

CP4220/4230 Convergence Instruction Sheet

INTRODUCTION

These instructions explain how to adjust convergence in the CP4220 and CP4230 projectors. Information provided here supplements the main Convergence Instructions drawing provided inside the top lid of the projector.

TOOLS REQUIRED

- 2.5 mm driver with heat-shrink tubing (2.0 inch and 6.5 inch lengths), included with projector. One driver is located on the the high security lid and the other is located in the packaging.

INSTRUCTIONS

⚠ WARNING Convergence adjustment must be performed by a qualified service technician.

ACCESSING THE LIGHT ENGINE

Remove the top lid to access to the light engine and liquid cooling system compartments.

1. Use the low security key to unlock the front top lid(Figure 1).
2. Lift the lid up and remove.

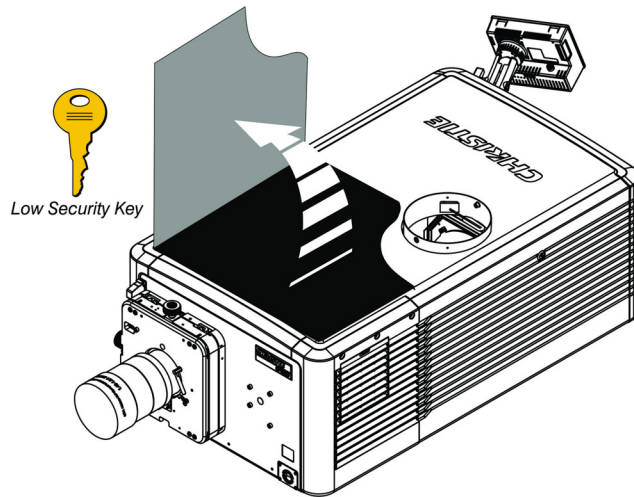


Figure 1 Remove top Lid from Projector

Remove the high security lid to access components in the light engine and cardcage compartments.
NOTE: Only Christie authorized service technicians should open the high security lid.

3. Use the high security key to unlock the high security lid (Figure 2).
4. Lift the lid up and remove.

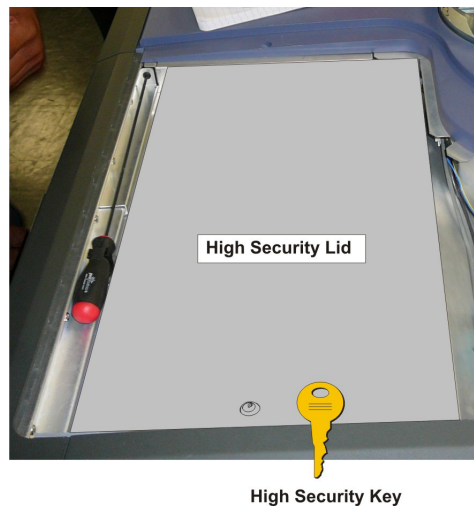


Figure 2 Remove High Security Lid

CONVERGENCE OVERVIEW

NOTICE! Do not run the projector while performing convergence with the Light Engine Fan Pack or the Cooling Duct removed. This will cause overheating of the Satellite Formatter Board FPGA's. However, the fan packs can be removed for a short time to access the adjustment screws. If this is necessary you can verify the temperature at the TPC status window.

The projector has three separate DMD panels to produce three separate red, green and blue image components. To get the most accurate color representation across the whole image it is essential the three panels are perfectly aligned so that all pixels line up. The following convergence procedure outlines how to achieve this.

