.....	17
Citation.....	18

# Introduction:

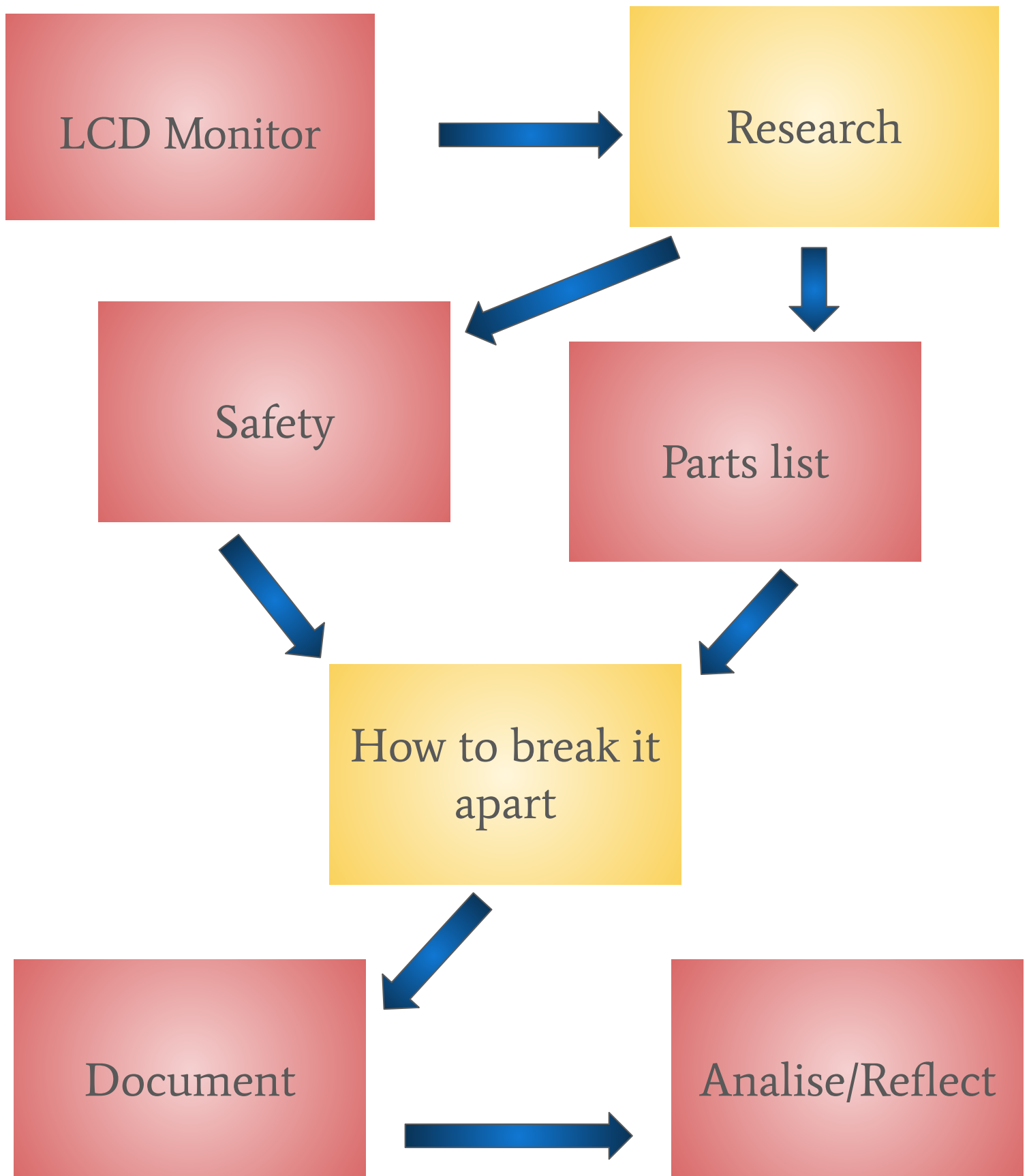
The device we choose for our reverse engineering project is an **ACER LCD** (Liquid crystal display) **Monitor**. It uses LCD technology to **display clear images** through a flat panel monitor. This type of monitor is a result of cumulative advancements by various scientist from the CRT. The **CRT**(cathode ray tubes) **monitors** which were invented in the early 1900s by Karl Ferdinand Braun have a much thicker display whereas LCDs can display through a **flat viewing surface**.

## Why we choose this:

We chose this monitor as we were very curious of how our **day to day device functions**. We were also very curious as to how monitors had **evolved**. We would be able to have a **detailed examination to learn** the intricate components of an LCD and break down it's function.



# Breakdown Process



# Safety Precautions

After unplugging the power cord, the power board of the monitor will still have power energy. Thus, before dismantling the monitor, it needs to be kept on a mat.

## Tools:

- Working Table
- Insulation Glove (preferred to have during entire time of dismantle)
- Cleaning cloth
- Table Mat (ESD Compliant workstation rubber mat)
- Knife
- Screwdrivers
  - Phillips-head screwdriver
  - Hex-head screwdriver

## Acronym Key:

LCDM	Light Construction & Development Management	PCBA	Printed Circuit Board Assembly
LCD	Liquid Crystal Display	CRT	Cathode Ray Tubes
VGA	Video Graphic Array	DVI	Digital Visual Interference

# Steps:

**Step 1:** Place Monitor on a mat.

Here is the ACER LCD Monitor's Front and back view of the Monitor.



