

The definitive projector setup guide.

Here, humbly, is a guide for first time projector owners to get the most out of their projector. Hey, veteran CRT owners might get something out of this too! Feel free to critique like crazy if I'm missing some steps (quote possible) and email me with comments. I've based this on the NEC XG, but of course the principles can be applied to any CRT projector, entry level or high end, ES or EM focusing.

Raster/tube face setup.

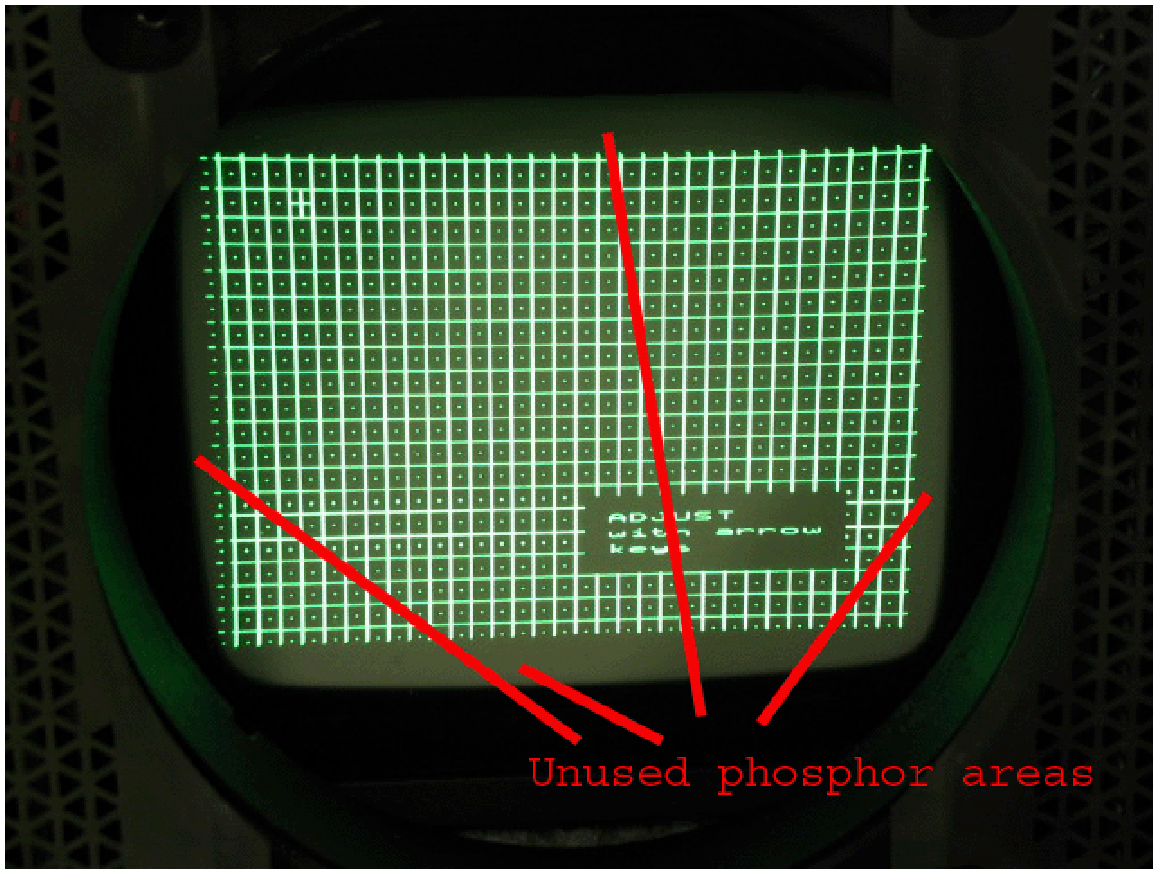
This is one of the most misunderstood areas of CRT projector setup. Here's some basics:

All CRT tubes come in a 4:3 format rather than a 16:9 configuration. Regardless of whether you project in a 4:3 format or a widescreen one, you want to use as much of the tube face as possible to maximize tube life. By using as much of the tube face as possible, you'll also increase the maximum resolution out of the tube as you're spreading the image out over a larger area of the tube face.

