TOSHIBA

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TECHNICAL TRAINING

TV-GEN-03

Subject: Digital Convergence Alignment
Product: PROJECTION TELEVISION, Rear CRT
Chassis: All Toshiba rear CRT projection televisions with digital convergence
Model Year: All
Models: All
Prerequisites: None

Purpose:
Upon completion of this Training Module, the technician will be able to properly converge a Toshiba CRT-based rear projection television set. Using the correct digital convergence alignment procedures will enable the technician to identify symptoms requiring more in-depth troubleshooting.
These skills will help improve servicing picture quality issues.

Objectives:
1. While performing a convergence alignment, specify when and when not to reload convergence backup data 100% of the time.

2. Following a written procedure, correctly reload the convergence backup data from the DCU memory.

3. Given the TV model number and picture size, identify the correct convergence overlay and grid 100% of the time.

4. Following a written procedure, and using the correct overlay(s), align the convergence to factory specifications.

5. While performing a convergence alignment, identify visual symptoms which indicate further troubleshooting is required, at least 80% of the time.

Product Specific Service Manuals:
This training is designed as an aid to the technician in servicing Toshiba products. It is not a replacement for the appropriate service manual(s). Toshiba service manuals contain product and model specific information and must be consulted prior to servicing any product.

Product Safety Precautions:
Product Safety Precautions are described in the Toshiba service manual(s) for products and models covered in this training. All safety precautions and checks must be complied with before returning any product to the customer. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.

Consider this:
Toshiba CRT based rear projection televisions allow convergence adjustments to be made in two areas:

1. **User convergence area** - This area can be accessed through the customer picture menu by using the remote control or the front panel keys. Adjustments can only be made by remote control.
2. **Service Mode convergence area** – This area should only be accessed by qualified service technicians. A remote control is required for both access and adjustment.

Readme: Qualified technicians should always align convergence in the Service Mode.

First things first - Overlays:
Convergence overlays are service tools available for purchase through Toshiba National Parts or Toshiba authorized parts distributors. The overlays are recommended as guides following a "worst-case" situation, such as a CRT or Digital Convergence Unit (DCU) replacement. While an overlay can also be used to perform a minor alignment, this module will assume the worst-case scenario.

Each overlay kit contains all grids relative to the screen size and aspect ratio of the unit to be aligned. Many older 4:3 aspect ratio units have only one grid to adjust. Newer 4:3 units of the same screen size also require adjustment in High Definition (HD) compressed mode. This mode can be accessed through the customer menu. Widescreen (16:9 aspect ratio) units built prior to 2001 have up to six different picture size modes that require adjustment:

1. Full/Standard/Natural
2. Wide 1
3. Wide 2
4. Wide 3
5. HD Full
6. HD Standard

Widescreen units built before the HD revolution have only picture size modes 1 through 4. Widescreen units built in 2001 and later are only adjustable in FULL mode. The settings for all other picture size modes are calculated from the FULL mode information by the DCU microprocessor.

The overlays come as one complete sheet and will have to be trimmed following the included instructions. Each kit also contains step-by-step, centering, focusing, and convergence alignment instructions. These instructions vary according to the type of unit. Kits used for more than one type contain instructions for all types covered.

Readme: In many cases, convergence problems have been corrected by exactly following the supplied instructions.

When using an overlay kit, it is important to know the type of unit it is designed for use with and the kit part number. The availability and part numbers of the overlay kits are subject to change as screen sizes are added or discontinued. Table 1 details the currently available overlay kit part numbers.

Part Number	Screen Size	Aspect Ratio	Picture Size	Model Year
PSOL40X1	40”	16:9	All	All
PSOL42W1	42”	16:9	Full	2002+
PSOL43X1	43”	4:3	All	All
PSOL4801	48”	4:3	N/A	All
PSOL50X1	50”	4:3	All	All
PSOL50W1	50”	16:9	Full	2002+
PSOL53X1	53”	4:3	All	2002+
PSOL55X1	55”	4:3	All	All
PSOL56X1	56”	16:9	All	All
PSOL57W1	57”	16:9	Full	2002+
PSOL61X1	61”	4:3	All	All
PSOL65X1	65”	16:9	All	All
PSOL7101	71”	4:3	N/A	All

Table 1

Each kit part number begins with the acronym PSOL, meaning **P**rotective **S**creen **O**ver **L**ay. Following the acronym are a series of alpha-numeric characters identifying the screen size and intended unit type. In Example 1, “40” identifies the kit for use with a 40 inch screen size. “X1” indicates the kit contains all grids for any unit in that screen size.

Example 1: PSOL40X1

In some cases there are models with different aspect ratios within a screen size category. In such cases, the letter “W” in the kit part number indicates use with wide screen (16:9 aspect ratio) units. See Example 2 for details:

Example 2

PSOL50X1 is used with any 50 inch unit with a 4:3 aspect ratio screen. **PSOL50W1** is used with any 50 inch unit with a 16:9 aspect ratio screen.

