LCD Hospital

Gateway to LCD Panel Repair World

www.lcdhospital.com
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History

• Feba Electronics (FEBA) incorporated in 1995 to provide repair services on ATM Parts, POS Equipments’, Laptops, PCB and Network Equipments.

• Since its establishment, FEBA has started to known as one of the fastest, reliable and affordable repair companies in EMEA region and has offices in Turkey and Russia.

• FEBA’s strong commitment to repair sector has paid off and first LCD Panel repaired in 2009.

• LCD Hospital, which is wholly owned by FEBA, is established in 2010 to offer tailormade LCD Panel repair solutions.
Organizational Structure

- FEBA GLOBAL ANKARA
  - TURKEY – Head Office
    - Head Count: 120
    - Capacity (Monthly): 7000
  - IZMIR RECEPTION
    - TURKEY
      - Head Count: 2
  - ISTANBUL RECEPTION
    - TURKEY
      - Head Count: 6
  - ANKARA RECEPTION
    - TURKEY
      - Head Count: 4

- FEBA ELECTRONICS ANKARA
  - TURKEY – Head Office
    - Head Count: 18
    - Capacity (Monthly): 11000
  - FEBA ELECTRONICS IZMIR
    - TURKEY
      - Head Count: 50
      - Capacity (Monthly): 3000
  - FEBA ELECTRONICS ISTANBUL
    - TURKEY
      - Head Count: 35
      - Capacity (Monthly): 3000
  - FEBA INTERNATIONAL MOSCOW
    - RUSSIA
      - Head Count: 40
      - Capacity (Monthly): 2000
  - LCD HOSPITAL
    - TURKEY
      - Head Count: 18
      - Capacity (Monthly): 3000
Geographical Locations

**Izmir:**
LCD Panel, LCD Monitor, LCD TV, Electronic Card Repair, Notebook, Motherboard

**Ankara:**
LCD Panel, LCD Monitor, Notebook, Desktop, LCD Panel Sale

**Istanbul:**
LCD Panel, LCD Monitor, LCD TV, Electronic Card Repair, Notebook, Motherboard

**Moscow:**
ATM, Electronic Card Repair
Main Components of LCD Panel

- TFT/LCD Glass Substrate
- Polarizer Film
- Gate PCB
- Gate IC Driver
- Source PCB
- Source Driver IC
- Interface Connector (Flex Cable)
- Backlit Inverter
- CCF Lamp
- Diffuser, Lens Sheet,
- Lightguide, Reflector Sheet
Why LCD Panel not Repaired?

I) Long Term Investment and Commitment on R&D

II) Lack of Technical Knowledge and Capabilities

III) High R&D Cost

IV) High Risk of Failure
Why LCD Panel not Repaired?

• **Long Term Investment and Commitment on R&D**

  – Unlike other service companies LCD Hospital took the initiative and decided to develop its own in-house LCD Panel Repair Technology.
  – In 2006, LCD Hospital formed a R&D Group, which consists of highly trained dedicated 7 professionals to work on the development of LCD Panel Repair Technology. After numerous efforts, researches and joint studies with Universities, first panel is successfully repaired in **November 2009**.
  – Since 2009 to till the second half of 2010 over **12,300** Laptop, Monitor, TV and Industrial LCD panels were repaired and examined during the trial period.
  – Another success of LCD Hospital’s ongoing R&D studies was **Real Time Process Monitoring Software (RTPM)**.
  – LCD Hospital R&D team developed a unique software program to able to monitor the all stages of LCD Panel repair process.
Why LCD Panel not Repaired?

• **High R&D Cost**
  
  – Since 2006 to till the end of 2010, LCD Hospital has spent 2.4USDm for R&D studies. The total investment amount was consist of machinery, trainings and other expenses (excluding labor cost).

• **Lack of Technical Knowledge and Capabilities**

• **High Risk of Failure**
TFT LCD Panel Market Analysis

<table>
<thead>
<tr>
<th>(Million units)</th>
<th>2010</th>
<th>EU Shipment (%15)</th>
<th>Defect Index (%2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD TV</td>
<td>228</td>
<td>34.2</td>
<td>0.6834</td>
</tr>
<tr>
<td>LCD Monitor</td>
<td>224</td>
<td>33.5</td>
<td>0.6705</td>
</tr>
<tr>
<td>Notebook</td>
<td>248</td>
<td>37.3</td>
<td>0.7452</td>
</tr>
<tr>
<td>Total LCD Panel Shipment</td>
<td>700</td>
<td>105</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: DisplaySearch
TFT LCD Panel Market Projections

