LG TRAINING CENTER

50PG20 TRAINING MANUAL

50PG20 PLASMA DISPLAY TRAINING MANUAL

Advanced Single Scan Troubleshooting

LG
Life's Good

Published March 2009

Overview of Topics to be Discussed

Section 1

Contact Information, Preliminary Matters, Specifications, Plasma Overview, General Troubleshooting Steps, Disassembly Instructions, Voltage and Signal Distribution

Section 2

Circuit Board Operation, Troubleshooting and Alignment of :

- Switch mode Power Supply
- Y-SUS Board
- Y Drive Boards
- Z-SUS Board
- Control Board
- X Drive Boards
- Main Board

50PG20 Plasma 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 Plasma 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.

ESD Notice (Electrostatic Static Discharge)

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.

Contact Information

Customer Service (and Part Sales)	**(800) 243-0000**
Technical Support (and Part Sales)	**(800) 847-7597**
USA Website (GSFS)	**http://gsfs-america.lge.com**
Customer Service Website	**us.lgservice.com**
LG Web Training	**lge.webex.com**
LG CS Academy	**lgcsacademy.com**

Presentations with Audio/Video and Screen Marks

http://136.166.4.200

LCD-DV:	**32LG40, 32LH30, 37LH55, 42LG60, 42LG70, 42LH20, 42LH40, 42LH50, 42LH90, 42SL80, 47LG90, 47LH85**
PLASMA:	**42PG20, 42PQ20, 42PQ30, 50PG20, 50PS80, 50PS60, 60PS11**

Also available on the Plasma page

Plasma Panel Alignment Handbook

New Training Materials on the Learning Academy site

Published March 2009 by LG Technical Support and Training

LG Electronics Alabama, Inc. 201 James Record Road, Huntsville, AL, 35813.

Safety & Handling Regulations

1. Approximately 10 minute pre-run time is required before any adjustments are performed.
2. Refer to the Voltage Sticker inside the Panel when making adjustments on the Power Supply, Y-SUS and Z-SUS Boards. Always adjust to the specified voltage level.
3. Be cautious of electric shock from the PDP module since the PDP module uses high voltage, 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 used extensively for processing the Drive Signals and should be protected from static electricity.
5. The PDP Module must be carried by two people. **Always carry vertical NOT horizontal.**
6. **Also the Plasma television MUST be transported vertical NOT horizontal.**
7. Exercise care when making voltage and waveform checks to prevent costly short circuits from damaging the unit.
8. 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: Y Board Failure, Mal-discharge on screen, etc.

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.

50PG20 PRODUCT INFORMATION SECTION

This section of the manual will discuss the specifications of the 50PG20 Advanced Single Scan Plasma Display Panel.

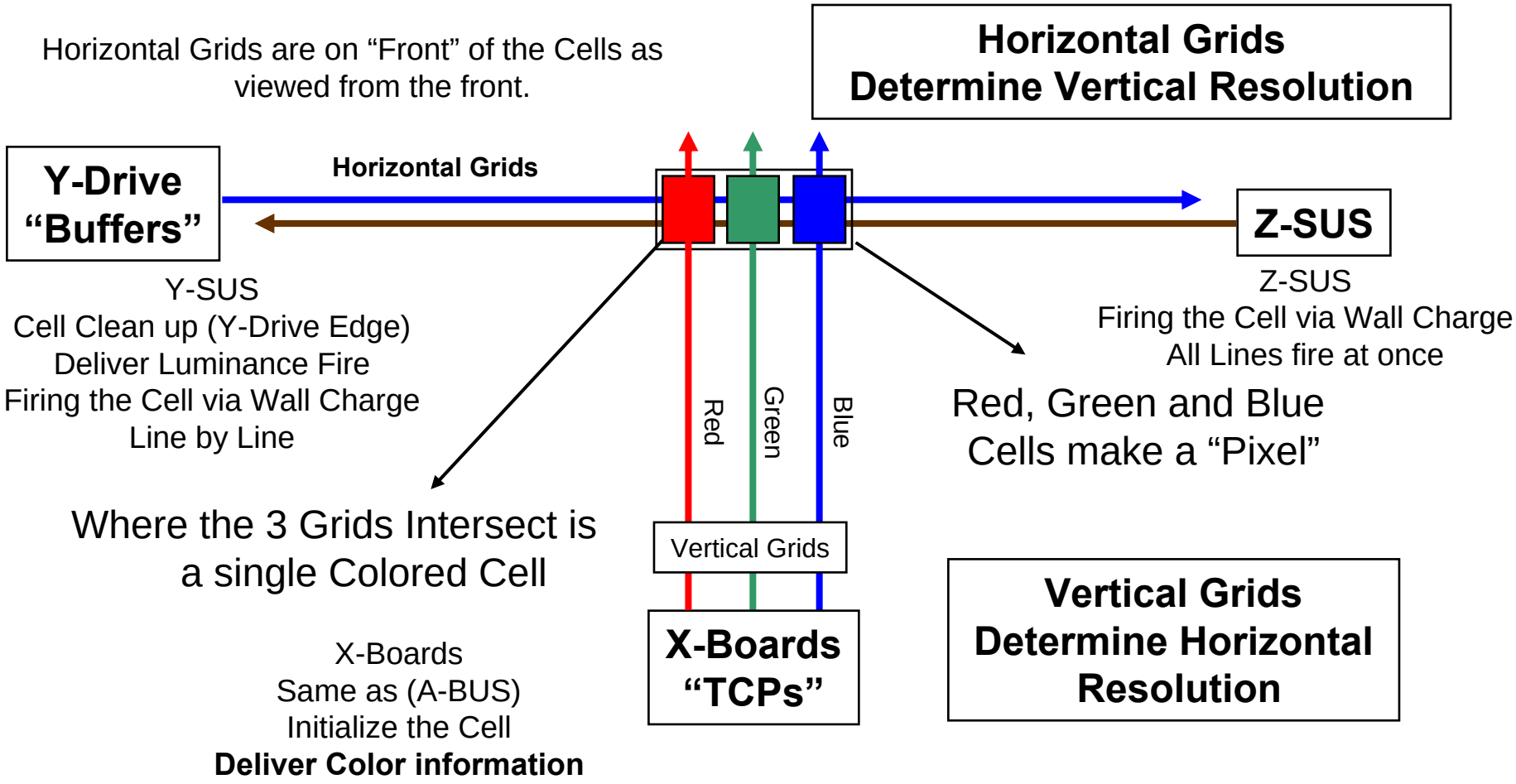
PLASMA HDTV

50” Class (49.9” diagonal)

- **720p HD Resolution**
- **Dual XD Engine™**
- **20,000:1 Contrast Ratio**
- **Fluid Motion**
- **3x HDMI™ V.1.3 with Deep Color**
- **AV Mode (Cinema, Sports, Game)**
- **Clear Voice**
- **LG SimpLink™ Connectivity**
- **Invisible Speaker System**
- **100,000 Hours to Half Brightness (Typical)**
- **PC Input**

Grid to Pixel to Resolution Relationship

Layout below as viewed from the rear.



Pixel Count to Resolution Comparisons

720P Logo

720P Panel

768

HD RESOLUTION 720p HD Resolution Pixels: 1365 (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.

	FORMATS		
NTSC	480I	Interlaced	240 Lines
SD	480P	Progressive	480 Lines
HD	1080I	Interlaced	540 Lines
HD	720P	Progressive	720 Lines
HD	1080P	Progressive	1080 Lines

BASIC PIXEL COUNTS

720P Panel
1365 (H) × 768 (V)

1080P Panel
1920 (H) x 1080 (V)

Possible Frame Rates:	**Interlaced**
	2 Fields to make a Frame
24FPS	
30FPS	**Progressive**
60FPS	**Each Field is a Frame**

Think of sync as the Panels "Refresh Rate"

50PG20 Specifications Logo Familiarization

HD RESOLUTION 720p HD Resolution Pixels: 1365 (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.

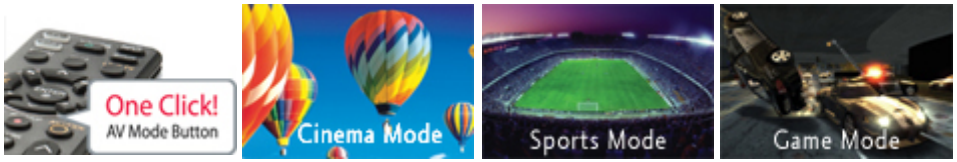
HDMI (1.3 Deep Color) Digital multi-connectivity
HDMI (1.3 Deep color) provides a wider bandwidth (340MHz, 10.2Gbps) than that of HDMI 1.2, delivering a broader range of colors, and also drastically improves the data-transmission speed.

Invisible Speaker
Personally tuned by Mr. Mark Levinson for LG
TAKE IT TO THE EDGE newly introduces 'Invisible Speaker' system, guaranteeing first class audio quality personally tuned by Mr. Mark Levinson, world renowned as an audio authority. It provides Full Sweet Spot and realistic sound equal to that of theaters with its Invisible Speaker.

Dual XD Engine
Realizing optimal quality for all images
One XD Engine optimizes the images from RF signals as another XD Engine optimizes them from External inputs. Dual XD Engine presents images with optimal quality two times higher than those of previous models.

50PG20 Specifications Logo Familiarization

AV Mode "One click" - Cinema, Sports, Game mode.
TAKE IT TO THE EDGE is a true multimedia TV with an AV Mode which allows you to choose from 3 different modes of Movies, Video Games and Sports by a single click of a remote control.



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

Save Energy, Save Money
Home electronic products use energy when they're off to power features like clock displays and remote controls. Those that have earned the ENERGY STAR use as much as 60% less energy to perform these functions, while providing the same performance at the same price as less-efficient models. Less energy means you pay less on your energy bill.

50PG20 Specifications Logo Familiarization

Tru-Surround is a sound-scheme that has the ability to take multi-channel encoded sources, such as Dolby Digital, and reproduce the multi-channel surround effect by just using two-speakers. The result is not as impressive as true Dolby Digital 5.1 (the front and side surround effects are impressive, but the rear surround effects fall a little short, with the sense they are coming from just to rear of your head rather than from the back of the room).

Dolby® Digital
In thousands of cinemas and millions of homes worldwide, Dolby Digital is the reigning standard for surround sound technology in general and 5.1-channel surround sound in particular.

LG SIMPLINK™ MULTI-DEVICE CONTROL
Allows for convenient control of other LG SimpLink products using the existing HDMI connection.

FLUIDMOTION (180 Hz Effect)
Enjoy smoother, clearer motion with all types of programming such as sports and action movies.
The moving picture resolution give the impression of performance of up to 3x the panels actual refresh rate.

FluidMotion (180 Hz Effect)

Enjoy smoother, clearer motion with all types of programming such as sports and action movies.
The moving picture resolution give the impression of performance of up to 3x the panels actual refresh rate.

LCD 60Hz

Moving Picture Response Time is 16.5 milliseconds
(120Hz takes MPRT to 8.25ms)

Panel Response Time is 4 to 8 milliseconds

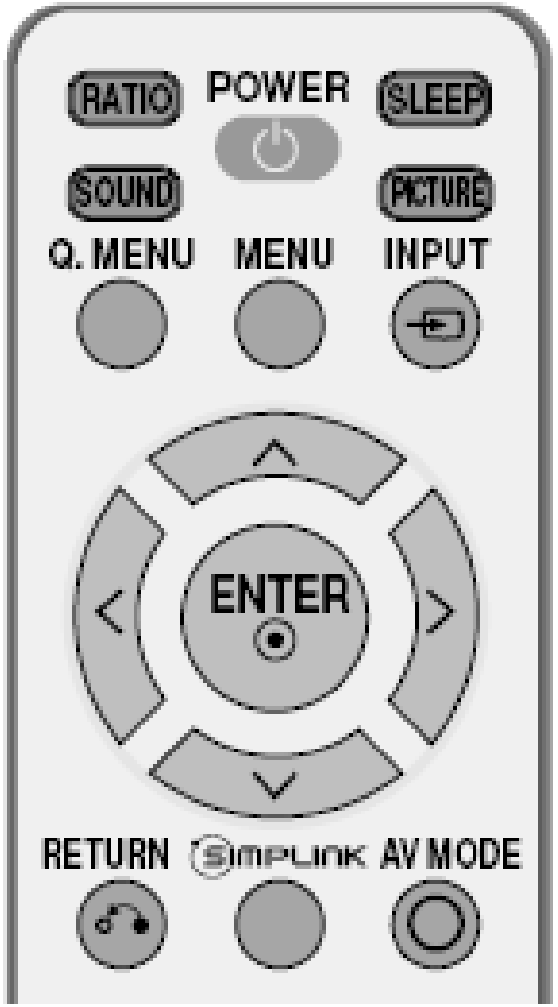
PDP 180Hz

Moving Picture Response Time is 5.44 milliseconds

Panel Response Time is less than 1 millisecond

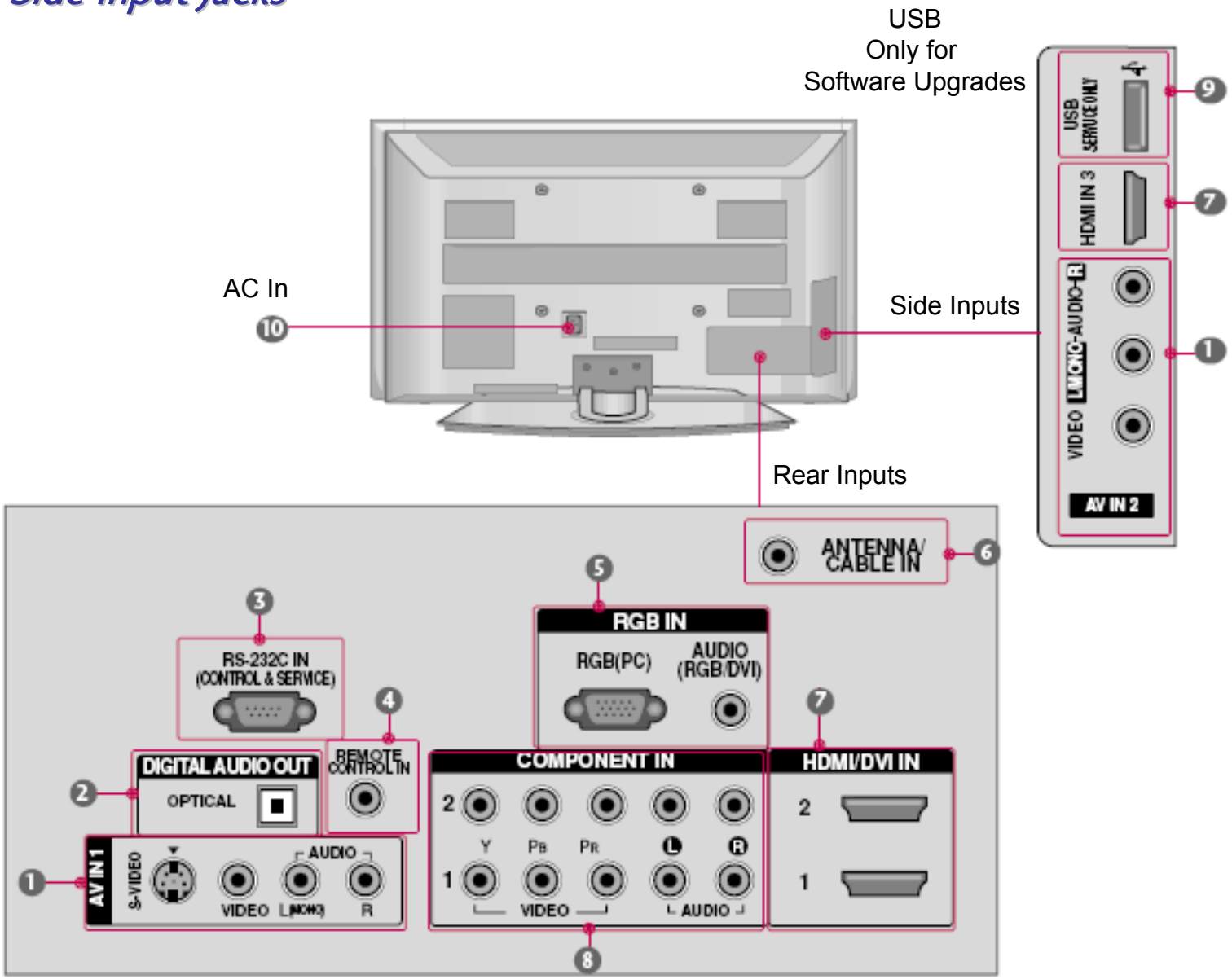
Remote Control

TOP PORTION



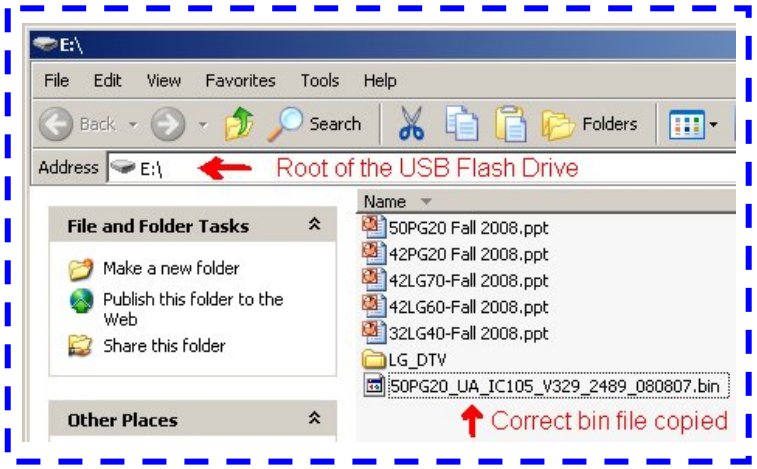
BOTTOM PORTION

Rear and Side Input Jacks

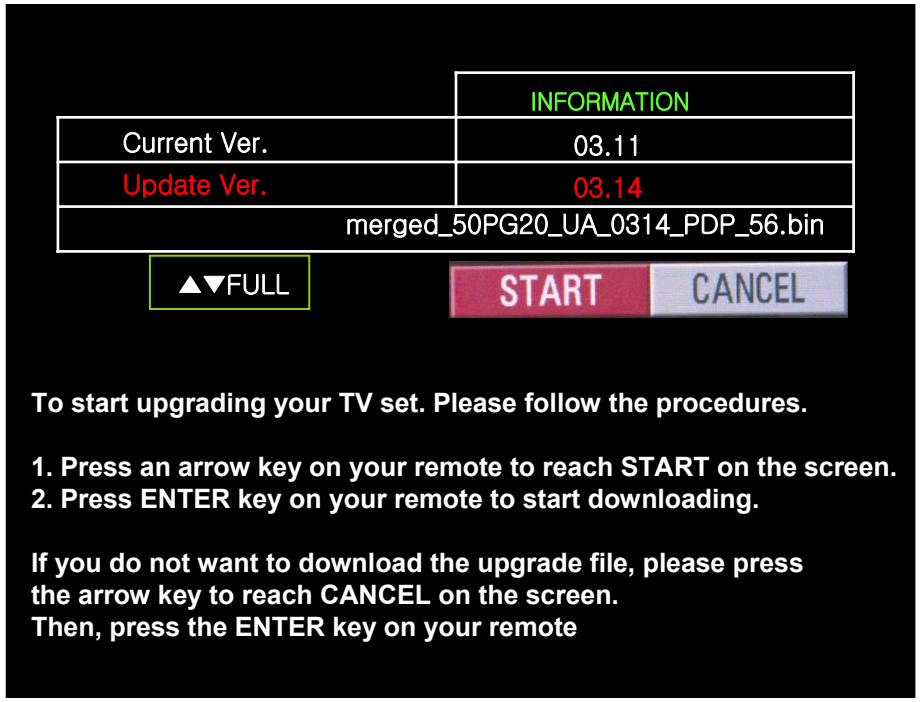


Software Upgrade (Automatic Download)

1. Copy new software (xxx.bin) to root folder in USB storage.
2. Turn on the TV
3. Connect USB storage to USB port on TV.
4. After about 5 seconds and it shows on screen.
5. Select 'START' button.



Snapshot of Windows® Explorer screen

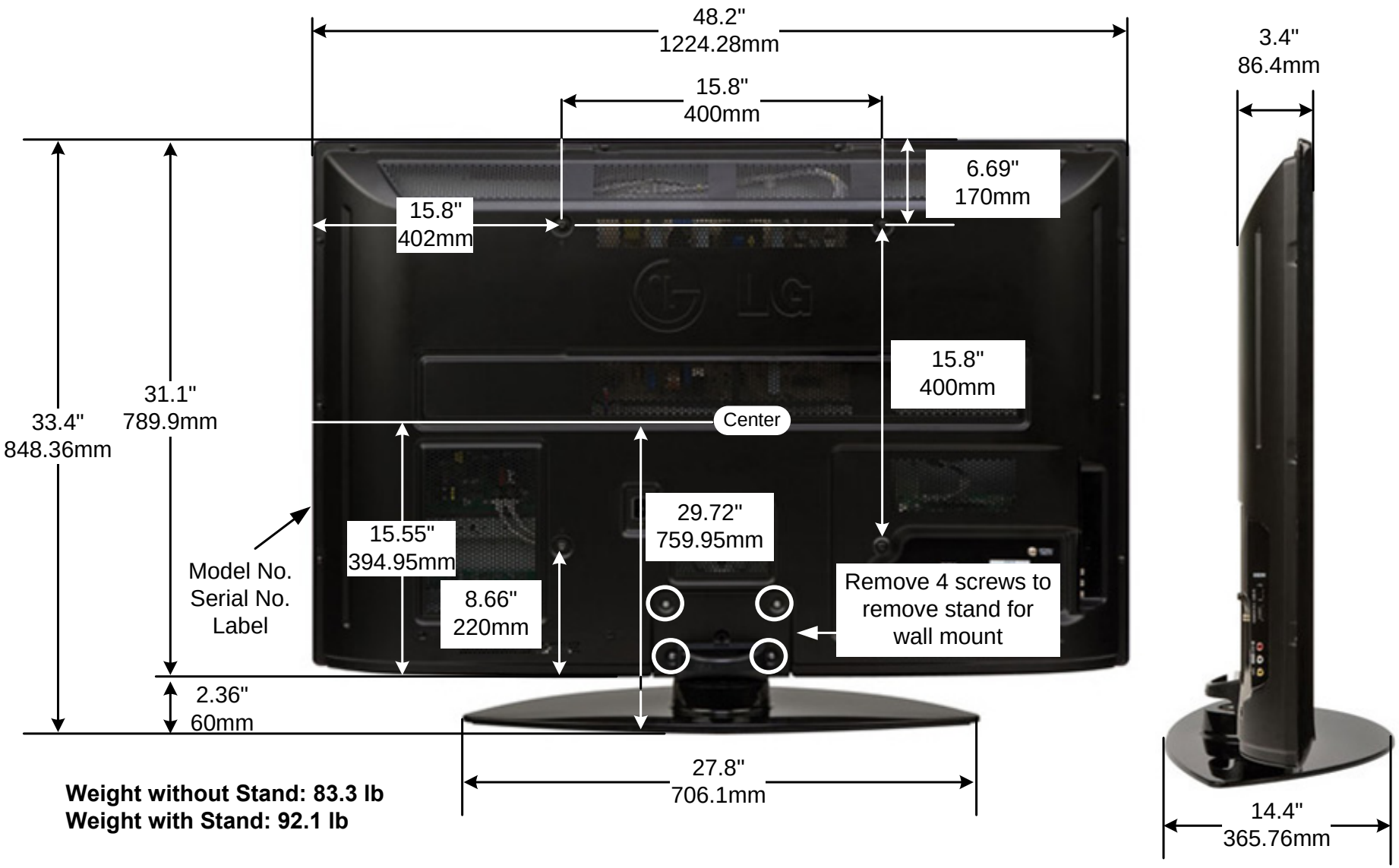


<USB download main screen>

Your File name and version number will differ. Use this just for reference.

50PG20 Product Dimensions

There must be at least 4 inches of Clearance on all sides



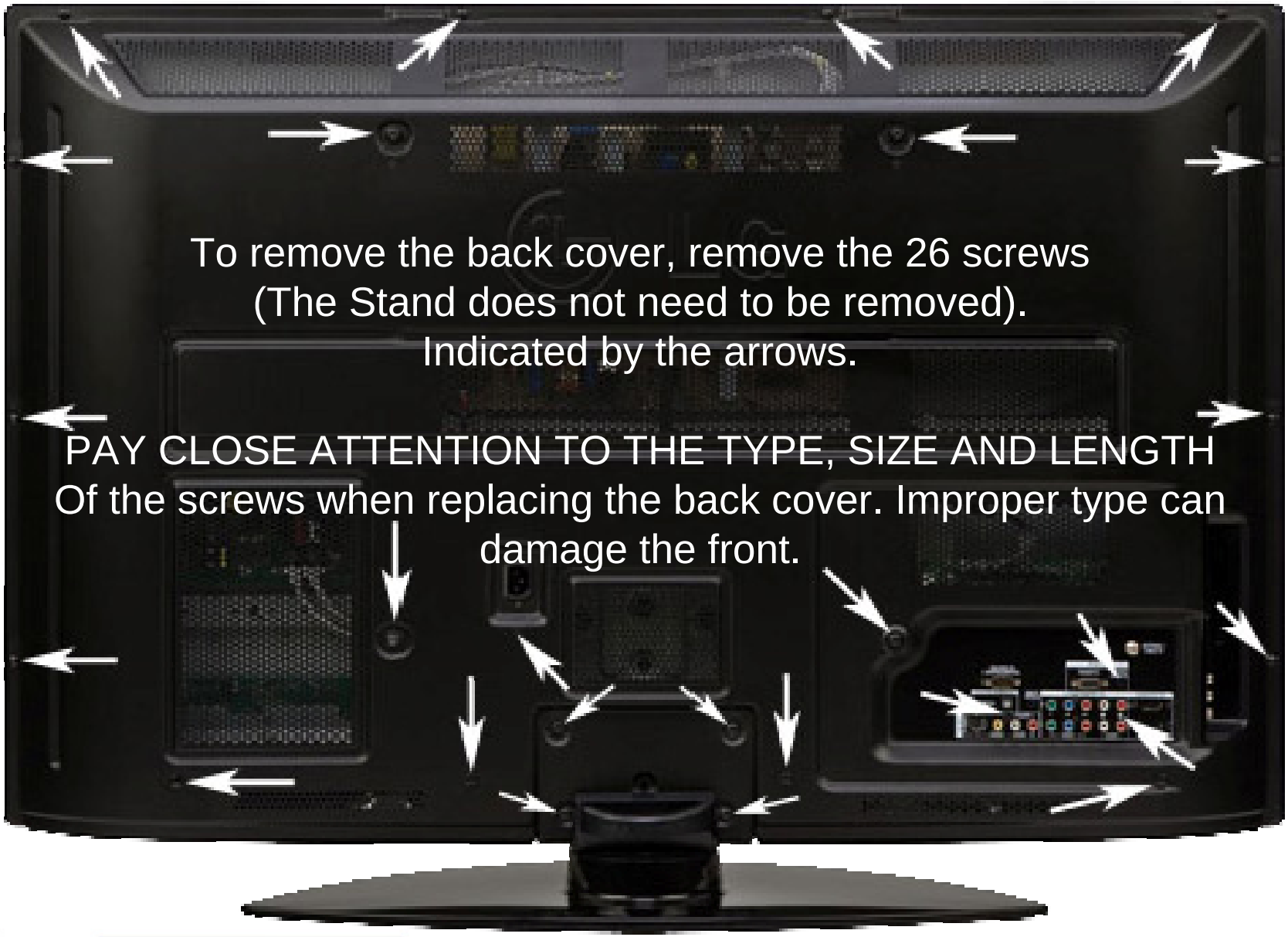
Weight without Stand: 83.3 lb
Weight with Stand: 92.1 lb

DISASSEMBLY SECTION

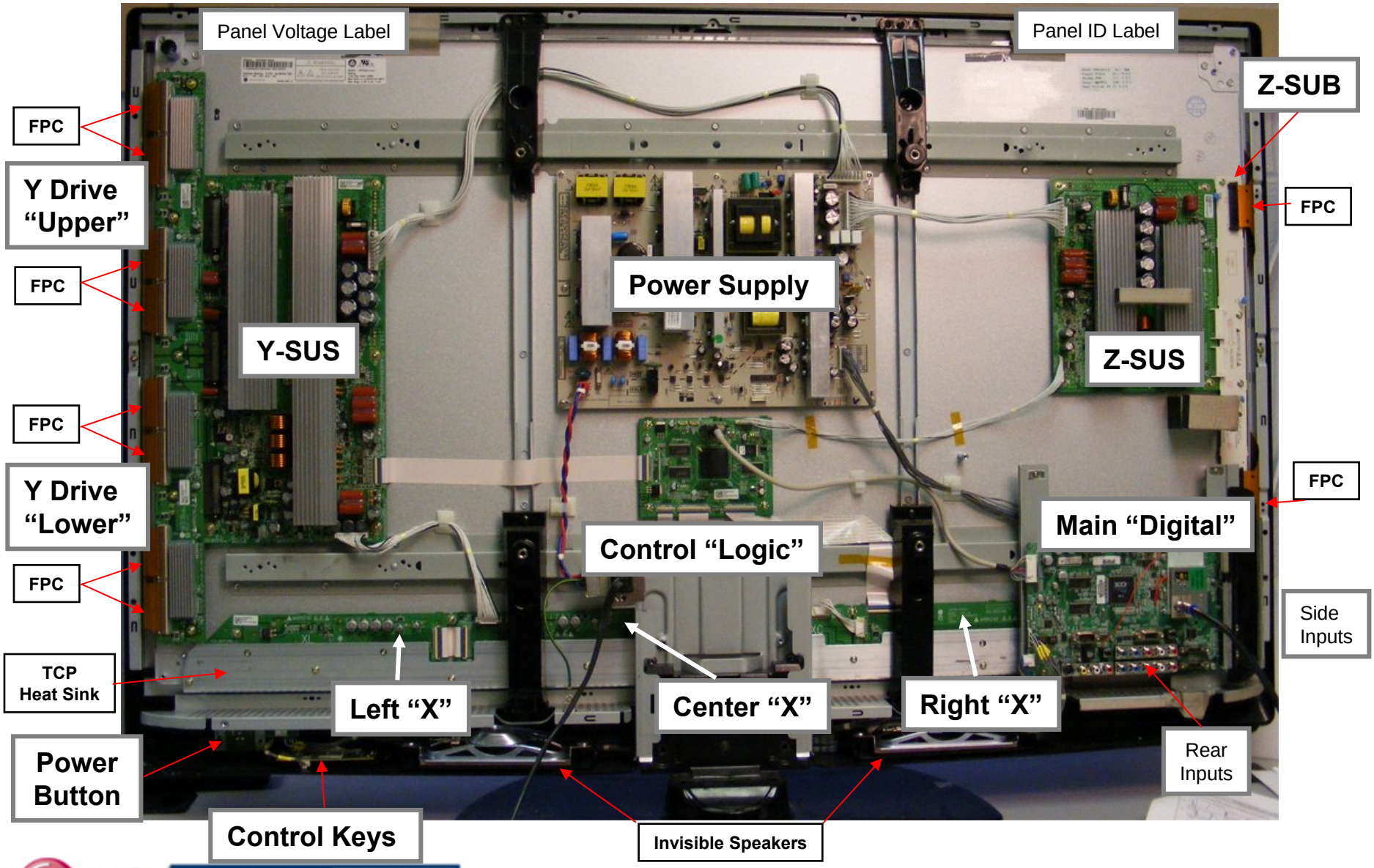
This section of the manual will discuss Disassembly, Layout and Circuit Board Identification, of the 50PG20 Advanced Single Scan Plasma Display Panel.

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.

Removing the Back Cover



Board Layout



Disassembly Procedure for Circuit Board Removal

Notes: 1) All Plugs listed are from left to right Pin 1,2, 3, ETC.
2) Remember to be cautious of ESD as some semiconductors are CMOS and prone to static failure

Switch Mode Power Supply Board Removal

Remove 8 screws securing the Power Supply and disconnect Connectors from Plugs **CN101** (AC Input)
P801 (Vs, Vs, NC, GND, GND, Va, Va, GND, M5V, M5V),
P802 (Vs, Vs, NC, GND, GND, Va, Va, GND, M5V, M5V),
P803 (22 pins).
After the board is replaced readjust RV901 (VS), RV902 (VA) according to the DC voltage levels indicated by the Voltage Label in the upper Left corner of the Panel.

Y-SUS Board Removal

Remove Connectors P209, P102 and P210
Remove the 9 screws holding the Y-SUS secured.
Lift gently and slide Board to the right to release from the Upper and Lower Y-Drive Boards.

Top Y Drive Board Removal

Remove the 4 connectors going to the Flexible Ribbon Connectors for the Panel.
Remove the 3 screws holding the Board in place.
Lift the Board up to unseat the Board from the screw Stand Off collars and pull the Board away from the Y-SUS Board connectors

Bottom Y Drive Board

Remove the 4 connectors going to the Flexible Ribbon Connectors for the Panel.
Remove the 3 screws holding the Board in place.
Lift the Board up to unseat the Board from the screw Stand Off collars and pull the Board away from the Y-SUS Board connectors

Disassembly Procedure for Circuit Board Removal (2)

Z-SUS Board Removal

Remove the following connectors P3, P2
Remove the 6 Screws
Lift the Board up slightly and pull Board to the left to disengage the connectors going to the FPC cables interface Boards.
When reinstalling Board, be sure to check Va/Vs and then readjust ZBias according to the voltage panel label.

Main Board Removal

Remove the following connectors P302, P303, P701 and the Speaker plug CN701
Remove the 2 Screws holding the decorative black plastic piece over the input jacks and remove.
Remove the 4 screws holding the Board in place and remove.
NOTE: If the Board just needs to be out of the way;
Remove the 2 Screws holding the decorative black plastic piece over the input jacks and remove.
Remove the two screws at the top of the Main Board mounting brackets, loosen the tape at the bottom of the bracket, unplug P701 and CN701 and swing the Board up and to the right.

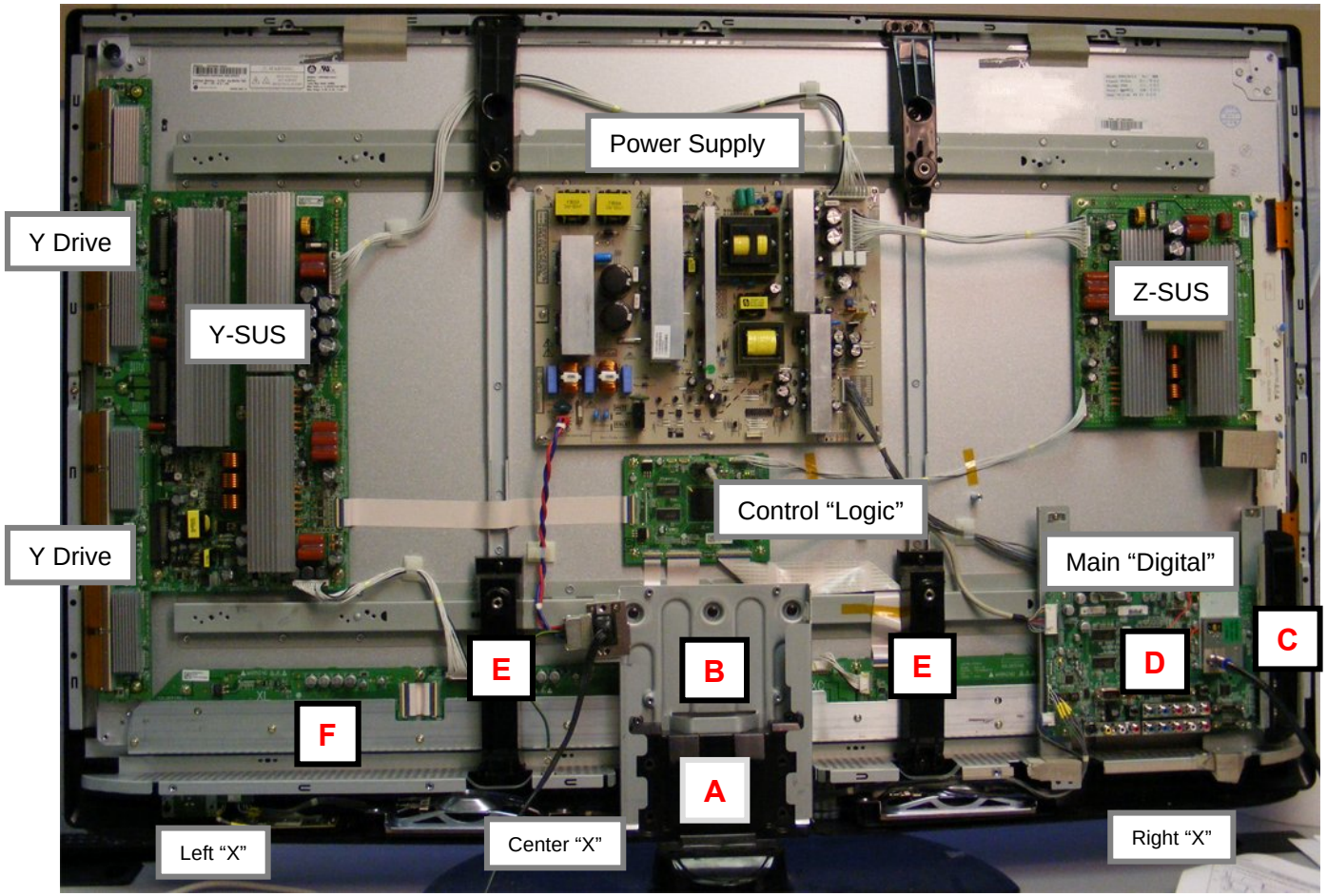
Control Board Removal

Remove the following connectors; P111, P163, P162, P161, P151
Carefully remove the LVDS Cable P121 from the Control Board by pressing the Locking Tabs together and pulling straight out.
Remove the 4 screws in each corner.
Pay attention to the back side. Note: The rubber looking pad is actually a “Temperature Transfer Medium”. Be sure to remove this pad from the old Board and place the pad back on the New Board before installation.

X Circuit Board Removal

X Board Removal

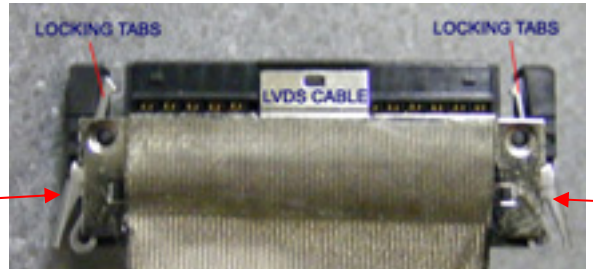
X Board Removal will require the most disassembly of all the boards. All the Brackets and Assemblies marked with A~F will need to be removed. This includes the Stand “A”. Before an X Board can be removed the Heat Sink Assembly “F” will also need Removal.



X Circuit Board Removal Continued

X Board Removal (continued)

Lay the unit face down on non-scratch material. To prevent damage to the LVDS Cable, carefully remove the LVDS Cable **P121** from the Control Board by pressing the Locking Tabs together and pulling straight back to remove the cable see illustration below.

