42LH20

Direct View LCD
OUTLINE

Section 1
Contact Information, Preliminary Matters, Specifications, LCD Overview, General Troubleshooting Steps, Signal Distribution, Disassembly Instructions and Voltages

Section 2
Circuit Board Operation, Troubleshooting of:
- Switch mode Power Supply
- Main Board
- T-CON Board
- Ft Control Board
- Side Keys
42LH20 LCD Direct View Display

Section 1

This Section will cover Contact Information and remind the Technician of Important Safety Precautions for the Customers Safety as well as the Technician and the Equipment.

Basic Troubleshooting Techniques which can save time and money sometimes can be overlooked. These techniques will also be presented.

This Section will get the Technician familiar with the Disassembly, Identification and Layout of the LCD Display Panel.

At the end of this Section the Technician should be able to Identify the Circuit Boards and have the ability and knowledge necessary to safely remove and replace any Circuit Board or Assembly.
IMPORTANT SAFETY NOTICE

The information in this training manual is intended for use by persons possessing an adequate background in electrical equipment, electronic devices, and mechanical systems. In any attempt to repair a major Product, personal injury and property damage can result. The manufacturer or seller maintains no liability for the interpretation of this information, nor can it assume any liability in conjunction with its use. When servicing this product, under no circumstances should the original design be modified or altered without permission from LG Electronics. Unauthorized modifications will not only void the warranty, but may lead to property damage or user injury. If wires, screws, clips, straps, nuts, or washers used to complete a ground path are removed for service, they must be returned to their original positions and properly fastened.

CAUTION

To avoid personal injury, disconnect the power before servicing this product. If electrical power is required for diagnosis or test purposes, disconnect the power immediately after performing the necessary checks. Also be aware that many household products present a weight hazard. At least two people should be involved in the installation or servicing of such devices. Failure to consider the weight of an product could result in physical injury.
Today’s sophisticated electronics are electrostatic discharge (ESD) sensitive. ESD can weaken or damage the electronics in a manner that renders them inoperative or reduces the time until their next failure. Connect an ESD wrist strap to a ground connection point or unpainted metal in the product. Alternatively, you can touch your finger repeatedly to a ground connection point or unpainted metal in the product. Before removing a replacement part from its package, touch the anti-static bag to a ground connection point or unpainted metal in the product. Handle the electronic control assembly by its edges only. When repackaging a failed electronic control assembly in an anti-static bag, observe these same precautions.

REGULATORY INFORMATION

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna; Increase the separation between the equipment and the receiver; Connect the equipment to an outlet on a different circuit than that to which the receiver is connected; or consult the dealer or an experienced radio/TV technician for help.
Safety and Handling Regulations

1. Approximately 20 minute pre-run time is required before any adjustments are performed.
2. Refer to the Voltage Sticker on the Switch Mode Power Supply silk screening. (+/- ½ volt).
3. Be cautious of electric shock from the Backlight section, it uses high voltage AC. Check that the Power Supply and Drive Circuits are completely discharged because of residual current stored before Circuit Board removal.
4. C-MOS circuits are sensitive to static electricity. Use caution when dealing with these IC and circuits.
5. Exercise care when making voltage and waveform checks to prevent costly short circuits from damaging the unit.
6. Be cautious of lost screws and other metal objects to prevent a possible short in the circuitry.

Checking Points to be Considered

1. Check the appearance of the Replacement Panel and Circuit Boards for both physical damage and part number accuracy.
2. Check the model label. Verify model names and board model matches.
3. Check details of defective condition and history. Example: Oscillator failure dead set, etc…
**Basic Troubleshooting Steps**

Define, Localize, Isolate and Correct

- **Define**  Look at the symptom carefully and determine what circuits could be causing the failure. Use your senses Sight, Smell, Touch and Hearing. Look for burned parts and check for possible overheated components. Capacitors will sometimes leak dielectric material and give off a distinct odor. Frequency of power supplies will change with the load, or listen for relay closing etc. Observation of the front Power LED may give some clues.

- **Localize**  After carefully checking the symptom and determining the circuits to be checked and after giving a thorough examination using your senses the first check should always be the DC Supply Voltages to those circuits under test. Always confirm the supplies are not only the proper level but be sure they are noise free. If the supplies are missing check the resistance for possible short circuits.

- **Isolate**  To further isolate the failure, check for the proper waveforms with the Oscilloscope to make a final determination of the failure. Look for correct Amplitude Phasing and Timing of the signals also check for the proper Duty Cycle of the signals. Sometimes “glitches” or “road bumps” will be an indication of an imminent failure.