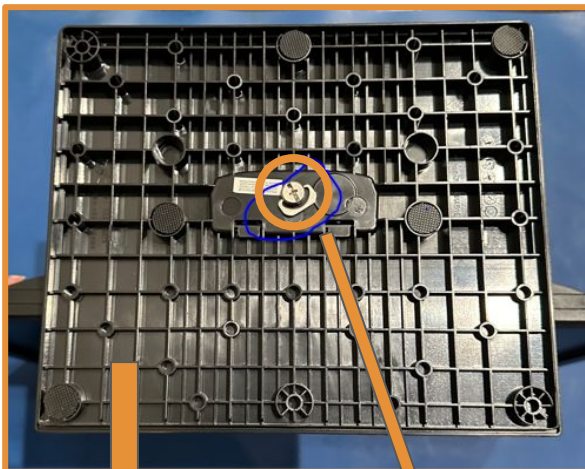
Front View



Rear View

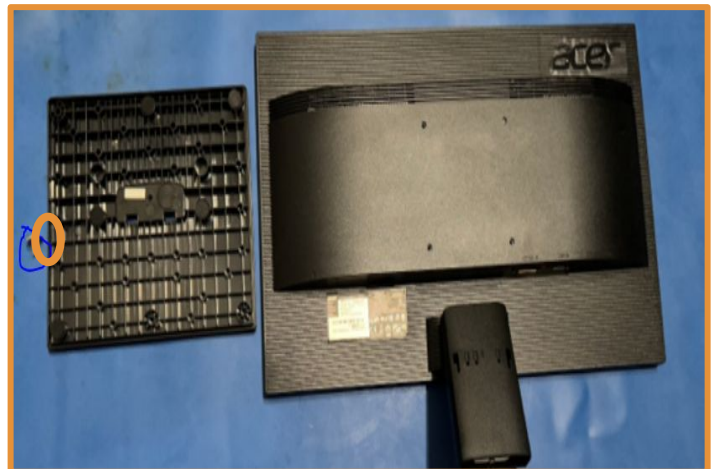
**Step 2:** Disassemble stand/base from the rear case

It is comprised of the **foot** (a square plate) and the **leg** (between foot and monitor). It has a **wing screw** on the bottom of the foot/base. Simply **flip up the wing** to turn the screw to remove it.



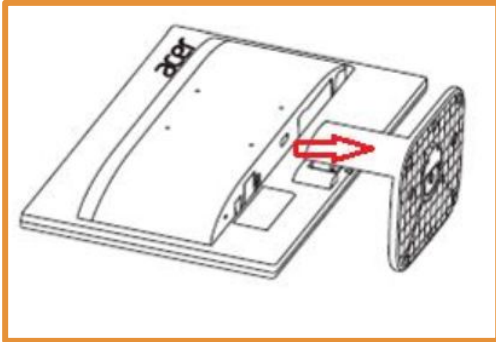
Stand/Base

Wing Screw



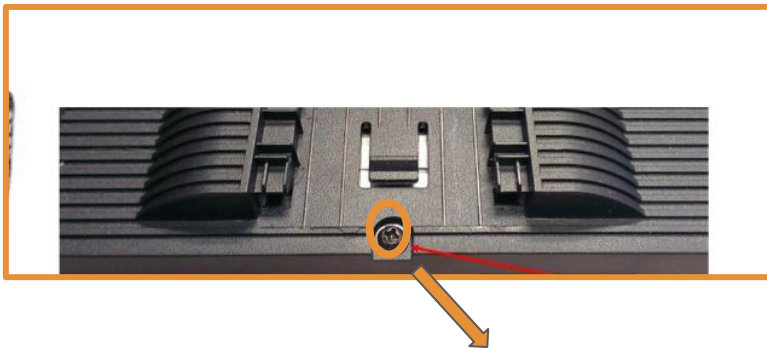
# Cover Removal:

**Step 3:** Disassemble rear case from Monitor  
Pull the rear case outwards in order to get it remove it.



Rear Case

**Step 4:** Disassemble front Bezel from Back  
Use a knife and insert between the front bezel and back. The housing is not a press-fit, but there are tabs that hold it together. Next, slide the knife along the seam and it will simply come off.



After, remove the one  $\frac{3}{8}$  inch long Phillips screw



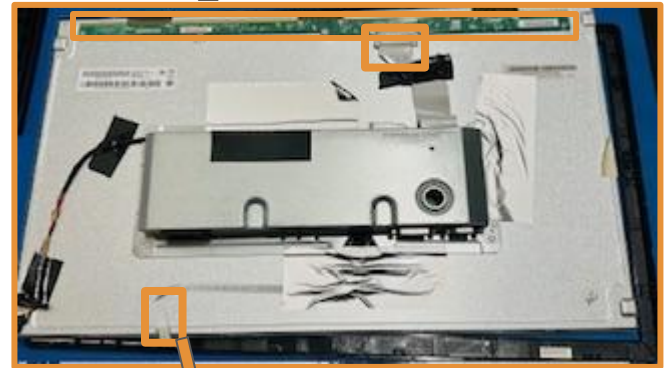
# Frame Removal:

## Step 5: Disassemble Button Bar from rest of Monitor

Tear off the tapes, take out the Panel and the Control Board of the Button Bar



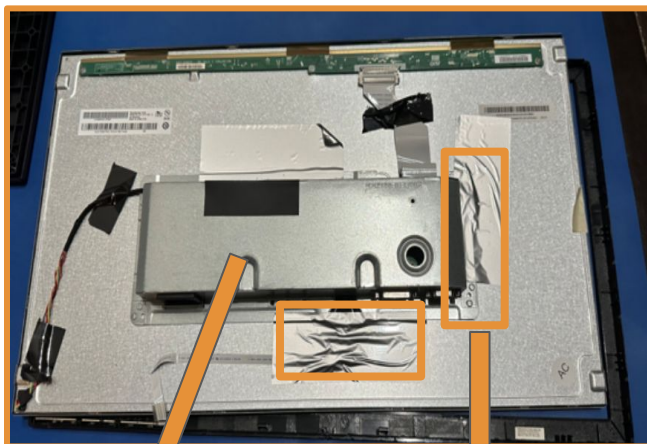
Button Bar



The flex cable is **adhered** to the **panel** with some light adhesive

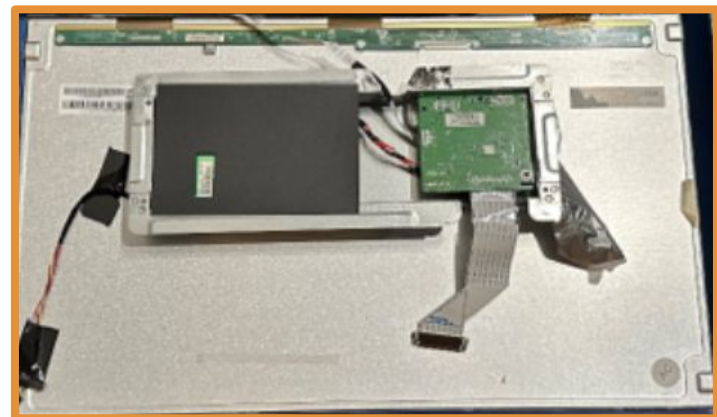
## Step 6: Disassemble Shielding

Remove the edge of the panel. There are two strips of what feels like **thick aluminum tape**. Those are actually used as EMI shielding. Tear down AL-Tape off Shielding.



Shielding

AL-Tape

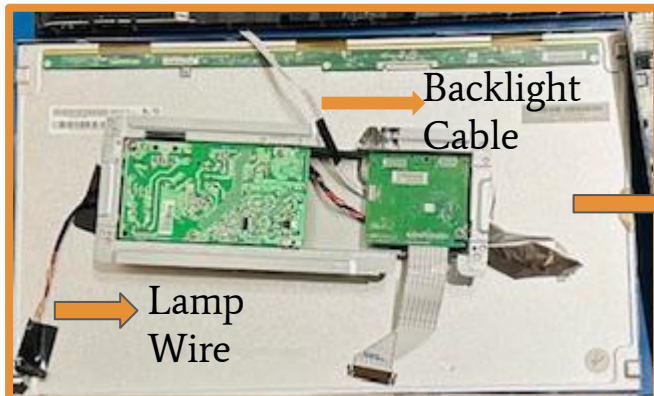


# Port Removal:

**Step 7:** Remove insulation sheet  
Pull the sheet from the power board.



Insulation Sheet



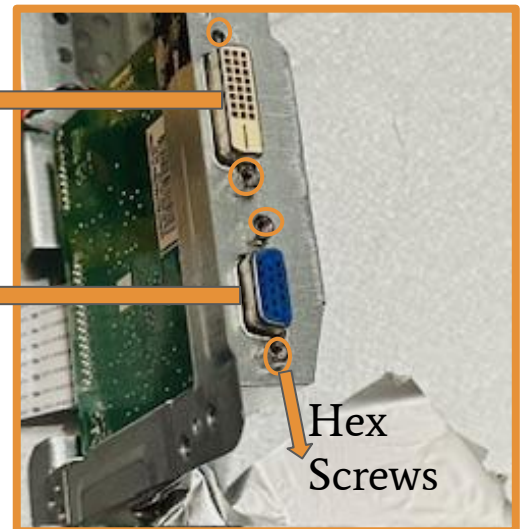
**Step 8:** Separate Ports from Shielding

Unscrew the **Four long hex screws** kept in a mini standoff with a **5mm nut driver** or a pillars to twist the **top of the standoff**. The 4 screws that have to be removed are 2 for the **VGA port** and 2 for the **DVI port**

