Error Codes

The CM2125 will display an error code on its right LCD display if it receives the wrong code or if a parameter exceeds its range limits.

CM2125 Interface Bus Error Codes

E1	Scan frequency beyond range of unit (Example: trying to set HFQ 260).
E2	Invalid bus command or bus command used incorrectly.
E3	Pixel resolution is beyond range of unit (Example: trying to set HPX 2049).
E4	Function not allowed in selected format (Example: trying to select the I line when the unit is in the analog mode).
E5	Invalid memory store/recall location (Example:RCL 76).
E6	Vertical timing entry too short (Example: blanking time is less than 1/H).
E7	Horizontal timing entry is too short. (Example: sync width is less than 0.3 uSec or blanking time is less than 1.5 uSec).
E8	Horizontal blanking time too long. (Example: the blanking time is set longer than the total horizontal scan time or the defined number of pixels can't be fit in the resultant active video time).
E9	Sync parameter change mode not enabled (Example: program needs SPE code before sync timing changes can be made).
E10	Vertical Pixel Count is forced to go below the range of the unit. This error only occurs from the front panel.

Fig. 34 - CM2125 Error Codes

Setting Sync Pulse Timing Through The Interface Bus

The parameter setups for the most common monitors have been stored in the CM2125's memory locations 0-42. These setups contain the correct pixel, sync frequency parameters, and sync polarities for the standard monitor types. These setups also contain the correct sync timing parameters, including back porch time, front porch time, and blanking times for both the horizontal and vertical sync pulses.These sync pulse timing parameters determine the position of the raster on the display. If the parameters are incorrect, the raster may be shifted off of center on the display.

As the horizontal and vertical sync frequencies and horizontal and vertical pixels values are entered, the CM2125 automatically determines the monitor format and adjusts the sync timings accordingly. If the CM2125 doesn't recognize the format, it sets the parameters to a sync timing default (see the Specification sheet for the timing values). The monitor will display a pattern, but it may not be centered correctly on the screen.

There may be situations where you do a lot of testing on a monitor type that isn't recognized by the CM2125. If so, you can set the CM2125 to generate the signal timings you need. This is completed through the interface bus. Your special setups can be stored in memory locations 43-69, and can be recalled using the front panel "recall" button.

Example: Programming the CM2125's sync pulse timings through the interface bus. For our example we'll use a non-interlaced, analog monitor with the following specifications:

	Horizontal	Vertical
Frequency	65.2 KHz	61.6 Hz
Resolution	1024 Pixels	1024 Pixels
Front Porch	360 nsec	62 uSec
Sync	770 nsec	92 uSec
Back Porch	770 nsec	92 uSec
Polarity	+	+

Fig. 35 - An example of a computer monitor's timing parameters

Computer program that sets the above parameters:

	Code	Description
100	SPE	enables sync parameters change mode
110	HFQ 65.2 KHZ	sets horizontal scan frequency
120	VFQ 61.6 HZ	sets vertical scan frequency
130	HPX 1024 PIX	sets horizontal pixel resolution
140	VPX 1024 PIX	sets vertical pixel resolution
150	OUT ANA	sets the video output to analog
160	HSY+	sets horizontal sync to (+)
170	VSY+	sets vertical sync to (+)
180	MOD NON	non-interlaced mode
190	THS 770 NS	sets horizontal sync time
200	THF 360 NS	sets horizontal front porch time
210	THB 770 NS	sets horizontal back porch time
220	TVS 92 US	sets vertical sync time
230	TVF 62 US	sets vertical front porch time
240	TVB 92 US	sets vertical back porch time
250	STO 45	stores setup in memory location 45
260	SPD	disables sync parameter change mode

When programming the sync timings through the interface bus, you need to make sure the pixel value doesn't exceed the time allotted by the programmed horizontal and vertical scanning frequencies or that the programmed setup doesn't exceed the bandwidth of the CM2125 (see Appendix H).

APPLICATIONS

INTRODUCTION

The Applications section will help you use the CM2125 to its fullest capabilities. It is divided into two main parts: 1) Understanding Monitors, and 2) Troubleshooting Monitors. The first part provides a basic overview of monitors and their operation. The second part covers troubleshooting applications using the CM2125.