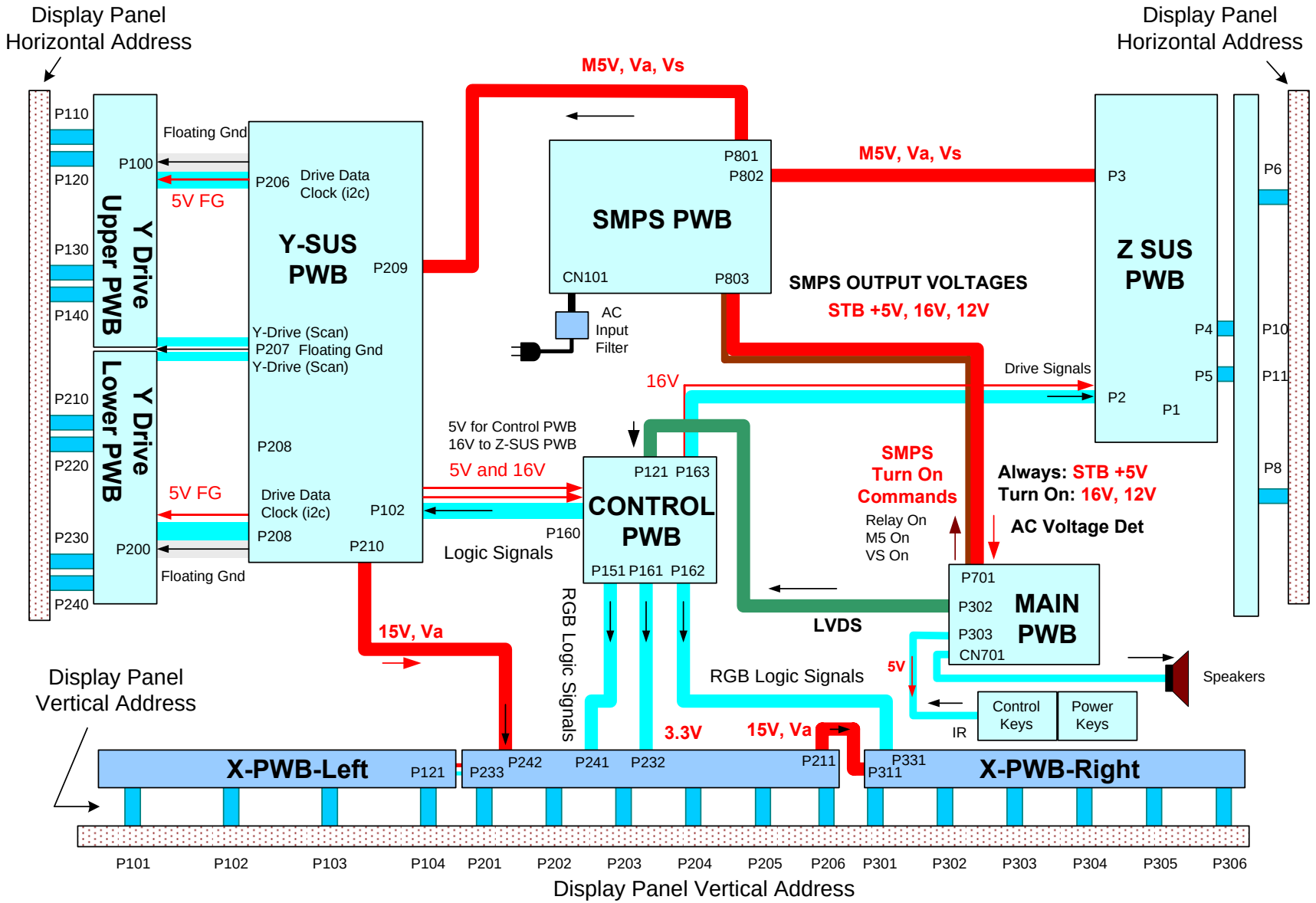


LVDS Cable Connector Control Board side

(A) Remove the Stand mounting support plastic piece.
(B) Remove the Stand Metal Support Bracket, unplug AC ground lug.
(C) Remove the Decorative Black plastic piece over side inputs.
(D) Remove the two screws at the top of the Main Board support bracket. Unplug Speaker and Front Input plugs and swing the Board out of the way.
(E) Remove both bottom black support braces 3 screws each.
(F) Remove the TCP Heat sink 9 screws and remove.

X DRIVE Board Removal:
Disconnect all connectors going to each Board that needs to be removed.
Left X Drive: P121, P101 through P104.
Center X Drive: P242, P241, P232 P211, P201 through P206.
Right X Drive: P331, P311, P503, P301 through P306.
Remove the 4 screws for each Board and remove the Board. One of the screws supports two Boards.
Reassemble in reverse order. Recheck Va/Vs/VScan/-VY/Z-Drive.

50PG20 Voltage and Signal Distribution Block Diagram

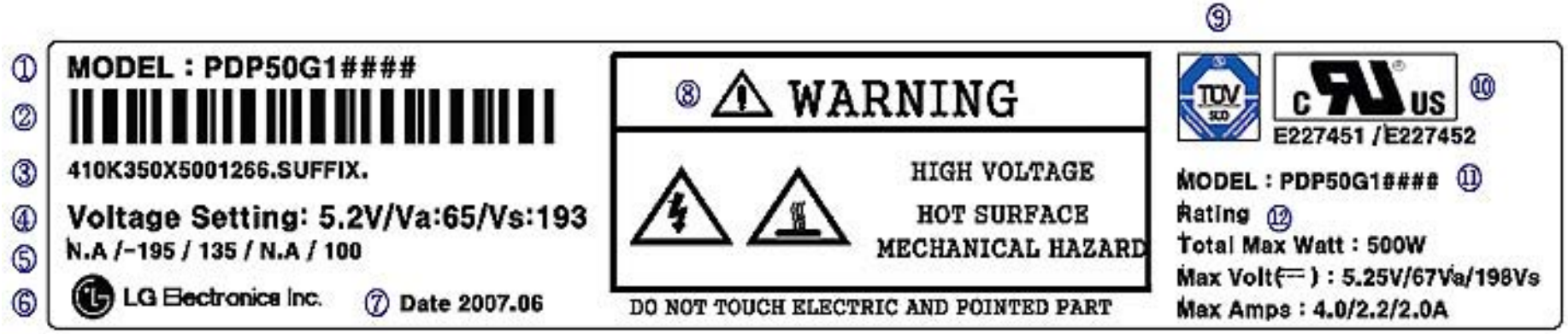


50PG20 Plasma Display

This Section will cover Circuit Operation, Troubleshooting and Alignment of the Power Supply,
Y-SUS Board, Y Drive Boards, Z-SUS Board, Control Board, Main Board and the X Drive Boards.

At the end of this Section the technician should understand the operation of each circuit board and how to adjust the controls. The technician should be able with confidence to troubleshoot a circuit board failure, replace the defective circuit and perform all necessary adjustments.

Panel Label Explanation



(1) Model Name
(2) Bar Code
(3) Manufacture No.
(4) Adjusting Voltage DC, Va, Vs
(5) Adjusting Voltage (Set Up / -Vy / Vsc / Ve / Vzb)
(6) Trade name of LG Electronics
(7) Manufactured date (Year & Month)
(8) Warning
(9) TUV Approval Mark
(10) UL Approval Mark
(11) UL Approval No.
(12) Model Name
(13) Max. Watt (Full White)
(14) Max. Volts
(15) Max. Amps

Adjustment Notice

All Adjustments Must Be Done in White Wash.

(Customer's Menu – Options – ISM – White Wash)

It is critical that the DC Voltage adjustments be checked when ever;

1) **SMPS, Y-SUS or Z-SUS Board is replaced.**
2) **Panel is replaced, since the SMPS does not come with new panel**
3) **A Picture issue is encountered**
4) **As a general rule of thumb when ever the back is removed**

ADJUSTMENT ORDER "IMPORTANT"

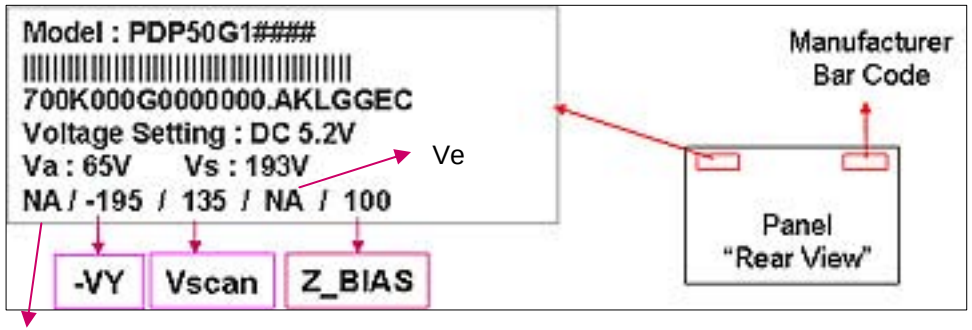
DC VOLTAGE ADJUSTMENTS

1) **SMPS Board: Vs Va** (Always do SMPS first)
2) **Y-SUS Board: Adjust -Vy, Vscan**
3) **Z-SUS Board: Adjust Zbias**

WAVEFORM ADJUSTMENTS

1) **Y-SUS Board: Ramp Up, Ramp Down**

Remember, the Voltage Label MUST be followed, it is specific to the panel's needs.



All label references are from a specific panel. They are not the same for every panel encountered.

The Waveform adjustment is only necessary

1) When the Y-SUS Board is replaced
2) When a "Mal-Discharge" problem is encountered
3) When an abnormal picture issues is encountered

SWITCH MODE POWER SUPPLY SECTION

This Section of the Presentation will cover troubleshooting the Switch Mode Power Supply for the Single Scan Plasma. Upon completion of the section the technician will have a better understanding of the operation of the Power Supply Circuit and will be able to locate voltage and test points needed for troubleshooting and alignments.

- **DC Voltages developed on the SMPS**
- **Adjustments VA and VS. Note: The M5V is pre-adjusted and sealed.**

- **Always refer to the Voltage Sticker located on the back of the panel, in the upper Left Hand side for the correct voltage levels for the VA, VS, -VY, Vscan, and Z Bias as they will vary from Panel to Panel.**

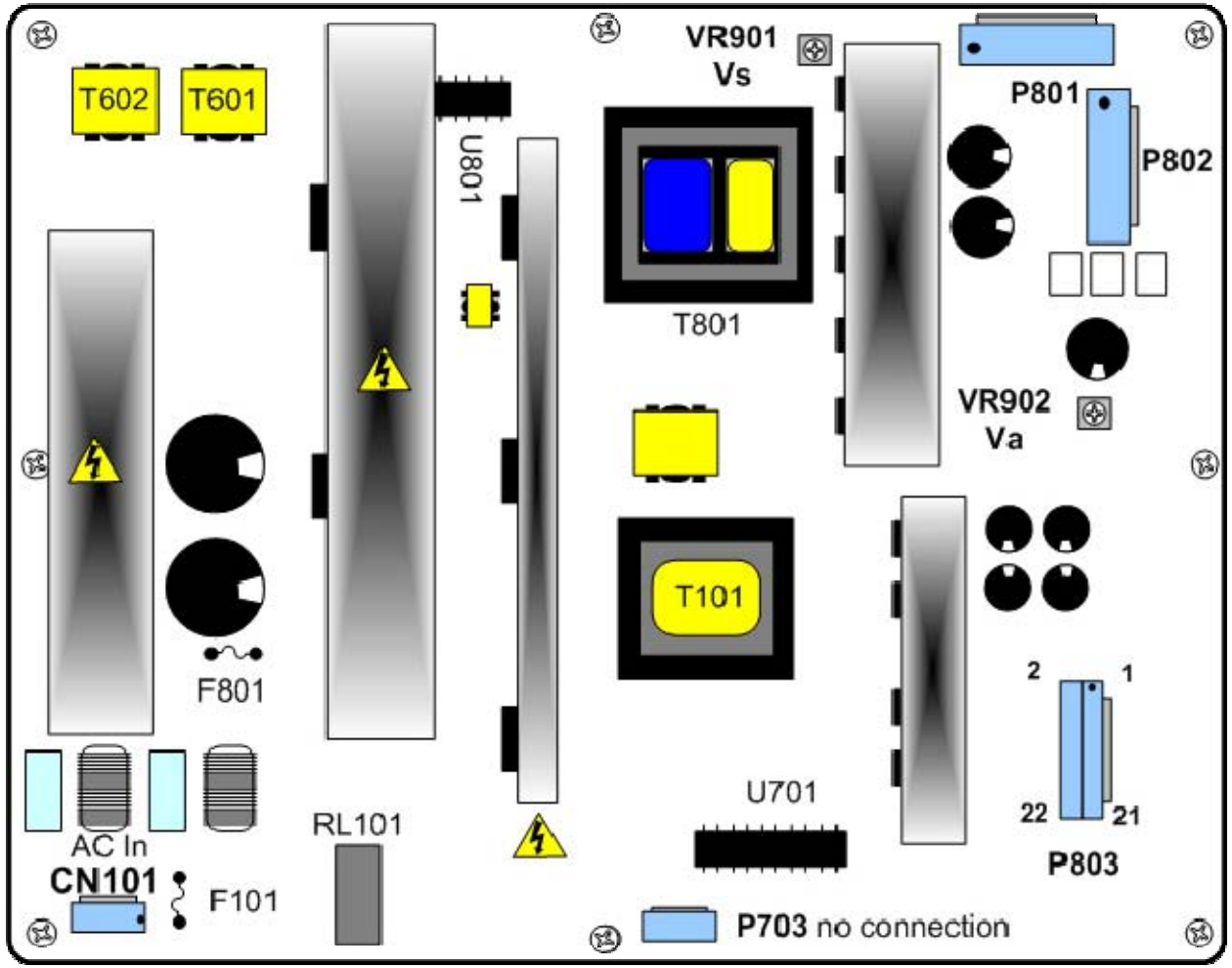
Switch Mode Power Supply Part Number

SMPS P/N (EAY41360901).
Check the sticker on the upper left side to confirm origin of the Panel or the White Label on the Power Supply itself to identify the Board P/N.

We will examine the Operation of the EAY41360901 .

Power Supply Board Layout

Hot Ground Symbol represents a SHOCK Hazard



P801

1	Vs
2	Vs
3	GND
4	GND
5	GND
6	Va
7	Va
8	GND
9	M5V
10	M5V

P802

1	Vs
2	Vs
3	GND
4	GND
5	GND
6	Va
7	Va
8	GND
9	M5V
10	M5V

P803

15V	2	1	15V
GND	4	3	GND
12V	6	5	12V
GND	8	7	GND
5V	10	9	5V
5V	12	11	5V
GND	14	13	GND
GND	16	15	GND
AC Det	18	17	5_V Det
VS_ON	20	19	RL_ON
AUTO	22	21	M5V_ON

Switch Mode Power Supply Overview

The Switch Mode Power Supply Board Outputs to the :

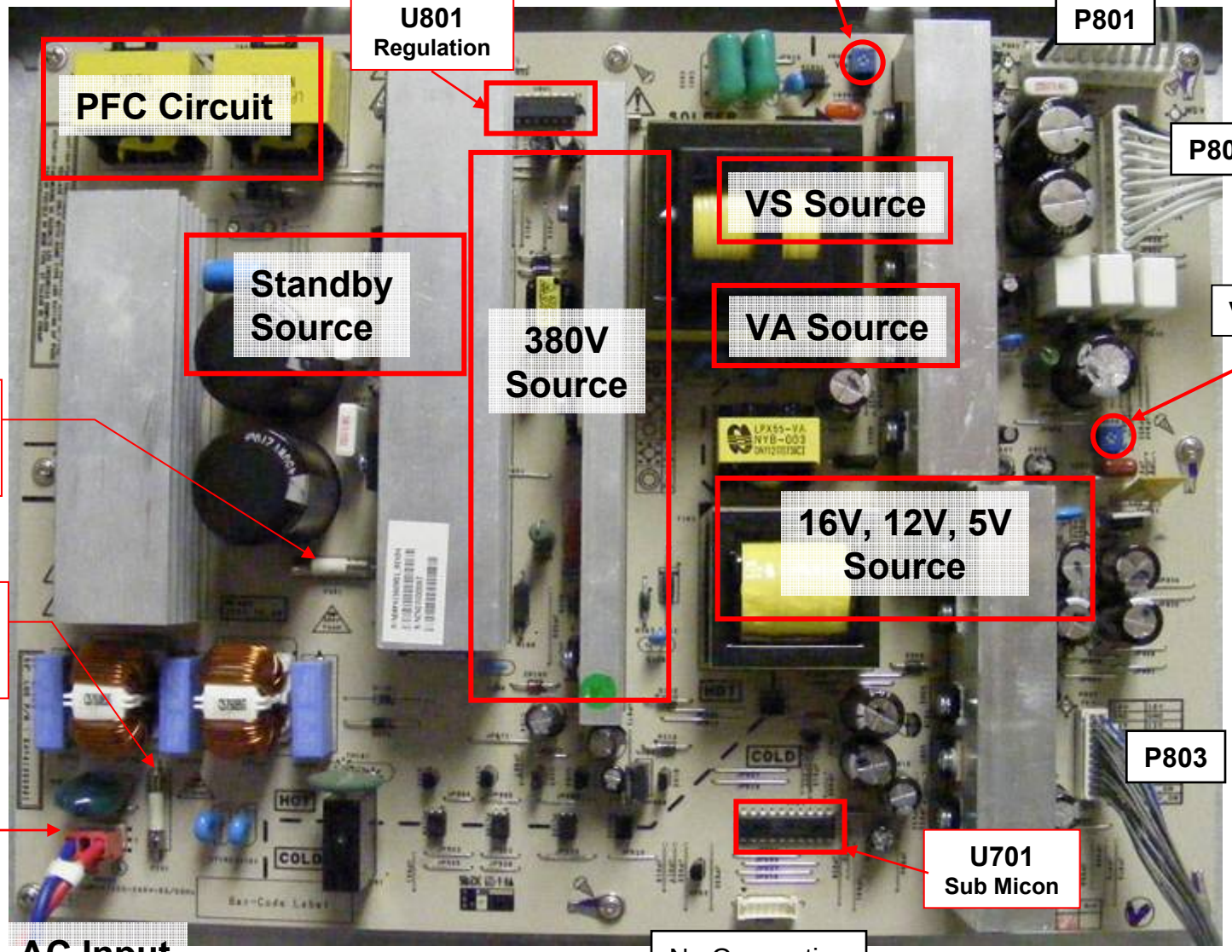
Y-SUS Board And Z-SUS Board	**VS**	**Drives the Display Panel Horizontal Grid**
	VA	**Primarily responsible for Display Panel Vertical Grid**
	M5V VCC	**Used to develop Bias Voltages on the Y-SUS, Z-SUS, X Drive, and Control Boards**
Main Board	**16V**	**Audio B+ Supply**
	12V	**Signal Processing Circuits and Fan Drive**
	5V	**Signal Processing Circuits**

Adjustments

There are 2 adjustments located on the Power Supply Board VA and VS. The 5V VCC is pre-adjusted and fixed. All adjustments are made with relation to Chassis Ground. Use "Full White Raster" 100 IRE

VA	**RV901**
VS	**RV902**

Switch Mode Power Supply Circuit Layout



Power Supply Operation and Troubleshooting

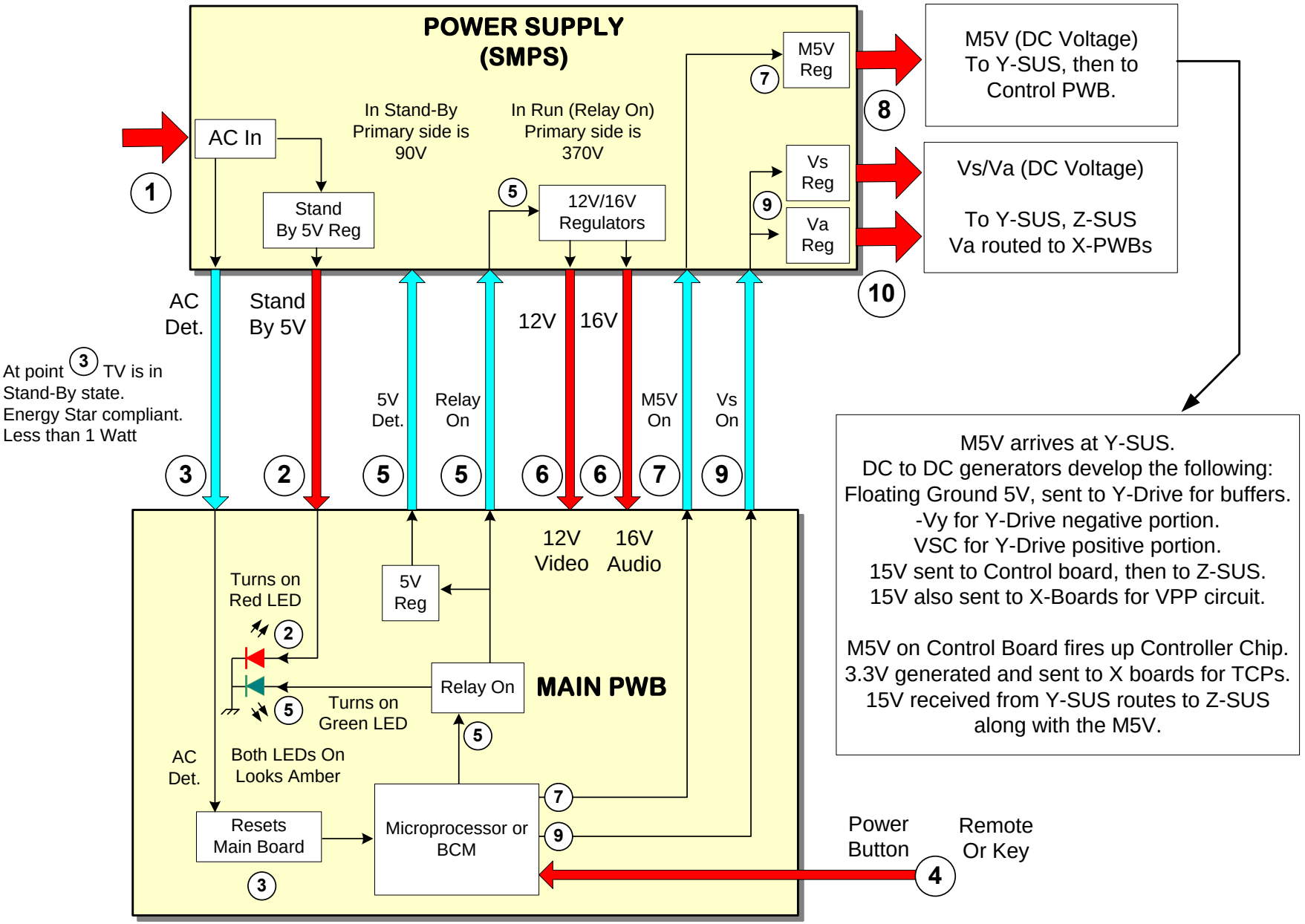
AC Voltage is supplied to the SMPS Board at Connector SC101 from the AC Input Filter. Standby 5V is developed from 330V source supply (which during standby measures 155V with relation to AC Ground). This supply is also used to generate all other voltages on the SMPS.
The 5V (standby) voltage is routed to the Sub Micon (U701) on the SMPS and through P803 to the Main Board for Micon operation (IC100).
AC detect Pin 18 of P803 is generated on the SMPS by monitoring the AC input and rectifying a small sample voltage. This AC Detect Voltage is routed to the Sub Micon (U701) on the SMPS and the Micon (IC100) located on the Main Board and is used as a basic “SMPS OK” signal. AC Det actually releases “Reset” on the Main Board.

When the Micon (IC100) on the Main Board receives an “ ON “ Command from either the Keyboard or the Remote IR Signal it outputs a high to RL-ON which enters the SMPS Board at Pin 19 of P803. The RL-ON command is sensed by the Sub Micon (U701) circuit which causes the Relay Drive Circuit to close Relay RL101 bringing the primary source voltage up to full power by increasing the 155V standby to 330V. At this time the 16V and 12V source becomes active and sent to the Main Board via P803. The relay on command on the main board turns on a 5 V general regulator that creates a 5V Det signal that is also set to the Power Supply.

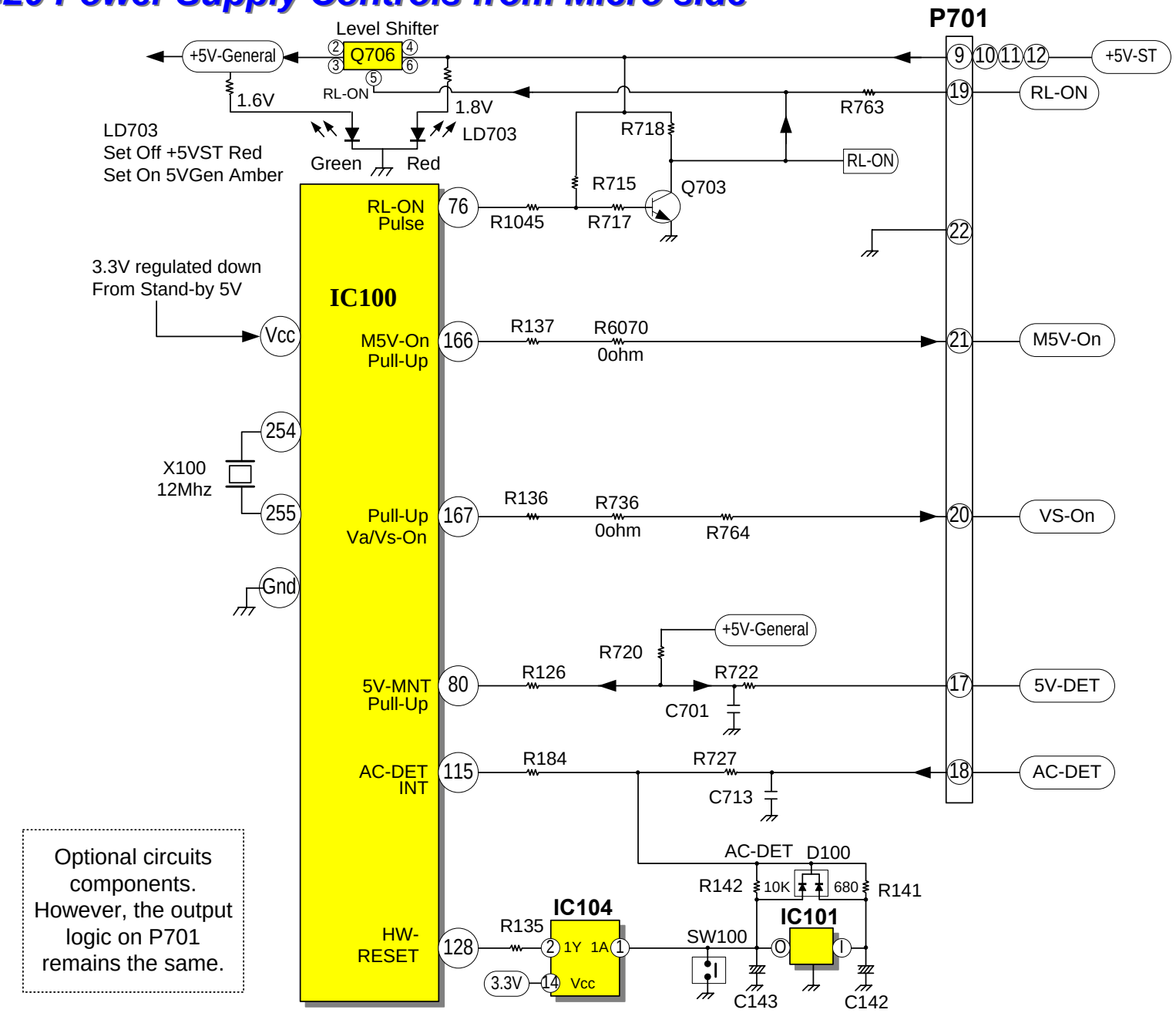
The next step is for the Micon (IC100) on the Main Board to output a high on M5V_ON Line to the SMPS at P803 Pin 21 which is sensed by the Sub Micon IC (U701) on the SMPS turning on the M5V line which is routed out P801 and P802 to the SUS boards. This same M5V kicks off the Control Board.

The last step to bring the supply to “Full Power” occurs when the Micon (IC100) on the Main Board brings the VS-ON line high at Pin 20 of P803 on the SMPS Board which when sensed by the Sub Micon IC (U701) turns on the VA and VS Supplies (VA is brought high before VS).

50PG20 Power Supply Start Up Sequence

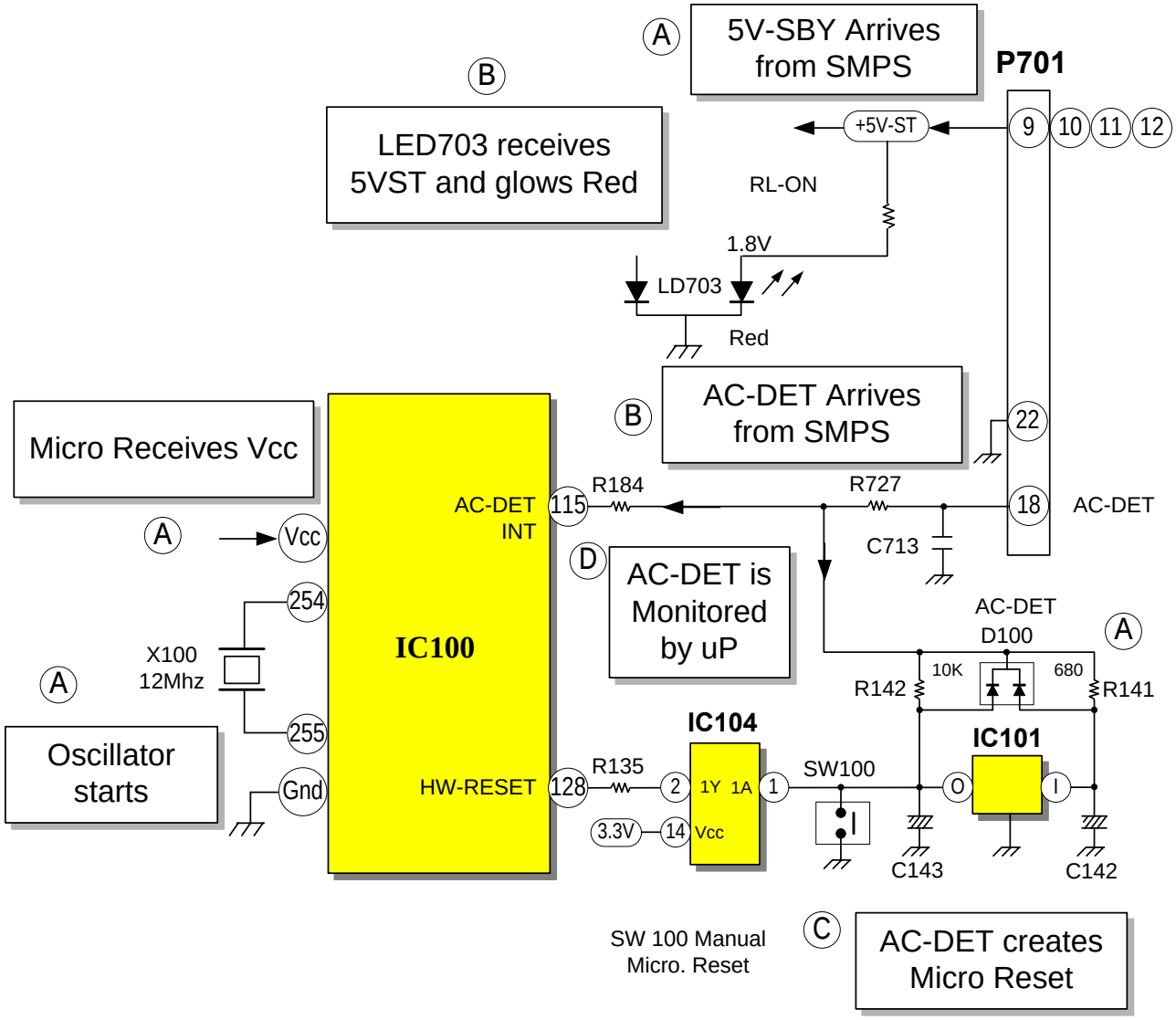


50PG20 Power Supply Controls from Micro side

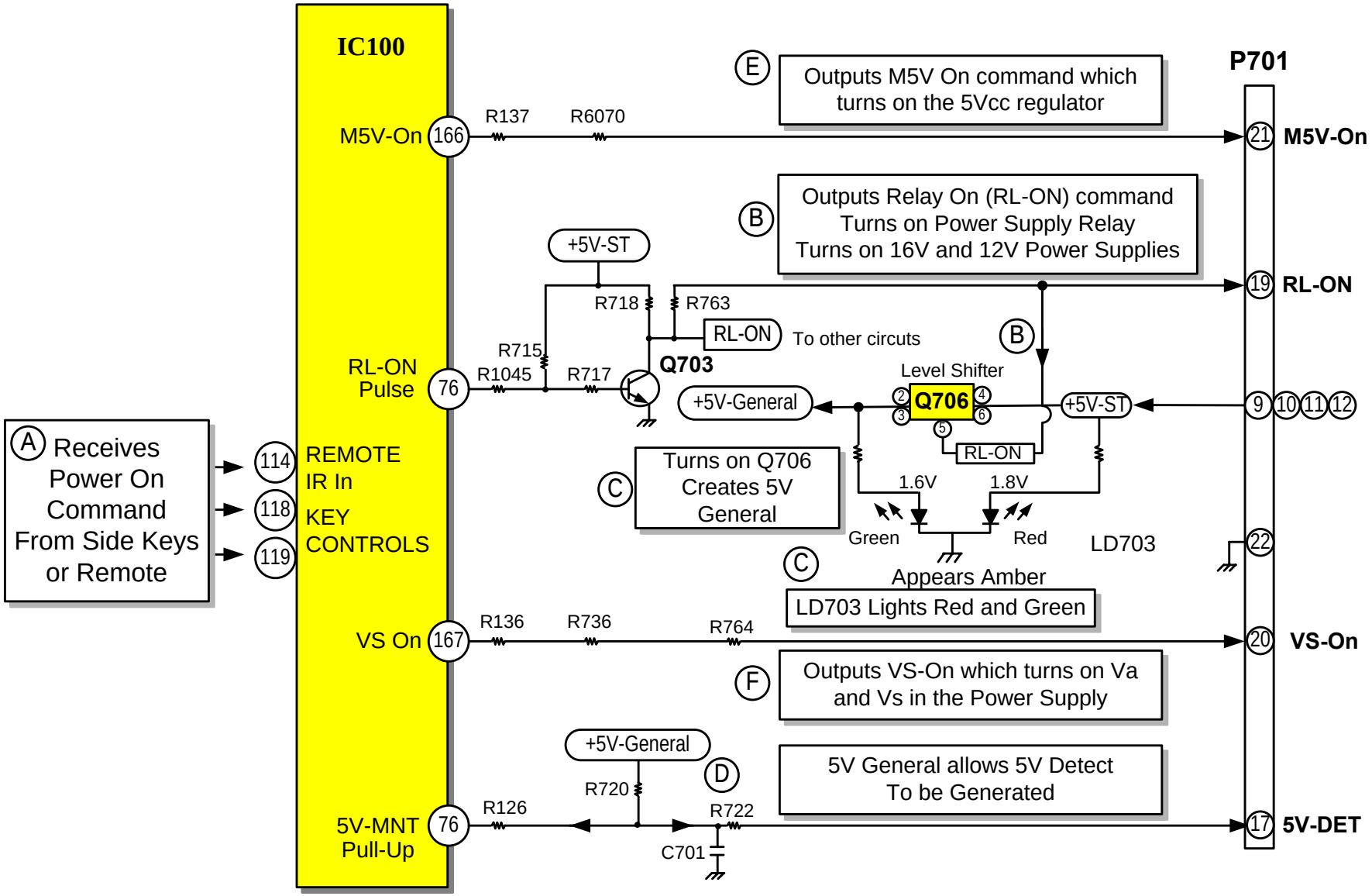


Optional circuits components. However, the output logic on P701 remains the same.

50PG20 Power Supply Controls from Micro side (During Stand By)



50PG20 Power Supply Controls from Micro side (At Turn On)



Power Supply Generic Troubleshooting Tips

Remember if a voltage is missing check for proper resistance before proceeding

Understanding the Power On Sequence when Troubleshooting a possible Power Supply Failure will simplify the process of isolating which circuit board failed to operate properly. In this Section we will investigate the Power on Sequence and examine ways to locate quickly where the failure occurred.

Check the Power On LED for Operation. A Red LED indicates a presence of 5V STB and AC-ON/DETECT. Failure of the Power ON LED to light is an indication of loss of 5V STB or AC ON/ Detect remember the 5V STB and AC-ON/DETECT are developed on the SMPS and sent to the Main Board.

Listen for Relay Click, the click of the Relay is an indication of RL-ON going high. RL-ON is sent from the Main Board to the SMPS and when present the U701 controls the Relay Operation. RL-ON going High and no Relay is a failure of the SMPS, RL-ON staying low is a failure of the Main Board.

Relay Operation means that the SMPS if working properly will output the 16V Supply to the Main Board. This voltage will allow the Tuner, Audio and Video Circuits on the Main Board to function, and if connected to an Antenna Input, Audio would be present. If the Relays closed and these supplies failed suspect a problem with the SMPS.

The next step of operation calls for the M5V_ON line from the Main Board to the SMPS to go high on P803 pin 21. A high on the M5V_ON Line activates the 5V VCC line. Loss of 5V VCC results in no “Raster”, no Display Panel Reset, no Y, Z, Control or X Board operation. Loss of 5V VCC and M5V_ON going high could be caused by any of these boards or failure of the SMPS. M5V_ON staying low indicates a problem on the Main Board.

VS-ON is the last step of the Power Sequence and is responsible for bringing the VS and VA Voltages up. The VS-ON signal pin 20 P803 is sent from the Main Board to the SMPS as a high, VS and VA and full operation of the Display Panel are now enabled. Loss of VS-ON results in loss of VA and VS and no Raster, no Panel Display Reset but Audio would be present. If VS-ON went high and VS and VA where missing the problem could be caused by a failure on the SMPS or a circuit using these voltages. A Resistance check should narrow the possible failures quickly.

Switch Mode Power Supply Static Test

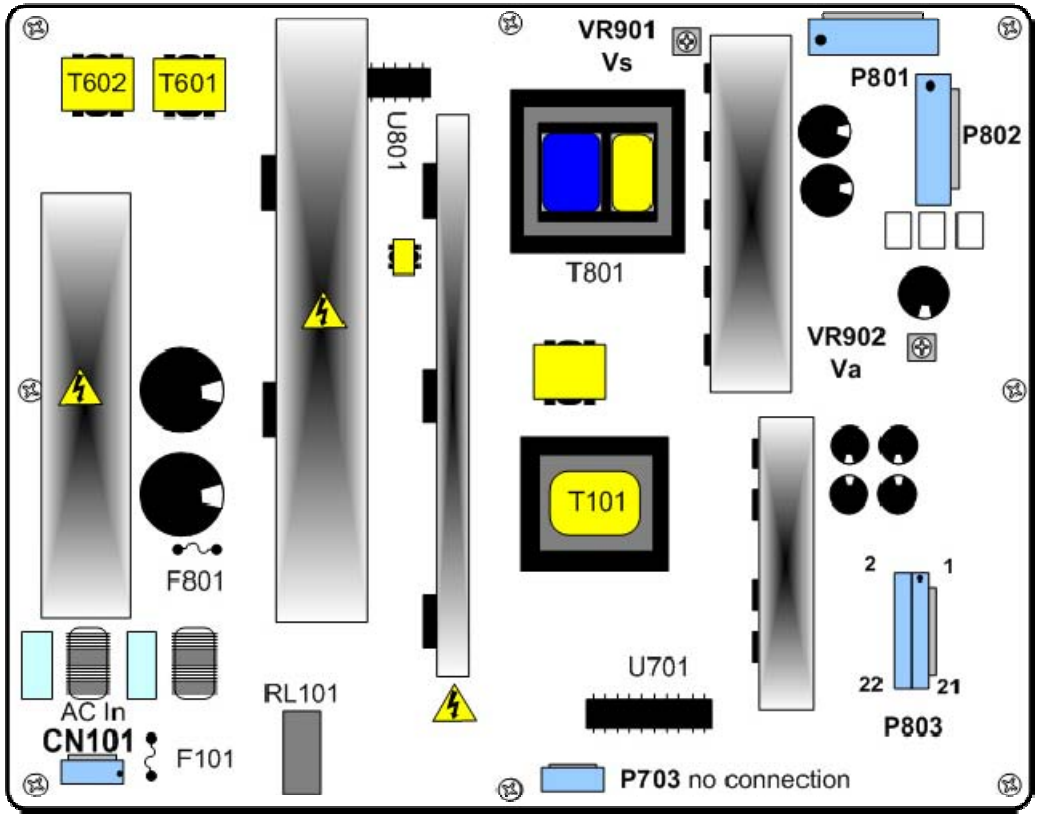
This test can confirm the proper operation of the SMPS without the need to exchange the board. This Power Supply can operate in a No Load State. This means that by applying AC power to CN101 and all other plugs disconnected, this power supply will function.
Simply removing P803 (Lower Right Hand Side of the Board), will cause the “AUTO” Pin 22 to go high from its normal low state allowing the Power Supply to go to full power on mode when AC Power is Supplied. ***Be careful after this test and make sure the VA and VS lines have discharged before reconnecting the supply cables.***

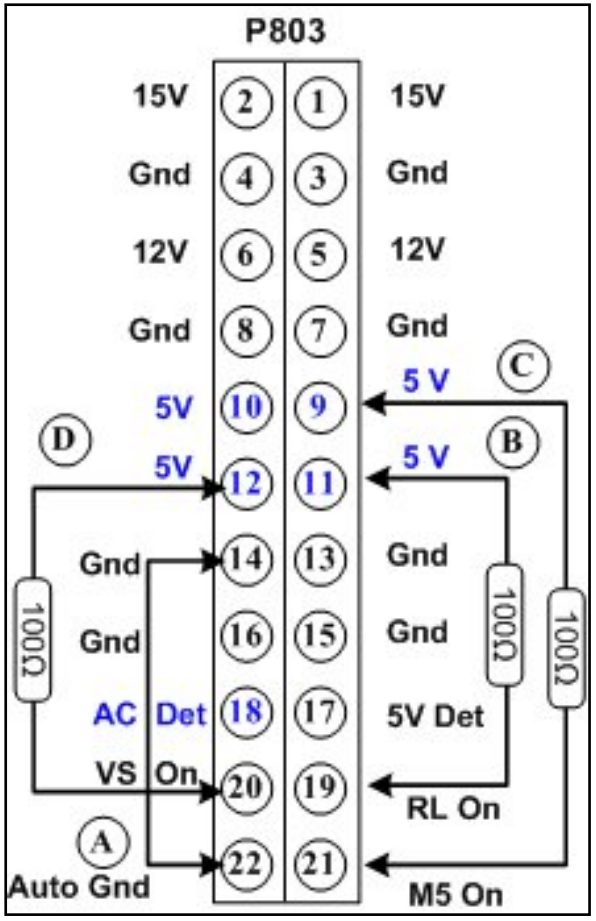
If either Y-SUS or Z-SUS is causing the power supply to shutdown, unplug the Z-SUS. This will allow the Y-SUS to function. If you unplug the Y-SUS from the SMPS, and jump the 5V VCC line to the Y- SUS for Control Board Power the Z-SUS will function.