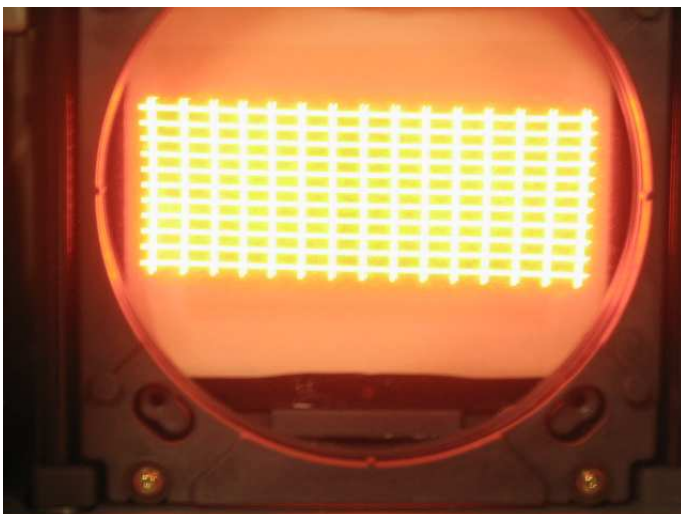
Note that the internal test pattern of the projector will always be slightly larger than the projected image. This is purposely done so that the test pattern will overshoot the screen slightly. By overshooting the screen, you'll be ensured perfect convergence right to the edge of the screen and past it. When the projected image then fills the screen, it will be perfectly converged.

The idea is to maximize the phosphor area of the tube without overshooting the tube face. There is cooling fluid between the glass face that you see on the tube and the actual phosphor behind it. If you overshoot the tube face, you're causing the electron beam to shoot off the phosphor onto the edge of the glass that has no cooling fluid on it, and the tube edge can overheat and implode. Shown below are some good and bad examples of tube phosphor use.

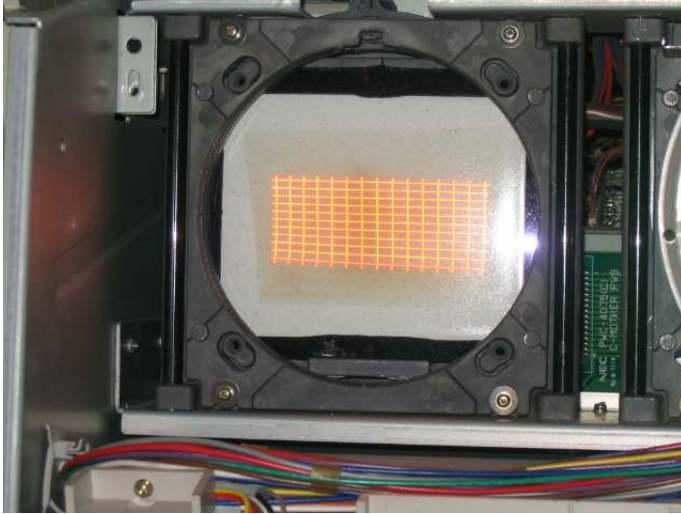
Good- the raster/test pattern is centered on the tube face, there is a visible margin between the edge of the tube and the test pattern. Maximum use is made of the tube face.



In a 16:9 (widescreen) configuration, less of the phosphor face is used, as the picture will be projected in widescreen mode as shown below. While the below image shows the test pattern being very close to the tube edges, the projected video image will be smaller (less width and height), so a margin of safety is still being used in this setup. Since you're (hopefully) not going to be projecting the test pattern for hours upon hours, there's no chance of a tube implosion with the test pattern running right to the edge of the tube in setup mode.



The NEC manual is somewhat flawed in that it tells you to mount the projector back a little more than what is ideal for maximum tube face use. The picture below shows a test pattern with a wide margin between the edge of the pattern and the edge of the tube. You'll end up using less phosphor area which will result in shortened tube life and lower overall resolution



You also want the test pattern centered on the face of the tube. Below are examples of rasters/test patterns that are shifted off center on the tube face. This will result in convergence drift and uneven tube wear.