You can use the APPLICATIONS section two ways. First, use it as a reference for how to do a specific test. For example, details on troubleshooting horizontal circuit problems are in the section entitled "Troubleshooting Horizontal Circuits." Use the Table of Contents to find the information you want.

Second, you can use the information in the APPLICATIONS section as a step-by-step troubleshooting guide. The material follows the COMPUTER MONITOR FUNCTIONAL ANALYZING TROUBLESHOOTING GUIDE ("Trouble Tree") that accompanies this manual. The "Trouble Tree" will help you decide what tests and signal injections to do for a given symptom. It outlines a logical troubleshooting sequence that will lead you to the defective stage in the least time.

The APPLICATIONS section provides you with specific details and procedures for troubleshooting defective monitors. After you have become familiar with the test procedures, you will be able to troubleshoot following only the steps outlined by the "Trouble Tree." Begin your troubleshooting by selecting the "Trouble Tree" path that best fits the symptom you observe.

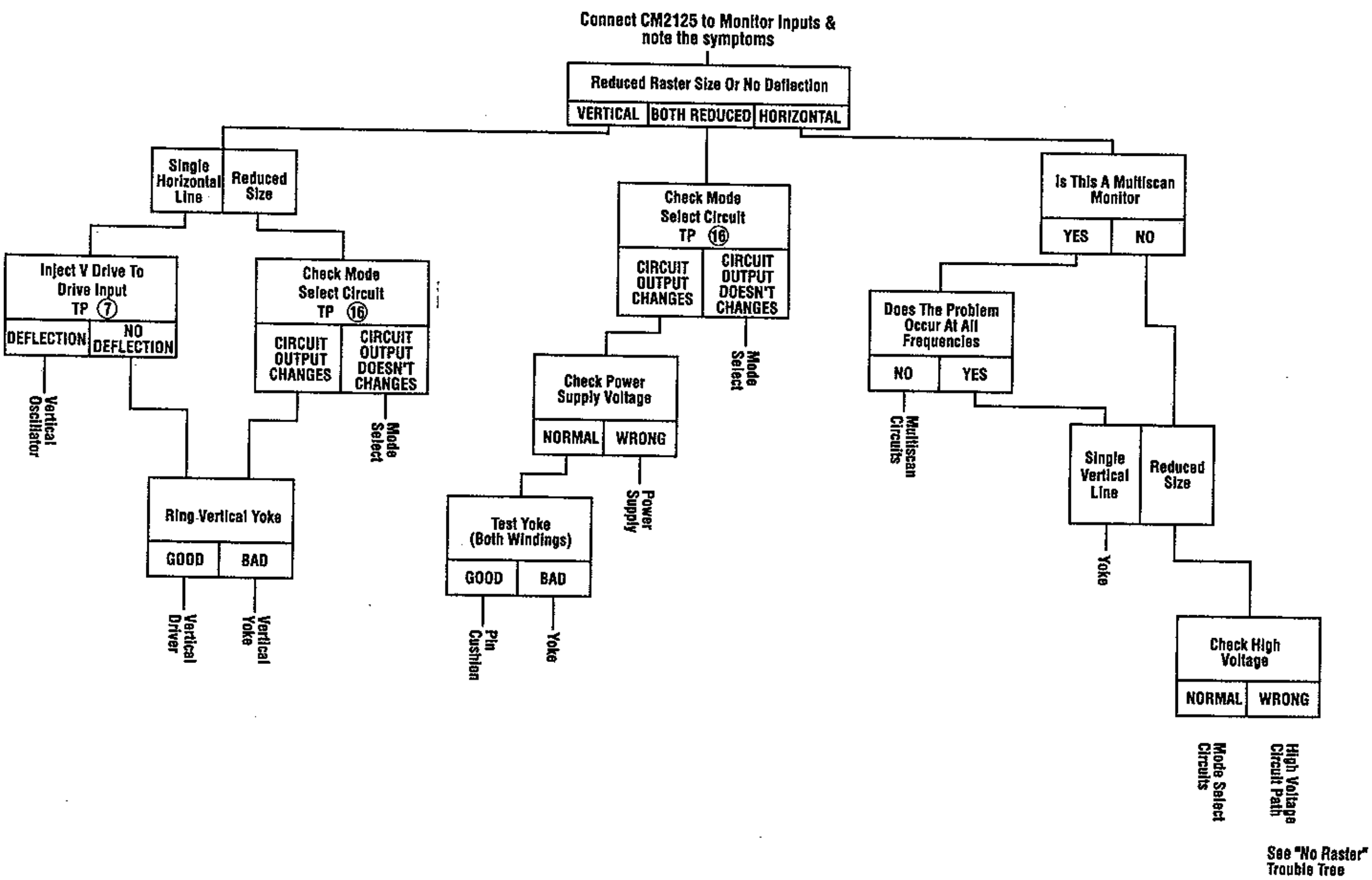

Fig. 36 - Select the "Trouble Tree" path that most closely matches the symptom of the computer monitor you are servicing.