Readme: The overlay dimensions are contained in the appropriate unit Service Manual, as shown in Figure 1. If a particular overlay kit is not available, or there is an urgent need for a complete convergence alignment before the kit can be delivered, strings and low-tack tape can be used to achieve the desired results.

50 inch Widescreen (16:9)
Horizontal size 1106mm
Vertical size 622mm

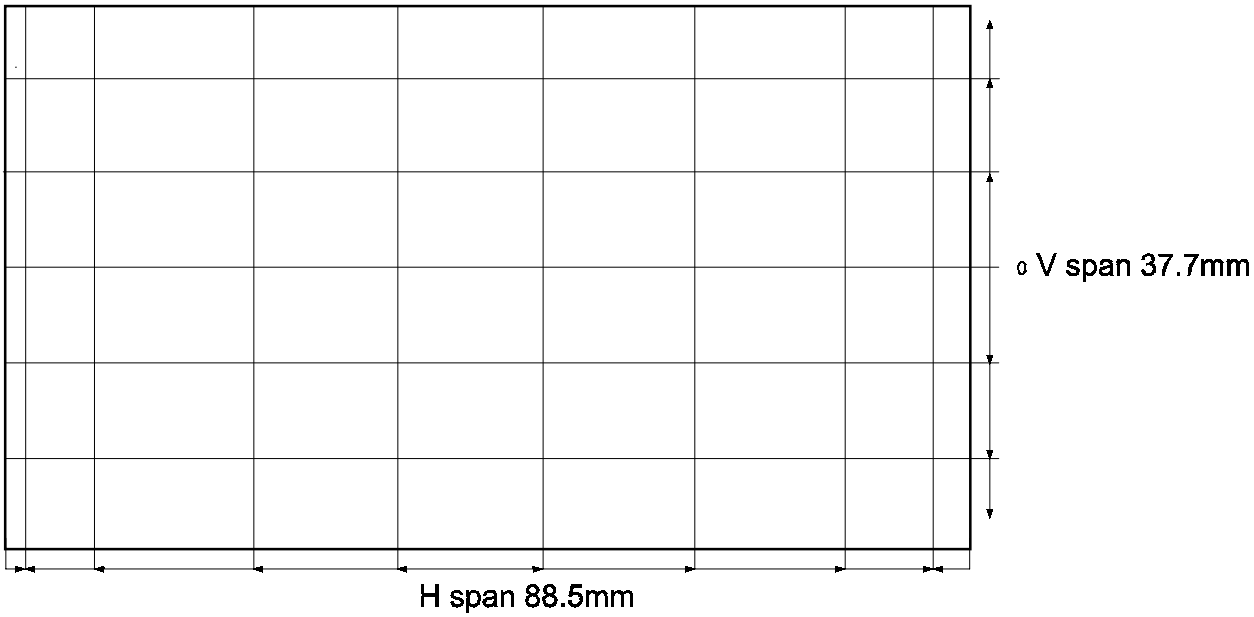

Figure 1

And then… Accessing Service Mode:

Once the correct overlay is placed on the screen, the unit must be put into Service Mode before any alignment adjustments are made. There are currently two methods of Service Mode entry, dependant upon the model and type of set. The methods are described as follows:

1. All digital convergence equipped units built prior to 2001 and all interlaced scan units:
    a. With the unit powered “ON”, press and release the MUTE key on the remote control.
    b. Press the MUTE key a second time and hold.
    c. While holding the MUTE key, press the MENU key on the front panel. A pale blue “S” will appear in the upper right corner of the screen, as shown in Figure 2.
    d. Press the MENU key on the front panel a second time. RCUT will appear in the upper left corner of the screen.

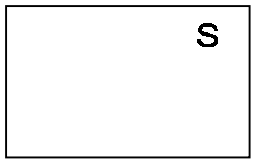

Figure 2

Readme: RCUT is a data address in the system EEPROM. The hexadecimal data contained in the address will be shown just below it, as shown in Figure 3.

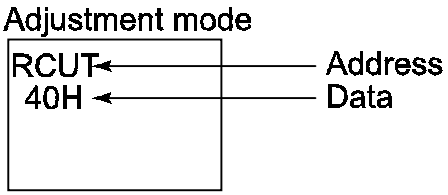

Figure 3

2. All progressive scan units built from 2001 forward:
    a. With the unit powered "ON", press and release the MUTE key on the remote control two times.
    b. Press the MUTE key a third time and hold.
    c. While holding the MUTE key, press the MENU key on the front panel. A pale blue "S" will appear in the upper right corner of the screen.
    d. Press the MENU key on the front panel a second time. RCUT will appear in the upper left corner of the screen.

Readme: Important parameters of the set can be accessed and adjusted from Service Mode. Use caution whenever working in this area.

The rubber meets the road - Convergence Alignment:

Readme: Always allow the set to warm up for at least 15 minutes before making any adjustments.