Source: DisplaySearch
TFT Market Analysis

- Global TFT LCD Panel (Monitor, TV and Laptop) shipment reached 699m units in 2010 and expected to surpass 1bn units in 2014.
- According to Display Search, 15% of Global TFT LCD Panel shipment (105m units) is assumed to be EU shipment.
- Due to the size of the LCD Panel market and unprecedented growth figures, LCD Hospital realized that LCD Panel repair market is too big to tackle down and started to consider giving Franchises.
- 2% (2.1m units yearly) of EU panel shipment is considered as defect in our projections. Since LCD Hospital’s repair capacity is only 2,500 per month compared to 175,000 monthly defective units, thus shortage in LCD Panel repair market would be filled by prospect LCD Hospital’s Franchisee.
- Almost every consumer electronics item (Cell Phone’s, Camcorder’s, Camera’s, Calculator’s, TV’s, Laptop’s, Industrial Monitors, Military and Medical equipments, special design) sold in the market are composed of LCD Panel.
Major Prospect Customers

- **Repair Centers**
- **LCD Panel Manufacturers (OEM’s)**
  - Notebook
  - TV
  - Monitor
- **Distributors**
- **Outsourcing Service Companies**
Our Goal

• to become one of the leading LCD Panel repair company, which offers LCD Panel repair services to any size and model of LCD Panels.
• to offer high level LCD Panel repair system in a most efficient way at a reasonable price.
• Targets to become a Global Brand via Franchising Model
What we offer?

• Machinery and Equipment List
• Software
  – Real-time Process Monitoring Software (RTPM)
  – Receiving and Shipping Software
  – LCD Panel Repair Information Database
• Workshop Training
• Know-How Transfer
## Machinery and Equipment List

<table>
<thead>
<tr>
<th>LCD Panel Repair Machines</th>
<th>Type</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonding Machine</td>
<td>COG/COF/TAB</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>Laminator</td>
<td>47 inch</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>De-Laminator</td>
<td>47 inch</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>Line Tester</td>
<td>47 inch</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>LCD Panel Tester</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>Ionising Bar &amp; Blow off Gun</td>
<td>All Sizes</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>Aging Test Chamber</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>Zero Clean Laminate Box</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>Clean Air Booths – Triple Boot</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>IC Driver Rework System</td>
<td>47 inch</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>Test Tables</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
<tr>
<td>Color Analyzer</td>
<td>All Sizes</td>
<td>Other Manufacturers</td>
</tr>
<tr>
<td>Polarizer Film Surface Detector</td>
<td>All Sizes</td>
<td>LCD Hospital</td>
</tr>
</tbody>
</table>

*Please be advised that, as of Sept 2011, above list will be finalized and distributed to the interested parties.*
Software

• Real Time Process Monitoring System Software (RTPM) is developed by LCD Hospital’s R&D team to able to monitor the all stages of LCD Panel repair process. RTPM Software is an advance tool; which provides web based real-time monitoring to enhance the production efficiency and transparency.

• Receiving and Shipping Software: provides total integration and automation from registering defect panels, keeping records of warranty periods (in-warranty and out-warranty) through customer complaint, repetitive repairs (RR), wrong part inbox (WPIB), death on arrival (DOA) and is capable of flexible and fully supported customization that ensures receiving and shipping processes can be handled with ease.

• LCD Panel Repair Database : All critical technical information that is needed to perform repair process are stored in this Database.
Screenshot of RTPM
Know – How Transfer and Workshop

- What is LCD Panel?
- What are the major LCD Panel defects?
- What is “Cleanroom”?
- What is an IC driver and its types?
- What is “Polarizer film”?
- Optical measurement of a LCD Panel?
- What is ACF?
- How to use an ACF?
- How to Test LCD Panels?
- Technical Instructions Manual and practical training.
Why LCD Hospital?