Monitor Types

The CM2125 provides the signals necessary to service all types of monitors. These include RGB computer monitors, data display terminals, monochrome computer monitors, RGB video monitors and specialized display monitors requiring non-composite video inputs.

These monitors fall into two basic types: digital and analog. They can be either monochrome or color. The input signals to a digital monitor are a TTL logic level that is either high (greater than 2 volts) or low (less than 0.8 volts). Color digital monitors have red, green, blue, and usually an intensity input, and can display up to 64 colors using combinations of logic "1"s and "0"s on the input lines. Monochrome digital monitors may display up to 64 shades of gray (or green or amber depending on the phosphor) by also using combinations of logic levels on the inputs. Appendix F shows these level combinations.

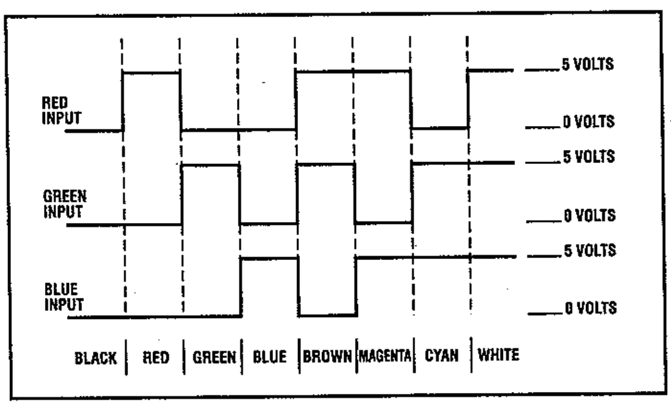

Fig. 37 - The signal input to digital monitors is either a logic low or a logic high.

Analog monitors can display an infinite number of colors or shades of gray. The video signal fed to an analog computer monitor is usually 0.7 VPP (black to white). The horizontal and vertical sync in analog monitors are usually digital levels.

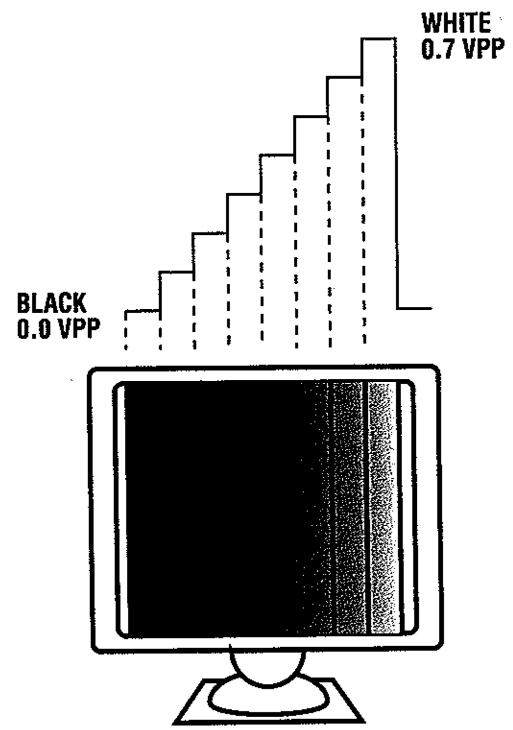

Fig. 38 - Analog monitors can display an infinite number of colo or gray shades.

Performance Capabilities

Four main parameters determine the performance capabilities of a monitor: horizontal frequency, horizontal pixels, vertical frequency and vertical pixels (lines). Here is a brief explanation of each:

Horizontal frequency is the number of times per second the electron beam travels horizontally across the CRT and back (horizontal scan). The inverse of horizontal frequency (1/H FREQ) is the horizontal scan time.