If the Y-SUS and Z-SUS Boards are working normal, when the SMPS comes up to full power on, “Display Panel Reset” will be visible. Shorting the Auto Pattern Gen. test points at this time should result with test patterns on the screen (if not check for 16V and VA to the X Boards).

For a “Stand-Alone” static test for the Power Supply, apply the usual 2 100Watt light Bulbs test on the Vs output line for a simulated load. If the Power Supply operates in this condition, it is assured it can maintain its output power under load.

Switch Mode Power Supply Static Test (Forcing on the SMPS in stages)





Remove AC between each test step

Ground the Auto Ground (Pin 22) on P803

AC Power Applied AC Det (Pin 18) and 5V STB (Pins 9 ~ 12) are 5V.

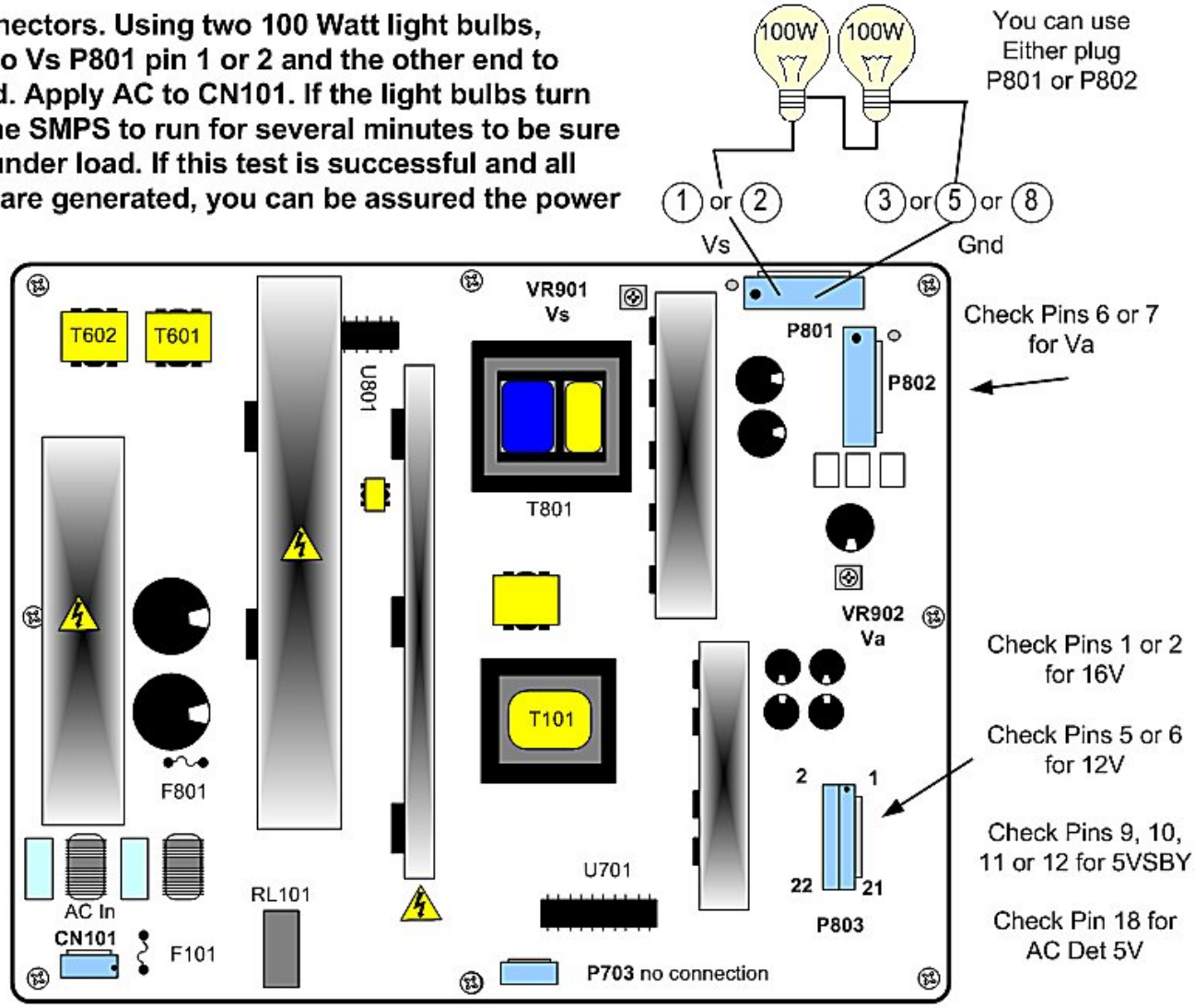
100Ω ¼ watt resistor added from 5V STB (Pins 9 ~ 12) to RL ON (Pin 19) closes relay RL101 turning on the 16V Supply

100Ω ¼ watt resistor added from 5V STB (Pins 9 ~ 12) to M5V_ ON (Pin 21) brings the 5V VCC line high

100Ω ¼ watt resistor added from 5V STB (Pins 9 ~ 12) to VS _ON (Pin 20) brings the VA and VS Lines high

Static Test Using Light Bulbs as a Load

Unplug all connectors. Using two 100 Watt light bulbs, attach on end to Vs P801 pin 1 or 2 and the other end to chassis ground. Apply AC to CN101. If the light bulbs turn on, allow the the SMPS to run for several minutes to be sure it will operate under load. If this test is successful and all other voltages are generated, you can be assured the power supply is OK.



Note: The light bulb test is not necessary for the SMPS to turn on and stay on. This SMPS will run without a load. But it is necessary to test the SMPS under a load.

Va and Vs Adjustments

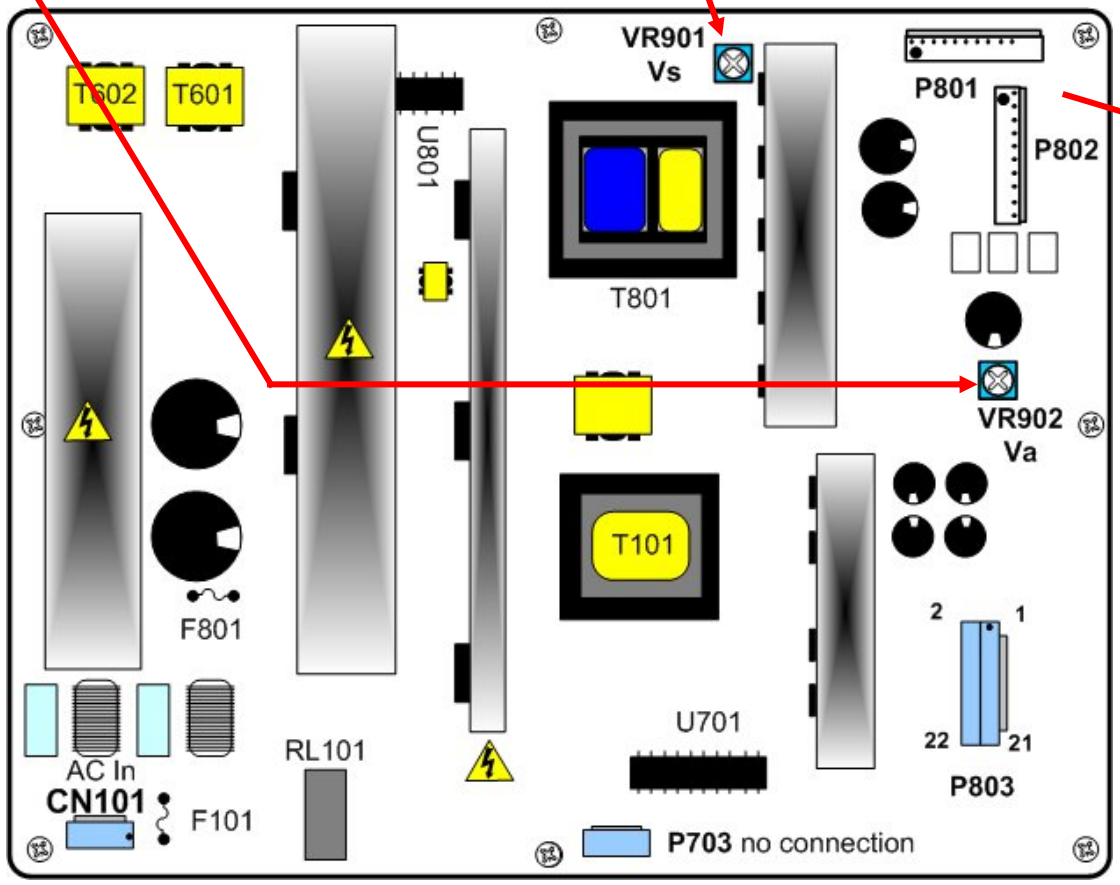
Panel Voltage Label

Model : PDP50G1####
||||||||||||||||||||||||||||||||||||||||||
700K000G0000000.AKLGGEC
Voltage Setting : DC 5.2V
Va : 65V Vs : 193V
NA / 195 / 135 / NA / 100

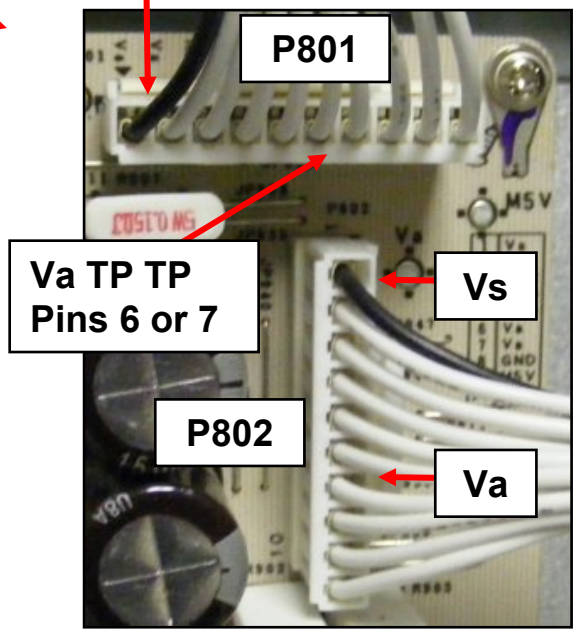
This Power Supply will come up and run with "NO" load.

Pull P803 Apply AC Power Power Supply Starts.

Y and Z-SUS Runs "Yes"
Pull "802"
Y-SUS Runs "Yes"
Z-SUS "No"
Pull "801"
Y and Z-SUS will not Run



Vs TP Pins 1 or 2



Use Chassis Ground

Use Full White Raster

CN101 and P801 Pin ID and Voltages

Voltage and Diode Test Measurements for the SMPS.
All voltages from a working unit.

Connector	Pin Number	Standby	Run	Resistance
CN101	1 and 3	120VAC	120VAC	480K

P801 CONNECTOR "SMPS Board" to "Y-SUS" P209

Pin	Label	STBY	Run	Diode Mode
1	Vs	0V	192V	OL
2	Vs	0V	192V	OL
3	nc	nc	nc	nc
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd
6	Va	0V	65V	OL
7	Va	0V	65V	OL
8	Gnd	Gnd	Gnd	Gnd
9	M5V	0V	5V	.897V
10	M5V	0V	5V	.897V

Diode Mode readings taken with all connectors removed.

P802 Pin ID and Voltages

Voltage and Diode Test Measurements for the SMPS.
All voltages from a working unit.

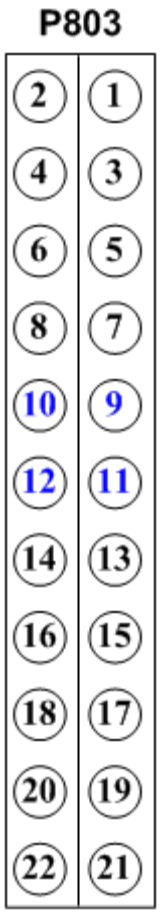
P802 CONNECTOR "SMPS Board" to "Z-SUS" P3

Pin	Label	STBY	Run	Diode Mode
1	Vs	0V	192V	OL
2	Vs	0V	192V	OL
3	nc	nc	nc	nc
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd
6	Va	0V	65V	OL
7	Va	0V	65V	OL
8	Gnd	Gnd	Gnd	Gnd
9	M5V	0V	5V	.897V
10	M5V	0V	5V	.897V

Diode Mode readings taken with all connectors removed.

P803 Connector ID, Voltages and Diode Checks

Voltage and Diode Test Measurements for the SMPS from working unit



P803 Connector "SMPS" to "Main Board" P701

Pin	Label	STBY	Run	No Load	Diode Mode
1-2	15V	0V	16V	16V	2.26V
3-4	Gnd	Gnd	Gnd	Gnd	Gnd
5-6	12V	0V	12V	12V	2V
7-8	Gnd	Gnd	Gnd	Gnd	Gnd
9-12	5V	5V	5V	5V	1.7V
13-16	Gnd	Gnd	Gnd	Gnd	Gnd
17	5_V Det	.15V	5V	5V	1.56V
18	AC Det	5V	5V	5V	2.56V
19	RL_On	0V	4.5V	0V	2.6V
20	Vs_On	0V	3.2V	0V	2.7V
21	M5V_ON	0V	3.2V	0V	2.6V
22	AUTO	0V	0V	5V	2.1V

Diode Mode readings taken with all connectors removed.

Using the Front Power LED for visual clues

Note: This information pertains to "Shorted" voltage lines, not Open voltage lines.

(1) STBY 5V Short or Open: Power LED does not light in stand by. No Power button function.

(2) AC Detect Open (Shorted Reset Line): Power LED is lit all Blue, 5V STBY OK. Power Button has no effect.

(3) M5V Vcc Short: Apply AC Power, goes to flashing Red and Blue. Relay Clicks "On and Off"

(4) 12V Short: Power LED is lit Red in stand by. At Power On, Power LED flashes 2 times Blue then 1 Long Blue goes back to Red. Relay clicks off immediately.

(5) 16V Short: Apply AC Power , Power LED flashes Blue. Relay clicks rapidly on and off.

(6) Va or Vs Short: Power LED is lit Red in stand by. At Power On, goes to Blue. Relay closes. Power LED blinks blue twice and 3rd blink stays blue. Relay opens, LED goes to red. Power Supply outputs 16V,12V and 5Vcc, drops to 0V after the relay opens. No Va or Vs. With Relay closed, 330V OK, then when relay opens, it drops to 155V.

Y-SUS BOARD SECTION (Overview)

This Section of the Presentation will cover troubleshooting the Y-SUS Board for the Single Scan Plasma.
Upon completion of the Section the technician will have a better understanding of the operation of the circuit and will be able to locate voltage and resistance test points needed for troubleshooting and alignments.

- Adjustments
- DC Voltage and Waveform Checks
- Resistance Measurements

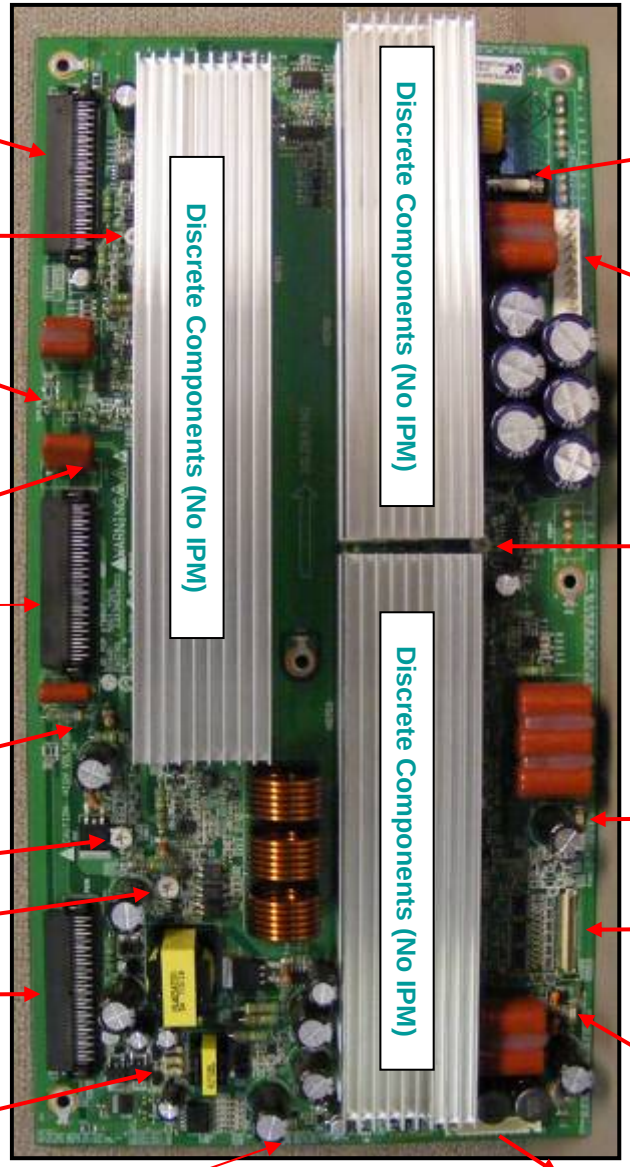
Operating Voltages

SMPS Supplied	VA	VA supplies the Panel Vertical Grid
	VS	VS Supplies the Panel Horizontal Grid
	M5V	5V Supplies Bias to Y-SUS, Z-SUS, Control, and X Boards

Y-SUS Developed	
-VY	-VY Sets the Negative excursion of the Y-SUS Drive Waveform
V SET UP (Ramp)	Ramp UP sets Pitch of the Top Ramp of the Drive Waveform
V Set Dn	V Set Down sets the Pitch of the Bottom Ramp of the Drive Waveform
VSC	VSC (VScan) Set the amplitude of the complex waveform.
15V	15V Used internally and routed out to Control board then to Z-SUS
5V FG	5V FG Routed out to the Y-Drive Board. (Floating Ground 5V)

Y-SUS Board Layout

P206, P207 and P208 provide Logic (Drive) Signals to the Y Drive Boards



P206
To Y-Drive

V SET DN VR 601

This Voltage will read Positive

-VY TP R201

Use right side Of C213 to test Y-SUS signal

P207
To Y-Drive

VSC TP R202

VSC ADJ R502

-Vy ADJ R501

To Y-Drive **P208**

Protecting Floating Gnd Power Supply Pulse

Floating Gnd Gnd	FS502 125V 1.5A
Floating Gnd 15V	FS501 125V 1.5A
Floating Gnd 5V	FS504 125V 1.5A

(All fuses read -90V) from chassis ground

Y Drive TP Bottom Y-Drive Board

Model : PDP 50G1####
Voltage Setting: 5.2V
Va : 65 Vs : 193
N.A. / -195 / 135 / N.A. / 100

-Vy Vsc

Voltage Label Related to Y-SUS

FS201 (Vs)
Glass 250V 4A

P209
VS and VA Input from the SMPS

V SET UP VR 302

FS202 (5V) 125V 10A

P102
Logic Signals from the Control Board

FS701 (Va) 125V 10A

FS503 (5V) 125V 5A

P210 **15V and Va to Center X Board**

VSC and -VY Adjustments

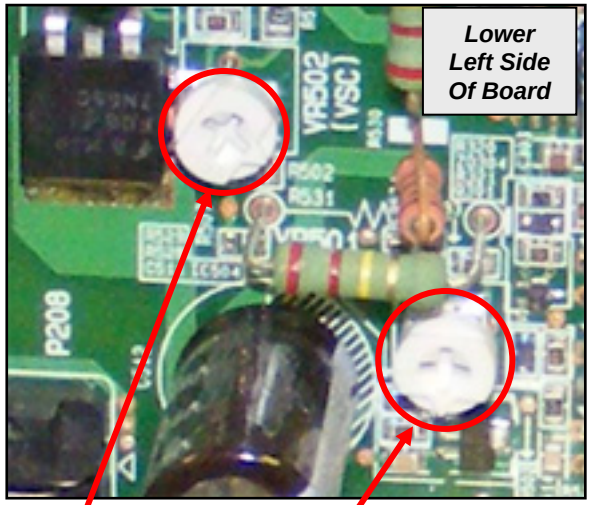
All Adjustments in White Wash

Y-SUSTAIN ADJUSTMENT DETAILS (Va / Vs adjustments should already be completed)

Model : PDP 50G1####
Voltage Setting: 5.2V
Va : 65 Vs : 193
N.A. / -195 / 135 / N.A. / 100

-Vy Vsc

These are DC level Voltage Adjustments. Waveform just for reference

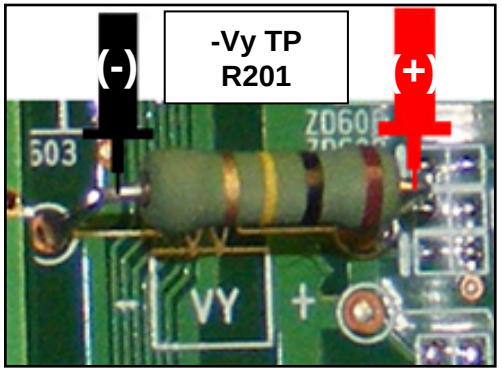


VSC ADJ VR502

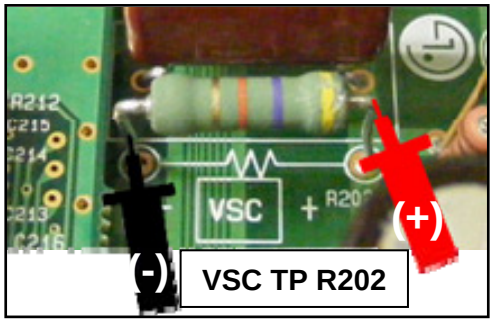
-VY ADJ VR501

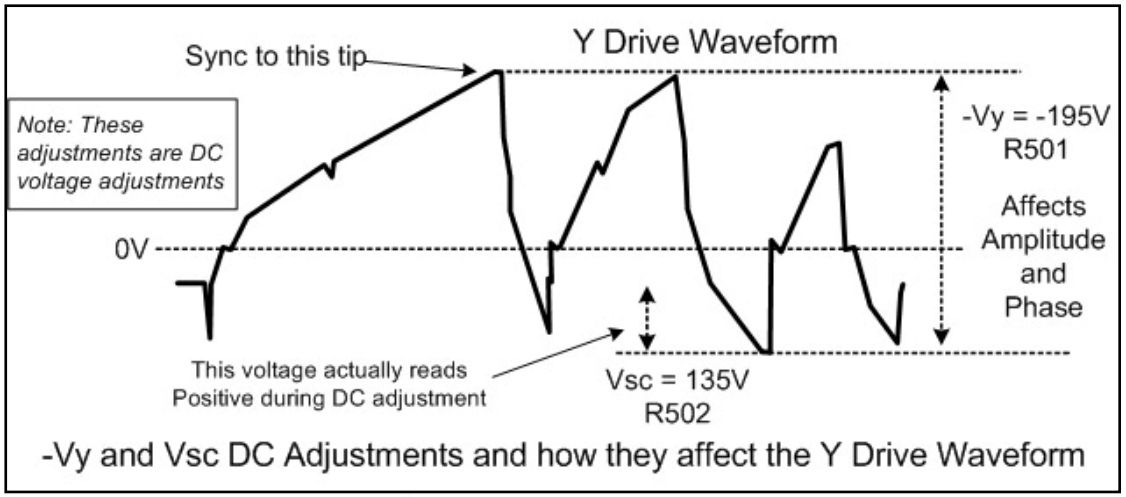
This Voltage will read Positive

Upper Left Side Of Board

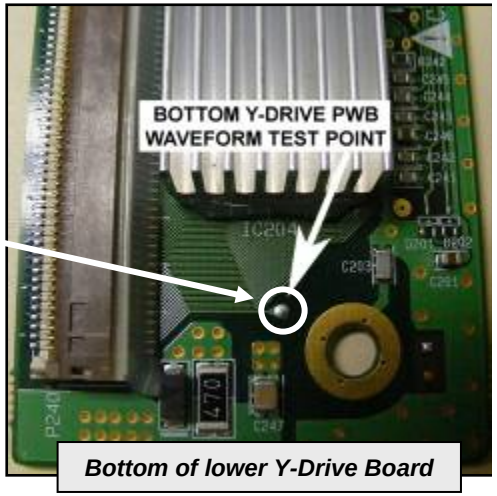


Lower Left Side Of Board





-Vy and Vsc DC Adjustments and how they affect the Y Drive Waveform

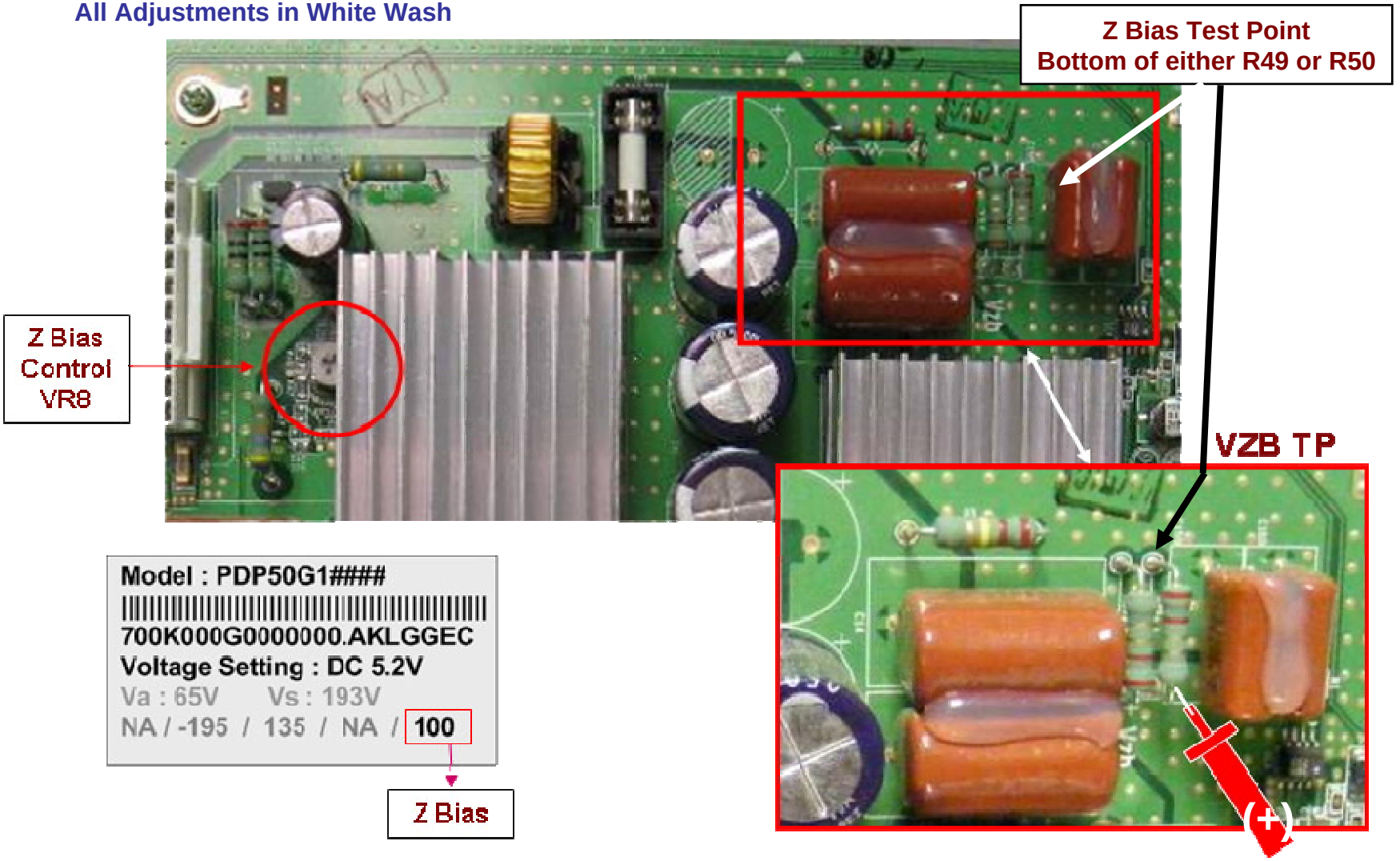


Bottom of lower Y-Drive Board

Z-SUS Adjust

All Adjustments in White Wash

Upper Right Hand Side of the Z-SUS Board



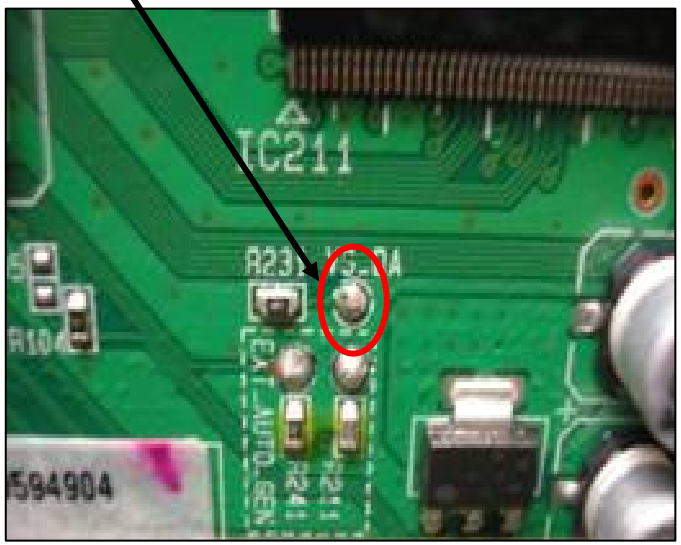
VR 8 adjust Z-Bias. It is measured from VZB Test Point to Chassis Ground,
Adjust to the level indicated on the Voltage Sticker on the upper Left Hand side of the Panel.

External Trigger for Observing the Y-SUS and Z-SUS Output Waveforms

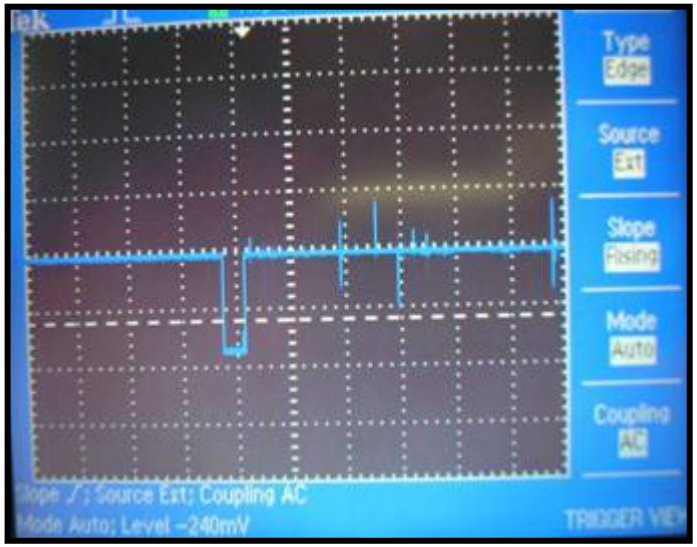
External Triggering of the Oscilloscope allows for a Stable Display of both the Y-SUS and Z-SUS Output Waveforms regardless of how distorted the waveforms may be, allowing the wave shape and phasing to be easily examined.

To set the Oscilloscope up for External Trigger first connect a Scope Probe set on direct to the External Input Jack. Next set the External Jack for AC Coupling either positive or negative slope, use the Trigger Menu on the Scope. Finally you will need to set the Trigger Level press the Trigger View and set the level as indicated in the picture below.

VS_DA Located on the Control Board just above the AUTO Gen Test Points may be used as an external trigger source for locking the waveform on the Oscilloscope



External Trigger Source



Trigger Level Adjust

Observing the Y-Drive Signal for V-Setup

Fig 1 Top: As an example of how to lock in to the Y-Drive Waveform. Figure 1 top shows the signal locked in at 4ms per/div. The signal for Vsetup is outlined within the Waveform

Fig 1 Lower: At 400uSec per/division, the waveform to use for Vsetup Is now isolated.

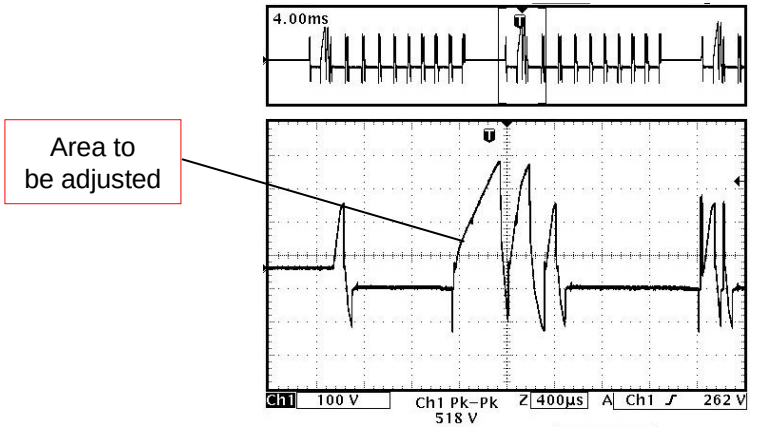


FIG1

Fig 2 Top: At 2ms per/div. the signal for Vsetup is now easier to recognize. It is outlined within the Waveform

Fig 2 Lower: At 100uSec per/division, the waveform to use for Vsetup Is now isolated.

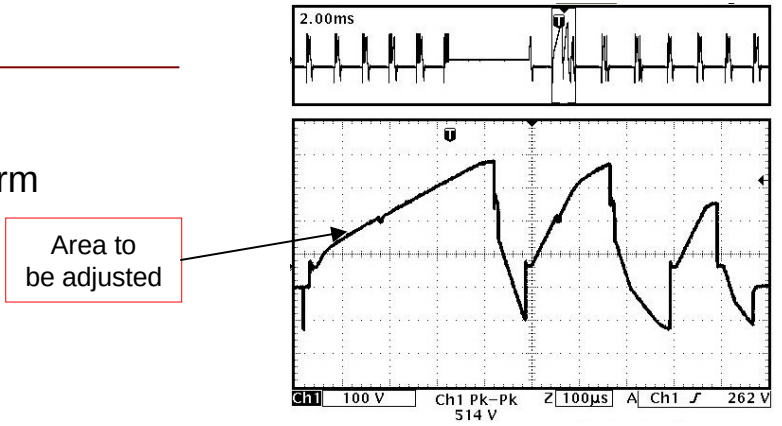


FIG2

Fig 3 Top: At 200uSec per/div. the signal for Vsetup is now clearly visible. It is outlined within the Waveform

Fig 3 Lower: At 20uSec per/division, the adjustment for Vsetup can be made.

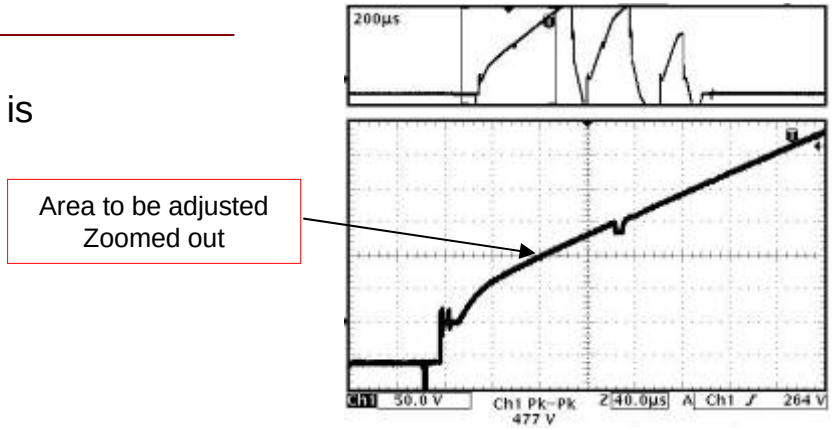


FIG3

Observing the Y-Drive Signal for V-Setdown

Fig 1 Top: As an example of how to lock in to the Y-Drive Waveform. Figure 1 top shows the signal locked in at 4ms per/div. The signal for Vsetdn is outlined within the Waveform.

Fig 1 Lower: At 400uSec per/division, the waveform to use for Vsetdn Is now isolated.

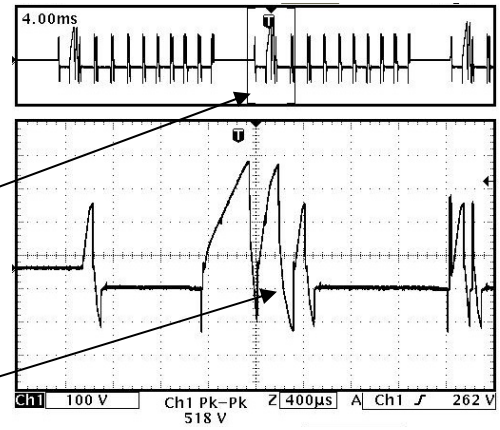


FIG1

Fig 2 Top: At 2ms per/div. the signal for Vsetdn is now easier to recognize. It is outlined within the Waveform

Fig 2 Lower: At 100uSec per/division, the waveform to use for Vsetdn Is now isolated.

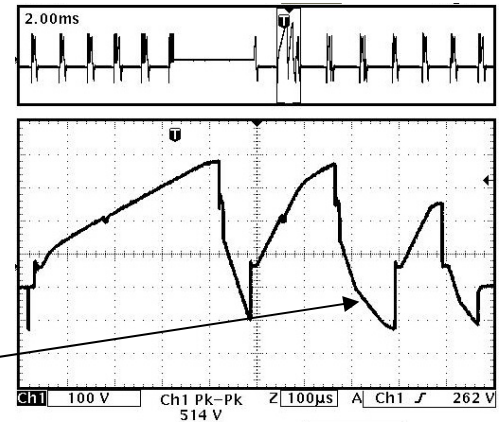


FIG2

Fig 3 Top: At 200uSec per/div. the signal for Vsetdn is now clearly visible. It is outlined within the Waveform

Fig 3 Lower: At 20uSec per/division, the adjustment for Vsetdn can be made.