DVI Port

VGA Port

Hex  
Screws



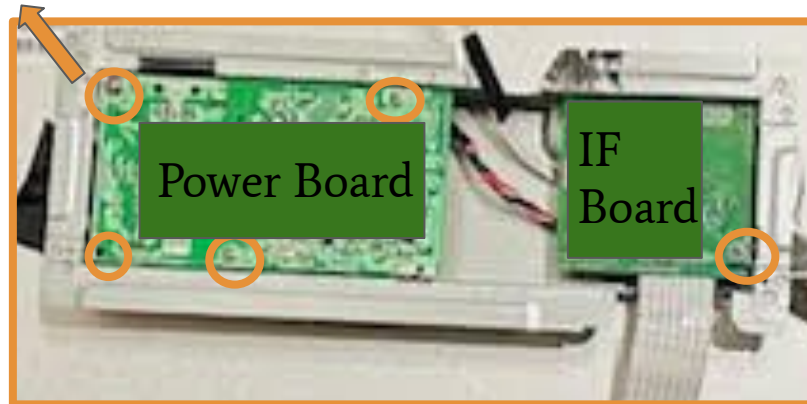
LCD Panel

# Part Separation:

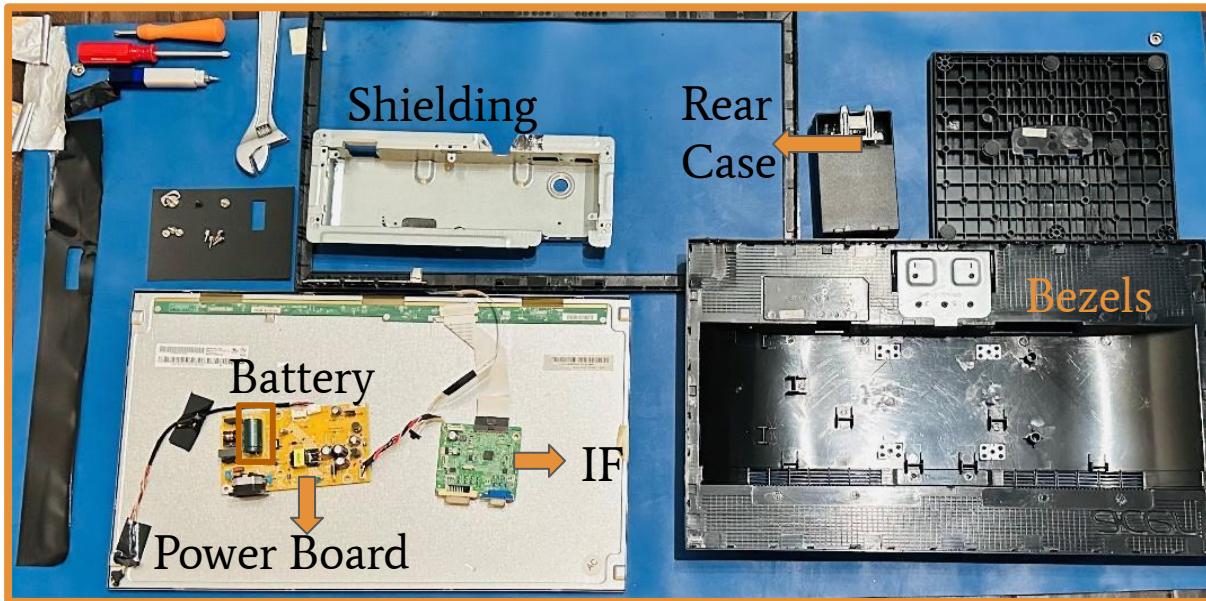
**Step 9:** Disassemble IF and Power Board from Shielding  
Unscrew regular star screws from the metal and boards.

**Powerboard:** The powerboard is a switch for circuits and wires, used to distribute power.

**IF Board:** The IF Board is used to set parameters and protection behavior for digital power products.



All parts disassembly of LCD monitor.



## Screws:

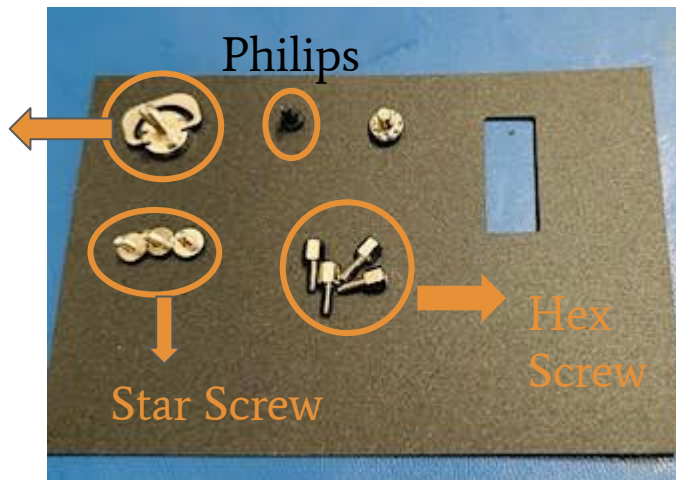
All Screws used.