Horizontal pixels are the number of dots or picture elements that can be displayed horizontally. A pixel is the smallest dot or picture element the monitor can produce.

Vertical frequency is the number of times per second the electron beam travels from the top of the CRT to the bottom and back (vertical scan). The inverse of vertical frequency (1/V FREQ) is the vertical scan time.

Vertical pixels are the number of picture elements that are displayed vertically on the CRT. Vertical pixels can be compared to "lines" in television terminology.

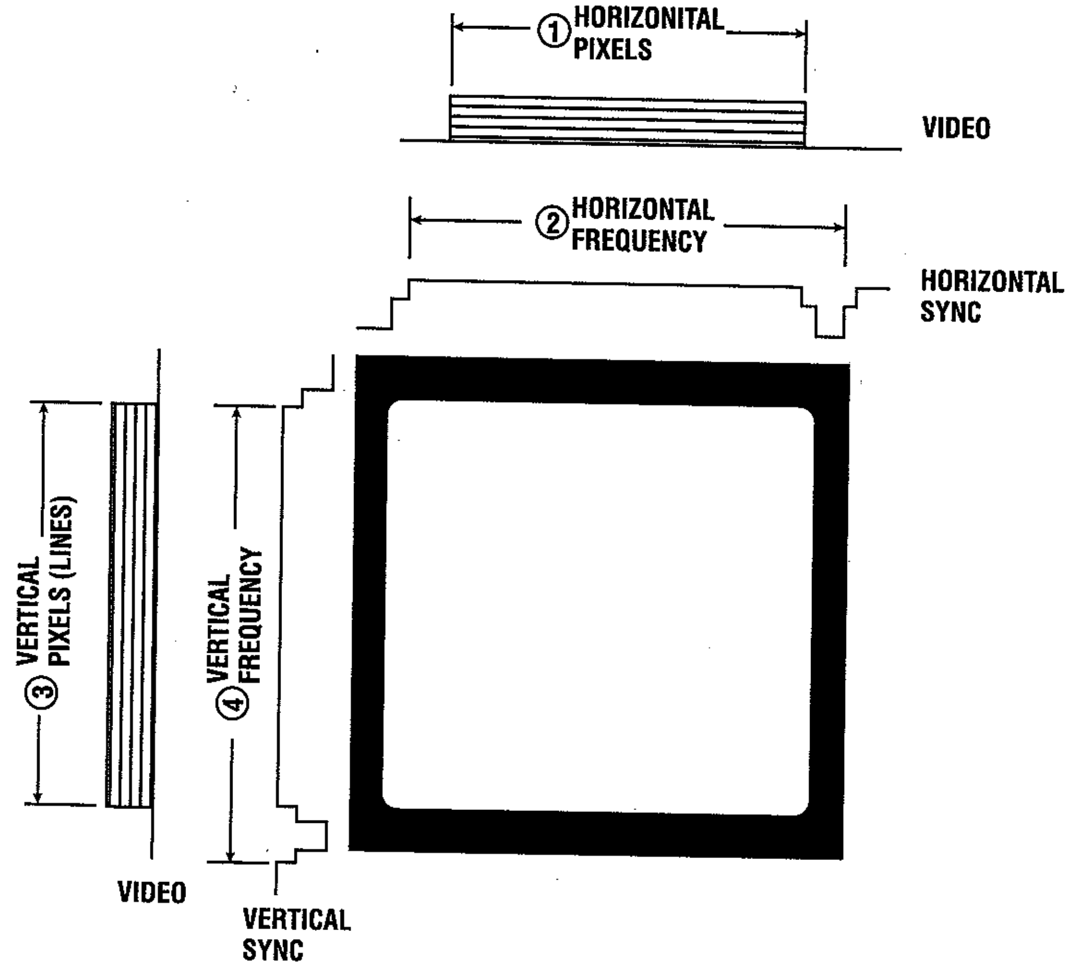

Fig. 39 - A computer monitor's performance capabilities can be defined by four parameters: (1) horizontal pixels, (2) horizontal frequency, (3) vertical pixels and (4) vertical frequency.

Increasing the horizontal frequency and the number of pixels displayed (displaying more pixels in less time) improves image clarity and resolution. High resolution monitors can produce images with as much detail as 35MM film. For more information, refer to Appendix G, "Calculating A Monitor's Bandwidth."