Image shifted too far to the right on the tube face:

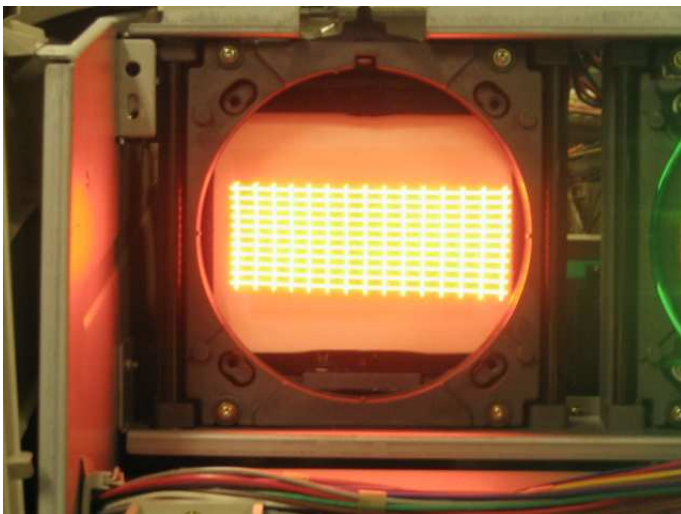


Image shifted too far up on the tube face and to the left:



The NEC XG chassis specifically has two sets of raster shift adjustments. The fine adjustment is the 'position' button on the remote. The coarse adjustments are done in the 'ref adjust' settings in the 'adjust' mode. The 'raster centering' mode will allow you to perfectly center the test pattern on each tube. While adjusting the 'ref adjust', make sure the 'position' settings are at 0,0. This will then allow you to fine tune the raster shift during the final adjustments while maintaining the overall centering of the coarse 'ref adjust' settings.

The height and width controls of the set will adjust how much of the tube face you're using with both the test pattern and the video image. You'll run out of width before you run out of height on the tube face, so maximize the width used without overshooting the tube face. The exact height can be dialed in during the geometry setup of the green tube.

Once your raster is centered on each tube, you can now check your throw distance to the screen. I normally recommend that you set your projector on the floor before mounting it to the ceiling if that's where the projector will be located. By temporarily floor mounting the set, you can move the projector back and forth a few inches to adjust the throw distance, then measure your throw distance and mark the ceiling appropriately to mount the bracket.

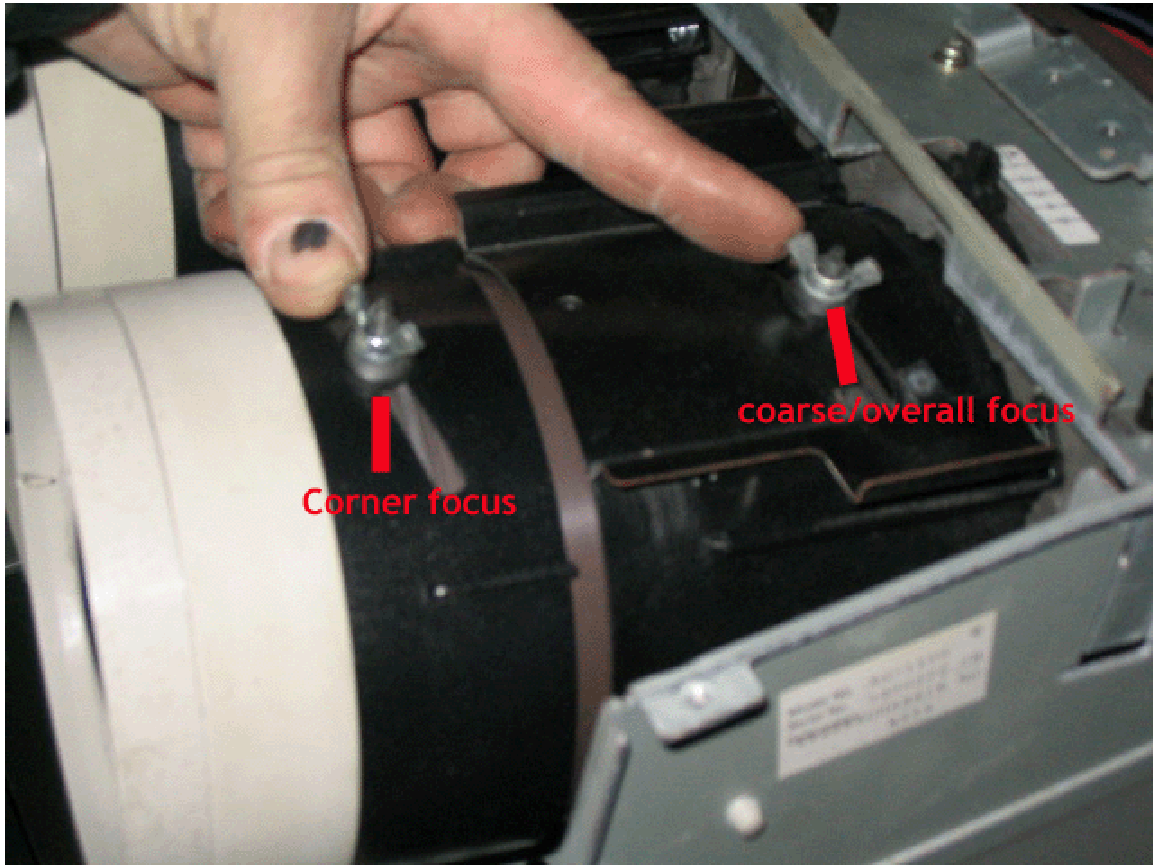
Typically I recommend that the test pattern overshoots the screen left to right by about 2-3" on each side. The actual video image should then fill the screen, and the width/amplitude control of the set should be able to compensate for slight adjustments needed to fill the screen.

