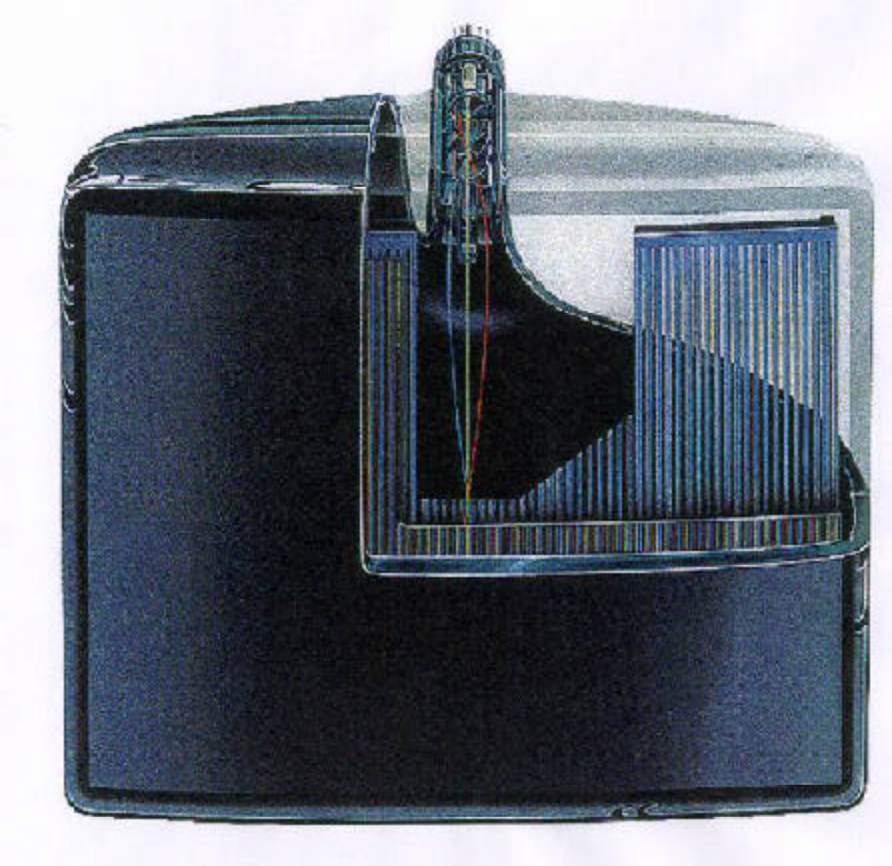
SONY

Training Manual

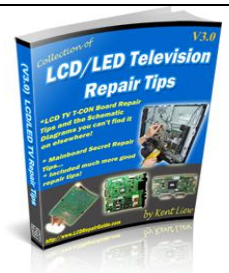
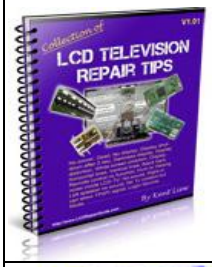


CRT Troubleshooting

Diagnostics and Troubleshooting

Course: CRT-01

Recommended Troubleshooting & Repairing Guide:

 V3.0 –LED & LCD TV Repair Tips ebook "More information on T-con Board & Mainboard Secret Repair Tips!"	 V2.0- LCD TV Repair Tips & Case Histories
 V1.0- Collection of LCD TV Repair Tips	 Vol-3 LCD/LED Monitor Repair Case Histories by Jestine Yong
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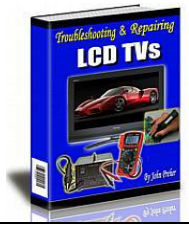
 Projection TV & DLP/LCD Projector Repair Membership Site	 Troubleshooting & Repairing LCD TV Guide
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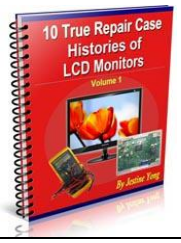
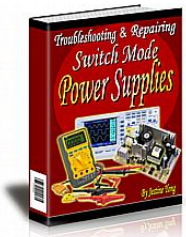
 LCD Monitor Repair Guide	 Vol .1- 10 Trus Repair Case Histories of LCD Monitor
 SMPS-Switch Mode Power Supply Repair Guide	 Testing Electronic Components like a Pro-For Beginner