V SET DOWN set too high can cause shut down. Remove LVDS cable to allow set to remain on and realign Set-Dn

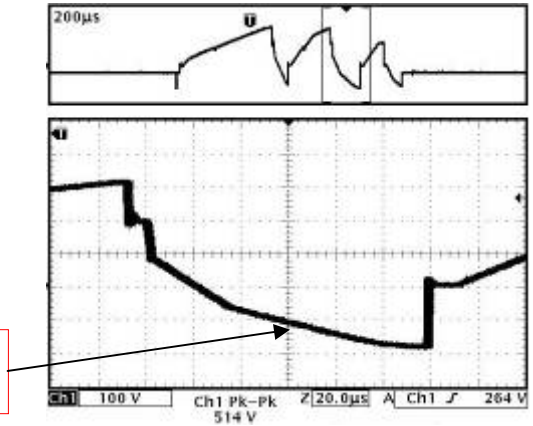
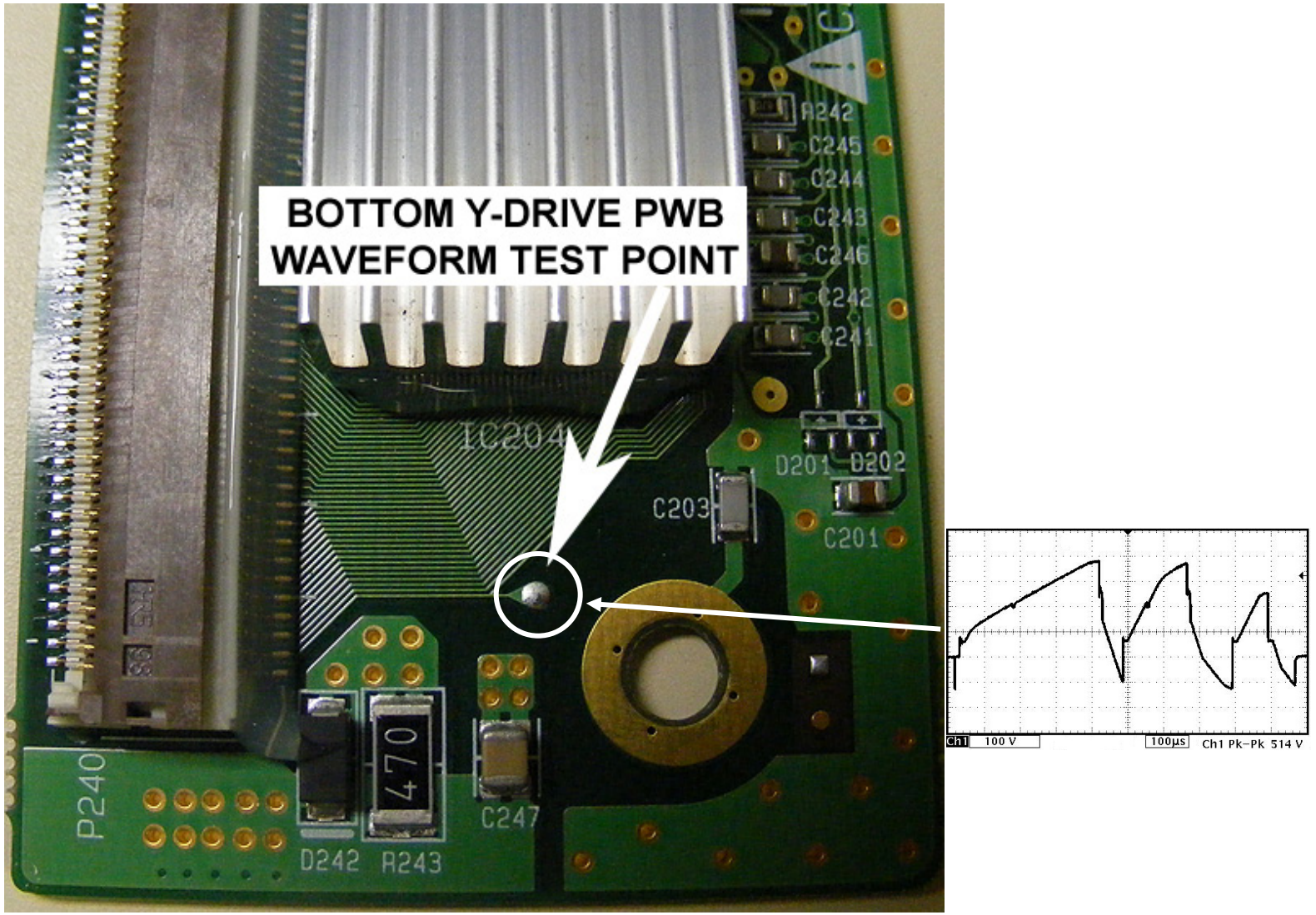


FIG3

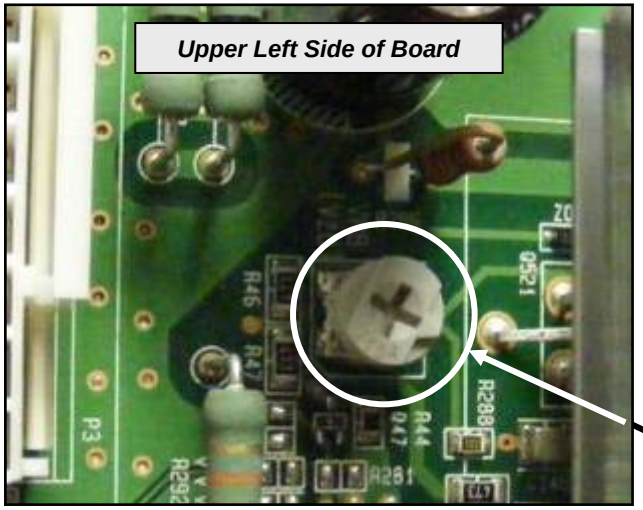
Y-Drive Waveform Test Point (Lower Y Drive Board) Blow Up



Bottom of lower Y-Drive Board

V-Set Up and V-Set Down Adjustments

Observe the Picture while making these adjustments.
Normally, they do not have to be done.
Always adjust if Y-SUS Board Replaced.

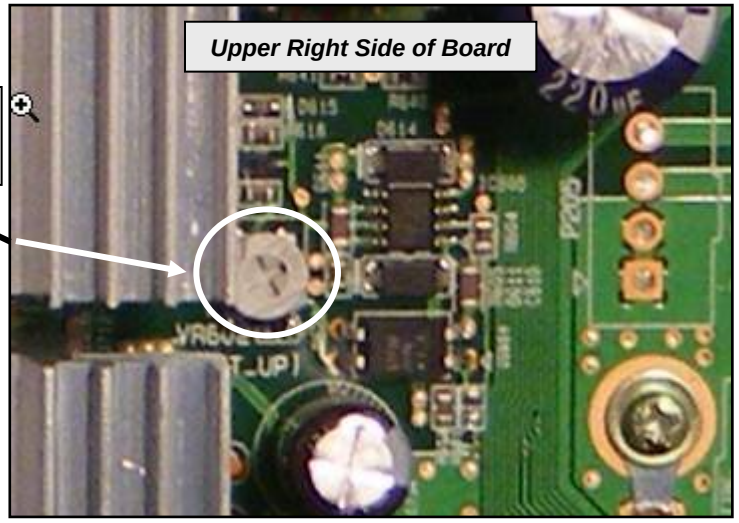


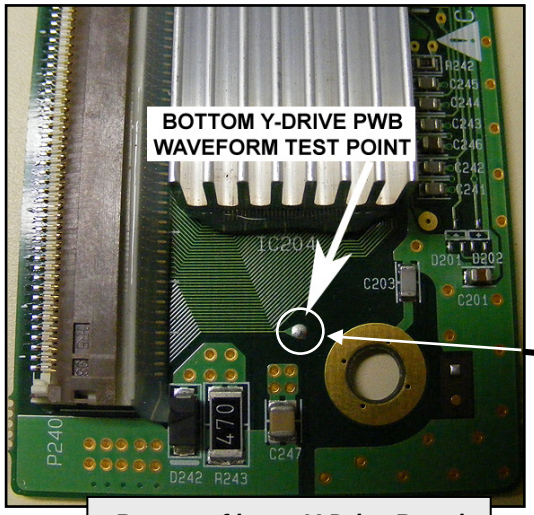
V SET DOWN set too high can cause shut down.

V SET DN VR 601

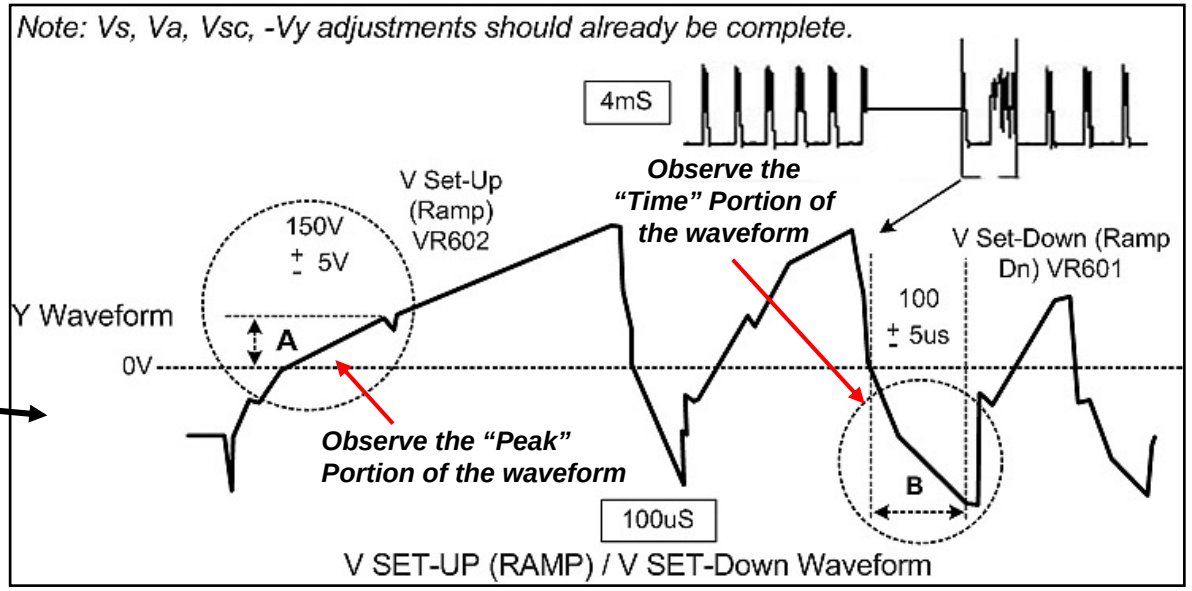
RAMP

V SET UP VR 602

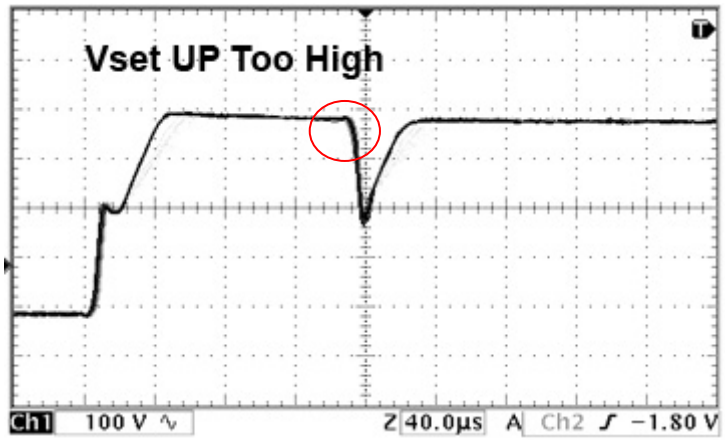


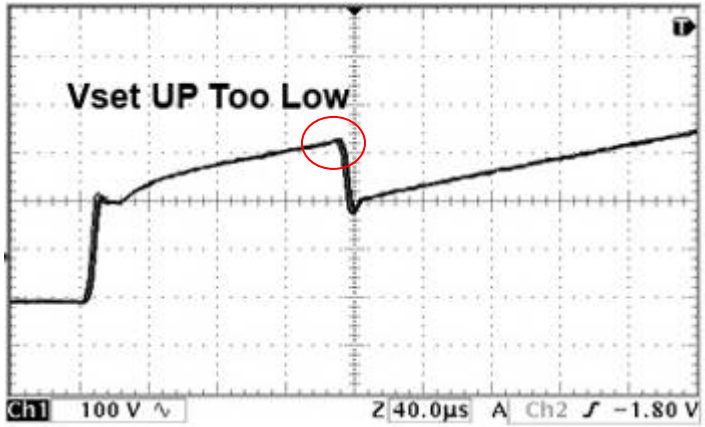


Bottom of lower Y-Drive Board

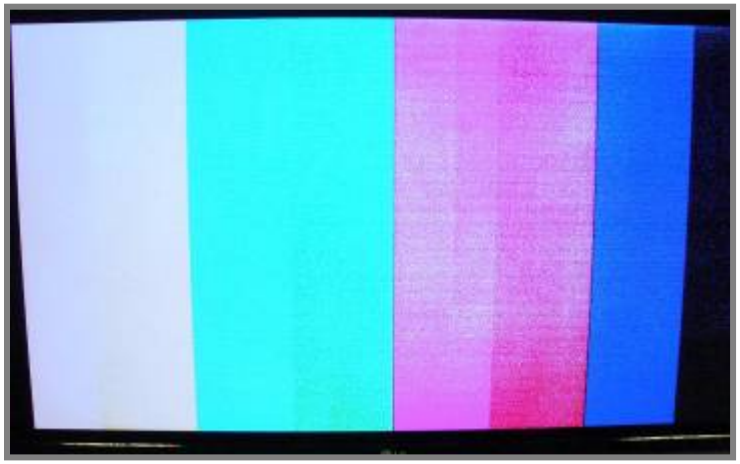


V Set Up Too High or Low

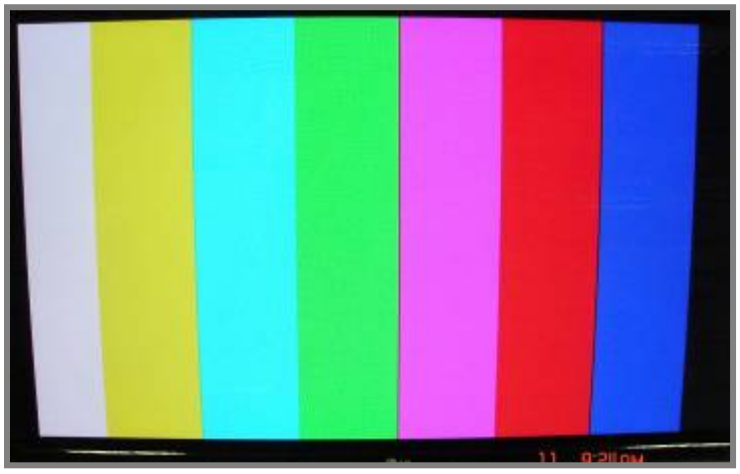




Panel Waveform Adjustment

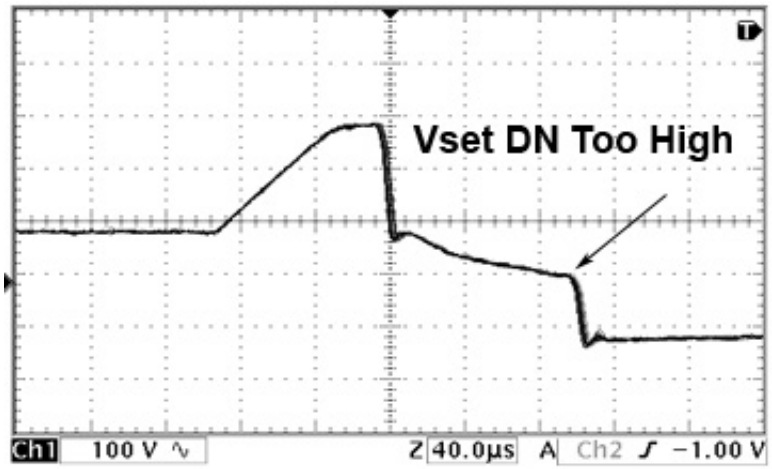


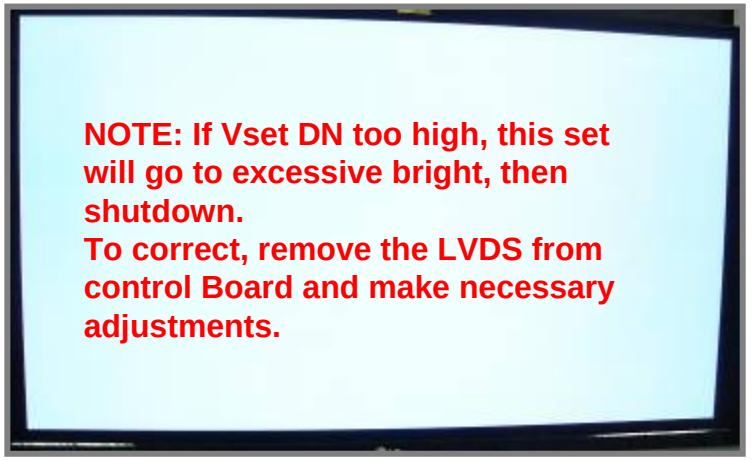
The center begins to wash out and arc due to **Vset UP** Peeking too late and alters the start of the **Vset DN** phase.



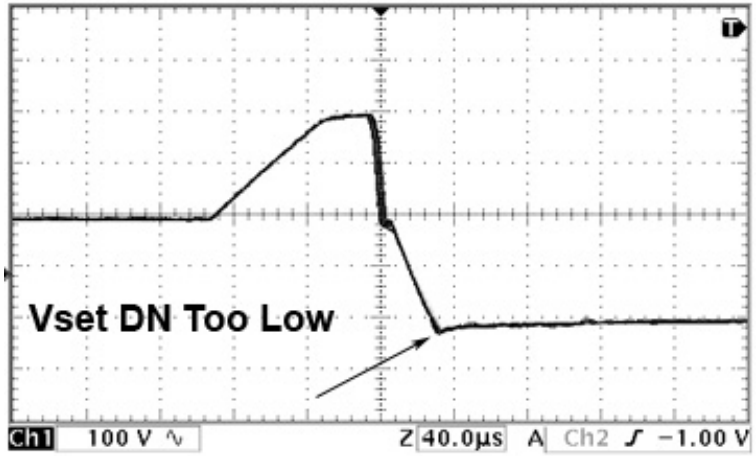
Very little alteration to the picture, the wave form indicates a distorted **Vset UP**. The peek widens due to the **Vset UP** peeking too quickly.

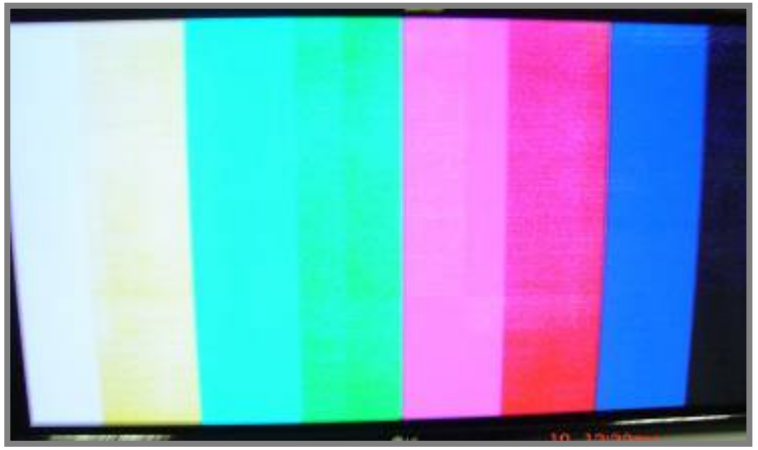
Panel Waveform Adjustment





All of the center washes out due to increased **Vset_DN** time.

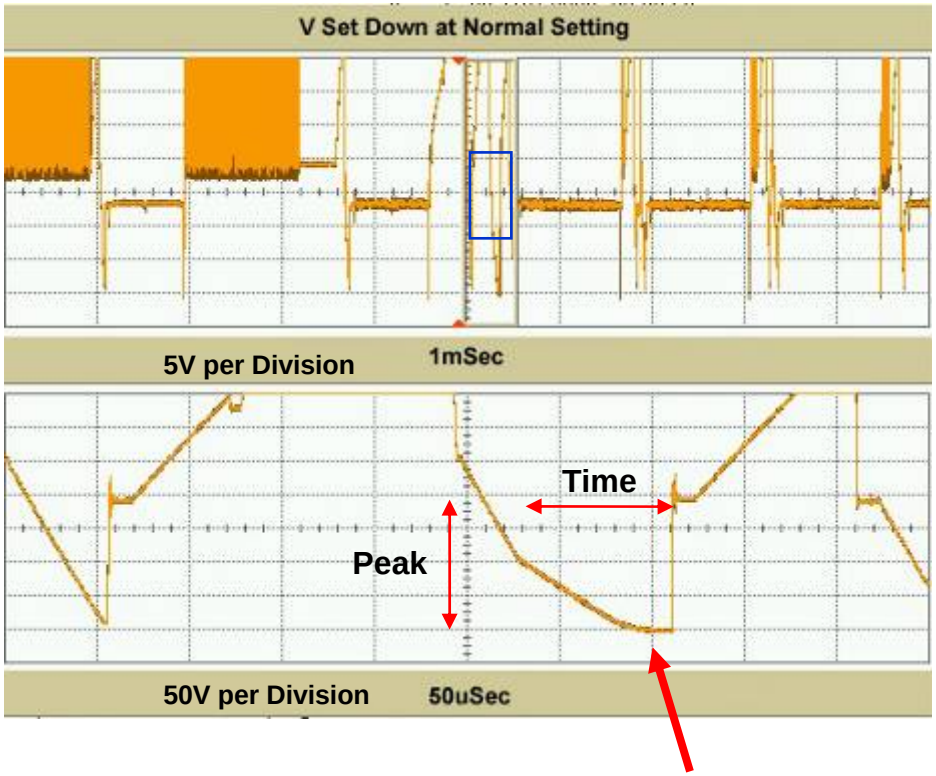




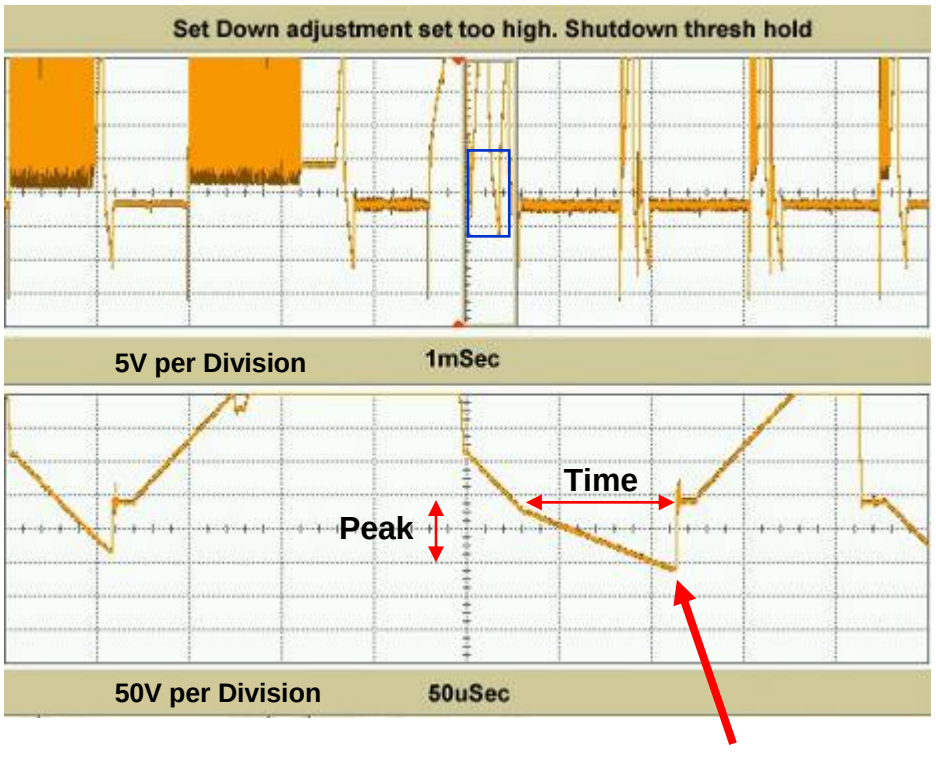
The center begins to wash out and arc due to decreased **Vset DN** time.

V Set Dn Too High Causing Shutdown

GOOD



NO GOOD



The above image is the Set Down signal set for Normal operation at 100uSec

NOTE: If Vset DN too high, this set will go to excessive bright, then shutdown.
To correct, remove the LVDS from Control Board and make necessary adjustments.

The above image is the Set Down signal set to High (Approx. 120uSec) This is the Shutdown Threshold level. Any higher, the set will shut down.

Notice that the amplitude of the Set Down (Bottom portion) peak begins to decrease.

Panel Waveform Adjustment

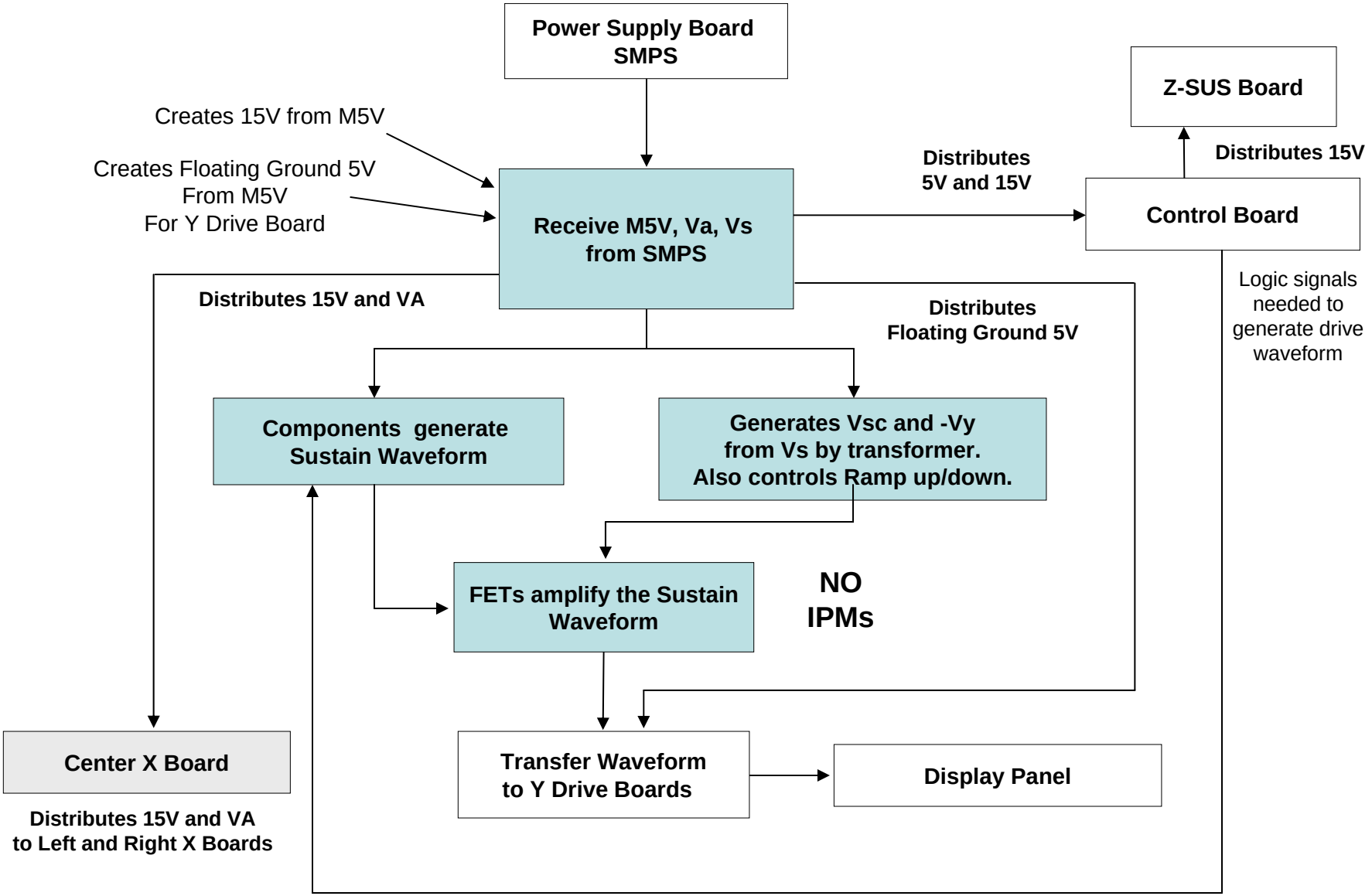
When VSC is too high

Both of these are DC adjustments

When VSC is too low

The image will display some distortion in a quickly changing image.

Y-SUS Block Diagram



Y-SUS P102 Plug Information Test Points 1 through 10

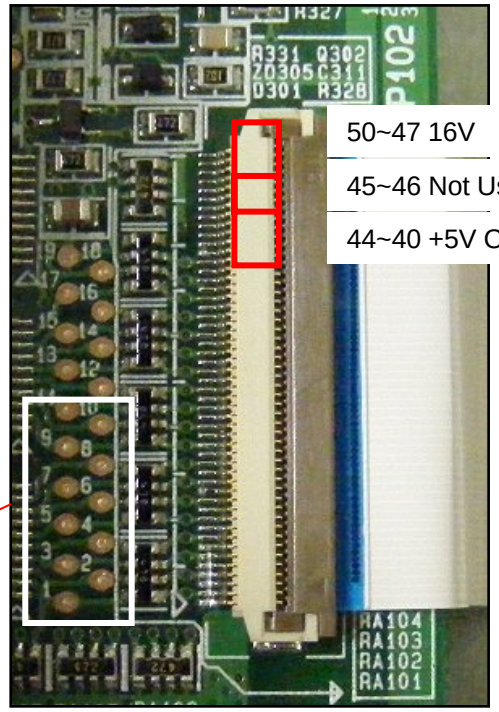
Voltage and Diode Test Measurements for the Y-SUS Board

This Chart relates to the Labeling shown on the silk screening shown on the Control Board

P102 CONNECTOR "Y-SUS Board" to P111 "Control" (1 OF 2)

Pin	Label	STBY	Run	Diode Mode
1	CLK	0V	3.2V	2.87V
2	STB	0V	0.76V	2.87V
3	OSC1	0V	0V	2.87V
4	OSC2	0V	3V	2.87V
5	DATA	0V	0.6V	2.87V
6	SUS_DN	0V	0V	2.87V
7	SUS_UP	0V	2V	2.87V
8	ER_DN	0V	1.2V	2.87V
9	ER_UP	0V	2V	2.87V
10	SET_UP	0V	0.26V	2.87V

Diode Mode readings taken with all connectors removed.



P102 This connector is a little confusing in its labeling.

This is a 50 Pin Connector. Pin 1 here is Pin 50 on Control Board.

Example: Labels are on Control Board silk screening.

However, this connector has many more pins than shown.

In other words, there is a ground between each pin.

Roughly the first 39 pins dedicated to Y-SUS.

Pins 40~44 are 5V B+ to the Control Board.

Pins 45~46 are not used.

Pins 47~50 is 16V output. To Control board then to Z-SUS.

Y-SUS P102 Plug Information Test Points 11 through 19

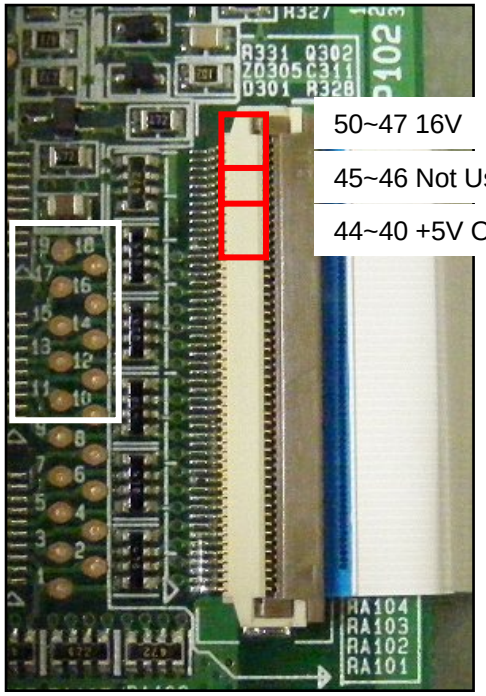
Voltage and Diode Test Measurements for the Y-SUS Board

This Chart relates to the Labeling shown on the silk screening shown on the Control Board

P102 CONNECTOR "Y-SUS Board" to P111 "Control" (2 OF 2)

Pin	Label	STBY	Run	Diode Mode
11	SET_DN	0V	0.2V	2.87V
12	PASS_TOP	0V	0.2V	2.87V
13	DELTA_VY	0V	0.16V	2.87V
14	DET_LEVEL	0V	0V	2.87V
15	SLOPE_KEY	0V	0V	2.87V
16	SET_UP	0V	1.9V	2.87V
17	SET_DN	0V	1.4V	2.87V
18	X_ER	0V	2.9V	2.87V
19	Y_ENABLE	0V	0.6V	2.87V

Diode Mode readings taken with all connectors removed.



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Pins 40~44 are 5V B+ to the Control Board.

Pins 45~46 are not used.

Pins 47~50 is 16V output. To Control board then to Z-SUS.

Y-SUS P209 Plug Information

Voltage and Diode Test Measurements for the Y-SUS Board

P209 CONNECTOR "Y-SUS" to P801 "Power Supply Board"

Pin	Label	STBY	Run	Diode Mode
1	Vs	0V	192V	OL
2	Vs	0V	192V	OL
3	nc	nc	nc	nc
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd
6	Va	0V	65V	OL
7	Va	0V	65V	OL
8	Gnd	Gnd	Gnd	Gnd
9	M5V	0V	5V	0.897V
10	M5V	0V	5V	0.897V

Diode Mode readings taken with all connectors removed.

Y-SUS P210 Plug Information

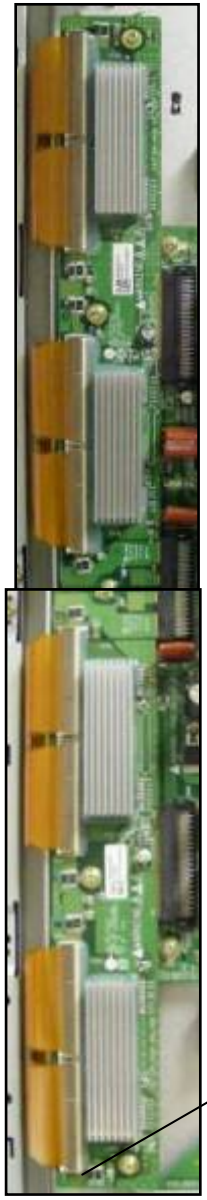
Voltage and Diode Test Measurements for the Y-SUS Board

P210 CONNECTOR "Y-SUS Board" to P242 "X-Drive Center"

Pin	Label	STBY	Run	Diode Mode
1	Va_C	0V	65V	OL
2	Va_C	0V	65V	OL
3	VPP_Out_XR	0V	62.4V	OL
4	VPP_Out_XR	0V	62.4V	OL
5	VPP_Out_XL	0V	62.3V	OL
6	VPP_Out_XL	0V	62.3V	OL
7	VPP_Out	0V	63.3V	OL
8	VPP_Out	0V	63.3V	OL
9	Gnd	Gnd	Gnd	Gnd
10	Gnd	Gnd	Gnd	Gnd
11	+15V	0V	15.9V	0.95V
12	+15V	0V	15.9V	0.95V

Diode Mode readings taken with all connectors removed.

Y DRIVE BOARD SECTION



Y-Drive Board works as a path supplying the Sustain and Reset waveforms which are made in the Y-SUSTAIN B/D and sent to the Panel through SCAN DRIVER IC's.

The Y Drive Boards supply a waveform which selects the horizontal electrodes sequentially.

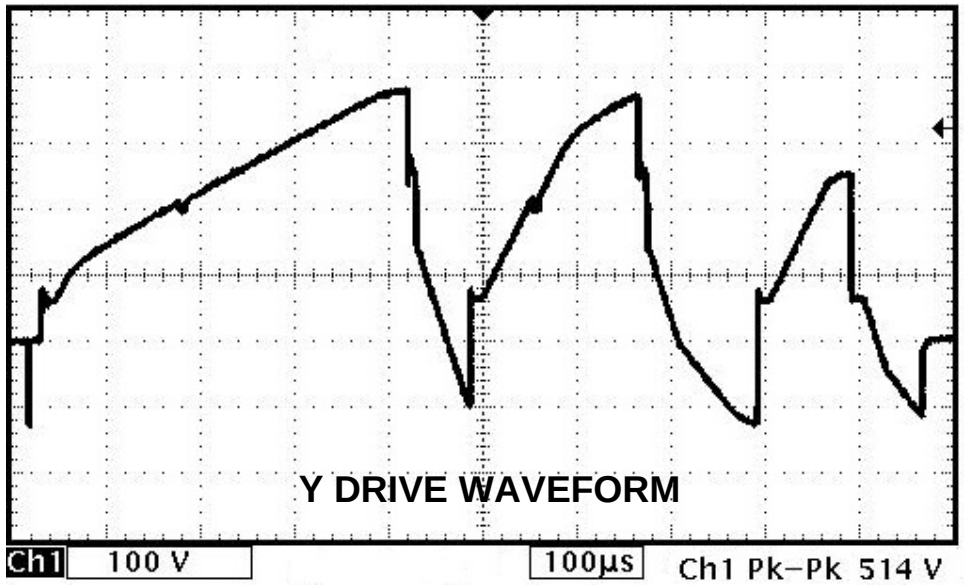
*** 50PG20 uses 8 DRIVER ICs on 2 Boards (TOP, BOTTOM: 4 each)**

50G1 Panel has 768 Vertical lines of resolution (Horizontal Grids determine V Resolution)

4 Ribbons (Tabs) separated into 2 = 192 grids per tab.

8 Ribbon inputs to 4 Tabs = 96 lines per ribbon input

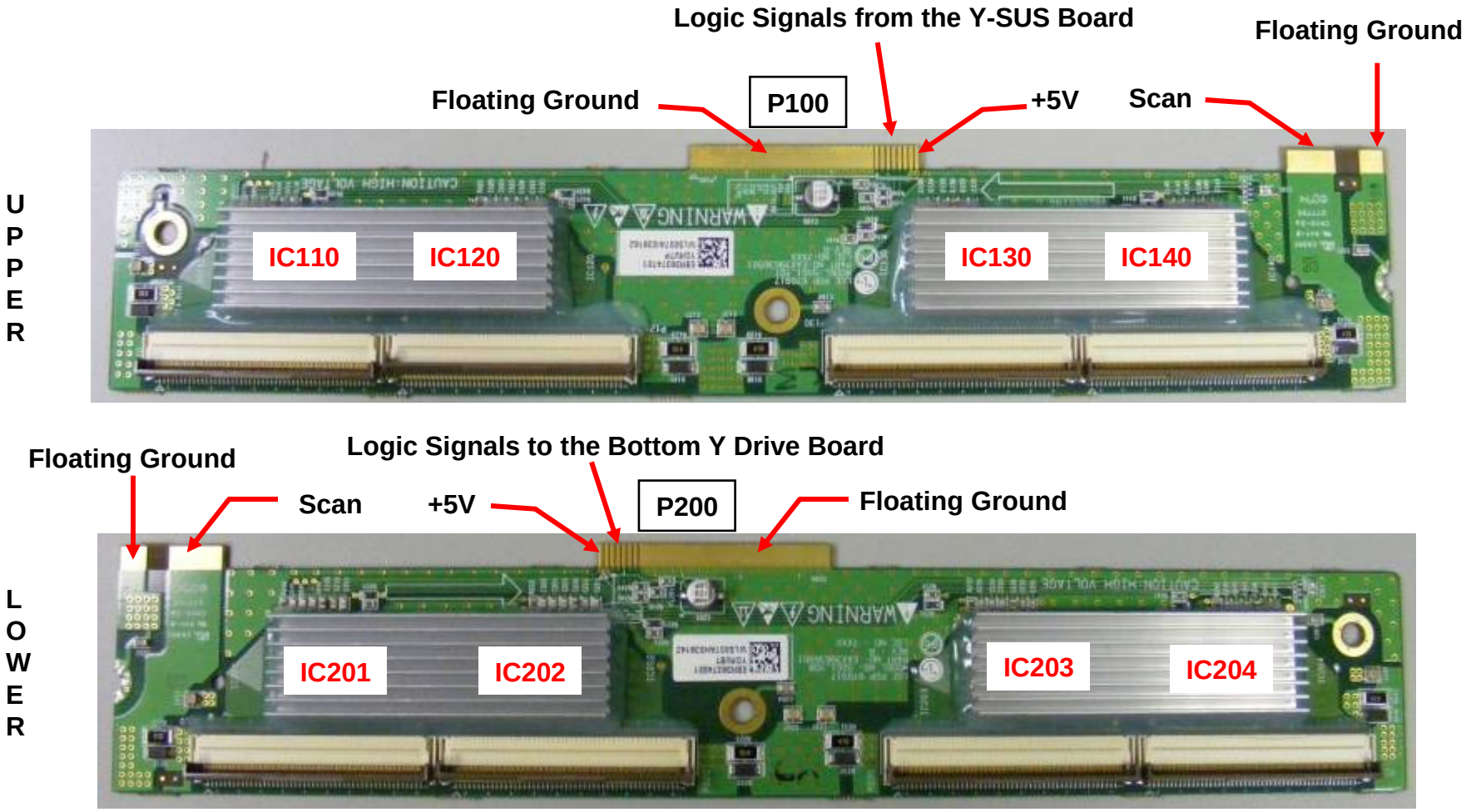
2 Buffers per Ribbon input = 96 lines per ribbon input



Y DRIVE WAVEFORM

Y Drive Board Layout

5 Volts (Floating Ground) 5VFG and Logic Signals from Y-SUS Board are supplied to the Top Drive Board on Connector P100.
5 Volts (Floating Ground) 5VFG input also enters the Bottom Y Drive Board at P200.



Y Drive to Flexible Ribbon (Panel)

To remove the Ribbon Cable from the connector first carefully lift the Locking Tab from the back and tilt it forward (lift from the outside edge as shown in Fig 1).
Lift up the entire Ribbon Cable gently to release the Tabs on each end.
Gently slide the Ribbon Cable free from the connector.