Focusing:

There are two distinct parts to focusing a CRT projector: The optical focusing, which is the relationship of the lens to the tube face and the screen, and the electronic focusing of the electron beam/image on the tube face. Both the optical and electronic focusing must be set perfectly in order to get a sharply focused image on the screen.

Optical Focusing.

Most projectors have lenses similar to the ones on the NEC. Each lens has two adjustments to optically focus the tubes, the back wingnut or knob that is the coarse/overall focusing, and the front adjustment that is for corner focusing only.

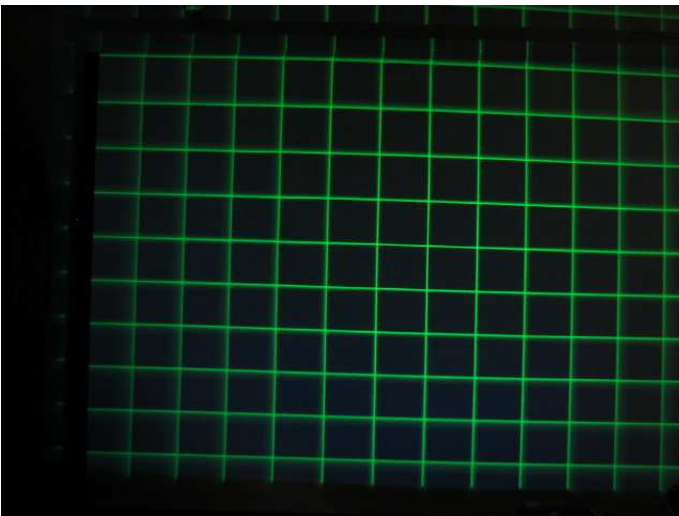


Loosen the back wingnut and grasp the front barrel of the lens to rotate the lens. Set the lens for the best focusing in the middle of the screen and tighten the wingnut. Then loosen the front wingnut and again rotate the front barrel. Tighten the wingnut once the corner focus is set.

Here is a picture of the coarse optical focus misadjusted. The whole screen is out of focus. If you put on sunglasses and look through the lens at the tube face, it should be in focus.

