

## Learning To Use The CM2000 Computer Monitor Analyzer

The CM2000 Computer Monitor Analyzer provides the ability to analyze computer monitors and isolate defective stages when troubleshooting. This Tech Tip will quickly familiarize you with the features and operation of the CM2000 to get you started making the best use of your Computer Monitor Analyzer.

### Connecting To A Monitor

The CM2000 SYNC & VIDEO OUTPUT jack provides all the signals needed to connect to the input terminal of a computer monitor. Most computer monitors use one of several standard types of input connectors. The interface connectors adapt the signals from the SYNC & VIDEO OUTPUT jack to the standard

connector on the monitor you are servicing. See Figure 1 to select the interface connector that matches the monitor you are servicing.

### To connect the CM2000 to a monitor:

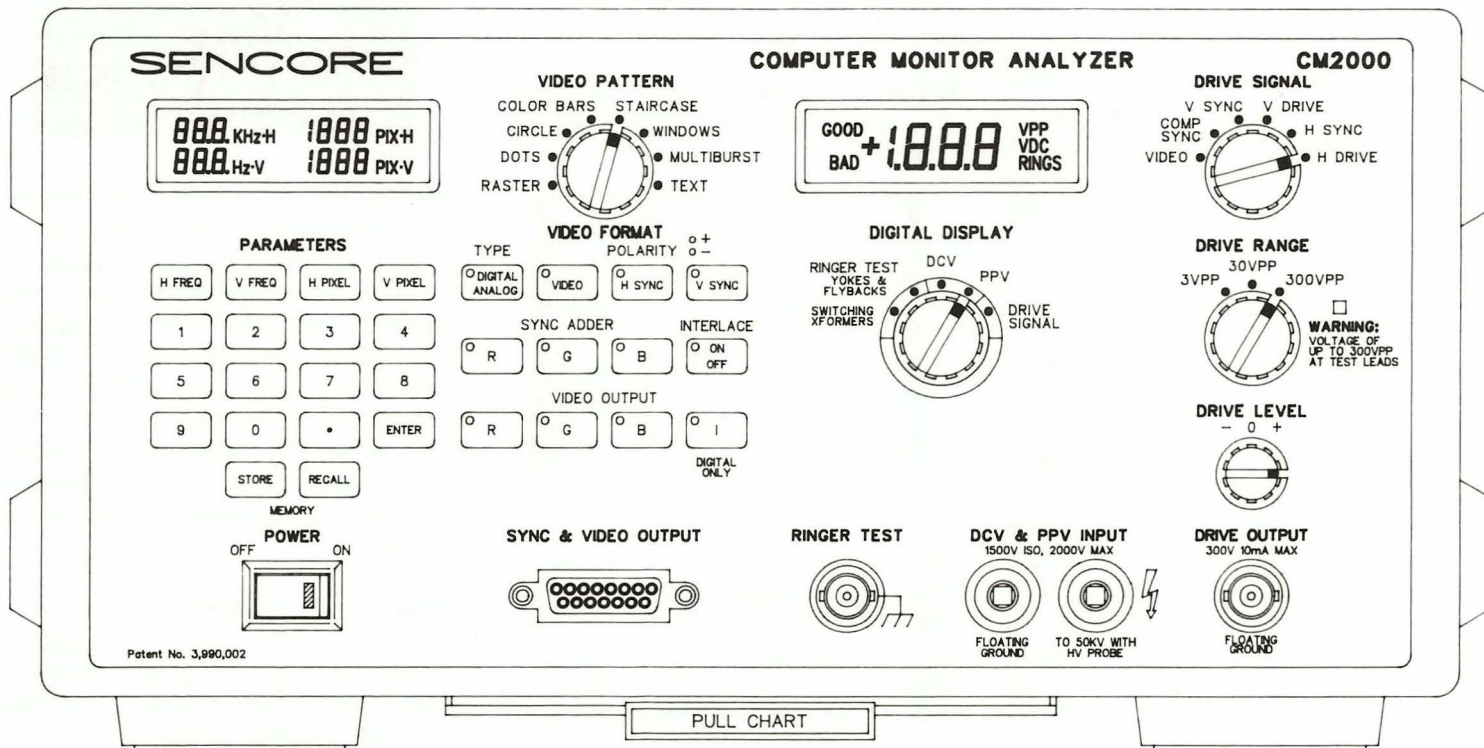
1. Turn off the power switch on both the CM2000 and the monitor.
2. Plug the matching interface connector into the SYNC & VIDEO OUTPUT jack.
3. Plug the monitor signal input cable into the interface connector. If the monitor does not have a cable, or if the cable is too short, use the (optional) OUTPUT EXTENSION CABLE between the SYNC & VIDEO OUTPUT jack and the interface connector.
4. Turn on the CM2000 (wait to turn on the monitor until you have chosen the signal format).