Convergence alignment instructions vary according to the unit type. The instructions assume a worst-case scenario, such as replacing all three CRTs or the digital convergence board, and the use of an overlay kit. All versions of the instructions are included as Appendices A through C of this document.

Readme: If the set requires only minor convergence adjustments, enter the procedure where you feel it is necessary.

1. Optical and electrical focus
    a. Remove or raise the screen to gain access to the CRTs.
    b. Reverse the lenses if necessary.
    c. Enter the convergence alignment service mode.
    d. Optically and electrically focus each CRT.
2. Mechanical tilt
    a. Check each CRTs tilt.
    b. Adjust if necessary.
    c. Store the data.

3. User convergence and magnetic centering
    a. Disconnect any input to Video 1.
    b. Enter the user convergence area.
    c. Vertically and horizontally center all 3 colors in all adjustable areas.
    d. Exit the user convergence area.
    e. Enter the convergence alignment service mode.
    f. Mechanically center all 3 colors.
        i. Stretch 2 pieces of string diagonally across the screen
        ii. Rotate the centering rings on each CRTs neck
    g. Lock the centering rings with adhesive.
    h. Exit the service mode.
4. Electrical centering
    a. Use a signal generator.
        i. Crosshatch pattern
    b. Enter service mode.
    c. Adjust HPOS to center horizontally.
    d. Adjust VPOS to center vertically.
5. Green geometry
    a. Enter the convergence alignment service mode.
    b. Secure the appropriate overlay to the screen.
    c. Adjust the green geometry to match the overlay.
        i. Start in the center of the screen
        ii. Work clockwise around the screen
6. Red convergence
    a. Align to green.
7. Blue convergence
    a. Align to green.
8. HD convergence
    a. Progressive scan 4:3 units only.
    b. Component video signal to HD 1 input.
    c. 1080i picture on or HD image shape compressed.
9. White balance
    a. Set white balance according to the appropriate Service Manual.
    b. Check picture quality using a live video signal.
10. Width, height, and vertical linearity
    a. Adjust if the memory IC (QA02) has been replaced.
    b. Adjust if the crosshatch pattern is not reasonably close to the overlay pattern.

Readme: The convergence alignment may not be complete at this point. Depending on the year of production and the type of unit being adjusted, there could be several different picture size modes that require adjustment.

End of the line? Specifications
Once all conceivable picture size modes have been aligned, verify the convergence meets factory specifications. The specifications listed in Table 2 reflect the maximum allowable misconvergence, in any direction, referencing either red or blue to green.

Screen Size	Zone								
	A	B	C	D	E	F	G	H	J
40	0.5mm	3.5mm	2.5mm	3.5mm	2mm	3.5mm	2.5mm	3.5mm	2mm
42	0.5mm	3.5mm	2.5mm	3.5mm	2mm	3.5mm	2.5mm	3.5mm	2mm
43	0.5mm	3.5mm	2.5mm	3.5mm	2.5mm	3.5mm	2.5mm	3.5mm	2.5mm
48	0.5mm	4mm	3mm	4mm	3mm	4mm	3mm	4mm	3mm
50 (4:3)	0.5mm	4mm	3mm	4mm	3mm	4mm	3mm	4mm	3mm
50(16:9)	0.5mm	3.8mm	2.7mm	3.8mm	2.3mm	3.8mm	2.7mm	3.8mm	2.3mm
53	0.5mm	4.5mm	3.2mm	4.5mm	3.2mm	4.5mm	3.2mm	4.5mm	3.2mm
55	0.5mm	4.5mm	3.2mm	4.5mm	3.2mm	4.5mm	3.2mm	4.5mm	3.2mm
56	0.5mm	4.5mm	3mm	4.5mm	2.5mm	4.5mm	3mm	4.5mm	2.5mm
57	0.5mm	4.5mm	3mm	4.5mm	2.5mm	4.5mm	3mm	4.5mm	2.5mm
61	0.5mm	5mm	3.5mm	5mm	3mm	5mm	3.5mm	5mm	3mm
65	0.5mm	5mm	3.5mm	5mm	3mm	5mm	3.5mm	5mm	3mm
71	0.5mm	5mm	3.5mm	5mm	3mm	5mm	3.5mm	5mm	3mm

Table 2

Zones A through J are the areas of the screen referenced by the specifications. The zones are illustrated in Figure 4.

H	**Q**	**J**	**K**	**B**
G	**P**	**A**	**L**	**C**
F	**N**	**E**	**M**	**D**

Figure 4

If the convergence cannot be aligned to factory specifications, further troubleshooting is required.

Don't Worry:
Beginning with the 2002 production year, HD Compatible units include a service feature that allows a qualified technician to restore factory convergence data from a back-up memory location.

Readme: Backup data should be loaded **only if corruption of the original data is suspected or if the set is severely misconverged.** Minor misconvergence issues should be corrected by performing the appropriate alignment procedure.