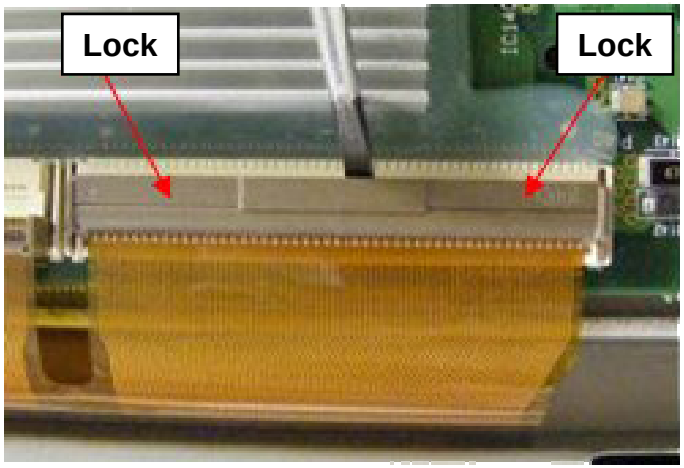


Fig 1

Fig 2

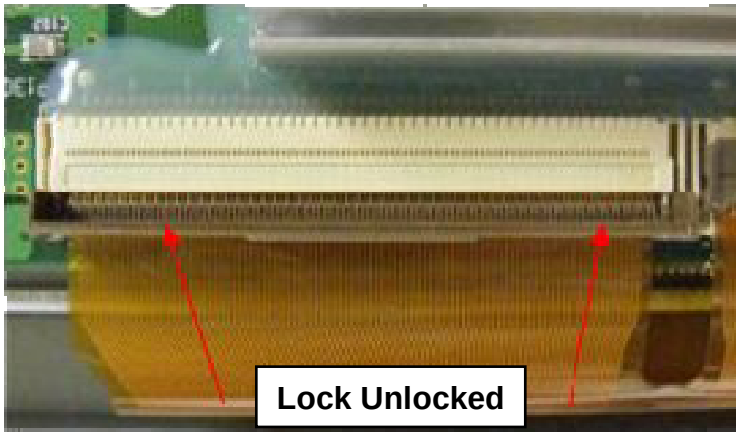


Fig 3

To reinstall the Ribbon Cable carefully slide it back into the slot see (Fig 2), be sure the Tab is seated securely and press the Locking Tab back to the locked position see (Fig 3).

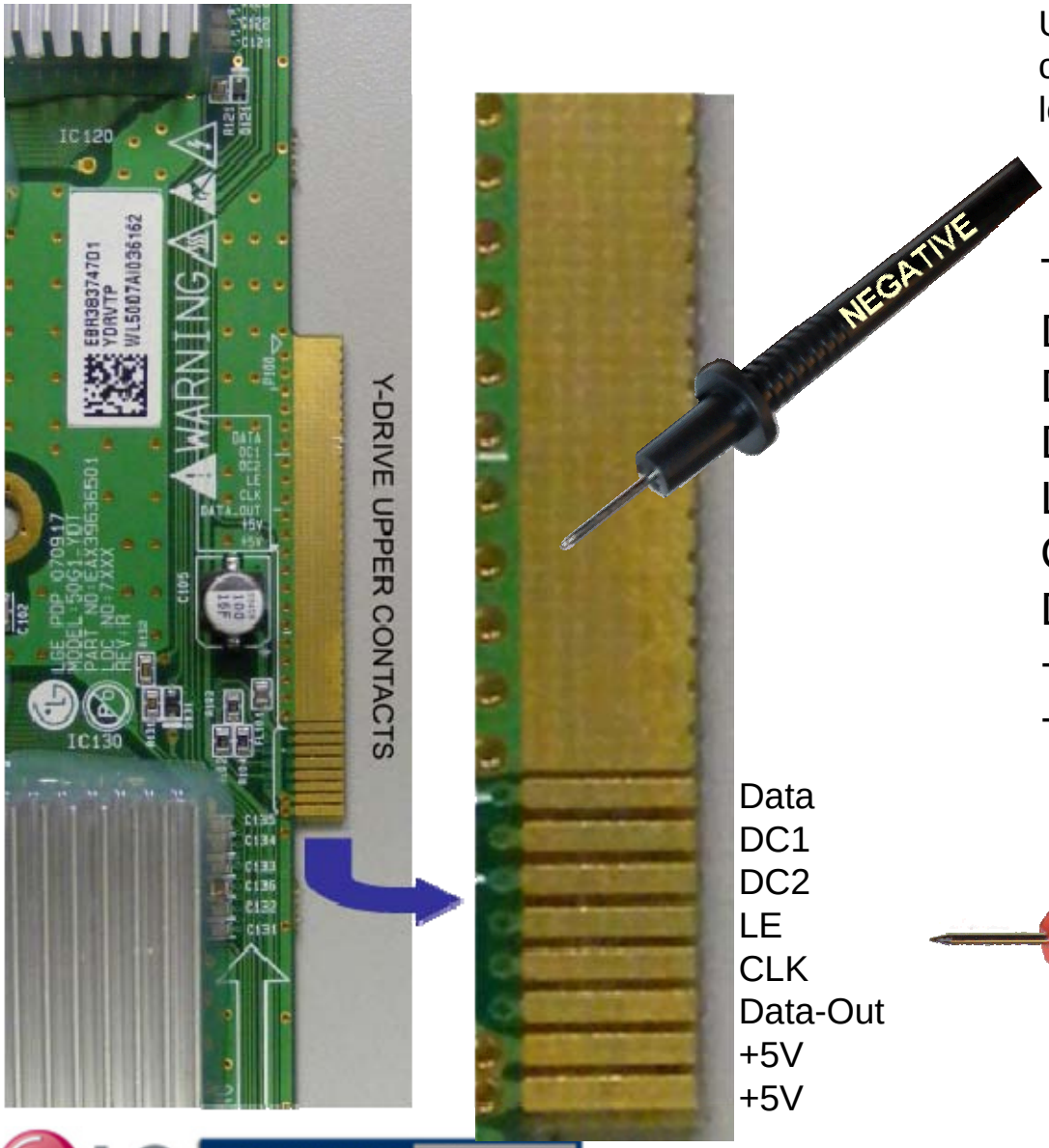
Y Drive Flexible Ribbon Incorrectly Seated

The Ribbon Cable is clearly improperly seated into the connector. You can tell by observing the linearity.

Note the cable is crooked. In this case the Tab on the Ribbon cable was improperly seated at the bottom. This can cause bars, lines, intermittent lines abnormalities in the picture.

Remove the ribbon cable and re-seat it correctly.

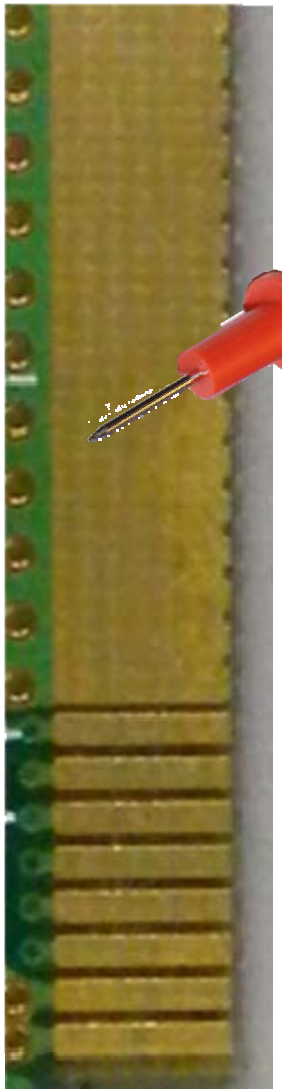
Y Drive Upper Troubleshooting



Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.

TEST POINT	READING
Data	Open
DC1	Open
DC2	Open
LE	Open
CLK	Open
Data-Out	Open
+5V	Open
+5V	Open

Y Drive Upper Troubleshooting

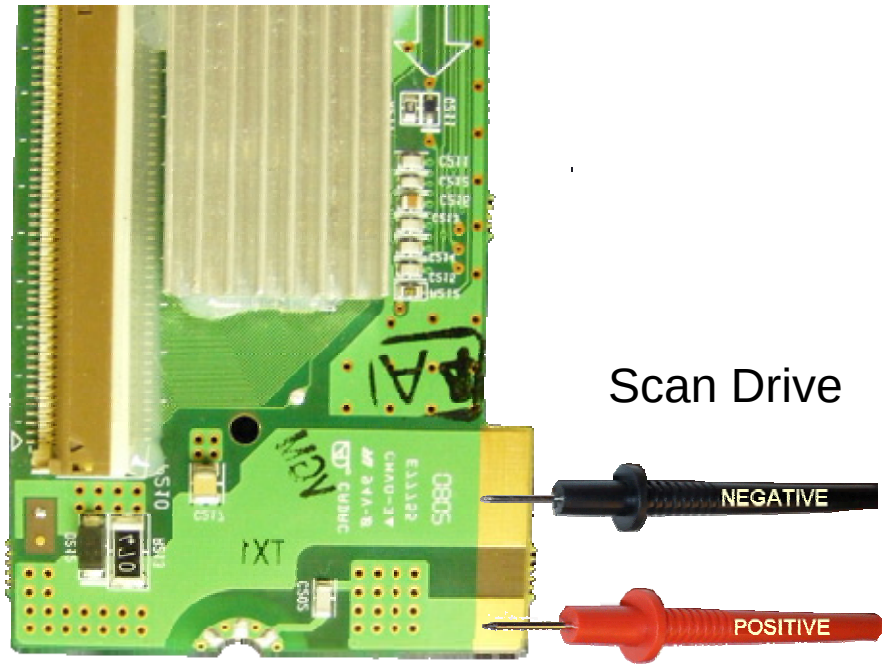


Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.

TEST POINT	READING
Data	.78 V
DC1	.63 V
DC2	.63 V
LE	.63 V
CLK	.63 V
Data-Out	.73V
+5V	.53V
+5V	.53V

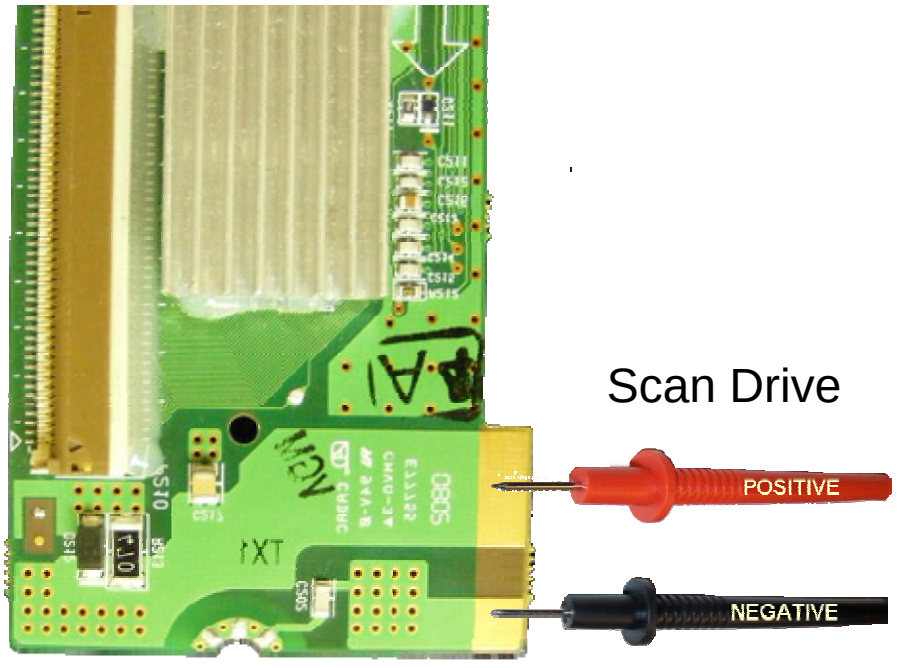
Y Drive Upper Troubleshooting

Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.



Floating Ground

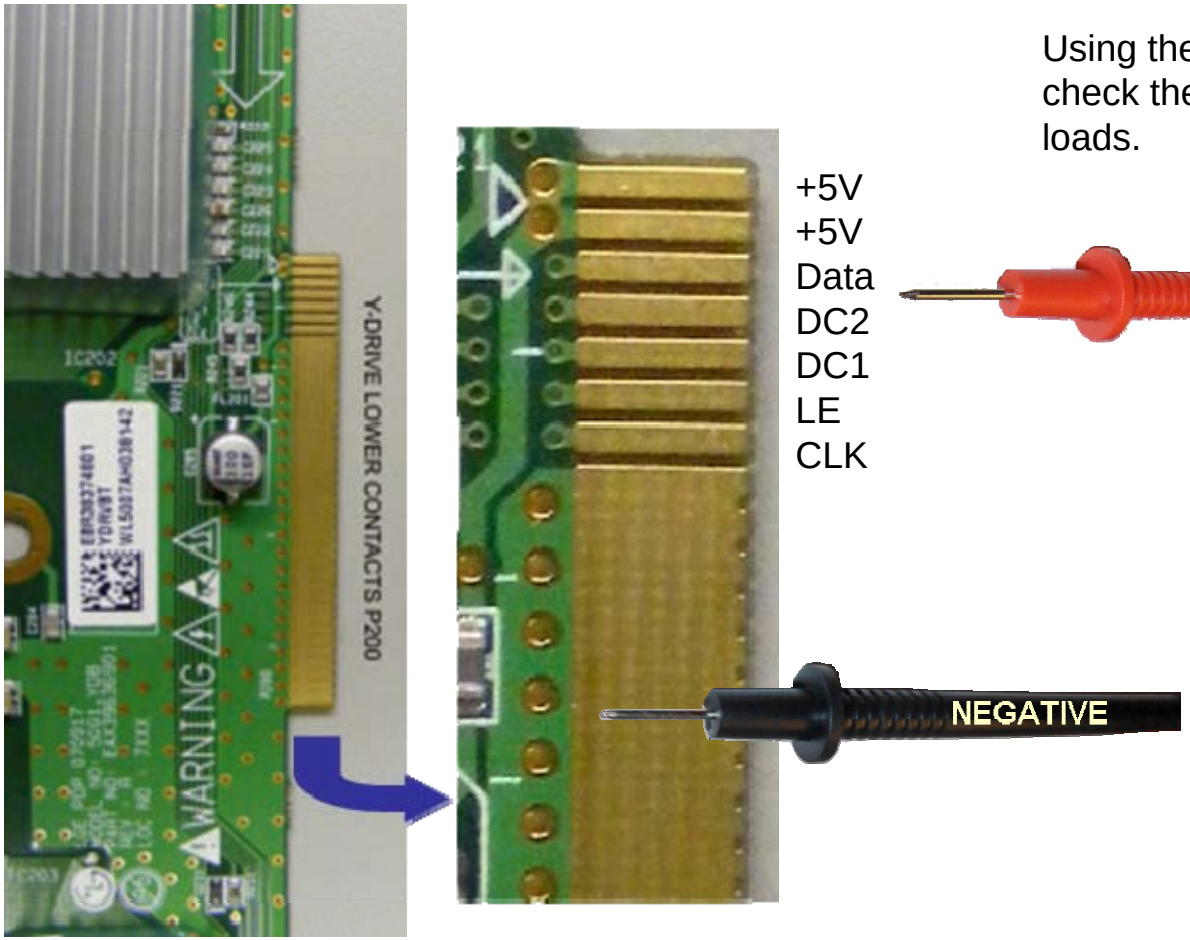
READING
0.659V



Floating Ground

READING
OPEN

Y Drive Lower Troubleshooting

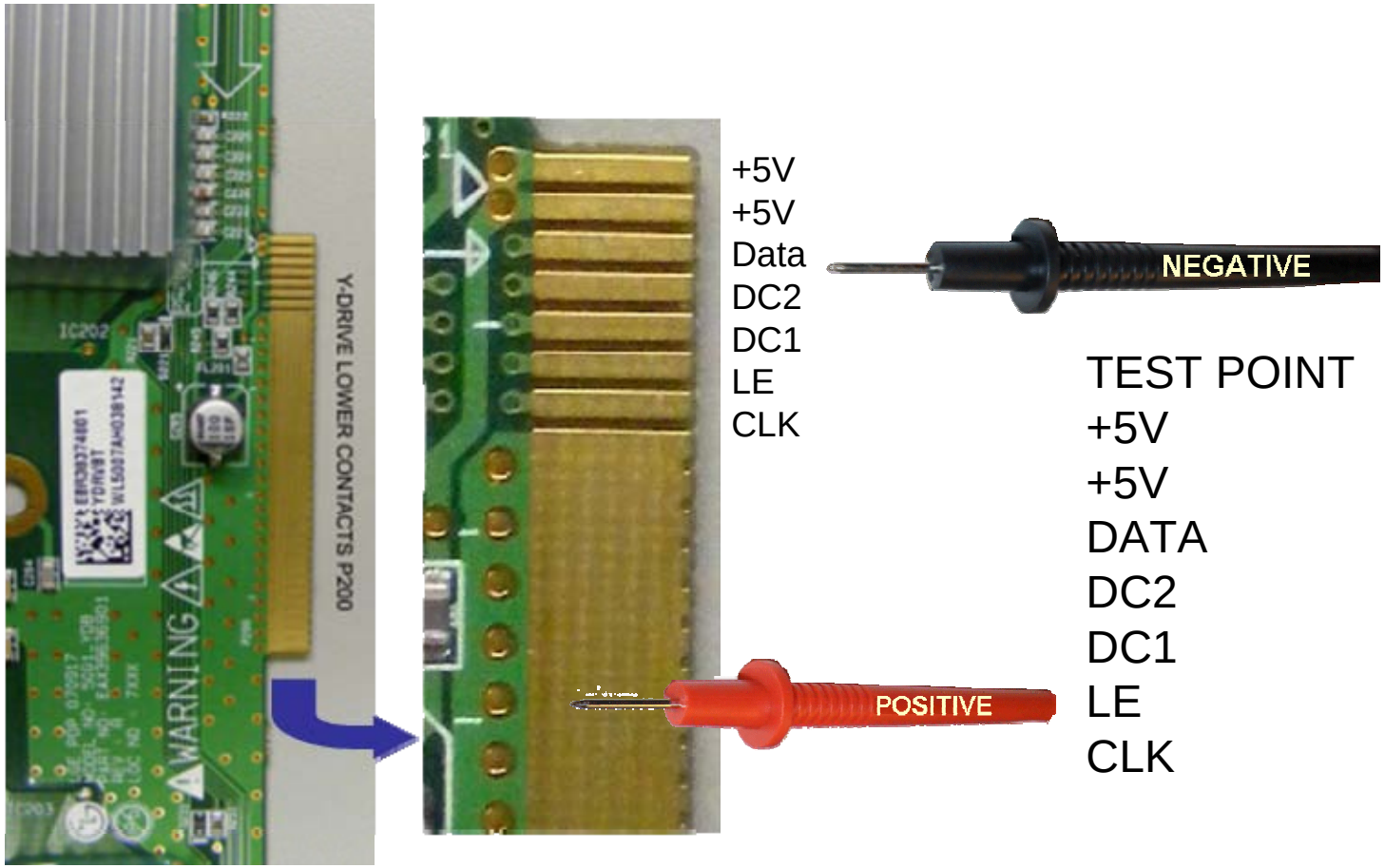


Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.

TEST POINT	READING
+5V	Open
+5V	Open
DATA	Open
DC2	Open
DC1	Open
LE	Open
CLK	Open

Y Drive Lower Troubleshooting

Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.



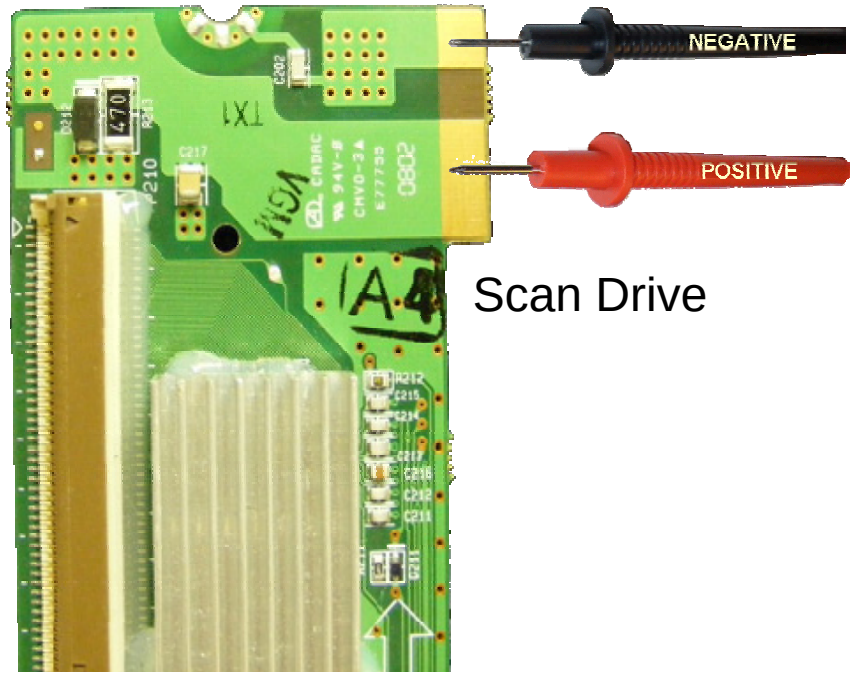
TEST POINT	READING
+5V	.52V
+5V	.52V
DATA	.78V
DC2	.61V
DC1	.62V
LE	.62V
CLK	.62V

Y Drive Lower Troubleshooting

Using the “Diode Test” on the DVM, check the pins for shorts or abnormal loads.

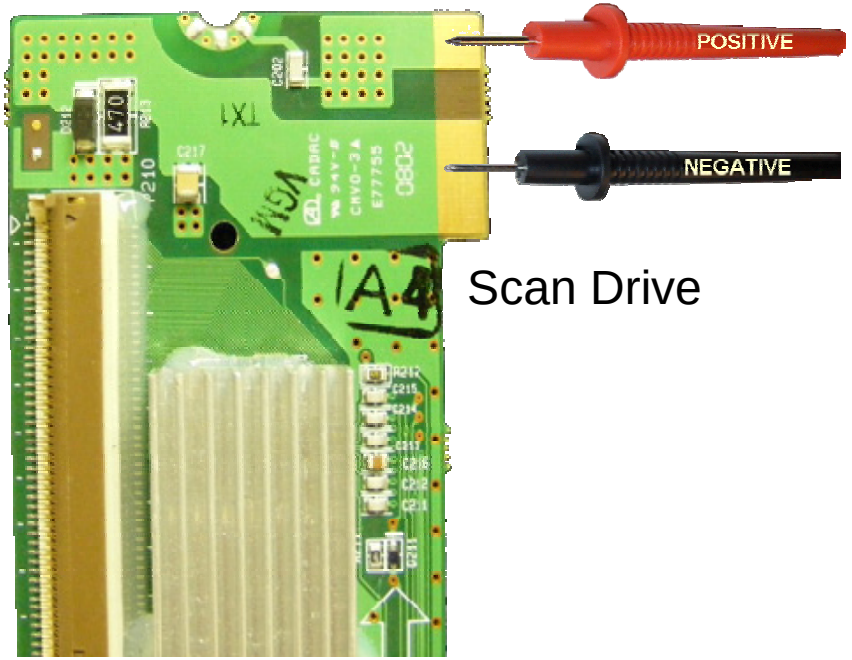
READING OPEN “OPEN”

Floating Ground



READING 0.66V

Floating Ground

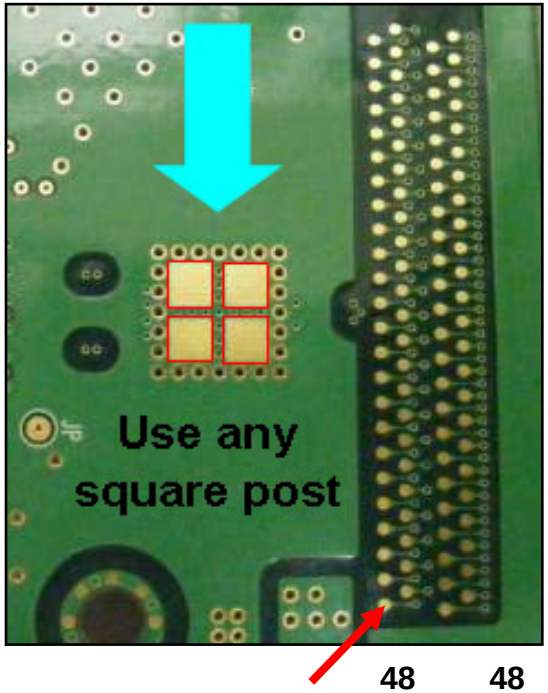


Y Drive Buffer Troubleshooting

YOU CAN CHECK ALL 8 BUFFER ICs USING THIS PROCEDURE (4 per/Board)

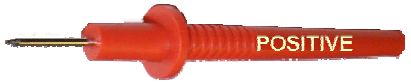
BACK SIDE OF Y-DRIVE Board

Buffer IC (Floating Gnd) **OUTPUT LUGS**



- **Any of these output lugs can be tested.**
- **Look for shorts indicating a defective Buffer IC**

Using the "Diode Test" on the DVM, check the pins for shorts or abnormal loads.



RED LEAD ON BUFFER IC

Indicated by Red outline

BLACK LEAD ON "ANY" OUTPUT LUG. READING 0.73 V

BLACK LEAD ON BUFFER IC

Indicated by Red outline

RED LEAD ON "ANY" OUTPUT LUG. READING "OPEN"

48 + 48
96 per FPC
4 FPC 2 sections per FPC
96 X 8 = 768

Troubleshooting the Z-SUS Board

This Section of the Presentation will cover troubleshooting the Z-SUS Board Assembly. Upon completion of this section the Technician will have a better understanding of the circuit and be able to locate voltage and resistance test points needed for troubleshooting and alignment.

Locations

- DC Voltage and Waveform Test Points
- Z BIAS Alignment
- Resistance Test Points

Operating Voltages

SMPS Supplied — VA (Not used), VS, M5V

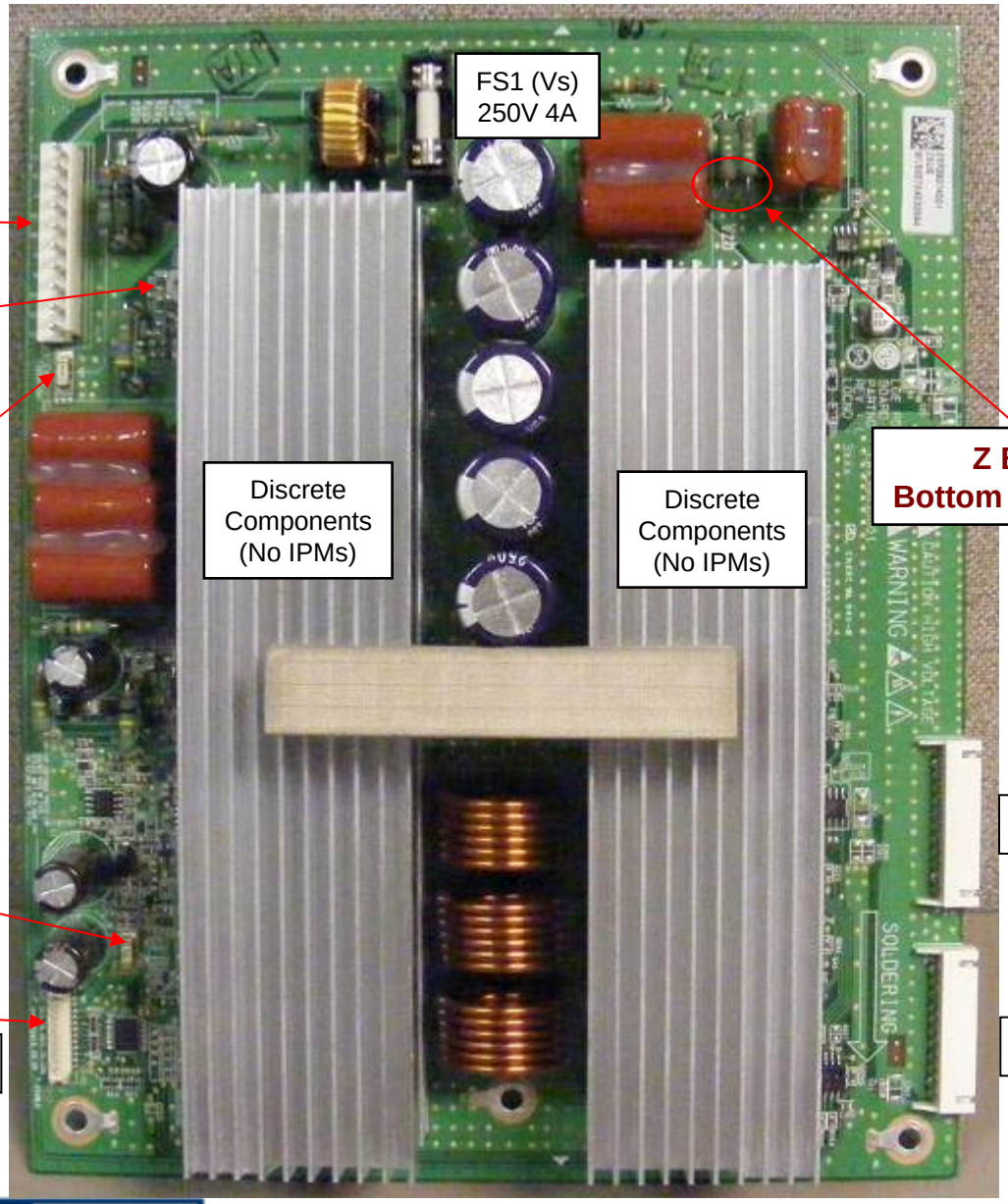
Y-SUS Supplies 16V To Control

Control Supplies 16V To Z-SUS — 16V

Developed on Z-SUS — Z Bias

Z-SUS SECTION

Service Bulletin Related to this Board.
Please read first before ordering. Related to Gender of plugs P4 and P5.



Supply Voltages from the Power Supply, VA, VS, and M5V

P3

Z Bias Control VR8

FS2 (5V)
125V 10A

FS3 (16V)
125V 1.5A

16V and Logic Signals from the Control Board

P2

Model : PDP 50G1####
Voltage Setting: 5.2V
Va : 65 Vs : 193
N.A. / -195 / 135 / N.A. / 100

Z Bias

Voltage Label related to Z-SUS

Z Bias Test Point
Bottom of either R49 or R50

***P4**

To Z-SUB Board

***P5**

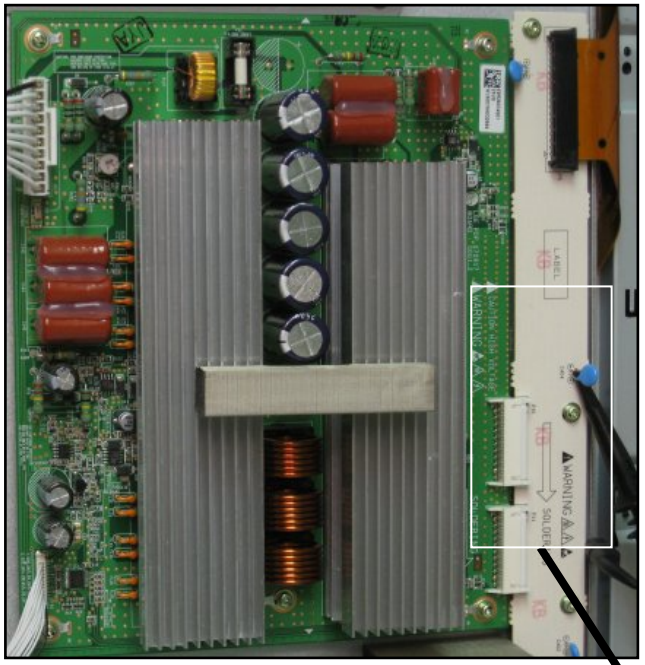
Z-SUS Waveform

The Z-SUS Board provides the amplified SUSTAIN and ERASE PULSE for generating SUSTAIN discharge in the panel. It receives LOGIC signals from the CONTROL Board.

This waveform is supplied to the panel through the Z-SUB board then to the FPC (Flexible Printed Circuit).

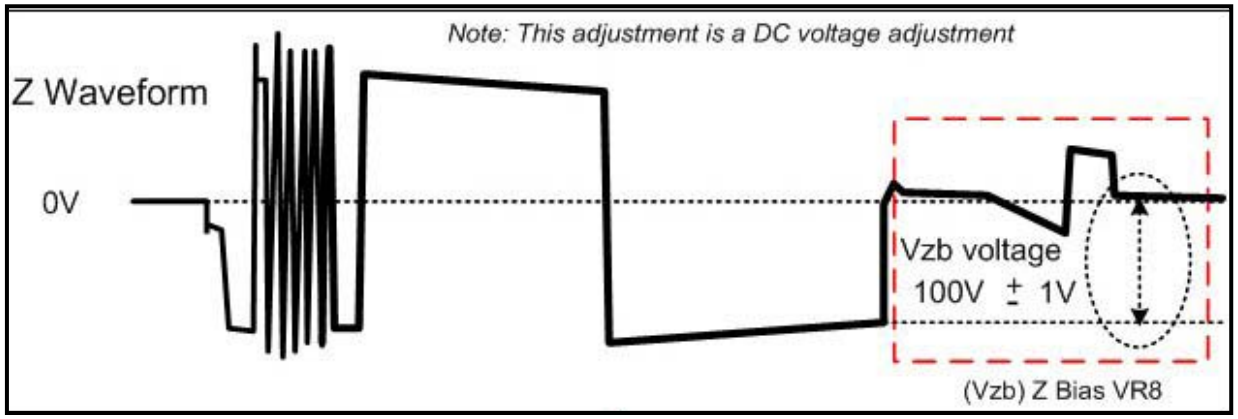
Z-Bias is a "DC" adjustment using a DVM.

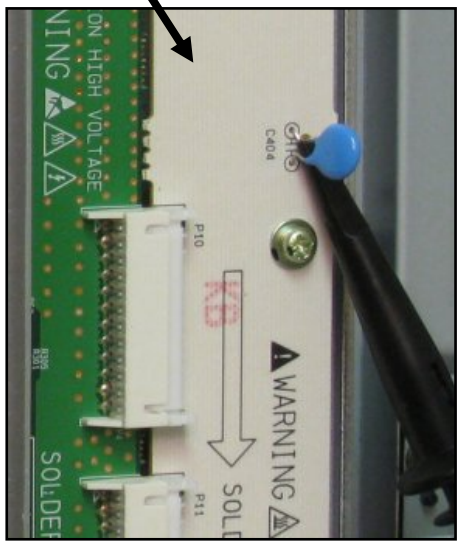
The effects of this adjustment can be observed on the scope looking at the Z-SUS output.



Note: Any cap can be used on the Z-SUB board. Bottom and top caps use bottom leg. Center cap, use upper leg.

Use Caution, legs are close together.



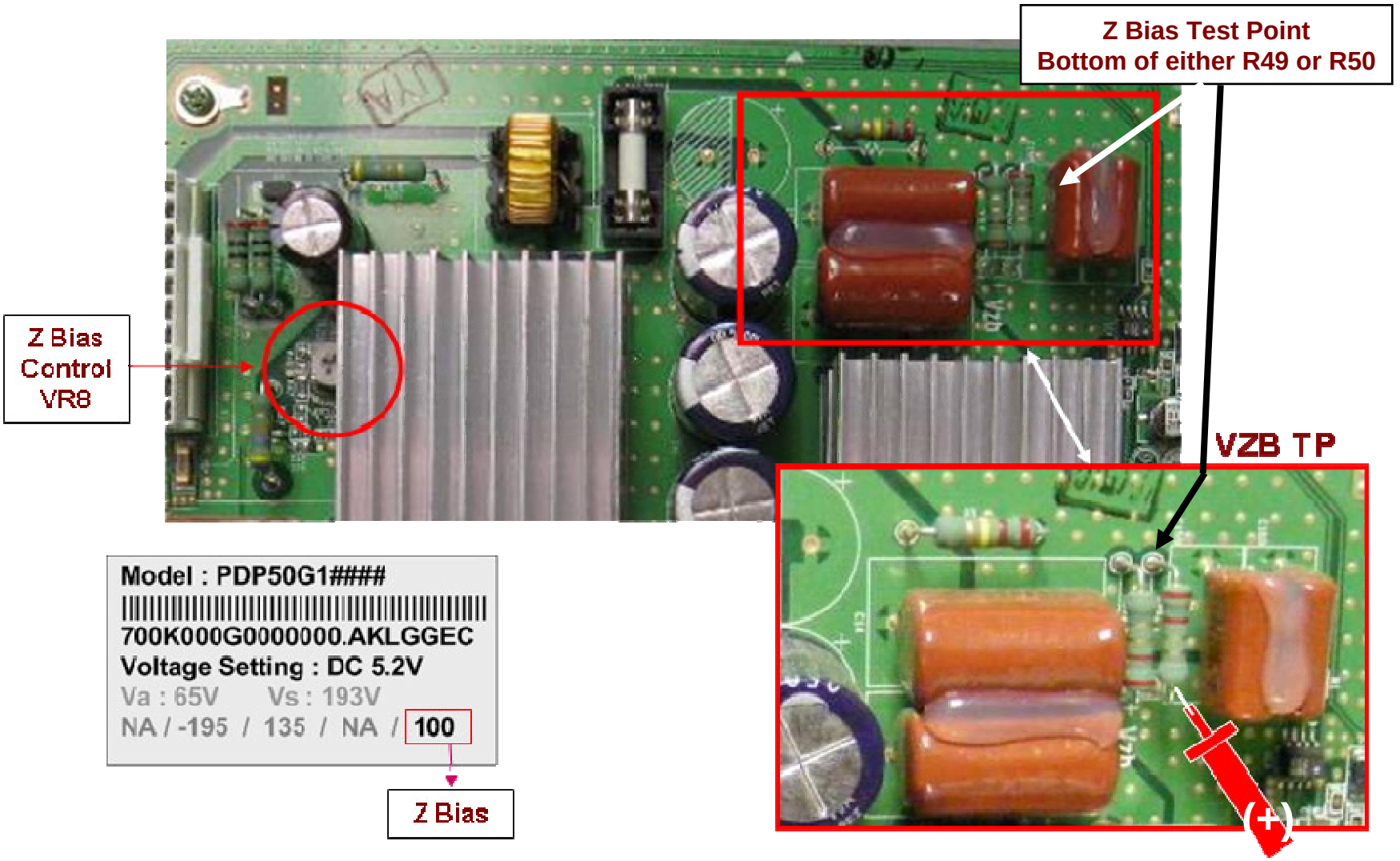


52V AC (RMS) use just as a check to see if Z-SUS is producing a output.

Scope probe connected to C404 top leg.

Z-SUS Adjust

Upper Right Hand Side of the Z-SUS Board



VR 8 adjust Z-Bias. It is measured from VZB Test Point to Chassis Ground,
Adjust to the level indicated on the Voltage Sticker on the upper Left Hand side of the Panel.

Z-SUS Board Understanding

Input Voltages from the SMPS Board

VS VS is input at P3 pins 1 and 2 and supplied to the driver IC circuit.

VA VA is not used on the Z-SUS Board.

M5V 5V in input P3 pins 9 and 10. It is used to Bias the circuits on the Z-SUS Board.