- **Correct**  The final step is to correct the problem. Be careful of ESD and make sure to check the DC Supplies for proper levels. Make all necessary adjustments and lastly always perform a Safety AC Leakage Test before returning the product back to the Customer.
This section of the manual will discuss the specifications of the 42LH20 LCD Direct View Display Panel.
Basic Specifications

Key Features

- 42" Screen
- 720p HD Resolution
- Two (2) HDMI(TM) (V.1.3 with Deep Color)
- ISFccc Ready
- Smart Energy Saving
- LG SimpLink (TM) (32-inch and above)
- LG Core Technologies (32-inch and above)
- Dynamic Contrast Ratio 12,000:1
- Response Time (G to G) 8ms
- Brightness 500 cd/m2
- Viewing Angle 178º / 178º
- Life Span (Typical) 60,000 hr
- Built-in Tuner ATSC/NTSC/Clear QAM
- HDMI™/HDCP Input 2 v1.3
- Cabinet Color Glossy Piano-Black
- Limited Warranty 1 Year Parts/Labor
**PANEL PIXELS (Logo Familiarization Explained)**

**HD RESOLUTION 720p HD Resolution Pixels:** 1366 (H) × 768 (V)

High definition television is the highest performance segment of the DTV system used in the US. It’s a wide screen, high-resolution video image, coupled with multi-channel, compact-disc quality sound.

<table>
<thead>
<tr>
<th>FORMATS</th>
<th>Lines Per Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD 480I Interlaced</td>
<td>240 Lines</td>
</tr>
<tr>
<td>ED 480P Progressive</td>
<td>480 Lines</td>
</tr>
<tr>
<td>HD 1080I Interlaced</td>
<td>540 Lines</td>
</tr>
<tr>
<td>HD 720P Progressive</td>
<td>720 Lines</td>
</tr>
<tr>
<td>HD 1080P Progressive</td>
<td>1080 Lines</td>
</tr>
</tbody>
</table>

Possible 2 Fields to make a Frame

**FORMATS**

- Interlaced
- Progressive

**Frame Rates:**
- 24FPS
- 30FPS
- 60FPS

Think of sync as the Panels “Refresh Rate”

**BASIC PIXEL COUNTS**

**720P PANEL**
1365 (H) × 768 (V)

**1080P PANEL**
1920 (H) × 1080 (V)
**SIMPLINK**
Allows for convenient control of other LG SimpLink products using the existing HDMI connection.

**Clear Voice Technology**
Automatically enhances and amplifies the sound of the human voice frequency range to provide high-quality dialogue when background noise swells.
Remote Control Familiarization

TOP PORTION

BOTTOM PORTION
Accessing the Service Menu

To access the Service Menu:
1) Turn the Set On
2) Simultaneously, Press and “Hold” the Menu Key on the Side Key pad and Press and “Hold” the Menu Key on the Remote approximately 5 seconds.
3) If Customer’s Menu appears, continue to hold until it disappears.
4) The Service Menu appears

Note: If a Password is required to enter the Service Menu. Enter; 0000
Rear and Side Input Jacks

Rear Input Jacks

USB Port
For Software Upgrades Only

Main PWB
Orientation
USB Download

1) Make 'LG_DTV' folder in USB Flash Drive.

2) Copy new software (xxx.epk) to 'LG_DTV' folder. Make sure to have correct software file.

3) With TV turned on, insert USB flash drive.

4) You can see the message “TV Software Upgrade”

5) Cursor left and highlight ‘START’ Button and push ‘Enter’ button using the remote control.

6) You can see the download progress Bar.

7) Do not unplug until unit has automatically restarted.

8) When download is completed, you will see “COMPLETE”.

9) Your TV will be restarted automatically.

※CAUTION:

Do not remove AC power or the USB Flash Drive. Do not turn off Power, during the upgrade process.
Disassembly:
This section of the manual will discuss Disassembly, Layout and Circuit Board Identification, of the 42LH20 LCD Direct View Television.

Upon completion of this section the Technician will have a better understanding of the disassembly procedures, the layout of the printed circuit boards and be able to identify each board.

Troubleshooting:
This section of the manual will also discuss troubleshooting.

Upon completion of this section the Technician will have a better understanding of how to diagnosis and resolve problems.
Removing the Back Step (1)

1. Lay the TV down on its face. Remove the 4 screws around stand indicated by the arrows.

2. Remove the Stand by Pulling it out of its Retaining bracket.

3. Remove the one screw hidden by the stand.

4. Reinsert the stand and stand the unit upright for service position to continue removing the back cover.
The Stand has to be removed first. Remove the 22 screws indicated.

Pay attention to the size and type of screw as there are many different types. Putting in the improper screw when reassembling may cause damage.

Remove the one screw hidden under the stand. See previous page.
Circuit Board Layout

- POWER SUPPLY (Includes Ballast)
- LVDS Cable
- Main PWB
- T-CON Under Shield
- Rear Inputs
- RF Input
- Backlight Connection To Left Side
- Backlight Connection To Right Side
- Key / Power Switch
- Ft IR/LED Control
- Speaker R
- Speaker L
- Master Power Switch
- AC Input
- Ft IR/LED Control
- T-CON p/n: EAT60663801
Power Supply PWB Removal

Disconnect P201, AC In and SK102, P401 and P402.

Remove the 6 screws indicated by the arrows.
If the TV won’t come on, be sure to check the Master Power Switch before assuming a failure has occurred.