Wing Screw

Philips

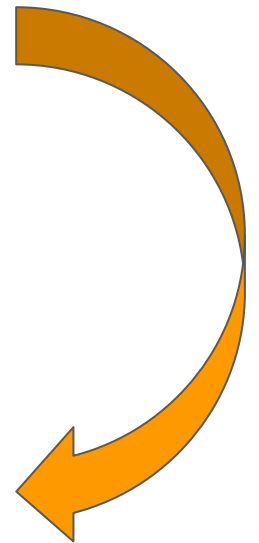
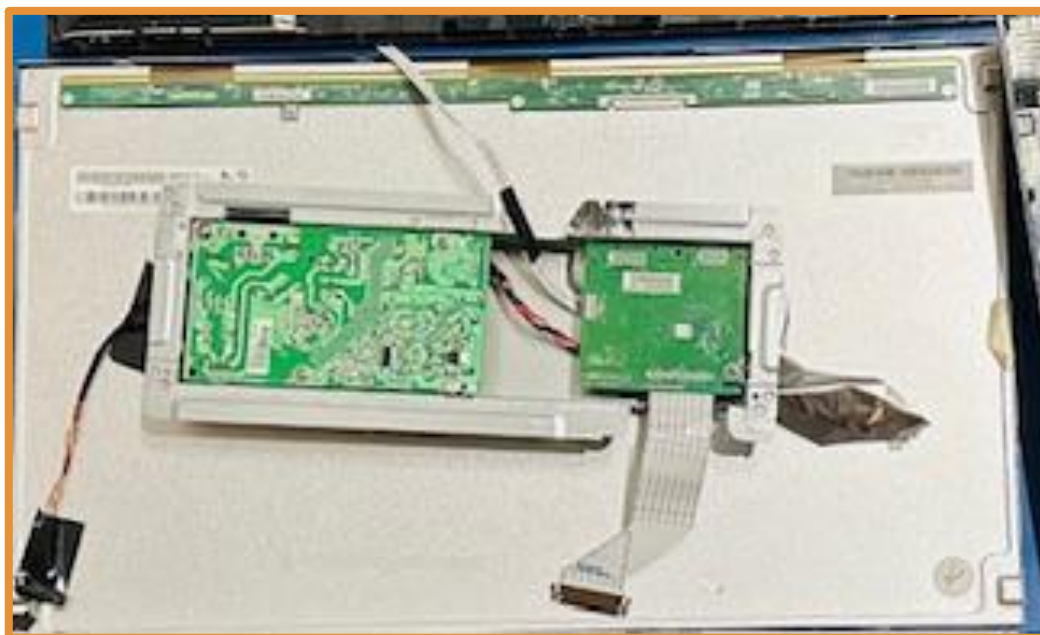
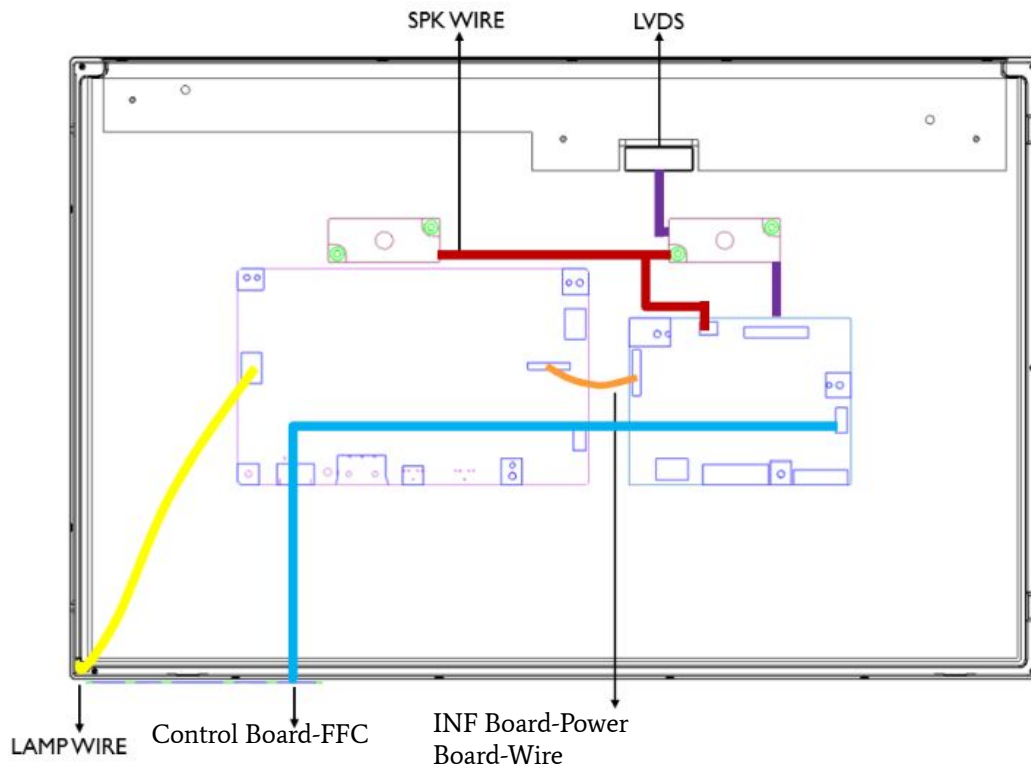
Star Screw

Hex Screw



# Wire Connectivity:

Here are the paths and labels for each wire and its place.