To load back up data:

1. Enter Service Mode as described in the appropriate Service Manual.
2. Enter convergence alignment mode by pressing the “7” key on the remote.
3. Display vertical stripes by pressing the “9” key on the remote.
4. Load the backup by pressing the “1” key on the remote.
    a. The following message will appear on screen for:
        ENTER: TO LOAD BACKUP DATA
        EXIT: TO EXIT
5. Press the “ENTER” key on the remote, as shown in Figure 5, to load the backup data.
    a. The displayed net pattern will misconverge briefly, then return to a normal state.

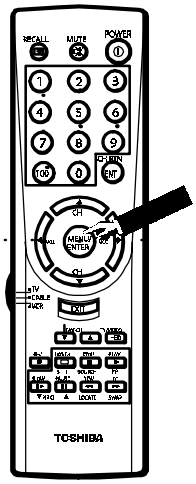

Figure 5

6. Following the alignment procedure in the service manual, make any necessary convergence adjustments.
7. Write the new data to convergence memory by pressing the “7” key on the remote one time.
8. Press the “Touch Focus” key on the front panel of the unit.
    a. The Touch Focus pattern will scroll across the screen two times. Once quickly, then slowly.
9. “CALIBRATION FINISHED” will display on screen and the unit will exit to service mode.
    a. The new convergence data is saved to memory and new backup data is created.
10. Power the unit off to exit service mode.

Readme: Do not attempt to load backup data if the digital convergence PCB has been replaced. Backup data in the new PCB memory is not created until convergence has been adjusted and the CALIBRATION procedure has been completed.

Something to think about:
It is important to know when a convergence alignment will not correct the unit problem. If after following the correct procedure, the convergence cannot be aligned to factory specifications, further troubleshooting is required. Table 3 lists a few of the many possible symptoms.

Repeated Touch Focus errors
Intermittent loss of convergence
Repeated convergence drift of any color
Selected color will not adjust in either direction
Convergence crosshatch pattern will not display
Convergence crosshatch pattern is severely distorted
Touch Focus pattern is not displayed
Touch Focus pattern is severely distorted
Back up data will not load
Cannot enter Service Mode
Data cannot be saved after alignment

Table 3

Points to remember:
Familiarity and practice help the technician develop confidence in performing a digital convergence alignment or determining the need for further troubleshooting. Having the knowledge and necessary tools available are an important first step in the process of gaining experience. While taking this first step, it is best to follow the alignment instructions carefully and exactly. Back up data, if available, is a useful tool if problems occur. It can provide a good starting point in certain cases, but it should not be viewed as a “cure-all” for convergence problems. In most cases, only minor adjustments will be necessary. Focus and centering adjustments will not be needed and the procedure can begin in the GEOMETRY stage. Minor adjustments made in this way do not require the use of back up data or an overlay kit. Simply make the needed adjustments, save the new data accordingly, exit the service mode, and you’re outta there!

Appendix A

Interlaced Scan Units with 4:3 Aspect Ratio

Section 1: OPTICAL & ELECTRICAL FOCUS

1. Follow the appropriate disassembly instructions to gain access to the CRTs.
2. If the wing nuts on the lenses are pointed toward the screen, reverse the lenses on each tube so the wing nuts are facing the back of the set. Leave the lenses in this position after servicing. Put the screen assembly back on.
3. From the Service Mode press the 7 key on the remote control to display the convergence crosshatch pattern.
4. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
5. Position a mirror for viewing the screen from the rear of the set. From the rear of the set, loosen the wing nut on the green lens, and adjust the lens for the best focus in the center area of the screen.
6. From the front of the set, adjust the electrical focus control for best focus in the center of the screen.
7. Repeat the optical focus, and then tighten the wing nut.
8. Repeat the electrical focus.
9. Push the 100 key to turn on the red tube, and the 0 key to turn off the green tube.
10. Adjust the red optical and electrical focus in the same manner.
11. Push the CH RTN/ENT key to turn on the blue tube, and the 100 key to turn off the red tube.
12. Adjust the blue optical and electrical focus in the same manner. Electrically defocus the blue slightly, to maintain uniform brightness.

Section 2: MECHANICAL TILT ADJUSTMENT

1. With the set still in convergence mode, and the convergence overlay on the screen, check each CRT's tilt. If a CRT's pattern is tilted, loosen the appropriate yoke with a non-magnetic screwdriver. Rotate the yoke until the pattern is aligned vertically and horizontally. Re-tighten the yoke.
2. Press the 7 key on the remote to store the convergence data.
3. After the data is stored, press the 7 key on the remote again to exit the convergence crosshatch pattern.
4. The unit will return to service mode and display a normal picture with the letter "S" in the upper right corner.
5. Power the unit OFF to exit service mode.

Section 3: USER CONVERGENCE AND MAGNETIC CENTERING ADJUSTMENTS

1. Disconnect any source at the Video 1 input.
2. Turn the power on.
3. Enter the user convergence screen through the customer menu.
4. Move the red vertical cross hair as far as it will go to the right. Note the location. Move the red vertical cross hair as far as it will go to the left. Note that location. Set the red vertical cross hair to the center of the two extremes.