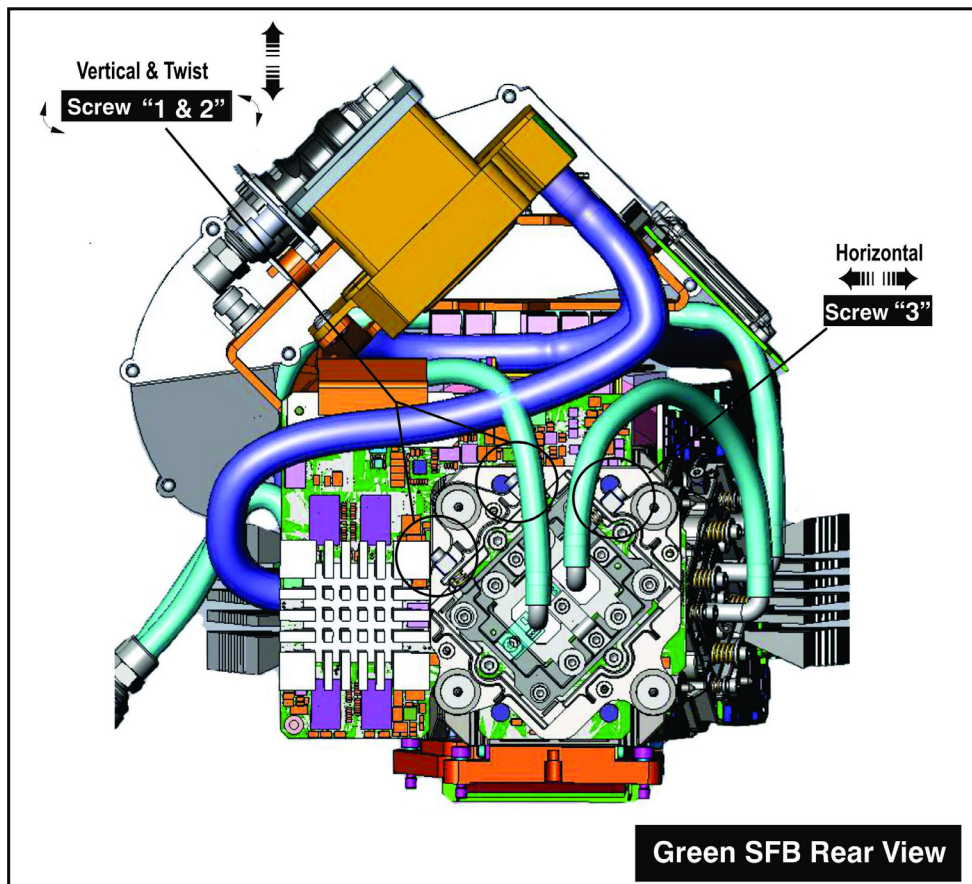


Figure 3

BEFORE PERFORMING CONVERGENCE

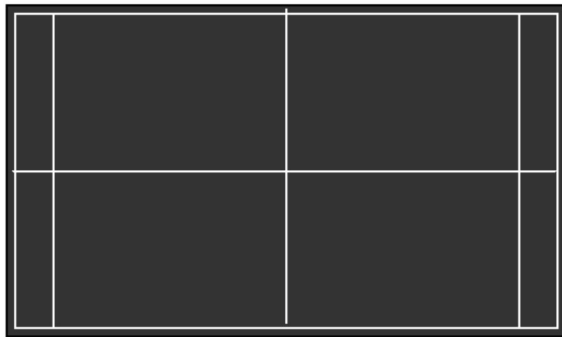
- Make sure the image-zoom and centering is complete before performing convergence.
For details, refer to *3.2 Integrator Alignment, on page 3-2, of the CP4220 and CP4230 Service manuals (P/N: 020-100691-xx/020-100622-xx)*.
- Make sure boresight procedures have been completed before performing convergence.
For details, refer to the *CP4220 and 4230 User Manual (P/N: 020-100690-xx/020-100621-xx)*.
- Use only a prime lens when performing convergence. DO NOT use an anamorphic or Wide Converter Lens (WCL).
- The projector should be set up to final maximum usable brightness for the installed application.
 - 14FL for Standard 2D
 - ~25-30FL for Single Projector 3D with a silver screen
 - 25FL per projector for Dual Projector 3D
- Once at the required power setting, the unit should be allowed to come “up to temperature” for at least 15 minutes. Note this nominal operating temperature for monitoring as you perform convergence.

IMPORTANT: *During convergence, the lid and/or filter side of the projector will be open, causing decreased prism cooling performance and possible shifts in convergence or DMD focus. The prism temperature should be monitored during the adjustment and kept within a few degrees of the nominal temperature achieved above by lowering the lamp power or periodically replacing the cover for a cool-down.*