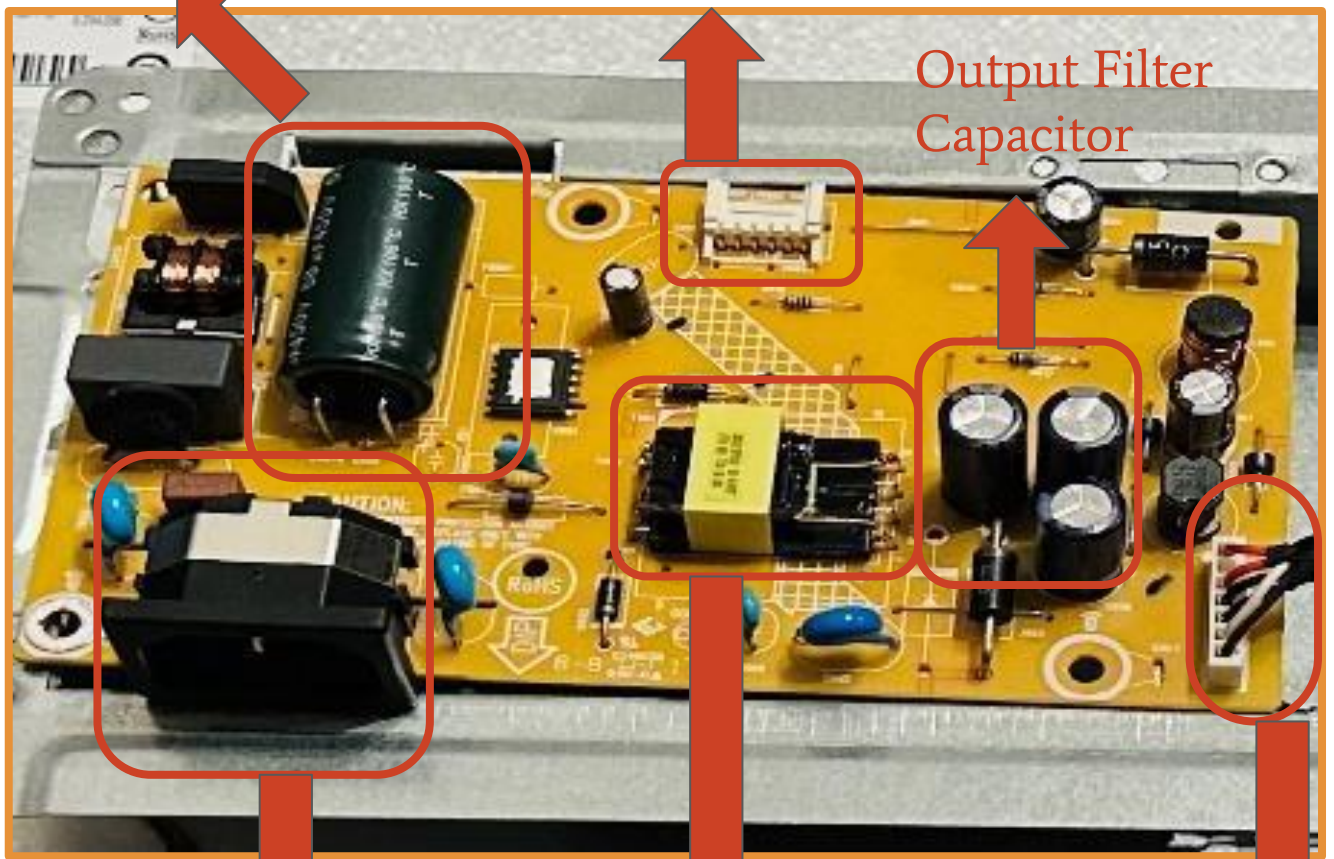
# Board break down:

Here are the breakdown of each board in the LCD Monitor.

Filter capacitor

Connecter for CCFL Lamps

Output Filter  
Capacitor



AC Input

Industry Power Inverter

Supply connector

# Power Board Breakdown:

There are a few important part in the power board that contribute to the monitor.

**Filter capacitor:** This is a capacitor that filters out a certain frequency or range of frequencies from the circuit.

**Used:**

- protect device from line voltage noises
- Protects ripple voltages
- Protects other devices from noise generated inside circuit