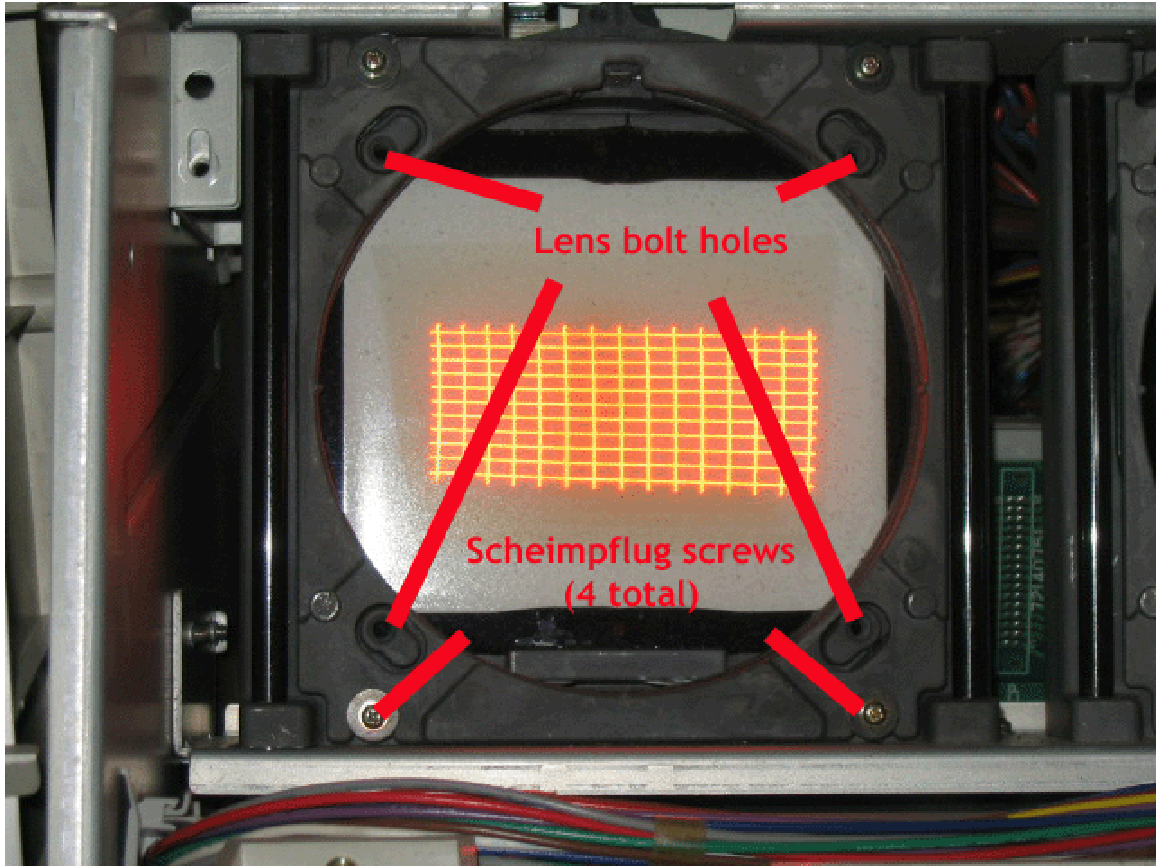


Here's a picture of the corner focus wingnut being out of adjustment. Note that the center of the image is in focus, but the edges are blurry.



Scheimpflug adjustments

Some projectors (including the NEC XG series) have an adjustment for altering the physical relationship between the tube face and the back of the lens. By having the ability to slightly adjust the position of the lens to the tube face, corner focusing can be improved upon. The NEC manual has a chart of what positions the plastic levers to set Scheimpflug should be at depending on your screen size. For the most part, the chart is accurate, however if a tube is set slightly cockeyed in its metal mounting frame, these tabs might need to be played with a bit. To adjust the Scheimpflug tabs, refer to the below picture:



With the lens still in place, loosen the lens bolts a few turns, but don't take them out completely. Also loosen the Scheimpflug screws (one in each corner) a few turns, but again, don't take them out completely.

With the 8 screws loose, the plastic tabs on the top of the lens frame should move side to side, and referring to the Scheimpflug settings in the NEC manual, set the tabs to their correct positions. Re-tighten each of the screws.

If you find the top and bottom or side to side focus to be off slightly, feel free to play with the positions of the plastic tabs to perfect the mechanical focusing. The Scheimpflug and lens focusing do somewhat interact, so you might need to readjust the lens focusing once the Scheimpflug has been reset.