### WARNING

Because many computer monitors use a full-wave "hot chassis," always plug the monitor you are servicing into an isolation transformer to protect yourself, the monitor, and your test equipment. Never isolate your test equipment as this may defeat that protection.

### Choosing The Signal Format

Each type of computer monitor receives a particular set of signals from the computer it is connected to. This signal format can be classified by the type of computer or video adaptor circuit which the monitor was designed to work with.



#183 E81#



Format	Storage Location	Connector
CGA	0	1
Hercules, MDA	1	1
EGA	2	2
PGC 1	3	3
PGC 2	4	3
MCGA 1, VGA 1	5	4
VGA 2	6	4
MCGA 2, VGA 3	7	4
Super VGA	8	4
8515A, XGA	9	4
1024 X 768	10	5
1280 X 1024	11	4
MAC II	12	4
Micro VAX	13	6 (BNC)
Sun color 1152 X 900	14	6 (BNC)
IBM RS6000 color 6091, 5081	15	6 (BNC)
HP 98789A, 98754A	15	6 (BNC)
Apollo DN2500, 3000, 3500, 4500	16	6 (BNC)
IBM RS6000 monochrome 8508	17	6 (BNC)
Apollo 19" color	18	6 (BNC)
Radius 1152 X 882	19	6 (BNC)

**Fig. 1: CM2000 format storage locations and interface connectors for common monitor formats.**

The signal format includes the following: horizontal and vertical scan/sync rate, the maximum number of horizontal and vertical pixels (smallest possible area of either light or dark), the polarity of the video signal and sync pulses, whether the signals are digital (TTL) or analog, whether sync is added to any of the video signals, and whether the signal is interlaced or not.

There are two ways to choose the correct signal format. The most common computer monitor formats are listed in Figure 1. These setups are stored in the CM2000's memory locations as listed. For these monitors, simply recall the stored format.

#### To recall a stored format:

1. Press RECALL.
2. Enter the desired format number.
3. Press ENTER.

If the monitor you are servicing is not listed in Figure 1, determine the monitor's signal format from the owner's manual or service manual specifications. Enter the signal parameters using the CM2000's PARAMETERS and VIDEO FORMAT keys. Refer to the CM2000's Pull Chart, Operation and Application Manual, or to Tech Tip #191 for more details on determining and entering a monitor's signal parameter.

Once you have entered a new format, you can store it in memory for future recall. Memory locations 20-39 are available for storing new formats from the front panel.

Now that you have selected the correct signal format for the monitor you are servicing, turn on the monitor and proceed with testing.

*Note: Some monitors are "multimode," meaning they are capable of operating at two or more formats. For example, there are 3 VGA listings in Figure 1. Test multimode monitors with each of the appropriate formats to ensure that they work properly in each mode.*

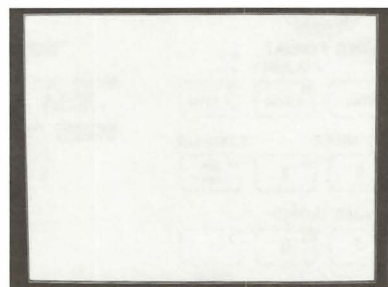
*Other monitors are "multiscan," capable of operating over a wide range of signal formats. For example, some multiscan monitors are capable of operating with CGA, EGA, VGA, and Macintosh formats. Test multiscan monitors with several different formats within the monitor's operating range.*

## Selecting Video Patterns

You will use each of the CM2000 video patterns to perform one or more tests of the monitor's operation. Following is a description of each pattern and its uses in troubleshooting and adjusting monitors.

To view the complete pattern, be sure that the "R", "G", and "B" VIDEO OUTPUT buttons are all selected as indicated by the lighted LED on each button.