**Converter for CCFL Lamp:** This is a simple converters operating at high frequency.

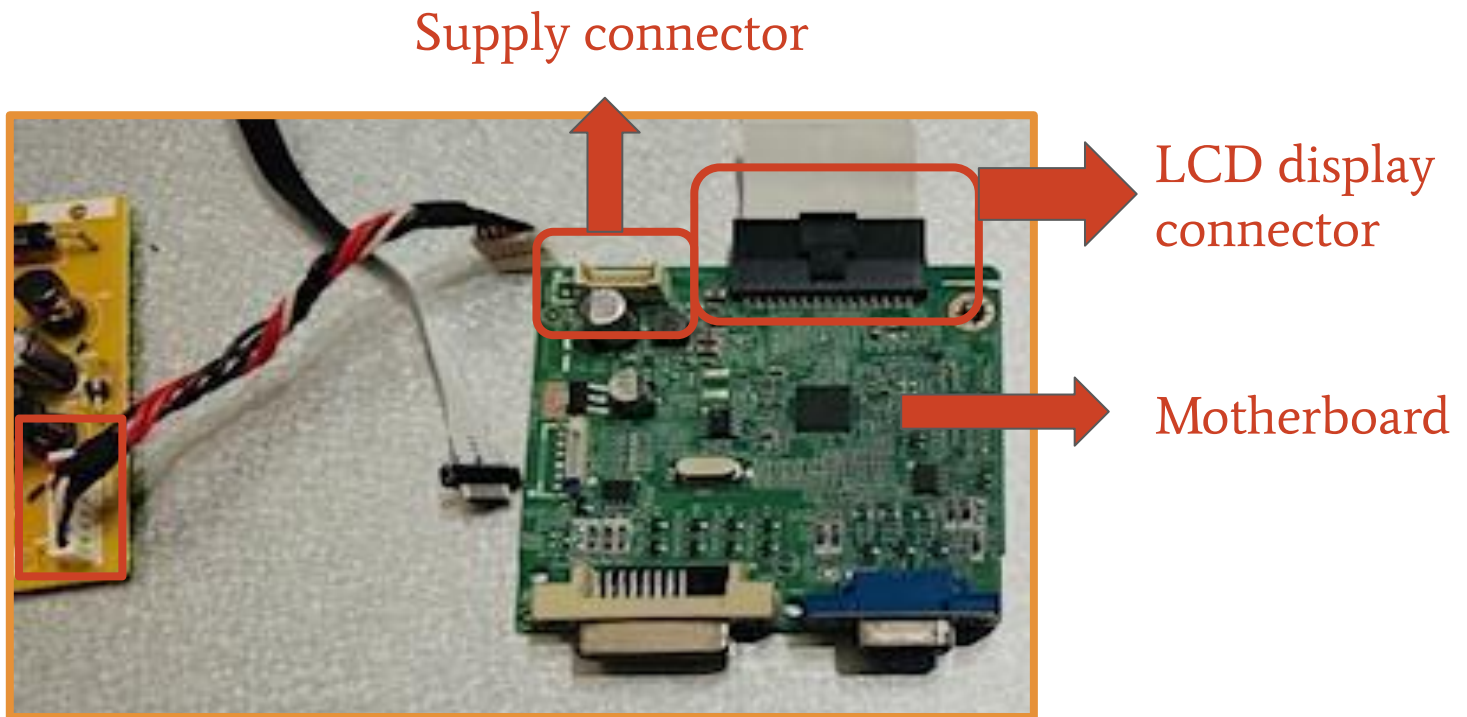
**Used:**

- Converts the lower voltage input form the power source
- Puts power source into higher voltage (required for efficient lamp operation)



# Board break down p2:

Here is the breakdown of the IF Board.

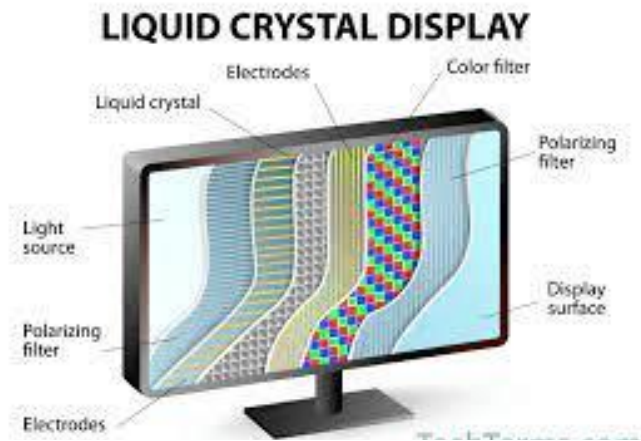


**Supply Connector:** The supply connector helps transfer an electrical current to provide power to the device. This connector can range from any shape.

**LCD display connector:** It is a flexible wire that connect the IF Board to the Monitor. It helps display on the screen of the monitor.

# LCD Screen Breakdown:

The LCD or Liquid Crystal Display consists of multiple parts.



Fact! If you remove the color filter from an LCD screen, you would only see a blinding white light.

**Backlight** - The first layer of a monitor is the light source. This normally consists of LEDs using RGB or red green blue.

**Polarizing Filter** - The next layer is the first of two polarizing filters. This controls the passage of light through the screen.




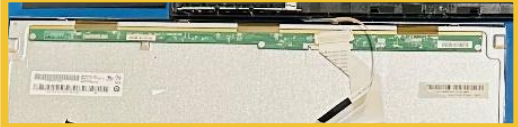
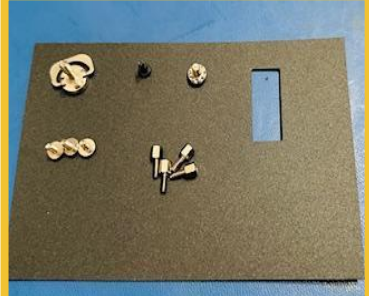

**Electrode + Liquid Crystals** - The electrode layer consists of electrodes which sandwich a layer of liquid crystals. These electrodes can twist the crystals to prevent the pass of light through the polarizing filter.

**Color Filter** - The next layer is the color filter, which produces color pictures. These color filters are actually made up of three filters. One red filter, one green filter, and one blue filter. As the light from the backlighting passes through the color filter, the color filter filters out the unnecessary colors.

