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TO: All Computer Service Centers

FROM: Bill Valentine, Technical Support

SUBJECT: CM-1 Color Monitor Adjustments

FILE: Tandy 2000

Enclosed is a discussion which describes the alignment and adjustments for the color monitor used on the Tandy 2000. I have included hints and some theory on color monitor convergence.

Color Monitor Setup and Adjustments

Basically there are four major types of adjustments. **Picture alignment** is done first to assure correct picture size and centering. **Convergence adjustments** force the three separate beams to intersect or converge at the same exact spot on the screen. **Color purity** adjustment assures that a beam will strike its correct color phosphor. **Color temperature** adjustments (sometimes referred to as color tint) vary the amount of intensity of each individual beam to produce the color white on the screen.

Picture alignment is accomplished by the vertical and horizontal size, position, and linearity controls. These adjustments only change the deflection currents delivered to the yoke, and will not affect color.

Convergence adjustments are necessary to align the three electron beams. Convergence problems may be readily seen by viewing a pattern of small white dots. If the beams are striking the correct color phosphor (the red beam should strike only the red phosphor), and the three beams converge at the same spot on the screen, and the beams are of equal intensity, then and only then, will you get a white dot on the screen. If convergence if not adjusted properly, you will see color fringing around the edges of the dot. If it is off badly you may see three separate colored dots.

Static convergence adjustments affect primarily the center area of the display. The adjustment consists of moving magnetized rings located on the neck of the CRT. Dynamic convergence adjusts the surrounding area (periphery), and the adjustment consists of tilting the yoke . Dynamic convergence should not be attempted unless the yoke was moved or replaced.

A color is said to be pure if it is not contaminated by any other colors. Purity adjustment assures that the red beam strikes only the red phosphor, the green beam the green phosphor, etc. Purity is adjusted by producing a solid red screen, and rotating magnets around the neck of the CRT until you do not get any areas of the screen that are not red. If purity is not adjusted properly you will usually see colored "blotches" or relatively large areas of the screen that have colors other than red. Green and blue purity should be verified, using the same procedure.

Color temperature refers to the ability of the monitor to produce white. The preferred color of white is subjective and may range from a cold bluish shade of white to a warmer red tint depending upon the customers preference. Since the CM-1 monitor does not have a tint control the only way you have to adjust the exact shade of colors produced by the display is by adjusting the DC current of the three beams (via the cutoff controls) or the peak to peak amplitude of each individual drive signal delivered to the guns (via the drive controls).

ALIGNMENT PROCEDURE:

Note: The following steps should be done in the order listed. It is important that the Color temperature adjustment be done last. You may have to go back to a previous step due to control interaction, but be sure to finish the remaining steps again. This procedure is not a replacement for the one shown in the service manual. It is an aid to further understand color monitor alignment, and should be used in conjunction with the service manual.

CAUTION! Q591 HORIZONTAL OUTPUT TRANSISTOR LOCATED ON THE RIGHT REAR SIDE OF THE CHASSIS HAS APPROXIMATELY 700 VOLTS ON ITS CASE. DO NOT TOUCH!

1.0 Begin the color alignment by degaussing the set. Hold the degaussing coil approximately five feet from the monitor before applying power to the coil. With the degaussing coil on, move it flat against the front of the screen. Slowly rotate the coil in a circular motion around the screen. When you have moved the coil around the screen sufficiently to cover all the screen completely, slowly bring the coil away from the monitor. Do not turn off the power to the coil unless it is at least five feet from the monitor. In the same manner, degauss the sides and rear of the monitor.

2.0 Prior to making any adjustments that will affect color, verify that picture size, centering and linearity is acceptable. Picture size should be 178mm vertically and 254mm horizontally. Exact picture size is not critical. Size is adjusted by the height pot VR403 and the width coil L-552. Picture centering is adjusted by the horizontal centering switch S-591 and the vertical centering switch S-491.

Picture linearity should be checked after any change to the picture size is made. Linearity is easily checked by generating a circle on the display that takes up most of the picture area. If the circle is egg-shaped adjust the vertical linearity pot VR-402. There is considerable interaction between the vertical size adjustment and the vertical linearity adjustment. You may need to adjust both for proper size while maintaining proper linearity. The following BASIC program will generate a circle:

```
10 CLS
20 SCREEN 4
30 CIRCLE(320,200),200
40 GOTO 40
```

3.0 Connect the monitor to the CPU and boot up the diagnostic diskette. Select the program called COLORALG. This program contains a white crosshatch pattern, a white dot pattern, and solid screen colors.