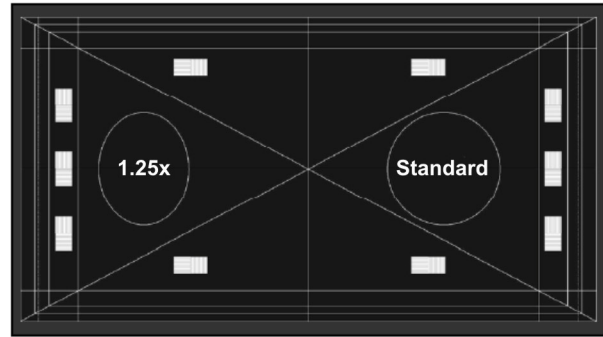
- Watch for over-temperature alerts when running near 6000W. Cool-down periods with the shutter closed and cover on may be required.
- The active screen file should be **4096 x 2160 no crop** to prevent any scaling of your reference test pattern.
- Typically the blue image component can be used as the fixed reference, so no adjustment is required. However, if you need to adjust the blue image component it is easy to adjust, but the side panel must be removed. The recommended normal convergence adjustments are from green to blue and red to green.
- It is recommended that the vertical and rotation adjustment be done first, as they work dependently together and the horizontal adjustment done last.
- Use extreme caution to not damage any components on the board.
- DO NOT push or force the adjustment screws when turning them.
- You do not always have to turn the screws simultaneously; however, adjusting one at a time will cause the need for an equal or equal and opposite turn on the other to achieve the adjustment desired.
- There are no Lockdown screws with the CP4220 and CP4230 light engines.

EVALUATING CONVERGENCE

1. Display either the Alignment Pattern or the Framing Pattern (**Figure 4**). **NOTE:** *The framing pattern may not be installed on the projector in some cases. Keep a copy of this pattern on your laptop and load it to the projector you are working on if it is not present.*
2. Zoom and focus the image so you can see the entire outer edge of the test pattern frame.



Alignment Pattern



Framing Pattern

Figure 4 Alignment and Framing Pattern

3. You should be able to judge the convergence issues by using the horizontal and vertical white lines. Look at one color at a time and remember that you can see a **possible 7 colors** to lead you to a valid conclusion. (**Figure 5**) The stripe pattern boxes along the outer frames can be very helpful as well.

Magenta=Blue+Red / **Yellow**=Green+Red / **Cyan**=Green+Blue / **White**=Red+Green+Blue

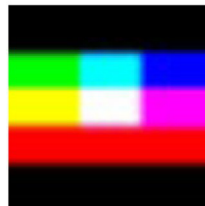
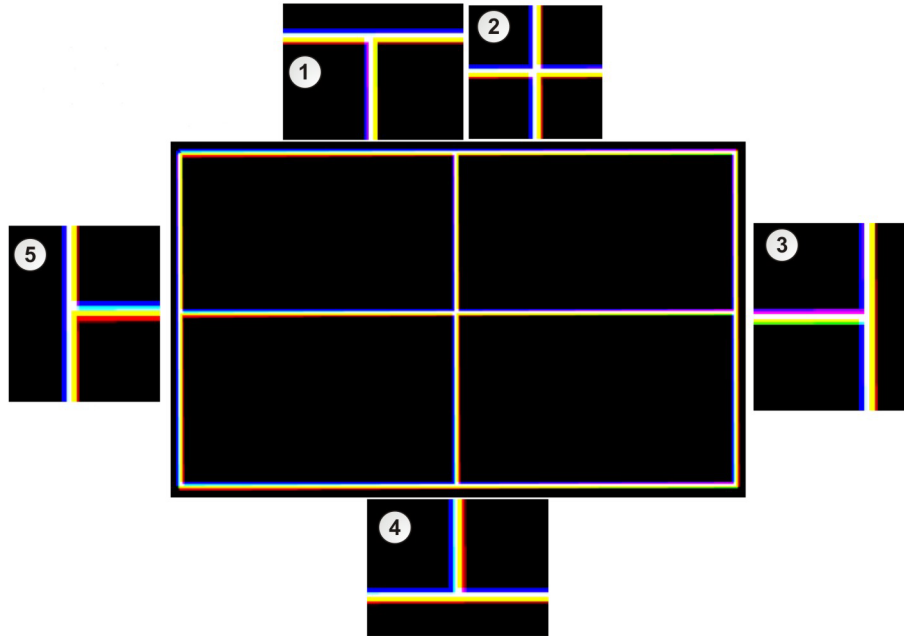


Figure 5 Seven Color Possibilities

4. Look for “twist” using the center vertical and horizontal lines – scan from one side of the screen to the other, observing any change in vertical position of the color in question relative to the point where you started. **(Figure 6)** is an example of a projector with two problems; Red is twisted counter-clockwise and Blue is high and to the left with no apparent twist.