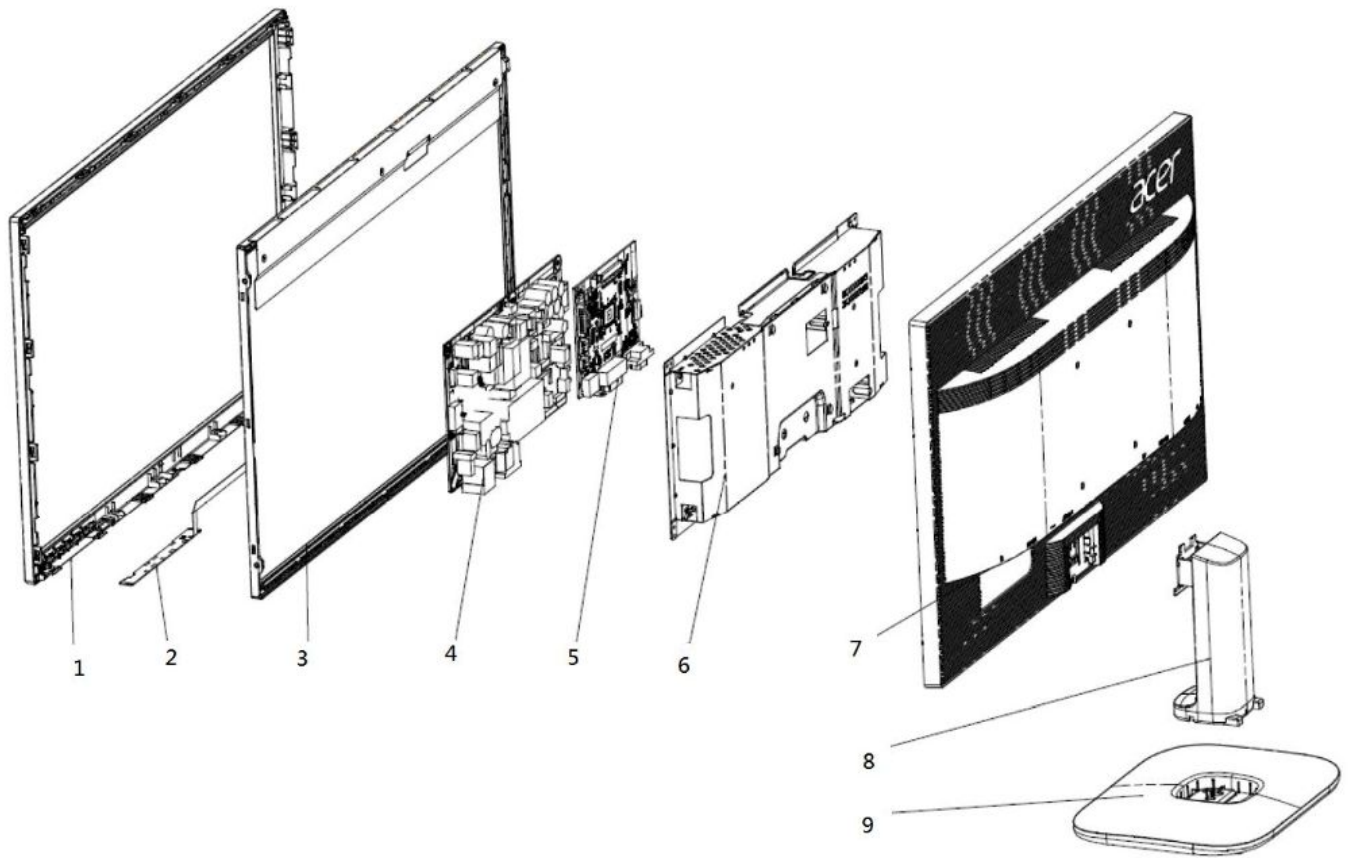
**Polarizing Filter** - After that is another polarizing filter, which produces the final image onto the screen.



# Component Function

Part and Description	Images	Description
LED LCD Panel 21.5"W		<p><b>PANEL:</b> The primary component (the screen) in an LCD monitor or TV.</p>
<p>Integration Framework Board IF Board</p> <p>Contains: Supply Connector, motherboard, and Display Connector</p>		<p><b>IF BOARD:</b> It is the processor which allows connection of different video source inputs to be selected and shown on a screen.</p>
<p>Constins:</p> <p>Supply connector Filter capacitor AC input Output Filter Capacitor Connector to CCFL Lamp Power inverter</p>		<p><b>POWER BOARD:</b> It connects to a separate board that appears to have the <b>microcontroller</b> and low voltage logic. It also has <b>connections directly to the monitor</b> backlights. When mains power is connected the board always provides 5v to the microcontroller logic board.</p>
<p>Contains:</p> <p>LCD display connector Board</p>		<p><b>CONTROL BOARD:</b> It controlled all the functions of an LCD. For example, they connect <b>different video source</b> inputs and show them on a screen</p>
<p>Screws:</p> <p>4 * Hexagonal screws 1 * M4 Wing Screw Stainless 4* 3.5 inch Screw Stainless 1 * Philips screw (3/8 inch long)</p>		<p>These are screws used to keep the shielding and boards in place.</p>
<p>Contains:</p> <p>Shielding has metal Bezel has plastic</p>		<p>Both shielding and Bezel have one job to protect the technology.</p>

# Conclusion:



1	Front Bezel
2	Printed Circuit Board Assembly control
3	Light Construction & Development Management
4	Power Board
5	IF Board
6	Assembly Shielding
7	Assembly Rear Case
8	Rear Case
9	Assembly BASE

# Summary:

Throughout this project we learned many aspects of the LCD Monitor as well as how they function together. The LCD Monitor contains two main boards the power board and the IF board. The power board provides 5v to the microcontroller logic board while the IF Board allows connection of different video source. They are both protected by a shielding which is protected by a plastic Bezel(Cover of the monitor). All of this connects to the LCD screen which displays light in many layers from the boards. Us, Team 8838E Egg enjoyed working together and collaborating through this online challenge! It was a great opportunity and an unforgettable experience. To summarize, we were able to learn many aspects of the monitor we disassembled through research and investigation. As future engineers, we appreciate this challenge, and will never forget it.



# Citations

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