**Power Supply (Master Power Switch) Location**

**MASTER AC SWITCH LOCATION**
(Bottom Left Side viewed from rear)
Power Supply (SMPS) PWB Layout

- **F501**
  - 3.15A/250V
  - Run 380V
  - STBY 168V
  - From Hot Gnd

- To Main P201
- To Backlights Left Side **P402**
- To Backlights Right Side **P401**
- To Master Power Switch **SK102**
- F100
  - 6.3A/250V AC IN

**AC IN**
- **SK101**

**Hot Ground Shock Hazard**
- Pin 1
- Pin 2

**From Hot Gnd**

**To**
- Main Power Switch **SK102**
- Backlights Left Side **P402**
- Backlights Right Side **P401**
- AC IN **SK101**

**Pin 1**

**Pin 2**
42LH20 POWER SUPPLY
TURN ON COMMANDS FROM MAIN PWB

**POWER SUPPLY (SMPS)**

- **Primary side fuse:**
  - Stand-By 168V
  - Run 380V

- No AC Det in this model
- Stand By 5V Reg
- **Bridge**
- 12V/24V Regulators

- **Ballast Control IC**
- **135V Regulator**
- **135V B+ for the Ballast**
- **Inverter On**
- Starts the Ballast
- **Backlights Light**
- **Manipulates Backlights**

**T-CON PWB**

- **12V LVDS**
- Along with Video
- On LVDS cable

**Ballast Section Of the Power Supply**

- **12V**
- **24V**

**MAIN PWB**

- **12V Video Processing**
- **Power On**
- **LVDS 12V Switch**

**Power On Inv On/Off LVDS Panel Control**

**Microprocessor IC100**
- Also Video Processor
- **Reset of Main Board**
- **Power On**
- **5V Switch**
- **Other Circuits 5V General**
- **Other Circuits**
- **Other Regs**
- **Reg For Micro**

**ANALOG DREERING**

- **A-DIM Fixed**
- **P-DIM**
- **Cust Menu for Backlight**

**DIGITAL DIMMING**

- **Picture Content**
- **Ft Control**
- **Power Button Or Remote Key**

**AC In**

- On
- Off

- Master (Main) Power Sw

At point ④ TV is in Stand-By state.
- Energy Star compliant.
- Less than 1 Watt

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PWM-DIM (PWM Dimming) Manipulates the Backlight Brightness via Customer's OSD. Manipulates the Backlight Brightness via the BCM Chip. Darker Picture, Darker Backlights to facilitate improved Contrast Ratio. 0.6V ~ 3.3V Range.
Ac voltage is supplied to the Power Supply at Connector SC100. This set does not use AC Detect. The AC input generates a Hot Ground primary power supply that runs in two states, Stand-By (168) and Run (380V) measured at Fuse F501. This primary voltage develops all other voltages that are output from the power supply. During Stand-By, the 5 Volt Standby should be present at connector P201, Pins 7, 8, 9 or 10. If Missing remove AC Power and unplug Connector P201, apply AC Power and recheck for presence of 5 Volt Standby. Loss of 5 Volt Standby would be a Power Supply Failure. Presence of 5 Volt Standby would be an indication of a failure on the Main Board or possibly the Front PWB (IR) assembly. Suspect a possible short circuit loading the supply. **Remember to observe the Front Power Indicating LED this may save some time. A lit LED indicates the Stand-By 5V voltage is present!**

The Main Board sends two commands to the Power Supply Board one being PWR the other is INV ON. These two voltages are used to control the power on turn on sequence. First via PWR (Pin 2) also known as POWER ON, activates the internal Ballast voltage and the 24 Volt and 12 Volt lines to the Main board. The 2\textsuperscript{nd} command is INV ON (P201 pin 20). It it the Lamp Lighting Command Signal. If either command (PWR-ON or INV-ON) is missing it will result in a no picture symptom.

These voltages can easily be checked with the volt meter! Remove AC Power, unplug the two Connectors to the backlights P401/P402. Reapply AC Power and press the ON-OFF Button on either the Remote Control or Power Button on the Unit. Watch for the Power ON LED to change color from red to blue. This is an indication the PWR Signal was created on the the Main board. Check P700 or P201 pin 2 for the PWR-ON command (2.8V) to the Power Supply. Check P201 for 24V (Pins 17 or 18) and 12V (Pins 13 or 14). Confirm Pin 20 of P201 went to 3.3V. This is the INV ON signal needed to light the Lamps. Problems with either voltage can be easily solved by following the simple steps on the next page.
AC Should not be applied at any time while adding resistors or while unplugging connectors as damage to the circuit PWB may occur.

a) The SMPS PWB “MUST” be producing STBY 5V on any of the pins 7, 8, 9 or 10 (5V).

If 5V Standby is not being generated, the SMPS PWB is defective and must be replaced. There is no need to continue with the next test.

(b) Unplug P700 on the Main PWB.

**TEST 1:**

(1) Add a 10K resistor between (5V STBY) pin 7, 8, 9 or 10 and Pin 2 (PWR). Apply AC. This will turn on the power supply.

- Check that the 24V and 12V power supplies are turned on, P201 (24V pins 17 and 18) (12V pins 13 and 14)

(2) Remove AC power.
Continue if the 1st test was successful. Leave original 10K resistor in place.

(3) Add another 10K resistor between (5V) pin 7, 8, 9 or 10 and Pin 20 (INV On).

(4) Apply AC Power. This simulates a Power On and Backlight On command.