Please visit: http://lcd-television-repair.com/newsletter/Recommend.html

Table of Contents

Chapter 1 - Inside the CRT

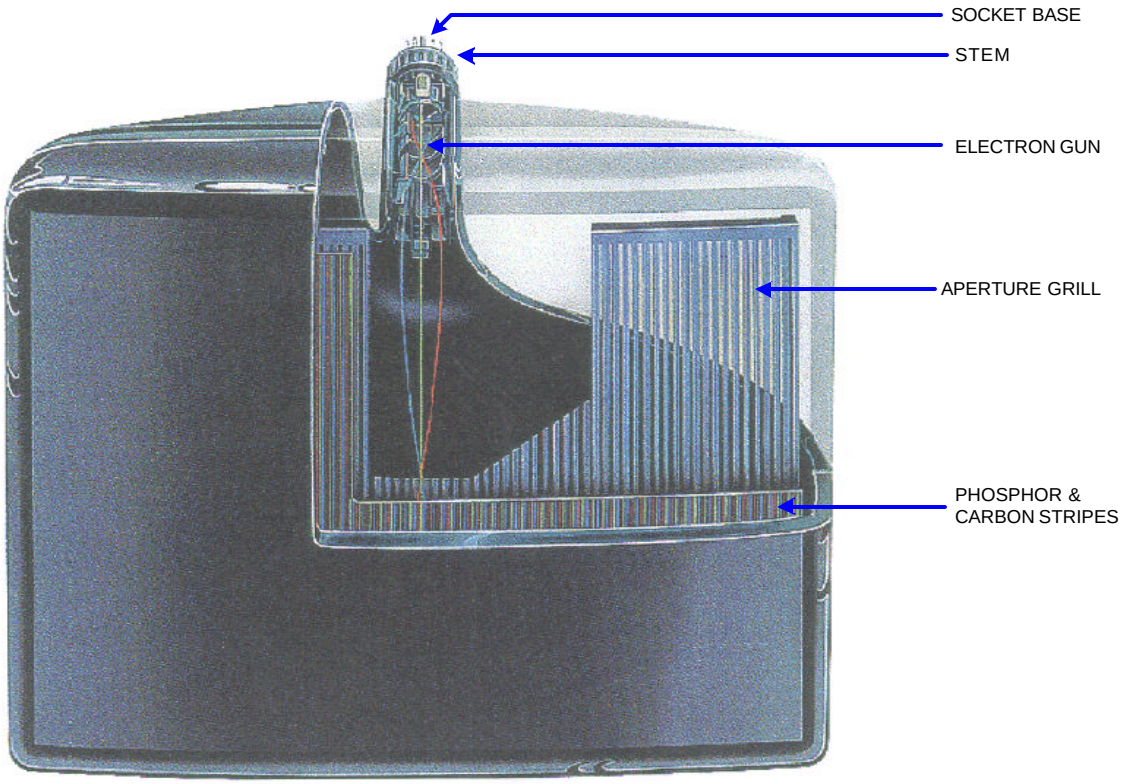


FIGURE 1-1 - EXPLODED VIEW CTR01.1-1 12/5/03

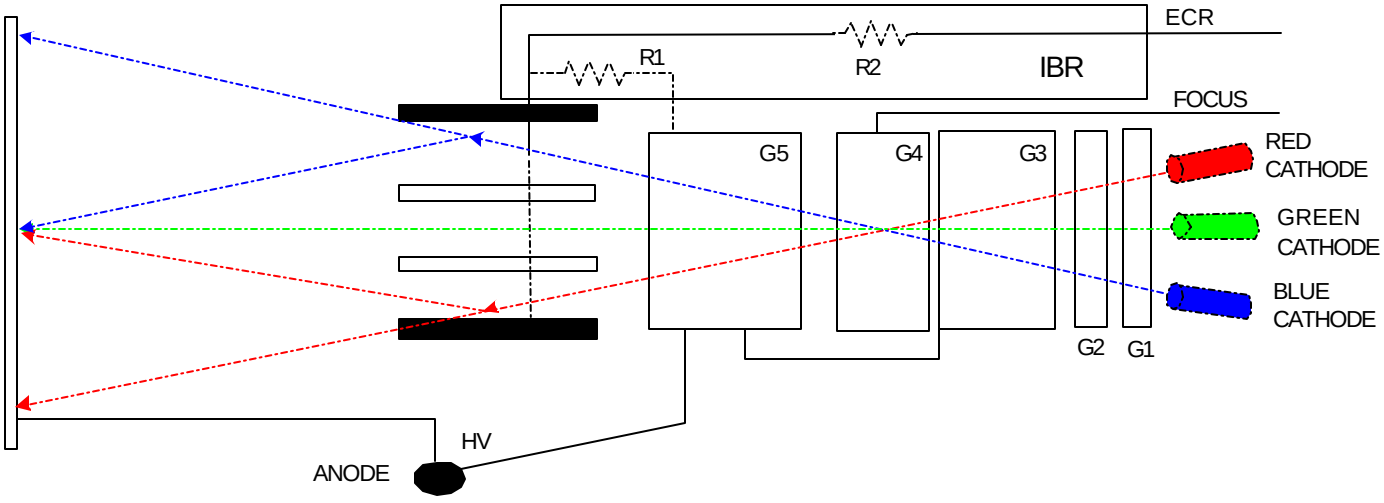


FIGURE 1-2 - TOP VIEW OF ELECTRON GUN CRT01.1-2 12/5/03

Chapter 2 - Repair Analysis Flowchart

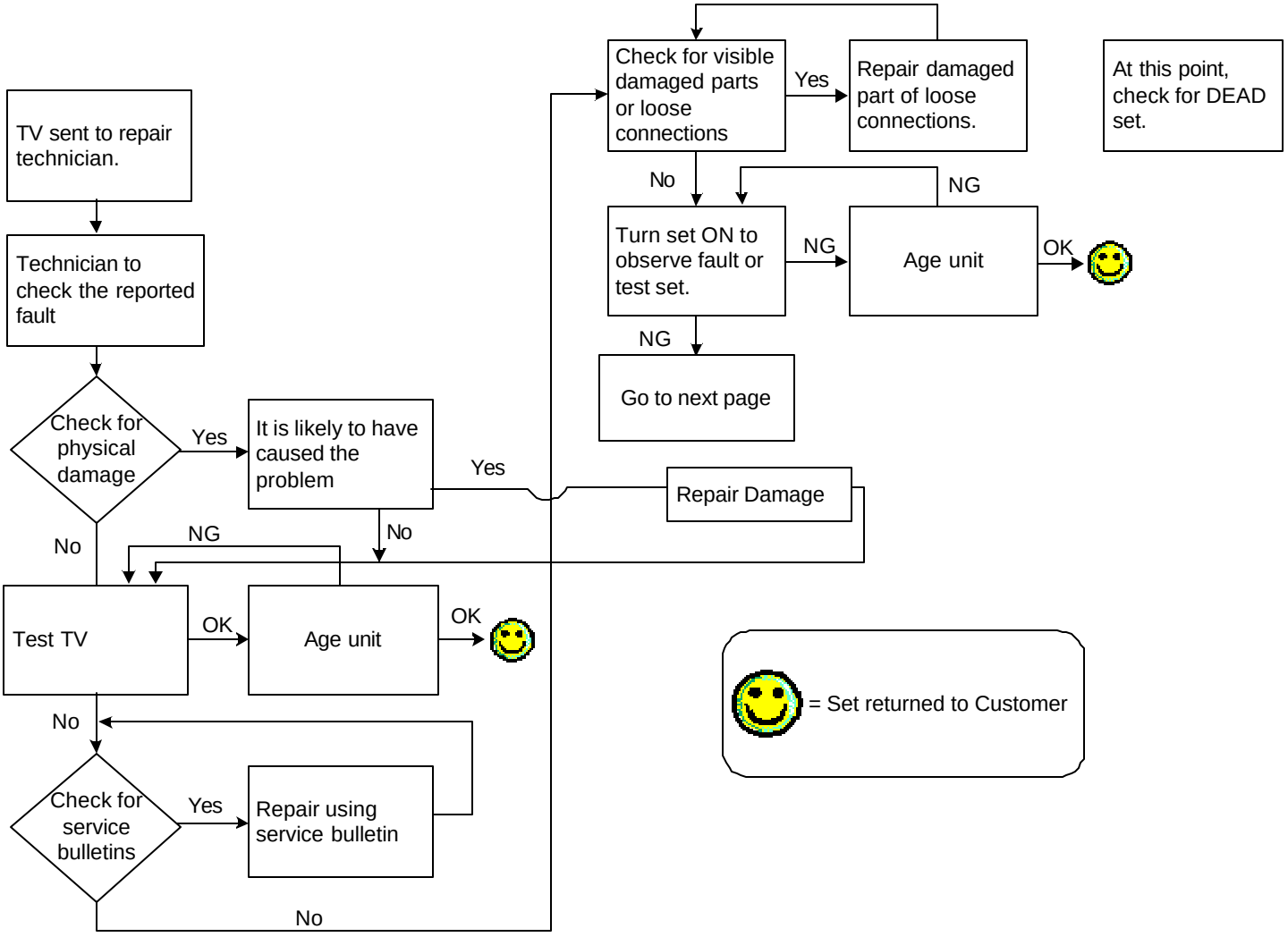


FIGURE 2-1 - ANALYSIS FLOWCHART

CTR01.2-1 12/3/03

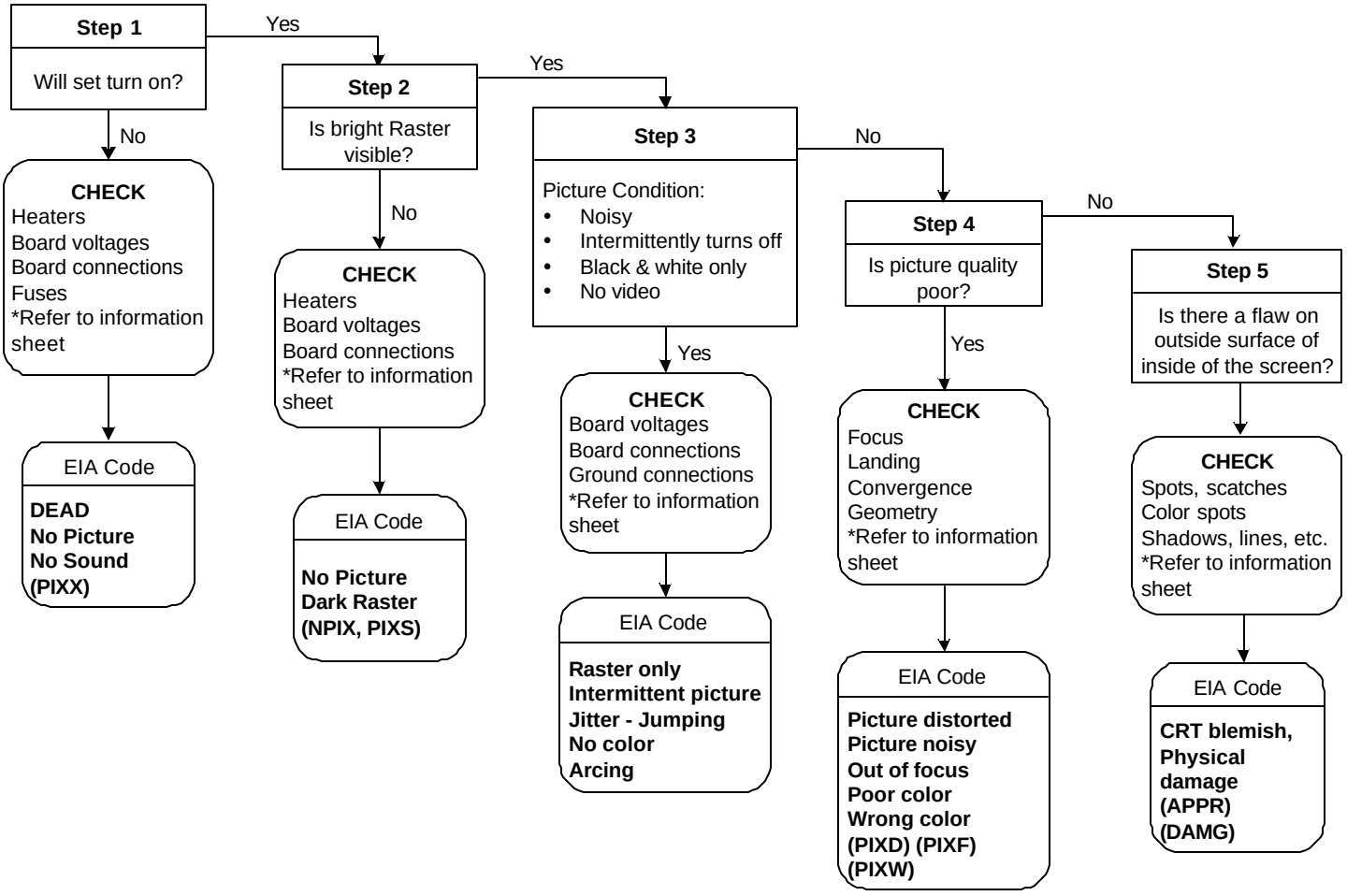


FIGURE 2-2 - ANALYSIS FLOW (CONTINUED)

CTR01.2-2 12/3/03

Chapter 3 - CRT Related Symptoms

Spots (black, white, burn, dust); color mixing; shadows; line kinks

Cause:

Flaw on or behind phosphor affecting the overall appearance of the picture.

EIA Code: APPR

EIA Description: Appearance defect

CTV Description: Visual defect

Arcing - popping noise from the CRT gun; raster noise; intermittent focus; intermittent brightness changes

Cause:

Current leak, stray electrons. Particles in the electron gun cause intermittent current leakage between elements.

EIA Code: ARCS; PIXI; PIXJ

EIA Description: Arcing; Intermittent picture; Jittery/unstable picture

CTV Description: Arcing; Short

No picture; sound is present, heater filaments are ON

Cause:

Cathode emission; short; low vacuum. The cathode emission may be weak; grids may be shorted; may be intermittent or consistent.

EIA Code: NPIX

EIA Description: No picture

CTV Description: White balance, short

No color in picture

Cause:

CRT short at cathode or grids causing a defect in “B” board (video drive).

EIA Code: PIXC

EIA Description: No color in picture

CTV Description: Short

Poor convergence; color distortion

Cause:

CRT gun is not perpendicular to the CRT face - physical damage; internal IBR resistor is damaged. Color distortion may consist of colored shadows in the picture.

EIA Code: PIXD

EIA Description: Picture distorted/noisy

CTV Description: Convergence

Geometric distortion

Cause:

CRT gun is not perpendicular to the CRT face - physical damage; internal IBR resistor is damaged.

EIA Code: PIXD

EIA Description: Picture distorted/noisy

CTV Description: Geometric

Entire screen is out of focus

Cause:

Leak current between G-3 and G-4. This may be constant or intermittent.

EIA Code: PIXF

EIA Description: Picture out of focus

CTV Description: Focus

Raster with retrace lines (normal or low brightness), no video

Cause:

Short between grids (typically G1 and G2). G2 drive circuit may become damaged.

EIA Code: PIXL

EIA Description: Raster is present, but no picture

CTV Description: Short

Dark or no picture, sound is present, limited brightness level adjustment

Cause:

Poor emission due to shorted grids or vacuum leak. Sound is present, but the picture is weak or cannot be seen.

EIA Code: PIXS

EIA Description: Dark picture

CTV Description: White balance

Color contamination or incorrect colors, typically at the corners.

Cause:

Purity – beam landing; DY ring magnets; CRT magnets; degauss defective

EIA Code: PIXW

EIA Description: Poor or incorrect color

CTV Description: Landing

Symptom/Cause: Mislanding, purity shift

No picture, no sound. HV will not turn ON.

Cause:

Vacuum leak; broken neck; frit leak; open filament heaters. Main fuse may be blown.

EIA Code: PIXX, DEAD

EIA Description: No picture, no sound

CTV Description: Broken CRT, open heaters

Chapter 4 - DEAD Unit Troubleshooting (DEAD or PIXX)

CRT Causes

No Heaters

Turn the power ON and visually check the heaters.

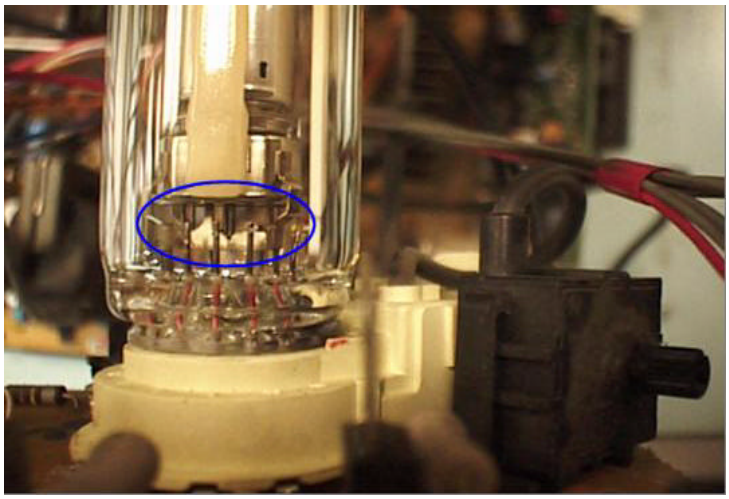


FIGURE 4-1

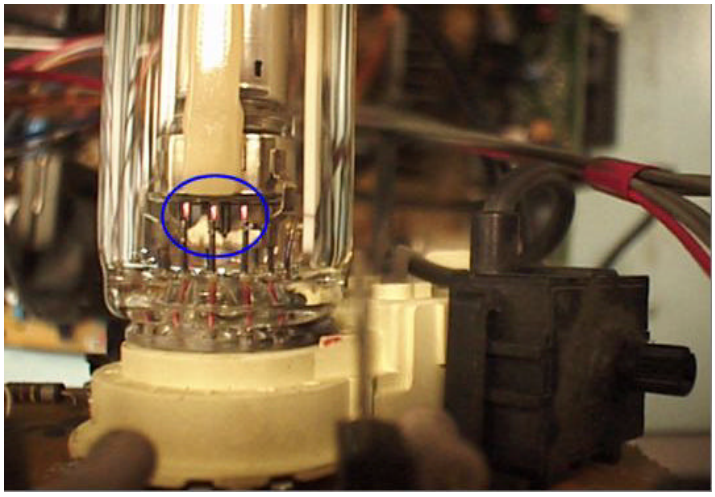


FIGURE 4-2

Broken CRT

Look for damage to the neck of body of the CRT.

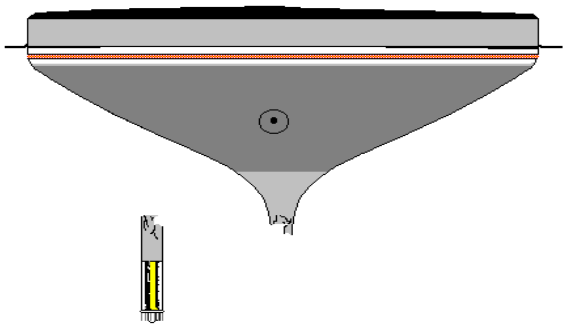


FIGURE 4-3 - BROKEN CRT

Table 4-1 – DEAD Unit (DEAD, PIXX) **Possible causes other than the CRT**		
Symptom	**CHECK ITEMS**	**COUNTER MEASURE**
No Picture / No Power	Power cord plugged in / Power on ?	Plug in / Turn power on
	Fuse	Change fuse
	Anode cap position	Connect anode cap securely if off
	Check G2 level	If too high (2 flash OCP), lower H-out may be defective. If too low (5 flash AKB) will occur. Adjust for correct level.
	Check B+ voltage	Check for short circuit to GND. AE-5A may be low H-out (2 flash OCP). Power IC problem. The fuse may be broken – replace fuse.
	Check FBT soldering connection	Re-solder bad connection.
	Check for crack board near FBT	Replace board
	Check M board connection	Secure M board, insert correctly.
	Check service bulletin information	Implement fix as per bulletin.
	Check DY connection	Check if DY connector is inserted into the board correctly.

Chapter 5 - No Picture or Dark Picture Troubleshooting (NPIX or PIXS)

Poor Emission, Vacuum

Adjust the Cathode drive and G-2 level and check for brightness changes.

Short, Hot Short

With CRT socket off, check each CRT pin for a short with another pin. (Note: G-1 and heaters have multiple pins.)

Heat expansion may cause “hot shorts”. For hot shorts, turn the set on, wait until problem occurs, then quickly shut down and check for shorts.