Video Adapter Card

Monitors that are connected to computers receive their signal from a video graphics adapter card or circuitry located inside the computer. The adapter card generates the video and sync signals needed by the monitor. There are several different video graphics standards, such as color graphics adapter (CGA), enhanced graphics adapter (EGA), and video graphics adapter (VGA). Each standard produces different sync frequencies and pixel counts, and each video adapter card requires a compatible type monitor. Multiscan monitors work with any type of video graphics adapter card because they can sync to a wide range of frequencies. Appendix D gives a listing of the common graphic standards.

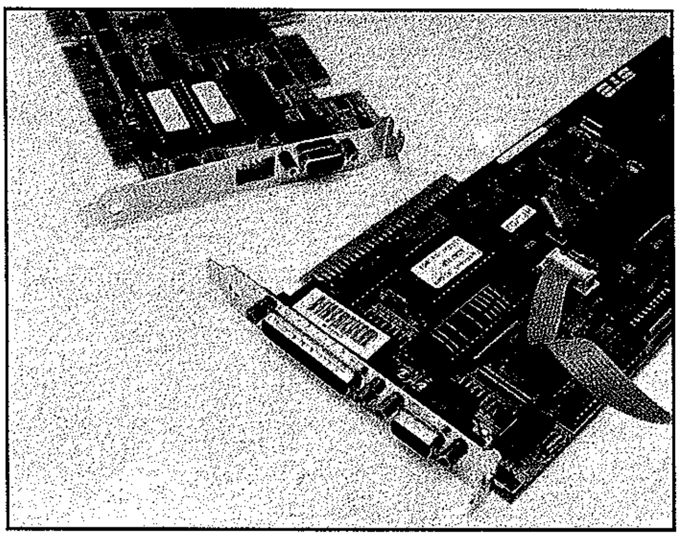

Fig. 40 - The video adaptor card is housed in the computer and is responsible for generating the video and sync signals.

Video Circuits

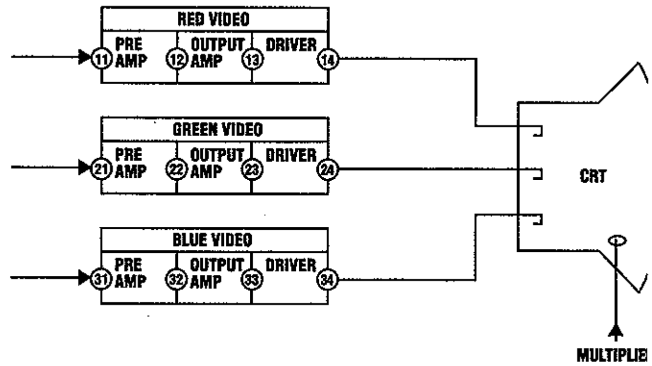

Fig. 41 - Video circuits block diagram.

The video circuits amplify the input signals to a lev that is sufficient to drive the CRT. They also set tl correct bias for the CRT and provide brightness aı contrast control. Color monitors have 3 sets identical amplifiers - one for each channel of the RG signal. Each channel must function identically order for the monitor to produce proper color.

Because of the fast scanning frequencies and hi resolutions in monitors, the bandwidth of the vid amplifiers is usually quite high. Bandwidths of MHz or more are not uncommon. (Contrast this wi the 4.2 MHz, or less, response of television receivers