Observe the Backlights.
   a) If normal, the backlights should turn on.
   b) If the do not, recheck connectors P401 and P401.
      **(Warning: Disconnect the AC Power first).**
      These pins carry 1.2Kv when active.
   c) Confirm the INV On/Off line Pin 12 is going to at least 3V.
   d) If no backlight activity, SMPS is defective.
### Power Supply Connector P201 Voltage and Resistance

#### P201 Odd "SMPS" to P700 "Main PWB"

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>21</td>
<td>&quot;A.DIM&quot;</td>
<td>0V</td>
<td>1.66V</td>
<td>Open</td>
</tr>
<tr>
<td>19</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>17</td>
<td>&quot;24V&quot;</td>
<td>0V</td>
<td>21.4V</td>
<td>0.71V</td>
</tr>
<tr>
<td>15</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>13</td>
<td>&quot;12V&quot;</td>
<td>0V</td>
<td>12.3V</td>
<td>0.96V</td>
</tr>
<tr>
<td>11</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>9</td>
<td>&quot;5V&quot;</td>
<td>5.14V</td>
<td>5.14V</td>
<td>1.67V</td>
</tr>
<tr>
<td>7</td>
<td>&quot;5V&quot;</td>
<td>5.14V</td>
<td>5.14V</td>
<td>1.67V</td>
</tr>
<tr>
<td>5</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>3</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>1</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
</tbody>
</table>

1ADIM Pin 21 Fixed and not used

#### P201 Even "SMPS" to P700 "Main PWB"

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>&quot;2PDIM&quot;</td>
<td>0V</td>
<td>3.2V</td>
<td>1.68V</td>
</tr>
<tr>
<td>22</td>
<td>&quot;Err Out&quot;</td>
<td>0V</td>
<td>0V</td>
<td>Open</td>
</tr>
<tr>
<td>20</td>
<td>&quot;INV.ON&quot;</td>
<td>0V</td>
<td>3.8V</td>
<td>1.6V</td>
</tr>
<tr>
<td>18</td>
<td>&quot;24V&quot;</td>
<td>0V</td>
<td>21.4V</td>
<td>0.71V</td>
</tr>
<tr>
<td>16</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>14</td>
<td>&quot;12V&quot;</td>
<td>0V</td>
<td>12.3V</td>
<td>0.96V</td>
</tr>
<tr>
<td>12</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>10</td>
<td>&quot;5V&quot;</td>
<td>5.14V</td>
<td>5.14V</td>
<td>1.67V</td>
</tr>
<tr>
<td>8</td>
<td>&quot;5V&quot;</td>
<td>5.14V</td>
<td>5.14V</td>
<td>1.67V</td>
</tr>
<tr>
<td>6</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>4</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>2</td>
<td>&quot;PWR-ON&quot;</td>
<td>0V</td>
<td>4.98V</td>
<td>0.886V</td>
</tr>
</tbody>
</table>

2PDIM Pin 24 can vary according to type of signal being processed and the OSD Backlight setting. 0.6V 0% to 3.3V 100%. Output from the BCM chip.

Diode Mode values taken with all Connectors Removed
Power Supply Connector SK101 and SK102 Voltage and Resistance

Diode Mode values taken with all Connectors Removed

**SK101 "SMPS" to AC IN**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L</td>
<td>120Vac</td>
<td>OL</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>OL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AC Voltage Readings Across Pins 1 and 2 for STBY and RUN.

**SK102 "SMPS" to MASTER POWER SWITCH**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>n/a</td>
<td>120Vac</td>
<td>OL</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>n/a</td>
<td>OL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AC Voltage Readings for either pin 1 or pin 2 in STBY and RUN with one lead on Neutral of SK101.

With the Master Power Switch Closed (On) AC flows. When Open (Off) AC open and does not flow.

Bottom Right of SMPS

![Image of SMPS with live and neutral connections]
General Backlight Information

To Backlights Over 1.2KV

Ballast Section of SMPS

Currently, number of lamps “Unknown”

EEFL (External Electrode Fluorescent Lamp)
LOW COST Large number of lamps driven by a single inverter
Introducing EEFL

CCFL (Cold Cathode Fluorescent Lamp)

- Simple structure
- Lamp manufacturing process
- Large number of Lamp
- Drive by single inverter

EEFL (External Electrode Fluorescent Lamp)

- Simple structure, Low price
- Lamp assembly structure
- Low Cost

- Graphs showing voltage and current for both CCFL and EEFL.
Introducing EEFL Contacts (Bulb Design)

Key: Long Life Time

**CCFL** (Cold Cathode Fluorescent Lamp)
- Lead
- Glass Bead
- Electrode
- \( \bigcirc \) : Hg
- \( \bullet \) : electron

**EEFL** (External Electrode Fluorescent Lamp)
- External electrode
- Phosphor
- \( \bigcirc \) : Hg
- \( \bullet \) : electron

- For CCFL, Hg gas is consumed mainly near the internal electrode
- For EEFL, longer life time is expected because there is no internal electrode consuming Hg gas
**Ballast PWB Layout**

- **Backlights Test Point**
  - Bottom of R406 or R403
  - 38V P/P

- **To Backlights**
  - Left Side
  - 1.2Kv

- **To Backlights**
  - Right Side

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**SMPS PWB**

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VBR-A (Analog Dimming)
This line is not used.