No Heaters

Turn the power ON and visually check the filament heaters for glow

HEATER NO GOOD

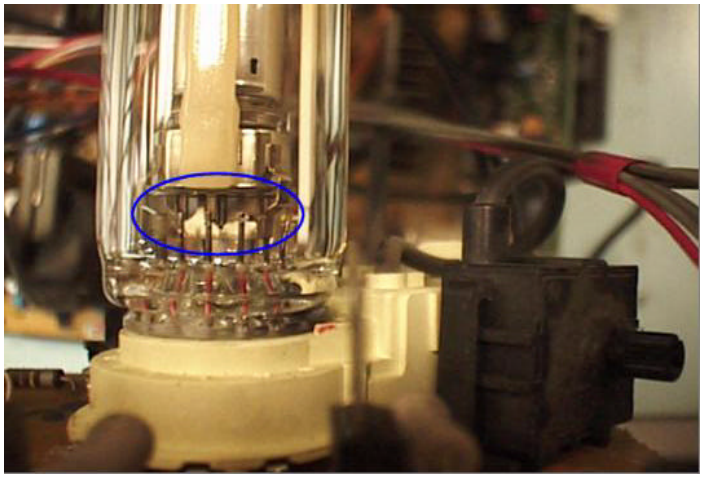


FIGURE 5-1

HEATER OK

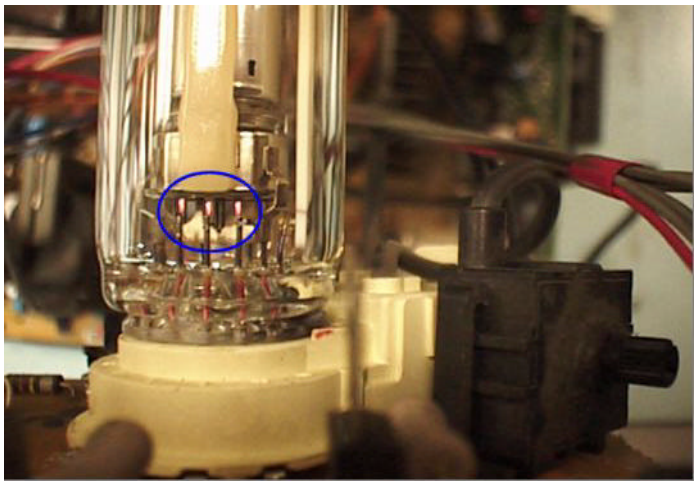


FIGURE 5-2

Table 5-1 – No Picture or Dark Picture (NPIX or PIXS) **Possible causes other than the CRT**		
Symptom	**CHECK ITEMS**	**COUNTER MEASURE**
No Picture	Voltages to each electron gun.	Trace back to power source for the cause.
	Video drive circuit.	Replace IC.
	Check if anode cap is on.	Connect the anode cap securely.
	C board: may be loose or off. (Normally a 5 flash AKB error)	Attach the C board properly.
	Filament heater. Heater voltage should be about 6.3 Vrms (Sound should work).	Trace cause of missing heater voltage and repair.
	G2 voltage. (2 flash OCP or 5 flash AKB error)	If too high, lower H-out may be broken (2 flash OCP error). If too low, 5 flash AKB error will occur. Readjust.
	B+ voltage	Repair short circuit to GND. AE-5A may be low H-out (2 flash OCP). Power IC problem. Broken / blown fuse. Repair
	FBT mounting	Repair / re-solder bad connection.
	FBT circuit - cracked board	Replace board.
	M board connection	Secure M board, insert properly.
	DY connector insertion	Reconnect DY properly
	Check service bulletin information	Implement fix as per bulletin.

Chapter 6 - Arcing, No Color, Intermittent Picture, Jitter, Raster Only or Retrace Lines (ARCS, PIXC, PIXI, PIXJ, PIXL)

PIXL, PIXI, PIXJ, PICC or ARCS – CRT Causes

Four causes may produce above symptoms and all are related to current flow between electron gun elements.

1. Internal Arcing (Popping sound)

Cause:

Current discharge from a high voltage potential to ground or to low voltage potential.

Arcing can occur when foreign particles as small as 2mm are present in the CRT gun. Factors for arcing are: voltage potential differences between the electrodes; distances between the electrodes; shape, size and location of the particles.

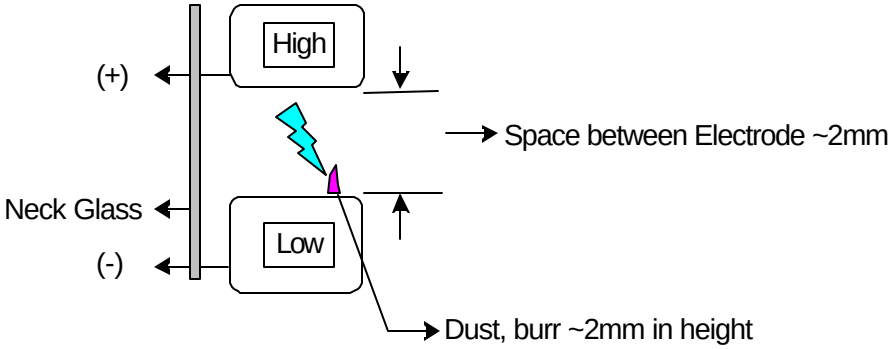


FIGURE 6-1 CTR01.6-1 12/5/03

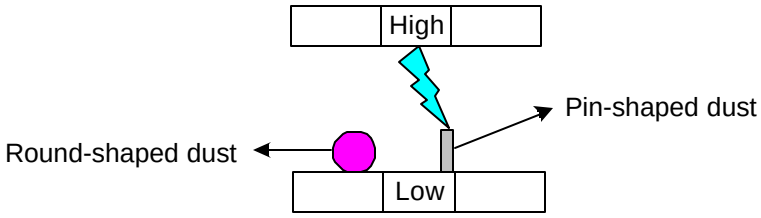


FIGURE 6-2 CTR01.6-2 12/5/03

Occasionally, arcing occurs between the cathodes, causing emission problems.

2. Stray Electrons

Cause:

As a result of cold emissions, electrons flow from a lower electric potential of the gun to a higher potential of the gun in areas that they would not otherwise normally flow.

Cold Emission occurs when an electron flow is induced by a strong electric field between two parallel electrodes.

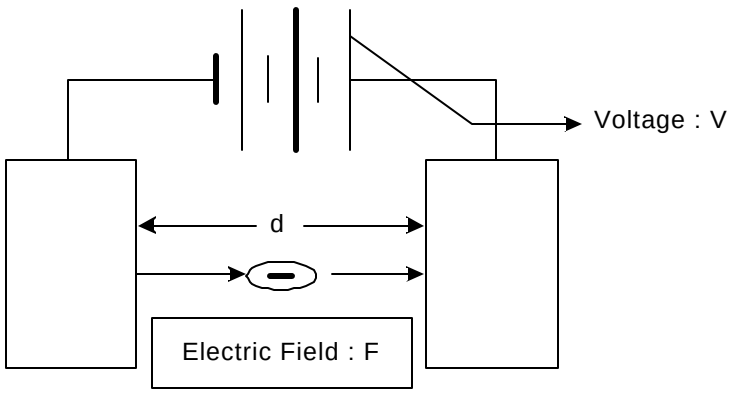


FIGURE 6-3

3. External Leaks

Cause:

These leaks occur between the CRT pins on the CRT socket and are caused by external contamination on the socket between the pins or by insufficient RTV.

Solution:

Clean socket and apply RTV compound in areas shown.

4. Shorts

Cause:

A complete short between two grids. It may be internal, usually caused by physical damage or mishandling; or external, caused by contamination or shorted wires.

Collateral Damage Caused by Arcing

Semiconductor Damage

Arcing can damage semiconductors.

Surface Burn Spots

When stray electrons occur in the neck area, areas of the screen can remain illuminated after deflection has ceased and cause CRT burn marks.

Focus Shift

A resistor divider normally supplies G4 voltage. When stray current flow occurs, the excessive current flow through the resistor can change its value, causing focus changes.

Brightness and White Balance Changes

On some units a resistor divider supplies G2 voltage. When stray current flows from G2, the excessive current flow through resistor can change its value, causing brightness level changes on direct view units and white balance changes on projection units.

On some units, this can also occur from G1, with similar results.

Horizontal Static Misconvergence (HME)

Stray current from G1, G2 and G4 or from the internal CRT wall may hit the C plate and flow through the IBRs C terminal, causing a potential change on this terminal and horizontal static misconvergence.

IBR Resistance Change

Stray electrons flowing through the IBR and ions bombarding the IBR directly can cause a temperature rise in the IBR, changing its value. This causes the horizontal static convergence to gradually shift with use.

Table 6-1 –– Causes other than the CRT		
PROBLEM	**CHECK ITEMS**	**COUNTER MEASURE**
Arcing	Open ground connections	Reconnect if loose.
	HV leaks around anode cap.	Clean anode / area. Apply sealer (if required).
	Arcing / leakage at socket pins.	Apply RTV G4 and IBR pins.
No color in picture	Check video drive circuit.	Repair IC.
Intermittent or jittery picture	Check connections on the boards.	Reconnect loose connections.
	Check for cracked circuit boards.	May be intermittent contact. Replace board.
	Check for cold soldering	Resolder the bad connection.
Raster only, no picture. Retrace lines	Check G-2 drive circuit.	Overdriving will produce retrace – Replace the defective part / readjust
	Check Video drive circuit.	Repair IC

Chapter 7 - Convergence / Beam Landing Troubleshooting (PIXD, PIXW)

Overview

Incorrect colors can be caused either by 1) incorrect beam landing (purity) – that is – one or more beams do land on their respective color phosphor stripe, or by 2) incorrect convergence – that is – the R, G, B beams are not superimposed over each other.

Identifying Convergence / Beam Landing Problems

Beam Landing

Poor beam landing is visible as a discoloration whenever there is a raster on the screen. In can be of any size and in any location on the screen. An example is shown in figure 7-1.

FIGURE 7-1

Convergence

The three beams produced by the CRT electron gun must be superimposed and converge on the same spot on the CRT face. A poorly converged unit will have discolorations at either horizontal or vertical areas of the picture. It will not occur in solid parts of the picture. An example of poor horizontal and vertical convergence is shown in Figure 7-2.

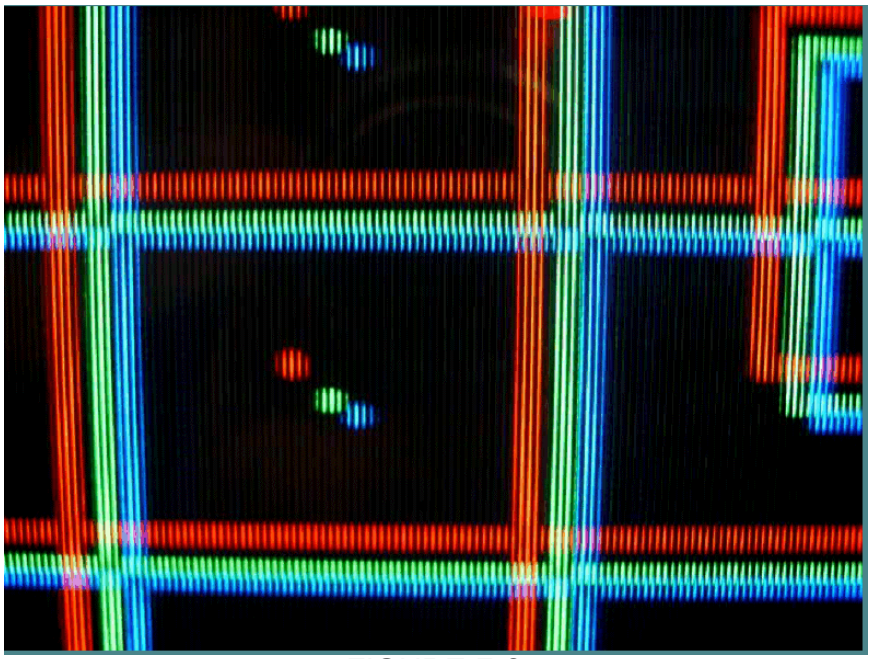


FIGURE 7-2 CTR01.7-2 12/5/03

CRT Caused

H-static Drift

The most common cause of color convergence problems attributable to the CRT is h-static drift caused by a change of the IBR resistor value. This occurs after a unit has been placed in service.

Stray current inside the electron gun, or arcing, can change the IBR resistor value. If this occurred, H-static in the center of the CRT will still be adjustable. The drift may stabilize after a period and further adjustment or CRT replacement may not be necessary.

Aging

Slight convergence drifts due to aging if the CRT may cause slight convergence drifts. The drift may be small and within tolerances, or may be large.

Magnetization

External environmental magnetization can magnetize the CRT over time so and create a purity problem.

Customer Dissatisfaction

The unit may be within acceptable limits but the customer may not be satisfied. This issue is more subjective than an actual “problem” and may require customer counseling, circuit touchups, or Sony Customer Service intervention.

Solutions

1. In all instances, fine adjustments to the CRT and circuits are the first steps to take to satisfy the customer.

   When appropriate, steps should include, external degaussing, circuit adjustments, DY ring adjustments, CRT magnet replacements, and permalloy strip replacements.
2. Replace the deflection yoke if step 1 does not yield satisfactory results. It usually has the same effect as replacing the CRT.
3. Replace the CRT if steps 1 and 2 do not yield satisfactory results. Consult with your Sony Technical representative before replacing a CRT if the unit is within acceptable limits and the customer is still dissatisfied.