1. **Top Center:** Note Yellow to the right, Magenta/Blue to the left and Yellow in the middle. This shows that Blue is separated from Green to the left. Blue above shows that Blue is higher than both Green and Red.

2. **Center:** Shows that Blue is high and to the left and Red is twisted.

3. **Right Side:** Note Blue to the left, Yellow to the right and White in the middle. This shows that Blue is separated from Green to the left. Compare to Left Side, where Magenta is to the top on the right, Red is on the Bottom to the left. This is evidence of counter-clockwise twist in Red and that Blue is high.

4. **Bottom Center:** Note Blue to left, Yellow/Red to the right, Cyan in the middle. This shows that Blue is separated from Green to the left and upward. Compare to Top Center where Red is to the right on the bottom, to the left on the top. This is evidence of counter-clockwise twist.

5. **Left Side:** Note Blue to the left, Yellow/Red to the right and White in the middle. This shows that Blue is separated from Green to the left. Compare to the Right Side where Red is to the bottom on the left, Magenta is on the top to the right. This is evidence of counter-clockwise twist in Red and that Blue is high.

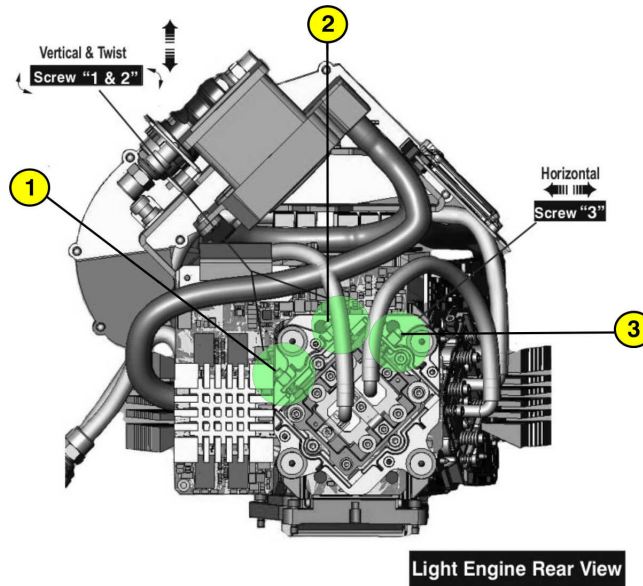
Figure 6 Poor Convergence Example (pattern simplified)

RED/GREEN/BLUE FORMATTER CONVERGENCE ADJUSTMENT

⚠ CAUTION Remove all jewelry (rings, watches, necklaces, bracelets etc.) before adjusting convergence.

NOTE: Do not apply excessive force on the adjustment screws. This might cause the convergence adjustment to become misaligned once you remove the adjustment tool.

The Red and Green Formatters are identical in physical layout and adjuster function. The Blue formatter board is slightly different in physical layout, but the adjustment functions are the same. The vertical and twist adjustments (Screws 1 and 2) interact with each other, while the horizontal adjustment (Screw 3) is independent, as described in (Figure 7).



Screen/Screw	1	2	3
↻	↻	↻	N/A
↻	↻	↻	N/A
↑	↻	↻	N/A
↓	↻	↻	N/A
←	N/A	N/A	↻
→	N/A	N/A	↻

Figure 7 Red/Green/Blue Formatter Convergence Adjustment

The physical layout of the Formatter boards dictates the behavior of the Twist and Vertical adjustments:

- The adjustment of the twist and vertical is more like a “Twist with the left-side of the screen as a sliding hinge point to allow vertical travel”.

- The vertical and twist adjustment screws (Screw 1 and 2) interact with each other such that if one is turned in the opposite direction of the other, the twist is affected.
- If both screws are turned equal amounts in the same direction, the image moves vertically.
- Remove the Light engine air filter and fan pack to access the blue convergence adjustment screws. For details, refer to **5.6.1 Light Engine Air Filter, on page 5-11** and **5.7.2 Light Engine Fan Pack (4 fans), on page 5-13 of the CP4220 and CP4230 Service manuals (P/N: 020-100691-xx/020-100622-xx)**. **NOTE:** Cooling is greatly affected by removing the filter and fan pack assembly. The FPGA temperatures can be monitored from the TPC.

You do not always have to turn the screws simultaneously; however, adjusting one at a time will cause the need for an equal or equal and opposite turn on the other to achieve the adjustment desired.