Sync Stages

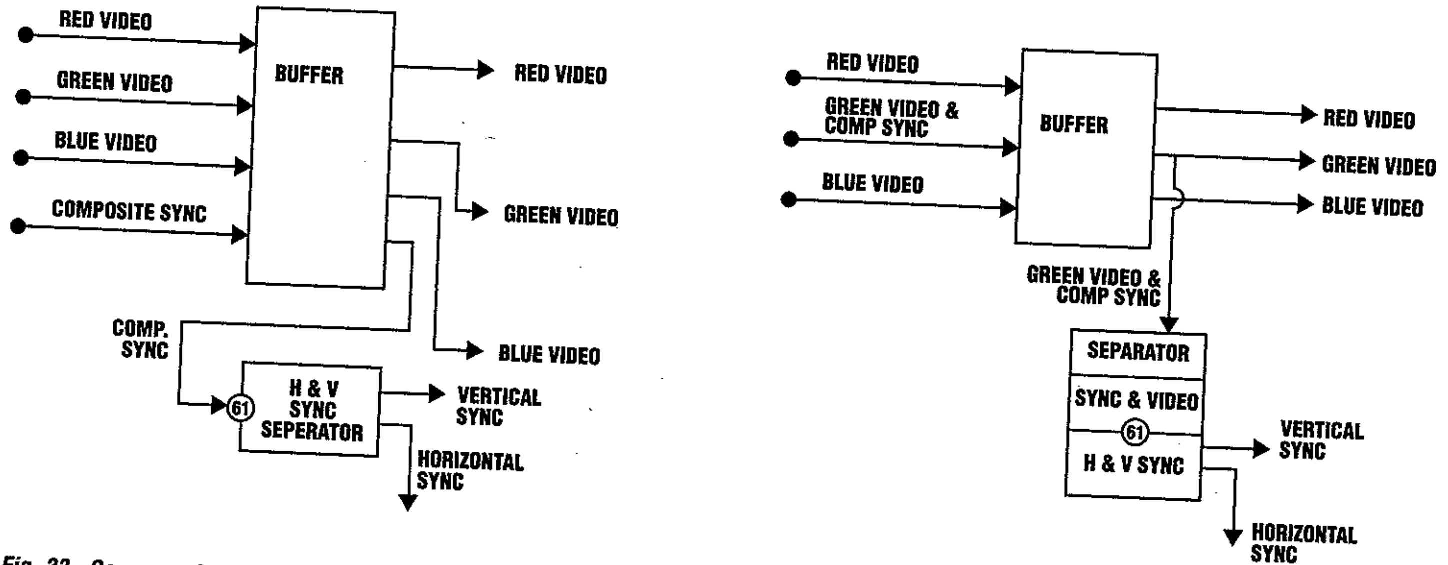

Fig. 33 - Some monitors have a composite sync input while others receive sync on one of the video lines.

Most monitors receive separate horizontal and vertical sync inputs that feed directly into the horizontal and vertical oscillators via a buffer. Some monitors use a composite sync input in which both the vertical and horizontal sync is fed in on the same pin. These monitors require a V&H sync separator stage to separate the sync signals before they are fed to the oscillators.

Other monitors, such as Apple Macintosh® monitors, use a composite sync signal on the green video input line. In these monitors, the sync must first be separated from the green video before the horizontal and vertical sync can be separated from one another.

Mode Select

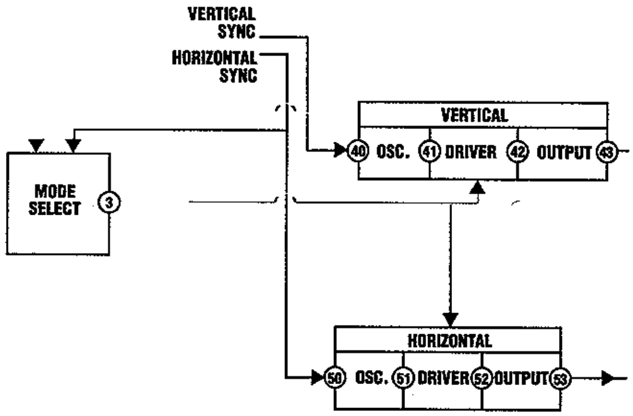

Fig. 43 - Mode select circuit block diagram.

Several monitor standards (PGC, MCGA, and VGA) have multiple graphics modes. The VGA standard, for example, has three modes as Fig 35 shows. VGA 1 and VGA 3 differ only in the number of pixels that are displayed. With everything else equal, the raster in VGA 1 (350 vertical pixels) would have less height than the raster in VGA 3 (480 vertical pixels), and the display would appear compressed.

Mode	Horizontal Resolution	Vertical Resolution (Pixels)	Horiz. Sync Polarity	Vert. Sync Polarity
(1) VGA	640	350	(+)	(-)
(2) VGA	720	400	(-)	(+)
(3) VGA	640	480	(-)	(-)

Fig. 44 - Standards for the three VGA modes.

A mode select circuit, used in some monitors, compensates for the compressed display that results from these different graphic modes. The mode select senses the input and tells the vertical driver to adjust the drive current to produce a full raster. The polarity of the horizontal and vertical sync pulses forms a code that tells the mode select circuit what graphics mode is applied. Figure 44 shows the polarity code. Test the mode circuits by changing the sync polarities and checking for proper raster height.