CRT Aperture Grill

An aperture grill that has shifted off its frame causes the symptom shown in Figure 7-3. The unit being dropped usually causes this. Check for other physical damage to unit or packaging to confirm. Replace the CRT.

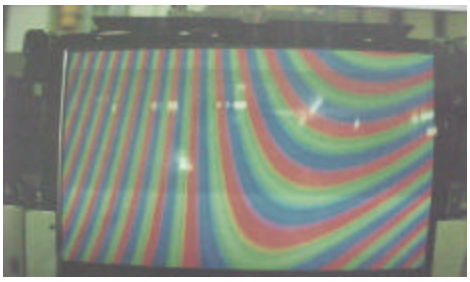


FIGURE 7-3

Non CRT Caused

Beam Landing (Purity M/L)

The beam landing discolorations are usually caused by either a magnetized CRT aperture grill or by external magnetic forces near the CRT that affects the CRT beam. The most common external items are:

Set Stand

If the set is on an iron or steel stand, take it off the stand. Discoloration will usually occur on the bottom of the screen. See Figure 7-4.

- If M/L disappears, inform customer of the need to change stand. If home service, add B/L magnet.
- If still M/L still exists, take off existing landing magnets on the effected corner and add new magnets to improve landing. Check landing, see Note 2.

FIGURE 7-4

Set Location

Check If set is on the floor or near building beams/posts. Move set to different location and recheck.

- If M/L disappears, inform customer to change location of set. If home service, add magnet.

FIGURE 7-5

- If M/L still exists, take off existing landing magnets on the effected corner. Add new magnets to improve landing.

DY Adjustment

Adjust 2-pole purity ring magnets on DY slightly.

DY Position

Check for loose DY, especially If M/L is extreme and concentrated on the right/left sides rather than at corners. See Figure 7-6. If DY is loose, slide DY forward or backward to improve landing and tighten. see Note 2.

FIGURE 7-6

Degauss Circuit

See Figures 7-7 and 7-8.

Switch unit off for 15 minutes (minimum). Turn on again and check if degauss is working by sound and vibration. If not working, repair degauss circuit (Check connector).

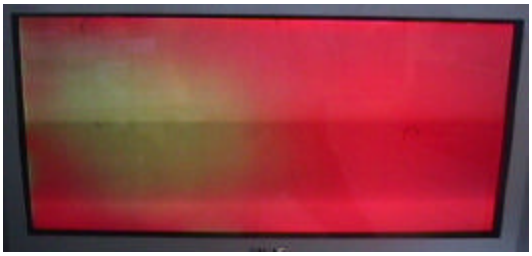


FIGURE 7-7

Weak L/D Magnets

These can occur in any screen edge or corner. See Figure 7-8.

Remove L/D magnets and replace with new one on the effected corner. Readjust.

FIGURE 7-8

Fine Convergence Adjustments

The following tables show the fine convergence adjustments, by model number

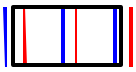
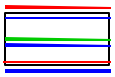
			
MODEL	**H STAT**	**V STAT**	**H-AMP = APH**
KV29S90, KV 21SE43C	H-STAT knob RV-701	4 pole VSTAT MAGNET	6 pole BMC MAGNET & NECK ASSY
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	H-STATE knob RV-1750	4 pole VSTAT MAGNET	6 pole BMC MAGNET & NECK ASSY
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	H-STAT knob RV-701	4 pole VSTAT MAGNET	6 pole BMC MAGNET & NECK ASSY
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	H-STAT knob RV-1761	4 pole VSTAT MAGNET	6 pole BMC MAGNET & NECK ASSY
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	H-STAT knob (RV9001)	4 pole VSTAT MAGNET	6 pole BMC MAGNET, NECK ASSY & BUS RSAP, LSAP
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	H-STAT knob (RV9001)	4 pole VSTAT MAGNET	6 pole BMC MAGNET, NECK ASSY & BUS RSAP, LSAP

Table 7-1A Convergence Adjustments

			
MODEL	**HCR**	**V-AMP = APV**	**VCR**
KV29S90, KV 21SE43C	6 pole BMC MAGNET	4 pole VSTAT MAGNET	6 pole BMC MAGNET
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	6 pole BMC MAGNET	4 pole VSTAT MAGNET	6 pole BMC MAGNET
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	6 pole BMC MAGNET	4 pole VSTAT MAGNET	6 pole BMC MAGNET
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	6 pole BMC MAGNET	4 pole VSTAT MAGNET	6 pole BMC MAGNET
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	6 pole BMC MAGNET, NECK ASSY & BUS RSAP, LSAP	4 pole VSTAT MAGNET	6 pole BMC MAGNET
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	6 pole BMC MAGNET, NECK ASSY & BUS RSAP, LSAP	4 pole VSTAT MAGNET	6 pole BMC MAGNET

Table 7-1B Convergence Adjustments

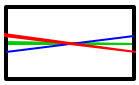
			
MODEL	**H-TILT = TLH**	**V-TILT = TLV**	**X CROSS - = XCV**
KV29S90, KV 21SE43C	DY tilt	DY tilt	No Adjustment
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	TLH PLATE	TLV VR	DY & XCV CORE
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	TLH PLATE	TLV VR	DY & XCV CORE
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	TLH PLATE	TLV VR	DY & XCV CORE
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	TLH PLATE & BUS RSAP, LSAP	TLV VR	DY & XCV CORE
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	TLH PLATE & BUS RSAP, LSAP	TLV VR	DY & XCV CORE

Table 7-1C Convergence Adjustments

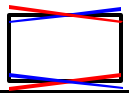
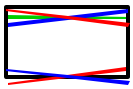
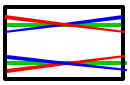
			
MODEL	**C CROSS = CCV**	**CQV**	**M CROSS = MVC**
KV29S90, KV 21SE43C	No adjustment	6 pole & 4 pole balance	4 pole balance
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	DY & XCV CORE	6 pole & 4 pole balance	XCV CORE & 4 pole balance
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	DY & XCV CORE	6 pole & 4 pole balance	XCV CORE & 4 pole balance
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	DY & XCV CORE	6 pole & 4 pole balance	XCV CORE & 4 pole balance
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	DY & XCV CORE	6 pole & 4 pole balance	XCV CORE & 4 pole balance
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	DY & XCV CORE	6 pole & 4 pole balance	XCV CORE & 4 pole balance

Table 7-1D Convergence Adjustments

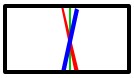
			
MODEL	**Y CROSS = YCH**	**C CROSS = CCH**	**CHH**
KV29S90, KV 21SE43C	DY tilt	DY tilt	No adjustment
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	DY & YCH reactor	DY & YCH reactor	No adjustment
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	DY & YCH reactor	DY & YCH reactor	No adjustment
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	DY & YCH reactor	DY & YCH reactor	No adjustment
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	Bus YBWU, YBWL	Bus RUBW, RLBW, LUBW, LLBW	Bus RUBW, RLBW, LUBW, LLBW
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	Bus YBWU, YBWL	Bus RUBW, RUMB, RLBW, RLMB, LUBW, LUMB, LLBW, LLMB	Bus RUBW, RUMB, RLBW, LUBW, LUMB, LLBW, LLMB

Table 7-1E Convergence Adjustments

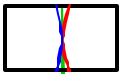
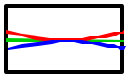
			
MODEL	**Y BOW = YBH**	**C BOW = CBH**	**X BOW – XBV**
KV29S90, KV 21SE43C	H-Static balance	H-Static balance	4 pole balance
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	H-Static balance	H-Static balance	4 pole balance
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	H-Static balance	H-Static balance	4 pole balance
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	H-Static balance	H-Static balance	4 pole balance
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	Bus YBWU, YBWL	Bus RUBW, RLBW, LUBW, LLBW	4 pole balance
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	Bus YBWU, YBWL	Bus RUBW, RUMB, RLBW, RLMB, LUBW, LUMB, LLBW, LLMB	4 pole balance

Table 7-1F Convergence Adjustments

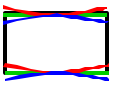
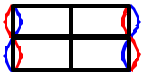
			
MODEL	**C BOW = CBV**	**CHCR**	**MBH**
KV29S90, KV 21SE43C	4 pole balance	4 pole & 6 pole balance	4 pole & 6 pole balance
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	4 pole & TLV balance	4 pole & 6 pole balance	4 pole & 6 pole balance & TLH & APH
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	4 pole & TLV balance	4 pole & 6 pole balance	4 pole & 6 pole balance & TLH & APH
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	4 pole & TLV balance	4 pole & 6 pole balance	4 pole & 6 pole balance & TLH & APH
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	4 pole & TLV balance	Bus RUBW, RLBW, LUBW, LLBW	4 pole & 6 pole balance & TLH & APH
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	4 pole & TLV balance	Bus RUBW, RUMB, RLBW, RLMB, LUBW, LUMB, LLBW, LLMB	4 pole & 6 pole balance & TLH & APH & Bus RUMB, RLMB, LUMB LLMB

Table 7-1G Convergence Adjustments

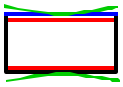
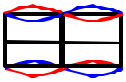
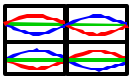
			
MODEL	**CVCR**	**CSV**	**MSV**
KV29S90, KV 21SE43C	4 pole & 6 pole balance	4 pole balance	4 pole balance
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300, KV24FS100, KV25FS100	4 pole & 6 pole balance	4 pole & TLV balance	4 pole & TLV balance
KV25FS12, KV25FS12C, KV27FS100, KV27FS13, KV27FS17, KV27FS200, KV27FV17, KV27FV300, KV29FV300, KV32FS13, KV32FS17, KV29FV17, KV29FV17C, KV34FS13C, KV34FS17, KV32FS100, KV32FS200, KV32FV300, KV34FS100, KV36FS100, KV36FS200, KV36FV300, KV38FS200	4 pole & 6 pole balance	4 pole & TLV balance	4 pole & TLV balance
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS17	4 pole & 6 pole balance	4 pole & TLV balance	4 pole & TLV balance
KV34XBR2, KV32HS20, KV32XBR450, KV36HS20, KV36HS20H, KV36XBR450, KV36XBR450H	4 pole & 6 pole balance	4 pole & TLV balance	4 pole & TLV balance
KV34XBR800, KV34DRC500, KV32HS500, KV32HV600, KV36HS500, KV35XBR800, KV38DRC500, KV40XBR800, KV42DRC800	4 pole & 6 pole balance	4 pole & TLV balance	4 pole & TLV balance

Table 7-1H Convergence Adjustments

Note 1: CRT Beam Landing adjustment tool (9-948-310-60) works effectively for Landing adjustment.

Note 2: Landing adjustment and inspection direction

Adjustment Direction: Face unit in an east or west direction (this creates a stronger geo-magnetic effect on the CRT)

Check Unit Direction: Set should turn to North and South, then degauss and check landing.

A minimum check of three directions is needed (east or west, and north and south).

Chapter 8 - Geometric Distortion (PIXD, PIXW)

Overview

In simple terms, geometric distortion causes straight lines appear angled, crooked, bent, too short, or too long

The most common causes geometric distortion are slight drifts caused by aging, fine circuit adjustment drift and customer dissatisfaction with acceptable limits.

1. In both instances, fine adjustments to the geometric control circuits are the first steps to take to satisfy the customer.
2. Readjust the DY tilt slightly
3. Replace the deflection yoke if step 1 does not yield satisfactory results. It usually has the same effect as replacing the CRT.
4. Replace the CRT if steps 1, 2 and 3 do not yield satisfactory results. But note: geometric distortion is not likely to be caused by a CRT.

Adjustments

Table 8-1 shows the most common generic geometric distortions and what to adjust to correct the distortion.

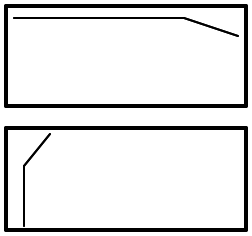
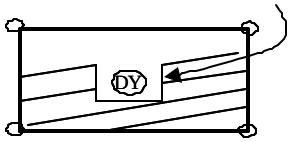
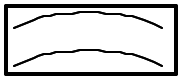
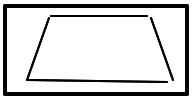
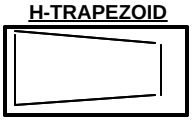
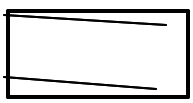
PROBLEM	CHECK ITEMS	COUNTERMEASURE
CORNER BEND 	L/D magnet position is too close to DY.	Take the magnet off, then readjust. The best position is around DY on the CRT carbon coating edge. Check visual L/D.  If the corner still bends, adjust the data register for Corner Pin.
	Check Permalloy Quantity	Take off Permally and readjust. Check the Convergence again.
PATTERN KINK 	Check Bus data	Adjust data register for Corner Bend.
V-PIN 	Check if DY is down.	Pull up DY to improve
	Y Axis Correction Magnet	Adjust DY up and down to improve. Touch up Y Axis magnet to share top, middle and bottom.
V-TRAPEZOID 	Bus Data	Adjust data register for Trapezoid.
	Bus Data DY Swing	Adjust data register for H-Trapezoid. Move DY left and right, then fix the DY wedge.
H-TRAPEZOID 	TLV VR on the DY (H-Trap)	Adjust the TLV VR a little bit. Last option.
TILT 	Picture Tilt	Adjust Manual Picture Rotation Menu (Circuit). If it is still tilted, readjust DY the tilt. (Before adjustment, the rotation menu should be set to 0.)