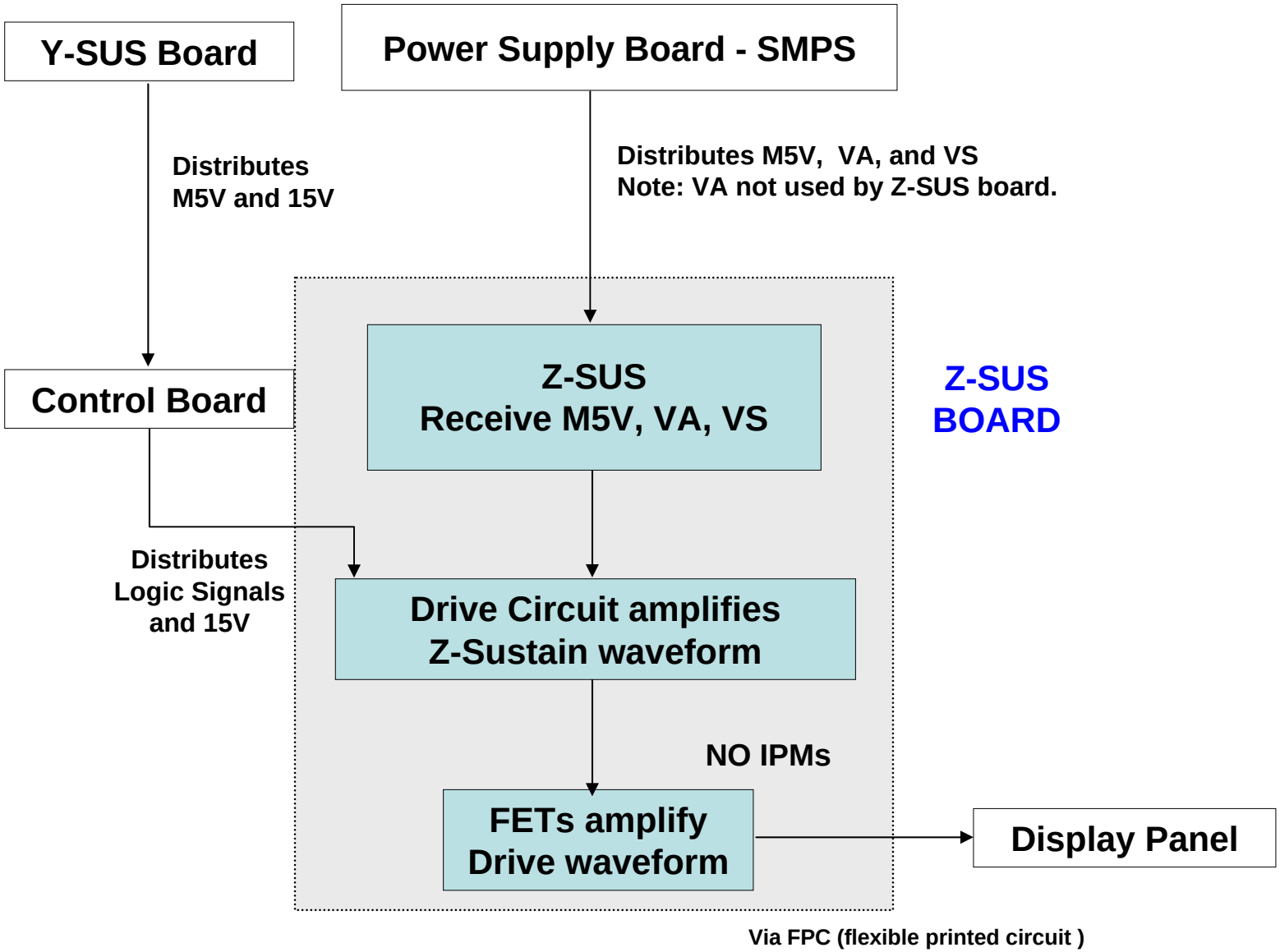
Input Voltages from the Control Board

15.9V 15.9V enters Pins 1 and 2 of P2 connector. Used in the amplification of Z drive waveform.

Voltages Developed on the Z-SUS Board

Z Bias Z Bias Voltage is used to Bias the output circuits driving the Sustain and Erase Pulses, removing previous images from the PDP. Z-bias is measured from the Vzb TP on the Z-SUS Board and adjusted by VZB Adj.

Z-SUS Basic Block Diagram



Z-SUS Noise Dampening Pads (Back Side)

Make sure the replacement Board comes with the noise reducing pads.

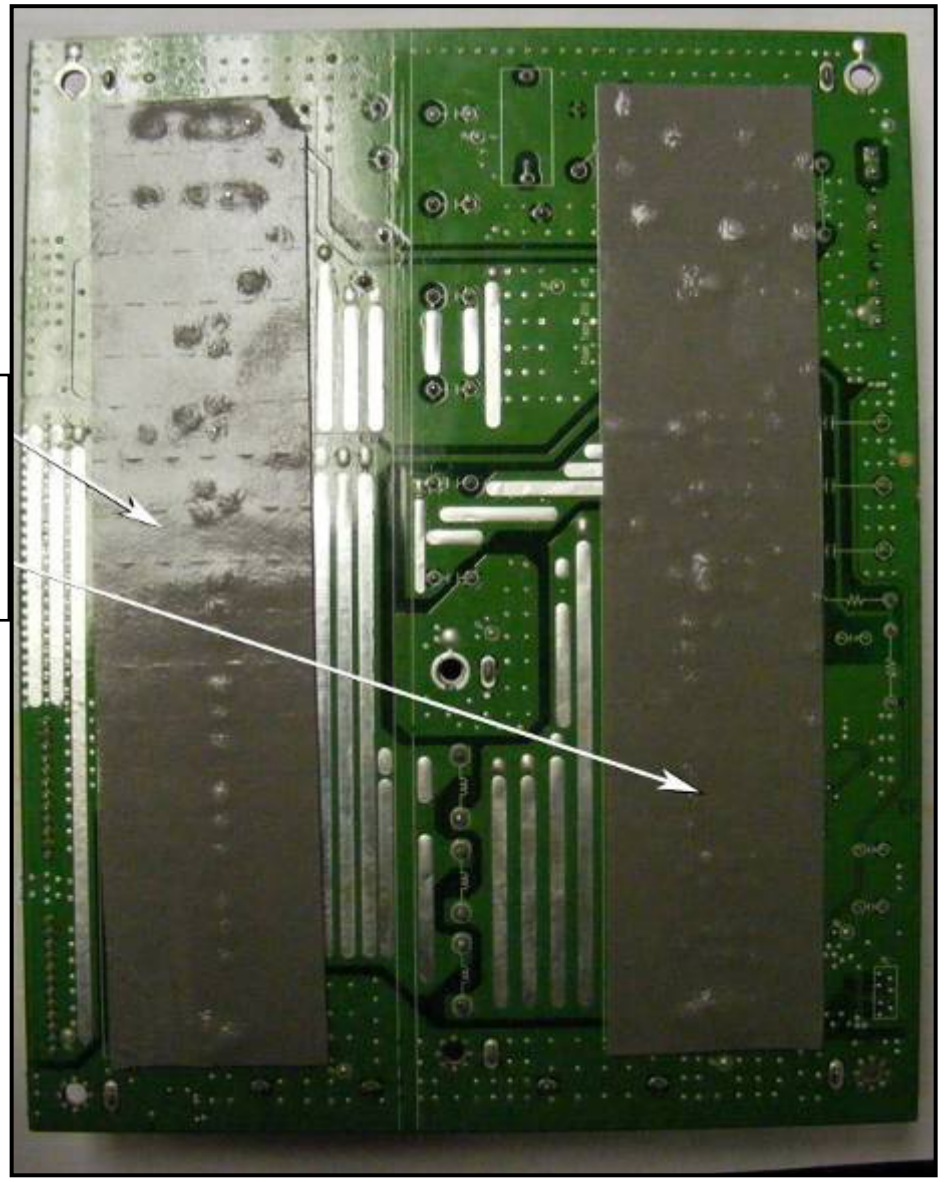
If they do not, contact parts and advise.

You should order a new Board.

EBR3837450

Original comes with insulation strips,

(Noise Prevention)



Z-SUS Connector P2 Voltages and Diode Check

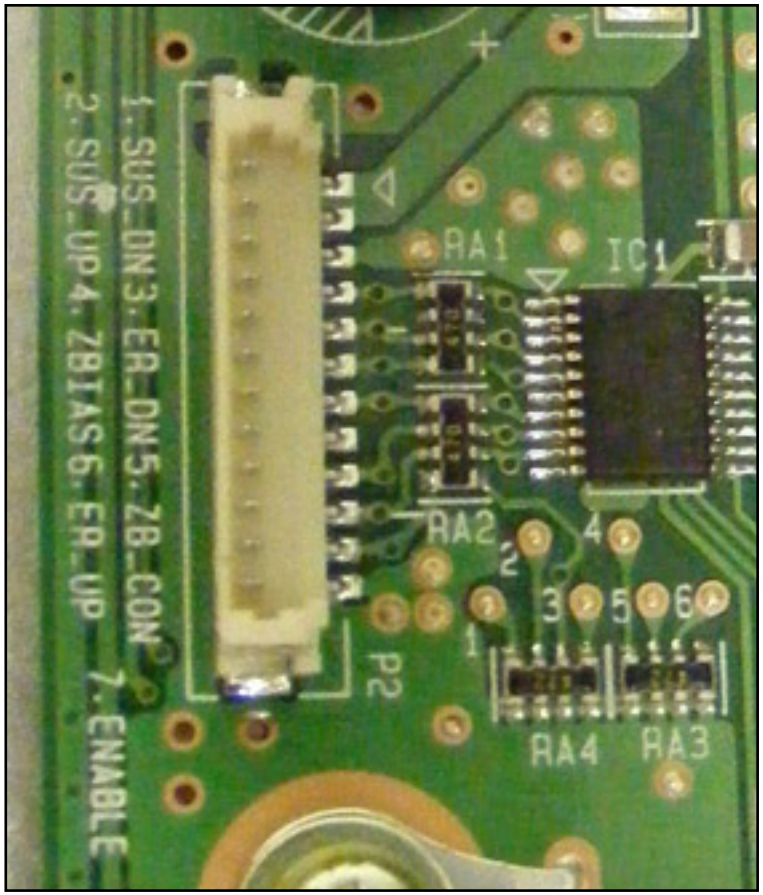
Voltage and Diode Test Measurements

P2 CONNECTOR "Z-SUS Board" to P163 "Control Board"

Pin	Label	STBY	Run	Diode Mode
1	SUS-DN	0V	16V	2.69V
2	SUS-UP	0V	16V	2.69V
3	ER-DN	Gnd	Gnd	Gnd
4	ZBIAS	0V	0.48V	2.85V
5	ZB-CON	0V	0.27V	2.85V
6	ER-UP	0V	0.1V	2.85V
7	ENABLE	0V	0.06V	2.85V
8	none	Gnd	Gnd	Gnd
9	none	0V	0V	2.85V
10	none	0V	1.93V	2.85V
11	none	0V	2.66V	0.66V
12	none	Gnd	Gnd	Gnd

Note: Pin 1 is actually Pin 12 on the Control Board.

This is because the pin numbers are inverted from the Control Board.



Diode Mode readings taken with all connectors removed.

Z-SUS Connector P3 Voltages and Diode Check

Voltage and Diode Test Measurements for the Z-SUS Board

P3 CONNECTOR "Z-SUS" to P802 "Power Supply Board"

Pin	Label	STBY	Run	Diode Mode
1	Vs	0V	192V	OL
2	Vs	0V	192V	OL
3	nc	nc	nc	nc
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	0V	0V	Gnd
6	Va	0V	65V	OL
7	Va	0V	65V	OL
8	Gnd	Gnd	Gnd	Gnd
9	M5V	0V	5V	1.3V
10	M5V	0V	5V	1.3V

Note: Va is not Used on the Z-SUS board, It is an Open connection

Diode Mode readings taken with all connectors removed.

CONTROL BOARD SECTION

This Section of the Presentation will cover troubleshooting the Control Board Assembly. Upon completion of this section the Technician will have a better understanding of the circuit and be able to locate voltage and resistance test points needed for troubleshooting.

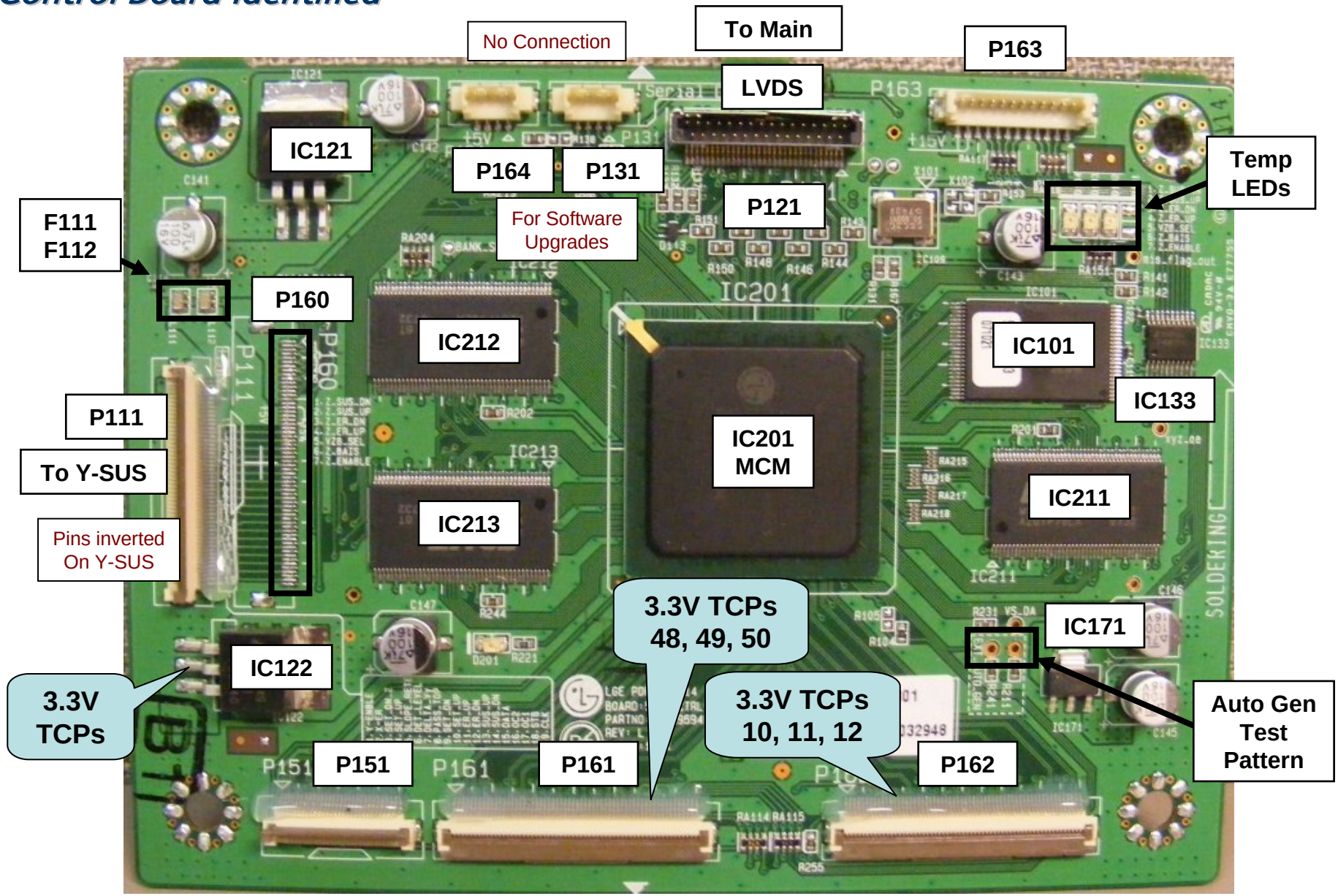
- DC Voltage and Waveform Test Points
- Resistance Test Points

Signals	Main Board Supplied	LVDS Signal
Operating Voltages	Y-SUS Supplied	5V VCC
	Developed on the Control board	1.8V (2) 3.3V

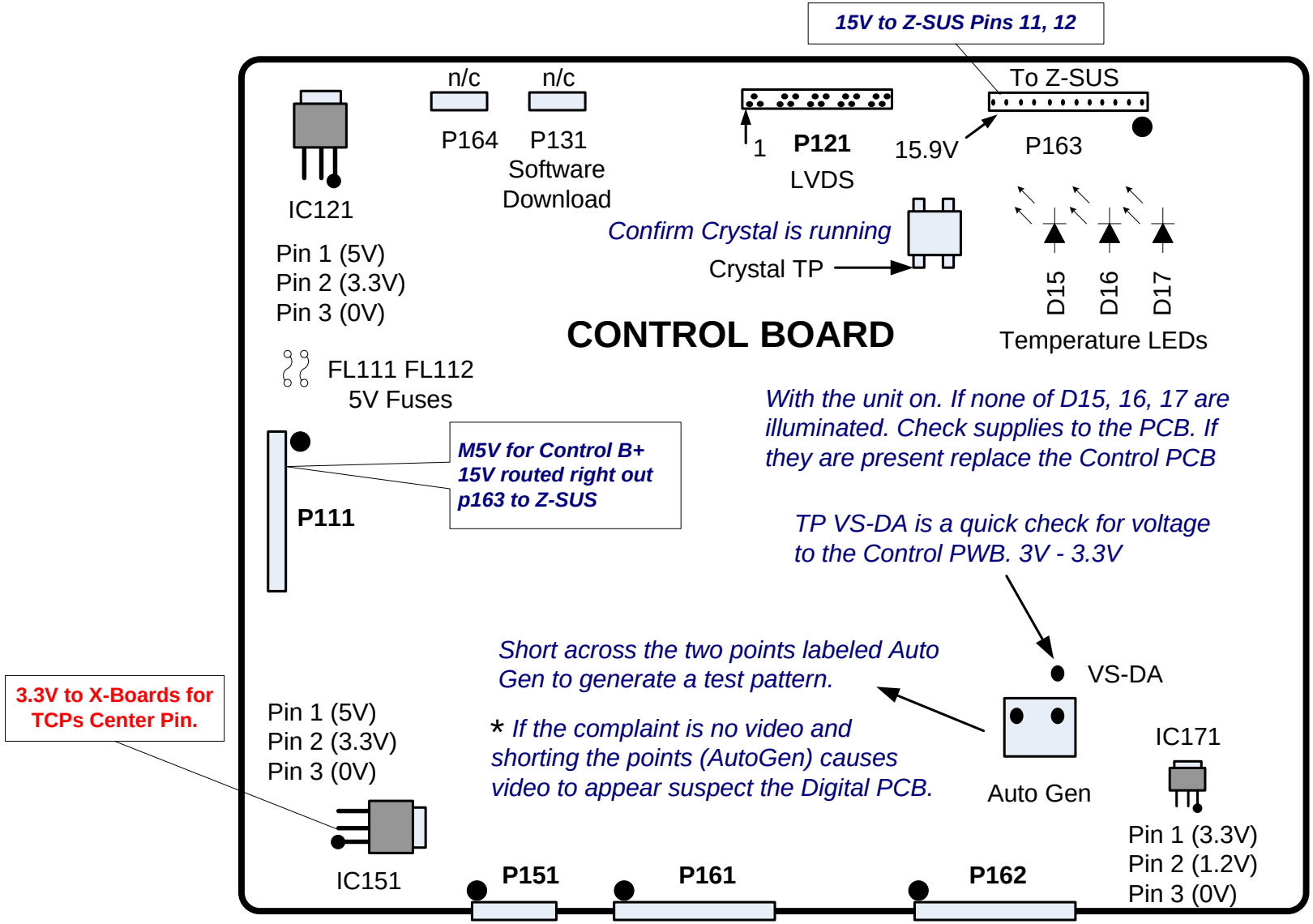
Y-SUS Supplied 15V supplied to Control board from the Y-SUS board. But routed through Control board to Z-SUS.

15V not used by the Control board.

Control Board Identified



50PG20 Control Board Pictorial



Control Board Quick Check

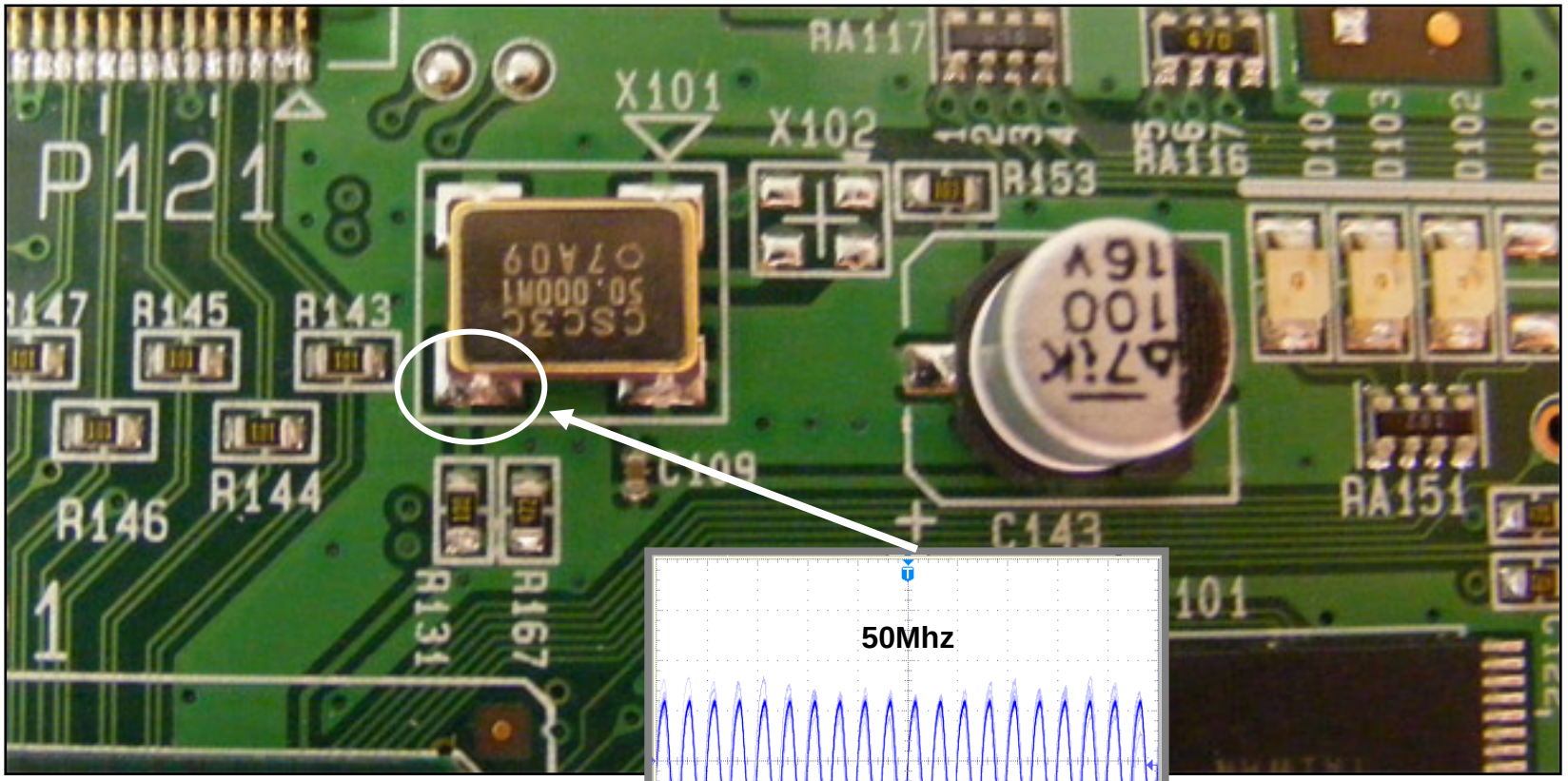
For quick Board test.
(All Board connectors Disconnected).

Jump 5V from Power Supply to IC121 Pin 1.
If the Temp LED lights,
Pretty much guaranteed, Board is OK.
But check FL111 and FL112 to be sure they are OK.

If testing the Z-SUS for functionality when the Y-SUS isn't running. Tap the 16V from pin 1 or 2 of P701 or P803 (removed from Main Board) and jump to pin 12 of P163. Jump 5 V to 5V in on Control Board. Confirm a good waveform output from Z-SUS.

When the Television has a problem related to;
1) Shutdown caused by Main Board
2) No Picture
This can be checked by the following.
(1) Disconnect the Main Board from all connectors. Apply AC power.
Since P803 is not connected, the set will come on. Short the two pins on the Auto Test Pattern lands.
If there is a picture of cycling colors, the Y-SUS, Y-Drive, Z-SUS, Power Supply, Control Boards and Panel are all OK.
Same test for (2) to tell if the No Video is caused by the Main Board.

Checking the Crystal "X101"



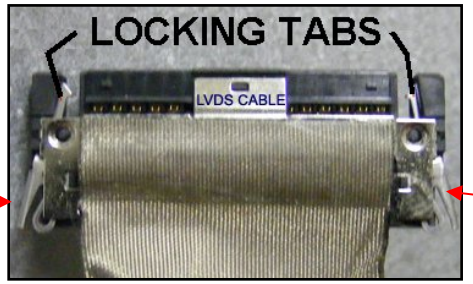
Check the output of the Oscillator package. The frequency of the sine wave is 50 MHZ.
Missing this clock signal can halt operation of the unit

500mV **40ns**

Control LVDS Signals

LVDS Cable P121 on Control Board shown. Press two outside tabs inward to release.

Use “Only” Component Input. Select by remote by guess since there’s no video. Toggle between Menu and Menu Off to see difference in waveform.



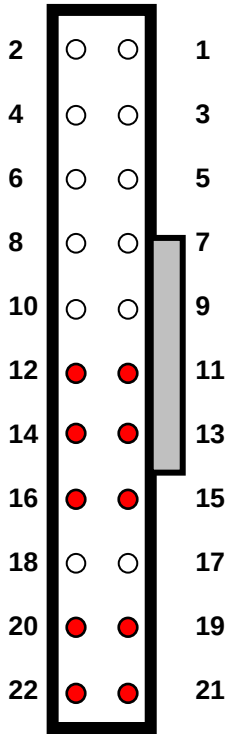
Press Inward

Press Inward

P302 on Main Board

Connector P302 Configuration

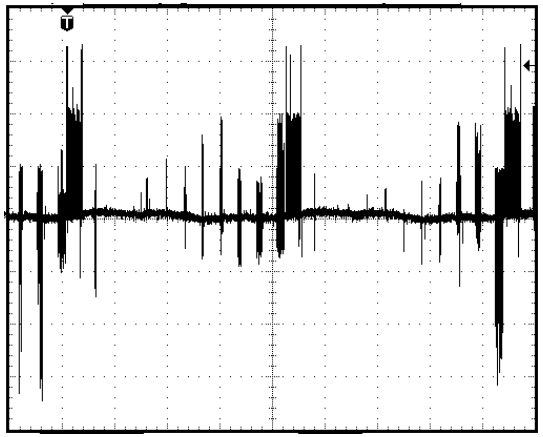
● - indicates signal pins.



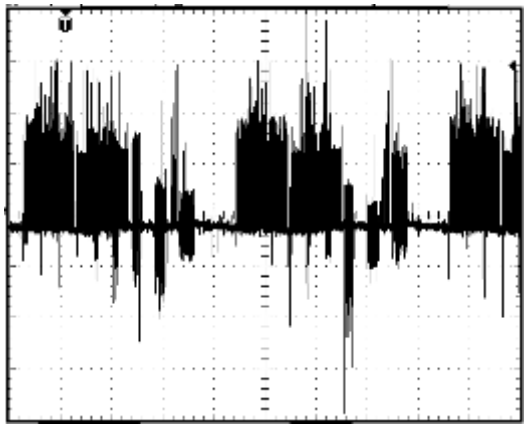
LVDS

Video Signals from the Main Board to the Control Board are referred to as Low Voltage Differential Signals or LVDS. Their presence can be confirmed with the Oscilloscope by monitoring the LVDS signals with no input signal selected while pressing the Menu Button “on” and “off” with the Remote Control or Keypad. Loss of these Signals would confirm the failure is on the Main Board!

Menu (OSD) Off



Menu (OSD) ON



Example of Normal Signals measured at 200mv/cm at 5µs/cm.

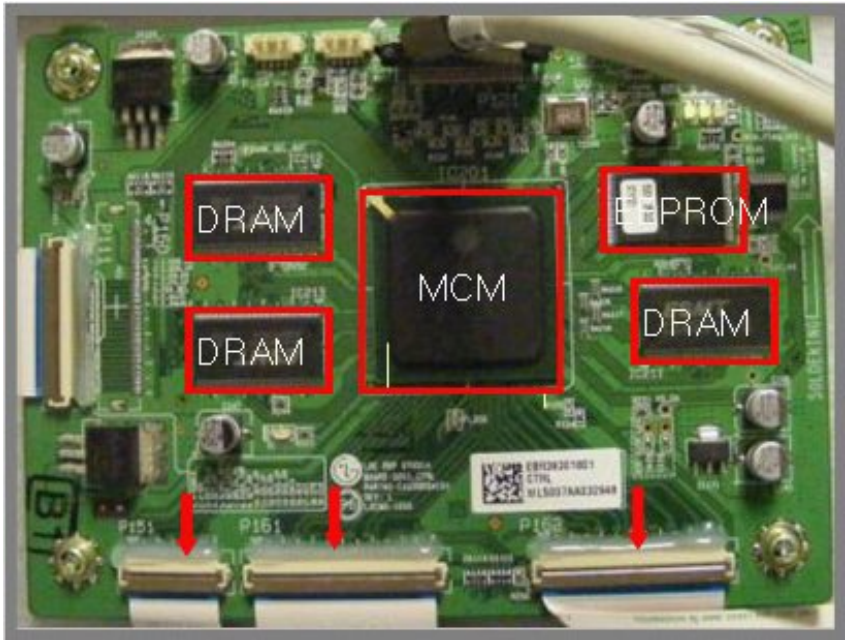
Control Board Signal Block

The Control Board supplies Video Signals to the TCP (Tape Carrier Package) ICs.

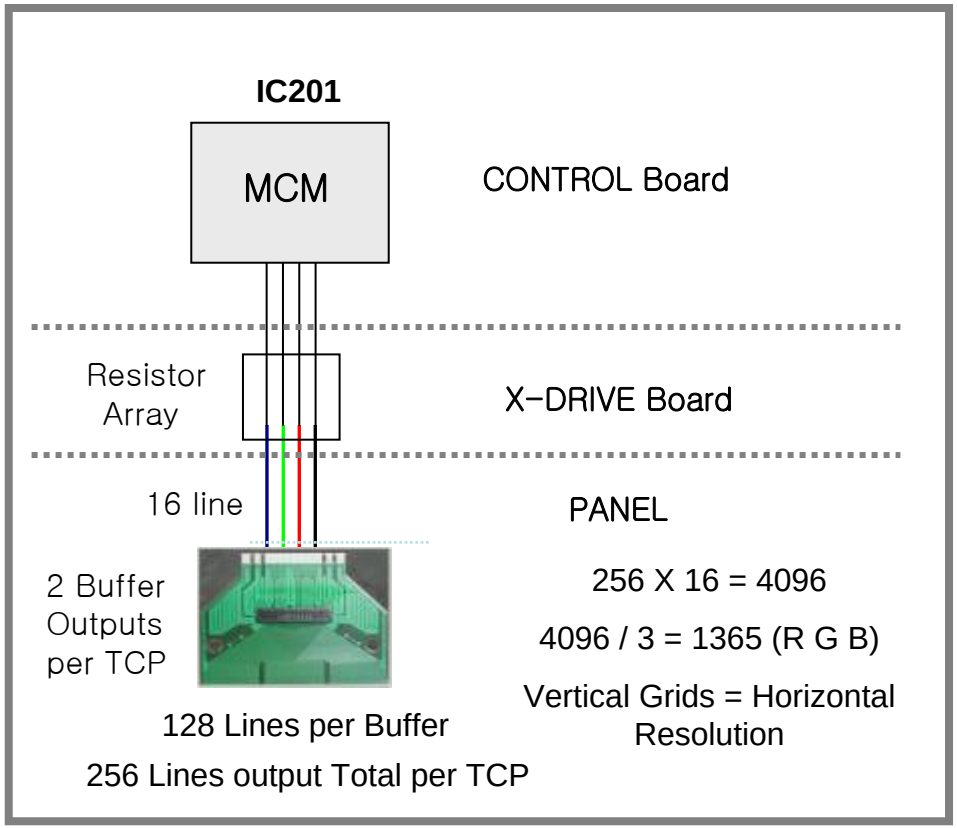
If there is a bar defect on the screen, it could be a Control Board problem.

Control Board to X Board Address Signal Flow

This Picture shows Signal Flow Distribution to help determine the failure depending on where the it shows on the screen.



Basic Diagram of Control Board



Control Connector P163 Voltages and Resistance

Voltage and Resistance Measurements

P163 CONNECTOR "Control PWB" to P2 “Z-SUS"

Pin	Label	STBY	Run	Diode Mode
1	ZSUS-DN	Gnd	Gnd	Gnd
2	ZSUS-UP	0V	2.7V	1.28V
3	Z-ER-DN	0V	1.9V	1.28V
4	Z-ER-UP	0V	0V	1.28V
5	VZD-SEL	Gnd	Gnd	Gnd
6	Z-BIAS	0V	0.06V	1.28V
7	Z-ENABLE	0V	0.1V	1.28V
8	none	0V	0.27V	1.28V
9	none	0V	0.48V	1.28V
10	none	Gnd	Gnd	Gnd
11	15V	0V	15.9V	1.15V
12	15V	0V	15.9V	1.15V

Pin configuration is inverted on the Z-SUS PWB

Diode Mode Readings taken with all connectors removed.

Control Connector P111 to P102 on the Y-SUS Slide 1 of 3 Label Explanation

LABELS P160 is a 60 Pin but the 50PG20 uses only 50 Pins P111 but P111 is covered in Silicone so P160 pins are used for description below.

CONNECTOR LABELS (Not Used by P111)

P160 This connector is a little confusing in its labeling.

This is a 60 Pin Connector to the Y-SUS board.

Example: The Labels outlined are on the silk screening.

However, this connector has many more pins than the Labels show.

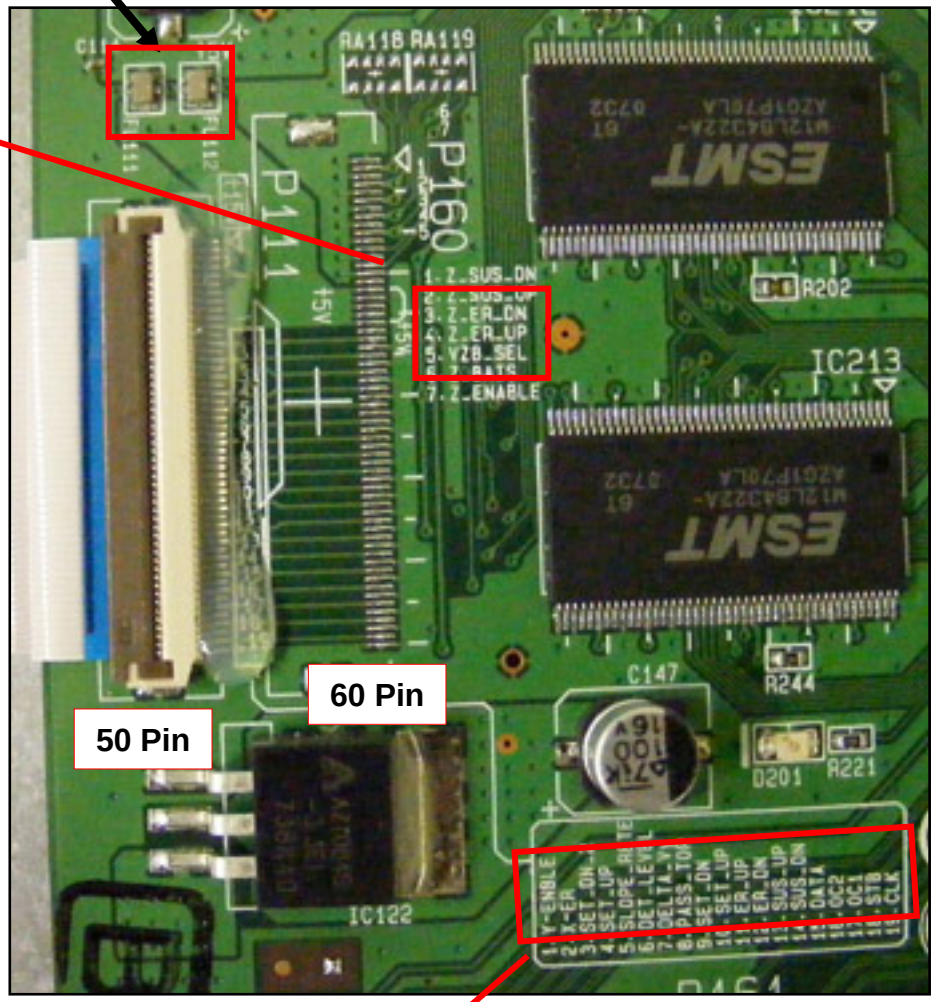
Actual: Pin 1 through 10 of P160 are not used in this model. Pins 17 through 21 are +5V .

Pins 23 through 60 are the Y-SUS drive signals. There is a ground between each pin.

Roughly 39 pins dedicated to Y-SUS beginning at pin 23.

Pin 1 on the Control Board P111 is pin 50 on the Y-SUS Board P102

FL111 and FL112 5V Fuse (Actually EMI Filters)



P111 CONNECTOR LABELS
(19 here is 49 on the connector)

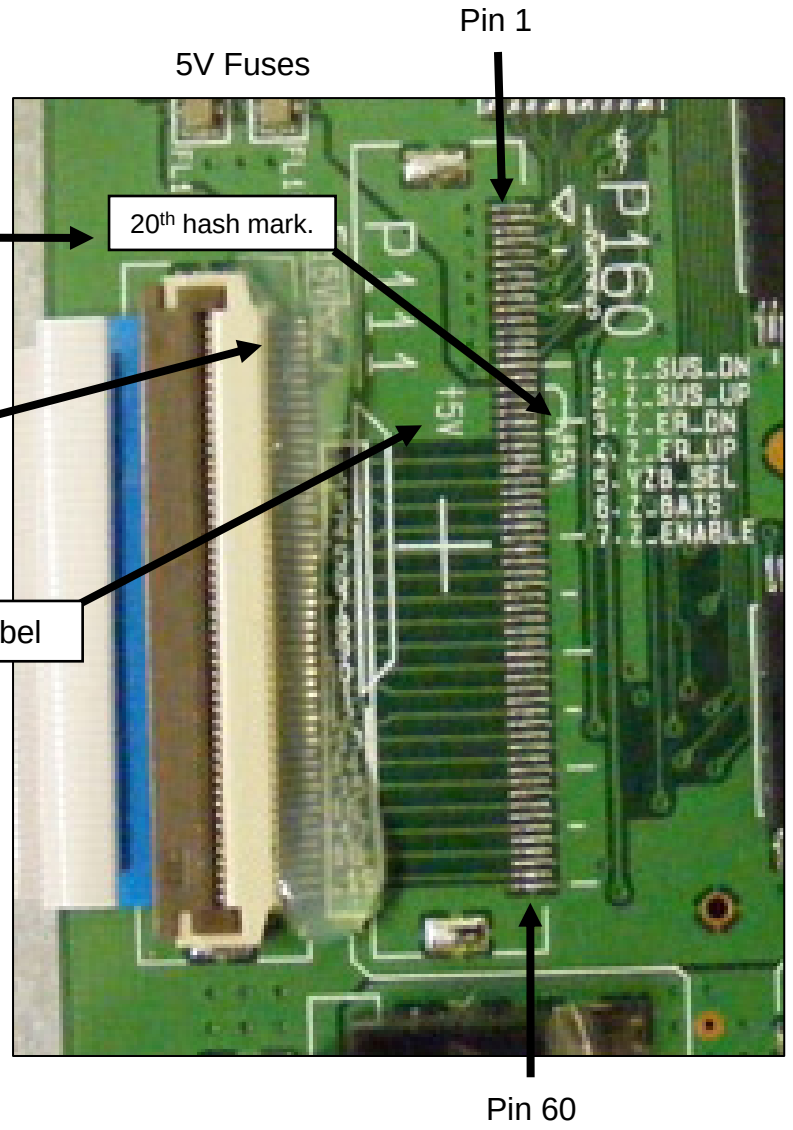
Control Connector P111 Blow Up for 5V Check Slide 2 of 3 Quick 5V Check

P111 CONNECTOR “Control PWB" to P102 “Y-SUS PWB"

Pins 17, 18, 19, 20 and 21 Deliver +5V to the Control PWB from the Y-SUS.
Easy to check using 20th hash mark.

P111 pins 1, 2, 3 and 4 are the 15.9V from the Y-SUS but they are covered in silicone. The Control board simply routes this voltage out P163 pins 11 and 12.

No problem making a voltage reading since 17~21 connectors are the same voltage.



Control Connector P111 Slide 3 of 3 Voltage Readings and Diode Check

P111 (P160) CONNECTOR "Control Board" to P102 "Y-SUS Board"

Pin	Label	STBY	Run	Diode Mode
1	Not Used Pin 10 Below is actually Pin 1 of P111 Pins are very close together read voltages safely. Note: Pin 1, 2, 3, 4 and 5 of P111 are actually 15.9V from the Y-SUS, but they do not connect to P160 Pins 11, 12, 13, 14 and 15.			
2				
3				
4				
5				
6				
7				
8				
9				
10				
11	Gnd	Gnd	Gnd	Gnd
12	Z-BIAS	0V	1.71V	OL
13	Gnd	Gnd	Gnd	Gnd
14	Z-ENABLE	0V	0V	OL
15	Gnd	Gnd	Gnd	Gnd
16	n/c	n/c	n/c	OL
17	5V	OV	4.75V	1.11V
18	5V	OV	4.75V	1.11V
19	5V	OV	4.75V	1.11V
20	5V	OV	4.75V	1.11V

Pin	Label	STBY	Run	Diode Mode
21	5V	OV	4.75V	1.17V
22	n/c	n/c	n/c	OL
23	Y-Enable	0V	0.6V	1.37V
24	Gnd	Gnd	Gnd	Gnd
25	X_ER	0V	2.9V	1.36V
26	Gnd	Gnd	Gnd	Gnd
27	Set_DN_2	0V	1.4V	1.37V
28	Gnd	Gnd	Gnd	Gnd
29	SET_UP	0V	1.9V	1.37V
30	Gnd	Gnd	Gnd	Gnd
31	SLOPE_RETE	0V	0V	1.37V
32	Gnd	Gnd	Gnd	Gnd
33	DET_LEVEL	0V	0V	1.37V
34	Gnd	Gnd	Gnd	Gnd
35	DELTA_Vy	0V	0.16V	1.37V
36	Gnd	Gnd	Gnd	Gnd
37	PASS_TOP	0V	0.2V	1.37V
38	Gnd	Gnd	Gnd	Gnd
39	Set_DN2	0V	0.2V	1.37V
40	Gnd	Gnd	Gnd	Gnd

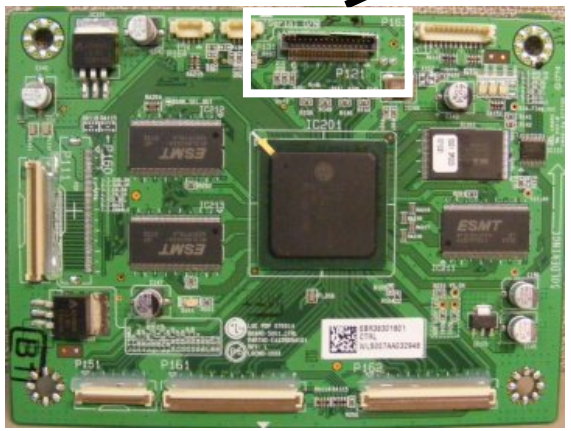
Diode Mode Readings with the PCB Disconnected.