Vertical And Horizontal Circuits

The vertical and horizontal circuits each consist Oscillator, Driver, Output, and Yoke. The oscill synchronized to the incoming video. It devel signal that is amplified and converted to a cu waveform by the driver. The output stage pro sufficient current to drive the deflection yoke yoke produces the magnetic field necessary to the electron beam up and down and back and across the face of the CRT.

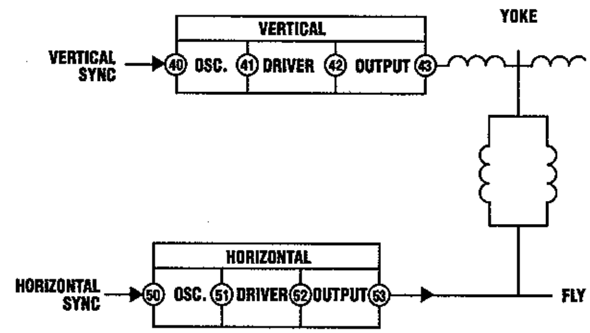

Fig. 45 - Vertical and horizontal circuits block diagram.

Problems in the oscillator result in no deflecti loss of sync. A problem in the driver, output or results in no deflection, partial deflection, or linearity.

High Voltage and Power Supply Circuits

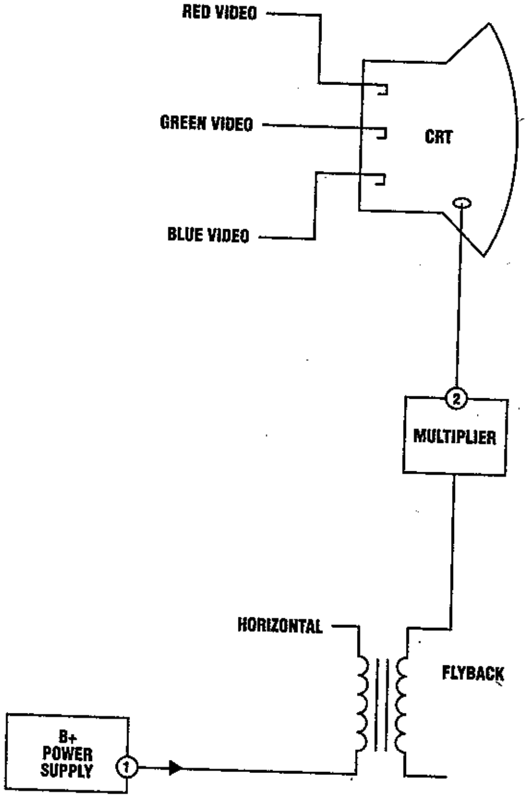

Fig. 46 - High voltage and power supply circuit block diagram.

The horizontal circuits have a second function besides providing deflection: they provide the drive signal to the flyback transformer that creates the focus and high voltage voltages, and other scan derived power supply voltages.

During normal operation, a large pulse is produced at the collector of the horizontal output transistor. The output connects to the primary of the flyback transformer so the pulses are induced into the flyback's secondary. The pulses are: 1) stepped up and rectified to produce the focus and high voltage,and 2) rectified to produce the DC voltages used to operate the monitor. Because these voltages depend on the pulse at the output transistor that occurs from horizontal scanning, they are called "scan derived".

Part 2 TROUBLESHOOTING MONITORS

GETTING STARTED

The CM2125 improves troubleshooting effectiveness through a technique called "Functional Analyzing". This method is made up of two parts: (1) signal injection and (2) signal tracing. Signal substitution lets you inject "known good" signals supplied by the CM2125, into the circuits. The low impedance of the Drive Signal output "swamps out" the signal that is present at the injection point and places a known good signal in its place. You watch the CRT to decide whether you are injecting before or after the defective stage. If the output remains bad, your injection is before the defective stage. If the output returns to normal, you can be confident that all the circuits between the injection point and the output are good.