Table 8-1 Geometric Adjustments

Fine Geometric adjustments

The following four tables show the geometric circuits to adjust, by model number.

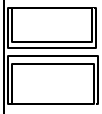
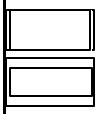
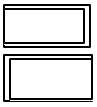
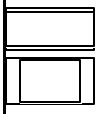
					
MODEL	**GROUP**	**V CENTER**	**V SIZE**	**H CENTER**	**H SIZE**
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300	DEF	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV20S90, KV21SE43C	DEF	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV24FS100, KV25FS100	DEF	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV25FS12, KV25FS12C	DEF	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV27FS12, KV27FS17, KV27FV17, KV29FS13, KV29FV17, KV29FS13C, KV29FV17C, KV32FS13, KV32FS17, KV24FS13C, KV24FS17	DEF	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS16	VP	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KV27FS100, KV27FS200, VK29FS100, KV32FS100, KV32FS200, KV34FS100, KV27FV300, KV29FV300, KV32FV300, KV36FV300, KV36FS100, KV36FS200, KV38FS200	VP1	Bus VPOS	Bus VSIZ	Bus HPOS	Bus HSIZ
KD34XBR2, KV32HS20, KV36HS20, KV36HS20H, KV32XBR450, KV36XBR450, KV36XXBR450H, KV32HS500, KV32HV600, KV34DRC500, KV34XBR800, KV36HS500, KV36XBR800, KV38DRC500, KV40XBR800, KV40DRC800	CXA2150D-1 & 2 2170D-1 & 2	Bus VPOS	Bus VSIZ	Bus HPOS, HCNT	Bus HSIZ

Table 8-2 A Geometric Adjustments

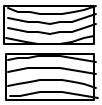
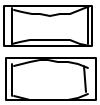
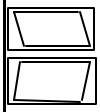
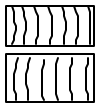
						
MODEL	**GROUP**	**ROTATION**	**V-CENTER**	**V-PIN**	**V ANGLE**	**V BOW**
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300	DEF	DY & User control	DY TILT	No adjustment	Bus VANG	Bus VBOW
KV20S90, KV21SE43C	DEF	DY ROTATION	DY TITLE & Y magnet	No adjustment	Bus VANG	Bus VBOW
KV24FS100, KV25FS100	DEF	DY & User control	DY & Y magnet	No adjustment	Bus VANG	Bus VBOW
KV25FS12, KV25FS12C	DEF	DY & User control	DY & Y magnet	No adjustment	Bus VANG	Bus VBOW
KV27FS12, KV27FS17, KV27FV17, KV29FS13, KV29FV17, KV29FS13C, KV29FV17C, KV32FS13, KV32FS17, KV24FS13C, KV24FS17	DEFL	DY & User control	DY & Y magnet	No adjustment	Bus VANG	Bus VBOW
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS16	VP	DY Rotation & TILT CORRECTION MENU	DY & Y magnet	No adjustment	Bus VANG	Bus VBOW & Y-MAGNET
KV27FS100, KV27FS200, VK29FS100, KV32FS100, KV32FS200, KV34FS100, KV27FV300, KV29FV300, KV32FV300, KV36FV300, KV36FS100, KV36FS200, KV38FS200	VP1	DY Rotation & TILT CORRECTION MENU	DY & Y magnet	No adjustment	Bus VANG	Bus VBOW & Y-MAGNET
KD34XBR2, KV32HS20, KV36HS20, KV36HS20H, KV32XBR450, KV36XBR450, KV36XXBR450H, KV32HS500, KV32HV600, KV34DRC500, KV34XBR800, KV36HS500, KV36XBR800, KV38DRC500, KV40XBR800, KV40DRC800	CXA2150D-1 & 2 2170D-1 & 2	DY Rotation & TILT CORRECTION MENU, Bus NSCO	DY & Bus VCEN	Bus VPIN	Bus VANG, LANG	Bus VBOW, LANG

Table 8-2 B Geometric Adjustments

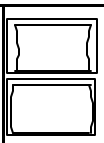
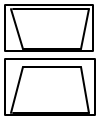
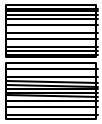
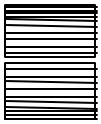
					
MODEL	**GROUP**	**PIN AMP**	**KEYSTONE**	**S CORRECTION**	**V LINEARITY**
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300	DEF	Bus PAMP	Bus TRAP	Bus SCOR	Bus VLIN
KV20S90, KV21SE43C	DEF	Bus PAMP, CPIN	Bus TRAP	Bus SCOR	Bus VLIN
KV24FS100, KV25FS100	DEF	Bus PAMP	Bus TRAP	Bus SCOR	Bus VLIN
KV25FS12, KV25FS12C	DEF	Bus PAMP	Bus TRAP	Bus SCOR	Bus VLIN
KV27FS12, KV27FS17, KV27FV17, KV29FS13, KV29FV17, KV29FS13C, KV29FV17C, KV32FS13, KV32FS17, KV24FS13C, KV24FS17	DEFL	Bus PAMP	Bus HTRP	Bus SCOR	Bus VLIN
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS16	VP	Bus PAMP	Bus HTRP & DY VR	Bus VSCO	Bus VLIN
KV27FS100, KV27FS200, VK29FS100, KV32FS100, KV32FS200, KV34FS100, KV27FV300, KV29FV300, KV32FV300, KV36FV300, KV36FS100, KV36FS200, KV38FS200	VP1	Bus PAMP	Bus HTRP & DY VR	Bus SCOR	Bus VLIN
KD34XBR2, KV32HS20, KV36HS20, KV36HS20H, KV32XBR450, KV36XBR450, KV36XXBR450H, KV32HS500, KV32HV600, KV34DRC500, KV34XBR800, KV36HS500, KV36XBR800, KV38DRC500, KV40XBR800, KV40DRC800	CXA2150D-1 & 2 2170D-1 & 2	Bus PIN, MPIN	Bus PPHA	Bus VSCO	Bus VLIN

Table 8-2 C Geometric Adjustments

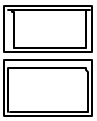
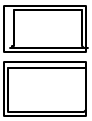
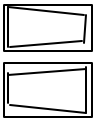
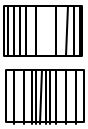
					
MODEL	**GROUP**	**UPPER CORNER PIN**	**LOWER CORNER PIN**	**V TRAP**	**HOR. S CORRECTION**
KV13FS100, KV13FS110, KV14FV300, KV20FS100, KV20FV300, KV21FM100, KV21FS100, KV21FV300, KV24FV300, KV25FV300	DEF	Bus UPIN	Bus LPIN	No adjustment	No adjustment
KV20S90, KV21SE43C	DEF	No Adjustment	No Adjustment	No adjustment	No adjustment
KV24FS100, KV25FS100	DEF	Bus UPIN	Bus LPIN	No adjustment	No adjustment
KV25FS12, KV25FS12C	DEF	Bus UPIN	Bus LPIN	No adjustment	No adjustment
KV27FS12, KV27FS17, KV27FV17, KV29FS13, KV29FV17, KV29FS13C, KV29FV17C, KV32FS13, KV32FS17, KV24FS13C, KV24FS17	DEFL	Bus UPIN	Bus LPIN	Bus VTRP	No adjustment
KV32FV27, KV36FS13, KV36FS17, KV36FV27, KV38FS16	VP	Bus UPIN	Bus LPIN	No adjustment	No adjustment
KV27FS100, KV27FS200, VK29FS100, KV32FS100, KV32FS200, KV34FS100, KV27FV300, KV29FV300, KV32FV300, KV36FV300, KV36FS100, KV36FS200, KV38FS200	VP1	Bus UPIN	Bus LPIN	Bus VTRP	No adjustment
KD34XBR2, KV32HS20, KV36HS20, KV36HS20H, KV32XBR450, KV36XBR450, KV36XXBR450H, KV32HS500, KV32HV600, KV34DRC500, KV34XBR800, KV36HS500, KV36XBR800, KV38DRC500, KV40XBR800, KV40DRC800	CXA2150D-1 & 2 2170D-1 & 2	Bus UCP, UXCG, UXCP, XCPP	Bus LCP, LXCG, LXCP, XCPP	Bus HTPZ	SLIN

Table 8-2 D Geometric Adjustments

Chapter 9 - Focus Troubleshooting (PIXF)

Overview

Figure 9-1 shows two examples of a focused CRT and two of an unfocused CRT. The focused examples are on the left and the unfocused ones are on the right.

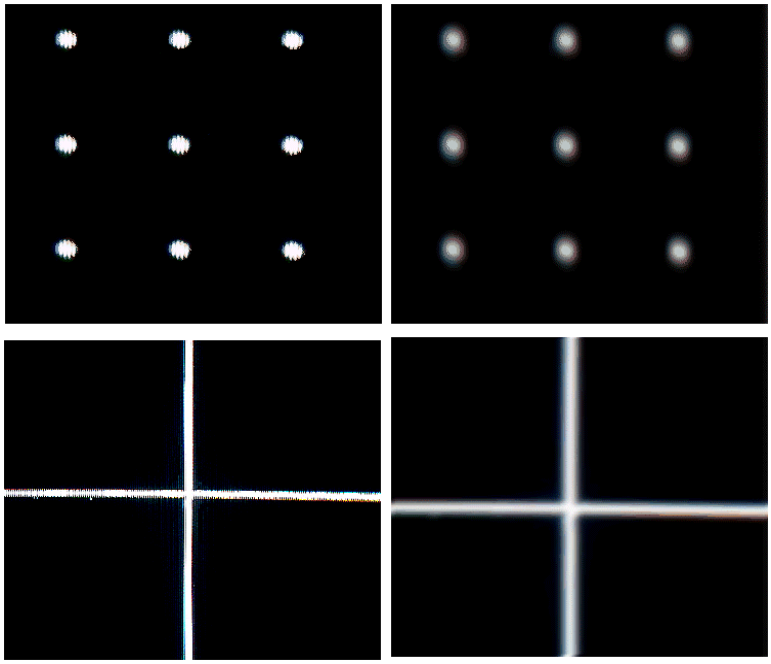


FIGURE 9-1

CRT Causes

Internal Current leakage

Check for a blue glow in the CRT neck assy. If present, it indicates a current leak within the CRT gun. See figure 9-2.

If a blue glow is not present initially, allow the unit to warm up for about 6 hours then recheck. Current leakage can develop with time.

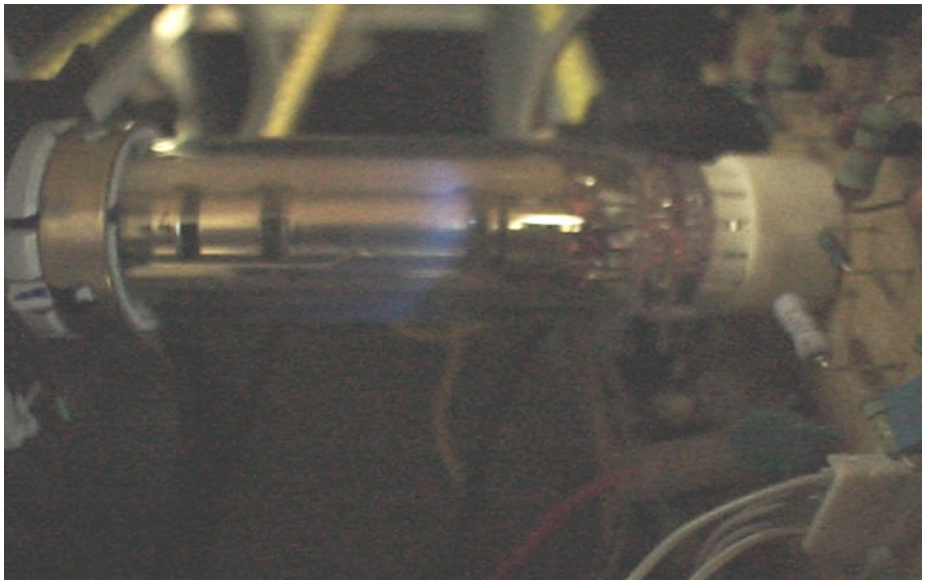


FIGURE 9-2

External Current leakage

Leakage between the CRT pins on the socket base due to dirt or insufficient RTV material. Remove the C board, clean the CRT base and the CRT socket, and reapply RTV material to the area shown in Figure 9-3.