VBR-B (PWM Dimming) Manipulates the Backlight Brightness via Customer’s OSD.
Manipulates the Backlight Brightness via the BCM Chip. Darker Picture, Darker Backlights to facilitate improved Contrast Ratio. 0.6V ~ 3.3V Range
Power Supply Backlight Drive Signal Effects

Waveform taken from lose coupling. Probe clamped on one of the Backlight Wires. Use caution, 1.2Kv. Slow scope setting to 2.5mS to see PWM results. The PWM amount can cause the frequency to be measured differently.

**VBR-B**
PWMDIM manipulates the ballast drive IC.

**VBR-A**
BR1 (ADIM) is not used.

- 80% on Backlight Bar In Customer’s OSD (3.0V PDIM Pin 13 MCN1)
  - 2.7mSec
  - 5.9mS

- 50% on Backlight Bar In Customer’s OSD (2.0V PDIM Pin 13 MCN1)
  - 3.1mSec
  - 5.2mS

- 20% on Backlight Bar In Customer’s OSD (1.22V PDIM Pin 13 MCN1)
  - 1.9mSec
  - 6.3mS
**LCD Controller Board**

The T-Con IC UC1 receives from the Main Board at CN5 12 Bit LVDS Signals (Video) which it processes into TFT Drive Signals which through connectors CN3 and CN4 controls the LCD Panel.

12V is supplied to the T-Con Board on connector CN5 from the Main Board (easily measured at fuse F1).

Diode LED1 is a boot up indicator and is helpful in troubleshooting as a quick indication of a loss of supply and or a Boot Up problem.

There are two DC to DC converters that create (17V developed at the cathode of D14) and (3.3V developed at the cathode of D13).

The 3.3V can also be measured at the ribbon connectors delivering signals to the TFT panel (CN3 pins 57, 58 or 59) and (CN4 pins 2, 3 or 4).
**T-CON (TFT Drive) PWB Removal**

Remove the 3 Screws in the T-CON shield and remove the shield

The two screws shown in the picture below are for the Service Position. They would have been removed when removing the shield. Be sure to reinstall them if servicing the T-CON PWB.

Disconnect CN3, CN4 and CN5. See next slide for details.
To remove the flex cables to the TFT Panel, CN3 or CN4: Place a soft thin object like a fingernail underneath the black locking tab and gently pull forward. (Shown by the arrows in Fig 1)

Flip the lock up and back from the flex cable. Then the flex cable can be easily removed.

To remove the LVDS cable CN5; Press in on the two tabs and slowly rock the cable out of the connector. (Shown by the arrows in Fig 3)
T-CON (TFT DRIVE) PWB WITH SHIELD

LVDS (Video and 12V) from Main PWB
Remember to replace screws for ground purposes if testing the PWB.
**T-CON (TFT Drive) PWB Checks**

Use LED1 to determine if The boot up sequence of The T-CON is OK. This LED will turn bright Blue Shortly after power is applied then go out shortly after backlights illuminate if all is OK.

**Power Off**
- Anode 0V
- Cathode 0V

LED OFF

**Power 1st On**
- Anode 3.3V
- Cathode 0V

LED ON

**Power On**
- Anode 3.3V
- Cathode 1.3V

LED OFF

Check the Regulator U10 for Correct Voltage

Check Fuse F1 for 12V From Pins 2, 3, 4 and 5.
If the 3.3Volts is missing, check the 3.3V DC to DC converter. Check at D13 cathode. See previous page for location.
**T-CON PWB Connector CN5 to Main PWB Voltage and Resistance**

Diode Mode values taken with all Connectors Removed

**CN5 CONNECTOR "T-CON PWB" to P801 "Main"**

<table>
<thead>
<tr>
<th>Pin</th>
<th>TXA1+</th>
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<th>1.1V</th>
<th>1.1V</th>
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<td>1.2V</td>
<td>1.1V</td>
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<tr>
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<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>22</td>
<td>TXAC-</td>
<td>0V</td>
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<td>1.1V</td>
</tr>
<tr>
<td>23</td>
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<td>1.1V</td>
</tr>
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<td>Gnd</td>
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<td>28</td>
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<td>3.3V</td>
<td>Open</td>
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<td>29</td>
<td>*PWM-DIM</td>
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<td>1.1V</td>
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<td>30</td>
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<td>Gnd</td>
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<td>32</td>
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<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
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</table>

*Pin 29 PWM-DIM 3.15V (Max 100%) to 0.6V (Min 0%)
Customer's Menu Backlight setting. But is Not Used by T-CON.

**NOTE:** The outside pins on each side are actually not counted, they are both ground. But they are counted in the table. (See arrow on the T-CON PWB CN5)
Main PWB IC100 Video Processor Overview

Input Signal Processing

IC100 is the main Microprocessor and the main Signal Processor and is responsible for:

- ATSC, NTSC, and QAM reception and processing
- RS 232 service only Port (software upgrades and home theater environment)
- Wired Remote Port
- (1) Component Input Y, Pr, Pb and Audio L R
- (2) HDMI Inputs (back) (1) HDMI (Side Input)
- RGB PC and (PC Audio)
- USB (software upgrades using flash drive). USB located on the Rear, no Side Inputs.
- AV Composite
- SIF and SAP

Output Signals

- 10 Bit LVDS (10 Pin) to the T-CON Board
- Audio output signals to the Speakers
- Digital Audio Output Coaxial and Optical
- ON OFF Controls to the SMPS turning on low voltage generation and Backlights
- Backlight intensity control signal (Digital Dimming) P-DIM
Removing the Main PWB

Remove the one screws at the bottom of the Decorative plastic piece on the right side. Remove the plastic piece.