Pin	Label	STBY	Run	Diode Mode
41	SET_UP	0V	0.26V	1.37V
42	Gnd	Gnd	Gnd	Gnd
43	ER_UP	0V	2V	1.37V
44	Gnd	Gnd	Gnd	Gnd
45	ER_DN	0V	1.2V	1.37V
46	Gnd	Gnd	Gnd	Gnd
47	SUS_UP	0V	2V	1.37V
48	Gnd	Gnd	Gnd	Gnd
49	SUS_DN	0V	0V	1.37V
50	Gnd	Gnd	Gnd	Gnd
51	DATA	0V	0.6V	1.37V
52	Gnd	Gnd	Gnd	Gnd
53	OSC2	0V	3V	1.37V
54	Gnd	Gnd	Gnd	Gnd
55	OSC1	0V	0V	1.37V
56	Gnd	Gnd	Gnd	Gnd
57	STB	0V	0.76V	1.37V
58	Gnd	Gnd	Gnd	Gnd
59	CLK	0V	3.2V	1.37V
60	Gnd	Gnd	Gnd	Gnd

Control Board Plug P121 "LVDS Plug" Location and Explanation

Pins are very close together making voltage checks risky. Use P302 on the Main Board for checks.

P121 LOCATION



CONTROL Board

Shows connector location on the Control Board

Control Board Plug P121 "LVDS Plug" Voltage and Diode Check

P121 Connector Odd Pins "Control" to P302 "Main"

Pin	STBY	Run	Diode Mode
1	Gnd	Gnd	Gnd
3	0V	0V	1.10V
5	0V	1.19V	1.10V
7	0V	1.26V	1.10V
9	0V	0V	1.10V
11	0V	1.15V	1.10V
13	Gnd	Gnd	Gnd
15	0V	0V	1.10V
17	0V	0V	1.10V
19	Gnd	Gnd	Gnd
21	0V	0V	1.10V
23	0V	5.29V	1.10V
25	0V	1.2V	1.10V
27	0V	3.29V	1.37V
29	0.89V	3.29V	OL
31	Gnd	Gnd	Gnd

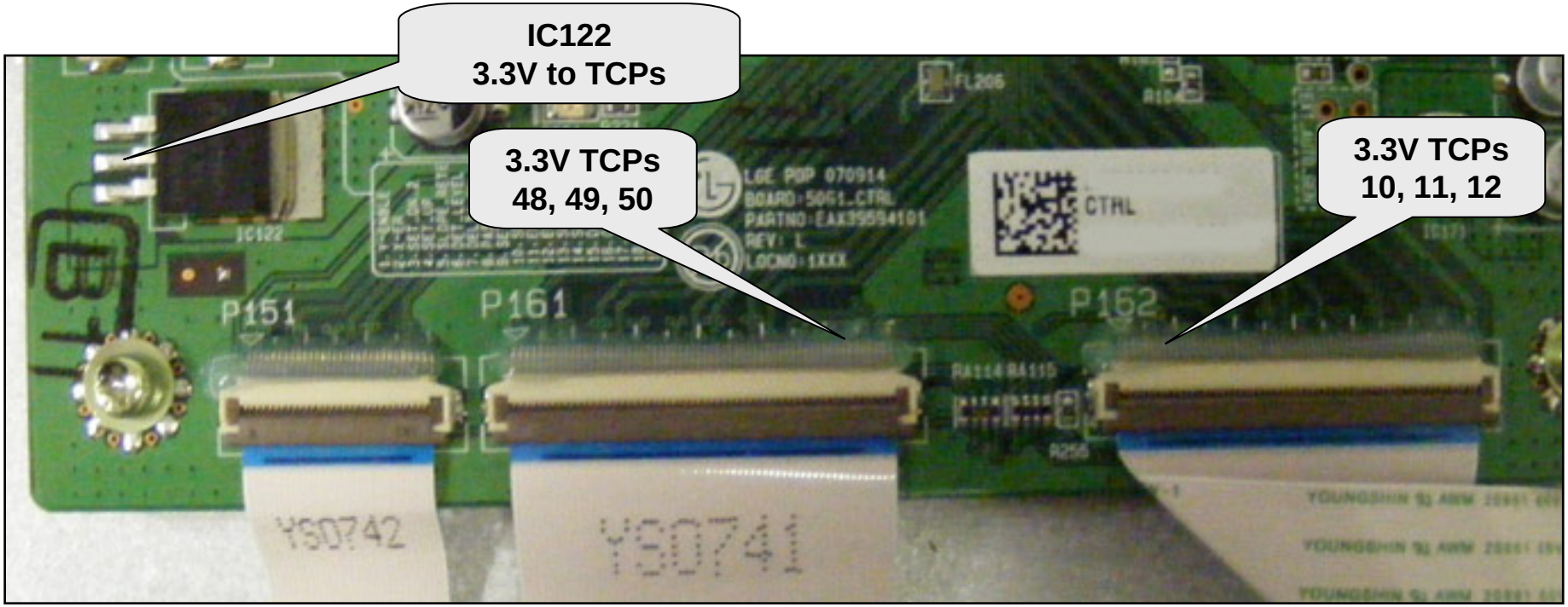
P121 Connector Even Pins "Control" to P302 "Main"

Pin	STBY	Run	Diode Mode
2	0V	0V	1.10V
4	0V	1.26V	1.10V
6	Gnd	Gnd	Gnd
8	0V	1.19V	1.10V
10	0V	0V	1.10V
12	0V	1.26V	1.10V
14	Gnd	Gnd	Gnd
16	0V	0V	1.10V
18	0V	0V	1.10V
20	0V	0.21V	1.10V
22	0.89V	0.56V	1.10V
24	0V	1.26V	1.10V
26	Gnd	Gnd	Gnd
28	0.89V	3.29V	OL
30	0V	0V	OL

Diode Mode readings taken with all connectors removed.

Control Board Plug P151-P161-P163 Voltage Reading Notes

As can be seen from the Picture below, these connectors are protected by coating and are too close together for safe readings.

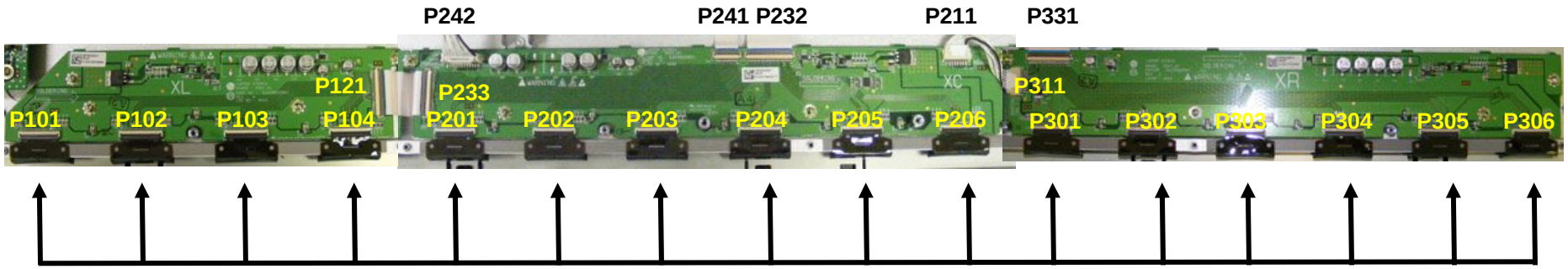


UNABLE TO READ THESE CONNECTORS,
THEY ARE COVERED IN SILICON.
You can poke through with a needle tip probe.

X Drive Boards (Also known as: A-BUS Boards)

Warning: DO NOT attempt to run the set with the Heat Sink over the TCPs removed. After a very short time, these ICs will begin to self destruct due to overheating.

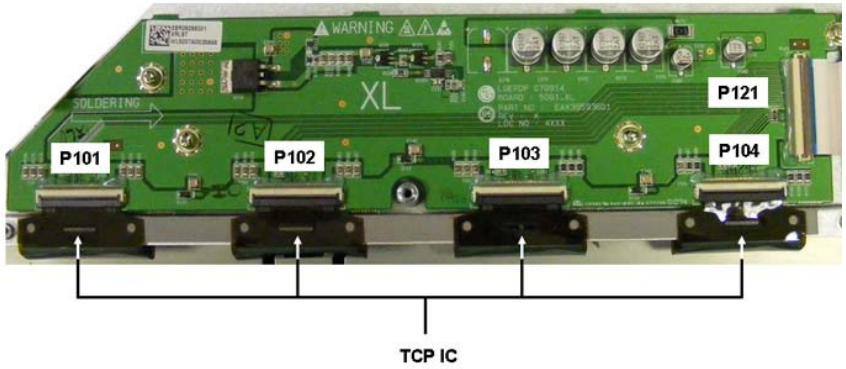
Left X Board **Center X Board** **Right X Board**



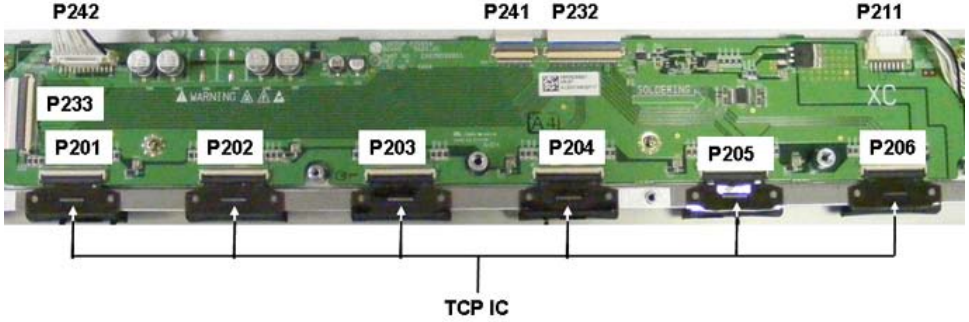
TCP IC's shown are part of the Ribbon Cable
TCP = "Taped Carrier Package"

X Drive Left Board

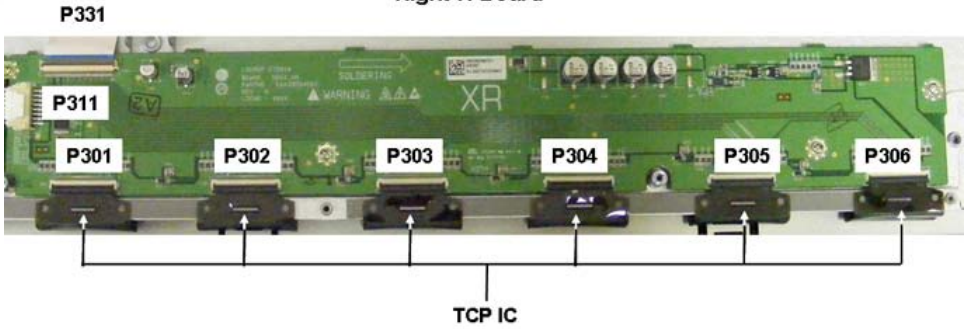
Left X Board



Center X Board

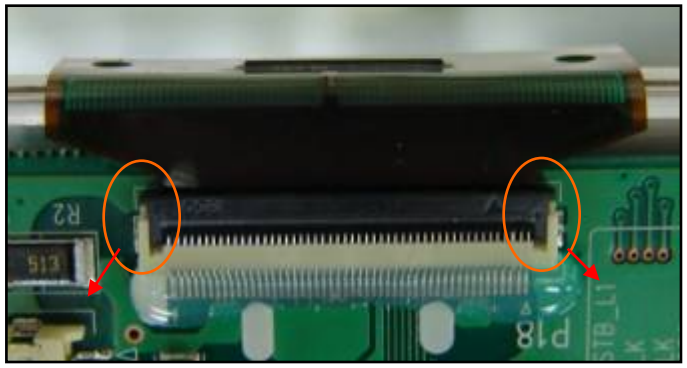


Right X Board

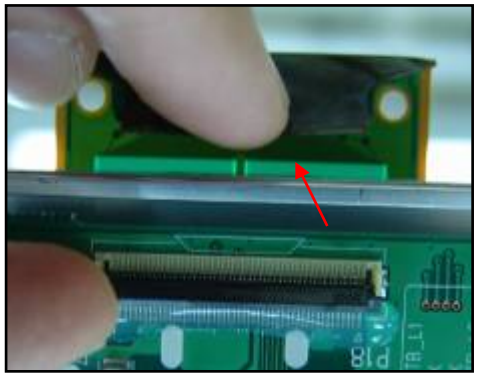


TCP (Tape Carrier Package)

TCP Connector Removal



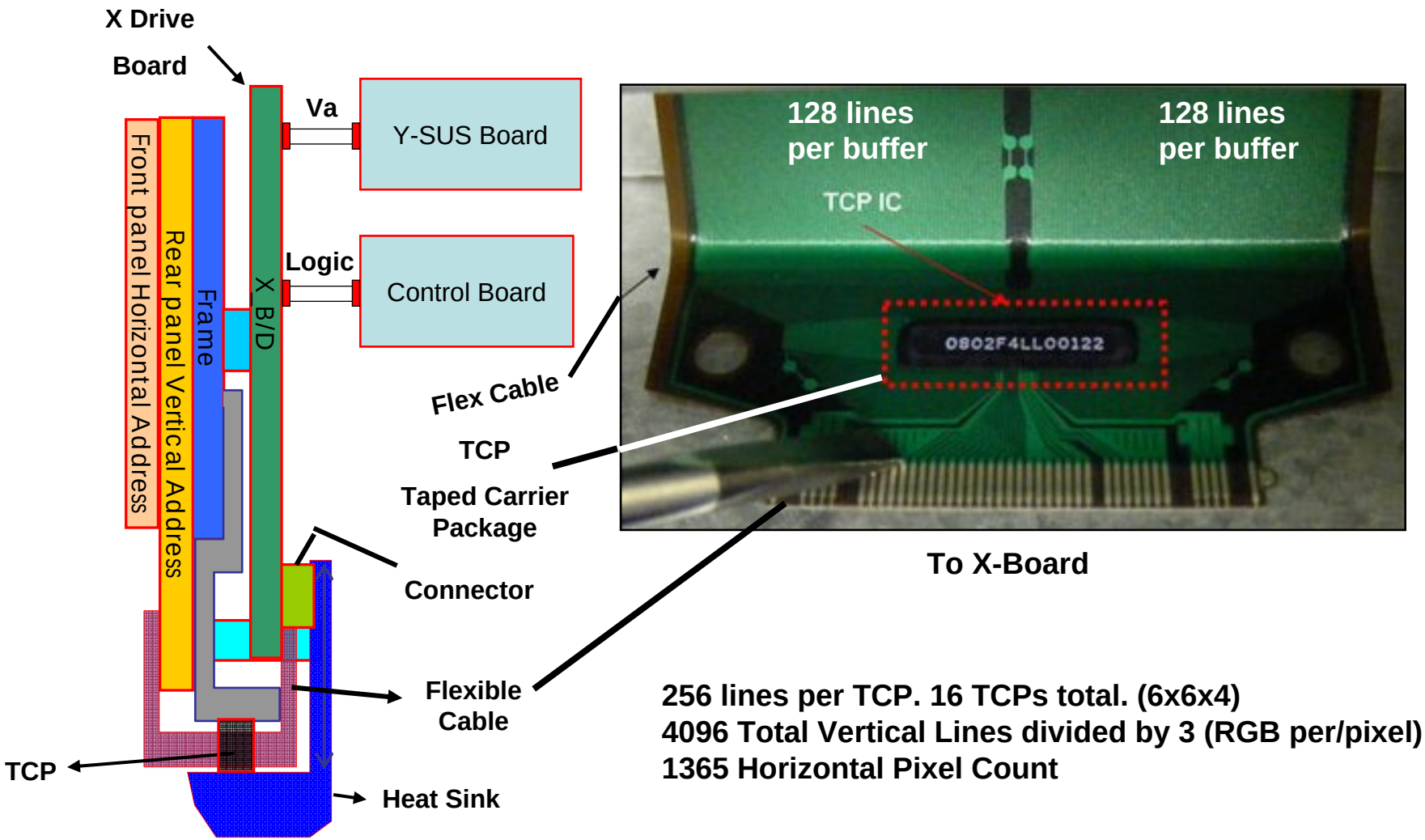
Lift up the lock as shown by arrows.
(The Lock can be easily broken.
It needs to be handled carefully.)



Pull TCP apart as shown by arrow.
(TCP Film can be easily damaged.
Handle with care.)

TCP (Tape Carrier Package)

TCP ICs supply RGB 16 (X2) bit signal to the Panel by connecting the PAD Electrode of the PANEL with the X Board.

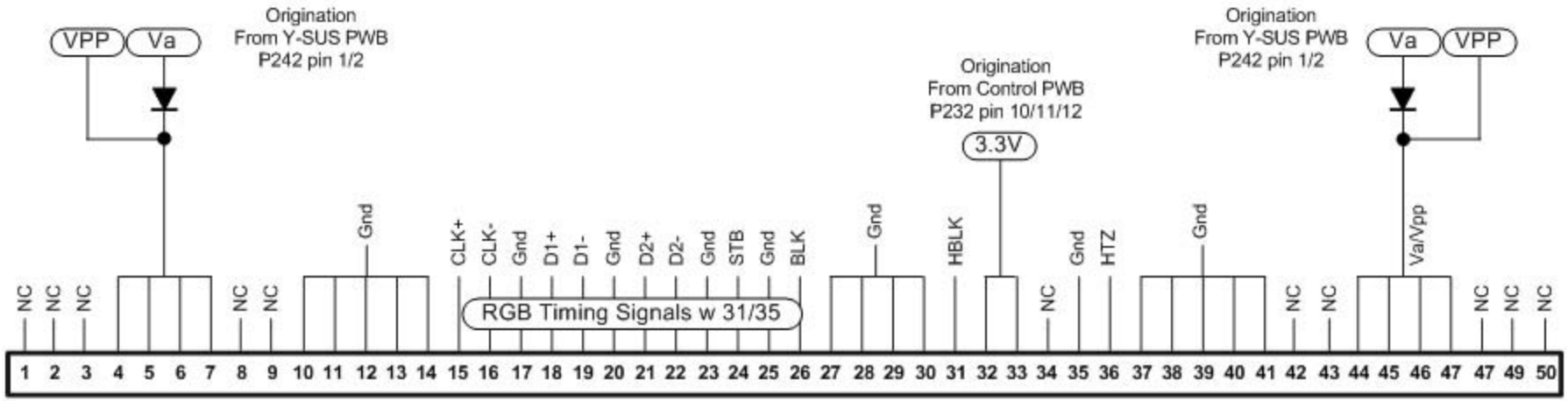


256 lines per TCP. 16 TCPs total. (6x6x4)
4096 Total Vertical Lines divided by 3 (RGB per/pixel)
1365 Horizontal Pixel Count

TCP Testing

ANY X BOARD TO TCP

P101~P104 or P201~P206 or P301~P306



Flexible Printed Ribbon Cable to TCP IC

(+) On any Gnd

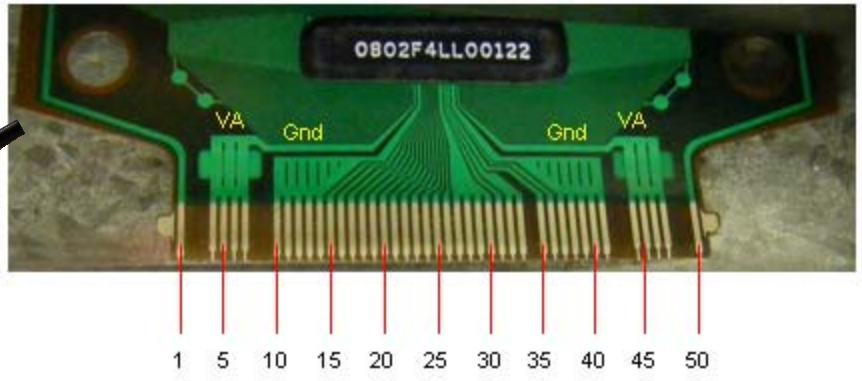
10,11,12,13,14,27,28,2
9,30,37,38,39,40,41

(-) On any Va or 3.3V

(4,5,6,7) or (44,45,46,47)
Or (32, 33)

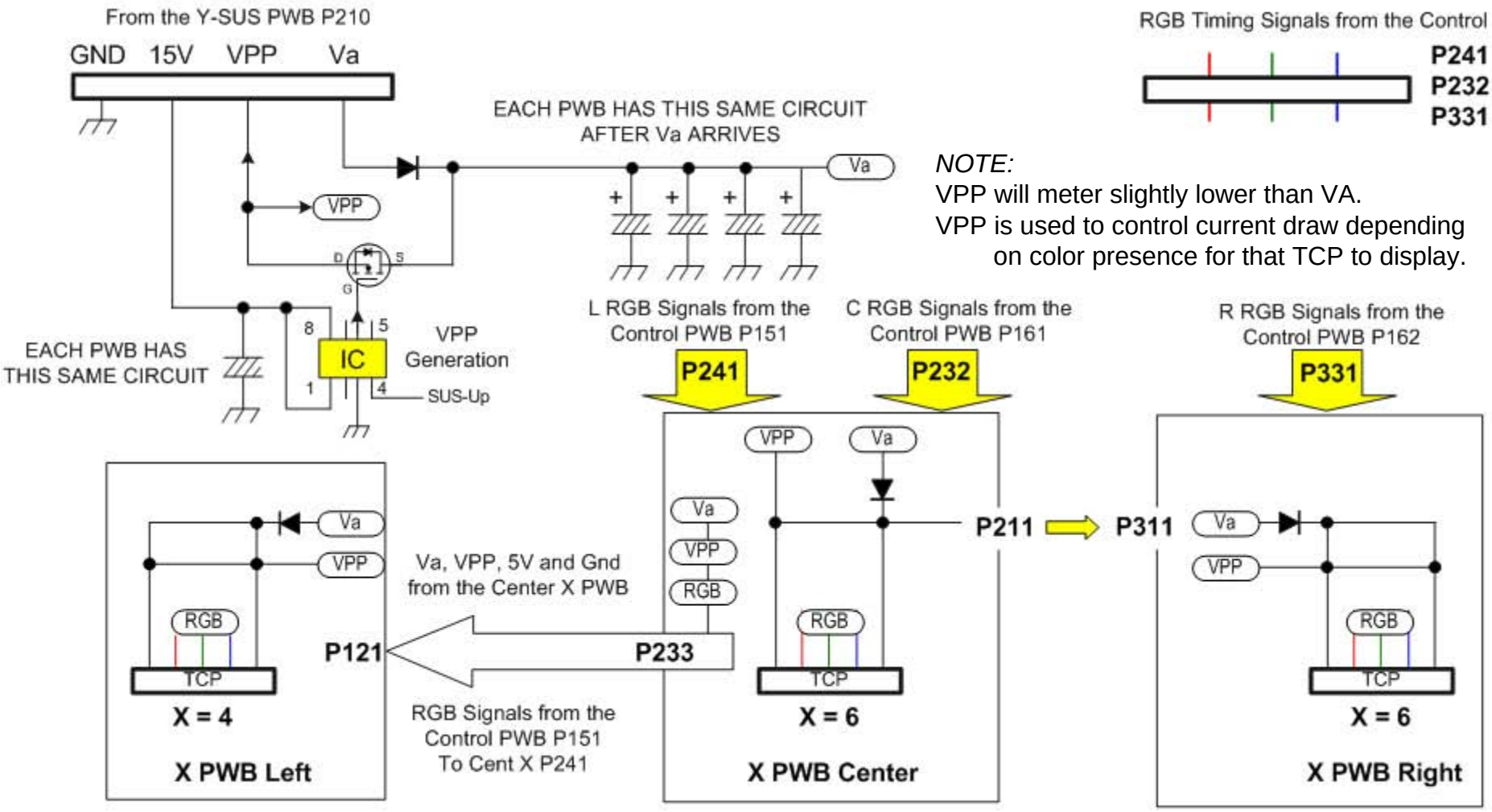
Typical Reading 0.65V

Opposite reads open



Look for any ribbon Damage. Cracks, folds Pinches, scratches, etc…

X Board Voltage Distribution



RGB Address Signals out to TCP IC's

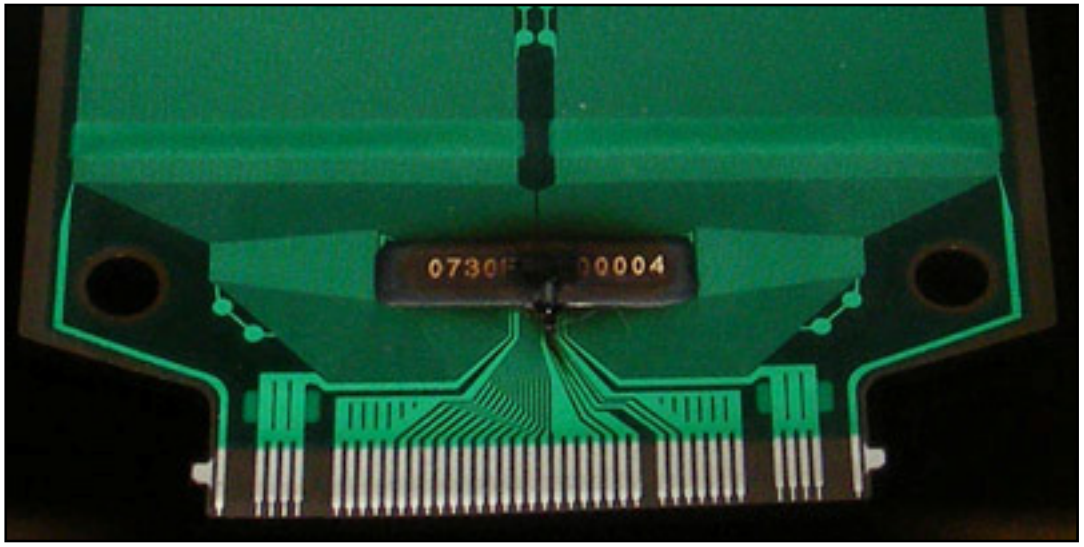
NOTE:
VPP will meter slightly lower than VA.
VPP is used to control current draw depending on color presence for that TCP to display.

TCP Visual Observation. Damaged TCP

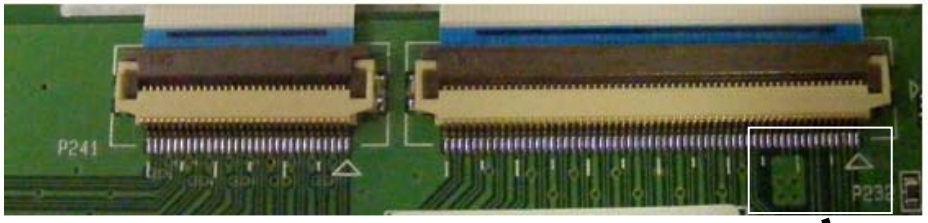
Warning: DO NOT attempt to run the set with the Heat Sink over the TCPs removed. After a very short time, these ICs will begin to self destruct due to overheating.

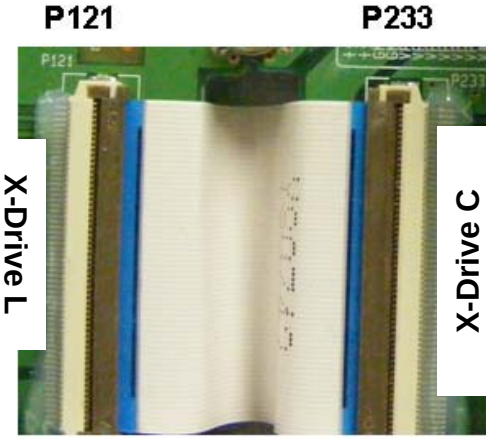
This damaged TCP can,

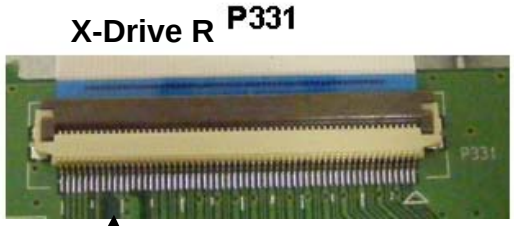
a) Cause the Power Supply to shutdown
b) Generate abnormal vertical bars
c) Cause the entire area driven by the TCP to be “All White”
d) Cause the entire area driven by the TCP to be “All Black”
e) Cause a “Single Line” defect



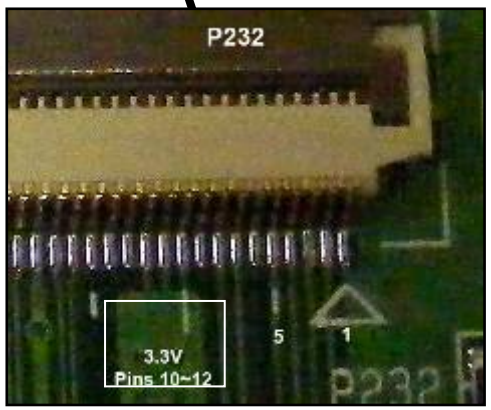
X Drive Connector P233, P121, P232 P241, and P331







P232 (X-Drive R) receives **3.3V**. Easy to check, use the pad for pins 50 51 and 52.



Checking 3.3V

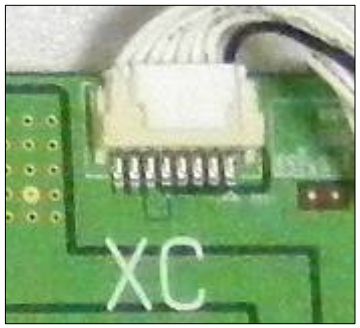
P232 (X-Drive C) receives **3.3V** for the X-Boards. Easy to check, use the pad for pins 10, 11 and 12.

These connectors on the X-Drive Boards would be impossible to read safely. Some are even Silicon covered which prevents the ability to read.

With these connectors, Check carefully for their seating accuracy. Improper seating can lead to many different symptoms. Lines, bars, noise, ect…. All Vertical in nature.

X Drive Center Connector P211 Voltages and Diode Check

Voltage and Diode Test Measurements for the X Drive Board



P211 CONNECTOR "X Center Board" to P311 "X-Left"

Pin	Label	STBY	Run	Diode Mode
1	VPP_Out	.15V	65V	OL
2	VPP_Out	.15V	61.8V	OL
3	VPP_Out	.15V	61.1V	OL
4	VPP_Out	.15V	62.2V	OL
5	NC	0V	0V	OL
6	+15V_R	0V	16V	2.91V
7	Gnd	Gnd	Gnd	Gnd
8	Gnd	Gnd	Gnd	Gnd

VPP_Out Voltages vary with video content

Diode Mode readings taken with all connectors removed.

X Drive Center Connector P311 Voltages and Diode Check

Voltage and Diode Test Measurements for the X Drive Board

P311 CONNECTOR "X Left Board" to P211 "X-Center"

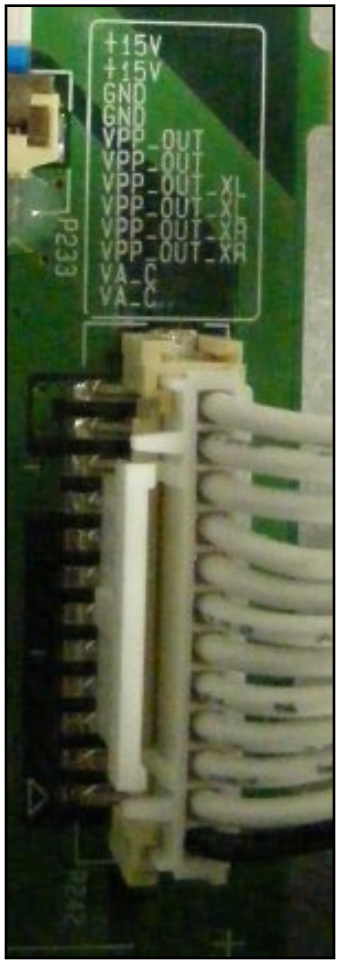
Pin	Label	STBY	Run	Diode Mode
1	Gnd	Gnd	Gnd	Gnd
2	Gnd	Gnd	Gnd	Gnd
3	+15V_R	0V	16V	OL
4	NC	0V	0V	OL
5	VPP_Out	.15V	62.2V	OL
6	VPP_Out	.15V	61.1V	OL
7	VPP_Out	.15V	61.8V	OL
8	VPP_Out	.15V	65V	OL

VPP_Out Voltages vary with video content

Diode Mode readings taken with all connectors removed.

X Drive Center Connector P242 Voltages and Diode Check

Voltage and Diode Test Measurements for the X Drive Board



P242 CONNECTOR "X-Drive C Board" to P210 "Y-SUS"

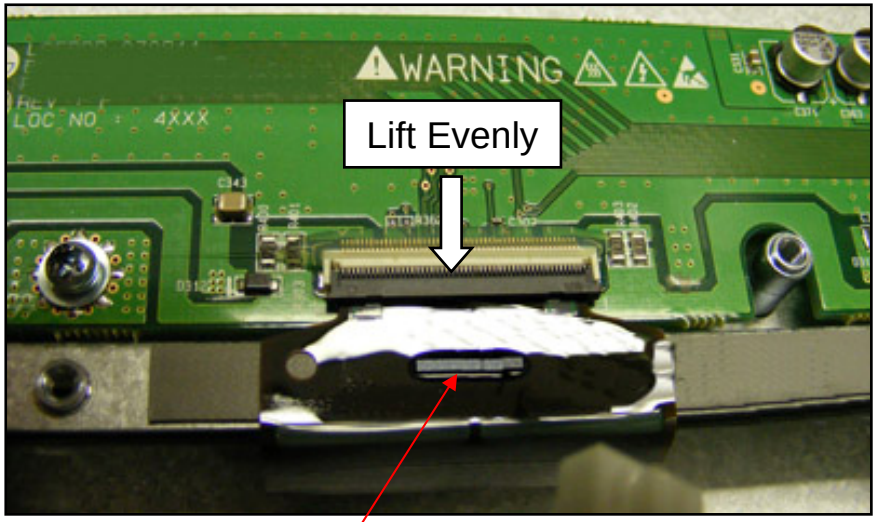
Pin	Label	STBY	Run	Diode Mode
1	Va_C	0V	65V	OL
2	Va_C	0V	65V	OL
3	VPP_Out_XR	0V	62.4V	OL
4	VPP_Out_XR	0V	62.4V	OL
5	VPP_Out_XL	0V	62.3V	OL
6	VPP_Out_XL	0V	62.3V	OL
7	VPP_Out	0V	63.3V	OL
8	VPP_Out	0V	63.3V	OL
9	Gnd	Gnd	Gnd	Gnd
10	Gnd	Gnd	Gnd	Gnd
11	+15V	0V	15.9V	OL
12	+15V	0V	15.9V	OL

Diode Mode readings taken with all connectors removed.

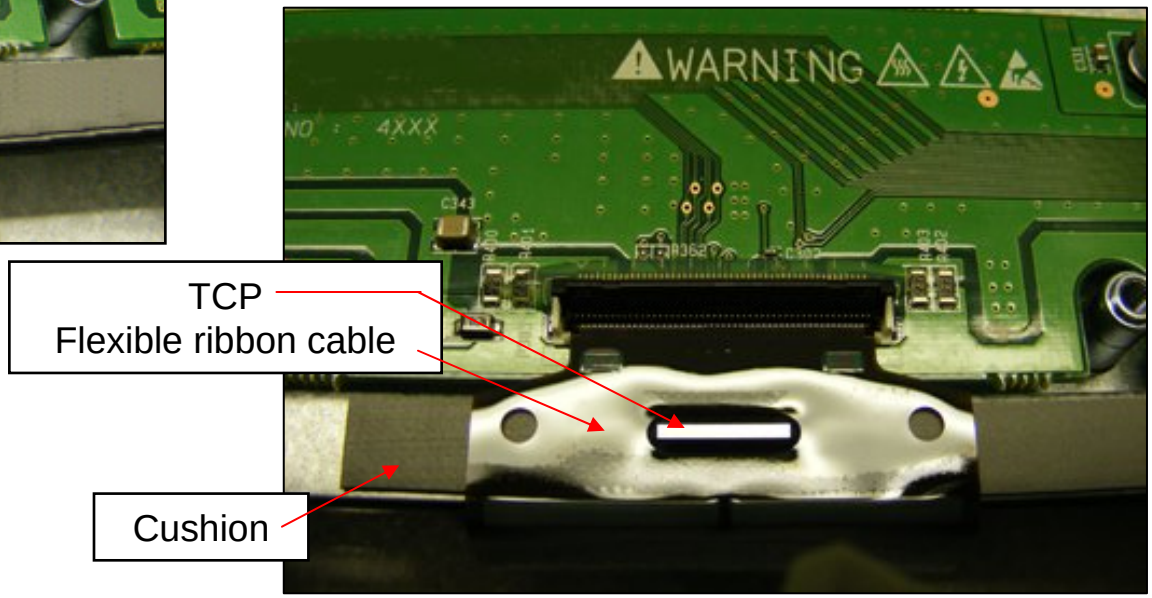
Left, Right and Center X Drive Removal

After removing the back cover, Main Board is lifted out of the way, 15 screws removed from heat sink covering TCPs and heat sink removed, the X-Drive Boards can be removed.

Gently pry the locking mechanism upward on all TCP connectors P101 ~ P104 P201~P206 P301~P306



Carefully lift the TCP ribbon up and off the cushion and out of the way.



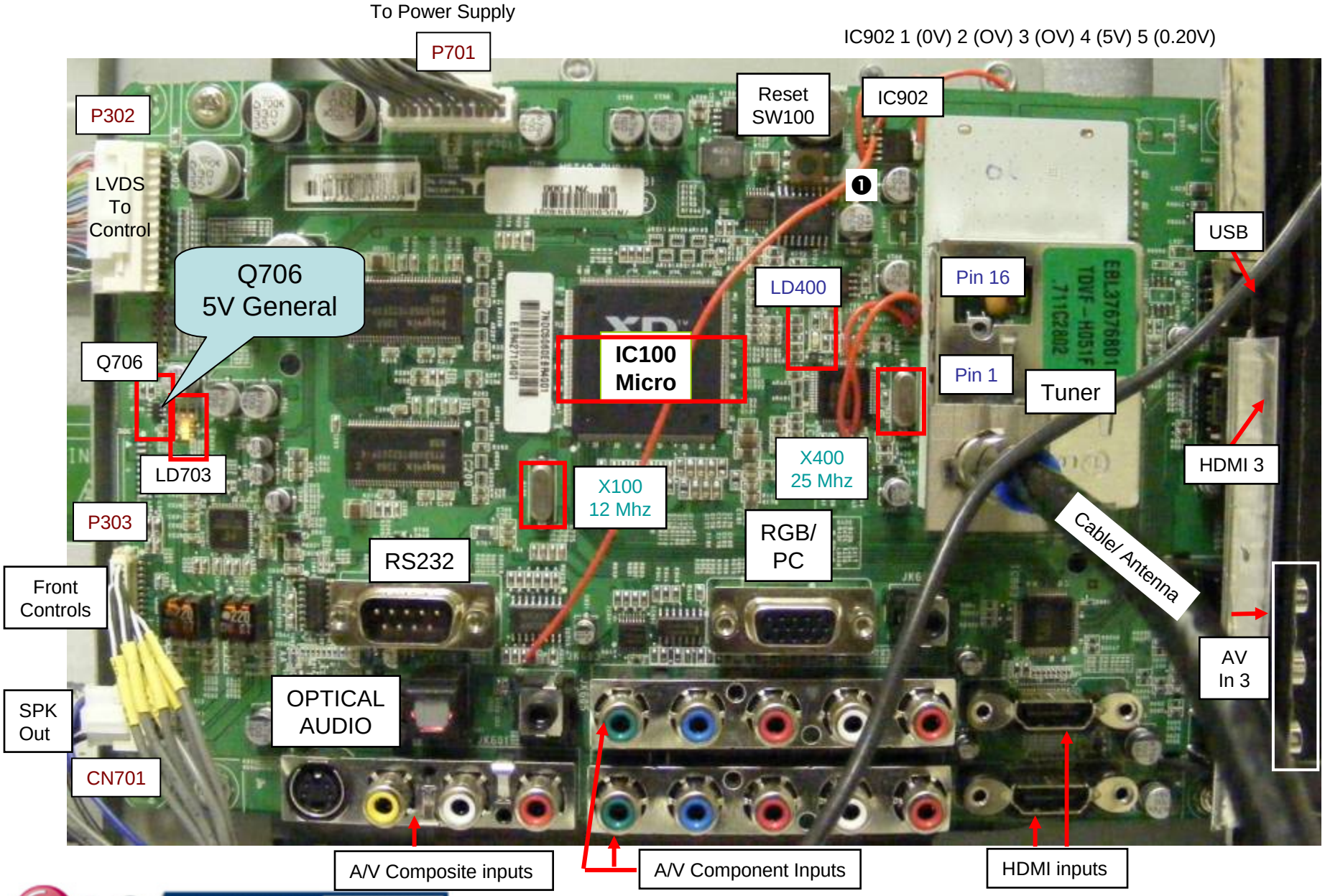
MAIN BOARD SECTION

This Section of the Presentation will cover troubleshooting the Main Board. Upon completion of this Section the technician will have a better understanding of the operation of the circuit and will be able to locate voltage and resistance test points needed for troubleshooting and alignments.