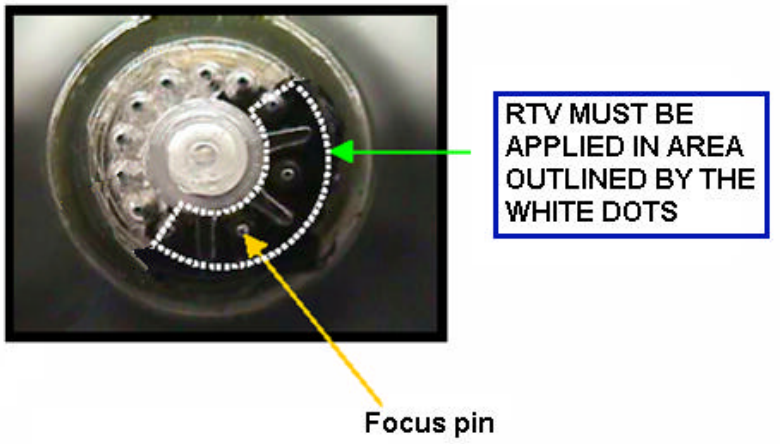


FIGURE 9-3

Non CRT Causes

Focus control

The focus control on FBT affects the entire screen.

- Adjust for best center focus with the focus control of the FBT; then correct the side focus with the focus phase control (next paragraph).

Focus Phase Control

The focus phase control (data bus) has a greater effect on the sides of the screen than on the center.

- Adjust for best focus on both sides of the screen with the focus phase control; then compensate at the center of the screen with the focus control (previous paragraph).

G2 and RGB Drive Levels

Excessive G2/drive levels will cause red beam flare at peak saturation which appears as poor focus.

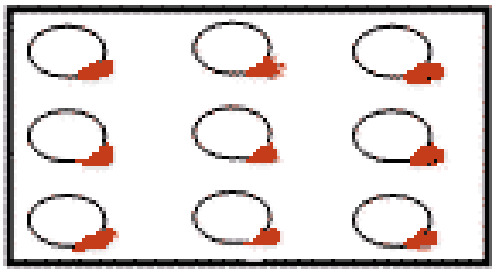


FIGURE 9-4

G4 Level

Poor focus can be caused by an incorrect G4 voltage level. G4 voltage is normally supplied by a resistor divider and this divider may change in value; either spontaneously, or due to overheating caused by stray current flow inside the CRT.

Set-up Levels (data bus)

Incorrect level setups can cause peak overdrive levels and blooming which can give the appearance of an out of focus CRT.

Chapter 10 - Convergence Supplemental Information

Process

A three-step process is used to adjust convergence:

1. Center adjustments
2. X and Y axis adjustments
3. Corner adjustments

The locations of these steps are shown in Figure 10-1.

Adjustment Steps

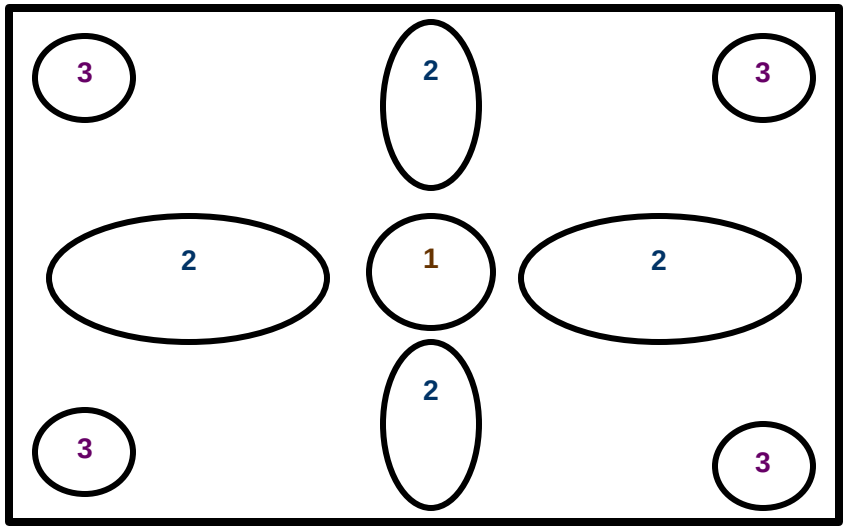


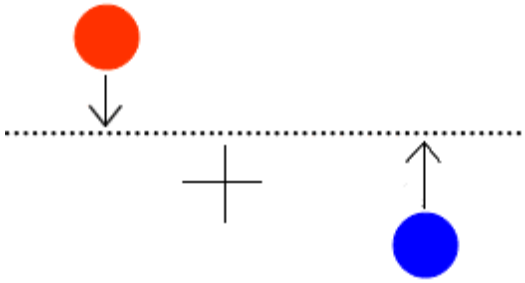
FIGURE 10-1 - CONVERGENCE STEPS

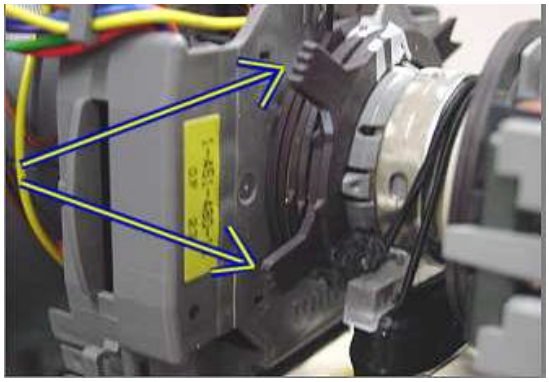
Note: To minimize interactions with each other, set all VRs and magnets to zero or null positions before starting.

Center Adjustments

V-Stat Adjustment

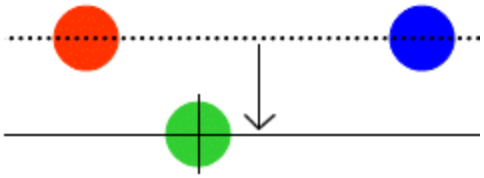
With H-Stat separated, adjust the 4-pole ring magnet to align the blue and red spots in the horizontal axis. This is done by either spreading apart or bringing together the two handles on the magnet.

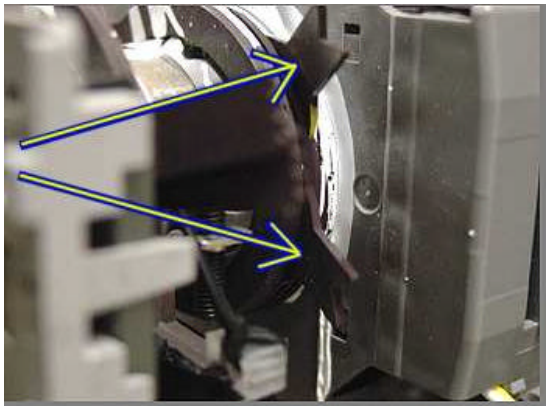




FIGURES 10-2 A & B

Rotate both 6-pole magnet rings together as a unit to align the red and blue (together) to the green in the horizontal axis.

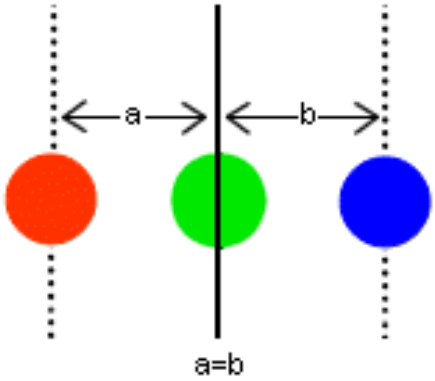


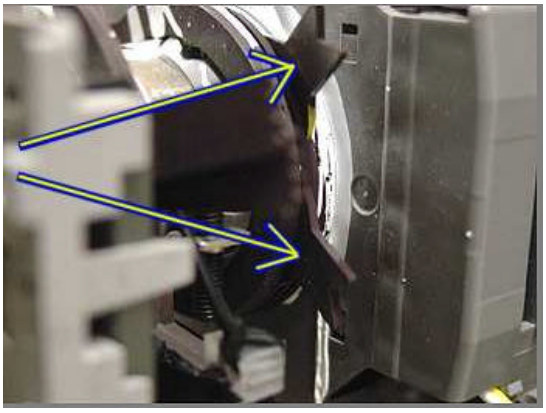


FIGURES 10-3 A & B

H-Stat Adjustment

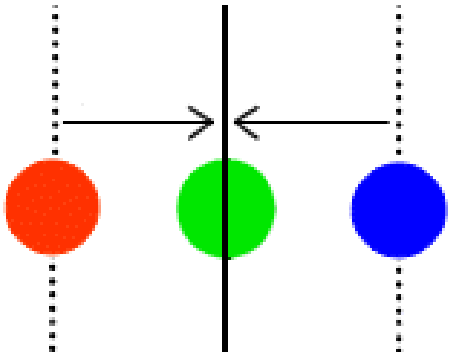
Separate or bring together the 6-pole magnet rings so that the blue and red spots are equal distance from the green.

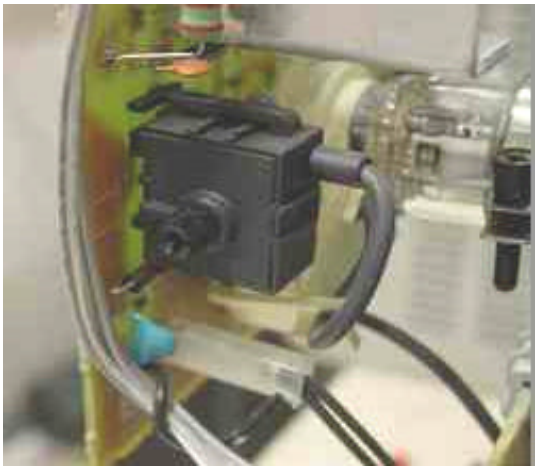




FIGURES 10-4 A & B

Adjust the H-Stat control on the C board to bring the red and blue spots in line with the green.





FIGURES 10-5 A & B

Y Axis Adjustments

These adjustments converge the center part of the screen, vertically, from top to bottom. See Figure 10-6.

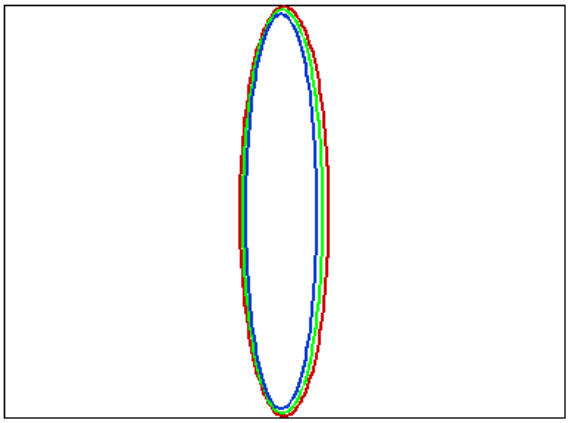
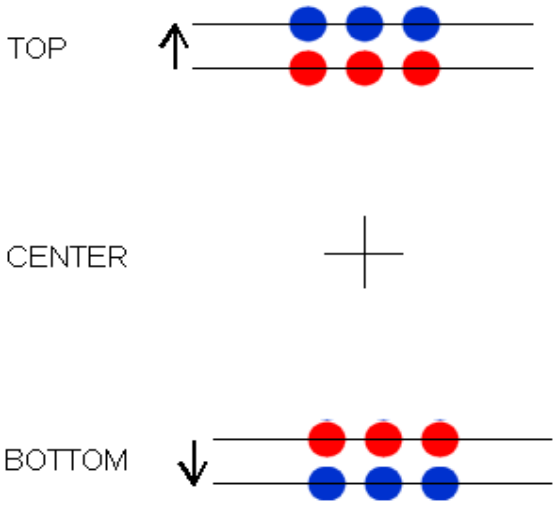
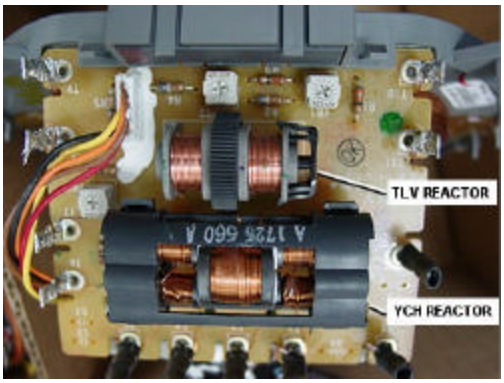


FIGURE 10-6 - Y-AXIS

TLV Reactor Adjustment

Separate the dots (again) with the TLV reactor control on the DY, and adjust the LTV reactor to converge the red and blue dots at the top and the bottom of the screen. See Figure 10-7a. The location of the reactors is shown in Figure 10-7b.