Appendix A

5. Move the red horizontal cross hair as far as it will go toward the top of the screen. Note the location. Move the red horizontal cross hair as far as it will go toward the bottom of the screen. Note that location. Set the red horizontal cross hair to the center of the two extremes.
6. Repeat steps 4 and 5 for the blue cross hair.
7. Repeat steps 4, 5, and 6 for all user convergence adjustment points.
8. Exit the customer convergence screen.
9. Enter the service adjustment mode.
10. Enter the service convergence adjustment mode to display the crosshatch pattern.
11. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
12. Rotate the centering rings on the green CRT to center the green cross bar. If the rings won't turn, remove the locking glue with a small knife. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen to locate the center of the screen.
13. Push the 100 key to turn on the red tube, and the CH RTN/ENT key to turn on the blue tube.
14. Center the red and blue crossbars, using the green crossbars as a guide.
15. Lock the centering rings with a pliable adhesive.
16. Exit the service convergence adjustment mode as described in Section 2.

Section 4: ELECTRICAL CENTERING

1. Turn the power on.
2. Using a signal generator, display a crosshatch pattern.
3. Enter the service adjustment mode.
4. Check the centering of the crosshatch pattern. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen, to locate the center.
5. If the horizontal position is off, use the channel up or down key to select the HPOS register. Use the volume key to center the pattern.
6. If the vertical position is off, use the channel up or down key to select the VPOS register. Use the volume key to center the pattern.
7. Turn the power off to save all adjustments.

Section 5: GREEN GEOMETRY

1. Enter the service adjustment mode and then enter the convergence adjustment mode.
2. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn off the blue tube.
3. Place the convergence overlay on the screen and align the center cross hairs with the center of the screen.
4. Use low tack drafting tape to secure the overlay to the screen. Make the overlay as flat as possible against the screen to reduce parallax errors.

Appendix A

Readme: If the microcomputer memory IC (QA02) has been replaced, or the crosshatch pattern is not reasonably close to the overlay pattern, make the adjustments in Section 9. (WID, HIT, & VLIN ADJUSTMENTS). Then proceed with step 5.

5. Push the 3 key on the remote until the blinking cursor in the upper left corner of the screen is green.
6. Move the blinking cursor to the right with the 6 key, then down with the 8 key, until it is one line to the right of screen center. The 4 key moves the cursor to the left, and the 2 key moves it up.
7. Push the 5 key to lock the cursor in place.
8. Use the 2, 6, 8, and 4 keys to align the TV's convergence pattern to the overlay pattern.
9. Push the 5 key to unlock the cursor.
10. Move the cursor to the next location and repeat steps 7 and 8. Continue around the screen, clockwise, from the center to the edges. Repeat the entire procedure to make fine adjustments.

Section 6: RED CONVERGENCE

1. Remove the overlay and press the 100 key to turn on the red tube.
2. Press the 3 key until the cursor turns red.
3. Align the red convergence pattern to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.

Section 7: BLUE CONVERGENCE

1. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn on the blue tube.
2. Push the 3 key until the cursor turns blue.
3. Align the blue convergence to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.
4. Push the 100 key to turn on the red tube and check the convergence with all three tubes on. The convergence pattern should be white with no red, green, or blue present. A slight blue halo may result from the defocused blue CRT.
5. Exit the adjustment mode as described in Section 2.

Section 8: WHITE BALANCE

1. Turn the unit back on and check the white balance.
2. Refer to the appropriate Service Manual and adjust the white balance as needed.
3. Check the picture quality using a live video signal. If the picture quality is acceptable, put the unit back together. If the picture quality is not acceptable, recheck the convergence alignment.

Appendix A

Section 9: WIDTH, HEIGHT, & VERTICAL LINEARITY ADJUSTMENTS

Readme: See the notes in Section 5, before performing the following procedure.

1. Exit the convergence adjustment mode as described in Section 2.
2. Press the MENU button on the unit control panel to display the RCUT register.
3. Use the channel up/ down keys to select the WID register.
4. Use the volume keys to adjust the WID register until the vertical lines are close to those on the overlay.
5. Use the channel up/ down keys to select the HIT register.
6. Use the volume keys to adjust the HIT register until the horizontal lines are close to those on the overlay.
7. Use the channel up/ down keys to select the VLIN register.
8. Use the volume keys to adjust the VLIN register until the horizontal lines are close to those on the overlay.
8. If needed, repeat both the HIT and VLIN adjustments for the best results.
9. Push the 7 key to return to the convergence mode and continue with Section 5.

Appendix B

4:3 Progressive Scan Units with Touch Focus

Section 1: OPTICAL & ELECTRICAL FOCUS

1. Follow the appropriate disassembly instructions to gain access to the CRTs.
2. If the wing nuts on the lenses are pointed toward the screen, reverse the lenses on each tube so the wing nuts are facing the back of the set. Leave the lenses in this position after servicing. Put the screen assembly back on.