- Dedicated Efforts and Spends on R&D
- Innovative and Entrepreneurial Business Approach
- High quality repair capabilities up to 47 inches
  - regardless of model
- **3,000 – 5,000 per month repair capacity**
  - easily expandable to 7,000 panels or more
- Experienced player on untapped LCD Panel Repair Market
- Cheap Labor Cost compared to Europe
- Being Situated in **Aegean Free Trade Zone**
- Experienced Management Team
- Highly Trained Technicians
LCD Hospital Service Offerings

I. Laptop – Notebook LCD Panel Repair and Exchange

II. LCD TV Panel Repair

III. LCD Monitor Panel Repair

IV. Industrial LCD Monitor Repair

V. Refurbishment and Resale of LCD Laptop Panels

VI. Roll out of LCD Panel Repair Technology via Franchising Model in Europe
Facilities

- Class 10,000 Clean room
- ESD Control
- Cell Inspection Microscope
- ITO line inspection machine
- Polarizer Laminator and Delaminator Machine
- LCD Bonding Machine for TAB, COF and COG
- IC Driver Rework Station
- Color Analyzer
- TAB, COF and COG Bonding Inspection System
- Aging Test Chamber
Services

• **LCD Panel Repair**
  – Polarizer film replacement
  – TAB, COG, COF bonding
  – Backlight and LED repair

• **PCB Repair**
  – Gate PCB repair
  – Source PCB repair

• **LCD Display Repair**

• **LCD TV Repair**
Polarizer Film Replacement

- Polarizer film applies to each side of the LCD Panel.
- Increase the brightness of display panel.
- Polarizer film replacement must be performed in a clean room environment with the proprietary equipment.
Polarizer Film Replacement

• The replacement of LCD Panel process consist of below stages;
  – Disassembly of LCD Panel
  – Detaching glass substrate from the panel and metal frame
  – Removal of polarizer film (delaminating)
  – Cleaning (using special chemicals) of glass substrate to the reapplication of the new polarizing film
  – Replacing polarizer film (laminating)
  – Color Analyzer for optical test

• Removal and replacement of polarizing film need to be conducted under stringent antistatic conditions (clean room environment).
• Panels placed in antistatic plastic bags.
• LCD Hospital is capable of replacing (delaminating and laminating) polarizer films up to 47 inch.
TAB, COF and COG Bonding

- The most common IC mounting methods are TAB, COF and COG.
- IC drivers provide the required current voltage needed to turn power switching elements on and off.
- **Horizontal or Vertical Lines** on the screen are common failures caused by failing driver IC’s and poor bonding to the conductive traces on the glass substrate.
- LCD Hospital successfully performs any type of IC driver replacements (TAB, COF and COG).
Bonding Process

• The purpose of the bonding is to replace the defect IC driver from the PCB and the LCD glass substrate.
• IC driver will be demounted from the LCD glass and the PCB.
• Connectors will be cleaned and examined under the microscope.
• LCD Panel will be checked by the ITO tester to find out if there is an IC driver defect or an ITO line defect.
• If there is an IC driver defect, the IC driver bonding process starts and new IC driver will be bonded on the LCD glass and PCB connectors.
BLU

• The most common BLU related defects are:
  – Diffuser sheet
  – CCFL Lamp and LED
  – Reflector sheet
  – Light guide

• LCD Hospital replaces the defective BLU parts
Electronics Laboratory Facilities

- Antistatic Area
- ESD Control
- SMD/BGA Rework Station
- Oscilloscope
- Multimeters
- Fault Locator
- PCB Test and Trouble Shooting System
- Powers Supply Load Tester
# LCD Panel Repair Checklist

<table>
<thead>
<tr>
<th>REPAIRABLE</th>
<th>YES</th>
<th>NO</th>
<th>REPAIRABLE SIZES AT THE MOMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>COF Gate Driver IC</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>COF Source Driver IC</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>TAB Bonding (Gate&amp;Source)</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Polarizer Film Replacement (front side)</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Polarizer Film Replacement (back side)</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Back Light Unit Repair</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Gate PCB Repair</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Source PCB Repair</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>COG Gate Driver IC</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>COG Source Driver IC</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Pixel Repair</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>ITO Line Repair</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Inverter PCB Repair</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>System Board PCB (TV)</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>AD Board PCB (TV)</td>
<td>X</td>
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<td>All Sizes</td>
</tr>
<tr>
<td>Chip in Class (Gate&amp;Source)</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Diffuser Sheet, Lens Sheet Replacement</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Light Guide, Reflector Sheet Replacement</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Broken Glass</td>
<td>X</td>
<td></td>
<td>-</td>
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<tr>
<td>Flex Cable Replacement</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
<tr>
<td>Connector Replacement</td>
<td>X</td>
<td></td>
<td>All Sizes</td>
</tr>
</tbody>
</table>
LCD Panel Repair Process
In Conclusion

• LCD Hospital envisage to roll out Franchising model by Sept 2011 with all;
  – Terms and Conditions
  – Complete LCD Panel Repair System
  – Complete LCD Panel Repair Management System

• Affordable and successful Franchising System

• On site Technical Support and Help Desk
  – Spare part and equipment procurement support