It is a good idea to locate the shorter blade 2.5mm driver on adjusting screw #2 (especially on the red Satellite board), and use the longer blade 2.5mm driver for screw#1 and horizontal screw #3.

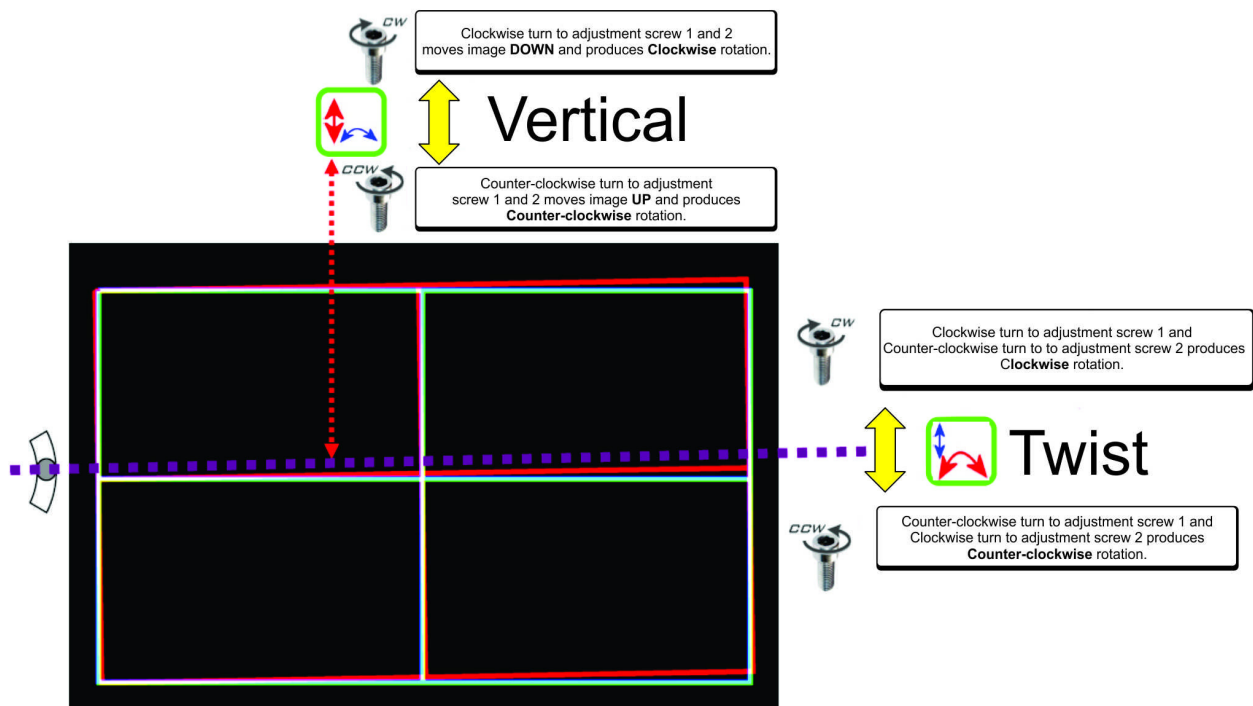


Figure 8 Red/Green/Blue Formatter Twist and Vertical Adjustments

- The horizontal adjustment screw is independent of the vertical and twist adjustments.