Electronic Focusing

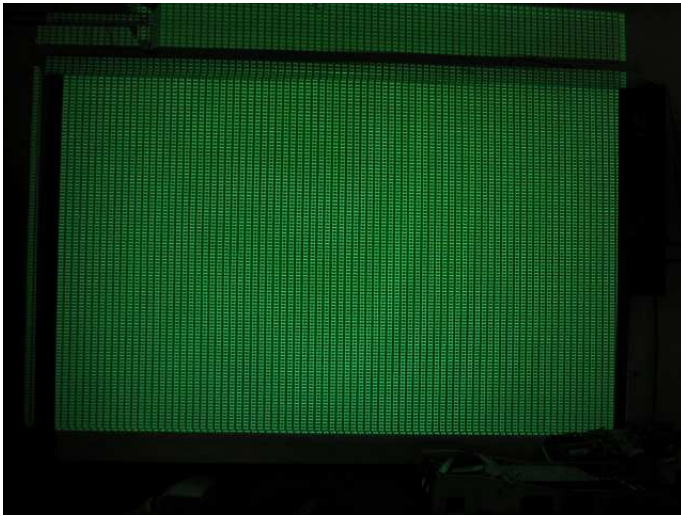
The second and equally important adjustment for focusing is the electronic tube focusing of the electron beam on the face of the tube. The NEC XG sets has 9 zones of electronic focusing along with 9 zones of astigmatism adjustment, found in the 'ref adjust' menu.

HINT: For best focusing, set the contrast control to 100%. This will push the tube harder and by setting the contrast to 100, the focus setting will improve even more once you set

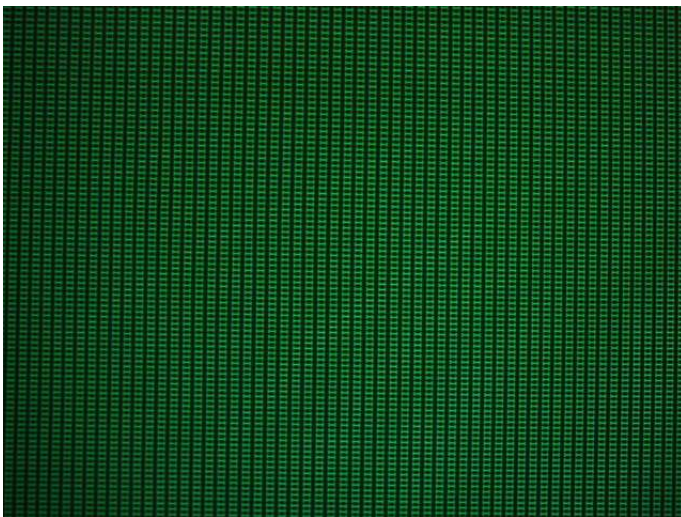
the contrast back down to 75% (factory default). Since you're not leaving the set at 100% contrast for long, there's no risk of damaging the tubes.

Start with the middle of the screen. Ramp the focus control up and down to get optimum focusing in the middle of the screen. Ideally this setting should be between -10 and 0. If you find that the best focusing is outside of this range, then adjust the focus trimpots found under the top cover of the projector on the card cage. These are the master focus trimpots that adjust the range of focusing of the controls within the remote.

Once the center focus has been adjusted, move to the top, bottom, side and corner settings. These edge controls have a lot less range and will affect the image a lot less than the center focusing. The 'H' test pattern works really well for setting the optimum focusing of the XG. A properly focused NEC projector will have a well focused H pattern all over the screen as shown below:



And a closeup:



Astigmatism control:

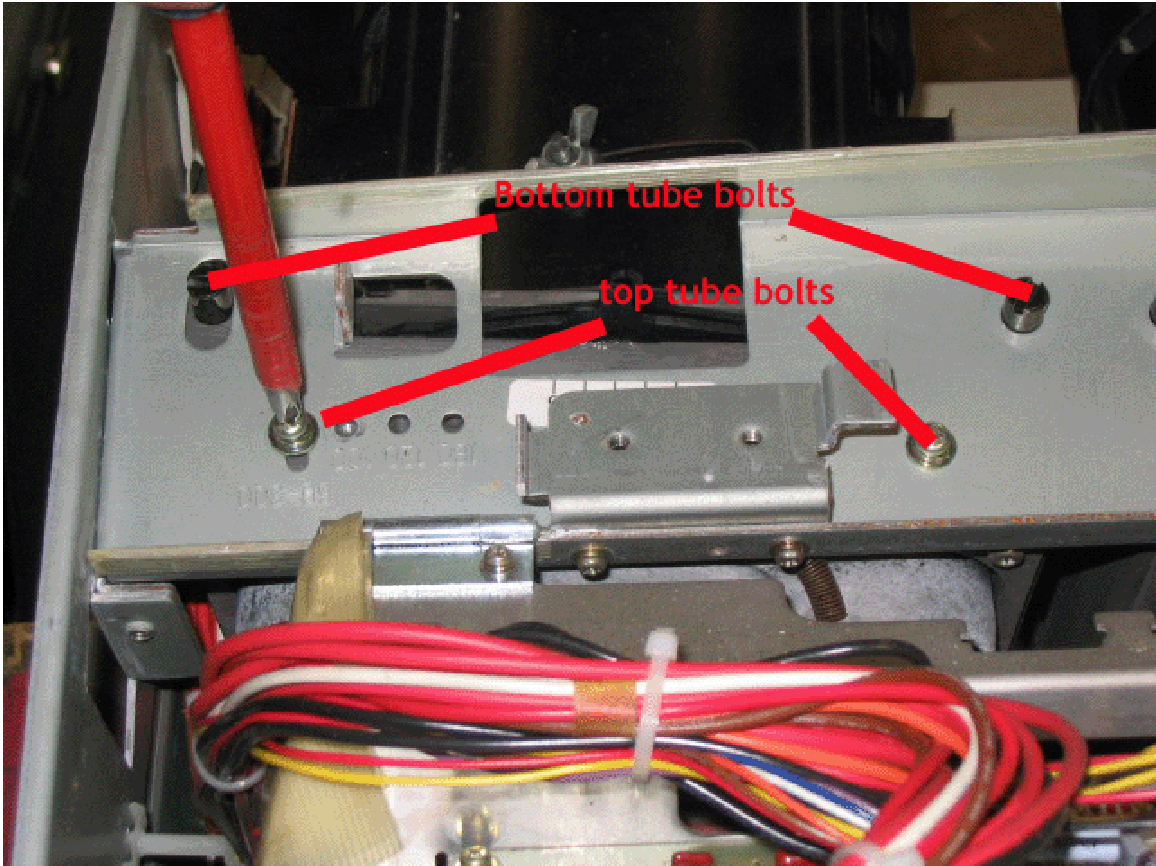
The NEC XG sets also have 9 zones of astigmatism. The clever engineers at NEC automatically put the set into defocused mode with the fine dot pattern displayed. Adjust each astig zone so that the defocused dots look round and aren't oval shaped. Once you exit the astig mode, the set will be in focus again. Again, the astig and focus controls do slightly interact, so you might need to retweak the focus controls. (Hey, don't whine, I once watched Guy Kuo, CRT setup master, spend 3 hours on just getting JUST the green tube focused 100%.)

Lens Toe In.

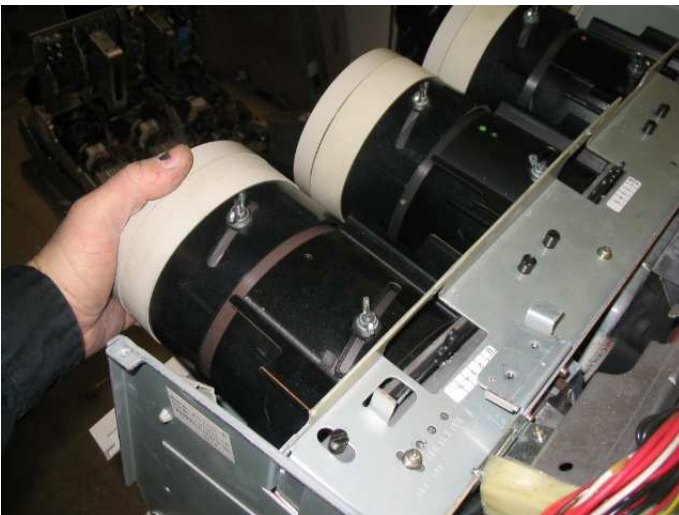
Once the raster centering is complete, you're ready to do the lens 'toe in'. I get a LOT of emails about this. Depending on the screen size that you're projecting onto, the red and blue lens/tube angle will need to be changed so that the images overlap with minimum convergence adjustment. The green tube is always your reference, and should be centered left to right on the screen, aiming at the middle of the screen. If your projector is set slightly cockeyed to the screen, you will not get a perfectly square image. Accuracy counts when installing a projector!