FIGURES 10-6 A & B = LTV REACTOR FUNCTION & LOCATION

APV or VCR Adjustment

Ideally, all three color dots should line up in the horizontal axis from the top to the bottom of the screen. If the screen looks like Figure 10-8, make corrections by rotating both 6-pole magnet rings together as a unit. Touch ups with the 4-pole ring magnets may be necessary as the rings interact with each other. Priority must be given to the center areas.

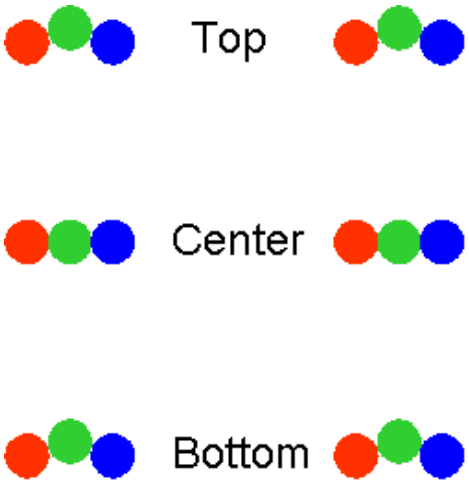


FIGURE 10-8

Y-Bow Adjustment

There are two adjustment methods when the red or blue are bowed but line up on the same side of the green in the vertical plane. See Figure 10-9.

- Use the YBWU and YBWL bus service mode registers on units that have these registers. Many units do not have these registers.
- On models without the YBWU and YBWL registers, make corrections with the H-STAT control.

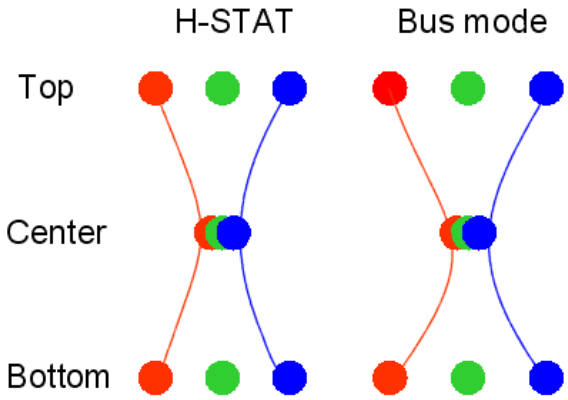


FIGURE 10-9

Y-Cross Adjustment

There are three adjustment methods when the red or blue shift their positions from the green as you go from the top towards the bottom of the screen. See Figure 10-10.

- Use the YBWU and YBWL bus service mode registers on units that have these registers. Many units do not have these registers.
- Tilt the DY up and down.
- YCH Reactor.

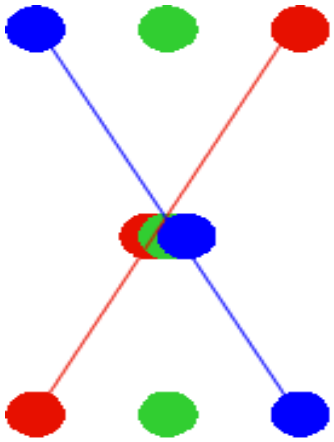


FIGURE 10-10

X Axis Adjustments

These adjustments converge the center horizontal part of the screen, from the left to the right of the screen. See Figure 10-11.

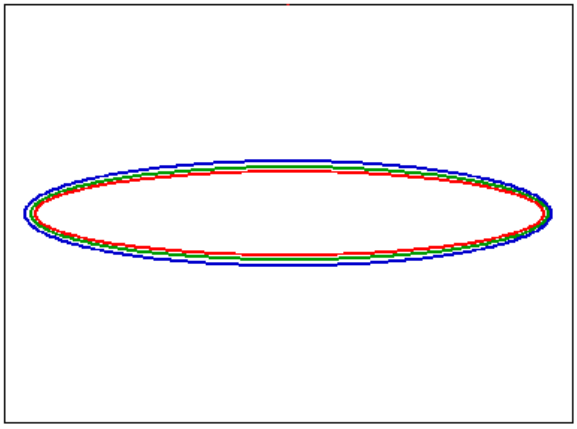


FIGURE 10-11 - Y-AXIS

APH adjustment

There are three adjustment methods when the red and green misconverge but are on the same side of the green at both sides of the screen. See Figure 10-12.

- Use the RSAP and LSAP bus service mode registers on units that have these registers.
- Use the 6-pole magnets.
- Move the neck assembly slightly forward or back.

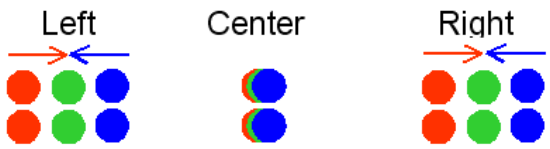
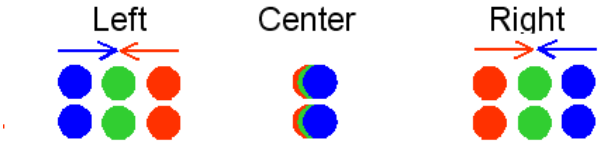


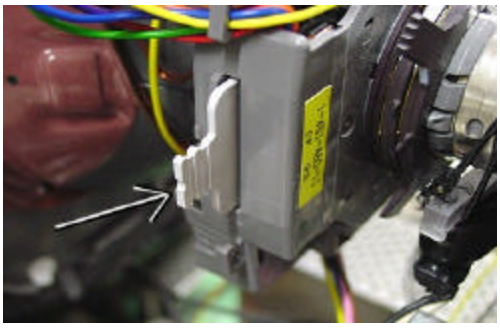
FIGURE 10-12

TLH adjustment

There are two adjustment methods in cases where the red and green misconverge in opposite directions on both sides of the screen:

- TLH plate on the side of the DY (slide TLH plate in or out to make changes). Inserting the TLH plate in an opposite side will make it move the red and blue in an opposite direction.
- Some models have bus service mode registers “RSAP” and “LSAP”.





FIGURES 10-13A & B - TLH PLATE FUNCTION & LOCATION

XCV Adjustment

For models with reactor controls, turn the control wheel to correct convergence keystone. Figure 10-7b shows the XCV reactor location. In convergence keystone, the red and blue dots cross vertical positions from side to side. See Figure 10-14

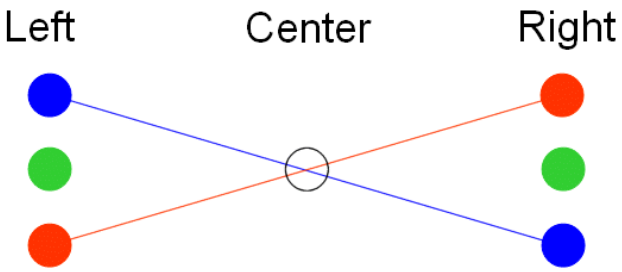


FIGURE 10-14

XBV Adjustment

Convergence bowing can only be corrected with the with the 4-pole ring magnets. In convergence bowing, the red and blue dots vary in their vertical position with respect to each other when scanned across the screen, but are always on the same side of each other. See Figure 10-15.

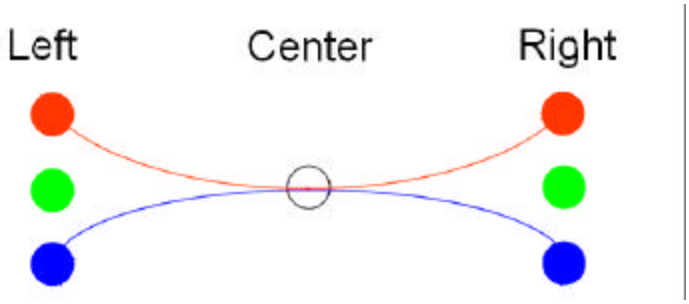
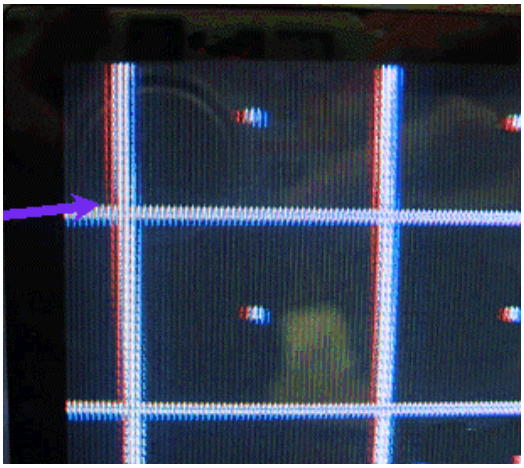


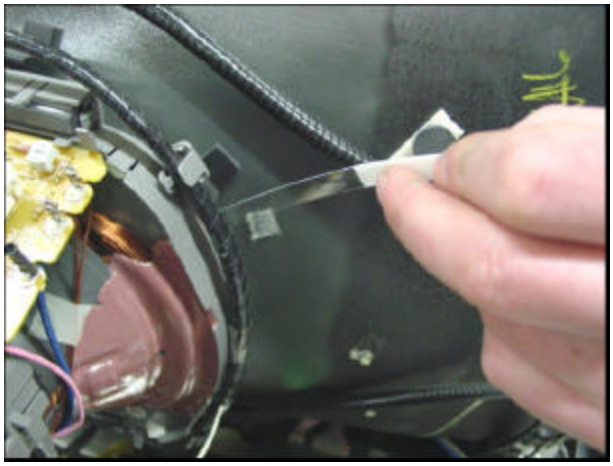
FIGURE 10-15

Corner Adjustments

Identify the corner with the convergence problem and insert permalloy strips behind the DY in the area corresponding to the convergence problem.

- Vary the position and depth of the strip until the mis-convergence is minimized.
- Several permalloy strips may be required in the same location.