**Raster** - This pattern produces a full-screen box, surrounded by a 1 pixel wide white border.

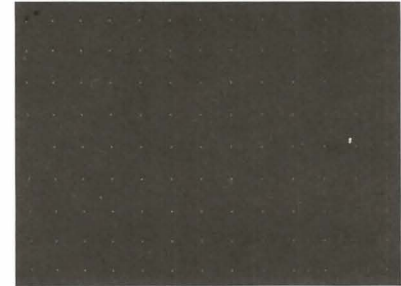


**Raster**

Use this pattern to test color purity and high voltage power supply regulation. In "+" VIDEO POLARITY, with all the VIDEO OUTPUT buttons on, the box should be pure white with no coloration. In "-" VIDEO POLARITY, the box switches to black. The outside white border should remain straight and ripple free in

either polarity. Any change in the height or width of the border as you switch video polarity indicates less than perfect high voltage power supply regulation.

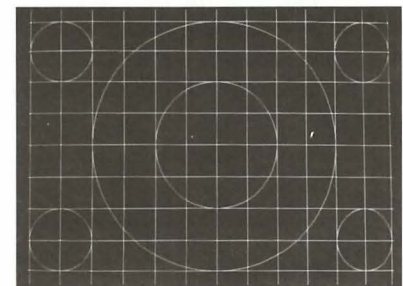
**Dots** - This pattern produces either 9 rows by 13 columns (at higher resolutions), or 11 rows by 15 columns of 1 pixel dots.



**Dots**

Use this pattern to test static and dynamic convergence. Check for white dots with no color fringing. Color fringing on dots near the center indicates static misconvergence. Color fringing on dots near the corners indicates dynamic misconvergence.

**Circle** - This pattern produces two centered circles and four corner circles on a 1 pixel wide cross hatch display.



**Circle**

Use this pattern to test the monitor's linearity and convergence. Check that each line is straight and that each box is square and the same size throughout the raster. Also check that each circle is round rather than egg shaped. Unequal spacing between vertical lines indicates horizontal nonlinearity. Unequal spacing between horizontal lines indicates vertical nonlinearity. If the CRT is converged properly, each line will be a single, white line without any colored fringing.

**Color Bars** - This pattern produces two rows of eight bars consisting of the three primary colors (red, green, blue), three secondary colors (yellow, cyan, magenta), plus black and white, as shown in Figure 2.



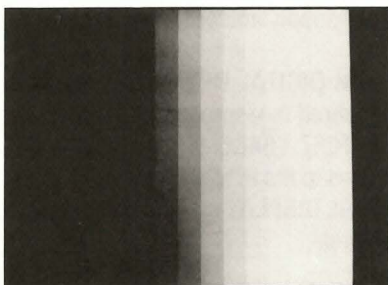
Black	Blue	Green	Cyan	Red	Magenta	Yellow	White
White	Yellow	Magenta	Red	Cyan	Green	Blue	Black

**Fig. 2: Bar sequence produced by the CM2000 Color Bars pattern.**

Use this pattern to test the monitor's ability to produce proper colors. Check that each color bar is present. A missing bar or wrong color sequence may indicate that a video channel is connected incorrectly or is defective. Also check that the colors are uniform in intensity from top to bottom and left to right. Non-uniform bars may indicate problems in the video amplifiers.

The Color Bars sequence shown in Figure 2 is for "Analog" TYPE format ("+" video polarity). When the "Digital" TYPE is selected, the pattern changes slightly, depending on the setting of the "I" output. With the "I" output on, the bar sequence is similar to the "Analog" TYPE with the bottom row of bars being brighter than the top row. When the "I" output is off, the top and bottom row of bars are the same brightness.

**Staircase** - On analog monitors, this pattern produces 16 evenly spaced bars ranging from black to 100% white (or amber or green, depending on monitor phosphor).



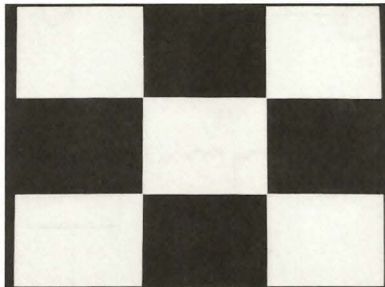
**Staircase**

Use this pattern to test the brightness and contrast linearity of analog and monochrome digital monitors. A properly operating analog monitor or monochrome digital monitor will display 16 distinct bars ranging from black to white. On a color monitor, each step should be a pure shade of gray with no hint of color.