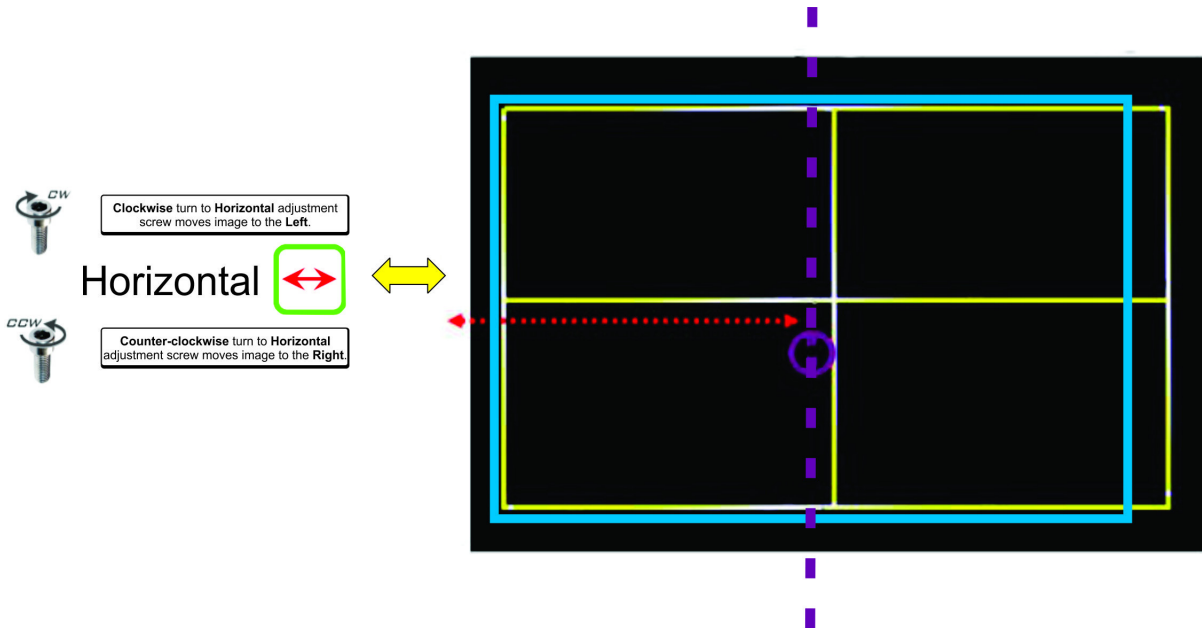


Figure 9 Red/Green/Blue Formatter Horizontal Adjustments

FINAL CONVERGENCE ASSESSMENT

When should you be satisfied with your adjustments? Read the following section before coming to a conclusion (**Figure 10**).

1. The best possible convergence would be described as follows:
 - a. The center area highlighted should be perfectly aligned showing solid white pixels.
 - b. The Red should be evenly 1/4 to 1/2 a pixel out all the way around the outer area not highlighted showing cyan (green+blue) towards the center of the screen.

- c. Green and Blue should always be perfectly aligned to each-other (to within ¼ pixel total in one or a combination of directions.)

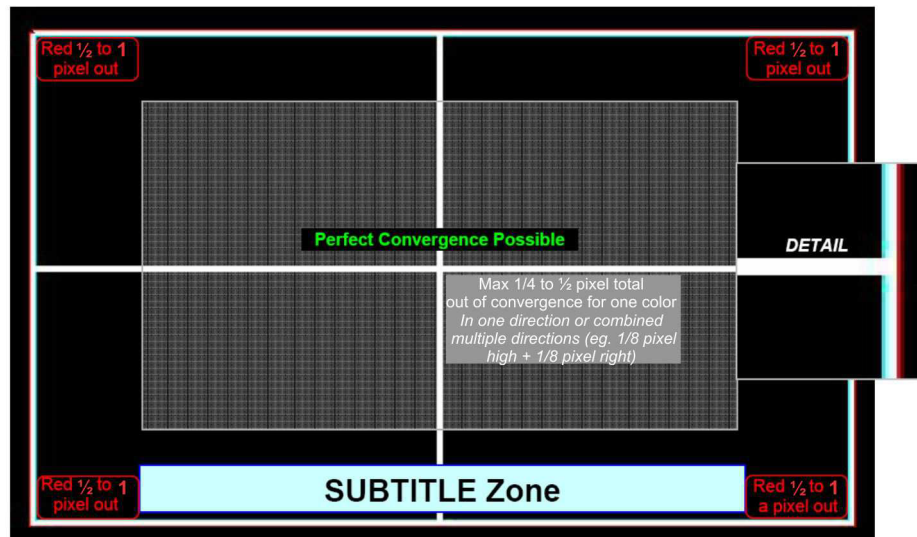


Figure 10 Best Possible Convergence

- 2. In certain circumstances, there may be further tolerance deficiencies in the prism assembly in combination with the projection lens that will cause the normal Red over-sizing to become slightly non-uniform.
 - a. In practice, this extra increase in size has generally appeared on the lower-right of the image, causing an apparent clockwise twist in the lower-right corner only – the upper left, right and lower-left all look OK.
 - b. The only way to deal with this will be to “Split the difference” pushing the rest of the image slightly twisted counter-clockwise to minimize the effect on the bottom of the screen, keeping the subtitle zone as converged as possible.
 - c. If the problem appears to be more than an extra 1/2 of a pixel out of uniformity, a new lens/ prism assembly may be the only solution.