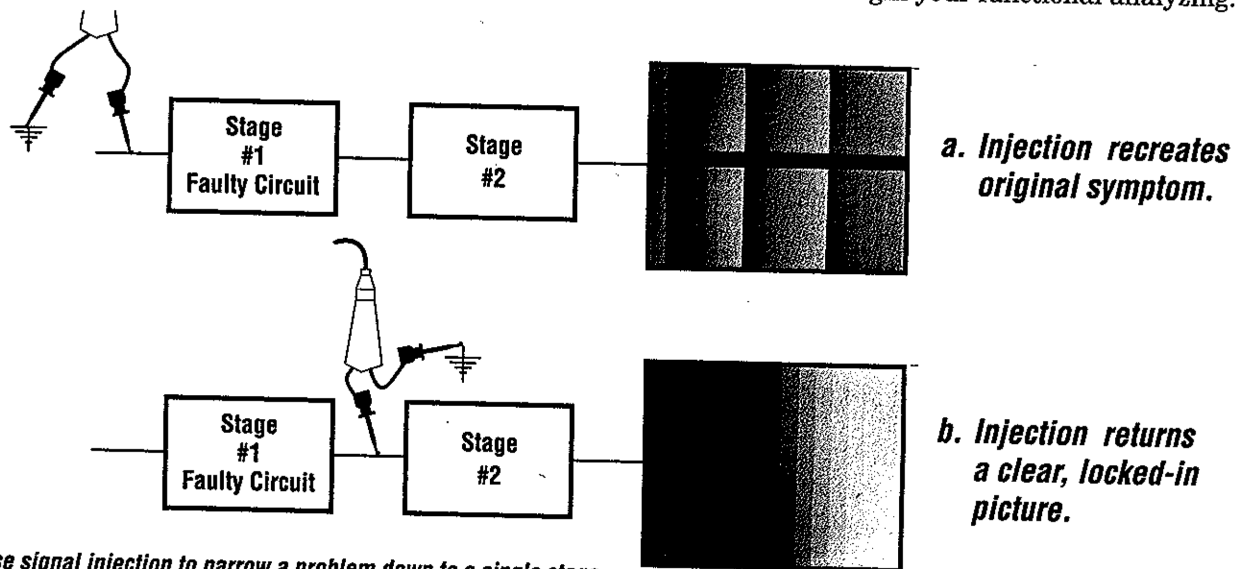

Fig. 47 - Use signal injection to narrow a problem down to a single stage.

Once you narrow the problem to a single stage, use signal tracing to find the faulty component. As you signal trace, compare the voltage levels, frequencies and waveshapes to those in the service literature.

Observe the following guidelines when using signal injection:

1. Match the Drive Signal level to that shown in the Service Literature. Too much signal may cause a bad stage to operate and lead to confusing results.
2. If no level is shown, never exceed the B+ voltage of the stage.
3. Match the Drive Signal polarity to the sign in the circuit.

The APPLICATIONS section of this manual follo the "Universal Monitor Block Diagrams" a "Monitor Functional Analyzing Troubleshooti Guide". Use the Universal Block Diagram and t "Trouble Trees" to identify the blocks that could cau the problem. Then locate that block in the servi literature and begin your functional analyzing.

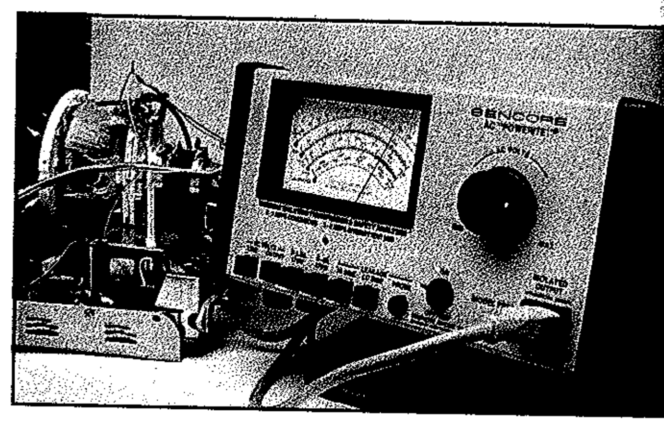

Fig. 48 - Always use an isolation supply before making any connections to the computer monitor chassis.

WARNING

Always use an isolation transformer when servicing any monitor chassis. Many monitors use a full-wave "hot chassis." Failure to isolate the chassis produces a dangerous shock hazard and may result in damage to the monitor or your test equipment.

Do not isolate your test instruments as this may create unsafe conditions.