Remove the two pieces of tape on the left side holding down the cables and the one at the top.

Remove the remaining 11 screws indicated by the arrows.

NOTE: Be sure to check on top and behind the Video Processor IC. Look for a piece of Chocolate (Heat Transfer Material). Be sure to transfer to new PWB if present.
IC100 runs hot, this is normal.

Look carefully on top and behind the Video Processor IC for Chocolate (Heat Transfer) material. Be sure to transfer to new PWB if replaced.

LD1000 Tuner OK when Green

To SMPS P700

For Software Upgrade via Jig

To Front PWB Assembly

USB

P600 P1204

Tuner TU1001

P801 to T-CON PWB

P801

X105

X100

SW100 Reset

IC100 Microprocessor and Video Processor
Voltages given on the 11X17 foldout “Interconnect Diagram”
Main PWB X100 and X1005 Check

IC100 Microprocessor Crystal

X100 Location

2.28Vp/p 12Mhz
Set on or off

4.95Vp/p 25Mhz
Only when set is on

X1005 Location

Tuner Control IC1004 Crystal

MAIN PWB
Main PWB LD1000 Function

Use LD1000 as a visual aid. This lets you know if the tuner internal PLL (Phase Locked Loop) system is locked. Illuminated PLL is normal. Off is abnormal tuner lock.
Main PWB Tuner with Shield Off (Pin ID)

![Diagram of Main PWB Tuner with Shield Off (Pin ID)]

**Outputs On Analog Channels**
- 19: VIDEO_OUT (3.15V)
- 18: AUDIO_OUT (2.45V)
- 17: NC-4
- 16: SIF (2.5V)
- 15: NC
- 14: IF_AG (3.2V)
- 13: DIF (-) (0V)
- 12: DIF (+) (0V)
- 11: Not Used
- 10: Not Used
- 9: AS (1.38V)
- 8: SCL (5V)
- 7: SDA (5V)
- 6: GND (2)
- 5: NC-(VT)
- 4: Not Used
- 3: Not Used
- 2: NC-2 (0V)
- 1: NC-1 (0V)

**Outputs On Digital Channels**
- 20: Shield
Main PWB Tuner Video and SIF Output Check

**USING COLOR BAR SIGNAL INPUT**

**Tuner Location**

- Pin 19: "Video" Signal
  - 450mVp/p
  - "Video Out" Signal only when receiving an analog Channel.

- Pin 16: "SIF" Signal
  - 2.24Vp/p
  - "SIF" Signal only when receiving a Digital Channel.

- Pin 12 and Pin 13: "Dig IF" Signal
  - 700mVp/p
  - "Dig IF" Signal only when receiving a Digital Channel.

**Note:**

- "Video Out" Signal only when receiving an analog Channel.
- "SIF" Signal only when receiving a Digital Channel.
## Main PWB Tuner Clock and Data Lines

### TDVW-H103F TU1001

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Shield</td>
<td>(3.15V)</td>
</tr>
<tr>
<td>19</td>
<td>VIDEO_OUT</td>
<td>(2.45V)</td>
</tr>
<tr>
<td>18</td>
<td>AUDIO_OUT</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>NC-4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>SIF</td>
<td>(2.5V)</td>
</tr>
<tr>
<td>15</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>IF_AGK</td>
<td>(3.2V)</td>
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<tr>
<td>13</td>
<td>DIF(-)</td>
<td>(0V)</td>
</tr>
<tr>
<td>12</td>
<td>DIF(+)</td>
<td>(0V)</td>
</tr>
<tr>
<td>11</td>
<td>NC-3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>AS</td>
<td>(1.38V)</td>
</tr>
<tr>
<td>9</td>
<td>SCL</td>
<td>(5V)</td>
</tr>
<tr>
<td>8</td>
<td>SDA</td>
<td>(5V)</td>
</tr>
<tr>
<td>7</td>
<td>GND (2)</td>
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</tr>
<tr>
<td>6</td>
<td>NC(-VT)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>RF_AGK</td>
<td>(4.46V)</td>
</tr>
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<td>4</td>
<td>+B (5V)</td>
<td>(5V)</td>
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<td>3</td>
<td>GND (1)</td>
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</tr>
<tr>
<td>2</td>
<td>NC-2</td>
<td>(0V)</td>
</tr>
<tr>
<td>1</td>
<td>NC-1</td>
<td>(0V)</td>
</tr>
</tbody>
</table>

**Note:**
SCL and SDA only active during an actual Channel Change.

### Waveforms

- **Pin 9 SCL**
  - 1V per/div
  - 100uS
  - 5V p/p

- **Pin 8 SDA**
  - 1V per/div
  - 100uS
  - 5V p/p
To confirm that the Main PWB is outputting Picture Content signals, check P801 (LVDS) cable for output. Check pins 6-7, 12-13, 15-16, and 18-19. Pins 9-10 carry the clock. These signals vary from each other, but looking for signals like the ones shown below on any of these pins will confirm the output of video content. This signal is using standard SMTE Color Bar output from a generator as the input source.