Color digital monitors, which are only capable of 2 signal levels, do not reproduce this 16 step pattern. Instead they produce color bars having the same sequence as the Color

Bars pattern, with the exception that the top row of bars is on the left half of the screen and the bottom row is on the right half of the screen.

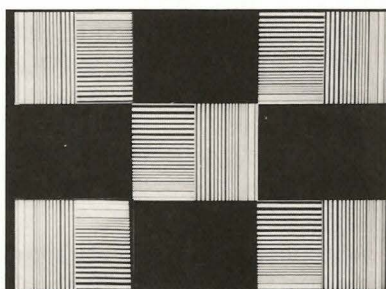
**Windows** - This pattern produces five white windows (four corners and center) on a black background.



**Windows**

Use this pattern to test the monitor's power supply regulation. Check for clear, distinct transitions between the black and white portions. All the white boxes should be the same brightness level and the entire screen should be free of ripple. The pattern should lock in with no "bounce" as you switch between "+" and "-" video polarity.

**Multiburst** - This pattern produces five sets of vertical and horizontal multiburst lines. The lines in each set are grouped according to line width. The lines in the first group are 1 pixel wide, the second group 2 pixels wide, the third group 3 pixels wide, etc.

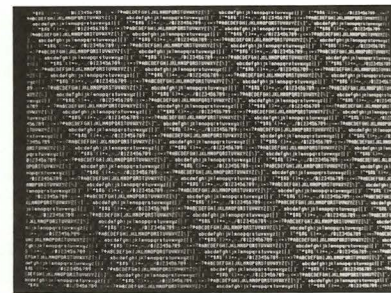


**Multiburst**

Use this pattern to test monitor resolution. Test horizontal pixel resolution by examining the vertical lines and test vertical pixel resolution by examining the horizontal lines. Both the vertical and horizontal 1 pixel wide lines should be individually distinct on a properly operating monitor.

**Text** - This pattern produces a screen filled with upper and lower case text characters to duplicate user conditions.

Use this pattern to test the final performance of a monitor. All the characters on the screen should be focused and easy to read.



**Text**

## Using Drive Signals

The Drive Signals provide known-good substitute signals for troubleshooting monitors. To use the troubleshooting drive signals, first connect the monitor to the CM2000 SYNC & VIDEO OUTPUT jack and choose the correct signal format for the monitor you are servicing. Then, use the substitute drive signals to inject into the area of the suspected defect to locate the defective stage. When you substitute a good signal beyond the defective stage, normal monitor operation will be restored.

Step-by-step procedures and trouble trees for monitor troubleshooting using signal substitution are in the APPLICATIONS section of the CM2000 manual.

Following is a description of each drive signal and how to use it in troubleshooting monitors. See Figure 3 for a block diagram of a typical monitor including the numbered test points referenced in the following discussion.

**Video** - This signal provides a standard video signal corresponding to the green portion of whichever video pattern is selected. Use it to substitute into video stages including the red, green, and blue channels. (Test Points 11, 12, 13, 14, 21, 22, 23, 24, 31, 32, 33, and 34)

The Video DRIVE SIGNAL produces the color of the channel into which it is injected. Use the Raster VIDEO PATTERN with the video DRIVE SIGNAL for most troubleshooting.

**Comp Sync** - This signal provides combined vertical and horizontal sync. Use it to substitute at any point before the sync separator in monitors that use composite sync input. (Test Point 61)