   Readme: The wing nuts can be accessed from the front of units with a screen size of 50 inches or larger. The bezel assembly can be raised approximately 6 inches and locked into place using an extra set of brackets.

3. From the service mode press the 7 key on the remote control to display the convergence crosshatch pattern.
4. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
5. Position a mirror for viewing the screen from the rear of the set. From the rear of the set, loosen the wing nut on the green lens, and adjust the lens for the best focus in the center area of the screen.

   Readme: No mirror is needed for units that provide front access.

6. From the front of the set, adjust the electrical focus control for best focus in the center of the screen.
7. Repeat the optical focus, and then tighten the wing nut.
8. Repeat the electrical focus.
9. Push the 100 key to turn on the red tube, and the 0 key to turn off the green tube.
10. Adjust the red optical and electrical focus in the same manner.
11. Push the CH RTN/ENT key to turn on the blue tube, and the 100 key to turn off the red tube.
12. Adjust the blue optical and electrical focus in the same manner. Electrically defocus the blue slightly, to maintain uniform brightness.
13. If the bezel assembly has been raised to allow front access, lower it into normal position.

Section 2: MECHANICAL TILT ADJUSTMENT

1. With the set still in convergence mode, and the convergence overlay on the screen, check each CRT's tilt. If a CRT's pattern is tilted loosen the appropriate yoke with a non-magnetic screwdriver. Rotate the yoke until the pattern is aligned vertically and horizontally. Re-tighten the yoke.
2. Press the 7 key on the remote to store the convergence data.
3. After the data is stored, "Please Press Touch Focus" will appear on screen. Press the "Touch Focus" button on the unit control panel.

Appendix B

4. "Finish" will appear on screen when the "Touch Focus" procedure is complete. The unit will return to service mode and display a normal picture with the letter "S" in the upper right corner.

   Readme: Beginning with units in 2002, Touch Focus will run twice. The first scan will be at a faster rate than the second scan. "CALIBRATION FINISHED" will appear on the screen before the unit returns to the Service Mode.

5. Power the unit OFF to exit service mode.

Section 3: USER CONVERGENCE AND MAGNETIC CENTERING ADJUSTMENTS

1. Disconnect any source at the Video 1 input.
2. Turn the power on.
3. Enter the user convergence screen through the customer menu.
4. Move the red vertical cross hair as far as it will go to the right. Note the location. Move the red vertical cross hair as far as it will go to the left. Note that location. Set the red vertical cross hair to the center of the two extremes.
5. Move the red horizontal cross hair as far as it will go toward the top of the screen. Note the location. Move the red horizontal cross hair as far as it will go toward the bottom of the screen. Note that location. Set the red horizontal cross hair to the center of the two extremes.
6. Repeat steps 4 and 5 for the blue cross hair.
7. Repeat steps 4, 5, and 6 for all user convergence adjustment points.
8. Exit the customer convergence screen.
9. Enter the service adjustment mode.
10. Enter the service convergence adjustment mode to display the crosshatch pattern.
11. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
12. Rotate the centering rings on the green CRT to center the green cross bar. If the rings won't turn, remove the locking glue with a small knife. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen to locate the center of the screen.
13. Push the 100 key to turn on the red tube, and the CH RTN/ENT key to turn on the blue tube.
14. Center the red and blue crossbars, using the green crossbars as a guide.
15. Lock the centering rings with a pliable adhesive.
16. Exit the service convergence adjustment mode as described in Section 2.

Section 4: ELECTRICAL CENTERING

1. Turn the power on.
2. Using a signal generator, display a crosshatch pattern.
3. Enter the service adjustment mode.

Appendix B

4. Check the centering of the crosshatch pattern. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen, to locate the center.
5. If the horizontal position is off, use the channel up or down key to select the HPOS register. Use the volume key to center the pattern.
6. If the vertical position is off, use the channel up or down key to select the VPOS register. Use the volume key to center the pattern.
7. Turn the power off to save all adjustments.

Section 5: GREEN GEOMETRY

1. Enter the service adjustment mode and then enter the convergence adjustment mode.
2. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn off the blue tube.
3. Place the convergence overlay on the screen and align the center cross hairs with the center of the screen.
4. Use low tack drafting tape to secure the overlay to the screen. Make the overlay as flat as possible against the screen to reduce parallax errors.

   Readme: If the microcomputer memory IC (QA02) has been replaced, or the crosshatch pattern is not reasonably close to the overlay pattern, make the adjustments in Section 9. (WID, HIT, & VLIN ADJUSTMENTS). Then proceed with step 5.

5. Push the 3 key on the remote until the blinking cursor in the upper left corner of the screen is green.
6. Move the blinking cursor to the right with the 6 key, then down with the 8 key, until it is one line to the right of screen center. The 4 key moves the cursor to the left, and the 2 key moves it up.
7. Push the 5 key to lock the cursor in place.
8. Use the 2, 6, 8, and 4 keys to align the TV's convergence pattern to the overlay pattern.
9. Push the 5 key to unlock the cursor.
10. Move the cursor to the next location and repeat steps 7 and 8. Continue around the screen, clockwise, from the center to the edges. Repeat the entire procedure to make fine adjustments.