The vast majority of projectors have a similar toe-in method to the NEC shown:

There are two screws or bolts that hold the top of the tube frame into place. Loosen these bolts, but don't remove them. Also loosen the bottom tube bolts that hold the bottom of the tube/lens assembly in place.



When the 4 bolts are loose, the tube/lens assembly will now swivel back and forth a few degrees. Firmly grasp the lens from the front and the tube will swivel side to side along with the lens.



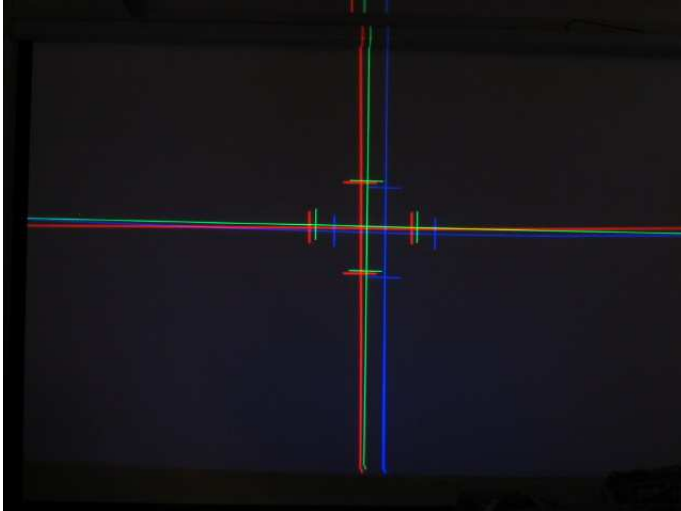
See the below pix to see how the R and B tubes will travel side to side:



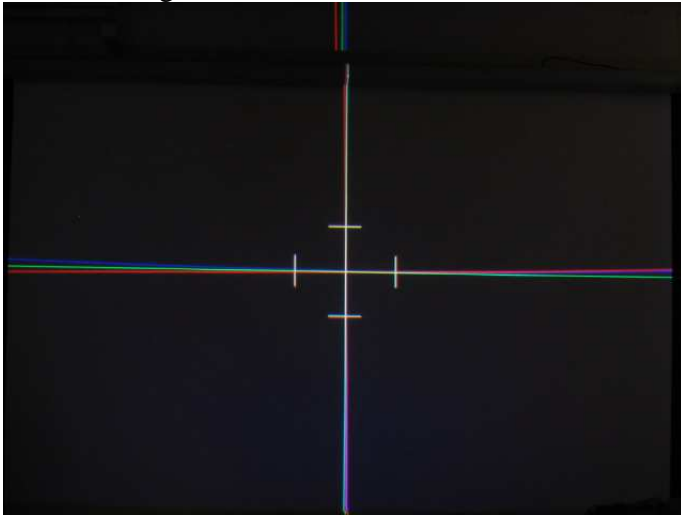
This left/right movement will drastically change the left/right position of the red and blue images as compared to the green. The lens toe-in will ONLY affect the HORIZONTAL position of the image, not the up/down (vertical) image of the red, blue and green tubes.

Everything should now be in focus, but your crosshairs will be slightly out of whack.

To get the correct lens toe-in for each lens, put up the crosshair pattern: The green tube vertical line should be in the middle of the screen, as should the horizontal line. If the horizontal line isn't in the middle of the screen, loosen the ceiling bracket of the projector and tilt the projector so that it is. If the projector is floor mounted, shim the projector front or back so that the entire green image is centered.



Using the lens toe-in method, move the R and B lens left and right so that the vertical lines are completely overlapped. In order to overlap the horizontal lines, use the 'raster shift' in the 'ref adjust' menu to shift the vertical image of the tubes that need correction. It's somewhat irrelevant whether you shift the R, G or B images. The final result will be the following:



The three images are now overlapped in the dead center of the screen, but the rest of the image will be out of alignment. So far so good!

You'll also notice that the NEC chassis is VERY prone to shifting convergence slightly if the covers are off. This is thanks to the thin sheet metal that NEC used throughout the construction. The 'position' control will compensate for slight shifts of the raster due to the chassis shifting. Do the final adjustments with all covers of the NEC in place!