**V Sync** - This signal provides vertical sync, timed with the video output signal. Use it to



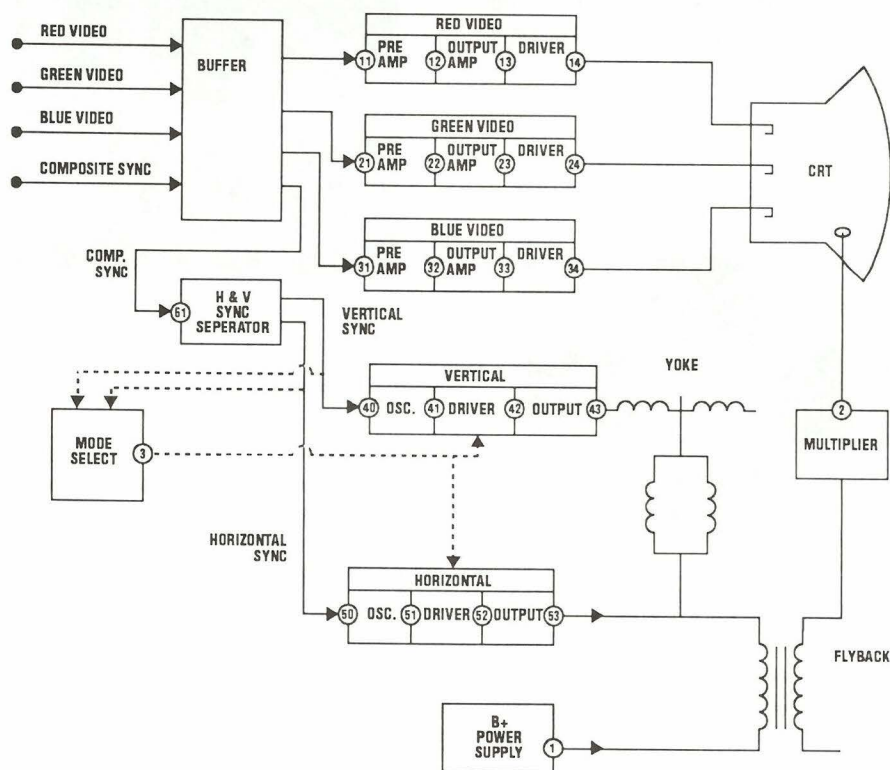


Fig. 3: Compare your monitor to this block diagram as a guide when substituting drive signals.

substitute into the vertical stages before the oscillator, but after the sync separator if there is one. (Test Point 40)

**V Drive** - This signal provides vertical drive. Use it to substitute into the vertical stages between the oscillator output and vertical output. (Test Points 41 and 42)

**H Sync** - This signal provides horizontal sync, timed with the video output signal. Use it to substitute into the horizontal stages before the oscillator, but after the sync separator if there is one. (Test Point 50)

**H Drive** - This signal provides horizontal drive. Use it to substitute into the horizontal stages between the oscillator output and the base of the output transistor. (Test Points 51 and 52)

#### To inject substitute Drive Signals:

1. Set the DIGITAL DISPLAY switch to "Drive Signal".
2. Set the DRIVE LEVEL control to "0".
3. Select the desired drive signal with the DRIVE SIGNAL switch.
4. Connect the DIRECT TEST LEAD to the DRIVE OUTPUT jack and connect the test clips to the circuit test point and ground.
5. Set the DRIVE RANGE control to the lowest range that includes the required signal level.
6. Adjust the DRIVE LEVEL control to match the level and polarity of the signal normally at the test point into which you are injecting.

*NOTE: Remember to connect the monitor you are servicing to an isolation transformer before making any test equipment connections.*

## Using Auxiliary Tests

**Ringer Test** - Once you have used signal substitution or signal tracing to isolate problems to the deflection or power supply circuits, you can use the CM2000 RINGER TEST to check for shorted turns in the yoke, flyback, or switching power supply transformer. The RINGER TEST is a simplified check of the coil's quality or "Q", and locates shorted turns that cannot be detected by other troubleshooting methods.

To ring a yoke or transformer, connect the DIRECT TEST LEAD across the coil to be tested and set the DIGITAL DISPLAY switch to either "Yokes & Flybacks" or "Switching Xformers" to match the device you are testing. The DIGITAL DISPLAY shows the number of times the coil rings before it damps out. A reading of 10 or more is GOOD and means that the coil does not contain a shorted turn. A BAD reading, less than 10 rings, indicates a shorted turn (If any winding of a transformer tests GOOD, the transformer does not contain a shorted turn.) Refer to the APPLICATIONS section of the CM2000 manual for more details on ringing yokes and transformers.

**DVM** - The autoranged DVM portion of the DIGITAL DISPLAY section measures external DC and peak-to-peak voltages to 2000 volts. Use the DVM DCV or PPV functions to aid you in troubleshooting any section of the monitor, including measuring at the collector of the horizontal output transistor to verify proper supply and pulse voltages.

Use the DIGITAL DISPLAY switch to select the desired measurement. Use the supplied DVM TEST LEADS to connect the external voltages to the PPV & DCV INPUT jacks. The DIGITAL DISPLAY readout displays the voltage levels.

**For more information,  
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