Section 6: RED CONVERGENCE

1. Remove the overlay and press the 100 key to turn on the red tube.
2. Press the 3 key until the cursor turns red.
3. Align the red convergence pattern to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.

Appendix B

Section 7: BLUE CONVERGENCE

1. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn on the blue tube.
2. Push the 3 key until the cursor turns blue.
3. Align the blue convergence to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.
4. Push the 100 key to turn on the red tube and check the convergence with all three tubes on. The convergence pattern should be white with no red, green, or blue present. A slight blue halo may result from the defocused blue CRT.
5. Exit the adjustment mode as described in Section 2.

Section 8: HD CONVERGENCE

1. Turn the unit ON.
2. Input a component video signal to the HD 1 component video jacks.
3. Press the TV/VIDEO button on the remote control until HD 1 input is selected.
4. Select HD 1 Image Shape Compressed from the User Theater Menu. The video displayed will be compressed with black panels above and below the image.
5. Repeat Sections 5, 6, and 7.

Section 9: WHITE BALANCE

1. Turn the set back on and check the white balance.
2. Refer to the appropriate Service Manual and adjust the white balance as needed.
3. Check the overall picture quality using a live video signal. If the picture quality is acceptable, put the unit back together. If the picture quality is not acceptable, recheck the convergence alignment.

Section 10: WIDTH, HEIGHT, & VERTICAL LINEARITY ADJUSTMENTS

Readme: See the notes in Section 5, before performing the following procedure.

1. Exit the convergence adjustment mode as described in Section 2.
2. Press the MENU button on the unit control panel to display the RCUT register.
3. Use the channel up/ down keys to select the WID register.
4. Use the volume keys to adjust the WID register until the vertical lines are close to those on the overlay.
5. Use the channel up/ down keys to select the HIT register.
6. Use the volume keys to adjust the HIT register until the horizontal lines are close to those on the overlay.
7. Use the channel up/ down keys to select the VLIN register.
8. Use the volume keys to adjust the VLIN register until the horizontal lines are close to those on the overlay.
9. If needed, repeat both the HIT and VLIN adjustments for the best results.
10. Push the 7 key to return to the convergence mode and continue with Section 5.

Appendix C

16:9 Progressive Scan Units with Touch Focus

Section 1: OPTICAL & ELECTRICAL FOCUS

1. Follow the appropriate disassembly instructions to gain access to the CRTs.
2. If the wing nuts on the lenses are pointed toward the screen, reverse the lenses on each tube so the wing nuts are facing the back of the set. Leave the lenses in this position after servicing. Put the screen assembly back on.

   Readme: The wing nuts can be accessed from the front of units with a screen size of 50 inches or larger. The bezel assembly can be raised approximately 6 inches and locked into place using an extra set of brackets.

3. From the service mode press the 7 key on the remote control to display the convergence crosshatch pattern.
4. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
5. Position a mirror for viewing the screen from the rear of the set. From the rear of the set, loosen the wing nut on the green lens, and adjust the lens for the best focus in the center area of the screen.

   Readme: No mirror is needed for units that provide front access.

6. From the front of the set, adjust the electrical focus control for best focus in the center of the screen.
7. Repeat the optical focus, and then tighten the wing nut.
8. Repeat the electrical focus.
9. Push the 100 key to turn on the red tube, and the 0 key to turn off the green tube.
10. Adjust the red optical and electrical focus in the same manner.
11. Push the CH RTN/ENT key to turn on the blue tube, and the 100 key to turn off the red tube.
12. Adjust the blue optical and electrical focus in the same manner. Electrically defocus the blue slightly, to maintain uniform brightness.
13. If the bezel assembly has been raised to allow front access, lower it into normal position.

Section 2: MECHANICAL TILT ADJUSTMENT

1. With the set still in convergence mode, and the convergence overlay on the screen, check each CRT's tilt. If a CRT's pattern is tilted loosen the appropriate yoke with a non-magnetic screwdriver. Rotate the yoke until the pattern is aligned vertically and horizontally. Re-tighten the yoke.
2. Press the 7 key on the remote to store the convergence data.
3. After the data is stored, "Please Press Touch Focus" will appear on screen. Press the "Touch Focus" button on the unit control panel.

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4. "Finish" will appear on screen when the "Touch Focus" procedure is complete. The unit will return to service mode and display a normal picture with the letter "S" in the upper right corner.

   Readme: Beginning with units in 2002, Touch Focus will run twice. The first scan will be at a faster rate than the second scan. "CALIBRATION FINISHED" will appear on the screen before the unit returns to the Service Mode.