This is just a sample of two pins on the LVDS. There are 8 pins on P801 carrying video.
Main PWB LVDS Connector P801 Pin Identification

- 12V for T-CON PWB
- Screen Size
- Video
- Video
- Video
- Video
- Video Clock
- PWM Dim (Not used on T-CON)

P801 LVDS
**Main PWB Connector P801 to T-CON Voltage and Resistance**

Diode Mode values taken with all Connectors Removed

**P801 CONNECTOR "Main" to CN5 "T-CON PWB"**

<table>
<thead>
<tr>
<th>Pin</th>
<th>LABEL</th>
<th>SBY</th>
<th>Run</th>
<th>Diode Check</th>
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<td>Gnd</td>
<td>Gnd</td>
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<td>*PWM-DIM</td>
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<td>3.1V</td>
<td>1.1V</td>
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<tr>
<td>4</td>
<td>OPC-OUT</td>
<td>0V</td>
<td>3.3V</td>
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<tr>
<td>5</td>
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<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
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<tr>
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<td>TXA3+</td>
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<td>1.2V</td>
<td>1.1V</td>
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<td>TXA3-</td>
<td>0V</td>
<td>1.2V</td>
<td>1.1V</td>
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<td>8</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>9</td>
<td>TXAC+</td>
<td>0V</td>
<td>1.2V</td>
<td>1.1V</td>
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<tr>
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<td>TXAC-</td>
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<td>1.1V</td>
<td>1.1V</td>
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<td>Gnd</td>
<td>Gnd</td>
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<td>12</td>
<td>TXA2+</td>
<td>0V</td>
<td>1.1V</td>
<td>1.1V</td>
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<td>1.2V</td>
<td>1.1V</td>
</tr>
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<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
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<td>1.1V</td>
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</table>

<table>
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<tr>
<th>Pin</th>
<th>LABEL</th>
<th>SBY</th>
<th>Run</th>
<th>Diode Check</th>
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<td>Gnd</td>
<td>Gnd</td>
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<td>12.1V</td>
<td>1.6V</td>
</tr>
</tbody>
</table>

*Pin 3 PWM-DIM 3.15V (Max 100%) to 0.6V (Min 0%)
Customer’s Menu Backlight setting. But is Not Used on T-CON.
Main PWB Connector P700 to Power Supply Voltage and Resistance

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
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<td>nc</td>
<td>nc</td>
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<tr>
<td>5</td>
<td>Gnd</td>
<td>Gnd</td>
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<td>Gnd</td>
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<td>5V</td>
<td>5.14V</td>
<td>5.14V</td>
<td>1.1V</td>
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<td>5V</td>
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<td>1.1V</td>
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<td>Gnd</td>
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¹ADIM Pin 21 Fixed and not used

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<td>5.14V</td>
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<td>Gnd</td>
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<td>²PDIM</td>
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</table>

²PDIM Pin 24 can vary according to type of signal being processed, OSD Backlight setting. 0.6V 0% to 3.3V 100% and the Intelligent Sensor. Output from the BCM chip.

Diode Mode values taken with all Connectors Removed
### Main PWB Connector P1204 to (Ft. IR/LED Control) Voltage and Resistance

**P1204 CONNECTOR "MAIN PWB" to P1 "Front IR / LED PWB Assy"**

<table>
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<th>Pin</th>
<th>Label</th>
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<th>Diode Check</th>
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<td>Gnd</td>
<td>Gnd</td>
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<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>9</td>
<td>IR</td>
<td>4.8V</td>
<td>4.8V</td>
<td>Open</td>
</tr>
<tr>
<td>10</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>11</td>
<td>3.3V_ST</td>
<td>3.29V</td>
<td>3.29V</td>
<td>0.6V</td>
</tr>
<tr>
<td>12</td>
<td>POWER On/Off</td>
<td>0V</td>
<td>3.29V</td>
<td>2.17V</td>
</tr>
</tbody>
</table>

Diode Mode values taken with all Connectors Removed
Main PWB Connector P600 to Speakers Voltage and Resistance

Use speaker out to test for defective Audio Amp IC600

<table>
<thead>
<tr>
<th>Pin</th>
<th>LABEL</th>
<th>SBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPK-R(-)</td>
<td>0V</td>
<td>10.7V</td>
<td>1.5V</td>
</tr>
<tr>
<td>2</td>
<td>SPK-R(+)</td>
<td>0V</td>
<td>10.7V</td>
<td>1.5V</td>
</tr>
<tr>
<td>3</td>
<td>SPK-L(-)</td>
<td>0V</td>
<td>10.7V</td>
<td>1.5V</td>
</tr>
<tr>
<td>4</td>
<td>SPK-L(+)</td>
<td>0V</td>
<td>10.7V</td>
<td>1.5V</td>
</tr>
</tbody>
</table>

Diode Mode values taken with all Connectors Removed
Front PWB Assembly (IR and LED Control) Layout (Back View)

The IR Sensor and Power LED control IC are located on the front of this PWB
**Front PWB Assembly (IR and LED Control) Layout (Back View)**