- DC Voltage and Waveform Checks
- Resistance Measurements

Operating Voltages	**SMPS Supplied**	5V 12V 16V
	Developed on the Main Board	2.5V 3.3V (2) 5V 9V

Main Board Layout and Identification



Main Board Back Side (Regulator Checks)

Bottom Leg Pin 1

IC701
1) 5V
2) 0V
3) 5V

IC709
1) 3.29V
2) 1.26V
3) 0V

IC702
3) 5V
2) 3.3V
1) 0V

IC501
1) 3.3V
2) 1.8V
3) 0V

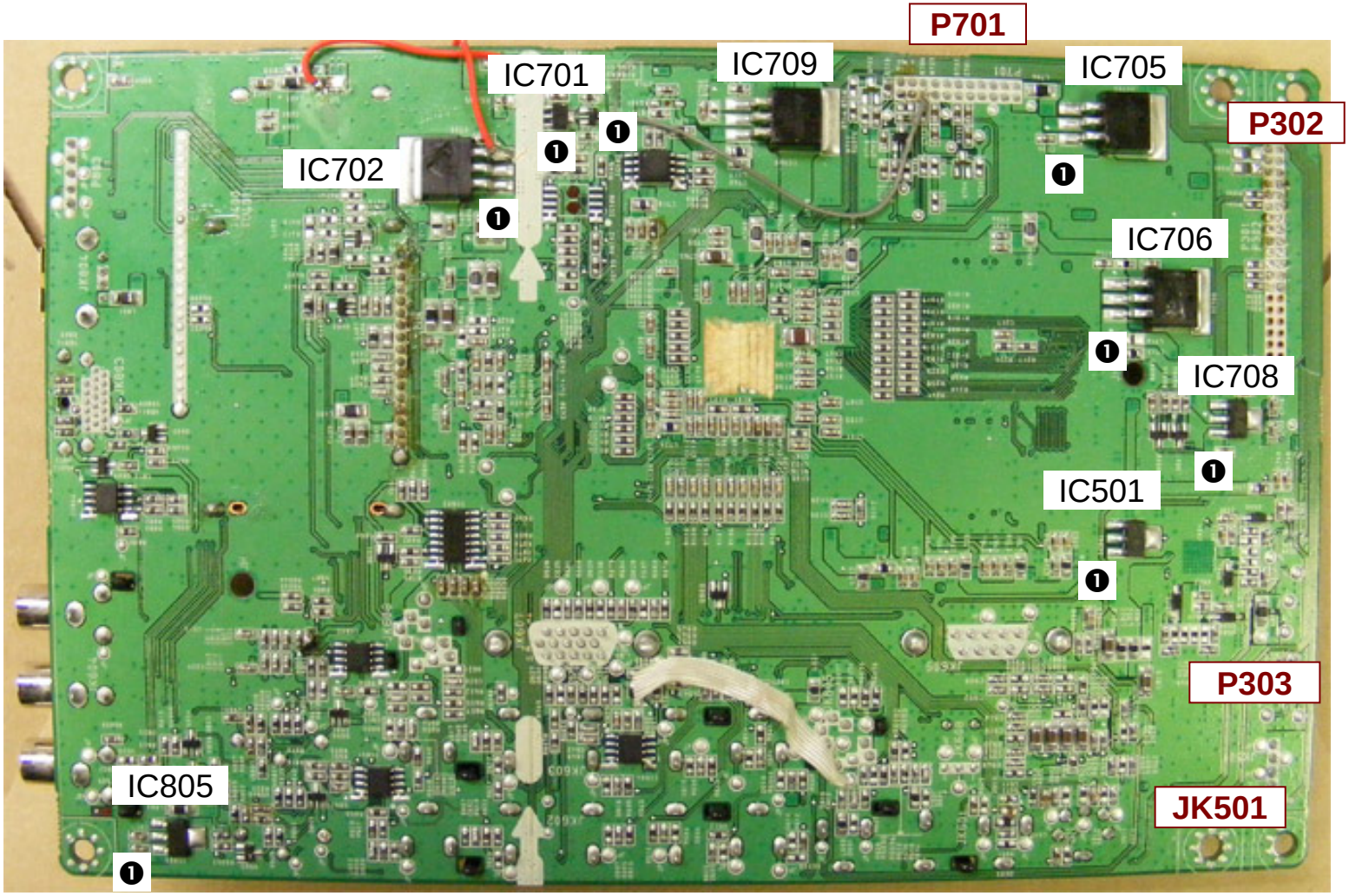
IC705
1) 5V
2) 3.29V
3) 0V

IC805
1) 5V
2) 3.3V
3) 0V

IC706
1) 5V
2) 3.64V
3) 1.38V

IC902
5) .29V
4) 5V
3) 0V
2) 0V
1) 0V

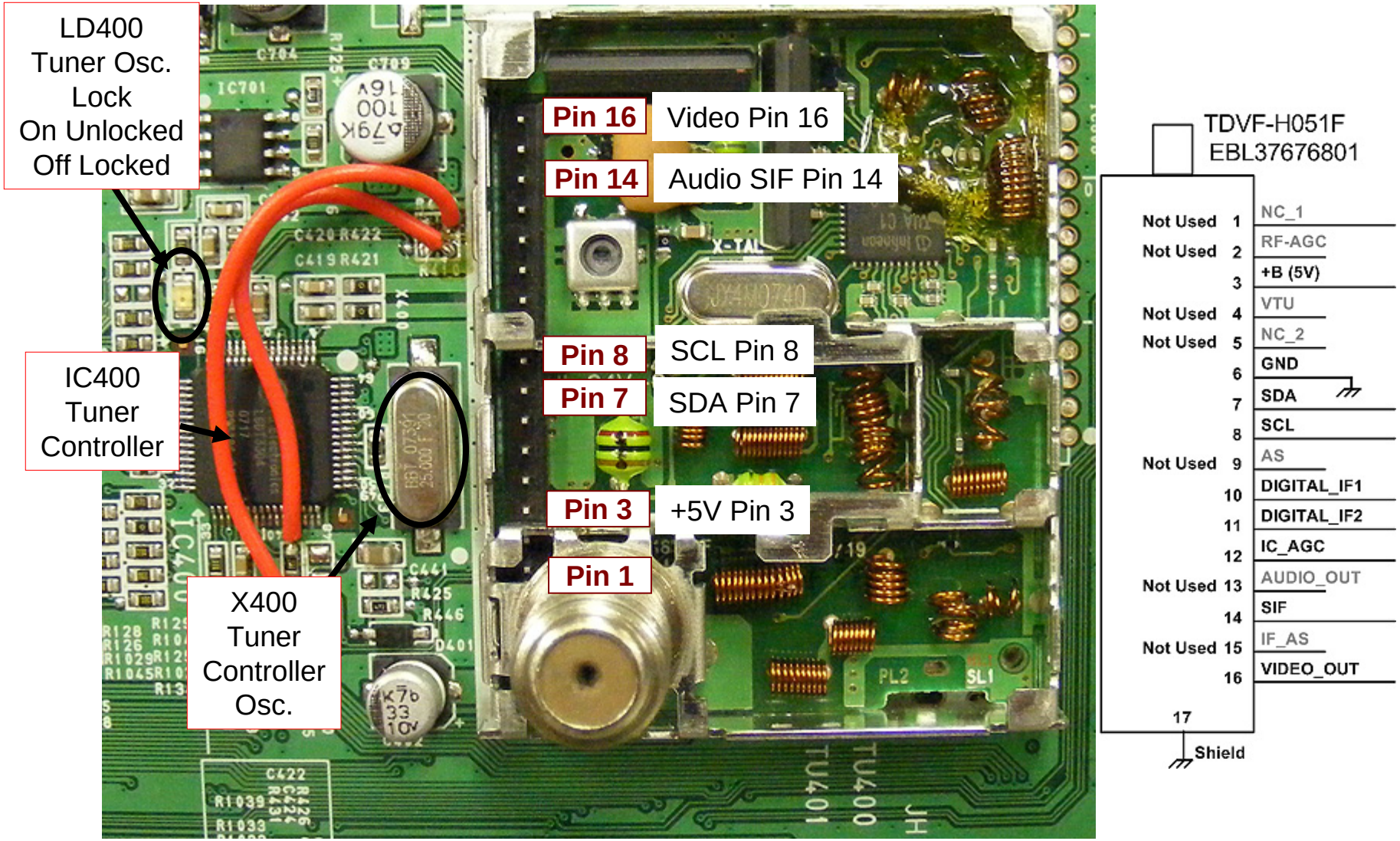
IC708
1) 5V
2) 3.3V
3) 0V



Be sure to prevent the Board from touching the frame while the Board is turned over.
Use a piece of cardboard or towel to insulate.

Tuner with Shield Off

TU400



Main Board Plug P302 "LVDS" Voltage and Diode Check

Diode Mode Measurements and Voltage Checks

P302 CONNECTOR "Main" Odd to P121 "Control Board"

Pin	SBY	Run	Diode Mode
1	0V	0V	Open
3	0V	0V	Open
5	0V	0V	Gnd
7	0V	0V	Gnd
9	0.89V	3.29V	1.64V
11	0V	1.25V	1.16V
13	0V	1.25V	1.16V
15	0V	1.27V	1.16V
17	0V	1.22V	1.16V
19	0V	1.24V	1.16V
21	0V	1.24V	1.16V
23	0V	0.58V	1V
25	0V	3.29V	OL

Odd Pins

Pin	SBY	Run	Diode Mode
2	0V	0V	OL
4	0V	0V	OL
6	Gnd	Gnd	Gnd
8	Gnd	Gnd	Gnd
10	0.89V	3.29V	1.64V
12	0V	1.21V	1.16V
14	0V	1.21V	1.16V
16	0V	1.21V	1.16V
18	0V	1.25V	1.16V
20	0V	1.21V	1.16V
22	0V	1.18V	1.16V
24	0.93V	3.29V	1.5V
26	Gnd	Gnd	Gnd

Even Pins

Diode Mode readings taken with all connectors removed.

Main Board Plug P303 Voltages and Diode Check

Voltage and Diode Test Measurements for the Main Board

P303 CONNECTOR "MAIN Board" to "Front Keys"

Pin	Label	STBY	Run	Diode Mode
1	IR	5V	5V	2.97V
2	Gnd	OV	OV	Gnd
3	KEY2	OV	3.29V	1.17V
4	Gnd	Gnd	Gnd	Gnd
5	KEY1	OV	3.29V	1.17V
6	Gnd	OV	OV	Gnd
7	STBY_5V	5V	5V	0.79V
8	Gnd	Gnd	Gnd	Gnd
9	RED_R	OV	OV	1.11V
10	Gnd	Gnd	Gnd	Gnd
11	RED_G	OV	2.84V	1.11V
12	Gnd	Gnd	Gnd	Gnd

Diode Mode readings taken with all connectors removed.

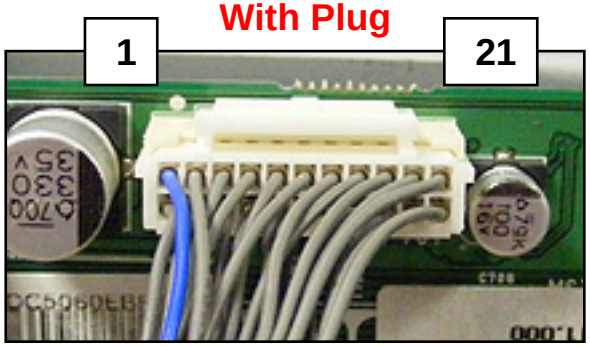
Main Board Plug P701 Voltages "Odd Pins"

Voltage and Diode Test Measurements for the Main Board P701

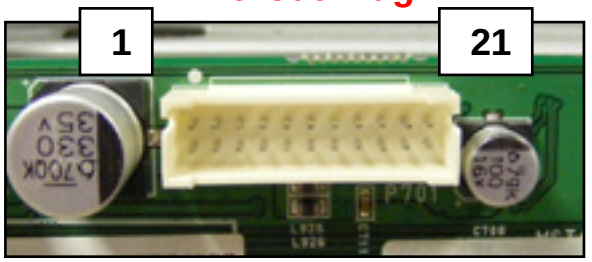
P701 CONNECTOR "Main" Odd Pins to P803 "SMPS Board"

Pin	Label	STBY	Run	Diode Mode
1	15V	0V	16V	2.87V
3	Gnd	Gnd	Gnd	Gnd
5	12V	0V	12V	OL
7	Gnd	Gnd	Gnd	OL
9	5V	5V	5V	0.79V
11	5V	5V	5V	0.79V
13	Gnd	Gnd	Gnd	Gnd
15	Gnd	Gnd	Gnd	Gnd
17	5_V Det	.15V	5V	3.24V
19	RL_On	0V	4.5V	OL
21	M5V_ON	0V	3.2V	1.21V

With Plug



Without Plug



Diode Mode readings taken with all connectors removed.

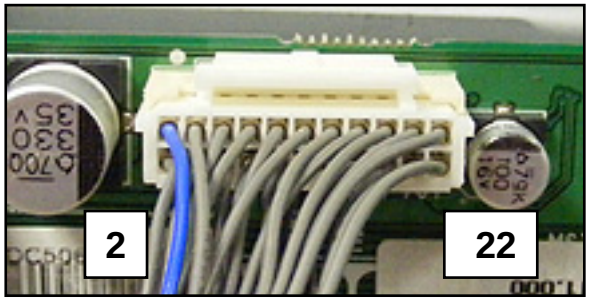
Main Board Plug P701 Voltages "Even Pins"

Voltage and Diode Test Measurements for the Main Board P701

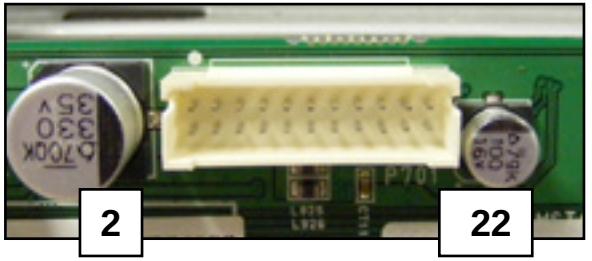
P701 CONNECTOR "Main" Even Pins to P803 "SMPS Board"

Pin	Label	STBY	Run	Diode Mode
2	15V	0V	16V	2.8V
4	Gnd	Gnd	Gnd	Gnd
6	12V	0V	12V	OL
8	Gnd	Gnd	Gnd	Gnd
10	5V	5V	5V	0.79V
12	5V	5V	5V	0.79V
14	Gnd	Gnd	Gnd	Gnd
16	Gnd	Gnd	Gnd	Gnd
18	AC Det	5V	5V	2.79V
20	Vs_On	0V	3.2V	1.21V
22	AUTO	0V	0V	Gnd

With Plug



Without Plug



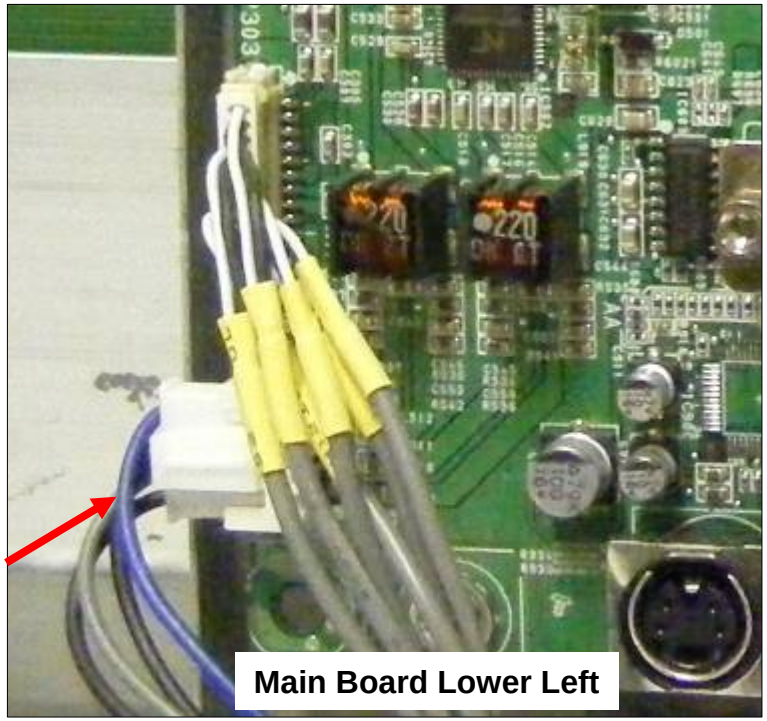
Diode Mode readings taken with all connectors removed.

Main Board Speaker Plug JK501 Voltages and Diode Check

Voltage and Diode Test Measurements for the Main Board Speaker Plug

JK501 CONNECTOR "Main" to "Speakers"

Pin	STBY	Run	Diode Mode
1	0V	8V	2.58V
2	0V	8V	2.58V
3	0V	8V	2.58V
4	0V	8V	2.58V



Diode Mode readings taken with all connectors removed.

INTERCONNECT DIAGRAM (11 X 17 FOLDOUT SECTION)

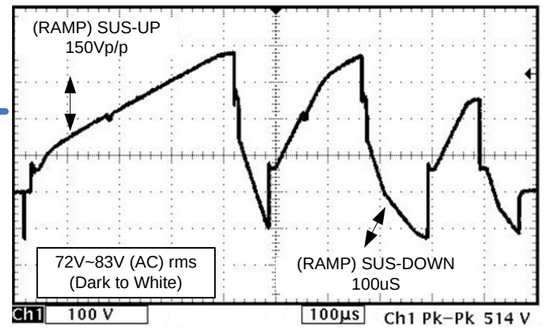
This section shows the 11X17 foldout that's available in the Paper and Adobe version of the Training Manual.

The Adobe version of this Training Manual allows the viewer to zoom in and out making reading of the small text easier.
This Power Point shows a graphical representation of the 11 X 17 foldout page so clarity is limited.

50PG20 INTERCONNECT DIAGRAM

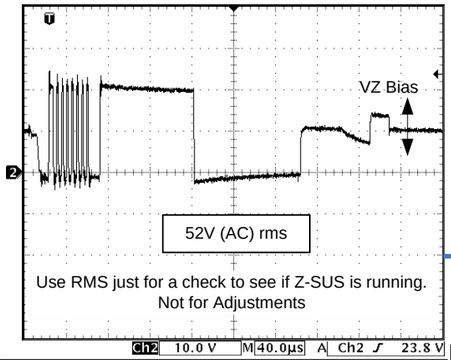
During SMPS Test (Described below), P803 disconnected;
1) P801 and P802 connected. Y-SUS and Z-SUS will produce sustain waveforms.
2) P801 connected P802 disconnected, Y-SUS will produce sustain waveform, Z-SUS does not.
3) P801 disconnected P802 connected. No SUS waveforms are produced due to a loss of control PWB B+ routed through the Y-SUS PWB.

Y-SUS DRIVE WAVEFORM



Use RMS just for a check to see if Y-SUS is running.
Not for Adjustments

Z-SUS DRIVE WAVEFORM



Use RMS just for a check to see if Z-SUS is running.
Not for Adjustments

Y-SUS TP

P110
P120
Y-SUS Top
P100
P130
P140
P206
FG5V
Set-dn
-VY TP
R201
SCAN
P207
SCAN
R202
VSC TP
VSC
FG5V
-VY
P208
P200
P210
P220
P230
Y-SUS Bottom
P240

Y-SUS

Discrete Components (Non-IPMs)

FS201 Vs
250V 4A
P209

Discrete Components (Non-IPMs)

Set-up
FS202
5V
10A
125V
P102 *

All -90V
125V 1.5A FS502
125V 1.5A FS501
125V 1.5A FS504
FS503 (5V)
125V 5A
P210

* VSC measurement is across R202
* -VY measurement is across R201

* Test points are open lands at P102 with pin one at the bottom

FS701
Va
125V 10A

5V for Control PWB
Delivered through P102
15V for Z-SUS also
routed through P102 and
out P163

Vs, Va and M5V

P803 Connector "SMPS" to P701 "Main"

Pin	Label	STBY	Run	No Load	Diode
1, 2	15V	0V	16V	16V	2.26V
3, 4	Gnd	Gnd	Gnd	Gnd	Gnd
5, 6	12V	0V	12V	12V	2V
7, 8	Gnd	Gnd	Gnd	Gnd	Gnd
9-12	5V	5V	5V	5V	1.7V
13-16	Gnd	Gnd	Gnd	Gnd	Gnd
17	5_V Det	0V	5V	5V	1.56V
18	AC Det	5V	5V	5V	2.56V
19	RL_On	0V	4.5V	0V	2.6V
20	Vs_On	0V	3.2V	0V	2.7V
21	M5V_ON	0V	3.2V	0V	2.6V
22	AUTO	0V	0V	5V	2.1V

VS Adj
P801
P802
VA Adj
SMPS POWER SUPPLY
P803
A/C IN
No Connection
P701

SMPS Test – Unplug P803 If all supplies do not run when A/C is reapplied, disconnect P801 and P802 one at a time to isolate the excessive load. This supply will operate with no external load.

Vs, Va and M5V

P2 / P163

Pin	Label	STBY	Run
1	SUS-DN	0V	16V
2	SUS-UP	0V	16V
3	ER-DN	Gnd	Gnd
4	ZBIAS	0V	0.48V
5	ZB-CON	0V	0.27V
6	ER-UP	0V	0.1V
7	ENABLE	0V	0.06V
8	none	Gnd	Gnd
9	none	0V	0V
10	none	0V	1.93V
11	none	0V	2.66V
12	none	Gnd	Gnd

P102 / P111

Pin	Label	STBY	Run
1	CLK	0V	3.2V
2	STB	0V	0.76V
3	OSC1	0V	0V
4	OSC2	0V	3V
5	DATA	0V	0.6V
6	SUS_DN	0V	0V
7	SUS_UP	0V	2V
8	ER_DN	0V	1.2V
9	ER_UP	0V	2V
10	SET_UP	0V	0.26V
11	SET_DN	0V	0.2V
12	PASS_TOP	0V	0.2V
13	DELTA_VY	0V	0.16V
14	DET_LEVEL	0V	0V
15	SLOPE_KEY	0V	0V
16	SET_UP	0V	1.9V
17	SET_DN	0V	1.4V
18	X_ER	0V	2.9V
19	Y_ENABLE	0V	0.6V

P210 / P242

Pin	Label	STBY	Run
1	Va_C	0V	65V
2	Va_C	0V	65V
3	VPP_Out_XR	0V	62.4V
4	VPP_Out_XR	0V	62.4V
5	VPP_Out_XL	0V	62.3V
6	VPP_Out_XL	0V	62.3V
7	VPP_Out	0V	63.3V
8	VPP_Out	0V	63.3V
9	Gnd	Gnd	Gnd
10	Gnd	Gnd	Gnd
11	+15V	0V	15.9V
12	+15V	0V	15.9V

No Connection
Software Download
P164
P131
IC121
Pin 1 (5V)
Pin 2 (3.3V)
Pin 3 (0V)
FL111 FL112
5V Fuses
P111
M5V
15V

15V
P1
P121
P163
Crystal
D15 D16 D17

With the unit on. If none of D15, 16, 17 are illuminated. Check supplies to the PCB. If they are present replace the Control PCB

CONTROL PCB

Auto Gen
(3.3V)
10,11,12
IC151
P151
P161
P162
IC171
Pin 1 (5V)
Pin 2 (3.3V)
Pin 3 (0V)
(3.3V) to
P161, P162
(3.3V)
48,49,50

* If the complaint is no video and shorting the points (AutoGen) causes video to appear suspect the Digital PCB.

Short across the two points labeled Auto Gen to generate a test pattern.

Remove all input signals from the unit so the menu will be the only video to be found on the LVDS cable.
NOTE: White noise from the tuner may cause these signals to vary. These were taken with the unit set to component with no input signal.

See next page for waveforms

P302

Pin	State	Ref#
11	Menu Off	10
	Menu On	11
12	Menu Off	08
	Menu On	09
13	Menu Off	12
	Menu On	13
14	Menu Off	06
	Menu On	07
15	Menu Off	14
	Menu On	15
16	Menu Off	04
	Menu On	05
19	Menu Off	16
	Menu On	17
20	Menu Off	02
	Menu On	03
21	Menu Off	18
	Menu On	19
22	Menu Off	00
	Menu On	01

To keys and IR
To Speakers

Z-SUS TP
Z-SUB
Z-SUS TP
P6
Z-SUS TP
P4
P10
P5
P11
Z-SUS TP
P8

FS1 (Vs)
250V 4A
VZB TP
P3
FS2 (5V)
125V 10A
VZB
FS3 (16V)
125V 1.5A
P2
15V

Discrete Components (Non-IPMs)
Discrete Components (Non-IPMs)

Z-SUS

** LD703 Lights Red in Stby. 5VSBY from SMPS OK.
Set on, Lights Red 5V General OK. Appears Amber

IC705
P701
IC709
IC701
IC707
Reset
IC902
P302
IC706
**LD703
Q706
IC708
P303
IC501
CN701
IC100 Micro
X100 12 Meg
1.5V SBY
LD400
X400
25 Meg
Run Only
Pin 16
TUNER
Pin 1
IC805

LD400 lit during initialization.
Tuner lock OK turns LED off.

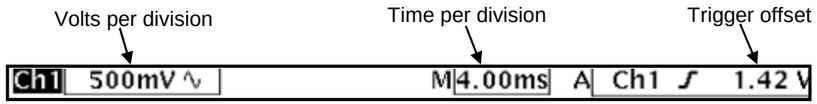
MAIN PCB

* Grayed Out ICs are located on Back

IC701	IC709
1) 5V	1) 3.29V
2) 0V	2) 1.26V
3) 5V	3) 0V
IC702	**IC501**
3) 5V	1) 3.3V
2) 3.3V	2) 1.8V
1) 0V	3) 0V
IC705	**IC805**
1) 5V	1) 5V
2) 3.29V	2) 3.3V
3) 0V	3) 0V
IC706	**IC902**
1) 5V	5) .29V
2) 3.64V	4) 5V
3) 1.38V	3) 0V
	2) 0V
	1) 0V
IC708	
1) 5V	
2) 3.3V	
3) 0V	

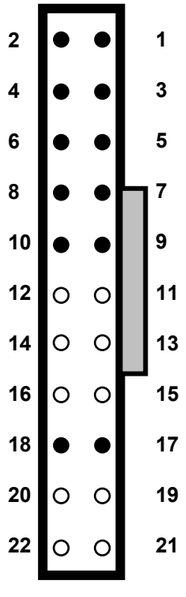
Va and 16V
(3.3V)
48,49,50
Va and 16V
(3.3V)
10,11,12

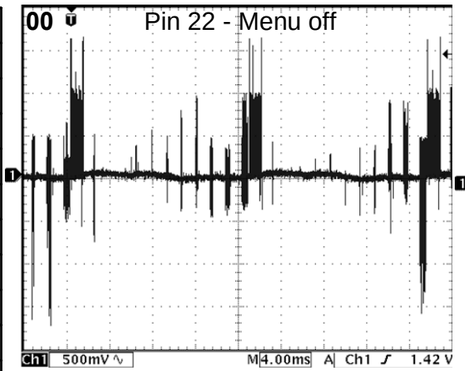
LEFT X DRIVE
P101 P102 P103 P104
P121
P242
P233
P241
P232
CENTER X DRIVE
P201 P202 P203 P204 P205 P206
P211
P331
P311
RIGHT X DRIVE
P301 P302 P303 P304 P305 P306

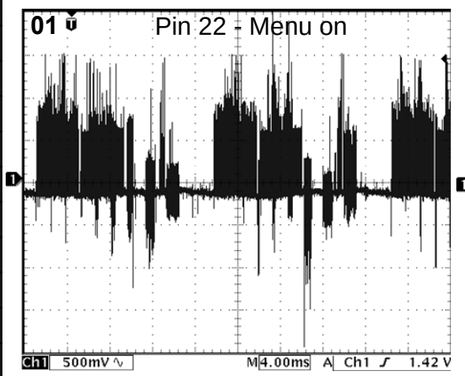


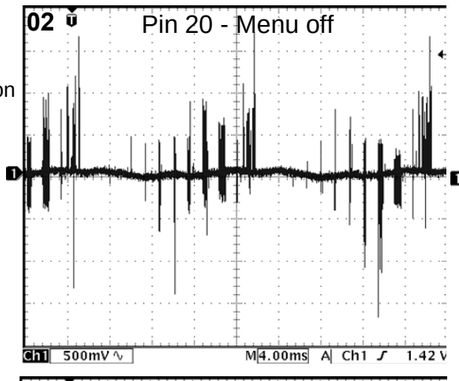
P302		
Pin	**State**	**Ref #**
11	Menu Off	10
	Menu On	11
12	Menu Off	08
	Menu On	09
13	Menu Off	12
	Menu On	13
14	Menu Off	06
	Menu On	07
15	Menu Off	14
	Menu On	15
16	Menu Off	04
	Menu On	05
19	Menu Off	16
	Menu On	17
20	Menu Off	02
	Menu On	03
21	Menu Off	18
	Menu On	19
22	Menu Off	00
	Menu On	01

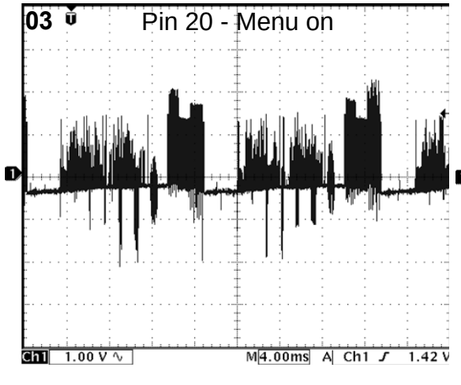
Connector P302 Configuration
○ - indicates signal pins.

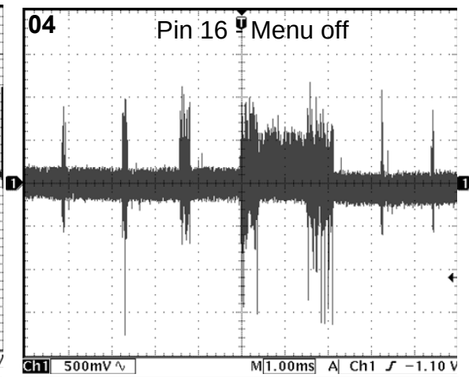


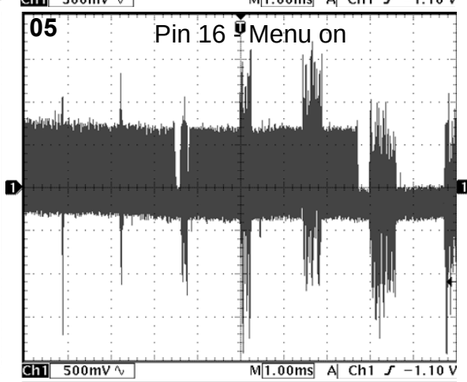


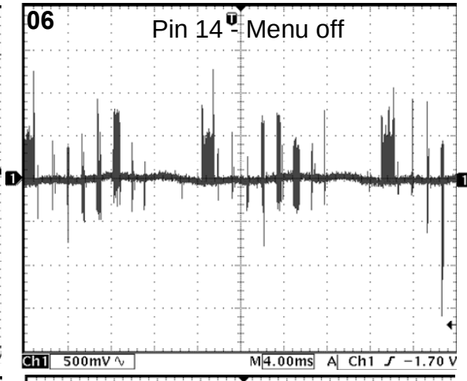


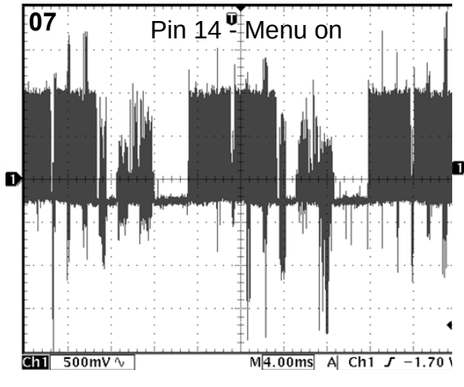


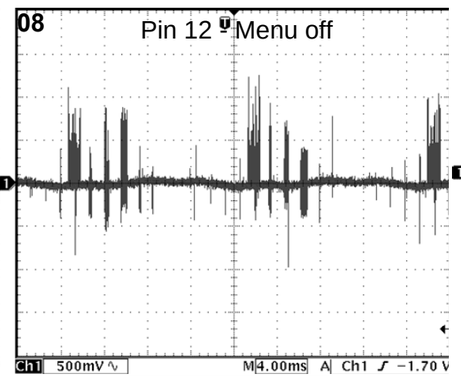


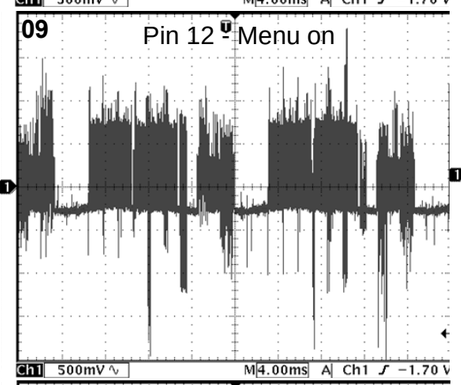


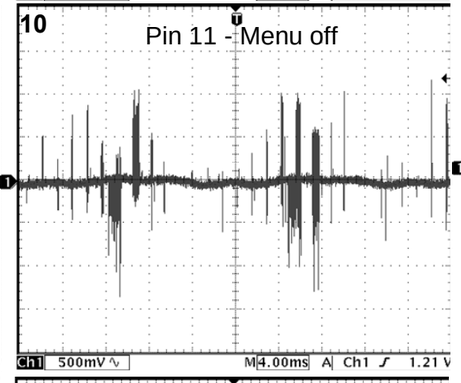


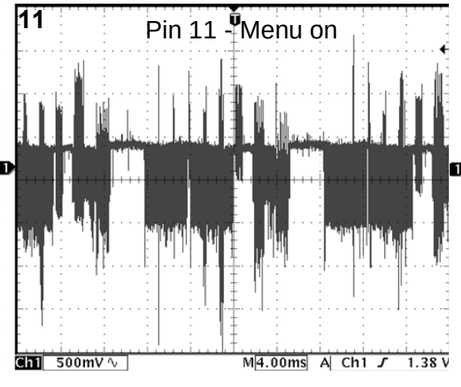


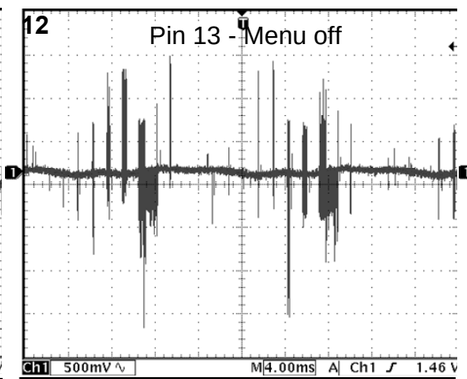


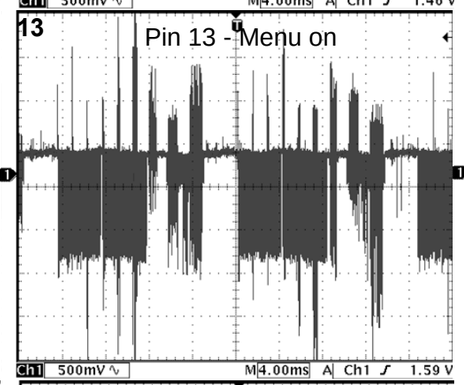


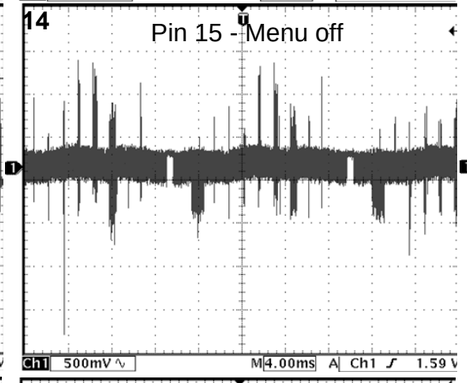


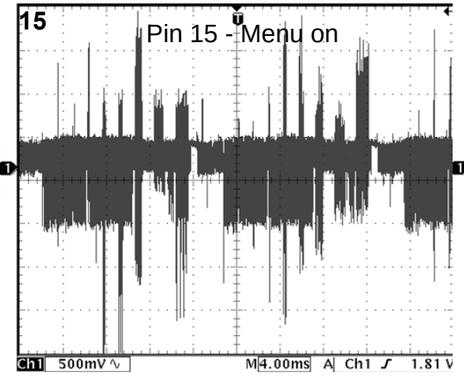


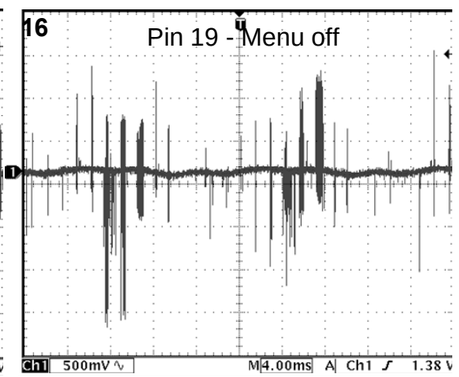


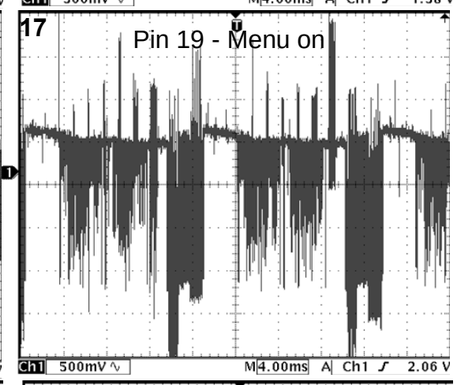


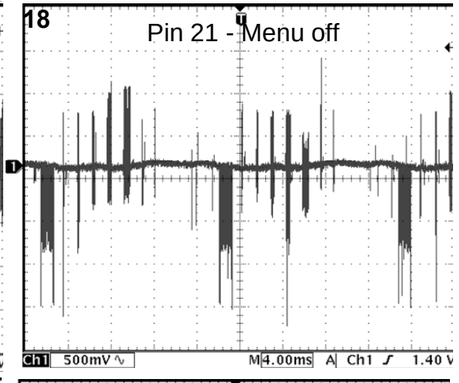


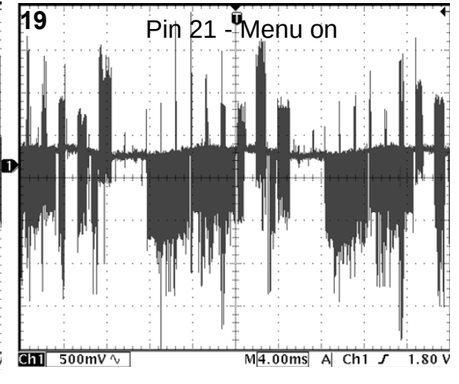












LG TRAINING CENTER

End of Presentation

This concludes the 50PG20 Presentation

Thank You

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