4.0 **Static Convergence**, this is the toughest one to understand without actually doing it. Start by selecting a white dot pattern. Turn the brightness down as low as possible. You will want to have very small, sharp white dots with as little brightness as possible. It might be necessary to adjust the focus pot (located on the flyback) for the sharpest dots possible. It is sometimes helpful to lower the ambient light in the room. It is important to keep the intensity low during all convergence procedures. If the brightness pot cannot lower it enough, then adjust the screen control (located on the flyback also). Look at the dots in the center area of the display. If they have any color fringing around the edges, or if you can see separate distinct colors instead of a pure white dot then static convergence adjustment is necessary. Notice a set of magnetic rings located on the neck of the CRT. They are marked as 4 pole, 6 pole, and P for purity. The 4 pole rings (there are two of them) control the convergence of the red and blue beams. The 6 pole magnets converge the red/blue beams onto the green beam. Notice that both 4 pole and 6 pole magnets have two rings with tabs to move them. Before moving anything, mark it. If all else fails you can at least get back to where you started. The tabs normally have a line of white paint across them to aid in restoring the rings to their original positions. The tabs may be moved apart or closer together with respect to each other, and the 4 pole tabs may be moved with respect to the 6 pole tabs. Also both 4 pole and 6 pole tabs may be rotated around the neck together. This gives you four planes of adjustment. A good example of their action is shown on page 16, figure 3 of the service manual. There is much interaction between the 4 pole and 6 pole adjustments, it will be necessary to adjust them both many times before convergence looks right.

If you have not done convergence adjustments on a monitor or color television previously, I would suggest that you plan on spending several hours the first time to get the feel of what the rings do. Do not be afraid to play around with them, after you have marked their original positions. The only way to get good at convergence is by doing it. I would also suggest you run the dot and crosshatch patterns on known good monitors to get an idea of how sharp and pure the convergence can be.

5.0 **Purity**, select a solid red screen. Turn up the brightness and verify that only a uniform red screen is displayed. If there are colored blotches visible, repeat the degaussing procedure and recheck purity. If you still have colored blotches adjust the purity rings located on the neck of the CRT for the most pure red screen you can get. If the yoke has been replaced, it may be necessary to move the new yoke away or toward the front of the CRT to achieve purity.

6.0 **Dynamic convergence**, select a crosshatch (white lines) pattern. Verify that the lines have no color fringing or separating of colors in the periphery surrounding the center of the screen. Absolute perfect convergence in the corners of the display is usually not possible. Again I would suggest you compare a known good monitor to get an idea of how pure the convergence should be in the corners. Dynamic convergence should not be necessary unless the yoke has been replaced or moved. Adjustment is made by tilting the yoke around its horizontal or vertical axis. It will be necessary to remove the rubber wedges that holds the yoke in place, and to remove any excess glue from the CRT in order to move the yoke freely. When you have the yoke adjusted properly you must replace the wedges without moving the yoke even the slightest amount . This requires considerable patience.

7.0 Color temperature, begin by setting the service switch (S601) to produce a single horizontal white line in the center of the display area. This is the easiest adjustment to make, so relax you're almost finished. What you will do is to set all beam intensity controls to minimum intensity, then slowly bring up the screen control untill you have a faint colored line. Then balance the cutoff controls to produce a faint white line.

On the back of the flyback notice two adjustments screws. The upper one is the focus adjustment, the bottom one is the screen control. The screen control sets the total DC beam current. It will change the beam intensity of all three beams equally. Set the screen control to fully counterclockwise. On the CRT socket there is a circuit board that contains the video drivers and the cutoff controls as well as the drive controls. Turn all of the cutoff controls (VR654,VR655,VR656) fully counterclockwise. Turn the customer brightness and contrast controls (VR682,VR681 located on the front of the monitor) fully clockwise. You should now have a totally black screen. Adjust the screen control slowly clockwise so that a faint line is produced on the screen. Notice the line's color. At this time only one color will be displayed so it is necessary to slowly advance the cutoff controls of the other two colors to bring them up to the same intensity. Continue to balance the cutoff controls such that you produce a faint white line.

Notice that you are blending the three colors to produce white. Set the service switch back to the normal position. Select a solid white display screen. Adjust the drive controls (VR651,VR653) to produce a white screen. You adjust the tint of white to be the most pleasing to the customer, or a color analyzer may be used. Connect the (+) terminal of a DC ammeter to test point TP-9Z and the (-) terminal to test point TP-1Z. Adjust the sub-bright pot (VR694) so the ammeter reads 550uA with the brightness and contrast controls turned all the way up and a solid color displayed on the CRT.