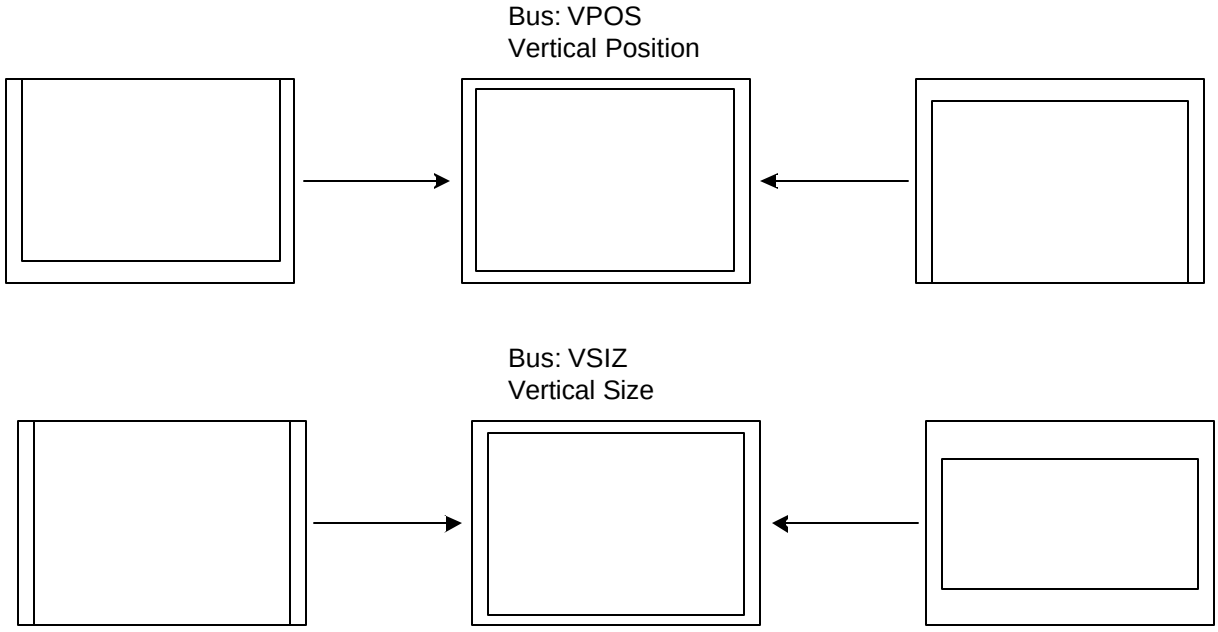


FIGURES 10-16A & B - CORNER ADJUSTMENT & PERMALLOY LOCATIONS

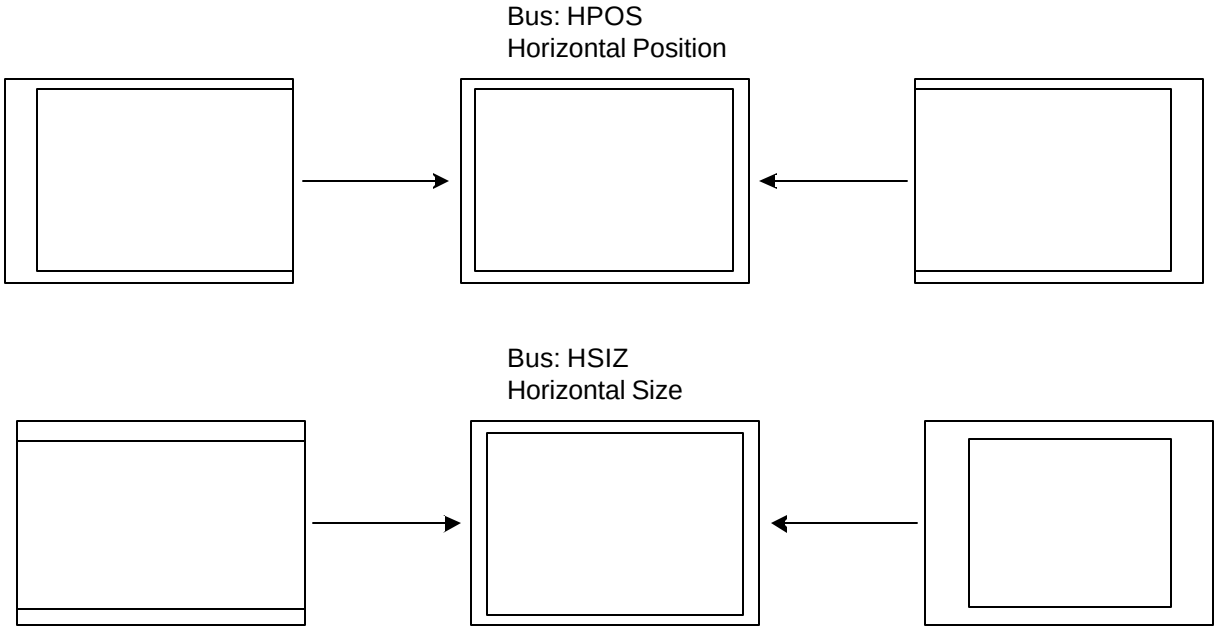
Appendix

Geometry Adjustment

1) Adjust V position and V size by using Bus service mode “VPOS” and VSIZ”.

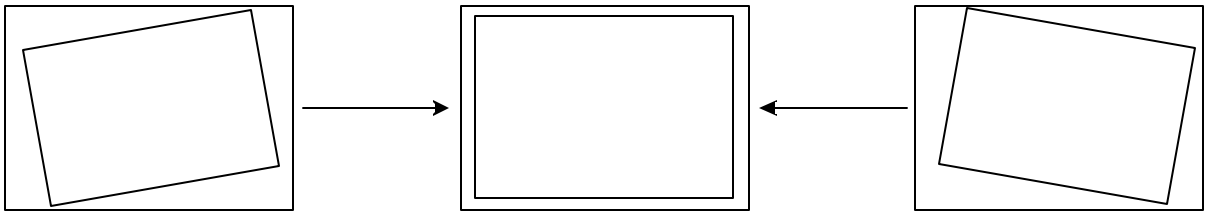


2) Adjust H position and H size by using Bus service “HPOS and “HSIZ”.



3) Adjust Rotation by rotating the DY. Note: Some models have adjustment in the user's menu. Be sure to adjust the menu to Zero value prior to the adjustment on the DY and H size by using Bus service mode "HPOS" and "HSIZ".

DY Rotation
Rotation

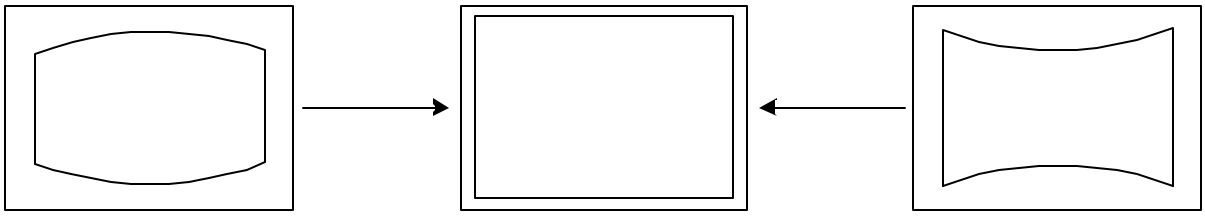


4) There are three methods to adjust V-Center depending on the chassis. One is DY tilt up and down. Note: This will effect convergence and landing. The second method is Y-Magnet on the neck assy. The third is Bus service mode "VCEN".

DY Tilt, Y-Magnet, VCEN
Vertical Center

5) Most models do have have an adjustment for V-PIN. The models which do are located in the Bus service mode VPIN.

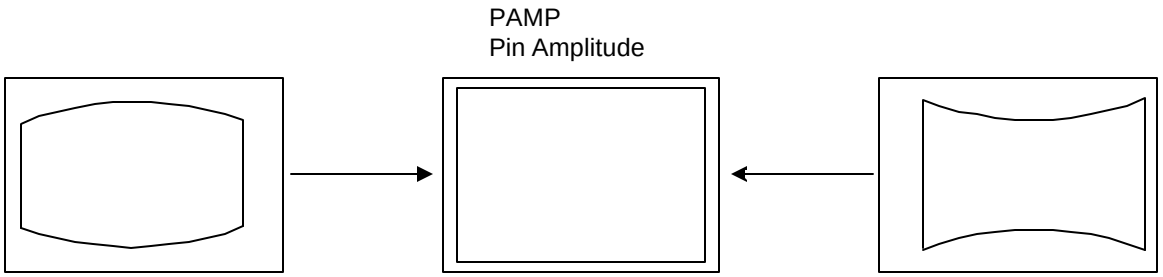
VPIN
Vertical Pin Cushion



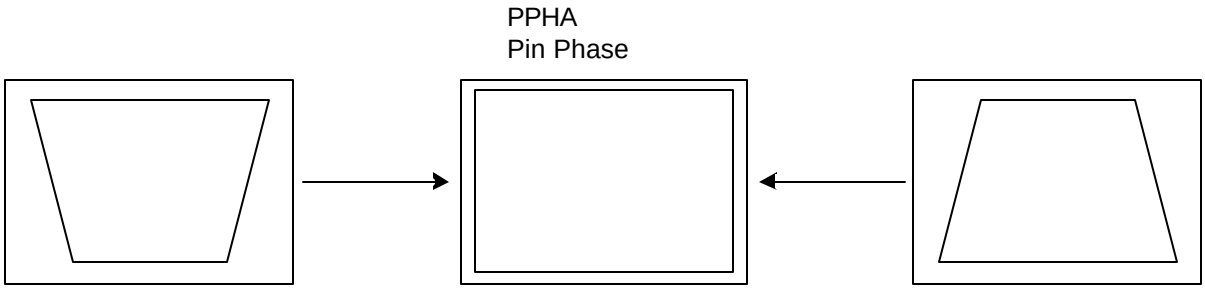
6) Adjust V-Bow by Bus service mode "VBOW". In the event that the center is straight but the sides are bowed, then use "LBOW" for adjustment.

VBOW or LBOW
Vertical Bow

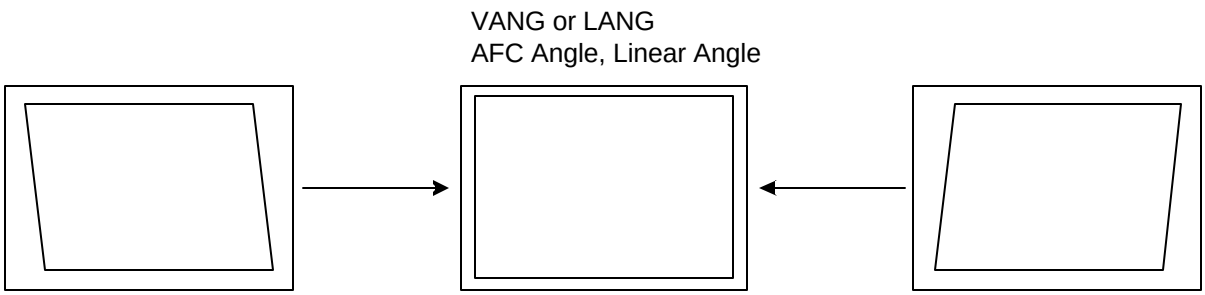
7) Adjust Pin Amp by Bus service mode “PAMP”.



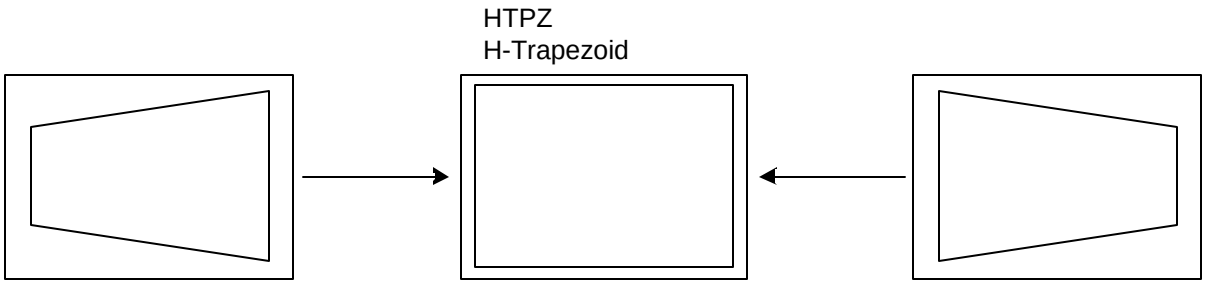
8) Adjust Pin Phase by Bus service mode “PPHA”.



9)



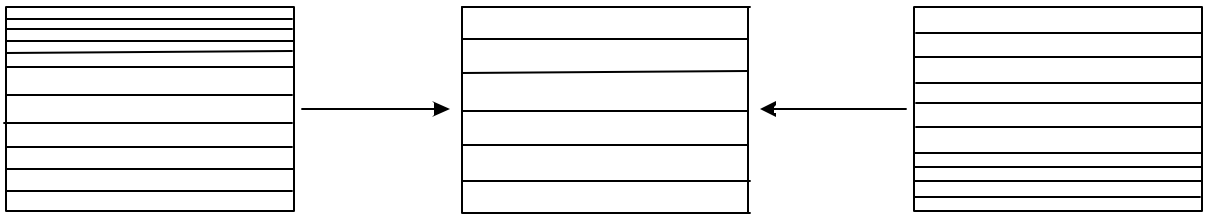
10)



11) Adjust vertical S-Correction and V Linearity so that the height of the squares is the same at the top, center and bottom of the screen using the Bus service mode “VSCO” and “VLIN”.

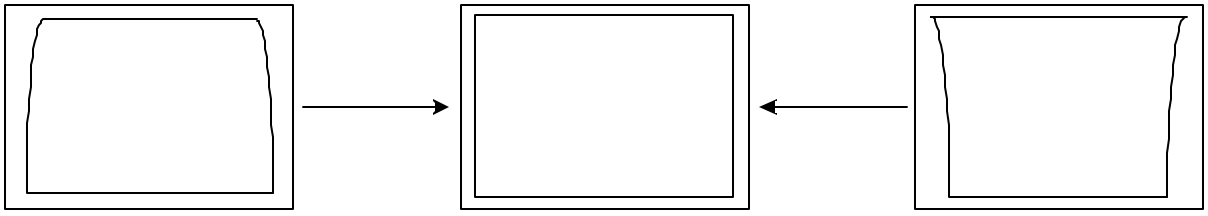
VSCO
S CORRECTION

VLIN
V LINEARITY

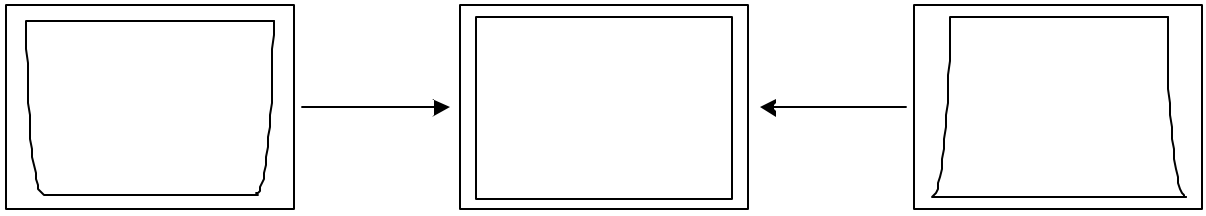


12) Adjust Upper Corner Pin and Lower Corner Pin using the Bus service mode “UCP” and “LCP”.

UPC
Upper Corner Pin



LCP
Lower Corner Pin



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1 Sony Drive
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