5. Power the unit OFF to exit service mode.

Section 3: USER CONVERGENCE AND MAGNETIC CENTERING ADJUSTMENTS

1. Disconnect any source at the Video 1 input.
2. Turn the power on.
3. Enter the user convergence screen through the customer menu.
4. Move the red vertical cross hair as far as it will go to the right. Note the location. Move the red vertical cross hair as far as it will go to the left. Note that location. Set the red vertical cross hair to the center of the two extremes.
5. Move the red horizontal cross hair as far as it will go toward the top of the screen. Note the location. Move the red horizontal cross hair as far as it will go toward the bottom of the screen. Note that location. Set the red horizontal cross hair to the center of the two extremes.
6. Repeat steps 4 and 5 for the blue cross hair.
7. Repeat steps 4, 5, and 6 for all user convergence adjustment points.
8. Exit the customer convergence screen.
9. Enter the service adjustment mode.
10. Enter the service convergence adjustment mode to display the crosshatch pattern.
11. Push the 100 key to turn off the red tube, and the CH RTN/ENT key to turn off the blue tube.
12. Rotate the centering rings on the green CRT to center the green cross bar. If the rings won't turn, remove the locking glue with a small knife. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen to locate the center of the screen.
13. Push the 100 key to turn on the red tube, and the CH RTN/ENT key to turn on the blue tube.
14. Center the red and blue crossbars, using the green crossbars as a guide.
15. Lock the centering rings with a pliable adhesive.
16. Exit the service convergence adjustment mode as described in Section 2.

Section 4: ELECTRICAL CENTERING

1. Turn the power on.
2. Using a signal generator, display a crosshatch pattern.
3. Enter the service adjustment mode.

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4. Check the centering of the crosshatch pattern. Use the center cross hairs of the convergence overlay, or two pieces of string stretched diagonally across the screen, to locate the center.
5. If the horizontal position is off, use the channel up or down key to select the HPOS register. Use the volume key to center the pattern.
6. If the vertical position is off, use the channel up or down key to select the VPOS register. Use the volume key to center the pattern.
7. Turn the power off to save all adjustments.

Section 5: GREEN GEOMETRY

1. Enter the service adjustment mode and then enter the convergence adjustment mode.
2. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn off the blue tube.
3. Place the convergence overlay on the screen and align the center cross hairs with the center of the screen.
4. Use low tack drafting tape to secure the overlay to the screen. Make the overlay as flat as possible against the screen to reduce parallax errors.

   Readme: If the microcomputer memory IC (QA02) has been replaced, or the crosshatch pattern is not reasonably close to the overlay pattern, make the adjustments in Section 9. (WID, HIT, & VLIN ADJUSTMENTS). Then proceed with step 5.

5. Push the 3 key on the remote until the blinking cursor in the upper left corner of the screen is green.
6. Move the blinking cursor to the right with the 6 key, then down with the 8 key, until it is one line to the right of screen center. The 4 key moves the cursor to the left, and the 2 key moves it up.
7. Push the 5 key to lock the cursor in place.
8. Use the 2, 6, 8, and 4 keys to align the TV's convergence pattern to the overlay pattern.
9. Push the 5 key to unlock the cursor.
10. Move the cursor to the next location and repeat steps 7 and 8. Continue around the screen, clockwise, from the center to the edges. Repeat the entire procedure to make fine adjustments.

Section 6: RED CONVERGENCE

1. Remove the overlay and press the 100 key to turn on the red tube.
2. Press the 3 key until the cursor turns red.
3. Align the red convergence pattern to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.

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Section 7: BLUE CONVERGENCE

1. Push the 100 key to turn off the red tube, and CH RTN/ENT to turn on the blue tube.
2. Push the 3 key until the cursor turns blue.
3. Align the blue convergence to the green pattern, using the same procedure used to align the green convergence pattern to the overlay.
4. Push the 100 key to turn on the red tube and check the convergence with all three tubes on. The convergence pattern should be white with no red, green, or blue present. A slight blue halo may result from the defocused blue CRT.
5. Exit the adjustment mode as described in Section 2.

Section 9: WHITE BALANCE

1. Turn the set back on and check the white balance.
2. Refer to the appropriate Service Manual and adjust the white balance as needed.
3. Check the overall picture quality using a live video signal. If the picture quality is acceptable, put the unit back together. If the picture quality is not acceptable, recheck the convergence alignment.

Section 10: WIDTH, HEIGHT, & VERTICAL LINEARITY ADJUSTMENTS

Readme: See the notes in Section 5, before performing the following procedure.

1. Exit the convergence adjustment mode as described in Section 2.
2. Press the MENU button on the unit control panel to display the RCUT register.
3. Use the channel up/ down keys to select the WID register.
4. Use the volume keys to adjust the WID register until the vertical lines are close to those on the overlay.
5. Use the channel up/ down keys to select the HIT register.
6. Use the volume keys to adjust the HIT register until the horizontal lines are close to those on the overlay.
7. Use the channel up/ down keys to select the VLIN register.
8. Use the volume keys to adjust the VLIN register until the horizontal lines are close to those on the overlay.
9. If needed, repeat both the HIT and VLIN adjustments for the best results.
11. Push the 7 key to return to the convergence mode and continue with Section 5.