- **Control IC U1 (Power LEDs)**
- **IR Sensor**

**POWER LEDS (LED1 through LED10)**
Front IR/LED Control Connector P1 and P3 to Main Voltage and Resistance

P1 Connector “IR/LED Control PWB“ to "MAIN PWB" P404

<table>
<thead>
<tr>
<th>Pin</th>
<th>LABEL</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCL</td>
<td>3.3V</td>
<td>3.3V</td>
<td>2.4V</td>
</tr>
<tr>
<td>2</td>
<td>SDA</td>
<td>3.3V</td>
<td>3.3V</td>
<td>2.4V</td>
</tr>
<tr>
<td>3</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>4</td>
<td>Key1</td>
<td>3.3V</td>
<td>3.3V</td>
<td>Open</td>
</tr>
<tr>
<td>5</td>
<td>Key2</td>
<td>3.3V</td>
<td>3.3V</td>
<td>Open</td>
</tr>
<tr>
<td>6</td>
<td>5V ST</td>
<td>5.1V</td>
<td>5.1V</td>
<td>1.5V</td>
</tr>
<tr>
<td>7</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>8</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>9</td>
<td>IR</td>
<td>4.8V</td>
<td>4.8V</td>
<td>2V</td>
</tr>
<tr>
<td>10</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>11</td>
<td>3.3V_ST</td>
<td>3.29V</td>
<td>3.29V</td>
<td>Open</td>
</tr>
<tr>
<td>12</td>
<td>POWER On/Off</td>
<td>0V</td>
<td>3.29V</td>
<td>2V</td>
</tr>
</tbody>
</table>

Diode Mode values taken with all Connectors Removed

P3 Connector “IR/LED Control PWB“ to “Side Key" P3000

<table>
<thead>
<tr>
<th>Pin</th>
<th>Label</th>
<th>STBY</th>
<th>Run</th>
<th>Diode Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Key1</td>
<td>3.3V</td>
<td>3.3V</td>
<td>Open</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
<tr>
<td>3</td>
<td>Key2</td>
<td>3.3V</td>
<td>3.3V</td>
<td>Open</td>
</tr>
<tr>
<td>4</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
</tbody>
</table>
Side Key Assembly

- CHANNEL (▼,▲) Buttons
- VOLUME (+, -) Buttons
- ENTER Button
- MENU Button
- INPUT Button
- POWER Button

To Main PWB
PWM-DIM (PWM Dimming) Manipulates the Backlight Brightness via Customer’s OSD. Manipulates the Backlight Brightness via the BCM Chip. Darker Picture, Darker Backlights to facilitate improved Contrast Ratio. 0.6V ~ 3.3V Range
Pay attention to the wire dress for the Side Key PWB. These wires can get pinched between the rear cover and lower left hand screw post. The wires can be dressed to the right of the post in the slot provided.
This section shows the 11X17 foldout that’s available in the Paper and Adobe version of the Training Manual.
Warning:
T-Con PWB under shield. Be sure to reinsert screws before operating set with shield removed.

**Pin Label** STBY Run Diode Check

1) 0V
2) 1.8V
3) 3.3V

**Power On**

1) 0V
2) 1.8V
3) 3.3V

**Err Out**

1) 0V
2) 1.8V
3) 3.3V

**PWR_ON**

1) 0V
2) 1.8V
3) 3.3V

**IC1000** (PWR ON) 1 (0V)
2 (3.3V)
3 (5V) 4 (7.4V) 5 (2.12V) 6 (3.28V)

**IC106** (HDCP EEPROM)

1 (Reset) .3V
2 (5V)
3 (3.18V)

4 (N/C)

5) 3.28
6) 5V

1.3V
3.16V

**IC107** (Audio + 120 MHz)

1 (5V) 2 (12V)

**IC105**

1 (0V)
2 (5V)
3 (3.28) 4 (7.4V)

5 (1.3V)

**IC104** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC103**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC102** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC100**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC1000** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC104** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC103**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC102** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC100**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC1000** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC104** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC103**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC102** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC100**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC1000** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC104** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC103**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC102** (3.3V_ST)

1 (5V)
2 (3.3V)

**IC100**

1 (0V)
2 (5V)
3 (3.28)

4 (7.4V)

**IC1000** (3.3V_ST)

1 (5V)
2 (3.3V)
42LH20 LVDS P801 WAVEFORMS

<table>
<thead>
<tr>
<th>LVDS P801 PIN 4 (OPC-Out)</th>
<th>LVDS P801 PIN 6 (TXA3+)</th>
<th>LVDS P801 PIN 7 (TXA3-)</th>
<th>LVDS P801 PIN 9 (TXAC+)</th>
<th>LVDS P801 PIN 10 (TXAC-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveforms taken using NTSC Color Bar RF input.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>LVDS P801 PIN 12 (TXA2+)</th>
<th>LVDS P801 PIN 13 (TXA2-)</th>
<th>LVDS P801 PIN 15 (TXA1+)</th>
<th>LVDS P801 PIN 16 (TXA1-)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LVDS P801 PIN 18 (TXA0+)</th>
<th>LVDS P801 PIN 19 (TXA0-)</th>
</tr>
</thead>
</table>

42LH20 P801 LVDS CABLE WAVEFORMS:
Waveforms taken using NTSC Color Bar RF input.